International Training to Support the Environmental Remediation of Sites Contaminated with Radioactive Materials – 14604

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ABSTRACT

The International Atomic Energy Agency (IAEA) supports efforts by its Member States to manage their nuclear and radiological liabilities through measures that include radioactive waste management, decommissioning of facilities, and remediation of contaminated sites. As part of these efforts, the IAEA has sponsored the development and deployment of a variety of training events for individuals from its Member States. One component is a two-week training course held annually at Argonne National Laboratory (Argonne) that is jointly sponsored by the IAEA and the U.S. Department of State. The training provides an overview of the life-cycle facility decommissioning/remediation process in which the discussion of facility decommissioning is integrated with explanations of approaches to achieving environmental characterization and remediation. The course has been held for the past several years, with lectures and hands-on exercises conducted by various experts in the field, including staff from the U.S. Environmental Protection Agency.

One of the challenges of this training program is that its participants vary widely in background, experience, training, and English language skills, as they come from around the world, representing 35 countries to date. In an attempt to establish a foundational set of concepts for prospective participants in the annual training program and take advantage of cost-effective Web-based training capabilities, the IAEA has undertaken to develop an online course to provide training in basic environmental remediation. The IAEA has commissioned Argonne to assist Tricord, Inc. in developing a five-module sequential course that covers (1) introductory concepts, (2) the environmental remediation planning process, (3) environmental remediation implementation, (4) post-remediation site management, and (5) exemplary case studies. The online basic training is expected to enhance the effectiveness of the in-person, two-week training course and increase the success of IAEA's public outreach activities.

INTRODUCTION

Radioactive contamination within the environment can come from a variety of sources. These include legacy wastes from uranium fuel-cycle processes such as mine tailings and purification residues, naturally occurring radioactive materials associated with various industrial activities such as oil and gas development, releases from nuclear and radiological accidents, and waste streams from past nuclear weapons research and production programs. Although some countries have a much greater radioactive environmental legacy than others, sites with

environmental radioactive contamination can be found across the globe.

The International Atomic Energy Agency (IAEA) supports efforts by its Member States to manage their nuclear and radiological liabilities through measures that include radioactive waste management, decommissioning of facilities, and remediation of contaminated sites. The IAEA, through its Technical Cooperation (TC) Department, supports national, regional, and even inter-regional projects that include a variety of training opportunities (e.g., courses, workshops, scientific visits, and expert missions) for participants coming from its Member States. One of these is a two-week training course held annually at Argonne National Laboratory (Argonne). This course has been offered regularly over the last four years and is jointly sponsored by the IAEA and the U.S. Department of State. The training provides an overview of the life-cycle decommissioning/remediation process in which the discussion of facility decommissioning is integrated with explanations of approaches to achieving environmental characterization and remediation. The course consists of lectures and hands-on exercises by various experts in the field, including staff from the U.S. Environmental Protection Agency and speakers from abroad.

One of the challenges of such a focused, technical training program is that its participants vary widely in background, experience, training, and English language skills, as they come from around the world, representing 35 countries to date. In response to this, the IAEA has developed a curriculum based on the full range of topics related to environmental remediation on which individuals working in this field should be trained. In addition, the IAEA has identified a structure for providing successively more advanced training, based on individual needs and capabilities, starting with introductory “Level 0” training in which basic concepts are taught and progressing through Levels 1, 2, and 3, with each level providing more technical and specialized training activities.

In an attempt to establish a foundational set of concepts for participants and take advantage of cost-effective Web-based training, the IAEA has sponsored the development of an online training course in basic environmental remediation to be taken prior to the two-week training. This Level 0 training is being developed by Tricord, Inc. with assistance from Argonne. The training material consists of a five-module sequence that covers (1) introductory environmental remediation concepts, (2) the environmental remediation planning process, (3) environmental remediation implementation considerations, (4) post-remediation site management, and (5) exemplary case studies. The online basic training is expected to enhance the effectiveness of the in-person, two-week training course and improve the ability of the IAEA to cost-effectively reach a much broader audience with basic information pertinent to environmental remediation of sites than might otherwise be possible. In addition, content presented in the Level 0 training material will be suitable to support IAEA outreach efforts to educate the general public on issues associated with environmental remediation of radiological sites.

TWO-WEEK TRAINING

The annual two-week training, currently jointly sponsored by the IAEA and the U.S. Department of State, provides an overview of the life-cycle facility decommissioning/remediation process in which the discussion of facility decommissioning is integrated with explanations of approaches to achieving environmental characterization and remediation. It has evolved since its initiation in 2010 and currently consists of a combination of lectures, case studies, demonstrations, and hands-on activities.

