Reactor Safety: Independence of Rasmussen Study Doubted

Few major government reports of recent years have occasioned as much public comment and controversy as that known as the Rasmussen report, the study of the likelihood and consequences of accidents at the nation's nuclear power plants. The study emphasized that such dangers were almost vanishingly small.

Commissioned by the Atomic Energy Commission (AEC) in 1972 and issued in October 1975, the Reactor Safety Study, as it was called, concluded that an individual's chances of being killed immediately following a nuclear reactor accident were comparable to those of his being killed by a meteorite. The findings have been bitterly attacked by nuclear power critics, and two more reviews of it are under way. Meanwhile, the nuclear industry, the government, and the pronuclear lobby have been praising the reactor safety study as an "independent" evaluation which shows that the nation can proceed full tilt with construction of nuclear power plants.

However, new evidence suggests that the atmosphere and circumstances under which the Rasmussen study was conducted were anything but conducive to obtaining an impartial study. Regardless of whether the final report was biased, the evidence illustrates the difficulty that powerful federal bureaucracies can have in commissioning objective scientific reports—especially when they have enormous stakes in the findings.

In the case of the reactor safety study, the AEC, which had promoted the development of civilian nuclear power for 20 years, was very nervous that the study might boomerang and produce results that delivered nuclear power a severe blow. This had in fact already happened once; nuclear power critics in the late 1960's discovered, and publicized, the results of a 1957 AEC-commissioned Brookhaven study that had estimated that a worst-case accident, although very unlikely, could cause 3,400 deaths, 43,000 injuries, and $7 billion in property damage.

The new evidence, which consists of internal AEC documents and interviews with key officials, shows that, for instance, the AEC chose Norman Rasmussen, a professor of nuclear engineering at the Massachusetts Institute of Technology (MIT), not only for his technical knowledge and national stature but because it regarded him as a "friend" of nuclear power. Also, whereas Rasmussen initially proposed that the study be done at MIT, the commission chose to have it done at AEC headquarters where they could keep close watch as it progressed. Also, the staffers assigned to the study were apparently poorly insulated from bureaucratic pressures that could undermine the study's integrity. Indeed, even the scientific peer review of the drafts of the report seem to have been hastened, and perhaps abused, in order to have the report published in time for congressional debate on extending the Price-Anderson Act, the 1957 law by which the government accepts limited liability for a major nuclear accident.

Evidence of all this has come to light in 50,000 internal AEC documents which the Nuclear Regulatory Commission (NRC), a successor agency to the AEC, released in response to a request made under the Freedom of Information Act. This request was filed by the Union of Concerned Scientists (UCS), an antinuclear group based in Cambridge, Massachusetts, and headed by Henry Kendall of MIT's department of physics.

The UCS has, in turn, issued some of these documents, together with its own report interpreting them and criticizing the AEC for its handling of the study's "institutional" aspects. More evidence that casts doubt on the independence of the study has come to light in interviews conducted by *Science* with Rasmussen and others who were involved. They have maintained that, while the atmosphere surrounding the study may have been biased, the study itself was not.

The reactor safety study was the first major attempt to calculate the probabilities of all possible accidents that could occur at a nuclear power plant. The AEC's Brookhaven National Laboratory had made one attempt at doing this in 1957, in connection with the AEC's effort to obtain passage of the Price-Anderson Act in the first place. In 1972, the AEC, anticipating the expiration of this act, decided to undertake an ambitious sequel to the Brookhaven study.

The new study would assign probabilities to the failure of a nuclear power plant's various safety systems, on the basis of possible component failures, operator error, poor maintenance, natural hazards, and other possible causes. It would then model the resulting radioactive releases and resulting public risks for each accident case. The resulting $4-million report is often portrayed as the most definitive work on the subject, although Rasmussen and other participants modestly say that their 9-volume product is a mere "first step" at approaching the problem.

But in the climate of public opinion that existed in 1972, when the AEC defined its objectives for the new study, it was obvious that any new estimate of the deaths, injuries, and property loss resulting from a reactor accident could become a political football, and that arriving at a credible, new figure—higher or lower than the old figure—would be difficult. Hence the AEC looked for an outsider of national repute to head its effort.

