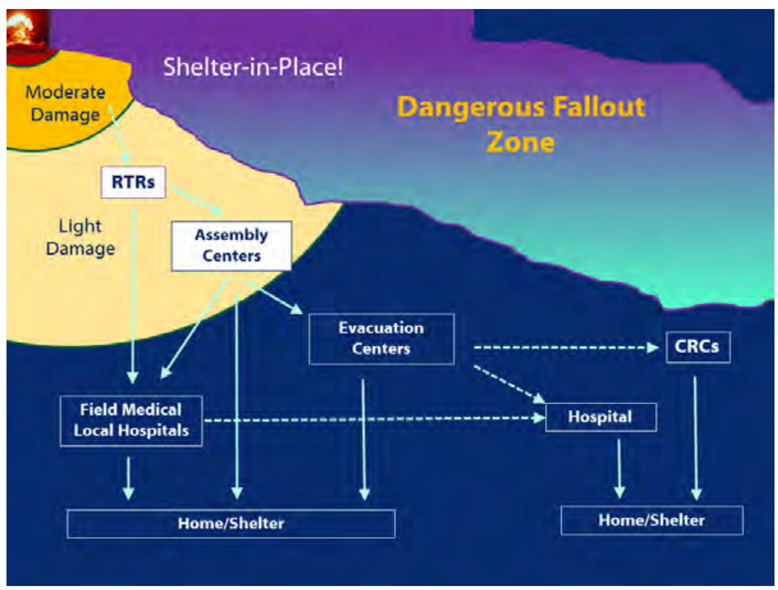
Fifty-Third
Annual Meeting Program

Assessment of National Efforts in Emergency Preparedness for Nuclear Terrorism: Is There a Need for Realignment to Close Remaining Gaps?



March 6–7, 2017

Hyatt Regency Bethesda
One Bethesda Metro Center
7400 Wisconsin Avenue
Bethesda, MD 20814

NCRP — Scientific Authority Since 1929 • Congressionally Chartered

Front cover: Schematic representation of the early phase of a coordinated response to a nuclear detonation. Can we pull off the unthinkable? (artwork courtesy of Armin Ansari)

NCRP Mission:

To support radiation protection by providing independent scientific analysis, information and recommendations that represent the consensus of leading scientists.

amazonsmile

NCRP Resource Development Committee is launching a series of efforts to increase the financial stability of NCRP. The first effort is to request Council members and friends who shop online at Amazon to make a simple (no cost) modification. Simply register at AmazonSmile (https://smile.amazon.com/), and the AmazonSmile Foundation will donate 0.5 % of the purchase price to NCRP at no charge to you! It's easy!

Follow the directions and be sure to select the National Council on Radiation Protection and Measurements (from the pull down list or searchable request) as the 501(c)(3) public charitable organization to receive the Amazon contribution for each purchase. Donations are anonymous. However, we would like to recognize your support and if you notify NCRP (Laura.Atwell@ncrponline.org) we will add your name to the NCRP list of AmazonSmile contributors.

Introduction

Assessment of National Efforts in Emergency Preparedness for Nuclear Terrorism: Is There a Need for Realignment to Close Remaining Gaps?

Fifty-Third Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP)

The issue of radiological emergency preparedness has evolved in the last 20 y from a primarily nuclear power plant focus to a wider, more comprehensive focus that includes response to all types of radiological and nuclear emergencies including terrorism. In 1998, the National Council on Radiation Protection and Measurements (NCRP) formed a scientific committee, chaired by Dr. John Poston, to provide information and recommendations regarding the radiological health and safety issues related to the threat of terrorist activities involving radioactive materials. The work culminated in the publication of NCRP Report No. 138, titled *Management of Terrorist Events Involving Radioactive Material* (2001). That report has been used and referenced in a variety of publications and guidance documents since its publication. Coincidentally, NCRP Report No. 138 was published in its final form about a month after the horrific terrorist events that took place on September 11, 2001. NCRP devoted its annual meeting in 2004 to further exploring this topic and Dr. Poston delivered the very first Warren K. Sinclair Keynote Address at that meeting.

Much has happened at the national and international level since then. A great deal of effort has been spent in the development of plans, guidance, exercises, training, etc., at the local, state and federal level, aimed at improving nuclear and radiological emergency preparedness in the United States. The aftermath of Hurricane Katrina in 2005 resulted in a number of important changes in our national approach to catastrophic emergencies. The tragic consequences of the 2011 Great East Japan earthquake and the accident at the Fukushima nuclear power plant were another reminder about critical challenges a nation would face in responding and later recovering from such incidents. The volume of published literature and the level of activity in the radiation emergency preparedness has increased steadily over the last two decades, and the threat still remains.

NCRP is devoting its annual meeting once again to this important topic. Unlike most other such conferences, this meeting will take an introspective and perhaps critical look at the advances that have taken place in the last 15 y, focusing on several key areas of preparedness, and will ask the questions:

- What are the remaining critical gaps in our ability to effectively respond to nuclear/radiological incidents?
- Are we doing enough to address these gaps?
- Are there areas where we have done enough and additional work will only achieve minimal, incremental gains? and
- Do we need to realign our national efforts?

The meeting has been divided into several topical areas that aim to explore these questions. The focus areas range from plans and guidance, training and exercising for both the first responder and the first receiver communities, recovery and return and communication, and in each area the selected speakers will take a critical look at the current state of that specific area and will conclude with suggesting three to five practicable priority actions/initiatives for future work.

The last session will take a comprehensive look at the proposed priority areas discussed earlier and will discuss overall priority areas that still need work. Our goal is to provide an informed footprint for where to focus our future efforts. We want to hear from you, the audience, and therefore have allowed plenty of time for questions and answers in each session. NCRP believes that these topics and gaps in knowledge are of such importance that a new commentary should be considered.

NCRP and the Radiation Research Society (RRS) are pleased to welcome the NCRP/RRS Scholars to this year's Annual Meeting. The three young scientists below received competitive travel awards made possible by the generosity of RRS. These awards are aimed at encouraging and retaining young scientists in the field of radiation science. Eligible applicants included junior faculty or students in the radiation sciences or junior health or medical physicists:

- Igor Koturbash, University of Arkansas for Medical Sciences, Little Rock
- Krishnanand Mishra, King Faisal Specialist Hospital and Research Centre, Riyadh
- Saloua Sahbani, University of Sherbrooke, Quebec

Questions can be submitted on cards during each session. Oral questions from the floor will not be accepted. The session chairs and speakers will address as many questions as time permits. All questions and answers will be published in *Health Physics* as part of the proceedings of the Annual Meeting.

The Fourteenth Annual Warren K. Sinclair Keynote Address will be given by Mr. Jack Herrmann, the Deputy Director of the Office of Policy and Planning within the Office of the Assistant Secretary of Preparedness and Response at the U.S. Department of Health and Human Services. Mr. Herrmann's presentation provides context and will set the stage for remainder of the meeting. The Forty-First Lauriston S. Taylor Lecture will be delivered by Dr. F. Ward Whicker, Distinguished Emeritus member of NCRP and Professor Emeritus at Colorado State University. Dr. Whicker's lecture will underscore the omnipresent nature of radiation in our environment and in our lives.

NCRP President, Dr. John Boice, will conclude the meeting by presenting a brief overview of recent NCRP activities and his vision for the future direction of NCRP.

NCRP is grateful to:

- the Joint Armed Forces Honor Guard from the Military District of Washington D.C. who will open our Annual Meeting;
- Kimberly Gaskins of the U.S. Nuclear Regulatory Commission who will sing our National Anthem (https://www.youtube.com/watch?v=DKTHosaa9do);
- Major Kimberly Alston for coordinating the military volunteers; and
- Thomas E. Johnson and students from Colorado State University for recording the presentations and making them available after the meeting.

Monday, March 6, 2017

Opening Session

8:10 am **Presentation of the Colors**
Joint Armed Forces Honor Guard from the Military District of Washington, DC

Singing of the National Anthem
Kimberly Gaskins
U.S. Nuclear Regulatory Commission

Program Welcome
Adela Salame-Alfie
Program Committee Co-Chair

NCRP Welcome
John D. Boice, Jr.
President, NCRP

Fourteenth Annual Warren K. Sinclair Keynote Address

8:30 am **Aren't We Ready Yet? Closing the Planning, Response and Recovery Gaps for Radiological Terrorism**
Jack Herrmann
U.S. Department of Health & Human Services

Are Existing Plans Sufficient for the Evolving Threat Environment?

James Blumenstock & Frieda Fisher-Tyler,
Session Co-Chairs

9:00 am **Preparedness is More Than a Plan: Medical Considerations for Radiation Response**
John F. Koerner
U.S. Department of Health & Human Services

Radiological Preparedness in the Land of Lincoln
Joseph G. Klinger
Illinois Emergency Management Agency

The ROSS: A Rad/Nuc Emergency Subject Matter Expert Filling a Critical National Need
William E. Irwin
Vermont Department of Health

9:45 am **Q&A**

10:00 am **Break**

Guidance, Training and Exercises: Emergency Responders

Brooke Buddemeier & Stephen Musolino,
Session Co-Chairs

10:30 am **Educating the Public About the Unthinkable: Development of a Preincident Nuclear Explosion Public Information Program**
Robert M. Levin
Ventura County Public Health

Radiological/Nuclear Preparedness in the First Responder Community
David Pasquale
New Mexico State Emergency Response Commission

A Retrospective Look at Rad Resilient City, UPMC's 2011 Preparedness Checklist to Save Lives Following a Nuclear Detonation
Monica Schoch-Spana
Johns Hopkins Center for Heath Security

11:50 am **Q&A**

12:05 pm **Lunch**

Summary

Guidance, Training and Exercises: First Receivers, Public Health

Cullen Case & C. Norman Coleman,
Session Co-Chairs

1:30 pm **First Receiver Gaps**
Cullen Case
National Marrow Donor Program

Triaging Thousands: Challenges in Survivor Screening After a Nuclear Detonation
John L. Hick
Hennepin County Medical Center, Minnesota

All-of-Nation Planning Approach to Medical Preparedness and Effective Response
C. Norman Coleman
National Cancer Institute

The Unmet Need to Engage/Train/Prepare the Medical Community for Mass Casualty Radiation Incidents
Judith L. Bader
U.S. Department of Health & Human Services

When the Walls Come Tumbling Down: Medical Surge Response to Nuclear Detonation
Dan Hanfling
Johns Hopkins Center for Heath Security

2:45 pm **Q&A**

3:00 pm **Break**

Recovery, Resilience and Reality: Going Beyond NCRP Report No. 175

Gerilee W. Bennett & Sara DeCair,
Session Co-Chairs

3:30 pm **Progress and Possibilities**
Gerilee W. Bennett
Federal Emergency Management Agency
Jill A. Lipoti
Rutgers University

Contemplating Completion: Defining an Exit Strategy
John J. Cardarelli, II
U.S. Environmental Protection Agency
Sara DeCair
U.S. Environmental Protection Agency

4:15 pm **Q&A**

4:35 pm **Break**

Forty-First Lauriston S. Taylor Lecture on Radiation Protection and Measurements

5:00 pm **Introduction of the Lecturer**
Jeffrey J. Whicker

Environmental Radiation and Life: A Broad View
F. Ward Whicker
Colorado State University

6:00 pm **Reception**
Sponsored by Landauer, Inc.

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Tuesday, March 7

8:15 am **NCRP Annual Business Meeting**

9:15 am **Break**

Communication, Education, and Public Information

Jessica Wieder, *Session Chair*

9:45 am **Communication Challenges in Crisis and Transition**
Michelle M. Laver
U.S. Department of Energy

Emergency Responder Communication Challenges Regarding Radiological Terrorism for the New Administration
Robert Ingram
Fire Department City of New York

Critical Areas for Improvement in Communications Regarding Radiological Terrorism
David P. Ropeik
Harvard School of Public Health

10:30 am **Q&A**

11:00 am **Break**

Bringing it All Together: Conclusions and Path Forward

Armin Ansari & Adela Salame-Alfie,
Session Co-Chairs

11:15 am **Panel Discussion**
Armin Ansari
Adela Salame-Alfie
Session Co-Chairs

12:00 pm **NCRP Vision for the Future and Program Area Committee Activities**
John D. Boice, Jr.
President, NCRP

12:30 pm **Adjourn**

Monday, March 6, 2017

Opening Session

8:10 am

Presentation of the Colors
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Fourteenth Annual Warren K. Sinclair Keynote Address

8:30 am

Aren't We Ready Yet? Closing the Planning, Response and Recovery Gaps for Radiological Terrorism
Jack Herrmann
U.S. Department of Health & Human Services

Following the tragic events of September 11, 2001 the nation has made significant strides in preparing for disasters and emergencies of all types. Federal funding to state, local, territorial and tribal public health and healthcare systems has required an all-hazards preparedness approach with special focus on those incidents that rise to the top of a jurisdiction's Threat and Hazard Identification and Risk Assessment. While disaster planners in many areas of the country have recognized the potential for nuclear accidents and radiological terrorism, these presumably rare events fall further down on their list to plan for when funding and human resources are limited.

In 2009, at a time when the events of 9/11 and Hurricane Katrina were fading into the past, anecdotal surveys and discussions with state and local health department planners suggested that hurricanes, floods, wildfires, and other natural disasters were their most pressing threats. However later that year, and throughout 2010, the H1N1 influenza pandemic took them away from natural disaster planning and instead had them focusing on emerging infectious diseases that could result in millions of lives lost. Planning efforts centered on how to distribute and dispense life-saving medical countermeasures and how health care systems would establish crisis standards of care in preparation for catastrophic patient surge and the resultant limitations of supplies, pharmaceuticals, and healthcare personnel.

Looking back over that decade from 2001 to 2010, one might conclude that our nation's experience with 9/11, Hurricane Katrina, and H1N1 adequately prepared us for anything. But the question still loomed out there-would we be prepared for a nuclear or radiological disaster the likes of which we had not seen since the 1979 Three Mile Island nuclear power station incident?

We may still not know the answer to that question today if it were not for the Fukushima Daiichi Nuclear Power Station accident following a devastating earthquake and tsunami in Japan on March 11, 2011. For the first time in our most recent history, a nuclear incident outside our country had consequences for the U.S. homeland. But even this incident, for its magnitude, did not measure up to the catastrophic damage and contamination of a large nuclear detonation. Fast forward to today, and the continued fear of terrorist actors with access to radiologic weapons of mass destruction, many are left wondering if our nation is truly prepared to respond to radiological terrorism.

In 2014, the Institute of Medicine convened public health, healthcare, emergency management, and other subject matter experts to address the nation's readiness to respond to an improvised nuclear detonation. The report, *Nationwide Response Issues After an Improvised Nuclear Device Attack* summarizes a plethora of challenges that still plague us. While federal, state and local efforts to plan for, respond to, and recover from radiological terrorist incidents such as an improvised nuclear device are in most cases in place, significant gaps remain in understanding the differences and nuances between planning for nuclear and radiologic events, command and control following these incidents, communicating with the public to mitigate public fear, clinical treatment and care for those exposed, and how to prepare for the longstanding recovery challenges of repatriating a contaminated city. Yet 2 y later, our nation is still largely focused on the response to two emerging infectious diseases-the Ebola and Zika viruses. It is also true that the risk of domestic and international violent extremism looms on the horizon, leaving many questions unanswered:

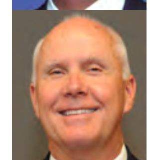
- Is the nation prepared to respond to an improvised nuclear device or other such act of terrorism?
- Are we confident our federal, state and local governmental leaders know who's in charge of responding to such events and do they have the legislative authorities and plans needed to protect the health and welfare of all Americans?
- Do members of the public know how to prepare and what to do in such an incident?
- Are our first responders and those on the front line of our public health and healthcare systems adequately trained and prepared for their roles during a radiation disaster?
- Have they sufficiently exercised these roles so they feel confident in their response to such incidents?
- Where do we need to advance the science so that we know the short-, intermediate- and long-term environmental effects of nuclear and radiologic incidents?
- And, what else don't we know that we should before we are faced with such a disaster?

Are Existing Plans Sufficient for the Evolving Threat Environment?

James Blumenstock & Frieda Fisher-Tyler, *Session Co-Chairs*

9:00 am

Preparedness is More than a Plan: Medical Considerations for Radiation Response
John F. Koerner
U.S. Department of Health & Human Services



Radiological Preparedness in the Land of Lincoln
Joseph G. Klinger
Illinois Emergency Management Agency

The ROSS: A Rad/Nuc Emergency Subject Matter Expert Filling a Critical National Need
William E. Irwin
Vermont Department of Health

Since 9/11, the practice community has witnessed an evolving and expanding threat environment, taking emergency preparedness planning beyond fixed nuclear power plants, further into the realm of the terrorism nexus. Nationally, there has been significant investment into preparedness for radiological and nuclear terrorism. Are we ready as a nation to address the radiological terrorism threat at regional, state and local levels? How have prior efforts worked to improve preparedness, response and recovery capabilities across regions, states and cities? Have investments in preparedness and response infrastructure been leveraged in ways that increase resilience? Is there a need for a strategic national network to integrate critical improvised nuclear device capabilities into existing plans already in place throughout the nation, to save lives in the aftermath of a radiological or nuclear terror attack? This session seeks to address questions such as these, and recommend specific actions to be taken to move us forward.

9:45 am **Q&A**

10:00 am **Break**

Guidance, Training and Exercises: Emergency Responders

Brooke Buddemeier & Stephen Musolino, *Session Co-Chairs*

10:30 am

Educating the Public About the Unthinkable: Development of a Preincident Nuclear Explosion Public Information Program

Robert M. Levin
Ventura County Public Health

Experts suggest there may be a future detonation of an improvised nuclear device (IND) in one or more major cities in the United States. Ventura County lies to the north of Los Angeles County. When the threat of an IND detonation in Los Angeles County was considered by Ventura County to be a theoretical possibility, the County's Terrorism Working Group (TWG) considered what the impact on Ventura County might be.

Some 80 people from 30 different agencies met to plan for such an eventuality. The TWG ad hoc group determined that some two million evacuees would flee toward Ventura County in as many as one million vehicles. There are four highways which leave Los Angeles County heading through Ventura County. There are few connecting streets in Ventura County that run from town to town which would allow for an alternate parallel flow of traffic to the highway system. Eight lanes of highway are available to carry evacuees from Los Angeles into Ventura County. These eight lanes can carry 250,000 vehicles in a 24 h period. If all but one of the lanes on the southbound side of the highways were turned into northbound traffic (“contra flow”), this would allow for 13 northbound lanes and up to 400,000 vehicles per day. Under the best of circumstances it would take 2.5 d for the evacuees to clear Ventura County. At the northern end of the county all highways come together into one highway with only three lanes. This narrowing would slow traffic even further. Evacuees would leave the highways into the cities looking for fuel, health care, decontamination, housing, food, water, and bathroom facilities. Traffic in all of the cities neighboring the highways would come to a standstill.

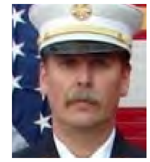
Ventura County decided on the need to formalize a strategic education initiative designed to make an “untalkable” issue easier to talk about. In 2012, Ventura County unveiled its pre-incident nuclear explosion public information program.

Ventura created a communications program that used traditional and social media to reach out to residents. The nucleus of the campaign was a series of town-hall meetings designed to put knowledgeable spokespeople in front of small groups, to answer questions and offer reassurance while presenting the educational message. A website was launched to serve as an informational resource for residents, health professionals, and first responders. Four educational videos were produced. Radio public service announcements were scripted. Direct mail assets and pamphlets were prepared. Thirty-five audiences were targeted and all materials translated into Spanish and Mixteco. Special efforts were expended to reach students and their parents.

Decision makers in the county were educated and involved in the project and given input into the shaping of the program. A series of unanticipated obstacles arose along the way. Our strategy and experience may be useful to other counties.

Assessment of National Efforts in Emergency Preparedness for Nuclear Terrorism

Radiological/Nuclear Preparedness in the First Responder Community



David Pasquale
New Mexico State Emergency Response Commission

This presentation will focus on the nation's preparedness level by looking at guidance, training and exercises, along with available metrics that may be used for an analysis.

It is difficult, if not impossible, to predict preparedness levels for a specific threat such as radiological/nuclear incidents by taking a single snap shot of the nation. A more effective measure of preparedness may be achieved by looking at regional areas of the nation and then examining three distinct layers of the response community. Those layers include emergency management, agency policies, and concept of operations and finally, capability of the response forces. These areas can be looked at as a three legged stool with each leg representing an essential element of preparedness.

Looking first at emergency management, the role of these agencies in guiding operational planning and performing a threat and hazard identification and risk assessment will be examined. Emergency management agencies are a critical component in preparedness. They act as facilitators to their regions and quite often are the conduit for state and federal funding grants to response agencies.

Next, agency policies and concept of operations will be discussed. In this area, existing federal guidance available to agencies and potential gaps that exist when compared to other threats will be explored. Agencies must provide guidance and policies for personnel for a myriad of incidents that first responders may encounter. Without support and vision from an agency's administration the mission will not proceed.

The third area will provide an overview of the first responder community with emphasis on training and equipment. In this element existing guidance for training, such as the National Fire Protection Association standards and available metrics that may be used for analysis, will be explained. Findings from Level 1 and 2 assessments received from responders nationwide during training opportunities will be discussed.

Finally, an overview of current successes in training such as the National Wildfire Coordinating Group will be provided. Opportunities to enhance radiological/nuclear prevention and response related programs, guidance, training and exercises with a national, state and local focus will be examined and offered.

A Retrospective Look at Rad Resilient City, UPMC's 2011 Preparedness Checklist to Save Lives Following a Nuclear Detonation

Monica Schoch-Spana
Johns Hopkins Center for Heath Security

In 2011, the University of Pittsburgh Medical Center (UPMC) Center for Health Security produced "The Rad Resilient City Checklist," a local planning tool that could help save tens of thousands of lives following a nuclear detonation. As presented to NCRP at the 2012 Annual Meeting, reducing exposure to radioactive fallout is the intervention that can save the most lives following a nuclear detonation. Yet, most Americans are not familiar with correct safety measures against fallout, and many believe that nothing can be done to reduce the suffering and death inflicted by a nuclear attack. The Rad Resilient City Checklist attempted to reverse this situation by converting the latest federal guidance and technical reports into clear, actionable steps for communities to take to protect their residents from exposure to radioactive fallout. The checklist reflected the shared judgment of a national advisory panel comprised of top decision makers, scientific experts, emergency responders, and leaders from business, volunteer and community sectors. This presentation will provide a retrospective look at this preparedness effort and the lessons that can help inform future radiological and nuclear terrorism response preparedness efforts.

11:50 am **Q&A**

12:05 pm **Lunch**

Guidance, Training and Exercises: First Receivers, Public Health

Cullen Case & C. Norman Coleman, *Session Co-Chairs*

1:30 pm

First Receiver Gaps

Cullen Case
National Marrow Donor Program

The Army says train as you fight and train often. Since 9/11 the U.S. preparedness community has worked diligently to buy the right equipment, train on the equipment, and write the plans for how and when to use it. However, there are still many gaps with nuclear and radiological issues being particularly complex given their size, scope and no-notice characteristics. In the efforts to prepare there is an overwhelming amount of information available from many sources. Health and medical planners and responders need a straightforward source of essential information and also a consolidated location for reference to learn the latest updated guidance, triage guidelines, treatment protocols, etc. Additionally, exercises outside of large state, regional, or national exercises have been isolated to single organizations (generally). Given the breadth of issues to be addressed, the lessons learned from the health and medical response need to be openly shared and, ideally, more organizations need to participate and do so in a coordinated manner. In response to a major radiological or nuclear incident, mass casualty radiological incident hospitals will need to work together. Key aspects of a response will be discussed along with tools available to help coordinate up-to-date knowledge.

Triaging Thousands: Challenges in Survivor Screening After a Nuclear Detonation

John L. Hick
Hennepin County Medical Center, Minnesota

One of the most difficult challenges is sorting survivors that are at significant risk of complications from radiation exposure. Community reception centers meet this need when resources allow, but in the immediate aftermath of a nuclear detonation, screening survivors with potential fallout exposure by their potential to benefit from bone-marrow cytokine support and evacuation for definitive medical treatment can be extremely difficult. A proposed sorting mechanism and discussion of some of the key issues will be presented.

All-of-Nation Planning Approach to Medical Preparedness and Effective Response

C. Norman Coleman
National Cancer Institute

The overwhelming size and scope of a major radiological/nuclear incident will produce tremendous stress on medical responders which is greatly amplified by the fear of radiation. It is expected that most first receivers and decision makers will have had limited experience with and knowledge in managing such an incident. There is the need for tools and knowledge to help them make sound and fair decisions and to provide as fair a decision-making process for the victims as possible. The Scarce Resources Project supported by the Assistant Secretary for Preparedness and Response (U.S. Department of Health and Human Services) helped establish an ethical framework for decision making and triage. Since an appropriate diagnosis is critical for the correct treatment of each individual and also for the most effective utilization of medical countermeasures and other resources, biomarkers of radiation injury are highly desirable. With support from the National Institute of Allergy and Infectious Diseases and the Biomedical Advanced Research and Development Authority, and input from a wide array of experts, biomarkers are being evaluated. Notably, these may have a "civilian" use as biomarkers for tissue injury for cancer care.

The Unmet Need to Engage/Train/Prepare the Medical Community for Mass Casualty Radiation Incidents

Judith L. Bader
U.S. Department of Health & Human Services

A wide spectrum of medical and civilian support personnel would be involved in responding to a large mass-casualty radiation incident in the United States. Most potential responders have had no formal training in radiation and many may not want to participate in a response. Providing adequate training for these diverse sets of workers is challenging, especially if the training is not required and updated regularly. Currently radiation training uptake is minimal and updating training content is expensive. Both "just-in-time" (simple training) and more in depth training, tailored to response roles, will be required. In the United States, both classroom (synchronous) and online (asynchronous) training/information resources are currently available, and several of these U.S. government-sponsored resources will be shown, including assets from the Assistant Secretary for Preparedness and Response, the Center for Radiological Nuclear Training, the Centers for Disease Control and Prevention, the Federal Emergency Management Agency, the Radiation Emergency Assistance Center/Training Site, and the Radiation Injury Treatment Network. Medical professional societies have not engaged significantly in fixing the training gap. A major national investment will be required to enable adequate numbers of both medical and nonmedical personnel to feel safe and adequately prepared to participate in a response.

