RADIATION SAFETY AND HEALTH PHYSICS

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THE Windscale reactor incident of October 1957, involving the release of radioactive fission products into the atmosphere[1], undoubtedly served to focus the attention of the general public on to the hazards of ionizing radiation and to the increasing risks of exposure. Interest has also been aroused by the publication of reports by the Ministry of Health, Medical Research Council[2] and the U.N. Scientific Committee[3]. The rapid expansion of the nuclear power programme, coupled with the increasing employment of sources of ionizing radiation in industry, medicine and research institutions, and also nuclear weapon testing, demands an increasing vigilance and knowledge of the risks and safety precautions on the part of many people. The U.K. Atomic Energy Authority has an excellent record of safety both with respect to its own staff and to the general public in the vicinity of its establishments, and has also exercised a rigorous control over the discharge of waste radioactive products into the environment[4]. The Fleck Committee set up to inquire into the organization for control of health and safety[5] nevertheless recognized the need for a rapid expansion of health physics and safety staffs in the Authority, and recommended that the Research Establishment at Harwell should set up a national training centre for health physics and nuclear safety staff to cater for persons both inside and outside the Authority.

A number of short courses on "Radiological Protection" have already been held at the Isotope School, Harwell; but it was felt that there was scope for a college of technology to undertake similar work. An approach was therefore made to the United Kingdom Atomic Energy Authority, Industrial Group, at Risley, in the spring of 1958 with the view of introducing courses in the Liverpool College of Technology later in the year. A scheme was prepared in conjunction with the Authority and this article provides a brief interim report, based on experience of three courses which have been run in late 1958 and early 1959.

Each course is of a fortnight's duration. The available places on the three courses have been taken up by representatives of the U.K. Atomic Energy Authority, public health departments, factory inspectorate, local industry, insurance, and education; members attending include medical officers, physicists, engineers, insurance accident surveyors, chemists, public health inspectors and safety officers.

The aim of the courses has been to provide an introduction to, and a general survey of, the problems of radiological protection against all forms of ionizing radiation. The very specialized problems of reactor safety and the processing of nuclear fuel elements have not been dealt with specifically, except in so far as environmental effects may be involved. Special attention in both lectures and practical work is, however, given to subjects such as the comparative properties of radiations, the sources of radiation including background and fall-out, the effects of radiation on plants, animals and man, contamination and decontamination, waste disposal, health physics instrumentation and monitoring procedures, absorption of radiation and shielding. Table 1 summarizes the lecture and practical topics which have been covered on the early courses; the programme is rounded off by visits to local institutions and works, by the exhibition of films, and by discussions.

The programme of practical work has been devised to provide a series of short-term experiments, underlining the basic problems of a comprehensive protection service. Some aspects of the practical work and the results which have been obtained have already proved of considerable interest and are briefly described. It is hoped to publish the detailed observations at a later date.

The experiments in radiobiology have been singularly successful in demonstrating the fate of various radioisotopes when brought into contact with biological organisms to be found in a natural environment. The techniques have been previously described by D. C. Pickering and myself[6]. The experiments with blanket weed (*Microspora*) have demonstrated conclusively the ability of the algae to concentrate many isotopes from their environment, and have particularly served to emphasize the importance of properly planned disposal procedures. A safe procedure for radioactive liquid waste is afterwards demonstrated to members of the course.

Table 1. SYLLABUS OF LECTURES AND PRACTICAL WORK

Lectures			Practical	
Section	Topics	No. of hours	Subject	No. of hours
Radiation and its sources	Comparative properties; units and calculations of dosages; background and fall-out; nuclear reactors, particle accelerators	6	X-ray equipment and sealed sources	1
			Techniques with open isotopes—counting and identification	7
Measurement and detection of radiation	Principles of measurement; types of counter and H.P. instruments	5	Calibration and operation of H.P. instruments. Dosage calculations	3
Interaction of radiation and matter	Radiation chemistry; radio-biology-genetics, metabolic processes	6	Radiobiology	7
Radiological protection	M.P.L.'s and M.P.C.'s; control of internal and external radiation in laboratories and plants, medical care, waste disposal, legal requirements, industrial practice, X-ray units	10	Contamination—prevention and removal	4
			Waste disposal	1
			Shielding	2
			Radiation monitoring	2
			Air sampling	2

Lectures have been presented by members of the Health and Safety Branch of the U.K. Atomic Energy Authority Industrial Group, Factory Inspectorate and the Universities of Leeds and Liverpool, in addition to College staff.

The importance of thorough testing of materials of construction for contamination properties is not generally appreciated. A fairly extensive investigation was undertaken by P. C. Thompkins *et al.* in the United States[7], but data concerning materials available in Great Britain are not readily available. A simple test procedure has been devised to provide a measure of contamination for a range of materials and isotopes. The method also enables a variety of surface protecting agents and decontamination procedures to be investigated. Results on a wide range of materials are gradually being accumulated to provide some form of quantitative assessment of comparative degrees of contamination.

