National Council on Radiation Protection & Measurements

National Crisis: Where are the Radiation Professionals? (WARP)

July 17, 2013 (workshop)

U.S. Department of Energy / Oak Ridge Institute for Science
& Education
Suite 300
4301 Wilson Blvd.
Arlington, Virginia

July 18, 2013 (writing committee)

National Council on Radiation Protection & Measurements
Suite 400
7910 Woodmont Avenue
Bethesda, Maryland

National Crisis: Where are the Radiation Professionals? (WARP)

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Professional Societies

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AGENDA

NATIONAL CRISIS: WHERE ARE THE RADIATION PROFESSIONALS?

July 17-18, 2013

DOE/ORISE
4301 Wilson Blvd, Suite 300
Arlington, Virginia
&
NCRP Headquarters
7910 Woodmont Ave., Suite 400
Bethesda, Maryland
(Facilitators: Richard Toohey and John Crapo)

Introduction

The community of radiation users, researchers, educators and regulators is concerned about the dwindling number of professionals in practically all areas of radiation. This crisis will continue to worsen as the projected demand continues to increase. There have been individual efforts by professional organizations and Federal agencies to address this loss of expertise in radiation science, but most efforts have been narrowly focused and not coordinated. As the Congressionally chartered organization charged to advise the U.S. government on radiation-related issues, NCRP believes this national crisis must be addressed now and has begun a coordinated, broad-based, and comprehensive effort to define the situation and propose realistic and achievable solutions.

With the acronym WARP (Where Are the Radiation Professionals?), NCRP with support from the DOE is holding a workshop on 17 July 2013 for stakeholders from four affected sectors: federal agencies, professional societies, universities, and the private sector. After a series of brief presentations, each group of stakeholders will convene to discuss proposed ways forward and then report back to the entire group. These reports will form the basis for an NCRP Statement on the "National Crisis: Where are the Radiation Professionals and What Must be Done?"

Wednesday, July 17, 2013 ***(DOE/ORISE)***

7:45-8:15	Registration/Check-in	

Opening Session – A Look Back and Overview of the Current Issues

8:15-8:45	Introductions and Opening Remarks	John Boice
8:45-9:15	Back to the Future	John Villforth
9:15-9:30	HPS Task Force Report and Survey	Kathryn Pryor
9:30-9:45	APS Nuclear Workforce Readiness Report	Lynne Fairobent
9:45-10:00	Break	

Federal Agency Perspectives – Operational Needs and Education Programs (Richard Toohey)

10:00-12:00	Federal Agencies present quad charts (5 min. each)

CDC	Robert Whitcomb
DHS	Mark Wrobel
DOD/USUHS-AFRRI	Chad Mitchell and David Lesser
DOE	Daniel Blumenthal
DOE/HSS	Patricia Worthington
DOE/Office of Science	Noelle Metting
EPA	Alan Perrin
FDA	Michael Noska
HHS/REMM	Julie Sullivan and Judith Bader
NCI	Martha Linet
NIH	Bert Maidment
NRC	Steven Schaffer
White House	Cindy Atkins-Duffy, summary comments

12:00-1:00	Working Lunch and Discussion of Morning Presentations

Professional Society Perspectives - Membership and Education Programs (Richard Toohey)

1:00-2:15	Professional Societies present quad charts (5 min each)

AAPM	Per Halvorsen
ABR	Paul Wallner
ACR	Edward Bluth
ASTRO	Andrew Salner
CRCPD	David Allard
HPS	Kathryn Pryor
NEI	Ralph Andersen
NRRPT	Karen Barcal
RRS	Kathryn Held

University Perspectives – Issues Related to Faculty, Students, Research, Funding, etc. (John Crapo)

2:15-3:00	Universities present quad charts (5 min each)

Health Physics/ABET	Richard Brey, Idaho State
Medical Physics/CAMPEP	Joann Prisciandaro, University of Michigan
Harvard/MGH	Pari Pandhaipande
Institute for Nuclear Security	John Crapo
ORAU/ORISE – NE and HP Programs	John Crapo
Oregon State	Kathryn Higley
University of Pennsylvania	Sydney Evans

Private Sector Perspectives (J. Crapo)

3:00-3:30 Private Sector present quad charts (5 min each)

Dade Moeller	John Fomous
Radiation Safety and Control Services	Fred Straccia
Risk Assessment Corporation	John Till
Mel Chew and Associates	Richard Toohey

Breakout Sessions

3:30-4:30

Facilitators and Questions to be Addressed

Federal Agencies	Daniel Blumenthal
Professional Societies	David Allard
Universities	Richard Brey
Private Sector	John Fomous

Proposed Discussion Questions:

1. What are the current and future employment prospects for radiation professionals across all practice areas/disciplines?
2. What is the mix of education and skill levels needed in each sector (i.e., what level of training is needed for radiation professionals in government, industry, medicine, etc.)?
3. Do current academic programs adequately cover anticipated needed skills such as radiobiology and emergency response? If not, is cross-training of radiation professionals needed and how can it be implemented?
4. How can we attract students into the training programs, especially women and underrepresented ethnic groups?
5. What are potential sources of financial support for education and training programs, including internships and practicums?
6. How can job creation be linked to the training program?
7. What types of cross-training programs are needed for other safety professionals such as industrial hygienists and safety engineers who may have radiation duties?
8. What are key factors to engaging and retaining bright young minds as radiation professionals? What are the primary professions that compete for these people and what are the keys to their success in engaging and retaining them?
9. How can current expertise be “captured” before it “decays” away?

Report Outs, discussion (Richard Toohey) (45 minutes, 15 minutes each to summarize answers)

4:30-5:15

Federal Agencies	Daniel Blumenthal
Professional Societies	David Allard
Universities	Richard Brey
Private Sector	John Fomous

Summary

5:15-5:30

Richard Toohey and John Crapo

Adjourn

Abbreviations

AAPM – American Association of Physicists in Medicine
ABET – Accreditation Board on Engineering and Technology
ABR – American Board of Radiology
ACR – American College of Radiology
ASTRO – American Society for Radiation Oncology
AFRRI – Armed Forces Radiobiology Research Institute
APS – American Physical Society
CAMPEP - Commission on Accreditation of Medical Physics Educational Programs, Inc.
CDC – Centers for Disease Control and Prevention
CRCPD – Conference of Radiation Control Program Directors
DHS – Department of Homeland Security
DoD – Department of Defense
DOE – Department of Energy
DOE/HSS – Department of Energy Office of Health, Safety and Security
EPA – Environmental Protection Agency
FDA – Food and Drug Administration
HHS/REMM – Health and Human Services/Radiation Event Medical Management
HP – Health Physics
HPS – Health Physics Society
MGH – Massachusetts General Hospital
NCI – National Cancer Institute
NE – Nuclear Engineering
NEI – Nuclear Energy Institute
NIH – National Institutes of Health
NRC – Nuclear Regulatory Commission
NRRPT – National Registry of Radiation Protection Technologists
ORAU/ORISE – Oak Ridge Associated Universities / Oak Ridge Institute for Science
RRS – Radiation Research Society
USUHS – Uniformed Services University of the Health Sciences

Thursday, July 18, 2013 ***(NCRP Headquarters)***

Writing Committee/Webinar:

Federal Agencies	Daniel Blumenthal
Professional Societies	David Allard - phone
Universities	Richard Brey
Private Sector	John Fomous - phone

John Boice
Dick Toohey
John Crapo
John Till
Norm Coleman
Judy Bader
Mike Noska
Kathy Pryor
Liana Watson (phone)
Robert Whitcomb
Eric Bernhard
Bert Maidment
Dave Schauer
Others? – All invited to contribute!

8:30-12:30

Re-cap from Session facilitators
Goals and Approaches
Types of training required
Accreditation?
Preparation for NAS participation on July 19, 2013 (National Academy of Sciences study on research directions in human biological effects of low level ionizing radiation) – John Boice, Chad Mitchell, Mike Noska, Dave Schauer, John Crapo

NCRP WARP STATEMENT DRAFT OUTLINE

1. Executive Summary
2. Introduction: a brief history of radiation professional training and needs
3. Current and near-future radiation professional needs
    a. Government
    b. Medicine
    c. Nuclear Power
    d. Research (e.g. radiobiology, epidemiology)
    e. Emergency response
    f. Environmental
4. Current training programs and radiation professional production
    a. Universities (U.S and overseas)
    b. Military services
    c. Alternate training programs/cross-training
5. Possible actions to prevent a shortfall of radiation professionals

    a. Student recruiting
    b. Student support
    c. Student and young professional retention
    d. Professional development programs
    e. Clearing house for positions available
6. WARP recommendations.
7. Appendices
    a. Quad charts by sector
        i. Professional societies
        ii. Government agencies
        iii. Colleges and universities
        iv. Private sector
    b. Other?

Lunch/Adjourn

Celebrate the 50th Anniversary of the Congressional Charter of the NCRP in 1964 as A Nonprofit Organization of Scientists to Address the Needs of the Nation in All Things Radiation

2014 Annual Meeting

NCRP – Achievements of the Past 50 Years and Addressing the Needs of the Future

Kenneth R. Kase, *Chair*

John D. Boice, Jr. & Jerrold T. Bushberg, *Co-Chairs*

March 10–11, 2014

Bethesda, Maryland

NCRP Statement. National Crisis: Where Are the Radiation Professionals? (WARP)

Purpose. To provide a comprehensive plan to replenish the nation's dwindling number of radiation professionals in all areas: government, medicine, private sector, industry, biological and radiation research, epidemiology, emergency response, homeland defense, risk modeling and assessment, regulations, clean-up, military and many associated fields. A nationally-coordinated effort is envisioned to educate, train, engage and retain radiation protection professionals to meet the radiation-related needs of the nation.

Approach. A one day meeting is planned for July 17, 2013 at the DOE/ORISE/ORAU facilities: 4301 Wilson Blvd, Arlington, VA 22203, hosted by DOE. The meeting will be followed by a smaller working group session the next day to draft a five page "statement" with appendices to represent the "business plan" and roadmap on how to move forward with a national effort to meet the nation's human capital crisis. The statement will be circulated to participants for comment and is envisioned to be published as an NCRP document. The issues will be revisited in a year's time to learn whether any impact has come from these efforts and how the approach might be improved.

Areas to Address. Each organization will be asked to make a brief 5-9 minute presentation with 1 or 2 slides maximum describing "mission", "resources and needs" and "wish list". A quad chart is envisioned: who they are, what they do, how they do it, and what their needs are, (and a wish list). There will be breakout sessions and some topics to consider for starters include, but are not limited to:

1. What are the current and future employment prospects for radiation professionals across all practice areas/disciplines?

2. What is the mix of education and skill levels needed in each sector (i.e., what level of training is needed for radiation professionals in government, industry, medicine, etc.)?

3. Do current academic programs adequately cover anticipated needed skills such as radiobiology and emergency response? If not, is cross-training of radiation professionals needed and how can it be implemented?

4. How can we attract students into the training programs, especially women and underrepresented ethnic groups?

5. What are potential sources of financial support for education and training programs, including internships and practicums?

6. How can job creation be linked to the training program?

7. What types of cross-training programs are needed for other safety professionals such as industrial hygienists and safety engineers who may have radiation-related duties?

8. What are key factors to engaging and retaining bright young minds as radiation professionals? What are the primary professions that compete for these people and what are the keys to their success in engaging and retaining them?

9. How can current expertise be "captured" before it "decays" away?

Steering Committee. Eric Bernhard (NCI), Dan Blumenthal (NNSA), John Boice (NCRP), Norm Coleman (NIH), Bert Maidment (NIAID), Charles Miller (CDC), Mike Noska (FDA), Dave Schauer (NCRP), Dick Toohey (Chew Assoc), Bob Whitcomb (CDC)

Timeline: 3 months to indefinite.

ADDITIONAL BACKGROUND INFORMATION AND REFERENCES

Background.

The human capital crisis continues to deepen. Government agencies, radiation societies, universities and the private sector are aware of the shortages but to date there has not been a national effort to provide an overall solution. The stresses faced in addressing the Fukushima nuclear reactor accident brought to light the need for radiation experts (Coleman 2013). The shortage of such experts was brought into vivid focus when the United States was "unable to identify a sufficient number of radiation experts" to satisfy agency-specific domestic needs, participate in the U.S.-based Advisory Team, and still deploy staff to Tokyo (Miller 2012). But the human capital crisis is more pervasive than just emergency response (REMM 2013). There are insufficient numbers of radiation health experts and radiation professionals at a time in history when the uses and exposures to radiation are expanding rapidly in medicine, electrical power generation, weapons development, environmental contamination and remediation (NAS 2013; APS 2008).

There have been and continue to be ongoing initiatives to shore up the dwindling workforce of radiation health professionals. This brief summary is not intended to list them all or to describe the crushing needs. Suffice it to say that there are recognized shortages:

> "The demand for a nuclear workforce for medicine, health physics, and energy is certainly not decreasing. All of these areas are important for national and world security and prosperity, yet their increasing needs come at a time when the nuclear workforce is shrinking" (NAS 2013).

These shortages are seen in medicine (Rosenstein 2009; Mills 2010; Thomadsen 2004); industry (NEI 2013; Ahearne 2012); health physics (HPS 2008, 2010; ORISE 2008; Nelson 2004); emergency response (Miller 2012); government (Miller 2012; NRC 2006) and radiation science (Coleman 2003, 2013). Training programs should be expanded and new programs created (MEIR 2013; ORISE REAC/TS 2013; Navy 2013; NRC 2006, 2013; HPS 2010; NIEHS 2013; DOE 2013). The bench of radiation experts is thin to nearly empty. The pipeline has gone from a gusher in the 1960s to a dribble in 2013.

There need to be jobs waiting at the end of the educational tunnel to retain the educated and trained young professionals of today (Ahearne 2012).

Short Bullets – The Needs of the Many

- *The need increases while human experts are decreasing*. As the need for well educated and trained graduates is intensifying, the enrollments and focused academic and training programs in radiation sciences are declining.
- *Need to maintain leadership*. Well-educated people in science and technology are needed to meet growing needs in government (NRC, EPA, DOE, etc.), medicine, industry, and homeland defense and to maintain the United States as a world leader in radiation science and technology.
- *Keeping the old is only a short term fix*. Engaging and retaining older workers has provided a stop gap measure to meet the nation's needs, but the gene pool of those on Medicare is quickly being depleted.
- *Can agencies meet their responsibilities?* The Nuclear/Radiological Incident Annex (NRIA) to the National Response Framework (NRF) describes the responsibilities of 14 Federal agencies to handle the immediate response and short-term recovery activities for radiological incidents involving releases of radioactive materials and their consequences. The core of radiation experts is depleted and without immediate action the Federal agencies will be unable, hard pressed at best, to fulfill their responsibilities, including Emergency Support Functions (ESFs) (NRIA 2008).
- *4 critical R's.* A human crisis can occur when one of the four Rs is not addressed: Recruitment, Resources, Retention and Retirement (Nelson 2004). None of these are being addressed sufficiently to have much of a future impact. We need to train, engage and retain young professionals now!
- *Go Navy*. There are a number of effective program. For example, the U.S. Navy Nuclear Operations program requires, hires and retains skilled nuclear technicians, power plant operators and subsystems specialists. These hands-on professionals perform the complex technical functions that are at the core of nuclear sub and carrier capabilities (US Navy 2013).

- *DOE Low-Dose Research Program*. As recent events have shown, lack of knowledge is far more expensive than the relatively modest dollar investment to support this Program. "Reducing resources to understand the effects of radiation exposure to humans will inevitably fuel unwarranted public stress and worry. Sustained funding of this successful effort has paid, and will continue to pay, a substantial societal benefit that expands knowledge of low-dose radiation effects and informs public policy" (Barcellos-Hoff 2011).
- *NIEHS and DOE*. The NIEHS Worker Education and Training Program (WETP), in partnership with the Department of Energy Environmental Management Program, has supported qualified domestic nonprofit organizations to develop and administer model health and safety education programs for hazardous materials or waste workers within the nuclear weapons complex (NIEHS 2013).
- *NRC needs and programs*. The NRC continues to be challenged by an aging workforce complicated by substantial increase in new work at a time when senior experts are increasingly eligible to retire. To mitigate the impact of this challenge, the Agency has developed human capital strategies to find, attract, and retain critical-skill staff. Furthermore, the Agency is being assisted in this effort by the Energy Policy Act (EPAct), which authorized NRC to fund scholarships, fellowships, and support grants to universities to partially support nuclear engineering and science programs that contribute to the availability of highly skilled graduates (NRC 2006, 2008).
- *How to meet the changing needs of the nation?* Safety-related radiation training programs that exist for Federal staff to provide regulatory oversight activities continually need to be improved to meet the changing needs of the nation and world circumstances (OIG 2013). The Institute for Radiation Security (University of Tennessee, Knoxville) is an encouraging new initiative (IRS 2013).
- *Even medical physicists are in short supply*. The expanding needs for medical physicists is tied to retirement, the increased incidence of cancer in our aging society, and the new and sophisticated modalities used to treat patients (Mills 2010; Thomadsen 2004).
- *Industry can't expand without professionals*. The U.S. nuclear energy industry will need thousands of workers for the future to replace retirees and to build and operate new nuclear plants (NEI 2010). The federal government also will need nuclear workers in the future in its laboratories, the military and government programs.
- *U.S. is losing intellectual leadership*. "U.S. loss of its intellectual leadership in nuclear science would gravely compromise its ability to capitalize on future discoveries in this critical area of science. It would also negatively impact the U.S. economy and safety as the country would not benefit from new technological developments in the field and would lose workforce trained in nuclear techniques" (NAS 2013).
- *Radiation biologists are diminishing*. Surveys of ASTRO, RRS, ABR, ACGME, ACR and ACRO conclude that programs in radiation biology are sorely "needed to supply future educators for radiation oncology, radiology, and nuclear medicine programs, as well as to supply the radiation biologists needed for many other areas, including translational research related to radiation oncology and mitigation of radiation injuries, diagnostic imaging, regulatory affairs, and homeland security" (Rosenstein 2009).
- *A Manhattan Project for a Radiation Profession Corps?* We need resources to support training, engaging and retaining radiation professionals so that the U.S. can be more resilient in the future. One overarching objective is to be able to respond to emergency needs in the future, scientific needs in the future, regulatory needs in the future, and so many other needs in medicine, environmental remediation, risk assessment, nuclear security and communication. Multidisciplinary cross-disciplinary approaches are needed (INS 2013).
- *The way it was*. There was a golden era in the 1960s and 1970s when the U.S. represented a dynamo of radiation activities with fellowships, training institutes, vibrant national laboratories. We were on top of the world producing the professionals needed for our dynamic society. Those days are gone and we would like to "return to the way it was". "Back to the Future" !
- *The time is now!* Who will address these needs? If not "you", then who? If not "now", then when? It is a national crisis that has been recognized for some time (Nelson 2004) and now is the time to act! Put aside all differences, all fears, all worries, and just go for it – leave a legacy for the future before it's too late. Seize the day and find the funds! A national coordinated effort is needed.

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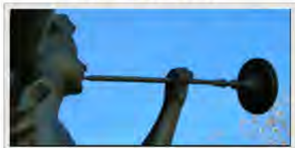
NATIONAL CRISIS: WHERE ARE THE RADIATION PROFESSIONALS?

NCRP

A Clarion Call



- A National Effort is Needed.
- Government, Universities, Private Sector, Military, Clinical – Everyone.

PLANNED WORKSHOP – July

- FDA, CDC, DOE, NRC, NCI
- HHS, DADE MOELLER, MEL CHEW
- RAC, NEI, ORAU, RRS, HPS
- NNSA, NIH, NIAID

National Council on Radiation Protection & Measurements

National Crisis: Where are the Radiation Professionals? (WARP)

July 17, 2013 (workshop)

U.S. Department of Energy / Oak Ridge Institute for Science & Education
Suite 300
4301 Wilson Blvd.
Arlington, Virginia

WARP Goal

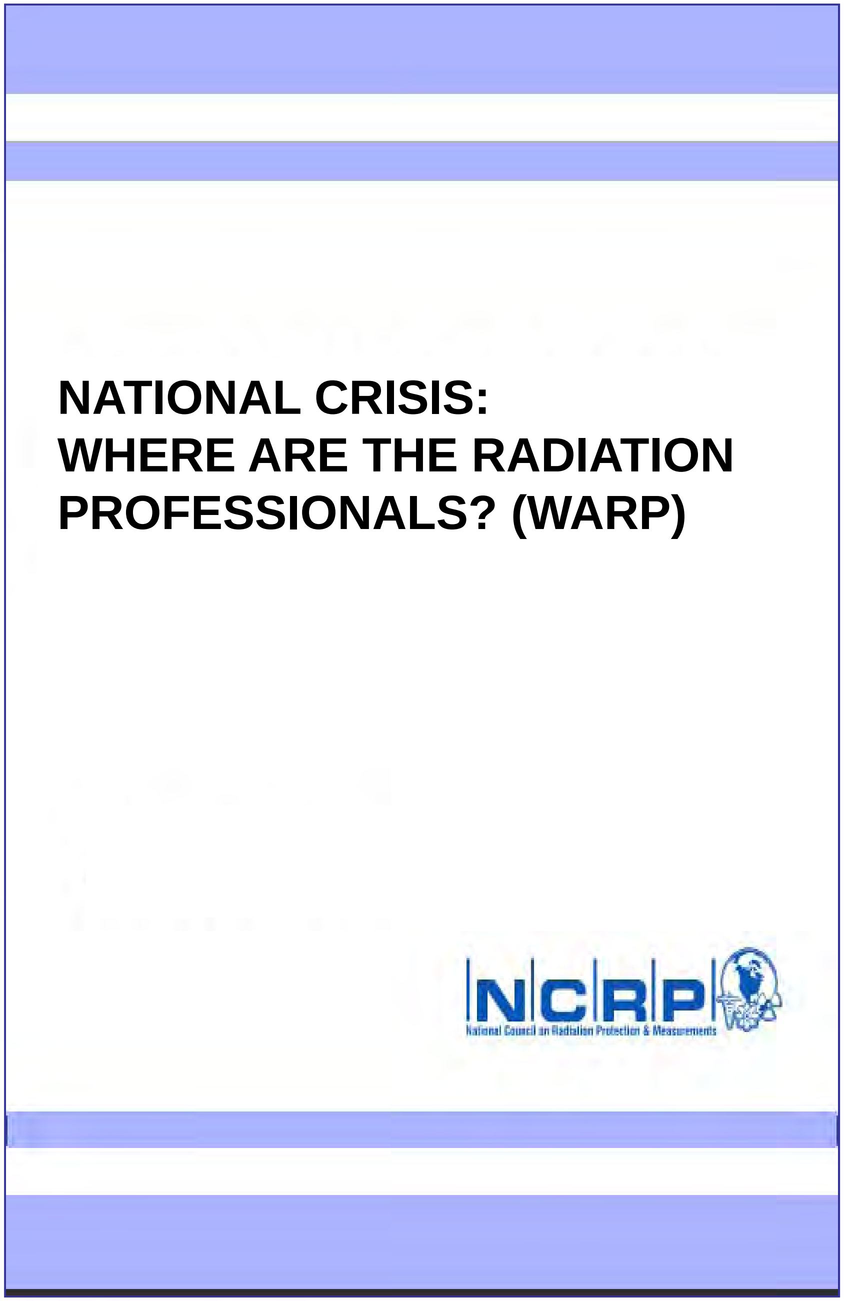
A “Manhattan Project” to replenish the dwindling, if not exhausted, supply of radiation professionals in the United States

WARP Approach

July 17 workshop with representatives from:

- 25 government
- 11 professional societies
- 7 universities
- 4 private sector
- 3 NCRP

- A National Effort



NATIONAL CRISIS:
WHERE ARE THE RADIATION PROFESSIONALS? (WARP)

NCRP
National Council on Radiation Protection & Measurements

A Clarion Call

- A National Effort is Needed.
- Government, Universities, Private Sector, Military, Societies, Clinical – Everyone.

PLANNED WORKSHOP – July

- FDA, CDC, DOE, NRC, NCI
- HHS, DADE MOELLER, MEL CHEW
- RAC, NEI, ORAU, RRS, HPS
- NNSA, NIH, NIAID, many more

WARP Next Step

- Draft document July 18
- Circulate to WARP participants
- NCRP statement approval
- Distribution including multiple journal publications
- Discussions with decision/policy makers
- WARP-ipedia

WARP Follow-Up

- July 19 - NAS Committee on research directions in human biological effects of low level ionizing radiation
- Possible future conference
- Reconvene workshop a year from now – how did we do?
- NCRP presentations or entire Annual Meeting on WARP

WARP Introductions

- Name, rank, and serial number

- Brief be and take a seat !

Back to the Future:

Evolution of Radiological Health Manpower

Presented at the NCRP Workshop, July 17, 2013.
National Crisis: **W**here **A**re the **R**adiation **P**rofessional ?
(**WARP**)

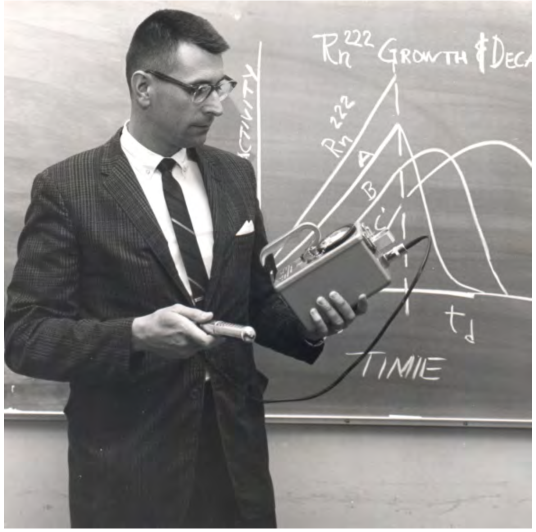
John C. Villforth, Retired Former Director,
FDA's Center for Devices and Radiological Health
240-361-3187 jcvillforth@comcast.net

How I become a "Radiological Health-er"

USAF, 1954-1961: Sanitary & Industrial Hygiene Officer in the Medical Service Corps

-Decontaminating aircraft from fallout; Electron tube disposal;
-Attended USPHS short course training in Basic Rad Health
-Attended USAEC Fellowship Program: Vanderbilt &ORNL , 1956-58
-Assigned to USAF Rad Health Lab, W-PAFB as the first USAF Health Physicist. 1958-61
-- Secretary of USAF AEC materials licensing committee
-- responsible for USAF-wide film dosimeter program.
-- Radar site and microwave evaluation
-- Radiation accident investigation

How I became a “Radiological Health-er”



USPHS, Division/Bureau of Rad Health, Rockville, MD;
1961 -1972

- Nationwide Fallout State surveillance network
- Radioactive materials program, Radium
- Medical and Occupational Radiation Program, including x-rays in healing arts
- Involved in State training program.
- Director of the Bureau of Rad Health in USPHS 1969 and FDA 1972

FDA, Center Devices and Radiological Health **1972 –’90**

Early USPHS Activities in Radiation Protection

- 1922-23 –Effects of Exposure at NBS Radium Calibration
- 1930 - Radium Dial Painters Investigation
- 1943 - Radiation Exposure at 43 Hospitals
- 1944-46 - Photofluorographic X-ray Machines for TB
- 1946 – NIH Animal Studies

USPHS and "Radiological Health?"

