

TRAINING PROGRAMMES IN RADIATION SAFETY CONDUCTED BY RADIOLOGICAL PHYSICS & ADVISORY DIVISION

D.P. Bhatia

Radiation Dosimetry & Training Section
Radiological Physics & Advisory Division

Radiological Physics and Advisory Division (RP&AD), BARC, is responsible for providing radiation safety related advisory services to all medical, industrial, research and agricultural institutions in the country. Training and education of the radiation workers of these institutions should be so oriented as to reap maximum advantage of the modern technological developments, at the same time causing minimal harm to the occupational workers and members of the public at large. To sustain their activities using radiation, these institutions need trained manpower on a regular basis. Also, continuous technological changes make it necessary to retrain the personnel working in these institutions. To this effect, the Division conducts a number of radiation safety related Human Resource Development Programmes and also participates in many such programmes conducted by other Divisions of BARC. Most of these training programmes are mandatory as well as regulatory in nature. These programmes are briefly described below:

Diploma in Radiological Physics (Dip. R. P.)

Medical exposures continue to constitute a major source of exposure to humans due to artificial sources of ionising radiation, and their use has enabled great progress to be made in many aspects of medicine. These practices need to be carried out in optimised radiation protection conditions as recommended by the International Commission on Radiological Protection. It is, therefore, necessary to ensure the protection of individuals against the hazards of ionising radiation used in medical diagnosis and

treatment. It can be done by harmonising and promoting the best practices of Medical Physics in the country by making available trained and qualified Medical Physicists, expert in Radiological Physics. Towards this end, RP&AD conducts a post M.Sc. Diploma course in Radiological Physics (Dip. R.P.)

The Diploma in Radiological Physics course is a multidisciplinary course conducted by RP&AD. The objective of the course is to provide qualified Radiation Safety Officers to industries and research laboratories, and Medical Physicists to Hospitals where ionizing radiation sources are used. Candidates with M.Sc. (Physics) qualification are eligible to apply for the course. Final selection is made on the basis of performance in an interview conducted by a selection committee constituted by officers drawn from different Divisions of BARC and a representative of the Physics Department of University of Mumbai. Many participants of this course have been sponsored by leading radiotherapy centres of the country. Many students from the neighbouring countries have also attended this programme, under sponsorship of the International Atomic Energy Agency and World Health Organisation. The course is designed to cover wide areas of medical physics, radiation physics, radiation safety, and peripheral subjects. The programme consists of a formal course of about 300 lectures, 50 tutorials and 25 practicals and a number of seminars divided into 3 terms. There is a written and viva voce examination at the end of each term.

The students of this course spend a good deal of their time in practical training. They are sent to different Sections of RP&AD and other Divisions

of the Health Safety & Environment Group of BARC for a period of four weeks. To integrate theory with practice in nuclear medicine, radiology and radiation therapy, a six-week outstation field training is also arranged at reputed radiotherapy centers of the country. Students, in groups of 2 to 3, are sent to these centres. Here, they assist the medical physicists of the assigned hospitals and get necessary hands-on experience in treatment planning & dosimetry of radiation therapy procedures. Finally, a 4-week training program is arranged at the Tata Memorial Hospital (TMH) and Radiation Medicine Center (RMC), Parel, where they are given intensive training, both theoretical and practical, on the role and duties of a medical physicist in the treatment of cancer.

To keep the trainees aware of the developments taking place in various fields, lectures on special topics are arranged by calling experts from various centres from time to time. Visits to various Divisions, Sections and important facilities in BARC and outside are also arranged for the benefit of the students. The trainees are also taken to hospitals and industries for familiarisation with equipment and techniques used by them. The final Diploma is given by the University of Mumbai based on a three-tier examination system. The successful candidates work as Medical Physicists /Radiation Safety Officers in leading radiotherapy centres or industrial institutions of the country. Many of them have been employed abroad in responsible positions.

Radiation Safety Aspects of Nucleonic Gauges (NG)

Nucleonic gauges find many non-destructive applications in industry for in situ determination of thickness, density and composition of materials, for measurement and control of process material in closed containers, for analysis of ores and minerals, well logging, etc. There are about 850 institutions in India, using more than 6000 gauges for different applications. It is mandatory for these institutions, particularly those which are in possession of gamma and neutron sources, to

have personnel trained in radiation safety and duly approved by the competent authority. To cater to this need, RP&AD is regularly conducting training courses on Radiation Safety Aspects of Nucleonic Gauges. Candidates sponsored by nucleonic gauge user institutions with minimum qualification of a Degree in science or Diploma in engineering are eligible to attend this course. The course is of seven working days' duration. The course consists of lecture-cum-discussions on radiation physics, radiation units, biological effects of radiation, radiation hazards evaluation and control, nucleonic gauges, and concerned subjects and practical-cum- demonstrations on proper and safe use of radioisotopes. Candidates successful in the course-end examination are certified by the competent authority as Radiological Safety Officers Level-1. This course is conducted by the Division at the Centre for Training & Certification in Radiological Safety (CT&CRS), Anushaktinagar, Mumbai, and also at Electronics Corporation of India Ltd., Hyderabad, and at some of the other user institutions, like Reliance Industries, Patalganga. So far, 55 such programmes have been conducted.

