

News & Comment

End Game for the N Reactor?

The Department of Energy plans a \$50-million rush repair job on the nation's oldest weapons reactor to bring it closer to modern safety standards

THE oldest of four reactors supplying plutonium for U.S. nuclear weapons—the N Reactor at Hanford, Washington—will be shut down in January for a hurried safety fix.

This news came in a surprise announcement from the Department of Energy (DOE) on 12 December, reversing the agency's position throughout the Chernobyl crisis that DOE reactors are entirely safe to operate as they stand.

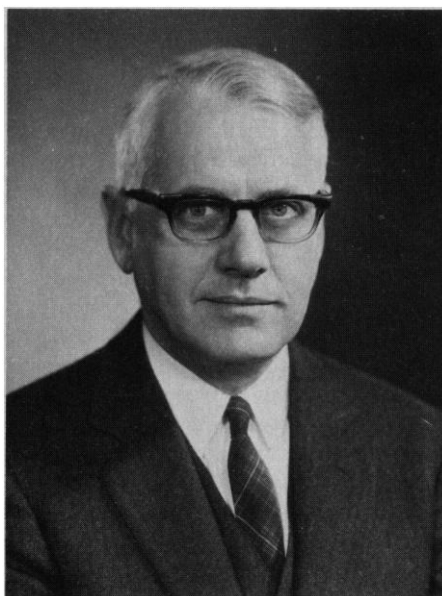
The change was prompted by six independent safety reviews commissioned last summer by the Secretary of Energy, John Herrington. The reports, published along with the new policy, were written by outside experts of high reputation. Unlike DOE's own analysis last June, the outside reviews criticize the management at Hanford and say the N Reactor should be modified or shut down.

The strongest remarks came from the nominal chairman, Louis Roddis, a nuclear engineer and former president of Consolidated Edison of New York. (To avoid advisory committee rules, DOE shifted from a committee to individual consultancies.) The others were Miles Leverett, a consultant with 25 years' experience with the N Reactor; Harold Lewis, a physicist at the University of California at Santa Barbara with a long record in advising the government on nuclear safety; Thomas Pigford, chairman of nuclear engineering at the University of California at Berkeley; Gerald Tape, a consultant and former president of Associated Universities, Inc.; and Admiral Eugene Wilkinson, former president of the industry's Institute for Nuclear Power Operations.

Roddis begins by quoting the last outside study of the N Reactor, written in 1966 by the Advisory Committee on Reactor Safeguards. In a severe accident, the ACRS said, the N Reactor would release more radioactivity than a civilian reactor. Writing only 3 years after the plant's start-up, the ACRS suggested that the government should weigh with care its need to run such a risky plant.

Two decades later, Roddis says DOE should simply "shut down the N Reactor

unless a positive judgment is made that the requirements for defense material warrant accepting public hazards exceeding those of commercial reactors." Lewis agrees. In his view, the most sensible policy would be to put the N Reactor out of its misery and "force a decision on a new production reactor." The other reviewers say remedial action is needed, but they do not think it would be wasteful or dangerous to run the plant for another 3 to 5 years.



Fabian Bechtrach

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The N Reactor gets so much attention because it is similar to the Chernobyl plant in two respects. It has a graphite-moderated, water-cooled core and it lacks a concrete containment dome. Herrington, under pressure from Congress to come up with a credible review, recruited the outsiders last May. Most decided that a Chernobyl-type explosion was not a real danger at the N Reactor. However, they did report something DOE had not stressed before. The N Reactor's age and poor maintenance are creating unanticipated hazards.

DOE told reporters that the six experts

agreed that a Chernobyl-style accident was "impossible or not plausible." This overstates their message. Roddis, for example, urges DOE to look into the possibility of longitudinal breaks occurring in the process tubes, writing: "If such a break can lead to stresses on adjacent tubes which can propagate in the core, then something like the Chernobyl accident might be possible. . . ."

Responding to its own studies and the experts' criticism, DOE Under Secretary Joseph Salgado declared on 12 December that the agency will embark on a \$50-million safety improvement campaign, starting with a shutdown of the N Reactor on 7 January. The changes will not be complete when DOE intends to restart the reactor next July. Meanwhile, Salgado says, the Westinghouse Corporation has been chosen to run the entire Hanford Reservation in south central Washington, now split among five contractors. The move is supposed to boost efficiency and centralize authority. Rockwell International will be relieved as manager of the N Reactor.

"National security" reasons require that the plant be kept running, according to Salgado. He did not elaborate. But in a telephone interview, the deputy assistant secretary for nuclear materials, John Meinhardt, said the President sets goals for plutonium output in his "nuclear weapons stockpile memorandum," a classified order that must be obeyed. The most recent goals cannot be met unless the N Reactor is running.

But others point out that DOE is not entirely at the mercy of the White House in these matters. DOE officials help draft the stockpile memorandum for the President. Many observers are skeptical of the DOE appraisal of the need for plutonium, noting that people who have made a career of manufacturing plutonium and weapons may not be able to give impartial advice.

In the name of national security, DOE resisted closing the N Reactor last July when a proposal to do so came before the House. Representative James Weaver (D-OR) wanted it shut down until the safety reviews were finished. His amendment failed. Rod-

dis is struck by the difference between the government's approach to safety in its own plants and its tough handling of commercial reactors. He writes: "A commercial reactor faced with such a large number of recommendations [for safety improvements] would very likely be forced to close until all were completed." But DOE would not turn off the N Reactor, and at this writing, it still has not.

In the House debate in July, loyalists of the N Reactor gave many reasons for keeping it running. Many cited its 23 years of safe operation. Sid Morrison (R-WA) said: "There have been no nuclear accidents with any significant consequence or offsite impacts. So why turn it off now? There is no justifiable reason." Tom Beville (D-AL) chairman of the committee that prepares DOE's budget, said: "The plant has been operating safely for 23 years and there is no reason to think that it will not operate safely for another 23 years, if that is necessary."

