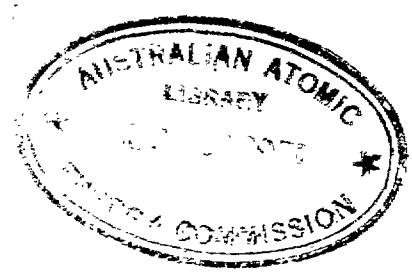
THE UNIVERSITY OF NEW SOUTH WALES



RADIATION HEALTH AND SAFETY

ANNUAL REPORT

for the year ended 31st December, 1970

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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.

LICENSING

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 1969, eight license applications were submitted, five for Radioactive Substances and three for Irradiating Apparatus, as the increase in radiation work and change in personnel demanded. Each new licensee has been made aware of his reponsibilities under the Radioactive Substances Act by forwarding to him a copy of the relevant legislation.

During 1970, 11 applications for extension of licenses were submitted in favour of ten licensees, and 59 applications for renewal of licenses were submitted. At 31st December, 1970, 67 licenses were held by the University, and a decision on three applications (Irradiating Apparatus) was being awaited. The scope of these licenses is shown in Appendix I.

New responsibilities devolving from the cancellation by the Radiological Advisory Council of individual Radiation Safety Officers nominated by license applicants are being considered.

PURCHASE AND TRANSFER OF RADIATION SOURCES

The multiplicity of ordering procedures through either commercial or federal channels is perplexing to new users. The section of the University's "Guide to Procedures" was revised to incorporate recent changes.

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 1970, 146 shipments of radioactive material containing a nominal total activity of 2,190.98 millicuries (mCi) were received. These items are listed in Appendix II together with the orders for radioactive materials and irradiating apparatus unfulfilled as at 31st December, 1970. In 1970, 148 shipments of radioactive material were ordered compared with 146 in the preceding year. No irradiating apparatus was received during 1970.

Nine sub-licensable demonstration sources (^{60}Co, ^{90}Sr, ^{241}Am) acquired in 1969 by the W.S. & L.B. Robinson University College at Broken Hill, are not listed in Appendix II. During 1970 assistance was given to an external researcher using University facilities in a brief study of neutron irradiated bacteriophage. An alpha-particle static-eliminator, prepared by Unisearch, was transferred to a government department.

INVESTIGATIONS AND REPORTS IN SCHOOL PROJECTS

Thirty seven departments in the University were engaged in radiation work at 31st December, 1970. 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 21 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.

In addition to the regular annual inspection of radiation equipment at Wollongong University College, this year the radiation equipment at the Robinson University College, Broken Hill, was also inspected.

The following projects were dealt with during the year :

1. Shielding assessment of an industrial radiography facility.

2. Design and installation of two liquid-density gauges.

3. Accommodation requirements for two X-ray diffractometers.

During the year radiation surveys with monitoring equipment were conducted and reports and recommendations issued on the equipment and sources listed below. These are in addition to other minor surveys for which reports were not issued.

1. Sludge density gauge.

2. Four radioisotope laboratory environs.

3. Two X-ray diffraction plants.

4. Demonstration gas-discharge tubes.

5. Selected laboratories were inspected by officers of the Radiation Branch of the Division of Occupational Health.

The radiation safety of seven field projects concerning Unisearch radioisotope applications in industry were considered during the year.

PERSONNEL MONITORING

The dose evaluations of 375 film badges worn by 66 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 Department of Public Health.

The results show that 98% 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.

Film badge results relating to hospital-based personnel holding appointments with the University are reported upon by the Hospital Physicist. The results relating to 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 160 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. This Code here replaces the "Code of Practice for the protection of persons exposed to ionising radiation in University Laboratories" which is no longer available.

Information Bulletins 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; items of general radiation interest are also included.

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 22 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 1970.

RADIATION INCIDENTS

During the year there were no incidents in which it was suspected that a University member was exposed to an excessive amount of radiation. On one occasion it was suspected that a postgraduate student had become contaminated. However investigation showed this to be unfounded.

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 has been converted to a flat charge independent of the number of students and their degree of involvement with radiation.

To assist decentralisation a separate radiation hazards policy for Wollongong University College became effective from the 1st January, 1970.

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 specific details of the University's radiation protection programme were received from two Australian universities.

During his visit to Robinson University College, Broken Hill, the Radiation Protection Officer delivered a public lecture entitled "Radiation Production and Protection", and he paid good-will visits to four local organisations which utilise radiation in their operations.

He 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.

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.

The experimental equipment has continued to operate satisfactorily at pressures up to 200psig in the A.A.E.C. Reactor HIFAR. The overall sensitivity of the equipment was assessed and the intrinsic collection efficiency of the precipitator was determined.

The computer programme which had been developed to evaluate the expected deposition on the wire electrode was used to compare the theoretical and experimental results. Agreement is found at high pressure. Omission of third generation fission products from the theoretical treatment was validated.

The literature pertaining to failed-fuel-element detection by electrostatic precipitation was reviewed.

ESTABLISHMENT

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

The radioisotope storage facility was used to house radioactive sources on behalf of some licensees, in addition to the storage of active waste material awaiting disposal.

Neutron-sensitive pocket dosimeters have been acquired to extend the coverage of the radiation protection programme.

Thanks are due to the Radiation Branch of the New South Wales Division of Occupational 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 staff and by staff members of the Divisions of the Bursar and the Registrar of the University.

