# A SWAT Team for Nuclear Accidents

*The NRC, under pressure to improve its accident analysis, has installed a new system that demands fast detective work and quick reporting*

When complex systems like airplanes and nuclear plants fail, postaccident inquiries should be penetrating, complete, and honest. Recently the Nuclear Regulatory Commission has taken steps to improve its own investigations, including the use of fast-working sleuths sent out from headquarters. The aim is to spur the nuclear industry—and the NRC staff as well—to better performance.

Although the NRC's new tactics are generally acknowledged to be working well, they were in fact begun in order to head off a more radical reform, one that would have taken responsibility for investigating accidents away from the NRC staff and placed it in the hands of an independent panel. Some experts, including two members of the commission itself, still argue that this independent approach is needed.

The new program began on 10 June 1985, the day after an emergency shutdown of the Davis-Besse reactor on Lake Erie in Ohio. That morning, William Dircks, who was then the NRC's chief of staff in Washington, quickly assembled some experts and sent them off to find out what had gone wrong. According to Dircks' plan, the group was drawn from NRC offices having no involvement with the troubled plant. This gave birth to the Incident Investigation Team, something the NRC had long considered but never established.

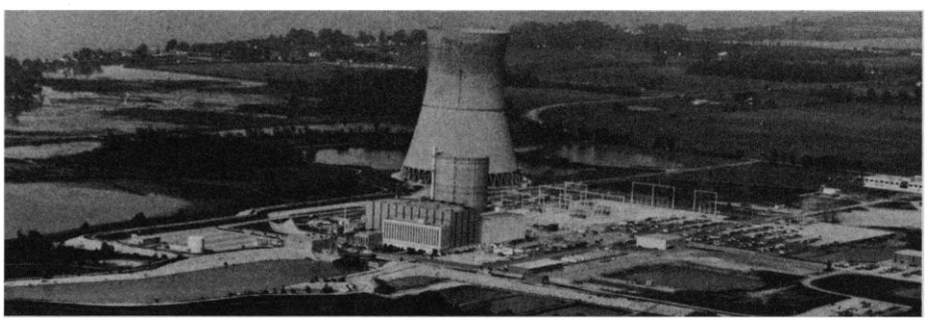
The IIT team, the nuclear version of a SWAT squad, is supposed to sweep in and "freeze" a plant in its disabled state. It interviews company employees, examines electronic logs, looks over the equipment, puts together a sequence of events, and issues a report* within 45 days. The team is meant to write a tight analysis pointing to one or two root causes of failure, including management error when appropriate, and not a laundry list. The aim is to provoke remedial action.

That is the goal. It contrasts with the old practice of running duplicate investigations and permitting regional or enforcement officials first crack at interpreting the evidence. This was the agency's custom even when a local NRC official's reputation might be on the line. A study group at the Brookhaven National Laboratory examined the record and found that reports often got bogged down in quarrels over whether operators had or had not obeyed NRC rules during a crisis.† In some cases this led to years of correspondence, but no action being taken on faulty hardware.

More than once, the NRC had to order a follow-up investigation. One case in 1983 involved the Salem plant in New Jersey, where an automatic scram system (designed to stop the fission process in the reactor) failed to work. A crucial bit of evidence was so pawed over that it became worthless. This was an electric relay; it made its way to the manufacturer and was lubricated before it reached the NRC.

The change of policy last June had a proximate and an historical cause, Davis-Besse being the proximate cause. Like many crises, it began in the wee hours, at 1:35 a.m. on 9 June 1985. Shortly after the graveyard shift came on duty, a main feedwater pump got a message from the automatic control system to shut down, and it did. In the fast-moving events that followed, an operator punched the wrong control buttons, shutting off water to the steam generators and causing the system to lose its capacity for heat removal. The reactor coolant began to overheat. Before serious damage occurred, technicians were able to turn on an auxiliary water supply (after rushing down four flights of stairs, unlocking padlocks, putting fuses into an empty fusebox, manually switching on a pump, and struggling with a wrench to open some critical valves). The staff got things under control moments before it would have been necessary to go into an emergency cooling routine known as "feed and bleed," a step that would have worsened the crisis. The plant is still shut down for renovations, and its owner hopes to restart it in April.

