RADIATION PROTECTION OFFICERS TRAINING IN SAUDI ARABIA: CURRENT STATUS AND FUTURE PERSPECTIVES

OMAR NOOR, MSC. HEALTH PHYSICIST
BIOMEDICAL PHYSICS DEPARTMENT
KING FAISAL SPECIALIST HOSPITAL AND RESEARCH CENTRE
Outlines

Introduction

Licensing of RPOs

Licensing Institutions for RPO Training

RPO Training at KFSH&RC
  ◦ Aims and Objectives
  ◦ Syllabus and course Material
  ◦ Teaching philosophy
  ◦ Training Assessment

Advance RPO training

National E-Learning RPO program
Introduction

- Increase in Radiation Application in Saudi Arabia
  - From 2010 to 2017: an increase of 2000 RW that are monitored by the Health Physics Section of KFSH&RC

- Increase in the number of non-compliances issued by the regulator

- Bonn Call-for-Action – **Action 4**
  - Strengthen radiation protection education and training of health professionals
Licensing of RPOs

Regulatory Body – King Abdullah City for Atomic and Renewable Energy (KA.CARE)

RPO must be licensed by KA.CARE

**Previous License requirement:**
- High school diploma
- Medical report
- Letter of employment
- Passing the RPO exam (70%)
- Payment of exam’s fee ($80)

License expires after 2 years

**Renewal requirements:**
- Submission of renewal application
Licensing of RPOs

Current Requirements

◦ Bachelor Degree in Science, Engineering or Health Sciences
◦ Attendance of an RPO training course (30 Hrs)
◦ Passing the RPO exam (70%) (+85% RPE)
◦ Medical Report
◦ Payment of exams’ fee ($80)

License expires after 2 years

Renewal requirements:

◦ Attending RPO training (30 Hrs)
◦ submitting appropriate applications
Licensing of RPOs

- Type of RPO License:
  - Diagnostic Radiology
  - Radiotherapy
  - Nuclear Medicine
  - Nuclear Gauges
  - Transportation
  - Gamma Irradiators
  - Research
  - Detection and Measurements

- Only two different licenses are permitted per individual
Licensing Institutions for RPO Training

- Medical vs Industrial

- Minimum of 5 lecturers
  - PhD/ MSc with 5 years of related experience
  - BSc with 10 years of related experience

- Minimum of 30 hours

- Maximum of 100 participants per training
RPO Training at KFSH&RC
Aim of RPO Training Program

- Acquire the **knowledge** of basic concepts and principles of **ionizing radiation** and its **instrumentation**

- Gain a clear **understanding**, **skill**, and **attitude** on radiation protection practices

- Understand the national and international **standards** and **regulations** on radiation protection
Course Objectives

Upon completion the participant will be able to identify the:

a) Nature of ionizing radiation
b) Types of biological effects of ionizing radiation
c) Quantities and units used for measurement of radiation
d) Devices used to monitor personnel monitoring devices
e) Basic principles of reducing exposure to radiation
f) Precautions that should be taken to minimize potential fetal exposures
g) Recommended management procedures for pregnant radiation workers and the pregnant patient
h) ALARA concept
i) Required radiation safety training for all personnel
j) Required audits, radiation surveys, calibrations and equipment performance evaluations
Targeted Audience

- Radiation safety officers (50%)
- Health and medical physicists (10%)
- Nuclear medicine and medical imaging professionals (10%)
- Radiologic technologists and radiologists (5%)
- Medical Doctors (5%)
- Students/ Recent Graduates (10%)
- Others (10%)
Teaching philosophy

- Provide equal learning opportunities for male and female (30/70)
- Create a friendly environment where participants can freely discuss issues and ask questions
- Plant the concept of safety culture in the participants' mind/life
- Encourage group work and class discussion
- Continuous support and help even after the program
- Develop sense of leadership and teaching skills
Program Layout

