

THE UNIVERSITY OF NEW SOUTH WALES

RADIATION HEALTH AND SAFETY

ANNUAL REPORT

for the year ended 31st December, 1971

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INTRODUCTION

The increase in the use of ionising radiation in the University and the need for further precautionary measures led to the appointment in 1961 of a full-time Radiation Protection Officer. The objectives of the radiation safety programme are to protect the health and safety of staff, students and public; to facilitate the use of radiation by providing advice and assistance on radiation safety matters; to ensure that all radiation work conducted by the University fulfils statutory requirements; and to minimise the possibility of a radiation incident occurring within the University. Association is maintained with those responsible for radiation safety in the University's teaching hospitals.

LICENSES

Under the New South Wales Radioactive Substances Act, 1957-67, all persons using or possessing radioactive materials or irradiating apparatus must either have a license* issued for the purpose, or be working under the direction and supervision of a licensee. During the year each new license applicant was visited to discuss the radiation safety of the proposed programme and a similar policy was applied to persons requesting an extension to their existing license.

Radiation work is kept under review to ensure that the correct licensing situation is maintained and so that the safe use and storage of all radioactive materials and irradiating apparatus can be checked. Details of all licenses are recorded. During 1971, seven license applications were submitted, six for Radioactive Substances and one for Irradiating Apparatus, as the increase in radiation work and change in personnel demanded. Each new licensee has been made aware of his responsibilities under the Radioactive Substances Act by forwarding to him a copy of the relevant legislation.

During 1971, 15 applications for extension of licenses were submitted in favour of twelve licensees, and 65 applications for renewal of licenses were submitted. At 31st December, 1971, 74 licenses were held by the University, and a decision on one application (Radioactive Substances) was being

* This spelling accords with that of the Radioactive Substances Act.

awaited. The scope of these licenses is shown in Appendix I. Licenses are not required in the Faculty of Military Studies which is located at Duntroon, A.C.T.

PURCHASE AND TRANSFER OF RADIATION SOURCES

During the year there were no externally imposed changes in the procedures for ordering radioactive materials via the various commercial or federal channels. To assist decentralisation the ordering procedures at Wollongong University College were reviewed.

Assistance has been given in arranging the correct submission of orders, and a record is maintained of all radioactive materials and irradiating apparatus ordered by various sections of the University. Incoming radioactive materials are addressed to a central reception depot where their arrival is recorded, after which they are delivered promptly to the licensee.

During 1971, 147 shipments of radioactive material containing a nominal total activity of 56,885.85 millicuries (mCi) were received. These items are listed in Appendix II together with the irradiating apparatus received and the orders for radioactive materials unfulfilled as at 31st December, 1971. In 1971, 155 shipments of radioactive material were ordered compared with 148 in the preceding year.

Three sets of sources, prepared by Unisearch Ltd, comprising teaching sources, a static eliminator and a tracing fluid, were transferred to three separate commercial organisations, one interstate. A sealed source was borrowed from the A.A.E.C. for a display shown on the University "Open Day".

INVESTIGATIONS AND REPORTS ON SCHOOL PROJECTS

Forty two departments in the University were engaged in radiation work at 31st December, 1971. Although some idea of the wide variety of these teaching and research projects can be obtained from Appendix II, there are additional projects which utilise the many long-lived radioactive materials that were purchased in previous years, and others which utilise 24 X-ray diffraction plants and other radiation sources in the University.

The radiation safety of school projects is considered in

the planning stages and monitoring surveys are subsequently carried out to confirm that the safety specifications are adequately met. Supplementary informal visits are also made to laboratories. An attempt is made to minimise personnel exposure levels wherever practicable.

The following projects were dealt with during the year:

1. Installation of an industrial radiography source.
2. Accommodation requirements for two X-ray diffraction plants; acceptance tests and safety instructions for one.
3. Storage requirements for three radioisotope facilities.

During the year radiation surveys with monitoring equipment were conducted on the equipment and sources listed below. Other minor surveys are not listed.

