Kemeny Report: Abolish the NRC

Congress should create a new, politically responsive agency to monitor nuclear safety, panel concludes

"The plants are safe; it's the people who aren't safe," said John Kemeny, chairman of the President's Commission on the Accident at Three Mile Island.* He was speaking on 31 October before a joint meeting of the chief congressional nuclear power subcommittees, chaired by Senator Gary Hart (D-Colo.) and Representative Morris Udall (D-Ariz.). That was Kemeny's summary of the dozens of findings and recommendations contained in the Commission's 179-page report released that day.

The most urgent task, according to the report, is not to retool machinery but to overhaul attitudes and institutions. "No amount of technical 'fixes' will cure this underlying problem," the Commission says. "Unless portions of the industry and its regulatory agency undergo fundamental changes, they will, over time, totally destroy public confidence, and, hence, *they* will be responsible for the elimination of nuclear power as a viable source of energy."

Although the Commission did find flaws in the design and operation of the plant at Three Mile Island, the members chose not to stress the need for specific technological improvements because they thought more specialized studies now being drafted would do just that. Instead, they plugged away at a phrase that became the catchword of the investigation: the flawed "mindset" of the people who supervise nuclear safety programs. According to the report, this is the conviction that nuclear plants are "sufficiently safe" to rule out the need for fundamental revision. This is a mistaken and dangerous notion: "The Commission is convinced that this attitude must be changed to one that says nuclear power is by its very nature potentially dangerous, and . . . one must continually question whether the safeguards already in place are sufficient to prevent major accidents."

Complacency pervaded the industry before the accident, the investigators concluded—so much so that, "we are convinced that an accident like Three Mile Island was eventually inevitable." The commissioners resisted reporters' attempts to find out whether they thought a second accident of this sort is also inevitable. However, their report warns: "We do not claim that our proposed recommendations are sufficient to assure the safety of nuclear power. . . . If the country wishes, for larger reasons, to confront the risks that are inherently associated with nuclear power, fundamental changes are necessary if those risks are to be kept within tolerable limits."

Like an Old Testament prophet, the commission calls for a great awakening among the owners, operators, and police agents of the nuclear realm. But it gives few details as to what precisely the awakening should accomplish. It sketches out some general objectives, but leaves the fine points to be filled in by administrators, presumably by the Nuclear Regulatory Commission (NRC) or its replacement. The main thrust, the commissioners agree, should be to make the federal government a more coherent and aggressive player in the nuclear arena. In a time of disillusion with central authority, it is interesting to find the Commission making a clear appeal for stronger federal powers, stiffer regulations, more supervision of industry, and—very important—greater political control over the nuclear regulators.

The Commission vented its wrath on the NRC. Commissioner Harry McPherson called the agency "a management mess . . . not so much mismanaged as unmanaged." At the NRC, "there was no systematic method of evaluating these [plant operating] experiences and looking for danger signals of possible generic safety problems," the report says. The NRC commissioners are isolated from the agency's managers, and supervision of safety issues is confused, inadequate, and haphazard. The Kemeny panel recommends that the NRC be abolished and replaced with an executive branch agency, headed by a single administrator appointed by the President, with the approval of Congress. The administrator should be given great discretion to organize the new agency as he sees fit, the report says, and his primary statutory mission should be to ensure public safety. The report asks that the present Advisory Committee on Reactor Safeguards (ACRS) be kept, given more general authority, and allowed to intervene in proceedings as a party. In addition, the report recommends the creation of a new 15-member oversight committee, less technically oriented than the ACRS. The new committee would report to the President and Congress annually on nuclear safety. The report also seeks the creation of an Office of Hearing Counsel, which would participate in proceedings as a neutral party in an effort to see that safety issues are thoroughly reviewed. There are a dozen recommendations for changes in federal regulation.

