# NEUTRON MONITORING FOR RADIOLOGICAL PROTECTION

At the end of a week's symposium on neutron monitoring for radiological protection held in Vienna by the Agency in September an international panel of experts summarised the information brought together by the papers and discussions. There were 147 participants from 23 countries and four international organisations for what was described by Professor I.S. Zheludev, Deputy Director General of IAEA for Technical Operations as "one of our most successful meetings this year".

Dr. G. Cowper (Canada), reviewing monitoring techniques, said he felt they could say to the applied health physicist that there had not been any very drastic changes as far as area monitoring was concerned but lively investigations were still in progress and they could look forward to some interesting developments in the future. He did not think they should be too worried about the massive dimensions of some of the rem counters because they did not have to be carried about daily. He would in fact have liked to see area monitors given more attention during the meeting. He considered that complexity of operation of instruments had become less of a problem as time went on, thanks to work in other disciplines. Package radiation detectors provided high reliability and would become even more trustworthy. They might even, with very low battery consumption, be able to dispense with the "off-on"-switch which was possibly the user's main concern.

On standards and calibration aspects Dr. M. Bricka (France) said it was very satisfying to see the rising concern for intercalibration. This proved that experimenters were sufficiently certain of their results to compare them with others. It was further interesting that some installations were now devoting work to intercalibration. Oak Ridge might be too distant for Europeans, but the Van der Graaf machine at the National Physical Laboratories, England provided a source of monoenergetic neutrons. They were still at a disadvantage in the high energy fields and he envisaged one day the construction of a Health Physics research synchrotron. As far as the future was concerned, the largest number possible of experimenters should be able to carry out measurements on existing sources, their results to be collated and put at everyone's disposal. It would help tremendously if they could have calibrated neutron sources available in Europe. In the meantime perhaps IAEA could assist by obtaining facilities at reactors in standard conditions of flux and spectra. The same procedure might be adopted for large accelerators of electrons or protons.

Dr. P.N. Krishnamoorthy (India) said that after hearing the large number of papers on personnel monitoring they must come to the conclusion that there had been no fundamental breakthrough during the last six months or longer. The situation in regard to actual monitoring was complicated if the

area were cluttered up with a lot of equipment, and changes in set-up brought other problems. For thermal neutrons nuclear emulsions and other devices might give a reasonable assessment. One should know the spectrum so that the contribution from fast neutrons could be clarified. With a nuclear emulsion it had been possible to measure fast neutrons above 300 KeV. An interesting development auguring well had been the development reported from Czechoslovakia of polymer emulsions with high hydrogen content. One might hope to be able to measure fast neutron doses at lower energies. Radiation personnel monitoring was possible using a large number of combinations of filters.

Dr. F.P. Cowan, head of the Health Physics Division at Brookhaven, who attended on behalf of the International Commission on Radiation Units and Measurement (ICRU), and the International Commission on Radiological Protection (ICRP), said he had learned much, had suffered some disillusionment and had been impressed with the work still needed to tidy up the field of neutron dosimetry. With their formidable arsenal of techniques they could establish several monitoring procedures. IAEA would probably have to consider whether they would have another symposium in a few years covering the whole area or whether "workshops" or discussions on specific topics would be more productive. He understood that IAEA had been planning a neutron handbook. ICRU was working on the preparation of two instrumentation handbooks, one dealing with instrumentation other than for neutrons and the other on neutron instrumentation. These might be combined to form a document emphasising the practical aspects of dosimetry. There were excellent handbooks on the theory of neutron dosimetry and the technical aspects of operation of instruments, but usually they did not get down to the practical things that the health physicist needed to know in choosing instruments or pointing out the good or bad features. They should strive for good communications, and mutual planning of programmes by ICRU and IAEA would be of benefit, not only in avoiding undesirable duplication, but in helping the sometimes relatively inexperienced men in the field.

Summing up, Professor Zheludev said that a variety of techniques and solid state detectors had been described. Impressive as the developments were, the discussions had high-lighted their limitations. From the information presented, one might not expect any spectacular solution of the continuing problems in dosimetry of neutrons in the coexistent gamma radiation field or of epithermal neutrons. The information on portable survey instruments and personnel dosimeters had shown the need for striking a judicious compromise between the natural instinct of physical scientists to improve sensitivity and accuracy, on the one hand, and the practical considerations of cost and convenience on the other. Such compromise would seem not unjustifiable in terms of present knowledge of the biological effects of neutrons at low doses. The symposium had also brought out the need for improving the situation in respect of standardization. Any suggestions for follow-up work by the Agency would be carefully considered within the limits of financial and man-power resources.