The curriculum of the “Interregional Training Course on Nuclear Facility Decommissioning and Environmental Remediation Skills” in 2013 included topics such as project planning, stakeholder engagement, conceptual site model development, dose assessment, the decommissioning process, decontamination techniques, regulatory considerations, safety and health issues, waste management and disposal, site characterization and measurement technologies, remediation approaches, cost estimation, and final status surveys. Case studies ranged from contaminated groundwater remediation by means of *in situ* permeable walls, to contaminated soil segregation strategies and reactor decommissioning.

The participants in the 2013 course reflected the diverse nature of the IAEA’s Member States that are assisted by its TC Department, with representation from Azerbaijan, Brazil, Bulgaria, Estonia, Georgia, Hungary, Indonesia, Kazakhstan, Libya, Lithuania, Malaysia, Mozambique, Niger, Peru, Poland, Romania, Serbia, Slovakia, Slovenia, Tajikistan, and Vietnam. Participants at various stages in their careers reflected a spectrum of technical backgrounds and had experience with a diverse set of decommissioning and environmental problems. Table I provides country of origin information for course participants since the initial course in 2010; Figure 1 displays the same information in map form. Participants varied widely in experience with technical issues and years of experience in relevant sectors. Consequently there was no “typical” participant; one of the challenges has been to make sure the training course addresses the differences in participant backgrounds, experiences, and interests.

TABLE I. Member States Represented in Joint IAEA and Argonne Training Courses on Environmental Remediation Since 2010.

Member State	Number of Participants	Member State	Number of Participants
Algeria	1	The Former Yug. Rep. of Macedonia	1
Armenia	2	Malaysia	6
Azerbaijan	3	Mozambique	1
Brazil	6	Niger	1
Bulgaria	4	Peru	1
Canada	1	Philippines	2
Croatia	1	Poland	2
Czech Republic	2	Romania	4
Estonia	1	Russian Federation	2
Georgia	1	Serbia	4
Greece	2	Slovakia	3
Hungary	3	Slovenia	2
Iraq	5	South Africa	1
Indonesia	1	Tajikistan	4
Kazakhstan	4	Thailand	1
Latvia	1	Ukraine	4
Libya	1	Vietnam	1
Lithuania	7	Total:	86

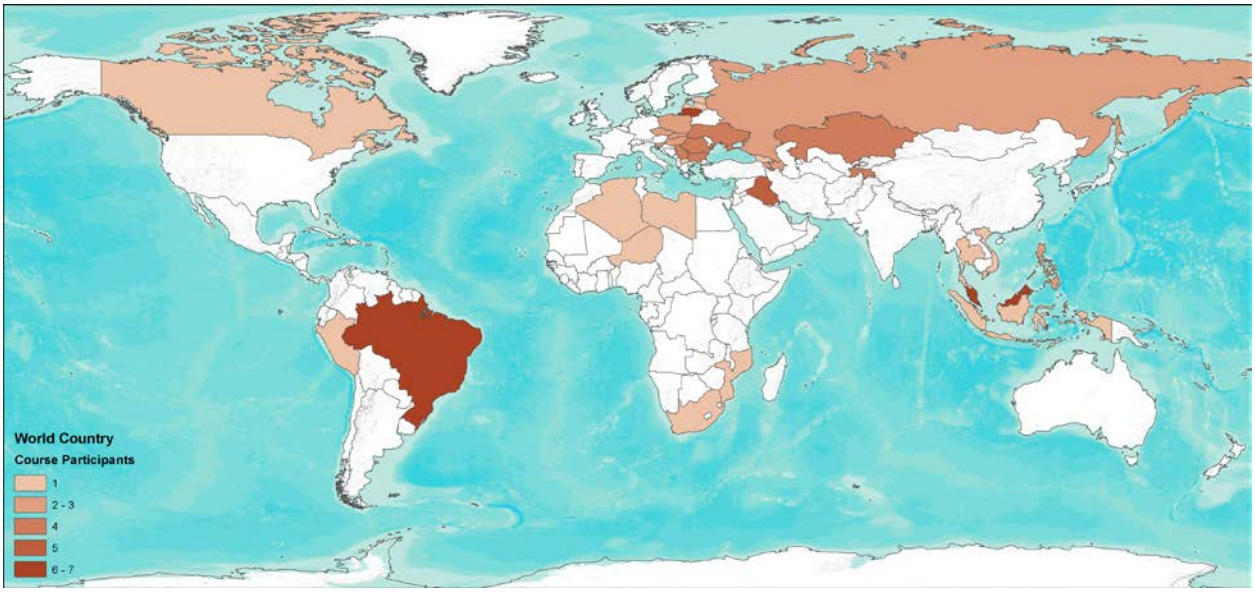

Fig. 1. Origin Countries for Participants in Joint IAEA and Argonne Training Courses.