• 34 hours training program – 6 hrs (additional day after a week)
• Lectures duration: 45 – 60 minutes (60%)
• Workshops duration: 1 – 2 hours (30%)
• Scientific visits: 45– 60 minutes (10%)
• 3 breaks per day; Morning, Lunch and after noon
• 2 activities per day; problem solving, workshop, scientific visit
• Evaluation test before and after the course
Syllabus and course Material

Adapted material from the IAEA Post Graduate Course in Radiation Protection

Module 1: Basic Knowledge
Module 2: Radiation Protection
Module 3: Radiation Protection Infrastructure
Module 4: Radiation Protection for specific Industries
Workshops

- Calibration and usage of Radiation Detectors
- Personal Dosimetry
- I-131 Therapy and Waste Management
- Nuclear Medicine Facility, Survey, Audit and Assessment
- Diagnostic Radiology – Shielding Verification, Survey, audit and assessment
Technical Visits

- Radiotherapy Facility
- Secondary Standard Dosimetry Laboratory - Radiotherapy Bunker
- Radiopharmaceutical and Cyclotron Facility
- Radioactive Warehouse
- Gamma Irradiation/ Sterilization Facility
Problem Solving Sessions

- 4 hours problem solving sessions
- Participants driven
- Full day of problem solving sessions – bonus
- Office Hours – Q&A sessions
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Day 1 (Sunday 4 June)</th>
<th>Day 2 (Monday 5 June)</th>
<th>Day 3 (Tuesday 6 June)</th>
<th>Day 4 (Wednesday 7 June)</th>
<th>Day 5 (Thursday 8 June)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:30 - 10:15</td>
<td>Introduction &amp; Evaluation Test&lt;br&gt;Mehenna Arib</td>
<td>Mod 1.7 Radiation Detection and Measurements&lt;br&gt;Mehenna Arib</td>
<td>Mod 2.1 Principle of Radiation Protection&lt;br&gt;Belal Moftah</td>
<td>Mod 3.1 Ionizing Radiation Legislation and Regulations&lt;br&gt;XXXXXX</td>
<td>Evaluation Test</td>
<td></td>
</tr>
<tr>
<td>10:15 - 11:00</td>
<td>Mod 1.2 Structure of the Matter &amp; Radiation Sources&lt;br&gt;Omar Noor</td>
<td>Mod 2.2 Protection from External Radiation Hazard&lt;br&gt;Mehenna Arib</td>
<td>Mod 3.4 Emergency Response Planning&lt;br&gt;Shada Wadi Alramahi</td>
<td>Mod 4.3 Radiation Protection in Radiotherapy 1 / 2&lt;br&gt;Belal Moftah</td>
<td>Problem-Solving Session&lt;br&gt;Ibrahim Al-Gain</td>
<td></td>
</tr>
<tr>
<td>11:00 - 11:10</td>
<td>Morning Break</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:10 - 11:55</td>
<td>Mod 1.3 Radioactivity&lt;br&gt;Refaat Al-Mazrou</td>
<td>Mod 2.3 Protection from Internal Radiation Hazard&lt;br&gt;Omar Noor</td>
<td>Mod 3.2 Transportation, Storage &amp; Safe Handling of Radioactive Waste&lt;br&gt;Fareed Mayhoub</td>
<td>Mod 4.3 Radiation Protection in Radiotherapy 2 / 2&lt;br&gt;Shada Wadi Alramahi</td>
<td>Problem-Solving Session&lt;br&gt;III&lt;br&gt;Mehenna Arib</td>
<td></td>
</tr>
<tr>
<td>11:55 - 12:15</td>
<td>Prayer Break</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12:15 - 13:00</td>
<td>Mod 1.4 Interaction of Radiation with Matter&lt;br&gt;Belal Moftah</td>
<td>Mod 2.4 Personal Dosimetry&lt;br&gt;Ibrahim Al-Gain</td>
<td>Mod 4.1 Radiation Protection in Nuclear Medicine 1 / 2&lt;br&gt;Ahnaf Arafat</td>
<td>Mod 4.2 Radiation Protection in Diagnostic Radiology 1 / 2&lt;br&gt;Ibrahim Enazi</td>
<td>Case study&lt;br&gt;Shada, Refaat</td>
<td></td>
</tr>
<tr>
<td>13:00 - 13:45</td>
<td>Mod 1.5 Radiation Quantities and Units&lt;br&gt;Omar Noor</td>
<td>Mod 2.5 Use of Radiation Monitoring Instruments&lt;br&gt;Mehenna Arib</td>
<td>Mod 4.1 Radiation Protection in Nuclear Medicine 2 / 2&lt;br&gt;Ahnaf Arafat</td>
<td>Mod 4.2 Radiation Protection in Diagnostic Radiology 2 / 2&lt;br&gt;Ibrahim Enazi</td>
<td>Technical visits I&lt;br&gt;Radiopharmaceutical and Cyclotron Department&lt;br&gt;Fareed, Ibrahim</td>
<td></td>
</tr>
<tr>
<td>13:45 - 14:00</td>
<td>Break</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:00 - 14:45</td>
<td>WORKSHOP 1 Calibration and usage of Survey Meters&lt;br&gt;Mehenna, Heba, Mariam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14:45 - 15:30</td>
<td>WORKSHOP 2 Personal Dosimetry&lt;br&gt;Fareed, Ibrahim, Shaima</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WORKSHOP 3 I-131 therapy &amp; waste&lt;br&gt;Fareed, Nour, Sara</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WORKSHOP 4 Nuclear Med. Facility survey and assessment&lt;br&gt;Ahnaf, Refaat, Shaima</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>WORKSHOP 5 Diagnostic Radiology and Shielding Verification&lt;br&gt;Mehenna, Mariam, Nour</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Overall evaluation Certificates of Attendance Closing Ceremony</td>
</tr>
<tr>
<td></td>
<td>WORKSHOP 6 Diagnostic Radiology Facility survey and assessment&lt;br&gt;Fareed, Omar, Heba</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ETRAP, 30 May - June 2, 2017**
Course Evaluation and Assessments
Assessments

