The NRC's Operations Center:
Exercising authority to respond

The Operations Center at NRC headquarters in Rockville, Md., is put to the test during exercises designed to prove and improve U.S. nuclear emergency preparedness and incident response capabilities.

By Susan Gallier

NRC staff at the Operations Center checking simulated plant conditions during an emergency preparedness exercise with the Clinton nuclear power plant in Illinois. Dozens of agency experts in nuclear reactors, radiation safety, security, and communications gather to carry out the agency's response and ensure the public's safety when an emergency occurs, or when the agency participates in an exercise.

One essential lesson from the events at Three Mile Island-2 in March 1979 can be summed up in three words: Preparedness takes practice. The emergency response capacity of the Nuclear Regulatory Commission and nuclear plant operators is more than just a set of procedures. Active training and evaluation are required to coordinate effectively with local and state authorities and protect the public in the event of an off-site radiological release.

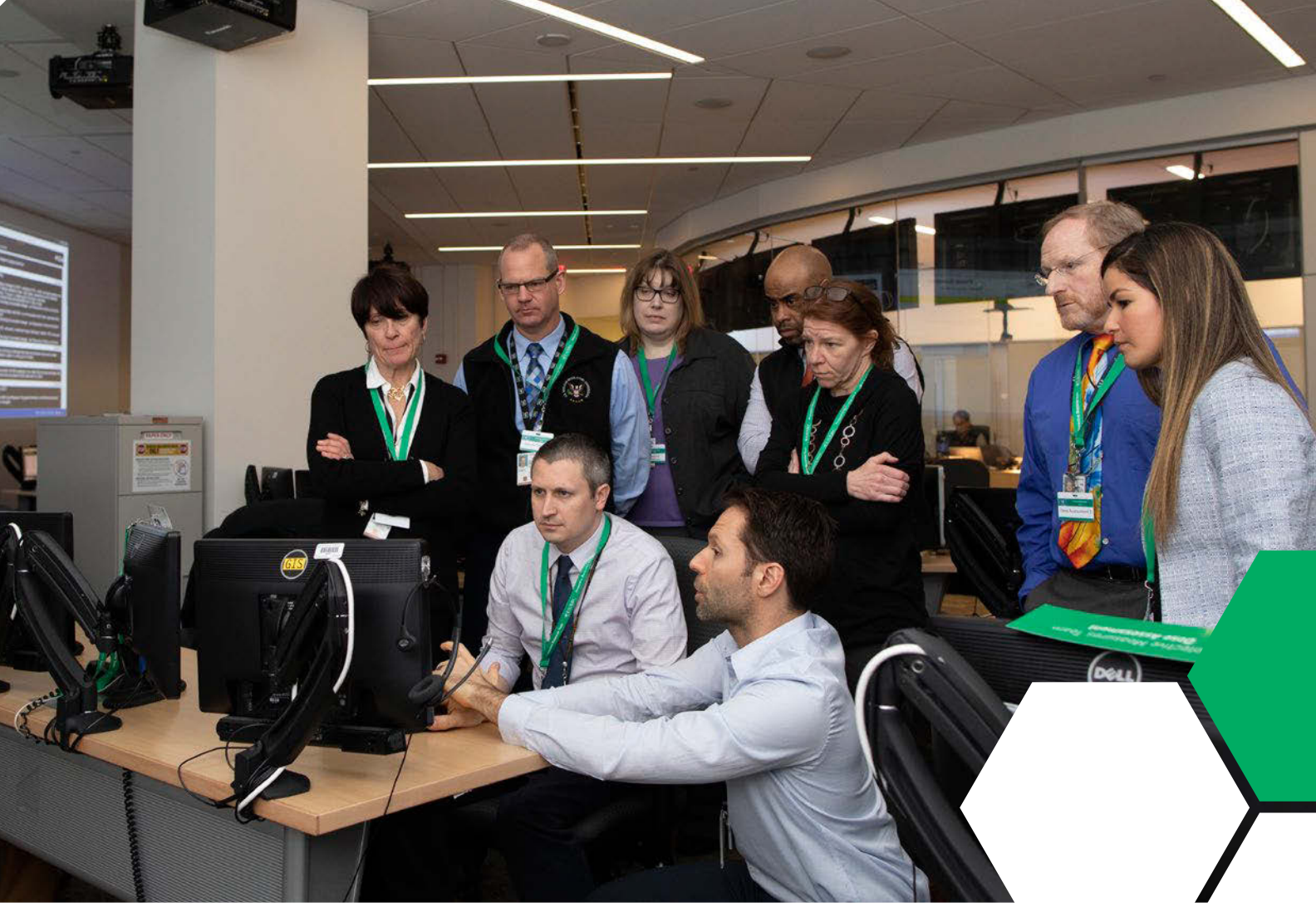
The NRC's emergency preparedness and incident response teams work in the Office of Nuclear Security and Incident Response (NSIR) to support licensees' mandated emergency preparedness programs. The Operations Center at NRC headquarters is staffed around-the-clock with NSIR officers who can respond to technical questions and evaluate licensee event reports, yet most of its infrastructure typically stands vacant, awaiting activation for an incident or a planned exercise. With full activation of the NRC's incident response program, the Operations Center comes to life, and teams of staff populate workstations. That process is regularly tested during exercises that involve NRC licensees, state and local responders, and similar incident response centers at each of the NRC's four regional offices.

