
IPTV link also available on Grand Rounds intranet site:
http://intranet.cdc.gov/od/odweb/about/directorGrandRounds.htm
For those outside of CDC, a broadband link is available at:
http://www.cdc.gov/about/grand-rounds (Grand Rounds internet site)
Grand Rounds Archives

2010

February
Every year, approximately 300,000 children around the world are born with neural tube defects (NTD), a failure of closure of the neural tube either in the cranial region or along the spine that result in anencephaly and spina bifida respectively. Infants born with anencephaly usually die within a few days of birth, and those with spina bifida typically live with various life-long disabilities and often experience mobility limitations. (Read more)

January
The polio crisis of the early 20th century has been largely forgotten in the U.S. due to the creation of the Salk vaccine and the effective immunization campaigns of the 1950s. Unfortunately, the wild poliovirus (WPV) still remains a real public health threat in many corners of the world. (Read more)

2009

December
On Thursday, December 17, CDC’s National Center for Zoonotic, Vector-Borne, and Enteric Diseases (NCZVED) presented the fourth Public Grand Rounds session entitled “Foodborne Diseases: Better Prevention with Better Public Health Information.” (Read more)

November
On Wednesday, November 18, CDC’s Office of Smoking and Health presented the third session of Public Health Grand Rounds entitled “The Public Health Impact of Tobacco Product and Advertising Regulation.” (Read more)

October
On Thursday, October 15, Dr. Frieden introduced the second session of the Public Health Grand Rounds entitled “Eliminating HAIs: A Primer”, a presentation on healthcare-associated infections presented by Chesley Richards, MD, Deputy Director DHP. (Read more)

September
On Thursday, September 17, Dr. Frieden kicked off the first session of the Public Health Grand Rounds entitled “Getting to Zero Traffic-related Deaths”, a presentation on motor vehicle safety sponsored by the Division of Unintentional Injury Prevention (DUIP), National Center for Injury Prevention and Control (NCIPC). (Read more)

February, 2010

“Folic Acid in the Prevention of Birth Defects”
Thursday, February 18, 2010
9:00 a.m. – 10:15 a.m. E.S.T.

- Video (283mb, total time: 1:07:35)
- PDF version of the PowerPoint presentation (5mb, 85 pages)
March, 2010:
“Radiological and Nuclear Disaster Preparedness”
Thursday, March 18, 2010
9:00 a.m. – 10:15 a.m. E.S.T.

Presented by:
Dr. Charles W. Miller, Chief, Radiation Studies Branch, National Center for Environmental Health | Dr. Robert L. Jones, Chief, Inorganic and Radiation Analytical Toxicology Branch, National Center for Environmental Health

Focused Discussion led by:
RADM Scott Detchman, Associate Director for Emergency Response, National Center for Environmental Health and Agency for Toxic Substances and Disease Registry | Discussants: Dr. John Halpin, Medical Officer, Emergency Preparedness and Response Office National Institute for Occupational Safety and Health | Dr. Katherine Uranek, Senior Medical Coordinator, Healthcare Emergency Preparedness Program, New York City Department of Health and Mental Hygiene | Dr. Daniel M. Sosin, Captain, U.S. Public Health Service, Acting Director, Office of Public Health Preparedness and Response

Facilitated by:
Dr. Tanja Popovic, Scientific Director, Public Health Grand Rounds

Live video will be available at the time of the event:

- Broadband: [http://cdc.wl.misolutions.net/live/cdc/6](http://cdc.wl.misolutions.net/live/cdc/6)
- Dial-up or slower connection: [http://cdc.wl.misolutions.net/live/cdc/7](http://cdc.wl.misolutions.net/live/cdc/7)

Useful Resources for Radiological/Nuclear Planning, Training, and Response

- CDC
- REAC/TS
- DHHS
- CRCPD
- National Council on Radiation Protection (NCRP)
  - Commentary No. 19 Key Elements of Preparing for Emergency Responders for Nuclear and Radiological Terrorism [http://www.nrcpublications.org/index.cfm?Prod=Hub-Area7ContentID=4984003012](http://www.nrcpublications.org/index.cfm?Prod=Hub-Area7ContentID=4984003012)
  - New York City Department of Health and Mental Hygiene
Continuing Education Credits