When the Walls Come Tumbling Down: Medical Surge Response to Nuclear Detonation
Dan Hanfling
Johns Hopkins Center for Heath Security

The medical community will be significantly overwhelmed in the setting of a mass casualty radiological incident. Few clinicians have experience in the management of radiologically contaminated patients, let alone the plans in place to manage them under surge conditions. The standards of care will have to change, requiring a shift in thinking in how to establish appropriate triage mechanisms immediately following an incident. We will review the anticipated casualty profiles from a radiological disaster (trauma, radiation only, and combined injury), discuss triage systems available to the medical community as well as what planning gaps there are that need to be addressed before an incident occurs. We will also review lessons learned from an example of real world events where hospital staff were forced to implement triage decision-making protocols in order to meet the overwhelming surge in demand for healthcare services that they faced.

2:45 pm **Q&A**

3:00 pm **Break**

Recovery, Resilience and Reality: Going Beyond NCRP Report No. 175

Gerilee W. Bennett & Sara DeCair, *Session Co-Chairs*

3:30 pm

Progress and Possibilities
Gerilee W. Bennett
Federal Emergency Management Agency

Jill A. Lipoti
Rutgers University

Published in December 2014, NCRP Report No. 175, *Decision Making for Late-Phase Recovery from Major Nuclear or Radiological Incidents*, emphasizes the importance of local, state and national plans addressing late phase issues and decision-making processes concurrently with emergency-response requirements. The Report includes eight recommendations ranging from a broad call for a national strategy promoting community resilience as a preferred approach for preparing to recover from nuclear or radiological incidents to more specific calls for research and strategies for cleanup and waste management. This panel will discuss progress of several key recommendations since publication of NCRP Report No. 175 as well as highlight how ongoing all-hazards resilience building initiatives across the country may benefit preparedness for nuclear and radiological incidents. The panel suggests that aligning nuclear/radiological preparedness with all-hazards disaster preparedness planning, urban disaster preparedness, and coastal risk management efforts could ensure opportunities to improve resilience to and recovery after a nuclear/radiological incident are not lost.

Contemplating Completion: Defining an Exit Strategy

John J. Cardarelli, II
U.S. Environmental Protection Agency

Sara DeCair
U.S. Environmental Protection Agency

The National Council on Radiation Protection (NCRP) published Report No. 175 which expands on the nation's radiation incident response and recovery guidance. The report recommends an inclusive stakeholder process for setting incident-specific goals, rather than prescribed standards for remediation. However, the process must include important considerations such as when government intervention may be terminated.

After the Windscale fires in the 1950s, monitoring for radioactivity in sheep's milk and meat was conducted. After 30 y of monitoring, repeated testing produced no results above background and there was no benefit to continued monitoring. However, farmers supported continuation of the monitoring at government expense since it assured their customers that the products were safe. In a future incident recovery, the stakeholders must discuss the parameters for cessation of monitoring, providing endpoints that are mutually agreeable. This presentation proposes new guidance for various metrics leading to cessation of monitoring. Similarly, new guidance will be proposed that determines when the cleanup goal has been achieved based on stakeholder consensus using statistics and metrics. The process is designed to reduce public fear and improve decision making. This was demonstrated during Liberty RadEx exercise, when the Community Advisory Panel came back with a hybrid decision through consensus building. The U.S. Environmental Protection Agency has vast experience with community involvement which results in a community more informed of the risks and the caveats for risk reduction.

A second gap is the lack of *awareness* of guidance on optimization. While it is difficult to interest members of the public in these esoteric areas, with increased efforts to bring radiological/nuclear scenarios into regular disaster preparedness efforts, first responders have begun to grasp the basic behaviors which are necessary to protect public health.

4:15 pm **Q&A**

4:35 pm **Break**

Forty-First Lauriston S. Taylor Lecture on Radiation Protection and Measurements

5:00 pm

Introduction of the Lecturer
Jeffery J. Whicker

Environmental Radiation and Life: A Broad View
F. Ward Whicker
Colorado State University

Since the Earth's creation some 4.5 billion years ago, primordial radioactivity has been part of the planet, and radiations from space have continuously impinged on its surface. Primordial radioactivity has helped shape the Earth's surface through the heat from radioactive decay energy, and omnipresent natural radiation has likely influenced the origin, and certainly the evolution, of all life forms in our biosphere today. I will briefly review our natural radiation environment and its impacts, from the beginning of life to the present. Then I will provide a broad overview of present day radioecology, which includes the use of radioactive tracers to study ecosystem functions, the fate and transport of radionuclides in the biosphere, and radiation effects on plants and animals. Large releases of radioactivity, although tragic and regrettable, have been studied in ways that have increased our knowledge of Earth's basic processes and of radionuclide transport and accumulation in the environment. On a much smaller scale, purposeful use of natural and anthropogenic radioactive tracers have contributed further to such knowledge. This information has underpinned basic concepts and provided data for constructing predictive models to calculate concentrations of radionuclides in, and radiation doses to, plants and animals. Sealed radiation sources have been used to study effects of chronic exposure on natural biotic communities. Existing transport models and knowledge on radiation effects provide the tools to evaluate human health risks and environmental impacts of radioactive releases. Applications have included guidance for environmental protection, radiation litigation, environmental cleanup decisions and informed responses to large releases of radioactivity. I will finish with a brief discussion of remaining knowledge gaps and potential new research approaches.

6:00 pm

Reception in Honor of the Lecturer
Sponsored by Landauer, Inc.

LANDAUER®

Tuesday, March 7

8:15 am **NCRP Annual Business Meeting**

9:15 am **Break**

Communication, Education, and Public Information

Jessica Wieder, *Session Chair*

9:45 am

Communication Challenges in Crisis and Transition
Michelle M. Laver
U.S. Department of Energy

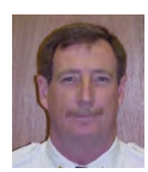
Over the last 5 y, the federal community has made significant progress in preparing for coordinated and efficient public communication efforts during a radiological response. Preparations include the development of prescripted messages and plume simulations in the event that there is detonation of an improvised nuclear device or a radiological release from a nuclear power plant. However, challenges remain for improving crisis communications across federal agencies.

Interagency language barriers, as well as variances in federal-to-local vernacular, lead to communications challenges that in times of calm can be confusing, but in times of crisis could cause major disruptions. In addition to dealing with language barriers, the federal community continues to work on overcoming the "stay in your lane" mentality that could impact the ability to identify a lead voice during a crisis.

Federal exercises over the past 2 y have identified the lack of a "lead" federal voice during an incident as a major challenge, and have attributed the problem to the nature of the authority structures of federal agencies, the desire of state and local leaders to maintain authority of an incident in their communities.

In a transition year, it will be key to review current guidelines based on law and on the precedent to be set by the new administration on communications procedure.

Emergency Responder Communication Challenges Regarding Radiological Terrorism for the New Administration
Robert Ingram
Fire Department City of New York



The emergency responder community trains for and responds to, many types of incidents on a daily basis, and has done so for years. This experience with fires, emergency medical calls, chemical spills, confined spaces, and other common calls for assistance has helped responders develop an understanding of the problems and a confidence in solving them. Radiation from an accidental release in a facility or during transportation, or from a terrorist event that causes radioactive materials to be released from their containment vessel, remains a cause of concern and fear.

Emergency responders are a segment of the general population and share some of the same fears of radioactive materials as the whole population. Radioactive materials incidents are not a common 911 call type. Radiation training has been included in emergency responder training standards for several decades and covers a broad range of topics from simple awareness and recognition to technical knowledge of the materials, detection and identification capabilities, self-protection, medical effects, and countermeasures to overall public and environmental safety and health. The safety factor of the radiation community has been very good, but without the actual response confidence in handling previous incident releases, many responders remain fearful of radiation. A single source site where responders can post and read after-action reports on actual radiation incidents may help communicate health and safety information, building responder confidence.

Competencies in standards do not always translate into compliance in training curriculum and exercises. The fire service has been the key local response agency to radiation accidents for many years and has developed training programs that meet the competencies found in 29CFR1910.120 [q], *How to Determine What Training is Required for Emergency Response Team Members*, and the National Fire Protection Associations Standard 472: *Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents*. The majority of fire service responders in the United States are volunteers who often make decisions on what they train for based on the time available and their areas' hazard assessment. This has often caused radiation training to be limited at best. Communicating timely and accurate hazards and risks associated with radiation threats and incidents may increase the amount, and level, of training in response to these types of incidents.

Many law enforcement and emergency medical services and other key disciplines did not address these standards requirements prior to 9/11 as they were considered outside their “normal” mission space. The change in the mission space caused by the new threat of radiological terrorism has required additional training and equipment. This training has started but will take time to impact the entire responder community, it will require funding for the training and equipment, and most of all, sustainment. Communicating the broad scope of capabilities necessary to safely manage a radiation incident and the requirement for all agencies to be involved may support the effort to train these disciplines in their new mission space.

The serious and much publicized radiological events that have occurred during the lifetime of many of today's responder community, Chernobyl, Fukushima, and Three Mile Island, have added to this fear within the responder community. The majority of today's responder communities are between 21 and 50 y of age. In studies conducted in recent years by federal agencies it was identified that this group did not receive the basics of nuclear information provided to the U.S. population at the start of the Cold War and the fear of a nuclear war. These studies have identified the gap that exists in understanding basic radiation terminology, protective actions including sheltering-in-place, informed evacuation, public messaging, and others. Despite studies like this, federal, state and local public officials have been slow to communicate emergency action plans to the public for radiological and nuclear incidents. Emergency management agencies at all levels have action plans for natural events such as hurricanes, tornadoes, coastal storms, and now they are including biological events and active shooters. Nuclear and radiological incident plans and protective actions need to be included and communicated to members of the public (and responders) in all media streams.

Several federal agencies have been tasked with radiological and nuclear mission space but this appears to remain fragmented without an organizing agency. The Domestic Nuclear Detection Office (U.S. Department of Homeland Security) remains in a detection and prevention mission and has provided a good amount of equipment, training and coordination but primarily among law enforcement organizations. The Federal Emergency Management Agency remains in the response mission but has limited outreach to the majority of response organizations. The U.S. Department of Health and Human Services (Assistant Secretary for Preparedness and Response) has stepped up its efforts in medical countermeasures, surge capabilities, and support services. All of this information and support comes to the responder community separately and it is left to the local-level planners to piece it together. It needs to be coordinated and communicated as one source.

Communications remains the top challenge for the responder community as we look to the new administration for a plan for radiological and nuclear preparedness:

- communicating radiation facts to alleviate fear;
- communicating public messaging on radiation terminology, how to protect themselves and expected public agency actions;
- communicating a coordinated response plan that includes all levels and agencies;
- communicating the necessary training; and
- communicating the recovery actions that will have to take place.

Critical Areas for Improvement in Communications Regarding Radiological Terrorism

David P. Ropeik
Harvard School of Public Health

The fear of ionizing radiation vastly exceeds the actual risk. In the event of a terrorist attack involving a radiological dispersal device (RDD)-the most likely form of nuclear terrorism-that fear poses a vastly greater threat to public health and safety than the radiation members of the public might be exposed to from such a device. Dramatic evidence from radiological events such as nuclear plant accidents (Three Mile Island, Chernobyl, Fukushima), or the theft or misuse of radiological material (Goiania), have firmly established that fear of radiation does far more harm than the radiation itself [see *The Dangers of Radiophobia, Bulletin of Atomic Scientists*, published online August 10, 2016 (http://dx.doi.org/10.1080/00963402. 2016.1216670)].

The academic, professional and government individuals and organizations who either study radiation safety or who are responsible for preparing against a radiological terrorist attack, understand this. Amongst themselves, they lament the public's excessive fear of radiation. Yet while a great deal of work has been done to minimize the likelihood of an RDD terrorist attack, practically nothing has been done by these professionals to proactively educate members of the public that the actual risk of ionizing radiation is far lower than commonly believed. Short of preventing such an attack in the first place, perhaps the most important work that needs to be done to limit the damage of such an attack-public education to put the risk of radiation in perspective-is not being done, by the very people and organizations the public depends on to educate us about radiation risk, and keep us safe.

There are many ways this important work should be done, covering all phases of emergency planning: pre-event, during the event, and recovery from the event. Certainly it must be done before an RDD attack occurs, because the challenge of risk communication in high-stress circumstances is much more difficult, especially given the importance of trust in public safety officials at such times, which depends more on empathy from those officials than education and information alone. It is also imperative that risk communication during such an attack must include both actions and messages that help put the actual danger for ionizing radiation in perspective. And communicating about the actual threat from the radiation spread by an RDD will have a great deal to do with how well, or poorly, the effected community recovers in the days and weeks following such an attack.

The biggest challenge in meeting this urgent need will not be figuring out the actions and messages that will help educate members of the public about the actual risk of ionizing radiation prior to, during, or in recovery from an RDD attack. The biggest challenge will be summoning the courage to do so in the first place. The task of trying to counter the public's deeply held fear of radiation is fraught with controversy and political cost, hurdles that to-date have proved too high for many individuals and organizations to dare attempt. It will take wisdom and true leadership, along with a carefully crafted risk communication program, to attempt to educate the public that their fear of radiation exceeds the risk, and poses a far greater threat than radiation itself.

But it is by far the most important work waiting to be done by the radiation emergency response community in order to minimize the danger of an RDD to public health and safety.

10:30 am **Q&A**

11:00 am **Break**

Bringing it All Together: Conclusions and Path Forward

Armin Ansari & Adela Salame-Alfie, *Session Co-Chairs*

11:15 am

Panel Discussion
Armin Ansari
Adela Salame-Alfie
Session Co-Chairs

12:00 pm

NCRP Vision for the Future and Program Area Committee Activities
John D. Boice, Jr.
President, NCRP

12:30 pm

Adjourn

Lauriston S. Taylor Lecture

Dr. F. Ward Whicker has been selected to give the 41st Lauriston S. Taylor Lecture at the 2017 Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP). The lecture, entitled “Environmental Radiation and Life: A Broad View,” will be the featured presentation at the 53rd Annual Meeting to be held March 6-7, 2017. The Lecture will be given in the Crystal Ballroom of the Hyatt Regency Bethesda, One Bethesda Metro Center, 7400 Wisconsin Avenue, Bethesda, Maryland at 5:00 p.m. on March 6, 2017. The lecture series honors the late Dr. Lauriston S. Taylor, the NCRP founding President (1929 to 1977) and President Emeritus (1977 to 2004). A reception sponsored by Landauer, Inc. follows the presentation and all are invited to attend.

Dr. Whicker is Professor Emeritus at Colorado State University (CSU), where he taught graduate level courses in radioecology and radionuclide transport modeling for over 40 y. He and his graduate students conducted research in these fields, leading to the development of approximately 175 open literature publications, dozens of technical reports, many book chapters, and five books. His formal teaching extended to organizations such as the International Atomic Energy Agency, the International Union of Radioecologists, and the U.S. Environmental Protection Agency. In 1989 he founded the Par Pond Radioecology Laboratory at the Savannah River Site, where he spent 3 y studying the behavior of radionuclides in aquatic ecosystems. Dr. Whicker is regarded as one of the founders of radioecology, the field addressing the fate and effects of radioactivity in the environment.

Dr. Whicker was elected as a Distinguished Emeritus Member of NCRP in 2004 after serving 12 y on the Council. His service to the NCRP includes the Board of Directors from 1994 to 2000; Scientific Vice President of Environmental Radioactive Waste; chairman of SC 64-23 on Cesium in the Environment; a member of SC 1 on Basic Criteria, Epidemiology, Radiobiology and Risk and SC 64 16 on Uncertainties in Application of Screening Models; and served on program committees for both the 1995 and 2001 annual meetings. He has served on review panels for many organizations, consulted for private organizations, and is frequently called as an expert witness on litigation issues concerning radioactivity in the environment. He served as Associate Editor for the Americas for the Journal of Environmental Radioactivity. His awards include the Sigma Xi CSU Chapter Honor Scientist, the CSU Glover Gallery of Distinguished Faculty, the Award for Significant Scientific Contributions from the Health Physics Society, the E.O. Lawrence Award from the U.S. Department of Energy, and the International Union of Radioecology's first V.I. Vernadsky Award. In “retirement,” he guides mountain trips for the Colorado Mountain Club, and volunteers time to lecture and advise graduate students at CSU.

Annual Warren K. Sinclair Keynote Address

Jack Herrmann has been selected to give the 14th Warren K. Sinclair Keynote Address at the 2017 Annual Meeting of the National Council on Radiation Protection and Measurements (NCRP). The Address, entitled “Aren't We Ready Yet? Closing the Planning, Response and Recovery Gaps for Radiological Terrorism” will be a featured presentation at the 53rd NCRP Annual Meeting to be held March 6- 7, 2017. The Address will be given at 8:30 a.m. on March 6, 2017 in the Crystal Ballroom, Hyatt Regency Bethesda, One Bethesda Metro Center, 7400 Wisconsin Avenue. The keynote speaker series honors Dr. Warren K. Sinclair, NCRP's second President (1977 to 1991).

Jack Herrmann is currently the Deputy Director of the Office of Policy and Planning within the Office of the Assistant Secretary of Preparedness and Response at the U.S. Department of Health and Human Services. Under the direction of the Deputy Assistant Secretary for Policy, Mr. Herrmann is responsible for leading strategic planning and evaluation, preparedness and response policy development and analysis, and coordination and collaboration with domestic and international partners to reduce adverse health effects of public health emergencies and disasters.

Mr. Herrmann earned a bachelor's degree from St. John Fisher College; a master's degree in education in counseling, family, and work-life studies from the University of Rochester; and is currently certified by the National Board of Certified Counselors and is a licensed mental health counselor in the State of New York.

Mr. Herrmann has served in volunteer staff or leadership positions with the American Red Cross for the past 20 y and responded to such disasters as the Northridge Earthquake; the events of September 11, 2001; and Hurricanes Katrina and Sandy.

Program Committee

Armin Ansari, *Co-Chair*
Centers for Disease Control & Prevention

Adela Salame-Alfie, *Co-Chair*
Centers for Disease Control & Prevention

Sally A. Amundson
Columbia University Medical Center

James S. Blumenstock
Association of State & Territorial Health Officials

Daniel J. Blumenthal
U.S. Department of Energy

Cullen Case, Jr.
National Marrow Donor Program

C. Norman Coleman
National Cancer Institute

John F. Koerner
U.S. Department of Health & Human Services

Tammy P. Taylor
Pacific Northwest National Laboratory

Registration

Monday, March 6, 2017	7:00 am – 5:00 pm
Tuesday, March 7, 2017	7:00 am – 11:00 am

Register online: http://registration.ncrponline.org

2018 Annual Meeting
Radiation Responsibility in Medical Imaging

Donald P. Frush &
Lawrence T. Dauer, *Co-Chairs*

March 5–6, 2018
Bethesda, Maryland

Biographies

Armin Ansari, Program Committee Co-Chair, is the Radiological Assessment Team Lead at the Centers for Disease Control and Prevention (CDC) serving as subject matter expert in CDC's radiation emergency preparedness and response activities. He received his BS and PhD degrees in radiation biophysics from the University of Kansas, starting his career as a radiation biologist, and did his postdoctoral research in radiation-induced mutagenesis at Oak Ridge and Los Alamos National Laboratories. He was a senior scientist with the radiological consulting firm of Auxier & Associates before joining CDC in 2002. He has led the development of key national guidance documents including guides for population monitoring and operation of public shelters after radiation emergencies and a number of training products for public health professionals. He is a past president of the Health Physics Society, adjunct associate professor of nuclear and radiological engineering at Georgia Institute of Technology, member of Georgia East Metro Medical Reserve Corps and Gwinnett County Community Emergency Response Team, and provides consultancy to the International Atomic Energy Agency. Since 2014, he has served as a member of the U.S. delegation to the United Nations Scientific Committee on the Effects of Atomic Radiation. He is the author of *Radiation Threats and Your Safety: A Guide to Preparation and Response for Professionals and Community*, a book specifically directed at audiences without radiation protection expertise.

Adela Salame-Alfie, Program Committee Co-Chair, is a Senior Service Fellow in the Radiation Studies Branch in the National Center for Environmental Health, Centers for Disease Control and Prevention. Prior to this appointment, Dr. Salame-Alfie spent 22 y with the New York State Department of Health in various capacities including Director of the Division of Environmental Health Investigation, Director of Preparedness for the Center for Environmental Health, and Director of the Bureau of Environmental Radiation Protection.

Dr. Salame-Alfie is a member of NCRP and co-chairs the SC 3-1 charged with developing dosimetry guidance for radiation emergency workers. She is a Lifetime Member of the Conference of Radiation Control Program Directors where she served as Chair and member of the Board of Directors, and chaired several committees. She is a Fellow Member of the Health Physics Society.

Dr. Salame-Alfie has extensive experience in radiological emergency preparedness and has published and co-authored many publications on the subject, including the Handbook for Responding to a Radiological Dispersal Device - First Responder Guide.

Dr. Salame-Alfie obtained her Master's and Ph.D. in Nuclear Engineering from Rensselaer Polytechnic Institute in Troy, New York.

Sally A. Amundson is an associate professor of radiation oncology in the Center for Radiological Research at the Columbia University Medical Center in New York. She holds a doctorate in radiation biology and cancer biology from the Harvard School of Public Health. Her research uses functional genomics approaches to study low dose radiation and bystander effects, unique effects of space radiation, and the development of gene expression approaches for radiation biodosimetry. She is co-director of the Center for High-Throughput Minimally-Invasive Radiation Biodosimetry. Prior to joining the group at Columbia, Dr. Amundson worked on molecular radiation biology in the Division of Basic Science at the National Cancer Institute (NCI), where she helped to develop global gene expression profiling techniques, and where she was an adjunct investigator in the NCI Radiation Epidemiology Branch. She has served on NCRP since 2004 and on the Science Advisory Committee of the Radiation Effects Research Foundation (RERF) in Hiroshima since 2009, chairing the RERF scientific review for 2012. Dr. Amundson is an associate editor of *Radiation Research*, and has served on the organizing and program committees for numerous meetings, including two of the American Statistical Association Conferences on Radiation and Health, which aim to integrate radiation biology with epidemiology. She is a recipient of the Michael Fry Research Award from the Radiation Research Society (RRS), and she is also a member of the RRS Council.

Biographies

Judith L. Bader has a BA from Stanford University and an MD from Yale University School of Medicine. She has been board certified in Pediatrics, Pediatric Hematology-Oncology and Radiation Oncology. She is the author of scores of publications in various disciplines including clinical cancer trials, genetics and epidemiology, computer usability technology, and planning for and responding to mass casualty radiation emergencies. Dr. Bader was a Senior Investigator in many cancer clinical trials, genetics and epidemiology research projects, and communications technologies projects during her 22 y in the U.S. Public Health Service at the National Cancer Institute (NCI), National Institutes of Health. She has been the Chief of the Clinical Radiation Branch of the Radiation Oncology Branch at NCI, Chief of Radiation Oncology at the Bethesda Naval Hospital (now Walter Reed), and founding physician of two private radiation oncology practices. Since 2004, Dr. Bader has also served as a Senior Medical Advisor to various U.S. Department of Health and Human Services (HHS) and interagency entities charged with planning for and responding to medical aspects of mass casualty radiation emergencies. She is the Founding and Managing Editor of the HHS/Assistant Secretary for Preparedness and Response-sponsored website Radiation Emergency Medical Management (https://www.remm.nlm.gov). She has served on various committees for the American Society for Clinical Oncology and the American Society for Radiation Oncology.

Gerilee W. Bennett is the Director of the Federal Emergency Management Agency's (FEMA) Interagency Coordination Division within the Office of Response and Recovery.

Ms. Bennett began her FEMA career as an Emergency Management Intern in 1991. She managed the Hazard Mitigation Grant Program for the Federal Insurance and Mitigation Administration, and moved to the Recovery Directorate in 2003. Ms. Bennett's team was responsible for leading the development and implementation of the National Disaster Recovery Framework, published September 2011. She has supported an array of disaster assistance operations from headquarters and field offices, including the 2016 Louisiana Flooding and Hurricane Matthew, Hurricanes Isaac and Sandy in 2012, the 2010 Gulf Coast oil spill, 2004 and 2005 hurricanes, the 2001 World Trade Center attacks, Hurricanes Opal and Fran in the 1990s, and the 1993 Midwest floods.

Ms. Bennett completed a BA in political science and German at the University of Idaho. In 2015, she earned an MA in security studies at the Naval Postgraduate School Center for Homeland Defense and Security. Her thesis is titled, *Lessons from Fukushima: Relocation and Recovery from Nuclear Catastrophe*.

James S. Blumenstock holds the position of Chief Program Officer for Health Security for the Association of State and Territorial Health Officials (ASTHO). His portfolio includes the state public health practice program areas of infectious and emerging diseases, immunization, environmental health, and public health emergency preparedness and response (including pandemic influenza preparedness). Dr. Blumenstock also serves as a member of the Association's Executive Management Team responsible for enterprise-wide strategic planning, administrative services, member support, and public health advocacy.

Prior to his arrival at ASTHO on November 1, 2005, Dr. Blumenstock was the Deputy Commissioner of Health for the New Jersey Department of Health and Senior Services where he retired after almost 32 y of career public health service. In this capacity, he had executive oversight responsibilities for a department branch of over 650 staff, an operating budget of approximately $125 million, which was comprised of the Division of Public Health and Environmental Laboratories; Division of Epidemiology, Occupational and Environmental Health; Division of Local Health Practice and Regional Systems Development; Division of Health Emergency Preparedness and Response, and the Office of Animal Welfare. During his tenure, Dr. Blumenstock also represented the Department on a number of boards, councils and commissions including the NJ Domestic Security Preparedness Task Force.

Dr. Blumenstock is the proud recipient of the ASTHO 2004 Noble J. Swearingen Award for excellence in public health administration and the Dennis J. Sullivan Award, the highest honor bestowed by the NJ Public Health Association for dedicated and outstanding service and contribution to the cause of public health.

He is also a Scholar of the University of North Carolina Public Health Leadership Institute, a Fellow of the Harvard National Preparedness Leadership Initiative, and held an elected office serving his community for 12 y.

Dr. Blumenstock received his BS degree in Environmental Science from Rutgers University in 1973 and an MA degree in Health Sciences Administration from Jersey City State College in 1977. He is a native of New Jersey which is still his primary residence with his wife of 43 y, Lee. They have three children and three grandchildren.