- Anonymous assessments
- Two assessments (before and after the course)
- Total of 30 questions
- Average of 2 questions per lecture
- Multiple choice
- Straightforward with few challenging questions
- Provides the speakers with an idea about the participants background
- Used as a mean of evaluating the speaker and the training overall
Training Assessment

- Average score in the initial assessment is around 50%
- On average a 25% shift by the end of the RSO Course
- Minimum score range between 10 – 20 %
- Strong correlation between the speaker evaluation and the post assessment test
- Significant improvement in lectures with hands-on components
- Early morning lectures generally had a better rate of improvement compared to after lunch or at the end of the day
Training Assessment

ETRAP, 30 MAY - JUNE 2, 2017
Speakers Evaluation

- By students performance in the assessment after the course (30%)
- Students evaluation (40%)
- Course director evaluation (30%)
  - Teaching plan
  - Utilization of teaching tools
  - Time managements
- Evaluation are submitted to speakers for analysis and reflection
- Speakers are requested to attend a training on developing teaching skills
Training Evaluation

Overall, how would you rate the RSO course?

Answered: 21  Skipped: 0

- Excellent
- Very good
- Good
- Fair
- Poor

0%  10%  20%  30%  40%  50%  60%  70%  80%  90%  100%
Training Evaluation

The workshops were

Answered: 21  Skipped: 0

![Pie chart showing the distribution of responses: Satisfactory and Very satisfactory]
Training Evaluation

How engaging were the speakers at the RSO course?

