2017 PEP and CEL Classes

Sunday PEP's

8:00-10:00 AM

PEP 1-A Part I – How Habits Govern Our Risk Communication Style

Ray Johnson; Radiation Safety Counseling Institute

Our natural preference or style for risk communication is a habit based on our lifetime of choices and experience. Our communication preferences have evolved so slowly and so naturally that we are not even aware that we have a particular communication style. Our preferred style can be identified by the Myers Briggs Type Indicator (MBTI). The MBTI measures our preferences for gaining energy (by Extroversion vs Introversion), how we gather information (by Sensing or Intuition), how we make decisions (by Thinking or Feeling), and how we prefer to relate to others (by Perceiving or Judging). This class will show us how to identify our MBTI preferences and how those preferences govern our habitual ways of communication. MBTI Insights have been gained from presentations of MBTI workshops to over 4,000 radiation safety specialists, mostly in the 1980s. These insights were reported in monthly columns in the HPS Newsletter for over ten years. The predominant communication preference for HPs is the Thinking language based on logical, rational, analysis of facts according to the scientific method. The second communication preference for HPs is Intuition based on creative insights, gut instinct, concepts, and imagination. HPs often begin to experience difficulties in communication with those who prefer Sensing based on sensory data and practical factual information (devoid of imagination). For many HPs the greatest challenge is communicating with those who prefer Feeling based on empathy, values, circumstances, and emotion. This class will show you the hierarchy of your communication preferences, as well as the strengths and limitations of each preference. Participants in this class should determine their MBRI preferences before the class by going to a free website at https://www.16personalities.com/free-personality-test. Please bring your profile information to the class for evaluation.

PEP 1-B EH&S "Boot Camp" for Radiation Safety Professionals, Part 1

Robert Emery and Janet Gutierrez; The University of Texas Health Science Center at Houston

A Unique 3 Part PEP Course Series

It is currently quite rare for organizations to maintain stand-alone radiation safety programs. Resource constraints and workplace complexities have served as a catalyst for the creation of comprehensive environmental health & safety (EH&S) or risk management (RM) programs, which include, among other health and safety aspects, radiation safety programs. But many of these consolidations were not inclusive of staff training to instill an understanding of the areas now aligned with the radiation safety function. This situation is unfortunate because when armed with a basic understanding of the other safety programs, the radiation safety staff can provide improved customer service and address many simple issues before they become major problems. This unique Professional Enrichment Program (PEP) series is designed to address this shortcoming by providing an overview of a number of key aspects of EH&S and RM programs from the perspective of practicing radiation safety professionals who now are involved in a broader set of health and safety issues. The PEP series will consist of three 2 hour segments:

- Part 1 will address "The Basics of Risk Management & Insurance" and "The Basics of Fire & Life Safety". The risk management & insurance portion of the session will address the issues of retrained risks (those which are not covered by insurance) and transferred risks (those covered by a financial vehicle), and how these aspects impact EH&S and RM operations. Included in the fire & life safety segment will be a discussion on the basic elements of the life safety code and the fire detection and suppression systems. The requirements for means of egress will also be discussed
- Part 2 will examine "Security 101 for Radiation Safety Professionals" and "The Basics of Biological & Chemical Safety". The first part of this session will focus on security as it is applied in the institutional settings. Various strategies employed to improve security controls will be presented. The second part of the session will address the classification of infectious agents and the various assigned biosafety levels. Aspects of chemical exposures, exposure limits, monitoring and control strategies will also be discussed
- Part 3 will focus on "Measuring and Displaying Radiation Protection Program Metrics That Matter to Management". Radiation protection programs typically accumulate data and documentation so that regulatory officials can assess compliance with established regulations. The implicit logic associated with this activity is that compliance equates to safety. But in this era of constricted resources, mere regulatory compliance is no longer sufficient to justify all necessary programmatic resources. Radiation protection programs are now expected to readily demonstrate how they add tangible value to the core missions of an organization. The demonstration of this value is expected to be in the form of some sort of performance metrics, but this is an area in which many radiation safety professionals have not been trained. The issue is further compounded by the need to display the metrics in manners that are succinct and compelling, yet another area where formal training is often lacking. This session will first describe a variety of possible radiation protection program performance measures and metrics, and then will focus on the display of the information in ways that clearly convey the intended message. Actual before and after data display "make-overs" will be presented, and ample time will be provided for questions, answers, and discussion.

Each PEP segment is designed so that participants can take any session individually, although the maximum educational benefit will be derived from the participation in all three sessions. The particular topics included in the PEP series have been consistently identified as extraordinarily useful to participants in the highly successful week-long “University of Texas EH&S Academy”. Ample time will be allotted for questions answers and discussion, and each segment will be supplemented with key reference information.

PEP 1-C International Electrotechnical Commission (IEC), Technical Committee (TC) 45 and Subcommittee: Nuclear Standards

Morgan Cox, Chairman TC 45

This presentation of international standards covers the efforts of 16 working groups & project teams addressing important issues such as 1) the instrumentation & control (I&C), & electrical power for nuclear facilities; 2) radiation detection & protection for workplace personnel, the public & the environment, & from airborne & waterborne effluents; and 3) safeguarding special nuclear materials at all locations.

Those efforts are from working groups and project teams in IEC Technical Committee 45, and from Subcommittees SC 45A and SC 45B. The overall work is distributed among over more than 250 experts as volunteers from some twenty plus countries of the world.

The SC 45B standards include those from Working Group (WG) B-5 responsible for radioactive aerosol measurements and environmental monitoring; WG B-8 for electronic personnel and portable detectors, plus passive radiation dosimeters; WG B-9 is responsible for installed radiation monitoring systems at all nuclear facilities including power reactors; WG B-10 continuously handles all of the issues of radon and radon progeny monitoring; WG B-15 is responsible for controlling the illicit trafficking of all types of radioactive materials, using a variety of detectors; WG B-16 develops standards for radioactive contamination monitors & meters; and WG B-17 covers security inspection systems using active interrogation with radiation sources.

