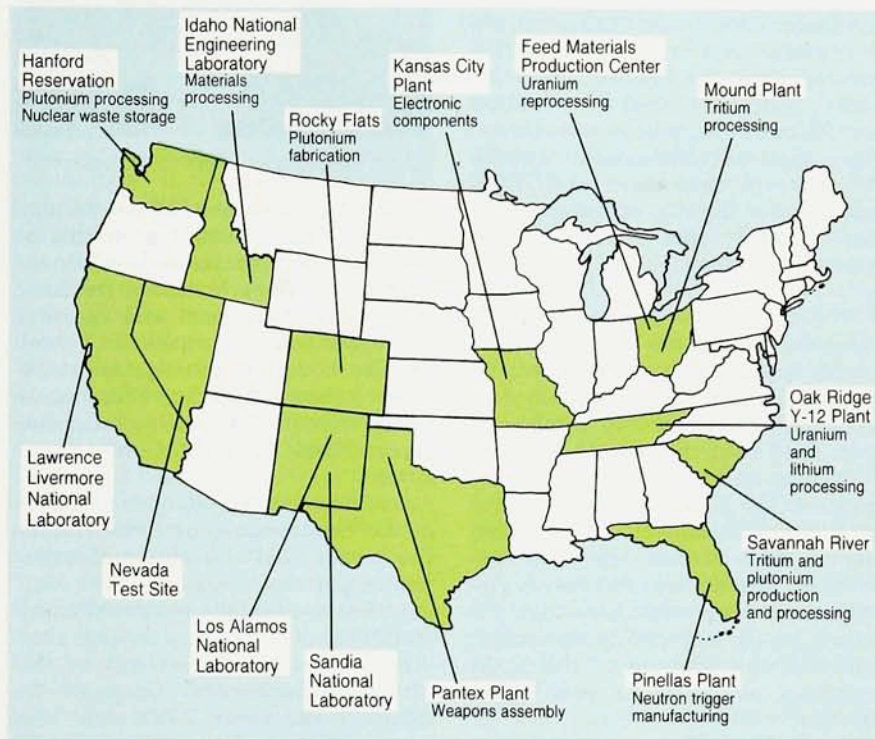


PERILS OF AGING US WEAPONS PLANTS STIR OUTRAGE AND FEAR OF A 'TIME BOMB'

The irony is inescapable: It is open season on US defense materials plants, which have been virtually off-limits to public scrutiny since they began producing isotopes for nuclear weapons in strict secrecy in the early 1950s. Suddenly the old and new problems at the reactors making bomb-grade chemicals and the factories processing the stuff are being exposed in Congressional hearings, front-page stories and television news shows. To many in Washington and across the country, the revelations of technical mishaps and radioactive spills almost defy belief.

The scope and seriousness of the troubles, which, it now appears, have plagued the plants virtually from their start, caused members of Congress who saw the reports and heard the testimony of investigators in late September to warn of disasters waiting to happen. If the defense reactors had been commercial power plants, said Senator John Glenn, an Ohio Democrat, they would have been closed years ago. Senator Ernest F. Hollings, a Democrat from South Carolina, where the Savannah River plutonium and tritium production complex is located, demanded an independent inquiry into all weapons materials facilities. "The plants must be run in ways that protect both the nation's defense and the workers' safety," said Hollings.

The intense scrutiny now being given the nation's weapons production plants began soon after the disastrous fire half a world away in a reactor at the Soviet Union's Chernobyl complex in 1986. To his credit, Energy Secretary John S. Herrington responded promptly to Chernobyl. He asked the National Research Council to study DOE's defense materials reactors and mobilized the department's own safety experts, known as "junkyard dogs," to examine the problems of all 14 nuclear installations. Herrington's most immediate worry was the N-Reactor at the Hanford Reservation, located near Richland, Washington. Built in the early



Major facilities of DOE's nuclear weapons complex.