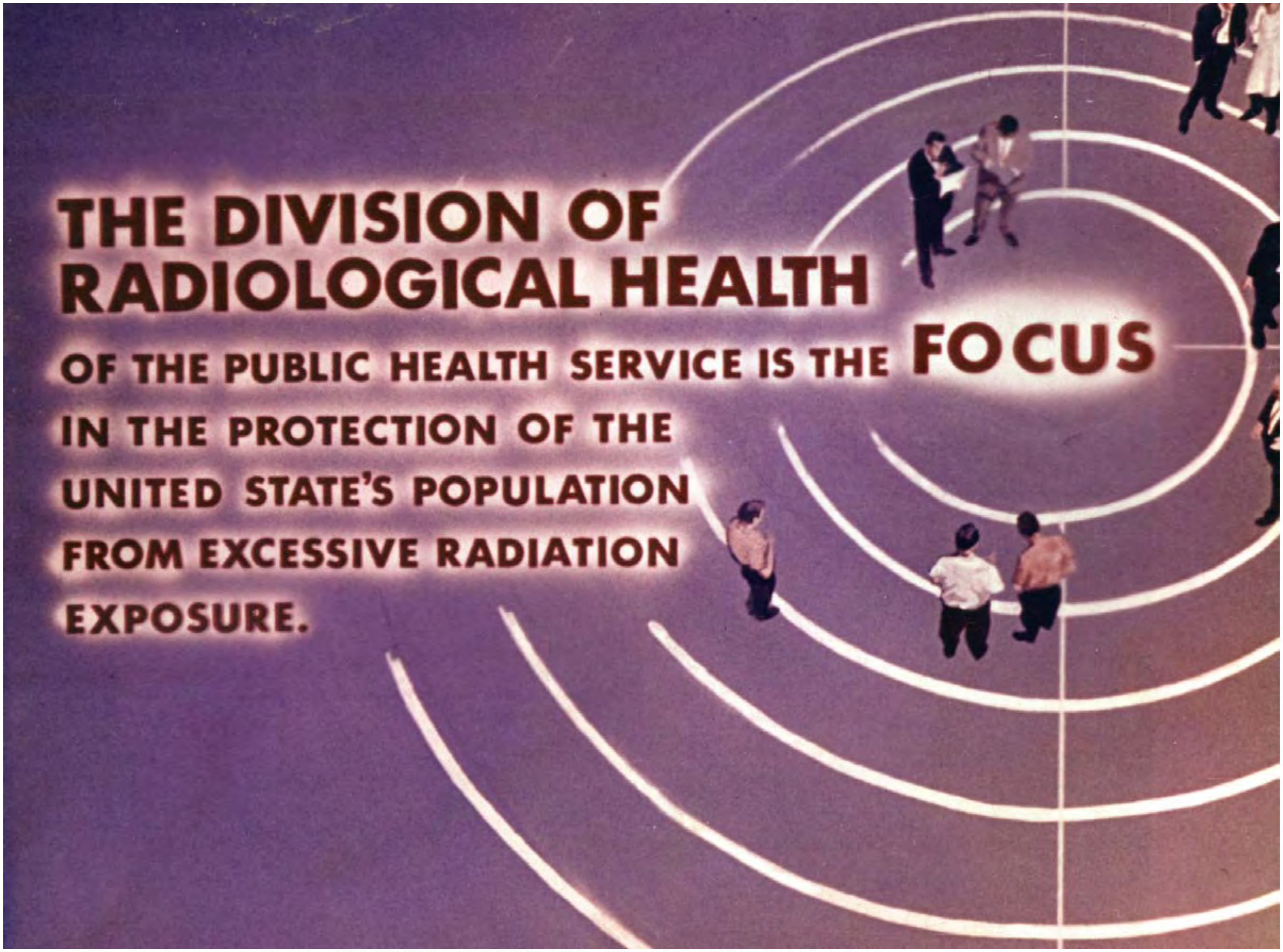
- 1946 - Term "Radiological Health" established
- 1949 - AEC-PHS Cooperative Studies
- 1950 - Radiation Training Program Expanded
- 1952 - PHS Officer Assigned to State HD
- 1953 - Off-Site Monitoring at Nevada Test Site
- 1955 - Assistance to AEC's Naval Reactors
- 1956 - National Fallout Surveillance Program
- 1958 – SG's Established "NACOR"
- 1959 – Fed Rad Council Established by President

Public Anxiety Drove Programs

Stimulants to the Early "Radiological Health Program"

- Hiroshima
- Threat of USSR and the Cold War
- AEC: Regulator or a Promoter?
- Weapons Testing and Fallout
- Uncertainties of the Effects of Radiation
- State Health Departments: On the Front Line
- Public Anxiety becomes Congressional Concern
- Congressional Concern Results in Action Programs

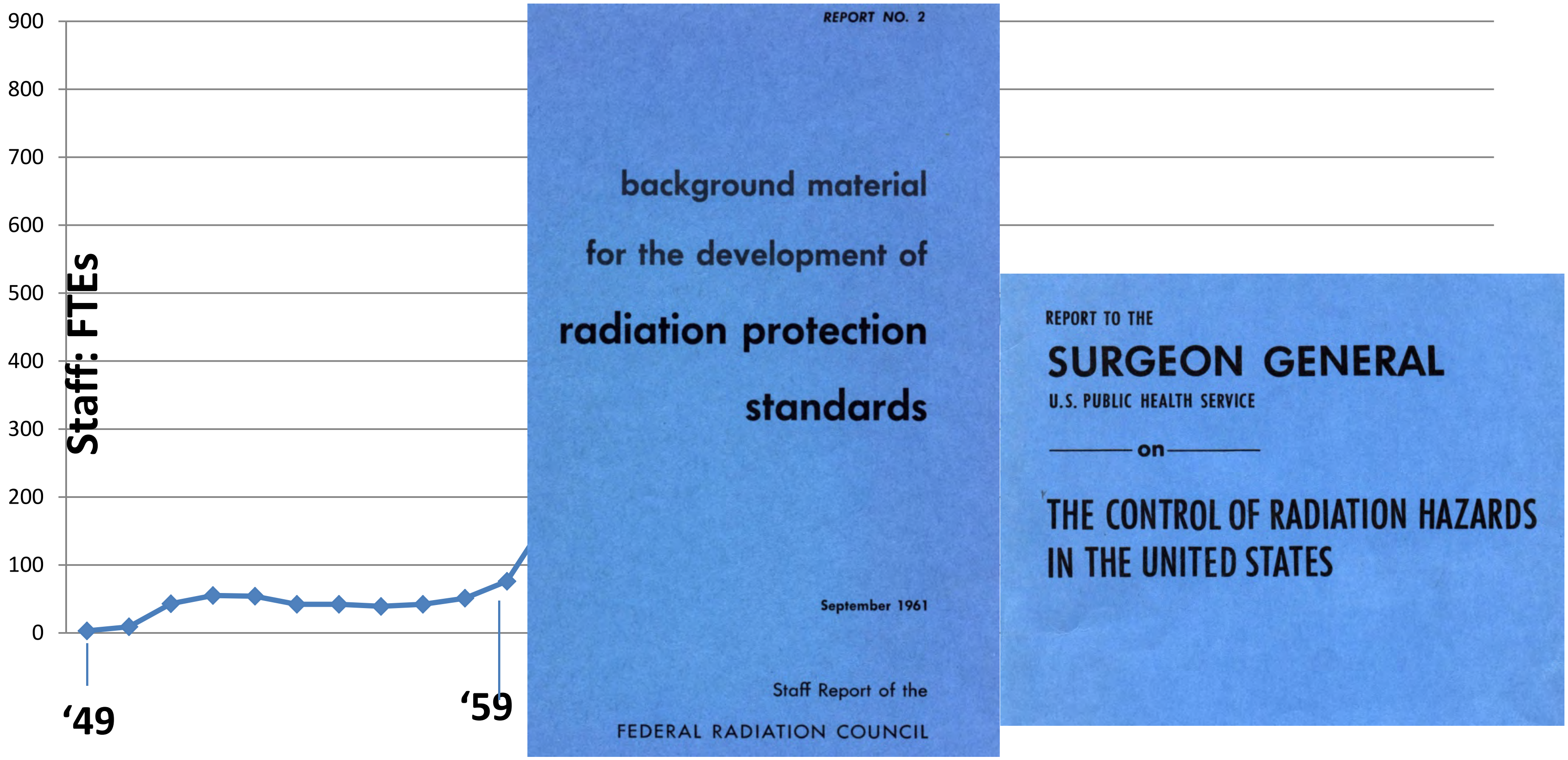
The Division of Radiological Health:
crated by the Department in July 1958



…with these Functions

Radiological Health Manpower

Resources: 1949 through 1959



There Was a Need for Trained Professionals

In the PHS, Government, States & Academia by…

-- Training Grants to Universities (20 to 35 institutions)

-- Research Grants, which also supported students
(20 to 100 institutions)

-- Short Course (1 and 2 week classes)Training
at four Rad Health Facilities: MD, MA, AL, NV
(as many as 100 class weeks per year)

-- On-the-Job Training: Assignment to States, and Reserve
Commissioned Corps

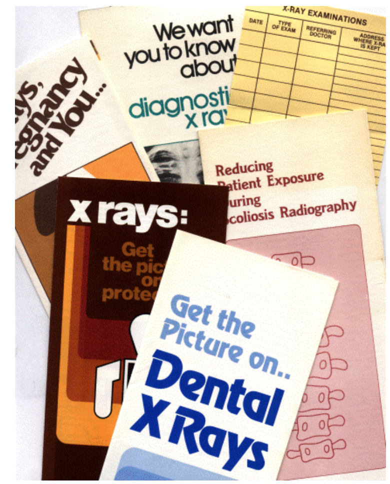
Through the '60s, Public Anxiety was Increasing…

- Color TV sets leaked X-rays – '67

  -Surgeon General advise, "Sit 6' to 8' from a TV"

- Microwaves and Lasers:

  - consumer products

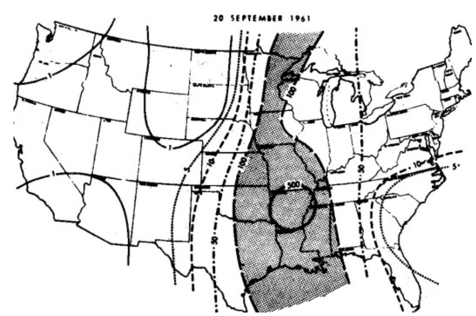


- Medical Radiation:

  -increased use and dose

- USSR Weapons Testing, - '61

  - High altitude, world-wide Fallout - 1961



The Result…

*Rad Health Training Grants, 1962-'72 *

*Rad Health Research Grants, 1962-'82

*Congressional Hearings:

-- Joint Committee on Atomic Energy – Fallout

-- Committee on Commerce, Science and Transport –
Oversight of Radiation Health and Safety

-- Radiation Control for Health and Safety Act , Oct 1968
Control over "Electronic Product" Radiation

*Grants transferred to EPA in 1972

Lets Look at an Example of a Problem…

- 1967 Unnecessary X-rays found in Color TV sets
- Poor Quality Control in manufacturing
- Surgeon General Issued Warning
- Public concerned about Exposure
- Congress held Hearings
- Experts Testified about other Machine Produced

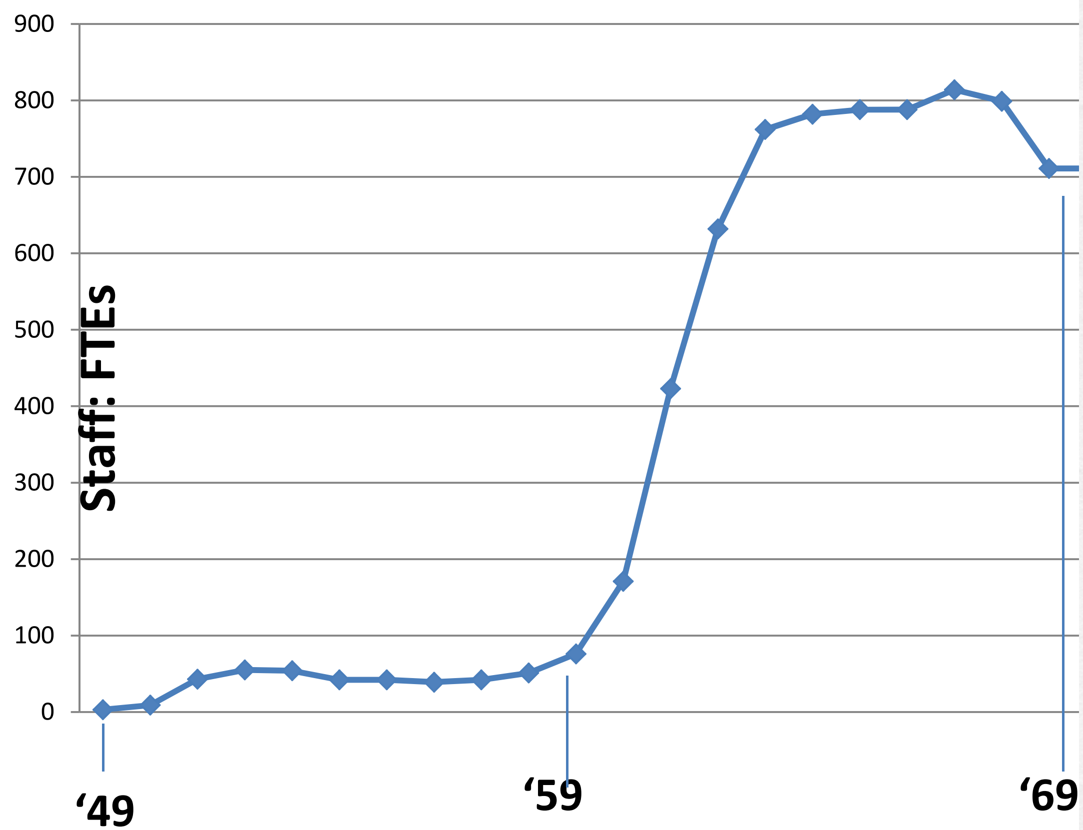
    Radiation; e.g., Lasers, Microwaves, X-rays

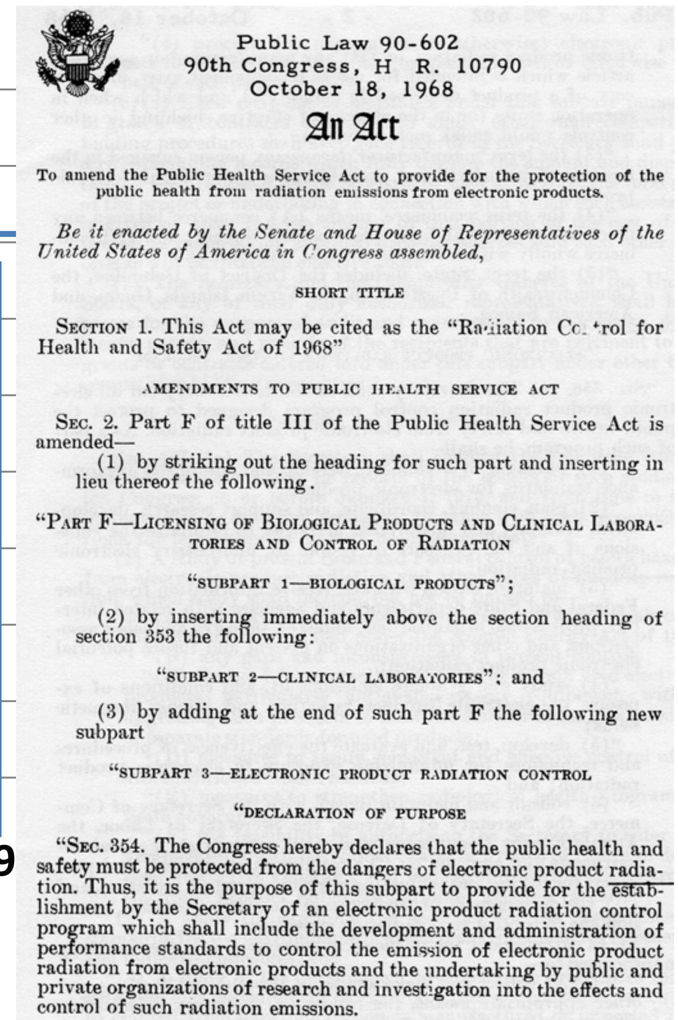
    No Federal Laws regulate these Devices

Congress Passed the Radiation Control Act (Oct 1968) to regulate these devices.

Let’s Turn to the Public Health Service

Radiological Health Resources: 1949 through 1968





Public Law 90-602
90th Congress, H R. 10790
October 18, 1968

An Act

To amend the Public Health Service Act to provide for the protection of the public health from radiation emissions from electronic products.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

SECTION 1. This Act may be cited as the “Radiation Control for Health and Safety Act of 1968”

AMENDMENTS TO PUBLIC HEALTH SERVICE ACT

SEC. 2. Part F of title III of the Public Health Service Act is amended—

(1) by striking out the heading for such part and inserting in lieu thereof the following:

“PART F—LICENSING OF BIOLOGICAL PRODUCTS AND CLINICAL LABORATORIES AND CONTROL OF RADIATION

“SUBPART 1—BIOLOGICAL PRODUCTS”;

(2) by inserting immediately above the section heading of section 353 the following:

“SUBPART 2—CLINICAL LABORATORIES”; and

(3) by adding at the end of such part F the following new subpart

“SUBPART 3—ELECTRONIC PRODUCT RADIATION CONTROL

“DECLARATION OF PURPOSE

“SEC. 354. The Congress hereby declares that the public health and safety must be protected from the dangers of electronic product radiation. Thus, it is the purpose of this subpart to provide for the establishment by the Secretary of an electronic product radiation control program which shall include the development and administration of performance standards to control the emission of electronic product radiation from electronic products and the undertaking by public and private organizations of research and investigation into the effects and control of such radiation emissions.

Ionizing Radiation Staff were Diverted to all aspects of Non-Ionizing Radiations?

- To measure these radiation – in the lab and in the field
- Study the biological effects of these radiations
- To develop standards to minimize the radiations
- To inform the industry what is needed for safety
- Be able to justify compliance and enforcement

Where do you fine find scientists who understand these non-ionizing products and also understands the Public Health consequences of their use?

Dispersion of Federal Radiation Functions

*AEC was split into DoE and NRC

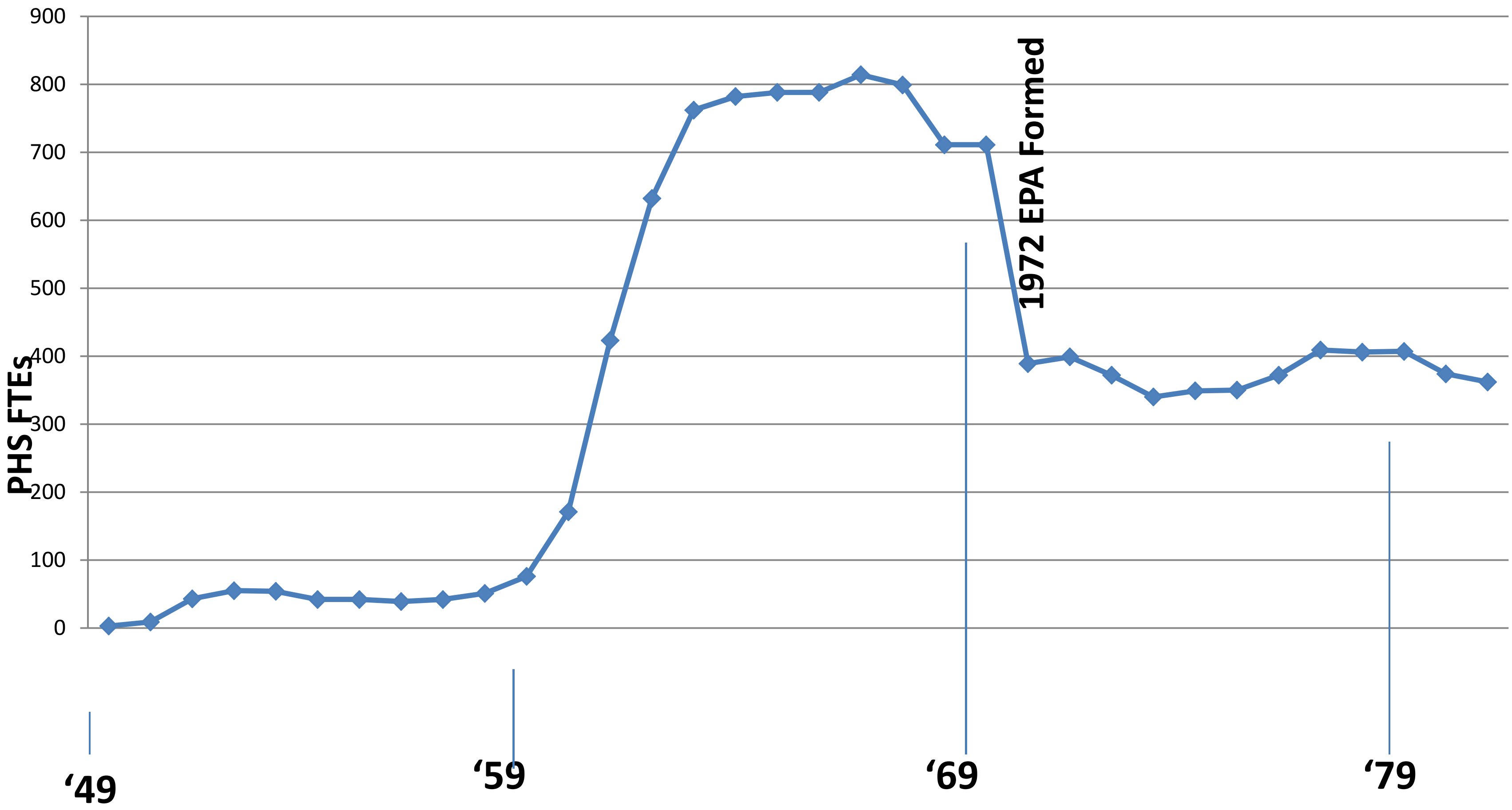
*EPA was formed by Presidential Reorganization 1971

*DHEW Environmental Functions Transferred to EPA (air, water, solid waste and 318 Rad Health FTEs transferred to EPA)

*BRH's remaining 389 FTEs transferred to FDA

The Public Health Service

Radiological Health Resources: through 1980s

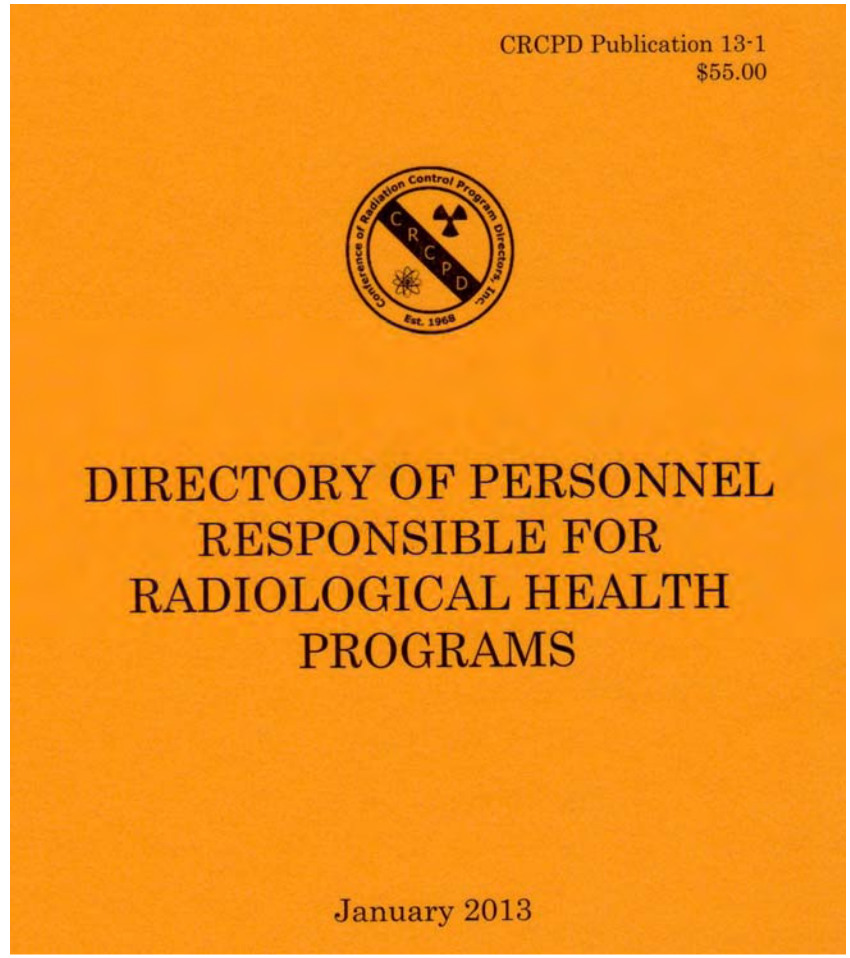


And Then What Happened?

- The regulation of “Electronic Products” (X-rays, Microwaves, Lasers, Ultrasound, etc,) stayed with FDA/BRH.
- FDA Consolidated BRH and Medical Devices into CDRH in 1982
- Medical Device Regulation Absorbed Funds and Manpower from Rad Health
- Historical Rad Health Programs – including Training and Research activities – were not supported.

Good News: State Radiological Health Programs have Carried the Day, but they must be supported.

The first meeting of the State Radiation Program Directors – March 1969, Montgomery, Alabama.



CRCPD Publication 13-1
$55.00

Conference of Radiation Control Program Directors, Inc.
CRCPD
Est. 1968

DIRECTORY OF PERSONNEL RESPONSIBLE FOR RADIOLOGICAL HEALTH PROGRAMS

January 2013

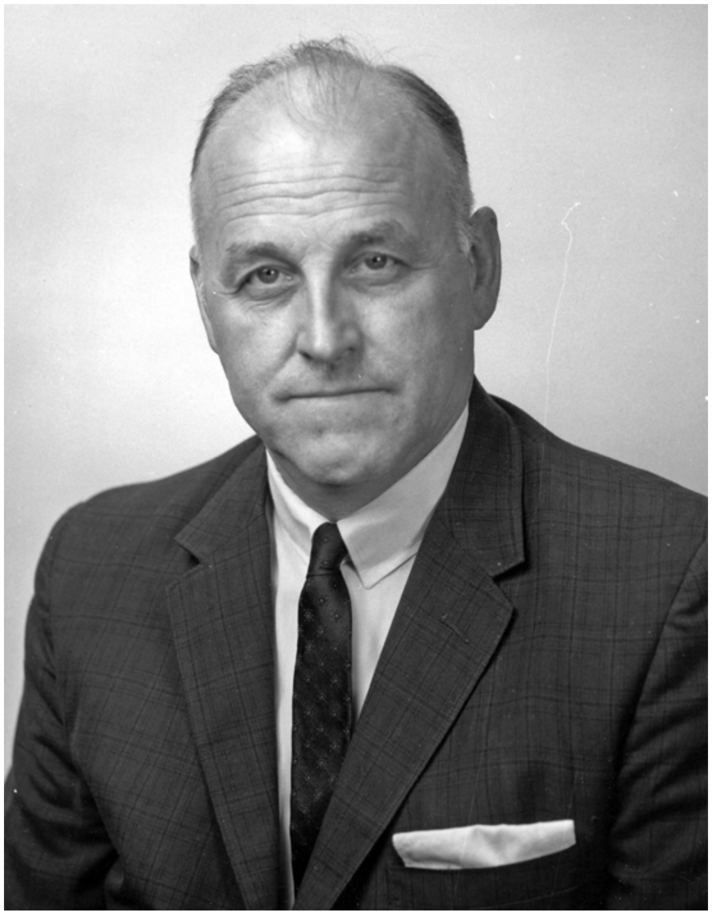
Today, the CRCPD has ~1,000 members representing all the State public health programs including the 37 of the NRC Agreement States

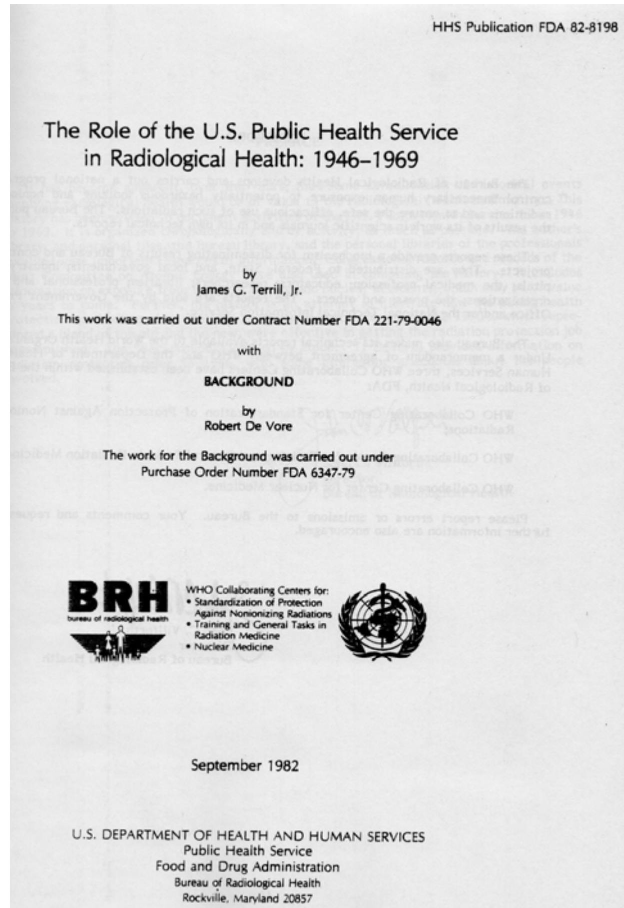
What Has Made all this Work

- The dose-response curve: We could measure it and refine it and produce guidelines
- There is a real fear of the effects radiation
- Being in Radiological Health gave one a purpose, "to reduce the effects of radiation"
- And the Agency had the Tools to make it happen:
  - Laws (Authority)
  - Budget
  - Collaboration with other organizations
  - Radiation Professionals as Leaders

But if we don't have Radiation Professionals, Can we Keep Protecting People?

Acknowledgement: Capt. James G. Terrill, Jr. A leader in Radiological Health and mentor to many of us, wrote the report: “The Role of the U.S. Public Health Service in Radiological Health: 1946 – 1969” which covers the evolution of this program.





HHS Publication FDA 82-8198

The Role of the U.S. Public Health Service
in Radiological Health: 1946–1969

by
James G. Terrill, Jr.

This work was carried out under Contract Number FDA 221-79-0046

with

BACKGROUND

by
Robert De Vore

The work for the Background was carried out under
Purchase Order Number FDA 6347-79

BRH
bureau of radiological health

WHO Collaborating Centers for:
- Standardization of Protection Against Nonionizing Radiations
- Training and General Tasks in Radiation Medicine
- Nuclear Medicine

September 1982

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Food and Drug Administration
Bureau of Radiological Health
Rockville, Maryland 20857

DHHS Publication FDA 82-8198 (Sept 1982)

Radiological Health Manpower as a Possible Model for "WARP"
by
John C. Villforth,
Former Director, FDA's Center for Devices and Radiological Health
NCRP Symposium, National Crisis: Where Are the Radiation Professionals? (WARP)
July 17, 2013

It is appropriate for NCRP to examine the question of "Where are the Radiation Professionals" (WARP) when the potential problems that are facing the professionals are as great now as in the Cold War period. Perhaps some insight into how one important group of radiation professionals was formed and contributed might offer some clues that could be applied to possible solutions. Let's look at the "gusher in the 1960s" as the NCRP pointed out.

The term "radiation professionals" in this symposium title is necessarily broad to includes all specialties involving radiation and in all areas of employment. But the inconclusiveness of the term may be so great that there may not be an easy solution. The National Research Council report (NAS 2013) focuses on the uncertain future of nuclear and radiochemistry expertise, for medicine, health physics and energy in government, industry and academia - a very big order. There is one category of radiation professional that has not been adequately recognized and analyzed - the "radiological health professional". That term was coined in the Spring of 1948 (The Role of the U.S. Public Health Service in Radiological Health: 1946-1969, HHS Publication FDA 82-8198) by a group of PHS leaders, including James G. Terrill, Jr., the Director of the organization that was variously known as the Division of Rad Health (DRH), the Bureau of Rad Health (BRH) and since 1982, as FDA's Center for Devices and Radiological Health (CDRH).

The term radiological health is almost as difficult to understand as health physicist, but in the late 1940s, following the Atomic Energy Commission formation, and during the US weapons testing activities, there was some confusion within the USPHS as to where the public health aspects of radiation protection should be established - in the occupational health program or the environmental health program. The ubiquitous nature of radiation from uranium tailings through weapons resting and fallout to waste releases in materials production was sufficient to place the fledgling rad health program in the environmental health activities of the PHS along with air and water pollution activities.

Nuclear weapons production and testing increased, nuclear power became promising, but the nuclear war always a possibility, so public and press concern increased and Congressional responded with hearings in the late 1950s (hearings by a Joint Congressional Committee) covered radioactive waste disposal, employee radiation hazards, fallout, and the effects of nuclear war. In response, in 1959, the President issued Executive Order 10831 establishing the Federal Radiation Council which, among other provisions, was implemented by the Secretary of the Department of Health, Education and Welfare and called for a substantial increase in the number of persons from Federal, State and local and industrial concerns being trained for work in radiological health.