The SC 45A standards include those from WG A-2 for sensor & measurement technology; WG A-3 uses the application of digital processing to safety in nuclear power plants; WG A-5 responds to special processing measurements & radiation monitoring; WG A-7 addresses the reliability of electrical equipment in reactor safety systems; WG A-8 covers the design of control rooms; WG A-9 is termed instrument systems; WG A-10 is upgrading & modernizing I&C systems; and WG A-11 addresses all electrical systems.

PEP 1-D TENORM Overview

Philip Egidi; US EPA, Washington DC

Natural radiation is ubiquitous, and naturally occurring radioactive material (NORM) often is unintentionally concentrated or relocated as part of industrial processes outside the nuclear fuel cycle. These radioactive materials are grouped together in a broad category called technologically enhanced NORM, or TENORM. While some federal regulations capture specific TENORM effluents or residuals, there is no specific cleanup standard or defined waste management regime for TENORM. Regulation and management of TENORM is left to the states to address. States have taken a variety of approaches to TENORM, creating a plethora of waste disposal limits, cleanup limits, and uncertainty in worker, public and environmental protection approaches. Unlike situations involving man-made radioactive materials, (TE)NORM is considered an existing situation by the International Commission on Radiation Protection. This overview will touch on sources of background radiation; evolution of the TENORM paradigm, provide examples of industrial practices impacted by TENORM, review the characteristics of some of these materials, and review some of the challenges presented by TENORM.

PEP1-E Practical Computational Modeling for Health Physics (1) – Introduction to Monte Carlo Simulations

Shaheen Dewji; Oak Ridge National Laboratory

Radiation transport codes are used in a breadth of application scopes in health physics, including estimating doses due to radiation exposures, characterizing radiation fields from sources, and conducting shielding calculations. In this introductory course, we will review the fundamentals of radiation interactions with matter and construct simple problems defining simulation geometries, materials, sources, and tallies. The objectives of this course are to: (1) provide participants with a background in Monte Carlo radiation transport code development; (2) provide a fundamental understanding of radiation interactions with matter; (3) help participants create and visualize a basic input file for Monte Carlo simulation; and (4) conduct and analyze the simulation data to interpret meaningful results.

Participants are responsible for obtaining their own license for MCNP® from RSICC at https://rsicc.ornl.gov. Participants are strongly encouraged to bring their own computers to the course with MCNP® installed.

PEP 1-F: Introduction to Stack Sampling

J.A. Glissmeyer[1], and Brian Asamoto[2; 1]Glissmeyer Environmental LLC and HI-Q Environmental Products, [2]Asamoto Engineering and HI-Q Environmental Products

This course will present essential information on stack sampling for radionuclides. The topics of bulk stream radiation monitoring, extractive sampling, sample transport, collection and monitoring will be introduced. The system design tools for these processes will also be covered. The performance criteria for locating sample extraction probes are described. Problems involved with stack sampling, and possible solutions, will also be discussed.

PEP 1-G A Forgotten Nuclear Accident – Bravo.

Casper 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 Bikini and Enewetak Atolls, the Republic of Marshall Islands (RMI). Later, on March 1st, 1954, the Bravo detonated and many outcome were unexpected. Since then, all northern atolls of RMI were never be the same – farmlands and the populations. The unexpected event is catastrophic resulting (1) from unpredicted weapon yields; (2) by the nuclear debris and fallout reached to the east of many inhabited Atolls and (3) to the Lucky Dragon, the nearby Japanese fishing vessel. Nuclear rescue missions to the populations exposed by Bravo fallout were performed; medical remediation for those badly injured were investigated.

BNL scientists and physicians played an pioneer and vital roles on the islanders radiological health and safety programs funded by the Department of Energy (DOE) for 40+ years, including the Marshall Islands Radiological Safety Program (MIRSP) which was established for bioassay monitoring and dose assessment. An overview of health physics whole-body counting, plutonium urinalysis, and LLNL's diet/intake/environmental studies will be discussed. Finally, the PEP presentation will analyze and summarize the global nuclear operational incidents as lesson learned that could be implied and implemented to up-to-date emergency planning and accident preparedness.

PEP 1-H Fundamentals of Gamma Spectroscopy

Benson Davis; ORTEC

Quantification of Radionuclide activity or concentration may be an essential step in assessing dose. Gamma Spectroscopy is a well-accepted and broadly used method to measure gamma emitting radionuclides with the benefit of simple sample preparation. 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.

Sunday 10:30 AM-12:30 PM

2-A Part II – How to Change Our Habits for Improved Risk Communication

Ray Johnson; Radiation Safety Counseling Institute

The Myers Briggs Type Indicator (MBTI) shows us how our natural communication style has evolved as a lifelong habit. Fortunately insights from MBTI can also show us where our opportunities lie for improved risk communication. However, to communicate in a different way requires that we change our habit or natural style for communication. The good news is that with MBTI insights we can understand why we have difficulties in risk communication and how we can change our communication habits if we wish to be more effective. We all know, however, that changing a habit can be exceedingly difficult. This class will show you the options for improved risk communication with your coworkers, your family, or the general public, if you are willing to commit the effort. The first step is to recognize that we have preferred communication habits and that there are other ways to communicate. The next step is to begin to appreciate the communication preferences of others. As we begin to appreciate the ways or habits for communication preferred by others we now have the option of learning their language and style. This class will show you how to begin learning and developing new habits for risk communication. Participants in this class should determine their MBRI preferences before the class by going to a free website at https://www.16personalities.com/free-personality-test. Please bring your profile information to the class for evaluation.

