dle year abroad with an appointment supported by the host institution also takes a budgetary load off American institutions. This does not place an excessive burden on institutions abroad, as many places, including the Weizmann Institute, would be happy to take on additional postdocs under these circumstances.

I do not think that it would be practical to make any formal arrangements through the APS involving two institutions and a candidate. However, publicizing the existence of this kind of program might make it generally acceptable and induce both institutions and candidates to consider it in individual cases.

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IUPAP on freedom

While the International Union of Pure and Applied Physics provides a variety of services to physicists, many of them might well be provided by other organizations. However, as the principal international agency for physics, it has had a special concern for the free movement of scientists from one country to another. Recently this cause has been sorely tried by new problems.

Over the years, IUPAP has struggled, for example, to insist that no physicist be barred for political reasons from an international conference organized by one of its Commissions. This is usually done by means of refusing visas. While success has been uneven, it has been steadily increasing, and in recent years few cases have been reported. However, few is too many, and at its last General Assembly in Washington, 1972, delegates voted unanimously a re-affirmation of IUPAP principles of free travel, which are similar to those of the International Council of Scientific Unions (ICSU). If it were stated by a conference's host country that visas would be refused for political reasons, IUPAP support for the conference would be withdrawn; if they were refused *de facto* too late for IUPAP to act, its international commissions would be warned against holding further conferences in the country. In 1973 no cases of visa refusal have been reported.

However, there can be harassments. In one 1973 case, following repeated cautions, visas were finally issued to twelve scientists who appeared to have been barred, but very late—too late for six of them to attend. While the letter of the agreement was observed, the spirit was not, and further conferences in the country concerned will require stronger guarantees.

There can also be more delicate problems. At the same conference, it was learned that several nationals of the host country who wished to attend the meeting were prevented from doing so. The Commission chairman, who was present, had worked hard and successfully to surmount the visa problem and now bent his best efforts to what appears to have been, legally, an internal matter. Therefore his interventions, although vigorous, had to be of a private nature and were not successful. We are faced with a new obstacle to the free movement of scientists.

Problems involving internal matters are no less pressing or less urgent than those that involve frontiers. They may not be dismissed or swept under the rug for that reason. However, many years of bitter experience from the United Nations downwards has proven how difficult these problems are and how frustrating it is to pin them down in rules, regulations or sanctions. Many authentic-sounding apolitical reasons can be invoked to cover an act of political discrimination, just as cries of political motivation can arise from disappointed applicants in a travel grant competition. The cause may be clear, but the lawyers are clever.

These questions will be reviewed at the coming IUPAP Executive meeting. However, all physicists involved in international gatherings must be alert to them and exercise their influence to safeguard those freedoms which are essential to science. Freedom of movement is one of the more important, and currently one that is threatened.

Larkin Kerwin
Secretary-General
IUPAP

Editor's note: We understand that the IUPAP executive meeting has now been held, and the ICSU principles concerning the free circulation of scientists were reaffirmed at that meeting.

Reactor safety questioned

I disagree with the bias of recent articles published in PHYSICS TODAY on the subject of nuclear power in general, and nuclear power-plant safety in particular (August 1973, page 30; May 1972, page 28). These articles, written by men working in the field who could be expected to be pro nuclear power, appear to be largely self-serving. Surely enough controversy has arisen over the question of nuclear-power generation that a qualified member of the opposition could be found to present another viewpoint.

One interesting aspect of the article by Charles Leeper (August, page 30) is the fact that many significant tests re-

main to be done. Note the verbs in the following quotes: "We plan to use some irradiating test fuels . . ." "In parallel with these tests, other tests will be run . . ." "Under these circumstances, we anticipate . . ." I think that the implication is obvious.

Regardless of how good things look on the drawing board or in a computer simulation, the fact remains that engineering drawings and computer simulations don't produce power. Quite often nuclear power plants don't either. Consider the case of Millstone One, located in Waterford Ct., as summarized recently in a local newspaper. (Millstone One is a pressurized water reactor with a capacity of 652 100 kW.)

1 Sept. 1972: Plant shut down because seawater leaked from the plant cooling system (water source is Long Island Sound) into the plant's feedwater system. The leakage was noted to have been "tiny." Subsequently, Northeast Utilities reported that faulty construction caused "fatigue cracking"; the cracks resulted from stresses that occurred when a water distribution system, fed by "feedwater spargers," was installed. Northeast reported that repairs would cost millions of dollars. Furthermore, the public was not officially informed as to the reason for the shutdown until December 1973, a fact I consider reprehensible.

10 March 1973: After repairs the plant was started up.

17 April 1973: Plant shut down for scheduled inspection. The leaks had been plugged, but the new spargers had cracked after five weeks of operation.

16 July 1973: As Northeast was about to restart the reactor, it was notified by General Electric that the control rods had been installed upside down. (Is Detroit building reactors too?) Since this did not "violate the strict AEC safety regulations," the reactor was started up on 28 July 1973.

30 July 1973: The reactor scrammed. An AEC report stated that the scram was not related to safety, and the reactor was started again. Subsequently, Northeast found that instruments measuring the water level in the reactor vessel reported different levels.

13 August 1973: Plant shut down.

15 August 1973: Plant started up after water-level measurements system was corrected.

17 August 1973: Finally, as I am writing this letter, the TV evening news reports that Millstone One has been forced to cut back to 80% of its capacity due to mechanical problems. This appears to be the result of vibrations within the spargers, which occur when the plant operates at full power.