As of January 2010
Credit Hours are available for:

- Physicians (CME)
- Non-Physicians (CME)
- Nurses (CNE)
- Certified Health Education Specialists (CECH)
- Pharmacist (CPE)
- Other Professionals (CEU)

ALL Continuing Education credits/contact hours for PHGR are issued online through the CDC/ATSDR Training & Continuing Education Online system, http://www2a.cdc.gov/TCEOnline.
Environmental Health - Radiation

The medical examiner/coronor's guide for contaminated deceased body management.
Hanzlick R, Nolte K, deJong J.

The RABIT: a rapid automated biodosimetry tool for radiological triage.

The view from the trenches: part 1-emergency medical response plans and the need for EPR screening.
Gougelet RM, Rea ME, Nicolalde RJ, Geiling JA, Swartz HM.

Triage dose assessment for partial-body exposure dicentric analysis.
Prasanna PG, Moroni M, Pellmar TC.
Health Phys. 2010 Feb;98(2):244-51.

A critical assessment of biodosimetry methods for large-scale incidents.
Swartz HM, Flood AB, Gougelet RM, Rea ME, Nicolalde RJ, Williams BB.

Selection by Dr. Armin Ansari
Radiation Studies Branch,
Division of Environmental Hazards and Health Effects,
NCEH

http://intranet.cdc.gov/scienceclips
External Viewers of CDC Grand Rounds

Number of External Viewers

- November 09': 105
- December 09': 205
- January 10': 4,404
- February 10': 7,480
PHGR January 21: Almost 5,000 Viewers!
PHGR February 18: 7,480 Viewers!
Stay Tuned

Apr 15  Preventing Health Effects from Nanotechnology
May 20  Chlamydia Prevention and Control
June 17  Obesity
PUBLIC HEALTH GRAND ROUNDS

March 18, 2010
Why is Radiation a Concern?

- Loss/misuse of radiation sources
- Accident in radiation industry
- Terrorism threat – procurement and use of
  - Radiological dispersal device (RDD)
  - Improvised nuclear device (IND)
Public Health Functions in Preparedness and Response to Radiological Incidents

- Pre-event
- Early-phase: initial hours
- Intermediate-phase: hours to days
- Late-phase: days to months
- Post-event
  - Early-phase: initial hours
  - Intermediate phase: hours to days
  - Late phase: days to months

Adapted from IOM, 2008, DHS, 2008, and RAND, 2009
- Identify pre-existing radiation sources/baseline
- Conduct training and exercises
- Coordinate with response partners

Pre-event

Early-phase

Intermediate-phase

Late-phase

Adapted from IOM, 2008, DHS, 2008, and RAND, 2009
- Monitor indicators of a release
- Identify likely areas of contamination
- Provide public guidance

Adapted from IOM, 2008, DHS, 2008, and RAND, 2009
Adapted from IOM, 2008, DHS, 2008, and RAND, 2009

- Identify agent and characterize contaminated area
- Assess victim decontamination and medical needs
- Conduct epidemiologic investigation
- Provide emergency laboratory support
- Establish victim registry
- Monitor shelter and mass care conditions
- Ensure food and water safety
- Monitor responder exposures and health
- Manage contaminated fatalities
- Define re-occupancy criteria
- Decontaminate facilities and resources
RADIOLOGICAL AND NUCLEAR DISASTER PREPAREDNESS

- Katherine Uraneck, MD
  - State and Local Perspective
- Charles W. Miller, PhD
  - Challenges and Opportunities
- Robert Jones, PhD
  - Detecting and Identifying Radiation Exposures and Contamination
- John Halpin, MD, MPH
  - Worker Safety and Health Issues
- Daniel Sosin, MD, MPH, FACP
  - How Public Health Preparedness and Response Resources can Support Radiologic and Nuclear Preparedness
STATE AND LOCAL PERSPECTIVE

Katherine Uraneck, MD
Senior Medical Coordinator
Healthcare Emergency Preparedness Program
New York City Department of Health and Mental Hygiene
Why Should State and Local Health Agencies Plan for Radiation Incidents?

