TECHNICAL ASSISTANCE FOR RADIATION PROTECTION

WORK OF SOME IAEA EXPERTS IN HEALTH PHYSICS

The growing recognition of the need for adequate radiation protection measures in all forms of atomic energy work is reflected in the increasing number of requests received by the International Atomic Energy Agency for the services of health physics experts, and often for associated equipment. While few of the experts sent out by the Agency during the initial phase of its technical assistance programme were concerned with radiological health and safety, about 20 experts in radiation protection and health physics have been assigned to various countries during the last two years.

Some of these experts completed their assignments in the course of last year and their reports are now available. Points from a few of these reports are presented here, so as to indicate the nature of the health physics problems encountered by different atomic energy centres and the assistance given by Agency experts in dealing with them.

United Arab Republic

Mr. A. K. Ganguly, an expert from India, was sent to the United Arab Republic in January 1962 for a period of six months as an adviser on health physics and radiation dosimetry. He worked with the UAR Atomic Energy Establishment and his tasks included assistance to a general training programme in health and safety matters, assistance in the development of procedures for dosimetric surveys and radiation protection measures, advice to local scientists on safety rules and regulations, and some research into health physics problems.

The UAR Atomic Energy Establishment has a 2 MW enriched uranium research reactor, and associated with it are some research units and departments for reactor engineering and radiation protection. In addition, there are a nuclear physics laboratory, a geology laboratory, a nitrogen plant and departments for chemistry and isotope production. More facilities are being built or planned. There are about 500 scientists and 200 technicians working in the Establishment.

So far as radiation protection facilities are concerned, the reactor as well as the isotope production laboratory are well provided with fixed health instruments. The equipment of the radiation protection department includes various instruments for radiation counting and facilities for air monitoring and film-badge processing, development and reading. At present there is no bio-assay laboratory for the assessment of internal contamination, but there are plans to organize one soon. Waste disposal has not yet become an acute problem; some disposal facility has been built during reactor construction, and the isotope production unit is equipped with a complete waste handling system.

The radiation protection department runs the routine protection service, environmental monitoring and survey, and a film badge service. The film-badge laboratory assesses beta and gamma ray exposures; neutron exposure monitoring has not yet been undertaken. The environmental monitoring deals with radiostrontium contamination of food, soil and vegetation.

In consultation with senior members of the department, the IAEA expert worked out a programme of training, demonstration and guidance in relation to various health physics tasks. He organized a six-week course of lectures on elementary principles for junior scientists, which was conducted with the active help of some senior members of the Establishment staff. But the training was not confined to lectures alone; a variety of laboratory work was undertaken to demonstrate the relevant techniques and establish the necessary procedures. Techniques of calibrating health instruments were demonstrated; decontamination techniques were shown and a large decontamination operation supervised; principles of radioactive contamination control were demonstrated; and procedures for different aspects of radioactive waste management were explained.

So far as routine operations were concerned, Mr. Ganguly helped in the establishment of routine radiation monitoring of the reactor building, calibration of counting instruments, and methods of maintaining records. He prepared a list of the instruments required, and many of them were procured. He also assisted in the organization of health and safety measures in the isotope production laboratory, and explained the procedures for routine health and safety operations and organizational requirements. In the environmental survey laboratory, a new method for estimating radiocaesium activity in fresh water and milk samples was developed and established in routine work. On the expert's advice, the organization of the radiation protection department was re-oriented so as to improve the routine operations and enable promising workers to undertake scientific investigations.

Mr. Ganguly assisted in the establishment of research groups for health physics problems, including a theoretical group and a chemical dosimetry group

for high energy gamma and neutron radiation fields. He initiated investigations on the capture of gamma rays from neutron shielding materials and on the possibilities of developing cheap and portable neutron sources.

Work was also started by him for the organization of a ventilation study group, and the need for organizing a hazards evaluation group was impressed upon the Establishment authorities.

