THE UNIVERSITY OF NEW SOUTH WALES

RADIATION HEALTH AND SAFETY

ANNUAL REPORT

for the year ended 31st December, 1973.

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C O N T E N T S

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 1973, five license applications were submitted, three for Radioactive Substances and two 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 1973, eight applications for extension of licenses were submitted in favour of eight licensees, and 74 applications for renewal of licenses were submitted. At 31st December 1973, 79 licenses were held by the University, and a decision on one application (Irradiating Apparatus) was being awaited. The scope of these licenses is shown in Appendix 1. Licenses are not required in the Faculty of Military Studies which is located at Duntroon, A.C.T.

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

PURCHASE AND TRANSFER OF RADIATION SOURCES

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 1973, 198 shipments of radioactive material incorporating 29 different radio-isotopes in a variety of compounds were received. These items, which have a nominal total of 151 349.30 millicuries (mCi), are listed in Appendix 2(a). Appendix 2(b) lists the orders for radioactive materials unfulfilled as at 31st December 1973. In 1973, 189 shipments of radioactive material were ordered compared with 181 in the preceding year.

Two X-ray diffraction plants, listed in Appendix 2(c), were received during the year.

Two items were borrowed from the AAEC, namely a 0.62 Ci Pu-Be neutron source for student experiments, and 500 gm of thoria grinding pellets for a research project. A tracer substance and two types of school sources, prepared by Unisearch Ltd, were transferred to commercial organisations.

A 300 mCi neutron source was taken to Queensland for use in a field project.

INVESTIGATIONS AND REPORTS ON SCHOOL PROJECTS

Forty-five departments in the University were engaged in radiation work at 31st December 1973. Although some idea of the wide variety of these teaching and research projects can be obtained from Appendix 2, there are additional projects which utilise the many long-lived radioactive materials that were purchased in previous years, and others which utilise 30 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.

During 1973 time was not available to conduct regular surveys with monitoring instruments. However, surveys were

conducted as requested, and nineteen 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 radio-isotope and x-ray facilities were inspected.

The radiation safety of two field projects concerning Unisearch radio-isotope applications in industry were considered during the year.

PERSONNEL MONITORING

The dose assessments of 317 film badges worn by 103 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 dose were investigated. The film badge service is operated by the Radiation Branch of the NSW Division of Occupational Health and Pollution Control.

The results show that 99% of the films worn received an average weekly dose of not more than 10% of the maximum permissible value for radiation workers. An analysis of the results, showing the number of films in each group, expressed as a percentage of the 100 mrem maximum permissible weekly dose (m.p.w.d.) for radiation workers, is shown in Appendix 3. The supply of films was interrupted during the year. Hence the number of films worn during 1973 is not comparable with figures for previous years.

Film badge assessments 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 3.

A personal radiation record is kept for each radiation worker in the University. For those persons who wear personal dosimeters, a current record of their cumulative radiation dose 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 220 examinees (staff and postgraduate students) participate in the programme. However, some rationalisation in borderline cases is desirable.

During the year under review one worker was subjected to a whole body count to confirm the absence of accumulated internal thorium contamination.

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 disposal. Low-level scintillator fluid was collected from the University.

The disposal of low-level active putrescent waste by incineration was effected as required during 1973.

The central radio-isotope 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 postgraduate student may have inhaled a significant quantity of tritiated water vapour, but investigation revealed that no serious internal contamination had occurred.

In two other incidents it was suspected that a total of three persons were exposed to an excessive amount of radiation. However, in both instances investigation showed that no overexposure had occurred.

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 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.

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

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 also presented a lecture on radiation safety in the University's Department of Applied Physics.

He also continued to hold membership of the Prince Henry and Prince of Wales Hospitals Radioisotope Review Committee and Radiation Protection Committee. Discussions were held with the hospital physicist on various radiation matters, including protection.

Copies were received of the Public Service Board's "Laboratory Construction Code to Provide Safe Working Conditions", in the drafting of which the Radiation Protection Officer had participated.

OVERSEAS VISIT

The Radiation Protection Officer undertook a three months tour of duty in Britain during 1973. He attended a four-week Advanced Radiological Protection Course at Harwell, and presented a paper entitled "Radiation Protection in an Australian University" at the Annual Conference of the Association of University Radiation Protection Officers held at the University of Nottingham.

