DOE Decides TVA is Cheapest, Most Flexible Option to Produce Tritium for Nuclear Weapons

Three successive Energy Secretaries have pondered the problem of how best to produce tritium gas for nuclear weapons. Tritium, a hydrogen isotope that decays at a rate of 5.5% per year, is used to increase the yield of nuclear weapons. The gas hasn't been generated for US warheads since 1988, when the last tritium-producing reactor at the Savannah River site near Aitken, South Carolina, was shut down for safety reasons. Each year that went by since, the Pentagon and some members of Congress have reminded the Department of Energy that tritium will be needed to refresh the aging warheads in the weapons armory.

With the end of the cold war race to provide a robust and reliable nuclear arsenal, the need for tritium abated. DOE weapons scientists claimed no new tritium would be needed under the Strategic Arms Reduction Treaty until 2005, and if START II is implemented by both the US and Russia, no tritium would be required until 2011. In the interim, DOE would simply recycle existing tritium from dismantled warheads. Even so, the Pentagon and Congress reminded DOE leaders, the department needed to decide how to come up with a steady supply of tritium. To do so, DOE had several options: build a linear accelerator dedicated to tritium production at Los Alamos National Laboratory or at Savannah River, reactivate the Fast Flux Test Reactor at the Hanford Reservation near Richland, Washington, buy a commercial nuclear power plant from an electric utility or, perhaps, purchase surplus tritium from Canada or Russia. The last choice would require changing the law forbidding such transactions to meet national security needs.

Though on the job only since August, Energy Secretary Bill Richardson took a bite into the vexing bomb problem and, on 22 December, announced that none of the usual options are acceptable. DOE preferred to produce tritium in the Tennessee Valley Authority's electricity-producing nuclear reactors.

In a press briefing at DOE headquarters, Richardson said the decision to use TVA's reactors had been based mainly on the issues of cost and flexibility. The cost will be "far less" to use the Watts Bar and Sequoyah reactors in Tennessee than the cost of the proposed particle accelerator (estimated at $6 billion) or of adopting TVA's proposal to complete its unfinished Bellefonte reactor in Alabama ($2.3 billion).

The TVA decision, which still must be approved by Congress, is "the best deal by far" for taxpayers, said Richardson. It requires no capital expenditure because TVA's reactor power plants are government owned and fully paid for and production is based on a proven technology, he added. TVA will provide the irradiating service at actual cost, though Richardson would not say how much that may be since the cost has yet to be negotiated. It also is the most flexible option "to meet our present and future tritium needs," said Richardson, because no tritium will be made unless and until it is needed.

At his briefing, Richardson acknowledged that the arrangement with TVA crosses a longstanding line separating civilian and military nuclear activities. Still, he said, using TVA's power reactors encourages nuclear nonproliferation because it avoids building an expensive new military facility. Richardson said DOE had used provisions of a 60-year-old law, the Economy Act, to require TVA to sell tritium at cost. Department officials said that if they had not been able to strike a deal, they would have asked the Navy to requisition the reactors under existing national security laws.

The decision drew sharp reactions. By violating the separation of military and civilian nuclear operations, some arms proliferation specialists say it undermines the US position in asking other countries not to divert materials from their civilian nuclear programs into weapons. DOE contends, though, that unlike plutonium, which is made in reactors, tritium is not controlled by law and cannot be used by itself to make a bomb.

The Alliance for Nuclear Accountability, a coalition of 28 environmental and peace groups, located mostly around DOE weapons plants, argued that the decision is "unnecessary and undermines nonproliferation efforts,

TVA'S WATTS BAR NUCLEAR REACTOR: Operating since 1996.

TVA'S SEQUOYAH NUCLEAR PLANTS: Operating since 1981.

wastes taxpayer dollars and threatens public health." At the Nuclear Control Institute, a Washington-based group advocating nonproliferation, Paul Leventhal, its president, said Richardson's plan is "a good decision as far as it goes" and gave him "high praise" for rejecting construction of a new military production plant. He agreed that existing reactors are "the cheapest, most assured method of producing tritium on an as-needed basis," but, he noted, such use should be reserved for national emergencies.

In Congress, Representative Edward J. Markey, a Massachusetts Democrat, opposed the plan, saying that DOE would be violating the separation of military and civilian production of nuclear material and that the plan is fundamentally inconsistent with US nonproliferation policy. Just last December, the US bombed Iraq because "we were concerned that Saddam Hussein was using civilian facilities to produce the materials and components of nuclear explosives and other weapons of mass destruction," said Markey in a statement. "Now, we are turning around and proposing to convert a civilian nuclear power plant here in the US into a nuclear bomb factory. That is fundamentally inconsistent with our broader nonproliferation strategy."

