

Operational Topic

A computer-based radiation safety training program can assist in satisfying the annual training requirements for radiation workers.

Computer- Based Radiation Safety Training for Hospital Radiation Workers

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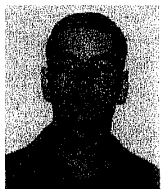
Abstract: Conducting a hospital-based radiation safety training class may lead to temporary technologist staffing shortages resulting in a reduction of patient services or even the cessation of all routine patient services. Use of an interactive computer-based radiation safety training software program may provide a practical alternative for hospital diagnostic and therapeutic radiation departments, as well as other hospital departments utilizing radiation sources, in meeting annual radiation safety training requirements for radiation workers. Medical radiation workers' participation in computer based radiation safety training can make a positive impact on radiation safety awareness in the hospital, assist license holders in satisfying regulatory training requirements, ensure maximum participation of staff technologists, and reduce the burden of technologist staffing shortages caused by traditional methods of training. Health Phys. 78(Supplement 1):S4-S8; 2000

Key words: computers; medical radiation; radiation protection; operational topic

Hospitals that utilize medical radiation sources are regulated by the Nuclear Regulatory Commission (NRC) and/or by State agen

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cies in an Agreement State. These facilities must provide annual refresher training on radiation safety and health risks to radiation workers who, during the course of their employment, are likely to receive in a year an occupational dose in excess of 1 mSv. This requirement is found in Title 10, Code of Federal Regulations, Part 19.12, Notices, Instructions and Reports to Workers (U.S. NRC 1998). Most medical institutions that use sources of ionizing radiation will typically schedule annual refresher radiation safety training classes for selected groups of workers consisting of technologists and other radiation staff personnel. Some traditional methods for providing this training include lecture presentations conducted by a qualified subject matter expert or the presentation of a video-based training film. In most cases, the hospital's Radiation Safety Officer (RSO) coordinates or conducts this type of training (AAPM 1995). However, at some facilities a qualified expert

may have to be brought in to conduct the training at a significant monetary cost to the hospital. Costs for specialized training like this can range in the hundreds of dollars for contracting the use of a qualified consulting firm to conduct in-house training. These costs may be prohibitive to smaller medical departments when considering the small number of radiation workers employed at their facility. Larger facilities that employ traditional training methods may encounter numerous radiation workers being temporarily removed from patient services. This can cause a significant reduction or even cessation in routine imaging studies performed at the facility while the training is being done. Additionally, some radiation workers may not be able to attend the required training for various reasons, perhaps due to illness or vacation. These employees are at risk of not receiving the required annual refresher training if a separate training session is not provided.

COMPUTER-BASED RADIATION SAFETY TRAINING

Today almost all medical facilities use personal computers in their work areas and some networked computers even have ready access to the Internet. Computers

can provide another possible alternative for presenting annual refresher radiation safety training in the form of a computer-based training program that can be accessed or downloaded via the Internet. Some University Radiation Safety Programs are already using the Internet as a means to provide computer-based radiation safety training to radiation workers employed at their facilities. At Princeton University, the Office of Environmental Health and Safety* developed an instructive computer-based radiation safety training program, accessible to anyone via the Internet (<http://www.princeton.edu/~ehs/>), in order to train many of their laboratory radioactive source users (Dupree 1999). Their web site, which focuses mainly on the fundamentals of radiation safety and physics, is used by radiation workers at the University as an adjunct to the traditional classroom radiation safety training they receive. Recognizing the practicality and potential of a computer-based training program, the authors of this paper simultaneously pursued the development a computer based program that would provide worldwide access to radiation safety training specific to medical radiation worker environments.

Program developers designed this training software program to assist NRC and State regulated medical facilities in meeting their "annual refresher" radiation safety training requirements for radiation workers employed at their facilities.

