

Book Review

Tritium on Ice: The Dangerous New Alliance of Nuclear Weapons and Nuclear Power

by Kenneth D. Bergeron

REVIEWED BY JAMES CLAY MOLTZ

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Kenneth Bergeron's book *Tritium on Ice* (MIT Press, 2002) is a disturbing account of the 1998 U.S. decision to allow the production of tritium for nuclear weapons in *commercial* reactors, breaking a decades-long taboo. The author argues forcefully that the tritium decision is bad for the United States from two perspectives: 1) nuclear safety; and 2) nonproliferation policy. Bergeron's well-written narrative offers a fascinating historical, technical, and political account of this complex and poorly understood issue.

Tritium on Ice pulls no punches, charging that the U.S. system of decisionmaking for nuclear safety is plagued by internal malaise and run by "bureaucrats who have lost their compass" (p. 167). His description of the Department of Energy (DOE) portrays "a vast, loosely coordinated collection of bureaucratic fiefdoms" that are "hamstrung by conflicting internal requirements and paralyzed by deeply embedded no-win situations for its leaders" (p. 11). In this context, it is small wonder, he argues, that decisions end up being "controlled by political game players and their captive technical specialists" (p. viii).

Bergeron's book joins a recent series of studies by journalists drawing on newly declassified documents to shed

light on previously hidden problems within the Cold War nuclear complex. Such books as Len Ackland's *Making a Real Killing* (University of New Mexico Press, 1999) about the highly contaminated Rocky Flats site in Colorado and Eileen Welsome's *The Plutonium Files* (Dell Books, 2000) on America's secret medical tests on unknowing U.S. patients have shown how secrecy kept citizens from knowing about serious breeches of trust and safety during the Cold War.

But what makes Bergeron's critique so compelling is that he is not a journalist, but a scientist—an "insider"—with 25 years' experience at Sandia National Laboratories working on nuclear safety issues. It is Bergeron's *professional* frustration with a system run amuck that led him to write this book, not his rejection of nuclear power or even nuclear weapons.

Bergeron's main gripe is that a system that is supposed to be preventing proliferation of material and know-how, while keeping nuclear facilities from harming U.S. citizens in an accident, has now shifted to putting a premium instead on mere cost savings and convenience, hardly the criteria to be used in cases of national security policy. In particular, he criticizes the eventual choice of probably

the worst reactors in the U.S. nuclear complex for the tritium job: antiquated models under the Tennessee Valley Authority (TVA) that rely on ice-filled containers to prevent severe accidents—hence the title of the book. How could such a lowest-common-denominator approach have prevailed?

Bergeron says that this is “not a tale of dark deeds” (p. 167). Instead, it is a transparent but highly flawed system of nuclear safety decisionmaking that is now compromised by a deadly combination of industry, DOE, and Congressional pressures on the Nuclear Regulatory Commission (NRC) that makes it impossible for the NRC to do its job. The current situation did not appear overnight, which is why Bergeron spends so much time on the early history of the civilian nuclear power sector in the United States, its subsidization by the federal government, and reasons why its associated regulatory bodies have failed to live up to their responsibilities, even after the frightening lesson on the possibility of catastrophic accidents provided by the Three Mile Island incident in 1979.

Much of the book focuses on the somewhat arcane but clearly important science of nuclear accidents, where researchers attempt to model what could possibly go wrong with multiple systems in order to prevent these events from actually occurring. Notably, it was not until 1974 that the Atomic Energy Commission (AEC) gave up its conflicting responsibilities for nuclear safety and promotion, when it was split into a separate regulatory body (the NRC) and a body focusing on U.S. energy needs, which became the job of the DOE. Yet, the structure of the NRC’s setup and the nature of its staffing and financing (eventually paid for by industry) meant that it failed to develop a strong and independent safety culture.

According to Bergeron, the U.S. nuclear program in the 1950s and 1960s looked like a strange science project run wild. Having built the bomb, the AEC was committed to showing that nuclear power could also be used for peaceful purposes. Thus, despite the abundance of cheap oil throughout this period, U.S. domestic nuclear plant construction moved forward with rapid abandon, similar to the pro-nuclear aims of the misguided Atoms for Peace program abroad, which also later ran into trouble. Even at home, nuclear safety standards emerged largely as a *post facto* necessity rather than a carefully thought-out plan to protect citizens and the environment.