Daniel J. Blumenthal manages the Consequence Management programs in the Office of Emergency Response at the National Nuclear Security Administration within the U.S. Department of Energy (DOE). The programs include atmospheric dispersion modeling, air and ground-based radiation monitoring, and radiation medicine. In 2009, he transferred from the U.S. Department of Homeland Security's Domestic Nuclear Detection Office where he was the Chief Test Scientist. He was responsible for designing and conducting field test campaigns for radiation detection systems as applied to the preventive radiological/nuclear detection mission as well as providing subject matter expertise on detector applications and performance. Prior to joining the Federal government he was a Senior Scientist at DOE's Remote Sensing Laboratory from 1996 to 2006 where he managed or provided scientific support to several DOE emergency response teams. Most recently Dr. Blumenthal led the initial DOE response team to Japan where he spent a total of seven weeks following the Fukushima Daiichi Nuclear Power Plant accident in March 2011. Since then he has supported many U.S. and international efforts related to lessons learned from Fukushima. These include documenting best practices associated with data management during an international response and writing the occupational dose section of the International Atomic Energy Agency's Fukushima Report.

Dr. Blumenthal's background is in nuclear physics - gamma-ray and charged particle spectroscopy. He received his undergraduate degree in physics from Columbia College in 1985 and his doctorate in nuclear physics from Yale University in 1994. He did a post-doctoral fellowship at Argonne National Laboratory from 1994 to 1996. He became an Certified Health Physicist in 2003.

John D. Boice, Jr., *NCRP President* and Professor of Medicine at Vanderbilt University School of Medicine, Nashville, Tennessee. He is an international authority on radiation effects and currently serves on the Main Commission of the International Commission on Radiological Protection and as a U.S. advisor to the United Nations Scientific Committee on the Effects of Atomic Radiation. During 27 y of service in the U.S. Public Health Service, Dr. Boice developed and became the first chief of the Radiation Epidemiology Branch at the National Cancer Institute. Dr. Boice has established programs of research in all major areas of radiation epidemiology, with major projects dealing with populations exposed to medical, occupational, military and environmental radiation. These research efforts have aimed at clarifying cancer and other health risks associated with exposure to ionizing radiation, especially at low-dose levels. Dr. Boice's seminal discoveries and over 440 publications have been used to formulate public health measures to reduce population exposure to radiation and prevent radiation-associated diseases. He has delivered the Lauriston S. Taylor Lecture at the NCRP and the Fessinger-Springer Lecture at the University of Texas at El Paso. In 2008, Dr. Boice received the Harvard School of Public Health Alumni Award of Merit. He has also received the E.O. Lawrence Award from the Department of Energy - an honor bestowed on Richard Feynman and Murray Gell-Mann among others - and the Gorgas Medal from the Association of Military Surgeons of the United States. In 1999 he received the outstanding alumnus award from the University of Texas at El Paso (formerly Texas Western College). Dr. Boice directs the Million U.S. Radiation Workers and Veterans Study to examine the lifetime risk of cancer following relatively low-dose exposures received gradually over time.

Biographies

Brooke Buddemeier is an associate program leader in the Global Security Directorate of Lawrence Livermore National Laboratory (LLNL). He supports the Risk and Consequence Management Division in their efforts to evaluate the potential risk and consequence of radiological and nuclear terrorism. Mr. Buddemeier is a member of NCRP and served on the scientific committees which developed Commentary No. 19, K*ey Elements of Preparing Emergency Responders for Nuclear and Radiological Terrorism* (2005) and NCRP Report No. 165, *Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers* (2010). From 2003 through 2007, he was on assignment with the Department of Homeland Security as the weapons of mass destruction emergency response and consequence management program manager for Science and Technology's emergency preparedness and response portfolio. He supported Federal Emergency Management Agency and the Homeland Security Operations Center as a radiological emergency response subject matter expert. He also facilitated the department's research, development, test and evaluation process to improve emergency response through better capabilities, protocols and standards. Prior to that, he was part of the LLNL Nuclear Counterterrorism Program and coordinated LLNL's involvement in the National Nuclear Security Administration's Radiological Assistance Program (RAP) for California, Nevada and Hawaii. RAP is a national emergency response resource that assists federal, state and local authorities in the event of a radiological incident. As part of RAP's outreach efforts, Mr. Buddemeier has provided radiological responder training and instrumentation workshops to police, firefighters, and members of other agencies throughout the nation and abroad. He has also provided operational health physics support for various radiochemistry, plutonium handling, accelerator and dosimetry operations. He is Certified Health Physicist who received his Master's in Radiological Health Physics from San Jose State University and a BS in Nuclear Engineering from the University of California, Santa Barbara.

John J. Cardarelli, II is a Captain in the U.S. Public Health Service detailed to the U.S. Environmental Protection Agency (EPA). He serves as a Health Physicist on the Chemical, Biological, Radiological and Nuclear (CBRN) Consequence Management Advisory Team (CMAT) to provide scientific and technical support for local and state governments, federal agencies, and international partners on radiological issues associated with (1) emergency response, (2) risk assessment, (3) policy development, (4) decontamination technologies, and (5) environmental characterization. He is the lead for developing and maintaining the EPA airborne radiological detection capability within the Airborne Spectral Photometric Environmental Collection Technology Program and serves as the radiation safety officer for the U.S. Nuclear Regulatory Commission (NRC) licensed materials within CMAT. He also is an Assistant Adjunct Professor at the University of Cincinnati, College of Medicine, Department of Environmental Health.

CAPT Cardarelli received a BS in Nuclear Engineering (1990), an MS in Health Physics (1992), and PhD in Industrial Hygiene (2000) from the University of Cincinnati. He holds a Professional Engineering License (nuclear specialty), and is board certified in both Industrial Hygiene and Health Physics. From 1992 until 2005, he worked for the Centers for Disease Control and Prevention at the National Institute for Occupational Safety and Health where he conducted dose reconstructions for epidemiologic studies of workers within the U.S. nuclear weapons complex and conducted numerous health hazard evaluations.

John enjoys coaching his daughter's (Maria) basketball team; cheering on the UC Bearcats with his son (Anthony), and traveling throughout the world with his wife (Melinda) and kids.

Cullen Case, Jr. is the Senior Manager of Logistics and Emergency Preparedness for the National Marrow Donor Program (NMDP)/Be the Match marrow registry and the Program Manager of the Radiation Injury Treatment Network. He is responsible for delivery of all cellular therapies the NMDP transports worldwide as well as organizational preparedness, crisis response, business continuity, and the exercising of all related plans for the NMDP. In his role with the Radiation Injury Treatment Network, he coordinates the preparedness activities of a group of 76 hospitals, blood donor centers, and cord blood banks preparing for a mass casualty radiological incident. While serving in the U.S. Army he managed the logistical response to Hurricanes Bertha (1996) and Fran (1996) in North Carolina as well as Hurricane Mitch (1998) in

Nicaragua. Mr. Case has a BS in Industrial Engineering, is a Certified Emergency Manager, a Certified Healthcare Emergency Professional, is a Stanford Certified Project Manager, and is working on his Masters in Public Administration. He longs for the simple days when he was just a Divemaster in the Florida Keys.

C. Norman Coleman received his BA in mathematics, *summa cum laude*, from the University of Vermont in 1966 and his MD from Yale University in 1970. He is board certified in three specialties-internal medicine from University of California San Francisco, medical oncology from the National Cancer Institute (NCI), and radiation oncology from Stanford University. He served in the U.S. Public Health Service at the National Institutes of Health [O-4 (ret)]. He was Assistant and tenured Associate Professor of Radiation Oncology and Medical Oncology at Stanford and from 1985 to 1999 was Professor and Chairman of the Harvard Medical School Joint Center for Radiation Therapy. Since 1999, he has been Associate Director, Radiation Research Program and Senior Investigator, with a molecular radiation therapeutics laboratory in the Radiation Oncology Branch of NCI. Since 2004 he has also been a Senior Medical Advisor in the Office of the Assistant Secretary for Preparedness and Response in the U.S. Department of Health and Human Services. His focus is on radiological and nuclear preparedness and planning but the programs apply to all hazards. This includes the Scarce Resources for a Nuclear Detonation project and participation at the U.S. Embassy in Tokyo during the Japan disaster in March 2011. Among his honors are Fellowships in American College of Physicians, American College of Radiology, American Society of Radiation Oncology, and American Society of Clinical Oncology. He is recipient of an Honorary Fellowship, Royal College of Surgeons, Dublin; Honorary Fellow, Royal College of Radiologists (London); the Gold Medal from the American Society for Radiation Oncology; and the 2011 Samuel J. Heyman, Service to America Homeland Security Medal. In 2015 the University of Vermont awarded him a Doctor of Science (honoris causa) for his public service and contributions to society. He received the Failla Award from the Radiation Research Society in 2016.

Sara DeCair has been a health physicist with the U.S. Environmental Protection Agency's (EPA) Office of Radiation and Indoor Air since 2003. She works on policy, planning, training and outreach for EPA's radiological emergency preparedness and response program. She is the project and technical lead for revising the Protective Action Guides Manual.

She previously worked for 7 y with the State of Michigan's Department of Environmental Quality. She spent three of those years in nuclear power plant emergency planning and before that was an inspector of radioactive materials registrants and a radiation incident responder.

Frieda Fisher-Tyler directs the Office of Radiation Control in the Delaware Division of Public Health, which regulates the use of ionizing radiation sources in the State of Delaware. She is certified in comprehensive practice by the American Board of Industrial Hygiene, and worked as an Industrial Hygienist, Radiation Safety Officer, and Environmental Health and Safety Director in the chemical and pharmaceutical industries prior to transitioning to state service in 2002. She serves as the governor-appointed U.S. Nuclear Regulatory Commission State Liaison Officer and Alternate Commissioner for the Appalachian States Commission for Low Level Radioactive Waste for Delaware. She leads the Technical Assessment Team for the Delaware Radiological Emergency Preparedness Program managed by Delaware Emergency Management Agency, and acts as Administrative Agent to the governor-appointed Delaware Authority on Radiation Protection. She served on the Board of Directors of the Conference of Radiation Control Program Directors (CRCPD) from 2010 to 2013, chairing the Homeland Security/Emergency Response Council for the Board, and represents the CRCPD on the Governmental Coordinating Council - Nuclear Sector managed by the U.S. Department of Homeland Security, Critical Infrastructure Protection. She served on the Board of Directors of the American Board of Industrial Hygiene from 2000 to 2003, serving a term as Board Vice Chair. She received her MHS degree from the Environmental Engineering Department, Bloomberg School of Public Health, Johns Hopkins University, and her BS degree from the Institute of Environmental Health, Colorado State University. She resides in Magnolia, Delaware.

Biographies

Dan Hanfling is a consultant on emergency preparedness, response and crisis management. He is a Contributing Scholar at the Johns Hopkins Center for Heath Security, Clinical Professor of Emergency Medicine at George Washington University and adjunct faculty at the George Mason University School of Public Policy. He currently serves as the Co-chair of National Academy of Medicine's Forum on Medical and Public Health Preparedness for Disasters and Large Scale Emergencies, and is a Special Advisor within the U.S. Department of Health and Human Services, Office of the Assistant Secretary for Preparedness and Response, focused chiefly on the National Hospital Preparedness Program.

Dr. Hanfling spent 18 y as principal consultant to the Inova Health System (Falls Church, Virginia) on matters related to emergency preparedness and response. He continues to practice emergency medicine at Inova Fairfax Regional Trauma Center, and is an operational medical director for a regional helicopter emergency medical service (EMS). He was instrumental in founding one of the nation's first healthcare coalitions, the Northern Virginia Hospital Alliance, created in October 2002.

His areas of expertise include biodefense and mass casualty management, catastrophic disaster response planning with particular emphasis on scarce resource allocation, and the nexus between healthcare system planning and emergency management. In addition to his hospital and EMS clinical responsibilities, he serves as a Medical Team Manager for the Fairfax County based Federal Emergency Management Agency and U.S. Agency for International Development sanctioned international urban search and rescue team (VATF-1, USA-1), and has responded to catastrophic disaster events across the globe.

Dr. Hanfling received his undergraduate degree in political science from Duke University, including a General Course at the London School of Economics, and completed his MD at Brown University. He completed his internship in Internal Medicine at Brown University and his emergency medicine training at the combined George Washington and Georgetown University residency program. He has been Board Certified in Emergency Medicine since 1997.

John L. Hick is a faculty emergency physician at Hennepin County Medical Center (HCMC) and a Professor of Emergency Medicine at the University of Minnesota Medical School. He serves as the Deputy Chief Medical Director for Hennepin County Emergency Medical Services and Medical Director for Emergency Preparedness at HCMC. He is an Advisor to the Director, Hospital Preparedness Program, Office of Assistant Secretary for Preparedness and Response (ASPR)/U.S. Department of Health and Human Services, serves as lead editor for ASPR's TRACIE (Technical Resources, Assistance Center, and Information Exchange) website and has been involved in several national efforts to enhance planning for nuclear detonation scenarios.

Robert Ingram has been assigned as the Weapons of Mass Destruction Branch Chief at the Fire Department of New York's (FDNY) Center for Terrorism and Disaster Preparedness since 2007. Chief Ingram has worked with hazardous materials response since 1984 and was assigned as the Chief in Charge of the Hazardous Materials Operations Office shortly after 9/11.

In Chief Ingram's position, the Center for Terrorism and Disaster Preparedness has worked on several projects focused on radiation issues with federal agencies including the Federal Emergency Management Agency, National Institute for Occupational Safety and Health, U.S. Department of Defense, U.S. Department of Homeland Security, U.S. Department of Justice, and U.S. Environmental Protection Agency. Chief Ingram has worked on radiation standards as a representative of the FDNY and the responder community with the American Society for Testing and Materials, the National Fire Protection Association, National Institute of Standards and Technology, and NCRP.

Chief Ingram is in his 42nd year with the fire service, and 35th year with FDNY. He has been a Battalion Chief since 2000 and has over 30 y of hazardous materials response experience. He holds a BS degree in Fire and Emergency Management from State University of New York Empire College and an MS in Homeland Defense and Security from the Naval Post Graduate Schools' Center for Homeland Defense and Security.

Biographies

William E. Irwin leads the Radiological and Toxicological Sciences Program at the Vermont Department of Health. He is responsible for all aspects of the Vermont Radiation Control Program in the healing arts, industrial applications, environmental surveillance and emergency preparedness. He is Chair-Elect for the Conference of Radiation Control Program Directors. Prior to serving in government, Dr. Irwin was Laser Safety Officer and a Radiation Safety Officer at Harvard University and the Massachusetts Institute of Technology. During that time, he was a consultant to industry and government on measurements and the health effects of radiofrequency radiation, laser radiation, extremely low frequency and nuclear magnetic resonance electromagnetic fields, as well as ionizing radiations produced by machines and radioactive materials. Both his PhD and MS were earned at the University of Massachusetts Lowell.

Joseph G. Klinger has been the Assistant Director of the Illinois Emergency Management Agency (IEMA) since January 2007. From May 2010 to February 2011, he served as the IEMA Interim Director and as the Governor's Homeland Security Advisor. Mr. Klinger currently maintains a Department of Homeland Security Top Secret clearance and serves as the Illinois Governor's Deputy Homeland Security Advisor. As Assistant Director, he oversees the day-to-day operations of the agency, which has 228 employees and an annual budget of $477 million.

A major component within IEMA is a robust nuclear safety program with many innovative programs. Illinois has 11 operating nuclear power reactors, more than any other state, and IEMA has been an Agreement State since 1987 with approximately 740 radioactive material licensees. IEMA also regulates 11,000 x-ray facilities, accredits over 13,000 radiologic technologists, and is one of four certifying states under the Mammography Quality Standards Act Program.

In June 2008, Mr. Klinger was appointed as a Commissioner on the Central Midwest Interstate Low-Level Radioactive Waste Compact Commission and currently serves as Chairman. The Commission oversees all low-level radioactive waste issues in the compact consisting of Illinois and Kentucky. He is currently the past-Chairperson for the Conference of Radiation Control Program Directors, Inc. (CRCPD) and serves as one of two representatives from the National Emergency Management Association for the National Alliance for Radiation Readiness.

Mr. Klinger has worked for IEMA for over 26 y. Prior to his role as Assistant Director, he served as the agency's Manager of the Radioactive Materials Program since 1996. He began employment as the Head of Radioactive Material Licensing in August 1988. From 1980 to 1988, Mr. Klinger was the Licensing Branch Administrator for the Texas Bureau of Radiation Control.

Mr. Klinger has been a consultant to the International Atomic Energy Agency (IAEA) and assisted IAEA in the development of the Radioactive Source Categorization document currently used globally for security efforts. He performed technical assist visits to Latvia and Panama in the global effort to control all significant sources of radioactive material. He has been a featured speaker at many state, national and international meetings, including a conference on the “Peaceful Use of Radioactive Materials” in Hanoi, Vietnam in March 1999. Most recently, in October 2013, he presented a poster session regarding CRCPD Orphan Source and Source Collection and Threat Reduction Program at the IAEA “Safety and Security of Radioactive Sources: Maintaining Continuous Global Control of Sources throughout Their Life Cycle” in Abu Dhabi, United Arab Emirates.

Joseph Klinger earned his BS in Microbiology/Chemistry and completed some graduate studies at the University of Texas at Austin, and his MS in Health Care Management/Public Administration at Southwest Texas State University (now Texas State University). He is currently enrolled in the Executive Leaders Program (ELP) through the Naval Postgraduate School - Center for Homeland Defense and Security. Over his 34+ y in Health Physics, he has completed extensive health physics training in courses at Oak Ridge Associated Universities, University of Texas, College of Engineering, and other institutions.

Biographies

In 1985, he was commissioned an Officer in the U.S. Navy Reserve as a Radiation Health Officer, Environmental Health Officer and Health Care Manager in the Medical Service Corps. He was deployed in 2004 to 2005 to the Middle East in support of Operation Enduring Freedom (Afghanistan) and Operation Iraqi Freedom. Mr. Klinger began his military career in 1967 as a U.S. Marine Corps Combat Infantryman in Vietnam and retired in 2008 as a Navy Captain.

John F. Koerner is an authoritative advisor in the Office of the U.S. Department of Health and Human Services Assistant Secretary for Preparedness and Response for all matters related to national medical preparedness and response to chemical, biological, radiological, nuclear and explosives (CBRNE) incidents. In that role, Mr. Koerner also leads the development of innovative, evidence-based interventions and guidance to support the Nation's medical and public health response to catastrophic disasters and terrorist incidents. He is broadly published as an internationally recognized expert in medical preparedness and response to radiation and other CBRNE incidents. He is a combat veteran and also serves as Board Member and Triage Chief during medical missions for a charitable organization. Mr. Koerner is a Board Certified Industrial Hygienist and received his Master's Degree in Public Health from the Johns Hopkins School of Public Health. He has spent two decades operating, researching and advising in the field of medical and public health response to terrorism.

Michelle M. Laver is the Director of Lab Outreach, Office of Public Affairs for the U.S. Department of Energy (DOE). In this role, Ms. Laver serves as a communications leader for the labs and as a communications strategy technical expert and single point of contact for all labs to better identify, coordinate and leverage media opportunities and to assist labs with sensitive communications issues. She also serves as a vital institutional resource and independent advisor for the Office of Public Affairs and the Department and as a strategic communications advisor to the National Labs, Secretary of Energy, Deputy Secretary, and senior leadership.

She previously served as the Deputy Director of Public Affairs for the National Nuclear Security Administration ensuring communication priorities and goals are met furthering public understanding of the National Nuclear Security mission.

Prior to joining DOE, Ms. Laver, a retired Air Force officer, served in a variety of military and national security positions. Commissioned through the Air Force Officer Training School in 1998, her first assignment was as an Occupational Therapist at Andrews Air Force Base, Maryland. She was then selected and served as an 89th Airlift Wing Protocol Officer prior to cross-training into public affairs. Her public affairs experience includes Armed Forces Network, wing, MAJCOM, joint staff and Headquarters Air Force, including two separate deployments to Iraq. Her final assignment while on active duty was as the Chief of Operations, Public Affairs Directorate, for Air Force Global Strike Command.

Robert Levin is the Health Officer/Medical Director for Ventura County Public Health. He has served in that capacity for the last 18 y. Most recently, Dr. Levin worked on nuclear preparedness including a written Nuclear Plan which delineates Ventura County's response to a nuclear explosion. He launched a public information campaign to educate his county on nuclear explosion preparedness in 2011. Dr. Levin received his medical degree from the University of Missouri in Columbia. He completed his pediatric residency at San Francisco General Hospital and the University of California, San Francisco. He is board certified in Pediatrics and Pediatric Infectious Diseases. He served as Chairman of Pediatrics at Natividad Medical Center in Salinas, California starting in 1983. In 1987 he moved his family to Chicago, Illinois, to become Program Director for Pediatric Residency Training at Christ Hospital in Oak Lawn, Illinois and then, in 1994 became Chairman of the Department of Pediatrics at Mount Sinai Hospital, Chicago. He went to Ventura County in 1998 to assume his current position as Ventura County's Public Health Officer. As Health Officer,

Dr. Levin has been the Chief Medical Officer overseeing all Ventura County terrorism-related activities and threats. In October 2007 he published the *Ventura County Nuclear Explosion Response Plan*, which was revised and updated in 2011. In February of 2010, he spoke on the topic of nuclear detonation response at the National Association of County and City Health Officials conference in Atlanta and the National Center for Disaster Preparedness, Columbia University. In 2013 he was a speaker at conferences put on by NCRP and by the Institute of Medicine. In 2014 he spoke at the North Atlantic Treaty Organization workshop in Los Angeles.

Jill A. Lipoti is an Assistant Teaching Professor, at the Department of Human Ecology at Rutgers University. She contributes to the development and implementation of the academic Minor in Sustainability. Dr. Lipoti also supports research in the areas of environmental, urban and societal sustainability.

Dr. Lipoti retired from the New Jersey Department of Environmental Protection in 2013. She was the Director of the Division of Water Monitoring and Standards, with responsibility for fresh water and marine water monitoring efforts. Prior to assuming this position, she was Director of the Division of Environmental Safety and Health with responsibility for directing the state's radiation protection programs, quality assurance, release prevention, pollution prevention, and right-to-know programs. Dr. Lipoti participated in nuclear emergency response planning and led an effort to improve planning for recovery from a nuclear accident. Under her direction, the effectiveness of the x-ray inspection program was improved through emphasizing the importance of measuring radiation exposure and image quality. She served as Chair of the Conference of Radiation Control Program Directors in 1999, and was presented with lifetime membership upon her retirement.

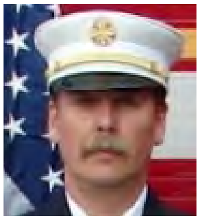
Dr. Lipoti was elected to the Council in 2001, and has served on the Board of Directors, Program Area Committee (PAC) 5, PAC 7, and Scientific Committee 5-1 which produced NCRP Report No.175, *Decision Making for Late-Phase Recovery from Major Nuclear or Radiological Incidents*.

Dr. Lipoti has provided advice to the International Atomic Energy Agency regarding radiation safety, traveling to Ethiopia and Uganda to consult with their radiation control program personnel. She has chaired the Radiation Advisory Committee of the Science Advisory Board, U.S. Environmental Protection Agency. Dr. Lipoti has MS and PhD degrees in environmental science from Rutgers, and received the George H. Cook Award for Distinguished Alumni from Rutgers in 2007.

Stephen V. Musolino is a scientist in the Nonproliferation and National Security Department at the U.S. Department of Energy's (DOE) Brookhaven National Laboratory (BNL) in Upton, New York. With more than 30 y of experience in Health Physics, his current research interests are in nonproliferation, counterterrorism, and planning for response to the consequences of radiological and nuclear terrorism. Since 1981, he has been part of the DOE Radiological Assistance Program as a Team Captain/Team Scientist and has been involved in developing radiological emergency response plans and procedures, as well as participating in a wide range of radiological and nuclear exercises and field deployments. During the Fukushima crisis, he was deployed in Japan as an Assessment Scientist with the DOE response team that was measuring the environmental consequences of the radioactive material released from the damaged nuclear power plants. Working with the first responder community in the New York metropolitan area, Dr. Musolino was involved with the development of guidance for response to the aftermath of a radiological dispersal device, and served on the scientific committee that developed NCRP Report No. 165, *Responding to a Radiological or Nuclear Terrorism Incident: A Guide for Decision Makers*. Earlier in his career at BNL, he was a member of the Marshall Islands Radiological Safety Program and participated in numerous field missions to monitor the populations living on islands affected by nuclear testing.

Dr. Musolino is a Fellow of the Health Physics Society, Distinguished Alumnus of Buffalo State College, and a member of the editorial board of the journal Health Physics. He earned a BS in engineering technology from Buffalo State College, an MS in nuclear engineering from Polytechnic Institute of New York University, and a PhD in health physics from the Georgia Institute of Technology. He is certified by the American Board of Health Physics.

Biographies



David Pasquale (retired) has 38 y of fire service experience, 26 of those years were spent as a Chief Officer involved in all aspects of emergency response including deployments to many large scale incidents such as hurricanes, interface fires, and homeland security prevent and response operations. Chief Pasquale commanded a National Incident Management System (NIMS) Type 1 Hazmat/Chemical, Biological, Radiological, Nuclear, and Explosives Team that provided regional response to the State of New Mexico. He organized New Mexico's first Type 1 Preventive Radiological/Nuclear Detection (PRND) Team and Regional PRND effort. The Chief served as an adjunct instructor for the New Mexico Fire Academy and the New Mexico Law Enforcement Academy, providing classes in command, hazmat, rescue and fire operations, to law enforcement, fire, emergency medical services, and military personnel. He was appointed to the New Mexico State Emergency Response Commission by Governor Richardson. He holds numerous certifications in fire/arson investigation, hazardous materials, special operations, and incident command. He now serves as Western Regional and Technical Standards Manager with Counter Terrorism Operations Support providing guidance as a subject matter expert on emergency response, NIMS, ICS, planning for large scale incidents (radiological dispersal devices and improvised nuclear devices) and weapons of mass destruction prevent and response operations.

David P. Ropeik is an Instructor at Harvard University and consultant on risk perception, risk communication, and risk management. He is author of *How Risky Is It, Really? Why Our Fears Don't Always Match The Facts* (2010) and co-author of *RISK, A Practical Guide for Deciding What's Really Safe and What's Really Dangerous in the World Around You* (2002). He has written more than 50 articles, book chapters, and other essays on risk perception and risk communication in both the peer-reviewed literature and the general media, including the *New York Times*, *Washington Post*, *Los Angeles Times*, *USA Today, The Guardian*, *The Boston Globe*, *Nature*, and *Scientific American*. He blogs for Psychology Today and The Huffington Post.

