Nuclear News

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On the cover: At American Electric Power's Cook plant, near Bridgman, Mich., workers build a negative-pressure enclosure around a feedwater heater during an asbestos removal and feedwater heater insulation project that won the Nuclear Energy Institute's 2016 Top Innovative Practice Award for Maintenance. An interview and photo feature on this project, as well as other maintenance-related articles, are included in the Special Section on Nuclear Power Plant Maintenance, which begins on page 43. (Photo: Advanced Nuclear)

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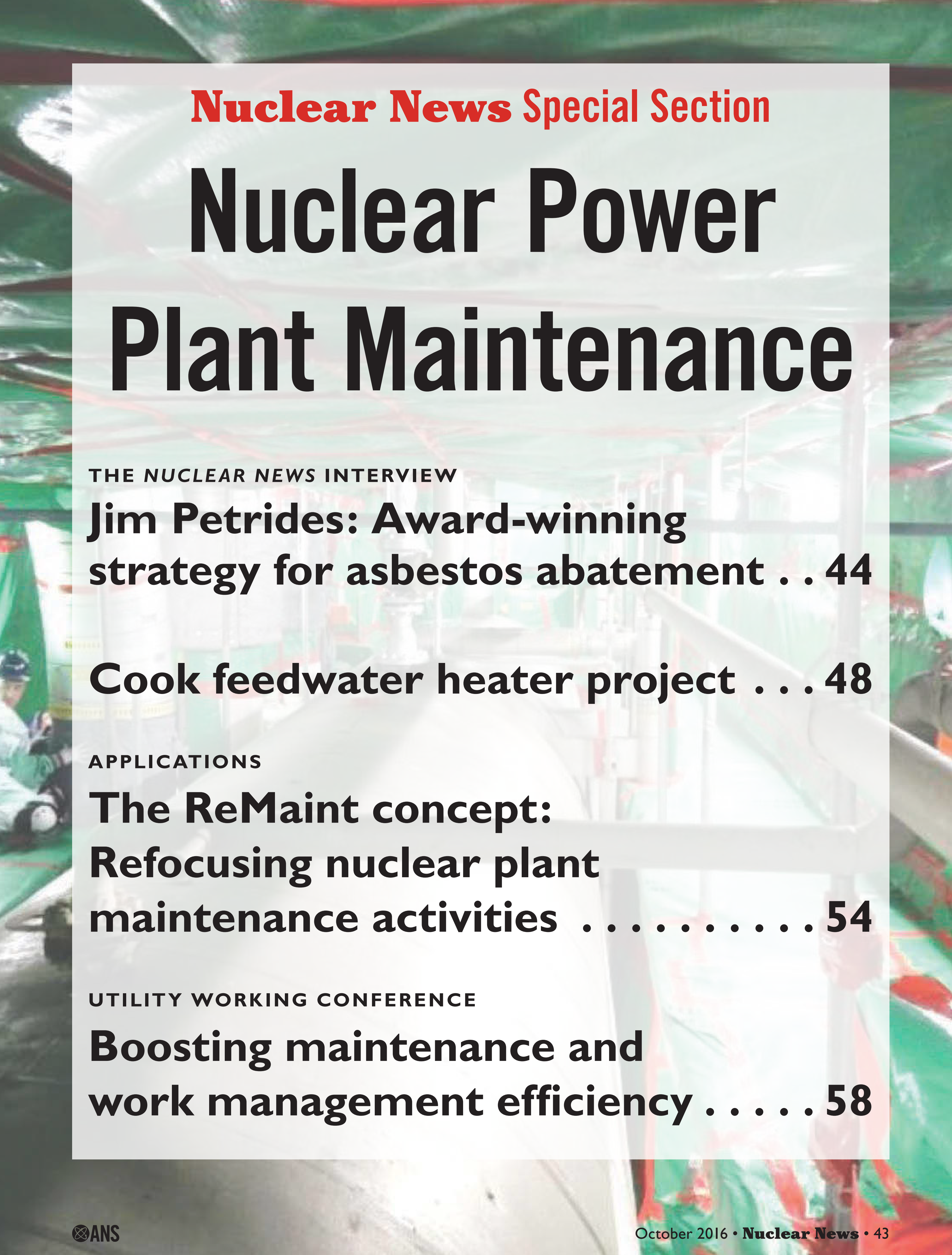


Nuclear News Special Section

Nuclear Power Plant Maintenance

THE *NUCLEAR NEWS* INTERVIEW

Jim Petrides: Award-winning strategy for asbestos abatement

How do you remove asbestos insulation from feedwater heaters in a nuclear plant while the plant is on line? If your answer is "very carefully," try adding a few more "verys."