Radiation Safety Aspects for High Intensity Irradiator Operators

The purpose of this mandatory course is to provide training in radiation safety to personnel involved in the operation and maintenance of high intensity irradiators. Candidates sponsored by irradiator user institutions with minimum qualification of tenth standard are eligible to attend this course. The course is of 15 working days' duration. The course consists of lecture cum discussions on radiation physics, radiation units, biological effects of radiation, radiation hazards evaluation and control, radiation detection & dosimetry, safety and design features of irradiators, radiation accidents, etc., and some practical-cum-demonstrations, and a visit to an irradiator installation. Candidates successful in the course-end examination are certified as Operators of High Intensity Irradiators.

Radiation Safety Aspects in Applications of Radioisotopes in Research (RA)

This mandatory training programme provides training in radiation safety in the use of radioisotopes in physio-chemical, biomedical, agricultural and industrial research. Candidates sponsored by user institutions with minimum qualification of graduation in science are eligible to attend this programme. The course is of seven working days' duration. The course consists of lectures on radiation physics, radiation units, biological effects of radiation, radiation hazards evaluation and control, planning of radioisotope laboratories, disposal of radioactive wastes, production of radioisotopes and labelled compounds, etc. and practical-cum-demonstrations on proper and safe use of radioisotopes. Candidates successful in the course-end examination are eligible to be nominated as Radiological Safety Officers Level-2.

Radiography Testing & Safety Level - 1 (RT-1)

RP&AD co-ordinates in the conduct of training programme on Radiography Testing Level-1 at different accredited training centres of the country. The purpose of this mandatory training programme is to provide training in radiography and radiation safety to industrial radiographers, who handle radiography equipment. Candidates with six-month experience as trainee radiographer in an industrial radiography department and minimum qualification of Higher Secondary (10+2) with physics and mathematics are eligible to attend this training programme. The course is of 15 working days' duration. The course consists of lecture-cum-discussions on radiation physics, radiation units, X-ray and gamma ray equipment, radiography techniques, defectology, test methods, work parameters, biological effects of radiation, radiation hazards evaluation and control, etc. and practical-cum-demonstrations on radiography and proper and safe use of radioisotopes. Candidates successful

in the course-end examination are licensed to work as industrial radiographers. This programme is conducted at centres like Institute of Quality Management, Mumbai, Indian Society for Non-destructive Testing, Visakhapatnam, Tiruchirapalli, etc.

Radiography Testing & Safety Level - 2 (RT-2)

RP&AD co-ordinates with Isotope Applications Division, BARC, in the conduct of training programme on Radiography Testing Level-2 at different centres in the country. The purpose of this mandatory training programme is to provide training in radiography and radiation safety to users of industrial radiography equipment. Candidates with two years' experience in an industrial radiography department and minimum qualification of B.Sc. (physics and mathematics) or Diploma in engineering are eligible to attend this programme. Candidates with lower qualification, if they have passed Radiography Testing Level-1, are also eligible to attend the programme. The course is of 20 working days' duration. Candidates successful in the course-end examination are licensed to work as site incharge of industrial radiography installations. This programme is conducted at centres like Regional Testing Centre, Mumbai & Kolkatta, and at Hindustan Shipyard, Visakhapatnam.

Radiation Safety for Radiation Therapy Technologists

This training course is meant for up-dating the knowledge of radiation therapy technologists in the field of radiological safety. Successful completion of this course is a desirable qualification for radiotherapy technologists as per stipulations of the Atomic Energy Regulatory Board. This need-based training programme of 7 days' duration is arranged by RP&AD at the Centre for Training & Certification in Radiological Physics or at some radiotherapy centres in the country. Course curriculum consists of 18 lectures and discussions on different topics related to radiation safety and practical demonstrations at a full-fledged local

radiotherapy centre. The minimum qualification for this course is Higher Secondary (10+2) in science subjects with at least 2 years' experience in a Radiation therapy department.

Radiation Safety Aspects in the Servicing of Radiotherapy Equipment

This is a mandatory training programme for engineers, who are engaged in the servicing of radiotherapy equipment. This 7-day training course is meant for creating awareness about radiation safety among service engineers. A sponsored candidate with Degree/Diploma in engineering is eligible for admission to this training course. The course curriculum consists of 16 lectures on topics related to radiation safety, discussions and practical demonstration at a full-fledged local radiotherapy centre. Successful completion of this training programme is a mandatory requirement to obtain license to carry out the servicing of radiotherapy equipment.

