2017 Midyear HPS Meeting PEP and CEL Programs

Professional Enrichment Program - Sunday, 22 January, 2017

Session 1: 8:00–10:00 AM

1-A Emergency Response Training for First Responders Made Simple; the Department of Energy's MERRTT Train-the-Trainer Program – Part 1

T. Clawson and M. Linsley
Technical Resources Group, Inc.

Excellent materials exist for training first responders (firefighters, HAZMAT, law enforcement, emergency medical technicians, etc.) on how to respond to a transportation incident involving radioactive material. Participants who successfully complete the PEP 1-X, 2-X, and 3-X sessions will be certified to teach materials contained in the Department of Energy's Transportation Emergency Preparedness Program's Modular Emergency Response Radiological Transportation Training (MERRTT).

The full MERRTT is a 16-hour program consisting of multimedia rich training material that includes Power-Point presentations, videos, practical exercises, student guides, instructor guides, test material, and regionally available training aids. MERRTT takes the complex topic of a radiological accident response and breaks it down into 16 easily understood modules and hands-on practical exercises. Attendees of a MERRTT program are presented with information that simplifies the topic while developing a comprehensive understanding of radioactive material, radiological survey instruments, and decontamination techniques for handling radiologically contaminated victims and resources available to responders during a response. An important element of the training is detailed information on the types of packages used to transport radioactive material. The course includes use of exempt-level radiation sources in the practical exercises to reinforce learning. Upon successful completion of the MERRTT course, students receive a certificate from the Department of Energy’s Transportation Emergency Preparedness Program, including up to 10.5 hours of continuing education hours (CEH) for medical response personnel. MERRTT also meets the Waste Isolation Project Plant (WIPP) Land Withdrawal Act training requirements and is listed on the Department of Homeland Security's federally approved courses listing.

This session will be a summary of the program and an initial review of the PowerPoint pesentations. Attendees will need to complete all three sessions (1-A, 2-A, and 3-A) to receive their Instructor certification and DVD of the course material.

1-B RESRAD Dose and Risk Assessment Methodology for Humans, Flora, and Fauna -- Part 1: RESRAD-ONSITE Code for Human Dose and Risk Assessment

C. Yu

The RESRAD Family of Codes is a suite of software tools developed by Argonne National Laboratory for the US Department of Energy (DOE) and US Nuclear Regulatory Commission (NRC). RESRAD family of codes is the industry standard in evaluating contaminated sites. It has been used by health physicists and radiological engineers as a tool for deriving cleanup criteria and radiological dose and risk assessment for releasing contaminated sites. RESRAD family of codes has been widely used in more than 100 countries. It has been applied to numerous sites and over 1000 journal and other papers have been published either based on or citing RESRAD codes. Applications of RESRAD codes include derivation of cleanup criteria, evaluation of remediation alternatives, radiological dose and risk assessment for humans, biota dose assessment, waste disposal facility performance assessment, and emergency response to nuclear incidents. This 3-part PEP is designed to cover dose and risk assessment for humans (Part 1) and nonhuman biota (Part 2), and comparison of RESRAD to Environmental Protection Agency's (EPA's) PRG and DCC Calculators used for CERCLA sites (Part 3). It is recommended to take 3 parts in sequence, but each part is designed so that it is a stand-alone session with minimal overlapping with other parts.

Part 1: Presents an overview of the RESRAD Family of codes and the methodology used in RESRAD-ONSITE code for human dose and risk assessment. The pathway analysis methodology will be discussed in detail. The parameters and data required in dose analysis, including dose coefficients and risk slope factors will be discussed. The verification and validation of the RESRAD codes will also be presented.

1-C Update to U.S. DOT Regulations

S. Austin
Plexus Scientific

The harmonization of domestic and international standards for hazardous materials transportation enhances safety by creating a uniform framework for compliance. Harmonization also facilitates international trade by minimizing the costs and other burdens of complying with multiple or inconsistent safety requirements and avoiding hindrances to international shipments. Harmonization has become increasingly important as the volume of hazardous materials transported in international commerce grows. The U.S. Department of Transportation (DOT) amended the Hazardous Materials Regulations to incorporate changes adopted in the 2009 Edition of the IAEA Safety Standards publication titled "Regulations for the Safe Transport of Radioactive Material, 2009 Edition."