PEP 2-B EH&S "Boot Camp" for Radiation Safety Professionals, Part 2

Robert Emery and Janet Gutierrez; The University of Texas Health Science Center at Houston

See PEP 1B for description

PEP 2-C Status of ANSI N42 RPI standards

Morgan Cox; Co-chair RPI and HSI standards

This summary covers the current status of American National Standards Institute (ANSI) N42 standards for health physics instrumentation in two sections:

This section includes the discussion of some seventeen ANSI N42 standards for Radiation Protection Instrumentation (RPI) in effect, being revised or being combined, including those for performance & testing requirements for portable radiation detectors, in ANSI N42.17A for normal environmental conditions and in ANSI N42.17C for extreme environmental conditions, being combined; and now published ANSI N42.323A/B, for calibration of portable instruments over the entire range of concern, i.e., in the normal range and for near background measurements; performance criteria for alarming personnel monitors in ANSI N42.20; airborne radioactivity monitors in ANSI N42.30 for tritium, ANSI N42.17B for workplace airborne monitoring, ANSI N42.18 for airborne and liquid effluent on-site monitoring, and ANSI N323C for test and calibration of airborne radioactive monitoring; instrument communication protocols in ANSI N42.36; in-plant plutonium monitoring in ANSI N317; reactor emergency monitoring in ANSI N320; quartz and carbon fiber personnel dosimeters in ANSI N322; installed radiation detectors in ANSI N323D needing to be updated and revised; ANSI N42.26 for personnel warning devices; radon progeny monitoring in ANSI N42.50; and radon gas monitoring in ANSI N42.51.

The new ANSI N42.54 standard is combining the salient materials for airborne radioactivity monitoring from ANSI N42.17B, ANSI N42.18, ANSI 323C and ANSI N42.30, with the comprehensive title of “Instrumentation and systems for monitoring airborne radioactivity”.

This section includes the discussion of twenty ANSI N42 standards recently developed, being developed, or being revised and updated for Homeland Security

Instrumentation (HSI), including those for performance criteria for personal radiation detectors in ANSI N42.32 that has been revised; portable radiation detectors in ANSI N42.33 in revision soon; portable detection and identification of radionuclides in ANSI N42.34; all types of portal radiation monitors in ANSI N42.35; for training requirements for homeland security personnel in ANSI N42.37 in revision published in 2017; spectroscopy-based portal monitors in ANSI N42.38 in revision; performance criteria for neutron detectors in ANSI N42.39, needing attention; neutron detectors for detection of contraband in ANSI N42.40, not addressed; active interrogation systems in ANSI N42.41; data formatting in ANSI N42.42, revised and updated; mobile portal monitors in ANSI N42.43; checkpoint calibration of image-screening systems in ANSI N42.44; criteria for evaluating x-ray computer tomography security screening in ANSI N42.45; performance of imaging x-ray and gamma ray systems for cargo and vehicles in ANSI N42.46; measuring the imaging performance of x-ray and gamma ray systems for security screening of humans in ANSI N42.47; spectroscopic personal detectors in ANSI N42.48; personal emergency radiation detectors (PERDs) in ANSI N42.49A for alarming radiation detectors and in ANSI N42.49B for non-alarming radiation detectors; backpack-based radiation detection systems used for Homeland Security in ANSI N42.53; and portable contamination detectors for emergency response in ANSI N42.58 needing some attention.

PEP 2-D Air Monitoring in Nuclear Facilities and the Environment - Part 1

J.T. Voss

Basic fundamentals of air sampling and monitoring includes basic calculations, interferences, and limitations of air sampling and monitoring systems.

The following exercise is presented: Calculate – concentration using count rate, counting efficiency, and sample volume, DAC and DAC-h, mrem/h and mrem from inhaling airborne radioactivity.
The following discussion of the interferences encountered in air sampling and air monitoring for airborne radioactive materials is presented.

- Radon and Thoron interference in aerosol and gas sampling
- Radon/thoron progeny concentrations compared to concentration limits for transuranics

Basic air effluent plume models are presented and discussed. Various plume modeling software programs are demonstrated.

Demonstration of the basics of air sampling and monitoring will be performed. Room radon will be collected on a filter, measured for alpha, beta, and gamma, then allowed to decay until the end of the 2 hour class when the decay measurements are made.

An overview of the requirements in the following documents is presented; 10CFR20, 10CFR835, 29CFR1910, 40CFR50, 40CFR61, NUREG 1400, ANSI N13.1-2011, and NUREG1400.
Deposition 2001a software developed at Texas A&M University is demonstrated.
Deposition Calculator Version 1 developed by Brent Blunt of Blunt Consulting LLC is demonstrated.

PEP 2-E Practical Computational Modeling for Health Physics (2) - Intermediate Monte Carlo Modeling with Anthropomorphic Phantoms

Shaheen Dewji; Oak Ridge National Laboratory

Computational phantoms can be employed to estimate or reconstruct organ and effective doses due to external and internal radiation exposures. In this course, we will build upon principles for those familiar with MCNP basics and apply computational modeling skills for internal and external radiation sources in reference male and female adult phantoms. Demonstrations of computing organ doses and effective doses will be conducted.

The objectives of this course are to: (1) review the history and capabilities of computational phantoms; (2) explore using the reference adult computational phantoms in dose estimation; (3) conduct rudimentary real-life problems and applications; and (4) provide in-person resources and support to navigate specific user needs. Participants should obtain a copy of the PIMAL (Phantom with Moving Arms and Legs) from the U. S. Nuclear Regulatory Commission Radiation Protection Computer Code Analysis and Maintenance Program website (https://www.usnrc-ramp.com). Participants are responsible for obtaining their own license for MCNP® from RSICC at https://rsicc.ornl.gov. Participants are strongly encouraged to bring their own computers to the course with MCNP® and PIMAL installed.

PEP 2-F Radiation Safety and the Gamma Knife -- from the Perspective of a Health Physicist

John Gough; Swedish Medical Center

The Leksell Gamma Knife is a Stereotactic Radiosurgery system made by Elekta that is used for the treatment of intracranial tumors and essential tremors. In August 2010, Swedish Medical Center at their Radiosurgery Center, in Seattle, WA purchased and installed a Gamma Knife Radiosurgery system. The system uses cobalt-60 as the radiation source and has a nominal installed activity of 6000 Ci. This course will review typical requirements for the installation of a gamma knife system including site planning, licensing, radiation shielding, coordination of installation, and source security. Additionally, we will explore the unique challenges for this installation at Swedish Medical Center and the support that was provided by the in-house health physics and radiation safety to complete this project.

