Preliminary Program

Tours & Social Events

Monday

Private Cruise on Scenic Lake Coeur d'Alene

1:00 pm to 5:00 pm Preregistration $50/Onsite: $55

Leaves from the DoubleTree Hotel Lobby

Travel to Idaho where you'll board the cruise boat for a two hour private cruise on Lake Coeur d'Alene. National Geographic reports this as one of the most beautiful lakes in the world, see why! The cruise is narrated and there is seating both inside on the main floor and in the open air up top. Along the way, pass by the famous floating green at the Coeur d'Alene Resort Golf Course. After the cruise, there is free time to browse in the shops, walk the world's longest floating boardwalk or grab a drink in one of the many café's. Tour price includes bus transportation, guide and two hour private cruise on the lake. Snacks, beer, wine and cocktails are available for purchase.

Historic Walking Tour of Downtown Spokane and Wine Tasting

1:30 pm – 4:30 pm Preregistration $25/Onsite: $30

Leaves from the Convention Center Front Entrance

This leisurely walk of about 2 miles will inform you about the Native Americans, early fur traders and pioneers who settled along the Spokane River. See the former Expo' 74 site, now Riverfront Park and view the Spokane Falls. As you walk through downtown, your guide will tell you about architects and point out ornate details on the buildings they created after the Great Fire of 1889. Learn about what these buildings were originally built for and some interesting and colorful stories about Spokane in the late 1800's. Along the way, we will stop for a wine tasting at the Nectar Tasting Room which features five wineries from around Washington State.

Spokane Indians Baseball Game

5:30 pm Preregistration $20/Onsite $25 (includes ticket and shuttle)

Leaves from the Davenport Grand Hotel Lobby

Take us out to the ball game. The Spokane Indians, a minor league member of the Class A Short Season Northwest League and a farm team for the Texas Rangers, will play the Vancouver Canadians at Avista Field, a short taxi ride or hotel shuttle from downtown. Game time is 6:30 pm. Meet at 5:30 in the Grand Hotel lobby for the hotel shuttle or arrange your own transportation.

Open Mike Night

Evening Free

Details are still being worked out on this fun event. Stop back for details.

Tuesday

5K Fun Run/Walk

6:30 am – 8:30 am Preregistration: $25/Onsite $30 (limited or no T-shirt Options for Onsite Registration)
Shirt size: __Small __ Medium __ Large __ XL __2XL __3XL

Leaves from the breezeway between the Convention Center and the INB Performing Arts Center

Our course begins on the river side of the Spokane Convention Center, between the Convention Center and the INB Performing Arts Center, a two minute walk from the Davenport Grand Hotel lobby. We will follow the Centennial Trail east, across the Spokane River, through the Gonzaga University campus, to Mission Park and back. Fun awards presented after the run.

Historic Spokane's "Age of Elegance" Tour

1:30 pm to 4:30 pm Preregistration $25/Onsite $30

Leaves from the Convention Center Front Entrance

Enjoy a bus tour of the rich history, historic homes and attractions of Spokane. Learn about the Native Americans that first discovered this area and where the city began as we travel along the Spokane River, view the Spokane Falls and the grounds of the former Expo

'74 site, now Riverfront Park. Learn about the Looff Carousel built in 1909, named one of the “Top Ten Carousels in the US” by the National Carousel Association. Then, ascend up "The Hill" with views of the city and stunning mansions. Tour inside the majestic Saint John's Cathedral, said to be one of the most beautiful cathedrals in the Pacific Northwest. Marvel at the stained glass windows, wood carvings and design. Discover Manito Park while strolling through the formal French Renaissance gardens, Perennial Gardens, Rose Gardens, authentic Japanese Gardens, and flower-filled Conservatory. Trip Advisor’s Travelers Choice Awards rated Manito Park “One of the Top 25 Parks in the US”. See the historic area of Browne's Addition where many of the old mansions, built in the late 1800’s, have been restored to their original splendor. Stop at Bing Crosby’s childhood home to see the largest public collection of Crosby's memorabilia in the country.

Tuesday

Hiawatha Trail Bike Tour

8:30 am-4:00 pm Preregistration $175 adult/$152 youth (minimum age – 4)

Leaves from Spokane Convention Center Main Entrance

On the Idaho/Montana border, the Old Milwaukee Railroad has been transformed into one of the most breathtaking bike rides in the world. This is rugged country with big mountains, and to keep the grade, railroad engineers designed a series of tunnels and high trestle bridges that remain today as remarkable engineering feats. On this 15-mile ride you’ll pedal through ten tunnels including the 1.6 mile-long Taft Tunnel. You’ll cross over seven canyon-spanning trestles with panoramic views of the Bitterroot and St. Joe Mountains. Our full day trip includes transport to and from Coeur d’Alene and a trailside picnic lunch. The tour includes transportation to/from Spokane, lunch at the end of the ride, and bike/helmet/light rental. Be sure to bring: sunscreen and sunglasses, athletic shoes, personal water bottle, camera (optional) and activewear appropriate for biking. Dress in layers depending on the weather.

Wednesday

Relish Spokane™ Food Tour

2pm to 5 pm Preregistration $39/Onsite $45

Leaves from the Spokane Convention Center Main Entrance

Description: Between tantalizing your taste buds with the delicious food of Spokane, you will be engulfed by the quaint, historical vibe of the city. Our walking food tour makes 6 stops over about 1.5 to 2 miles. As you stroll the city, you will be satisfied with several savory tastings from local bakeries, bistros, and other local unique shops. The visits range from French delights to saucy bites that will provide enough of the local ethnic eateries to get you acquainted to the real Spokane, WA! And all of this is accompanied with fun facts about the town's culture, people,

architecture and history. Our small group tours allow for a more intimate experience, leaving your appetite and hunger to learn about our small-big city satiated! Not recommended for people with special food needs or allergies.

Spokane Pub Crawl

6:30 pm till ???? Pre-registration (depending on shirt size, see below): $15/$20 / Onsite: $25/$30 (minimum number of onsite orders required otherwise onsite payment will be refunded)

Leaves from the Front entrance to the Davenport Grand

An HPS annual meeting tradition! Not only is Washington State the home to some fabulous Northwest microbrews, Washington Wine Country is famous for its "perfectly balanced" wines! Whether you prefer a pint glass or a wine glass, it's all available within easy walking distance in downtown Spokane. Destinations that are a bit farther will also be identified for those who want to stretch their legs. Crawlers will leave from the front of the Davenport Grand Hotel. Includes a commemorative t-shirt; variety of colors available with pre-registration.

SHIRT OPTIONS:
Sizes: small, medium large, XL pre-registration: $15 late registration: $25
Sizes: 2XL, 3XL, 4XL pre-registration: $20 late registration: $35
Colors: neon green, black, gray, cardinal, aquatic blue

Shirt #1:	Size:		Color:		Price:		
Shirt #2:	Size:		Color:		Price:		
Shirt #3:	Size:		Color:		Price:		

Total $ _____

Front Back Colors

An Evening of Songs and Stories of the Pacific Northwest

6:30 – 9:30 pm Preregistration $40/onsite $45

This fun Night Out will take place at O'Dougherty's Irish Grille and Pub, a short walk across the street and parking lot from the Davenport Grande.

Enjoy a delicious meal followed by Songs and Stories of the Pacific Northwest. Your meal will include your choice of Tullamore Dew Whiskey Steak (cooked medium), Donegal Salmon (baked with lemon butter) or Corned Beef and Cabbage, with a Caesar salad, Shepherd's bread, and garlic mashed potatoes as accompaniments and a no-host cash bar. Following the meal we will be treated to Songs and Stories of the Pacific Northwest by noted Northwest folk entertainer Hank Cramer. Hank is in high demand for folk festivals, concerts, and cultural presentations, and hails from Winthrop, Washington (home to our President Nancy Kirner, who **highly** recommends him). He even has some ties to our profession as a former emergency planner. Check out his website at http://hankcramer.com/ , but for a more engrossing taste of what he will be doing, don't miss a YouTube video at https://www.youtube.com/watch?v=oigaOkSBhH0. You won't want to miss this unique night out.