- 1 known terrorist incident involving radioactive materials
  - Explosive Radiological Dispersal Device planted in Moscow park 1995

- Radiation accidents, including transportation accidents, are rare but not uncommon

- All public health agencies, state, local, tribal and territorial are potential responders to a radiation incident
2004 Industrial Radiography Malfunction at U.S. Postal Office Midtown Manhattan

- 29 August – Industrial radiographic equipment malfunctions at U.S. Post Office
  - Occupants evacuated from building
  - Multiple streets closed
  - Multiple federal, state, and local agencies respond
- 30 August – Removal of source completed
- DOHMH response:
  - Shielded source and areas in Post Office
  - Conducted extensive environmental surveys
  - Communicated to public and press
  - Canvassed area with > 2,000 fact sheets
  - Conducted dose estimates for employees of U.S. Postal Service, contractor, and public
2006 United Kingdom Polonium-210 Poisoning

- 2 November: Alexander Litvinenko has tea with “persons of interest” in London
- 6 November: Litvinenko admitted to hospital
- 23 November: Litvinenko dies
- Cause of illness: Radioactive Polonium-210
- 738 tested in UK for internal contamination

- 160 U.S. citizens identified and notified of potential contamination
- >20 U.S. state and local public health agencies involved
  - Notification
  - Communication
  - Bioassay coordination
Potential Public Health Roles In a Radiological/Nuclear Emergency

- Identify *radiological* agent or cause
- Determine *radiological exposure and contamination*
- Provide medical/public guidance *radiological protective actions and medical management*
- Conduct environmental and human surveillance for potential *radiological contamination or exposure*
- Conduct epidemiologic investigations, if needed
- Coordinate *radiological* sampling and laboratory testing
- Coordinate requests, receipt, and distribution of Strategic National Stockpile if needed
- Coordinate *radiological monitoring/screening* (environment and people)
- Mitigation and recovery

Pre-event  Early-phase  Intermediate-phase  Late-phase
State and Local Public Health Capability and Capacity to Respond to a Radiological/Nuclear Incident

- **Response capability and capacity varies across state and local jurisdictions**
  - States with nuclear power plants: 31 states
  - States with high risk metropolitan areas

- **Inconsistent integration of radiation control programs with public health agencies**
  - State radiation control programs reside in state public health agencies in 35 states
  - Radiation control/expertise is found elsewhere with state government in remaining 15 states
Challenges to Planning & Response for State, Local, Tribal, and Territorial Jurisdictions

- Lack of awareness public health responsibilities in radiological/nuclear emergencies
- Lack of funding
- Lack of subject matter expertise
- Lack of human resources for planning, exercises, and response
Meeting the Challenge: Finding Funding

- Increase priority of radiological/nuclear planning
- Utilize multiple grant lines
- Participate in regional planning efforts
- Examples of funding sources
  - Department of Homeland Security
    - Urban Areas Security Initiative Grants (UASI)
  - CDC
    - Public Health Preparedness Grants
  - Department of Health and Human Services
    - Office of the Assistant Secretary for Preparedness and Response (ASPR) – Health Preparedness Program
  - Other
    - Conference of Radiation Control Program Directors (CRCPD)
Example of Utilizing Multiple Funding Sources: NYC Radiation Equipment Detection Project

- 57 NYC hospitals provided with radiation detection equipment – UASI grant 2006-08
  - Area radiation detectors
  - Survey meters and probes
  - Personal dosimeters

- >900 Non-fire Department ambulances provided with dosimeters – UASI grant 2007

- ~ 1000 EMS & hospital staff trained on radiation detection equipment – UASI & ASPR grants 2007-08

- Radiation Safety Officer Symposium on Radiological Terrorism – ASPR and CDC grants 2009

- 17 NYC hospitals to drill radiation detection – UASI grant 2010

UASI, Urban Areas Security Initiative Grants
ASPR, Office of the Assistant Secretary for Preparedness and Response
Meeting the Challenge: Finding Subject Matter Expertise

- Identify and partner with federal agencies and state organizations
  - Centers for Disease Control and Prevention (CDC)
  - U.S. Department of Energy (DOE)
  - U.S. Environmental Protection Agency (EPA)
  - State radiation control programs
  - Conference of Radiation Control Program Directors (CRCPD)
  - Radiation Emergency Assistance Center/Training Site (REAC/TS)