I wonder if any of these problems are plaguing other nuclear power plants. In any event, I think that this chronology speaks for itself. I also think that the viewpoint of articles such as those I referred to earlier are, at best, too remote from the nuts and bolts of nuclear power-plant operation.

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The blandly reassuring article on the safety of reactor emergency core cooling systems (ECCS) by Charles Leeper leaves unanswered as many questions as it answers. Some of these potentially embarrassing questions are:

▶ The article asks the question: "How safe are reactor emergency cooling systems?," but does not answer it. Leeper is quite confident in describing tests yet to be performed ("tests contemplated . . .", "we anticipate . . .", "would investigate . . .", "we plan . . .", "it will show . . ."), but makes minimal mention of tests already performed. No data points appear on the sole graph in the article. Other authors, no less reputable, claim that previous tests were generally either flawed in design or execution, cancelled for budgetary reasons, or gave results that cast doubt on the adequacy of ECCS design[1,2].

As of 31 March 1973 there were 30 operable civilian reactors in the US, 60 under construction, and 75 more on order[3]. Why are these seemingly necessary tests being conducted *after* so many reactors have been built with what *may* be faulty designs? Conversely, if the present designs are known to be satisfactory, why bother with the extensive series of tests outlined in the article? The analogy to testing an airplane after it has been put into passenger service is not perfect, but it is not wholly inappropriate, either.

▶ Given the huge investments that the AEC, Aerojet Nuclear and the rest of the industry have in the present reactor technology, what guarantees does the public have that unfavorable test results will not be distorted or suppressed? This is a common phenomenon in the drug and pesticide industries. The AEC itself has suppressed reports critical of ECCS reliability on at least one occasion; only after the Union of Concerned Scientists sought a subpoena under the Freedom of Information Act was the report made available.

▶ The Price–Anderson Act limits the liability of reactor operators and manufacturers to $500 million of US Government insurance plus the maximum available amount of commercial insurance, currently $60 million. In the event of a loss-of-coolant accident in

which the ECCS did not function adequately, the potential damage could be more than an order of magnitude greater than the above limit[4]. Does the nuclear industry now have enough confidence in the adequacy of existing ECCS technology to assume full liability? If not now, when will they have sufficient confidence? By 1977, when the ACT expires?

References

1. I. A. Forbes, D. F. Ford, H. W. Kendall, J. J. MacKenzie, Environment **14**, no. 1, pages 40–47, Jan–Feb, 1972. Published by Scientists Institute for Public Information, 438 N. Skinker Blvd., St. Louis, Mo. 63130.
2. D. F. Ford, H. W. Kendall, *An Assessment of the ECCS Rulemaking Hearing*, available for $8 from Union of Concerned Scientists, P.O. Box 289, MIT Branch Station, Cambridge, Mass 02139.
3. USAEC figures quoted in *Radiation Data and Reports* 14, 391 (1973).
4. USAEC report Wash-740.

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THE AUTHOR COMMENTS: The August article was intended to treat the subject of how the safety information required for emergency-core cooling-system licensing determinations is generated. It further describes the verification program to provide experimental support for the computer codes used in the licensing determinations. These are clearly important parts of the total reactor safety program.

Specifically Aerojet Nuclear is charged by the AEC with the production of computer codes for the safety analysis of plants and with the generation of experimental data and supporting logic to assess the accuracy of these computer codes. The purpose of the article was to present the logic and to indicate the overall approach for verifying computer models and codes. It is felt that more specialized journals are the proper media for the presentation of specific data and the results of the verification activities.

Gollon's points concerning the timing of experimental efforts, information distortion potential, and Price–Anderson Act implications are recognized by program principals, but were not felt to be germane for this article. The position of Aerojet Nuclear in safety matters has been consistently conservative, which might be expected since its business depends significantly upon the generating of objective safety information. The article facts and conclusions continue that position.

Readers might be interested to know that Aerojet Nuclear is responsible for thirteen reactors, ten of which are operational, and four of which range in power from 40 to 250 MW (thermal). We are, therefore, very much involved in the "nuts and bolts" of operational problems and are actively involved in operational safety efforts.

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EDITOR'S NOTE: Confusion about the author's intentions may have been generated by the article title selected by the editorial staff, "How safe are reactor emergency cooling systems?" as opposed to the author's original title "Nuclear Safety: Emergency Core Cooling."

Working with children

As a result of reading the June 1972 issue devoted to "Physics for children," I have used one day a week, this past year, on working in physics activities with children along with one or two specially related projects in the natural sciences. The children with whom I am involved are primary-grade level (1–3) and are emotionally handicapped, attending a residential children's center school. My involvement has led me to the following conclusions: 1. There are many science programs in existence; one must choose carefully. 2. In working with children one should take his cues from the classroom lead teacher. 3. With respect to source materials, I have drawn from the programs described in PHYSICS TODAY along with publishers' teacher's guides recommended by the Rochester School System. This provides a failsafe approach for the adult initially unversed in child-educational development with respect to the classroom situation. 4. Children have related to me in a straightforward and accepting manner; there is no "generation gap." 5. Emotionally handicapped teachable children can and have benefitted in a therapeutic manner as well as a learning experiential way from physics activities. 6. There are many opportunities for a physicist to use his skills besides teaching, such as developing teaching aids or computer-aided instruction methods; the situation is open-ended.

In conclusion, the physicist can aid the child and, in return, the child can aid the physicist by presenting him with an opportunity to rediscover the fact that the child has this in common with him; he (the child) is naturally curious and thus explores; he also describes things about him and does, indeed, search, experiment and discover.

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