No two exercises are the same. Not only is every exercise dependent on variable human performance and every plant located in a unique community, but emergency preparedness benchmarks continually evolve with advancements in technologies and procedures.

Responsive leadership

Jeffrey Grant and Patricia Milligan work in NSIR's Division of Preparedness and Response, contributing to the NRC's continual cycle of evaluation and improvement. Grant has found his niche as a team leader in incident response. Emergency preparedness and incident response are "ever-changing," he said. National policies, emerging technologies, potential event sequences, and interactions with the international nuclear community are all part of the kaleidoscope. "They're not static for even a second," Grant said. "You have to have your ear to the ground with everything that's going on."

Just what distinguishes emergency preparedness and response from incident response? Grant explains it this way: "Emergency preparedness focuses on the licensee's response and our regulatory activities to ensure that licensees have a healthy program and that they are doing everything under their emergency plans and agreements. Incident response is how the NRC would respond to an event—our plans and protocols and how we fit into the bigger picture."



Milligan is a senior-level advisor and health physicist specializing in protective measures. During an incident or an exercise, she leads a group of radiation protection experts as one of three protective measures team directors. "I have the perspective of having boots on the ground during events," she said.

An exercise plan

Every two years a nuclear power plant must carry out an emergency preparedness and response exercise that simulates a reactor safety event, security incident, or natural disaster. Each exercise includes the participation of local emergency response agencies and is evaluated by the Federal Emergency Management Agency. FEMA has responsibility for state and local response, while the NRC focuses on supporting the licensee's response and ensuring that the plant can be restored to a safe condition.

The NRC's Operations Center participates in about four full-activation emergency preparedness nuclear plant exercises each year. Other exercises test response capabilities on a national or international scale, isolate and focus on specific stages of incident response, or test emergency preparedness at nonpower facilities.

Several planned spring 2020 exercises were postponed because of the coronavirus pandemic and will be rescheduled. In the meantime, some state and local emergency responders have drawn comparisons between the COVID-19 public health emergency and radiological emergency response.

"The COVID-19 response has really been enlightening because we've seen, and it's been mentioned to us by our state contacts, that there are a lot of similarities between response to COVID and response to radiation events," Milligan said. "For example, in monitoring for a virus, you can't see it, you can't taste it, you can't smell it, you can't touch it—but you have to do testing for it, and you have to take protective measures as you monitor." While radiation monitoring and pandemic monitoring have parallels, radiation monitoring has one clear advantage: "You can detect it and measure it pretty readily," Milligan said.