These changes to DOT regulations affect the packaging and transportation of radioactive material. The changes impact marking of packages, reporting of total activity in a package, placarding of certain shipments of LSA-I and SCO-I materials, several key definitions, shipping paper retention requirements, surveys, labeling, and assessment of radiation hazards from packages or conveyance that have been suspected to leak radioactive material. Organizations that are offering packages of radioactive material for transport or transporting these materials need to be aware of these changes and incorporate them into their existing shipping program.

1-D PIMAL (Phantom with Moving Arms and Legs) 4.1.0

S. Dewji and M. Hiller
Center for Radiation Protection Knowledge, Oak Ridge National Laboratory

Computational phantoms with articulated arms and legs have been developed to enable radiation dose estimates for adult male and female receptors in different postures. Using a user-friendly graphical user interface (GUI), the PIMAL (Phantom wIth Moving Arms and Legs) software can be employed to adjust the posture of a phantom, generate a corresponding input file for the Monte Carlo N-Particle (MNCP) radiation transport code, and perform the radiation transport simulations for the dose calculations in MCNP. The MCNP code can be run natively from the PIMAL interface, or externally in the MCNP command prompt via the generated MCNP PIMAL input file. The objectives of this event are to: (1) review the history and capabilities of computational phantoms; (2) highlight the development and capabilities of the PIMAL software application; (3) demonstrate how to install PIMAL and navigate its capabilities with simple and intermediate-level real-life problems and applications; and (4) provide in-person resources and support to navigate specific user needs using PIMAL.

This software was developed by Oak Ridge National Laboratory for the U. S. Nuclear Regulatory Commission Radiation Protection Computer Code Analysis and Maintenance Program and can be obtained at https://www.usnrc-ramp.com. (Note: Users are responsible for obtaining their own license for MCNP from RSICC at https://rsicc.ornl.gov; MCNP is recommended, but not required, to learn how to use the PIMAL platform at this event)

Session 2: 10:30 AM–12:30 PM

2-A   Emergency Response Training for First Responders Made Simple; the Department of Energy's MERRTT Train-the-Trainer Program – Part 2

T. Clawson and M. Linsley
Technical Resources Group, Inc.

Please see PEP 1-A for a full description of this 3-part program. This session will be a continuation of the Power-Point presentations and a review of three of the five hands-on practical exercises included in the MERRTT program. Attendees will need to complete all three sessions (1-A, 2-A and 3-A) to receive their Instructor certification and DVD of the course material.

2-B   RESRAD Dose and Risk Assessment Methodology for Humans, Flora, and Fauna -- Part 2: RESRAD-BIOTA Code for Biota Dose Assessment

S. Kamboj, C. Yu, and K. McLellan

Please see PEP 1-B for the introduction. Part 2 presents the RESRAD-BIOTA code, a biota dose assessment tool designed for demonstrating compliance with the dose rate criteria set in DOE Order 458.1. The development of RESRAD-BIOTA code was sponsored by DOE, with support from NRC and the US Environmental Protection Agency. The RESRAD-BIOTA code provides a complete spectrum of biota dose evaluation capabilities, ranging from generic screening to comprehensive receptor-specific dose estimation. The DOE graded approach methodology and its implementation in the RESRAD-BIOTA code will be demonstrated with examples. The advanced analysis capabilities in RESRAD-BIOTA code, including geometry-based dose coefficients, organism wizard, food chain model, and sensitivity and probabilistic analysis, etc., will be discussed.

2-C A Forgotten Nuclear Accident -- Bravo

C. Sun

This is a PEP presentation based on decades of personal experience from managing the Marshall Islands Radiological Safety Program (MIRSP) at Brookhaven National Laboratory (BNL). It starts with the selection of Bikini Island for the US Pacific Test Ground in the Republic of Marshall Islands (RMI). Later, on March 1st 1954, the Bravo detonated. Since then, Bikini has never be the same -- space and the people. The catastrophic event was resulted (1) from unpredicted weapon yields and (2) by the nuclear debris and fallout reached to the east of many inhabited Atolls.

BNL scientists played an important role on the radiological health and medical care of exposed populations funded by the Department of Energy (DOE) for about 40 years. The MIRSP was established for bioassay monitoring and internal dose assessment. The overview will explain the dose assessment methods include whole-body counting, urinalysis and LLNL's environmental and diet/intake studies. Finally, the presentation summarized and analyzed the operational activity as lesson learned that could applied and implemented to modern emergency planning and accident preparedness.