1960s with a life expectancy of 20 years, the N-Reactor was most nearly like the RBMK-1000s at Chernobyl. All are graphite-moderated, water-cooled and without a concrete containment dome capable of withstanding steam and hydrogen explosions that might occur in a runaway accident.

Although a DOE team had looked at the N-Reactor and decided nothing drastic had to be done, Herrington appointed six nuclear plant specialists to perform separate reappraisals. On the basis of the team's reports citing faulty equipment, "widespread complacency" about safety among workers and managers, and practices that left Hanford the world's biggest waste dump, he ordered the reactor shut down (PHYSICS TODAY, February 1987, page 63.)

The most recent incident occurred on 29 September at the Rocky Flats plutonium-processing center near

Golden, Colorado. A DOE inspector and two employees of Rockwell International Corp, which manages the installation, received small doses of plutonium radiation when they walked into an unmarked room of Building 771 where workers were cleaning contaminated equipment. The building, which is central to reprocessing plutonium, was closed on 8 October. Three days later DOE was under assault for numerous instances of accidental leaks and deliberate dumps of uranium waste at a processing plant outside Fernald, Ohio. The state's governor, Richard Celeste, demanded that the facility be permanently closed. "If terrorists had buried all that uranium there, there would be strong action taken immediately," he declared. "In this case, it was our own government that left the time bomb."

Over the past 33 years, though, the most perturbing problems took place

ELLIOT ROTHMAN/PHYSICS TODAY

at the five reactors of the Savannah River complex, near Aiken, South Carolina, operated from the start by E. I. du Pont de Nemours Inc. In April the P-Reactor was shut down for improvements to its safety systems. When technicians attempted to restart it in August, they encountered a power lag that prevented a sustained reaction. When they tried again two days later, the reactor suddenly experienced an unexpected neutron surge. The operators stopped it within minutes by reinserting the control rods. DOE safety teams rushed to the Savannah River facility to investigate the trouble and, to their horror, discovered that the reactor operators had neither understood the situation nor followed the proper procedures. The inspectors recommended that the P-Reactor be shut down until DOE was satisfied that the operators could run it safely (see *PHYSICS TODAY*, September, page 47).

'Prelude to disaster'

Meanwhile, accounts of the incident began appearing in newspapers in South Carolina and in Washington, DC. Nervous about the whole episode, DOE shut the reactor down on 17 August and initiated a full safety review of the plant. A memo written by Richard Starostechi, whom Herrington had brought in from the Nuclear Regulatory Agency to be DOE deputy assistant secretary for safety, health and quality assurance, criticized the attitude of the plant operators as being "a prelude to disaster."

The P-, K- and L-reactors at Savannah River are currently the sole suppliers of plutonium and tritium for the nation's nuclear arsenal. Because plutonium has a half-life of about 24 400 years, there are abundant quantities for US nuclear weapons. In fact, Herrington told a Congressional committee last February, using an apt if somewhat disconcerting metaphor, the nation is "awash in plutonium." The real cause for concern is tritium, a hydrogen isotope that boosts the explosive power of nearly all 22 000 US nuclear warheads. Because it has a relatively short half-life of 12.3 years, tritium is in constant demand for topping up warheads. Pentagon sources say that a critical shortage of tritium could compromise national security by next summer and that without production the present stockpile would need to be cannibalized.

While incidents like the one at the P-Reactor have been alarmingly frequent for decades, they have previously been shrouded in secrecy. Indeed,



John S. Herrington: Candor for bureaucrats.

since the Savannah River facility went on line in 1953, top officials in the weapons agencies were routinely kept in the dark about its troubles. Apparently only local and regional managers were informed. In recent months, however, investigators at the Government Accounting Office made public dozens of memorandums and reports that have shattered the silence.