Choice of a Chief

The AEC documents released by the UCS indicate that the AEC first sought to have the study led by a believer in the safety of nuclear plants, Manson Benedict, an Institute Professor at MIT's department of nuclear engineering who, since 1966, had been a director of the Atomic Industrial Forum, the nuclear industry "public education" association. According to the documents, Benedict refused in March of 1972 partly "for personal reasons" but suggested his colleague Rasmussen for the job. Although Rasmussen says he had been "neutral" on the nuclear power question, officials at the AEC perceived him as "friendly" to the cause. Rasmussen had a background in consulting for the private insurers of nuclear power plants, and his one published article on reactor safety indicated that he believed that the benefits outweighed the risks, according to the UCS report.

What sort of a person was the AEC searching for when it approached Benedict and Rasmussen? Stephen Hanauer, one of the AEC officials most deeply involved in the study, says that the agency gave consideration to hiring a nuclear power critic, but "I'm sure that consideration didn't last very long." Hanauer and Saul Levine, the AEC staff director on the project, both told *Science* that the agency needed someone who knew about the operation of nuclear power plants and about industrial accident analysis. Nearly all such people, they said, are advocates of nuclear power. ("There doesn't seem to be anyone who is neutral, and the critics don't bother to study these things," adds an official.) In addition they said that the study director

would have to be acceptable to the nuclear industry, because otherwise, the utilities and the manufacturers might have been unwilling to make essential data available to the study group.

An "Independent" In-House Study?

Benedict and Rasmussen together submitted a seven-page outline of how the study should be done, including the proposal that it be done at MIT. But the commission decided to have the study done at headquarters. Hanauer guessed that the commission wanted to watch the study closely: "The commission wanted more control over the study. They were afraid it would get out of control." There was some feeling, he said, that the 1957 Brookhaven study had been done without enough monitoring by AEC.

Documents released by the UCS show that many people, from Rasmussen on down to various AEC bureaucrats, accepted the premise that AEC should be involved in the study—which flies in the face of later, official claims that great care was taken to preserve the study's independence.

For example, Rasmussen and Benedict's outline proposes that the AEC should control the sensitive results of the study. In discussing the study's schedule, it says:

> additional time would be needed to bring a report on this controversial subject into a form which the AEC would be willing to issue. . . .
>
> We recognize that the sensitive nature of these studies will require careful control of all official information releases. We feel that during the course of the project, any official releases should be mutually agreed to by the AEC and MIT. . . .

A later memo from AEC official Jerome Saltzman, who was not involved in the study project, says: "We have a role . . . by helping reduce unintended implications that might creep in . . . and by helping with the matters of tone, credibility and appearances." Saltzman wrote, "The first purpose of the proposed study is to aid in the evaluation of or need for modification of Price-Anderson." Thus it seems that other officials may have viewed the "independent" study as something they should have a hand in.

Both Levine and Hanauer maintained in their interviews with *Science* that, while the AEC bureaucracy was nervous about the forthcoming study, the study group—which at its largest consisted of about 50 people—was allowed complete freedom to go about its work. Yet it is evident from the AEC documents that some staffers who worked on the study were highly sensitive to the fact that, depending upon their nature, their findings could undermine public confidence in nuclear power. For instance, in a series of 1973 memos to Levine a staffer, Ed Gilbert, wondered about what "an objective reader" of the report might think if the facts he discovered did not support "our predetermined conclusions." He said:

> Our RSS report must find that the A-E [the architect-engineer], the licensee, the vendors, and the AEC did an adequate job . . . to assure the safety and reliability of the two plants studied . . . (1) what information do we need to gather to support such a finding? Disadvantages. . . . The facts may not support our predetermined conclusions.

A later Gilbert memo said:

> The information we seek should . . . serve to engender the reader's confidence about the AEC's role in assuring high quality workmanship and Q-A [quality assurance] practices; it should not have the effect of raising unanswerable questions.