During the same year, the Surgeon General of the USPHS formed a National Advisory Committee on Radiation (NACOR) which also described an increased need for highly trained radiation health specialists and radiological technicians. The report also pointed out that, "most of the ionizing radiation received by the population today, other than that received from natural sources, has been received from x-ray machines employed by the health professions." This broadened the scope beyond the original concerns over exposure from various radioactive materials. NACOR continued its advice to the Department and in their 1963 report, "...recognized within the Nation an increasingly broad interest in education and research in all the radiological sciences, including the forthcoming study of education in radiological sciences by the national Academy of Sciences - NRC"

The impact of the anxiety of the Cold War and the weapons program plus the recognition of the concern over the medical uses of radiation, as expressed by Congressional hearings, executive orders, and advisory committees put the Departments radiological health program (DRH) into action to provide training for DRH's own staff, State, local and other Federal agencies, on all aspects of radiological health. The result was that short term (one or two week) courses were conducted at four of the DRH laboratories around the country. In 1969 there were 99 class weeks of specialized classes conducted. The USPHS Radiological Health staff increased from 171 FTEs in 1960 to 800 FTEs in 1968. Training Grants were started in 1960 and they increased to 35 grants to universities until 1970 when the program was terminated. Similarly, research grants to universities started in1960 and peaked in 1966 with 104 grants that supported students who were working on these research projects.

The Radiological Health program was given another charge when the Congressional hearing of 1967 and '68, on x-ray exposure from color television set called attention to the fact that there was no Federal agency with authority to regulate electronic products such as laser, microwaves and x-rays. The Radiation for Control for health and safety Act that was passed in 1968 was delegated to be implemented by the Bureau of Radiological Health. One of the provisions of the Act was to, "plan, conduct, coordinate and support research, development, training, and operational activities to minimize the emissions of and the exposure of people to unnecessary electronic product radiation;" But training grants disappeared in 1975 and research grants were down to less than 20 grants and finally disappeared by1990. This was unfortunate because there was a need for trained staff to deal with the effects of the exposure from all aspects of the electromagnetic spectrum and ultra sound.

Concern over the environment and pollution resulted in the 1971 Presidential Reorganization Plan No.3 that established the Environmental Protection Agency (EPA), and all the environmental staff (318 FTEs) and resources in the Department were transferred to that new organization. In that same year, the remaining radiological health program was transferred to the Food and Drug Administration, where they continued to regulate the safety of machine produced electronic products.

In 1976, Congress passed the Medical Device Amendments to the Food and Drug Act and FDA had the responsibility to assure the safety of medical devices. The complexity of that authority put a demand on the FDA for resources, and in 1982 the Bureau of Radiological Health and the Bureau of Medical Devices were merged into FDA's new Center for Devices and Radiological Health (CDRH). Today the resources in the radiological health portion of the FDA are estimated to be less than 50 FTEs and the availability of these staff members to deal with is very limited and there is no opportunity for CDRH to have the resources and support to continue the training and educational in radiological health personnel when new replacements fill the gaps of the retirees.

In the 1960 to 1980 period, the radiological health program was stimulated by the public fear over radiation and this translated to Congressional hearings and legislation. The legislation identified authority and support for educational programs. The Presidents and Department Secretaries amplified the public's anxiety over radiation and during this twenty year period there was hardly a radiological health professional - either federal, state or academic - that did not have some support that did not have some support from the PHs's radiological health program.

WRAP? They are gone and there is no immediate opportunity to fill the gap. But if the scientific and public health community can clarify the concern to the extent that Congress and the public recognize the importance of research and action programs, then maybe - just maybe - there may be support to reestablish some radiological health training.

Health Physics Society Human Capital Crisis Task Force

Kathy Pryor, CHP
Past President, HPS

What's the Problem?

- Need to fill the pipeline with new radiation safety professionals
  - Large number of impending retirements
  - Shrinking academic programs
  - "Nuclear Renaissance" and increased medical use of radiation will require radiation safety professionals
- Task Force formed to study the problem in 2002
  - Chaired by Kevin Nelson, Ph.D, CHP – Mayo Clinic
  - Six representatives from academic institutions, state/federal agencies, health care, nuclear power, DOE national laboratories
  - Develop a white paper on human capital crisis in radiation safety

Approach

- Goals of study
  - Verify current HP manpower status
  - Project future needs for radiation safety professionals
  - Identify ways to meet current/future needs
- Data Collection
  - Used publicly available, non-biased references whenever possible
  - Gathered data on current and future employment needs using a tailored questionnaire
  - HPS academic program directors and ORISE human resources data base provided information on academic program size and funding

HPS

Results

- Confirmed the need for a significant number of new HPs in 2003
  - At least 6700 new radiation safety professionals needed across all employment sectors in the near term
  - Total did not include part-time or consulting HPs
- Need strong, healthy academic programs
  - HP graduates declined 55% in 2002 over 1995 levels
- Stable source of academic funding is critical
  - Virtually no academic funding available from federal agencies in 2003
  - HPS scholarships/fellowships help, but provide limited support

HPS Position Statement

- PS015, *Human Capital Crisis in Radiation Safety*
  - Position: significant financial commitment by Congress and federal agencies is needed to support education of professionals and teachers, research, equipment and scholarships/fellowships
  - PS has been shared with congress and federal agencies on every HPS government relations visit since 2004
  - Basis for HPS's advocacy of NRC's IUP scholarship, fellowship and curriculum development program
  - HPS has helped to generate positive results in funding the IUP program over multiple years
  - PS has not been updated since June 2005

HPS

Current Situation

- HPS is in the process of updating PS015
  - Problem: lack of new data on workforce needs
  - Draft revision is more qualitative in nature
- Academic programs have shown some growth since original 2003 white paper
- NRC has been providing academic program funding through IUP
  - Victim of sequestration and shrinking budgets
- Growth in nuclear power sector has not taken off as quickly as anticipated; impact of plant closures
- Current workforce is not retiring as quickly as expected – poor economy

Readiness of the U.S. Nuclear Workforce for the 21st Century Challenges

A Report from the APS Panel on Public Affairs Committee on Energy and Environment

June 2008

Purpose

- Identify critical shortages in the U.S. nuclear workforce and to problems in maintaining relevant educational modalities and facilities for training new people.

Report Focus

- Report focuses primarily on nuclear scientists and engineers who have at least a Bachelor's degree.

- An assessment of the adequacy of the technician and construction workforces was not a primary goal of the study.

Work Group Members*

- Sekazi Mitingwa, Chair, MIT
- Carol Berrigan, NEI
- Robert Eisenstein, Sante Fe Alliance for Science
- Lynne Fairobent, AAPM
- Darleane Hoffman, Lawrence Berkeley National Laboratory
- Ruth Howes, Marquette University
- Andrew Klein, Idaho National Laboratory
- William Magwood, IV, DOE
- Patrick Mulvey, American Institute of Physics
- Marc Ross, University of Michigan
- Jeanette Russo, APS Office of Puplic Affairs
- Francis Slakey, APS Washington Office

*Affiliations listed were as of writing the report.

Audience for the Report

- The report was intended to be used by:
  - The Executive Branch of the Federal government
  - Members of Congress,
  - State governors and legislators
  - University administrators and faculty, and
  - The physics community at large.

Organization of the Report

- A partial overview of Federal support for university nuclear science and engineering research and education
- A summary of past reports on these topics and on the closely-aligned fields of nuclear chemistry and radiochemistry, and on radiological health physics;
- A discussion on the impacts of DOE's *Innovations in Nuclear Infrastructure and Education (INIE)* program;
- The results of a survey of the needs of those facilities if they are to play a significant role in the U.S. nuclear future;
- A discussion of the status of facilities for measuring fission and neutron-capture actinide cross sections, which are crucial for designing and implementing advanced nuclear reactor fuel cycles;
- Findings relative to the workforce and educational facilities, and their adequacy to meet both public and private future nuclear challenges; and
- A summary and recommendations.

Recommendations –
Focus to Federal Government Action

- Naming a single Federal agency to act as a steward for an ongoing, robust university-based nuclear science and education program.

- Stabilizing the long-term funding and management of nuclear science and engineering education programs, including university-based reactors.

Recommendations –
Focus to Federal Government Action

- Establishing a two-part funding program for university reactors that:
  - Negotiates with universities to provide one-time funding to bring each reactor up to an acceptable level of modernization, and
  - Then provides annual Federal funding to maintain that level.

- Helping to establish a two-year nuclear technician training program at community colleges to meet future nuclear workforce needs.

- Helping to establish the use of distance-learning methods to exploit training reactor facilities more effectively.

Recommendations – Focus to Federal Government Action

- Instituting educational programs that train displaced workers in other engineering and science disciplines to perform nuclear engineering and technology jobs.

- Establishing a cross-cutting workforce initiative that addresses the national security, energy, and public health needs for trained nuclear chemistry and radiochemistry personnel.

Recommendations – Focus to Federal Government Action

- Providing adequate funding for degreed health physics programs to train necessary numbers of health physicists for nuclear power and other industries.

- Supporting research on the fundamental physics of actinide fission and neutron capture, along with measurements of relevant data.

Recommendations – Focus to Industry

- Nuclear vendors and utilities should expand undergraduate student internships, graduate student traineeships, cooperative education opportunities, and training on reactor simulators at their facilities.

Questions?

Lynne A. Fairobent
Manager of Legislative and Regulatory Affairs
AAPM
lynne@aapm.org

National Crisis: Where are the Radiation Professionals?

Government Organization: Centers for Disease Control and Prevention

WHO WE ARE

Overall Mission

"Promote public health protection from environmental radiation exposures through science and education."

Includes ionizing and non-ionizing radiation-related concerns:

- Airline travel
- Airport security scanners
- Cell phones
- Doses from Cold War nuclear weapons production and testing
- Electromagnetic fields
- Emergency Preparedness and Response
- Radiation exposures to pregnant women
- Radon
- Spacecraft radiation sources

WHAT WE DO

- Provide scientifically based technical assistance and guidance to state, local, tribal, and territorial health departments to safeguard the American public against radiation exposures.
- Provide radiation-related education, training, and information to the public health and clinician communities, and the general public.
- Work collaboratively with state, local, tribal, territorial, federal and international public health partners on radiation-related health threats.
- Support the ability of CDC and HHS staff to respond to nuclear/radiological emergencies
- Explore emerging radiation related health threats

HOW WE DO IT

Civil Service, USPHS and Contract Staff

- Communications Specialists
- Emergency responders
- Epidemiologists
- Health Physicists
- Medical Doctors
- Physicists
- Pharmacists
- Public Health Advisors
- Radiochemists

OUR NEEDS!

- Currently unable to fulfill emergency responsibilities with current staffing
- Imminent retirements
- Growth in agency expectations
- Program gaps widening
- HPs with Public Health approach
- Surge capacity for emergency response

National Crisis: Where are the Radiation Professionals?

Government Organization: Centers for Disease Control and Prevention

Who We Are

Between 1990 and 2011, RSB participated in detailed dose reconstructions for nine different DOE nuclear weapons production and testing locations. Fukushima Daiichi nuclear power station incident in Japan travelled around the world. Radiation levels were not sufficient to harm people outside Japan, but the presence of this fallout resulted in a major public health response in the U.S.

RSB is also interested in other radiation exposures received by members of the public. All people are exposed to varying levels of radiation at all times from a variety of natural and man-made sources. The largest single source of radiation exposure from natural sources for most people is radon. The U.S. Environmental Protection Agency estimates that radon causes 21,000 lung cancer deaths in the U.S. each year. Radon is the leading cause of lung cancer among U.S. non-smokers and 2nd leading cause of lung cancer among U.S. smokers. On average, the largest single source of exposure to ionizing radiation to the American people each year is from medical diagnostic imaging procedures. There has been more than a three-fold increase in the average annual radiation dose from medical diagnostic imaging exposures to the U.S. population from 1982 to 2005. The radiation doses from these medical diagnostic imaging exposures can be in the range for which there is epidemiologic evidence of increased cancer risk. Finally, RSB continues to provide technical expertise and communication about numerous radiation-related concerns including:

- Airport security scanners
- Cell phones
- Electromagnetic fields
- Radiation exposures to pregnant women
- Doses from Cold War nuclear weapons production and testing
- Spacecraft radiation sources
- Airline travel
- Nuclear power plants

What We Do

The overall mission of the Radiation Studies Branch at CDC is to "Promote public health protection from environmental radiation exposures through science and education." RSB accomplishes this mission by:

- Providing scientifically based technical assistance and guidance to state, local, tribal, and territorial health departments to safeguard the American public against radiation exposures.
- Providing radiation-related education, training, and information to the public health and clinician communities, and the general public.

- Working collaboratively with state, local, tribal, territorial, federal and international public health partners on radiation-related health threats.
- Supporting the ability of CDC and HHS staff to respond to nuclear/radiological emergencies.
- Exploring emerging radiation related health threats.

How We Do It

CDC employs the following specialists in Civil Service, US Public Health Service and Contractors in our current radiation-related positions:

- Communications Specialists
- Epidemiologists
- Health Physicists
- Medical Doctors
- Physicists
- Pharmacists
- Public Health Advisors
- Radiochemists

Our Needs

Many of the original RSB staff have retired and/or moved on to other positions within CDC. One additional person is planning to retire at the end of the year. Soon there will be only one remaining person in RSB with a collective memory of RSB's historical activities. This shortage of radiation Subject Matter Experts has put CDC in a position where it is currently unable to fulfill its emergency responsibilities as defined in the National Response Framework and the associated Nuc/Rad Incident Annex. This dwindling technical staff coupled with the increasing emergency and non-emergency responsibilities is creating a growing human capital crisis. Therefore, it is imperative that CDC work with our NCRP colleagues and Federal partners to develop a strategy to continue our important mission and future radiation related activities.

National Crisis: Where are the Radiation Professionals?

Government Organization: US Department of Homeland Security, Domestic Nuclear Detection Office

MISSION

- **DNDO: To prevent nuclear terrorism**
- **DNDO was established on April 15, 2005 with the signing of NSPD 43 / HSPD 14 for the purpose of improving the Nation's capability to detect and report unauthorized attempts to import, possess, store, develop, or transport nuclear or radiological material for use against the Nation, and to further enhance this capability over time**

WHAT WE DO

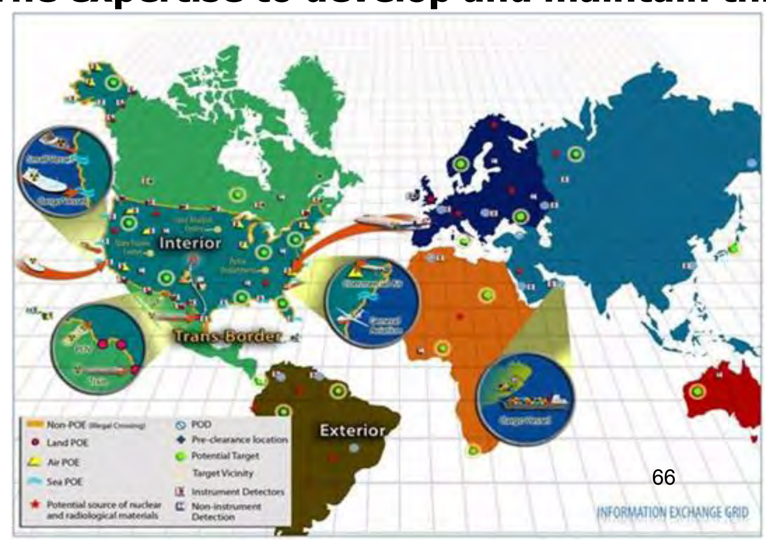
- **Develop the Global Nuclear Detection Architecture**
- **Develop, acquire, and support the domestic nuclear detection and reporting system**
- **Detect – Employ instruments and improve training to increase detection probability & effective response**
- **Coordinate – Ensure that stakeholders facilitate situational awareness through information sharing**
- **Conduct a transformational R&D program**
- **Execute the National Technical Nuclear Forensics Center within DNDO**

HOW WE DO IT

- **Nuclear engineering and physics**
- **Nuclear forensics**
- **Modeling and simulation expertise**
- **Information systems and operations**
- **Test and evaluation science**
- **Program managements**
- **Law enforcement**
- **Planning**
- **Intelligence**
- **Operations Support**

OUR NEEDS!

- **The expertise to develop and maintain this:**



National Crisis: Where are the Radiation Professionals?

Government Organization: US Department of Homeland Security, Domestic Nuclear Detection Office – Academic Research Initiative

MISSION

- **DNDO: To prevent nuclear terrorism**
- **Academic Research Initiative:**
  - **Advance fundamental knowledge for nuclear detection and related sciences**
  - **Develop human capital for the nuclear science and engineering profession**
  - **Sustain a long-term commitment to build academic capability**

WHAT WE DO

HOW WE DO IT

- **Executed jointly by DNDO and the National Science Foundation (NSF)**
- **Solicitation process managed by NSF – 5 topic solicitation currently under review**
- **Grant management transferred to DNDO after the first year**
- **Program Statistics**
  - **Number of Awards: 51 total, 40 active**
  - **Number of Universities: 42 total, 31 active**
  - **$3M in new awards annually**
  - **Grants up to 5 years, $350K/year**

OUR NEEDS!

- **Expertise in science and engineering necessary to advance capabilities for preventing nuclear terrorism**
- **ARI Program supports students in array of disciplines, emphasizing nuclear science and engineering:**
  - **Students Currently Supported and Involved: 154, 94**
  - **Publications : 2010: #70, 2011: #62, 2012 (partial): #32**
- **HS-STEM Internship also started this summer**

National Crisis: Where are the Radiation Professionals?

Government Organization: US Department of Homeland Security, Domestic Nuclear Detection Office - National Nuclear Forensics Expertise Development Program

MISSION

-**DNDO: To prevent nuclear terrorism**

-**National Technical Nuclear Forensics Center:**

- -**Provide centralized planning, integration, and stewardship of US Government nuclear forensics activities**
- -**Develop advanced pre-detonation nuclear forensics capability**
- -**Restore and maintain an enduring technical nuclear forensics workforce**

WHAT WE DO

-**Nuclear forensics:** Collection, analysis and evaluation of pre-detonation (intact) and post-detonation (exploded) radiological or nuclear materials and devices

-**National Nuclear Forensics Expertise Development Program (NNFEDP):** Comprehensive USG effort to grow and sustain uniquely qualified technical expertise required to execute the nation's nuclear forensics mission

-**Nuclear Forensics and Attribution Act (PL 111-140)**

HOW WE DO IT

-Create academic pathway from undergrad to post-doc study in nuclear to geochemical science

-Specialties directly relevant to nuclear forensics, with end goal of filling specific expertise gaps in technical workforce

-Undergrad scholarships and summer school; graduate fellowships and internships; post-doc fellowships at national labs; junior faculty awards; university education awards; senior scientist-student mentoring

- Support to over 250 students and faculty, as well as 22 universities, since inception (2008); strong partnerships with 11 national labs

OUR NEEDS!

-Nuclear forensics technical experts

-Multi-disciplinary backgrounds needed:

- Radiochemists
- Geochemists
- Analytical Chemists
- Nuclear Engineers
- Reactor Engineers
- Process Engineers
- Physicists
- Nuclear Physicists
- Statisticians
- Metallurgists

US Department of Homeland Security, Domestic Nuclear Detection Office (DNDO)

DNDO was established on April 15, 2005 with the signing of NSPD-43 / HSPD-14 for the purpose of improving the Nation's capability to detect and report unauthorized attempts to import, possess, store, develop, or transport nuclear or radiological material for use against the Nation, and to further enhance this capability over time. The mission requires a broad range of expertise, to include nuclear engineering and physics and nuclear forensics. DNDO manages two programs to develop human capital in these fields, the Academic Research Initiative (ARI) Program and the National Nuclear Forensics Expertise Development Program (NNFEDP). The ARI is a university grant program jointly executed with the National Science Foundation intended to advance fundamental knowledge for nuclear detection and related sciences. The NNFEDP provides undergrad scholarships and summer schools; graduate fellowships and internships; post-doc fellowships at national labs; junior faculty awards; university education awards; and senior scientist-student mentoring.

National Crisis: Where are the Radiation Professionals?

Government Organization: Armed Forces Radiobiology Research Institute

MISSION

-Reduce the severity of health consequences for military and civilian personnel

-Conduct radiobiology and related research of operational relevance to DoD

-Collaborative research with other federal and civilian agencies and institutions

-Develop radiation countermeasures to FDA IND status and then hand-off for further development

-Prepare for and respond to radiological emergencies

WHAT WE DO

Conduct Research in five focus areas:

- Radiation Countermeasures
- Radiation Combined Injury
- Biodosimetry
- Internal Contamination and Metal Toxicity
- Agent Defeat

Educate: Medical Effects of Ionizing Radiation Course

Emergency Response: Military Medical Operations

HOW WE DO IT

-Civilian, Military, and Contract Employees: Radiation Biologist, Biochemists, Cell and Molecular Biologists, Microbiologists...

-Dosimetry: Physicists, Health Physicists

-NRC licensed cobalt and nuclear reactor operators

-Veterinary and Animal Husbandry Staff

-Good Laboratory Practice certification (Jan 2014)

-Facilities

- Cobalt sources
- Nuclear Reactor
- SARRP
- LINAC

OUR NEEDS!

-Advanced Development of promising radiation medical countermeasures to IND status

-Continue development of a Good Laboratory Practice program to further advance development of radiation countermeasures

-Program growth

-Program Gaps

-Medical Radiobiology Advisory Team staffing

-Radiation Biologists

Recruitment and Utilization of Radiation Professionals in the Department of Defense

NCRP: Where are the Radiation Professionals?
July 2013

Radiation Professionals in the Department of Defense (DoD) support the warfighter by ensuring the safe use of radioactive materials and radiation producing equipment in environments which span from laboratory settings, to industrial jobsites, to medical treatment facilities, to battlefield and shipboard settings. Further, our radiation professionals are called upon to cover the past, present and future: 1) retrospective dose reconstruction and environmental cleanup, 2) day-to-day regulatory compliance and 3) research into radioprotectants, advances in medical imaging and new detection capabilities. This broad oversight is accomplished through continuous recruitment, incentives for continuing education and certification, participation in professional organizations and committees and robust communication between subject matter experts and satellite activities.

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National Crisis: Where are the Radiation Professionals?

Government Organization: Department of Defense

MISSION

DoD-The mission of the Department of Defense is to provide the military forces needed to deter war and to protect the security of our country. The department's headquarters is at the Pentagon.

Health Physics within DoD - Provide uniquely qualified professional scientists and leaders with expertise in radiological health to protect and defend the force

WHAT WE DO

Ensure the safe use of radioactive materials and radiation-producing equipment.

- **Battlefield environments**
- **Installations within the standing infrastructure**
- **Equipment containing radioactive materials from small commodities to ships, submarines & air craft**
- **Non-destructive testing**
- **Medical use/research**
- **Non-ionizing radiation sources**
- **Environmental cleanup issues**
- **Dose reconstruction**

HOW WE DO IT

Active duty, Civil Service, and Contract Staff

- **Scientists, inspectors, safety officers, compliance officers, medical and product reviewers**

Regulations

- **Grounded in CFR requirements**
- **Specific to unique operating environments**

Training

- **Recognized professional degrees/certifications**
- **DoD/service-specific requirements**

OUR NEEDS!

- **Continuous recruitment**
- **Continuing education/certification**
  - **Environmental/remediation**
  - **Radio-epidemiology**
  - **Medical physics advances**
  - **Regulatory oversight**
  - **Internal dosimetry**
  - **Dosimetry/detection**
  - **Consequence management**
- **Distance learning opportunities to provide formal education to individuals with extensive experience**

National Crisis: Where are the Radiation Professionals?

Government Organization: Department of Energy, National Nuclear Security Administration

MISSION

National Security

- Managing the Stockpile
- Preventing Proliferation
- Powering the Nuclear Navy
- Emergency Response
- Countering Nuclear Terrorism

WHAT WE DO

Consumer side

- Emergency Response: search, render safe, consequence management (modeling, monitoring, medicine)
- Nonproliferation: monitoring, verification, safeguards R&D and Ops
- Global Threat Reduction Initiative: convert, remove, protect

Supply side

- University consortiums for Nuclear Science and Security, Nonproliferation Enabling Capabilities , & Verification Technology
- GTRI Nuclear Security Education Project
- NGSI Human Capital Development (HCD) Program
- Ad hoc partnerships with universities (our data, their students)
- Other training: REAC/TS, RAP, CTOS, etc.

HOW WE DO IT

- People
  - DOE National Laboratory personnel (1000's of scientists, medical professionals, engineers, technicians)
  - Federal technical staff (program managers, team leaders, HPs)
- Methods
  - Operations (on & off site, domestic & international)
  - Analytical work, studies
  - R&D
  - Policy
- Work locations
  - National Labs
  - Field work
  - HQ (DC & Field offices)

OUR NEEDS!

- Expertise
  - Nuclear weapons design
  - Nuclear/radiological materials characterization
  - Nuclear safeguards
  - Radiation detection
  - Radiation dose assessment
  - Radiation medicine
  - Nuclear policy
- Surge capacity for emergency response
- Replenish lab and fed retirees

DOE/NNSA Summary for WARP Workshop

Mission: NNSA is responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. It also responds to nuclear and radiological emergencies in the United States and abroad. Additionally, NNSA federal agents provide safe and secure transportation of nuclear weapons and components and special nuclear materials along with other missions supporting the national security.

<u>Managing the Stockpile:</u> Maintaining the safety, security and effectiveness of the nuclear deterrent without nuclear testing – especially at lower numbers – requires increased investments across the nuclear security enterprise.

<u>Preventing Proliferation:</u> Keeping weapons of mass destruction (WMD) out of the hands of state and non-state actors requires a coordinated effort on the part of suppliers of proliferation-sensitive materials, equipment, and technologies. These efforts include both R&D and the implementation of technologies to accomplish the mission. In support of the R&D mission, several University consortiums have been created to fund researchers to conduct work collaboratively with DOE/NNSA National Laboratory scientists.

<u>Powering the Nuclear Navy:</u> The Naval Nuclear Propulsion Program provides militarily effective nuclear propulsion plants and ensures their safe, reliable and long-lived operation. This mission requires the combination of fully trained U.S. Navy men and women with ships that excel in endurance, stealth, speed, and independence from supply chains.

<u>Emergency Response:</u> NNSA ensures that capabilities are in place to respond to any NNSA and Department of Energy facility emergency. It is also the nation's premier responder to any nuclear or radiological incident within the United States or abroad and provides operational planning and training to counter both domestic and international nuclear terrorism.

<u>Countering Nuclear Terrorism:</u> NNSA provides expertise, practical tools, and technically informed policy recommendations required to advance U.S. nuclear counterterrorism and counterproliferation objectives. It executes a unique program of work focused solely on these missions and builds partnerships with U.S. government agencies and key foreign governments on these issues.

National Crisis: Where are the Radiation Professionals?

Government Organization: US Department of Energy, Office of Health and Safety, Office of Health, Safety and Security

WHO WE ARE

Overall Mission

- Establishes worker safety and health requirements and expectations for DOE to ensure protection of workers from the hazards associated with DOE operations.
- Supports the Department of Labor and the National Institutes for Occupational Safety and Health in the implementation of the Energy Employees Occupational Illness Compensation Program Act.
- Conducts a number of health studies to determine worker and public health effects from exposure to hazardous materials associated with DOE operations.
- Supports international health studies and programs in Japan, Spain, Russia, and the Marshall Islands.
- Supports medical surveillance and screening for current/former workers.
- Supports the Radiation Emergency Assistance Center/Training Site Program.
- Supports U.S. Transuranium and Uranium Registry, a large human database.
- Assists DOE organizations to obtain Voluntary Protection Program (VPP) status.
- Supports the Federal Technical Capability Program (FTCP).

WHAT WE DO

- Responsible for developing and implementing health and safety policies and regulations to ensure the DOE workforce conducts work safely and productively.
- Domestically, our commitment is made visible through an aggressive program to provide scientific evidence and information on the state of health of workers in a cross-section of DOE facilities.
- Internationally, we are responsible to Congress for managing nuclear legacy issues in other countries and to the Executive Branch through DOE for international scientific agreements in several countries.
- The major contributor to the national and international organizations that determine radiation protection standards. The results from the Japan and Russian programs are the primary basis for the world-wide radiation protection standards. They are important to the well-being of DOE and nuclear industry workers, and for compensation issues.

HOW WE DO IT

- Radiobiologist
- Health Physicists
- Environment Monitoring
- Industrial Hygienist
- Epidemiologists
- Statisticians
- Safety Technical Managers
- Physicians

OUR NEEDS

- HPs
- Radiobiologist
- Statisticians
- Epidemiologist
- Impeding retirements

Department of Energy
Washington, DC 20585

Office of Health and Safety
Office of Health, Safety and Security

Our Mission

The Office of Health and Safety (HS-10) is responsible for developing and implementing health and safety policies and regulations to ensure the Department of Energy (DOE) workforce conducts work safely and productively. HS-10 supports the Department of Labor and the National Institute for Occupational Safety and Health in the implementation of the Energy Employees Occupational Illness Compensation Program Act. HS-10 is also responsible for conducting a number of health studies to determine worker and public health effects from exposure to hazardous materials associated with Department operations, providing support to international health studies and programs in Japan, Spain, and the Russian Federation, implementing medical screening and environmental monitoring in the Marshall Islands, and medical surveillance and screening programs for current and former workers.

Domestically, our commitment is made visible through an aggressive program to provide scientific evidence and information on the state of health of workers in a cross-section of DOE facilities.

Internationally, we are responsible to Congress for managing nuclear legacy issues in other countries and to the Executive Branch through DOE for international scientific agreements in several countries. HS-10 is the major contributor to the national and international organizations that determine radiation protection standards. The results from the Japan and Russian programs are the primary basis for the worldwide radiation protection standards. They are important to the well-being of DOE and nuclear industry workers, and for compensation issues.

How we do it?

HS-10 is responsible for developing and issuing DOE's occupational radiation protection policy, requirements, and guidance. Regulation title 10, Code of Federal Regulations (CFR), part 835, *Occupational Radiation Protection*, is designed to protect the health and safety of workers from radiological hazards at DOE facilities. The radiation exposure monitoring systems is the database of occupational radiation exposures for all monitored DOE employees, contractors, subcontractors, and members of the public. The regulation, 10 CFR 835.702, requires annual, individual radiation exposure records to be documented. Important major regulations covering workers are also included in other regulations, specifically 10 CFR 851, *Worker Safety and Health Program,* and Integrated Safety Management System in DOE Acquisition Regulation Clauses.