- Identify and partner with state and local experts
  - Nuclear power plant safety and response personnel
  - University and research radiation safety personnel
  - Hospital radiation safety and nuclear medicine personnel
  - State and local chapters of professional radiation safety organizations
Example of Partnering: NYC Radiation Materials Security Audits

- 2005: Nuclear Regulatory Commission issues Increased Controls Regulations
- 2006: NYC DOHMH partners with non-regulatory agencies to conduct security audits of 32 hospitals
  - New York Police Department (NYPD)
  - Private and public hospitals
  - Department of Energy (DOE) Brookhaven National Laboratories
- 2009: 48 additional hospitals, research, and academic licensees audited
- Result: Best Practice Guidelines, Self-Audit Checklists, better inventory of radiological materials, better security at hospitals
Meeting the Challenge: Augmenting Human Resources

- Hiring new staff may not be an option; hence current staff need to find expeditious methods for creating plans
- Utilize and modify plans and protocols created by federal, state, and other localities
Multi-day conference
Optional radiation training to be offered
Multiple tracts daily
  - Medical response
  - Risk communication and training
  - Public health operations
Promising practices and past lessons to be shared
Charles W. Miller, PhD
Chief, Radiation Studies Branch
National Center for Environmental Health
What is Radiation?

- Alpha
- Beta
- Gamma Ray
Penetration Abilities of Different Types of Radiation

**Alpha Particles**
- Stopped by a sheet of paper
- Especially damaging to internal tissues if inhaled or swallowed

**Beta Particles**
- Stopped by a layer of clothing or less than an inch of a substance (e.g., plastic)
- Damaging to internal tissues if inhaled or swallowed and can cause external skin burns

**Gamma Rays**
- Stopped by inches to feet of concrete or less than an inch of lead
- Damaging to tissues externally and internally
Contamination vs. Exposure

- **Exposure**: coming in contact with radioactive waves or particles, e.g., having a chest x-ray
- **Contamination**: deposition of radioactive material in undesired locations

A person can be exposed but not contaminated – think x-ray exams!
Health Effects of Radiation Exposure

- In general, the amount and duration of radiation exposure affects the severity or type of health effect.
  - Lethal: in high doses
  - Mutagenic: damage to the genes
  - Carcinogenic
People on Earth Are Exposed to Radiation Every Day of Their Life

In 2006, the average person in the United States received an annual radiation dose of 6.2 milliSieverts

<table>
<thead>
<tr>
<th>Source of Radiation</th>
<th>Percent</th>
<th>Contribution to Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radon &amp; thoron (Background)</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>Space (Background)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Internal body (Background)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Terrestrial (Background)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Medical procedures</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Consumer products</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Industrial releases</td>
<td>&lt; 1</td>
<td></td>
</tr>
<tr>
<td>Occupational</td>
<td>&lt; 1</td>
<td></td>
</tr>
</tbody>
</table>

Radiological Dispersal Example
Goiânia, Brazil - September, 1987

- Source capsule removed from abandoned radiotherapy machine
- “Glowing” powder distributed to family and friends
- Six year-old girl ate sandwich with contaminated hands
- Physician diagnoses acute radiation sickness in exposed woman; “glowing” powder was Cesium-137
Nuclear Detonation
Example: Hiroshima, August 1945

- August 6, 1945 – 8:15 am
- Detonation height – 600 meters (2,000 ft)
- Blast yield equivalent to 15,000 tons of TNT
- 4.7 square miles (12 km²) of the city were destroyed
## Comparison of the Impact of the Goiânia and Hiroshima Events

<table>
<thead>
<tr>
<th>People Affected</th>
<th>Goiânia 1987</th>
<th>Hiroshima 1945</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deaths</td>
<td>4</td>
<td>100,000</td>
</tr>
<tr>
<td>Treated</td>
<td>54</td>
<td>37,000 injured</td>
</tr>
<tr>
<td></td>
<td>(46 given Prussian Blue)</td>
<td>177,000 survivors</td>
</tr>
<tr>
<td>Contaminated</td>
<td>249</td>
<td>Unknown</td>
</tr>
<tr>
<td>Monitored (for contamination)</td>
<td>112,000 (took 3 months to complete)</td>
<td>None available</td>
</tr>
</tbody>
</table>
Public Health Functions in Preparedness and Response to Radiological Incidents