Thursday

Hanford B-Reactor Tour

8:00 am-6:00 pm Preregistration $50/Onsite $55

Lunch choice: _□ Pulled Pork Sandwich □ Caesar Salad w/Brisket of Beef

□ Caesar Salad (vegetarian, no meat)

Leaves from the Spokane Convention Center Main Entrance

Visit the Hanford B-Reactor, the world's first production nuclear reactor, which created plutonium for the Manhattan Project. It is now part of the Manhattan Project National Park. This tour will depart from the Convention Center by bus for a three-hour ride to Hanford. A delicious box lunch will be provided from the Shrub Steppe Smokehouse (your choice of pulled pork sandwich, Caesar salad with brisket of beef, or vegetarian Caesar salad, with a potato salad side and drink). The tour will have over two hours at the B-Reactor, allowing ample time to explore this historic facility at your leisure, then make stops at other historic parts of the nation's newest National Park. We will return to Spokane at approximately 6 pm.

Friday

LIGO (Hanford) Tour

8:00 am-6 pm Preregistration $50/Onsite $55

Lunch choice: _□ Pulled Pork Sandwich _□ Caesar Salad w/Brisket of Beef

_□ Caesar Salad (vegetarian, no meat) Leaves

from the Spokane Convention Center Main Entrance

The Laser Interferometer Gravitational-wave Observatory (LIGO) made history in February 2016 with the announcement that it had measured gravitational waves, confirming their existence for the first time. The LIGO at Hanford is one of two such observatories in the world. Our tour of this scientific wonder will involve a three-hour bus ride to LIGO, located on the Hanford Site, followed by a two-hour tour covering the mile-long arms of the observatory and the control room. A delicious box lunch will be provided from the Shrub Steppe Smokehouse (your choice of pulled pork sandwich, Caesar salad with brisket of beef, or vegetarian Caesar salad, with a potato salad side and drink).

AAHP Courses

AAHP1: The Role of a Radiological Operations Support Specialist (ROSS)
William Allen

During radiological and nuclear emergencies, routine decisions and operations for state and local response agencies become increasingly complex. These actions require on-scene radiation specialists to provide expertise and address key issues in safeguarding the public and responders. Some jurisdictions have some of these specialists; others do not. In the worst emergencies, likely all jurisdictions will not have enough. Through the creation of a new National Incident Management System (NIMS)-Typed position, the Radiological Operations Support Specialist (ROSS), the Departments of Homeland Security (DHS) and

Energy (DOE) want to train, equip, and certify radiation experts to integrate with the incident command system during a radiological response. When activated, the ROSS will directly support the incident commander, agency decision makers, and elected officials during a radiological emergency.

This training consists of both instruction and group activities to help develop skills that will be needed in a radiological emergency by the ROSS. It is an introductory course including components of a larger training curriculum currently being developed for ROSS certification.

The training begins with an introduction to the ROSS program's origin, purpose, and current status. Next, instructors describe key references and documents that the ROSS will need to leverage to accomplish their mission in support of emergency managers and incident commanders. Some of these references include the Planning Guidance for Response to a Nuclear Detonation, the National Response Framework's Nuclear/Radiological Incident Annex, EPA PAG Manual, and ROSS Resource Guide. By fostering a fundamental understanding of these references, the training shows students how to identify key federal resources, best use these specialized assets during a response, and understand how public protection recommendations are generated.

In addition to references and documents, the course introduces students to key tools, such as RadResponder, HotSpot, and CMWeb, that the ROSS can use in a radiological emergency to collect and disseminate radiological data. Using drills and exercises, instructors reinforce how the ROSS will use these tools to support the emergency response on the ground, focusing on key skills, knowledge, and abilities of radiation professionals, such as:

- FRMAC and other data product interpretation and briefing
- Integration of health physics into the Incident Action Planning process
- Monitoring plan development
- Radiological data mapping, information sharing, and public safety decision-making

This training covers the key resources and tools used by the ROSS during an emergency. Those interested in taking this class should be familiar with the incident command system and NIMS (i.e., ICS-100, ICS-200, IS-700, IS-800) and have a good foundation of health physics / radiation protection and emergency preparedness training and experience.

Please sign up early; class size is limited to 40.

AAHP2: Lessons in Communication From HPS's Ask the Experts
Linnea Wahl

Communicating about radiation and its risks is arguably one of the hardest things a radiation protection professional does. How can we communicate difficult information successfully? *Research* tells us that when we talk to people who are concerned or upset, they

want reassurance that we care about them, they have difficulty understanding and remembering what we tell them, they focus on what they hear first, and they focus on the negative news over the positive. *Experience* tells us all this and more.

Experts who support the Health Physics Society's (HPS's) Ask the Experts feature have that experience after answering nearly 12,000 questions from colleagues, regulators, curious folks, angry folks, and frightened folks. Our Ask the Experts experience has taught us lessons such as when to stop with the details already, which words will get the discussion off in the right direction, and when a speedy response is better than a technically perfect response. We have also learned that it is preferable to use plain language (as opposed to tech talk) and capture the big picture instead of dwelling on the minutiae. People want an uncomplicated answer that they can readily understand.

In this course, we will share the lessons we've learned, illustrated by examples drawn from Ask the Experts questions and answers. These are lessons that all radiation protection professionals.

AAHP3: How Randomness Affects Understanding of Radiation Risk Assessments and Decisions for Radiation Safety

Ray Johnson, MS, PSE, PE, DAAHP, FHPS, CHP; Director, Radiation Safety Counseling Institute

Randomness and Measurement Uncertainties - For a health physicist, radiation risk assessments begin ideally with measurements to characterize the source of radiation. While we depend on radiation instruments to tell us about radiation, how often do we evaluate the uncertainties of measurements? Misunderstandings abound when it comes to interpretation of measurements. Most people want absolute values for measurements and do not want to know about uncertainties and seldom ask questions such as, "Was the best instrument used, was it calibrated and working properly, was it used properly, was the measurement taken in the right place, etc.?" Interpretations of measurements may also have as much to do with attitudes and perceptions of risks as they do about technology. Also, measurements are only part of the information needed for risk assessments.

Randomness and Risk Assessments – While health physicists usually understand that radiation is of main concern for stochastic effects (future random chance of cancer), most of the world does not understand randomness or probabilities. Most people just want to know if they will be "safe or not safe." They do not want to hear about radiation risk estimates as probabilities. When confronted with a risk probability, they are inclined to substitute an easier question, such as, "How do I feel about getting cancer?" They can easily answer this question without any technical knowledge or understanding of statistics.

Randomness and Uncertainty in Safety Decisions – Research has shown that when chance or randomness is involved, people's thought processes for safety decisions are often seriously flawed. How many people understand the principles that govern chance, the development of ideas on uncertainty, and how these processes play out in decisions for radiation safety? The normal processes for safety decisions can lead to mistaken judgments and technically inappropriate reactions for radiation safety (consider reactions following Fukushima).

Is Telling the Truth the Answer to Communicating Risk Assessments? - While we may all agree that HPs have an ethical responsibility to tell the truth about radiation risk assessments, the big question is, "What is the truth?" If we tell people the scientific truth about radiation will that allay their fears or lead to a better understanding? Can our best technical information

overcome the common automatic belief in "Deadly Radiation" and other radiation myths perpetuated subconsciously throughout the population? Most importantly, how does anyone actually determine the truth? Is seeing or hearing the basis for believing?

Possible Answers - Perhaps the best way to help people make appropriate decisions for radiation safety is to guide them in the steps for making the risk assessment themselves. People have more confidence in decisions they make for themselves rather than depending only on experts to tell them the answers. While experts may believe they know the answers to risks assessments, theiranswers may not consider all of the nuances of safety decisions typically used by non-technical people. Several tools will be presented for effective risk communication.

Professional Enrichment Program Lectures

Sunday, 8 – 10 AM

PEP 1-A

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

R. Emery and J. Gutierrez, The University of Texas School of Public Health

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

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-B

Integrating the Radiation Protection Program into the OSHA Injury and Illness Program: A Primer for Business Managers

S. Larson, Tufts University

The primary sources of guidance and advice for business mangers on the management of radiation protection programs are documents authored by the U.S. Nuclear Regulatory Commission (US NRC) and the National Council on Radiation Protection (NCRP). However, most business organizations using ionizing radiation producing machines or radioactive materials engage in other activities that present additional occupational safety and health hazards. Some of these hazards are regulated by the Occupational Safety and Health Administration (or state OSHA programs). In 2016, OSHA revised the Safety and Health Management Program guidelines originally published in 1989. It's significant that OSHA refers to this document as describing a management system. In October 2016, the International Standards Organization (ISO) is planning to publish ISO45001 Occupational Health and Safety Management Systems. These two documents reference another document, ANSI Z10 Occupational Safety and Health Management Systems 2005, 2012). In a business organization, programs consist of many plans and systems consist of many interdependent programs. In summary, any business intending to establish a positive safety culture must embrace safety as a core objective at the same level as profitability, productivity, quality and environmental compliance and sustainability. In this course, the participants will learn the history, current use and future of safety plans, safety programs and safety management systems and why it's unlikely that a safety culture can be sustained in a business organization without adopting a safety management system.