Supporters also saw the plant's complex technology as a virtue. John Myers (R-IN) spoke of the "tripled" safety systems and the computer that monitors temperatures in the core and is capable of shutting down the reaction. Norman Dicks (D-WA) was impressed by the "several feet of reinforced concrete and a cylindrically shaped confinement system of vents and filters designed to control and minimize a radioactive release."

These statements reflect assurances given earlier by DOE. General manager of the Hanford Reservation, Michael Lawrence, testified in May about the N Reactor's "multiple-redundant systems," and its "thick, reinforced concrete biological shield."

In June, DOE issued a "Technical Safety Appraisal of the N Reactor" finding "no indications" that "employees or the public are being subjected to unacceptable risks."

The outside reviewers do not paint such a rosy picture. Lewis writes that it is "statistically specious" to argue that because the N Reactor has run safely in the past, it will run safely in the future. The catch is that the N Reactor is unique. (Among other things, it has the highest peak power level—4000 megawatts thermal—of any reactor in the United States.) Therefore, the N Reactor's 23-year record is a weak basis on which to make any prediction.

The outsiders have many other safety concerns, including:

Graphite swelling. Miles Leverett, a consultant on the N Reactor since its construction, learned in August when visiting the plant that the graphite moderator blocks are swelling faster than previously realized. Until recently, they were shrinking. The back-and-forth distortion has bent some process tubes first inward, then outward.

The graphite literally will "hit the roof" in 1990 or 1991, Roddis says, forcing a shutdown. Leverett writes that it would be a waste of money and an added risk to workers' health to replace the graphite. He prefers to replace the entire reactor, but thinks it can be run safely for a few years. The reports do not stress the point, but some of the reviewers agree privately that no one knows exactly how rapidly the graphite will swell from this point on, for experience is a poor guide. The plant is operating near the limit, but no one can see just where the limit is.

Tube embrittlement. The N Reactor contains over 1000 metal process tubes that isolate the fuel rods and high-pressure hot water from the graphite. Neutrons from the fission reaction bombard the tubes when the reactor is running and make it more brittle. The tubes will reach their design limit for toughness in 4 or 5 years, according to Roddis. Pigford says 5 years. The tubes are now under stress from the distorted graphite, and Roddis says, "I understand there are a number of tubes you can't see through from one end to the other."

Roddis is concerned that a tube could split along its length, spraying steam onto the hot graphite, perhaps breaking other tubes nearby, and causing a catastrophic accident. DOE's analysis assumes that if a tube breaks, it will crack along the narrow dimension.

Hydrogen explosions. During a severe accident, chemical processes could generate a large amount of combustible hydrogen. Studies assume that safety systems would prevent a large buildup of gas so that the explosive limit would never be reached. However, similar assumptions led people to minimize potential hydrogen problems in commercial reactors, and the accident at Three Mile Island proved them wrong. The hydrogen "burn" at Three Mile Island was restrained by the strong containment building.

The N Reactor's confinement system could not withstand a large hydrogen explosion, according to Pigford. The uncertainties in this area, he says, are "unacceptable and should be resolved with the highest priority." Others agree.

Weak confinement. The N Reactor uses a complex, interactive valve system for preventing the escape of radioactivity in an accident, rather than a rigid shell. Several reviewers say the assumptions that underlie it have never been tested. Wilkinson writes that a major accident at the N Reactor could cause a "containment failure similar to that at Chernobyl." But, because there are fewer people in southern Washington than in the Ukraine, the impact would be less severe.

On this reasoning, he concludes that a Chernobyl-style accident "is not plausible at the N Reactor." DOE official Salgado says there are no plans to install a rigid containment because it would cost too much. But the present system will be thoroughly tested in the next few months.

Remote control room and maintenance. Several reviewers were surprised to find that the N Reactor has no mechanism for remote operation or shutdown. They urge that a remote shutdown device be installed immediately. Pigford is dismayed that the plant has no "on-line" testing of radiation levels for the reactor coolant system. Samples must be taken manually. "Temperature and pressure control equipment for nonradioactive samples is in disrepair," Pigford reports. Standards are exceeded regularly, causing more rapid corrosion and subjecting workers to greater exposure. "On-line sampling should be restored," he writes.

Management and peer review. All six reviewers find the management to be somewhat lax, described by Lewis to have the feel of "a family operation." They recommend that workers be taught greater respect for safety rules. All urged DOE to create a permanent, independent oversight body. At the press conference, Salgado said no action is being taken on this until DOE receives additional policy recommendations from the National Academy of Sciences next spring.

Some of these concerns will be addressed in the 6-month period of renovation, but not all. For example, it is not clear that there is any cost-effective way to deal with the swelling graphite or tube embrittlement. A lengthy memo from Mary Walker, DOE Assistant Secretary for Environment, Safety, and Health, promises that many of the safety issues will be remedied in the accelerated fix-up program. Some issues will not be tackled until next spring when DOE has completed a probabilistic risk assessment of the entire plant, dealing with severe accident possibilities. Meanwhile, attorneys for the National Resources Defense Council have asked the government to delay all work on the reactor until a full environmental impact statement has been prepared. They will take the issue to court otherwise.

DOE has committed itself to a strenuous catch-up program aimed at bringing the N Reactor closer to parity with civilian safety standards. When all is done, however, it will not begin to meet "normal" risk expectations. In the coming weeks, DOE will have to consider whether it is worth the \$50 million, the continued public risk, and the excess irradiation of workers that will be required to bring this plant on-line for its last gasp. ■ **ELIOT MARSHALL**