1. Two radiographic x-ray plants.
2. Three electron microscopes.
3. An X-ray diffraction plant.
4. Demonstration gas-discharge tubes.
5. Selected laboratories were inspected by officers of the Radiation Branch of the Division of Occupational Health and Pollution Control.

A visit was made to Wollongong University College where the radioisotope and X-ray facilities were inspected.

PERSONNEL MONITORING

The dose evaluations of 369 film badges worn by 89 members of the University during the year were routinely examined and the results were forwarded, in most cases with a letter of interpretation, to the director of the project. The circumstances leading to any unusual exposure were investigated. The film badge service is operated by the Radiation Branch of the N.S.W. Department of Health.

The results show that 99% of the films worn received an average weekly exposure of not more than 10% of the maximum permissible level for radiation workers. An analysis of the results, showing the number of films in each exposure group, expressed as a percentage of the 100 mrem maximum permissible weekly exposure (m.p.w.e.) for radiation workers, is shown in Appendix III. The supply of film badges was interrupted during the year. Hence the number of films worn during 1971 is not comparable with figures for previous years.

Film badge results relating to hospital-based personnel holding appointments with the University are reported upon by the Hospital Physicist. The results relating to hospital-based full University members are incorporated in Appendix III.

A personal radiation record has been established for each radiation worker in the University. For those persons who wear personal dosimeters, a cumulative record of their current radiation exposure is maintained.

The programme of medical examinations for the University's radiation workers continued during the year. The examinations, which are conducted at the Prince of Wales Hospital, comprise a full initial examination with subsequent annual examinations dependent upon the type of radiation work being conducted. Approximately 170 examinees (staff and postgraduate students) participate in the programme.

RADIATION PUBLICATIONS

A copy of the "Code of Practice against Radiation Hazards" of Imperial College, has been forwarded to each new licensee. The Code is used in conjunction with the statutory legislation and is supplemented with rules that are appropriate to the University's own circumstances.

Information circulars are issued periodically to advise on various aspects of radiation safety within the University, and to draw attention to those matters which may require action.

DISPOSAL OF RADIOACTIVE WASTE

Waste radioactive material from various Departments in the University was monitored and transferred to the central storage facility pending a further bulk waste disposal. Some 45 litres of low level organic solvent liquid scintillant was collected from the University.

The disposal of low level active putrescent waste by incineration was effected as required during 1971.

The central radioisotope storage facility is used to house radioactive sources on behalf of some licensees.

RADIATION INCIDENTS

During the year there was one incident in which it was suspected that a University Officer was exposed to an excessive amount of radiation. An investigation showed that over-exposure was extremely unlikely; nevertheless, a full medical examination is in progress.

The radiation emergency instructions in the University's "Guide to Procedures" were updated. No changes were made to the list of radiation monitoring equipment held in the University, nor to the Kensington campus site plan showing all the radiation facilities, copies of which are retained by the two servicing Fire Brigade Stations.

RADIATION INSURANCE

Insurance cover with respect to personal injury from radiation was renewed. Staff are covered by Workers Compensation Insurance. Students, visitors, and the public in surrounding areas are covered by a Public Liability Policy, the premium for which is now independent of the number of students and their degree of involvement with radiation. A separate policy operates for Wollongong University College.

ADVISORY SERVICES

As education in protective measures is important in the achievement of radiation safety, many discussions have been held with radiation workers, and advice given on various aspects of radiation safety. Part of the Radiation Protection Officer's time is spent in answering enquiries and in supplying technical information on various aspects of radiation work, on protection, and in recommending suitable monitoring equipment. Information on laser safety (non-ionising radiation) has also been provided.

Many enquiries continue to be received regarding the availability, ordering procedure and delivery of radioactive materials.

Requests for information about the University's radiation protection programme were received from four universities (one overseas), and from two other institutions.

A request was received to comment on a manuscript dealing with public information on the proposal to establish a nuclear power station in Australia.

The Radiation Protection Officer was invited to deliver a series of lectures to two of the Radioisotope Courses sponsored by the Australian School of Nuclear Technology, and to assess students' homework assignments. He continued as the University's representative on the Committee on Safety in Laboratories which has been established by the Public Service Board to enquire into safety standards in the planning and operation of scientific laboratories in New South Wales.