PEP 1-C

Randomness and Interpretation of Radiation Measurements

R. Johnson, Radiation Safety Counseling Institute

For a health physicist, radiation risk assessments begin ideally with measurements to characterize the source of radiation. While we depend on radiation instruments to tell us about radiation, how often do we evaluate the quality or uncertainties of measurements? Misunderstandings abound when it comes to interpretation of measurements. Most people want absolute values for measurements and do not want to know about uncertainties and seldom ask questions such as, "Was the best instrument used, was it calibrated and working properly, was it used properly, was the measurement taken in the right place, etc.? There are over 20 factors that can affect the quality of measurements that may not be considered when interpreting measurements. Two key factors, in particular, govern

measurement interpretations: 1) measurements have no meaning until interpreted and 2) measurements only have meaning in terms of how they are interpreted. Thus, recorded or reported radiation measurements have no inherent meaning by themselves, they are just numbers Interpretations of measurements may also have as much to do with attitudes and perceptions of risks as they do about technology. For example, a worker at an industrial facility observed the RSO taking readings with a Geiger counter and saw the meter go off scale. That was enough information for this worker to start an uproar that eventually involved several hundred other workers, the union, and management. Another worker at a food production facility heard a GM meter in use for surveying the installation of a new x-ray machine for product quality control. He raised concerns and when the company manager heard there was radiation in his facility, he told the x-ray company to remove their machine. This resulted in the loss of a $4 million sale for 20 x-ray machines.

Radiation safety specialists have the advantage for interpreting radiation measurements based on knowledge of comparative readings from background and other sources. Most people without this specialized knowledge do not know that we live in a sea of radiation which surrounds us all the time. Furthermore, a screaming Geiger counter may sound alarming, but radiation risks depend on many other factors, such as the type of radiation, the proximity of people, and the duration of exposures. A Geiger counter reading or other measurements of radiaton are only part of the information which specialists would use for assessing potential risks. Unfortunately, all radiation measurements have many potential sources for errors which people may not know about and may therefore assume the measurements represent the real world. For interpreting radiation measurements, how much do we rely on technical understanding and how much on our interpretation as an emotional reaction regarding safety?

PEP 1-D

Status of (1) ANSI N42 RPI Standards and (2) International Electrotechnical Commission (IEC)Technical Committee 45 and Subcommittee Nuclear Standards

M. 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:

(1)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; 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 a 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 in revision; 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; 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.

(2)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 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. 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-E

Radiation Protection at Accelerator Facilities

M. Quinn, Fermilab

The Radiation Protection at Accelerator Facilities class will present an overview of the composition of accelerator radiation fields for electron, proton, and ion accelerators at all energies. Ionizing radiation produced by high-intensity laser sources will also be discussed. General methods of designing radiation shielding at accelerators will be presented, with special attention being devoted to low-energy neutron phenomena that are found at nearly all accelerators. The production of induced radioactivity in both accelerator components and environmental media will be covered, along with a discussion of radiation detection instrumentation commonly used at accelerator facilities.

PEP 1-F

Air Monitoring in Nuclear Facilities - Part 1

J.T. Voss, Los Alamos National Laboratory

Basic Fundamentals of Air Sampling and Air Monitoring

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

The following exercises are presented:

- Calculate concentration using count rate, counting efficiency, and sample volume
- Concentration conversion factors (such as pCi/L to uCi/mL or Bq/M3)
- Calculate DAC (Derived Air Concentration) and DAC-h
- Calculate the DAC level on a filter from the number of DPM on the sample filter and the sample time and the sampling rate
- Calculate the number of DAC-h on a filter from the number of DPM on the filter and the air sampling rate

• Calculate the DPM on a filter to reach an 8 DAC-h accumulation
• Calculate the 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
• Uranium-238 decay chain
• Thorium-232 decay chain
• Comparison of typical radon/thorn progeny concentrations compared to desired concentration limits for transuranic airborne activity

Air Sampling and Air Monitoring Regulatory Requirements
An overview of the requirements the following is presented:
• 10 CFR 20 (Standards for Protection Against Radiation)
• 10 CFR 20 Subpart D (Radiation Dose Limits for Individua10 CFR 20 (Standards for Protection Against Radiation)
• NUREG 1400 (Air Sampling in the Workplace)
• 10 CFR 835 (Occupational Radiation Protection)
• 29 CFR 1910 (Occupational Safety and Health Standards)
• 40 CFR 50 (National Primary and Secondary Ambient Air Quality Standards)
• 40 CFR 50 Appendix B (Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere)
• 40 CFR 61 (Radiological National Emission Standards for Hazardous Air Pollutants)
• ANSI N13.1-1999 R2011 (Sampling and Monitoring Releases of Airborne Radioactive Substances From the Stacks and Ducts of Nuclear Facilities)

PEP 1-G
Heat Stress for Health Physicists, Part 1 of 2
G. Ceffalo, Bechtel

Heat, or thermal stress, is a work hazard related on a worker being exposed to low temperatures and wind chill; or high temperatures, radiant heat and humidity. These thermal factors can stress a worker, reducing their effectiveness, and requiring controls, typically in the form of heat management or time limitations. From a HP perspective, accommodating heat stress controls can either adversely affect radiological controls, or harmonize with a set of controls and optimize worker safety.

Part 1 of this two-PEP series is intended to aid an HP understand the concepts, measurements and terms associated with heat stress. While heat stress is typically the specialty of Industrial Hygienists, part 1 of this PEP set should enable a HP to be an active participant in hazards evaluation and control processes that include thermal stress. The PEP will demonstrate the fundamentals of measuring and quantifying the contributors to heat stress, and understanding the effect of different contributors to heat stress. Evaluating controls and mitigation will be discussed in part 2 of 2.

PEP 1-H

Laser Safety for Health Physicists

B. Edwards, Vanderbilt University

This course provides an overview of laser physics, biological effects, hazards, and control measures, as well as a concise distillation of the requirements in the ANSI Z136.1-2014 Standard for the Safe Use of Lasers. Non-beam hazards, emerging issues, and accident histories with lessons learned will also be covered. Course attendees will learn practical laser safety principles to assist in developing and conducting laser safety training, performing safety evaluations, and effectively managing an institutional laser safety program. While some knowledge of laser hazards will be helpful, both experienced and novice health physicists with laser safety responsibilities will benefit from this course. Attendees may find it helpful to bring their own copy of ANSI Z136.1-2014.

Sunday, 10:30 AM – 12:30 PM

PEP 2-A

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

R. Emery and J. Gutierrez, The University of Texas School of Public Health

See description for PEP 1-A. 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.

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 2-B

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.

PEP 2-C

Why Our Natural Intuitive Processes Fail for Radiation Risk Assessments

R. Johnson, Radiation Safety Counseling Institute

We often employ intuitive processes when we make assessments and choices in uncertain situations, such as dealing with radiation risks. The normal processes for safety decisions by a caveman confronted with a saber-toothed tiger do not do very well in today's world and may lead to decisions that are incongruous or even harmful. Studies have shown that the parts of our brain involved in decisions for risk assessments are closely connected to the seat of our emotions. The amygdala, which is linked to our emotional state, especially fear, is activated when we make decisions couched in uncertainty. Mechanisms by which people analyze situations involving chance are a complex product of evolutionary factors, brain structure, personal experience, knowledge, and emotion. Making wise assessments and choices in the face of uncertainty is a rare skill. We often start with a naive realism, namely the belief that things are what they seem. However, when viewed more broadly, we may realize that things are not what they seem, but something quite different. This is illustrated by the story of the wise men and the elephant. By necessity we employ certain strategies to reduce the complexity of risk assessments and our intuition about probabilities plays a role in that process.