The design team worked over 150 h in a collaborative effort between the School of Public Health and the Department of Nuclear Engineering and Radiological Sciences at the University of Michigan, to develop the beta version of this software program. The training program is accessible via the Internet (<http://www-ners.engin.umich.edu/research/MedSafe>). Written in a web page format, the program was authored using the readily available Netscape Composer. Training modules were developed for several common subjects in medical radiation safety relating to hospital facilities that are licensed to use radioactive devices and sources. Since the training modules were written primarily for medical radiation technologists, the most basic information on radiation physics was not included. For most technologists, this basic information should be well understood from previous academic studies and experience. Most of the written material in each module was referenced from

several NRC regulatory guides, notably NRC Regulatory Guide 10.8 (U.S. NRC 1987), NRC Regulatory Guide 8.29 (U.S. NRC 1996), and NUREG-1556 (U.S. NRC 1997). Use of illustrations and photographs throughout each of the modules provides helpful visual aid to the training experience and reinforces the topics discussed. The software is designed to allow participants to register onto the program, so long as they agree to complete all training modules in the series. Highlights of the training program include the addition of several web links, shown in Table I, which target other web sites with additional information on radiation protection and professional organizations in the medical radiation fields. A comprehensive quiz containing a series of multiple choice questions is provided at the end of the program. The quiz covers much of the material presented in each of the training modules and can be utilized to document participation and successful completion of the training session. Quiz scoring results are returned immediately upon submission of the completed quiz with explanations for each wrong answer. A list of the topics for the training modules is included in Table 2. An index page listing all of the modules is included in the program for easy navigation to any of the topics presented.

*Princeton University, Office of Environmental Health and Safety, 262 Alexander Street, Princeton, NJ 08544, 1997.

§ Netscape Composer HTML utility, Netscape Communicator, version 4.05, 301 E. Middlefield Road, Mountain View, CA 94043, 1998.

Table 1. Web links to related medical radiation safety web-sites.

Site name	Internet address
Radiation Health Home Page, University of Michigan	www.umich.edu/~radinfo
ABCs of Nuclear Science	user881 b 1.gov /NSD _docs/ abc/home.html
Nuclear Regulatory Commission	www.nrc.gov
Biological Effects of Radiation	www.nrc.gov/NRC/EDUCATE/REACTOR/06-BIO / index.html
Biological Effects of Low Level Radiation	www.beileoruine.com
American Registry of Radiologic Technologists American	www.arrt.org/about.htm
College of Radiology	www.acr.org
Health Physics Society	www.hps.org
The "Virtual" Medical Center Radiology Center Table of	WWW.sci.lib.uci.edu/~martindale/MedicalRad.html
the Nuclides	www.dne.bnl.gov/CoN/index.html
Code of Federal Regulations	www.access.gpo.gov/nara/cfr/cfr-table-search.html
Society of Nuclear Medicine	www.snm.org

The Medical Radiation Safety software program provides a broad overview of common hospital radiation sources, safety procedures, and health risks associated with most radiation departments in the facility. Some training modules include specific instructions for participants to use additional time, after completion of the training program, to obtain and review site-specific written procedures for their particular job responsibilities. This is an important point because, unfortunately, computer-based training does have its limitations. Many radiation safety requirements are site-specific for a particular facility. It would be impractical, perhaps impossible, to include all information on specific radiation safety requirements for different facilities into a single software package. Therefore, in order to meet the full intent of Federal and State regulatory training requirements, participants using this training program should perform a complimentary process of participation in computer-based instruction followed by an informative review of published job-specific safety procedures. The review of safety procedures should cover the particular requirements of the medical facility's regulatory license. This is only one recommendation on how the training program could be used as a tool for training purposes. Some hospital facilities may prefer to use computer-based training as a supplement to normal classroom sessions for those individuals who are absent on the day the training is given. The program was designed as an alternative tool for hospitals to use in assisting them in complying with requirements of its radiation safety program.

Upon entering the Medical Radiation Safety Training computer program, participants progress through the series of written modules on hospital radiation safety principles and practices, which include various graphical illustrations. To facilitate the training experience,

technologists are presented with one interactive multiple-choice question at the completion of each module of instruction. Feedback answers are immediately displayed to the participant. An example of the program's registration entry page is shown in Figs. 1a and 1b. The individual registration function is not

currently available on the beta version of the program that can be accessed via the Internet. It is planned that this will be incorporated into a future downloadable or CD-ROM version of the training software.

An excerpt from the first module of instruction, "Hospital Radiation

Table 2. Listing of medical radiation safety training modules.