The underlying reason for the crisis, the IIT team found, was "the licensee's lack of attention to detail in the care of plant equipment." The operator, Toledo Edison, evaluated mistakes in the past "in a superficial manner" so that fundamental problems were left uncorrected, according to the IIT report. This led to multiple equipment failures, including the loss of redundant safety systems. No one asked the IIT group, and it did not offer to comment on how the NRC's own stewardship of nuclear safety might have contributed to the incident.



**The Davis-Besse plant on Lake Erie**

*An emergency shutdown last June triggered "one of the most intensive and thorough fact-finding efforts since Three Mile Island," the NRC chairman said.*

This leads to the historical reason for the IIT. Davis-Besse was not just a technical crisis, but a political turning point as well, a chance for the NRC staff to settle an old argument and take some heat off itself. The issue was the NRC's credibility.

For years, critics have asked whether the NRC can be expected to render a full account of accidents when its own role as a safety enforcer is central to events. It cannot, says Harold Lewis, a physicist at the University of California at Santa Barbara. It is foolish to ask the NRC to scrutinize itself, he argues. Lewis has been an analyst of nuclear problems since before the NRC

*The NRC has issued two IIT reports to date: "Loss of Main and Auxiliary Feedwater Event at the Davis-Besse Plant on June 9, 1985" (NUREG-1154) and "Loss of Power and Water Hammer Event at San Onofre, Unit 1 on November 21, 1985" (NUREG-1190).

†"An Independent Safety Organization" (NUREG/CR-4152), issued by the NRC in Washington, 15 February 1985.

existed, beginning as chairman of an American Physical Society panel on reactors in 1974. In 1979, he joined the NRC's Advisory Committee on Reactor Safeguards, on which he now serves.

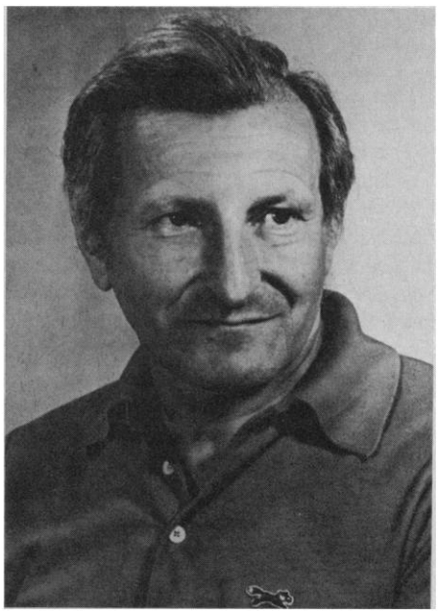
The decision to create the IIT and send it to Davis-Besse, Lewis says, was "clearly an effort to avoid what I regard as the inevitable, which is to have independent investigations of accidents." When an airplane crashes, the government does not ask the Federal Aviation Administration to find out why. The FAA has too much at stake as a manager of flight control towers. Instead, the government calls upon the National Transportation Safety Board, whose sole job is to investigate accidents. In 1977, Lewis wrote to Representative Morris Udall (D–AZ), chairman of the committee that authorizes NRC funds, urging that a separate safety board be established. The agency's response in 1978, Lewis says, was: "It's a dumb idea, and even if it weren't a dumb idea, we do investigations just fine already, and there aren't any nuclear accidents anyway."

Lewis's letter was prophetic. Less than 2 years after he sent it, a major accident occurred at Three Mile Island. Just as Lewis had recommended, the government set up an independent inquiry, chaired by John Kemeny of Dartmouth College. At the same time, the NRC set up its own self-review panel headed by attorney Mitchell Rogovin. Both the Kemeny and the Rogovin studies favored an independent board of the kind Lewis had in mind. As a step in this direction, the Carter Administration created a standing presidential advisory panel on nuclear safety. But when the Reagan Administration arrived, this panel was disbanded. No review board survives.