Crafted by the same AEC that was promoting nuclear power, the eventual regulations were highly forgiving of design flaws and allowed dubious assumptions about the impossibility of full core meltdowns to guide regulations.

As Bergeron notes, “by allowing severe accidents to be disregarded entirely, the government invited design choices that were unwise” (p. 42). One of these was the “ice-condenser” reactor, which economized on the cost of building a full containment structure by offering instead a system where piping flowed through canisters of flaked ice to provide supplemental cooling. Bergeron says that subsequent studies highlighting the dangers of these reactors were suppressed by DOE, itself pressured by a nuclear industry that had fallen deeply into debt after over-expanding. In these conditions, the NRC ended up “grandfathering” the ice condensers rather than shutting them down, despite known problems.

Among the various operators, Bergeron argues that the Depression-born TVA emerged as one of the worst safety violators. Weaned on a culture of “rolling up its sleeves”—to build large dams and other public works projects—the TVA for decades resisted outside advice. Alone among nuclear operators, it constructed nuclear plants using its own designs and engineers, rejecting the notion of hiring contractors with greater experience. The result was an internal culture that treated safety inspectors as foreigners and silenced whistle blowers within its workforce by shifting them to other responsibilities or firing them.

To set the stage for his account of the tritium decision, Bergeron describes in great detail the decision in the early 1970s by strongly “free market” lawyers under President Richard Nixon to privatize enrichment services. They hoped that by making supply contracts so onerous on existing users (including those abroad) they might stimulate demand for private competitors. But the plan backfired. Instead, the new U.S. stinginess only stimulated the very kind of proliferation-prone, foreign enrichment programs that the Atoms for Peace program had hoped to pre-empt in setting up the contracts in the first place.

This dangerous effort and the corresponding (but failed) attempt by President Jimmy Carter to gain agreement on strict controls on enrichment at the international level show the risks the U.S. government took when it placed economics ahead of national security in its nuclear policy. This tendency, which Bergeron argues has only grown over time, has caused the United States to lose sight of the fact that its main goals must remain the prevention of accidents and nonproliferation of nuclear weapons.

THE TRITIUM DECISION

In the 1950s, scientists discovered that radioactive tritium (a rare isotope of hydrogen) could be used to boost the power of nuclear weapons. It is the “hydrogen” in the hydrogen bomb. During the Cold War, the United States produced tritium at Savannah River, South Carolina.

Given the sensitivity of this material, U.S. policy from the very beginning required that production of tritium and other materials for nuclear weapons be kept separate from facilities engaged in commercial nuclear operations. The rationale behind this directive was three-fold: the need for greater secrecy at weapons plants, the desirability of their isolation from population centers in case of an accident, and the goal of setting a good example for other countries in not using civilian programs for secret weapons purposes.

In the late 1980s, however, post-Three Mile Island NRC safety regulations caused a number of military production reactors to be shut down, due to their vulnerability to accidents and lack of adequate containment structures. This group included the K Reactor tasked to produce tritium at the Savannah River site. This halt in tritium production led the Bush administration to look for alternative means of producing future tritium.

According to Bergeron, a number of competing designs were considered in the late 1980s: including construction of a new heavy-water reactor, retrofitting the existing plant with new safety features, and experimenting with a Modular High-Temperature Gas-cooled Reactor. But success in the arms control sector in 1991 (with the START I agreement) reduced the urgency of the problem, as tritium from dismantled weapons would now be available in considerable quantities to “top up” old warheads, in which tritium gas significantly deteriorates within 10 years. Thus, other options could be considered.

Under the Clinton administration, another tritium production option was an expensive yet safe accelerator-based production plan. A far murkier plan began to be cooked up by the TVA. Heavily in debt from over-expansion in the nuclear sector and strapped for funds to finish a long-stalled reactor at Bellefonte, Alabama, TVA officials saw the tritium option as a means of salvaging their investment. The plan pushed by the TVA envisioned the government paying to complete the reactor, which would be devoted to military purposes, although the steam produced by the reactor could be sold to commercial electricity producers. Still, DOE balked at the cost of the project and studies criticized

the precedent it would set in mixing commercial and military work.