In 2014, Advanced Nuclear, a subsidiary of Irex Contracting Group, was awarded a contract to remove asbestos-containing insulation from five feedwater heaters and approximately 600 feet of lineal piping at Michigan's Cook nuclear power plant. The work garnered plant owner American Electric Power (AEP) a 2016 Top Innovative Practice (TIP) Award in the Maintenance category from the Nuclear Energy Institute (*NN*, July 2016, p. 32). Commenting on the project, Bryan Horvath, the Cook construction manager who oversaw the asbestos removal, said, "It all went very smoothly. No one got hurt. I don't think you could have asked for a better outcome."

On August 24, *NN* Associate Editor Michael McQueen spoke with the president of Advanced Nuclear, James Petrides, about the project and some of its major challenges.

Petrides: "Removing the insulation prior to the outage resulted in a significant cost savings and reduced outage duration."

Why was this asbestos abatement project undertaken?

Cook was removing the feedwater heaters in order to install new ones. The old feedwater heaters had been there for nearly 40 years. The existing heaters and some associated piping were insulated with asbestos-containing material. Removing the insulation prior to the outage resulted in a significant cost savings and reduced outage duration. We had to remove the asbestos prior to the cutting of pipes, etc., so that other workers weren't contaminated.

When was this work performed and how long did it take?

We started about three months prior to the fall 2014 outage at Unit 1. We spent a couple of months removing the asbestos from two feedwater heaters, the 5A and 5B, and the 2B condensate heater. We reinsulated them with a temporary non-asbestos insulation that was fairly quick to install. There was so much heat radiating from the feedwater heaters that if they had been left uninsulated, the efficiency of the plant could have been compromised. And, more than that, the temperatures on the turbine deck would have been dangerously elevated. During the outage, we insulated the newly installed heaters with permanent non-asbestos insulation. We also worked on the 6A and 6B feedwater heaters, removing asbestos and installing temporary insulation, in preparation for their removal during the spring 2016 outage.

So we removed the asbestos, reinsulated the feedwater heaters, and prepared for the removal of the other feedwater heaters in the process. This process was about getting the plant ready to upgrade all of the feedwater heaters. There are still two more to do in 2018.

And the asbestos-abatement work was conducted while the plant was on line?

Yes. We removed the asbestos prior to the outage, while the unit was running, with the majority of the work being performed in a negative-pressure enclosure. If we had performed the work during the outage, we estimate that the outage duration would have been an additional 10-and-a-half days, at a significant cost to the company. The revenue from the plant's electricity generation is about a million dollars a day, not counting the cost of keeping everyone on-site. So by shortening the outage, the savings are in the ballpark of $15 million to $16 million. And that's just the base cost.

Also, the removal of this material while the plant was on line allowed for the visual inspection of piping, vessels, and equipment, including expected cut lines, prior to the start of the outage. This gave other contractors the ability to refine planning and scheduling and reduced the number of personnel in the work areas during the outage. The asbestos-abatement project reduced needed resources and supervision, including physical resources, such as overlapping power requirements, lighting, ventilation, and water and drainage. The number of contractor personnel in highly congested areas was also reduced, lessening the risk of a safety-related incident due to multiple craft congestion.

What is the size of the feedwater heaters?

They're approximately 8 feet in diameter and nearly 30 feet long. The new ones are slightly larger.

Has this sort of thing been done before, or is this a first-of-a-kind project?

