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1. **NUCLEAR: Experts weigh extending the lives of nuclear power plants to 80 years** (*ClimateWire, 09/20/2010*)

Peter Behr, E&E reporter

Next year, when two nuclear reactors near Syracuse, N.Y., are shut down for normal refueling operations, technicians will enter their cavernous containment structures looking for signs of aging in the thick steel walls surrounding shrouds of concrete.

Constellation Energy Nuclear Group, which runs the Ginna and Nine Mile Point 1 reactors, volunteered for the inspections at the Department of Energy's request. It is a new phase in a government and industry investigation into the possibilities of running the nation's 104 nuclear plants for as long as 80 years -- twice their expected lifespans when they were originally licensed.

The failure of Congress to reach agreement on climate and energy legislation has left the future of U.S. new nuclear projects up in the air, focusing more attention on the possibility and the challenges of further extending the life expectancy of the current nuclear fleet, industry officials say.

Nuclear Regulatory Commission officials, Energy Department counterparts, utility executives and research leaders are scheduled to meet in February for a "tabletop" conference on the technical and regulatory issues that could confront a new wave of relicensing applications by reactor owners. Today's reactors, most of which were built in the 1960s and 1970s, were initially licensed for 40 years. Half of them have won NRC approval to operate for another 20 years, and the rest are expected to do the same.

Now the question is, "Is there life after 60?" as James "Joe" Sheppard, former CEO of STP Nuclear Operating Co., told a DOE conference on the question two years ago. DOE is supporting research into extended reactor life, as are nuclear plant operators through the Electric Power



Unit 1 of Nine Mile Point Nuclear Station, located at Scriba, N.Y., started up in 1970, making it one of the nation's oldest operating nuclear power plants. Photo courtesy of Constellation Energy.

Research Institute (EPRI), an industry research and development organization. An industry-created international research program, the Materials Ageing Institute, based in France, is also stepping up investigations on the issue.

Well before the first 20-year relicensing period ends, power plant owners will have to know what new components and equipment upgrades will be required to extend the lives of current reactors to 80 years, and how high the costs and regulatory hurdles will be, before deciding whether to take that route or decommission the plants and shutter them, industry officials say.

The recession has dramatically slowed the growth in U.S. electricity demand, but beginning in 2014, utilities will again be facing pressures to bring on new generation and launch more electricity conservation and load shifting programs, according to Energy Department and industry forecasts.

Today, the future is muddled with policy uncertainties and unknowns. "Right now, there are no good options for utilities," said Charles Forsberg of the Massachusetts Institute of Technology's Department of Nuclear Science and Engineering, who is the executive director of MIT's nuclear fuel cycle study.

2 key questions

"I believe utilities will have an interest [in a second relicensing period] if the plants continue to be safe and economical to run," said former NRC Chairman Dale Klein.

Those two questions -- safety and economics -- lie at the heart of the research agenda now under way on plant aging.

"What DOE and NRC are concerned about are the things we don't know about," Julie Keys, senior project manager for the Nuclear Energy Institute. "They are looking for that smoking gun."

Some industry executives like Sheppard have compared reactors to the fictional "Six Million Dollar Man," whose left eye and three limbs were replaced with bionic substitutes, giving him vastly enhanced powers.

But the environment inside nuclear plants is like nothing else, subjecting reactor components to intense heat, stress, vibration and neutron bombardment that could potentially cause hidden weaknesses in reactors, pipes, joints, wiring and other components. Replacement of impaired components is a major industry activity now.

"Utilities today see no problem in swapping out steam generators or reactor cooling pumps," said Brian Sheron, director of NRC's Office of Nuclear Regulatory Research. Reactor heads have been replaced. Analog control systems have been upgraded with digital ones.

"Conceptually, the reactor vessel could be replaced. It comes down to the economic decisions of the affected utilities," said Neil Wilmshurst, EPRI's director of nuclear programs.

"One of the questions we have is, are there any [aging] effects that would structurally affect the concrete?" Sheron said -- for example, the concrete supports for the reactor vessel that are subject to radiation exposure. "Not that we think it would crumble, but if one were to have a seismic event -- an earthquake -- would the structures withstand the forces?"

"This gets down to developing techniques to measure the condition of the plants," said Forsberg. "The R&D challenge is to figure out how to analyze a 4-foot thick chunk of concrete" -- without demolishing it.

There is miles and miles of electrical cabling that controls critical systems, Sheron added. Over time, the wire's insulation can become brittle and vulnerable. "It has to function under accident conditions," he said. The NRC is looking now at that issue to see if it is a problem, he added.

Another potential issue is leakage from buried pipes. "We obviously are worried about those," said Sheron. "It depends where they are buried and how difficult it would be to replace or repair them. It could be prohibitively expensive."

No 'showstoppers' yet

"We have not identified any technical issue which we would consider to be a showstopper," said Wilmshurst. "There may be some out there. Conceptually, it would be hard to envisage replacement of the reactor containment building. That is why there is a significant focus on the mechanism of concrete aging."

"I don't think I've heard any challenge to the concept of operating the nuclear plants beyond 60 years," Wilmshurst added. "Of course, the plants won't operate beyond 60 years if they aren't demonstrated to be safe."

If they are proved safe, the older plants have a major economic advantage over new ones, he added. Most are essentially paid for. There are no solid estimates of the cost of meeting a post-60-year renovation budget, but it stands to be far less than building a new reactor, he added.

John Butler, director of engineering and operations support for the Nuclear Energy Institute, said nuclear plant operators want to a clearly defined regulatory process in place to govern relicensing out to 80 years before committing to major investments in refurbishing plants beyond the 60-year horizon.

"If they don't have regulatory certainty, that's a big negative in going in that direction," he said.

The accelerating research programs supported by the Energy Department and the industry are aimed at identifying the potential longer-range issues, such as impairment in a reactor's concrete structures. "It's too early to say there won't be problems with it. That's the reason we're getting into it as early as we are," said Butler.

But the furor that began last year over leakage of radioactive tritium from underground pipes into the groundwater around the Vermont Yankee nuclear reactor in Vernon, Vt., illustrated how concerns about reactor safety could suddenly swamp relicensing plans. Last February, the Vermont Senate voted overwhelmingly in opposition to a renewed 20-year license for the plant when the current NRC license expires in 2012.

Concerns about 'public perception issues'

Although the NRC has not concluded its relicensing review, misstatements by plant officials about potential leakage may have been the last straw for Vermonters after an embarrassing collapse of part of the plant's cooling tower in 2007.

Nuclear power opponents like Jim Warren, executive director of NC Warn in North Carolina, have challenged the NRC's approach to regulating fire risks to wiring that connects vital control systems in old plants.

Klein said that the NRC's initial approach to the danger to reactor wiring in a fire would have imposed impossible conditions on some reactor operators, which have no practical way, for example, of relocating built-in wire channels to create more separation between wiring networks and backups. The NRC is developing an alternative approach that assures safe operation at a bearable cost, he said.

Warren said that the wiring debate demonstrates how necessary safety issues on older plants may be compromised to keep the plants running. "I'm referring to years and years of the same pattern, where they kick problems down the road," he said. "That's a broken regulatory system."

"The NRC has a very high confidence in licensing reactors up to 60 years," Klein said. "The NRC will not compromise safety by keeping the plants running [beyond 60 years] in an unreasonable manner."

The Vermont Yankee controversy "highlights the fact that nuclear power needs to be very cognizant of public perception and trust," said EPRI's Wilmshurst. "The industry has to raise its own accountability standards and seriously understand the potential public perception issues."

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