Briefing

APS Critiques Nuclear Safety R & D

This May marks the fourth anniversary of the great debate over an arcane but important piece of plumbing in nuclear power plants called the emergency core cooling system. The ECCS issue has been overshadowed lately by new concerns over the possibility of nuclear theft and sabotage. But a noteworthy study released by the American Physical Society on 28 April is a reminder that the argument over reactor accidents—and the adequacy of systems that are supposed to mitigate them—is still not resolved.

The APS report is the product of a year-long examination of the government's nuclear safety research programs. In brief, the society's 12-man study group found no reason for "substantial short-range concern" about nuclear accidents. And the group said that emergency cooling systems probably would prevent a catastrophic meltdown of a reactor core if called upon "under most circumstances."

Nevertheless, the APS group said, there is a general lack of "well-quantified understanding" about such backup safety systems as emergency cooling. This it attributed to a paucity of experimental information and to resulting weaknesses in computer codes used to simulate reactor accidents and the response of emergency systems. The APS offered a number of recommendations for strengthening safety research programs, which are now run by the Nuclear Regulatory Commission.

Concern over ECCS performance arose within the old Atomic Energy Commission in the late 1960's. What had been an internal technical debate surfaced into public view in 1971 and, with a year-long series of public hearings in 1972–73, did much to make nuclear safety a major public issue. The debate subsided with the AEC's adoption of stricter, more conservative rules for predicting ECCS performance. But it left a residue of questions about the management, funding, and basic philosophy of safety research programs. Last year, in an unusual departure for a scientific society, the APS undertook to explore these questions.

Among its other main conclusions, the APS study group said:

- A major AEC analysis of reactor accidents, called the Rasmussen report, had underestimated the number of deaths and illnesses that would result from a major release of radioactivity in a reactor accident by a factor of 25 to 50. Rather than the 310 cancer deaths predicted to result from a large release of fission products, the APS group set the number between 10,000 and 20,000 in a densely populated area.
- The engineering sophistication of reactor control rooms, as well as the training of reactor operators, is below standards maintained for military commands and air-traffic control centers.
- Much more could be done to measure objectively the success or failure of quality control programs in the nuclear industry.
- Research on recovery from nuclear reactor accidents is not being done now, but should be.

Outside review of the safety research program "has probably not been sufficient." Small outside review groups, preferably with no other connection to the nuclear community, should monitor experimental and theoretical programs, and results should, to the extent possible, be published in refereed journals.

About one-quarter of the cost of the APS study was paid by the (then) Atomic Energy Commission and the rest by the National Science Foundation. Along the way, the study group seemed to strike an amicable but arms-length relationship with safety program officials. Criticism was mild and often tempered by praise for improvements instituted in the past 2 years.

In response, Herbert J. C. Kouts, the NRC's safety research chief, told *Science* that money for safety R & D on light-water reactors has roughly doubled in the past 2 years to $70 million, that scores of new projects had been started, and that formerly withered relations with university researchers had been revived. Kouts said he had read the APS study, agrees with many (though not all) of its recommendations, and intends to make use of it.

"We'd been looking for a competent outside review," Kouts said. "We felt that if nuclear power is to be better accepted by the public, our programs are going to have to be 'signed off' on by the larger technical community."

—R. G.

drophone might not be worthwhile, since the individual sensors are less important than the way their information is processed. On the other hand, ability to locate and reach the other side's hydrophones might open up various possibilities for interfering with his network.

Just how far the *Glomar Explorer* has contributed to opening up the deep ocean floor is hard to say because, despite the profusion of material about the ship's exploits, its actual capabilities are far from clear. CIA officials disseminated a lot of information on a semi-official basis for a brief period in March, but are now unwilling to comment. "That's a non-starter around here," a CIA man told *Science*, saying by way of explanation that the Russians had tolerated the U-2's overflights up until the first official confirmation by the United States government.

Some newspapers gained the impression that the CIA, while ostensibly trying to bottle up the story of the *Glomar Explorer*, had actually been helpful all along in getting it out. There is room for endless speculation, but the account best suited to the agency's purposes might be one that would justify the cost of Project Jennifer on the one hand, and not humiliate the Russians on the other.

As it happens, the general version that emerged in public last March fulfills both objectives. The Russian submarine was raised intact from the ocean floor some 750 miles northwest of Oahu, the story goes. About half way up the 16,500 foot ascent, a rattling of cables was heard on the *Glomar Explorer*'s deck and two thirds of the captured submarine broke away, damaging the claws and sinking back to the bottom. The third that was recovered contained no missiles, no code room, and maybe, but not definitely, either two nuclear tippable torpedoes or the evidence for their existence. Reports that the whole submarine, or two of its nuclear torpedo warheads had been recovered, were specifically denied.

While this version of events may be accurate, it contains a number of implausibilities that raise questions about the semi-official version. For one thing, the ability to raise the total bulk of a submarine from a depth of 16,500 feet would be an advance of some two orders of magnitude beyond the current state of the art (*Alcoa Seaprobe* can raise 50 tons from 18,000 feet.) Scholley, Alcoa Marine's president, says flatly that "There is no way on God's green earth that they could have lifted the whole submarine up."

For another, the chances that the CIA found the submarine in one piece seem in fact to be less than overwhelming. Unlike surface ships which tend to maintain their