Mr. Ropeik's extensive work in the nuclear field includes serving as a member of the Veterans Board on Dose Reconstruction, which oversaw the joint U.S. Department of Defense and Veterans Administration program to compensate veterans exposed to nuclear radiation. He has advised the International Atomic Energy Agency (IAEA) and several member states on risk communication, and wrote the curriculum the IAEA uses to train member states in risk communication. He has spoken on, taught, or consulted on risk communication and dealing with the news media to government officials, nuclear regulators and emergency managers, nuclear-related professional and trade organizations, journalism organizations, and academic audiences, in countries around the world.

Prior to his consulting career, Mr. Ropeik was the co-director and principal faculty member of the Harvard School of Public Health's professional education course "The Risk Communication Challenge."

Before joining Harvard, Mr. Ropeik was a television reporter for WCVB-TV in Boston from 1978 to 2000, where he specialized in reporting on environment and science issues. He twice won the DuPont-Columbia Award, often cited as the television equivalent of the Pulitzer Prize, a National Headliner Award, the Gabriel Award, and seven regional Emmy Awards. He wrote a science column for *The Boston Globe* 1998 to 2000. He was a Knight Science Journalism Fellow at the Massachusetts Institute of Technology (MIT) 1994 to 1995, a National Tropical Botanical Garden Fellow in 1999, and a member of the Board of Directors of the Society of Environmental Journalists from 1991 to 2000.

Monica Schoch-Spana, a medical anthropologist, is a Senior Associate with the Johns Hopkins Center for Heath Security. She holds faculty positions with the School of Medicine at the University of Pittsburgh, the Department of Anthropology at Texas State University, and the National Consortium for the Study of Terrorism and Responses to Terrorism. Her areas of expertise include community resilience to disaster, public health emergency preparedness, public engagement in policymaking, and crisis and risk communication.

Since 1998, Dr. Schoch-Spana has briefed federal, state and local officials, as well as medical, public health, and public safety professionals, on critical issues in health security. National advisory roles include serving on the Homeland Security Subcommittee of the Board of Scientific Counselors for the U.S.

Environmental Protection Agency, the Resilient America Roundtable of the National Academy of Sciences and National Research Council (NRC), the Institute of Medicine Standing Committee on Medical and Public Health Research during Large-Scale Emergency Events, and the NRC Committee on Increasing National Resilience to Hazards and Disasters.

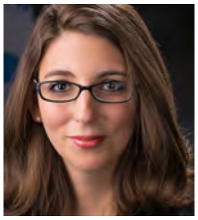
Dr. Schoch-Spana has led research, education and advocacy efforts to encourage authorities to enlist the public's contributions in epidemic and disaster management. Her studies have been influential in debunking myths about mass behaviors in the context of bioterrorism, reframing the management of catastrophic health events to include social and ethical-moral dimensions, and persuading leaders to share governance dilemmas with members of the public including how to allocate scarce medical resources in a disaster. She has chaired national working groups to produce peer-reviewed, evidence-based consensus guidance for authorities on how to partner with citizens and civil society in relation to bioterrorism response, influenza pandemic planning, and nuclear incident preparedness, and she has organized three national meetings on how to strengthen community resilience to extreme health events.

In 2003, Dr. Schoch-Spana helped establish the Center; prior to that she worked at the Johns Hopkins University Center for Civilian Biodefense Strategies starting in 1998. She received her PhD in cultural anthropology from Johns Hopkins University (1998) and a BA from Bryn Mawr College (1986).

Tammy P. Taylor is the Chief Operating Officer of the National Security Directorate at the Pacific Northwest National Laboratory (PNNL). Dr. Taylor leads the mission execution, capability development, and project management of the directorate of three divisions and four project management offices. Prior to joining PNNL in the summer of 2013, Dr. Taylor served in a number of positions over 14 y at Los Alamos National Laboratory (LANL). She served in positions as the Deputy Associate Director of Chemistry, Life and Earth Sciences, the Division Leader of Nuclear Engineering and Nonproliferation, a group leader, project leader, staff member and Director's Postdoctoral Research Fellow. From early 2007 to mid 2010 she was an Intergovernmental Personnel Act assignee from LANL in the Office of Science and Technology Policy (OSTP) in the Executive Office of the President. She managed the national science and technology portfolio on nuclear defense issues including nonproliferation, detection, render safe, and attribution, as well as nuclear detonation response and recovery issues such as preparedness, planning, medical countermeasures, decontamination, and long-term recovery within the National Security and International Affairs Directorate of OSTP for Dr. John Holdren and Dr. Jack Marburger, Science Advisors to President Obama and President Bush, respectively. Dr. Taylor has conducted research and performed program development activities on topics related to radiological/nuclear threat reduction and environmental restoration. She has expertise working with the emergency responder community to identify needs in support of radiological and nuclear terrorism preparedness and adapt traditional emergency response to response involving terrorism threats. Her research prior to September 2011 focused on environmental remediation of groundwater and safe handling, fate, and remediation of beryllium. Dr. Taylor has an MS and PhD in Environmental Engineering from the Georgia Institute of Technology. Her undergraduate degree in Civil Engineering is from New Mexico State University. She is a Council Member of NCRP and a long-time member and supporter of the American Nuclear Society, the American Society of Testing and Materials, the Health Physics Society, and the Institute of Nuclear Materials Management.

Jeffrey J. Whicker has worked at Los Alamos National Laboratory for over 25 y. He received a PhD in Environmental and Radiological Health Science from Colorado State University and is certified by the American Board of Health Physics. He is an author or co-author on over 125 scientific publications, invited talks, book chapters, and presentations mostly on indoor and outdoor radiological air quality and measurement that span issues ranging from worker protection, homeland security, public risk assessment, and environmental quality. His body of work has been cited in peer-reviewed journals over 500 times. Dr. Whicker served on the Editorial Board for the journal *Radiation Protection Dosimetry* and as President of the Environmental/Radon Section of the Health Physics Society.

Biographies



Jessica S. Wieder is a member of the U.S. Environmental Protection Agency's (EPA) Center for Radiation Information and Outreach and is the senior public information officer for EPA's Radiological Emergency Response Team. Ms. Wieder was part of the team tasked with communicating about EPA's efforts and radiation levels in the United States during the 2011 Fukushima Daiichi nuclear accident. She has facilitated international panels on public communication about radiation risks after terrorist incidents and was part of the contingency planning team for the 2011 launch of the Mars Science Laboratory. In 2010, Ms. Wieder was detailed to Federal Emergency Management Agency's Chemical, Biological, Radiological, Nuclear and Explosives Branch, where she helped establish their Improvised Nuclear Device Response and Recovery Program and created the intergovernmental Nuclear/Radiological Communications Working Group. With her guidance, this group developed the nuclear detonation messaging document *Improvised Nuclear Device Response and Recovery: Communicating in the Immediate Aftermath*. She was also the lead author for the communications chapter for the second edition of the White House's *Planning Guidance for Response to a Nuclear Detonation*. In 2013, she was awarded EPA's Exemplary Customer Service Award for her leadership in enabling all levels of government to provide quick, effective communications to the American people in response to large-scale radiological emergencies.

Contracts/Grants/Contributors/Sponsors

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Contracts

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Contributors

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PREPAREDNESS IS MORE THAN A PLAN: MEDICAL CONSIDERATIONS FOR RADIATION RESPONSE

John F. Koerner, MPH, CIH
Senior Special Advisor for CBRNE Science & Operations
ASPR Immediate Office

NCRP Annual Meeting
March 6, 2017
Bethesda, MD

Resilient People. Healthy Communities. A Nation Prepared.

Disclosure

The views and opinions expressed in this presentation are strictly that of the presenter and are not necessarily the views of ASPR, the Department of Health and Human Services, or the United States Government. No endorsement of products is implied. I have no conflicts of interest.

Goals

Purpose: To describe and discuss:

- Existing Plans
- Systems approach
- Methods to assess operational capabilities
- The way forward to implementation

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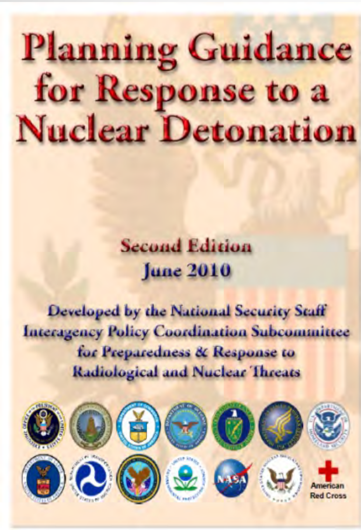
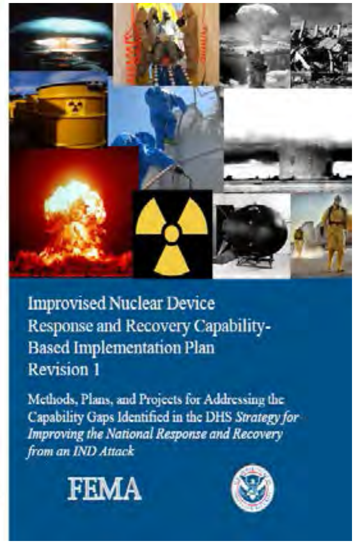
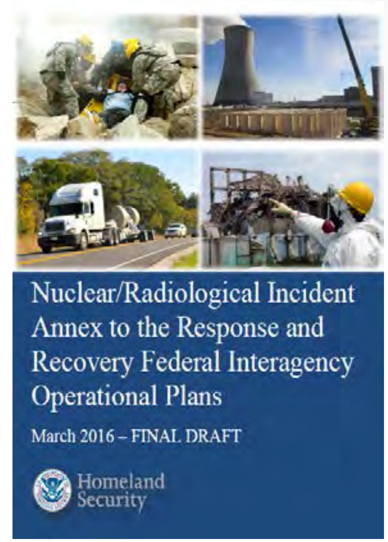
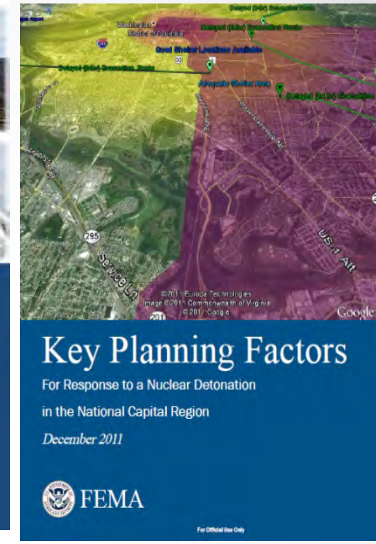
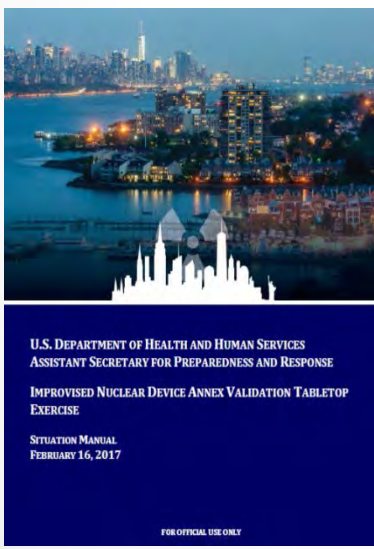
We have Plans …

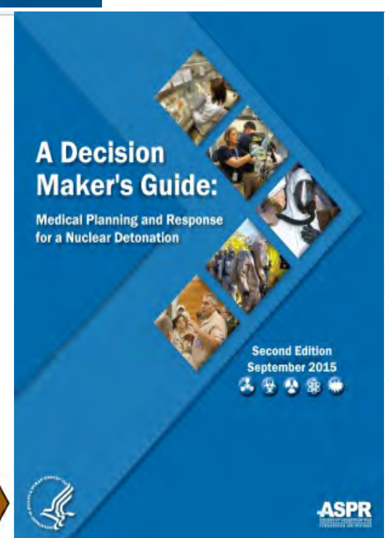


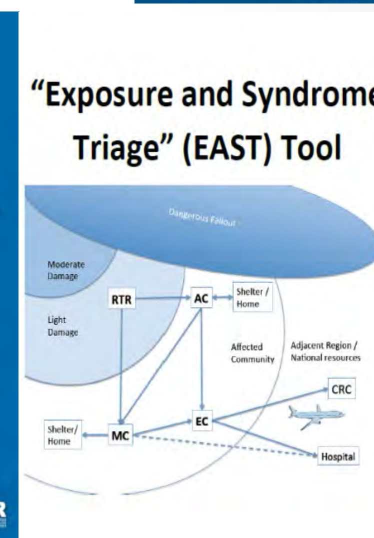












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… and Details: The Drum Beats …

- ***The 'RTR' medical response system for nuclear and radiological mass-casualty incidents: a functional TRiage-TReatment-TRansport medical response model.*** Hrdina, C. M., Coleman, C. N., Bogucki, S., Bader, J. L., Hayhurst, R. E., Forsha, J. D., Marcozzi, D., Yeskey, K. and Knebel, A. R. Prehosp. Disaster Med. 24, 167–178 (2009).

- ***Medical planning and response for a nuclear detonation: a practical guide.*** Coleman, C N. et al. Biosecur Bioterror 10, 346–371 (2012).

- ***User-managed inventory: an approach to forward-deployment of urgently needed medical countermeasures for mass-casualty and terrorism incidents.*** Coleman, C. N. et al. Disaster Med. Public Health Prep . 6, 408–414 (2012).

- ***Assessment of biodosimetry methods for a mass-casualty radiological incident: medical response and management considerations.*** Sullivan, J. M., Prasanna, P. G., Grace, M. B., Wathen, L. K., Wallace, R. L., Koerner, J. F. and Coleman, C. N. Health Phys. 105, 540–554 (2013).

- ***Role of dicentric analysis in an overarching biodosimetry strategy for use following a nuclear detonation in an urban environment.*** Blumenthal, D. J., Sugarman, S. L., Christensen, D. M., Wiley, A. L., Livingston, G. K., Glassman, E. S., Koerner, J. F., Sullivan, J. M. and Hinds, S. Health Phys. 106, 516–522 (2014).

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… on and on.

- ***The medical decision model and decision maker tools for management of radiological and nuclear incidents.*** Koerner, J. F., Coleman, C. N., Murrain-Hill, P., FitzGerald, D. J. and Sullivan, J. M. Health Phys. 106, 645–651 (2014).

- ***Public health and medical preparedness for a nuclear detonation: the nuclear incident medical enterprise.*** Coleman, C. N. et al. Health Phys. 108, 149–160 (2015).

- ***Biodosimetry: Medicine, Science, and Systems to Support the Medical Decision-Maker Following a Large Scale Nuclear or Radiation Incident.*** C. Norman Coleman, John F. Koerner Radiat Prot Dosimetry, 172 (1-3): 38-46 (2016).

- ***More work in process detailing:***
  - **Radiation TRiage, TRansport, and TReatment (RTR)** required capabilities and expectations
  - **Fatality Management** considerations and models

Pillars of the Problem Set

1. **We invested** in creating evidence-based guidance and concepts, developed drugs and dosimetry, and do a great deal of preparedness planning.

2. **We must link** these efforts to actualizing the broader challenges (e.g. triage systems, diagnostics capacity, and other space, staff and stuff dependencies).

3. **We must assess capabilities** for implementation which is a monumental task and we seek to enlist more partners via NCRP to join an incubator environment to disrupt the status quo.

4. **Transition to implementation** requires all levels to find smarter ways to utilize existing capabilities and truly assess the delta between the demand signal and what is possible at a given time.

5. **Preparedness assessment determinants**, from the ground up, require a clear, data and experience driven approach to assess operational capacity for required capabilities with an understanding of co-dependencies and interdependencies.

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Key Factors to Success

Feasible – Scalable, flexible, sustainable, portable, cost-effective

Evidence-based – Best available scientific information

Multi-use – Smarter ways to utilize existing capabilities

Collaborative – Informed by partnerships and multi-level participation

Critical Capabilities

How we handle these will impact how quickly & completely we recover

- Baseline Resilience
- Communication
- Triage & Lab Surge
- Behavioral Health

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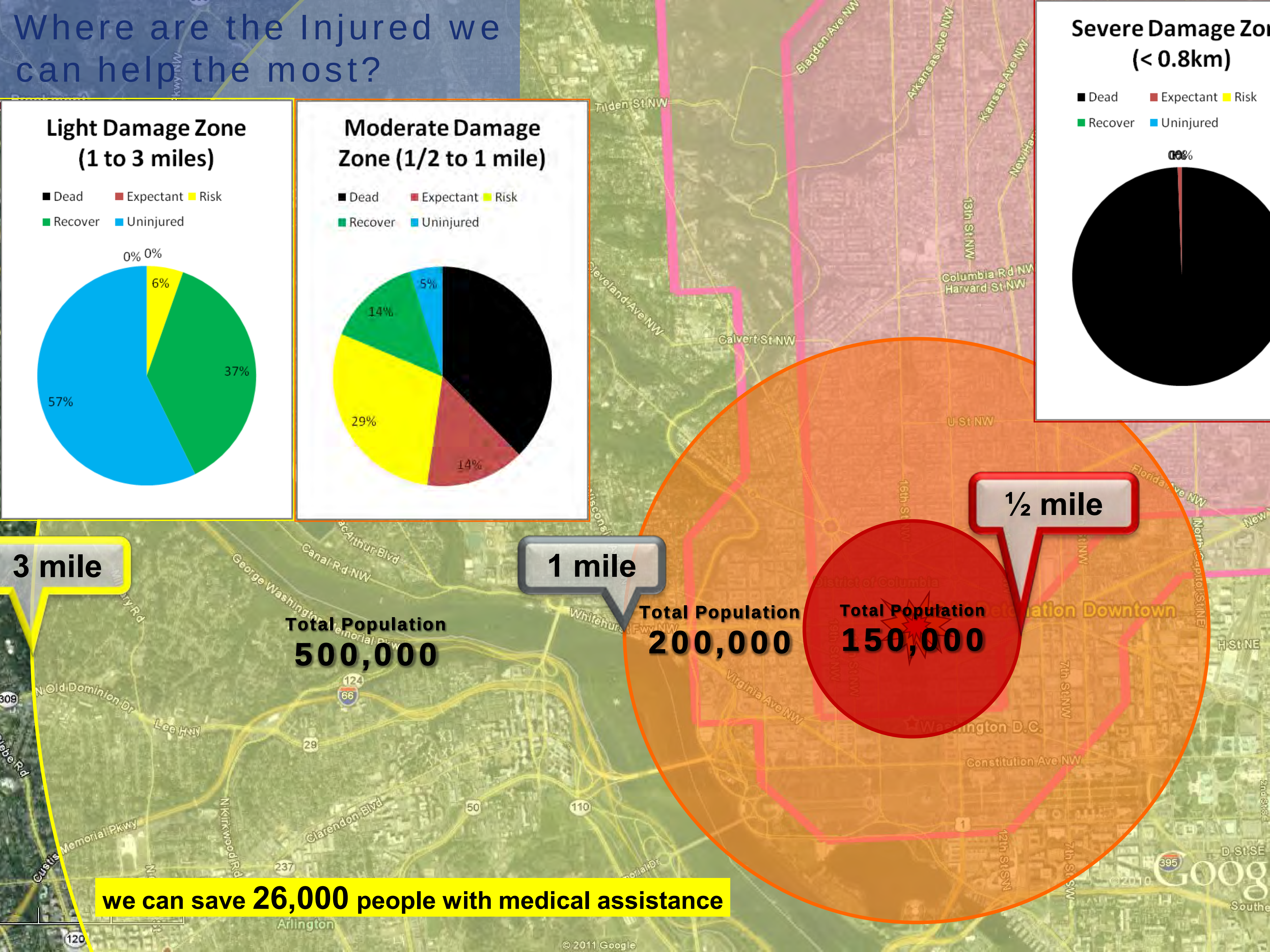
Where are the Injured we can help the most?
Light Damage Zone (1 to 3 miles)
Dead
Expectant
Risk
Recover
Uninjured
0% 0%
6%
37%
57%
Moderate Damage Zone (1/2 to 1 mile)
Dead
Expectant
Risk
Recover
Uninjured
5%
14%
29%
14%
Severe Damage Zone (< 0.8km)
Dead
Expectant
Risk
Recover
Uninjured
3 mile
1 mile
½ mile
Total Population
500,000
Total Population
200,000
Total Population
150,000
we can save 26,000 people with medical assistance
Washington D.C.
Arlington
© 2011 Google

“Moderate” Damage Zone?

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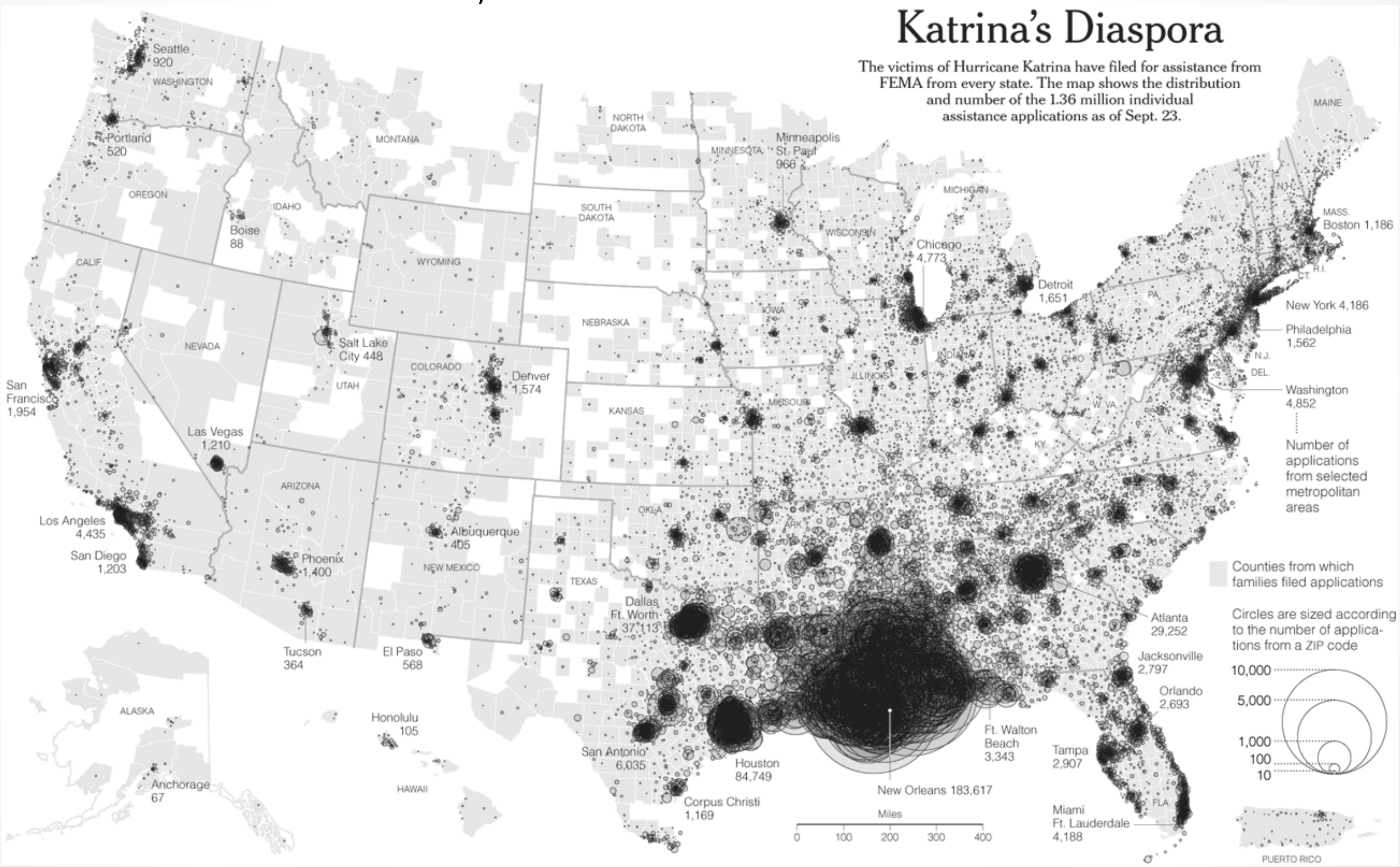
Route Clearance

What do we really know?
Where people will go

Source: New York times - October 2, 2005



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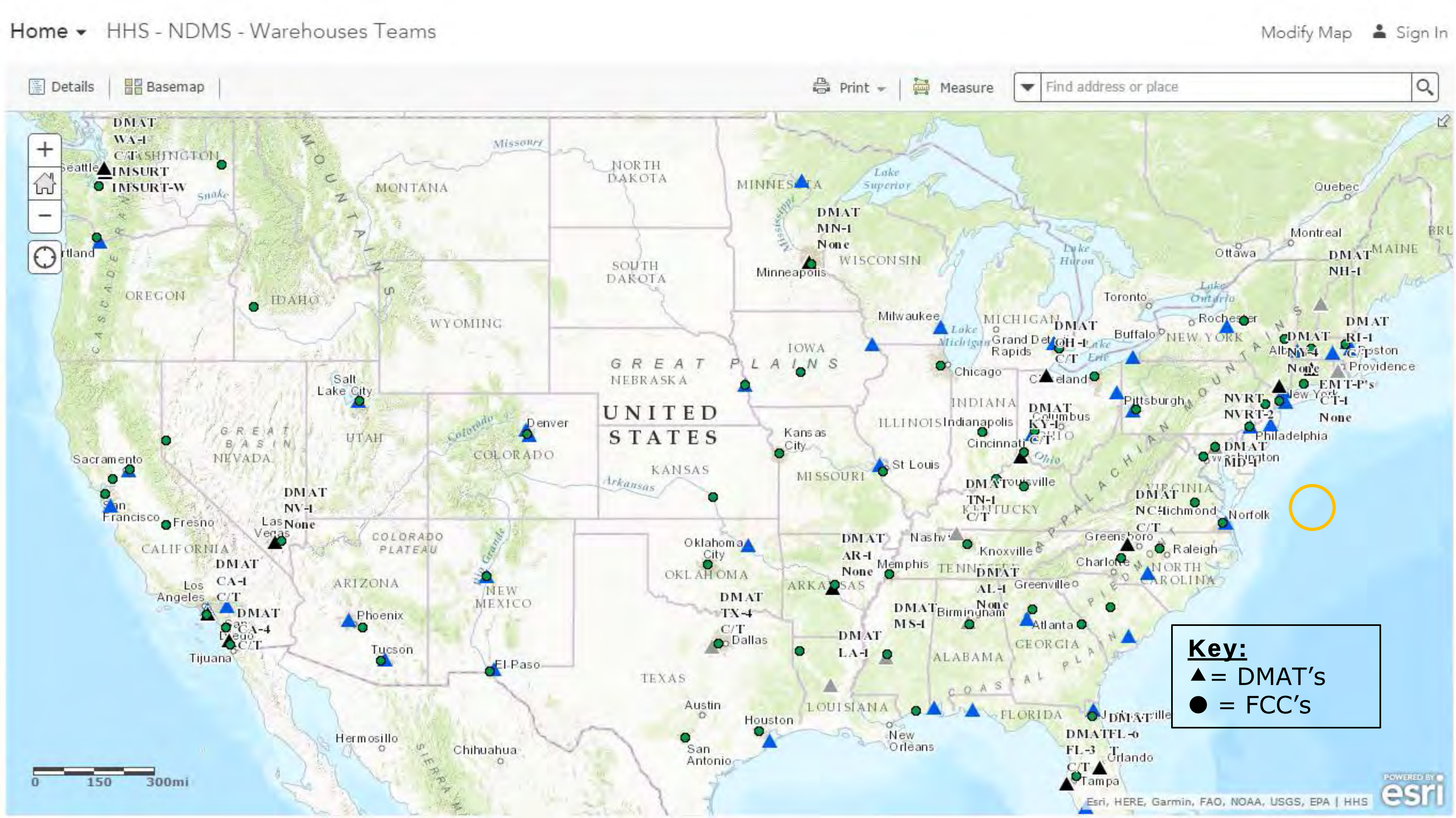
We know where Federal Teams are



