HPS PEP Abstracts

Annual Meeting Cleveland, 2018

SUNDAY 15 July 0800-1000 Timeslot

PEP 1-A

CAP88-PC Version 4.1 Update

Brian Littleton and Ray Wood

The EPA is preparing a new release of the CAP88-PC model, version 4.1. This new release updates the existing version 4.1 with new data and includes some small modifications to the user environment. This course will help users of the CAP88-PC model to understand the changes in the new version relative to previous versions, describe the bases for the model, and instruct users on proper use of the model for regulatory compliance. The course will include descriptive presentations about the model along with demonstrations on using CAP88-PC version 4.1 for specific types of scenarios. Additional information on future update paths and regulatory approaches will also be presented.

PEP 1-B

Status of ANSI N42 RPI & HSI standards

Morgan Cox

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

This section includes the discussion of some seventeen ANSI N42 standards for Radiation Protection Instrumentation (RPI) in effect, being revised or being combined, including those for performance & testing requirements for portable radiation detectors, in ANSI N42.17A for normal environmental conditions and in ANSI N42.17C for extreme environmental conditions, being combined; and now published ANSI N42.323A/B, for calibration of portable instruments over the entire range of concern, i.e., in the normal range and for near background measurements; performance criteria for alarming personnel monitors in ANSI N42.20; replaced airborne radioactivity monitors in ANSI N42.30 for tritium, ANSI N42.17B for workplace airborne monitoring, ANSI N42.18 for airborne 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 is being revised; reactor emergency monitoring in ANSI N320 is being revised; quartz and carbon fiber personnel dosimeters in ANSI N322; installed radiation detectors in ANSI N323D needs to be updated and revised; ANSI

N42.26 for personnel warning devices; radon progeny monitoring in ANSI N42.50 in development; and radon gas monitoring in ANSI N42.51.

The newly published ANSI N42.54 standard combines the salient materials for airborne radioactivity monitoring from ANSI N42.17B, ANSI N42.18 (airborne only), ANSI 323C and ANSI N42.30, with the comprehensive title of “Instrumentation and systems for monitoring airborne radioactivity”.

This section includes the discussion of twenty ANSI N42 standards recently developed, being developed, or being revised and updated for Homeland Security Instrumentation (HSI), including those for performance criteria for personal radiation detectors in ANSI N42.32 that has been revised; portable radiation detectors in ANSI N42.33 in revision; 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 revised and published in 2017; spectroscopy-based portal monitors in ANSI N42.38 in revision; performance criteria for neutron detectors in ANSI N42.39, needing attention; neutron detectors for detection of contraband in ANSI N42.40, not addressed; active interrogation systems in ANSI N42.41; data formatting in ANSI N42.42, revised and updated; mobile portal monitors in ANSI N42.43; checkpoint calibration of image-screening systems in ANSI N42.44; criteria for evaluating x-ray computer tomography security screening in ANSI N42.45; performance of imaging x-ray and gamma ray systems for cargo and vehicles in ANSI N42.46; measuring the imaging performance of x-ray and gamma ray systems for security screening of humans in ANSI N42.47; spectroscopic personal detectors in ANSI N42.48; personal emergency radiation detectors (PERDs) in ANSI N42.49A for alarming radiation detectors and in ANSI N42.49B for non-alarming radiation detectors; backpack-based radiation detection systems used for Homeland Security in ANSI N42.53; portable contamination detectors for emergency response in ANSI N42.58 needing some attention; and ANSI N42.60 training for radiological/nuclear initial response, being developed.

PEP 1-C

RadNet Deployable

Michael R. Messer

The RadNet deployable consists of 40 deployable monitoring stations. These monitoring stations are equipped with low and high-volume air samplers, gamma exposure radiation detector, near-real-time satellite communications, GPS and weather station.