Adapted from IOM, 2008, DHS, 2008, and RAND, 2009
Pre-existing radiation sources (baseline) generally unknown

- Environmental **surveillance**: informs decisions during the event
- Human **surveillance**: provides baseline urine concentrations

Training and realistic exercises lacking

- Increase awareness of public health roles/responsibilities

Coordination among partners minimal

- Form alliances between public health and radiation control programs
- Communications
- Environmental characterization
  - Underuse of modeling resources
    - Integrated Modeling and Atmospheric Assessment Center capabilities
    - Identify people and places likely to be contaminated
    - Drive protective actions
    - **Lawrence Livermore National Laboratory**: Any sheltering in the first few hours following a nuclear detonation in an urban environment can save on the order of 200,000 people from significant radiation exposure
  - Environmental surveillance
Federal, State, and local public health authorities do not have capacity to perform epidemiologic, laboratory, and health physics functions related to population monitoring following a nuclear or radiological emergency.
CDC’s Addressing the Population Monitoring Challenge

- **Developed**
  - Guide for state and local public health planners

- **Developing**
  - Data collection and reporting tools for radiation-related epidemiologic investigations
  - Guidance for using hand-held instruments for emergency purposes
  - Innovative bioassay techniques for internal monitoring

- **Working with partners to expand the radiation workforce available to state and local agencies through the Medical Reserve Corps**
Gaps in
- Managing contaminated fatalities
- Managing cleanup and recovery of impacted land and facilities
- Defining re-occupancy criteria

Coordination required between numerous partners and stakeholders, including public health authorities
Remedial Actions and Defining Re-occupancy Criteria

Issues to be addressed

- Types and levels of contamination present: chemical, biological, and/or radioactive
- Intended use of the restored area: residential, school, industrial, tourism, etc.
- Remedial action most cost effective and acceptable to the community
- Acceptable level of residual radioactivity
Looking Forward

Hiroshima, 1945

Hiroshima, 2010
DETECTING AND IDENTIFYING RADIATION EXPOSURE AND CONTAMINATION

Robert L. Jones, PhD
Chief, Inorganic and Radiation Analytical Toxicology Branch
National Center for Environmental Health
Assessment of exposure versus contamination
Assessment of internal contamination
- Radionuclide detection technologies
- Importance of radionuclide testing
- CDC’s Urine Radionuclide Screen
- CDC and state capabilities and needs
### Assessment of Radiation Exposure and Contamination

<table>
<thead>
<tr>
<th>Radiation Exposure</th>
<th>External Radionuclide Contamination</th>
<th>Internal Radionuclide Contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO contamination on clothes or body</td>
<td>ON clothes or body</td>
<td>INSIDE the body</td>
</tr>
</tbody>
</table>

- **Lymphocyte depletion**
- **Chromosome analysis**

- **Radiation meter**
- **Urine bioassay**
- **Whole body counter**
- **Radiation meter**
## Detection of Internal Radionuclide Contamination

<table>
<thead>
<tr>
<th>Radionuclides</th>
<th>Urine bioassay detection</th>
<th>Primary radiation emission</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Uranium</strong> <em>((^{235}\text{U}, ; {238}\text{U})), Thorium</em></td>
<td>yes</td>
<td><strong>alpha and beta particles</strong></td>
</tr>
<tr>
<td><strong>Strontium, Plutonium</strong> <em>((^{238}\text{Pu}, ; {239}\text{Pu}))</em></td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td><strong>Americium, Californium, Neptunium</strong>,</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td><strong>Phosphorus, Curium, Polonium</strong></td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td><strong>Cesium, Cobalt</strong> <em>((^{57}\text{Co}, ; {60}\text{Co})), Radium</em></td>
<td>yes</td>
<td><strong>Gamma rays</strong></td>
</tr>
<tr>
<td><strong>Iodine</strong> <em>((^{125}\text{I}, ; {131}\text{I})), Technetium-99m</em></td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td><strong>Selenium, Molybdenum, Iridium</strong></td>
<td>yes</td>
<td></td>
</tr>
</tbody>
</table>