PEP 2-G Integration of Health Physics into the Medical Management of Radiation Incident Victims

Stephen L. Sugarman; REAC/TS

In the event of a radiation incident it is essential that the radiation dose a patient may, or may not, have received is rapidly assessed so that proper medical treatment can be planned. The initial information needs to be easily obtained and able to provide a realistic potential of dose magnitude. Various techniques can be employed to help gather the necessary information needed. Evaluation of nasal swabs and wound counts can help with ascertaining the potential for significant intakes of radioactive materials, and mathematical dose estimations can help with determining the potential magnitude of external doses. Externally contaminated areas must be assessed so that treatment and decontamination priorities can be determined. As time goes on and more information, such as bioassay or biological dosimetry data, is received the health physicist will be called upon to interpret that data and communicate its meaning to the healthcare staff. Support duties can also include assistance with communicating with the patient, other medical staff, or external entities such as regulators and the media. Coupled with a good event history and other data, health physicists and physicians can develop a strategy for providing proper medical care to individuals who may have been involved in a radiological event. It is, therefore, essential that health physicists are able to seamlessly integrate themselves into the patient care environment and effectively communicate their findings to a wide variety of people. This PEP will describe methodologies to rapidly assess radiation doses and use real case reviews to reinforce the teaching points.

PEP 2 –H Fundamentals of Alpha Spectroscopy

Benson Davis, ORTEC

Quantification of Radionuclide activity or concentration may be an essential step in assessing dose. Alpha Spectroscopy is a well-accepted and broadly used method to achieve detection low limits in that quantification. 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.

Sunday 2:00-4:00 PM

PEP 3-A Title: The Fallacy of "Safe-Siding" Health Risk Estimates

Eric G. Daxon

Health physicists live in two worlds that were never meant to merge – the regulatory compliance world and the health risk management world. The former was intended for the occupational use of ionizing radiation. The later is intended for use primarily in emergency environments but has its uses in the occupational setting. It is common practice to use safe-sided health risk estimates in both environments by either high-siding the dose estimates or high-siding the risk estimates or both. This is especially true in the early stages of a major nuclear incident. The purpose of this PEP session is to re-examine the practice of safe-siding health risk estimates or dose estimates from the standpoint of total health risk. The session will use case studies as a vehicle to conduct this re-examination. One case study will be focused on the individual in an occupational setting; the second on a groups in occupational and emergency settings; the third will be on the use of guidance doses in emergency response operations and military operations.

PEP 3-B EH&S "Boot Camp" for Radiation Safety Professionals, Part 3

Robert Emery and Janet Gutierrez; The University of Texas Health Science Center at Houston

See 1B for description

PEP 3-C Gamma Spectroscopy for Health Physicists – Practical Applications

Doug Van Cleef, Mirion Technologies, Inc.

This course presents a quick review of gamma spectroscopy principles and technology, followed by three examples of gamma spectroscopy applications for health physicists. We will consider gamma spectroscopy as a tool for common health physics laboratory applications, waste packaging applications including TRU, and nuclear materials interdiction applications. Common limitations and interferences will be included in the examples. The course will include ample time for Q&A to allow students to address specific application considerations. The course is two hours in duration and the American Academy of Health Physics will grant 4 Continuing Education Credits (PEP 3-C) for completion.

Objective: Upon completion of this course, students will have a brief review of gamma spectroscopy principles and some practical examples of gamma spectroscopy analyses relevant to health physicists.

3-D Air Monitoring in Nuclear Facilities and the Environment – Part 2

J.T. Voss

Hands-on use of Air Sampling and Air Monitoring Equipment Including Analysis Methods and Algorithms

Air sampling pumps, air flow and dP gauges are demonstrated in this class.

- Simple calculations for air flow and pressure drops in sample lines are demonstrated.
- Types of air sample pumps (rotary vane, centrifugal, and diaphragm), vacuum and pressure lines, sample nozzles, air sample flow controllers (such as throttling valves, mass flow controllers, critical flow orifices, and pinch valves) are discussed and their operational characteristics are explained.
- Types of sample flow measurement systems (such as dP gauges, mass flow meters, and rotameters) are discussed and their operational characteristics are explained.
- Power required versus air sampling rate for various types of air sample pumps is discussed.
- Types of filter media are compared and the suggested applications for each are discussed. Various air sample filters are used in the hands-on demonstration.
- Typical operation, maintenance, and calibration procedures are presented.
- Calibration equipment is provided to demonstrate how the air samplers and monitors are calibrated.
- Air sample filters are counted and airborne concentrations are calculated.
- The uncertainties and limitations in the completed air sampling report are explored.

PEP 3-E Introduction to Stack Sampling

J.A. Glissmeyer, Glissmeyer Environmental LLC and HI-Q Environmental Products and Brian Asamoto, Asamoto Engineering and HI-Q Environmental Products

This course will present essential information on stack sampling for radionuclides. The topics of bulk stream radiation monitoring, extractive sampling, sample transport, collection and monitoring will be introduced. The system design tools for these processes will also be covered. The performance criteria for locating sample extraction probes are described. Problems involved with stack sampling, and possible solutions, will also be discussed.

PEP 3-F (WAS PEP TH-3) ASTM Standards That Influence or Are Directly Applicable to Radiation Protection

Ed Walker

The American Society for Testing and Materials (ASTM) is a consensus standard organization producing standards ranging from test methods and material specifications to consumer product testing to guides for analyzing and safeguarding people and the environment. ASTM is organized into over 140 main committees that have generated and maintain 12000+ standards. Most individuals in the profession of radiation protection are familiar with and apply ANSI standards generated by N13, N42, and N43. Few individuals outside of analytical labs, however, are aware of ASTM standards that influence or directly impact radiation protection. There are at least six committees that have subcommittees that generate such standards. This presentation will describe the ASTM organization structure and the protocols that are used to generate and maintain standards. The presentation will then describe the various subcommittees producing applicable standards and provide a brief summary of standards that support development and conduct of radiation protection and measurement programs.