It's the first time we've done large-scale asbestos removal from operating steam lines at this plant while it was on line. The standard method is to take the plant off line and do it cold, without the heat stresses. I was told that as far as AEP knows, this is believed to be the most asbestos removed on line, cubic-yard-wise, from a U.S. nuclear plant.

What sort of prep work did you do?

We knew that this project required expertise in various areas. Before submitting our bid, we evaluated the scope of work and conducted conference calls with individuals who had expertise in asbestos abatement, nuclear, safety, heat stress, and labor relations. We also did a lot of front-end work in conjunction with the plant, with Bryan Horvath and the management team at AEP. So it was a collaborative effort between AEP and Advanced Nuclear to ensure that we trained everybody and that we acclimated them.

Can you give some specifics?

We assembled equipment and supplies while refining work area designs, including engineering controls, with an emphasis on things such as air-flow paths, fiber capture, cooling-air intakes and outflows, exhaust-air paths, rotation of employees, convection currents, decontamination areas, and worker evaluation areas in clean rooms. We secured high-volume air conditioners that were appropriate for the site-specific conditions that we would encounter. We considered the elevated ambient air temperatures that were present in the work areas, and we sized our air conditioners with consideration for the reduced efficiency of the units due to the high ambient temperature and its effect on the intake air.

Can you speak to worker training?

We instituted specific additional training to educate all personnel of upcoming potential work environments and potential hazards. Our management and safety team assembled training packages to improve skill sets of supervisors and all involved workers. We instituted and performed site-specific, pre-job training for supervisors, with comprehension evaluations.

What was involved in acclimating the workers?

We recognized that we needed to acclimate all of our workers and supervisors to the elevated temperatures that would be encountered in the negative-pressure enclosure. The feedwater design temperature was listed as 350 °F, but we measured temperatures as high as 392 °F. We used the staging of materials, as well as the set-up of the enclosure, as a work task that would allow us to begin the acclimation process. We communicated to everyone involved what our goals were, how the process would work, and how we wanted to proceed. We asked the workers to assist us in this process by ingesting appropriate fluids, mostly plain water, and limiting all caffeinated drinks. We took wet-bulb temperature readings of our work areas, which were posted and communicated to all of our team members, to ensure that everyone had as much available information as possible for proper decision making.

As we began the setup of the negative-pressure enclosure, we continued the education process with on-the-job training for all site personnel. This training included the application of process control theories, with a top-down emphasis on the ultimate goal of absolute safety for all removal procedures and practices. The team members worked in pairs, conducting peer checks while performing all work tasks. We asked team members to implement evaluations of each other during the work cycles, since one of the symptoms of heat stress can be disorientation and impaired mental performance.

What were some of the problems or challenges that were encountered in dealing with the heat?

The workers had to wear special Tyvek-type suits that don't breathe, and it's very laborious work as well. On just an 80 degree day, they would lose five to six pounds in sweat in those suits. You put them into a 300-plus degree area—it's just stupid hot. You can't touch steel. You have to wear a cooling vest. We iced down the vests the workers wore to help keep their core temperatures down. We did a lot of things to reduce worker heat stress.

What are some of the other things you did?

As the work progressed, we asked for volunteers to participate in specific measures that in other circumstances might be viewed as being personally invasive. For example, we had several workers use wrist-worn devices to measure heart rate, skin temperature, and blood pressure. We asked others to measure their blood pressure, heart rate, and skin temperature as they entered and left the negative-pressure enclosure. We used devices like fingertip blood pressure monitors and noncontact thermometers to measure physiological conditions. We used these readings to establish baselines to help determine if workers were encountering unsafe levels of heat stress or were overexerting themselves inside the enclosure and becoming overheated.

Measures were also used to motivate the work teams, including supplying lunch as individual phases of the project were completed. We supplied items such as Italian ices and fruit pops on exceptionally hot or humid days. We avoided any items with milk products or added or artificial sweeteners, which might make an overheated worker feel nauseous. We supplied various fruits and vegetables that are touted as being internally cooling, such as peaches, watermelon, nectarines, and grapes.

How long were the workers exposed at a time?