Radionuclides of concern can be found at:
- www.energy.gov/media/RDDRPTF14MAYa.pdf
CDC’s Urine Radionuclide Screen

Step 1: Screen for the presence of any radionuclides
- Identifies presence of alpha, beta or gamma emitting radionuclides
- Results for the first 100 samples in 8 hours
- Throughput: alpha or beta - 250 samples/day, gamma - 3,000 samples/day

Step 2: Identify and quantify specific radionuclides
- Goal - 22 radionuclides (current capability – 7)
- Specific radionuclide assays:
- Throughput: 250 samples/day

Sample requirement: 70 mL of urine (spot sample). All methods CLIA certified.
Why Rapid Urine Bioassay Is Important

- Define baseline contamination
- Identify persons with post-event internal contamination
  - Estimate radiation dose
  - Assist in short and long term medical care decisions
- Identify contaminated versus non-contaminated persons
  - Reduce the “stress” on the public health system
  - Provide psychological assurances to the un-exposed
- Provide support to epidemiological investigations
Laboratory Goals and Needs for Effective Response

CDC

- Develop rapid CLIA-approved methods for 22 priority radionuclides, and increase sample throughput

State and local

- Establish Laboratory Response Network-Radiologic
  - Participation: 10 or more state laboratories
  - Training and technology transfer
  - Performance evaluation
WORKER SAFETY AND HEALTH ISSUES

John Halpin, MD, MPH
Medical Officer
Emergency Preparedness and Response Office
National Institute for Occupational Safety and Health
Workers should have a basic understanding of

- **Health risks:** Acute vs. long-term effects of exposure
- **Radiation protection:** Time, distance and shielding
- **Radiation response zones:** Restrict responder access

* DIAGRAM: Zones with different radiation boundaries:*
  - Extreme caution radiation boundary: 10,000 mR/hr
  - High radiation boundary: 1,000 mR/hr
  - Medium radiation boundary: 100 mR/hr
  - Low radiation boundary: <10 mR/hr
Radiation Monitoring Equipment

- Personal dosimetry
- Radiation survey meters
Safe response requires well defined limits for exposure to radiation

- OSHA: Sets occupational limit for radiation workers
  - 50 milliSievert/yr
  - Enforceable by law
- Other organizations provide recommendations for emergency responders
  - EPA recommendation: 250 milliSievert total exposure
  - Balances risk of exposure with opportunity to perform life-saving activities
Personal Protective Equipment

- **Affords protection from**
  - *Internal contamination*: radioactive material entering the body via inhalation, ingestion, or open wounds
  - *External contamination*: radioactive dust deposited on one's body
Existing Guidance

Planning Guidance for Response to a Nuclear Detonation

First Edition
January 16, 2009

Developed by the Homeland Security Council Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats

NCRP Report No. 138, Management of Terrorist Events Involving Radioactive Material

NCRP Report No. 138 on Management of Terrorist Events Involving Radioactive Material is 232 pages with 13 sections, eight appendices, a glossary, list of acronyms, conversions of conventional and International System of dosimetric quantities, and references. The Report’s main emphasis is on guidance to “first responders” and “emergency medical personnel” that would be involved in the management of terrorist events involving radioactive material. The sections of the report are: 1. Introduction (4 pages), 2. Considerations Impacting Response (7 pages), 3. Characteristics and Consequences of Terrorist Incidents that Involve Radioactive
HOW PUBLIC HEALTH PREPAREDNESS AND RESPONSE RESOURCES CAN SUPPORT RADIOLOGICAL AND NUCLEAR PREPAREDNESS

Daniel Sosin, MD, MPH
Acting Director
Office of Public Health Preparedness and Response
How Public Health Preparedness and Response Resources Can Support Radiological and Nuclear Preparedness

- Support All-hazards Preparedness
- Focus on Public Health Strength
- Commit to Planning and Exercises

Pre-event | Early-phase | Intermediate-phase | Late-phase

Post-event