PIN-POINTING THE PINHOLES

Nuclear power reactors are complicated atructures. They may contain tens of thousands of pieces of fuel enclosed in canisters of specially designed alloys. Watch has to be kept on each piece - or fuel element - in case something goes wrong with one of them. Experts called together by the Agency have considered the ways in which this can be done.

The purpose of the canisters is to prevent the escape of radioactive fission products generated in the fuel during operation, and to protect the fuel from possible chemical attack by liquids or gases used for cooling purposes. A failure - which may be no more than a pinhole - means that the canister no longer performs its functions to the standard required.

Failures occur in only a very small fraction of the fuel elements loaded into reactors. For example, in the United Kingdom, five power stations with altogether ten reactors had 137 failures out of nearly 400 000 fuel elements, and the record elsewhere is in general equivalent. Again, most failures can be allowed to remain in the operating reactor until it is convenient to remove them. Only 16 of the 137 failures in the UK reactors called for quick replacement.

Nevertheless, the continuous release of radioactivity into the coolant from a number of small failures could give rise to problems in, say, carrying out maintenance of plant components, because of health hazards; and a single serious failure could lead to a prolonged shut-down of the reactor and might prejudice its future operation.

It is important, therefore, from the point of view of both safety and economics, to have efficient ways of establishing whether a failure has occurred and, if so, where it is. The purpose of the panel meeting held in November was to review detection and location systems now in use, to examine experience in various types of reactor, and to prepare a report covering the subject more fully than has been done before.

All of the methods now employed are based on detecting the presence within a reactor of radioactive gases or particles which could have escaped only from the fuel. Differences are due primarily to the fact that there are variations in fuel, coolant and other features from one type of reactor to another.

The UK report was presented by D.K. Cartwright, and one from Japan also indicating few failures by K.Mochizuki. S.Jacobi, Federal Republic of Germany, described the operation of a reactor for ten weeks using a fuel element

which had intentionally been pierced. S. Ceja, US, spoke of experience in several reactors, and O. Strindehag, Sweden, of calibration of systems for water-cooled reactors. A. Roguin, France, dealt with techniques, tests and experience connected with six reactors. Methods proposed for the Czechoslovakian heavy water reactor were reported by Z. Melichar, and locations of failures in the CANDU pressurized heavy water reactors by J. Lipsett, Canada, who also acted as Chairman of the panel. As an introduction to the discussions D.S. Briggs, IAEA, summarized techniques and literature on the subject.

As a result of their meetings, the panel was able to draw up information papers on the methods used in light water reactors, reactors moderated with heavy water and cooled by heavy water, boiling light water, gas or organic liquid, natural uranium reactors moderated with graphite and cooled by gas, advanced gas-cooled reactors and fast reactors.

The experts taking part came from Canada, Czechoslovakia, France, Federal Republic of Germany, India, Italy, Japan, Sweden, UK and USA, and there were also two representatives from Euratom. The proceedings are to be published by the Agency.

RADIATION INSIDE REACTORS

A "correspondence club" of scientists in many countries is being organized by the Agency to make available information about the measurement of radiations which occur inside reactors. It will be guided by a working group of world experts appointed with the collaboration of Governments.

One of the Agency's continuing interests is to try to ensure that fullest use is made of research reactors, particularly in developing countries. The work carried out with these reactors can aid many branches of science, but for many of the studies it is necessary to know what happens to different materials when exposed to radiation inside the different types of reactor. Varying types of radiation produce differing effects, and it is extremely important to obtain accurate information of the amount of radiation received by a sample. Methods of measurement also vary according to the information required; it is therefore necessary that the methods used should be well understood, so that the experimental results from different laboratories can be properly compared.