In discussing the private sector, the report lays heavy stress on the need for new institutions that will assure the competence of plant operators and managers. It recommends that accredited centers be set up for training operators, and that graduates be given a degree. This would become a prerequiste for employment at a nuclear plant. As Commissioner Theodore Taylor put it, "We are concerned with what's in the operator's head." In the past, operators were not necessarily educated in the fundamentals of the industry that employed them. Several commissioners said they would like to encourage the birth of a new service industry whose sole mission would be to operate nuclear reactors. Utilities would sign contracts with these service companies for management of plants. This system, it is thought, would raise the profession's standards.

By emphasizing institutional reforms of this sort and soft-pedaling the mechanical problems, the report may mislead some people into thinking the latter

*Other members of the Commission were Bruce Babbitt, Patrick Haggerty, Carolyn Lewis, Paul Marks, Cora Marrett, Lloyd McBride, Harry McPherson, Russell Peterson, Thomas Pigford, Theodore Taylor, and Anne Trunk.

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are minor. For example, one editorialist wrote that "It was a close call, but none of the Commission's findings even suggests a dangerous flaw in the current *design* of nuclear power plants, unless it is the confusing arrangement of control-room monitoring devices" (The Washington *Star*). For the record, it is worth mentioning some of the machinery's contributions to the accident, as recorded in the Commission's report and technical staff papers.

• Because of the way the control panel was designed, more than 100 alarms went off during the first minutes of the accident; it was not unusual to have 50 or so alarms activated during "normal" operation of the plant. "Off-normal conditions" were indicated by a red, green, amber, or white light on the control panel, depending on the individual system in crisis. There are hundreds of indicator lights. To say the least, the scene was confusing.

• Some important control indicators were mounted on the large panels facing the operators; others were hidden from view on the back of the control consoles. No one had thought to design the system so that the most important indicators would be grouped in one place where they would be constantly and readily visible.

• The single piece of machinery most responsible for the accident was the pilot-operated relief valve on the pressurizer. It became stuck open and spilled water out of the reactor's coolant system for 2 hours. The same valve caused a similar accident at another plant in 1977, but did less damage because the plant was not running at full power, and operators spotted the problem sooner. (The lessons of the 1977 accident were never passed along to other users of Babcock and Wilcox equipment.)

• The indicator light for this relief valve, because of the way it was designed, showed that the valve was closed throughout the accident. This led the operators to assume wrongly that the valve was closed. This assumption was one of the major "operator errors" at Three Mile Island.

• A valve in the condensate (steam cooling) system could not be opened by remote control from the control room during the emergency; it had to be twisted open manually. This task and other problems with the condensate system took the shift supervisor away from the control room for 45 minutes during the first critical hour of the accident.

• The control room computer, which keeps a record of events occurring in the plant, was running $2\frac{1}{2}$ hours behind real time at one point, and its printer jammed for 73 minutes.

• Because of the way the water and steam circulation systems were designed by Babcock and Wilcox, the steam generators were highly intolerant of error. When circulation in the steam loop stops, as it did at 4 a.m. on 28 March 1979, the steam generators boil dry rapidly and cease to relieve the reactor of excess heat. In this case, they boiled dry in 1 minute and 45 seconds, an event that was missed for several minutes in the general confusion before remedial action was taken. This was another one of the "people problems," as the Kemeny report labels them, that increased the confusion in the control room at Three Mile Island.

• When the coolant water in the reactor began to boil, the steam it produced incapacitated the pumps that keep the coolant flowing through the fuel core. They had to be turned off. This accelerated the heat-up. According to a technical staff analysis on thermal hydraulics, these pumps had never been tested for their capability to run with a system full of steam.

• Because the piping ran uphill from the steam generators to the reactor vessel, water which condensed in the generators did not flow into the hot fuel core. The staff concluded: "If the steam generators had been elevated relative to the reactor and the piping arranged to permit drainage of that water into the reactor, damage to the core could have been delayed and perhaps prevented." The refusal of water to flow uphill at Three Mile Island was one of the things that made it impossible for the operators to establish "natural circulation" cooling in the reactor, as they tried to do during the first hours of the accident, after the pumps failed.