He also continued to hold membership of the Prince Henry and Prince of Wales Hospitals Radioisotope Review Committee and Radiation Protection Committee.

He delivered a lecture entitled "Practical Aspects of Radiation Safety and Control" at the Health Department's "Safe Use of Ionising Radiation in Industry" Seminar in Sydney. He also presented a lecture on radiation safety in the University's Department of Applied Physics.

RESEARCH

The aim of this project is to investigate fundamental aspects of the electrostatic precipitation method of burst cartridge detection. A further research grant was received from the Australian Institute of Nuclear Science and Engineering.

A comprehensive report on the research work described in previous Annual Reports was completed. Entitled "An Investigation of the Electrostatic Collection of Particular Fission Products and their Contribution to a Scintillation Detector Signal", this thesis was presented for examination in the School of Nuclear Engineering.

ESTABLISHMENT

The degree of Doctor of Philosophy was conferred upon the Radiation Protection Officer at the July meeting of the University Council.

During absences of the Radiation Protection Officer, Mr. C.L. Samways deputised in matters requiring urgent

attention.

Thanks are due to the Radiation Branch of the N.S.W. Department of Health, the Australian Atomic Energy Commission, the Commonwealth X-ray and Radium Laboratory and the New South Wales Radiological Advisory Council for their support in the programme.

I am grateful for the co-operation of all licensees, and for the assistance provided by the academic, technical and administrative staff of the University.

R. Rosen

R. Rosen,
Radiation Protection Officer.

1972

APPENDIX ILicenses Held Under the Radioactive Substances Act

TYPE	PURPOSE	NUMBER
Radioactive Substances	Scientific & research	45
	Industrial, scientific & research	1
	Diagnostic, scientific & research	5
	Diagnostic, scientific research & therapeutic	1
	Therapeutic	1
Irradiating Apparatus	Scientific & research	21
	Total number	74

APPENDIX II(a) Radioactive Materials Received During 1971

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Chemical Technology	Sodium 24	10	Glass strength study
	Silver 108 + 110	2 x 10	"
Textile Technology	Carbon 14	0.1	Wool fibre studies
Wool & Pastoral Sciences	Hydrogen 3	1	Rumen studies in sheep
	Carbon 14	2	"
	Sulphur 35	5	Agronomy studies
Biochemistry	Hydrogen 3	100	Protein studies
	"	2	Heart disease studies
	"	1	Phosphorylation of protein
	Carbon 14	0.5	Protein chemistry studies
	"	3 x 0.1	Diabetes studies
	"	0.05	"
	"	2 x 0.05	Class use
	"	1	"
	"	0.25	Liver metabolism studies
	"	3 x 0.05	"
	"	0.0005	Instrument calibration
	"	2 x 0.25	Metabolic studies
	"	2 x 0.05	"
	"	5 x 0.1	Cell wall studies
"	0.1	Peptide studies	
"	0.05	Enzyme kinetic studies	
"	0.1	Macromolecular modification	

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Biochemistry (cont'd)	Carbon 14	0.5	Macromolecular modification
	Phosphorus 32	10	Photophosphorylation
	"	5 x 5	Plant phosphorylation
	"	10	Phosphorylation of protein
	"	3 x 10	Nucleotide sequencing
	"	2 x 10	Casein phosphorylation
	"	2 x 10	Protein phosphorylation
	Sulphur 35	20	Enzyme studies
Botany	Nickel 63	1	Fatty acid studies
	Hydrogen 3	5	Plant chromosome studies
	Carbon 14	0.05	Lipid research
	"	1	"
	"	1	Transport studies in plants
	Phosphorus 32	3	"
Microbiology	Carbon 14	0.1	Yeast permeability studies
	"	2 x 0.05	Microbiological permeability studies
	"	0.1	"
	"	4 x 0.05	Metabolic pathways study
	Phosphorus 32	2	Labelling of micro-organisms
Zoology	Hydrogen 3	250	Water studies in marsupials
	"	5	Marsupial spermatogenesis study
	"	0.01	Instrument standardisation