The expert had discussions with a committee on power reactor siting, in the course of which he indicated a detailed programme of studies needed for the evaluation of sites. He also participated in some meetings of a committee on reactor safety.

Mr. Ganguly notes in his report that the Establishment authorities showed keen interest in his programme of work and gave continuous help for its successful execution. Every effort was made to implement his recommendations.

Greece

An American expert, Mr. R. E. Alexander, spent about a year in Greece under the Agency's technical assistance programme. His tasks were to assist in organizing the health physics department and a central radiation survey service for the Greek Atomic Energy Commission, in the preparation of a hazards report for the research reactor at the Democritus Nuclear Research Centre (DNRC), and in the preparation of safety regulations for the centre.

Operational monitoring, which includes surveys, surveillance and other activities for the protection of radiation workers, is rapidly assuming increasing importance at the DNRC. The work is directed by a physicist with specialized training, assisted by other physicists and technicians. The Agency expert was in daily consultation with the physicists, in regard to such problems as techniques for surveys and contamination control, area classifications and ventilation requirements. He also worked with the local staff on several technical problems, such as design requirements for an instrument calibration facility, calibration of existing neutron survey instruments and calibration of the existing continuous air monitor.

During Mr. Alexander's stay in Greece a special building was being constructed at the DNRC to house the health physics laboratories, and he advised the authorities on various aspects of the building and on the equipment to be purchased for the laboratories. The plan provides, among other things, for laboratory facilities for personnel monitoring, environmental monitoring and health physics research, as well as for facilities for radiometric measurements and instrument calibration and maintenance.

Environmental monitoring is in a relatively advanced stage. At the request of the Greek authorities, Mr. Alexander carried out a review and evaluation of the work and prepared a detailed plan for its expansion. He also assisted in the selection of new equipment to be ordered for this work.

The health physics department of the Greek AEC conducts a centralized film badge service for the whole country, serving the DNRC and nine other centres, including seven hospitals. The present programme deals with an average of more than 500 film badges per month, but the load is growing steadily. The badge used at present is useful for hard gamma ray measurements only, but a new badge is now being designed, which will also allow measurements of beta and X-radiation as well as fast and slow neutrons. Mr. Alexander assisted in dealing with certain technical difficulties associated with the film badge service, especially those arising in calibration, film badge design, and interpretation of film response to different types of radiation.

Radioactive waste disposal is now in the final planning stages at the DNRC. The Agency expert was consulted on problems relating to the collection, processing, packaging and disposing of radioactive wastes and those concerning decontamination of equipment and protective clothing. The specific problems discussed included ultimate disposal of the wastes, control of releases of liquid wastes to the municipal sewerage system, methods of packaging the wastes for storage and transportation, and the collection and monitoring system for liquid wastes.

Mr. Alexander also advised the Greek scientific staff on various aspects of a national radiation safety programme, based on health and safety legislation for the whole country. The legislation will strengthen the controls on the use of radioactive materials and radiation-producing apparatus, and licences will be required so as to ensure adherence to the provisions of a national health and safety code. Mr. Alexander assisted in a review of similar codes adopted in other countries and suggested appropriate measures for Greece. He emphasized the urgency of completing the legislation and strengthening the licensing procedure.

At the request of the head of the health physics department, Mr. Alexander made a study of the health physics set-up in the Greek AEC and made certain recommendations for reorganization. It was agreed that the most pressing need was to establish authoritative safety regulations at the DNRC, around which a comprehensive radiation safety programme could be built up. Following a study of the existing situation at the DNRC, the expert submitted a proposal as to how these regulations could best be formulated. He notes that although radiation hazards are minimal at the present stage of the research effort at the DNRC, the added duties of the national radiation protection programme, along with the planned expansion of the DNRC, will soon make it necessary to increase the

scientific and technical staff. Members of the present staff, Mr. Alexander notes, are well qualified and trained; they were always responsive to his suggestions and eager to obtain his advice on various technical problems.