PEP 3-G How Do We Know They're Good? Design and Administration of a Bioassay Oversight Program

Cheryl Antonio, Dade Moeller and Associates

An essential part of running a bioassay program is the quality oversight of the measurements. Whether the program is for a large or small number of measurements, there are key elements critical to assuring that good measurements are obtained. Standards such as ISO-17025, ANSI/HPS N13.30, and DOELAP provide guidance but the practical issues of implementing that guidance sometimes are rather subjective. Key elements include a well-developed contractual statement of work, knowledge of the measurement and data handling processes as well as the lab quality assurance and control provision, plus the client's own review and verification of measurements. The importance of adequate documentation of these elements cannot be understated, particularly in light of litigations and trends in worker compensation programs. Experience gained through many years of running large scale bioassay programs as both a provider and a client, as well as auditing both large and small scale programs will highlight many of the challenges posed to the oversight process, as well as how these challenges can be efficiently and cost-effectively met.

Monday 12:15-2:1 5 PM

PEP M-2 So now you're the RSO: Elements of an Effective Radiation Safety Program

Thomas L. Morgan, Columbia University

Designation as a Radiation Safety Officer brings with it unique opportunities and challenges. The author will offer insights on how to manage a radiation safety program from his 20+ years' experience as a RSO at medical, university, and industrial facilities. Regardless of the type of facility, number of radiation workers, or scope, an effective radiation safety program must be driven from the top down. Senior management must embrace the goals of the program. The RSO must have the trust of senior management as well as a good working relationship with line managers and workers. These relationships are built on the integrity, knowledge, experience, and accessibility of the RSO. This talk will focus on the role of the RSO in achieving and maintaining an effective program.

PEP M-3 Medical Laser Safety Program – What Health Physicists Need to Know

Deirdre Elder, University of Colorado Hospital, Aurora

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 requirements of the American National Standard for Safe Use of Lasers in Health Care (ANSI Z136.3) and the Recommended Practices for Laser Safety in Perioperative Practice Settings developed by the Association of Perioperative Registered Nurses will be discussed.

PEP M-4 Establishing Site Reference Criteria for Remediation of Contaminated Land

Steven H Brown, Centennial, Colorado

This one hour course will present a brief overview of methods currently being used in the US (and similarly in Canada) to establish acceptable levels of residual radionuclide contamination (e.g., Bq/gram in soil) that will meet the regulatory authority's annual public dose limits and/or related radiological public risk based criteria. The course will describe and define the public exposure scenarios (living conditions and characteristics under which future exposure can occur) and the associated exposure pathways being applied to each of these major exposure scenarios. In general, these methods are being applied in circumstances in which the radiological quality / composition of the "source term" is known and therefore the important radionuclides that will ultimately dominate the dose from deposition onto / into the soil are predictable (prior to operations) or known (through site characterization post operations) with acceptable confidence. This allows the analyst to identify one or two specific radionuclides as the " reference nuclide(s)" based on reasonable assumptions as to its "dominance" for dose delivery within the relevant exposure scenarios and pathways being considered. A simplified list of the "steps" of this process would proceed as follows:

1. Define the relevant present and future public exposure "scenarios" for a specific locale at present, and in the future given considerations of land use, demographic considerations, human occupancy times, etc. (e.g., residential housing, farmers, ranchers, recreational use, etc)

2. Define the relevant exposure pathways for each of selected exposure scenarios (e.g., direct exposure via ground or cloud shine, ingestion of water and/or foodstuffs, direct inhalation (e.g., radon at uranium contaminated sites), inhalation via soil resuspension, etc.)
3. Using appropriate transport and dose assessment models (acceptable to the regulator), perform fate - transport / pathway and dose modeling to establish the concentration in soil for the reference nuclide that will result in just reaching the regulators annual public exposure limit (the "reference" concentration and associated "reference" dose)
4. A "reverse" fate - transport / pathway and dose analysis is then performed for other important nuclides in the mixture to establish their "reference concentrations", i.e., the concentration of each nuclide that would result in achieving the same reference dose (e.g., regulatory limit) as the reference radionuclide.
5. Following operations to achieve unrestricted release of the site, and/or when it is required or desirable to release a portion of the impacted land area for unrestricted release, a "sum of fractions" rule is then applied for all the important radionuclides that have been defined from the source term mix to ensure that the regulatory public dose limit is not violated, regardless of the specific relative concentrations of each nuclide at any location (or any soil sample) based on the verification survey data set, e.g., radiological surveys and analytical results.
Several specific case studies will be presented to demonstrate "real life" applications including examples that have been accepted by the US DOE (for use in their Abandoned Uranium Mine program) and by the US NRC (for license termination and release for unrestricted use at former uranium sites) and methods being used by the US EPA at radiologically contaminated sites under their purview,

PEP M-5 New Generation Models for Internal Dose Calculations

Michael Stabin, Vanderbilt University

Traditional mathematical model-based anatomical models have been replaced with more realistic standardized anatomical models based on patient image data. Other recent model changes that will affect standardized dose estimates for radiopharmaceuticals include replacement of the traditional ICRP 30 GI tract model with the ICRP human alimentary tract (HAT) model and use of updated tissue weighting factors for calculation of effective dose. Calculation of internal dose estimates from animal or human data sets requires knowledge of a number of important principles and relationships in kinetic analysis and dose assessment, and knowledgeable use of available software tools. Adjustments to traditional dose calculations based on patient-specific measurements are routinely needed, especially in therapy calculations, for marrow activity (based on measured blood parameters), organ mass (based on volumes measured by ultrasound or Computed Tomography (CT)), and other variables. This program will give an overview of standard calculation techniques and models, and demonstrate how new models have introduced changes to standard calculations, with practical examples worked out in several important areas of application.