Indeed, a number of commissioners themselves kept close tabs on the study. William Kriegsman, who sat on the commission in 1973 and 1974, says that the commission asked for frequent briefings because it was nervous about the study's findings, but that many commissioners seemed pleased with the "hard line" the study took, which they felt would work to the advantage of nuclear power.

Reviewers Not Answered

The AEC released the "draft" Rasmussen report in August 1974, and invited public comments on it. The final report was released in October 1975, in time to meet a deadline set by the Joint Committee on Atomic Energy, which sought the report to serve as the basis for discussions about extending the Price-Anderson Act. Many of the public comments on the draft were critical: some of them, from antinuclear organizations, were predictably so. Others, from federal agencies such as the Environmental Protection Agency, were unexpected.

But the documents show that the two internal reviews conducted by the AEC turned up equally devastating comments that criticized things such as the omission of sabotage or the confusing manner in which the material was presented. Many of the criticisms, as far as can be determined, were discounted. The chief revision between the draft and final document was a revision of the accident consequences model, which was due largely to pressure from the outside from a subcommittee of the American Physical Society's study group on light water reactor safety.

AEC official statements later made much of the care and deliberateness that went into the reviews of the Rasmussen report. But the documents show that, in June 1974, the AEC appointed a group of mainly in-house reviewers and gave them 11 days to review a multivolume draft of the draft Rasmussen report. One outside reviewer, Daniel Kleitman of MIT, who was called in to review the probability calculations, was unable to cancel a trip to New Mexico. He told *Science* that he reviewed the report in the evenings, in his hotel room. "I got quite frustrated, late at night, finding this thing was organized in an abominable manner and spread out over thousands of pages. It was so badly organized that even people with lots of time and goodwill would have had a hard time knowing what was going on."

Kleitman's written comments contained some perfunctory praise for the study, but mainly consisted of scathing criticism. The method of calculating the probability of certain accident probabilities "leads to silliness, added complication . . . and error." The method of presenting results made them look more "wonderful" than they really were. For example, using the data, Kleitman calculated a rate of core meltdowns among 150 reactors over 20 years of "one every 5 years."

He suggested another method that would be simpler and more accurate, but would lead to higher probabilities of reactor accidents. But he said that, after mailing in his comments, he never was able to discuss them with AEC.

The second internal AEC review, of the August 1974 draft, turned up other criticisms which echoed those made publicly. Hanauer himself wrote a lengthy critique of the treatment of common mode failures; another staffer thought the likelihood of earthquakes had been underestimated; another criticized the study's silence on the subject of sabotage in view of the fact that it claimed to be considering "all" possible accidents.

However, there is disagreement as to whether these criticisms were fairly accounted for by the study group. UCS claims that the final report was not changed to respond to Kleitman's criticisms, as well as to many other criticisms that were offered. But official comments later exploited the fact that there had been a peer review in order to bolster the report's scientific credibility. For example, Marcus Rowden, chairman of the NRC, later wrote to Congress that, "detailed consideration was given to peer review comments made on the draft, and appropriate changes were made in converting the draft into the final report."

The story of the Rasmussen report indicates the politicized environment in which this "independent" study was

carried out. However, Rasmussen is the first among those who worked on it to argue that despite the prejudicial circumstances everyone involved did his best to be objective.

Ultimately, of course, the study will be judged on its substantive merits, which have already been debated considerably, but which will be reviewed further, both in a subsequent report by the UCS, and by a new, "independent" study group appointed by the NRC, headed by Harold A. Lewis, of the University of California at Santa Barbara.

—DEBORAH SHAPLEY

Videoconferences via Satellite: Opening Congress to the People?

The 3½-hour legislative hearing conducted 8 June by the Senate Subcommittee on Science, Technology, and Space was like no other ever held by this or any other congressional committee. Senator Adlai E. Stevenson (D–Ill.) and the other three senators participating were seated in their usual places in the Commerce Committee hearing room in the Dirksen Senate Office Building in Washington. But the several panels of scientists and other witnesses taking part were 800 miles away, in the federal courtroom in Springfield, Illinois. The hearing was a videoconference, with the senators and the witnesses engaged in a two-way visual and audio exchange via the new U.S.–Canadian Communications Technology Satellite (CTS), which the National Aeronautics and Space Administration placed in synchronous orbit 22,300 miles above the earth in January of 1976.