Our subconscious mind is designed to jump intuitively to conclusions often with very little evidence. It is not designed to know the size of the jumps. Our confidence in our intuition is a function of the coherence of the story we construct. The quality or quantity of the evidence does not count for much because a very good story can be constructed based on very poor evidence. How many people automatically conclude that radiation is bad with very little (and likely very poor) evidence? Kahneman says, "Considering how little we know, the confidence in our intuitive beliefs is preposterous – and also is essential." We have to believe in something. Swimming against the tide of human intuition for safety decisions can be exceedingly difficult. Confidence in our intuition is not usually based on a logical analysis of the probability that our judgment is correct. Confidence in our intuition is a feeling based on the coherence of information from which we construct a story and the ease of processing that information. While it is not common to admit uncertainty, expressions of high confidence mean we have constructed a coherent story, not necessarily that the story is true. For example, many people are very confident about their intuition regarding radiation risks even though their beliefs are based on mythology (beliefs not technically true).

PEP 2-D

Search and Secure and RAILS

K. Uhrig, MELE Associates, and R. Kahn, ANL

In today's volatile world, it is imperative that radioactive sources are protected or securely disposed. The Office of Radiological Security (ORS) works hard to secure radioactive sources both domestically and internationally by protecting, reducing, and removing radioactive sources. ORS's Search and Secure (S&S) Program works directly with foreign governments to assist in establishing effective and sustainable programs to improve radiological security by providing training and equipment for the search, location, identification, recovery, transportation, and secure storage of sealed radiological sources that have fallen out of regulatory control (i.e., orphan sources). These training courses are conducted in partner countries where participants are taught key S&S concepts and practical skills on how to plan, organize and conduct searches. To sustain these capabilities, training participants are given access to RAILS, the Realistic Adaptive Interactive Learning System. RAILS allows users to refresh their training and train new individuals in a virtual hands-on interactive environment, where they can practice using radiation detection equipment to locate orphan sources. This PEP will discuss the importance of the S&S mission, key search concepts, and discuss key radiation detection equipment. It will also demonstrate RAILS and its use for sustaining training. Participants will be provided a RAILS account and may bring a mobile device or laptop to access it. Devices will also be available at the PEP for testing RAILS.

PEP 2-E

Integration of Health Physics into the Medical Management of Radiation Incident Victims

S. 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-F

Air Monitoring in Nuclear Facilities – Part 2

J.T. Voss, Los Alamos National Laboratory

Methods of Extracting Representative Samples from Stacks, Ducts, the Environment, and Work Areas

Deposition 2001a software developed at Texas A&M University is demonstrated. Sampling rakes and shrouded probes for stacks and ducts are discussed as well as methods of measuring air flow rates through stacks and ducts. Isokinetic sampling limitations are discussed. The guidance in ANSI N13.1-1999 R2011 (Sampling and Monitoring Releases of Airborne Radioactive Substances From the Stacks and Ducts of Nuclear Facilities) is more fully explored using Depo 2001a.

Equipment used for Air Sampling and Air Monitoring

- Types of air pumps are discussed and their operational characteristics are explained.
- Types of vacuum and pressure lines are discussed and operational characteristics are explained.
- Types of sample nozzles are discussed and their operational characteristics are explained.

• Types of sample flow controllers are discussed and their operational characteristics are explained.
• Types of sample flow measurement systems are discussed and their operational characteristics are explained.
• Power versus air sampling rate for various types of air sampler pumps is discussed.
• Types of filter media are compared and the suggested applications for each are discussed.
Typical operation, maintenance, and calibration procedures are presented.

PEP 2-G

Heat Stress for Health Physicists, Part 2 of 2
G. Ceffalo, Bechtel

Heat, or thermal stress, is a work hazard related on a worker being exposed to low temperatures and wind chill; or high temperatures, radiant heat and humidity. These thermal factors can stress a worker, reducing their effectiveness, and requiring controls, typically in the form of heat management or time limitations. From a HP perspective, accommodating heat stress controls can either adversely affect radiological controls, or harmonize with a set of controls and optimize worker safety.
Part 2 of this two-part PEP will provide information on techniques and equipment available to help manage heat stress. If an HP can be part of the design of the hazard control set, more effective controls can be selected, optimizing worker safety, comfort and radiological consequences. The controls will include PPE selection, respiratory protection, cooling devices for both the worker and the areas; and discussion of time management.

PEP 2-H
Performing ANSI Z136-Based Laser Hazard Calculations
B. Edwards, Vanderbilt University

This course provides a step-by-step guide to performing laser hazard calculations based on the principles and methodology in the ANSI Z136.1-2014 Standard for the Safe Use of Lasers. Attendees will gain an understanding of how to complete these calculations for continuous wave, pulsed, and repetitively pulsed laser systems. While some knowledge of laser hazards will be helpful, both experienced and novice health physicists with laser safety responsibilities will benefit from this course. However anyone not already familiar with the fundamentals of radiometry and the arcane conventions of the Z136 series of standards for the safe use of lasers would benefit from attending the Laser Safety for Health Physicists PEP so they'll have some familiarity with the concepts under discussion. Attendees will also find bringing their own copy of ANSI Z136.1-2014 a useful reference.

Sunday, 2 – 4 PM

PEP 3-A

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

R. Emery and J. Gutierrez, The University of Texas School of Public Health

See description for PEP 1-A. 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 3-B

So now you're the RSO: Elements of an Effective Radiation Safety Program

T. 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 3-C

Errors in Randomness and Understanding of Stochastic Risk Assessments

R. Johnson, Radiation Safety Counseling Institute

While health physicists usually understand that radiation is of main concern for stochastic effects (future random chance of cancer), most of the world does not understand stochastic effects, randomness, or probabilities. Most people just want to know if they will be "Safe or Not Safe." They do not want to hear about radiation risk estimates as probabilities. When confronted with a risk probability, they are inclined to substitute an easier question, such as, "How do I feel about getting cancer?" They can easily answer this question without any technical knowledge or understanding of randomness or probabilities. Research has shown that when chance or randomness is involved, people's thought processes for safety decisions are often seriously flawed. Not many people understand the principles that govern chance and how these processes play out in decisions for radiation safety. The normal processes for safety decisions can lead to mistaken judgments and technically inappropriate reactions for radiation safety (consider reactions following Fukushima Dai-ichi).

Health physicists have long been puzzled and often frustrated about how people can make instant decisions regarding radiation with little or no actual data. Studies in psychology show that our ability to make instant decisions for safety is a part of how our brains are wired for our protection. We are programmed to fear first and think second. We have survived by this innate ability to foresee dangers and take protective actions accordingly. Instant prediction of danger is not something we do consciously by evaluation of facts or circumstances. This is done by our subconscious mind which functions as a superfast computer processing all incoming signals by associations with images and experiences in our memories. Thus we are programmed for instant response without any conscious thought. While this instinct for safety is important for our survival, it is also prone to substantial errors for some dangers, such as radiation. There are at least 15 or more ways that our subconscious is prone to errors relative to the actual circumstances.

My studies are showing that even professionals with technical understanding are also prone to errors. This can be demonstrated by the question, "Are your sources of radiation safe?" An instant answer to this question can only come from the subconscious because a conscious evaluation of data takes time to process. Also, when asked, "How do you know?" the answers invariably come down to beliefs in what we have heard or read about radiation safety. Out subconscious mind is prone to running ahead of the facts to draw coherent conclusions from a few scraps of evidence. Subconscious impressions then become the basis for instant decisions and long term beliefs about radiation.

PEP 3-D

Overview of NRC Regulations in 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Materials. "

R. C. Ragland, Jr., Nuclear Regulatory Commission, Region I Office

The presentation will provide an overview of the NRC Regulations in 10 CFR Part 37, "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Materials." Special emphasis will be placed on new requirements for the development of an access authorization program and procedures, a security plan, implementing security procedures, coordination with local law enforcement,

development and implementation of a security training program, development of an audit program, response to the identification of suspicious activity, and lessons-learned/experience gained from NRC Implementation. The target audience includes individuals who are responsible for developing, maintaining, or overseeing a 10 CFR Part 37 security program.

PEP 3-E

Excel: Tips and Tricks for the Health Physicist
A. Wilding

The course will focus on the use of spreadsheet programs in the performance of health physics related calculations and activities. Main focus will be the use Microsoft Excel but additional insight into the use of non-spreadsheet alternatives (such as R / R Studio) will be explored. Areas to be covered will include advanced spreadsheet functions such as pivot tables and data consolidation techniques as well as the extension of Excel capabilities using visual basic and other add-in applications

PEP 3-F

Air Monitoring in Nuclear Facilities – Part 3
J.T. Voss, Los Alamos National Laboratory

Hands-on use of Air Sampling and Air Monitoring Equipment Including Analysis Methods and Algorithms
• Calibration equipment is provided to demonstrate how the air samplers and monitors are calibrated
• Various air sample filters are used in the hands-on demonstration
• Air sample filters are counted and airborne concentrations are calculated
• Various sample analysis methods and algorithms are demonstrated

Air sampling pumps demonstrated are rotary vane, centrifugal, diaphragm, and ejectors. Air sample flow controllers such as throttling valves, mass flow controllers, critical flow orifices, and pinch valves are demonstrated. Air sampling rate meters such as dP gauges, mass flow meters, and rotameters are demonstrated.

