Certification in Ionising Radiation Safety within Australia and New Zealand

Candidate's Kit - Version: 3.0, February 2022

Australasian Radiation Protection AccreditationBoard Inc.
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Contents

Sponsoring societies:

ACPSEM Australasian College of Physical Scientists & Engineers in Medicine — www.acpsem.org.au

Australasian Radiation Protection Society — www.arps.org.au

AIOH Australian Institute of Occupational Hygienists — www.aioh.org.au

Introduction

This document describes requirements for Certification in Ionising Radiation Safety within Australia and New Zealand. This certification scheme has been designed as an appropriate level of study and experience for professionals wishing to have their fundamental radiationprotection competencies recognised. The required reading and practical experience gainedthrough certification are intended as a broad introduction to the technical principles that will be used throughout a career in radiation safety.

Certification is sponsored by the following professional societies:

- Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM),
- Australian Institute of Occupational Hygienists Incorporated (AIOH), and
- Australasian Radiation Protection Society (ARPS).

Certification is administered by the **Australasian Radiation Protection Accreditation Board Inc** herein referred to as **The Board.** The board consists of four members appointed by each of the three Sponsoring Societies. The Board elects its own Chairman and appoints Examiners as required.

It is envisaged that many candidates will be recent graduates in science or engineering. The standard for certification has been set such that with part-time study they can complete the syllabus and gain certification within one year of taking up an appointment in which they can gain relevant experience. Other graduates and non-graduates will be accepted as candidates provided they can show adequate evidence that they have the ability to achieve the required entrance standard which includes skills in physics, chemistry, mathematics, computation, anatomy and physiology. Non-graduate candidates should contact the Secretariat to discuss their entrance to the course; they will be assessed on the basis of other relevant courses, examinations and professional activities that they have completed.

Certification is for a period of five years. In order to maintain their certification for a further five years, candidates must demonstrate that they are actively maintaining theirexpertise as described below.

Candidates are required to pay various fees as listed in the Application form. These fees have been set to recover the costs associated with the conduct of the examinations and theexpenses of the Board. The fees are determined by the Board and are subject to change from time to time as determined by The Board.

Objectives of Certification

The objective of this certification scheme is to ensure that successful candidates:

1. understand the duties and responsibilities of a Radiation Protection Advisor,
2. have a broad knowledge of ionising radiation, its effects, and its relevance tomining, medicine, the public, industry, education and research,

3. are able to use radiation monitoring equipment to identify and quantify radiationhazards,
4. have a broad knowledge of the techniques for radiation protection and the abilityto design and implement protection strategies,
5. have a broad knowledge of current legislation, standards, and guidelines, and
6. have the necessary oral and writing skills to communicate their conclusions.

Certification Process

To obtain certification, all candidates will be required to complete both a theoretical and a practical component of study.

In order to complete the theoretical component of the certification, a candidate must:

1.1 Complete a self-paced reading program (see Appendix A), and
1.2 Pass a written examination based on the prescribed reading material and therequirement for adequate skills in numerical computation.

In order to complete the practical component of the certification, a candidate must:

1.3 gain practical experience in the use of radiation monitoring equipment,
1.4 complete an assignment (approximately 5000 words) in which the candidateprepares a radiation protection program for a nominated institution or commercial operation,
1.5 complete twelve months relevant experience preferably under the supervision of a person with ARPAB certification,
1.6 pass a practical examination in the use of monitoring equipment,
1.7 defend the presented radiation protection program at an oral examination/interview (generally held in conjunction with the practical examination) and satisfy the examiners that he/she is able to perform the duties at ARPAB certification level.

Applicants must complete the certification process within 18 months of being accepted intothe program (within 12 months for applicants accepted for fast-track assessment).

1.1 Theory Syllabus

The prescribed texts appear in Appendix A.

It is assumed that candidates have completed physics and some chemistry at the first year level in a university or equivalent. Candidates are advised to acquire a knowledge of relevant anatomy and physiology and should have completed senior secondary school mathematics.