Accreditation of Nuclear Medicine Technologist in Radiation Safety

Diploma in Medical Radioisotope Techniques (DMRIT) is the qualification required for a technologist to work as Radiation Safety Officer (RSO), Level-II in a nuclear medicine department. However, technologists without DMRIT qualification but already employed in a nuclear medicine department for more than 5 years, may also be recognised as RSOs by the competent authority, provided they are graduates and their proficiency in the field of radiation safety is certified by RP&AD. For the accreditation of technologists of the latter category to function as RSOs in their departments, RP&AD conducts a training programme of 3 weeks' duration on radiation safety in a nuclear medicine department. Candidates successful in the course-end examination are qualified to apply to the competent authority for being recognised as RSO (Level II) in their department. The first training programme for this purpose was conducted during January 14 - February 1, 2002 at CT&CRS. The programme consists of lectures

and demonstrations on topics like basic radiation physics, radiation dosimetry & monitoring, planning of nuclear medicine installations, operational limits, radioactive waste disposal, Quality Assurance (QA) procedures in nuclear medicine, etc. 25 technologists from various nuclear medicine centres all over the country participated in the first training programme.

Training in Radiation Safety for M.Sc. Students

RP&AD conducts a two-week visit-cum-training programme for M.Sc. (Medical Physics) students of Anna University, Chennai, and M.Sc. (Radiation Physics) students of Mangalore University, Mangalore. These students are trained in radiation hazard evaluation and control and associated topics. This programme is mandatory for being eligible to be certified as Radiological Safety Officers (Level-III) and to work in radiation oncology centres of the country.

Familiarisation Programmes on Radiation Safety

Instances of theft of radioactive sources and equipment and illicit trafficking of radioactive materials have been brought to the notice of concerned authorities in India and abroad. These could result in various health hazards to the public and entail expensive and elaborate

Table 1: Training Programmes conducted/co-ordinated by RP&AD

Programme	Minimum Qualification	Duration	Programmes Conducted/ Candidates Trained	Remarks
Diploma in Radiological Physics (Dip. R.P.)	M.Sc. (Phys.)	One Year	40 / 621	Qualify as RSO (III)
Radiography Testing Level-1 (RT-1)	XII (Phys. Math)	15 days	29 / 846	Mandatory
*Radiography Testing Level-2 (RT-2)	Dip. Eng./ B.Sc.	20 days	26 / 765	Mandatory
Radiation Safety Aspects of Nucleonic Gauges (NG)	Dip. Eng./ B.Sc.	7 days	55 / 1617	Mandatory
Radiation Safety for Industrial Irradiator Operators (IRAD)	X Pass	15 days	4 / 61	Mandatory
Radiation Safety in Research Applications (RA)	B.Sc.	7 days	22 / 493	Mandatory
Radiation Safety for Radiation Therapy Technicians (RTT)	10+2 in Science	7 days	23 / 368	Mandatory
Accreditation of Nuclear Medicine Technologists	B.Sc.	3 weeks	1 / 25	Qualify as RSO (II)
Radiation Safety in Servicing of Radiotherapy Equipment	B. Engineering	7 days	5 / 84	Mandatory
#Radiation Safety for Food Irradiation Plants	B.Sc.	30 days	2 / 39	Mandatory
Certification Course for Industrial Radio-graphers	X Pass	10 days	64 / 2147	Replaced by RT-1 course
Radiation Safety in Industrial Applications of Radioisotopes	Dip. Eng./B.Sc.	4 weeks	45 / 1006	Replaced by NG & RA course
*Industrial Radiography & Safety (IRG-1)	Dip. Eng./ B.Sc.	6 weeks	48 / 1447	Replaced by RT-2 course
Familiarisation Programmes	--	2-3 days	30 / 703	Awareness/ Refresher Programme
M.Sc. (Med.Phys.) Anna/Mangalore University	B.Sc. (Phys.)	10 days	19 / 191	Qualify as RSO (III)
Foreign Trainees	--	1-3 months	39	

* Conducted by Isotope Applications Division, BARC

Conducted by Food Technology Division, BARC

procedures to mitigate the consequences. The problem has been recognised internationally. Towards this end, RP&AD arranges a number of awareness programmes for personnel like customs officers, security staff, cargo handlers and staff of port authorities in collaboration with National Academy of Customs, Excise and

Narcotics (NACEAN), to ensure safety of radiation sources and security of radioactive materials and to make various organisations aware of their role in preventing accidents/incidents, which affect the safety and security of radiation sources.

RP&AD also conducts two/three day need-based familiarisation programmes on radiation safety for radiologists, medical X-ray technologists and defence personnel.

Foreign Trainees

The International Atomic Energy Agency and World Health Organisation refer a number of persons to BARC, from neighbouring countries, who are engaged in use of radiation in various fields. RP&AD provides and co-ordinates training in the field of radiation safety to these WHO / IAEA fellowship holders from other countries.

Conclusion

As illustrated in Table 1, a trained manpower of about 10,500 persons has been generated

through these HRD programmes in the field of radiation safety. This trained manpower is responsible for ensuring radiation safety in about 3000 institutions involved in non-nuclear fuel cycle applications of radiation. These HRD programmes have resulted in:

- Improvement in work practices and working environment.
- Decrease in average individual dose to radiation workers.
- Increase in the confidence level in handling emergencies.
- Downward trend in the number of incidents / emergencies in these institutions.