A review of current clinical trials for therapeutic use of radiopharmaceuticals will be presented, along with discussion of current issues in radiation biology that are pertinent to the interpretation of calculated dose estimates.

Tuesday 12:15-2:15 PM

PEP T-1 The Case Against LNT

Alan Fellman, Dade Moeller and Associates

Radiation safety programs must establish compliance with radiation regulations which 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.

PEP T-2 Radiological Operations Support Specialist Reference Toolkit

Brooke R. Buddemeier, LLNL and Dan Blumenthal, NNSA

Lawrence Livermore National Laboratory (LLNL) has developed a *prototype* ROSS Reference Toolkit in support of the ROSS. The ROSS Reference Toolkit provides summaries of recommendations from key references in easy to look up tables and clickable links to the references for response and planning for radiological events and exercises. The objective of the Toolkit is to provide a resource to help discern the appropriate guidance and recommendations for different categories of radiological response issues. Key issues have been broken out into several categories, including: Perimeters/Zones, Worker Safety, Shelter & Evacuation, Population Monitoring, and Recovery Resources.

There is a lack of scientific community consensus on several key response issues, decision points, and courses of action. The goal of the ROSS Reference toolkit is to catalog appropriate guidance for different types of events and discuss the *pro et contra* for various options that ROSS may need to consider. Scientific community review and feedback is being sought to help make this a robust tool for radiation safety professionals responding to a radiological or nuclear event.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. LLNL-ABS-724924

PEP T-3 NDA Systems used for the qualification of TRU waste to WIPP

Jeff Chapman, Oak Ridge National Laboratory

This session will present an overview of NonDestructive Assay (Assay) systems currently deployed across the U.S. for the measurement of transuranic waste. Additionally, and where applicable, measurement devices used in the "IAEA community" for the conduct of Material Control and Accountancy will be discussed. Methodology, Instrumentation, and application limitations will be discussed.

PEP T-4 Nanotechnology and Radiation Safety

Mark D. Hoover, National Institute for Occupational Safety and Health

This course will present an update for health physics professionals on relevant national and international experience and resources in nanotechnology safety, including a graded approach to sampling, characterization, and control of nanoparticles in the workplace. Case studies of good practice as well as experience "when things have gone wrong" will be presented. Highlights from the new NCRP report on Radiation Safety Aspects of Nanotechnology will be presented. Nanotechnology and nanoengineered structural materials, metals, coatings, coolants, ceramics, sorbents, and sensors are increasingly being evaluated and applied in radiation-related activities. Anticipating, recognizing, evaluating, controlling, and confirming protection of worker safety, health, well-being, and productivity during these activities is essential.

PEP T-5 Nuclear Security Awareness for the Health Physicist

Craig Marianno, Texas A&M University

Health physicists can play a vital role in security at nuclear and radiological facilities. Their awareness of nuclear security and its implementation should go beyond source control and accounting. This PEP is meant to provide participants an overview of nuclear security fundamentals. The concept of nuclear security culture and its relation to safety culture will be provided. The topics of threat assessment and insider threat analysis/mitigation will also be presented. Security risk will be discussed in addition to how risk is evaluated at facilities. The class will conclude with a tabletop exercise that will help students understand security and safety integration.

Wednesday 12:15-2:15 PM

PEP W-1 Determination of Dose to the Lens of Eye of Fukushima Prefecture Wild Mice

Brian Perri, Colorado State University
The March 11, 2011 Fukushima nuclear accident in Japan resulted in widespread radioactive contamination within the 20-km evacuation zone. Mice living within the contaminated region receive radiation doses from both external environmental contamination, as well as internally deposited contamination. Cataract formation in the eyes of mice is a possible deterministic effect of ionizing radiation. The development of a voxelized mouse model, produced from Computed Tomography (CT) data, will allow use of a Monte Carlo Nth Particle (MCNP) simulation. Simulations will include doses to the lens of the eyes from external sources (received while both above and below ground), as well as doses from internal contamination. Concentration of radionuclides in the soils in the area of where mice are captured will be evaluated and used in the Monte Carlo models to determine external dose. Average concentration of radionuclides in tissues of captured mice will also be determined and utilized in the Monte Carlo Models to determine internal dose. Additionally, veterinary ophthalmologists will be assessing the lenses of the mice captured in Fukushima Prefecture to determine if cataracts are present. Lens dose determination is a key part of ascertaining the dose to cataract formation in wild mice in Fukushima Prefecture.

PEP W-2 Decay Chain Calculations: A Primer

David Stuenkel, Trinity Engineering Associates

Many problems encountered in health physics require the calculation of the activities of radionuclides in a decay chain or cascade at a later time based on the initial activities and/or production rates of the radionuclides in that decay chain. This PEP session presents the system of differential equations describing the decay and ingrowth of radionuclides in a decay chain along with methods to solve it. It will include discussion of both analytical solutions (i.e., the Bateman equations) and numerical methods for practical problems that involve decay branching, physical or biological removal mechanisms, and external sources. This PEP includes a discussion of the stability of various single-step and multi-step numerical methods through an analogy with the movement of a mass attached to spring. Understanding the system of differential equations describing the decay and ingrowth of radionuclides and some of the methods to solve this system of equations will help the health physicist to select an appropriate solution method when confronted with such a problem.