On 30 September, at a joint hearing of the Senate Governmental Affairs Committee and the House Government Operations Subcommittee, Senator Glenn voiced the worries of many members of Congress, saying that "there seems to be no end to the problems uncovered." Congress decided in the early 1950s that the Atomic Energy Commission should keep civilian nuclear plants scrupulously separate from military ones. As a consequence, DOE answers only to itself for safety at its nuclear operations.

Critics have long assailed DOE's lack of external oversight as a formula for failure. Some have urged that all reactors and processing facilities be routinely inspected by the Nuclear Regulatory Commission, which has rigorous procedures and trained staff to do the job. After Glenn and Representative Mike Synar, Democrat of Oklahoma, released memorandums and reports documenting the failures at Savannah River and other facilities, Herrington was forced to concede DOE's haphazard oversight. He now admits that safety was frequently overlooked in pursuit of maintaining production schedules for weapons. "Things got too cozy" between DOE managers and plant operators, says Herrington. In the event, DOE made public some unsettling accounts of years of chaotic and complacent oper-



Richard E. Hecker: "Bum rap" for du Pont.

ations.

Among the most damaging evidence is a 1985 memorandum, by du Pont plant supervisor G. C. Ridgely, listing 30 "reactor incidents of greatest significance" at Savannah River between 1957 and 1985. The specific problems included an accident in 1970 in which two fuel rods were inadvertently allowed to melt, resulting in radioactive contamination inside the reactor core; in 1960, as a reactor was being restarted, operators allowed it to run wild, causing a volatile power burst more than 12 times faster than what is considered safe. Many of the reactor incidents were attributed by Ridgely to "gross procedural violations."

Another memo, prepared by du Pont engineer Frederick Christensen when he retired in 1981, stated that an incident in 1965 could have turned into a catastrophe when a foreman attempted to stop a coolant leak by closing off the flow of water to the reactor. That act was prevented by a senior supervisor, who realized that a steam build-up might follow and possibly cause an explosion. Christensen wrote at the time, "One trained man stood between us and disaster."

Synar released a report by the NUS Corp, dated May 1988, reviewing the operating history of the Savannah River complex through 1987. The NUS document cites dozens of radioactive spills and worker exposures. Another report, written by an official at DOE's Idaho Operations Office, discloses as many as 43 unplanned reactor shutdowns per year at Savannah River—far greater than the number of similar shutdowns at commercial power plants.

DOE officials now admit that the department and its predecessor agencies, AEC and the Energy Research

and Development Administration, withheld reports about serious accidents from the public. Glenn Seaborg, a former AEC chairman, does not recall being informed of many of the incidents now coming to light. Robert C. Seamans Jr., the onetime head of ERDA, speculates that local managers and agency officials did not pass on accounts of accidents for several reasons: They might worry administrators unnecessarily, draw blame to plant operators, panic local citizens if the incidents were announced publicly, and suggest that the system was incapable of producing adequate quantities of plutonium and tritium for the nation's nuclear arms. Equally important, an obsession with secrecy in defense matters, a legacy of World War II and the cold war, has been the enemy of free-flowing information even within defense-related agencies. Whatever the reason or reasons, by not passing on reports of incidents at the plants, operators and managers were covering their critical assets.

'A bum rap'

For its part, du Pont, which has been involved in nuclear weapons work virtually since Fermi's first chain reaction in 1942, claimed it had dutifully notified regional Federal offices of the many mishaps at Savannah River. The company's chairman, Richard E. Heckert, held a press conference in Washington on 11 October to defend its record and employees. "Things are fine down there if the government will let us go on with our business," he declared. "It's a bum rap." Du Pont decided last April to give up running Savannah River, which it had operated from the beginning. Westinghouse will take over next April.