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Zoology (cont'd)	Carbon 14	0.25	Kangaroo metabolic studies
	Iron 59	0.2	Blood transferrin studies
	Iodine 125	0.5	Kangaroo metabolic studies
Anatomy	Hydrogen 3	5 curies	Macromolecular tissue uptake
	"	10	"
	Iodine 125	0.5	"
	"	0.2	"
	Gold 198	.3 x 50	"
Human Genetics	Iron 59	2 x 1	Transferrin labelling
Pathology	Iodine 125	5	Animal liver studies
Physiology and Pharmacology	Hydrogen 3	5	Animal physiology studies
	"	30	Muscular blood studies
	Carbon 14	0.1	Biliary phospholipid study
	"	0.05	Biliary lipid studies
	Sodium 24	1	Ovine bile studies
	Chromium 51	5	Blood cell study
	"	10	Capillary permeability studies
	"	5	Blood volume study
	"	2	Tissue exchange experiments
	"	2	Animal blood flow studies
	"	5	"
	"	10	Biliary tract studies
	Cobalt 60	0.006	Calibration source

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Physiology and Pharmacology (cont'd)	Nickel 63	1	Biliary phospholipid study
	Iodine 125	0.5	Capillary permeability studies
	"	3 x 0.2	Animal blood flow studies
	"	0.005	Sheep insulin studies
	"	0.2	Animal blood flow studies
	Iodine 131	0.2	Capillary permeability studies
	"	2	Tissue exchange experiments
	"	4 x 2	Animal blood flow studies
	Xenon 133	2 x 25	"
	Applied Physics and Optometry	Cobalt 60	880
Chemistry	Hydrogen 3	2 x 15 curies	Labelling studies
	"	20 curies	Hydrocarbon studies
	Carbon 14	0.25	Exchange reaction studies
	"	1	"
	"	0.1	"
	"	0.00005	Reference source
	"	0.0005	"
	Sodium 22	0.2	Class use
	Phosphorus 32	2 x 3	"
	Sulphur 35	5	"
"	10	Industrial flotation studies	
	Scandium 46	10	Class use

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Chemistry (cont'd)	Cobalt 57	10	Mossbauer studies
	Iodine 125	2 x 5	Class use
	Iodine 131	3 x 5	"
	Caesium 137	5	"
	Gold 198	50	Detection studies
Physics	Sodium 22	0.4	Study of diffusion in solids
	Sodium 24	2 x 5	Blood transport studies
	Chlorine 36	0.05	Biophysical diffusion studies
	Potassium 42	3 x 1	Study of diffusion in solids
	"	2 x 1	Blood transport studies
	Scandium 46	0.56	Thermal conductivity studies
	Strontium 90	0.1	Beta transmission studies
	Silver 110 m	2 x 6	Study of diffusion in solids
Physics (Wollongong)	Americium 241	0.02	Alpha scattering studies.

(b) Radioactive Material on Order at 31st December 1971

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Biochemistry	Phosphorus 32	5	Photosynthesis studies
Botany	Hydrogen 3	1	Fungal studies
	Sulphur 35	0.5	"
Physiology	Carbon 14	1	Ovine bile studies
	Iodine 125	0.2	Animal blood flow studies
	Iodine 131	2	"
Surgery	Carbon 14	4 x 0.05	Diabetes studies
Chemistry	Iodine 131	5	Class use
Physics	Sodium 22	0.002	Sealed demonstration source
	Scandium 46	0.4	Thermal conductivity studies
	Cobalt 60	0.01	Sealed demonstration source

(c) Irradiating Apparatus Received during 1971

SCHOOL	APPARATUS	QUANTITY	PURPOSE
Applied Geology	X-ray spectrometer	One	Research and teaching
Mining Engineering	Diagnostic x-ray plant	One	Research
Applied Physics	X-ray diffraction plant	One	Teaching and research

APPENDIX IIIAnalysis of Exposures Received by
Radiation Film Badges During 1971

Exposure Range (% m.p.w.e.)	Number of films in group
0 - 5	365
6 - 10	2
11 - 15	0
16 - 25	1
26 - 50	1
51 - 100	0
> 100	0