Candidates must possess the ability to perform basic manipulation of equations, exponentials, and logarithms, and explain the use of graphical techniques, countingstatistics and counting precision as it relates to radiation protection.

Candidates are expected to have a clear understanding of the underlying principles of radiation included in the following topics:

- The structure of matter
- Radioactivity and radiation
- Radiation units
- Biological effects of radiation
- Natural and man-made radiation
- The system of radiological protection
- Radiation detection systems and measurement
- Internal and external radiation hazards
- Radiation interactions

Candidates are expected to have a broad understanding of the principles of radiation practice and protection over a wide range of applications as detailed in the following:

- nuclear reactor health physics
- radioactive waste
- medical imaging radiotherapy, and radiation protection in medicine
- uranium, HMC, and rare earth mining, and NORM
- health physics laboratory techniques, and
- radiological emergencies.

General questions regarding radiation protection legislation will be included in thetheory exam.

1.2 Written Examination

All candidates will be required to pass a 2 hour written examination based on the prescribedTheory Syllabus.

The written examination contains three sections.

Section 1 consists of 25 multiple choice questions, and is worth 25% of the overallscore.
Section 2 consists of 12 short answer questions, and is worth 60% of the overall score.
Section 3 consists of 1 question from a choice of 6, and is worth 15% of the overall score.

Candidates will be required to achieve a pass mark of 70% in each section. During thewritten examination candidates may consult the prescribed texts in Appendix A.

1.3 Practical Work with Radiation Monitors

Candidates will be expected to have a broad understanding of the principles of operation of radiation detectors. It is important to understand how to select a suitable monitor for astated purpose (e.g. monitoring for spilt radioisotopes, estimation of dose to staff from a known source). An understanding of the use of absorbers to identify the type of source is also essential.

1.4 Assignment – Radiation Protection Program

Candidates are required to prepare a Radiation Protection Program for a medium to large institution such as a major hospital, a university, a large mine or a mineral processing plant.In very large institutions it may be necessary to limit the program to a single department or operation in order to contain the length of the assignment. Candidates are encouraged to choose a topic that is relevant to their place of employment. The examiners will be looking for a document that can make a contribution to radiation safety either at the practical or administrative level. The program should be quite detailed and approximately 5000 words in length. Candidates may choose to include descriptions of the scenarios that have been identified (e.g. dose to fingers of staff injecting radioisotopes in a nuclear medicine department), assessments of the seriousness of the problem (i.e. dose estimation, probability that there will be a mishap), plans recommended for controlling the practice (e.g. supply syringe shields, instruct staff) and methods for ensuring that the recommendations are effective and are being followed. If the program is developed from apre-existing program or prepared in association with others, then the candidate should clearly indicate what his/her contribution has been.

Preparation of the Radiation Protection Program is part of the practical section of the certification. Candidates will be required to defend their program during an oral examination/interview which will generally be held following the practical examination. The program should be submitted at least four weeks prior to the practical examination so that examiners can assess them prior to the interview.

1.5 Practical Experience

Candidates are required to complete one year of relevant experience working under the supervision of a suitably qualified person, preferably a Certified Radiation Protection Advisor. During this period, candidates must spend a minimum of 60% of their time performing relevant duties. The Board will assess each candidate on the basis of:

- a written report prepared by the candidate describing his/her experience, itsduration and its relevance,
- copies of relevant report(s) prepared by the candidate,
- a written reference from a suitable referee supporting the candidate's claimsabove, and
- additional evidence from the examiners after discussing the candidate's workduring the oral examination.

The written report should be brief and pertinent with reports appended. If reports havemultiple authors, then the covering letter should detail the contribution made by the candidate. The referee will normally be the candidate's work supervisor.

