Reactor Mishap Raises Broad Questions

Alert operators avert major accident, but underlying problem may afflict other reactors

One difference between the accident at Three Mile Island and the emergency shutdown of the Robert E. Ginna reactor near Rochester on 25 January is that the operators behaved very differently. In the earlier case they blundered several times, perhaps because the control room was ill designed, or because they themselves were ill prepared, or because the accident began at the inauspicious hour of 4:00 a.m. In this recent crisis, the operators seem to have solved each mechanical problem as quickly as it arose.

An apparent lesson is that the skill and alertness of those running the reactor have a critical bearing on the amount of damage an accident may cause. The question remains: does this offer any reassurance about the safety of reactors?

During the Ginna emergency, some radiation escaped in quick-decaying noble gases and as iodine-131, but the quantities were smaller than at Three Mile Island. About a dozen workers who were contaminated and had to take showers received insignificant doses, according to the Nuclear Regulatory Commission (NRC). The owner of the plant reports that the maximum level of radiation detected offsite was about 1 millirem per hour, registered briefly on the morning of 25 January, after the largest radioactive steam release. (For reference, a chest x-ray exposes the recipient to about 25 or 30 millirems of radiation.)

Although the physical impact of this accident appears to have been slight, the event raised nagging questions about the future operation of pressurized water reactors. According to the NRC's official odds on the likelihood of certain occurrences (contained in a paper known as WASH-1400), the type of spill that occurred at Ginna—a small-break loss of coolant—should happen about once every 40 years in a nation like ours with 75 reactors. But theory does not seem to match recent experience. Since 1975, the United States has experienced four accidents of the Ginna variety—that is, a small break in the steam generator leading to a loss of coolant. There have been other (non-Ginna) types of accidents as well, such as the one at Three Mile Island.

Most pressurized water reactors have corrosion and circulation problems in steam generator pipes, the ailment found at Ginna long before this breakdown. Ginna's owners thought they had solved the problem. It is not known yet whether corrosion led to the pipe break at Ginna, but it is widely suspected that this is so. Ginna is 12 years old. Younger plants of the same design may soon find themselves afflicted with tremors of old age. Small loss-of-coolant accidents may begin to occur even more frequently than the present rate of about one a year.

The Ginna reactor is small. It has a power output of 470 megawatts, a little over half that of the Three Mile Island reactor. It was built by Westinghouse for the Rochester Gas and Electric Company, which has operated it since 1970 in a small town at the edge of Lake Ontario. The Three Mile Island reactor, vintage 1978, was built by Babcock & Wilcox. Like Ginna, it is a pressurized water system.

The chief mechanical difference between what happened at Three Mile Island and at Ginna is that the first case involved overheating and loss of pressure, while the second involved only loss of pressure. In both plants, the trouble began in the steam generators, part of the "secondary side" of the plant.

In these tanks, "secondary" water is boiled to steam when it comes into contact with pipes filled with superheated, pressurized water. This very hot pressurized water—also called the coolant or "primary side" water—circulates through the reactor, where it picks up heat and a certain amount of radioactive material. At Three Mile Island, the steam generator tank boiled dry, causing the primary system to overheat, expand, and force open a relief valve. Soon the entire system was overheating, losing pressure, and filling with steam. The Ginna crisis began in the same location, but by a different means. One or two of the pipes carrying superheated primary water through the steam generator burst. The pressure fell. Radioactive material spilled out of the primary circuit, but the reactor did not overheat. The reason: the operators understood and solved mechanical failures quickly.

Members of the NRC's emergency management team who went to Ginna gave a brief account of the events several days later on 28 January. Ronald Haynes, the team leader, was full of praise for the operators. He said that they recognized there was a leak in the primary system very quickly, because the pressure dropped more than 1000 psi—off the register—in less than 5 minutes. This was at around 9:30 a.m. The reactor shut down automatically and emergency cooling systems began pumping cold water into the fuel core. By 9:40, the operators had decided that the leak was in one of the two steam generators. The main coolant system was losing pressure and spilling radioactive water into the secondary system, and from there into the atmosphere. They closed valves sealing off the leaky piece of equipment.

As the pressure began to build again in the primary system shortly after 10:00 a.m., a pressure relief valve became stuck open, releasing coolant into an overflow tank and eventually bursting the tank and spilling 1900 gallons of radioactive water onto the floor of the building. Fortunately, the operators noticed this quickly. Within 4 or 5 minutes, according to Haynes, they sealed the leak by closing a manually operated block valve on the same line. Operators at Three Mile Island had problems when the same valve became stuck. But in their confusion they failed to notice the leak for 2 hours and 20 minutes.

After the operators at Ginna closed the leaky steam generator and the valve, they faced another problem. As the pressure fell during the first minutes of the crisis, steam had come out of solution and formed a pocket in the dome above the reactor core. The danger was that the steam would expand, force water away from the core, and allow the fuel to overheat. This is what happened at Three Mile Island.

At Ginna, the operators collapsed the bubble by taking two steps simultaneously. They slowly increased pressure in the primary system by adding water, and they switched on the powerful reactor coolant pumps. These circulated water through the vessel, cooling the metal walls and eliminating the source of new steam. The same tactics would not have worked at Three Mile Island, according to one NRC official, because there was too much steam in the system by the time the operators understood the problem.

