state & society

How strict should the rules be on reactor safety?

Reactor safety has been getting a lot of attention lately, both from the Atomic Energy Commission and the public. An AEC hearing on one of the safety features of power reactors has been going on since last January, and the Joint Committee on Atomic Energy is planning to begin its own hearings on reactor safety in February.

The interest in safety has been the result of some findings in 1971 that the predicted margin of safety in an emergency backup system of power reactors might not be as great as has been thought and because of the discovery that a type of fuel rod in use in four reactors in the US has been crumpling from the high pressures in the reactor core.

The backup system is called the emergency core cooling system, or ECCS. It is designed to spray or flood the core of a reactor with water in the event of a lost-of-coolant accident, known in the reactor business as LOCA. In a LOCA, the hot, pressurized water that normally carries heat from the reactor core to create steam to turn turbines is ejected from the core because of a break in a pipe. When this happens the reactor core continues to heat up because of the remaining fission products. Water must somehow be returned to the core in about a minute or the core will melt, releasing the UO_2 from the fuel rods and eventually melting down through the reactor vessel down into the earth, in what is known as the "China Syndrome." In this case there is the possibility that fission products could be released to the environment.

The AEC claims that the probability of a LOCA itself is very small and that there is little danger of such a catastrophe, but some tests carried out in 1971 on a model simulating a reactor's coolant loops indicated that the computer models used to predict the behavior of a reactor during a LOCA were not as accurate as had been thought. As a result, in June 1971, the AEC issued new rules (Interim Acceptance Criteria) for the operation of power reactors to ensure that in the event of a LOCA the accident would be controllable with currently designed ECCS.

According to many environmental groups that were fighting licensing of nuclear reactors around the country, however, the new rules weren't enough. In particular, the Union of Concerned Scientists, a Boston group that includes a number of physicists and nuclear engineers, offered technical arguments that the Interim Acceptance Criteria did not make reactors safe enough. Rather than debate the issue of ECCS safety in many individual hearings around the country the AEC decided to hold a single rulemaking hearing on the subject in Washington. Many of the groups who opposed some power plant sitings and licensing formed a group called Consolidated National Intervenors. The Union of Concerned Scientists was a part of that group. The hearings began in January of last year and have included the AEC regulatory staff, which is responsible for setting operating rules and licensing reactors, reactor manufacturers (which include Babcock & Wilcox, Combustion Engineering, General Electric and Westinghouse), representatives of some elec-

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New constitution expands IEEE's aims

The Institute of Electrical and Electronics Engineers is amending its constitution so that it can undertake professional activities. The amendments come as a result of a vote by the membership in which about 85% of those voting favored the change. About 50 000 of the 131 000 members of the Institute voted.

The amendment changes the stated purposes of IEEE from solely scientific and educational to include professional aims, "directed toward the advancement of the standing of the members of the professions it serves." The Institute was formed in 1963 by a merger of the American Institute of Electrical Engineers and the Institute of Radio Engineers.

IEEE had been working on the professional problems of its membership since the periods of heavy unemployment in the late 1960's. It set up programs for continuing education and career development, published salary surveys and unemployment data, participated in government programs to assist the unemployed and set up an office in Washington. According to IEEE Executive Director Donald G. Fink, however, these activities were limited by the Institute's constitution to an "insubstantial fraction of the Institute's efforts and resources."

In the spring of 1971 an amendment that would make the improvement of the economic well-being of the membership the primary purpose of the IEEE was submitted by petition, but it was rejected by the membership. The IEEE Board then sent out a questionnaire to the members to try to find out what sort of amendment on professionalism, if any, they wanted. Opinion was two to one in favor of an amendment. An amendment that was com-

FINK

piled on the basis of the questionnaire passed by a seven-to-one margin.

Some of the activities that the amendment allows the IEEE are "the conduct and publication of surveys and reports on matters of professional concern to the members of such professions, collaboration with public bodies and with other societies for the benefit of the engineering profession as a whole and the establishment of standards of qualification and ethical conduct."

The Institute is currently working on plans to implement some of the newly permitted programs and to expand those it already conducts. One of these, which the IEEE Board says will almost definitely come about, is the establishment of a pension program, probably of the "floating" type, which remains in effect even if the employee changes jobs. This may be administered by the IEEE for its members.

Another program mentioned in the amendment that IEEE plans to get under way is the establishment of employment guidelines for engineers and their employees. At the present time this is being studied by the Engineers Joint Council, the National Society of Professional Engineers (which includes the IEEE), and other engineering societies, as well as the 100 000-member American Chemical Society. It is expected that the employment guidelines will be announced some time in 1973.

One problem facing the engineering profession is the lack of adequate manpower data and planning. The amendment permits the IEEE to expand its manpower activities, and the Institute plans to do just that during 1973.