Though the troubles at the nuclear defense facilities stunned Congress and the public, most of the incidents in fact should have been familiar. A National Research Council study headed by Richard A. Meserve, who has a PhD in physics from Stanford and a JD from the Harvard Law School, found that safety was being compromised at the plants for decades. The Meserve report, issued in October 1987, chastized DOE on three main counts: failure to set clear safety guidelines; skimping on technical and hardware upgrades that would improve safety and compensate for aging; and neglecting to manage and review the operations of its contractors, with the result that "safety oversight of the production reactors is ingrown and largely outside the scrutiny of the public." The Meserve

report also was critical of the backlog of approximately 200 unresolved reactor incidents—mishaps whose causes remained unidentified and whose solutions were unknown.

A new safety oversight board

Anticipating the Meserve report, DOE closed the Hanford N-Reactor and ordered power levels reduced to 45% of full capacity at Savannah River to reduce stress on the aging reactors. Herrington appointed John Ahearne, formerly chairman of the Nuclear Regulatory Commission and now at Resources for the Future, to head an independent safety oversight board within DOE.

Although DOE and its predecessor agencies had claimed most of the defense reactors could be operated indefinitely, it is now obvious that they either have exceeded their designed lifetimes of 20 years or so or are certainly in need of major overhauls. Cracks in the reactor vessel forced the shutdown of the Savannah River C-Reactor in late 1986. The Meserve report noted that "all of the Savannah River reactors may eventually have to be retired from service due to stress corrosion cracking."

A recent report by the Government Accounting Office warns of deteriorating defense production plants, and it singles out Savannah River as being "less than marginal." According to GAO, operating the defense production plants safely would take between \$15 billion and \$25 billion. But to make improvements at all the facilities, install modern waste disposal equipment and clean up the environ-

ment in and around all the plants would run to at least \$100 billion, according to GAO estimates.

Herrington has already announced plans for the construction of two new production plants, which would cost \$6.8 billion in 1988 dollars and, if construction starts in 1990, would be on line in the year 2000.

A cheaper alternative

Meanwhile, DOE is considering a cheaper alternative that may be ready much sooner: the WNP-1, a conventional light-water reactor at Hanford that was 63% completed before financial problems and uncertainties about future electricity demand forced the owner, Washington Public Power Supply System, to stop construction. GAO has calculated that WNP-1 could be converted into a tritium-producing facility for \$2.6 billion plus an undetermined amount that DOE would pay WPPSS for the reactor. The conversion would take about six years.

Congress has taken action in the 1989 Defense Appropriations Act to make the defense reactors safer. One of the provisions of the act amends the Atomic Energy Act of 1954, in order to create the Defense Nuclear Facilities Safety Oversight Board, an independent organization of the sort that DOE has lacked all these years. The new board would operate like the Nuclear Regulatory Commission, monitoring defense reactors just as the NRC now watches commercial ones.

—IRWIN GOODWIN, WITH REPORTING
BY COREY S. POWELL

ACADEMY OF ENGINEERING SETS UP BIG PRIZE HOPING TO RIVAL NOBELS

The National Academy of Engineering has initiated a grand new international award to honor engineers and technologists for "contributing to the advancement of human welfare and freedom." In creating the award, the academy admits it seeks to bestow an aura of prestige that it considers to be lacking from the public image of the engineering profession. "Our society tends to reward the discoverer of basic scientific principles but overlook the engineer who puts that principle into practice in products and services that yield societal and economic benefits," said Robert M. White, the academy's president, announcing the prize at the academy's annual meeting on 28 September. "We hope that in years to come the award named for Charles Stark Draper will be just as well

known and respected as the Nobel Prizes are today for chemistry, physics and medicine."

That could happen, because the prize is surely sizeable. It will consist of a gold medal and \$350,000, which puts it just below the current value of a Nobel Prize. Endowed by the Charles Stark Draper Laboratory of Cambridge, Massachusetts, the new award will be first presented at the annual meeting of the engineering academy next October and given subsequently every other year.

"It is fitting that the award honors 'Doc' Draper," declared White. His life's work epitomized the kind of far-reaching innovation the new prize will recognize." Born in a small Missouri town in 1901, Draper graduated from Stanford University in 1922