Last year, Markey and Representative Lindsey Graham, a South Carolina Republican, were successful in attaching an amendment to the defense authorization bill that would have prevented the use of civilian reactors for making tritium. The amendment was subsequently jettisoned by the Senate, but the two chambers agreed to prohibit DOE from spending any funds to implement a tritium decision in fiscal 1999. Markey and Graham intend to reintroduce a version of their amendment this year, and a Graham aide predicts a "healthy and robust debate" when it comes before the House. DOE expects to present its implementation plan to Congress by the end of February.

Richardson's decision will expand a 15-month-old Department of Energy demonstration project at the Watts Bar reactor, in which metal absorber rods containing an isotope of lithium are inserted into reactor fuel elements to produce and capture tritium. When the rods are struck by the neutrons that sustain the chain reaction, the lithium breaks up into tritium and helium. Technicians will remove the rods later this month, when the reactor is shut down for refueling, and extract the tritium. DOE's plan also holds open the option of using one or both of the Sequoyah light-water reactors to augment the supply of tritium.

The method for making tritium at Watts Bar does not reduce the electrical output of the plant, DOE engineers assert, and they expect to persuade the Nuclear Regulatory Commission that it poses no additional safety risk.

DOE claims it needs about 5.5 pounds of tritium per year, beginning in 2005, to sustain the arsenal, and 3.3 pounds by 2011 if the START II agreement is in effect. **IRWIN GOODWIN**

Washington Ins & Outs

New Leaders at RPI and AUI; Changes at NASA and NSF

Rensselaer Polytechnic Institute, one of the earliest universities in the US to offer science and technology instruction, has selected **Shirley Ann Jackson**, a condensed matter physicist who is chairwoman of the Nuclear Regulatory Commission, to be its next president. RPI was founded in 1824 in Troy, New York. Jackson will be the first African-American woman to head a leading research university. Her presidency will start on 1 July. She succeeds R. Byron Pipes, a mechanical engineer who became president in 1993 and left office last April.

As head of the NRC since 1995, Jackson restored the agency's credibility and improved its monitoring of nuclear power plants in the aftermath of several troubling accidents—particularly at the Three Mile Island reactor in Pennsylvania and the Northeast Utilities Millstone Point reactor in Connecticut. She has described herself to interviewers as a "change agent," and, in fact, the phrase characterizes her career. As an undergraduate at MIT, for instance, she was a founder of the Black Students Association and helped increase the number of African-Americans entering the university from 2 to 57 in just one year. She went on to earn a PhD in physics at MIT, the first black woman to do so.

Jackson was a researcher at AT&T Bell Laboratories in 1976–91 and then taught at Rutgers University for four years. She has served as a trustee of both Rutgers and MIT, where she was also on the board of directors and the board's executive committee. MIT's president, Charles M. Vest, said that Jackson has been one of a handful of his close personal advisers. "That calm, reasoned voice on the other end of the telephone has been a source of strength and wisdom for me," he noted. "She will be a truly outstanding university president."

Riccardo Giacconi, director general of the European Southern Observatory, which operates observatories in Chile's Andes Mountains, will become president of Associated Universities Inc when his term ends at ESO on 1 July. ESO, headquartered in Garching, near Munich, has appointed **Catherine Cesarsky**, who headed the *Direction des Sciences de la Matière* at France's *Commissariat à l'Energie Atomique* since 1994, to be its new director general as of 1 September.

AUI is a not-for-profit science management organization that runs the National Radio Astronomy Observatory (NRAO) under a cooperative agreement with the National Science Foundation. In 1946, AUI was founded by nine research universities in the northeast US to build and manage Brookhaven National Laboratory on the site of an Army base on New York's Long Island. In 1997, a public controversy erupted when trace amounts of tritium were detected in the lab's groundwater. The source of the tritium was identified as the spent fuel storage tank of Brookhaven's High Flux Beam Reactor. Federico Peña, then Secretary of Energy, terminated AUI's contract to operate the lab (see PHYSICS TODAY, May 1997, page 45). AUI continues to manage NRAO and its facilities in Charlottesville, Virginia and Tucson, Arizona.

Prior to his appointment at ESO, which operates the La Silla and Paranal Observatories, Giacconi had served as director of the Hubble Space Telescope Science Institute near Baltimore in 1981–92. Before that, he was engaged in research at Princeton University, American Science and Engineering Inc and Harvard University's Center for Astrophysics. He is best known in scientific circles for his pioneering contributions to x-ray astronomy, particularly in the revelations of the orbital Einstein Observatory, which operated from 1978 to 1981.

Giacconi's recent appointment was hailed by Paul Martin, a Harvard physicist and AUI's board chairman. "It's hard to imagine anyone better qualified," said Martin. "His foresight has been at the heart of great astronomical ventures, including the Ein-