A typical exercise

A simulated event on March 19, 2019, at Exelon Generation's Clinton plant in Illinois initiated a typical biennial

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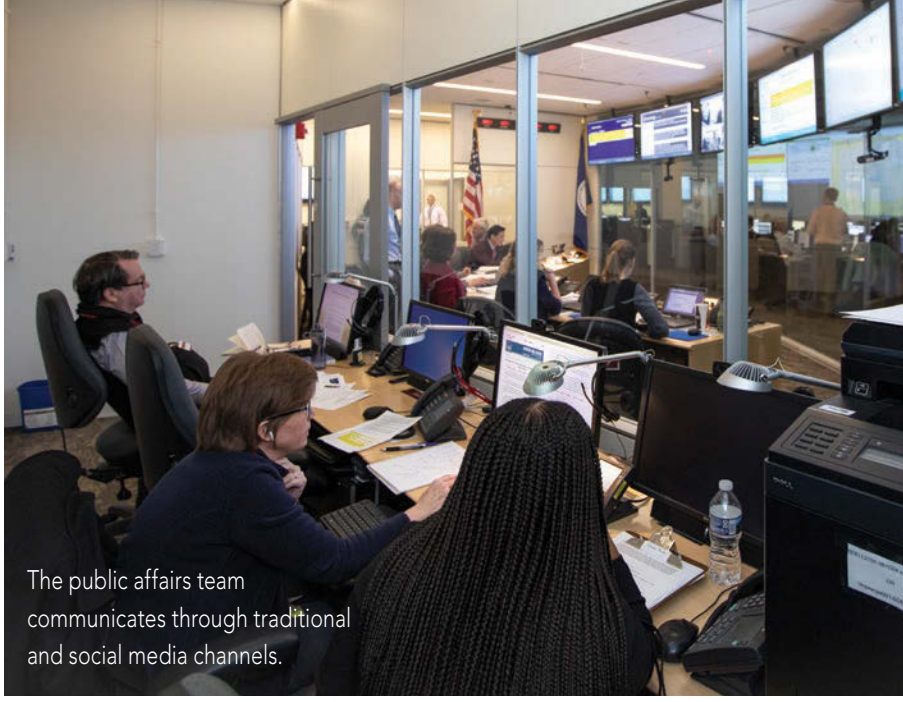


The public affairs team communicates through traditional and social media channels.

nuclear power plant exercise. It began with an Alert in response to abnormal plant conditions. Operators initiated a manual scram that resulted in an Anticipated Transient Without Scram, and the simulated event escalated, requiring the declaration of a Site Area Emergency and then a General Emergency and the development of protective action recommendations for state and local government agencies.

Grant is involved in every exercise that includes the activation of the Operations Center. During the Clinton exercise he was embedded with the executive team, which usually includes an NRC commissioner. NRC staff, including teams of reactor safety, protective measures, and security experts, report to the executive team during an exercise or a response.

"My job is to be in the room and lend my expertise, making sure there is a flow of communication into that room and that the executive team knows what to do with the information they have," Grant explained.

There is a lot of need for education out there on all things radiation.

While reactor safety experts focus on restoring a reactor to a safe condition, protective measures experts must anticipate and mitigate the effects of a potential off-site radiation release. If significant radiation could go beyond a plant's boundary, the protective measures team assesses how it might affect nearby communities and the environment by modeling potential radiation doses based on myriad factors—some, like geographical features, that are fixed, and some, such as weather, that are always in flux. Recommended protective measures may include evacuation, sheltering in place, and the supplemental use of potassium iodide.

During an emergency preparedness exercise, Milligan's team makes independent assessments of radiological consequences and then reviews the licensee's assessments of the same data. "If we can offer some advice, we will offer it," Milligan said. "We support what they're doing. Often we just act as an independent check for them.

"We have the ability to do some interesting plume mapping," Milligan added. "We can see where the plume is going, see the projections, and help with some suggestions for potential enhancements of protective measures." Those suggestions are informed by detailed population data that are kept up-to-date by NRC staff. "A lot of the questions that our executive team gets—and that I know the White House would get—are related to the number of schools in the area and how many children are there," Milligan said. "We can get all that information and make recommendations so that when our executive team has to brief the president, they can say, 'This is what we know.'"

Milligan, a scientist by training, said that incident response gives her "the ability to not only do the science but also to look at peoples' lives and how we work to ensure the safety of the public." After 18 years in preparedness and response she has learned a lot about politics and people, she said, noting that "there is a lot of need for education out there on all things radiation."

From planning to follow-up

A typical nuclear power plant exercise with participation from the Operations Center, like the one conducted at Clinton in 2019, plays out over about six hours. "It's really compressed and intense," Grant said. Behind that one intense day lie three months of planning.