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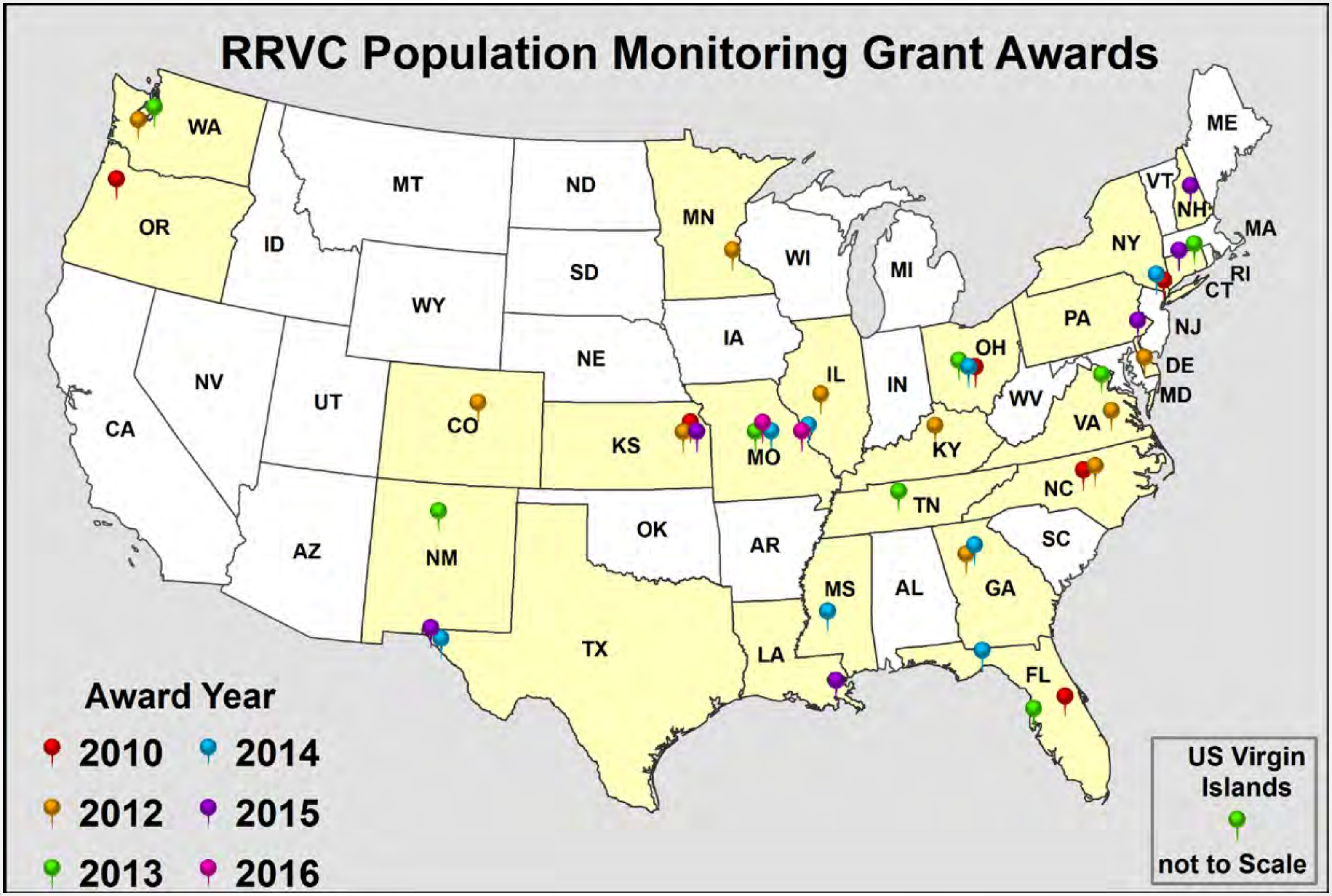
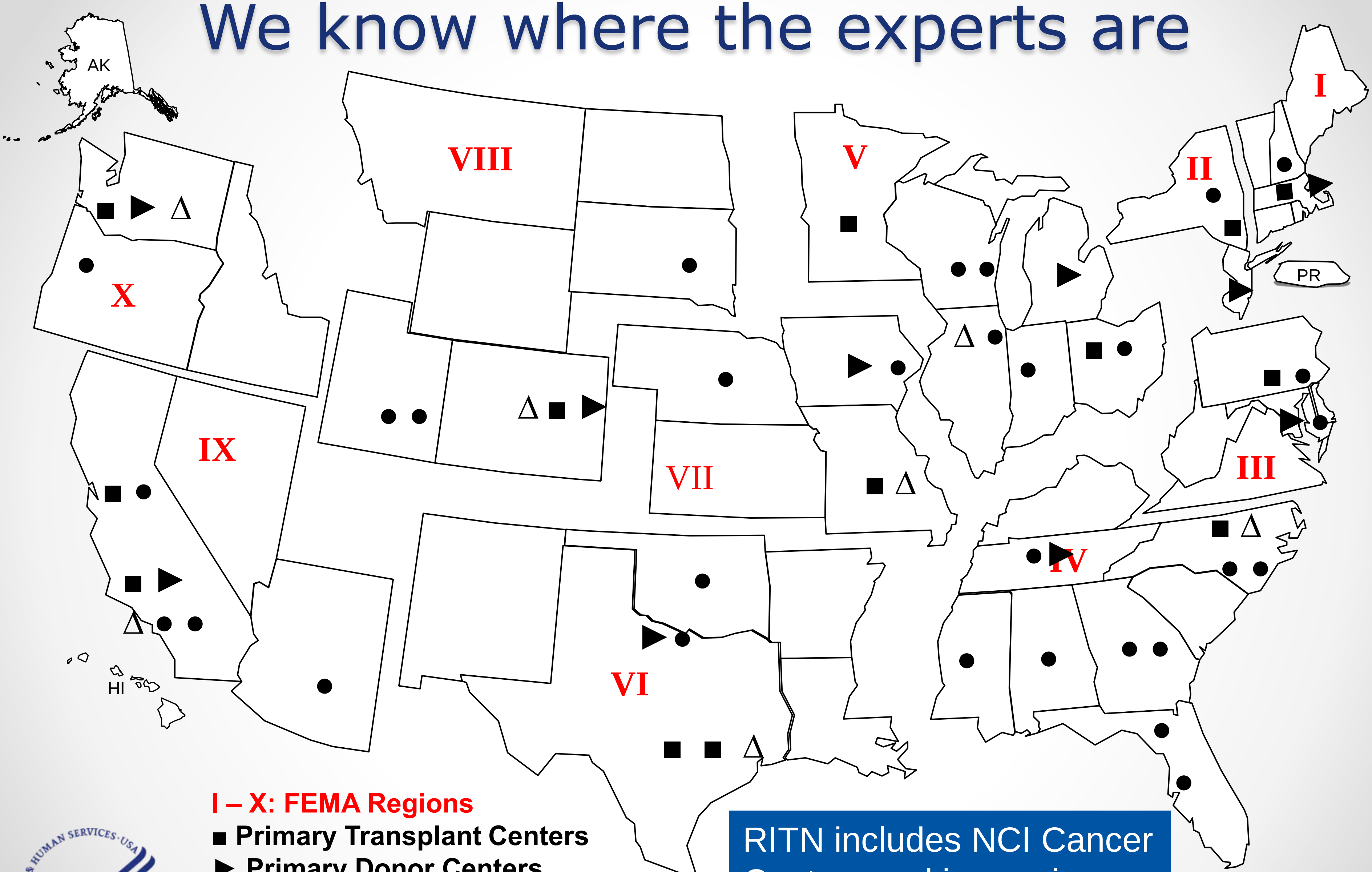
We know where local teams are



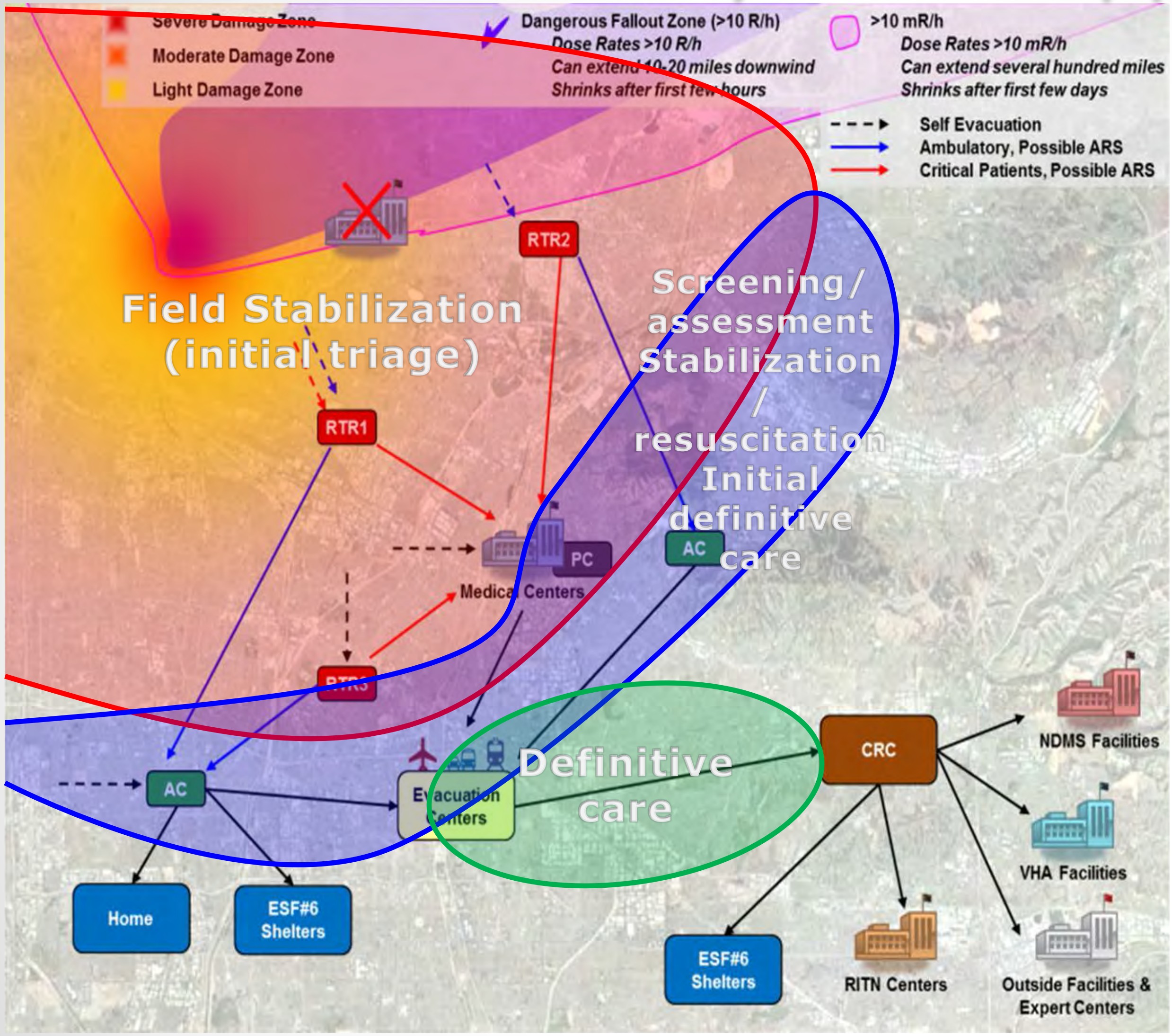
We know where the experts are



I – X: FEMA Regions
- ■ **Primary Transplant Centers**
- ► **Primary Donor Centers**
- ∆ **Cord Blood Banks**
- ● **Secondary Transplant Centers**

RITN includes NCI Cancer Centers and is growing

RTR: A Systems Approach



Type	Location	Operator	Time	Function
RTR1	Damage zones and around blast area	Local	< 48 hrs	Trauma assessment, triage, stabilization
RTR2	Edge of the fallout zones	Local	< 48 hrs	Trauma assessment, triage, stabilization (decon if possible)
RTR3	Outside damage and fallout zones	Local	< 48 hrs	Trauma assessment, triage, stabilization (decon if possible)
Assembly/ Screening Centers	In local area and region outside danger zones	Local, NGOs, MRC	1 day – 1 wk	Radiation screening, gross decon, initial assessment
Medical Centers	In local area and region	Local, NGOs, (VHA, NDMS, FMS)	1 day – 1 mo	Radiation screening, decon, triage, trauma and emergency care
Local / Distant ESF#6 Shelters	In local area and region / outside region	ESF #6	1 day – mos	Mass care, routine medical, hematology, outpatient (distant)
Evacuation Centers	In local area and region	LSTTF, DOD, NDMS	< 1 wk	Staging for casualty or patient transport

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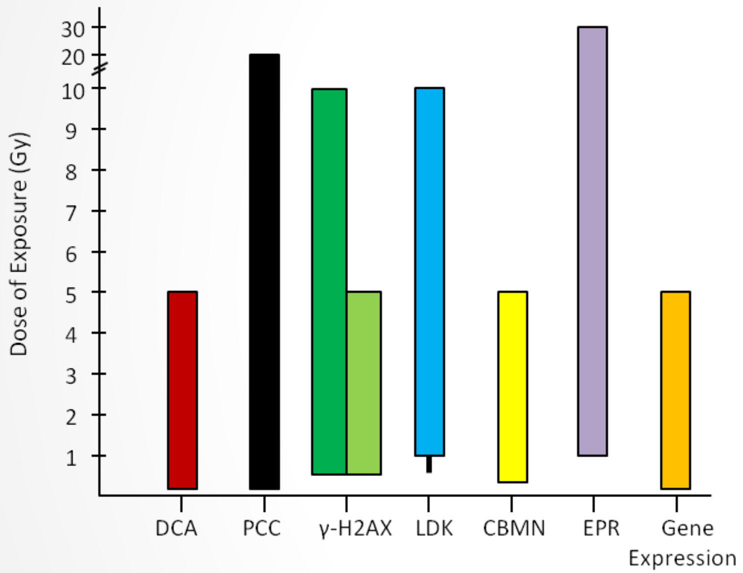
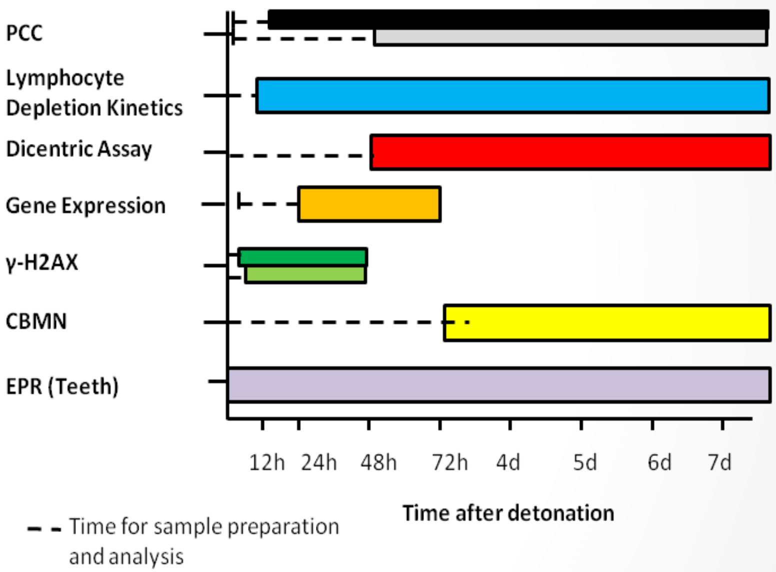
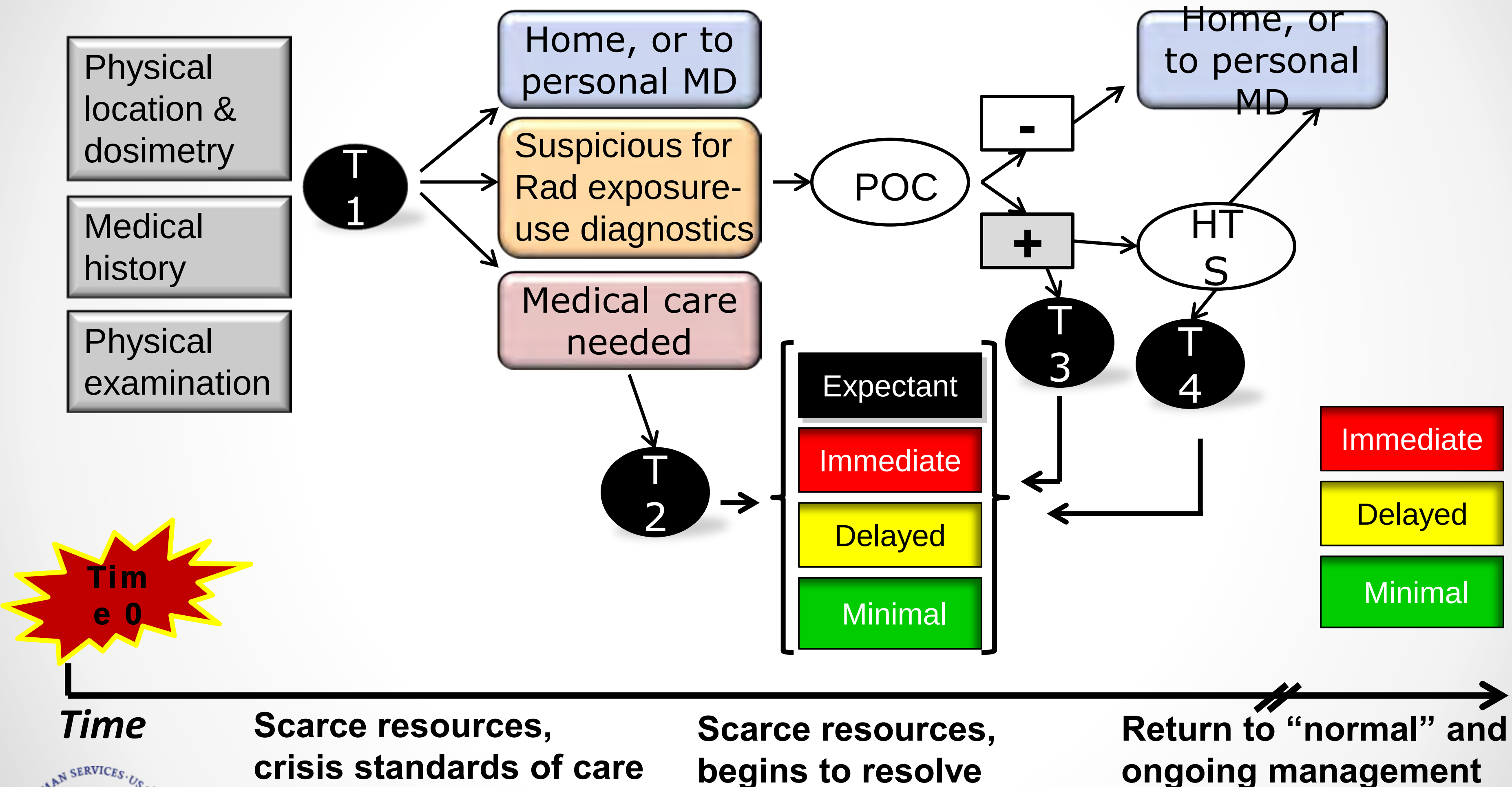
Assessment of biodosimetry methods for a mass-casualty radiological incident: medical response and management considerations



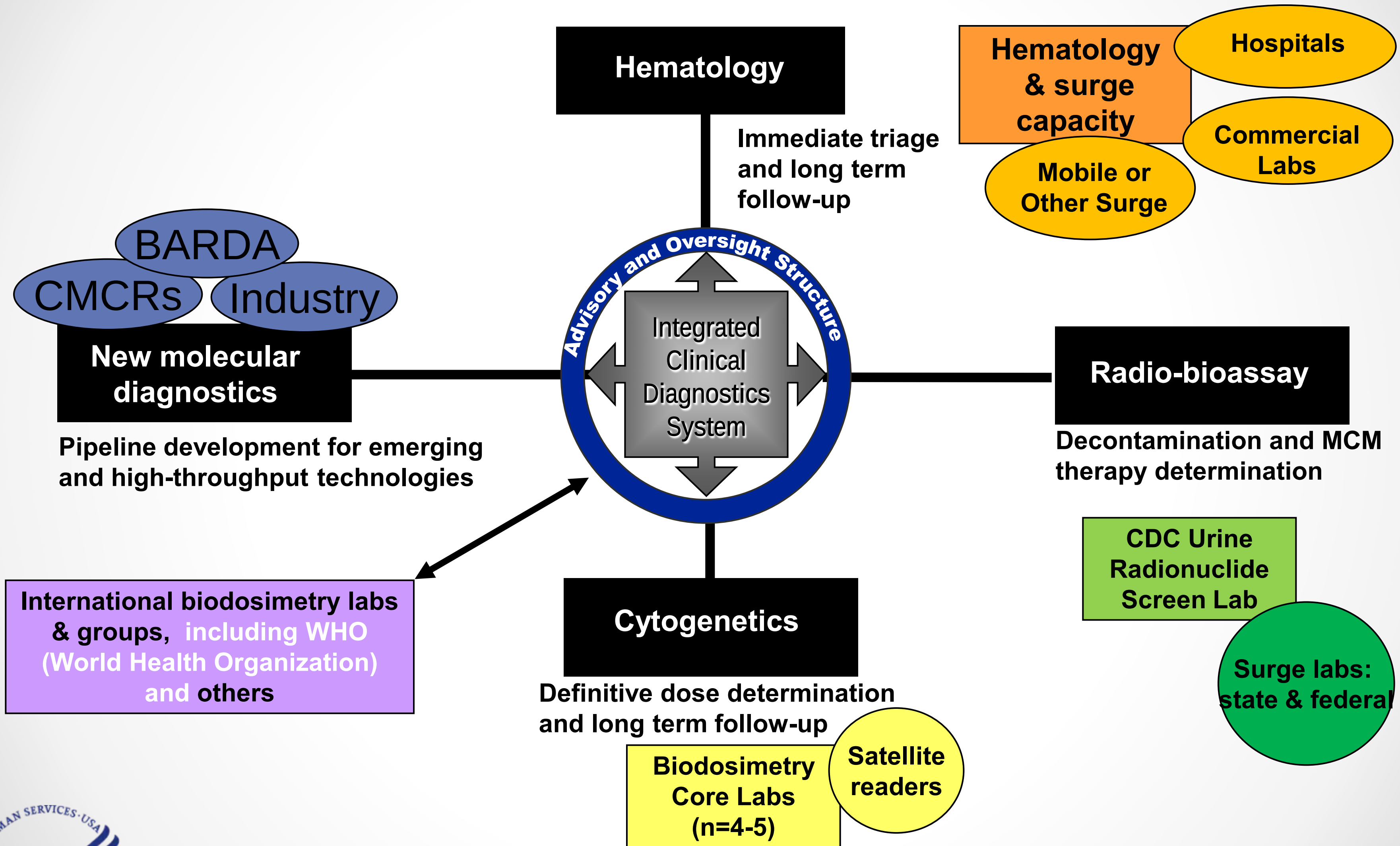


Sullivan, JM et al, Health Phys

Integrating Evidence-basis & Response into Triage – from Sullivan, et al.