Detection Levels, Interferences, and Limitations
The uncertainties in reference standards are explored, including standard calibration sources, decay correction for radioactive sources, ingrowth for radioactive sources, reproducible placement of the standard calibration sources in proximity to the detector. The uncertainties in the device to be calibrated are explored. The effects of background count rate, sample count time, and detector

efficiency are explored. Interferences in the detection device are explored. All pertinent interferences and uncertainties are explored. Methods of determining the limitations of the measurements are explored.

PEP 3-G
Archival Systems for Managing and Organizing Radiological Data
B. D. Fisher, Argonne National Laboratory

Archival systems are an efficient tool for managing and organizing radiological data, but not everyone has the time to maintain and check the quality of information stored in the system. This program will discuss guidance for large sets of data and information. It will provide recommendations for designing the framework of an archive system, with a focus on maintaining data quality through evolving standards; techniques for developing metadata and linking data; and how to address incomplete data sets. What interpolation or error statistics should you apply, when you suddenly discover that your data is missing information, and you can neither retrieve nor repeat the data collection? The program will provide scenarios, and conclude with the various ways to present radiological data to stakeholders in addition to confidence building methods for information that results from sets of data.

PEP 3-H
Non-ionizing Radiation: An Overview of Biological Effects and Exposure Limits
B. Edwards, Vanderbilt University

This course provides a fundamental overview of non-ionizing radiation (NIR) hazards and biological effects. Course attendees will learn the basic terminology and nomenclature, spectral region designations, regulatory framework, and consensus guidance associated with NIR. The course material will begin at the edge of the ionizing part of the electromagnetic (EM) spectrum and walk participants through a tour of the optical, radiofrequency (including microwave), and extremely low frequency (ELF) portions of the EM range, finally ending with static electric and magnetic fields. The existence of a series of exposure limits covering the entire NIR spectrum forms one of the course's basic themes. This continuous line of "safe" exposure levels helps establish the concept that NIR dose response curves are at least well enough understood at all parts of the spectrum to provide a reasonably safe exposure envelope within which we can operate.

After completing this course, attendees will be conversant in the major sources and associated hazards in each part of the NIR spectrum, along with the recognized exposure limits and control measures for those sources. Armed with this information, safety professionals can better recognize, evaluate, and communicate the hazards associated with the spectrum of significant NIR sources, and address workers' concerns in a credible, fact-based, knowledgeable, and professional manner. While some knowledge of optical, radiofrequency, ELF, and static electromagnetic field characteristics may be helpful, both experienced and novice health physicists with NIR interests or responsibilities will benefit from this course.

Monday, 12:15 – 2:15 PM

M-1

The Neutron – It's Discovery and Application

J. 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.

M-2

Radiation Safety's Role in Mitigating the "Insider Threat" Risk

R. Emery, The University of Texas School of Public Health

While organizations maintain many layers of controls to prevent outsiders from gaining unauthorized access to cause loss or harm, persons who have been granted legitimate access can become an "insider threat", and because they are very difficult to detect, cause over $100 billon is losses annually. Although the typical insider targets assets or data, in some cases their actions can also have significant impacts on workplace and environmental health and safety. Because much of an organization's radiation safety program activities are carried out with the workers in their workplace, this represents a unique opportunity to assist in the possible detection of insider threats. This presentation will discuss the threats represented by insiders and will detail their recognized traits so that radiation safety professionals can enhance their situational awareness and report suspicions to the appropriate authorities.

M-3

How Randomness Affects Our Decisions for Radiation Safety

R. Johnson, Radiation Safety Counseling Institute

As health physicists we understand that radiation is a random phenomenon. We also understand that our practice of ALARA is to minimize the future random chance of cancer. Thus, dealing with randomness is a normal part of our practice as specialists in radiation safety. Unfortunately, most of the rest of the world wants to deal only with absolutes and does not want to know about uncertainty or probabilities. Most people want specific answers to questions such as, "Am I safe or not safe?" "Will I be harmed or not harmed?" Most people do not want to hear about risk estimates. When presented with a probability of cancer as a risk of one out of some number of those exposed, they will often conclude that they are the one. Or, not understanding risk probabilities, they may substitute an easier

question, such as, “How do I feel about getting cancer?” This is a question they can readily answer without any knowledge of radiation science or statistics. This approach eliminates any concerns for randomness or probabilities. Everyone knows of someone who has had cancer and they are aware of the horrible consequences. The prospects of radiation causing cancer become an overwhelming influence on decisions for radiation safety. Our natural human instincts for safety are not well suited to situations involving randomness or uncertainty. Thus, while people may not be certain about the risks of radiation effects, they are certain that they do not want to become a victim of cancer.

How do people make judgments and decisions when faced with imperfect, incomplete, or uncertain information? Research has shown that when chance is involved, people’s thought processes are often seriously flawed. What are the principles that govern chance, the development of ideas about uncertainty, and how those processes play out in decisions for radiation safety? We will look at how we make choices and the processes that lead us to make mistaken judgments and poor decisions when confronted with randomness and uncertainty. When information is lacking, this invites competing interpretations. Unfortunately, misinterpretation of data may have very negative consequences. How often is past performance a good indicator of the future? The human mind is built to identify a definite cause for each situation and it can have a hard time accepting the influence of unrelated or random factors. According to Mlodinow, “Random processes are fundamental in nature and ubiquitous in our everyday lives, yet most people do not understand them or think much about them.” This PEP session will explore the role of chance in the world around us and how chance affects our decisions for radiation safety.

M-4

Radiation safety instruments for emergency responders – what responders need and how the instruments are used

P. A. Karam, NYPD Counterterrorism

There are currently far more radiation detectors in the hands of emergency responders than there are in the hands of radiation safety professionals, but the health physics community, in general, just isn’t familiar with the people who are using these instruments, how the instruments are being used, or what emergency responders need – what does a firefighter need, for example, when responding to a radiological emergency compared to a cop involved in an interdiction mission? Not to mention the fact that information gathered by cops might be used for evidentiary purposes. In this PEP we’ll first take a look at the people who are using radiation detection instruments in an emergency response capacity and will then look at their various missions. From there we’ll go on to see what characteristics might go into making a good instrument for this category of users and how they can be used effectively.

M-5

Performing Depositional Studies in Sample Lines with Deposition Calculator, Version 1

B. Blunt, Blunt Consulting LLC

Deposition Calculator is an object oriented software package that is used to estimate losses (deposition) of particulate material in sample lines. This software package was written as a replacement for Deposition 2001A. ANSI N13.1-2011 requires that a sample transport system be designed such that depositional losses of a 10 micron AED particle is less than 50%. The Deposition Calculator can be used to estimate the losses of any size particle, or a particle distribution and thus demonstrate compliance with ANSI N13.1-2011.

This course discusses the uses of Deposition Calculator and will delve into the studies included in the software package as they relate to sample line design and performance. Additional topics will include the mechanisms of depositional losses, bend calculations, flow related decisions made by the software, and methods for modeling a shrouded probe. The course will also discuss the limitations of the software and the models. The student will leave the class with a much better understanding of the subject of depositional losses and how to best use the available software to estimate such losses in sample transport systems. Deposition Calculator Version 1 will be supplied to each student.

Tuesday, 12:15 – 2:15 PM

T-1

Nanotechnology and Radiation Safety

M. 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. 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.

T-2

Estimating Patient Peak Skin Dose from DICOM Information for Fluoroscopically Guided Interventional Procedures

C. Martel, Philips Healthcare

The current method generally accepted method for assigning peak skin dose to patients during fluoroscopically guided interventional

procedures uses the cumulative air kerma displayed at the fluoroscopy console. However, limitations with this approach result in significant underestimates and overestimates of actual peak skin dose. Underestimating peak skin dose can result in missed skin reactions. Overestimating peak skin doses can result in increasing healthcare costs and burdens to patients and staff when patients are asked to return to the clinic for observation. The DICOM file available from fluoroscopic systems that employ Radiation Dose Structured Reporting provides information that can be used to estimate peak skin dose. Examples of calculating peak skin dose estimates using DICOM files will be presented.