One heat-stress guidance chart suggested stay times as low as five minutes, depending on things such as the physical condition of the worker, worker acclimation, air movement, and the level of physical exertion required. We had workers in for an hour, an hour-and-a-half at a time. The average time was probably closer to 30 to 40 minutes. We had special cool-down areas, air-conditioned tents, set up. And then they went back in pretty quickly. So our production was well above what it otherwise would have been without all the safety measures and preparation.

By the way, while we worked, two people in the plant experienced heat stress issues—it was about 100 degrees on the turbine deck—but we believe the efforts we took prevented our workers from encountering any heat stress problems. The project resulted in zero burns, zero injuries, zero recordables, zero heat-stress events, and zero human-performance events.

Will you be doing this at other plants?

We've been asked to submit proposals to some other plants, but until contracts get awarded, of course, we can't say. But even then, probably not of the scope of this project.

Other thoughts?

This project was a success due to the dedication and teamwork of everyone involved. Without a great team consisting of dedicated insulators, AEP, and the Advanced Nuclear field staff, this project would not have been possible. **NN**

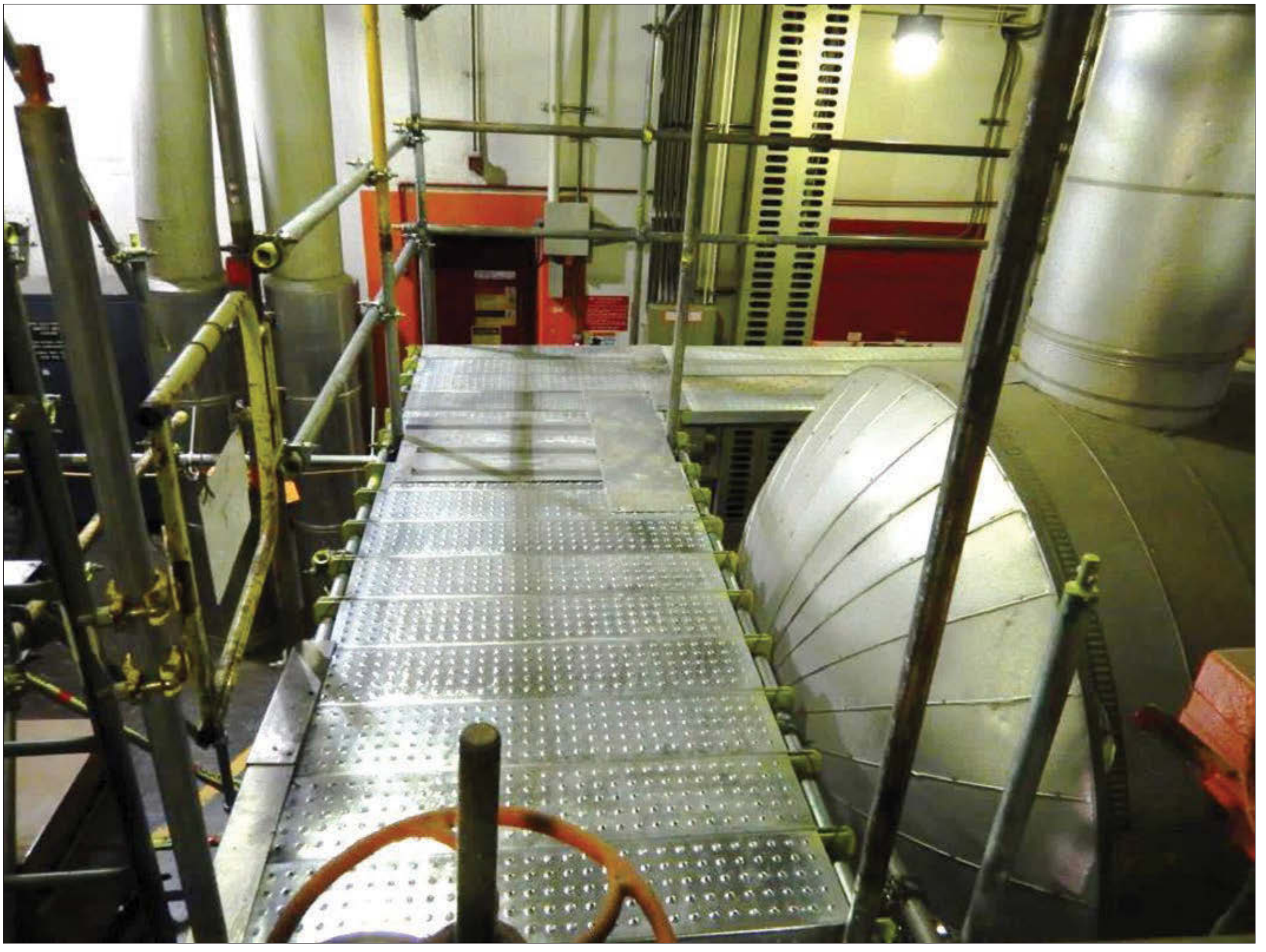
Cook feedwater heater project

The Cook nuclear power plant, owned and operated by American Electric Power (AEP), is located just north of Bridgman, Mich., on 650 acres along the eastern shore of Lake Michigan. The plant's two pressurized water reactors—the 1,084-MWe Unit 1 and the 1,107-MWe Unit 2—produce enough electricity for more than 1.5 million homes. Unit 1 began commercial operation in August 1975, and Unit 2 in July 1978. In 2005, the Nuclear Regulatory Commission renewed the operating licenses of both reactors, allowing for operation at Cook-1 through August 2034 and Cook-2 through August 2037.

As part of AEP's plan for replacing Cook's feedwater heaters, specialty contractor Advanced Nuclear was hired to perform asbestos abatement on these components. (Photos: Advanced Nuclear)

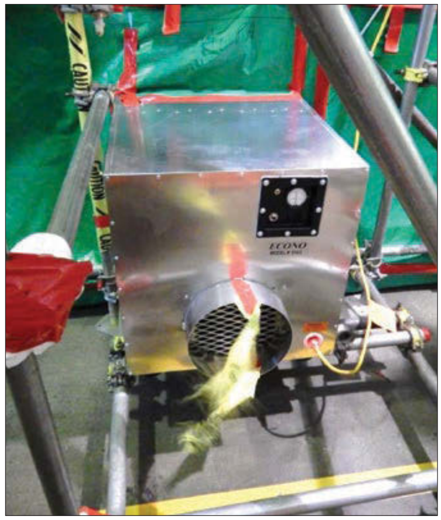
Photo: AEP

The Cook nuclear plant, near Bridgman, Mich.

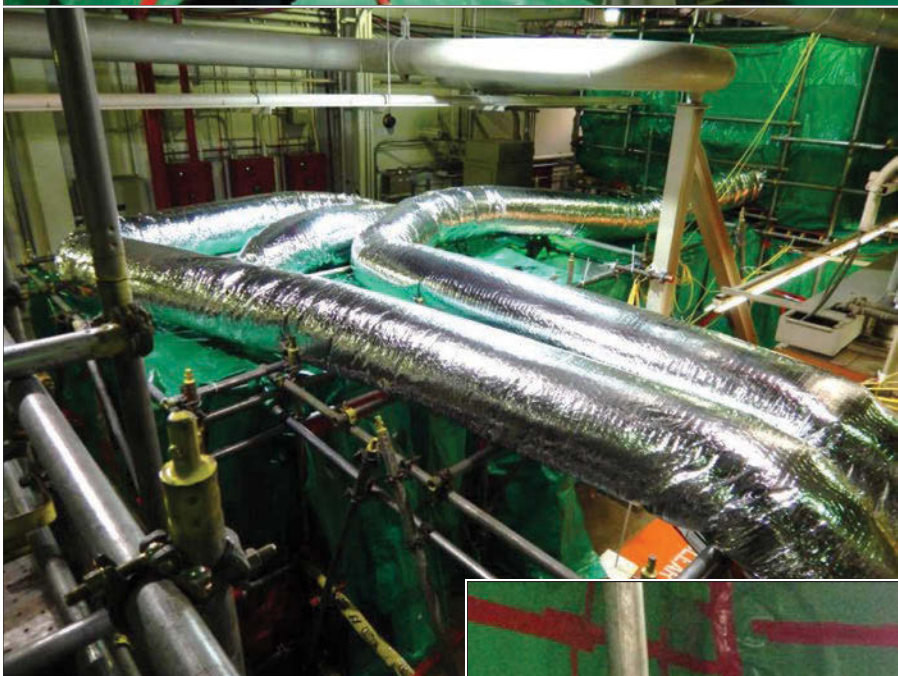


An upper deck scaffold for accessing the Unit 1 5B feedwater heater

Left: Workers build an asbestos-abatement enclosure to protect the plant from contamination.