Integrated Clinical Diagnostics System



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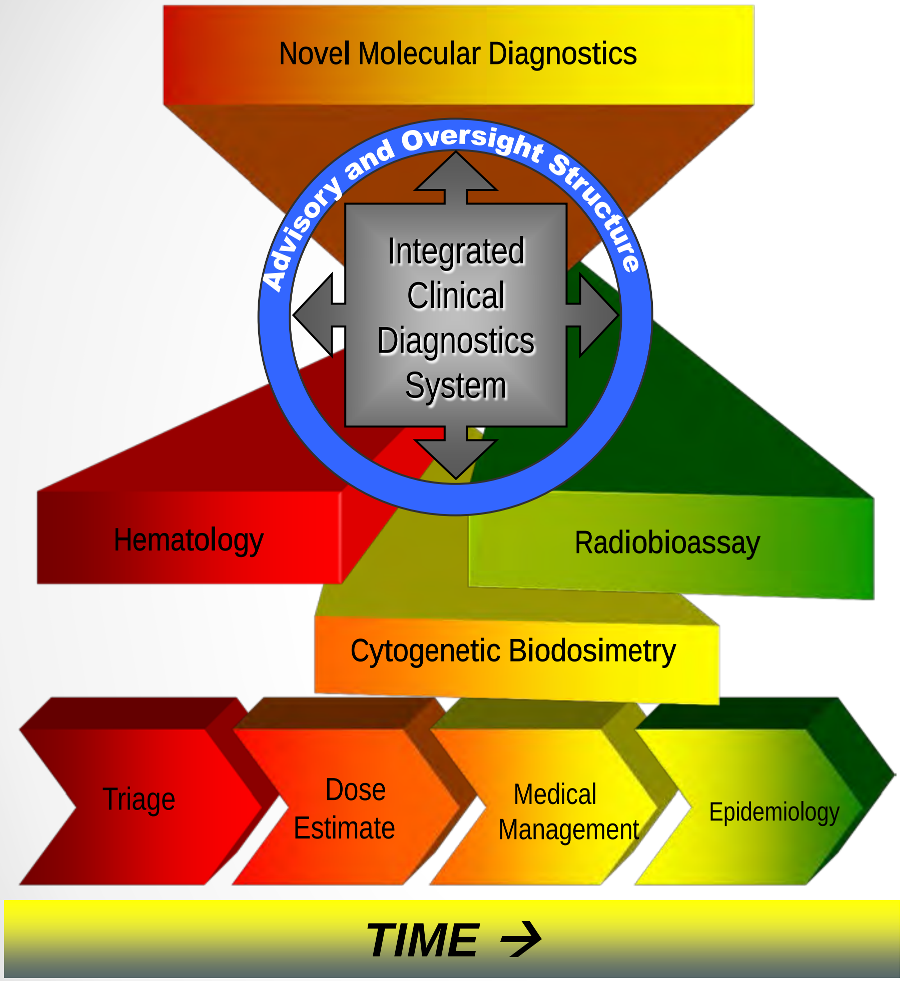
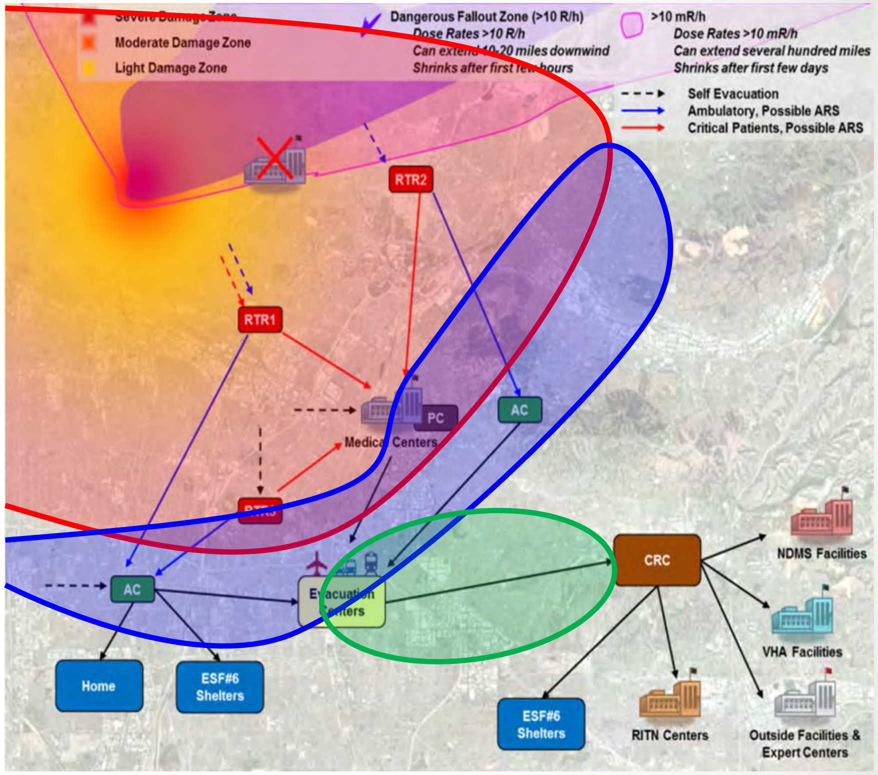
Integrated Clinical Diagnostics Approach



Linking triage to a good biodosimetry architecture - medically relevant timing



Critical Components for Operational Capacity

1. **Capabilities Analysis Tool (*CAT*)** – *A coordinated IT solution for local capabilities analysis*

2. **Local Capability Assessment** – *A physical survey of existing locations, types, and capabilities of devices – GIS*

3. **Hematology Data Collection Tool (*HemeDAT*)** - *leverages existing system(s) - simple, common cloud-based interface*

4. **Operating Procedures** - *best practices for local/regional methods for patient data and information collection and sample management*

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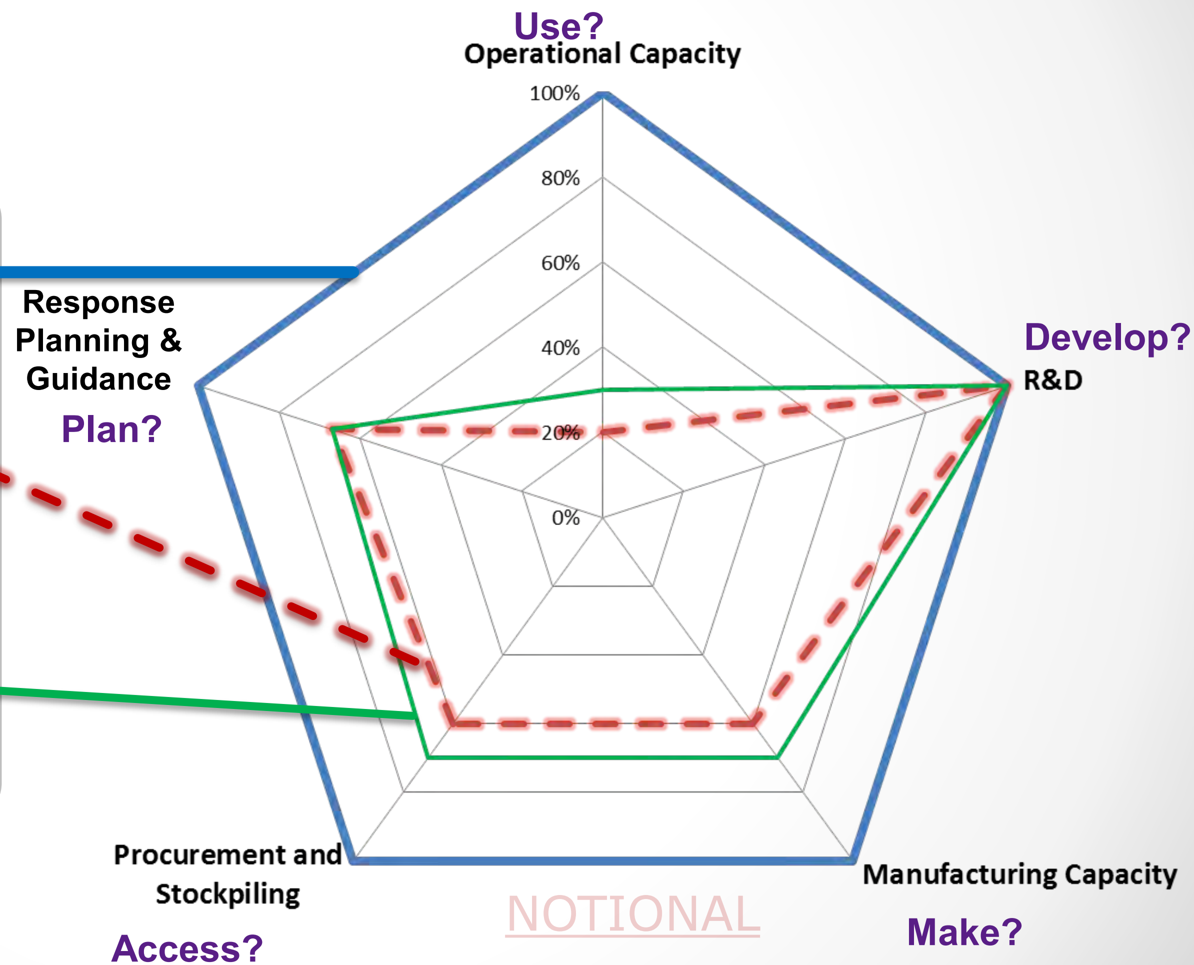
Preparedness Assessment Determinants

Need — Preparedness Goals express our strategic end state

Current — Current levels show our present state of preparedness

Projected — Projected level is an estimate given a 5-year resource constraint



Preparedness Assessment Determinant Measures

Use?

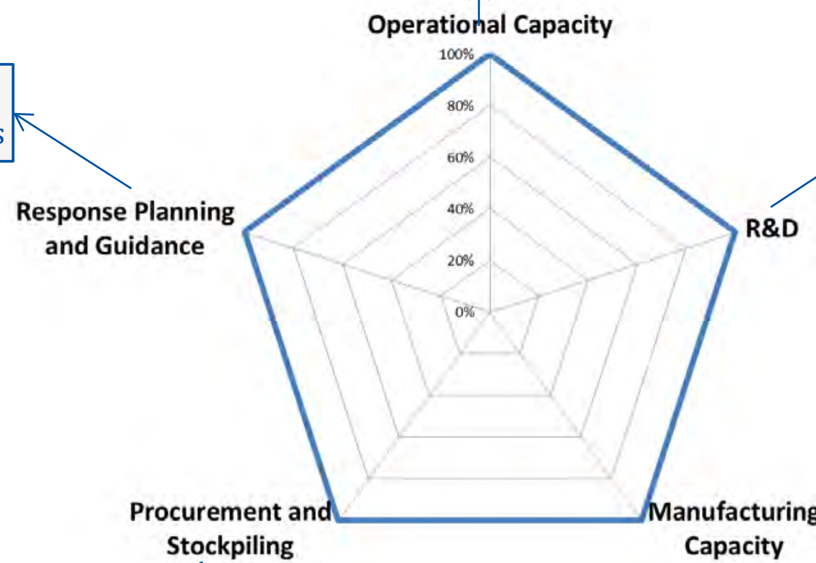
$$\frac{\text{Amount that can be administered in an emergency}}{\text{Need–based quantity } *}$$

Plan?

Average evaluation score of six critical planning elements

Develop?

Scaled to Technology Readiness Level (TRL) or EUA status (if approval for indication would not be sought)



Access?

$$\frac{\text{Amount in the SNS or otherwise accessible}}{\text{Need–based quantity } *}$$

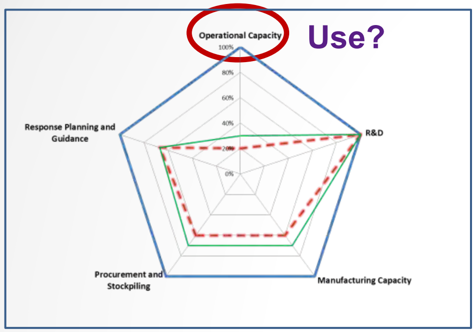
Make?

$$\frac{\text{Amount that can be manufactured over the shelf life}}{\text{Need–based quantity } *}$$

* Need-based quantity (NBQ) is the approximate number of people who would benefit from being pretreated, diagnosed, or treated with a particular medical countermeasure class (i.e., vaccine, therapeutic, mitigating agent, prophylactic, diagnostic) to optimally reduce morbidity and mortality following the consensus scenario(s) under consideration.

Operational Capacity

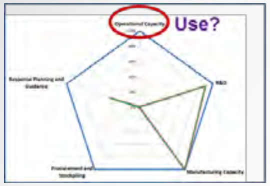
Capacity to administer MCM at time of need



$$\text{Operational Capacity Measure} = \frac{\text{\# courses that can be administered in an emergency}}{\text{Need–based quantity}}$$

- Number of individuals to whom MCMs **can** be administered during a public health emergency
- Determined by constraining parameters based on assessment of space, staff, and supplies
- Document assumptions made, particularly for systems parameters (e.g., coalitions, triage)

EXAMPLE Operational Capacity: Results for Dimethy-helpykine



Category	Sub-category	Parameter	Applicable Parameters for MCM Class	Qty	Shifts /day	Availability	Patients treated per Parameter	# of patients treatable	Constraint (# of patients treatable per sub-category)
Space	Hospital	Acute beds	Yes	4,410	1	20%	1	882	11,242
		Non-acute beds	Yes	51,800	1	20%	1	10,360	
	Hospital (+100 miles outside MSA)	Acute beds (+100 miles outside MSA)	No	2,954	1	20%	1		
		Non-acute beds (+100 miles outside MSA)	No	29,776	1	20%	1		
Staff	Physicians	Physician	Yes	8,550	2	20%	18	15,390	31,687
		Physician Assistant	Yes	9,054	2	20%	18	16,297	
	Registered Nurse	Registered Nurse	Yes	89,433	2	20%	10	89,433	89,433
Supplies		IV Pump	No		1		1		

Treatment of ARS:

$$\text{Operational Capacity Measure} = \frac{\#\text{ courses that can be administered in an emergency}}{\text{Need}-\text{based quantity}} = \frac{11{,}242}{1{,}600{,}000} = \sim 1\%$$

For Official Use Only

Conclusions

- Co-dependencies and interdependencies
  - The terrain and time are as important as the science
  - Goals of care and ability to provide care rely on:
    - Staff, space, and stuff
    - Transportation
    - Communication
    - Infrastructure (routes, power, water, cash machines, etc.)
    - Medically relevant timing
    - Human behavior
  - Triage, dose assessment, treatment decisions are inseparable
- Cogent preparedness planning requires:
  - Actual data-driven analysis
  - Understanding all the important factors
  - A national approach that drills down to each point of care
  - Vision and innovation
  - Partners, partners, partners

Are Existing Plans Sufficient for the Evolving Threat Environment?

- Specific actions must be taken to move us forward.
- Integrate IND/RDD response capabilities & protective actions into existing state/local plans. Advocate for a strategic National approach.
- Leverage/transfer knowledge in IND preparedness planning through Regional and National collaboration and link to existing plans for natural disasters.
- Create an Integrated Clinical Diagnostics System (ICDS) to enhance surge capacity and develop a national CONOPs for hematology surge (LDK), dicentrics, novel dosimetry methods and radiobioassay.

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Illinois Emergency Management Agency

Radiological Preparedness
In the Land of Lincoln

NCRP Annual Meeting 2017

Inspire Magazine - Chicago Skyline

IND Project

"You cannot escape the responsibility of tomorrow by evading it today"

-Abraham Lincoln

IND Project

Purpose: Enhance collaboration and develop actionable response plans, procedures, guidelines and policy to an IND.

Assume first 72 hours local, state, federal response with a transition to Unified Coordination Groups within 96 hours.

Participants:

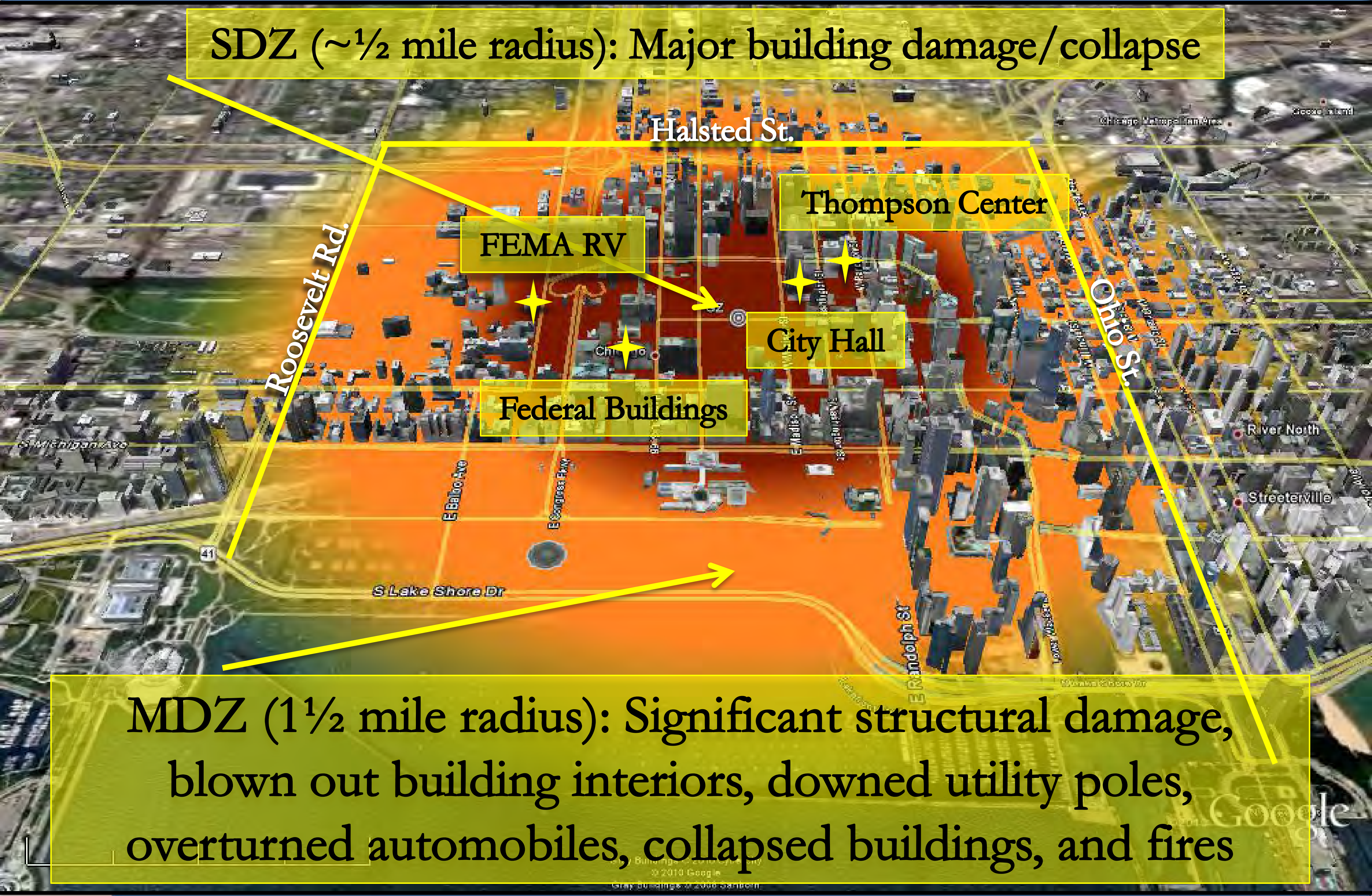
- FEMA Region V
- Illinois Emergency Management Agency (IEMA)
- Chicago Office of Emergency Management and Communications (OEMC)
- Cook County DHSEM
- Argonne National Laboratory
- DHS – Office of Science & Technology

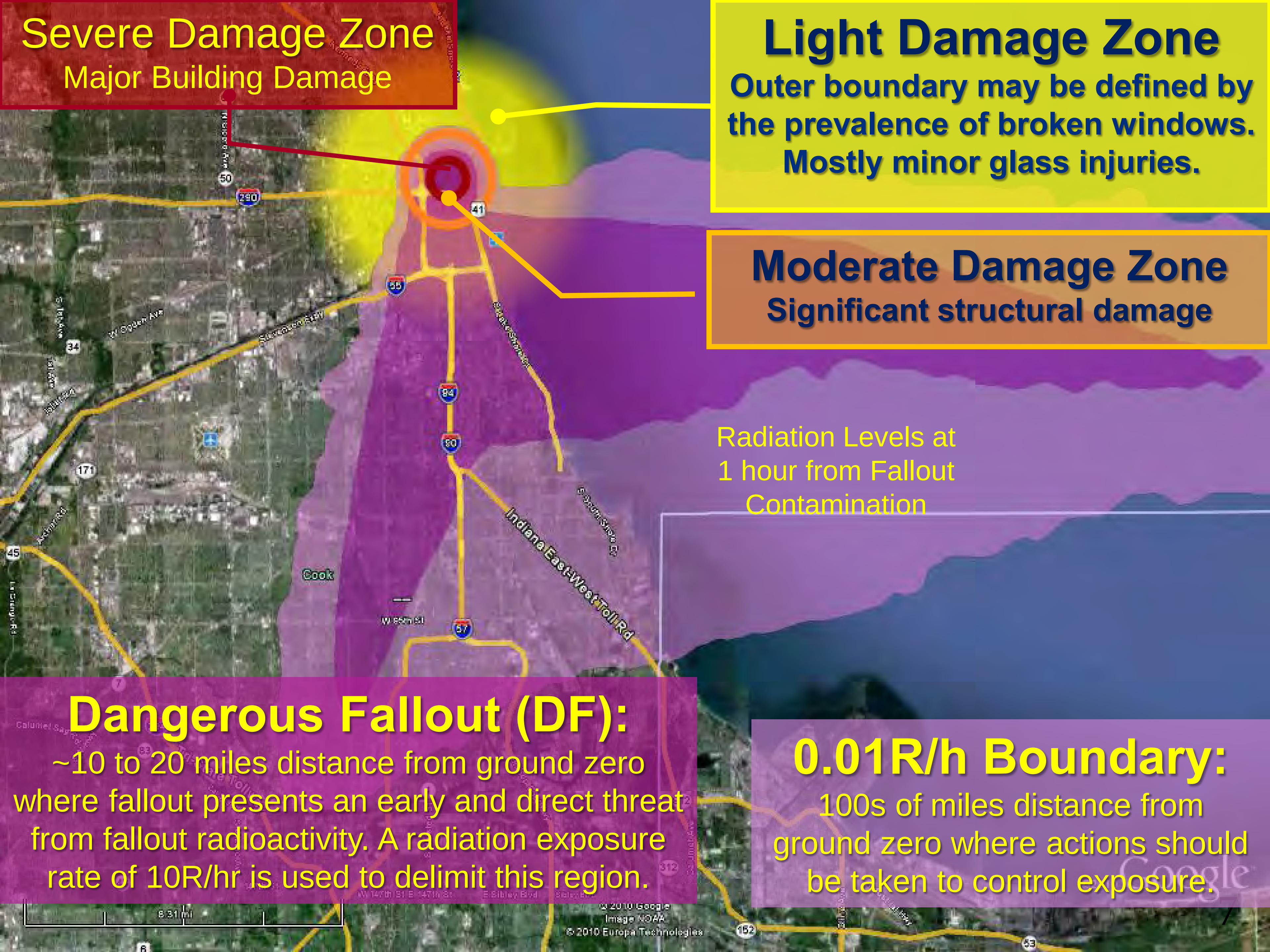
Planning Assumptions

A no-notice, 10 kiloton IND detonation occurred in the City of Chicago at noon on a workday. Ground Zero is the corner of LaSalle and Monroe, in the Central Business District.

- Severe damage zone
- Moderate damage zone
- Light damage zone
- Fallout hazard zone

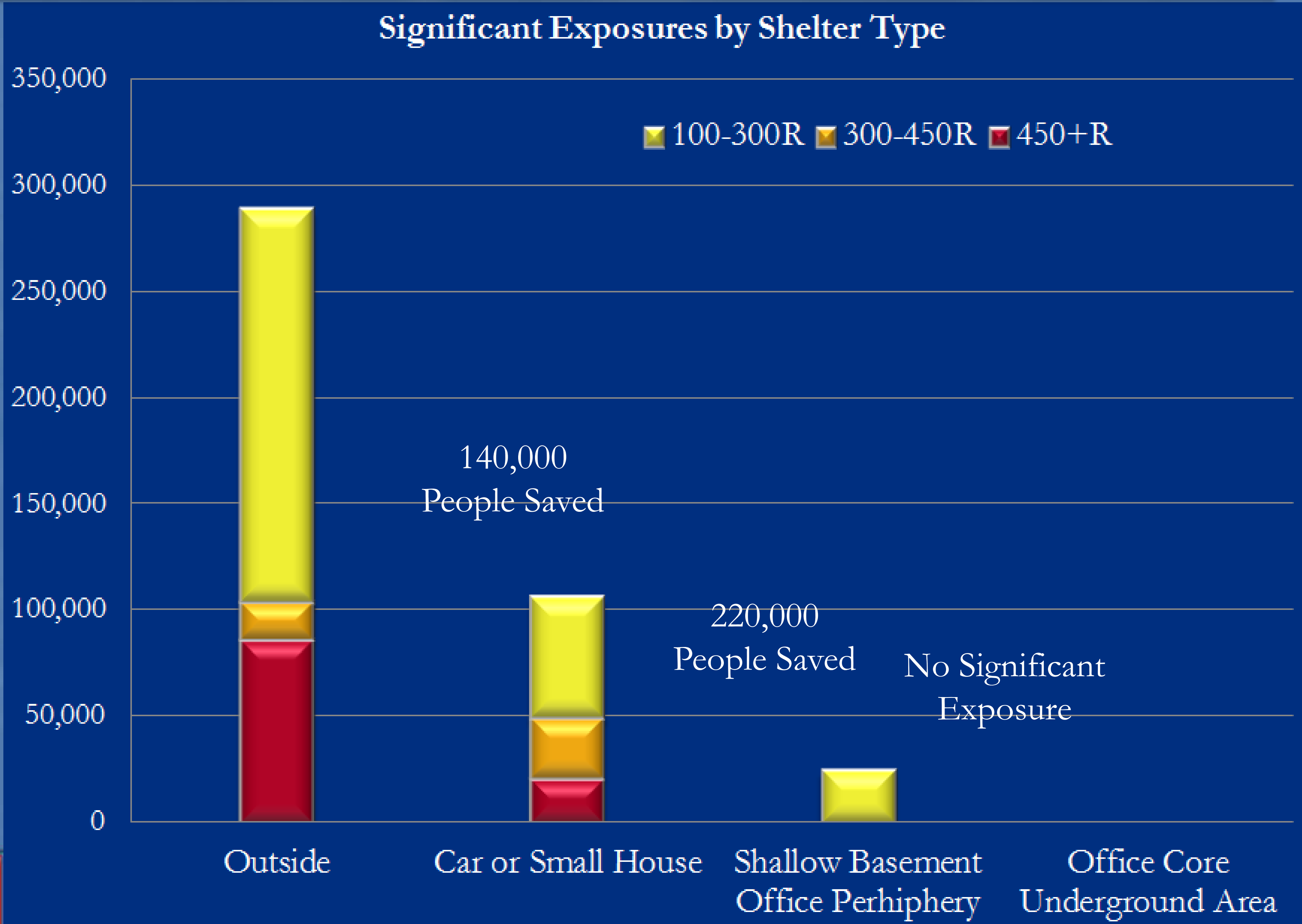
Severe and Moderate Damage Zones





Severe Damage Zone
Major Building Damage
Light Damage Zone
Outer boundary may be defined by the prevalence of broken windows. Mostly minor glass injuries.
Moderate Damage Zone
Significant structural damage
Radiation Levels at 1 hour from Fallout Contamination
Dangerous Fallout (DF):
~10 to 20 miles distance from ground zero where fallout presents an early and direct threat from fallout radioactivity. A radiation exposure rate of 10R/hr is used to delimit this region.
0.01R/h Boundary:
100s of miles distance from ground zero where actions should be taken to control exposure.
Indiana East-West Toll Rd
W Ogden Ave
Stevenson Expy
Cook
290
55
94
90
57
41
50
34
171
45
8.31 mi
© 2010 Google
Image NOAA
© 2010 Europa Technologies
Google