• As the fuel core heated up, a large amount of hydrogen gas collected in the reactor vessel and coolant pipes. This gas blocked the circulation of coolant water and steam; it accelerated the heat-up. Had the Babcock and Wilcox design included remotely controlled gas vents at the top of the coolant loops, this hydrogen might have been siphoned out of the system.

• The seals on the reactor vessel appear to have leaked radioactive gases and hydrogen into the atmosphere of the containment building, causing a hydrogen "burn" or explosion during the first day of the accident.

• Pipes and tanks holding liquids that came from the containment building also appear to have leaked, permitting radioactive gases to escape into the auxiliary building, and from there to the environment.

• Charcoal filters intended to remove radioactive iodine from the air leaving the auxiliary building "did not perform as designed," apparently because they had been "partially expended" before the accident. It is not clear whether this was a design or maintenance error.

The Commission cited some of these defects specifically and asked that they be corrected. But it did not go the extra step and demand that the "fundamental changes" in nuclear power production include a general redesign of the Babcock and Wilcox system, now in use at eight other plants.

Another thing the Commission did not do was to ask for a moratorium on the

A Review to Review the Review

President Carter, who has something of a sweet tooth for option papers, has commissioned a panel to review the review of nuclear power safety written by the Kemeny Commission. The President has asked the members to draft an option paper and submit it to him within 30 days. The group will be cochaired by Frank Press, the President's science adviser, and John Deutch, undersecretary of the Department of Energy (DOE). It will include seven other members, as follows: Gus Speth, chairman of the Council on Environmental Quality; James McIntyre, director of the Office of Management and Budget; Lloyd Cutler, White House counsel; Eliot Cutler, the President's energy policy coordinator; Stuart Eizenstat, the domestic policy adviser; Zbigniew Brzezinski, national security adviser; and John Macy, director of the Federal Emergency Management Agency. The staff will be directed by Richard Meserve of Press's office and David Bodde, chief of nuclear policy at DOE. Bodde is also chairman of the DOE task force developing a response to the Kemeny report.—E. M.

licensing of new nuclear plants while its recommendations are being carried out. The members were taken to task on this point by several congressmen, including Hart and Udall, who have proposed a 3-year moratorium on new licenses. Hart wanted to know why, if 8 out of 12 commissioners favored a moratorium, and if all agreed the NRC was "unable to fullfill its responsibility for providing an acceptable level of safety," the Kemeny group did not ask that plant licensing be delayed. The explanation, according to Commissioner McPherson, was that it was impossible to get a majority to agree on how a moratorium—once begun—would be called off.

In their appearance before Congress on 31 October, several of the commissioners argued that their report asked for a de facto moratorium. They cited recommendation number eight for reform of the NRC, which says that before the federal regulatory agency issues new operating or construction permits, it should "assess the need to introduce new safety improvements recommended in this report," review the competence of the applicant in light of the recent findings, and "condition licensing upon review and approval of the state and local emergency plans." Many state and local jurisdictions have no plan for dealing with a nuclear accident. Presumably they should not be allowed to have a new reactor built within their borders.

For the most part, the Commission focused on the future. It gave few specific directions concerning the 70 plants already in operation or the 92 that have received construction permits. In the future, the report says, power plants should be built "in areas remote from concentrations of population." As for plants in operation or under construction, it simply recommends that federal regulators demand better training of operators, improve safety analysis and enforcement, and try more diligently to discover generic technical problems. The government should force utilities to solve these problems and make corrections within firm deadlines. It should also "adopt criteria for revocation of licenses," and sanctions short of revocation such as putting a plant on probation or ordering an immediate shutdown.