ONLINE LEVEL 0 TRAINING

Given the diverse backgrounds of participants in this annual training event, as well as in other similar workshops and training courses, the IAEA recognized the need for establishing a baseline level of knowledge for participants prior to their arrival for training. The IAEA also recognized that Web-based training provides a cost-effective and accessible means to offer future participants with a baseline understanding of the materials to be covered in the annual training course. Out of this arose the concept of providing online Level 0 training that focuses on the environmental remediation process for radioactively contaminated sites. Tricord, Inc. was assisted by Argonne in developing the training content and implementing the content in a user-friendly online format. Figure 2 shows the title screen of the resulting online training course. Figure 3 provides an example of a content screen.

The Level 0 course content consists of five modules:

1. An introduction to environmental remediation that covers the basics of radiation concerns, common sources of radioactive contamination in the environment, and key concepts from a remediation process perspective.

2. An explanation of the environmental remediation planning process and its key components.

3. A discussion of environmental remediation design and implementation.

4. A review of post-remediation site management considerations.

5. Three case studies that illustrate the key concepts of the Level 0 training.

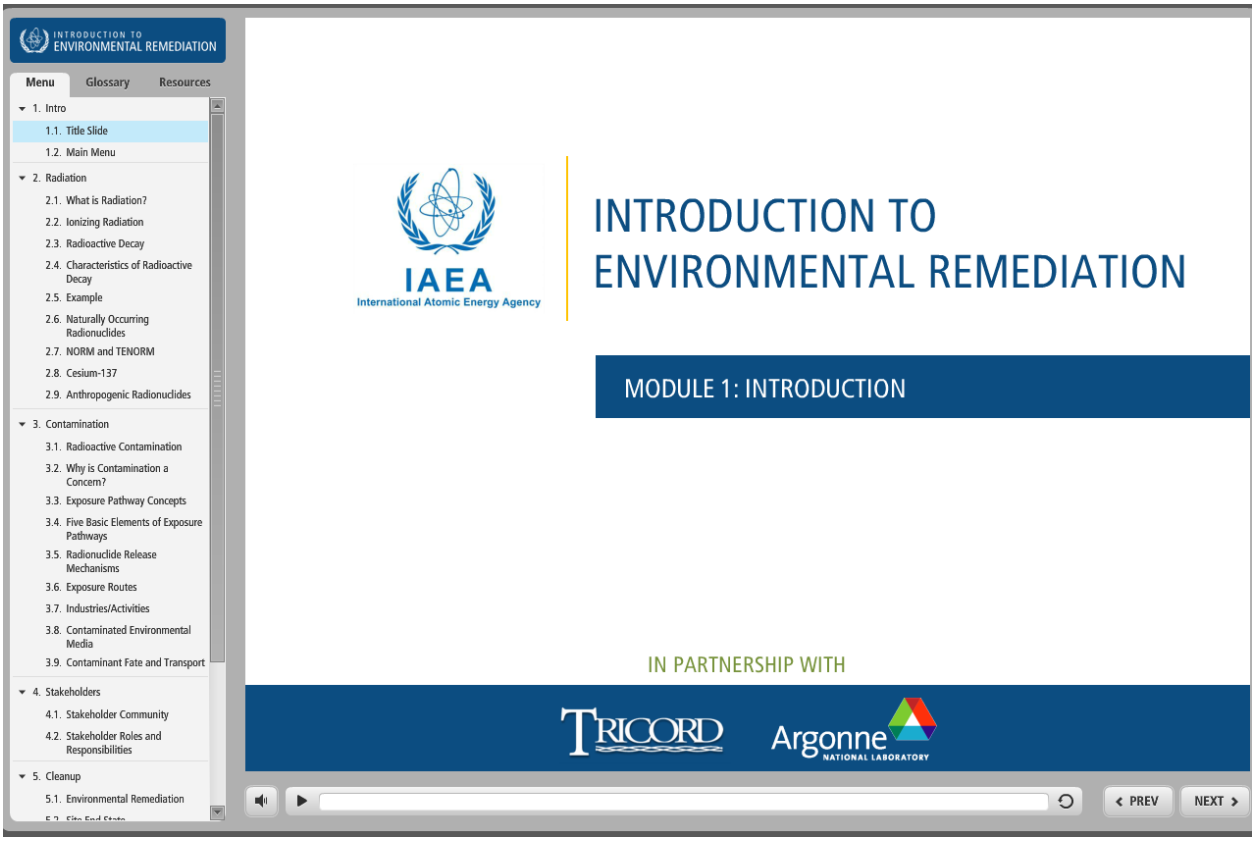

Fig. 2. Title Screen of the Online Training Module.

Each of the five modules is designed to be completed by a user in approximately 30 minutes. Challenge questions are incorporated within each module to keep students focused and to provide them with an opportunity to evaluate their understanding of the material being presented. The training ends with a review quiz that evaluates students' overall understanding of the basic concepts.