HS-10 also conducts health studies to determine worker and public health effects from exposure to hazardous materials associated with Department operations and supports international health studies and programs. The records of more than 600,000 people who have worked in the nuclear field since the Manhattan Project helped identify whether certain exposures or jobs in the past may have affected workers or members of communities surrounding DOE over the long term. Comprehensive Epidemiologic Data Resource (CEDR) is a prime example of the Department's commitment to worker and community health programs. The internet presence and capabilities of CEDR facilitate the sharing of information and de-identified data collected during DOE-supported epidemiologic, environmental, and related health studies.

Additionally, HS-10 provides assistance to Headquarters and field elements in implementation of policy and resolving worker safety and health issues. The scientific bases for these responsibilities are derived from the scientific studies that we support, such as the Japan and the Russian programs.

Our Needs

According to Committee on Science, Engineering and Public Policy, education and training should be an integral part of federally funded research projects and success in that area needs to be reviewed and measured.

The managers of DOE offices focused on radiation effects on humans and environment have, over the years, tried to follow this principle. Our programs require a flow of young investigators trained in radiobiology, epidemiology, biostatistics, medical and health physics, environmental sciences, and related basic and applied sciences.

Thus, we must pay increased attention to providing an adequate supply of radiation scientists to academia, industry, and federal laboratories.

Desired result: training of future professionals and ability to infuse scientific curiosity and creativity that is brought by intelligent students.

National Crisis: Where are the Radiation Professionals?

US Department of Energy – **Office of Science**

WHO WE ARE

- **"The mission of the Energy Department** is to ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions."
- **AEC –> ERDA --> DOE**
- **The origins of the Office of Science** trace back to the Manhattan Project; the classified nature and sprawling logistical and technical demands of this work created large, multi-purpose facilities that became the nation's first national laboratories

WHAT WE DO

- **The lead federal agency** supporting fundamental scientific research for **energy**; the Nation's largest supporter of basic research in the **physical sciences**
- **Two principal thrusts**: direct support of scientific **research** and direct support of the development, construction, and operation of unique, open-access **scientific user facilities**
- **A long-standing mission** to understand how radioactive materials affect the human genome

HOW WE DO IT

- **The Office of Science is the steward of ten of the 17 DOE laboratories;** these 10 laboratories provide essential support to the missions of SC programs
- **Research is also supported through grants and contracts to universities /institutions**
- **SC supports 27 radiation user facilities :** Synchrotron Radiation Light Sources (5), High-Flux Neutron Sources (3), Electron Beam Micro-characterization Centers (3), Fusion Energy Facilities (5), High Energy Physics Facilities (3), and Nuclear Physics Facilities (8).
- **Federal workforce:** 10-12 HPs or other radiation professionals, in total
- **Contractors:** varies by Lab from 2 to well over 100 radiation professionals per lab

OUR NEEDS!

- **Radiation technicians, technologists, health physicists** for continued research and user facility missions
- **Radiation biologists, chemists, physicists, and epidemiologists for future research missions** (program growth, program gaps)
- **Replacement for impending retirements** of senior scientists leaving gaps in critical areas of expertise

National Crisis: Where are the Radiation Professionals?

U.S. Department of Energy – **Office of Environmental Management (EM)**

WHO WE ARE

- **The mission of the Office of Environmental Management (EM) is to complete the safe cleanup** of the environmental legacy brought about from five decades of nuclear weapons development and government-sponsored nuclear energy research
- This legacy includes sites with large amounts of radioactive wastes, spent nuclear fuel (SNF), excess plutonium and uranium, thousands of contaminated facilities, and contaminated soil and groundwater.
- In 1989, EM was charged with the responsibility of cleaning up 107 sites across the country. As of September 2012, completed cleanup at 90 of the sites

WHAT WE DO

- **Waste Management** - planning and optimizing tank waste processing and nuclear materials, including spent nuclear fuel
- **Site and Facility Restoration** - to identify and advance strategies to plan and optimize EM soil and groundwater remediation, deactivation and decommissioning (D&D), and facility engineering projects and processes
- **Program Management** - to assure effective project, acquisition, and contract management, manage the safeguards, security and emergency preparedness activities
- **Communications and Engagement** - to develop guidance, monitor, and oversee EM's interactions with affected entities, communities, and stakeholders

HOW WE DO IT

- **(Bulldozers, dump trucks, front loaders)**
- **Building demolition**
- **Construction of waste disposal facilities**
- **Waste treatment --** Hanford Waste Treatment Plant (under construction), Defense Waste Processing Plant (Savannah River)
- **Waste transportation**
- **Operation of world's only deep nuclear waste disposal facility (WIPP)**
- **Employs hundreds of radiation professionals**

OUR NEEDS!

- **Radiation technicians, technologists, health physicists** for facility management and cleanup missions
- **Scientists and engineers for applied research missions** and program management
- **Replacement for impending retirements** of senior scientists and engineers

DOE Office of Science (SC)

The mission of the Energy Department is to ensure America's security and prosperity by addressing its energy, environmental and nuclear challenges through transformative science and technology solutions.

The origins of the Office of Science trace to the Manhattan Project; the classified nature and sprawling logistical and technical demands of this work created large, multi-purpose facilities that became the nation's first national laboratories. In 1946, enactment of the Atomic Energy Act transferred responsibility for nuclear research and development from the War Department to a new independent civilian agency, the Atomic Energy Commission (AEC), led by five Commissioners appointed by the President. The Commission's charter ensured continuity of the Manhattan Project research activities. It provided for a diversified program of basic research with emphases on basic nuclear processes, the production of nuclear energy, and the utilization of nuclear materials for medical, biological, health, or military purposes.

The Office of Science portfolio has two principal thrusts: direct support of scientific research and direct support of the development, construction, and operation of unique, open-access scientific user facilities. These activities have wide-reaching impact. The Office of Science supports research in all 50 States and the District of Columbia, at DOE laboratories and more than 300 universities and institutions of higher learning nationwide. The Office of Science User Facilities provides the Nation's researchers with state-of-the-art capabilities that are unmatched anywhere in the world.

The Office of Science manages this research portfolio through six interdisciplinary scientific program offices: Advanced Scientific Computing Research, Basic Energy Sciences, Biological and Environmental Research, Fusion Energy Sciences, High Energy Physics and Nuclear Physics. In addition, the Office of Science sponsors a range of science education initiatives through its Workforce Development for Teachers and Scientists program.

The Office of Science is the steward of ten of the seventeen DOE laboratories; these 10 laboratories provide essential support to the missions of SC programs: **Ames** Laboratory, **Argonne** National Laboratory, **Brookhaven** National Laboratory, **Fermi** National Accelerator Laboratory, **Lawrence Berkeley** National Laboratory, **Oak Ridge** National Laboratory, **Pacific Northwest** National Laboratory, **Princeton Plasma Physics** Laboratory, **SLAC** National Accelerator Laboratory, and **Thomas Jefferson** National Accelerator Facility. DOE/SC supports 27 user facilities that employ radiation professionals: Synchrotron Radiation Light Sources (5), High-Flux Neutron Sources (3), Electron Beam Microcharacterization Centers (3), Fusion Energy Facilities (5), High Energy Physics Facilities (3), and Nuclear Physics Facilities (8).

In the Federal workforce we count approximately 10-15 radiation professionals. The number of contractor personnel varies by Lab from two to well over 100 radiation professionals per lab, depending on the research and/or user facility needs of that Lab. Directly or indirectly we employ radiation technicians, technologists, health physicists, radiobiologists, radiation chemists, and physicists.

Depending on future budget and policy, continuing needs may include: 1) Radiation technicians, technologists, and health physicists for continued research and user facility missions; 2) Radiation biologists, chemists, physicists, and epidemiologists for future research missions (program growth, program gaps); and 3) Replacement for impending retirements of senior scientists leaving gaps in critical areas of expertise.

National Crisis: Where are the Radiation Professionals?

Government Organization – U.S. Environmental Protection Agency, Radiation Protection Program

MISSION

To protect human health and the environment from unnecessary exposure to radiation

- Reduce exposures through sound environmental radiation regulations
- Provide technical expertise for management of radioactive waste and contaminated media
- Develop and provide credible information for making effective risk management decisions
- Prepare for and respond to radiation emergencies
- Promote responsible management of natural and man-made radiation sources and encourage safer alternatives

WHAT WE DO[1]

Provide radiation protection regulations, information and guidance, including:

- Establishing generally applicable regulations for radioactivity in the environment ("outside the fence")
- Providing standard methods for performing radionuclide dose and risk assessments (Federal Guidance reports)
- Issuing Protective Action Guides Manual
- Communicating with the public (on a day-to-day basis and following radiological incidents)
- Developing waste management regulations including for WIPP
- Assessing the domestic impacts of major nuclear incidents

HOW WE DO IT

EPA's radiation protection professionals carry out the Agency's mission through their knowledge of:

- Health physics
- Environmental fate and transport of radionuclides
- Epidemiology and statistics
- Radionuclide dose and risk assessment methods
- Science based policies and regulation
- Site assessment and decontamination methods
- Radioactive waste management practices
- Radiochemistry and laboratory analytical methods
- Emergency response guidance and policies
- Public communication (routine and emergency)

OUR NEEDS!

- More radiation protection professionals capable of addressing the many technical, policy and public information challenges that fall within EPA's mandate ("human capital crisis")
- Surge capacity for emergency response
- Prepare for impending retirements

OUR CURRENT COURSE…

- Ensure that EPA's Radiation Protection Program is a good option as a workplace
- Promote knowledge transfer through mentoring and structured on-the-job training
- Support educational opportunities for current staff, encourage and support student intern opportunities

[1] *Statutory Authority: Reorganization Plan No. 3 (1970), Atomic Energy Act, Clean Air Act, Safe Drinking Water Act, CERCLA, Public Health Service Act, Nuclear Waste Policy Act, Energy Policy Act of 1992, WIPP Land Withdrawal Act, Uranium Mill Tailings Radiation Control Act, National Response Framework & associated federal plans*

National Crisis: Where are the Radiation Professionals?
U.S. Environmental Protection Agency, Radiation Protection Program

The U.S. Environmental Protection Agency, like so many other agencies and organizations across the nation, is facing a “human capital crisis” in hiring radiation protection professionals. EPA’s Radiation Protection Program has a mission of health safety, science-based regulation setting, risk assessment, waste management and emergency response. It will become increasingly challenging to sustain legally mandated radiation protection activities as the health physics community ages into retirement without a new generation to learn from its experience and continue its work.

The human capital crisis is particularly difficult at EPA because of the Agency’s uniquely broad mission. EPA requires radiation professionals[1] with knowledge of health physics, environmental fate and transport, regulations, waste management, emergency response and public communications. This diverse skill set typically is not only the product of classroom education – rather, it tends to accumulate over time through job immersion facilitated by experienced mentors.

The Fukushima nuclear power accident, while posing no public health threat in the U.S., highlighted the importance of environmental radiation professionals to public health and national security. EPA had a limited number of radiation experts and they were in demand at all times during the incident response. The relationships between technical, policy and communications staff – built over years of working together – were integral to the Agency’s success in tracking the dispersion of radionuclides in the environment, determining the absence of a health threat and keeping the public informed. Future success will depend upon our ability to recruit new radiation professionals and integrate them into multidisciplinary environmental science teams.

[1] This includes health physicists, radiobiologists, radiochemists, radioecologists and biophysicists, along with statisticians, geologists, hydrogeologists, geochemists, engineers and public information specialists.

National Crisis: Where are the Radiation Professionals?

Government Organization: US Food and Drug Administration

WHO WE ARE

Overall Mission

-Protecting the public health by assuring the safety, effectiveness, quality, and security of human and veterinary drugs…and products that emit radiation

-Facilitate the development and availability of medical countermeasures

-Preparing for and responding to radiological emergencies

-Protecting human subjects in trials of radioactive drugs

-Protecting employees who work with radiation and radioactive materials

WHAT WE DO

Radiation Protection Regulations and Requirements

-Radiation Control Law (Federal FD&C Act) / Radiation Control for Health and Safety Act of 1968
-Public Health Service Act
-Bioterrorism Act of 2002
-Homeland Security Act
-21 CFR 361.1 (RDRC)
-Pandemic and All-Hazards Preparedness Reauthorization Act of 2013 (PAHPRA)

HOW WE DO IT

-Civil Service, USPHS CC and Contract Staff

-Inspectors, safety officers, compliance officers, medical and product reviewers

-Emergency responders (collateral duty)

-Physicists

-Health Physicists

-Medical Physicists

-Radiologists

-Nuclear Medicine specialists

-Nuclear pharmacists

-Radiochemists

OUR NEEDS!

-Impending retirements

-Program growth

-Program gaps

-HPs

-Surge capacity for emergency response

National Crisis: Where are the Radiation Professionals?

Government Organization: US Department of Health and Human Services - ASPR

MISSION

-Support domestic and international public health emergency preparedness and response activities

-Prepare for and respond to radiological emergencies

-All hazard plans, response guidance, just-in-time tools

-Deploy medical personnel as requested

-Facilitate the development and availability of medical countermeasures

WHAT WE DO

-A little of everything; Policy, Response, just-in-time resources and tools, CONOPs development, Facilitation of medical countermeasure research and development

-National Response Framework ESF #8 lead agency

-Lead the implementation of the Pandemic and All-Hazards Preparedness Reauthorization Act (PAHPRA)

-Develop National Health Security Strategy

-Develop requirements for medical countermeasures

-Develop operational plans, analytical products, and training exercises to ensure preparedness

-Participate in interagency workgroups, exercises, and planning

HOW WE DO IT

-**Offices**

-Biomedical Advanced Research and Development Agency (BARDA), Office of Policy and Planning, Office of Emergency Management

-**Divisions**

-International Health Security, Medical Countermeasure Strategy & Requirements, Tactical Programs (CBRNE Branch)

-Staff

Civil Service, USPHS CC and Contract Staff

-Scientists, medical personnel, planners

-Physicians (Oncologists, ED)

-Medical support teams (DMATs)

OUR NEEDS!

-Personnel needed for current needs and replacement

-Surge capacity for emergency response (SME level support)

Department of Health and Human Services – Assistant Secretary for Preparedness and Response
Julie Sullivan

The Department of Health and Human Services (HHS) Office of the Assistant Secretary for Preparedness and Response (ASPR) is a Staff Division in the Office of the Secretary. ASPR serves as the principal advisor to the Secretary on all matters related to public health and medical emergency preparedness and response and leads a collaborative approach to the Department's preparedness, response and recovery portfolio. In addition to this policy responsibility, the office of the ASPR also has operational responsibilities: both for the advanced research and development of medical countermeasures, and also for coordination of the federal public health and medical response to incidents. HHS is the lead agency for Emergency Support Function (ESF) #8 – Public Health and Medical Services – of the National Response Framework, leads the implementation of the Pandemic and All-Hazards Preparedness Reauthorization Act (PAHPRA), and is responsible for the development of the National Health Security Strategy. Radiation professionals within ASPR support domestic and international public health emergency preparedness and response activities with a focus on radiological emergencies of all types. They participate in interagency workgroups, exercises, and planning committees, and aid in the development of resources such as; all-hazard and radiological/nuclear specific plans, operational plans, response guidance, requirements for medical countermeasures, analytical products, and training exercises to ensure public health and medical preparedness and just-in-time tools to be used in the event of a response. Additionally, the Biomedical Advanced Research and Development Agency (BARDA) facilitates the advanced research and development of medical countermeasures and diagnostics for a radiological/nuclear incident.

Within ASPR, radiation professionals are concentrated into three offices, BARDA, the Office of Policy and Planning's divisions of International Health Security and Medical Countermeasures Policy and Planning, and the in the Office of Emergency Management's division of tactical programs. These offices are staffed by Federal Employees, members of the U.S. Public Health Service Commissioned Core, and contract staff. The backgrounds of these staff vary and include scientists (including NIH, CDC), medical personnel (including oncologists (radiation, medical, hematology, transplant) and emergency physicians), and planners. During a response, medical support teams composed of federal intermittent employees from the National Disaster Medical System may be used.

Personnel knowledgeable in the radiation sciences are needed to continue the above mentioned activities in ASPR and will be needed in the future for replacement of those who retire. Additionally, there is the need for additional personnel at the subject matter expert level, in the event of an emergency response such as that after the Fukushima nuclear power plant accident.

National Crisis: Where are the Radiation Professionals?

Government Organization: ASPR

MISSION

- Lead the country in preparing for, responding to, and recovering from the adverse health effects of emergencies and disasters by
  - Supporting our communities' ability to withstand adversity,
  - Strengthening our health and response systems, and
  - Enhancing national health security.
- **Vision:**
  - The nation's health and response systems and communities will be prepared, responsive, and resilient to limit the adverse health impact of emergencies and disasters.

WHAT WE DO

Goal 1: Promote resilient communities, fostering a nation able to withstand and recover from public health emergencies

Goal 2: Strengthen Federal public health and medical preparedness, response, and recovery leadership and capabilities

Goal 3: Promote an effective medical countermeasures enterprise

Goal 4: Strengthen ASPR's leadership role in coordinating and developing public health and medical emergency preparedness, response, and recovery policy for the Department

Goal 5: Improve the preparedness and integration of health care delivery systems

Goal 6: Improve management of the ASPR organization and investment in its people

HOW WE DO IT

- Work with national, state, local, tribal governments and private sector entities to address mission and goals for preparedness and response
- Use evidence-based practices to support activities across all mission activities
- Support research that advances the mission
- Deploy assets (people and materiel) as necessary to support response activities in accordance with federal and state regulation and policy
- Support education and training activities as resources permit

OUR NEEDS!

- Address budget constraints and uncertainty now and future; Augment radiation SME cadre nationally and locally in various professions
- Support responder job-specific training for radiation incidents
- Support academic radiation biology community which is small and getting smaller
- Promote research, both basic and applied

National Crisis: Where are the Radiation Professionals?

Government Organization: Radiation Epidemiology Branch, National Cancer Institute

MISSION

- Identify, understand, and quantify risk of cancer in populations exposed to different types of radiation
- Conduct radiation research that informs radiation protection and addresses public health and clinical needs
- Develop innovative dosimetric, epidemiological and statistical methods to further above research goals
- Respond to needs of public, Congress, and other government agencies for research on urgent questions on radiation exposure and cancer risk
- train epidemiologists and dosimetrists
- communicate knowledge about radiation risks

WHAT WE DO

- Identify and conduct epidemiologic and dosimetric research relevant to cancer risks in areas with greatest potential for influencing radiation protection, public health and clinical impact including: cancer risks from medical, occupational and environmental exposures to ionizing and non-ionizing radiation
- Develop and apply new methods to improve radiation exposure assessment
- Develop approaches and software for statistical modeling of radiation exposure assessment, cancer risk assessment, and cancer risk projection that incorporate uncertainties in radiation exposure measurement
- train radiation epidemiologists, dosimetrists, & statisticians

HOW WE DO IT

- Radiation epidemiologists
- Health and medical physicists
- Statisticians with expertise in radiation epidemiology and statistics
- Collaborators in many countries with expertise in 3 areas above plus radiologists, physicians performing fluoroscopically-guided interventional procedures, nuclear medicine specialists, radiation oncologists, radiobiologists, and others

OUR NEEDS!

- Impending retirements
- Radiation epidemiologists to work on epidemiologic studies of medical, occupational and environmental exposures
- Statisticians to conduct research in radiation epidemiology and dosimetry
- Health and medical physicists to conduct research in radiation epidemiology and development of new approaches for radiation exposure assessment

National Crisis: Where are the Radiation Professionals?

Government Organization: National Institute of Allergy and Infectious Diseases – Radiation Nuclear Countermeasures Program (RNCP)

MISSION

Create the infrastructure, scientific database, and radiobiology expertise to accelerate the identification, development and licensure of radiation/nuclear medical countermeasures (MCMs) for the Strategic National Stockpile.

NIAID RNCP focused on MCMs and biodosimetry devices to be used in mass casualty radiation/nuclear public health emergency incidents.

WHAT WE DO

Manage a multi-element program portfolio to pursue the mission:

- cooperative agreements,
- grants,
- contracts,
- SBIR grants, and
- interagency agreements

Major programs include the Centers for Medical Countermeasures against Radiation (CMCRs) and Product Development Support Services Contract

HOW WE DO IT

RNCP is focused on:

- Developing MCMs to improve survival and mitigate injury from acute radiation syndromes (ARS) and the delayed effects of acute radiation exposure (DEARE)
- Improving efficacy and ease of use of decorporation agents
- Developing high-throughput, rapid, and accurate biodosimetry for radiation exposures
- Revitalizing the science base by attracting and establishing a cadre of highly qualified investigators and modernizing critical infrastructure and research facilities.

OUR NEEDS!

- Radiobiology expertise
- Dosimetry expertise
- Radiation animal models expertise
- Product development experience with expertise in radiation research and FDA licensure under the Animal Rule
- Radiobiology cross-training with expertise in toxicology, pharmacology, cell biology, molecular biology, immunology, microbiology, physics, chemistry, etc.

Centers for Medical Countermeasures against Radiation –Education and Training Websites

David Brenner, Ph.D.
Columbia University Medical Center
http://www.cmcr.columbia.edu

Nelson Chao, M.D.
Duke University
http://www.radccore.org/

Jacqueline Williams, Ph.D.
University of Rochester
http://radoncu19.urmc.rochester.edu/

William McBride, Ph.D.
University of California
http://radonc.ucla.edu/body.cfm?id=296

Joel Greenberger, M.D.
University of Pittsburgh Medical Center
http://www.pittcmcr.org/

National Institute for Allergy and Infectious Diseases – Radiation Nuclear Medical Countermeasure Development Program – July 2013

In 2003, the White House Office of Science and Technology Policy and White House Homeland Security Council jointly developed priorities for radiation biodosimetry and medical countermeasures. In 2004, NIH/NIAID established a robust program with a special appropriation from Congress. A Blue Ribbon Panel provided review and guidance for NIAID's strategic plan and research agenda. Priority research areas were: basic and translational science, radiation biodosimetry, focused product development, and infrastructure for research and product development. The objectives were to create the infrastructure, scientific database, and radiobiology expertise to accelerate the identification, development and deployment of radiation/nuclear medical countermeasures (MCMs) for the Strategic National Stockpile. NIAID RNCP focused on MCMs and biodosimetry devices to be used in mass casualty radiation/nuclear public health emergency incidents. In 2012, NIAID updated the strategic plan and research agenda (http://www.niaid.nih.gov/topics/radnuc/Documents/radnucprogressreport.pdf) which focused on:

- Developing MCMs to improve survival and mitigate injury from acute radiation syndromes (ARS) and the delayed effects of acute radiation exposure (DEARE)
- Improving efficacy and ease of use of decorporation agents
- Developing high-throughput, rapid, and accurate biodosimetry for radiation exposures
- Revitalizing the science base by attracting and establishing a cadre of highly qualified investigators and modernizing critical infrastructure and research facilities.

NIAID RNCP has developed a portfolio of cooperative agreements, grants, contracts, SBIR grants, and interagency agreements to pursue the mission including the Centers for Medical Countermeasures against Radiation (CMCRs), a Product Development Support Services Contract, and other focused awards to identify and develop biodosimetry and MCM candidates. NIAID has developed a multi-element program to pursue its public health emergency mission and include:

- **Cooperative Agreements**
  - Centers for Medical Countermeasures against Radiation (CMCRs)
  - MCM Development and Mechanisms of Action
- **Specific Tissue Injury Grants**
  - Immune reconstitution
  - Oral Decorporation Agents
  - Mechanisms, Diagnostics, and Medical Countermeasures (MCMs)
  - Gastrointestinal MCMs
  - Lung MCMs
  - Skin MCMs
  - Combined Injury MCMs
- **SBIR**
  - Medical Countermeasure Development
  - NIAID Omnibus
- **Contracts**
  - Oral Forms of DTPA (2)
  - RERF
  - Product Development Support Services
  - BAA for specific syndrome MCM development
- **Inter/intra Agency Agreements**

They types of expertise needed to cover the spectrum of needs for the program are: radiobiology, dosimetry, radiation animal model development, pharmaceutical product development experience with expertise in radiation research and FDA licensure under the Animal Rule. Additionally, the program needs scientific expertise combined with radiation as radiobiology cross-training with in toxicology, pharmacology, cell biology, molecular biology, immunology, microbiology, physics, chemistry, etc.

National Crisis: Where are the Radiation Protection Professionals?

Government Organization: US Nuclear Regulatory Commission

MISSION

NRC licenses and regulates the civilian use of radioactive materials to protect public health and safety, promote the common defense and security, and to protect the environment.

NRC's mission covers three areas:

- **Reactors – Power and research / test**
- **Materials – used in medical , industrial, and academic settings, and nuclear fuel production**
- **Waste – transportation, storage and disposal, and decommissioning of facilities**

WHAT WE DO

- **Perform safety evaluations and environmental impact assessments**
- **Inspect operating facilities and programs**
- **Develop rules and compliance guidance**
- **Perform research to support the technical information needs of the agency**

HOW WE DO IT

- **In-house technical staff**
- **Commercial contractors**
- **DOE National Laboratories**
- **Other federal agencies**

OUR NEEDS!

- **Mid-level radiation protection professionals with 10-15 years of practical experience**
- **Health Physicists and Radiochemists with strong environmental backgrounds**
- **Health Physicists with strong medical treatment backgrounds**

National Crisis:
Where are the Radiation Protection Professionals?
The Nuclear Regulatory Commission Staff Needs and Perspective

Steven A. Schaffer, Ph.D.
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission

The U.S. Nuclear Regulatory Commission (NRC) licenses and regulates the civilian use of radioactive materials to protect public health and safety, promote the common defense and security, and protect the environment. NRC's regulatory mission covers three main areas:

- Reactors - Commercial reactors for generating electric power and research and test reactors used for research, testing, and training
- Materials - Uses of nuclear materials in medical, industrial, and academic settings and facilities that produce nuclear fuel
- Waste - Transportation, storage, and disposal of nuclear materials and waste, and decommissioning of nuclear facilities from service

In all three areas we have a need for various radiation protection professionals with experience in protecting nuclear workers, the public, and the environment from overexposure to ionizing radiation. These professionals perform safety evaluations and environmental impact assessments of license applications and amendments, inspections of operating facilities and programs, and regulatory research supporting the technical needs of rulemaking, safety evaluations, and inspections. Our professionals include the technical disciplines of Health Physics, Nuclear Medicine, Nuclear Engineering, Physics and Radiochemistry.

The NRC supports a grant program to colleges and universities aimed at training new radiation protection professionals. We also have active recruitment and incentive programs to attract newly trained professionals. In addition, we have fellowships for our staff. The NRC designates specific disciplines in which staff may pursue advanced degrees targeted to the master's or doctoral level. Program participants receive tuition, full pay, and benefits while they complete their graduate degree at approved universities. In addition to the fellowship program, NRC has a Health Physics training program using a system of in-house and contractor training courses. All these programs successfully helped fulfill the needs of our recent growth due to new reactor licensing.

In general, our agency needs the mid-level radiation protection professional. These are people with 10 to 15 years of practical experience who have worked at relevant facilities or performed relevant academic research projects. Due to the nature of our organization, we cannot provide that kind of practical technical experience in-house. We also need Health Physicists with strong environmental backgrounds and Radiochemists to support safety and environmental impact assessments of new reactors, uranium recovery facilities, shallow land and deep geologic waste disposal facilities, and the decommissioning of various nuclear facilities. In addition, we need Health Physicists with strong medical treatment backgrounds because of the increase use of various radio-techniques for disease diagnosis and therapy.

In summary, the NRC has been able to meet most of our staffing needs in the various fields of radiation protection. We have done this through various academic training grants, recruitment and incentive programs and in-house training and fellowship programs. What we inherently lack is the ability to provide, by in-house means, the more advanced practical and hands-on technical experience in radiation protection.

MAJ VANHORNE-SEALY

National Crisis: Where are the Radiation Professionals?

Government Organization: Department of Homeland Security

MISSION

- Ensure a homeland that is safe, secure, and resilient against terrorism and other potential threats.
- Prepare for and responding to radiological emergencies, supporting disaster resilience.
- Protect employees who work with or may encounter radiation and radioactive materials
- Develop, acquire, and support the domestic nuclear detection and reporting system
- Characterize detector system performance before deployment
- Provide centralized planning, integration, and advancement of U.S. government nuclear forensics programs

WHAT WE DO

Homeland Security Act

National Infrastructure Protection Plan (2009)

- Training and Exercises
- Threat and Vulnerability Assessments
- Research and Development

National Response Framework (2013)

- Planning
- Environmental Response/Health and Safety
- Interdiction and Disruption
- Screen, Search and Detect

National Disaster Recovery Framework (2011)

- Guidance for pre- and post-disaster recovery planning
- Public Information and Warning

HOW WE DO IT

- **Civil Service, USPHS CC and Contract Staff**
- **Law enforcement, inspectors, safety officers, compliance officers, medical and product reviewers**
- **Emergency responders (collateral duty)**
- **Physicists**
- **Health Physicists**

OUR NEEDS!

Basic Radiation Training at all levels

- Locals: Responders, Providers and Support Staff

Surge capacity for emergency response

- How do we taps into local HP resources

Interagency Collaboration

- Continuity of effort will allow for more productivity

Detection experts

Health effects experts

National Crisis: Where are the Radiation Professionals?

Professional Society: American Association of Physicists in Medicine (AAPM)

MISSION

- **AAPM is the premier organization in medical physics, a broadly-based scientific and professional discipline encompassing physics principles and applications in biology and medicine.**
- **The mission of the AAPM is to advance the science, education and professional practice of medical physics.**

WHAT WE DO

- **Promote the highest quality medical physics services for patients.**
- **Encourage research and development to advance the discipline.**
- **Disseminate scientific and technical information in the discipline.**
- **Foster the education and professional development of medical physicists.**
- **Support the medical physics education of physicians and other medical professionals.**
- **Promote standards for the practice of medical physics.**

HOW WE DO IT

- **Promote accreditation and periodic review of clinical practices.**
- **Promote the development of professional practice standards.**
- **Promote Continuing Medical Physics Education requirements for physicists in clinical practice.**
- **Collaborate with government and accrediting agencies to effect reasonable and effective regulations governing the clinical use of new and existing modalities.**
- **Promote consistent standards for education and clinical residency training in medical physics.**
- **Promote medical physics involvement in the training and continuing education of physicians and health professionals.**
- **Promote and participate in the development of procedures and guidelines for the safe, efficacious implementation and utilization of new technologies.**
- **Develop technical reports on the science behind medical applications of radiation.**
- **Promote research in medical applications of radiation.**

OUR NEEDS!

