# Professional Enrichment Program and Continuing Education Lectures for the 2019 HPS Midyear Meeting in San Diego, California

## Professional Enrichment Program

### Sunday, 17 February

#### PEP 1A Evaluation or MARSSIM and MARSAME Surveys

*David Stuenkel, Trinity Engineering Associates*

The *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) provides guidance on how to demonstrate that a site complies with applicable radiation dose- or risk-based release criteria. In a similar way, the *Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual* (MARSAME), a supplement to MARSSIM, provides guidance on how determine proper disposition of materials and equipment. While both MARSSIM and MARSAME provide comprehensive guidance, the focus of both is on the design and evaluation of final surveys, known as final status surveys in MARSSIM and disposition surveys in MARSAME. This presentation will discuss the evaluation of final status surveys and disposition surveys. This will include preliminary data review; calculations of upper confidence levels, minimum detectable concentrations, and minimum quantifiable concentrations; and the performance of statistical tests. Illustrative examples will be used to demonstrate these concepts.

#### PEP 1B Harmony in Concepts and Units for Internal Dose Calculations for Nuclear Medicine Applications or for Protection of Radiation Workers

*Michael Stabin, CHP, PhD, RADAR, Inc.*

Internal dose calculations for nuclear medicine applications or for protection of radiation workers are based on the same fundamental concepts and units. The various systems developed to provide a basis for the needed calculations (e.g., ICRP 30/60/103, MIRD, RADAR) use equations that appear to be different, but are in fact identical when carefully studied. The RADAR method harmonized the defining equations and units employed to provide quantitative analysis for these two general problem areas. This program will show, from a theoretical standpoint, how all of these systems are identical in concept and will then show, using practical examples, how each is applied to solve different problems. For nuclear medicine, an overview will be given of the current state of the art and promise for future improvements to provide more patient specificity in calculations and better ability to predict biological effects from calculated doses. For occupational applications of internal dosimetry, an overview will be given of currently applicable models and methods for bioassay analysis and dose assessment, showing several practical examples.

#### PEP 1C Medical Laser Safety Program—What Health Physicists Need to Know

*Deidre Elder, University of Colorado Hospital*

Medical laser systems are used in many clinical settings, including ophthalmology and dermatology clinics, interventional radiology and cardiology, and the operating room. Whether it is a small clinic or a large academic medical center, a health care facility with laser applications should have a program in place to ensure the safety of patients and personnel. Health physicists and medical physicists may be asked to oversee laser safety programs at medical facilities and need the tools to run an effective program. The 2018 edition of the American National Standard "Safe Use of Lasers in Health Care" (ANSI Z136.3-2018) was released in August and will be discussed along with other standards that apply to the use of medical lasers.

**PEP 2A Alpha Spectroscopy for the HP**

*Craig Maddigan, ORTEC*

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.

**PEP 2B Thorium Molten Salt Reactors (TMSR): Key Radiation Protection Challenges**

*Casper Sun, Health Physicist*

Join this lecture for an overview of thorium molten salt reactors (TMSR) and their radiation safety requirements. In recent years, the potential of TMSR has captivated the attention of our nuclear energy industry. Key benefits include fuel flexibility—the ability to burn spent fuels, thorium, and unwanted plutonium—as well as reduced risk, both during normal reactor operations and in case of emergency. As Richard Martine noted in *MIT Technology Review* (2016), “cheaper and cleaner nuclear plants could finally become a reality . . . the technology was invented more than 50 years ago.” Overall, TMSR is a very promising option for nuclear energy, but there’s work to be done. We’ll review the top radiation protection considerations around TMSR today, including neutron radiation protection, fuel loading management and chemical separation, and controlling neutron flux in the core. Lastly, you’ll get a quick look at things to come: robotic radiation workers operating advanced nuclear reactors.

**PEP 2C Full-Range Risk Training for Health Physicists**

*Rick Whitham and Kim Kearfott, Associate Faculty SPEA Homeland Security, Nuclear Engineering and Radiological Sciences, University of Michigan*

Radiation safety officers often face many more challenges than just health physics. Because health physicists typically work alone, programs providing training need to provide students a full range of risk tools to ensure program success and safety. HPs need to develop the ability to explain complex topics across different populations from researchers to support staff and even to the public without invoking fear, including the psychology of stress management. HPs need the ability to brief both up and down the management chain on how secondary concerns—e.g., legal weaknesses and challenges, environmental requirements, changing licensing or protection requirements, labor-union challenges, and other topics—could prove problematic and even expensive to the larger organization. As research becomes more complex, HPs often need to plan for seemingly mutually exclusive safety requirements involving one or more simultaneous hazards: radioactive material, machine generated radiation, nonionizing radiation, chemicals, explosives, biologicals, or more in addition to human and environmental concerns. This presentation will present both scenarios and recommendations to improve health physics training.

**PEP 3A Gamma Spectroscopy for the Health Physicist**

*Craig Maddigan, ORTEC*

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.