Greatest Opportunity to Save and Sustain Life



Whole Community Approach

- Over 300 federal, state and local public and private entities
- Elected officials summit
- Provided data during three Summits and 16 Workshops
- Embedded joint planner FEMA V, IEMA and Chicago

Identify Tasks

- Mass search and rescue
- Health and Medical
- Decontamination
- Environmental Health and Safety
- Mass Care
- Fatality Management
- Command, Control and Coordination
- Situation Assessment
- Critical Communication
- Public Messaging
- On-scene Security
- Firefighting
- Critical Transportation
- Essential Infrastructure
- Logistics
- Public and Private Resources

Joint Planning Efforts

Identified subtasks for each major task and established:

- Task Sequencing: Organize the subtasks, sequenced in the necessary order
- Interdependencies Task Sequencing: How subtasks between tasks influence one another
- Time Phased Task Sequencing: How long do subtasks take and when can they start
- Resource constrained Time-Phased Task Sequencing: What resources are available to do subtasks at any given time

Products

Integrated IND Response Plan

- Annex A: Task Organization
- Annex B: Intelligence
- Annex C: Operations – Pre-planned regional hubs
- Annex D: Logistics
- Annex F: External Affairs
  - Tab 1. Coordinated Messaging
  - Tab 2. FAQs
- Operational Playbook

December 5, 2013 TTX

FEMA V Integrated IND Senior Leaders TTX

Tested on blast + 72 hours

Six Tasks

- Critical transportation
- Mass care services
- Public & private services and resources
- Public information and warning
- Operational coordination
- Situation assessment

December 5, 2013 TTX

- All were performed “with some challenges.”
- All draft Annexes updated and finalized in June 2014.
- Draft Integrated IND Plan finalized Oct 2016

Major challenge with ability to monitor radiation levels of evacuees and manage decontamination ops within 72 hrs

National Efforts

- The Radiological Operations Support Specialist (ROSS)

  DHS/FEMA, DOE - NNSA/CRCPD

- Radiation Response Volunteer Corps (RRVC)

  CDC/CRCPD

  – Population monitoring/Reception Center Assistance
  – Registration through Medical Reserve Corps
    – 17 state agencies, 1 HPS chapter,11 city/county agencies

IL Path Forward

- Finalize all hazards revamped IEOP-Jun 17
- Prepare RDD, RED appendices to the IEOP-Dec 17
- Existing IPRA Annex for NPPs annual review
- Prepare IND Annex and associated appendices to the IEOP-Dec 17
- Train
- Exercise

The ROSS: A Rad/Nuc Subject Matter Expert Filling a Critical National Need

William Irwin, ScD, CHP

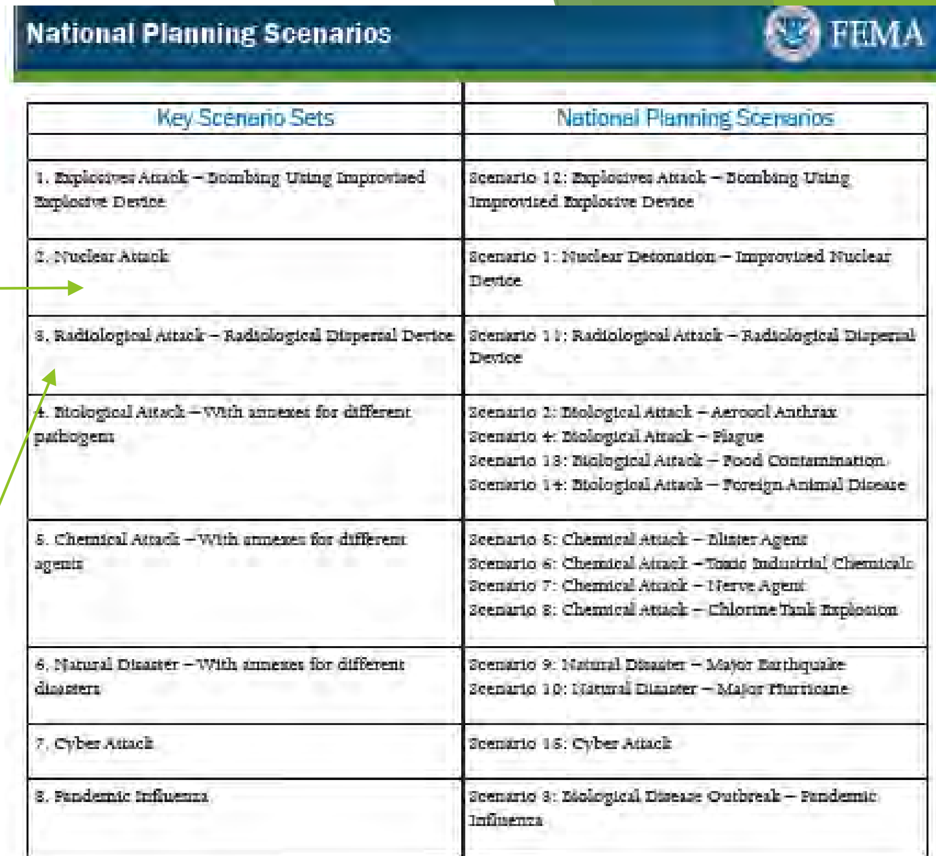
Vermont Department of Health

National Council on Radiation Protection and Measurements Annual Meeting

6 March 2017

The ROSS Arose Out of 9/11

- With Homeland Security Presidential Directive HSPD-5 of February 2003, multiple interagency working groups were assembled to identify gaps in our radiological and nuclear preparedness.
- January 2008's National Response Framework identified two of the fifteen planning scenarios for which the nation needs to be prepared are the radiological dispersal device (RDD) and the improvised nuclear device (IND).
- The U.S. Department of Homeland Security (DHS) has led multiple efforts to develop solutions for weaknesses in our RDD and IND preparedness.
- One gap was the nation's lack of radiological and nuclear emergency subject matter experts. The ROSS is a solution. The ROSS can help your emergency management agency fill this gap.


National Planning Scenarios
FEMA

Key Scenario Sets	National Planning Scenarios
1. Explosives Attack – Bombing Using Improvised Explosive Device	Scenario 12: Explosives Attack – Bombing Using Improvised Explosive Device
2. Nuclear Attack	Scenario 1: Nuclear Detonation – Improvised Nuclear Device
3. Radiological Attack – Radiological Dispersal Device	Scenario 11: Radiological Attack – Radiological Dispersal Device
4. Biological Attack – With annexes for different pathogens	Scenario 2: Biological Attack – Aerosol Anthrax Scenario 4: Biological Attack – Plague Scenario 13: Biological Attack – Food Contamination Scenario 14: Biological Attack – Foreign Animal Disease
5. Chemical Attack – With annexes for different agents	Scenario 5: Chemical Attack – Blister Agent Scenario 6: Chemical Attack – Toxic Industrial Chemicals Scenario 7: Chemical Attack – Nerve Agent Scenario 8: Chemical Attack – Chlorine Tank Explosion
6. Natural Disaster – With annexes for different disasters	Scenario 9: Natural Disaster – Major Earthquake Scenario 10: Natural Disaster – Major Hurricane
7. Cyber Attack	Scenario 15: Cyber Attack
8. Pandemic Influenza	Scenario 3: Biological Disease Outbreak – Pandemic Influenza

While primarily created for the RDD and IND, ROSS are also prepared and tested to assist state and local incident commanders and emergency managers with nuclear power plant incidents.

What is a ROSS?

- The Radiological Operations Support Specialist is a radiation protection specialist trained and exercised to prepare for, respond to, and recover from any radiological or nuclear incident.
- A special emphasis is placed on skills, knowledge, and abilities required to help decision-makers engaged in consequence management for the most serious nuclear facility releases as well as terrorist incidents from mass poisonings to dirty bombs and nuclear detonations.
- The ROSS is taught empirically-tested and proven methods by leading scientists and emergency management professionals from the national laboratories and federal, state and local emergency response organizations.

What is a ROSS?

- They come from state and local organizations where they have working knowledge of incident command and emergency management. They know how states work, but they are also taught what to expect when the federal authorities arrive, and how to best use what the federal agencies bring.
- The ROSS can be used to supplement existing radiological and nuclear emergency resources.
  - Imagine round-the-clock operations for weeks on end and an incident impacting multiple municipalities, states or countries.
- The ROSS can be used during planning, as well as during exercises and incident response.
- A ROSS is not a hazmat technician or radiation protection technician, though both might become ROSS!

In the Worst Incidents, Many ROSS May Be Needed

INCIDENT COMMANDER

ROSS in EOC

SAFETY OFFICER

Possible ROSS support location

LIAISON OFFICER

PUBLIC INFORMATION OFFICER

PLANNING SECTION

OPERATIONS SECTION

LOGISTICS SECTION

FINANCE/ ADMINISTRATION SECTION

Possible ROSS support location

Possible ROSS support location

SERVICE BRANCH

SUPPORT BRANCH

TIME UNIT

RESOURCES UNIT

SITUATION UNIT

DOCUMENTATION UNIT

DEMOBILIZATION UNIT

BRANCH I

BRANCH II

COMMUNICATIONS UNIT

SUPPLIES UNIT

PROCUREMENT UNIT

MEDICAL UNIT

FACILITIES UNIT

COMPENSATION & CLAIMS UNIT

Possible ROSS support location

Possible ROSS support location

Possible ROSS support location

FOOD UNIT

GROUND SUPPORT UNIT

COST UNIT

DIVISION A

DIVISION B

DIVISION A

DIVISION B

ROSS

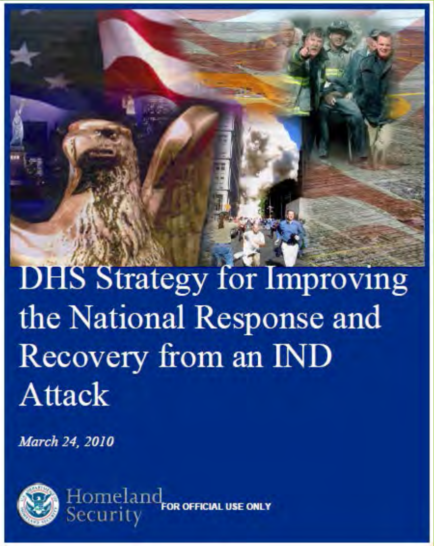
ROSS

ROSS

ROSS

Slide courtesy of Brooke Buddemeier, Lawrence Livermore National Laboratories

Planning for the ROSS



- The DHS Science and Technology (S&T) Directorate, the Federal Emergency Management Agency (FEMA) Office of Response and Recovery, and the Department of Energy (DOE) National Nuclear Security Administration (NNSA) have led the way.
- Being the ROSS is a state person trained and certified to help his or her own state, as well as other states, the Conference of Radiation Control Program Directors (CRCPD) engaged to ensure state and local needs are met.
- Leaders from these four organizations form the Steering Committee responsible for what has occurred to date and what will transpire in the future.

Testing the Concept

- In 2014, I was asked by NNSA to test the ROSS at Vibrant Response 14, a National Level Exercise where Army North tests thousands of chemical, biological, radiological, nuclear and explosive incident response troops, along with civil authorities.
- I tested the ROSS role for two days at the most forward incident command post (ICP) near the simulated severe damage zone just hours after detonation near Indianapolis Motor Speedway, and then tested it again for two days at the Indiana Emergency Operations Center (EOC).
- To learn the most possible from the test, I was followed by two trained evaluators every day. Afterward, an after action report (AAR) was prepared from observations and interviews with state and local responders the ROSS served.

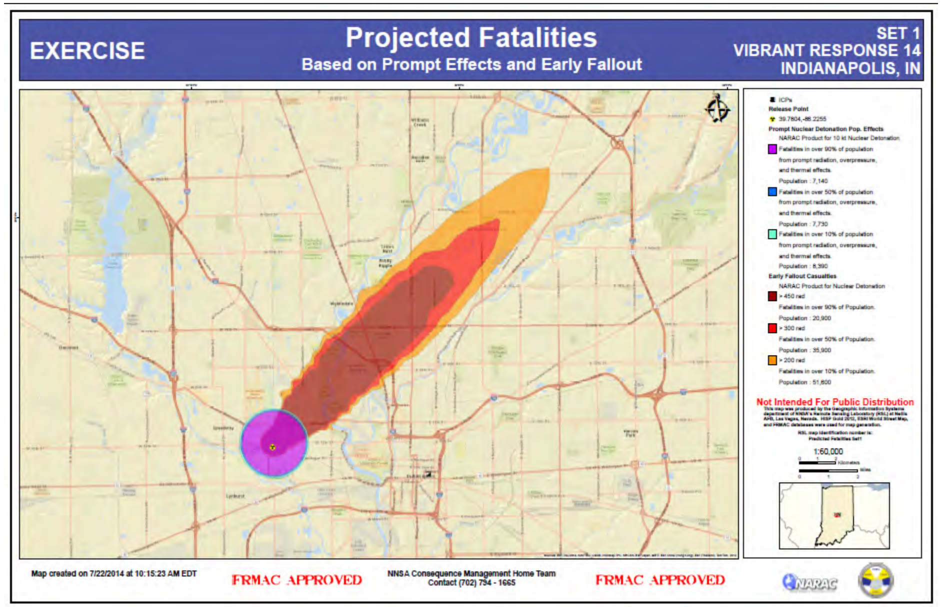
Muscatatuck Urban Training Center

As we drove in, these scenes were everywhere

The whole operation occurred with helicopters, Humvees, smoke, sirens and soldiers all

At the civil authority's ICP, the Incident Management Team was ready for tornadoes and floods. They had no idea what to do with over 100,000 dead or dying, debris thirty feet deep, and lethal radiation exposure rates everywhere responders wanted to go.

It became clear to us all that the ROSS was a critical need!



- At the Indiana EOC, I engaged in numerous projects with the various emergency support functions and advised the Policy Group.
- One of the most interesting projects was with the public information officer, the Indiana Health Department, the National Atmospheric Radiological Assessment Center and the US Department of Health and Human Services to:
  - Develop graphics to show where people survived the radiation dose, but would die without immediate help, and
  - Draft diagnostic guidance for health care practitioners so they could triage their patients who were going to come to them in large numbers seeking help.

More ROSS Testing

- ROSS were again tested at IND exercises Vibrant Response 15 in Missouri, Vibrant Response 16 in Pennsylvania, and at the nuclear power plant exercise Southern Exposure 15 in South Carolina.
- In each case, evaluators followed the ROSS and interviewed exercise participants and wrote an AAR to improve our concept for developing more ROSS.
- Concurrently, DHS S&T contracted with Lawrence Livermore National Laboratory (LLNL) to conduct a formal job task analysis (JTA) with input from people who would be ROSS and people who would request ROSS.
- The JTA and ROSS exercise AARs were then used to identify the ROSS skills, knowledge and abilities needed for Type 1,Type 2 and Type 3 ROSS in accordance with National Incident Management System (NIMS) resource typing.

Lawrence Livermore National Laboratory

Basic Health Physics Knowledge

Note: Passing Part 1 of the AAHP Exam represents at least an "Intermediate" proficiency in all categories. CHP or PhD in Radiological Health Physics represents at least "Advanced" in all categories. NRRPT Certification represents at least a "Novice" proficiency in all categories.

ROSS Minimum Knowledge

1. Measurements and Instrumentation	Type 1 (Highest)	Type 2	Type 3
1.1 Types of Measurements	Intermediate	Novice	Novice
1.2 Selection of Instruments	Intermediate	Novice	Novice
1.3 Analytical Techniques for Sampling	Intermediate	Novice	Novice
1.4 Measurement Methods	Intermediate	Novice	Awareness
1.5 Interpretation and Reporting of Results	Intermediate	Novice	Awareness
1.6 Quality Control and Data Quality Objectives	Awareness	Awareness	Awareness
1.7 Instrument Calibration, Maintenance, and Performance Testing	Novice	Awareness	Awareness
2. Standards and Requirements	**Type 1 (Highest)**	**Type 2**	**Type 3**
2.2 History and Development (regulation basis and past exposures and events)	Intermediate	Novice	Awareness
2.3 Use and Application	Intermediate	Novice	Awareness
2.4 Types of Regulations (jurisdiction / authorities)	Intermediate	Novice	Awareness
2.5 Interpretation and Knowledge	Intermediate	Novice	Awareness
3. Hazards Analysis and Controls	**Type 1 (Highest)**	**Type 2**	**Type 3**
3.1 Hazard Identification	Novice	Awareness	
3.2 Evaluate and Assess Significance/Consequence	Novice	Awareness	Awareness
3.3 Devise and Implement Controls	Intermediate	Novice	Novice
3.4 Types of Engineered Controls	Novice	Awareness	
3.5 Designs and Specifications	Novice	Novice	Awareness
3.6 Selection and Evaluations (PPE, dosimetry, shielding, & decon)	Intermediate	Novice	Novice
3.7 Use and Operations	Awareness	Awareness	Awareness
3.8 Document and Communicate	Novice	Novice	Awareness
4. Operations and Procedures	**Type 1 (Highest)**	**Type 2**	**Type 3**
4.1 Standard Operating Practices and Procedures	Intermediate	Novice	Novice
4.2 Emergency Response (see Radiological Response Knowledge and Tools)	Advanced	Intermediate	Novice
4.3 Basis for Operations and Program	Novice	Novice	Awareness
4.4 Program Types	Novice	Awareness	
4.5 Records	Novice	Awareness	
5. Fundamentals and Education	**Type 1 (Highest)**	**Type 2**	**Type 3**
5.1 Skills of the Trade - explain	Intermediate	Intermediate	Novice
5.2 Types	Novice	Novice	Awareness
5.3 Other Fundamentals	Intermediate	Intermediate	Intermediate

Note: these are taken from CHP required knowledge categories

Awareness means you have a common knowledge or an understanding of basic techniques and concepts

Novice means you understand and can discuss terminology, concepts, principles, and issues related to this competency

Intermediate means you are able to successfully complete tasks in this competency as requested. Help from an expert may be required from time to time, but you can usually perform the skill independently.

Advanced means you can perform the actions associated with this skill without assistance. You are certainly recognized within your immediate organization as "a person to ask"

These are the knowledge areas for ROSS identified and verified in the Job Task Analysis. They are based on those needed to certify as a health physicist.

We can develop ROSS from all levels of interest and experience

Radiological Response Knowledge & Tools

RR1. Models and Software Tools	ROSS Capability Type Type 1 (Highest)	Type 2	Type 3
RR1.1 Atmospheric Dispersion Modeling (e.g. Hot Spot, RASCAL, HPAC, NARAC)	Novice	Awareness	Awareness
RR1.2 Dose Assessment Modeling (e.g., RESRAD-RDD & TurboFRMAC)	Awareness	Awareness	
RR1.3 Monitoring Planning (10 point strategy, MARSIM Methodology, & Visual Sample Plan)			
Emergency Monitoring Strategies (e.g., 10 point Strategy)	Intermediate	Intermediate	Intermediate
Software tool (e.g., Visual Sampling Plan (VSP) & MARSIM)	Awareness		
RR1.4 Information Management / Data Telemetry / Databases			
RadResponder	Intermediate	Intermediate	Intermediate
CMWeb	Intermediate	Novice	Awareness
HSIN	Novice	Awareness	Awareness
RR1.3 FRMAC/IMAAC Product Interpretation & Customization	Intermediate	Intermediate	Novice
RR2. Radiological Emergency Response Standards and Guidance (e.g., NCRP, ICRP, ANSI, & IAEA - see references)	Intermediate	Novice	Awareness
RR3.0 Response Doctrine and Framework	**Type 1 (Highest)**	**Type 2**	**Type 3**
RR3.1 Federal, State, and Local Radiological Response Doctrine (Federal, State, and Local Plans manuals frameworks, & playbooks - see reference list)	Intermediate	Novice	Awareness
RR3.2 Federal Radiological Response Assets & Capabilities			
Advisory Team for the Environment, Food, and Health	Intermediate	Intermediate	Novice
FRMAC	Intermediate	Novice	Awareness
All other resources (see ROSS Resource Guide)	Novice	Awareness	Awareness
RR3.3 State Radiological Response (e.g. implication of a NRC agreement vs. non-agreement State & Impact on Home Rule vs Dillon Rule governance)	Intermediate	Novice	Awareness
RR4. Radiological Threats	**Type 1 (Highest)**	**Type 2**	**Type 3**
Understanding Radiological Terrorism, sources of concern, and potential impacts	Intermediate	Novice	Awareness
Understanding Nuclear Terrorism and potential impacts	Intermediate	Novice	Awareness

Note: For resources that require an account to access

Awareness	Know how to request access
Novice	Have an active account and understand how to navigate
Intermediate	Active account and familiar with sending, receiving, and requesting data

Awareness	Know it exists and what it does
Novice	Know how to activate and use asset
Intermediate	Know activation, expected timelines, and response integration.

It is equally important that the ROSS not just be book smart, but also be skilled in radiation protection, rad/nuc emergency response, with software, and both leading and working with teams.

ROSS Training

- With the skills, knowledge and abilities needed for Type I, II and III ROSS identified, a formal ROSS training curriculum was developed.
- The DHS S&T Directorate contracted LLNL to develop training objectives and lesson plans.
- Brooke Buddemeier of LLNL, Jim Rogers of FEMA and I test taught some of the lesson plans: 8-hour courses at the spring 2016 CRCPD annual Meeting and the summer 2016 Health Physics Society Meeting.
- Through each, we collected a list of more than 150 professionals interested in serving the nation and states and locals as ROSS.

HPS Specialists in Radiation Protection

The Pilot Course

- The week of September 19 through 23, 2016, we taught a forty-hour course, FEMA MGT 455, to sixteen initial ROSS candidates.
- NNSA Counter Terrorism Operations Support (CTOS) staff attended the training to see if it is ready for the FEMA Radiological Emergency Preparedness (REP) Program catalog.
- They were favorably impressed, and are working with us toward hosting additional courses on the east and west coast.
- LLNL training development staff subsequently revised the ten training blocks for extensive student and NNSA, DHS S&T, CTOS, FEMA CBRN and other observer feedback.
- Once in the REP catalog, students can train on FEMA-sponsored travel funds just like many state and local responders do now for other courses.

Our First ROSS Candidate Class

- Roland Benke, Atom Consulting of Texas
- Steve Cima, private consultant from Texas
- Ken Gavlik, Philotechnics of Tennessee
- Michael Geier, Palm Beach County, Florida
- Jim Griffin of MJW Technical Services, New York
- Michael Howe of FEMA, Washington, DC
- Kim Kearfott, University of Michigan
- Angela Leek, Radiation Control Program Director, Iowa
- Susan Masih of Sunflower Medical Physics, South Dakota.
- Matt McKinley, Radiation Control Program Director, Kentucky
- Toby Morales of Arizona Radiation regulatory Authority
- Norman Miller of Tennessee Radiation Control Program
- Jennifer O'Riorden of Brigham & Women's Hospital, Massachusetts
- Chris Salz of the Ohio Emergency Management Agency
- Jeff Semancik, Radiation Control Program Director, Connecticut
- David Stuenkel, Trinity Engineering of Ohio

Exercised ROSS are Bill Irwin of Vermont, Kay Foster of Illinois, Ken Yale of Michigan and Jeff Semancik of Connecticut.

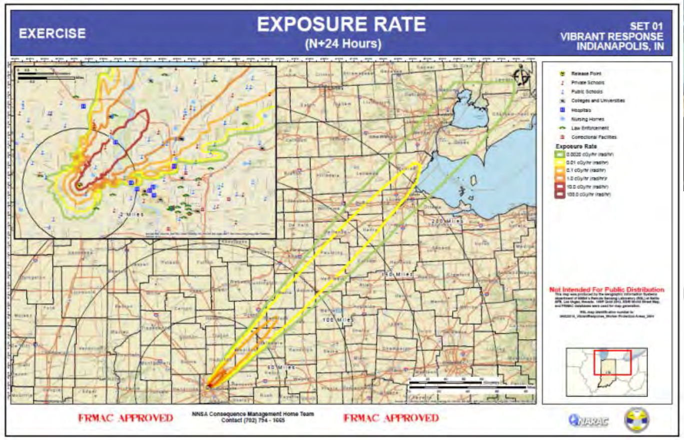
The Curriculum

- ROSS cadre management (activation, care and feeding, continuing training, compensation, demobilization).
- How ROSS can integrate into the incident command and emergency management organizations most effectively
- Guidelines, standards and references the ROSS may use to provide the best recommendations for decision makers or those advising decision makers.
- The complex characteristics of RDDs, nuclear facility releases and nuclear detonations, and their human, environmental and societal effects.

The Curriculum

- Effectively communicating complex and sensitive information with responders, leadership and the public
- Software, tools and applications that can help the ROSS provide the best information about conditions and expectations early and often.
- Selection and application of the most appropriate guidance during all phases of incident response and recovery.

RADIOLOGICAL OPERATIONS SUPPORT SPECIALIST
R.O.S.S.



Dr. John Nastrom of the National Atmospheric Release Assessment Center teaching students about the software used to project source releases, deposition from releases, doses from plumes and deposition and how to customize data products for better decision-making guidance.

RADIOLOGICAL OPERATIONS R.O.S.S. SUPPORT SPECIALIST

- Instructors included the nation’s leading scientists and radiological emergency preparedness experts.

- Content included deep dives into resources, references, tools and applications.

- Efficiently and effectively communicating recommendations to decision-makers was heavily emphasized and repeatedly exercised.