These units can be deployed to critical monitoring locations after a radiological incident has occurred or where an imminent threat is encountered. EPA relies on federal, state and local partners to assemble and operate RadNet deployables during a radiological incident. The PEP workshop will consist of an orientation of the RadNet deployable and program followed by an exercise to allow participants to gain hands on experience to build, operate and tear down the deployable monitor.

PEP 1-D

Power Reactor Dry Fuel Storage Neutron Measurements - Practical Applications

Pat LaFrate

ANI Information Bulletin 11-02, Neutron Monitoring, requires nuclear utilities to perform neutron characterizations where significant neutron exposure is a concern, including reactor containments, Independent Spent Fuel Storage Installations (ISFSIs), Dry Shielded Canisters (DSCs) and station neutron sources. The purpose of this evaluation was to determine if the current personnel TLD Neutron Correction Factors (NCFs) were appropriate for worker neutron exposure from Dry Fuel Storage campaigns and neutron monitoring activities.

Objective: Upon completion of this course, students will receive a brief overview of neutron measurement principles using a neutron spectrometer, Tissue Equivalent Proportional Counters (TEPCs), TLDs, and neutron sensitive electronic dosimeters along with some practical examples of neutron spectroscopy and TEPC analyses relevant to health physicists.

PEP 1-E

Non-ionizing Radiation: An Overview of Biological Effects and Exposure Limits

B. Edwards, Cree Inc.

This course provides a fundamental overview of nonionizing 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.

PEP 1-F

Understanding the Legal Concepts for Radiation Litigation – Part I

Raymond Johnson

Plaintiffs in radiation litigation cases will normally file a lawsuit based on a claim of negligence on the part of a radioactive material licensee. To justify a negligence case the plaintiff has to present four elements in a lawsuit**. 1. Standard of Care** – the plaintiff has to establish that the licensee has a duty to protect workers. In other words the licensee is legally bound not to cause an unreasonable risk of harm to workers or others. The question then is, "What is the duty owed?" Is it ALARA? Is it the federal (or state) dose limits? How much radiation can a worker receive? **2. Breach of Duty Owed** – the plaintiff has to show that the licensee failed to implement radiation safety practices, for achieving the duty owed, which resulted in an unacceptable radiation exposure? **3. Proof of Causation -** the plaintiff has to prove that the breach of duty led directly to the damages claimed? This leads to questions, such as, does radiation cause the ailment claimed by the plaintiff? Was the dose sufficient? Was the time sequence proper (taking latency into account)? Could other factors have caused the ailment? Is the ailment more likely than not to have been caused by radiation, i.e. greater than 50% probability of causation? **4. Damages** – legally recognized damages may include: physical pain, emotional distress, economic loss, medical expenses, and loss of consortium. The strategy of the plaintiff's attorney will be to dramatically present the four elements for negligence and appeal to the juror's fears (such as fear of cancer). Typically both the plaintiff and attorney will rely upon popular radiation myths and junk science to justify their lawsuit. They may fail to distinguish between real and perceived risks. Both mythology and perceived risks will be addressed as well as other defense strategies and how to avoid radiation litigation.

SUNDAY 15 July 1030-1230 Timeslot

PEP 2-A

ASTM Standards that Either Directly Impact or Influence Radiation Protection Planning and/or Operations

Ed Walker

This presentation will be in two parts. The first part will describe the organization of ASTM, The different types of standards generated, and the processes that produce consensus standards. This will include a description of the ease of membership in ASTM, the benefits of receiving published standards, and the involvement for any member to participate in the development and approval process for new and existing standards. A brief description of five of the standards committees (out of a total of 140) that have generated standards that either directly impact or are relative to the design, installation, and operation of equipment, systems and operating protocols. The second part of the presentation will describe the sub-committees within the five main committees that generate and maintain the standards of interest for a radiation protection program. A brief description of standards by each subcommittee will be described and how and/or why the radiation protection programs and associated radiation protection professional should incorporate, either directly or by reference, these standards into any radiological facility radiation protection program.