There were few surprises in the Commission's findings of fact, except for those having to do with the hydrogen bubble. The investigation revealed that the NRC was profoundly ignorant of the radiolytic chemistry in the reactor coolant during the accident. The Commission's experts concluded that, contrary to what the NRC had feared during the first weekend after the accident, there never was and never could have been any risk of a hydrogen explosion in the reactor vessel.

More remarkable than this, the investigation found that the NRC escorted the President on a visit to the reactor control room on Sunday, 1 April, even though some of its highest officials believed there was a chance the hydrogen bubble might explode. It was not until after the President had left, at around 4 p.m., that the NRC concluded there was no danger of an explosion. The Kemeny Commission was unable to determine how the bubble disappeared as quickly as it did.

The impact of the accident on public health was negligible, except in terms of mental health. The Commission found that there was "immediate short-lived mental distress" among people living within 20 miles of the reactor. The maximum radiation dose received by any person off-site, excluding employees of the utility, was estimated to be 70 millirems, or, as a technical paper put it, "about one-half the normal exposure the average American receives from natural background radiation each year." The effect in terms of increased cancer incidence should be undetectable.

The damage to the fuel core was severe. At least 90 percent of the fuel rods burst, the center of the core slumped downward, and, during the hottest period of the accident, the core became partially molten. A staff paper concludes that the fuel will not begin to reheat, provided that it continues to be cooled by water containing boron at a concentration of 3180 parts per million. (The utility is keeping the concentration at 3500 parts per million by adding boric acid.) A hypothetical accident analysis done for the Commission concluded that if the fuel had become entirely molten, it probably would not have penetrated the containment building floor. Even if the fuel had gone through the concrete, the report said, it probably would not have gone through the rock that underlies the floor.

If the plant can be refurbished, the Commission estimates that the total cost of the accident will be between $1 billion and $1.86 billion, figures that include the cost of buying replacement power from other utilities.

The worst news, as one commissioner said, is that the accident is still in progress. It will not be over until the utility has removed and disposed of several hundred thousand gallons of radioactive water and tens of thousands of cubic feet of radioactive gas trapped in the containment building.—ELIOT MARSHALL

Academy Takes a "Million Dollar Bath" with Einstein

An embarrassed National Academy of Sciences is taking what one spokesman called a "million dollar bath" in its efforts to raise money for its controversial statue of Albert Einstein. The memorial cost $1.8 million, and a national fund-raising campaign begun almost a year ago has not come close to its goal.

In an apparent effort to offset the lag in contributions, the Academy has sold, for a record-breaking $455,000, two sets of rare books by naturalist John James Audubon. The Academy has also been accused in two lawsuits of skirting payment of $114,000 in commissions.

The Einstein fund fell short because of bad press, according to Academy officials. Late last year, critics attacked sculptor Robert Berks for his "bubble gum" style, the astrological connotation of the star-studded base, and the statue's cost (*Science*, 23 January). Berk's fee, which he says was "due on delivery" last 22 April, came to $1.1 million. "We had an agreement," he says, "and they lived up to it." Academy president Philip Handler says many corporations and individuals have turned down requests for contributions. More than 150,000 letters seeking donations were sent out.

Last 18 April, a few days before Berks was paid, the Academy sold for $425,000 their four-volume set of Audubon's *Birds of America*, which was published in London from 1827 to 1834. They also sold for $30,000 the *Viviparous Quadrupeds of North America*, which was published in the 1840's. Only 200 sets of the oversized edition of *Birds of America* were published, and 134 exist today, 94 of them in the United States. The Library of Congress has two copies, and the National Gallery of Art and the Smithsonian have one each.

The Academy received its copies of the books in 1932 as a gift from John Campbell Merriam, an Academy vice president. Handler says the sale is unprecedented and that "no other treasures have been sold."

A suit has been filed by a consultant to the Academy, David Schaff, and by Sotheby Parke Bernet Inc., one of the

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