It is recommended that candidates maintain a logbook during this period detailing the tasks undertaken and including copies of any technical reports to which they have contributed. If a logbook has been kept, candidates are encouraged to discuss it with theexaminers during their oral examination.

1.6 and 1.7 Practical and Oral Examination

The practical examination will last for 30 minutes. Its purpose is to ensure that all candidates are familiar with the theory of operation, selection and use of radiation monitors. They will be asked to undertake several monitoring tasks involving the location ofhidden sources and the identification of source type (alpha, beta, ganmma, neutron, mixed). They will then be asked to advise on safe distances and precautions. The tasks required of candidates may be varied for those who work in specialised areas, e.g. underground mining, and candidates are advised to briefly state their area(s) of expertise intheir application.

The oral examination/interview will last approximately 30 minutes. The candidate will beasked to defend his/her Radiation Protection Program. The examiners may also use this occasion to clarify any outstanding issues regarding the candidate's assessment.

Examinations will be arranged according to the availability of examiners and the number of candidates. They will be conducted by arrangement in any capital city or other centre where there are enough candidates to justify the effort.

Candidates will be notified of their results as soon as possible after each examination.

Fast-Track Certification

For people who have worked for more than 5 years in radiation protection, you may beeligible for fast-track certification. This process recognises that some applicants may already possess the requisite knowledge expected of an ARPAB-certified person.

When an application is made to enter the ARPAB program, The Board will assess whetherthe applicant is eligible to enter the ARPAB certification process, and if they are, whetherthey will be assessed using the normal method (as outlined above) or fast-track method.

Fast-track assessment still requires applicants to complete the written examination (item1.2), and pass a practical examination (item 1.6). However instead of submitting an assignment (item 1.4), the candidate may submit a document (such as a peer-reviewed paper or technical report) which demonstrates they have radiation protection knowledgeand skills equal to or in excess of those required for ARPAB certification. Fast-track candidates will still be required to defend their work orally (item 1.7).

Application Procedure

Applicants should obtain a current copy of this Candidates Kit from the ARPAB website.

Applicants must complete the Application Form (downloaded from the website) and forward their application electronically to the ARPAB Secretariat. If the application is accepted, an invoice for the Enrolment Fee specified in the Application Form will be sent by the Treasurer.

Applicants must demonstrate that they have attained an adequate level of education or equivalent experience. Qualifications should be listed together with the highest levels attained in physics, mathematics and chemistry. In order to verify academic achievements,candidates will be requested to present original certificates and/or correspondence for inspection during the theory examination.

Applicants with a degree or major in another discipline should prepare a brief statement addressing their ability to achieve the objectives of certification. Applicants without a degree should prepare a similar statement with more emphasis on relevant experience and short courses that have been completed.

The application should include proposals for obtaining the required practical skills and the required one year of relevant experience. A statement from the Head, Chief or Director of the Department or Organisation in which the candidate is working shall berequired to demonstrate the employer's willingness to provide the required relevant experience.

For those applicants that wish to be considered for Fast-track assessment, please forward supporting evidence with your application. This will enable the Board to make an assessment of your application.

Notification of Results

All applications for enrolment will be acknowledged in writing or by email. At a later date, candidates will be notified of the acceptance or non-acceptance of their application.

Candidates who pass the written examination will be notified in writing by the Board thatthey have successfully completed the theory, but not practical, part of the certification.

Candidates who successfully complete the course will be awarded a certificate stating thatthey have gained Certification in Ionising Radiation Safety from the Board and the Sponsoring Societies.

The names of all successful candidates will be forwarded to the Registrar of each of the Sponsoring Societies.

Enquiries from candidates regarding their assessment should be directed to the Board. Candidates who feel aggrieved by a decision of the Board should note that there is no mechanism for appeal to the Sponsoring Societies.

In certain circumstances, a candidate may be requested to perform additional work in order to satisfy the Board that he/she has achieved the required standard.