PEP 2-B

Integration of Health Physics into Emergency Response

Stephen Sugarman

In the event of a radiation incident it is essential that the radiological situation is properly, yet rapidly, assessed so that a proper response can be planned. Various techniques can be employed to help gather the necessary information needed. There are many groups of responders that need to be considered such as law enforcement, EMS, fire, and healthcare providers. Most, if not all, of these groups have relatively little understanding of the realistic hazards associated with radiation. It is not always necessary to incorporate wholesale changes to the way things may usually be done in the absence of radioactive materials. For instance, law enforcement officers routinely incorporate stand-off distances when approaching a suspect or other dangerous situation. Firefighters are familiar with the use of protective clothing and respiratory protection. EMS and healthcare providers routinely incorporate contamination control practices – universal precautions and proper patient handling techniques – into their everyday jobs. Coupled with a good event history and other data, health physicists can help to develop a strategy for safely and effectively responding to a radiological event. Support duties can also include assessment of dose responders or patients and assistance with communication issues affecting incident response, medical care, or with external entities such as regulators and the media. As time goes on and more information, such as bioassay or biological dosimetry data, plume data, and other additional data is received the health physicist will be called upon to interpret that data and communicate its meaning to the decision-makers and otherwise advise incident command. It is, therefore, essential that health physicists are able to seamlessly integrate themselves into the response environment and effectively communicate their findings to a wide variety of people.

PEP 2-C

A Forgotten Nuclear Accident -- Bravo
Casper Sun, PhD, CHP

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

BNL scientists, played a important role on the radiological health and medical care of exposed populations funded by the Department of Energy (DOE) for about 40 years. The MIRSP was established for bioassay monitoring and internal dose assessment. The overview will explain the dose assessment methods include whole-body counting, urinalysis and LLNL's environmental and diet/intake studies.

Finally, the presentation summarized and analyzed the operational activity as lesson learned that could applied and implemented to modern emergency planning and accident preparedness.

PEP 2-D

Nanotechnology and Radiation Safety

Mark D. Hoover

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 nanomaterials and advanced manufacturing hazards in the workplace. Case studies of good practice will be presented, as well as experience "from when things have gone wrong". Highlights from NCRP Report 176 on Radiation Safety Aspects of Nanotechnology will be included. Nanotechnology and nanoengineered structural materials, metals, coatings, coolants, ceramics, sorbents, and sensors are increasingly being evaluated and applied in radiation-related activities. Anticipating and recognizing hazards, evaluating exposures, and controlling and confirming protection from risks to safety, health, well-being, and productivity during these activities is essential.

PEP 2-E

Laser Safety for Health Physicists

B. Edwards, Cree Inc.

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.

PEP 2-F

Preparation as an Expert or Fact Witness and Risk Communication – Part II

Raymond Johnson

As a specialist in radiation safety you may be called upon to provide testimony for either the plaintiff or defense in a radiation lawsuit. To qualify as an expert you will need to meet the Daubert Criteria. Namely, your testimony has to be grounded in defensible science, your hypotheses must be testable, subject to peer review, with a known error rate according to existing standards, and generally accepted within the scientific peer community. You will also be challenged on your credentials as an expert in terms of your education and experience directly relevant to the case. Having advanced degrees, such as a Ph.D, or certification as CHP, may not be adequate credentials relevant to a particular case. While someone may be an expert in some area, this does not necessarily qualify them as an expert for the particular elements of a lawsuit. Part of the professional ethics for CHPs is not to practice beyond their area of knowledge and expertise. Opposing attorneys will scrutinize every aspect of your credentials to identify weaknesses that may be used to discredit your expertise. If you do not meet the Daubert Criterial, the opposing counsel may ask the judge not to allow your testimony. As an expert you may be called upon to use tools for effective risk communication to explain radiation risks to attorneys, judges, and jurors. We will review some of these tools in this session as well as what it means to "tell the truth" and elements of credibility for a witness. We will also review tools for counseling upset workers (such as active listening) as a strategy for avoiding radiation litigation.