2-D Fundamentals of Alpha Spectroscopy

B. Davis

This course offers a fast-paced review of the basic principles of alpha spectroscopic analysis for the Health Physicist. The course includes a review of the nature and origins of alpha-particle emitting radioactivity, basic physics of alpha particle interaction with matter, considerations and consequences of sample preparation for alpha spectroscopy, alpha spectroscopy system components and calibrations, and a primer on interpretation of alpha spectroscopy data.

Session 3: 2:00–4:00 PM

3-A Emergency Response Training for First Responders Made Simple; the Department of Energy's MERRTT Train-the-Trainer Program – Part 3

T. Clawson and M. Linsley
Technical Resources Group, Inc.

Please see PEP 1-A for a full description of this 3-part program. This session will include a review of the two of five remaining hands-on practical exercises, a 25-question test required for completion of the MERRTT Train-the-Trainer program, and a review of the administrative issues involved in hosting and a completing the DOE's MERRTT program. Attendees will need to complete all three sessions (1-A, 2-A, and 3-A) to receive their Instructor certification and DVD of the course material.

3-B RESRAD Part 3

RESRAD Dose and Risk Assessment Methodology for Humans, Flora, and Fauna -- Part 3: Comparison of RESRAD-ONSITE and EPA PRG and DCC Calculators

J. Cheng, S. Kamboj, and C. Yu

Please see PEP 1-B for the introduction. Part 3 presents the RESRAD-ONSITE code, which is used by both DOE and NRC for deriving cleanup criteria or Derived Concentration Guideline Levels (DCGLs) for radioactively contaminated sites. EPA recommends using the Preliminary Remediation Goal (PRG) and Dose Compliance Concentration (DCC) Calculators for CERCLA sites. Understanding the similarity and differences between RESRAD-ONSITE and PRG/DCC Calculators is essential in selecting the appropriate tool for evaluation of contaminated site. This PEP provides an overview of the modeling approach of these three software tools and discusses the key differences in the modeling assumptions, formulations, default parameter values, and their influence on the calculated results.

3-C "Hey, Why Do We..."

C. Ribaudo and M. Roberson

This class will be a compilation of skill-testing questions in a quiz format for broad scope licensees to assess their understanding of why certain radiation safety practices are in place. The correct answers are provided along with the NRC regulatory citation so that Radiation Safety Officers and other operational health physicists can have a working knowledge of the regulatory basis for certain - perhaps quirky - requirements. There's more to the rationale (in most cases!) in why we do things besides "We've always done it this way!" It is hoped that questions and answers will generate useful discussion amongst participants and lead to a better understanding of regulatory requirements. A disclaimer from the authors that this class does not substitute as formal guidance from your NRC or State regulatory authority.

3-D Fundamentals of Gamma Spectroscopy

B. Davis

This course offers a fast-paced review of the basic principles of gamma spectroscopic analysis for the Health Physicist. The course includes a review of the nature and origins of gamma emitting radioactivity, basic physics of gamma interaction with matter, consequences of gamma interactions on gamma spectra, gamma spectroscopy system components and calibrations, gamma spectroscopy analysis methods, and interpretation of gamma spectroscopy data.

3-E Health Physics response: Emergency Response versus Occupational Response
B. Haley

How Health Physics during a response is different than in an occupational setting. This will be a thoughtful discussion using operational problems to discuss/demonstrate how decision timelines and processes are very different during an emergency than in the work setting. The discussion will focus on integrating health physicists into emergency response organizations and processes.

Continuing Education Lectures

CEL-1 Meeting the National Need: An Overview of the DOE Isotope Program
E. Balkin

The DOE Isotope Program fills a critical need within the US as a supplier of stable and radioisotopes IN SHORT SUPPLY for the medical, research, industrial, and governmental communities. This talk will provide an overview of the program, its mission, and accomplishments.

CEL-2 Recent Topics in the Field of Low Dose Radiation Biology
N. Metting

The field of low dose radiation biology focuses on biological responses to radiation exposures that are at or near current workplace exposure limits. It was not until the advent of molecular biology that low dose effects could even be measured. Until recently, most molecular studies of radiation effects were carried out using an isolated cell type in monolayer culture, and the responses of those cells were then extrapolated to mammalian tissues and whole organisms. New research indicates that fundamentally different cellular and molecular responses can occur as a function of the level of biological organization (cells, tissues, whole organisms), and that normal, intact tissue responds, in general, differently to radiation than do single cells or monoculture cell populations. Responses of special interest include radio-adaptive responses, systems genetics of inter-individual variation, and low dose and/or low dose-rate effects on proteomic and metabolic responses, the immune system, and epigenetic regulation. Recent progress on several of these topics will be presented.