T-3

A Contemporary Approach to Managing Low-Level Radioactive and Mixed Waste at an Academic Institution

M. J. Zittle, University of Washington

Management of low-level radioactive and mixed waste at academic institutions is challenging due to the small quantities and wide variety of wastes generated. These organizations are often non-profit or government funded and it is critical to maintain regulatory compliance while minimizing disposal costs, despite the unpredictable and often unreasonable cost of waste disposal.

This course will present waste management strategies for various waste streams and processes including sanitary sewer disposal, decay-in-storage, bench top treatment, minimization techniques and waste processing services, as well as the EPA mixed waste conditional exemptions. This course emphasizes the importance of training generators and utilizing process knowledge, accurate sample analysis, standard operating procedures, and quality assurance to efficiently manage radioactive and mixed waste.

The presenter recently overhauled the course to include an updated broker/processor directory, a variety of new recycling and disposal options, and case studies of waste disposal challenges and successes. Participants with low-level radioactive or mixed waste disposal challenges are encouraged to bring detailed descriptions of their waste for discussion of disposal options.

T-4

Understanding Ionizing Radiation Carcinogenesis

O. G. Raabe, University of California-Davis

A comparative evaluation is described for two types of radiation carcinogenesis. Ionizing radiation induced cancer from internally deposited radionuclides is analyzed with data from human studies for Ra-226, and from laboratory animal studies for alpha radiation associated with Ra-228, Ra-226, Ra-224, Pu-238, Pu-239, Th-228, Cf-252, Cf-249, and Am-241 and for beta radiation associated with Sr-90, Y-90, Y-91, and Ce-144. Intake routes included ingestion, inhalation, and injection.

Cancer induction risk associated with protracted ionizing radiation exposure is observed to be a rather precise function of lifetime

average dose rate to the affected tissues rather than a function of cumulative dose. The lifetime effects are best described by a three-dimensional average dose-rate/time/response relationship that competes with other causes of death during an individual's lifetime. At low average dose rates the time required to induce cancer may exceed the natural lifespan yielding a lifetime virtual threshold for radiation induced cancer.

In sharp contrast the Atomic Bomb Survivor Studies display a somewhat linear relationship of proportionality between increased lifetime solid cancer rates and acute ionizing radiation exposures. Resolving this paradox involves the conclusion that two completely different carcinogenesis mechanisms are associated with these two types of exposures to ionizing radiation. These are induction of cancer in the case of protracted exposures and promotion of carcinogenic processes in the case of single acute exposures.

T-5

Elements of Credibility for Professional Health Physicists

R. Johnson, Radiation Safety Counseling Institute

As professionals in radiation safety perhaps one of our most cherished attributes is our credibility. But, what is credibility? Is it trustworthiness, honesty, truthfulness, faithfulness, admiration from others, reliability, dependability, integrity, reputation, status, or believability? Our credibility probably has all of these elements and more. Our peers may judge our credibility according to how we are introduced as a speaker. Introductions often include information on our employment, service to the profession, college degrees, publications and awards, etc. The chances are that we have devoted a large part of our career to developing our technical expertise and credentials for credibility. While such efforts may establish credibility with our peers, how credible are we with members of the public, especially those who have concerns for radiation safety or health effects? Will technical or professional credentials suffice for public credibility?

Despite many years of education and professional experience, many health physicists are challenged about how to achieve credibility with the general public. Our best efforts to convey the “truth” about radiation safety (as we understand it) have apparently not changed the public’s sentiments about radiation. Generally members of the public would seem to be as concerned and afraid of radiation today as they were after the bombs in Japan. If we are telling the “truth” why aren’t we believed? One of the elements for public credibility may be how well we can accept the public’s dismay and fears about radiation. This can be especially difficult when their fears do not seem to have a rational technical basis. Perhaps it would be helpful to remind ourselves that, “ the public may not care how much we know, until they know how much we care.” Do we care? Yes, deeply, but how will others know? We might begin by letting people know that it’s OK to be afraid of radiation. While technical expertise is crucial for credibility, so also may be our ability to identify with public fears. Some of the tools for achieving public credibility could include active listening (hearing and reflecting feelings), asking questions (rather than giving answers), providing opportunities for people to answer their own questions, and giving non-defensive responses. These and other options will be explored. This PEP will also look at how people determine truth and judge credibility.

Wednesday, 12:15 – 2:15 PM

W-1

Internal Dosimetry Developments from 1949 to 2016

D. J. Strom, Dade Moeller & Associates

Standard Man was born as an adult at the 1949 Tri-Partite Conference held at Chalk River, and has evolved through variations of Reference Man into today's 'reference family' and 'reference hermaphrodite." Although much work had been done on ingestion intakes of radium prior to 1949, and considerable attention had been given to intakes of radionuclides during the Manhattan Project, this conference was the formal beginning of the concepts, quantities, and units of the "dosimetry" of "internal emitters," as radionuclides in the body were called in the old days. This PEP class covers some history as well as applications and computations associated with radionuclides in the body (as opposed to on the body or outside of the body). The progress in ICRP Publication 130 (2015), with the additions of the NCRP wound model, the ICRP Human Alimentary Tract Model (HATM), and the revised Human Respiratory Tract Model are presented, as are the new digital phantoms, and the very unscientific decision to average men and women.

A brief discussion of the history of radon and thoron decay products is presented, along with the ICRU's latest foray into that field. Medical dosimetry (MIRD), dose reconstruction for compensation programs like EEOICPA, and dose reconstruction for radiation epidemiology are briefly discussed. The class emphasizes the fact that for assessment of external irradiation we do personnel dosimetry for individuals, but for assessment of internal irradiation we do dosinference (or worse, doswaggery) not on an individual, but on Reference Man. Except perhaps for tritium and the alkali metals like 40K and 137Cs, so-called internal dosimetry does not provide the dose you got and will get, but the dose Reference Hermaphrodite would have gotten had ½(he) + ½(she) inhaled, excreted, or carried a given activity, conditional on the models being correct. Course participants will be directed to numerous resources on internal dosimetry on the Internet.

W-2

Uses and Misuses of Dosimetric Terms in Patient Radiation Protection

C. Borrás, Radiological Physics and Health Services Consultant

According to the Linear Non-Threshold Dose Hypothesis, all radiation doses carry risks. To minimize them, the International Commission on Radiological Protection (ICRP), introduced many years ago the principles of practice justification, protection optimization and dose limitation, and defined the dosimetric terms: equivalent dose, effective dose, committed dose and collective effective dose. Although all these terms are based on mean absorbed dose, they cannot be measured directly; instead they are inferred using operational quantities defined by the International Commission on Radiation Units and Measurements (ICRU). To determine external exposure, ambient dose equivalent, H*(10), and directional dose equivalent, H'(0.07, Ω), are used for area monitoring; and personal dose equivalent, Hp(d), is utilized for individual monitoring. Compliance with dose limits can be ascertained with the use of properly-worn dosimeters. To link the

protection and operational quantities to physical quantities which characterize the radiation field (such as tissue absorbed dose, air-kerma free-in-air and particle fluence), the ICRU advises the use of computed conversion coefficients. To assess internal exposure, the ICRP recommends the use of activity quantities in combination with dose coefficients based on physiological models and 4-D computations. The unit for all the ICRP and ICRU quantities listed above is the sievert (Sv); doses are assumed to be well below 100 mSv, and thus, only stochastic effects are considered. At doses above about 0.5-1 Sv, where tissue reactions (deterministic effects) may occur, the dosimetric quantity to use is the absorbed dose in the irradiated tissue modified by the radiobiological effectiveness of the radiation for the biological endpoint of concern. The unit is the gray (Gy). Exposures in radiotherapy are clearly expressed in absorbed dose to the irradiated tissue,and exposures in medical imaging should be expressed also in this way. Yet, many publications use the term 'patient effective dose' instead, ignoring the huge uncertainties incurred when applying population risks to individual patients. Effective dose was meant to be used in planned exposure situations to show regulatory compliance with dose limits and constraints for workers and the public. It is applied to a reference person - the terms wR and wT used in its computation are derived averages over age and gender from large populations - and it was never intended to provide a measure of risk to individuals. That measure can be assessed only by determining organ doses, a task which is not trivial.