SUNDAY 15 July 1400-1600 Timeslot

PEP 3-A

Statistics, Uncertainty, and Detection Decisions – a practical review for Health Physics Practitioners

Doug van Cleef

This course presents a quick but thorough review of the basic elements of counting statistics, uncertainty, and detection decisions and their application to radiation detection. In the course of the review, we will review basic procedures for estimating and propagating uncertainty, appropriate sources of reference information for detection system performance, and consensus standards guidance for these practices. The course will include ample time for Q&A to allow attendees to address specific application considerations. The course is two hours in duration and the American Academy of Health Physics will grant XX Continuing Education Credits (course number) for completion.

Objective: Upon completion of this course, students will have a solid working foundation for understanding the principles and applications of uncertainty as it applies to the radiation detection processes.

Who should attend: Experienced technologists who need a review of the current thinking on application of statistics for radiation measurements and reporting, or new technologists seeking a solid, practical introduction to the importance of statistics in radiation measurements. The subject will presented almost entirely from a layman's perspective, so experienced statisticians who are seeking a thorough review of statistical principles might be disappointed in the depth of the content.

PEP 3-B

Where Did This Come From? Lessons Learned from High-Routine Bioassay Investigations Empty

Eugene Carbaugh

This PEP class provides actual case studies of high-routine bioassay measurements and discusses the investigation process, resolution, and lessons learned from each. High routine bioassay results can come from several sources, including normal statistical fluctuation of the measurement process, interference from non-occupational sources, and previous occupational intakes, as well as new intakes. A good worker monitoring program will include an investigation process that addresses these alternatives and comes to a reasonable conclusion regarding which is most likely. A subtle nuance to these investigations is the possibility that a newly detected high-routine measurement might represent an old intake that has only now become detectable. This can result from the worker being placed on a different bioassay measurement protocol, a change in analytical sensitivity, unusual biokinetics associated with highly insoluble inhalations, or lack of a clear work history. As sites close down, the detailed dosimetry records of specific worker exposures are archived, becoming relatively inaccessible, with only summary dose information available. Likewise, the "tribal knowledge" of the site becomes lost or seriously diluted as knowledgeable employees retire or move on. Therefore, it is incumbent upon the site performing a potential intake investigation to thoroughly address the possible alternatives or face the consequence of accepting responsibility for a new intake. The presenter has encountered all of the foregoing issues in the course of investigating high-routine bioassay measurements at the U.S. Department of Energy Hanford Site. The important lessons learned include, 1) have good measurement verification protocols, 2) confirm intakes by more than one bioassay measurement, 3) conduct interviews with workers concerning their specific circumstances and recollections, 4) have good retrievable site records for work history reviews, 5) exercise good professional judgment in putting the pieces together to form a conclusion, and 6) clearly communicate the conclusions to the worker, the employer, and the regulatory agency.

PEP 3-C

Coping with Natural Disasters and Radioactive Materials

Philip Simpkins

Baker Hughes, a GE company (BHGE) operates in 120 countries, with approximately 70,000 employees, generating $23 Billion Combined Revenue with 125 years of experience. At BHGE doing the right thing takes priority over everything else. As a result, Health, Safety and Environment (HSE), Quality and Integrity are built into everything that we do. That includes when natural disasters threaten!

As a Company, we work with radioactive materials, at our bases, multiple jobsites both onshore and offshore, we also have sources in transit and on dedicated marine vessels; this coupled with the people tooling and equipment we have to meet Legal, Client and Internal requirements successfully, means that we need robust procedures, competent personnel and excellent communications between all parties concerned.

This session will look at the problems and solutions associated with using licensed radioactive materials in and around the Gulf Coast States, including the Gulf of Mexico particularly Texas and Louisiana and how as a Company BHGE complies with all of its requirements and responsibilities when natural disasters threaten or strike.