PEP W-3 Science-based Response Planning Guidance for the First 100 Minutes of the Response to a Radiological Dispersal Device Detonation (Planning Guidance)

William Irwin, Vermont Department of Health

This Department of Homeland Security Science and Technology Directorate has developed planning guidance for the initial response to a radiological dispersal device detonation. The guidance that delineates Missions and Tactics that should be executed by first responders and local response agencies in the first 100 minutes of a response based on realistic estimates of the possible consequences. It includes recommendations for equipment requirements, including personal protective equipment (PPE), and public messaging. The first 100 minutes of a response to an RDD detonation are critical as this period sets the stage for how the overall response will be executed. First responders will be tasked with multiple activities, such as confirming a radiological release, conducting lifesaving rescue operations, issuing protective actions, and characterizing the scene. These activities must take place within the first few minutes of responders arriving on scene and the effectiveness and coordination of these early actions will define how well or how poorly the response will go in the emergency phase and beyond, as other state and federal assets and specialized teams arrive on scene to support the response. This document provides actionable guidance, sample text for an RDD response protocol, and annexed tools that can be used for local planning of an effective response to an RDD to protect first responders and the general public, and establish interagency coordination and integration of state and federal assets. In addition, the lecture will include a primer on the scientific experiments that underlie the guidance and realistic health and environmental consequences of an RDD.

PEP W-5 Low Dose Rate Brachytherapy Seeds Used for Localization of Non-Palpable Lesions

Richard P. Harvey, Roswell Park Cancer Institute, University of Buffalo

Low activity radioactive seeds are now being used for localization of non-palpable lesions in order to assist the surgeon with excision of cancerous tissue. This method is being used in breast wide excision with and without sentinel lymph node procedures. This course will focus on the initiation of a radioactive seed localization program and recent experiences.

Thursday 12:15-2:15 PM

PEP TH-1 Potential radiation effects from diagnostic and interventional radiological procedures

Cari Borrás, MHPS President

The radiobiological principles underlying radiation protection standards in the medical field, published by the International Commission on Radiological Protection (ICRP), the National Council on Radiation Protection and Measurements (NCRP) and the Biological Effects of Ionizing Radiation

(BEIR) Committee, will be reviewed. The effects of ionizing radiation at the cellular level, in animal experiments and in epidemiological studies will be summarized. The possibility of stochastic effects and tissue reactions (previously known as deterministic effects), due to diagnostic and interventional radiological procedures will be assessed. Human data on radiation induced cancers and threshold doses of tissue reactions, such as cardiovascular diseases and cataract induction, for follow up times up to 20-40 years, will be explored. The dose response of normal tissues will be considered, including effects on children and the developing embryo and fetus. The latest risk estimates per unit dose will be presented and current guidelines on radiation protection optimization will be discussed.

PEP TH-2 International Guidance on Radiation Emergency Management

Ed Waller, University of Ontario

The year 2016 marked the 30th anniversary of the Chernobyl nuclear power plant accident and this year we mark the 30th anniversary of the radiological accident in Goiania, Brazil. Both accidents, with tragic loss of life and widespread social, psychological and economic effects, underscore the importance of being prepared to respond to a nuclear or radiological emergency. In our very recent memory, the accident at the Fukushima-Daiichi nuclear power plant solidifies our need to continually improve upon our response capabilities and communications strategies in the event of an accident or malicious act involving nuclear or radiological material. The IAEA has, over the years, provided guidance on emergency preparedness and response (EPR) for nuclear or radiological emergencies. IAEA Safety Standard GSR Part 7 defines the goals of emergency response, and other documents provide details related to implementation.
In this PEP, we discuss, in broad terms, the major components related to international guidance on radiation emergency management, based primarily on IAEA GSR Part 7 Preparedness and Response for a Nuclear or Radiological emergency. As such, this talk outlines a “roadmap” of international guidance and how to utilize it. It is proposed that the topics discussed form the basis of local training in emergency preparedness and response.

PEP TH-4 Neutrons: Discovery, Detection Application and Health Physics

Jeff Chapman, Oak Ridge National Laboratory

This session will present the interesting and somewhat contradictory circumstances that lead to the discovery of the neutron, in 1932, by James Chadwick. With its discovery, the physics community---primarily lead by Fermi---studied the experimental behavior of neutron capture, and ultimately fission, induced by thermal neutron capture. Later, the determination of neutron multiplicity was sought, and with almost complete surprise the average number of neutrons per fission was measured at greater than 2, sufficient to sustain a neutron chain reactor. Applications of the neutron will be discussed, as well as some of the more interesting health physics issues that arise in the detection and interpretation of dose resulting from neutron exposure.

CONTINUING EDUCATION LECTURES (CEL)

Monday 7:00-8:00 AM

CEL-1 What Happened to an HPS Position on Air Crew Dose?

Nancy Kirner

In 2016, the HPS was asked by two of its members to adopt a position that would strengthen regulations concerning radiation doses that were being received by commercial air crew. This request was referred to the Scientific and Public Issues Committee for further consideration. This course briefly summarizes the sources of radiation encountered during commercial air travel, with reference to characterizations and recommendations of ICRP Publication #132. The current regulatory scheme in the United States concerning the radiological safety of aircrew as it pertains to the request for an HPS position is also discussed.

CEL-2 The Linear Non-Threshold Model and Its Implications for Radiological Security

C. A. Potter, Sandia National Laboratories

The system of radiation protection controls, from international and national guidance through regulation, is based on the linear non-threshold model (LNT); that is, that any amount of radiation exposure will cause harm and the frequency of harm in a human population is directly proportional to the dose received by the population. The LNT has been under review and reconsideration recently to the point where it has been shown that the likelihood of harm may have been overstated at its origin. The Health Physics Society itself is on record opining that there is no evidence for radiological harm, whether stochastic or deterministic in nature, for doses of 10 rem or less.

The US Environmental Protection Association in its Protective Action Guides (PAG) has recommended evacuation of population likely to receive a 5-rem dose and relocation of those who might receive 2 rem in the first year following a radiological event. It has been shown that evacuations of large populations result in deaths through motor vehicle accidents, physical maladies, or otherwise, perhaps comparable to those expected by the LNT. While the 1993 guide was specifically designed for reactor accidents, the recent 2016 guide has expanded the PAGs to include radiological terrorism such as a radiation dispersal device or radiation exposure device.