This was, as one senator put it, a "historic first" in the use of television in the legislative process. The hearing happened to be about a bill to improve U.S. capabilities in forecasting the weather and climate trends, but, the important thing on this occasion was the communications technology which was being employed and what it presaged.

"By this device," said Senator Stevenson, referring to the CTS, "Congress may be able to conduct hearings in all parts of the world without leaving the Capitol or requiring witnesses to travel to the Capitol." He suggested that the videoconference via satellite would ultimately lead to significant savings in both time and money for members of Congress and witnesses—and to a much fuller public involvement in legislative deliberations.

The videoconference on the climate bill, which came off smoothly except for some distracting scratchiness in the audio system at the Washington end, required use of NASA's Portable Earth Terminal (PET), a television van which the agency has been moving about the country to accommodate a variety of CTS experiments in educational TV, refresher medical courses for rural doctors, and the like. The PET was parked outside the Federal Building in Springfield to exchange signals with the CTS, which was similarly linked with the Goddard Space Flight Center at Greenbelt, Maryland. Goddard and the hearing room in the Dirksen Building on Capitol Hill were connected by telephone lines and microwave.

This videoconference was the second of three demonstrations of congressional applications of the videoconference-CTS technology which have been planned by Fred B. Wood of George Washington University. The first demonstration arranged by Wood, who is director of the university's program of policy studies in science and technology, took place 15 April. Representative Charles Rose (D–N.C.), holding forth at a small studio at NASA headquarters in Washington, engaged in a lengthy closed-circuit videoconference discussion with some high school students and local officials assembled in the library of a high school in Raeford, North Carolina, a small town in his congressional district.

The students, about 150 of them, had chosen a panel of five to put most of the questions to Rose, and observers say that this interview was anything but stage-managed. The panel's questions ranged from pot and abortion to energy and the social security system. More than once, Rose, who is said to be an adept user of the tube, had to confess he was at a loss for an answer. "From a political point of view, I think Rose came out ahead because he was open and forthright and did not pretend to know things which he didn't know," observes Wood, who believes that this videoconference met its aim of achieving an open dialog between congressman and constituents.

An extremely ambitious demonstration of applying the videoconference-CTS technology to the problem of making a busy member of Congress more accessible to the press in his home district or state is planned for 21 July. At 11 a.m. on that day, Senator Howard Metzenbaum (D–Ohio) will conduct, from the NASA studio in Washington, an hour-long press conference with what evidently will be a good cross-section of virtually the entire press corps of Ohio. The reporters will gather at the studios of eight different television stations which, located in various cities across the state, constitute a microwave-linked educational TV network. This network will be linked to the CTS via the NASA ground terminal at the agency's Lewis Research Center in Cleveland. Although the press videoconference will be by closed circuit, it will be taped for showing statewide the next night (Friday, 22 July) at 10 o'clock over the Public Broadcasting Service.

In view of these demonstrations, Senator Lee Metcalf (D–Mont.), chairman of the Joint House-Senate Committee on Congressional Operations (which 3 years ago held hearings on Congress and its use of existing and emerging communications systems), is highly enthusiastic about the potential the videoconference-CTS technology holds for helping to overcome what he regards as a deep malaise affecting relations between members of Congress and their constituents. Following the videoconference on the national climate program legislation, Metcalf spoke thus:

> For too many years the federal government has been seen to be remote, unresponsive, insulated, and untrustworthy. All of us sense the feeling of distrust whenever we are able to return to our home states, visits which have become more and more infrequent over the years as congressional sessions have steadily lengthened and the workload has continued to expand. In these circumstances, there are compelling reasons for us to be looking for new ways of relating the work of the Senate to the people, for bringing more citizens into our hearings as participants, for listening to voices other than those of the professional witnesses we tend to hear year after year in the development of legislation. Ultimately, if we can realize the use of this [communica-