

SAFETY CULTURE IN ACTIVITIES INVOLVING IONISING RADIATION - EDUCATIONAL PROJECT

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Abstract: The Brazilian National Commission of Nuclear Energy (CNEN) requires a Radiological Protection Plan for all installations authorized to work with radioactive material and a qualified Radiological Protection Supervisor. The CNEN requires the certification of practical experience in the area plus a qualification exam, applied by them. ATOMO, has opted to develop on-line courses, using multimedia resources, available at the time this congress takes place. ÔMICCRON, a multimedia enterprise, is in charge of the program and design. First, the research and brochures have to be adapted for the electronic language, through links, hot words and icons, especially developed for additional information. Besides the images and graphs from the original brochures, Ômicron developed, in graphic computing, specific animation explaining the procedures in more details, illustrating and simplifying the comprehension of the more complex subjects. The CD ROM presentation was enhanced with some slide displays, automatically changing the pictures, as the explanations are given. For practical visualization of these complex and important procedures, the CD also shows some technical videos. At the end of each unit covering a specific subject, the students will be submitted to self-evaluation tests, for more profitable results. This CD is not only an electronic brochure, but mainly an on-line course with weekly Internet support via e-mail or chat site, where the learners will access the instructors and a frequent questions database, useful links and related sites, permanently upgraded. Before going to the following module, the learner has to pass a written test prepared by ATOMO, via Internet. At the end of the course, a certificate will be given. The control will be made through the use of a password, provided for the authorized company and /or users. The instructors will evaluate the learners' advancement by Internet. In the case of companies, this tool will be equally offered, by using a personal manager password.

1. Introduction

The National Commission of Nuclear Energy – CNEN, Regulation NE 3.01, Basic Guidelines of Radiological Protection, requires a Radiological Protection Plan for the activities with Radioactive Materials, 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 materials. In the past, a training of around 200 hrs was demanded by the CNEN. Considering that 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, ATOMO, an institution with large experience in the co-ordination and execution of Radiological Protection Supervisor courses, has opted to develop on-line courses, using multimedia resources, available at the time this congress takes place, in Portuguese language.

The aim of this paper is to offer, to those interested is qualifying with the governmental authorities as radiological protection supervisors or becoming experts in radiological protection, practical examples for achieving effective and economical safety, thoroughly optimised, in activities involving ionizing radiation, enabling the learners to acquire deep practical knowledge and culture to innovate and improve the safety procedures.

This work also presents a scientific development of informatics, justifying the approach of the two subjects, that is, the knowledge of Radiological Protection and the Multimedia project development. In the following sections we describe these subjects.

2. Course Program

At first we will deal with the development of the radiological protection knowledge required for the students to submit to the CNEN qualification exam. The developed program will be approached concisely.

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

As shown, the CD is divided in three modules. This program was extracted from the main national and international standards, such as IAEA [1,2,3,4], ICRP [5], ICRU [6], BEIR [7] and UNSCEAR [8] and from recent radiological protection literature [9,10].

We made an effort to give a maximum of information in a concise and clear way.

3. Methodology

ÔMICCRON, a multimedia enterprise, is our partner in this project and in charge of the program and design.3.1 The Multimedia Course.

3.1 The Multimedia Course

The course was developed in multimedia language and counts on two resources: an interactive CD-ROM and Internet support.

For this reason, the written course was adapted for multimedia language, considering the numerous possibilities of resources, links and hypertexts that enhance the explanations to provide the learners with an interactive, dynamic, efficient and pleasant course.

Taking profit of the advantages and respecting the limitations of each of these resources, the codes of program and design were integrated and developed, generating an interesting and inviting interface, which being easy to navigate will motivate the user to explore at most each chapter presented.

3.2. THE CD- ROM

All the course content, divided in specific modules, is in the CD-ROM.

For each chapter presented, the user will be able to access the CD information. This access will be interactive, not necessarily linear, the user going deeper into explanatory or elucidation topics, always respecting the course development structure, finishing the unit subject before starting the following module.

We consider the subject to be presented rather complex and difficult to assimilate. Therefore, to make this course more accessible didactically, we made an effort to improve the means of access to the electronic media, which will replace the instructor presence, making the learner feel more confident as the course runs. For this purpose, besides the conventional media – texts and photos – the course counts on last generation multimedia resources, such as videos, narration, animations, illustrations, diagrams, interactive graphs, hypertexts and Internet access, among others.

These resources aim to teach the subjects presented as well as possible, what would not occur using only the conventional media. Moreover, the use of this technology provides a more dynamic and detailed course, enabling the learner to view and review a given subject as many times as necessary, or even to link to another correlated topic of the same course, ensuring the greatest profit of the content proposed, from both the quantity and quality of the information offered.