The first three courses have provided invaluable experience and have suggested numerous lines of future developments. In particular, more advanced courses of three to six months duration are under active consideration in addition to an expansion of work on a number of research projects, leading to the new M.C.T. award.

I wish to acknowledge my indebtedness to the U.K. Atomic Energy Authority for advice in the preliminary stages and assistance with lectures and equipment, to Prof. F. W. Spiers for advice and lectures in the early stages, to Prof. A. B. Semple (Medical Office of Health, Liverpool) for advice and lectures, to Dr. Sing for his constant and active support and encouragement, and to Mr. D. C. Pickering for his indefatigable contributions in radiobiology.

[1] (*a*) Stewart, N. G., and Crookes, R. N., *Nature*, **182**, 627 (1958). (*b*) Chamberlain and Dunster, *ibid.*, **182**, 629 (1958). (*c*) Maycock and Vennart, *ibid.*, **182**, 1945 (1958). (*d*) Bush and Spiers, *ibid.*, **183**, 515 (1959).

[2] "The Hazards to Man of Nuclear and Allied Radiations". Medical Research Council (H.M.S.O., Cmnd. 9780, 1956).

[3] Report of the U.N. Scientific Committee on the Effects of Atomic Radiation; U.N. General Assembly; Official Records, New York, 13th Session. Supp. 17 (*A*/3838) (1958).

[4] Dunster and Farmer, *IGS/R/R3* (January 1958).

[5] "The Organization for Control of Health and Safety in the U.K.A.E.A." (Cmnd. 342). (H.M.S.O., 1958.)

[6] Lucas, J. W., and Pickering, D. C., *Nature*, **182**, 1242 (1958).

[7] Thompkins, P. C., *et al.*, *Indust. Eng. Chem.*, **42** (8), 1469 (1950).

BRITISH UNIVERSITIES FILM COUNCIL

THE twelfth annual general meeting of the British Universities Film Council took place in Cardiff during May 8–10. This short survey describes its development and traces the main tasks which it set itself in the field of university teaching and research. This year's discussions and lecture-demonstration programmes included a report on closed-circuit television relay experiments for 'overflow' lecture rooms, a survey of television university courses in the United States, and a demonstration of visual-aid equipment for the ideal lecture room. Among other things, the Council is at present interested in liaison with the International Scientific Film Association, further exploration of a possible lectureship in film and continuance and improvement of the catalogue and journal.

The present honorary secretary of the British Universities Film Council, Mr. C. J. Duncan, of King's College, Newcastle, recently reviewed the short history of the Council in an address at Göttingen. He rightly emphasized that the Council is a gathering of university representatives, brought together through a common interest in films for university purposes. This at once makes clear the practical advantages of personal contacts developed between individuals in each university or college, and of the direct personal ways in which they can in turn infect their colleagues with their own enthusiasm for using or making films.

However hampered by financial stringency—in a medium far less expensive than is commonly assumed—however different the rate of progress in member institutions, that keynote of enthusiastic co-operation has been a feature of the Council since its foundation in the autumn of 1948. A few months earlier, the Cambridge University Film Council had been set up and it was this body which called the first gathering of 'film representatives' from all universities and colleges. The aims of the Council, as then laid down, have not materially changed since then, although the emphasis may have varied. Briefly stated, these aims are the promotion of the production, distribution and use of films in university teaching and research. The aims have been practically pursued in hard-working sub-committees which act as special reporting and planning bodies to the executive and the Council, which meets annually each year at a different university. The tonic effect of the visits has already been noticed, for during the meeting, the host-university staff and students, and interested bodies from outside, are invited to attend demonstrations, exhibitions of equipment, and programmes of films of interest to universities. Past chairmen have come from Cambridge, Edinburgh, the Imperial College of Science and Technology, London, and the Royal Technical College, Glasgow.

The Council's membership has grown to include to-day, as full members, thirty-two institutions in Great Britain alone, with a good hope of soon enlisting in addition the new colleges of advanced technology (Loughborough is already a member of long standing). Among the Council's associate members are the Scientific Films Association, London; Shell Public Relations Department; the French Institute, London; and Eastman Kodak Co. (Non-Theatrical Film Section), Rochester, New York. Close contacts and visiting arrangements exist with Dutch, German, French and Polish organizations mainly devoted to research films. This contact with foreign bodies is expanding and is promoted by members attending international gatherings, such as the annual congress of the International Scientific Films Association.

Nearly all British universities and colleges have through their delegates participated in the work of the executive or its sub-committees. With the help of the British Film Institute and the support of subscriptions from member universities, the Council collects and disseminates information and advises on suitable films, or relevant parts of films and related material. Good liaison exists with organizations doing comparable work in education, research, industry and commerce. The Council's library, centrally housed at the British Film Institute, contains films recommended by the Library Sub-Committee, but only a fraction of what would be desirable is in fact there. The Catalogue, in the hands of an active and energetic sub-committee, conducted from Glasgow, already contains more than 1,500