In addition to the primary content, the training also provides students with access to a Glossary of important terms and a Resources section that offers supplementary information.

The Level 0 training module will be available for use by participants of the 2014 annual training course to be held at Argonne in the spring of 2014. The goal is that students arriving at this course will come armed with a common terminology and the set of concepts required as basic prerequisite knowledge for the course. As an online training tool, the Level 0 training will allow the IAEA to cost-effectively reach a broad audience.

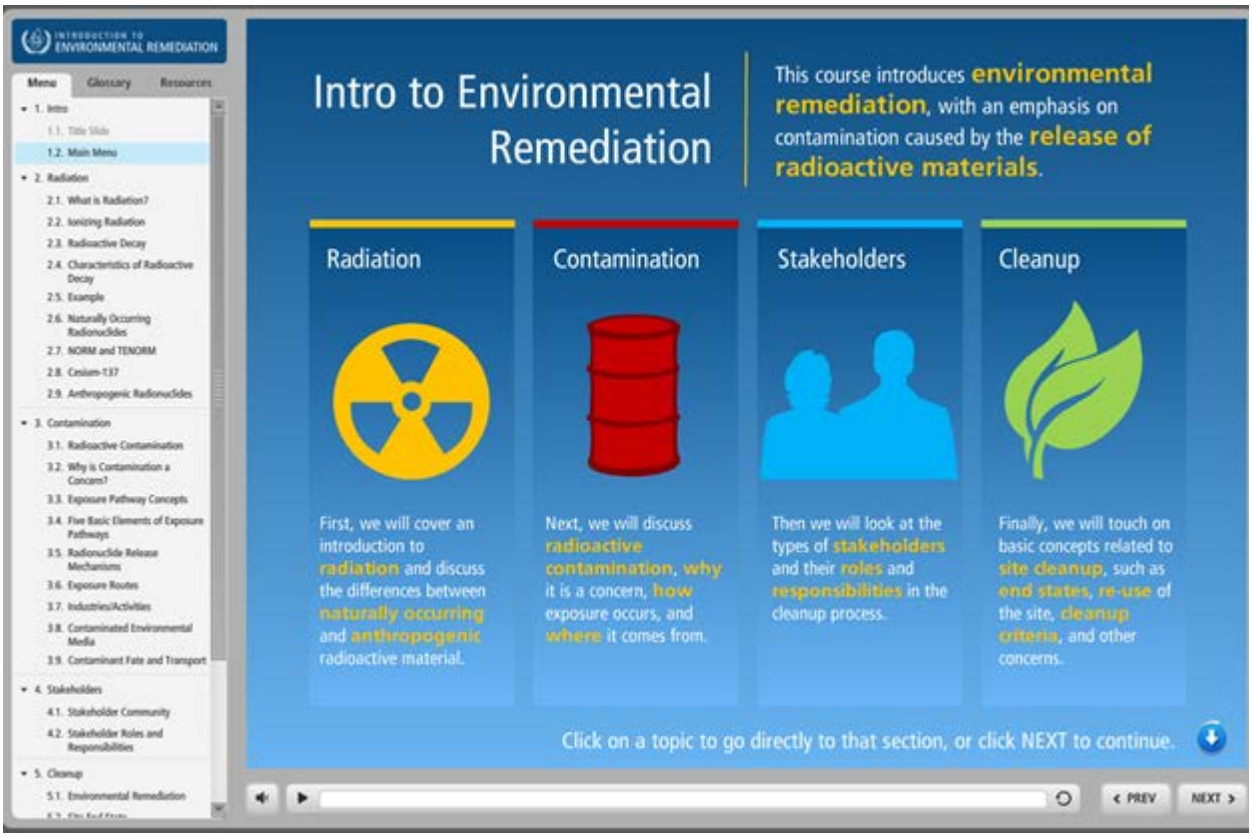

Fig. 3. Example Screen from First Level 0 Training Module.

CONCLUSIONS

As part of its efforts to support its Member States in managing their nuclear and radiological liabilities, the IAEA has offered a variety of training opportunities for individuals from its Member States. One these events is a two-week long training course held annually at Argonne and jointly sponsored by IAEA and the U.S. Department of State. This training focuses on the decommissioning of facilities and the remediation of sites contaminated by radioactive materials.

The two-week training has attracted a diverse set of participants from across the globe, representing a wide spectrum of past experience and training. The diversity of participants has proven a challenge to presenting a course that is beneficial for all involved. Part of the solution to this challenge is the development and deployment of a Level 0 online training course with the goal of ensuring that participants will acquire the proper basic knowledge to benefit greatly from the two-week course. The preparation of this online training is nearing completion, with the expectation that it will be available prior to the 2014 annual training course.