- **Ensuring adequate supply of Qualified Medical Physicists across all subspecialties.**
  (This includes graduate education programs, clinical residency programs, board certification programs, and continuing education services.)
- **Ensuring adequate (and consistent) level of support for research into the medical applications of radiation.**

Mission Statement - Adopted by the AAPM Board of Directors - November 28, 2009

Vision: The American Association of Physicists in Medicine (AAPM) is the premier organization in medical physics; a broadly-based scientific and professional discipline encompassing physics principles and applications in biology and medicine.

Mission: The mission of the American Association of Physicists in Medicine is to advance the science, education and professional practice of medical physics.

Goals: The goals of the American Association of Physicists in Medicine are to:

1. Promote the highest quality medical physics services for patients.
2. Encourage research and development to advance the discipline.
3. Disseminate scientific and technical information in the discipline.
4. Foster the education and professional development of medical physicists.
5. Support the medical physics education of physicians and other medical professionals.
6. Promote standards for the practice of medical physics.

Govern and manage the Association in an effective, efficient, and fiscally responsible manner.
The American Association of Physicists in Medicine (AAPM) is a scientific and professional organization, founded in 1958, composed of over 8,000 scientists whose clinical practice is dedicated to ensuring accuracy, safety and quality in the use of radiation in medical procedures such as medical imaging and radiation therapy. Medical physicists are uniquely positioned across medical specialties due to our responsibility to connect the physician to the patient through the use of radiation producing technology in both diagnosing and treating people. The responsibility of the medical physicist is to assure that the radiation prescribed in imaging and radiation therapy is delivered accurately and safely.

One of the primary goals of the AAPM is the identification and implementation of improvements in patient safety for the medical use of radiation in imaging and radiation therapy. We do this through our association's activities and in cooperation with other societies such as the American Society for Radiation Oncology (ASTRO) and the American College of Radiology (ACR). The following highlight some of the steps we have taken, and continue to take to increase safety for patients.

- The AAPM participates in the development of procedures and guidelines for the safe, efficacious implementation and utilization of existing, new and advanced technologies. This includes developing cooperative technical standards with the ACR and performing new technology/procedure assessment with ASTRO.
- The AAPM is a founding member of the Alliance for Radiation Safety in Pediatric Imaging (known as Image Gently®) and the Radiation Safety in Adult Medical Imaging Campaign (known as Image Wisely®).
- The AAPM produces many detailed scientific, educational and practical reports for technology and procedures for medical imaging and radiation therapy. These reports include specific processes for radiation dose measurement and calibration, quality assurance and peer review. These reports are presented in educational forums at national and regional meetings and are also publicly available.
- The AAPM provides medical physics guidance to facility accreditation organizations such as the Intersocietal Accreditation Commission (IAC), the ACR, ASTRO, and the Joint Commission.
- The AAPM initiated (over 40 years ago) and provides oversight of the Radiological Physics Center in Houston, Texas, which is federally funded to provide medical physics and quality review support to the National Cancer Institute (NCI) and national clinical trials groups.

AAPM

- The AAPM accredits national dosimetry calibration laboratories, which provide accurate calibration of field instruments used by medical physicists to determine clinical dose levels.
- The AAPM has been a leader and partner in guiding and facilitating improved system connectivity and communication in the medical information environment, specifically as it relates to accurate information transfer during procedures that use medical radiation.
- The AAPM provides education on medical errors, error analysis and reduction and responds rapidly to needs in the area of technical quality and safety. For example:
  - The special Quality Assurance meeting held in 2007, together with ASTRO and NCI;
  - A Computed Tomography (CT) Dose Summit held initially in 2010 to address CT dose protocol consistency; and
  - A Safety in Radiation Therapy meeting was held in 2010 in collaboration with ASTRO and included treatment team members, manufacturers, government agencies, and patient interest groups.

In addition to these activities, AAPM has devoted a substantial part of its energy to the creation and recognition of a position known as Qualified Medical Physicist, or QMP. These physicists have a unique combination of education in the principles of physics, radiobiology, human anatomy, physiology and oncology through a graduate degree, as well as clinical training in the applications of radiation physics to medicine, such as the technologies of medical imaging and treatment delivery, radiation dose planning and measurement, as well as safety analysis and quality control methods. Following this, an individual demonstrates competence in his/her discipline by obtaining board certification (currently offered for ionizing radiation imaging and radiation therapy through the American Board of Radiology). Certification is a rigorous, multi-year process that requires considerable supervised clinical experience as well as passage of written and oral examinations. The AAPM recognizes a Qualified Medical Physicist for the purpose of providing clinical medical physics services, as an individual who is board-certified in the appropriate medical subfield and has documented continuing education (AAPM Professional Policy 1).

All of the efforts mentioned are aimed at providing safer, more accurate and more effective patient procedures using medical radiation and we will continue to work toward achieving the absolute minimum error rate. However, there are some challenges we face in trying to meet these goals:

- While the AAPM has a clear definition of a Qualified Medical Physicist, there is no consistent national recognition of this credential. Medical physicists are licensed in 4 states (TX, NY, FL, HI) and regulated at widely varying levels in the other 46 states.

- The reports that AAPM (and others) publish have only the force and effect of professional and scientific guidelines.

- There are no consistent national staffing standards for medical physics services nor are there consistent standards for accrediting practices that utilize medical physics services.

- As stated above, clinical training in medical physics is a crucial component of preparing new entrants into the profession. A formal medical physics residency is the best method for accomplishing this, and the American Board of Radiology (ABR) now requires completion of a medical physics residency to qualify for entry into final stages of the examination process. Funding sources and mechanisms for such residency programs are inconsistent and have been a significant factor in the rate of creation of such residency programs.

National Crisis: Where are the Radiation Professionals?
Private Organization: The American Board of Radiology

MISSION

The mission of the American Board of Radiology is to serve patients, the public, and the medical profession by certifying that its diplomates have acquired, demonstrated, and maintained a requisite standard of knowledge, skill, understanding, and performance essential to the safe and competent practice of diagnostic radiology, interventional radiology, radiation oncology, and medical physics.

WHAT WE DO

-Provide Initial Certification in diagnostic radiology (DR), interventional radiology/diagnostic radiology (IR/DR), radiation oncology (RO), and medical physics (MP)

-Provide certification pathways to AU-, RSO-, and AMP-eligibility that are based upon: 1) fulfillment of NRC training and experience requirements, 2) passing performance on specific ABR exam content

-Offer Maintenance of Certification (MOC) programs in DR, IR/DR, RO, and MP

HOW WE DO IT

-Develop and administer examinations for initial certification in DR, IR/DR, RO, MP

-Develop and administer MOC examinations in DR, IR/DR, RO, MP

-Publish study guides, content outlines, practice exams, and other tools to assist candidates and diplomates in their preparation for ABR examinations

-Set MOC standards that are increasingly focused on practice performance assessment and improvement

-Continually work to align all MOC elements with the practice lives of our diplomates, as well as with the demands associated with external stakeholders (eg. state licensure, hospital credentialing, federal incentive programs, etc.)

OUR NEEDS!

-Active liaison with a wide variety of stakeholder organizations to ensure relevance of examinations and MOC requirements

-Continuing support of a dedicated cadre of volunteers to assist in examination development and delivery

-Commitment to MOC participation among all diplomates (including those holding "lifetime" certificates)

-MOC programs that incorporate measures of safe and appropriate use of medical imaging and radiation (work is underway)

The American Board of Radiology (ABR)

The ABR was incorporated in 1934 and is one of the 24 member boards comprising the American Board of Medical Specialties (ABMS). Between 1934 and 1994, all of the more than 50,000 certificates awarded by the ABR to candidates for certification in diagnostic radiology, radiation oncology and medical physics, were issued bearing only the date the certificates were issued. These certificates were generally considered to be “lifetime,” although they were more precisely defined as “non-time limited.” Once initially certified by the ABR, diplomates had minimal contact other than for periodic requests for verification of credentials as requested by various entities and the public.

In order to better serve the public and the profession(s) in 2006 the ABMS implemented a program of Maintenance of Certification (MOC) composed of 4 primary parts, which was adopted by all member boards:

- Part 1: Evidence of Professional Standing
- Part 2: Evidence of participation in a program of Lifelong Learning and Self-Assessment
- Part 3: Evidence of Cognitive Expertise
- Part 4: Evidence of evaluation and improvement of performance in practice

This program is designed to ensure that diplomates attain a requisite level of skill and knowledge at the completion of their post-graduate residency training, and in addition, maintain their skills, knowledge and professionalism throughout the duration of their careers. Beginning in 1995, all diplomates in radiation oncology were issued only 10-year time-limited certificates and are required to participate in MOC. The same requirement was implemented for diagnostic radiology and medical physics diplomates in 2002.

The initial certification process includes written qualifying (computer-based) examinations in basic sciences, physics, and clinical content. Candidates in training programs approved by the Accreditation Council on Graduate Medical Education (ACGME) are eligible to sit for the basic science examinations during their training and for the clinical examination after completion of training. The oral examination is a case-based, clinical examination.

Material covered in the ABR initial certification examinations is based on the curricula requirements promulgated by the ACGME Residency Review Committees (RRCs) in Diagnostic Radiology and Radiation Oncology, and published in their *Program Requirements for Graduate Medical Education*. Program requirements include didactic training and procedures required by the US Nuclear Regulatory Commission (NRC) to fulfill their requirements for eligibility as Authorized Users of NRC-regulated isotopes. Didactic training (and subsequent examination) includes radiation safety, protection, hazards, and regulations.

Examination of medical physicists was previously based on curricula developed by the American Association of Physicists in Medicine (AAPM), but beginning in 2014, will be based on curricula developed by the Commission on Accreditation of Medical Physics Educational Programs (CAMPEP). Both curricula provide competencies to enable certified physicists to serve as institutional radiation safety officers or authorized medical physicists.

A current goal of the ABR is to increase the participation in MOC by diplomates certified prior to issuance of time-limited certificates, and to increase the relevance of the MOC processes to the current practice of medicine and governmental agency requirements.

National Crisis: Where are the Radiation Professionals?
Private Organization: **American Board of Radiology Foundation**

MISSION

The mission of ABRF is to demonstrate, enhance, and continuously improve accountability to the public in the use of medical imaging and radiation therapy.

VISION

-Medical radiation is used safely & optimally

-Practice performance is enhanced over the practice lifetime of the healthcare professional

-Systems are better and safer; public health is improved

-Dissemination of research findings, education, training, and team care are the norm

WHAT WE DO

-Develop and implement a national strategy for safe, appropriate, and patient-centered medical imaging

-Develop policies, standards, measures, and protocols that enhance the quality, safety, and cost-effectiveness in the use of medical imaging and radiation therapy

-Disseminate information and educational materials that result in safe, optimal use of medical imaging and radiation therapy

HOW WE DO IT

-Convene diverse group of stakeholders: representatives from public, private, and professional sectors to:

-Select the most important gaps to address

-Match gaps to one or more relevant domain(s): patient/consumer groups, healthcare organizations, payers, business coalitions, quality/standards/measures/EBM groups, certifying and accrediting bodies, healthcare professionals, government/regulatory agencies, public awareness/education alliances, equipment manufacturers

-Pursue individual initiatives to address the gaps

-Report back to one another and to broader audiences through meetings and publications

OUR NEEDS!

$$$

The American Board of Radiology Foundation (ABRF)

The American Board of Radiology Foundation (ABRF) is a 501(c)3 organization focused on creating a high-functioning, well-coordinated health system in which medical imaging and radiation are used safely and appropriately to deliver all the benefits that can be realized, while minimizing risk and waste.

The Foundation's long-term vision is an inclusive public/private/professional effort with sole focus on serving the public good in the use of medical imaging and radiation therapy.

- Radiation is safely used in medical imaging and radiation therapy
- Radiation is optimally used in medical imaging and radiation therapy
- Practice performance in medical imaging and radiation therapy is enhanced over the professional practice lifetime of the healthcare professional
- Public health is improved through better and safer systems, disseminiation of research findings, education and training, and team approaches to the use of radiation in healthcare

The Foundation seeks to use the following strategies to reach its vision and fulfill our mission:

- A public/private/professional partnership to convene, coordinate, guide, and support efforts aligned with the mission
- Policies, standards, measures, systems, and protocols that enhance the quality, safety, and cost-effectiveness in the use of medical imaging and radiation therapy
- Dissemination of information and educational materials that result in a safe, optimal use of medical imaging and radiation therapy

The Foundation is felt to occupy a unique altruistic role among radiologic organizations. The current struggle for U.S. healthcare reform largely centers on the public need for increased value as defined by quality in outcomes, safety, and services, as well as affordable access to services. During this time of intense debate over how to reform our healthcare system, the values and principles underlying our profession are subject to misunderstanding, distortion, or even worse, being ignored.

Our society has become accustomed to the use of leverage, negotiation, and politics to achieve progress, so idealism may be viewed as tainted by a zealous form of self interest. However, a sense of altruism underlies the fundamental reason each of us chose a profession in healthcare. How do we express this altruistic sense of professionalism in a manner that is unquestioned by the public?

The Foundation has convened a series of summits including a wide variety of stakeholders to fulfill its mission, but has been hampered in its efforts by a lack of a stable and sufficient funding mechanism.

http://www.abrfoundation.org/about

National Crisis: Where are the Radiology Professionals?
American College of Radiology

Mission

The mission of the ACR is to serve patients and society by maximizing the value of radiology, radiation oncology, interventional radiology, nuclear medicine and medical physics by advancing science of radiology, improving the quality of patient care, positively influencing the socio-economics of the practice of radiology, providing continuing education for radiology and allied health professionals and conducting research for the future of radiology.

What We Do

Represent all our members and the n36,000 diagnostic radiologists and radiation oncologists practicing in USA.

The College is organized around the following five pillars:

-Advocacy

-Clinical Research

-Economics

-Education

-Quality and Safety

How We Do It

- Annual Meetings
- Capital Hill Visits
- Professional Staff
- Lobbyists
- Annual Workforce Survey of Practice Leaders (survey present workforce, who was hired past year, who plan to hire next year and in 2 years)
- Provide Continuing Education seminars/workshops
- Setting Quality & Safety standards and accrediting radiology facilities

Our Needs

- Ability to be flexible regarding training of residents and fellows.
- Ability to accurately predict the effect of healthcare policy changes on workforce needs.
- Understand how disruptive technologies will effect and influence workforce demands.

National Crisis: Where are the Radiology Professionals? American College of Radiology

Edward I. Bluth, MD, FACR, FSRU

The mission of the American College of Radiology is such that we are intimately involved in all issues dealing with Radiology professionals. The ACR represents approximately 36,000 diagnostic radiologists, radiation oncologists and physicists practicing in the United States of America.

The ACR is governed by a board of Chancellors. One of the Chancellors is chairman of the Human Resources Commission. Through this Commission, an annual workforce survey of practice leaders is conducted. This survey, which has been done for the past two years, is now an annual activity. The survey identifies the makeup of the present workforce, what type of specialists and subspecialists were hired during that year and what is the prediction for hiring specialists and subspecialists the next year and in the following two years. This survey monitors radiologists, physicists, and technologists.

The ACR hopes therefore to play an important role in predicting the training needs for radiologists, physicists, technologists and those other allied health professions involved inradiological sciences. We hope to use this information to influence the training of radiologists and allied health professionals. The Commission also hopes to predict the effect of healthcare policy changes on workforce needs and have a role in influencing those changes. Additionally, we hope to understand how disruptive technologies will affect and influence workforce demands in the future and as a result we hope to be able to offer guidance to our members regarding these issues.

National Crisis: Where are the Radiation Professionals?

American Society for Radiation Oncology (ASTRO)

MISSION

- ASTRO is dedicated to improving patient care through education, clinical practice, advancement of science and advocacy.
- ASTRO has 10,000 members, with 4500 radiation oncologists. Other members include researchers, physicists, nurses.
- Radiation oncologists are board certified physicians who treat 60% of cancer patients using high-energy X-rays, electron beams, or radioactive isotopes.

WHAT WE DO

- Provide state-of-the-art education and lifelong professional development in the effective use of radiation as a tool for the treatment of patients with cancer and benign disease.
- Publish the premier scientific and practice journals in radiation oncology.
- Advance the science through research and innovation to improve clinical outcomes for each patient.

HOW WE DO IT

- Education and CME/SAM offerings – ASTRO Education Staff
    - Nuclear Radiologic Preparedness Training Course Part I: Evaluation of the Problem; Part II: Treatment of Exposed Patients; Part III: Follow-up and Planning [2008 ASTRO Annual Meeting, 99 attendees; Scheduled for 2014 ASTRO Annual Meeting]
- Increase investment in radiation oncology research by supporting sustainable and predictable funding – ASTRO Government Relations Staff

OUR NEEDS!

- Funding of specific high-value, high-quality projects to develop or enhance centers of excellence in radiation-related cancer biology and radiation biology.
- Strengthening the basic cancer biology/radiation biology curricula of post-graduate training programs to better prepare residents in radiation oncology to understand and expeditiously adapt new scientific discoveries into their clinical practice and to encourage research efforts in these areas of investigation.
- Aggressively and widely "market" the activities of these researchers in cancer biology and radiation research.

Radiation Oncology Manpower Projections

- It is estimated that between 2010 and 2020, the total number of patients receiving radiation therapy will increase by 22%, and the number of radiation oncologists will increase by 2% (Smith, *JCO,* 2010).
- ASTRO remains committed to supporting collaborative cancer care, conducting research, providing education, meeting national needs, and collaborating with other professionals.

National Crisis: Where are the Radiation Professionals?

American Society for Radiation Oncology (ASTRO)

MISSION

- ASTRO is dedicated to improving patient care through education, clinical practice, advancement of science and advocacy.
- ASTRO has 10,000 members, with 4500 US radiation oncologists and 2500 international physicians. Other members include researchers, physicists, and nurses.
- Radiation oncologists are board certified physicians who treat 60% of cancer patients using high-energy X-rays, electron beams, protons, or radioactive isotopes. They work with a comprehensive radiation oncology team including physicists, dosimetrists, nurses, engineers, data managers, radiation therapists (technologists) and others to provide a coordinated care experience. They work collaboratively with medical oncologists, surgeons, radiologists, pathologists and other members of the cancer team to provide coordinated care for cancer patients. They serve as radiation experts and resources in their hospitals and communities around issues of cancer control, radiation safety, preparedness, and if needed monitoring, decontamination and triage in consultation with colleagues.

HOW WE DO IT

- Education and CME/lifelong learning offerings – ASTRO Education staff and faculty
- Large annual meeting and many disease and procedure focused meetings, journals
    - Nuclear Radiologic Preparedness Training Course Part I: Evaluation of the Problem; Part II: Treatment of Exposed Patients; Part III: Follow-up and Planning [2008 ASTRO Annual Meeting, 99 attendees; Half day symposia being planned for 2014]
- Increase investment in radiation oncology research by supporting sustainable and predictable funding – ASTRO Government Relations staff and members

WHAT WE DO

- Provide state-of-the-art education and lifelong professional development in the effective use of radiation as a tool for the treatment of patients with cancer and benign disease.
- Publish the premier scientific and practice journals in radiation oncology.
- Advance the science through research and innovation to improve clinical outcomes for each patient.

OUR NEEDS!

- Funding of specific high-value, high-quality projects to develop or enhance centers of excellence in radiation-related cancer biology and radiation biology.
    - In a 2012 report to Congress, NIH acknowledged that less than 1% of the total NIH budget in FY 2010 and 2011 was spent on radiation oncology research. Just over 4 percent of NCI's budget was spent on radiation oncology-specific projects in FY 2010 and 2011. The funding for radiation oncology research is not adequate to sustain new discoveries or the scientists in the field.

AMERICAN SOCIETY FOR RADIATION ONCOLOGY
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National Crisis: Where Are the Radiation Professionals?

Government Organization: **CRCPD & States**

David J. Allard, CRCPD's Liaison to the NCRP

MISSION

- **CRCPD's Mission** is "to promote consistency in addressing and resolving radiation protection issues, to encourage high standards of quality in radiation protection programs, and to provide leadership in radiation safety and education."
- CRCPD & States - **Primary Goal** is to assure that radiation exposure to individuals is kept to the lowest practical level [ALARA], while not restricting its beneficial uses.
- Protect the environment, public H&S from controllable sources radiation at the state level

WHAT WE DO

States - Radiation Protection Laws, Regulations and Guidance.

- Establish & amend state Radiation Control Laws
- Promulgate and update Radiation Protection Regulations

CRCPD - develop Model Regulations, Standards, White Papers, Guidance, and Position Statements

States - Train staff for 'Permitting,' Inspection and Emergency Response

- Functional Areas: Radioactive Materials, Waste, X ray / Accelerators, Radon, Reactors & RadChem

HOW WE DO IT

States: Managers, Supervisors, Civil Service, Admin Support, Contract Staff and Union Reps

- Licensing, Registration and Certification Staff
- Inspectors, Compliance and/or Legal Staff
- Emergency Responders (everyone has a role)
- Radiological Health Physicists
- X-ray and Nuclear Medicine Technologists
- Nuclear Engineers and Safety Specialists

Promote: Professional Leadership, Inter-agency / Association Cooperation, Information Exchange and Regulatory Uniformity

OUR NEEDS!

States - Staff Hiring and Development

- Impending 'Baby Boomer' Retirements
- Appropriate Knowledge Transfer
- Program Gaps, Growth and Training
- 'Growing' and Retaining Radiological HPs
- Training: RAM, X ray, Radon, Emergency Response, Non-ionizing, Qualifications
- Fair Salaries, Benefits and Pensions in State Government, Agencies & Organizations
- Surge Capacity for Emergency Response at State & Local Level

NCRP WARP Meeting

July 17, 2013

National Crisis: Where Are the Radiation Professionals?

The CRCPD / State Government Organization Perspective

David J. Allard, CRCPD's Liaison to the NCRP

Abstract & Summary

The CRCPD is a non-profit professional organization formed in 1968 to provide a common forum for state Radiation Control Programs, as well as a direct interface with their federal counterparts. CRCPD's mission is "to promote consistency in addressing and resolving radiation protection issues, to encourage high standards of quality in radiation protection programs, and to provide leadership in radiation safety and education." The shared primary goal of the CRCPD and individual states is to assure that radiation exposure to individuals is kept to the lowest practical level [ALARA], while not restricting its beneficial uses, and, to protect the environment, public health and safety from controllable sources radiation at the state level. While the CRCPD is the organization that may represent states collectively, and interface with various counterpart federal agencies, the individual states are [most often] responsible for radiation control within their borders.

Most states have established radiation protection laws, regulations and provide the regulated community with appropriate guidance. These laws, regulations and guides pertain to the functional areas of: radioactive materials, low-level radioactive waste, x ray and accelerators, indoor radon and emergency response for power reactors. At this point in time, it is a fairly infrequent situation where a state needs establish or amend a state radiation control law, however, states often promulgate and update their regulations. This is where the CRCPD provides value through the development of model state regulations, guidance, standards, white papers and position statements. To implement state radiation control programs requires a cadre managers, supervisors, administrative support, and technical staff.

State staff will perform the functions of: permitting (i.e., licensing and registration of radiation sources), certification of individuals or operations, inspection of facilities and operations, and, radiological emergency response. Technical and admin staff most likely enter state employment through a Civil Service Commission process, but in the case of upper management, may be appointed. For management and operational technical positions, staff come from the occupational disciplines of: Radiological Health Physics, X-ray and Nuclear Medicine Technology, Nuclear Engineering and the Nuclear Safety areas. Regardless of an individual's academics, experience and professional credentials, currently in state radiation control programs, they will most likely require additional training to qualify for licensing, inspection or compliance work. Similarly, specific training is required for state emergency responders with respect to the national emergency response framework, emergency support functional areas and state and federal, state and local protocols and procedures for effective nuclear / radiological emergency response.

With the CRCPD and states' shared objects to promote professional leadership, inter-agency / association cooperation, information exchange and regulatory uniformity – we need to maintain a highly trained workforce in the technically challenging areas of radiation protection and control and nuclear safety. With the ongoing and impending 'Baby Boomer' retirements from state service there needs to be opportunity for appropriate knowledge transfer. To do this state human resource (HR) organizations need to critically examine their staff hiring approaches and staff development requirements. Without a change in HR practices where key staff positions are allowed to overlap with outgoing and incoming staff, important program experience and institutional knowledge may be lost. For perhaps every state, the fiscal situation is the same, with revenue shortfalls causing hiring freezes and stagnant salaries. Each state is faced with the dilemma of fair salaries for management and union contract-covered staff, and the increasing cost of benefits and pensions in state agencies, organizations and government overall.

Through the years, state government salaries have been low relative to their federal and private sector counterparts. Yet states have been able to recruit and retain staff, e.g., Radiological Health Physicists (RHPs), with the prospect of good healthcare benefits and a defined retirement income at the end of an individual's career. Should states continue to move away from that traditional model and maintain lower salaries, but with reduced healthcare and pension benefits – this will no doubt lead to fewer numbers of candidate RHPs to hire, and long-term problems in growing and retaining RHPs. There is current evidence in the NRC Agreement States area to illustrate the program gaps and difficulty states are having in 'growing' and training RHPs.

Looking ahead, this writer predicts that states will need to retrain individuals and recent graduates with degrees in science for state radiation control work in the areas of: radioactive materials, x ray / accelerators, radon, radiological emergency response and non-ionizing radiation. Once training and qualifications are complete, states may have to accept the fact they will have a significant fraction of their staff leave state service for federal or private sector positions. Lastly, for some state and local-level radiological emergency response scenarios (e.g., NPP accidents, RDDs or INDs), there will never be sufficient numbers of RHPs for surge capacity population radiation monitoring. Thus, we must go 'back to the future' with the old Civil Defense model and recruit volunteers for radiation monitoring.

National Crisis: Where are the Radiation Professionals?

Professional Organization: Health Physics Society

MISSION

Promoting excellence in the science and practice of radiation protection

WHAT WE DO

Support and promote best practices in radiation safety
Conduct public information and outreach efforts
Facilitate professional contacts and interaction
Accredit academic programs (thru AIHA)
Inform Congress and federal agencies on Radiation Safety issues
Conduct continuing professional education programs

HOW WE DO IT

Hold annual and midyear technical meetings

Publish Health Physics Journal, Operational Radiation Safety and HP News

Provide continuing education opportunities

Support 42 US and 2 international chapters

Recognize professional accomplishments

Involve students through Student Support Committee activities, fellowships and grants

Develop and maintain ANSI standards in rad safety

Maintain relationships with vendors

"Ask the Experts" and radiationanswers.org web page

Employment exchange

OUR NEEDS!

Sustain the services of the Society to the HP profession by maintaining/increasing membership levels

- **Recruitment and retention of Full members**
- **Attract student members and retain after graduation**
- **Identify and develop qualified volunteers for leadership positions**
- **Develop/deploy multimedia outreach program to appeal to younger radiation safety professionals**
- **Increase efficiency of delivery of professional/technical info to members**

Abstract – Health Physics Society Quad Chart
Kathryn H. Pryor

Who we are:
The Health Physics Society (HPS) was founded in 1956 as a professional society dedicated to promoting excellence in the science and practice of Radiation Safety. The HPS has a current membership of approximately 5000, consisting of plenary/full, associate, fellow, life, student and affiliate categories of membership. Our plenary membership was as high as 4200 in 2001, but today, plenary membership has fallen to 2700. The 61 affiliate (vendor) members exhibit at our meetings. The HPS has 9 technical sections, and charters 42 local chapters in the US and 2 international chapters (Taiwan, Republic of Georgia).

What we do and how we do it:
The HPS provides products and services to support and promote best practices in radiation safety. This is principally accomplished through technical meetings, continuing education opportunities, national consensus standards and professional publications.

The HPS holds two technical meetings each year – the mid-year topical symposium and the annual meeting. The meetings provide attendees with current technical presentations, vendor exhibitions and networking opportunities with other radiation safety professionals. Embedded in each meeting are Professional Enrichment Program (PEP) and Continuing Education Lecture (CEL) courses, which provide professional level continuing education opportunities and continuing education credits for health physicists who are certified by the American Board of Health Physics. The professional accomplishments of members are recognized annually by various HPS awards, which are presented at the annual meeting's awards banquet.

The HPS provides additional education opportunities through our Professional Development Schools, which are held approximately annually. The PDS's consist of three to five days of instruction on a single topic or focus area by HPS members who are experts in that area.

The HPS engages in public information and outreach efforts through our "Ask the Experts" feature on our website, our Position Statements and Fact Sheets, and our Radiationanswers.org website. Our government relations program, consisting of a Congressional/Federal Agency Liaison and a Washington Representative (who is resident in DC), seeks to promote the HPS as a source of expertise in radiation safety for congress and federal agencies.

The HPS publishes two professional journals – *Health Physics* and *Operational Radiation Safety* – and the monthly electronic publication *Health Physics News*. The HPS also functions as the secretariat for the ANSI/HPS N13 and N43 committees, developing and publishing consensus standards. Through our members' only website, members can post resumes and job openings.

The HPS awards 8 to 10 named scholarships/fellowships to students and provides partial travel support to the annual meetings through 60 to 70 travel grants. In addition, two of the technical sections provide awards to students for presentations in their topical area. Students have opportunities to participate in the HPS through the Student Support Committee, the Student mentoring program, and Student reception. The chair of the student support committee is one of the advisors to the Board of Directors.

The HPS accredits academic programs in health physics through ABET via a Memorandum of Understanding with the American Industrial Hygiene Association (AIHA).

Our needs:
Recruitment and retention of members into the HPS is of prime importance. The HPS needs to reverse the decline in membership and maintain sufficient membership levels to continue to provide products and services to the health physics profession. Without adequate membership levels, the volunteer pool will shrink to the point that it will be difficult to put on technical meetings, teach continuing education courses, provide education and outreach to the public, federal agencies and congress, publish the technical journals and develop consensus standards.

To this end, the HPS needs to recruit and retain plenary/full members to replace those who have retired or passed on. We also need to attract and retain students while still in their academic programs, and then transition them to plenary members upon graduation. We need to identify and develop qualified volunteers for committee chair, director and officer positions within the HPS. Attracting younger members requires a more forward-thinking approach to communications (e.g., social media, webinars and electronic communications).