CEL- 3 Dose Coefficients: What are they, where do they come from, and how do we use them?
S. Dewji
Center for Radiation Protection Knowledge, ORNL

A dose coefficient is a measure of radiation dose (e.g., absorbed or equivalent dose rate, committed equivalent dose, or committed effective dose) to a specified tissue or to the whole body per unit intake of a radionuclide for internal emitters and per unit concentration of a radionuclide in an environmental medium for external irradiation.

For decades, Oak Ridge National Laboratory (ORNL) has led the effort in the computation of internal and external dose coefficients in the support of federal regulations and international guidance. Dose coefficients have applications in a variety of fields, including occupational radiation protection, emergency response, and nuclear medicine. The Center for Radiation Protection Knowledge at ORNL has developed the Dose and risk CoeFicient PAcKage (DCFPAK) software application (https://www.dcfpak.org/), which has archvied the fundamental dose and risk coefficients over the past 36 years.

The science behind the history and development of dose coefficients, as well as applications on how to employ dose coefficients will be discussed.

CEL-4 Radioecology 1 – Introduction to Radioecology and Environmental Protection Programs
C. A. Condon

This course will be an introduction to the field of Radioecology and its prevalence in the field of Health Physics. It will begin with a basic introduction to radioecology including natural & anthropogenic sources of radiation as well as basic fate and transport of radionuclides through environmental systems. The course will continue by covering how radionuclides are recommended to be regulated (International Commission of Radiological Protection & National Council on Radiation Protection) and how they are currently regulated in the environment in the United States (Nuclear Regulatory Commission & Department of Energy). Following this we will discuss how the US regulates and addresses sites with historical contamination of radionuclides that are classified under RCRA (Resource Conservation and Recovery Act) & CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) and the controversies facing these decisions. Finally, this class will cover the current international state of radioecology (including current controversies on low dose effects to wildlife) and the future of radioecology. [This CEL is ideally to be followed by the other radioecology CEL on dosimetry and modelling which will build off information given in this course.]

CEL-5 Radiological Toolbox 3.0.0
S. Dewji and M. Hiller
Center for Radiation Protection Knowledge, Oak Ridge National Laboratory

The Radiological Toolbox software developed by Oak Ridge National Laboratory (ORNL) for the U. S. Nuclear Regulatory Commission is designed to provide electronic access to a vast and varied array of data needed in the field of radiation protection and shielding. Such data consolidates physical, chemical, anatomical, physiological, and mathematical parameters, which would otherwise require consulting multiple sources to retrieve this information. This software provides ready access to data of interest in radiation safety and protection of workers and members of the public. The data include dose coefficients for intakes of radionuclides, external exposure to radionuclides distributed in environments, and for exposures to photon and neutron radiation fields. Other supportive data include interaction constants and coefficients for alpha, beta (i.e., electron), gamma (i.e., photon or x-ray) and neutron radiations, nuclear transformation data, biological, radiological and physiological data, and supplemental information on various related topics. The functionality and example problems will be explored to enable participants to harness the full capabilities of this software. The Radiological Toolbox 3.0.0 can be obtained from the U. S. Nuclear Regulatory Commission Radiation Protection Computer Code Analysis and Maintenance Program at https://www.usnrc-ramp.com.

CEL-6   Radioecology 2 – Dose to Biota
D. R. Neville

The components and estimation of doses to biota are covered in this course as well as the relevant endpoints of concern. Biota doses come from a variety of components in the environment, ranging from cosmic/solar, external gamma and internal sources. The contributions from naturally occurring and anthropogenic/ TENORM vary considerably for terrestrial versus freshwater and marine biota, which are each treated in the presentation. Differences in the relative sensitivities and relevant endpoints for each are discussed with regards to Derived Consideration Reference Levels (DCRLs). Methods of calculation of these doses include homogenous ellipsoids as well as more detailed voxel models. Finally, the complexities in the production of these models are covered, including geometry, density, elemental composition and relative compartmentation of radionuclides relative to those found in the surrounding environment.