

Safety Culture in Activities Involving Ionizing Radiation Long-Distance Courses for Industrial Applications

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Abstract

ATOMO is a firm with long experience in the layout and coordination of Radiological Protection courses and, for this reason, has developed long-distance courses, both in Portuguese and in English, using multi-media resources already available for the areas of Gammagraphy, Nuclear Gauges, Accelerators and Large Irradiators. On developing this project, we focused companies and their personnel to be trained, aiming avoiding their relocation and providing the comfortable of studying at their more convenient time. Omicrom, a multimedia firm, our partner in this project, has been responsible for the course program and design. This work consisted in the adaptation of the traditional material for electronic language, through links, hot words and icons especially developed for additional information. Besides images and graphics from the original handouts, animations were developed at Ômicrom studios, explaining the procedures with more details and simplifying the comprehension of more complex subjects. For enhancing the CD ROM, slides were produced, where the pictures move automatically as the explanations are narrated. The CD also comprises some videos, where the students may visualize practically the complex procedures, which are extremely important. At the end of each topic, the students evaluate their knowledge through multiple choice tests, which deal with the subject studied in the related chapter. This and other highly updated resources are utilized for assuring a better learning. The CD is not only an electronic handout, but a long-distance course providing weekly support for the students, through Internet, direct access to the instructors by e-mails or chat, previously arranged, access to a data bank constantly updated for more frequent questions, plus link addresses and pages of interest for radiological protection. The tests are taken at the end of each module, before starting the following one. Each module comprises several chapters, totaling four modules. Each CD ROM is customized, with the buyer company name and one or more access passwords, depending on the number of users requested. The instructor accompanies the development of each student through the Internet, verifying if the course has been concluded, the grade obtained in the tests and the time spent. As the same, the company will receive a supervisor password, which allows the evaluation of its workers in the course. This CD Rom is pioneer in Brazil and Latin America and it is our intention to become a benchmark in this field. We thank the support of the IAEA and FAPESP.

1. Introduction

The National Commission of Nuclear Energy – CNEN, Regulation NE 3.01⁽¹⁾, Basic Guidelines of Radiological Protection, requires a Radiological Protection Plan for the activities with Radioactive Material, according to the three international basic principles of Radiological Protection: Justification, Optimization and Dose Limit. Moreover, the CNEN also requires a trained and qualified Radiological Protection Supervisor in all installations authorized to work

with radioactive material. In the past, a training course for qualified Radiological Protection Supervisor in Gammagraphy was required by Brazilian National Commission of Nuclear Energy with at least 240 hrs. For Irradiators and Accelerators, 132 hrs and Nuclear Gauges, 80 hrs were demanded by the CNEN. Nowadays the CNEN does not require the attendance of a regular course, but only the certification of practical experience in the area plus a qualification exam, applied by them. The exam required by the CNEN is divided in three parts, consisting of a written test with multiple choice questions, a test with open questions and a third practical test in the customer facilities or “on the job”. ATOMO, an institution with large experience in the coordination and execution of Radiological Protection Supervisor courses, has opted to develop on-line courses, using multimedia resources.

The aim of this work is to give practical examples to work safely in activities involving ionizing radiation, efficiently and at reasonable costs, with thorough mastery of security and innovation culture for students willing to qualify, together with the Government authorities, as radiological protection supervisors or to be security and safety experts.

The Spanish version, although not providing the qualification certificate, is always revised related to the international recommendations from the ICRP, ICRU and IAEA.

This procedure of updating the material is very important since, in some circumstances, some national safety standards are not immediately updated, according to the international recommendations.

2 Courses Already Developed

The courses in Portuguese and in Spanish are equally developed, because Brazil has recently adopted the ICRP publication no 60 and the IAEA publication no 115, inserting them in Brazilian regulations. In the table below, the subjects and sub-items presented in each module of the course are showed.