Finally, we need to increase the efficiency of development and delivery of professional/technical products and services for our members. We need to move towards innovative ways to provide professional products/services to our members in the face of shrinking budgets, travel restrictions and competition with other interests for members' time and attention.

National Crisis: Where are the Radiation Professionals?

Organization: US Commercial Nuclear Power Reactors

MISSION

-Protecting worker and public health and safety in support of safe, reliable and economic operation and decommissioning of commercial nuclear power reactors

- Comply with USNRC, USEPA, and USDHS/FEMA radiation protection regulations
- Pursue excellence in radiation protection (in accordance with Institute of Nuclear Power Operations criteria)
- Manage radiation liability and risk (in accordance with American Nuclear Insurers criterai)

WHAT WE DO

Develop and implement comprehensive radiation protection programs to support safe, reliable and economical operation and decommissioning of commercial nuclear power reactors, including:

- Occupational radiation protection
- Public radiation protection (radiological effluents and environmental monitoring)
- Radioactive source safety and security
- Radioactive waste management
- Emergency planning, preparedness and response

HOW WE DO IT

-40-60 Health Physicists

-800-1200 Health Physics Technicians

-20-40 Radio-chemists

-240-360 Radiochemistry Technicians

-600-800 Contractor Health Physicists and Health Physics Technicians

OUR NEEDS!

-Continued professional development of existing staff

-Replacement staff to address retirement and attrition

-Entry level professional and technician staff

-Stability in regulations and standards

-Enhanced emergency response (radiation protection) capability for severe accidents

-Better understanding of low dose radiation risk incorporated into radiation protection policy and regulation

National Crisis: Where are the Radiation Professionals?

Organization: National Registry of Radiation Protection Technologists (NRRPT)

MISSION

Develop standards and procedures for the registration of Radiation Protection Technologists (RPTs); to institute examinations leading to registration; and to issue written proof of registration to individuals who possess the required qualifications for registration.

The objective is to encourage and promote the education and training of RPTs and, by so doing, promote and advance the science of Health Physics.

WHAT WE DO

Evaluate applicants – 5 year minimally qualified

Perform examinations – Criteria based, 150 question exam covers broad-based radiation protection knowledge of accelerators, university health physics programs, medical health physics, power reactors, government radiological facilities, radioactive waste disposal, transportation of radioactive material, fundamentals, and regulatory requirements

Registration Maintenance – 5 year cycle to demonstrate currency

HOW WE DO IT

Initial job task analysis to determine scope and extent of required knowledge

Review of applicant education and experience

Examinations

-Developed by multi-disciplinary Panel of Examiners

-Two exams per year in US

-Version for use in Canada

American Council of Education (ACE) Credit Recommendation – 30 semester hours

OUR NEEDS!

Backfill for impending retirements

More programs to develop RPTs

-In-House development programs

-More college/university programs

Sustainable employment throughout the year to maintain core of contract RPTs

Closer working relationships with sister organizations

National Registry of Radiation Protection Technologists

The NRRPT was established in 1976 through the sponsorship of the Health Physics Society and the American Board of Health Physics. The purposes of the NRRPT are to develop standards and procedures for the registration of Radiation Protection Technologists (RPTs); to institute examinations leading to registration; and to issue written proof of registration to individuals who possess the required qualifications for registration. The objective of the NRRPT is to encourage and promote the education and training of Radiation Protection Technologists and, by doing so, promote the science of Health Physics.

The NRRPT currently has 5,257 registered members, of which approximately 1600 maintain Active Practitioner status.

National Crisis: Where are the Radiation Professionals?

Scientific Society – Radiation Research Society

MISSION

- **To encourage in the broadest manner the advancement of radiation research in all areas of the natural sciences;**
- **To facilitate cooperative research between the disciplines of physics, chemistry, biology and medicine in the study of the properties and effects of radiation;**
- **To promote dissemination of knowledge in these and related fields through publications, meetings and educational symposia.**

WHAT WE DO

Serve as a home for a broad spectrum of researchers in all branches of the radiation sciences

HOW WE DO IT

- **Hold annual meeting attended by national and international radiation researchers**
- **Offer facilities for "Scholars-in-Training" (SITs), consisting of:**
  - **Discounted membership and registration rates**
  - **1 day workshop for SITs held prior to annual meeting**
- **Provide financial support for radiation meetings attended by our SITs (e.g. Gordon conference, ERR, NCRP, etc.) as well as providing financial support for International Congress of Radiation Research**

OUR NEEDS!

Junior faculty members

- **Providing opportunities for career development (generation of faculty positions)**
- **Assistance with grant funding (small pilot grants, bridging funds)**

Senior faculty members

- **Job security**
- **Bridging funds**
- **Acknowledgement of radiation as a viable field**

Where Are the Radiation Professionals? – A RRS (and CMCR) Perspective.

Jacqueline Williams, PhD, FASTRO
Professor, University of Rochester Medical Center

The Radiation Research Society offers a unique home to all radiation professionals, especially those involved in any form of radiation research, but focused on radiation chemists, physicists, biologists and oncologists. The Society holds an annual meeting, which draws together many members of the radiation research community, both national and international. In order to try and assist our budding researchers, we offer a separate class of discounted membership (Scholars-in-Training [SITs]) to graduate and post-doctoral students, and offer these young people a number of benefits, including discounted meeting registration, travel funding to attend the annual meeting (~100 are provided annually), and a dedicated workshop held immediately prior to the annual meeting.

As the former Chair of the Membership Committee and immediate past President of the Radiation Research Society, I have observed that the overall membership numbers of the Society have been in a relatively steep decline since the early 1990s. Most noticeably, despite the efforts being made on behalf of the SITs, the average number of graduates making the transition from SIT to full membership is ~3-8%. This has led to a growing "black hole" in our membership ranks between the younger trainees and the increasingly gray, older members. Surveys performed by the SITs themselves and also by the membership committee have resulted in a long list of reasons why this transition is not being made, but many cite the lack of available progressive employment (the lack of a clear career path) and the perception that there are few grants available in the field (with fierce competition for those that are available). So I would go further to ask where are all of the radiation professionals going once they have been trained?

The efforts currently being made by the RRS are to expand on the proffered travel funding to include those members that can be defined as junior faculty. In addition, I am currently leading an effort to develop a Foundation with the sole mission of providing assistance to junior faculty in the form of meeting travel grants, pilot funding and/or funding for sabbatical visits to mentors/ teaching labs. However, the limitation on funding means that such efforts will be a mere drop in the bucket when it comes to rescuing our declining membership numbers.

With respect to the CMCRs, following the events of 9/11, there was a realization at the Federal level that there was little to no ability to respond to a large scale nuclear or radiological event and a dearth of radiation scientists to be able to enable such a response, leading to part of the NIAID CBRN funding being targeted particularly at the radiation response. As a participant, and now PI, of one of the resulting Centers for Medical Countermeasures against Radiation (CMCR), currently ending their eighth year of funding, I have witnessed a transition in Federal attitudes towards radiation and its workforce. In the original RFI, questions were raised regarding training and education of a radiation research workforce. In the original RFA, all CMCRs were required to have a training component; this was removed during the subsequent recompete, although the CMCRs are still strongly encouraged to include members from diverse disciplines in their Centers in an attempt to broaden the radiation workforce. However, this has had limited results and, if anything, has increased the numbers of scientists competing for the ever decreasing numbers of grants available in this field.

NOT PRESENTING

National Crisis: Where are the Radiology Professionals?
American Registry of Radiologic Technologists

Mission

The ARRT promotes high standards of patient care by recognizing qualified individuals in medical imaging, interventional procedures and radiation therapy.

ARRT's nine-member Board of Trustees, 75-member staff, and over a hundred volunteers serving on various committees work together to achieve the mission.

What We Do

ARRT offers certification programs in 15 categories of medical imaging and radiation therapy and maintains a searchable database of individuals who earned initial certification and maintain registration of that certification. The database is public and is available to employers, patients, and members of the profession.

How We Do It

ARRT develops personnel standards that define what it means to be qualified to perform medical imaging and radiation therapy and uses those standards to evaluate individuals applying for certification and registration. The standards fall into three categories: Education, Ethics, and Examination. The education requirement applies at entry into the profession and to points beyond entry. At entry, individuals must document completion of an accredited educational program that includes both didactic and clinical requirements as specified by ARRT. Every two years after initial certification individuals must document completion of suitable continuing education to maintain registration of their certificate. The ethics requirement must be met at the point of initial certification and every year upon renewal of registration. *ARRT's Standards of Ethics* include both a Code of Ethics which is aspirational and Rules of Ethics which are enforceable. The examination requirement applies only at entry into the profession, but for all certifications issued in 2011 and thereafter, there is a structured self assessment that must be completed every ten years to assess knowledge gaps which must then be remediated.

Our Needs

Better business intelligence to more quickly detect changing practice patterns which affect the qualifications needed for technologists in medical imaging and radiation therapy.

National Crisis: Where are the Radiation Professionals?

Accrediting Organization: Health Physics Academic Programs

MISSION

- to educate radiation safety professionals to meet the challenges of the future.

WHAT WE DO

- Programs specialize in many different areas including every facet of the nuclear fuel cycle (mining, enrichment, fabrication, power generation, recycling and disposal) to radiological control at national laboratories, hospitals, and research centers.

- Our students are engaged in every aspect of the nuclear industry ranging from radioanalytical surveillance, radioecology, dosimetry, and radiological engineering to radiation biology, and regulatory support.

HOW WE DO IT

-There are about 40 programs nationally which self-report a capability to provide some training/education in Health Physics.

-Perhaps 12 programs have sufficient faculty and staff to provide the numbers of newly graduated students at B.S., M.S., and Ph.D. levels to have an appreciable effect on the national needs for radiation professionals.

Considering these programs, 7 are currently accredited by ABET Inc., at the M.S. or B.S

OUR NEEDS!

The short term needs are evident: Federal funding of previously existing student scholarship and fellowship programs, cut recently in the administration's proposed budget, must be restored.

Specific research programs aimed at improving current technology in Health Physics need to be developed.

Who we are:

Overwhelmingly the mission of the Health Physics Academic Programs in the United States is to educate radiation safety professionals to meet the challenges of the future. Programs specialize in many different areas from operational safety in every facet of the nuclear fuel cycle (mining, enrichment, fabrication, power generation, recycling and disposal) to radiological control at national laboratories, hospitals, and research centers. Our students are engaged in every aspect of the nuclear industry ranging from radioanalytical surveillance, radioecology, dosimetry, and radiological engineering to radiation biology, and regulatory support.

There are about 40 programs nationally which self-report a capability to provide some training/education in Health Physics. Perhaps 12 programs have sufficient faculty and staff to provide the numbers of newly graduated students at B.S., M.S., and Ph.D. levels to have an appreciable effect on the national needs for radiation professionals. Considering these programs, 7 are currently accredited by ABET Inc., at the M.S. or B.S. levels[1].

What we do:

Undergraduate programs typically award B.S. degrees in Physics, Engineering, and Environmental Sciences. Most programs require about 120 credits for graduation, perhaps up to a third of those credits are in discipline specific topics, another third in math and physical sciences, and the remaining third in general educational requirements. Graduate programs at the M.S. level typically have at least a 30-credit graduation requirement and vary with respect to thesis or non-thesis options. As research degrees, Ph.D. programs vary considerably. The majority of current academic programs have access to some sort of distance learning capability; however, this technology is not universally exploited within the discipline. With few exceptions, most distance learning programs are relatively small. During strong economic times the programs as a whole can produce between 100 to about 170 graduates annually. Current graduate production based on a great deal of experience is anticipated to follow labor market trends. We are in the mist of arguably the worst job market in several decades. The nature of the job market varies considerably among various regions in the country. It appears to be strongest in the Southeast, and East central regions of the country. While graduate production has been anemic, it has been steady; but it is likely to drop over the next few years.

How we do it:

While undergraduate students are eligible for various loans and federal at-large student grants, it is estimated that not more than 5% of undergraduates are supported institutionally in the disciplines of Health Physics or Radiological Engineering nationally. Graduate Student support is more prevalent. Most graduate students are at least partially supported through programs, as part of faculty research, or scientific support contracts. Until recently, some graduate student funding was available through the United States Nuclear Regulatory Commission and the United States Department of Energy. Industry and professional societies do provide some support at different institutions. Many institutions contacted to develop a picture of the present situation, reported student support resources dwindling to alarmingly low levels.

[1] 6 of the 7 are accredited under the auspicious of ABET's Applied Science Accreditation Commission, 1 is accredited under the Engineering Accredit Commission in the area of Radiological Engineering.

Our Needs!

Optimistically, we all anticipate that the economy will pick up in the future. At that instant in time two things are likely to occur. Retirements that have been long pending will be implemented, and frozen demand for new professionals will be opened. The current pipeline of young professionals in the discipline will be insufficient to meet demand. This scenario has been long understood. We further anticipate that starting salaries will rise in response to high demand and low supply followed by an inevitable migration of individuals with mismatched qualifications into this specific market.

The short term needs are evident: Federal funding of previously existing student scholarship and fellowship programs, cut recently in the administration's proposed budget, must be restored.

Efforts must be made to develop industrial and government agency ties to place qualified students into entry level and intern positions to replace people and even more importantly experience being lost by attrition.

Specific research programs aimed at improving current technology in Health Physics need to be developed. If research funding is available and targeted to existing viable programs, these programs will once again bloom. Research areas for potential investment span the discipline from new and improved instrumentation for surveillance and monitoring, dosimetry and radionuclide translocation research, to radioecology, radiobiology, epidemiology, and toxicology – explicitly to develop better precision on fundamental dose response relationships. All areas in radiological emergency response are open ended research and development problems which the academic community could contribute to under the auspicious responsibility of educators.

National Crisis: Where are the Radiation Professionals?

Accrediting Organization: Commission on Accreditation of Medical Physics Educational Programs, Inc.

MISSION

-CAMPEP's mission is to promote consistent, high quality education and training of medical physicists.

-This mission is achieved by evaluating and accrediting medical physics educational programs that meet the educational standards established by CAMPEP in collaboration with its sponsoring organizations.

WHAT WE DO

-Establish educational standards such as defining appropriate levels of clinical training and education, evaluation criteria, and documentation for graduate, residency, and continuing education programs.

-Verify these standards are achieved and maintained by programs applying and/or accredited by CAMPEP.

HOW WE DO IT

-Establish guidelines for graduate, residency, and continuing education programs.

-Review application material submitted by educational programs seeking accreditation.

-Provide recommendations to programs following the evaluation process.

OUR NEEDS!

-Ensure CAMPEP and the value of medical physics accreditation is appreciated by physicians, administrators, professional colleagues, and the general public.

Commission on Accreditation of Medical Physics Educational Programs, Inc.

The Commission on Accreditation of Medical Physics Educational Programs, Inc. (CAMPEP) is a nonprofit organization with a mission to promote consistent, high quality education and training of medical physicists. (Medical physics is the application of physics to the practice of medicine, including but not limited to the application of ionizing radiation to the diagnosis and/or treatment of human diseases.) The mission of CAMPEP is achieved by evaluating and accrediting graduate, residency, and continuing education programs that meet the educational standards established by CAMPEP in collaboration with its sponsoring organizations. Accreditation is a voluntary, non-governmental process of peer review to ensure that a program or institution meets defined standards. A program seeking accreditation must submit its application materials to CAMPEP. The submitted materials are reviewed by the appropriate CAMPEP committee (Graduate Education Program Review Committee (GEPRC), Residency Education Program Review Committee (REPRC), or Continuing Education Review Committee (CERC)). Once the materials have been reviewed, questions and recommendations are provided to the programs. In the case of graduate and residency programs, a formal site visit to validate the application materials is performed by a survey team, consisting of 2- 3 medical physicists and usually a physician. At the conclusion of the site visit, an exit interview is performed to provide general findings and recommendations to the program director, and a subsequent written report is prepared for the appropriate CAMPEP committee. The committee votes on the report and submits its recommendations for accreditation to the CAMPEP board of directors for a final decision on accreditation. Programs may be granted full accreditation (5 year accreditation), partial accreditation (3 year accreditation with periodic reports demonstrating how the program is remediating deficiencies), accreditation deferred (providing a non-compliant program with an opportunity to implement planned or suggested improvements) or accreditation withheld.

The goal of CAMPEP is to ensure that the CAMPEP medical physics accreditation process is fully understood and appreciated by physicians, hospital administrators, professional colleagues, and the general public.

National Crisis: Where are the Radiation Professionals?

Academic Radiology: Harvard Medical School, Massachusetts General Hospital

MISSION

-Ensure that patients receive the greatest net benefit from diagnostic imaging

-Optimize radiation exposure levels to maximize benefit and minimize risk

-Guide appropriate utilization of imaging that involves radiation exposure

WHAT WE DO

-Research
- -Dose-reduction technologies
- -Risk-reduction strategies
- -Medical decision-making

-Institutional Policy
- -Dose monitoring
- -Imaging Protocols

-Education
- -Physicians, physicists, technologists

HOW WE DO IT

-Radiologists and Nuclear Medicine Specialists
-Medical Physicists
-Imaging Technologists

-Referring Clinicians

-Health Informatics Experts

-Experts in Medical Decision-Making

OUR NEEDS!

-Interdisciplinary clinical teams

-Interdisciplinary research

-Interdisciplinary education and training

Radiation Risks and Medical Decision-Making:
Moving Evidence to Practice

Pari V. Pandharipande, M.D., M.P.H.

Abstract for WARP Meeting, July 17, Arlington, Virginia

As a radiologist and health services researcher, I see a clear need to develop rational approaches to decision-making when radiation exposure is a concern, but there are few investigators working in this field. Most research in cancer risks from imaging is centered in epidemiology, cancer biology, and medical physics. The translation of evidence into practice has received far less attention, a gap in dissemination that threatens patient care. While radiation-induced cancer risks may not seem different than other medical risks that physicians commonly weigh, unique features related to their magnitude, timing, and cumulative effects make them difficult to conceptualize. Early studies indicate that many physicians do not know or understand key properties of radiation risks, making them vulnerable to harmful biases when deciding whether or not to order an imaging test. This evolving area of inquiry is already being outpaced by policy decisions: recent institution-level mandates for cumulative exposure reporting will leave many patients and physicians with data that they are not equipped to interpret. Investments to build a greater workforce in this field will be critically important and should ideally target expertise in decision science, mathematics and physics, survey research, clinical medicine, and health policy. The best time to build is now, when there remains an opportunity to effectively shape new policies and practices, and when the solutions yielded could also benefit fields beyond clinical imaging.

THE UNIVERSITY of TENNESSEE KNOXVILLE

INSTITUTE FOR NUCLEAR SECURITY

Mission

Align the collective expertise and capabilities available within the membership to grow an internationally-recognized resource that plays a significant role in global nuclear security

What We Do

Focus on five principal thematic areas, or "pillars" for addressing nuclear security concerns:

- Policy, Law and Diplomacy
- Education and Training
- Science and Technology
- Operational and Intelligence Capabilities
- Real world missions

How We Do It

- Policy Analysis
- Research
- Education
- Training
- Field activities

Our Needs!

- Education/Training for mid-career professionals
- Stable support for graduate student research
- Opportunities for greater faculty engagements with mission agencies
- Research and academic programs in Nuclear Engineer field related to Nuclear Security
- Agency engagement with our academic mission (visits, lectures, seminars, internships, etc.)

HOWARD H. BAKER JR. CENTER FOR PUBLIC POLICY

Y12 National Security Complex

OAK RIDGE National Laboratory

ORAU OAK RIDGE ASSOCIATED UNIVERSITIES

About the Institute

Founded in 2012, the UT Institute for Nuclear Security (INS) seeks to achieve the following:

- Marshal and coordinate the collective resources of the members to more effectively solve important global security needs,
- Enable better and broader collaborations among the members,
- Develop an intellectual leadership position in shaping the national and international dialogue on nuclear security policy and practice,
- Establish a standing means to communicate the remarkable synergy in nuclear security capabilities both among the members as well as to potential sponsors, and
- Enhance the ability of the members to engage in activities that attract and educate the next generation of experts in this field.

Through the INS, UT and the INS Members bring together a university nuclear security program, strong nuclear security missions, close organizational ties, geographic co-location, and access to working nuclear facilities all engaged in nationally/globally relevant work.

INS focuses its efforts in five principal thrust areas:

- Policy, law, and diplomacy
- Education and training
- Science and technology
- Operational and intelligence capability building
- "Real world" missions and applications

The INS reaches across the many UT disciplines and academic departments that can contribute to the nuclear security field. INS fosters research, development, service, teaching, and related scholarly activities across the entire membership - both at the university and among our partner institutions. INS supports the development of enhanced educational capabilities for nuclear security within the academic units of the UT, and more broadly through the ORAU partnership.

The objectives for the INS are to:

- Establish a robust set of collaborative projects in nuclear security across the Members,
- Strengthen the nuclear security focus in the UT Howard H. Baker Jr. Center for Public Policy and in the UT academic units,
- Increase the competitiveness of the Members in pursuing sponsored programs through strategic partnering,
- Engage academic and Member staff in new collaborative and synergistic opportunities,
- Develop new educational and training offerings in nuclear security, building on the collective expertise and capabilities of the Members, and
- Increase the leadership and intellectual influence of the Members in nuclear security issues.

UT is joined in this effort by Charter Members Oak Ridge National Laboratory, the Y-12 National Security Complex, and Oak Ridge Associated Universities.

More information on the UT Institute for Nuclear Security is available at *nuclear.utk.edu*.

National Crisis: Where are the Radiation Professionals?

University Programs: Oak Ridge Associate Universities

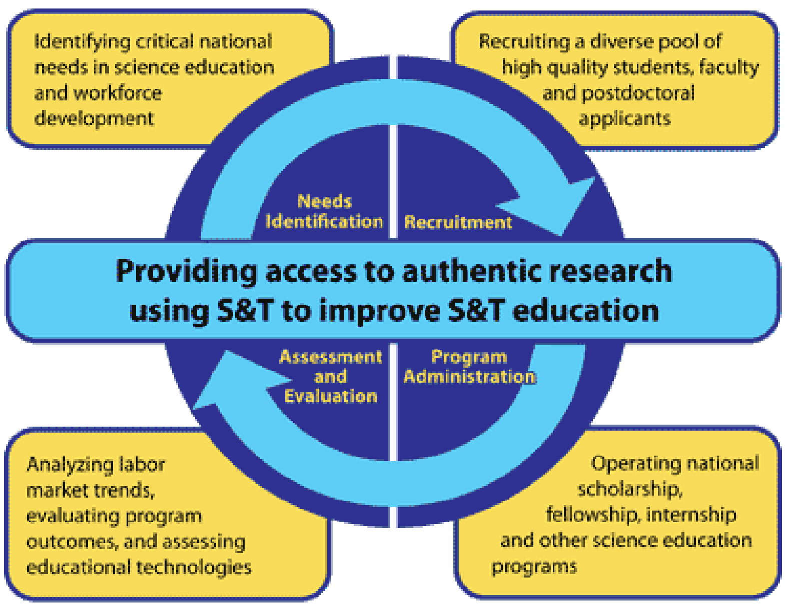
MISSION

To advance national priorities and serve the public interest by integrating academic, government, and scientific resources globally.

WHAT WE DO

Oak Ridge Associated Universities (ORAU) provides a single resource for developing and administering high-quality, experience-based programs to fill the pipeline with the next generation of science and technology leaders. (http://www.orau.org/science-education/default.aspx)

HOW WE DO IT



OUR NEEDS!

- Concrete partnerships and relationships with academic programs (suppliers) and employers (end users)
    - Opportunities
    - Mentors
- Increased sources of funding
- Better optics on emerging markets

Health Physics Enrollments and Degrees, 2011

Summary Information

Number 71 | ***Oak Ridge Institute for Science and Education*** | **2012**

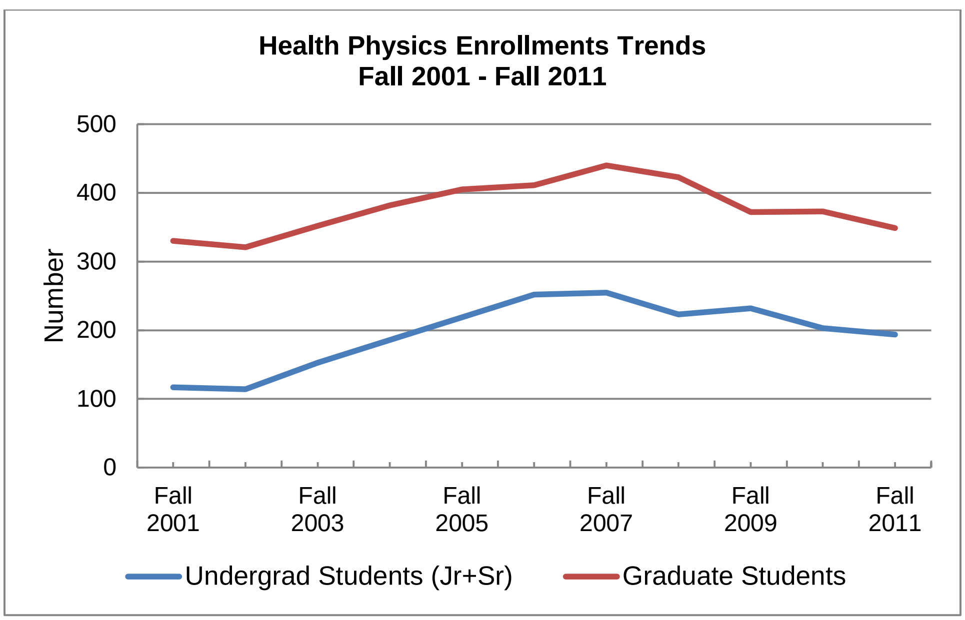
Survey Universe. The survey includes degrees granted between September 1, 2010 and August 31, 2011. Enrollment information refers to the fall term 2011. The enrollment and degree data include students majoring in health physics or in an option program equivalent to a major. Twenty-four academic programs reported having health physics programs during 2011. The data for two health physics options within nuclear engineering programs are also included in the enrollments and degrees that are reported in the nuclear engineering enrollments and degrees data.

Degree Trends. Bachelor degrees increased slightly between 2010 and 2011, but were 15% less than during 2005 through 2009 and 30% less than in the mid-1990s. Master's degrees decreased slightly (by 4%) between 2010 and 2011, and continued to be larger than the numbers in the early 2000s, but were 21% lower than experienced in 2008 and almost 60% lower than during the mid-1990s. Ph.D. degrees in 2011 were only one-third the number in 2010 and continued a pattern of oscillations reported over the last ten years, but considerably less than in the early 2000s and were only 10% of the number experienced during the late 1970s and early 1980s.

Health Physics Degrees, 2001 - 2011

Year	B.S.	M.S.	Ph.D.
2011	64	85	5
2010	62	89	15
2009	77	83	9
2008	73	108	8
2007	79	91	28
2006	71	90	12
2005	78	77	14
2004	54	64	14
2003	56	73	25
2002	41	76	20
2001	37	71	23

Enrollment Trends. Undergraduate junior and senior student enrollment in 2011 was almost 25% lower than in 2007, but 65% higher than in 2001. Graduate student enrollment in 2011 was 20% lower than in 2007 and only slightly higher (5%) than in 2001.



Prepared by: Analysis and Evaluation, Science Education Programs, Oak Ridge Institute for Science and Education, October 2012.

This document was prepared for the U.S. Nuclear Regulatory Commission by the Oak Ridge Institute for Science and Education (ORISE) through an interagency agreement with the U.S. Department of Energy (DOE). ORISE is managed by Oak Ridge Associated Universities under DOE contract number DE-AC05-06OR23100.

Nuclear Engineering Enrollments and Degrees, 2011

Summary Information

Number 70 ***Oak Ridge Institute for Science and Education*** **2012**

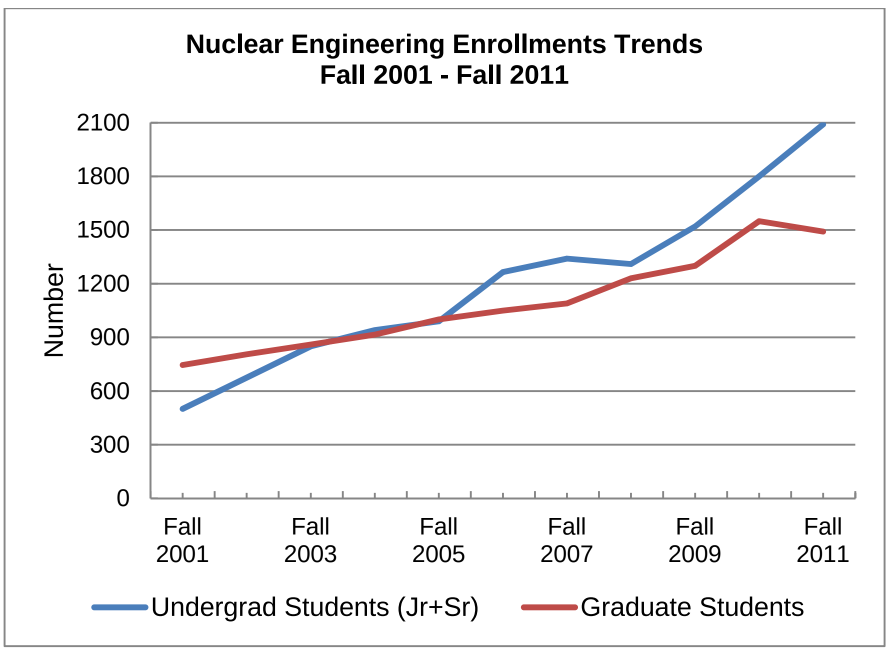
Survey Universe. The survey includes degrees granted between September 1, 2010 and August 31, 2011. Enrollment information refers to the fall term 2011. The enrollment and degree data include students majoring in nuclear engineering or in an option program equivalent to a major. Thirty-two academic programs reported having nuclear engineering programs during 2011, and data was received from all thirty-two programs. The data for two nuclear engineering programs include enrollments and degrees in health physics options that are also reported in the health physics enrollments and degrees data.

Degree Trends. Bachelor degrees increased 18% in 2011 over 2010, matching the number of bachelor degrees in the late 1980s but 40% less than the numbers in the late 1970s. Master's degrees decreased 9% between 2010 and 2011, matching the number of master's degrees in the mid-1990s but 40% less than the numbers in the mid-1970s. Ph.D. degrees remained the same between 2010 and 2011, but about 10% less than the numbers in the early 1990s and 35% less than in the early 1970s.