The amendment to the IEEE constitution states that the IEEE may not engage in lobbying, but it gives the Institute increased leeway in its dealings with the government. Previously, Institute representatives had to wait until they were approached by a government agency before they could offer information or advice. They can now advise agencies and Congress on scientific and technical policy freely, and presumably they will push policy changes that will provide more opportunities for engineers. The IEEE will also be able to increase its programs for unemployed members. In addition to continuing and strengthening its employment workshops, the Institute is considering a job referral service.

The number and extent of projects planned by the IEEE are dependent on one thing at this point: money. In the poll taken before the amendment was drawn up, the US membership indicated that they would be willing to pay about $5.00 per member for the support of professionally oriented activities. A regional assessment in that amount has been made, and the US members have been asked to indicate whether they feel their money should be spent in professional or technical areas or both. It is likely that some of the plans for new projects will have to wait until the dollars are in. —SMH

Ten named to Office of Technology Assessment

The Office of Technology Assessment (see PHYSICS TODAY, May 1972, page 70) recently established by Congress is now being formed. The OTA, which has been strongly supported by Senator Edward M. Kennedy (D.-Mass.), is intended to provide members of Congress with advice and information on the impact of ongoing and proposed federal programs. The office will consist of six members of each house, half Democrats and half Republicans, and a nonvoting director. There is also an advisory council made up of ten members of the public who are expert in science or engineering or the administration of technological activities and two *ex officio* members drawn from the government. The council will be able to recommend subjects for assessment and to review assessments already completed.

The members of the board as of this writing include Kennedy, Hubert H. Humphrey (D-Minn.), Ernest F. Hollings (D-S.C.) Richard S. Schweiker (R-Pa.) and Peter H. Dominick (R-Col.) in the Senate and John Davis (D-Georgia), Mike McCormack (D-Wash.), Charles A. Mosher (R-Ohio), James Harvey (R-Mich.), and Charles Gubser (R-Calif.) in the House. There has been speculation that the post of director will be offered to the former chairman of the House subcommittee on science, research and development, Emilio Q. Daddario.

The office will be funded on a continuing authorization that is intended to reduce the pressure of partisan influences in Congress. The first authorization is $5 million for two years.

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tric utilities and the intervenor group.

So far the hearings have revealed a wide range of opinion on the suitability of the presently designed ECCS. The AEC regulatory staff has put forth its own findings on what should be done in a set of proposed changes to the interim acceptance criteria. The changes, which are not binding on the operators of power reactors and only represent the regulatory staff's position at this point in the hearings, set acceptable limits to the course of an accident based on a complicated procedure that is used to calculate the predicted events in a LOCA. They were drawn up, an AEC spokesman said, as a result of the commission's own ongoing research on the subject as well as facts that have been brought out during the hearings. They related to calculations done for each reactor that are used to predict what will happen in a reactor in the event of a cooling accident and give the regulatory staff a basis for setting the permitted operating levels. Specifically, the proposed changes lower the predicted temperature of the hottest fuel rod in a reactor in the event of a LOCA by 100 deg F to 2200 deg F. They also limit the length of time a fuel rod may stay at elevated temperatures if an accident occurs and require that fuel-rod swelling and the consequent effects on emergency cooling water be taken into account when predicting ECCS behavior.

Once the calculational procedures are finalized by the AEC, ECCS behavior will be calculated for each reactor and the AEC will limit the reactor's operation accordingly. In any event, it will be some time before they are officially changed. The hearings are being carried out in a quasi-judicial manner with cross examination of witnesses and may go on for several more months. Then the AEC commissioners will have to review the findings internally and decide on the final evaluation criteria.

The discovery of crushed fuel rods in some reactors has complicated the ECCS hearings. This problem stems from an as yet unexplained densification and settling of uranium fuel pellets in reactor fuel rods and the subsequent caving-in of the fuel cladding in places where cavities were left. So far this has been found in three plants, all fueled by Westinghouse—The Beznau 1 reactor in Switzerland, the R. E. Ginna plant owned by the Rochester Gas and Electric Company and Unit 1 of the Point Beach Nuclear Plant of the Wisconsin Electric Power Company.

The problem is most severe in "unpressurized" fuel rods, rods in which the internal pressure is about 15 psi—most fuel rods currently used are pressurized to about 200 to 400 psi and can better withstand the high pressures inside a reactor core (about 2200 psi in a pressurized water reactor). According to the AEC, a small number of the affected fuel rods have ruptured.

The Atomic Energy Commission is dealing with the problem in the affected reactors by requiring them to operate at lower power ratings and to monitor carefully for increased radioactivity in cooling water due to a ruptured fuel rod. Also, the commission is asking all reactor owners to revise their calculations that predict behavior of ECCS in a cooling accident by taking fuel rod densification and flattening into account. This is because the flattened fuel rods are more prone to develop hot spots and could be more dangerous in a LOCA. More reactors may have to reduce their

operating temperatures and hence their power output as a result of the calculations.