MODULE	SUBJECT	SUB-ITEMS
I	RADIOLOGICAL PROTECTION INFRASTRUCTUE	<ul style="list-style-type: none"> • Nuclear Physic • Biological Effects of Radiation • Dosimetric Quantities • Statistics
II	BASIC RADIOLOGICAL PROTECTION FUNDAMENTALS	<ul style="list-style-type: none"> • Radiation Risk • Detectors Theory • Dose Calculation • Calibration • Basic Legislation • Optimization
III	DOSE EVALUATION AND RADIOLOGICAL PROTECTION ENGINEERING	<ul style="list-style-type: none"> • Monitoring • Shielding Calculation
IV	PRACTICAL RADIOLOGICAL PROTECTION OF THE DIFFERENT INDUSTRIAL APPLICATIONS	<ul style="list-style-type: none"> • Safe Transport of Radioactive Material • Basic Concepts of Industrial X-ray, Nuclear Gauges and Irradiators

The modules mentioned previously, besides the discussion over each subject, extracted from the main international and national standards, such as those from the IAEA ⁽²⁾, ICRU ^(4,5) and from

the present radiological protection literature, also show illustrations and films. The radioactive material transportation film was kindly provided by the IAEA, the instruments calibration was filmed at the IPEN facilities and specific calibration procedures, photographed and filmed in Voith, Embrarad, Metaltec and IPEN facilities. Effort was made for the maximum information, concisely and clearly exposed. The results expected in this course introduction have already been discussed by Sahyun ⁽⁶⁾, in another paper.

3. Methodology

The CD-ROM and Internet site technical development were in charge of Ômicrom Programação Gráfica Ltda, our partner in this project.

3.1 Multimedia Course

This course was developed using multimedia resources. The content is available in CDS-ROM and is linked to a Web system, for validation and training follow-up. Among the resources used in the CD, it is highlighted the surfing by links and hypertext, the use of illustrations, photographs, animations and full-screen videos, which enhance the explanations so that the student is provided with an interactive, dynamic, efficient and pleasant course.

3.2. CD ROM

The course content is divided in four modules, which are released to the participants as they advance in the course. For each chapter presented, the user will be able to access all the information comprised. This access will be done interactively not necessarily linearly, and the participants can explore explicative or dissertative topics, always respecting the course development structure, depleting each unit subject before starting the next module.

We understand that the subject to be presented is rather complex and of difficult assimilation. To make this course more accessible didactically, we improve the access to the electronic media, which will replace the instructor physical presence giving confidence to the students along the course. For this purpose, besides the conventional media - texts and photos – the course counts on latest generation multimedia resources, such a videos, narrations, animations, illustrations, photos, diagrams, interactive graphics, hypertext and access to Internet, among others.

In the beginning of each module, the participants have access to a menu of chapters, indicating which are concluded and which are incomplete.

In the end of each chapter there is a follow-up evaluation, to measure the subject comprehension.

3.3 Internet

Every user licensed for the course has access to on-time information, through the website where the students can solve possible questions, directly with the responsible instructors, via a “questions and answers” interface. A data bank, with the more frequent questions is available, representing another source of research for the course.

Still via Internet, the users will have access, to a dissertative evaluation, to be taken at the end of each CD module. Once the students succeed in these tests they will be automatically allowed to go to the following CD-ROM module.

Finally, the course participants can count on an updated reference basis on-line, through links, carefully chosen, to other related home-pages to be presented in the course.

3.4 Safety

The program is planned to run directly from the CD-ROM, without the necessity of installation in the user computer, not stimulating the use of a same CD among several users.

The learner will have to take and pass a practical test with the instructors in charge in order to receive the course conclusion certificate.

4. Future Development

In the two existing versions, the search for words resource will be introduced to help the students memorize definitions or technical expressions, making it easier to locate subjects needing revision.

In the Spanish version, the ICRP publication nº100 will be introduced, as soon as an issue of these recommendations is available.

It is the authors intention to develop a similar course in the Medical Field, sub-divided in Radio Diagnosis, Radiotherapy and Nuclear Medicine.

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6. Referências

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