Nuclear Engineering Degrees, 2001 - 2011

Year	B.S.	M.S.	Ph.D.
2011	524	277	113
2010	443	303	113
2009	395	233	87
2008	454	260	127
2007	413	227	89
2006	346	214	70
2005	268	171	74
2004	219	154	75
2003	166	132	78
2002	195	130	67
2001	120	145	80

Enrollment Trends. Undergraduate junior and senior student enrollments increased by 30% in 2011 over 2010, continuing the upward trend reported in all but one year since 2001. Graduate student enrollments decreased by 4% in 2011 compared to 2010, the first decrease reported in 10 years.



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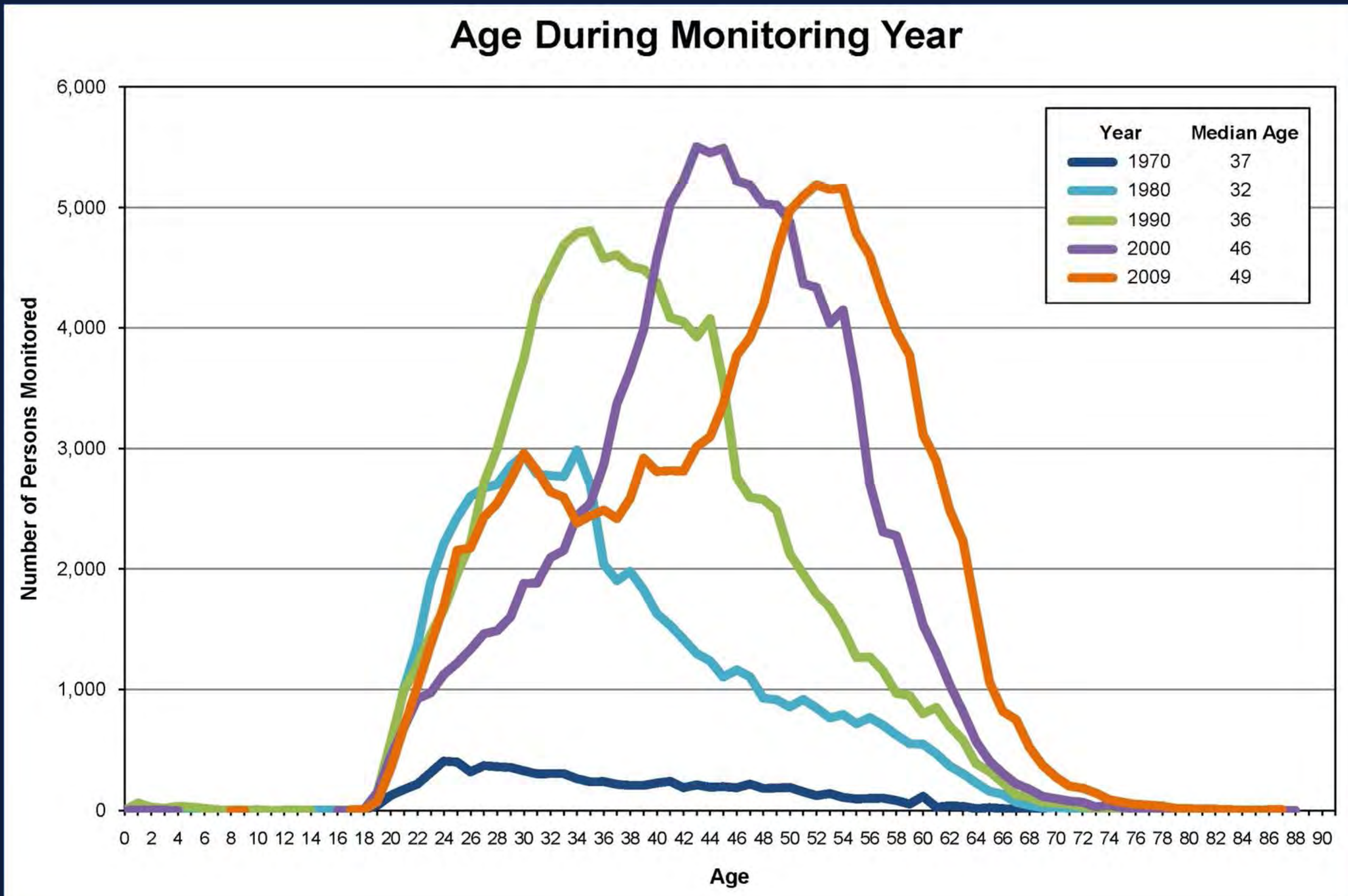
Nuclear Workforce Ageing Trends



Source: US NRC Radiation Exposure Information and Reporting System

National Crisis: Where are the Radiation Professionals?

Specialty: Radioecologists / Environmental Health Physics

MISSION

- Protect public and environment from unnecessary exposure to anthropogenic and technologically enhanced natural radioactivity
- Establish and conduct environmental radiological surveillance programs
- Assess environmental radiological impact using models and/or field measurements
- Develop dispersion models, determine biological uptake and transfer coefficients, and derive dose-conversion factors
- Prepare / respond to large scale radiological releases
- Create and deploy countermeasures for existing / planned / accidental radiological releases

WHAT WE DO

- Establish/enforce requirements of environmental radiation protection regulations including those of:
  - NRC, DOE, EPA, MSHA, USGS/DOI,
  - State and Tribal entities
  - International treaties and obligations
- Revise radiation regulations and standards based on evolving science, current law, and public policy
- Improve the science underpinning all of the above
- Conduct radiological remediation efforts

HOW WE DO IT

- National, international and state policy development and implementation:
  - Scientists and managers in DOE, EPA, NRC, CDC USGS, State and tribal offices
- Scientific research
  - Faculty and students in Academia
  - Health Physicists/ Radioecologists in National Laboratories
- Cleanup and remediation actions:
  - Consulting companies
- Emergency response
  - All of the above

OUR NEEDS!

- Impending retirements risk:
  - Loss of institutional knowledge
  - Loss of technical expertise
  - Heightened probability of accidental exposures
  - Insufficient human capital for emergency response /consequence management
- Outmoded technical knowledge and data gaps
  - Restrict efforts to create cost effective solutions that meet stakeholder needs and regulatory obligations

Where are the Radiation Professionals: Radioecology/Environmental Health Physics

K.A. Higley, PhD, CHP, Professor

Radioecologists and environmental health physicists are concerned with the movement of radionuclides through the biosphere, up to and including the exposure of humans. They protect the public and environment from unnecessary exposure to anthropogenic and technologically enhanced natural radioactivity. They establish or conduct environmental radiological surveillance programs and assess impact using models and/or field measurements. As part of Federal, State or private research groups they determine biological uptake and transfer coefficients, and derive dose-conversion factors. For many, their work may involve development and application of calculational tools to estimate radiological transport. Some create new protocols to measure radionuclides in the environment. Others work to develop strategies to block and /or mitigate the consequences of radiological releases from accident or routine events.

These very specialized radiation professionals help develop and revise the technical basis underpinning many of the regulations and standards for protection of the public and the environment based on evolving science, current law, and public policy. They work with international organizations such as the IAEA, UNSCEAR and ICRP to see that the US interests are reflected in international treaties and other obligations related to the safe release or disposal of radionuclides.

Unfortunately, the number of environmental health physicists and radioecologists is dwindling. Individuals with knowledge and expertise in this area are rapidly aging. Academic programs that have focused on environmental health physics or radioecology have largely disappeared, and only a handful of graduates are produced each year. Unfortunately, the need for individuals with this specific expertise remains. Recent publications from the IAEA and the ICRP have highlighted the vast gaps in our understanding of the movement and transfer of radionuclides in the biosphere. Published studies challenge the safety protection framework currently employed for protection of the environment. Increased use of fracking as a resource extraction technology have raised concerns over managing large quantities of NORM waste. These issues cannot be addressed without a sound understanding of environmental health physics and radioecology. It also calls into question our ability to effectively and economically protect the public and environment from radioactive releases resulting from accidents or intentional discharges.

The US needs individuals trained in the field of radioecology/environmental health physics. Impending retirements risk loss of institutional knowledge. With the loss of technical expertise comes the heightened probability of accidental over exposures – or conversely, costly and destructive over remediation. Most importantly, use of outmoded technical knowledge will hinder the effort to create technically defensible, cost effective solutions that meet stakeholder needs and regulatory obligations.

National Crisis: Where are the Radiation Professionals?

Summer Undergraduate Program to Educate Radiation Scientists, SUPERS@PENN

MISSION

-To expose talented undergraduate students to careers related to STEM fields, especially those involving cancer and radiation.
-To attract students into the program who come from underserved populations, including race, socioeconomic class, women and persons with disabilities.
-To mentor students during and after the program
-To follow student's careers until they achieve a PhD (or similar degree).

WHAT WE DO

Educate rising college sophomores and juniors in radiation biology, physics, imaging, space radiation using:
- -Lectures
- -Small group sessions (journal clubs)
- -One on one laboratory training

Students are given the opportunity to present their research as a chalk talk and a power point presentation during the program.

HOW WE DO IT

-Grant Co-PIs: Evans, Koumenis

-Program Director: Tuttle

-Education evaluator: Shea

-Advisory Board: Zeman, Rockwell, Avery, Busch, Ross

-Sponsors (social) – Siemans, Department of Radiation Oncology, Penn SOM

-PIs, graduate students, post-docs, senior technicians

-Students

OUR NEEDS!

-Program growth
- -support to increase size and scope of program
- -funds to address increasing costs

-Program gaps
- -i.e. expand mentoring in program
- -add career mentoring to program

-Increased access to racial minorities by visiting school that serve under represetned minorities

Summer Undergraduate Program to Educate Radiation Scientists

Sydney M. Evans, Costas Koumenis, Stephen Tuttle
University of Pennsylvania, Perelman School of Medicine, Philadelphia, Pa. 19081

SUPERS@PENN is a 10-week summer internship residency designed to introduce rising college juniors and seniors to the radiation sciences. The program was proposed based on two articles identifying the need to recruit and retain young scientists into fields related to radiation research (Rockwell *Rad. Res.* 2003, Coleman *Rad. Res*. 2003). SUPERS has 3 specific aims: (1) Expose talented undergraduate students to cancer and radiation research related fields, (2) Attract students from underserved populations; racial and ethnic minorities, socioeconomically deprived, women and persons with disabilities. (3) Mentor students as they continue along a trajectory from undergraduate to graduate school in cancer and radiation research. Rising juniors and seniors are accepted into the program based on 1) academic performance, particularly in science and math courses and 2) likelihood that a student will pursue an advanced degree that ultimately leads to a research career.

The centerpiece of the program is an individualized hypothesis driven research project. Students are matched to a PI/mentor based on common interests (noted in the students' application essay). Proficiency is gained in various laboratory methods that allow the student to test their hypothesis. There are thrice weekly didactic lecture series (formal lectures and journal clubs) to introduce students to areas related to radiation and cancer research, providing a "global view" of how their research fits into the larger field. The students present their work twice during the summer, first as a chalk talk outline of their hypothesis/specific aims and methods and again at an end-of-program retreat, presenting their results and conclusions. The retreat includes an invited speaker who interweaves their scientific interests with biographical information pertinent to their own career path.

The program has met with considerable quantifiable success. Applicants have increased from 22 in 2010 to 68 in 2013. The quality of the applicant pool has also shown a measurable increase, in 2010 the mean GPA of the applicant pool was 3.35 (3.62 for accepted students); in 2013 the mean GPA of the applicant pool was 3.64 (3.85 for accepted students). In 2013, applications and acceptances came from an increased geographic area, with 32% of applications for the class of 2013 coming from outside of Mid Atlantic region compared to 9% in 2010. Applications from racial and ethnic minority groups have averaged 22.3%, from Pell Grant recipients 21.0%, and from females 49.1%. These acceptance rates have mirrored that obtained for the total applicant pool. To date we have had one disabled (deaf) student participate in the program. Rising juniors in the program were invited back for a second summer based on merit, a total of 14 invitations have been extended and 11 (78%) of those were accepted.

SUPERS students are listed as co-authors in 11 peer reviewed publications and 7 have given posters and/or oral presentations at national meetings, including a Gordon Conference and SPIE. One of our students interned at the HIMAC facility in Japan, illustrating the type of enthusiasm for radiation research that our program can generate. Of our 29 alumni, 8 are enrolled in PhD programs, 3 are pursuing a Masters degrees (one additional student completed her M.E.). Seven alumni are in medical school. The remaining 10 students are taking a gap year (5), working a science lab (2), or went into other careers, primarily business (3).

Many people work to make this program a success, including a physician who specializes in assessing educational learning programs. An advisory panel meets every other year to critically examine the data and provide feedback for program improvement.

We are currently writing a renewal application for the SUPERS program, with the objective of introducing more students, especially those from URPs, to radiation/cancer research. We continue to track alumni as they complete their advanced degrees and move forward into the early stage of their careers.

National Crisis: Where are the Radiation Professionals?

Private Sector: Dade Moeller

MISSION

Support our clients' efforts to protect human health and the environment from potential exposures to radiation and hazardous substances . Core competencies include:

- Radiological and nuclear safety
- Public and occupational health
- Industrial hygiene
- Environmental impact analyses
- Dade Moeller Training Academy
- Medical physics

Ensure compliance with state and federal regulations governing safety and health

WHAT WE DO

Provide consulting, operational services, and training to federal agencies and commercial businesses. Dade Moeller has managed projects in the areas of:

- Radiation protection programs
- Radioactive material licenses
- Final status surveys
- Health care / medical physics
- D&D
- Emergency response
- Integrated safety management
- Industrial hygiene

HOW WE DO IT

Pursue business opportunities in the safety, health, and environmental fields consistent with the company's core competencies

- Identify the key drivers or events related to the priorities of potential clients
- Constantly strive to increase client and geographic diversification
- Recruit and hire highly qualified employees who have relevant expertise
- Develop teams for future, undefined opportunities
- Identify and develop long term contract targets with strategic partners

OUR NEEDS!

- Continued economic improvement
- Continued pipeline of qualified employees
- Increased diversity (e.g., gender, ethnicity, age) of qualified employees in the pipeline
- More work

Dade Moeller & Associates

Founded in 1994 to provide professional-level health physics and environmental protection consulting services to government and industry, Dade Moeller & Associates (Dade Moeller) bears the name of the late Dr. Dade W. Moeller, CHP, PE, a leading scientist and educator in the field of health physics. The firm employs 225 highly skilled professionals across the country, including more Certified Health Physicists (35+) than any other private entity in the US.

Dade Moeller has established an exceptional reputation providing consulting services in radiological and nuclear safety, public and worker health, industrial hygiene, environmental impact analyses, and training. Our staff covers a wide range of technical and scientific disciplines and has extensive knowledge of technical requirements governing radiation protection, permissible levels of radiation dose to workers and the public, industrial hygiene, and environmental protection.

Dade Moeller's primary business focus has been on helping customers manage and operate nuclear facilities, radioactive materials, and associated equipment in accordance with regulations, safety requirements, and technical drivers that apply to their operations. We have successfully managed projects in the fields of health physics, medical physics, nuclear safety, emergency response, technology assessment, radioactive waste management, Integrated Safety Management, risk assessment and management, environmental impact analyses, industrial hygiene, and environmental protection and compliance.

Dade Moeller provides technical management and subject matter expertise to a wide array of clients. Our staff includes scientists and engineers with proven records of accomplishment and established reputations for excellence. Many employees have advanced degrees, have received national recognition in their areas of expertise, and hold board certifications in their fields.

With regard to education and training, Dade Moeller operates the Dade Moeller Training Academy, which offers training on a complete range of radiological topics. We offer classroom and online training courses for safety and radiation workers, hazardous material handlers, and professional development. As part of this effort, we interact with educational institutions to help train and hire personnel in the radiation safety arena:

- Thomas Edison State College – In the fall of 2013, we will offer an online version of our Radiation Safety Officer course through Thomas Edison State College (Trenton, NJ). Students will receive 3 academic credit units for the 45-hour online course.
- University of Tennessee – We will offer a Radiation Instruments Workshop through UT in August 2013. It is a 4.5-day class with 2 days at the UT campus and 2.5 days at Dade Moeller's laboratory in Oak Ridge, TN.
- Fountainhead Community College/Roane State Community College – As our project needs require, we work with both schools to find Junior Radiological Control Technicians. This provides us with potential employees and allows the students to complete requirements to be ANSI 3.1 certified.

National Crisis: Where are the Radiation Professionals?

Commercial Organization: Radiation Safety & Control Services, Inc.

MISSION

- Provide highest value radiological project services and products to nuclear, industrial, medical, and government facilities who use radiation and/or radioactive material.
- Develop solid solutions to unique problems for our clients relating to the measurement, characterization, storage, use, decommissioning, disposal and other processes involving radiation and/or radioactive material.

WHAT WE DO

PROJECT SERVICES
- Radiological Project Management
- Technical Staffing and Consulting

INSTRUMENT SUPPORT
- Portable and Fixed Instrument Calibration and Repair
- Laboratory Analysis (including source leak testing, sample analysis, and radon testing)

PRODUCT SALES
- Radiation Measurement Products
- Radiation Instrument Simulators
- Software to Support Nuclear and Radiological Industries

HOW WE DO IT

- We maintain a full service licensed instrumentation calibration and repair facility.
- We develop, manufacture, and sell products which help our clients fulfill their missions.
- We maintain a full-time consulting staff which includes ten ABHP Certified Health Physicists and many professional and technical experts in various fields including Project Management, ALARA, Hydrogeology, Soil Science, Radiochemistry, Decommissioning, Final Status Surveys, and Engineering.
- We provide field service staffing support on-site at our client facilities.

OUR NEEDS!

- Degreed Part-time and full-time radiation safety professionals
- Qualified HP Technicians
- Individuals experienced in business development and understand the nuclear / radiological market.
- Surge capacity professionals for short-term projects and emergencies

Radiation Safety & Control Services, Inc.
Abstract for WARP Workshop

RSCS, Inc. was established in 1989 and is a small business owned and operated by three principals. The company is fully insured and is an equal opportunity small business employer. Our company principals have earned Health Physics degrees from the University of Massachusetts - Lowell in Radiological Sciences and Protection and have earned Comprehensive Certification from the American Board of Health Physics. Our team of over 80 professionals have experience in all areas of radiological operations and decommissioning, including nuclear power, industrial, medical, and research applications.

Our company supports all phases of the nuclear fuel cycle including operational nuclear plant support, decommissioning, and new-build activities. Our small licensee support has included decommissioning and operational radiation-related projects at hundreds of university, medical, and industrial sites. Our project management and consulting group of professionals are highly skilled and specialize in planning and solving problems related with complex and high risk radiological work activities.

Our field professionals are supported by our radiological instrumentation consulting, instrument repair and calibration division which supplies both field survey instrumentation and specialty monitoring equipment to our projects. The RSCS corporate headquarters in Stratham, New Hampshire is home to our support offices, our analytical laboratory, and our instrument calibration and repair facility. The RSCS home office staff includes key professionals including administrators, project managers, health physicists, radio-chemists, geologists and laboratory and instrumentation specialists. The RSCS field support staff includes individuals experienced in decommissioning management, radiation protection, engineering, hydrogeology, industrial safety, and project and cost controls.

We provide full spectrum service assisting our clients with innovative and cost effective solutions for the licensing, use, and disposition of radioactive materials and radiation generating equipment: Our range of services include:

- Radioactive Material Licensing and Program Development
- Decommissioning Plan Development
- Final Status Survey Plans and Implementation (MARSSIM)
- Free-Release of Materials and Equipment (MARSAME)
- Nuclear and Radioactive Material Program Management and Technical Support
- Incident Response, On-Site and Off-Site Exposure Evaluations
- Radiation Safety Program Audits
- Environmental, Area/Facility and Personnel Monitoring and Reporting
- Groundwater and Soils Contamination Support
- Waste Minimization, Characterization, Shipping, and Disposal Management
- Sample Analysis Data Management and Reporting

Our professionals have been supporting all aspects of decommissioning projects over 20 years and have extensive experience with specialty equipment and software including: ISOCS, Microshield, Visual Sample Plan, the RESRAD family of tools, and others. We have been on the forefront of aiding sites in the use of the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) and MARSAME. We have been implementing the MARSSIM process for over 15 years at several of our decommissioning projects and are currently implementing a MARSAME characterization process for the release of all turbine building equipment at sites in the US and Europe.

National Crisis: Where are the Radiation Professionals?

Private Industry: Risk Assessment Corporation

MISSION

Environmental radiological and chemical risk assessment

WHAT WE DO

Research and implementation of environmental risk assessment related to:

- historical dose reconstruction
- safety analysis and facility design
- risk communication
- training courses in radiological and chemical risk assessment

HOW WE DO IT

RAC team has scientists with skills in

- nuclear and chemical engineering
- environmental transport modeling
- exposure analysis
- dosimetry
- risk analysis
- database management
- risk communication

Scientists are advanced degreed (~1/2 Ph.D.)

Some staff are HP certified

OUR NEEDS!

Although we are stabilized in size, we are looking in the future to add several persons who are:

- self motivated
- creative thinkers
- writing and mathematical skills
- willing to work independently

WARP Workshop Abstract
July 17, 2013 - Arlington, VA

Radiation Protection Professionals: Ideas for Strengthening the Workforce from Private Industry Perspective

John E. Till, Ph.D., President
Risk Assessment Corporation, Neeses, SC 29107

This abstract summarizes ideas related to strengthening the radiation protection professional workforce from my perspective in private industry. These thoughts are grouped into several specific areas that need to be addressed.

1. <u>Developing defensible data for the argument</u>. We need a defensible set of data on which to base the argument for support. From my perspective, I see three areas within which radiation protection professionals fall:
    a. <u>Maintaining the workforce that currently exists</u>
    b. <u>Planning for the future work force</u>
    c. <u>Unexpected events</u>

    The two key areas are planning for the future and unexpected events (I am assuming current needs are being met). To justify additional support to plan for the future we need the data to clearly show we are not prepared. Based on the references I have seen, these data need to be updated before the argument can be made.

    To plan for unexpected events, we must develop a system where a "surge" of professionals is organized and continuously updated. Evidently this pool of experts does not currently exist or we would not have issues with Fukushima.

2. <u>Pay attention to what private industry wants</u>. Keep these points in mind with regard to private industry:
    a. Private industry wants to play a role in educating and developing its own professionals.
        i. Companies want to invest locally and not necessarily on a national scale, rather, they prefer to place resource close to where facilities are located in order to keep individuals they help train within their work force (trained employee retention).
        ii. Private industry also wants input to curriculum, internships, and certification.
    b. Resources for education and training within private industry are currently very limited due to natural gas prices, a nuclear renaissance developing more slowly than anticipated, and an apparently adequate supply of professionals. It is difficult to argue that they need to invest in educating professionals on a national scale.

3. <u>Commercial training courses are one option to enhance qualifications</u>. RAC has had considerable experience with commercial training courses related to radiological and chemical risk assessment. There are elements of this training that are important to understand before embarking on this option:
    a. The fiscal climate for commercial courses is very difficult at this time due to the continued recession and need to cut government spending
    b. Attendees expect and intense and rigorous course especially with these courses being expensive when they are conducted well.
    c. International attendance at our courses has been very strong and this factor is one key to success within the US.

National Crisis: Where are the Radiation Professionals?

Private Sector: M. H. Chew & Associates (CAI)

MISSION

- **Provide high-quality and extremely credible analytical and technical services in the areas of radiological protection and health physics, industrial hygiene and toxicology, occupational safety and health, safety analysis, risk assessments, nuclear facility design and engineering, and professional staffing services.**

WHAT WE DO

- **Support federal agencies and their contractors including DOE, NNSA, NRC, CDC, NIOSH, and NASA, and state and local governments.**
- **Provide consulting and staffing services to the private sector, including nuclear power plants, licensees, and manufacturers**

HOW WE DO IT

- **Small disadvantaged business (minority-owned) headquartered in Livermore, CA**
- **Branch offices in Richland, Idaho Falls, Las Vegas, Arvada, Cincinnati, Oak Ridge**
- **Virtual office network**
- **Minimal bureaucracy**
- **Frequent and comprehensive information exchange**
- **Internal QA reviews**

OUR NEEDS!

- **Staffing for the future**
- **Long-term, stable government policy and funding (ain't happenin', but would be nice)**
- **A different model for funding ES&H support:**
  - ➢ **Maintain the bomb squad between bombings**
  - ➢ **Direct vs. overhead funding**
  - ➢ **Social vs. economic model**

M. H. Chew & Associates, Inc.
Environmental, Safety and Health
Engineering, Radiation Protection and Nuclear Safety

M. H. Chew and Associates (CAI) is a minority-owned small disadvantaged business headquartered in Livermore, CA, with branch offices in Richland, Idaho Falls, Las Vegas, Arvada, Cincinnati, and Oak Ridge. CAI provides high-quality, extremely credible services to clients in both the public and private sectors in the areas of radiological protection and health physics, industrial hygiene and toxicology, occupational safety and health, safety analysis, risk assessments, nuclear facility design and engineering, and professional staffing services.

Founded in 1988 and for over 25 years, the firm has been providing these services to the Department of Energy (DOE), its prime contractors and other government agencies including the National Institute for Occupational Safety and Health (NIOSH), the National Aeronautics and Space Administration (NASA), and the Centers for Disease Control and Prevention (CDC), as well as to state and local governments, and private sector NRC licensees. In recent years, along with the company's established reputation for radiological protection and health physics, industrial hygiene and toxicology, occupational safety and health, safety analysis, risk assessments, nuclear system engineering, technology and design support, CAI has added a corporate emphasis on providing technical services to support our nation's most advanced programs and major projects including Safety and Mission Assurance (S&MA) for NASA's Johnson Space Center; nuclear, systems and process engineers for the Plutonium Pit Disassembly and Conversion Facility (PDCF), the Mixed Oxide (MOX) Fuel Fabrication Facility, the Advanced Fuel Cycle Facility (AFCF) and the UREX+ Demo Plant; scientists and security specialists to assist LLNL in the development of an integrated approach to address security and safety requirements and industrial hygienists, fire protection specialists, safety professionals and USQ preparers for LLNL's 10CFR851 compliance program and Building 332 USQ processes.

As with other employers in the radiological sciences, CAI is concerned about maintaining capability and competency as the most senior and experienced personnel retire out. Although there appears to be an adequate number of students for the near term, they cannot immediately fill the roles of their predecessors. Internships, co-operative education, fellowships and practica are needed to impart the hands-on experience and knowledge needed in the future workforce. However, there is a more serious problem: the radiological resources of the federal government were sorely tested by the Fukushima Dai-Ichi nuclear power plant accident, primarily in concern for 80,000 U.S. military personnel and dependents stationed in Japan, some 8,000 miles distant. A comparable accident or radiological attack in the U.S. would be extremely difficult to manage to say the least. This is the old question of how one pays to train and support the bomb squad in between infrequent bomb threats. We believe a new funding mechanism is needed in which ES&H personnel, especially at the national laboratories, are independently and directly funded, rather than through an overhead tax on research or production dollars, which puts the ES&H function in direct competition with its customers for support. An effective safety culture is very hard to establish under this mechanism, whereas direct funding could permit developing a mutually beneficial social, rather than strictly economic, relationship between ES&H and research/production staff. In addition, this will help maintain a well-trained and highly competent cadre of ES&H professionals who will be available in a national radiological emergency.

1. What is a radiation professional?
   a. By Discipline
      - Radiation Protection Program Implementation/Management
      - Regulatory compliance/inspections
      - Radiological Engineering
      - Radiological Assessment
        - Environmental Monitoring
        - Decontamination/Decommissioning
        - Environmental Restoration
      - Waste Management
      - Radiological Emergency Response/Management
      - Diagnostic and therapeutic medicine
      - Instrumentation and dosimetry
      - Education
      - Research and Development

   b. By Practice Area
      - Academia/Universities
      - Consultants
      - Government, local
      - Government, state
      - Government, Federal
      - Industry
      - Laboratory, analytical
      - Laboratory, research & development
      - Medicine
      - Utilities

   c. By Occupational Classification
      - Health Physicist
      - Medical Health Physicist
      - Medical Physicist
      - Physical Scientist
      - Radiation Safety Officer
      - Radiation Scientist
      - Radiation Technologist

   d. By Certication
      - ABHP
      - ACR
      - SNM
      - ABMP
      - ARRT
      - NRRPT

   e. By Education and Training
      - Health Physics
      - Medical Physics
      - Nuclear Engineering
      - Nuclear Physics
      - Nuclear and Radiochemistry
      - Public Health
      - Radiobiology
      - Radiological Engineering

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July 17, 2013

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NAS Workshop - Committee on Research Directions in Human Biological Effects of Low Level Ionizing Radiation - July 18-19, 2013 – Washington DC

Where are the Radiation Professionals? (WARP) Initiative

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July 19, 2013

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NCRP
Scientific Authority Since 1929

Outline

- Introduction
- Goal
- Approach
- Workshop 17-18 July 2013
- Military Significance of AFRRI

CDR Chad Mitchell, MSC USN

NCRP Scientific Authority Since 1929

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Executive Director Emeritus NCRP, Adjunct Associate Professor, Georgetown and UNLV

CDR Chad Mitchell

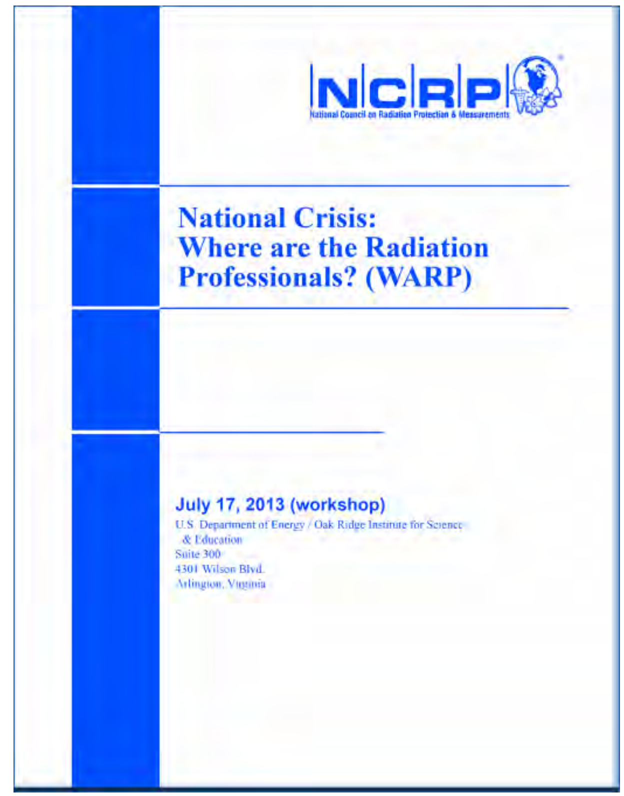
Medical Service Corps, U.S. Navy, Radiation Health Specialty Leader Deputy Director, Fleet Programs

John Crapo

Associate Director for National Security and Emergency Management, ORISE

WARP Goal

A "Manhattan Project" (?) to replenish the dwindling, if not exhausted, supply of radiation professionals in the United States



NCRP
National Council on Radiation Protection & Measurements

National Crisis:
Where are the Radiation Professionals? (WARP)

July 17, 2013 (workshop)
U.S. Department of Energy / Oak Ridge Institute for Science & Education
Suite 300
4301 Wilson Blvd.
Arlington, Virginia

WARP Workshop

Setting the Stage

- Back to the Future – John Villforth
- HPS Task Force Report and Survey – Kathryn Pryor
- APS Nuclear Workforce Readiness Report – Lynne Fairobent

32 individual presentations using similar (Quad Charts & Abstracts)

Breakout Sessions

•Government
•Professional societies
•Universities
•Private sector

Wrap up

WARP Approach

Workshop with representatives from:

- government agencies (25)
- professional societies (11)
- universities (7)
- private sector (4)
- NCRP (3)

A National Effort

Snapshot of Attendees

ASTRO
CRCPD
HPS
RRS
OSU
Harvard
Penn
AFRRI
DHS
DoD
DOE
EPA
FDA
NCI
NIH
NIAID
USUHS

Snapshot of Attendes

AAPM
ABR
ACR
ASRT
NEI
NRRPT
ISU
ORISE
CDC
HHS
OSTP
RAC
CAI
Moeller
NCRP

Snapshot of Attendees

MGEN Julie A. Bentz
Director, Strategic Capabilities Policy National Security Staff at the White House.