Current methods of organ dose calculations, like placing external dosimeters such as TLD or OSL on the patient's skin, making measurements in physical phantoms which simulate patients, and performing Monte Carlo radiation transport calculations using mathematical phantoms, not only are time-consuming but also they have large uncertainties. The question is whether we need to assess individual risk in order to optimize patient protection. If the goal is not to assess risk, but to reduce it, dose-related machine parameters can be measured easily and compared against previously-established diagnostic reference levels (DRLs). The ICRU recommends the following determinations: For radiography/fluoroscopy, use incident or entrance air-kerma, and for computed tomography, use CT air-kerma (or dose) index, CT air-kerma (or dose) length-product and more recently, CT size-specific dose estimate.

This course will focus on the definition and determination of quantities and units used for radiation protection in the medical field, and those which are acceptable for patient dosimetry.

W-3

A Forgotten Nuclear Accident -- Bravo
C. Sun, U.S. Nuclear Regulatory Commission

This presentation is 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 1, 1954, the Bravo detonated. Since then, Bikini has never been the same -- space and the

people. The catastrophic event resulted (1) from unpredicted weapon yields and (2) from the nuclear debris and fallout reached to the east of many inhabited Atolls.

BNL scientists played an important role in 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 including whole-body counting, urinalysis and LLNL's environmental and diet/intake studies. Finally, the presentation summarizes and analyzes the operational activity as lesson learned that could be applied and implemented to modern emergency planning and accident preparedness.

W-4

Setting up and operating a radiation instrument calibration facility for a major law enforcement agency

P. A. Karam, NYPD Counterterrorism

Over the last decade emergency response agencies have purchased a tremendous number of radiation detectors for use in both interdiction and emergency response capacities. Although the radiation safety community recognizes the value of annual instrument calibrations, the cost of doing so can be prohibitive for those with large numbers of instruments. In addition, the training received by most emergency responders does not include radiation safety or instrument calibration. Yet the benefits of setting up and operating an in-house calibration facility are undeniable. This PEP describes the path taken by one such agency, culminating in establishing and operating an instrument calibration facility for a major city police department. Included in this presentation will be a description of the instruments that are being calibrated, the physical space and equipment used, ALARA considerations, training police officers to calibrate instruments, and developing procedures aimed at meeting all regulatory requirements while allowing for the most efficient use of time and resources.

We will also discuss the calibration goals, including the possibility that instruments must be able to meet both regulatory and evidentiary performance standards; and the fact that ANSI standards are not always consistent with these requirements – and in some cases, do not cover some particular instrumentation needs. Finally, we will discuss some of the additional work performed in our calibration laboratory (including testing new instrument designs), and some possible expansions of our role in coming years.

W-5

Overview of Nondestructive Assay Systems

J. 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.

Thursday, 12:15 – 2:15 PM

Th-1

Developing radiation safety materials for emergency responders - recognizing what they need to know and communicating it effectively

P. A. Karam, NYPD Counterterrorism

Emergency responders are involved in interdiction missions every day and they must also be prepared to respond to any sort of radiological event – not only the terrorist attacks we all worry about, but even relatively minor events such as vehicular accidents involving radioactive materials. It's only fair to the responders to teach them about the potential risks they might be exposed to, in addition to trying to alleviate whatever fears they might have. At the very least, it's important for responders to understand how to keep themselves safe – and how to recognize when they are in potential danger. Unfortunately, there is only a limited amount of time available for training – this makes it important to get the most utility out of every training session, and also means distilling a huge body of knowledge down to its fundamentals – and finding a way to present it that will stick with the students. In this PEP we will discuss what the responders really need to know and will review some ways to present this information – written and verbally – to help communicate the most important knowledge to the responders. In addition, we will discuss how to augment this basic training for more advanced students.

Th-2

CAP88 PC Version 4 Topics

R. J. Rosnick, U.S. Environmental Protection Agency

This lecture is an introduction to the CAP88 version 4 code, including what it does, how it does it, the models and equations used behind the scenes, how and where to download, install, and run the code, the file types and where the files would be located, etc. Also included (for more advanced users) is how to correctly interpret output reports and error logs, how to modify input files (including population files), and a more detailed explanation of the limitations of the CAP88. This course would be intended for a novice or new user, although more experienced users could also benefit from the background information.

Th-3

Developing a Laser Safety Program – Where does a Health Physicist Begin and How do you Establish a Program from Scratch?

R. P. Harvey, University of Buffalo

The health physicist has a diverse role and may engage in many different disciplines. One of those arenas may encompass non-ionizing radiation and the safe use of lasers. Health physicists have traditionally focused on radiation protection from ionizing forms of electro-magnetic radiation and may have limited knowledge in laser safety. An individual in this situation may need guidance and tools to develop a laser safety program from its foundation. This course will attempt to provide guidance and methodology to establish a laser safety program at any organization.

Th-4

Decay Chain Calculations, A Primer

D. 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 a 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. 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.

Th-5

A Million Ways to Fill a Bottle

R. Jones, Pacific Northwest National Laboratory

A well-rounded internal dosimetry program contains several important elements. Within the Department of Energy complex, most of these elements are heavily assessed as well as accredited. One of the least discussed, yet arguably the most critical part of an internal dosimetry program is determining who to sample. As the nuclear workforce ages and legal remedies for illness have been tested, a growing need is developing to provide defendable answers on an individual basis to the question: “why didn’t I get a sample.” This presentation will cover methods of integrating an internal dosimetry program into radiological work planning in order to determine how people are selected for radiobioassay sampling. Also covered is the evolution of the Pacific Northwest National Laboratory’s approach from within the Hanford program to an independent service over the last generation. In addition, the presentation will provide a high-level review of the internal dosimetry program at the Pacific Northwest National Laboratory, as a separate entity from the Hanford site. Be prepared to interact with the speaker and each other.

Continuing Education Lectures

Monday

CEL-1
Strategies for Keeping Your Radiation Safety Program on Course in a Sea of Constant Change
R. Emery, University of Texas School of Public Health

The University of Texas School of Public Health recently conducted a straw poll of approximately fifty very experienced safety professionals (inclusive of health physicists) and the results were astonishing: 80% had reported to the person they current report to for a period of less than 5 years, and 25% for a period of less than 1 year! These striking results underscore the old adage that "change is constant". But adapting to change is not something that is traditionally addressed in our academic preperation. Interestingly, although change is indeed constant, the underlying data that drives radiation safety programs doesn't change. What does change is the framing of the delivery of this important information to ensure continued program support. This presentation will discuss the dilemma of constant change and provide some tips on the personal management of change and will present options to consider for communicating essential information to the ever-changing environment.

CEL-2
Five Tools for Effective Responses to Workers, the Public, and the Media
R. Johnson, Radiation Safety Counseling Institute

Most health physicists have had extensive education in the technology of radiation safety and perhaps little in the area of risk communication and dealing with upset people. One of the reasons many of us choose health physics is because we like the technical challenges. And then we discover that from day-to-day people issues may demand more of our time and energy, and that we may not be well prepared for dealing with such issues. To help HPs better deal with people issues, this lecture will present five simple tools to consider when addressing radiation risk concerns of workers, the public, and the media. These include 1) Active Listening, which is a response that reflects the content and feeling of another person's message. In many cases when another person's feelings are really heard, their upset goes away. 2) Asking questions, rather than giving answers. When we give answers, which we are technically trained for, we may discover that others will discount our answers, or that we are actually answering the wrong questions. 3) Providing opportunities for others to answer their own questions. People have a vested interested in their own answers. 4) Staying non-defensive, recognizing defensiveness and deciding to throw back marshmallows when others are throwing rocks. 5) Options on what to say, when you do not know what to say, or what you might think of saying may cause more difficulties. Each of these tools will be presented with examples. Attendees are encouraged to bring at least one scenario to this CEL where one of or more of these communication tools may be applied. Time will be allowed for practicing these tools during this lecture, however, skill in the use of

these tools will only come from continued practice.

CEL-3
Current uses of radiopharmaceuticals in nuclear medicine therapy
M. Stabin, Vanderbilt University

A variety of radiopharmaceuticals are used in nuclear medicine therapy. The use of radioiodines to treat thyroid diseases and P-32 to treat polycythemia vera [Ferreira et al. 2007] (which is no longer in use) were established decades ago. Development and investigation of new agents is always progressing; an important issue, however, is clinical acceptance of new therapies that are intended to replace existing therapies. Resistance to change can cause difficulties in sustaining new products, as the approval process for new drugs is quite expensive, and poor market performance has caused distribution of some very good agents to be discontinued. Nonetheless, some very effective new agents have been developed recently, and the future of radiopharmaceutical therapy is bright. In this talk, we will overview the existing agents and their application. We will also review how implementation of patient-individualized dosimetry for these therapies is needed to optimize the effectiveness of these agents; at present this is not a common practice.