**PEP 3B**

**Cancelled**

**PEP 3C Technical Basis and Operational Experience for Clearance of Personal Property From SLAC Accelerator Facilities**

*James Liu[1]*, Ryan Ford*, Jim Allan, and Sayed Rokni, Radiation Protection Department, SLAC National Accelerator Laboratory*

At high-energy particle accelerators, induced radioactivity in accelerator components or materials can occur as a direct or indirect consequence to exposure to the particle beam and/or the secondary radiation particles due to beam losses. Management of the potentially activated materials is an important part of the radiation protection program. This presentation addresses the release of the materials from radiological control (i.e., clearance of personal property) in accelerator facilities to meet the DOE Order 458.1 requirements. SLAC, a high-energy electron accelerator facility, has successfully released metals for recycle in the past few years. The SLAC material clearance program with its technical bases are consistent with the DOE Technical Standard DOE-STD-6004-2016 “Clearance and Release of Personal Property From Accelerator Facilities.”

The technical bases that support the clearance of metals (e.g., aluminum, iron, steel, copper, and lead) associated operational experience at SLAC will be presented. The emphasis of the technical basis is placed on the volumetric radioactivity aspects, instead of surface contamination, due to potential activation at high-energy accelerator facilities and the more challenging measurement methods for volumetric radioactivity. The technical basis includes process knowledge (e.g., characteristics of induced radioactivity, proxy radionuclides versus the hard-to-measure radionuclides, and surface maximum activity), measurement protocols (including quantification of detection capability), and a release criterion based on that the release measurements are indistinguishable from background (IFB).

SLAC has developed and implemented a material management and release program for the material clearance and metal recycling. The program includes the establishment of radiation detection instrumentation and measurement methods to meet the ANSI N13.12 screening-level requirements for clearance of accelerator materials. These instruments include portable instruments with sufficient detection capability for survey on material surfaces, field gamma spectrometer for confirmatory measurements, and a portal gate monitor. The discussion will also include best practices for instrument setup, field measurements, documentation and record management, and communication with stakeholders. A summary of recycling progress, as well as lessons learned and mitigation of safety hazards, at SLAC will be provided.

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## Continuing Education Lectures

### Monday, 18 February

#### CEL 1 The Case Against LNT

*Alan Fellman, CHP, NV5*

Radiation safety programs must establish compliance with radiation regulations that continue to be based on the linear no-threshold (LNT) hypothesis and the ALARA principle, despite overwhelming sound, peer-reviewed science that demonstrates the existence of a carcinogenic threshold and/or hormesis at low doses. LNT and ALARA insist that when we make changes that lower worker dose by as little as one µSv, we are making the workplace safer. Public-health authorities and many radiation safety professionals have convinced most members of the public that when we evacuate 150,000 persons following Fukushima to keep them from receiving tens of mSv, we are improving public health despite the fact that this decision has resulted in more than 1,600 fatalities among evacuees. Yet despite compelling evidence revealing LNT to be fraudulent, the consistent response taken by regulatory agencies and scientific bodies whose recommendations are cited as the basis of regulatory actions is to deflect or rationalize away the science at best or simply pretend it doesn't exist at worst so as to maintain allegiance to a worldview of radiation safety built on ALARA and LNT. A sample of relevant findings supporting this allegation will be presented.

#### CEL 2 Dosimetry Challenges of New Nuclear Medicine Theranostic Agents

*Michael Stabin, CHP, PhD, RADAR, Inc.*

The term theranostics is defined as the integration of a diagnostic test with a specific therapeutic intervention. The diagnostic test should identify patients who will likely respond to a particular therapy, fail to respond to a given drug, or eventually exhibit adverse events. The therapeutic application seeks to treat a specific disease. This session will describe the criteria for selecting good theranostic radiopharmaceuticals and provide an overview of several useful theranostic agents in use, or under consideration for use, in nuclear medicine therapy, with a focus on the radiation dosimetry aspects.

### Tuesday, 19 February

#### CEL 3 Fundamentals of Environmental Health Physics

*Jeffrey J. Whicker, PhD*

Environmental health physics is a multidisciplinary application of radiation protection to the public and the environment from exposures to radioactive materials released or present in the surrounding environment. It requires study of the transport, fate, and effects of radioactive materials in the environment and knowledge of how human and nonhuman receptors interact with the environment. The origins of environmental health physics can largely be traced to above-ground nuclear testing and the recognition that regulations were needed for public safety. Today, all key regulatory agencies (e.g., EPA, NRC, DOE) have requirements related to radiation protection of the public. Key elements for public radiation protection include (1) dose limits (public and non-human biota), (2) requirements for facility emission controls (e.g., filters, waste treatments, etc.), (3) measurements (effluent and environmental surveillance) to measure emissions and effectiveness of engineered controls, (4) requirements for radioactive wastes, (5) release limits for property leaving sites with radiological operations, (6) emergency preparedness for accidental releases, and (7) knowledge of radiation risk imposed in the context of that inherent from naturally occurring radioactive materials. In this course, we will discuss the fundamental aspects of the practice of environmental health physics including a regulatory overview, development of goals for property release (how clean is clean?), important aspects of environmental sampling programs, and general methods to calculate radiation doses to identified receptors.

**CEL 4 Personnel Contamination Monitoring the 411**

*Shawn W. Googins, CHP, Technical Services Manager, Radiation Safety & Control Services Inc.*

This CEL will cover the basics of personnel contamination monitoring from simple frisking with GM pancake probes to sophisticated hand-foot-cuff monitors and whole-body personnel contamination monitors. Learn some of the methods and equipment used, the capabilities, and the limitations of the equipment. Refresh your understanding of the equipment's MDAs for passive internal monitoring and more! Practical examples and information will be presented.