Each module comprises a general index, through which the user will have access to all the subjects mentioned in the given module. Therefore, the learner will be able to explore each of these subjects, going deeper whenever is necessary, through the hypertext resources, which permit to picture the content in an ampler and more complete way. Subjects difficult to understand can count on a video or graphic animation demonstration, especially designed for a better visualisation of the item.

Different CD- ROMS were produced according to the designated area.

3.3 Internet

One of the strongest points of this course, besides the dynamism and rich information supplied in the CD, is the integration with the Internet. Each licensed user has access to on-line information, where problems can be solved directly with the instructors in charge, through a question and answer (Q&A) interface. A database with the most frequent questions is in this area, where the learners may count on an extra source of research for the course.

Still in the Internet, the users will have access to an evaluation to be carried out at the end of each CD module. This evaluation is composed of multiple choice tests. Succeeding in these tests, the learner will be automatically authorized to pass to the following CD-ROM module.

Finally, the learner can rely on an updated reference database on-line, through links to other home-pages carefully chosen and related to the subjects to be presented in the course

3.4 Technologies to be used

Considering the complexity of the course, the best available programs in the present market were studied for the production of this material.

Concerning the items: navigation, hypertext and general course layout were produced in Asymetrix Toolbook II 8.0, with advantages over the competitors due to the high integration level with diverse media, native access to a database, besides the support from the integration with Internet. It is a renowned tool for the production of interactive courses in CD-ROM. This software permits easy program maintenance, enabling any future upgrade.

The animation used has good performance, even in lower capacity computers. To guarantee that this occurs, the Macromedia Flash and Macromedia Director were chosen which count on high animation production quality with synchronised audio. Yet, the files generated from these software have a high level integration with Internet.

It will be also used: files attached in PDF format (adobe acrobat), DOC (Word for Windows) and PPT (PowerPoint), all with the required support to run without the necessity of programs installed in the user computer.

For the video productions, it was used the compression Divx technology (MPEG4), running at 30 squares per second, in 320x240 screen, with proper transfer rate for the pattern of CD-ROM readers proposed for this project (24 speeds).

The narration was produced in a studio, with a professional narrator and computerised in Microsoft Waveform (WAV) with 16 bits sampling, Monos at 22khz

The CD is prepared to run in PC computers, with Pentium 100 or superior (or similar) processor, with 16MB RAM memory and video device with 265 colours or superior, running Windows 95 or superior. The installation space is minimum, approximately 2 Megabyte.

The Internet site is based on ASP technology in NT IIS 4.0 web hosting service and SQL 7.0 database. The safety protocol is based on SSL.

3.5. 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.

Each licensed CD will be accompanied by one or more passwords. Each password will be used to identify a specific user via Internet and give access to the CD. Only with this password the user may log in the system for clearing up questions and doing the exercises proposed for each module.

All the evaluations will be done via Internet. Succeeding in an evaluation, a same user cannot repeat it, inhibiting the action of non-licensed users. After each evaluation, the learner will receive a new password allowing the access to the following CD-ROM chapter.

For each password released, the respective keys will be designated, so that the user may have access to the following course modules. Thus, the user of another CD-ROM cannot use the same passwords to go ahead without having accomplished the previous phases.

Out of safety, each time the learner takes a test via Internet, three confidential and not related pieces of information from the database system will be required: the personal password to access the Internet; the password for the chapter (key) plus the CGC company number he/she works for. This procedure aims to annul third parties action that might try to cheat and other possible attempts of fraud.

Moreover, a user will have a limited number of accesses to each of the module site resources, making the release of personal passwords to non-authorized users not interesting at all.

After finishing the course and receiving the certificate, the learner will have his/her password automatically cancelled and the CD-ROM will not be valid any longer. The company will be able to buy other licenses or keep it as reference for future consultation.

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

We believe that all these precautions will make the misuse of this material not interesting, assuring the success of this multimedia course.

4. Expected Results

We expect great social revenue, inducing the people involved in the research and in the courses not to fear the ionizing radiation. Applying the correct safety procedures it is less dangerous than other activities involving pyrophoricity or electricity of high amperage, since radiation does not have the random risk. On the other hand, people will be able to evaluate the ionizing radiation benefits for the humankind nowadays, in all fields of activities. These well trained people will be the focus to divulge the peaceful uses of nuclear energy in their communities, reducing the harmful and alarming impression existing in the population, introduced by those who are against the technological advancement, since the nuclear energy is a top line technology.

This CD- ROM course is a pioneer in Brazil and Latin America and is our target to make it a national reference. It is under the scope of this project to translate this CD into Spanish, with the necessary adaptations to each of the Mercosul State members' regulations.

5. References

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