Tuesday

CEL-4
NORM/TENORM: HISTORY + SCIENCE + COMMON SENSE = ???
W. E. Kennedy, Jr., Dade Moeller & Associates

Since the early twentieth century, beginning with the search for domestic sources of radium, it has been understood that rock formations contain primordial concentrations of naturally occurring radioactive materials (NORM). NORM includes the radionuclides associated with the uranium or thorium decay chains, and Potassium-40. These sources are all around us to some degree in rocks and soil. They are of primary concern during mineral resource recovery, where human actions modify the NORM concentrations or isotopic distributions, creating technologically enhanced NORM (TENORM). Sources of NORM/TENORM span many human activities, including: using clay for production of bricks or ceramics; mining waste from extracting rare earths or other metals such as aluminum; using heavy casting sands which potentially contain thorium; purifying drinking water, which can concentrate radium or uranium in waste; and recovering oil and gas, which can produce large volumes of TENORM waste. Most recently, there have been news reports and concerns about TENORM waste issues associated with application of newer oil and gas recovery technologies, using horizontal drilling coupled with hydraulic fracturing. The major radiation protection concerns of NORM/ TENORM are protecting workers, members of the public, and the environment similar to any activity involving radioactive materials, with one important difference: there is no Federal guidance for NORM/TENORM waste management – the regulatory

authority lies with the States. Individual States are left to cope with emerging NORM/TENORM radiation protection issues on an ad hoc basis with little scientific support. As a result, State guidance and regulations vary greatly. A harmonized approach would be most beneficial. We are currently at the confluence of history, science, and common sense. This continuing education lecture will provide an overview of NORM/TENORM issues, with an eye to developments which may shape, or reshape, future industrial applications.

CEL-5

Herbert M. Parker (1910-1984): Laying the Foundations of Medical and Health Physics

R. L. Kathren, Washington State University at Tri-cities, Richland

This presentation chronicles the life and legacy of Herbert M. Parker and how his contributions have impacted the parallel professions of medical and health physics. In 1938, after six highly productive years in Manchester, England, during which he codeveloped a revolutionary cancer radiotherapy treatment system that bears his name, Parker accepted an invitation to come to Swedish Hospital in Seattle to research supervoltage x-ray therapy for cancer. Four years later, at the urging of Simeon Cantril, he joined Clinton Laboratories at Oak Ridge, serving as head and principal architect of the health physics organization and as the principal architect of the program there. Subsequently he was personally selected by Arthur Holly Compton as the best possible choice to cope with the extraordinary problems associated with plutonium production at Hanford Pu production site to which he transferred in the summer of 1944. Here, Parker developed a highly successful radiation protection program that included included the first DAC, derived for plutonium, and new quantities and units for physical and biological dose that live on today in the form of the gray and sievert. After WWII, he was instrumental in creating and managing the Hanford Laboratories whose contributions to health physics, radiation biology and environmental protection, achieved world reknown. He personally made numerous important contributions across the entire spectrum of health physics, often through the many committees on which he served, including prescient contributions in the areas of radioactive waste management, dosimetry, standards, and environmental protection. His his many honors include the HPS Distinguished Scientific Achievement Award and the AAPM Coolidge Medal and he is the only health physicist to grace the cover of the national magazine Business Week.

CEL-6

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

M. 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.

Wednesday

CEL-7

Twelve Barriers to Effective Radiation Risk Communication

R. Johnson, Radiation Safety Counseling Institute

Communication specialists have identified twelve barriers or roadblocks that could interfere with our best efforts to provide helpful information to persons concerned with radiation risks. These roadblocks are called the "dirty dozen" (as defined by Dr. Thomas Gordon) and they represent our typical approaches to communications. Thus, the use of any of these approaches is not about right or wrong, but whether our normal approach opens or closes the door for further dialogue. People with concerns for radiation risks usually want their concerns (feelings) heard and to know their concerns are understood and appreciated. Feelings are an element of every communication, especially involving risks or safety. Technical people, such as specialists in radiation safety, may often miss the feeling dimension of risk communication and focus only on the technical aspects for which they have training and experience. It may seem that other person's concerns for radiation are misguided and our response may be to attempt to straighten out their misunderstandings of radiation. Would you agree that pointing out another person's errors of technical understanding may not be the best way to open a dialogue? This approach is only one of the following dozen that will be described in this lecture, including:

1. Ordering, directing, commanding
2. Warning, threatening, promising
3. Moralizing, preaching, giving shoulds and oughts
4. Advising, giving solutions, suggestions, and answers
5. Teaching, lecturing, giving logical arguments
6. Judging, criticizing, disagreeing
7. Praising or agreeing
8. Name calling, labeling, stereotyping
9. Interpreting, analyzing, diagnosing
10. Reassuring, sympathizing, consoling
11. Probing, questioning, interrogating
12. Withdrawing, distracting, humoring, sarcasm, diverting.

The common factor in each of these twelve approaches is that they all miss the feelings of the other person. We might want to remind ourselves that ***"People may not care how much you know, until they know how much you care."*** We will explore how each of these twelve approaches could be barriers that interfere with radiation risk communications.

CEL-8
Overview of Federal Resources Available for Response to a Radiological/Nuclear Accident or Incident
K. Groves, FHPS

This presentation will review those resources that the Federal Government either provides or funds to support local, regional or state entities in the event of a radiological/nuclear accident or incident. Most are provided by the Department of Defense through NORTHCOM, the Department of Energy through the NNSA's Office of Emergency Operations, and the Environmental Protection Agency's Radiological Emergency Response Team. Other Federal Agencies also provide support, including the Department of Health and Human Services through the Centers for Disease Control and Prevention, and the Department of Veterans Affairs. Federal funded State resources include the National Guard's Weapons of Mass Destruction Civil Support Teams in each state and territory. While most emergencies are local and local assets need to be able to respond in the early phase; two of the Federal response teams can respond to assist within hours; they are the DOE's Radiological Assistance Program (RAP) teams and the State's Civil Support Teams (CSTs).

Thursday

CEL-9
Communicating radiation safety information to the public, the media, and other non-health physicists
P. A. Karam, NYPD Counterterrorism

Let's face it – most of the people we meet or communicate with don't understand radiation and are inclined to be frightened of it. And a surprisingly large number of scientists – including health physicists – either try to avoid speaking to the public or to the media or they don't do a good job of communicating what they know in a manner that the public is able (or willing) to absorb. As a result, the radiation-related stories that come out tend to be dominated by people who are either not terribly knowledgeable about radiation or who have an agenda to push. We need to do better. In this PEP, we'll discuss some of the Do's and Don'ts of communicating radiation information to the public, drawing upon Andrew Karam's experience working with members of the media in over 100 interviews. We'll also discuss some factors to keep in mind when developing graphics for showing the public, whether for use in video interviews or for your own blog or website.

CEL-10

Radiation Dosimetry as Part of an Integrated Radiation Protection Program

C. A. Potter, S. H. Goke, Sandia National Laboratories

Radiation protection programs are designed to provide engineered and administrative controls that prevent workers from receiving unnecessary radiation dose, whether from an external radiation field or from radioactive material that individuals may have taken internally. Radiation dosimetry programs are frequently designed with the objective being to assess and report doses to management and ultimately to regulating bodies. While this one of the important reasons for having a dosimetry program, it does not result in the possibly more important goal of preventing additional exposure following uncontrolled contamination or generation of a radiation field.

A radiation protection program can work more effectively if rather than considering workplace control and dosimetry separate tasks, the design is around defense in depth. In this paradigm, the first line of defense is the understanding of the radiation sources and the worker's procedures, including those invoked following the identification of an anomaly that could cause exposure. The second line of defense would be the periodic radiation survey program that identifies unaddressed contamination and external fields. The third line of defense is the dosimetry program.

An effective dosimetry program is well-integrated into the radiation protection program. Under normal operations it is a quality assessment on the effectiveness of the radiation survey and workplace control processes ensuring that there are not unidentified losses of control. Under abnormal operations where contaminations or exposures have occurred, it helps with recovery by identifying exposures that have occurred or are continuing and evaluating the significance. This CEL will describe experience at Sandia National Laboratories on how program integration is achieved and how feedback is looped into the workplace control process to ensure that unnecessary exposures are minimized.