PEP 3-D

Promise and Peril of "Citizen Science" & Anticipating and Adapting to Change within Your Organization

Robert Emery

The practice of radiation safety is actually the convergence of a variety of professional disciplines, thus changes and developments that affect the field can emerge from various sources. This PEP is designed to address two contemporary issues confronting radiation safety program operations. The first contemporary topic covers the promise and peril of "citizen science" and why this matters to radiation safety. The second contemporary topic covers strategies for keeping your radiation safety program on course in a sea of constant change.

Promise and Peril of "Citizen Science" & Why This Matters to Radiation Safety

The proliferation of personal electronic devices has resulted in an exponential expansion in the ability to rapidly gather and disseminate information – some accurate, some not so accurate, and some downright wrong. With virtually every member of the workforce and community now equipped with this technology, the notion of "citizen science" has expanded, wherein citizens and employees can collect and instantly transmit data and information about exposures and situations. While this technique holds great promise as a "force multiplier" to address various concerns, the technique is largely unfiltered and can result in the dissemination of misinformation, apprehension, and confusion. This presentation will discuss the evolution of "citizen science" and how it has changed with recent technological developments and then will provide a series of suggested steps for radiation safety programs to take to proactively address the challenge.

Strategies for Keeping Your Radiation Safety Program on Course in a Sea of Constant Change

The University of Texas School of Public Health recently conducted a straw poll of approximately fifty very experienced health & safety professionals 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 academic health & safety programs. 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.

PEP 3-E

Performing ANSI Z136-based Laser Hazard Calculations

B. Edwards, Cree Inc.

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.

PEP 3-F

Michael Stabin

Dose estimates for radiopharmaceuticals may be established based on data from preclinical (i.e. animal species) or clinical studies (involving human patients or volunteers). This session will describe current approaches in both areas, and show examples. Traditional mathematical model-based anatomical models have now been replaced with more realistic standardized anatomical models based on patient image data and have been incorporated into the software code OLINDA/EXM 2.0. The code employs these anthropomorphic models, the new ICRP human alimentary tract (HAT) model and updated (ICRP 103) tissue weighting factors for calculation of effective dose. Adjustments to traditional dose calculations based on patient-specific measurements are routinely needed, especially in therapy calculations, for marrow activity (based on measured blood parameters or image data), organ mass (based on volumes measured by ultrasound or Computed Tomography (CT)), and other variables. Many interesting radiopharmaceutical therapy agents are currently in use, for thyroid disorders, neuroendocrine tumors, and treatment of bone metastases. Clinical experience, success rates, and management of normal tissue toxicity with many nuclear medicine therapy agents will be reviewed. The need for patient-individualized approaches to therapy will be emphasized. Discussions of relevant release criteria for therapy patients and current issues in radiobiology will be included.

MONDAY 16 July 1215-1415 Timeslot

PEP M-1

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

Thomas L. Morgan, Ph.D., C.H.P.

Executive Director, Radiation Safety Services, Chief Radiation Safety Officer

Columbia University

New York, NY

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

PEP M-2

Ethical Decision Making with Link to Safety Culture & Radiation Safety's Role in Mitigating Insider Security Risks

Robert Emery and Janet Gutiérrez

The practice of radiation safety is actually the convergence of a variety of professional disciplines, thus changes and developments that affect the field can emerge from various sources. This PEP is designed to address two contemporary issues confronting radiation safety program operations. The first contemporary topic covers ethical decision-making and the link to safety culture. The second contemporary topic covers the radiation safety professional's role in mitigating insider security risks.