R Rosen

R. Rosen
Radiation Protection Officer
1971

APPENDIX I

Licenses Held Under the Radioactive Substances Act

TYPE	PURPOSE	NUMBER
Radioactive Substances	Scientific & research	41
	Industrial, scientific & research	1
	Diagnostic, scientific & research	5
	Diagnostic, scientific research & therapeutic	1
	Therapeutic	1
Irradiating Apparatus	Scientific & research	18
	Total number	67

APPENDIX II

(a) Radioactive Materials Received During 1970

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Chemical Engineering	Caesium 137	5	Void measurements
	"	10	" "
	Uranium 238	0.62	Leaching experiments
Chemical Technology	Carbon 14	1	Polymerisation studies
	"	0.1	Instrument calibration
Textile Technology	Carbon 14	3 x 0.05	Wool keratin studies
	"	0.10	" " "
Wool & Pastoral Sciences	Hydrogen 3	2 x 5	Rumen studies in sheep
	Carbon 14	5	" " " "
	Chromium 51	0.75	" " " "
Biochemistry	Hydrogen 3	5	Bacterial cell-wall study
	"	2 x 5	D.N.A. Studies
	Carbon 14	0.002	Instrument calibration
	"	0.01	Adrenal enzyme studies
	"	2 x 0.01	Steriod metabolism studies
	"	0.05	Protein studies
	"	0.05	Hemin degradation studies
	"	0.1	" " "
	"	0.01	Bacterial cell-wall study
	"	4 x 0.1	" " " "
	"	7 x 0.05	Metabolic studies
	"	5 x 0.1	" "
	"	1	" "
	"	5	" "
	"	2 x 0.1	Carbohydrate metabolism studies
	"	0.2	" " "

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Biochemistry (Cont.)	Phosphorus 32	5	Virus labelling
	"	2 x 5	Protein studies in milk
	"	4 x 5	Photophosphorylation
	"	2 x 10	"
	"	10	Rat liver studies
	Sulphur 35	20	Steroid metabolism studies
Botany	Hydrogen 3	0.004	Instrument standardisation
	"	0.5	Plant chromosome studies
	"	2 x 25	Fatty acid synthesis
	Carbon 14	0.002	Instrument standardisation
	"	2 x 0.05	Fatty acid synthesis
	"	5 x 0.1	" " "
	"	4 x 0.5	" " "
	Phosphorus 32	3	Nutrient uptake studies
Microbiology	Carbon 14	0.05	Micro-algae permeability studies
	Phosphorus 32	2	Labelling of micro organisms
Zoology	Hydrogen 3	0.01	Instrument calibration
	"	0.02	" "
	"	50	Kangaroo metabolism studies
	"	50	Water studies in marsupials
	"	250	" " "
	Iron 59	0.5	Protein transfusion studies

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Civil Engineering	Chromium 51	250	Storm runoff investigation
	"	700	" "
	Americium 241	200	Soil moisture studies
Anatomy	Hydrogen 3	1	Optic nerve tracer studies
Human Genetics	Iron 59	4 x 1	Labelling of serum transferrins
Medicine	Hydrogen 3	0.25	Hormone assay
	"	1	" "
Physiology	Hydrogen 3	0.25	Immuno assay studies
	Carbon 14	0.5	Acid transport studies
	Chromium 51	2	Blood volume studies
	"	10	Capillary permeability study
	Nickel 63	1	Fatty acid analyses
	Iodine 131	1	Class instruction
Chemistry	Carbon 14	0.5	Class use
	Sodium 22	2 x 0.2	" "
	"	0.2	Ion migration studies
	Sodium 24	50	Tracing pipeline
	Phosphorus 32	3	Class use
	Sulphur 35	0.5	Fermentation studies
	"	5	Class use
	Scandium 46	10	" "
	Cobalt 57	10	Mossbauer studies
	Iron 59	5	Industrial weathering investigation
	Zinc 65	2	Class use
	Bromine 82	2 x 20	Industrial leak detection

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Chemistry (Cont.)	Bromine 82	50	Adsorption studies on flour
	Krypton 85	100	Feasibility studies
	Cadmium 109	0.2	Class use
	Silver 110m	5	Surgical swab studies
	Iodine 125	5	Class use
	Iodine 131	2 x 5	" "
	"	2 x 10	" "
	Caesium 137	5	" "
	Cerium 144	1	Undergraduate teaching
	Thulium 170	10	Industrial radiography
	Tantalum 182	2	Solvent extraction studies
	Tungsten 185	5	" " "
	Thallium 204	3	Feasibility studies
	Polonium 210	100	Industrial static eliminator
	Radium 226	0.27	School sources
Physics	Sodium 22	0.2	Study of diffusion in solids
	"	0.4	" " " "
	Sodium 24	2 x 1	Blood uptake studies
	"	10	" " "
	Potassium 42	2 x 1	" " "
	"	7 x 1	Study of diffusion in solids
	Strontium 90	0.004	Demonstration source
	Silver 110m	6	Study of diffusion in solids
	Caesium 137	0.006	Demonstration source
	Americium 241	0.0005	" "

(b) Radioactive Material on Order at 31st December, 1970

SCHOOL	SUBSTANCE	QUANTITY (mCi)	PURPOSE
Physiology	Hydrogen 3	5	Animal physiology studies
Applied Physics and Optometry	Cobalt 60	880	Gamma radiography
Physics	Potassium 42	3 x 1	Study of diffusion in solids
	Strontium 90	0.1	Beta transmission studies

(c) Irradiating Apparatus on Order at 31st December, 1970.

SCHOOL	SUBSTANCE	QUANTITY	PURPOSE
Applied Geology	X-ray spectrometer	One	Research and teaching

APPENDIX III

Analysis of Exposures Received by Radiation Film Badges During 1970

Exposure Range (%m.p.w.e.)	Number of films in group
0 - 5	358
6 - 10	8
11 - 15	6
16 - 25	2
26 - 50	0
51 - 100	1
> 100	0