# Reactor troubles highlight safety concerns

One of three defense nuclear reactors at the federally owned Savannah River Plant in Aiken, S.C., was voluntarily shut down last week by E.I. du Pont de Nemours & Co., the firm that operates it under contract to the Department of Energy (DOE). Du Pont acted after an investigation of some unusual behavior by the reactor and questionable behavior by its operators—all occurring as Du Pont employees attempted to restart the reactor following a four-month-long scheduled shutdown for modifications.

According to Roger Rollins, chief of the reactor branch in the DOE's Savannah River Operations Office, the safety of plant workers and nearby residents was never in jeopardy. DOE officials are concerned, however, about the actions of people handling the unexpected startup difficulties, says Will Callicott, a spokesman in the agency's Washington office. Their decision to increase power in the face of uncertainties over the cause of the startup problems "is not something that we [DOE] can tolerate," Callicott told SCIENCE NEWS. It suggests, he says, that procedures "probably need to change."

The incident involved the P reactor, used to produce plutonium and tritium for nuclear weapons. Control rods — which absorb neutrons, and therefore slow or halt nuclear chain reactions—are partially withdrawn from a reactor's core as it is started. Physicists calculated how far the P reactor's 427 control rods should be withdrawn to reach criticality — self-sustaining nuclear chain reactions. But when operators restarted the P reactor on Aug. 7, these calculations proved too low.

As they investigated why, the reactor operators had the choice of shutting the reactor down, maintaining it at current power or increasing its power. They decided to increase power. Then, after a day and a half of problems sustaining its power, the operators shut it down. Analysis showed the reactor was "less reactive" than anticipated owing to a buildup of neutron-absorbing helium-3. A decay product of tritium, this helium was "poisoning" (slowing) the chain reactions.

Rollins says the P reactor's technical staff "just plain made a mistake in determining how much helium-3 was in the fuel elements." He attributes the miscalculation in part to the uniqueness of the situation: Never had one of these reactors been restarted after such a long shutdown, and with fuel that had already been used for so long — 7 1/2 months of the fuel's nine-month operational life.

After shutting the reactor down, operators restarted it again on Aug. 10, and it sustained a minor power surge. Rollins describes this 15- to 20-second-long increase as "very small—less than one-half of 1 percent of power." It's also the type of anomaly that can be due to no more than a minor temperature fluctuation in the reactor's cooling water, he adds.

A week after the surge, Du Pont decided to shut the plant down for tests and a refueling—previously scheduled to occur in mid-September — and conduct a full-scale reevaluation. The DOE and an independent review committee it has dispatched will also examine what happened. Even though there was no safety problem, says Callicott, DOE is concerned "that people operating the reactor were perhaps too quick to conclude that what they had was not a problem."

The safety of the DOE's aging production reactors has come under considerable criticism. Citing safety concerns, the agency closed its N reactor in Hanford, Wash., this year (SN: 3/5/88, p.153). The three remaining defense production reactors, all at Savannah River, were built in the 1950s. Last November, members of a National Academy of Sciences committee issued a report saying it was uncertain how much longer any of these could safely operate. Also unknown, the panel said, is whether two new reactors (now being planned), or alternatives for supplying weapons-grade nuclear materials, will be available before Savannah River's reactors encounter age-related problems precluding safe operation.

The U.S. General Accounting Office (GAO) has issued more than 30 reports in recent years — including four this year — identifying problems with defense reactors. In addition to deteriorating from age, "many facilities were constructed to comply with less stringent codes and standards than exist today," says GAO's J. Dexter Peach. Savannah River's plants "are now only allowed to operate at about half their designed power levels" because of safety concerns, Peach says. But solving their safety, health and environmental problems will be costly — about $20 billion, according to an estimate GAO published in July. *— J. Raloff*

# Take heart: Ventricular tachycardia cure

An improved understanding of the electrical flaws causing rapid heartbeats — or tachycardia, which means literally "heart hurry" — has led cardiologists to develop an innovative treatment for one potentially fatal form of the condition. Cardiologists successfully used electrical shocks to treat seven patients suffering from severe ventricular tachycardia, an abnormal rhythm of the heart's lower pumping chambers, according to a report in the August CIRCULATION.

Such arrhythmias can be difficult to treat with drugs or open-heart surgery, but with electrical shock administered by catheter, Patrick Tchou and his colleagues at the University of Wisconsin in Milwaukee appear to have eliminated the patients' tachycardia. Other researchers previously used a similar approach on arrhythmias affecting the heart's upper chambers.

In pretreatment studies, the Wisconsin scientists pinpointed the patients' tachycardia to a specific conduction defect in the electrical impulses that cause the heart's lower chambers to contract.

"Through excellent deductive reasoning," observes Melvin M. Scheinman of the University of California, San Francisco, in an accompanying editorial, Tchou's group determined the mechanism of the tachycardia. Because the normal circular flow of electricity in these patients' hearts was interrupted by a slowing of conduction in the left bundle branch, consisting of specialized conducting tissue, they reasoned that the right bundle branch would be critical to maintaining the tachycardia, and they destroyed it.

After placing an electrode catheter near the right bundle branch — a "well-defined and accessible electrical landmark" — of anesthetized patients, they administered two electric shocks with the catheter tip serving as the cathode. Following treatment, all the patients recovered from their tachycardia and accompanying fainting spells, although two patients subsequently died of other heart conditions. The rest remained active and symptom-free as much as 55 months after the procedure.

While this particular arrhythmia is not common, it occurs more often than is recognized, the researchers say, and the new treatment not only is "relatively safe" but is "probably preferable" to standard long-term drug treatment, which carries major side effects. All the patients who had tried the drug treatment (six of seven) either could not tolerate it or failed to respond.

While praising the study as a "landmark," Scheinman does say the treatment warrants further critical appraisal before being accepted into cardiologists' clinical arsenal. He cautions that the defect itself can be difficult to detect, even by the most experienced electrophysiologists, and that serious damage to other tissues could occur during treatment. "Application of this technique," he warns, "is not for the novice!"

Scheinman concludes that the discovery nonetheless provides "a potential Rosetta stone" for more precise understanding of the circuits of ventricular tachycardia, and in a field where most treatment remains palliative, it may open the way for further curative techniques without the need to resort to open-heart surgery. *— C. Eron*