Current module set	Future module sets
Hospital Radiation Sources	Nursing Procedures in Hospital Radiation Therapy
Review of Radiation Units	Nuclear Medicine Title 10, Revised Part 35 Requirements
Biological Radiation Risks	Radiation Safety Program Audits
ALARA	Radiation Safety for Animal Care Workers
NRC and State Medical Licensing	Radiation Safety for Ancillary Hospital Staff
Basic Principles of Radiation Protection	Practical Radiation Safety Tips for Nuclear Medicine
Radiation Safety Procedures	Practical Radiation Safety Tips for Radiology
Radiation Waste Handling Procedures	Practical Radiation Safety Tips for Radiation Therapy
Radiation Surveys	
Laboratory Radiation Safety	
Occupational Radiation Monitoring Program	
Radiation Emergencies	
Contacting the Radiation Safety Officer	

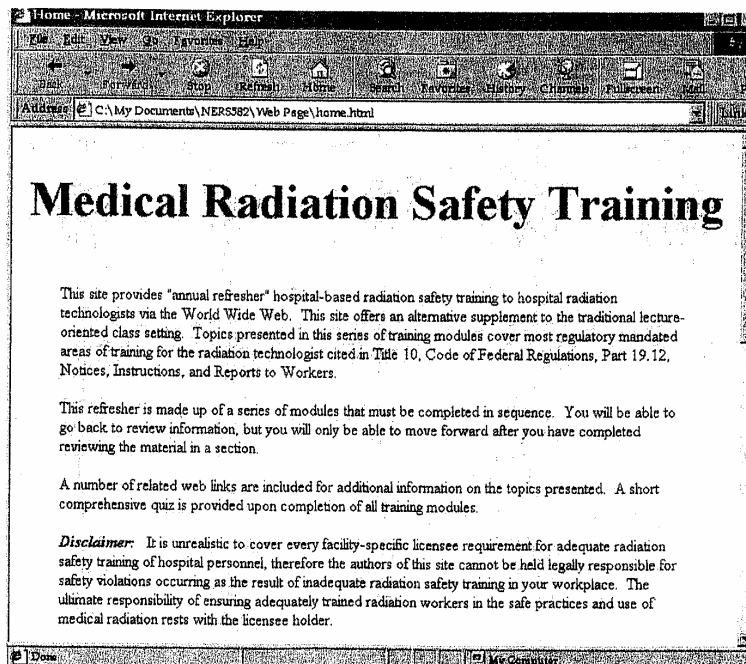


Figure 1a. Example of the registration entry page.

Sources," is shown in Figs. 2a and 2b. Types of equipment may vary from site to site, and illustrations are provided to give participants a generic idea of what devices may look like. After participants finish all of the training modules, they may option to complete and submit the comprehensive multiple choice quiz. A flow chart, which illustrates the basic layout of the training program, is shown in Fig. 3. At the registration page, if an individual chooses to click on the icon "Disagree," to the conditions for participation in the program, they are quickly diverted to the University of Michigan's Radiation Protection Home Page. Radiation Safety Officers, radiation workers, technologists, and other medical personnel interested in hospital radiation safety are encouraged to access the beta version of the training program via the Internet. Comments and suggestions on the content of the program are also encouraged and can be sent to the authors using the contact information provided in the web site.

Upgrades planned for future versions of the software include adding additional module sets on radiation safety procedures tailored to specific types of medical workers such as laboratory research technologists, nursing staff involved in brachytherapy and radioiodine therapies, animal care workers, and ancillary hospital staff. Ultimately, future upgrades of this software training program will evolve into a full-multimedia computer-based program with video/audio clips, animations, and interactive graphical illustrations on a CD-ROM format. Program developers are investigating methods for interfacing the individual registration process with a common database software program. This customized feature would enable hospital management or Radiation Safety Officers to maintain individual records

on medical radiation workers who have successfully completed the computer-based training program.