All these questions about reactor safety may be hurting the power reactor program in the US. Certainly, reactors have not come on stream as fast as was predicted in the early and mid-1960's. But after a period of almost a year in which only one or two reactors were licensed for operation by the AEC, the commission expected about 15 more to be operating by the end of 1972. —SMH

APS letter protests Soviet emigrant policy

At the request of the Council of the American Physical Society, APS President Philip M. Morse has sent a letter to Mstislav Keldysh, President of the Soviet Academy of Sciences, protesting the treatment of Soviet scientists trying to emigrate. The letter reads:

"Dear Professor Keldysh:

The many friends of Soviet science, among the membership of the American Physical Society, have learned with dismay the serious penalties imposed on scientists who desire to emigrate from the Soviet Union.

The Council of the American Physical Society has asked me to transmit to you our concern at this barrier to the free flow of science and scientists. We join with our colleagues of the US National Academy of Sciences in urging you to transmit this concern to the members of your Academy and to your government.

Please be sure that our request is made in the spirit of friendship and collaboration with Soviet physicists that we have enjoyed for so long."

The National Academy of Sciences Council has asked Harrison Brown, the NAS foreign secretary, to contact academies in other countries on the general problem of freedom of circulation for Soviet scientists to see if there is support for a joint appeal to the Soviet academy. An NAS spokesman said that the problem would be discussed soon at a meeting of representatives of the academies of several nations.

New faces at NSF physics section

Three staff changes have occurred in the Physics Section of the National Science Foundation, according to Marcel Bardon, who heads the section.

Jonas Schultz, after a year as associate program director for particle physics, has returned to the University of California at Irvine.

Under a new arrangement, NSF makes a grant to a university for one or two years while a faculty member works at NSF, thus allowing the Foundation to employ people very active in their fields. Two physicists who have joined the section under this arrangement are Boris Kayser from Northwestern University, who is associate program director for theoretical physics and Morton Brussel of the University of Illinois, who is associate program director for nuclear physics. Bardon told us, "We are actively looking for university physicists to come to NSF to help us manage the various physics programs for next year."

in brief

Applications are now available for the American Vacuum Society scholarships for graduate study for the academic year 1973–74. They carry a maximum stipend of $4000. A special $1000 scholarship is available for students in New Mexico, Arizona, Texas and Oklahoma. Write to AVS, 335 East 45th St, New York, N. Y. 10017. The application deadline is 30 March.

The Joint Institute for Laboratory Astrophysics announces the start of the annual competition for its Visiting Fellowship Program (16 January application deadline) and for Postdoctoral Research Associateships (15 February deadline) for the period 1973–74. Write to David G. Hummer, Secretary, Visiting Scientists Program, JILA, University of Colorado, Boulder, Colo. 80302.

A new journal, *Superconductivity Research*, is being published by Cambridge Scientific Abstracts, Inc, Suite 437, 6611 Kenilworth Ave., Riverdale, Md. 20840. The annual subscription price is $125.00 for institutions and $20.00 for individuals whose institutions subscribe. The journal has no page charges.

the physics community

Xerox and Kodak volunteers help schools in Rochester

A program in the Rochester elementary schools in which volunteer scientists from Xerox and Kodak serve as science consultants has been successful and is expanding into the secondary schools. The program, which has been going on for about five years, is aimed primarily at inner-city schools and helps give the students the scientific training they might otherwise miss.

The program was started by a group of Rochester scientists concerned about the lack of access in the public schools to the scientific and technical expertise of many of the people who work in the Rochester area. In the inner-city schools especially, a heavy emphasis is placed on developing reading and mathematical skills, with the result that science studies may suffer.

The group decided that those interested could work as consultants in the school, visiting about once every other week for a period of about four hours. On the average, each consultant is assigned to two classrooms and he works closely with the teachers, so that material presented in the consultants' visits will coordinate with regular classroom work.

Kodak and Xerox are jointly involved in the program. Presently Kodak provides about 10 consultants, and Xerox provides 45 regular consultants and 10 reserve consultants, who give specialized demonstrations and act as substitutes when a consultant cannot meet with his class as scheduled. John McInally serves as coordinator for the group from Xerox, and John Holtzclaw coordinates those from Kodak.

Until recently eight city schools have participated in the program, according to McInally. Immaculate Conception Elementary School, the Rochester School for the Deaf and the State School at Industry also participate. This year the consultants were invited to expand their activities to one of the area secondary schools and the Science Consultants Program now includes Benjamin Franklin High School. —SMH

F. Dow Smith becomes OSA president-elect

F. Dow Smith is the president-elect of the Optical Society of America for 1973. He will succeed Robert E. Hopkins of Tropel, Inc, who assumed the presidency on 1 January.

Smith is vice-president and corporate scientist at Itek Corporation, where he specializes in the application