Answered: 21 Skipped: 0

- Extremely engaging
- Very engaging
- Somewhat engaging
- Not so engaging
- Not at all engaging
Participants Feedback

- Minimize the time of course
- Keep the lectures with the workshop in the same day & every day.
- More practice for exam
- Assign a group leader for the workshops
- Start the daily earlier and the dismissal earlier
- Creating a WhatsApp Group
CERTIFICATE OF ATTENDANCE

THIS IS TO CERTIFY THAT

ATTENDED A 40 HOURS OF A

RADIATION SAFETY OFFICER COURSE

HELD DURING THE PERIOD

1 - 5 MUHARRAM 1438 (2 - 6 OCTOBER 2016)

AT

KING FAISAL SPECIALIST HOSPITAL & RESEARCH CENTRE.
BIOMEDICAL PHYSICS DEPARTMENT
RIYADH, SAUDI ARABIA

Ali, Al-Balaa, MBA-IT
Executive Director
Executive Administration for Radiation Protection and Safety, SFIDA

Belal Mofteh, PhD
Chairman
Biomedical Physics Department
Research Centre, KFSH&RC

Arif Mohamma, PhD
Chief Health Physicist
Biomedical Physics Department
Research Centre, KFSH&RC

This certificate is issued under the training service license (1 - 7) - T - 100 - 1 issued by the National Center for Radiation Protection
Advance RPO Training
Targeted Audience

- Geared toward RPOs with minimum of 5 years or
- RSO with MSc or PhD in Nuclear Engineering/ Medical/Health Physics or related programs
- Participants who get 90 % or higher in the pre Evaluation Assessment
Proposed Training Program

- First two days will be shared with the basic RPO training

- Shielding calculation and shielding verification (6 hours)
  - Theoretical lectures reviewing Publications and international standards/ recommendations
  - Shielding verification exercise of existing facilities (Practical session)

- Radiation Protection Program/ Manual (3 hours)
  - Developing procedures
  - Record keeping
  - Auditing (Practical session)
Proposed Training Program

- **Training the Trainers (6 hours)**
  - Training program design
  - How adults learn
  - Design of handout material
  - Utilization of online training modules
  - Delivering lectures in RP (*Practical Session*)

- **Handling Radiation Emergencies (3 hours)**
  - Design of emergency plans
  - Planning for Emergency Drills
  - Handling a Radiological Emergency Accident (*Practical Session*)
Establishment of a National E-Learning RP Training program
E-Learning RP Training program

- IAEA Approved Technical Cooperation Project for 2018/2019
- Development of an E-Learning training in Radiation Protection focusing in Medical Applications
- The training will be made available to;
  - all health care professionals
  - Patients undergoing radiation diagnosis/ therapy
  - Concerned members of the public
- Various level of intensity and complexity
- Based on the current E-Learning RP training program at KFSH&RC
# E-Learning RP Training Program

## Courses

### Catalogue Content

<table>
<thead>
<tr>
<th>Results 1 - 14 of 14</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title</strong></td>
</tr>
<tr>
<td>Radiation Safety For Referring Physicians</td>
</tr>
<tr>
<td>Radiation Safety For Y-90 (Zevalin) Therapy</td>
</tr>
<tr>
<td>Radiation Safety in Blood Bank</td>
</tr>
<tr>
<td>Radiation Safety in Cath. Lab. (Technologists)</td>
</tr>
<tr>
<td>Radiation Safety in Computed Tomography</td>
</tr>
<tr>
<td>Radiation Safety in Cyclotron</td>
</tr>
<tr>
<td>Radiation Safety in Dentistry</td>
</tr>
<tr>
<td>Radiation Safety in Fluoroscopy, Angiography, Radiography &amp; Cath. Lab. (Nurses)</td>
</tr>
<tr>
<td>Radiation Safety in Fluoroscopy, Angiography &amp; Radiography (Technologists)</td>
</tr>
<tr>
<td>Radiation Safety In Iodine-131 Therapy</td>
</tr>
<tr>
<td>Radiation Safety in Laboratory</td>
</tr>
<tr>
<td>Radiation Safety in Nuclear Medicine</td>
</tr>
<tr>
<td>Radiation safety in PET CT</td>
</tr>
<tr>
<td>Radiation Safety In Radiotherapy</td>
</tr>
</tbody>
</table>
National E-Learning RPO Program

Knowledge Centre

Radiation Safety in Nuclear Medicine

Getting Started
Posted on 13-Nov-2012, by System Administrator
1. Start the module by clicking on the Launch button.
2. To evaluate this course click on the Evaluation link (The completion of the course evaluation is Optional).
3. To print the certificate go to the certification link available on the left side of the iLearn portal (a copy of the certificate will be sent to your Hospital email)...Read More >>

Evaluation
Please take the evaluation after completing the course.