Israel

A French expert, Mr. G. Soudain, went to Israel on a brief assignment last year to advise the Israeli Atomic Energy Commission on the setting up of a photographic dosimetry laboratory capable of processing all films used in the country. He also discussed some other dosimetric problems.

The task regarding the dosimetric laboratory was to decide what equipment and organizational arrangements would be most suitable, the problem being somewhat complicated by the fact that the institutes to be served by the laboratory are scattered throughout Israel. It is expected that films from 150 institutes other than the Commission itself will be processed in the laboratory; most of the institutes use only a few films.

In making his recommendations Mr. Soudain gave detailed consideration to (1) preparation and dispatch of dosimeters, (2) use and processing of films, and (3) the system of notification of the users and maintenance of an up-to-date individual card index of monitoring results.

As regards general organization, plans have been made for 3000 films every fortnight, but it is expected that the number will rise later to about 6000. The expert thought that it would be better to provide for this expansion from the beginning. Staff, too, has been planned for a routine output of 3000 films a fortnight; the expert suggested how the proposed staff of 13 persons should be allocated for different tasks.

Regarding fast neutron dosimeters, certain difficulties had been experienced in Israel, apparently due to the development process. Mr. Soudain had extensive discussions on the properties of the dosimeters and their calibration, and explained the results of work done in France on the development of the emulsions. He states, however, that it is not essential to issue fast neutron dosimeters to persons working at a reactor, especially in view of their limitations and high cost. In his view, the relationship between doses of gamma rays, thermal neutrons and fast neutrons needs to be established once only. Moreover, as soon as gamma irradiation has been detected by the gamma film, it will be possible, by inquiry and possibly by trials, to determine the doses received by a given person as a function of the various irradiation parameters. After an evaluation of the local conditions, Mr. Soudain came to the conclusion that only personnel carrying out unusual experiments involving special risks of exposure need wear the fast neutron dosimeter.

Mr. Soudain notes that the importance and number of questions that were put to him regarding fast neutron dosimeters revealed a sound understanding of the problems involved. He thought it would be useful if one person could spend two or three weeks in an experienced laboratory in order to complete training in this field, preferably before routine work began.

Other questions discussed by the experts included dosimetry of tritium, calibration of films, gamma spectrometry, whole-body counting, and measurement of the activity of atmospheric dusts. Referring to a visit to the reactor at Rehovot, he says he was very favourably impressed by the way in which supervisory work around the reactor and the experimental facilities was organized.

Philippines

A health physicist from New Zealand, Mr. R. A. Borthwick, who was assigned to the Philippines for the whole of last year, worked at the Philippine Atomic Research Centre where a research reactor is under construction.

On his arrival in the Philippines, Mr. Borthwick found that several aspects of the health and safety programme of the research centre had already been firmly established. Environmental survey work had begun with well selected monitoring stations and numerous samples had been collected for later analysis and measurement. Preparations had also been made for a film badge service.

Mr. Borthwick assisted in the organization of the film badge service, and when the minimum equipment necessary for its operation was available, a service was started for the research centre personnel on a fortnightly basis. Subsequently the service was improved technically and expanded to provide monitoring for all personnel of the Philippine Atomic Energy Commission (PAEC) likely to be exposed to radiation, as well as for the Government hospitals in Manila. At the time of the expert's departure plans were being made for extending the service to all users of radiation in the country.

Mr. Borthwick reviewed the organization and duties of the health physics department at the research centre, and assisted in the preparation of a safety manual, which is now in use in all establishments of the PAEC. He also helped in drawing up procedures for the procurement, storage and handling of radioisotopes, as well as for the segregation and collection of radioactive wastes, decontamination of laboratories, equipment and personnel, area monitoring and other duties relating to reactor health physics. The environmental survey programme was continued, and the gamma background survey was made more accurate with the acquisition of a more sensitive Geiger-Mueller survey unit.