Meanwhile, several congressmen proposed bills to create a nuclear safety board, without success. Then in 1984 Congress ordered the NRC to study the idea. The NRC gave the task to Brookhaven, and Brookhaven's report in February 1985 took the fence-straddling approach of favoring an independent group, but suggesting that it be made a part of the NRC, answerable directly to the five NRC commissioners. This would rock the boat, but not as much as creating a truly independent board. Lewis and the ACRS endorsed the proposal in a letter dated 13 March 1985.

However, the NRC staff—especially those who now analyze accidents—did not like the idea. Voicing this opposition, Dircks wrote to the commissioners on 28 March 1985 that the change would be "costly and disruptive, would not result in unique improvements, and would provide little or no benefits in terms of public perceptions."

The Brookhaven plan was still under review in June when the Davis-Besse plant went down. Dircks seized upon the incident to "cut off the debate at the pass," an NRC official says. Dircks dispatched the IIT team to Ohio and fired off a memo to the commissioners urging them to approve his action. He asked for the NRC's imprimatur on the just-hatched IIT squad so that it might be declared the agency's final response to all the criticism. In future, according to Dircks' memo, he or his successor would be empowered to decide when and where to run special IIT inquiries, and also to name the members of the team. This policy he described as incorporating "the intent" of the recommendations from the ACRS, Harold Lewis, and Brookhaven. A majority of the commission, including Chairman Nunzio Palladino, went along.



**Harold Lewis, physicist**

*He recommended an independent nuclear safety board in 1977, and still does.*

Commissioners Frederick Bernthal and James Asselstine did not. They favored establishing a more independent group. The ACRS also continued to press the case for more independence, and wrote a sharp letter to Palladino on 14 November pointing out that it was "incorrect" for Dircks to say that the IIT program reflected the intent of the Brookhaven plan. It warned that the agency, having opted for self-evaluation, would be hard-pressed to maintain credibility.

The split of opinion continues. Palladino wrote back to the ACRS on 23 January that the Davis-Besse review was one of the best and most intense inquiries since Three Mile Island. He said this proved the new system was working.

Meanwhile, some credibility-boosting steps have been taken. One was the NRC's decision in January to assemble an ad hoc group of outsiders to consider whether the agency shared any blame for what happened at Davis-Besse. That review is still underway. Another step was taken in the second IIT report, issued on 22 January. It deals with a mishap at the San Onofre (unit 1) reactor in southern California.

Without getting into the details, suffice it to say that the incident had some qualities in common with other crises. It began in the early morning hours of 21 November. An electric circuit failed, cutting off power to the control room for 4 minutes. Fast work by operators overcame a number of obstacles and brought the plant under control within hours—but not before five key safety valves failed, a "water hammer" accident cracked a main feedwater line, and a steam line ruptured. Under slightly different conditions, the water hammer damage could have been much worse. The IIT team did not pin down the root cause of all this, but it said the likely causes were poor maintenance, poor valve design, and poor valve testing procedures. It also pointedly listed correspondence between the NRC staff and the utility stretching over many years and dealing with steps to be taken to lessen the risk of water hammer damage. The IIT concluded that the NRC had not resolved its concern in a clear-cut fashion.

A third IIT report is to be released on 25 February, this one on a failure that took place at the Rancho Seco plant in northern California (*Science*, 24 January, p. 334).

Some have expressed reservations about the IIT's work, including the disgruntled owner of the San Onofre plant, Southern California Edison, which found the IIT report unfair. But many NRC critics agree that the IIT program is an improvement. Asselstine, for example, would like to see a more aggressive and independent system of self-review, but concedes that the IIT reports are "excellent . . . well done . . . helpful to the commission." The main weakness he sees, aside from the much debated credibility issue, is that IIT teams have a narrow focus. He favors a broader type of inquiry that would ask big questions of NRC and industry managers. If the NRC is not willing to support this kind of work, he says, "It is time for Congress to take a tough look at establishing an independent review board."

Lewis says the IIT may be a "major step forward," but he worries that the NRC can just as easily take a major step backward when it chooses. "In the end, the issue of independence is going to arise," he says, and it will not arise from incidents like those at Rancho Seco and Davis-Besse. "It will arise when there is a real accident. And there will be." ■ ELIOT MARSHALL