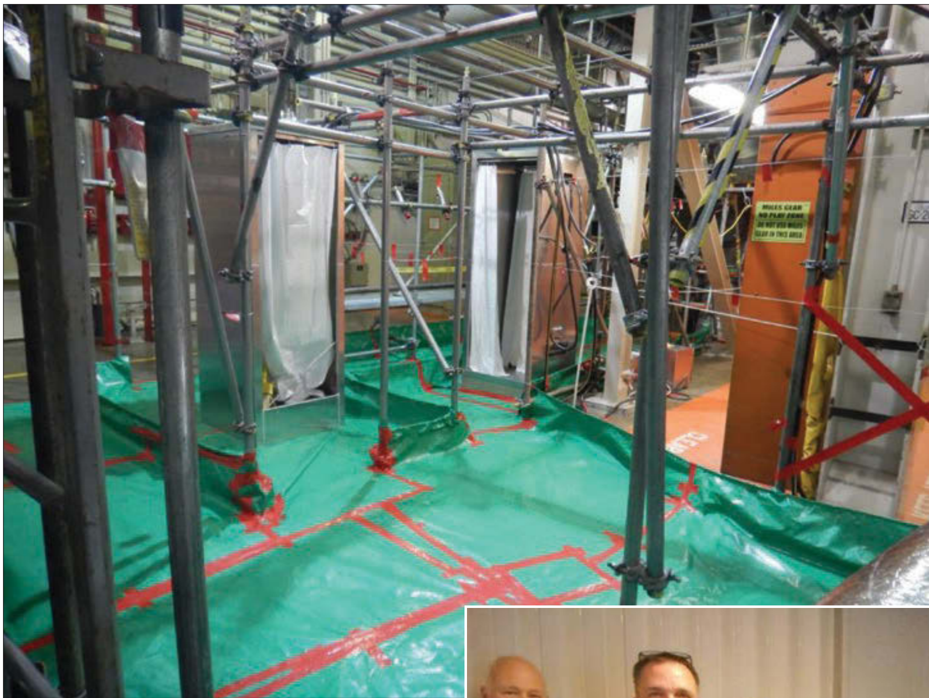


Above: HEPA machines were used to ensure negative differential pressure in the enclosure's asbestos-removal area.



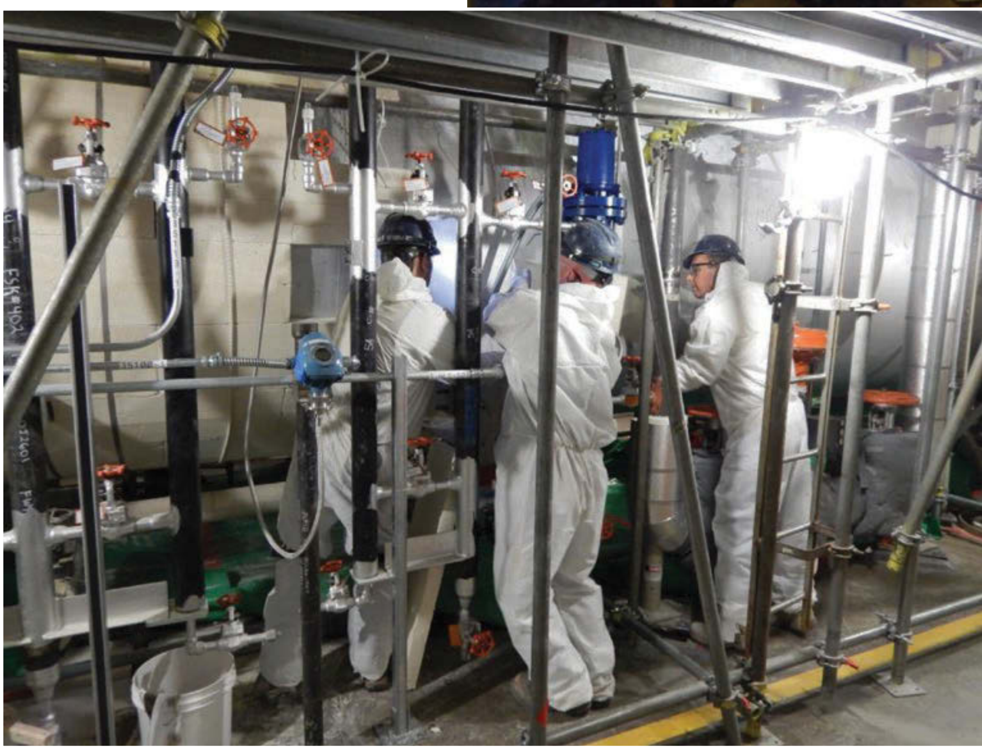
Above: Air-conditioning duct work for the enclosure