For the NRC, planning begins with outreach to the plant to ensure that everyone involved in an exercise knows what they're bringing to the table and what their roles are during the response, Grant said. Meanwhile, plant staff are making their own preparations. "Typically, we join in their preparatory exercises and meetings to make sure everything is synced up and harmonized," Grant said. "We also have extensive training in that three-month window to prepare our responders for the exercise itself."

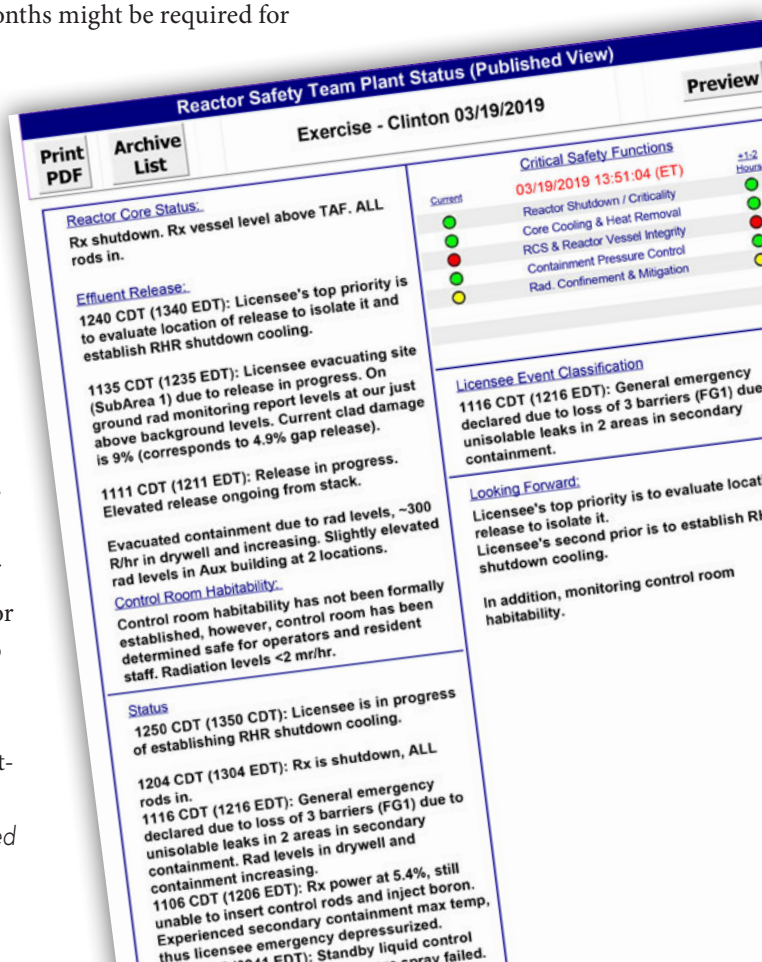
A documented exercise plan ensures that evaluators know exactly what to assess. "There is a whole lot of planning around the team that evaluates the forward-deployed team at the site, as well as in the region and back at headquarters," Grant said. "Typically, there is an evaluator for each functional area." Evaluator reports submitted after the exercise assess how individuals performed tasks within their assigned procedures. "We're also evaluating whether the procedures themselves are adequate to be able to perform a lot of these key essential functions," Grant said. "It's twofold."

During a "hot wash" at the conclusion of each exercise, participants can describe their experience and suggest opportunities for improvement. Feedback from evaluators and participants is factored into the after-action report produced by incident response program managers, and corrective actions are added to a database for adjudication and resolution. Just as planning for an exercise typically takes about three months, another three months might be required for follow-up, according to Grant.

Corrective actions may include changes to procedures. In that case, Grant said, "We have to go through the whole cycle of training everybody who fills that role before we can officially close that item out." Information can be shared with licensees through the Nuclear Energy Institute or through the Institute of Nuclear Power Operations. The cycle is complete when new training has been incorporated into the outreach materials provided to licensees prior to each exercise.

Above: Exelon Generation's Clinton plant in Illinois.

Below: An image of the reactor safety team's plant status report from the 2019 Clinton exercise.



Training transitions

Training can be delivered online, by an instructor, or through activity-specific practical applications. It's "all of that and more," Grant said.