This situation lowers the bar for the radiological terrorist. The adversary has no need for a device to cause any radiological harm, only to create an exclusion area to the 5 or 2-rem PAG. This results in evacuation or relocation of the affected population and associated response. While there is no increased risk from such exposure, there is now an increased risk from the evacuation itself. Re-evaluation of post-event actions requires strong consideration and balancing of risk between deterministic risk from radiation exposure and additional risk introduced by response actions.

Tuesday 7:00-8:00 AM

CEL-3 Channeling Richard Feynman: How Lessons from the Great 20th Century Physicist can inform and inspire Great Health Physics in the 21st Century

Mark D. Hoover, National Institute for Occupational Safety and Health

Whether working on the atomic bomb, exploring and explaining quantum physics, investigating the Challenger disaster, or declaring his prescient vision of a future for nanotechnology ("There's plenty of room at the bottom."), Richard P. Feynman (1918-1988) was an insightful and thoroughly grounded practitioner and thinker. This lecture will revisit some of the many experiences of this great 20th century physicist that can inform and inspire our pursuit of great health physics in the 21st century, especially our need to make decisions in the face of uncertainty. Individuals planning to attend the lecture are invited to read the entertaining and informative collection of Prof. Feynman's writings *The Pleasure of Finding Things Out.*

CEL-4 Radiation in Flight

Joseph Shonka, Shonka Research Associates

In 2014, measurements of a extreme solar flare that missed earth by 7 days, along with analysis that showed such an event had a 10% probability of occurrence per decade led the US and UK science and technology advisors to recommend a course of action should such an event occur. Unlike the US, carriers in the EU and UK are regulated, and the doses that would have been received exceeded allowable limits. There are no radiation dose limits for US aircrew and passengers. This CEL will summarize the conclusions of those meetings and address both routine and extreme events from radiation that occur in flight. The CEL will also address methods that are being considered to control that radiation routinely and during space weather events. Recent efforts by the ISO to develop standards for measurement of radiation in flight will also be summarized.

Wednesday 7:00-8:00 AM

CEL-5 How MBTI Preferences Determine Our Risk Communication Habits

Ray Johnson, Radiation Safety Counseling Institute

While most people may believe their decisions for radiation safety are well thought out, rational, and prudent. That may not be the case. For survival all of us are hard wired to be constantly alert to anticipate or expect dangers before they occur. Expectations rule our lives and our minds are wonderful expectation-prediction machines. Actually the past, present, and future are closely connected. Our minds function like a time machine. When presented with a stimulus or new information, we immediately search our stored knowledge and memories to evaluate the new information and make predictions about the future. We are especially sensitive to predictions that may indicate possible harm to ourselves or our families. For many (most) people the word “radiation” is automatically associated with danger. The media has done a good job of instilling the notion that “radiation” really means “deadly radiation.” These are the words that may come up when anyone searches their stored memories and impressions to make a decision about radiation safety today. Since this search and retrieval is done at a subconscious level, people are not aware that their fears and corresponding decisions for radiation safety may not be relevant to today’s circumstances. Fueling decisions for radiation safety are expectations or images of unacceptable consequences of exposure to radiation. Fears are always about imagination of dangers to be avoided. When asked about what would happen if exposed to radiation, one person said, “I will get red bumps all over my body.” While this image has no connection to reality as HPs might understand radiation effects, the image of “red bumps” is a powerful expectation to be avoided at all costs. Most people’s fearful expectations of the dangers of radiation are not helped by information on risk probabilities. While they may not understand probabilities, they do know they do not want to take a “chance” on cancer, no matter how small the chance may be as predicted by HPs. There are no rewards for most people (except possibly radiation workers or cancer patients) to take any risks for radiation. Negative expectations will rule when making decisions for radiation safety.

CEL-6 A First Time Hot Cell Window Replacement at the Idaho National Laboratories Hot Fuel Examination Facility

Patrick Bragg

In October 2016 the Hot Fuel Examination Facility (HFEF) located at the Materials and Fuels Complex (MFC) on the Idaho National Laboratory (INL) completed a first time replacement of a 1975 era hot cell window without incident. HFEF is a unique world class hot cell facility for Post Irradiation Examination (PIE) of nuclear fuels and materials. The window replacement involved multiple health and safety disciplines and required months of planning and a phased approach. The result of which was a like for like removal and replacement of a 14000 lbs window tank unit with zero detectable airborne radioactivity generation, contamination spread and minimal radiation exposure. This complex and mutli-disciplined task was accomplished by following the fundamental radiation protection principals of time, distance, shielding, and source minimization. The As Low As Reasonably Achievable (ALARA) philosophy in conjunction with the lesser referenced Keep It Simple (KIS) method led to another in a long line of firsts in the history of the INL. The success of this project will serve as the blueprint for additional window replacements to ensure the continued success of the INL’s PIE program.

Thursday 7:00-8:00 AM

CEL-7 Proceedings of the Annual Core Research Reactor Characterization
Alexandra Robinson, Sandia National Laboratory

CEL-8 Safety Culture in Research: Anticipating Danger Anticipating Danger Where No One Has Gone Before

Alice Dale, University of Kansas

Implementing or improving Safety Culture can often seem like an uphill battle, and in a research setting even more so as discovery processes bring about increased pressures on the culture. This dynamic environment provides unique challenges when trying to balance constantly changing projects, facilities, researchers, radioisotope and use of other materials of risk.

The author will identify the spectrum of cultures, share the needed values for Safety Culture's foundation, discuss the ways that radiation safety staff must wear multiple hats when addressing and strengthening Safety Culture, and demonstrate how to get support from administration and researchers. Also included in this course are some examples of Safety Culture in action, ways to determine if you are on the right track, and strategies to encourage and lead a positive culture from the perspective of a researcher turned radiation safety professional.

The ability to champion safety culture into the next generation is directly related to how we are viewed as safety professionals, understanding the fundamentals of the particular material of risk, and the realization that campus culture mimics how safety and health professionals interact with regulators.