Below: The enclosure included a "clean" area, shown here, a shower area, and a "dirty" area, where the asbestos removal took place.



The base flooring for the enclosure's shower area

The American Electric Power oversight and management team (from left): Bryan Horvath, projects oversight; Scott Dailey, construction manager, projects; Dewayne Timmons, construction manager, mechanical; Rita Gitersonke, administrative assistant; Gary Richardville, project manager; Steve Case, projects oversight; Jim Ponton, construction manager; and Jeff LaDuke, construction manager.



Workers install the final metal protective jacketing over the block insulation on the Unit 1 5B feedwater heater.

Following the completion of air sampling and analysis, a worker disassembles the enclosure.

Unit 2’s 6B feedwater heater after reinsulation

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know that this is something that could get a lot of traction, because we have a long history of very traditional cost regulation at FERC, but it's something to consider, and it's something that people are working on."

Hammond also pointed out that there are some efforts at the regional and federal levels to value the kind of energy reliability that nuclear provides. "We see, for example, in PJM, capacity markets that penalize sources for not being there as promised and that also change the amount of money that you can get based on your resource's ability to always be there," she said. "Nuclear will always be there." In addition, Hammond noted that a handful of states are beginning to take the cost of carbon into account in their integrated resource planning activities. "There is a big push at the state level to broaden the scope of what integrated resources planning means in a way that I think could be beneficial to nuclear power," she said.

On the subject of climate change, Hammond mentioned both the Clean Power Plan—the Environmental Protection Agency's signature climate program for existing power plants that was issued last year—and New York's Clean Energy Standard. "The Clean Power Plan doesn't do a lot for nuclear power on the surface," she said. "In fact, I was a little bit disappointed by it. It really focuses primarily on shifting from coal to natural gas, and then ultimately shifting that to renewables. It does not give credit for keeping existing nuclear power plants in place and running. . . . But there is a way to use the Clean Power Plan, as well as state goals like New York's Clean Energy Standard, to make a great case for nuclear power. . . . There are pushes in states to move beyond renewable portfolio standards to get clean energy standards, putting nuclear power on an even playing field with other nonemitting sources."

Hammond concluded with a look at some statistics taken from a new report she coauthored for the group Nuclear Matters that explores the carbon benefits of nuclear power and how individual states can leverage those benefits to achieve compliance with the Clean Power Plan in a way that promotes nuclear. "Using three-year averages from the total power sector," she said, "we have 4 million gigawatt hours in 2015, with 2.3 billion tons of CO_2 at a social cost of $368 billion by 2020. What do we have if we look at nuclear power? We have 790,000 gigawatt hours—20 percent of the nation's electricity, but with zero carbon emissions—63 percent of the nation's clean energy. It's fascinating for me to see—only 20 percent of the total electricity, but 63 percent of the clean electricity. That is a social benefit of $85 billion by 2020."

Continued