Dr. Cindy Atkins-Duffin
Assistant Director for Nuclear Matters, Office of Science and Technology Policy (OSTP), Executive Office of the President

Example of Quad Chart – All are available and will be Published

National Crisis: Where are the Radiation Professionals?

Scientific Society – Radiation Research Society

MISSION

- To encourage in the broadest manner the advancement of radiation research in all areas of the natural sciences;
- To facilitate cooperative research between the disciplines of physics, chemistry, biology and medicine in the study of the properties and effects of radiation;
- To promote dissemination of knowledge in these and related fields through publications, meetings and educational symposia.

WHAT WE DO

Serve as a home for a broad spectrum of researchers in all branches of the radiation sciences

RADIATION RESEARCH SOCIETY

HOW WE DO IT

- Hold annual meeting attended by national and international radiation researchers
- Offer facilities for "Scholars-in-Training" (SITs), consisting of:
  - Discounted membership and registration rates
  - 1 day workshop for SITs held prior to annual meeting
- Provide financial support for radiation meetings attended by our SITs (e.g. Gordon conference, ERR, NCRP, etc.) as well as providing financial support for International Congress of Radiation Research

OUR NEEDS!

Junior faculty members

•Providing opportunities for career development (generation of faculty positions)

•Assistance with grant funding (small pilot grants, bridging funds)

Senior faculty members

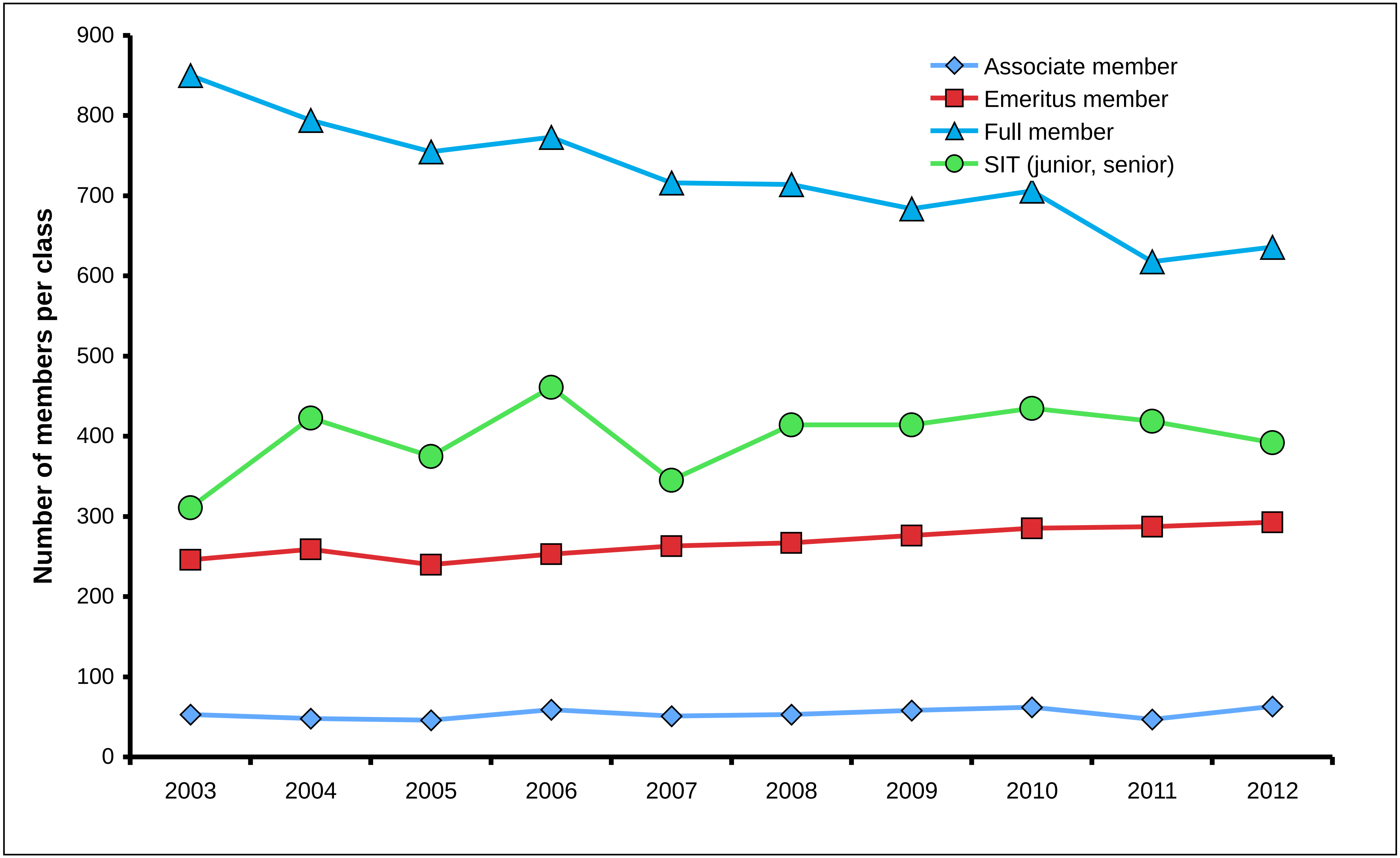
•Job security

•Bridging funds

•Acknowledgement of radiation as a viable field

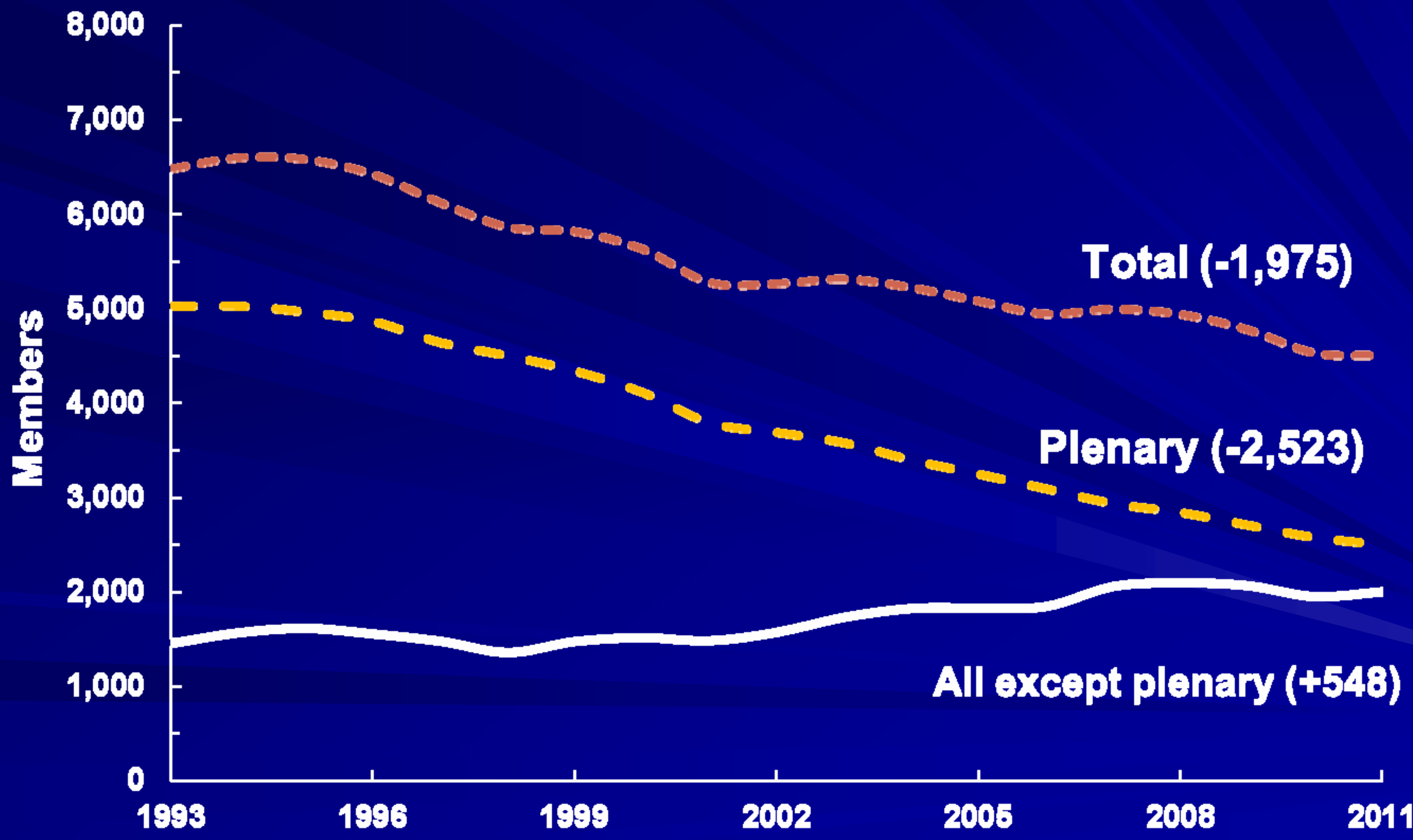
Declining Society Members

Radiation Research Society



Declining Society Memberships

Health Physics Society



Thanks, Armin Ansari

Declining Numbers of Graduates in Health Physics Programs

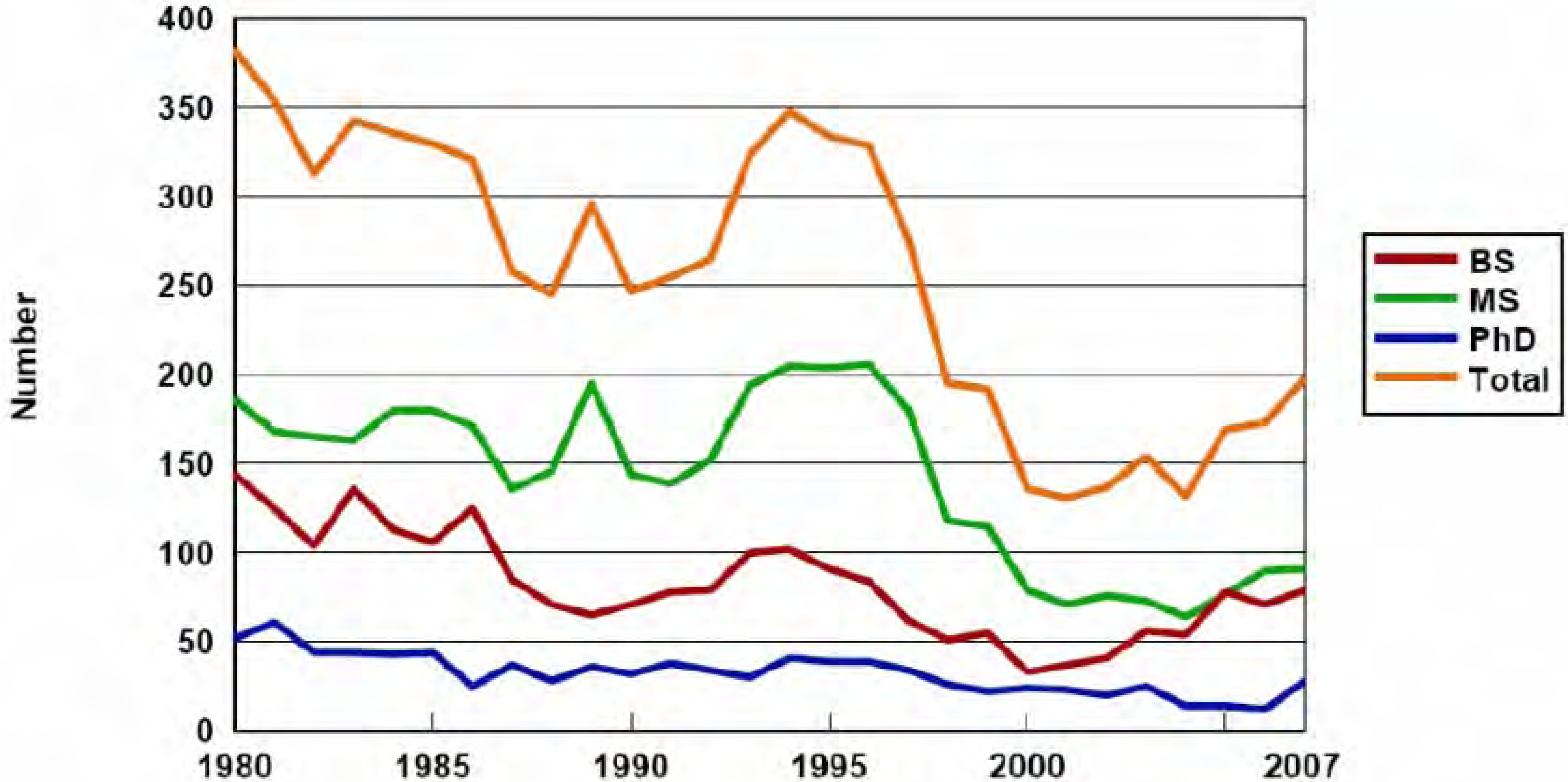
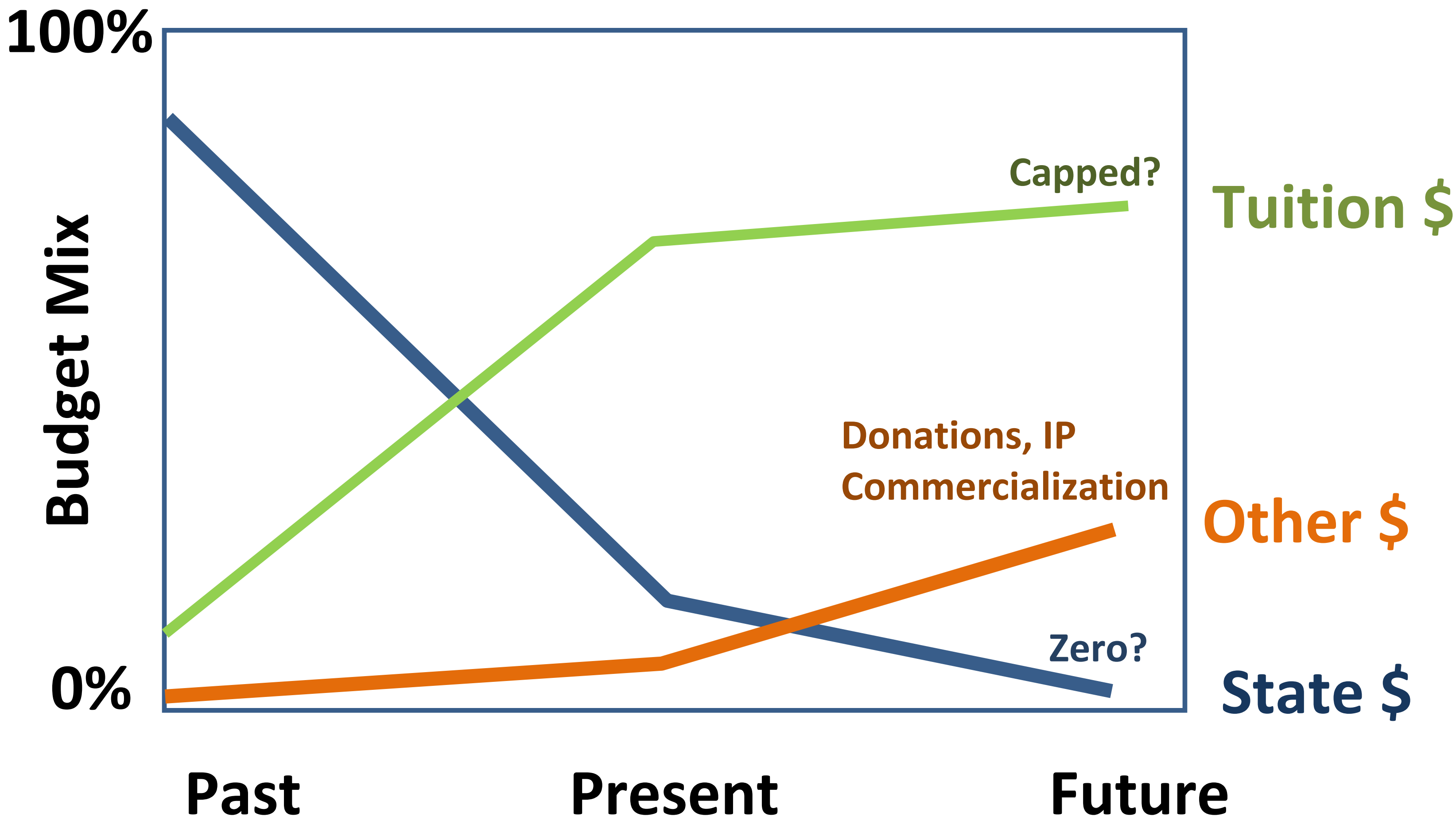


Fig. 3.2 Number of students graduating from health physics programs, including Bachelor's, Master's, and Ph.D. degrees[23], 1980-2007.

Thanks, Lynne Fairobent, AAPM

Budget Model for Academic Programs: Survival of the *Revenue Generators**



*Conventional wisdom: Undergraduate programs bring in tuition $; Graduate programs lose $

Thanks, Kathryn Higley, OSU

18 July at NCRP
Preliminary Overview

- **Report title**: Where Are the Radiation Professionals--Today, Tomorrow, and in an Emergency?
- **Baby boomer** retirements will severely affect the number of radiation professionals available for medicine, nuclear power, national defense, environmental restoration, and emergency response.

Delayed maintenance

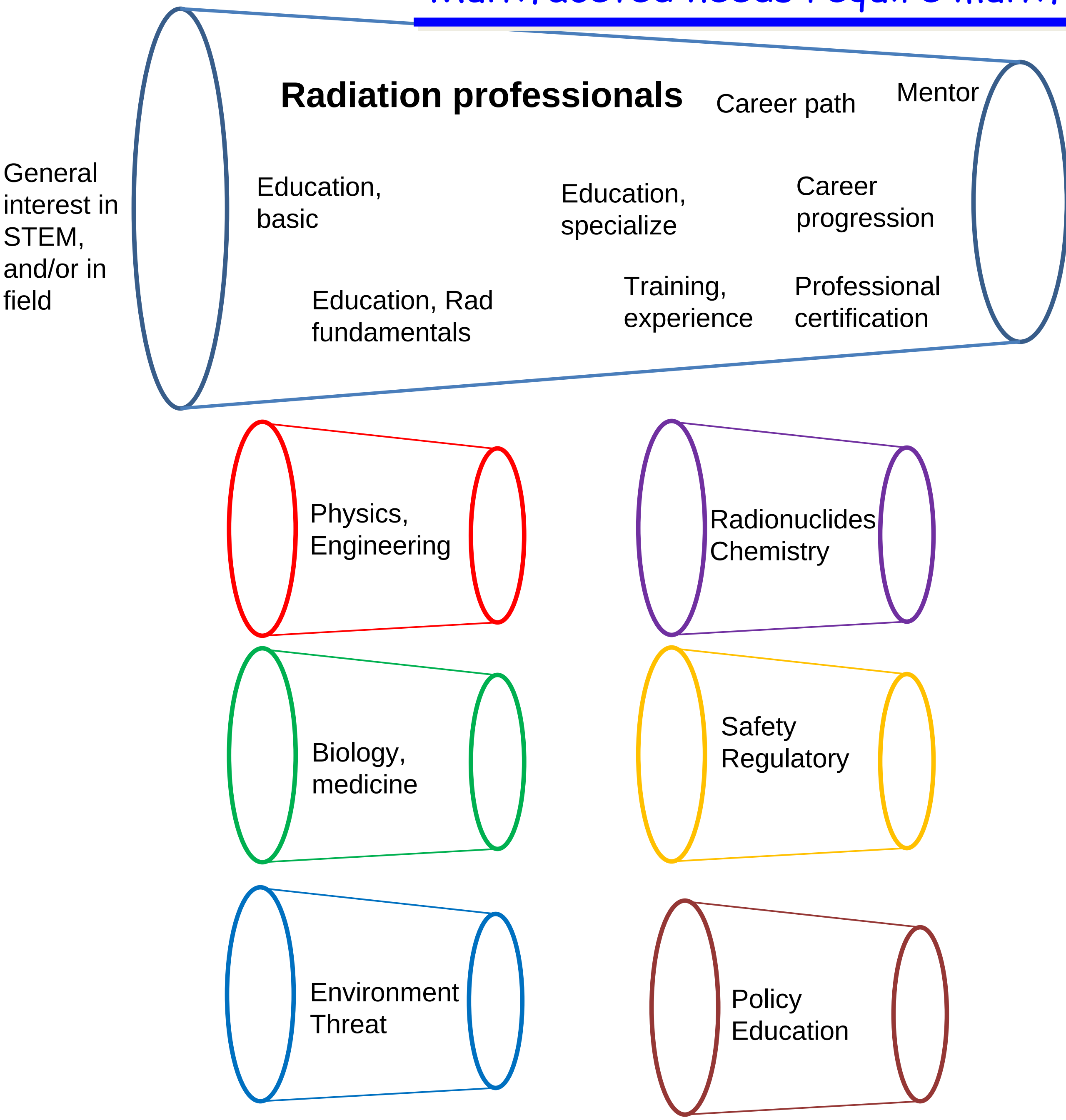
18 July at NCRP

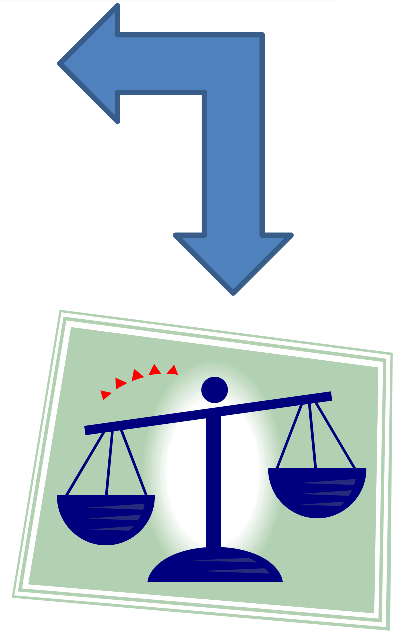
Preliminary Overview

Needs and Tasks:

- **Data gathering** to monitor supply and demand
- **Improve coordination** among government, academia, and the private sector to ensure national capability to manage radiological incidents and maintain the radiation sciences enterprise
- **Continued federal support** of academic education programs and basic research in radiobiology, medical countermeasures, improved detection capability and nuclear forensics
- **Conclusion**: We need radiation professionals who can develop the new science required for the future, ensure the safe use of radiation for the health and welfare of the US population and respond to radiological incidents.

Multifaceted needs require multifaceted approaches





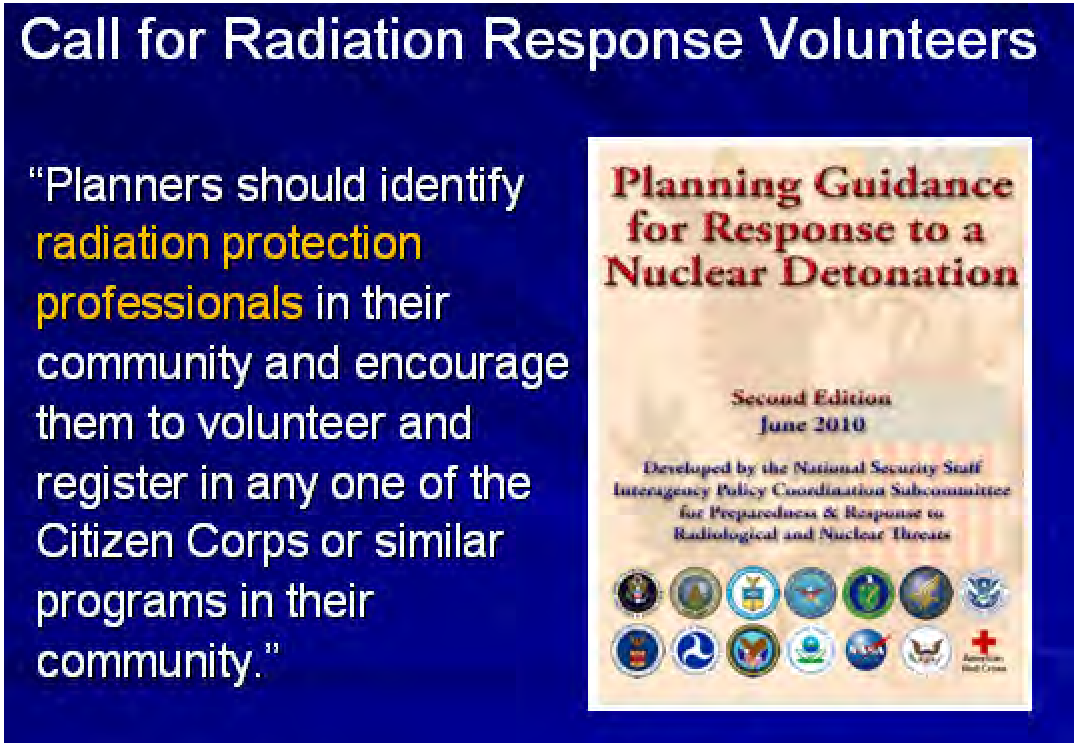
Monitor needs, availability of job, type of trainees:

Predict and provide needs and try to balance

Recognize what isn't predictable

18 July at NCRP
Preliminary Overview

- In an Emergency: a **surge** capacity needs to be developed through better coordination of federal assets and a national "reserve corps" (under PHS?) of Radiation Professionals.



WARP Next Steps

- Draft NCRP Statement
- Circulate to WARP participants
- NCRP Statement approval
- Distribution including multiple journal publications (HP, RR, JRP, JACR)
- Discussions with decision/policy makers

NATIONAL CRISIS:
WHERE ARE THE RADIATION PROFESSIONALS? (WARP)

NCRP
National Council on Radiation Protection & Measurements

Thanks

A Clarion Call ?

- A National Effort is Needed.

DoD Quad Chart and Military Significance of AFRRI

CDR Chad Mitchell, MSC USN

National Crisis: Where are the Radiation Professionals?

Government Organization: Department of Defense

MISSION

DoD-The mission of the Department of Defense is to provide the military forces needed to deter war and to protect the security of our country. The department's headquarters is at the Pentagon.

Health Physics within DoD - Provide uniquely qualified professional scientists and leaders with expertise in radiological health to protect and defend the force

WHAT WE DO

Ensure the safe use of radioactive materials and radiation-producing equipment.

- **Battlefield environments**
- **Installations within the standing infrastructure**
- **Equipment containing radioactive materials from small commodities to ships, submarines & air craft**
- **Non-destructive testing**
- **Medical use/research**
- **Non-ionizing radiation sources**
- **Environmental cleanup issues**
- **Dose reconstruction**

HOW WE DO IT

Active duty, Civil Service, and Contract Staff

- **Scientists, inspectors, safety officers, compliance officers, medical and product reviewers**

Regulations

- **Grounded in CFR requirements**
- **Specific to unique operating environments**

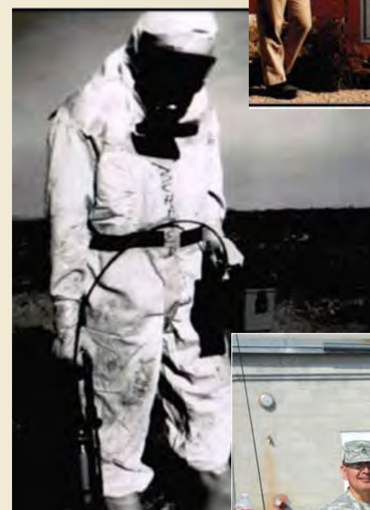
Training

- **Recognized professional degrees/certifications**
- **DoD/service-specific requirements**

OUR NEEDS!

- **Continuous recruitment**
- **Continuing education/certification**
  - **Environmental/remediation**
  - **Radio-epidemiology**
  - **Medical physics advances**
  - **Regulatory oversight**
  - **Internal dosimetry**
  - **Dosimetry/detection**
  - **Consequence management**
- **Distance learning opportunities to provide formal education to individuals with extensive experience**

Military Significance of AFRRI



No other military assignment has fostered as much inter-governmental cooperation:

- *Radiological exercises and disaster drills*
- *Test site surveys: Johnston Atoll, Nuclear Test Site, etc*
- *Support for real world emergencies: Fukushima, TMI*

In the Navy alone, over 50 officers have

- *Developed projects for M.S. and Ph.D. theses*
- *Worked at national labs: LANL, LBNL, Oak Ridge, Hanford*
- *Held positions of influence with HPS, NCRP and other organizations*

Influenced US government policy through

- *Verification of nuclear weapons treaties*
- *LD 50 measurements relevant to discontinuation of neutron bomb development*