Operational Radiation Safety

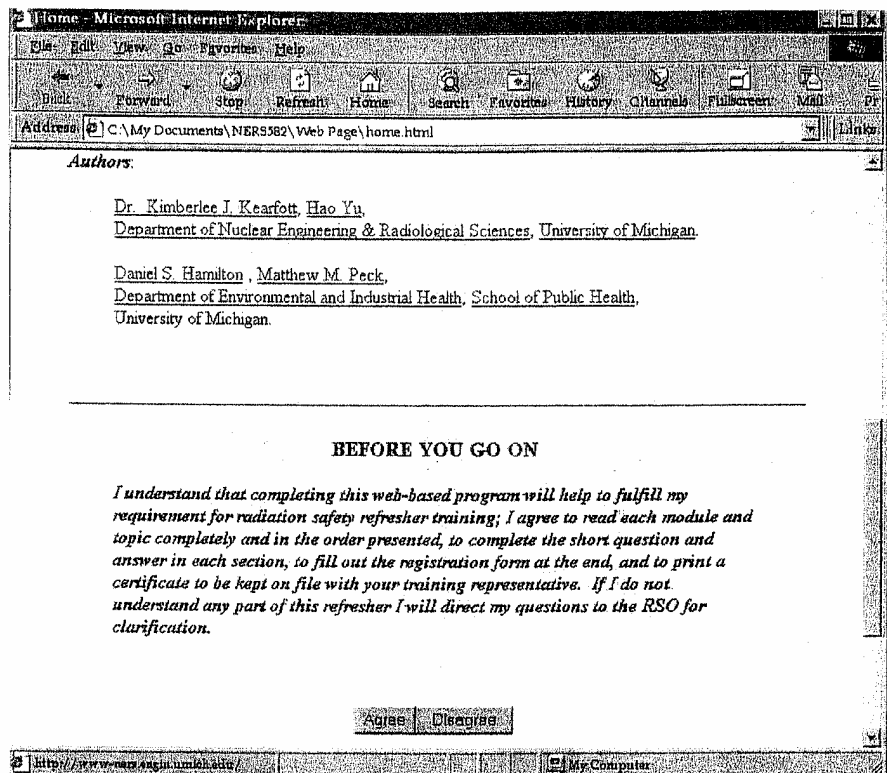


Figure 1b. Example of the registration entry page (continued).

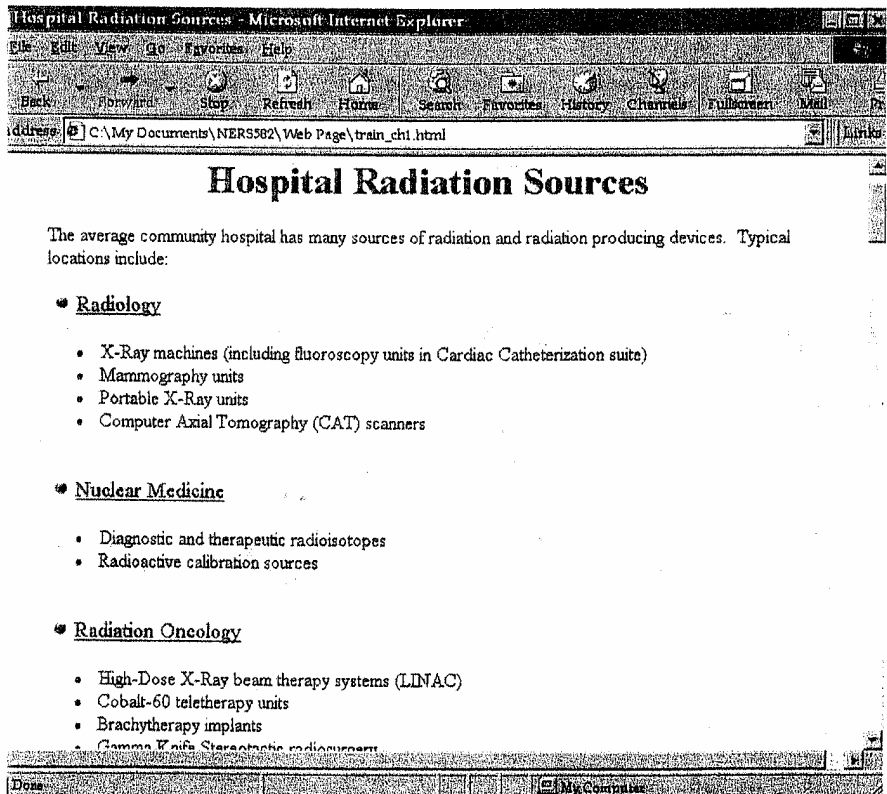


Figure 2a. Extract from the first instruction module, "Hospital Radiation Sources."