Soon after his arrival, Mr. Borthwick was given a copy of the national radiation protection regulations which had been prepared the previous year. These regulations covered all aspects of radiation protection, including the establishment of maximum permissible exposures, but they did not include any detailed regulation for the transport of radioactive materials or the management of radioactive wastes, which were to be the subject of further study and negotiation. At Mr. Borthwick's suggestion, certain changes were made in the section on maximum permissible exposures.

Mr. Borthwick assisted in the preparation of a national programme for radioactive waste management and of reports on a radioactive waste facility for the research centre. The national programme includes management procedures for every possible user of radioisotopes in the Philippines and indicates which isotopes are to be sent to the research centre for processing. The reports on a waste facility outline collection procedures for all types and classes of waste, both liquid and solid.

During Mr. Borthwick's assignment, the training institute of the PAEC conducted two training courses on radiological health, and he helped with lectures and experimental exercises.

Mr. Borthwick was also asked to assist in many other activities of the PAEC. He joined the PAEC staff in inspections of the handling and storage facilities possessed by the licensed users of radioisotopes, attended meetings of the IAEA reactor hazards evaluation group which visited the Philippines, and reviewed the plans for the supporting laboratories designed for the research centre.

TECHNICAL ASSISTANCE EXPERTS IN THE FIELD

In the middle of May 1963, 30 IAEA experts were serving in over 20 countries (including those served by a regional expert) under the Agency's programme of technical assistance. The list is given below:

Name and Nationality	Country to which assigned	Subject Matter
A. H. Barrada (UAR)	Morocco	Agricultural Uses of Radioisotopes
S. R. Basu (India)	Afghanistan	Nuclear Physics
R. T. Bayard (USA)	Thailand	Reactor Physics, Reactor Programming
L. A. Berteig (Norway)	Iraq	Health Physics
G. J. Billek (Austria)	Brazil	Radiochemistry
R. M. Bidwell (USA)	Brazil	Nuclear Metallurgy
R. A. Borthwick (New Zealand)	Thailand	Health Physics
T. H. Bryant (UK)	Middle East (regional expert)	Hospital Physics
T. L. Boyle (USA)	Mexico	Prospecting for Uranium by Aerial Methods
W. C. Burch (USA)	Iran	Reactor Construction
J. Cameron (UK)	Turkey	Development and Evaluation of Uranium Deposits
R. L. Ceriani (Argentina)	Paraguay	Medical Applications of Radioisotopes
T. v. Egidy (Fed. Rep. of Germany)	Korea	Nuclear Physics
L. v. Erichsen (Fed. Rep. of Germany)	Iraq	Radiochemistry
V. A. Golikov (USSR)	Ghana	Agricultural Applications of Radioisotopes
K. S. Gussgard (Norway)	Ghana	Health Physics
F. R. Gustavson (USA)	Iran	Nuclear Engineering
G. Jenkins (UK)	Pakistan	Nuclear Construction Engineering
J. Jurenka (Czechoslovak SR)	Tunisia	Testing Materials by Radiation Methods
P. J. Knapp (USA)	Iran	Health Physics
E. C. S. Little (UK)	Pakistan	Agricultural Applications of Radioisotopes
A. D. McEachern (Canada)	Argentina	Non-Destructive Testing of Nuclear Fuel Elements
V. Machacek (Czechoslovak SR)	Indonesia	Radiochemistry
T. Nielsen (Norway)	Ceylon	Nuclear Electronics
E. A. Noble (USA)	Argentina	Nuclear Raw Materials
R. B. Shields (Canada)	Thailand	Maintenance of Nuclear Electronics Workshop
A. J. Sunde (Norway)	Iraq	Nuclear Electronics
A. Tavcar (Yugoslavia)	UAR	Agricultural Applications of Radioisotopes
W. Timmermann (Belgium)	Brazil	Nuclear Instrumentation
P. B. Vose (UK)	Korea	Agricultural Applications of Radioisotopes