He called at fourteen universities and at the four university reactors in Britain, where he observed radiation protection programmes and facilities and discussed mutual problems with the radiation protection officer. He also visited five radiation research laboratories, two radiological centres, three hospital physics departments and two instrument manufacturers. On the return journey he called at Israel, where radiation protection practice was discussed.

On the basis of overseas observation recommendations have been made to enhance the effectiveness of the University's radiation protection programme.

This tour of duty severely curtailed the time available for research.

ESTABLISHMENT

To assist arrangements for autonomy, Dr. N.F. Kennon was appointed Radiation Safety Officer for Wollongong University College.

Acknowledgement is made to the Radiation Branch of the Health Commission of New South Wales, the Australian Atomic Energy Commission, the Australian Radiation 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.

As part of the arrangements for the abovementioned overseas visit, Mr. C.L. Samways was appointed Deputy Radiation Protection Officer, and it is a pleasure to thank him for maintaining the programme during my absence.

R. Rosen.

R. Rosen
Radiation Protection Officer.
1974

APPENDIX 1

Licenses Held Under the Radioactive Substances Act at 31.12.73

TYPE	PURPOSE	NUMBER
Radioactive Substances	Scientific & research	50
	Industrial, scientific & research	1
	Diagnostic, scientific & research	5
	Diagnostic, scientific, research & therapeutic	1
	Therapeutic	1
Irradiating Apparatus	Scientific & research	21
Total number		79

APPENDIX 2

(a) Radioactive Materials Received During 1973

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Chemical Engineering	Hydrogen 3	20 curies	Grinding studies
	"	1	Water purification
	"	1.0	Artificial membrane studies
	Carbon 14	0.1	" " "
	"	3 x 0.25	" " "
	"	0.5	Water purification
Textile Technology	Carbon 14	0.5	Wool fibre studies
	"	0.1	Diffusion studies
	"	0.06	Detergent studies
	"	0.05	" "
	"	0.04	" "
	"	0.03	" "
Wool & Pastoral Sciences	Hydrogen 3	5	Ovine water determination
	Sulphur 35	250	Agronomy studies
	Chromium 51	2 x 10	Rumen studies in sheep
	"	10	Sheep digestion studies
	Ruthenium 103	2	" "
Civil Engineering	Americium 241	300	Soil moisture measurements
Biochemistry	Hydrogen 3	2 x 1	Protein studies
	"	6 x 1	Metabolic studies
	"	10	" " "
	"	0.25	" " "
	"	2 x 1	Enzyme studies

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Biochemistry (Cont'd)	Hydrogen 3	1	Rodent metabolism studies
	"	25	Carbohydrate metabolism studies
	"	1	" " "
	Carbon 14	4 x 0.25	Cell wall studies
	"	0.25	Animal retinal studies
	"	2 x 0.25	Animal lipid studies
	"	0.05	" " "
	"	1.0	Carbohydrate metabolism studies
	"	2 x 0.1	" " "
	"	0.5	" " "
	"	0.25	Protein studies
	"	0.05	" "
	"	5	Enzyme studies
	"	0.01	" "
	"	0.005	" "
	"	2 x 0.01	Metabolic studies
	"	8 x 0.05	" "
	"	2 x 0.25	" "
	"	0.1	" "
	Phosphorus 32	5	Plant phosphorylation
	"	2 x 5	Protein phosphorylation
	"	3 x 10	" "
	"	10	Class use
	"	3 x 5	Metabolic studies
	"	5	Animal R.N.A. studies
	"	2 x 5	Nucleic acid studies
	"	5	Cell wall studies
	Sulphur 35	2 x 20	Enzyme studies