Radiation Safety Modules Evaluation Incomplete
RADIATION PROTECTION IN NUCLEAR MEDICINE

RADIOACTIVITY & RADIATION

- All matter in our environment is composed of atoms.
- Most atoms on the earth are stable.
- Some atoms are unstable (Radioactive), giving off energy in the form of radiation in order to reach a stable state.
- An example for radioactive atoms is Carbon-14 which exists in all living things, Iodine-131 and Yttrium-90.
- When outer electrons of the atom absorb radiation energy they leave the atom and the atom becomes ionized.

ATOMIC STRUCTURE
Most atoms on the earth are stable (Ref. 1)

TYPES & SOURCES OF RADIATION

- There are two types of radiation:
  - Ionizing radiation (example: X, Gamma rays and Beta particles)
  - Non-Ionizing Radiation (Example: Radio Waves and Micro waves)
- The sources of radiation are:
  - Natural Radiation Background (Amounts of radioactive substances naturally occur in soil, rocks, plants, animals and in our own bodies).
  - Man-Made Sources of radiation are radioactive materials produced in nuclear reactors (Iodine-131, Yttrium-90) and radiation producing equipment (x-ray machines and accelerators)
- Radiation can be produced either from radioactive atoms (used in nuclear medicine) or using electrical machines (used in diagnostic x-ray machines).

IONIZING RADIATION
Ionizing radiation used in medicine is produced either from radioactive materials or from radiation producing Machines (Ref. 1)

Total US average dose equivalent = 3.6 millisievert/year

ETRAP, 30 MAY - JUNE 2, 2017
BIOLOGICAL EFFECTS OF RADIATION

- Cell nucleus containing DNA is the most sensitive part to radiation in the cell.
- Chronic Exposure to radiation (exposure to low levels of radiation over a period of years) may lead to a slight increase in the probability of cancer incidence and leukemia (Stochastic Effects).
- Acute Exposure to radiation (exposures to high levels of radiation in a short time) may produce the same effects faster and may also cause hair loss, skin burns, radiation sickness or even death (Deterministic Effects).
- Radiation may also increase the risk of genetic abnormalities (Hereditary Effects).

OUTCOMES AFTER CELL EXPOSURE (Ref. 1)

RADIATION PROTECTION IN RADIATION THERAPY

RADIATION PROTECTION DURING BRACHYTHERAPY

- Brachytherapy treatments may involve placing the source directly against the diseased tissue (direct loading) or placing a source into applicators or tubes for a prescribed time (after loading).
- Brachytherapy using high dose rate sources must be carried out in a controlled environment where:
  - Staff must remain outside the room during the treatments.
  - The treatment room must be fitted with interlocked doors and warning signs.

Translationci: βαλ δεχται ένα λεκτικό γεγονός και κοιστήστε στην επιλογή του ενός άνθρωπου που επιλέγει μια καρδιά για τον καθαρισμό της καρδιάς. Η καρδιά αυτής της πρώτης έκθεσης, η δεύτερη έκθεση, η τρίτη έκθεση, η τέταρτη έκθεση και το πέμπτονον.
The three practical basic principles for radiation protection are:

- Maximize the distance from the radioactive source.
- Minimize the time of exposure to radiation.
- Use appropriate shielding.
Conclusion

- Some positive changes from the regulatory body i.e. RPO requirements
- The current RPO Training has proven to be effective
- More effort is needed to improve the teaching skills of some of our lecturers (TTT)
- Improving and finalizing the advance RPO training course
- Seek international support (IAEA) in the development of the National e-learning program in radiation protection
THANK YOU