Although Bergeron praises Secretary of Energy Hazel O’Leary for her policies of nuclear openness, he faults her for reversing a negative Environmental Impact Study on the commercial option just as she was leaving office. Her decision opened the door for considering an exception for tritium from the ban on creating weapons materials in commercial facilities.

Bergeron says that an interagency study called for by the U.S. Congress only further whitewashed the issue by arguing in a short 10-page memo (instead of a full report) that commercial tritium production would break no laws. The memo, however, made inappropriate (according to Bergeron) parallels between the past sale of steam (hardly a dangerous commodity) by Hanford production reactors and plans to create tritium (a critical weapons material) at a commercial facility.

Based on this report, entering Energy Secretary Bill Richardson decided to take the decision one step further, largely because of cost considerations. He shocked TVA officials by announcing in 1998 that DOE would produce tritium not by finishing the Bellefonte reactor as a devoted tritium producer, but by renting space in the existing reactor at Watts Bar, Tennessee, for periodic “irradiation services,” thus saving considerable funds. According to Bergeron, however, the decision blithely ignored a welter of previous reports regarding safety hazards and proliferation risks at this civilian ice-condenser facility. He calls the decision made by Richardson, a former professional baseball player, a “moral lowball” (p. 137).

Bergeron argues that the new demands for secrecy at the Watts Bar facility will end up compromising safety even more, complicating an already difficult job with the ice-condenser design. Based on the many safety studies he cites, this is a sobering warning indeed, given the proximity of the population center around Chattanooga to Watts Bar.

In the aftermath of 9/11, Bergeron also makes a case against the Watts Bar decision on proliferation grounds. He asserts that secrecy will undoubtedly fail at this civilian facility and that design information will inevitably get out to rogue states and even to non-state actors that will seek to boost the power of their nuclear devices. “If tritium were available, why would this hypothetical nation or group not take that additional step?” (p. 87). While this risk may indeed be a serious one, Bergeron fails to connect the dots for the reader as to how exactly this chain of events would occur, even at Watts Bar. Still, even if the likelihood of its occurrence might be somewhat lower

than Bergeron suggests, one can fairly ask: Is this a risk worth taking?

Although the book is extremely well researched, Bergeron's history has a few small gaps and oversights. He fails to mention the role of the Zangger Committee in nuclear export controls, focusing only on the Nuclear Suppliers Group. He also hints at past problems in export controls by mentioning India, Israel, and Pakistan, but he fails to spell out the role of foreign technology in these countries' eventual nuclear weapons programs. Non-specialist readers may have trouble making this linkage themselves.

Given the raft of problems Bergeron aptly portrays in the 1998 decision, his conclusion appropriately returns to the underlying issue: "Why do we even need new tritium?" Here, however, Bergeron's considerable reliance for his case on START II and its necessity for the actual dismantlement of nuclear weapons is unfortunate, given the treaty's demise since the book went to press. Under START II, studies cited by Bergeron indicated that new tritium might not be needed for weapons until 2029. Without it, this need may come considerably sooner.

The Bush administration's January 2002 Nuclear Posture Review, which calls for a large reserve of nuclear

weapons, and the decision not to require warhead dismantlement in the May 2002 Moscow Treaty, suggest that less tritium will likely be available for refurbishing old warheads than would have been anticipated under START II. Regrettably, this situation will provide further support to those who see early production of tritium as necessary, exposing the very risks that Bergeron outlines. In this regard, it is hard to argue with Bergeron's more general conclusion that "something is wrong with the priorities" of current U.S. nuclear policy.

Tritium on Ice provides another reason why dismantlement of warheads should be in U.S. national interests. Failure to dismantle warheads creates a backdoor excuse for renewed production of tritium—a technology no one should want to see proliferated.

Fortunately, whether or not new tritium is eventually produced, the U.S. decision to rely on the commercial reactor at Watts Bar and cross the line between weapons and civilian facilities is still reversible. This is the one measure of hope that comes from Bergeron's book. Time will tell if members of Congress and future administrations will heed Bergeron's sobering advice.