RESEARCH ON REACTOR PHYSICS DATA

The achievement of reliable and economic nuclear power requires a thorough knowledge of a great number of factors, ranging from basic physical phenomena to the most minute engineering techniques. Great progress has been and is being made in acquiring this knowledge. Nevertheless, gaps remain and reactor designers are continually in search of more complete and accurate information.

In the early years of nuclear reactor research, each national program tended to develop its own reactor physics information. The first United Nations Conference on the Peaceful Uses of Atomic Energy, held in Geneva in 1955, led to a great increase in the exchange of information about reactor science and technology and in the number of fruitful international contacts among reactor scientists. By the time of the Second Geneva Conference on the peaceful atom, in 1958, it had become clear that major research programs in several important branches of reactor science were progressing independently, but in parallel courses, in different countries. In some instances nearly duplicate projects had been carried on.

One field of research on which several nations were working, the physics of heavy water lattices, was the subject of a special session at the 1958 Conference. The problem was so complex that further communication between the participants seemed desirable. The International Atomic Energy Agency accordingly organized a panel on the physics of heavy water lattices in August and September 1959.

It was revealed during the discussions of this panel* that fundamental reactor physics data for heavy water moderated cores measured by investigators in different countries did not agree entirely. One of the main reasons for this appeared to be that the available facilities were utilized mainly for measurements of rather limited range which were needed in the design of specific reactor projects.

The Norwegian Proposal

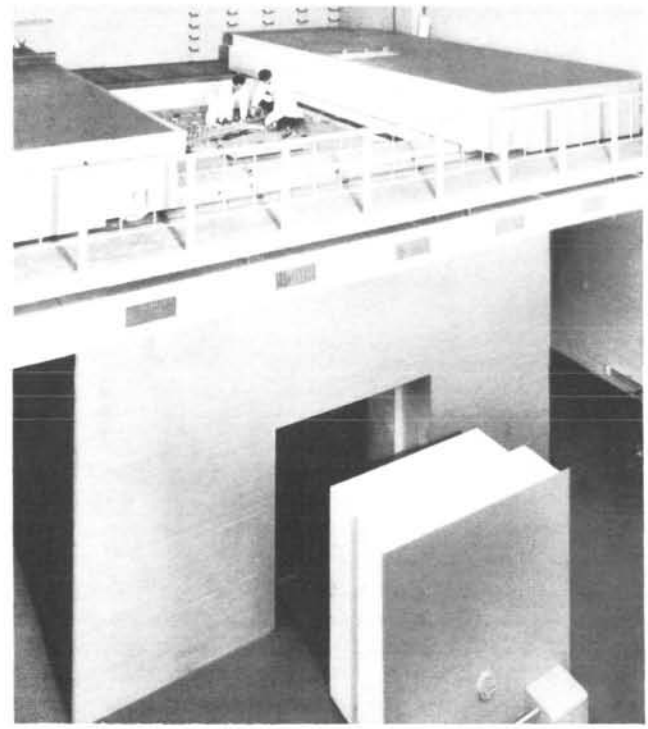
Against this background, it was of great interest when, early in 1959, the Government of Norway proposed to the Agency the undertaking of a joint program in reactor physics utilizing the facilities and staff of its zero power reactor, NORA, then under construction.

The proposal appeared to offer promise of obtaining precise basic data of wide applicability. This was partly because of the design of NORA, which is built with an extremely simple geometry. For example, exceptional care has been taken to make the bottom of the cylindrical vessel absolutely flat, so as to make it possible to solve the theoretical equations relating to the geometry of reactor cores. This will increase the accuracy of comparisons between experimental results and theoretical calculations. NORA is also an unusually flexible facility, designed for measurements of cores moderated by light water, heavy water, or a mixture of the two, with variable and mixed lattices.

The proposal had interest also because of the preliminary research program suggested by Norway, which, in addition to the measurement of integral reactor physics data of cores moderated entirely by light water or heavy water, includes studies on mixed heavy and light water moderators. Such mixtures can give a very novel form of reactor control. No extensive measurements have yet been carried out in this field.

The significance of the project was further enhanced when the United States Government offered to make available for it a core enriched to 3 per cent in the isotope uranium-235. This core had originally been part of a critical facility used in development

The zero energy facility NORA at Kjeller, Norway. Photo shows the reactor block with movable top shielding



* *A summary, in English, of the proceedings of this panel was published by IAEA in 1960 under the title "Heavy Water Lattices".*

work for the nuclear merchant ship Savannah. Since the two cores which Norway had available consisted of natural uranium and 1.7 per cent enriched uranium, respectively, it became possible to conduct studies during the program on three core loadings of varying enrichments and thus to broaden considerably the range of experiments possible.

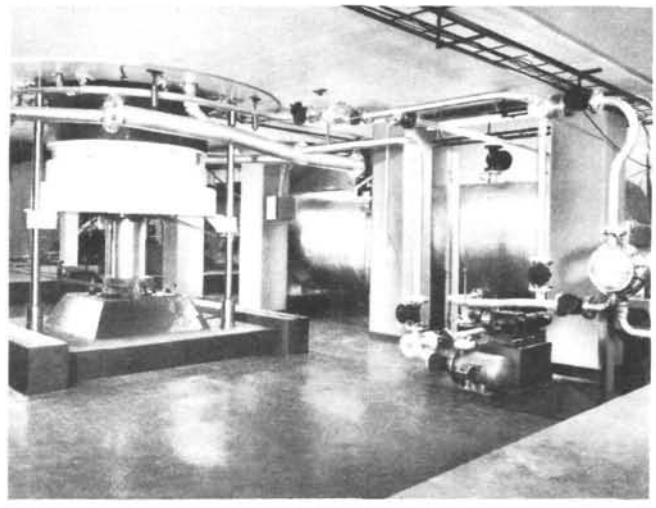
Approval of the Project

The main outlines of the proposed undertaking were first presented to IAEA's Board of Governors in September 1960. The necessary documents were then prepared and received approval from the Board in February 1961.

The direction of the project is centered in a five-member Joint Scientific Program Committee, under the Chairmanship of Dr. Raja Ramanna of India, who was a mutual choice of the Agency and Norway. The Agency is represented on the Committee by Dr. Pierre Louis Balligand and Dr. Carlo Salvetti, Norway by Mr. Olav Kasa and Dr. Henrik Ager-Hansen.

The primary functions of the Committee are to determine the detailed research program on an annual basis and to select from among those nominated by IAEA the international team of scientists who will carry out the research. The Committee is expected to meet twice a year at Kjeller, Norway, site of NORA. The first meeting is scheduled to take place in April 1961.

The opportunity to nominate scientists for the research team is one of the most attractive aspects of the project from the Agency's point of view. Some of those selected may be assigned on Agency fellowships. Others may participate at the expense of their own countries. Following the approval by the Board of Governors in February, the Agency invited Member States to submit the names and qualifications of scientists they wished to suggest for the project. The Agency is now reviewing the qualifications of the persons suggested.



In the basement of the NORA reactor building, a hydraulic jack, seen here in a lowered position, removes a plug from the bottom graphite reflector to enable reflector experiments to be carried out. The heavy water storage tank is to the right

All the results and information gained through the program, which is expected to last about three years, will be placed at the disposal of the Agency's Member States.