Ethical Decision-Making Tools for Enhancing Organizational Safety Culture

Recent investigations of several tragic events have repeatedly identified the absence of a culture of safety as a common contributing factor. An organization's safety culture is a collective reflection of individual decisions made by its workforce, each carrying with them ethical implications. Safety culture, good or bad, is the sum product of many individual ethical decisions, yet the notion of ethical safety decision-making is not often discussed. This presentation will describe ethical dilemmas safety professionals can encounter, and how the decisions that are made can impact an organization's overall safety culture. A set of ethical decision-making tools will be presented, along with a suggested path forward for actually improving safety culture within an organization.

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

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.

TUESDAY 17 July 1215-1415 Timeslot

PEP T-1

Radiation Shielding - A Lost Art?

Edward Waller

Is radiation shielding an art that is being lost? Have modern computer resources made is such that non-Monte Carlo techniques for radiation shielding are being lost? Do we always need a voxelized phantom model when a blob of water may well do the job??

This PEP will explore these questions and provide some insight into the evolution of radiation shielding calculations and design. For the health physicist, radiation shielding represents the primary engineered barrier for the prevention of external dose, and is an essential component of any ALARA program. As such, the health physicist and nuclear engineer must work hand-in-hand to ensure the safety of the shielding design. This presentation will briefly review the history of radiation shielding, provide an overview of key concepts related to neutron and gamma radiation shielding calculations an finally discuss applications to a variety of scenarios, including specific examples from medical x-ray facilities, radiation sources and power reactors. The overall goals of radiation shielding will be presented with the intent of providing a general refresher on the importance of radiation shielding. References for this PEP include (but are not limited to) Radiation Shielding, by Shultis & Faw, ANS, 2000; Reactor Shielding for Nuclear Engineers, N.M. Schaeffer (ed.), AEC TID-25951, 1973 and Engineering Compendium on Radiation Shielding, R. G. Jaeger (Editor), Springer-Verlag, 1968.

WEDNESDAY 18 July 1215-1415 Timeslot

PEP W-1

Measuring and Displaying Radiation Protection Program Metrics that Matter to Management

Janet Gutiérrez

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 Professional Enrichment Program (PEP) 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.

This PEP session 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.

The particular topics included have been consistently identified as extraordinarily useful to participants in the highly successful week-long "University of Texas EH&S Academy".

PEP W-2

Radiology Dosimetry: Organ Doses vs Effective Dose

Cari Borrás

The course will focus on the definition and determination of quantities and units used for radiation protection in the medical field, highlighting the problems in patient dosimetry. Although many scientific papers quantify occupational and medical exposures in terms of effective dose, its use in patient dosimetry–where dose limits do not apply–carries large uncertainties. The International Commission on Radiological Protection (ICRP) defined effective dose as a quantity to be used only for occupationally exposed workers and members of the public, where 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 organ or tissue, modified by the radiobiological effectiveness of the radiation specific to the biological endpoint of concern; it is expressed in Gray (Gy). Effective dose 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, as is the case in medical exposures. That measure can be inferred only by determining organ doses. Current methods of organ dose estimations, like placing calibrated ion chambers, diodes, film and/or thermoluminescent or optically stimulated luminescent dosimeters on patients or in phantoms, making measurements in physical phantoms that simulate patients, and performing Monte Carlo radiation transport calculations using mathematical phantoms, not only have large uncertainties, but also they may be very time-consuming. Examples of staff and patient dose assessment in radiological procedures, especially in relatively high exposure modalities such as interventional radiology and computed tomography (CT), will be illustrated. The ability of electronically calculating, displaying, transferring and archiving doses from radiography, mammography, CT and diagnostic and interventional fluoroscopy –with its advantages and caveats–will be explored. The recent 'Patient - Radiation Dose Structured Report', developed by the Digital Imaging and Communications in Medicine (DICOM) Standards Committee, which estimates organ absorbed doses based on individual image acquisition parameters and specific patient characteristics, will be introduced. The Committee on Biological Effects of Ionizing Radiation (BEIR VII) has calculated risks for many organs/tissues exposed to low doses of low Linear Energy Transfer (LET) radiations and ICRP has published new threshold dose values for tissue reactions. With these values, risks to patients can be estimated. However, the real question is whether we need to assess individual risk in order to optimize patient protection. If the goal is not to assess risks, but to reduce them, dose-related machine parameters can be measured easily and compared against previously-established diagnostic reference levels (DRL)s generated for a specific modality and type of procedure. DRL-acceptable dosimetric quantities for projection radiography and fluoroscopy are incident air kerma (Kai), entrance surface air kerma (Kae or ESAK) and air kerma area product (PKA, also called KAP or DAP), and, additionally, for interventional fluoroscopy, reference point air kerma Ka,r. In CT, currently accepted metrics are volumetric CT dose index (CTDIvol), dose-length-product (DLP) and size-specific dose estimate (SSDE). Examples of DRLs for adult and pediatric studies will be presented and discussed.