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Biochemistry (Cont'd)	Calcium 45	1	Protein binding studies
Biological Technology	Carbon 14	2	Micro-organism uptake
Botany	Hydrogen 3	1	Fungal studies
	Carbon 14	0.05	" "
	"	1	Plant lipid studies
	"	2	" " "
	"	0.01	" " "
	"	0.1	Plant physiology studies
	Phosphorus 32	2 x 3	" "
	Americium 241	50	Soil moisture studies
Microbiology	Carbon 14	0.5	Micro-organism labelling
	"	0.25	Culture studies
Zoology	Hydrogen 3	2 x 1	Marsupial hormone assay
	"	1	Hormone studies in monotremes
	Carbon 14	0.005	" " "
	"	0.05	Rabbit circulatory studies
	Sulphur 35	100	Animal oviduct studies
	Iodine 125	0.2	Marine animal studies
Anatomy	Iodine 125	0.2	Protein uptake assay
	"	2	" " "
Community Medicine	Hydrogen 3	1	Nucleic acid studies
	Iron 59	2 x 1	Tranferrin studies
Medicine	Hydrogen 3	0.004	Prostaglandin estimations

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Medicine (Cont'd)	Hydrogen 3	0.002	Prostaglandin estimations
Obstetrics & Gynaecology	Hydrogen 3	0.25	Plasma hormone assays
	"	0.25	Protein binding studies
Paediatrics	Carbon 14	0.05	Collagenase studies
Pathology	Hydrogen 3	5	Lymphocyte studies
	Iodine 125	1	Albumin distribution studies
	"	4 x 0.5	Vascular permeability studies
	"	5	" " "
	"	5	Radio-immuno-assay
Physiology & Pharmacology	Hydrogen 3	5 x 1	Capillary permeability studies
	"	2 x 0.25	" " "
	"	0.002	Prostaglandin estimations
	"	2 x 1	Neurotransmitter release
	Carbon 14	0.05	Drug binding to cells
	"	2 x 0.05	Capillary permeability studies
	"	3 x 0.25	" " "
	"	0.25	Neurotransmitter release
	"	0.05	" " "
	Sulphur 35	1	Drug binding to cells
	Chromium 51	2 x 5	Teaching studies
	"	4	Class renal studies
	Strontium 85	1	Lung blood flow
	Iodine 125	5	Capillary permeability studies

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Physiology & Pharmacology (Cont'd)	Iodine 125	3	Class renal studies
	Iodine 131	5	Class use
	Xenon 133	20	Rabbit blood flow
Chemistry	Hydrogen 3	20 curies	Grinding studies
	"	40 "	Radiation labelling
	"	40 "	Hydrocarbon studies
	"	30 "	" " "
	Sodium 22	0.4	Class use
	Phosphorus 32	3 x 3	" "
	Sulphur 35	10	Industrial tracer
	"	1	Yeast fermentation
	"	0.5	" " "
	"	2 x 5	Class use
	"	100	Animal oviduct studies
	Calcium 45	1	Class use
	Scandium 46	5	" "
	Cobalt 57	10	Mossbauer studies
	Cobalt 60	25	Attenuation studies
	"	1	Class use
	Zinc 65	1	" "
	Yttrium 91	1	" "
	Cadmium 109	0.1	" "
	Iodine 125	0.5	" "
	Iodine 131	5 x 5	" "
	Caesium 137	10	" "
	Cerium 144	15	" "
	Thulium 170	1	" "
	Tantalum 182	1	" "
	Tungsten 185	1	" "
	Radium 226	0.36	School sources
	Americium 241	50	Industrial static eliminators
	"	4.8	School sources

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Physics	Sodium 22	2 x 0.4	Study of diffusion in solids
	Sodium 24	5	Membrane studies
	Potassium 42	8 x 1	Study of diffusion in solids
	Silver 110m	10	" " "

(b) Radioactive Material on Order at 31st December 1973

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Biochemistry	Carbon 14	1	Enzyme studies
	"	0.05	" "
	"	0.25	Animal liver studies
	Phosphorus 32	10	RNA Phosphorylation
Physiology & Pharmacology	Hydrogen 3	0.25	Organ transport studies
	Carbon 14	0.05	" "
	"	0.25	" "

(c) Irradiating Apparatus received during 1973

SCHOOL	APPARATUS	QUANTITY	PURPOSE
Chemical Technology	X-ray diff-ractometer	One	Teaching and research
Metallurgy	"	One	" " "

APPENDIX 3

Analysis of Doses Recorded by Radiation Film Badges during 1973

Dose Range (% m.p.w.d.)	Number of films in group
0 - 5	315
6 - 10	1
11 - 15	0
16 - 25	1
26 - 50	0
51 - 100	0
> 100	0