

In the Wake of Three Mile Island

On April 27, one month to the day after the Three Mile Island nuclear-power plant near Harrisburg, Pa. was crippled by a series of human errors and equipment malfunctions (SN: 4/7/79, p. 227), the reactor was brought to cold shutdown. The shutdown came five days earlier than expected, as the last remaining pressure gauge failed, according to a spokesman for the Nuclear Regulatory Commission. The reactor core—still about 175°F—will continue cooling indefinitely by the natural circulation of water through the reactor. According to current estimates, it will be at least two years before the plant can operate again.

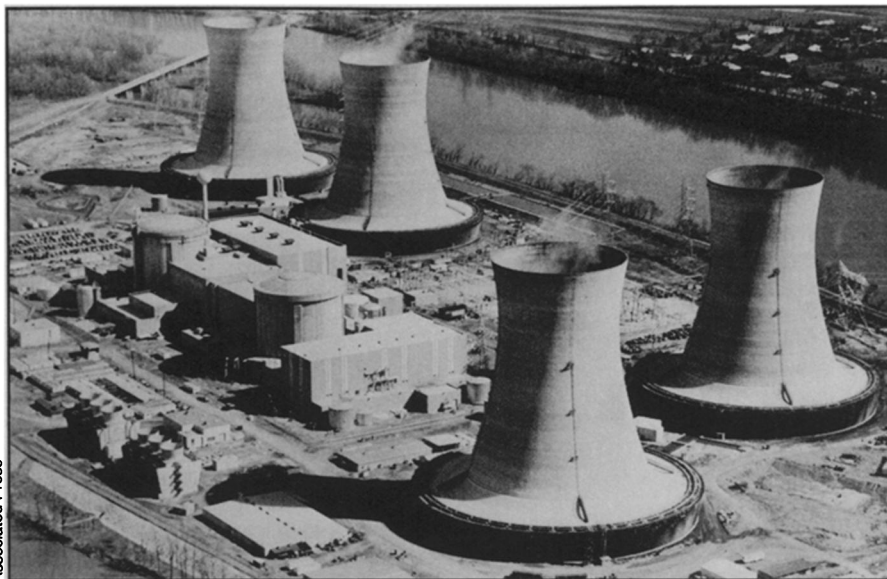
As a safety measure, NRC last week ordered the shutdown of nine other nuclear-power plants—all identical in design to the one that malfunctioned at Three Mile Island—so that safety changes could be made. Five of the nine, already shut down for other reasons, will remain down for the changes. Two others—Rancho Seco 1, near Sacramento, Calif., and Oconee 3, near Greenville, N.C.—were to close last weekend. Oconee 1 and 2 are scheduled to shut down separately by May 19.

Among the changes required by NRC are an improvement in the auxiliary feedwater system that supplies coolant to the reactor's secondary system. Instead of lowering reactor power when there is a loss of feedwater, the system will automatically supply emergency coolant.

Although Babcock & Wilcox Co., maker of all nine plants, feels the shutdown is an "ultraconservative" measure, it expects to recommend reactor-design changes itself within the next six weeks, according to John H. MacMillan, its vice president for nuclear-power generation, who testified at Senate hearings Monday. Babcock & Wilcox is already considering installation of more specific control-board indicators to keep reactor operators better informed of core temperatures, pressure and coolant-water levels.

Perhaps equally important are changes Babcock & Wilcox has already begun instituting in the training of reactor operators who work with its power plants. The changes include recreation of the Three Mile Island accident sequence on its reactor-controls simulator and a stressed emphasis on maintaining core coolant circulation through the reactor at all costs.

According to "one top [Babcock & Wilcox] executive" in the April 26 NUCLEONICS WEEK (a newsletter serving the nuclear industry), "perhaps there was not enough emphasis and reemphasis [in reactor-operator training] on the essential attention that must be paid to maintaining a proper cooling environment for the core." He said that "if the core is uncov-



Accident occurred in the No. 2 reactor, the lower cylindrical building near center.

ered—as happened at Three Mile Island-2—the potential for a serious accident is so great that any other actions by operators become secondary."

MacMillan told the Senate Environment and Public Works subcommittee on nuclear regulation Monday that operator error led to the Three Mile Island-2 reactor's core being completely uncovered for 50 minutes to one hour and partially uncovered for 10 hours. Without coolant, rods housing the fuel overheated, causing extensive damage.

So badly damaged was the core that it now looks like an inverted pyramid of debris and fragmented fuel, according to NRC reports cited in a Washington Post account of a hearing Monday by NRC's Advisory Committee on Reactor Safeguards. NRC representatives reported that 93 percent of the flow path for cooling water through the core is blocked by debris and that resistance to circulating water is twice what it normally is, the Post says.

On the positive side, the nuclear-power industry views destruction of the reactor core as a one-in-a-lifetime "opportunity" to glean actual data and experience on reactor accidents, the problems and hazards of large-scale decontamination and on how well equipment withstands exposure to high-level radiation.

But at least four inquiry commissions will study the Three Mile Island accident to learn something much more basic and perhaps generic to the nuclear-power industry—just what happened, how and why.

A 12-member commission named by President Jimmy Carter and chaired by Dartmouth University President John Kemeny will inspect the plant later this

month. The panel will also hold two days of hearings in the Middletown, Pa., area involving both technical people and local citizens. The Edison Electric Institute, an association of electric companies, is launching its own technical inquiry. In a release announcing the move, EEI said the electric-power industry will also establish a scientific review panel "of experts not associated with our industry to examine the collective industry response to [Three Mile Island] safety reviews." The Nuclear Regulatory Commission expects to begin its own investigation soon and the Advisory Committee on Reactor Safeguards has already begun investigatory hearings.

Among the issues these groups will attempt to sort out are:

- Why a hydrogen explosion that occurred 10 hours into the accident on April 28 was not reported to NRC until April 30.
- Why feedwater-control valves had been locked shut—in violation of the plant's operating license—prior to the accident and why an NRC inspector visiting the plant only days before the accident failed to notice them.
- Whether and to what extent the design of the Babcock & Wilcox reactors makes them more prone to accidents. For example, the failure of a pressure-relief valve to seal was a major cause of the Three Mile Island accident. An NRC official told the Senate subcommittee Monday that there have been 150 cases in the past where this valve—unique to Babcock & Wilcox reactors—had to be activated to handle cooling-water malfunctions; and four of those times it failed to seal.
- Finally, whether local residents were protected adequately from radioactive emissions due to the accident. □