Milligan said that the training provided by Grant and his staff is effective. "Anytime there's a significant change, or even a minor change that could trip us up, they make sure we have a chance to be trained on it as soon as it becomes available," she said. "That way we stay fluent in any changes."

Changes can be as simple as upgrades to the hardware and software used by response staff. Even videoconferencing comes with

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a learning curve, and training is needed to make sure that the staff knows how to use new technology during a response.

As an example, Grant pointed to forthcoming changes to WebEOC—a platform to share information in real time within the NRC. "We're currently making some changes to it," Grant said. "We have a series of 12 tabletop exercises we need to run through before we will have qualified everyone on the new way of doing business. Once we're comfortable with that, senior leadership will make the decision to move it into production, and we will officially toggle over to the new way of doing business."

Lessons from Fukushima

Shortly after the magnitude 9.0 Great East Japan Earthquake and subsequent tsunami struck on March 11, 2011, the NRC activated its Operations Center—first to monitor the tsunami's effects on the Pacific coast of the United States, and then to support domestic and international responses to the damage sustained at Tepco's Fukushima Daiichi plant. Activation was maintained around-the-clock until May 16. As with the accident at TMI-2, lessons were gleaned as the event and response sequence unfolded.

Milligan was involved in the NRC's Fukushima response, which she said reflects the broad scope of work in the NRC's Division of Preparedness and Response. "When you work internationally, there are certain things you can and cannot do because of conventions that [the United States has] signed," she said. "I never got involved with that as a scientist." Before joining the NRC, Milligan had focused on data: "'The answer is 3, and here are my calculations, now go away,'" she said, by way of example. "Now, I'm looking at and understanding the nuances of international conventions and how we can work with international colleagues—what we can and cannot do."

NSIR staff observed the impact of rapid relocations and evacuations prompted by radiological releases from Fukushima Daiichi. "You see a tremendous psychosocial impact on people," Milligan said.

"One of the problems in Japan was that they were moving medically fragile people," she noted. Evacuation plans that called for shifting patients from one facility to another one nearby were unworkable when both facilities had suffered damage. Reevaluating those plans proved instructive for nuclear regulators and local responders in Japan and around the world, and, according to Milligan, prompted some to ask: Do medically fragile people need to be moved?

"It's always good to have the opportunity to go back, take a look at what happened—however low the probability—and ask what was learned and then how to move forward," Milligan said. The events at the Fukushima Daiichi plant "gave us a chance to step back and look at how we can better think about the different challenges to reactors in preparedness and response," she added.

The NRC has changed its dose assessment

NRC liaison team members ensure Congress, federal agencies, state and tribal governments, other countries, and the International Atomic Energy Agency are kept in the loop.

methodology to consider releases from two reactors at the same site, and U.S. plants must now ensure that they have reliable communications not only within the site, but going out to off-site responders so that coordination can be maintained even if the plant staff loses normal communication tools.

Keeping the Operations Center fully activated for over two months revealed the need for a long-term NRC response plan, Grant said. With a typical nuclear plant emergency preparedness exercise contained to six hours, the NRC's incident response program was well suited to short-term events. Logistics for longer-term events include assigned shifts, communication between shifts, and regular communication to a broader group of external stakeholders. "We practice those activities to try to make a program that is as viable during an exercise as during a real event," Grant said.

Preparing for new technologies

Milligan has been involved in the rulemaking process for risk-informed, performance-based emergency planning requirements for small modular reactors. A proposed rule, "Emergency Preparedness for Small Modular Reactors and Other New Technologies," was published for public comment in the May 12 *Federal Register*, and the comment deadline has been extended to September 25.

"Emergency preparedness isn't going away for small modular reactors," Milligan said. "It's a new technology for us to work with. As we become more familiar with that technology, we will certainly have plans to exercise extensively before any one of these small modular reactors comes on line. It would probably be very similar to how we exercise with a research or test reactor or a fuel cycle facility. Requirements will still be in place for licensees if they end up with a site-boundary emergency planning zone, which means that the risk profile is very, very low.

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"Moving into new technologies and rethinking emergency preparedness for the future has been a tremendous challenge and very exciting," Milligan added. "Here we are, potentially shaping how nuclear power is going to look—certainly in emergency preparedness—for the next generation. That's exciting and very fulfilling."