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It will be several weeks before the postmortem is done on Ginna's damaged steam generator. It is known, however, that special maintenance work was begun last year on the pipes in the steam generator, and that more work was planned for the spring. Whether this had an effect on the system remains to be discovered.

If corrosion was the villain, then many of the pressurized water reactors in the country may be regarded as potential victims of Ginna-like failure. The NRC reports that in 1981 alone, 14 reactors experienced small leaks in the steam generator resulting from stress and corrosion. And *Nuclear Technology* of last October notes that "Corrosion has affected almost 90 percent of steam generators operation prior to 1977. . . ." The problem is formidable.—ELIOT MARSHALL

Antinuclear Movement Gains Momentum

Prompted by activism in Europe and bellicosity at home, Americans are getting seriously worried about nuclear war

1982 promises to be a very big year for antinuclear war activism in the United States. A broadly based movement to bring about an end to the arms race has been unfolding with astonishing rapidity, perhaps marking the end of an era of relative political quiescence that began with the end of the Vietnam war.

The shape of the movement differs considerably from the antiwar movement of the 1960's. Unlike then, scientists and other professionals are very much in the lead, and student activism is little in evidence. Another difference is that this is a single-issue movement which is not linked, as was opposition to the war, to a variety of controversial social issues.

The current phase began in 1980 when the Cambridge-based Physicians for Social Responsibility took it upon themselves to stage several seminars across the country at which the consequences of a nuclear strike were graphically portrayed and audiences were educated in gruesome detail about the impossibility of an adequate medical response to casualties.

Although President Carter raised fears by opening the subject of a limited war with his famous directive allowing for selective strikes on enemy military installations, the behavior of the Reagan Administration has given strength to the movement by aggravating these fears. There was President Reagan's loose talk about the possibility of a limited nuclear war in Europe. There has been the volatile behavior of Defense Secretary Alexander Haig who suggested that a demonstration nuclear blast might be a good way to show we mean business in the event of a conventional war.

There has been the break from President Carter's nonproliferation policy in the form of a proposal to use wastes from nuclear power plants for the production of weapons-grade plutonium. There has been the decision to deploy MX missiles in old Minuteman silos, a move which is construed as a move toward developing a first-strike capability. And, of course, there is the European Nuclear Disarmament campaign, spurred in large part by the NATO decision to deploy new land-based missiles in Europe, which inevitably is worming its way into American consciousness. Today's activists are arguing that the costs of the arms race are becoming ever more numerous and visible: in alienating us from our allies, in draining resources away from social programs and diverting capital from the country's sagging industrial base, and in generating unprecedented feelings of insecurity among the citizenry. One Gallup poll, for example, revealed that no less than 47 percent of the public expects a nuclear confrontation with the Soviet Union within the next decade.

The rationale for continued weapons buildup has few prominent advocates outside the government these days. At the same time members of the arms control community—former U.S.S.R. ambassador George Kennan being perhaps the most prominent spokesman—are advancing increasingly urgent arguments in favor of reassessing the country's defense strategies.

What has happened in the past year or so, in short, is that arms control is no longer being identified in the public mind as synonymous with pacifism, unilateral disarmament, or naiveté about Soviet intentions. The massive involvement of churches in calling for disarmament is evidence that the issue has surmounted narrower causes. The Pope himself in December sent scientific delegations to the heads of nuclear nations about the need for disarmament.

The movement has nowhere near reached the proportions and intensity of the Vietnam antiwar phenomenon, but it shows potential for enveloping a far greater cross section of society and thus in the end being far less divisive. Significantly, the nuclear war issue is now becoming increasingly liberated from linkage with the antinuclear power movement. Indeed, many groups, notably the Union of Concerned Scientists, which spent the 1970's agitating against nuclear power have now turned their attention to war. Decoupling from the power issue has permitted involvement of many conservatives, says Jerome Grossman, president of the Council for a Livable World, who terms the nuclear power issue "very divisive."

Although the disarmament movement is blossoming all over the country, a large part of its root system is in Cambridge, Massachusetts, specifically in Harvard University and the Massachusetts Institute of Technology (MIT), and more specifically in MIT's physics department, which contains veterans of the Manhattan Project. No one has a compelling reason for why this is so, although physicist Kosta Tsipis of MIT—who is working on disarmament issues full-time now—suggests that Cambridge is the only place with a closely grouped cluster of institutions where "the density of motivated people is high."*

The thrust of the movement so far has been educational, aimed at the grass roots rather than the decision-makers. Many organizers have been concerned about the ramifications of getting people scared out of their wits about nuclear war without offering them a specific alternative to work for. But now the idea of a bilateral nuclear freeze—that is, a halt to the production, testing, and deployment of nuclear weapons and delivery systems, seems to have become the

*Among physicists MIT is contributing to the nuclear war debate are George Rathjens, Henry Kendall (head of the Union of Concerned Scientists), Kosta Tsipis, Jack Ruina, Herman Feshbach, Bernard Feld, Francis Low, Victor Weisskopf, and Jerome Wiesner.

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