CONCLUSION

Hospital management is continually challenged with the

increasing costs of managed care and the formidable task of providing the best quality care to

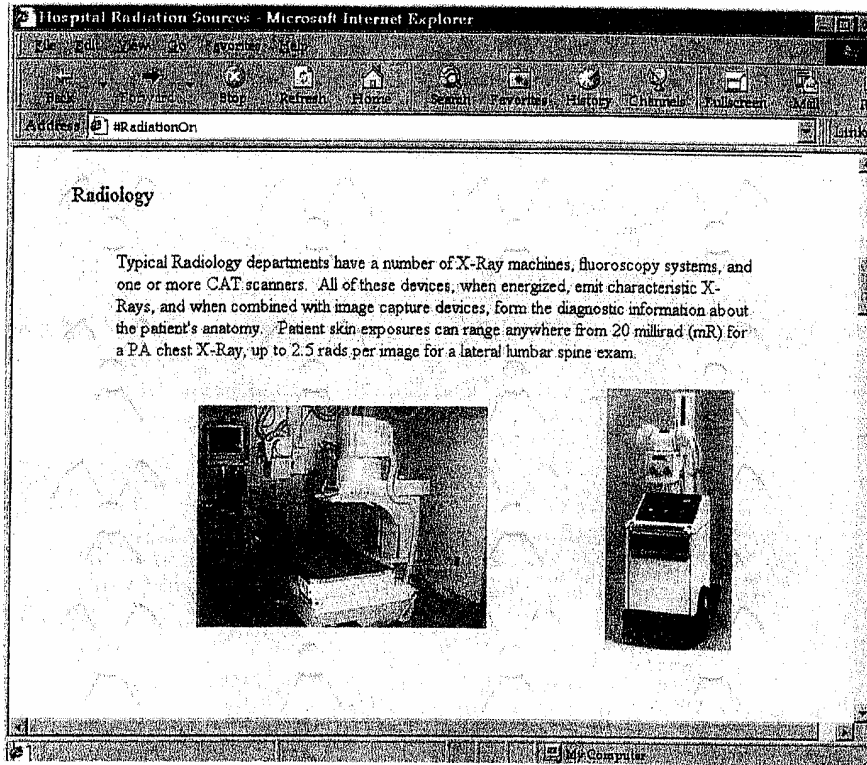


Figure 2b. Extract from the first instruction module, "Hospital Radiation Sources" (continued).

patients. One important aspect of this continuing effort requires well-trained workers in medical radiation safety. A practical easy-to-use computer-based radiation safety training program could prove to be an instrumental and economic alternative in the training of medical radiation workers while making a significant impact on radiation safety awareness within the medical facility. A computer-based training program focused on medical radiation safety can assist medical facilities in a) complying with regulatory training requirements; b) increasing hospital worker participation in radiation safety training; c) providing more flexibility in the scheduling of radiation workers to complete training; and d) ensuring that the number of routine patient services are not significantly affected by temporary staffing shortages.

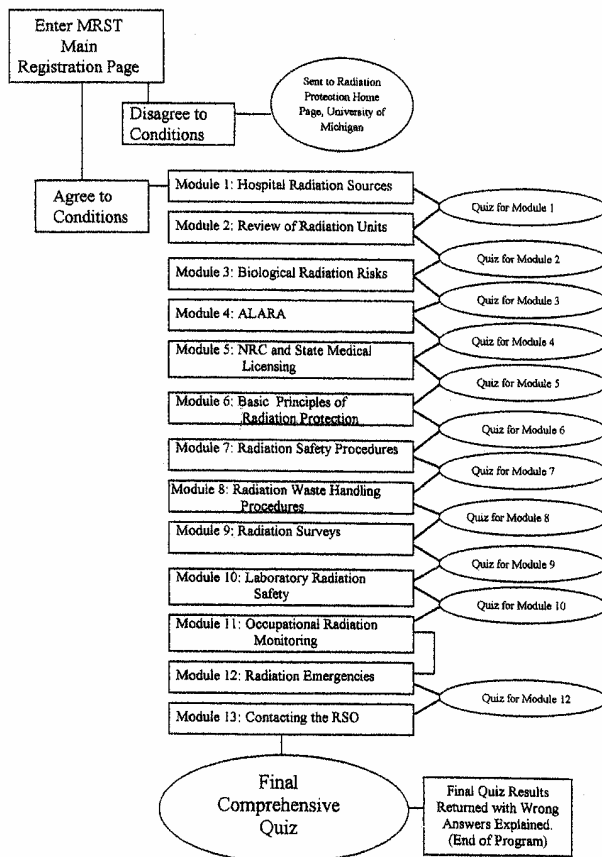


Figure 3. Flow-chart illustrating the basic layout of the training program.

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