Maintenance of Certification

The Board regards Certification to be an indication that the incumbent is actively engaged in the field of radiation protection and is maintaining his/her relevant expertiseand knowledge of the field.

Every five years, successful candidates will be sent a certification renewal form. When renewing certification, candidates must submit:

- a one page summary of experience gained, conferences and/or seminars attended, papers and/or reports prepared, awards gained and any other relevant material arising during the preceding three years as evidence of their continuing professionalactivity; and
- the renewal certification fee.

Applications for renewal will be assessed by The Board. The Board reserves the right to change the requirements for renewal from time to time.

Powers of The Board

This Certification is determined and administered by the Board. The Board has over-riding authority to administer this Certification and reserves the right to alter any rule, condition, the syllabus, prescribed texts and/or fees from time to time.

The Board's decision is final in all matters regarding this Certification. There is nodirect mechanism for appeal to the Sponsoring Societies.

Candidates are advised to ensure that they always have the latest edition of this Kit which is available from the ARPAB website.

Code of Ethics and Post Nominals

Successful candidates are required to abide by the Codes of Ethics of the SponsoringSocieties. Certification may be withdrawn by the Board in cases involving serious breaches of these Codes.

The post nominals of CRSA (Certified Radiation Safety Advisor) may be used while ARPAB certification remains current.

Fees

Fees are specified in the Application Form. Fees are not refundable.

Appendix A

Prescribed Texts (can be taken into the written examination)

1. A.Martin, S.Harbison, K.Beach and P.Cole, An Introduction to Radiation Protection.6th Edition, CRC Press, 2012, ISBN 9781444146073.
2. Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, General Safety Requirements Part 3, No. GSR Part 3, IAEA Vienna 2014.Download at http://www-pub.iaea.org/MTCD/publications/PDF/Pub1578_web- 57265295.pdf
3. ICRP Publication 103, 2007 Recommendations of the International Commission on Radiological Protection. J. Valentin, (ed.), Elsevier 2007.
4. ARPANSA Radiation Protection Series (RPS) documents

Recommended texts (for further reading, but cannot be taken into the written examination)

1. H.Cember, Introduction to Health Physics, 4th Edition 2008, McGraw-Hill.
2. E.J.Hall, Radiobiology for the Radiobiologist, 6th edition, 2006, Lippincott Williams & Wilkins.

Appendix B

Sample ARPAB Written Examination PaperPart A – Multiple Choice Questions (1 mark each)

1. Carbon dating is possible because

   A. The specific activity of ^{14}C in living organisms has changed over time, and one can identify the era of time the organism lived based on its current specific activity.
   B. ^{14}C is in secular equilibrium with its progeny.
   C. The specific activity of ^{14}C in living organisms is relatively constant through time, but decays after the death of the organism.
   D. The specific activity of ^{14}C in wood increases over time due to shrinkage (petrification) of the wood.
   E. The rate of ^{14}C generation due to cosmic ray sources plus nuclear weapons testing hasincreased ^{14}C levels by a factor of 1.02 (1 + cos θ) where θ is the latitude.

2. Beta minus emission occurs when
   A. The nucleus contains an excess of protons
   B. The nucleus contains an excess of neutrons
   C. The nucleus contains an excess of electrons
   D. The nucleus contains an excess of photons

Part B – Short answer questions (6 marks each)

1. List at least 3 differences between stochastic and deterministic effects. Define the terms absorbed dose, equivalent dose and effective dose, and state the units used.Which of these units are used to establishing dose limits, and give examples.

2. List 4 radionuclides that contribute to your natural radiation dose. For eachradionuclide, describe the exposure pathway(s).

Part C – Essay question (select one question – 15 marks)

1. You have been asked to detail the requirements to establish a new diagnostic X-ray medical imaging clinic. Discuss the design considerations when specifying the shielding.

2. A university group wishes to use radionuclides for research purposes. There are currently no radioactive laboratories on campus. What needs to be considered in order to establish such a laboratory?