PEP W-3

The MARSAME Methodology: Fundamentals, Applications, and Benefits

Alex Boerner

Published in January 2009, the "Multi-Agency Radiation Survey and Assessment of Materials and Equipment" manual (MARSAME) was a joint effort between the U.S. Department of Energy (DOE), the U.S. Department of Defense (DoD), the U.S. Environmental Protection Agency (EPA), and the U.S. Nuclear Regulatory Commission (NRC) to aid sites in the clearance of materials and equipment (M&E). The MARSAME manual supplements the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), published in 1997.

As cited in the MARSAME, a variety of M&E can be applied to this process, including (but not limited to) metals, concrete, tools, equipment, piping, conduit, and furniture. The MARSAME methodology is a defense in depth methodology which involves a stepwise approach to material release. The process starts with an initial historical assessment to identify potential radionuclides and radioactive processes that could have impacted the material. After this initial knowledge is gained, Measurement Quality Objectives (MQOs) are developed as a basis to plan characterization and final surveys for material release. Finally, the survey plans and survey implementation results are reviewed against Data Quality Assessment (DQA) criteria developed to ensure that the survey results meet the original objectives.

Flexibility and a graded approach are inherent components of the MARSAME methodology. Because large quantities of M&E potentially affected by radioactivity are present in the United States and abroad, owners of the M&E need to identify acceptable disposition options. Thirteen disposition scenarios are described in MARSAME. If the methodology is appropriately planned and implemented, the benefits of the MARSAME approach include worker and public protection, reduction in the amount of disposed radioactive waste, reuse of materials (resulting in environmental and material sustainability advantages), and cost savings.

This class introduces participants to the MARSAME methodology. It will be an interactive learning environment and (limited) exercise discussions are included. (Please bring a calculator just in case!). During the class, practical applications of MARSAME will be discussed to present how the process can be adapted to release material under a variety of scenarios. Lessons learned from MARSAME implementation will also be discussed.

PEP W-4

A Radiation Grassroots Response Group-Your Responsibility and How to

John C. White

In any major event, National and even State resources can take some time to marshal and be effective. During that critical early period, it is essential that local responders have the ability to use equipment and contact Subject Matter Experts already present in the local area. In a major Radiological Incident of any type, Radiation Safety professionals will be a critical need. It is essential that the Health Physicist know the local responders and emergency managers, and have a working relationship with those groups. It is also essential that an understanding of local resources is widespread, to be able to bring the maximum capabilities to bear to reduce exposures and manage the response environment. This Lecture presents one such solution to this difficult problem. North Texas is the fourth largest Metropolitan area in the country, but has 143 municipal authorities in a Home Rule State. The North Texas Radiation Response Group was formed to gather and disseminate information, and provide a common meeting event for responders to become familiar with area capabilities, determine equipment gaps, and advance training and radiological response programs in the Metro area. Significant success has been achieved with equipment purchase, training capabilities notification, and face-to-face meetings of those with common purpose.

This lecture will demonstrate the need for your action in your area, and provide you the basic building blocks to organize your own local Group with a focus on radiological response.