Three Years of Focused Development

- Our goals are to develop at least 200 ROSS over the coming years.
  - We want multiple ROSS in every state who can respond within minutes of an incident's start.
  - ROSS can be part of existing state or local organizations, as well as come from outside organizations like universities and industry to compliment existing staff.
  - ROSS can serve as primary technical advisors or technical specialists in those jurisdictions that do not have sufficient full-time staff should the worst occur.
  - ROSS can also be deployed to other states where the need exists.
  - ROSS can help write and exercise plans, as well as respond during exercises and incidents.
- With this cadre, FEMA is developing management processes to maintain ROSS skills and connectedness, to activate ROSS for exercises and real events, and to support the ROSS when activated, in a fashion similar to that used for Urban Search and Rescue Teams.

Priority Actions: **Are Existing Plans Sufficient for the Evolving Threat Environment?**

- Integrate IND/RDD response capabilities & protective actions into existing state/local plans. Advocate for a strategic National approach.
  - Though federal resources will eventually come to help, all emergencies are local incidents and state and local resources must be depended on in the first hours and days,
  - The ROSS has been developed to enhance state and local response capabilities by an interagency collaboration that has focused on closing a national gap for the past fifteen years.

Priority Actions: **Are Existing Plans Sufficient for the Evolving Threat Environment?**

- Leverage/transfer knowledge in IND preparedness planning through Regional and National collaboration and link to existing plans for natural disasters.
  - The ROSS are recruited from state and local pools of radiation protection professionals, and taught the most recent approaches to rad/nuc preparedness, response and recovery by the nation's leading experts.
  - While valuable for actual emergencies, the ROSS' greatest role will be preparing our nation for response and recovery through skilled and knowledgeable planning.

VENTURA COUNTY

PUBLIC HEALTH

A Department of Ventura County Health Care Agency

VENTURA COUNTY
PUBLIC HEALTH
A Department of Ventura County Health Care Agency

March 6, 2017

LOCAL PREPAREDNESS

Achieving Our Local Nuclear Objective

Robert M. Levin, MD
Health Officer, Ventura County, California

VENTURA COUNTY
PUBLIC HEALTH
A Department of Ventura County Health Care Agency

ARE WE PREPARED?
IF NOT, WHAT'S KEEPING US FROM GETTING THERE?
WHAT CAN WE DO?

Are we prepared for a nuclear attack at the local level?

Are you $#@&!^% nuts?

VENTURA COUNTY PUBLIC HEALTH

What is a fair test of our preparedness?

When the majority of people in our country know where to go and what to do.

VENTURA COUNTY PUBLIC HEALTH

And when would that be?

When people can recall and complete a simple mantra.

Stop, drop and…

Only you can prevent…

If you drink, don't…

In California, for a long time, we had…

Use a gun, go to jail!

This morphed into…

Play the accordion, go to jail!

Others in the works but not there yet…

Prophylactics: No glove, no love.

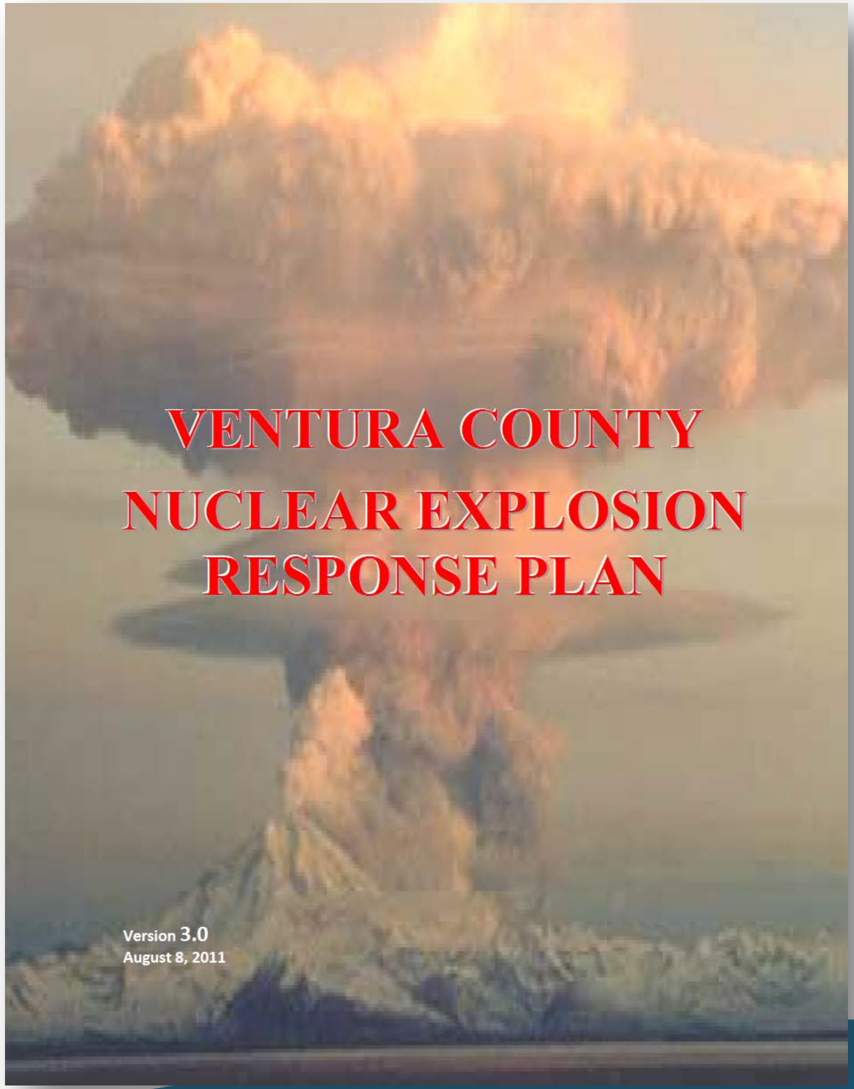
Earthquakes: Drop, cover and hold on.

Active shooter: Run, hide, fight.

We must promote one message

Get inside, Stay inside, Stay tuned.

The Ventura County Nuclear Explosion Response Plan



VENTURA COUNTY PUBLIC HEALTH

Law Enforcement Plan

VENTURA COUNTY PUBLIC HEALTH

How could we learn which way the fallout cloud was heading?

Create our own plume tracking group.

What we've done in Ventura County

VENTURA COUNTY PUBLIC HEALTH

Challenges

Tremendous!

- FEMA
- State Officials
- Nearby Los Angeles officials
- Local elected officials
- Local appointed bureaucrats and administrators

The campaign was announced through the press

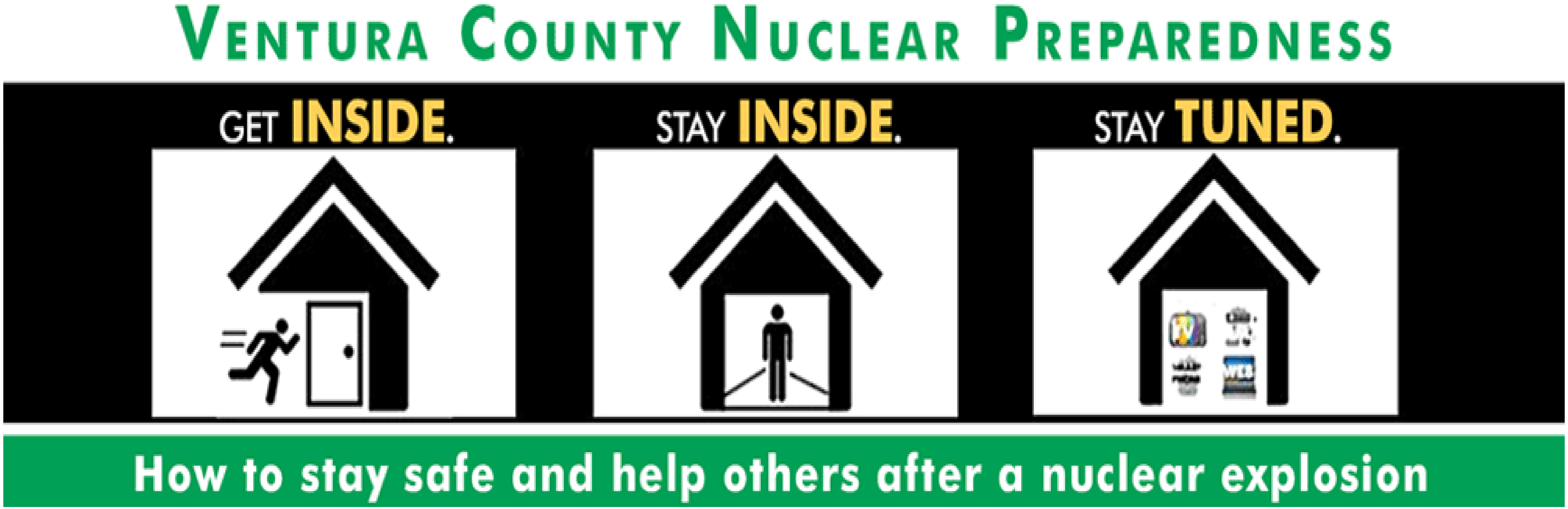
“What do you know that we don’t know?”

What else have we done?

Town Hall Meetings.

VENTURA COUNTY PUBLIC HEALTH

"Get Inside. Stay Inside. Stay Tuned."



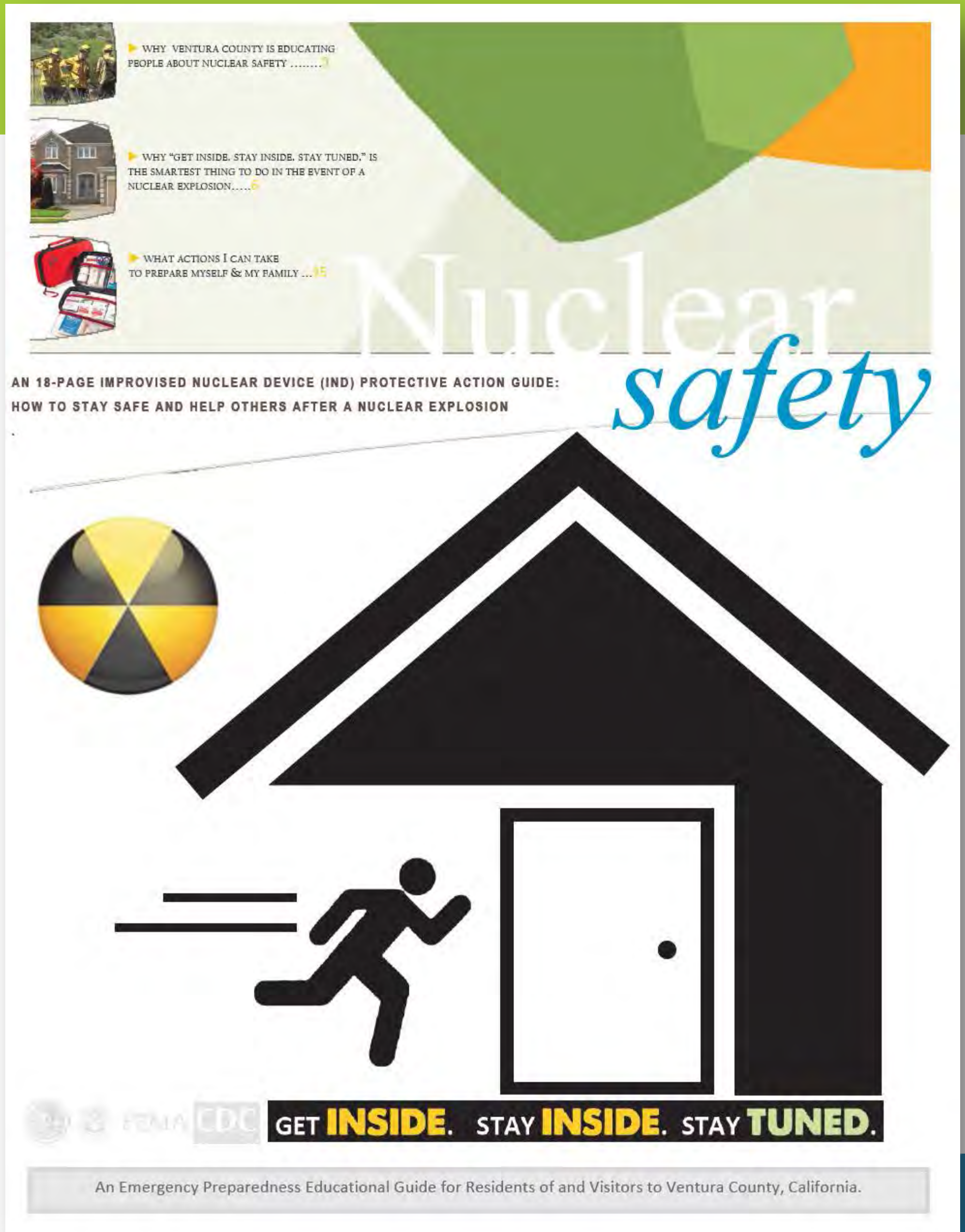
VENTURA COUNTY PUBLIC HEALTH

A phone bank was established

VENTURA COUNTY PUBLIC HEALTH

We emphasized helping our neighbors.

We created an 18 page educational document to educate the general public.



VENTURA COUNTY
PUBLIC HEALTH

A web site was created

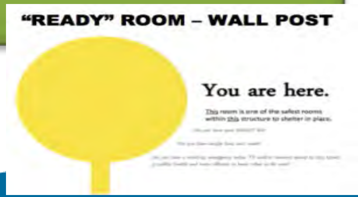
GET INSIDE. STAY INSIDE. STAY TUNED.

How to stay safe and help others in the event of a nuclear explosion

What is a nuclear explosion?	Why must I know how to survive?	How can *I* survive a nuclear explosion?	How can I help *others* survive?	What is "Get Inside. Stay Inside. Stay Tuned?"
What if I have kids?	What if I own pets or farm animals?	Where do I get an emergency kit?	How can I get more involved?	How can I learn more?

Learn more about how to survive by watching our PSA, reading our FAQs and by downloading our 18-pp informational guide

FAQ



A letter was sent to all parents of school children.

Dear Parents and Guardians:

In the coming weeks, Ventura County will commence an educational public health campaign that is the first of its kind in our nation. The topic: Teaching county residents how to stay safe and help others if there were ever a nuclear explosion set off by terrorists in nearby Los Angeles. Just as we prepare for all sorts of public health challenges, from earthquake safety, to fire safety to annual flu vaccinations, it's important that we also prepare for an unlikely man-made event. Why now? Good question. *We have absolutely zero knowledge of any terrorist threat to Ventura County or any other county in the country.* However, it's the responsibility of public health departments to protect and care for the residents they serve. And nuclear safety is just another one of the public health topics we think is important for residents to learn.

To give a little background, we have been developing a nuclear safety plan in Ventura County since 2006. While some people along the way have asked, "Why are you doing this? You're going to scare my family," most have said, "Thank you for taking this seriously." Ventura County's Emergency Planning Council has determined that it is our responsibility to prepare the residents of our county. We have been provided federal funding to support our efforts. This program will run for the next 18 months and will ultimately be incorporated into our ongoing education efforts.

The name of our public health program is **"Get Inside. Stay Inside. Stay Tuned."** Why? Because in the event of a nuclear explosion, the safest way to avoid dangerous radioactive fallout is to *immediately* get inside a building – and to *stay* inside that building – until public health officials say it's safe to come out.

So, why are we giving you an early heads up? As a parent myself, I recognize that if a nuclear explosion were to occur during school hours, there would be a natural tendency for me and other parents like me to rush to their children's school to pick them up. **"Get Inside. Stay Inside. Stay Tuned."** is the safest plan to follow. No matter where you are, the safest place to be is *inside* a building, *away* from the radioactive fallout. A car is not a safe place to "shelter" – and would likely put you and your children at further risk. You may, in fact, get stuck in traffic and develop serious health problems from radiation exposure.

My request for you today: Be comfortable that our schools are one of the safest places to be in an emergency, and your children will be cared for as long as necessary in the event of a nuclear explosion so that you can stay off the road and they will have healthy parents to come home to. And as of _______, 2013, please visit us on the Web at ReadyVenturaCounty.org, or email me directly at nuclearsafety@ventura.org to ask any questions you may have about nuclear safety.

Yours, in health,

Robert M. Levin, MD
Ventura County Public Health Officer

A curriculum was created for teachers to use in schools

NUCLEAR EXPLOSION PREPAREDNESS

Curriculum for School Staff

The Things Educators Need to Know to Protect Their Students: (These educational points may be used to instruct the school staff and, more particularly teachers, or they may be used by teachers to educate certain target audiences, e.g., students, parents, etc.)

There is no knowledge of any specific threat.

Get Inside. Stay Inside. Stay Tuned.

The danger to us in Ventura County will be fallout, not blast effects.

Fallout is radioactive.

Radiation in high doses can hurt us.

Most exposures to fallout in Ventura County would not be fatal. The amount of radiation reaching Ventura County in fallout, IF any radiation reaches Ventura County, will be greatly diminished by the distance from Los Angeles.

As a general principle, people are protected from radiation based on time, distance and shielding.

If there is ever a nuclear explosion in Los Angeles, we in Ventura County should all Get Inside, Stay Inside and Stay Tuned.

Parents should not come to the schools. Their children will be all right. Parents could get stuck in traffic and be exposed to dangerous amounts of radiation. (Everyone must stay off the roads. We need to keep them open for people leaving Los Angeles, for emergency vehicles and for trucks that will bring food, gasoline, etc., into and through our county.)

Get Inside the nearest solid structure.

Once inside, move to the most central part of the building, whether it's the auditorium, gym, cafeteria or a classroom. Position yourself as far away from outside walls as you can. Stay Inside.

As you've drilled, send a few students to the school's storage site to get food and water before any fallout arrives. The food and water can be kept inside, near an outside wall, without becoming radioactive.

You will have to Stay Inside for somewhere between a few hours and a day or two, or even longer.

As the time goes by, the radioactive fallout outside will become weaker and weaker.

Stay Tuned to communications systems: the radio, internet, television, EAS broadcasts, and the County's nuclear website. Stay off your cell phones. The County Health Department will tell you when it is safe to go home and provide options for how to go home. Children will not be sent to homes where no one is there.

Recommended Protocol for Communicating for and with Parents/Guardians: Parents may call 211 for questions about nuclear explosions. They may also go to www.ReadyVenturaCounty.org or e-mail questions to nuclearsafety@ventura.org In the aftermath of a nuclear explosion as with most disasters, cell and land line phone calls are highly discouraged to avoid line congestion. Text messaging may be a useful method of communication between parents, their children and teachers.

Where You Can Go To Learn More: www.ReadyVenturaCounty.org

We wrote a disaster plan for the schools

School Shelter in Place Following a Nuclear Explosion

SHELTER IN PLACE is a short-term measure implemented when there is a need to isolate students and staff from the outdoor environment to prevent exposure to airborne contaminants.

The procedures include closing doors, windows and vents; shutting down the classroom/building heating, ventilation and air conditioning (HVAC) systems to prevent exposure to the outside air; and turning off sources of ignition.

SHELTER IN PLACE allows for the free movement of staff and students within a building, although one should not leave the room until further instructions are received. Those in relocatable classrooms and buildings with exterior passageways must remain in the classroom while **SHELTER IN PLACE** is instituted. This measure is appropriate for, but not limited to, gas leaks, hazardous material spills, external chemical release, dirty bombs, and, in this case, radioactive fallout from a nuclear explosion.

Preparedness
In any emergency, local authorities may or may not immediately be able to provide information on what is happening and what you should do. Use available information to assess the situation. If you see large amounts of debris in the air, or if local authorities say the air is badly contaminated, you will want to "shelter-in-place." However, you should watch TV, listen to the radio, or check the Internet often for information or official instructions as it becomes available. If you are specifically told to evacuate or seek medical treatment, do so immediately.

a) Coordinate basic communication and reporting procedures within the school.
b) Identify population groups requiring special assistance during an emergency, e.g., special needs, and ensure that preparations are made to provide assistance.
c) Coordinate training and exercises with public safety agencies.
d) Invite HazMat or Public Health to do a walk-through at the school to determine the safest sites to shelter-in-place on the school campus for this type of event.
e) Train students from each class to collect supplies from the Emergency Storage Container to stock classrooms. Students should only be allowed to do this if there is no evidence of fallout in the air or on the ground.
f) If you intend to include a shelter-in-place option in your emergency plan, be sure to keep the following in mind:
   - Implement a means of alerting occupants to shelter-in-place that is easily distinguishable from that used to signal an evacuation. (Horns or buzzers could be confusing. Verbal announcements leave no room for misunderstanding.)
   - Train employees in the shelter-in-place procedures and their roles in implementing them.

Response
Notification will come from emergency responder or administrator.

1. Activate notification system.
2. **ANNOUNCEMENT:**
   a. Make an announcement in person directly or over the public address system:

      Example: **"Attention please. We have a hazard in the community and are instituting SHELTER IN PLACE procedures. Students and staff should remain inside with windows and doors securely closed and air conditioning units turned off. Those who are outside should immediately move to the protection of an inside room. Do not go outdoors until you receive further instructions."**

3. **PRINCIPAL/SITE ADMINISTRATOR ACTIONS:**
   a. Make an announcement on the public address system. Give clear instructions, remain calm and convey reassurance that the situation is under control.
   b. Lock down the school.
   c. If there are parents or visitors arriving at or inside the building, provide for their safety by asking them to stay – not leave. When authorities provide directions to shelter-in-place, they want everyone to take those steps immediately. No one should drive or walk outdoors.
   d. Unless there is an immediate threat, ask employees and visitors to call their emergency contact to let them know where they are and that they are safe.
   e. Aside from the preceding, ask students and teachers not to use their cell phones. This will clog the system and interfere with important emergency communications.
   f. If the school has voice mail or an automated attendant, change the recording to indicate that the school is closed, that the students are safe and the staff is committed to maintaining their safety, and that staff, students and visitors are remaining in the building until authorities say it is safe to leave. It will be more reassuring to parents and make it less likely that they will endanger themselves by coming to the school to retrieve their child, if they can speak to a live person instead of a recorded message.
   g. Quickly lock exterior doors and close windows, air vents, and fireplace dampers. Have employees familiar with your building's mechanical systems turn off all fans, heating and air conditioning systems. Some systems automatically provide for exchange of inside air with outside air. These systems, in particular, need to be turned off or disabled.
   h. Listen to the radio, watch television, or use the Internet for further instructions until you are told all is safe or to evacuate. Local officials may call for evacuation in specific areas. Be skeptical of messages that don't fit in with what you have been taught or are likely to cause panic as these may be sent by people who want to take advantage of the situation to create chaos.
   i. When clearance is received from appropriate agencies, give the **ALL CLEAR** instruction to indicate that the normal school routine can resume.

We created talking points for the PTAs

Ventura County PTA Talking Points:
Nuclear Explosion Preparedness

What is the overview of this public information campaign?
To prepare the residents of Ventura County to respond to a nuclear explosion in neighboring Los Angeles County.

Why are you educating us about this today?
In the same way we prepare for an earthquake or a wildfire, we must prepare for a nuclear explosion. Keep in mind that there is no knowledge of any specific threat. Al Qaeda has been threatening this since September 11. Nothing has changed. This is just for safety's sake.

What's the main message you want to convey?
That we will survive a terrorist detonation of a nuclear bomb; that we can help others — friends, family, whether they are from Ventura or Los Angeles County — survive; and what actions are available to us to keep us safe.

Is there a slogan that encompasses this nuclear explosion public information campaign?

"GET INSIDE. STAY INSIDE. STAY TUNED."

If a nuclear explosion is much more likely to occur in Los Angeles than in Ventura County, why should we be concerned about it?
The danger to us in Ventura County will be from fallout, not blast effects. When a nuclear bomb explodes, it creates a huge mushroom cloud composed of fallout. Fallout is radioactive. Radiation in high doses can hurt us. Most exposures to fallout in Ventura County would not be fatal. The amount of radiation reaching Ventura County in fallout, IF any radiation reaches Ventura County, will be greatly diminished by the distance from Los Angeles. We should also be concerned because people fleeing Los Angeles will need our help. We can make a huge difference in their safety and comfort if we are prepared. It's also true that there will be many more people in Ventura County eating and drinking and using our services. If we are prepared, it's more likely that there will be enough of everything for all of us.

So what steps should we take to protect ourselves?
If there is ever a nuclear explosion in Los Angeles, we in Ventura County should all:

"GET INSIDE. STAY INSIDE. STAY TUNED."

What should parents do about their children?
Parents should not come to the schools. Their children will be all right. Parents could get stuck in traffic and be exposed to dangerous amounts of radiation. (Everyone must stay off the roads. We need to keep them open for people leaving Los Angeles, for emergency vehicles and for trucks that will bring food, gasoline, etc., into and through our county.) You'll help your children the most by staying healthy and not taking a chance on getting radiation-related illness.

How do I protect myself and others I am with?
"**Get Inside.**" the nearest solid structure. Once inside, move to the most central part of the building. Position yourself as far away from outside walls as you can. "**Stay Inside.**" Get enough food and water to last everyone for two days or more if possible. You will have to Stay Inside for somewhere between a few hours and a day or two or even longer. "**Stay Tuned.**" to communications systems: the radio, internet, television, EAS broadcasts, and the County's nuclear website. Stay off your cell phones. The County Health Department will tell you when it is safe to leave your shelter.

What kind of communication is likely to be available?
Parents may call 211 for questions about nuclear explosions. They may also go to www.ReadyVenturaCounty.org or e-mail questions to nuclearsafety@ventura.org. In the aftermath of a nuclear explosion as with most disasters, cell and landline phone calls are highly discouraged to avoid line congestion. Text messaging may be a useful method of communication between parents, their children and teachers.

Are the schools prepared to take care of our children?
The schools know that, just as for any other disaster, they must care for your children, for as long as it takes. They have developed a disaster plan specific to a nuclear explosion, and they have developed a curriculum so that all superintendents, principals, teachers and school nurses are knowledgeable and on board.

Where You Can Go To Learn More: www.ReadyVenturaCounty.org

Potassium iodide guidance for physicians

Ventura County Public Health

A Division of the Ventura County Health Care Agency

BARRY R. FISHER, MPPA
Director

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Phone: 805-981-5101
Fax: 805-981-5110

ROBERT M. LEVIN, M.D.
Health Officer/Medical Director

VENTURA COUNTY PUBLIC HEALTH POSITION ON POTASSIUIM IODIDE FOLLOWING A NUCLEAR EXPLOSION

Should residents take potassium iodide (KI) in the event of a nearby nuclear explosion?

In the early hours and days following a nuclear explosion, a very small fraction of the fallout exposure will be from radioactive iodine. Nevertheless, KI, a medication that can protect humans from the effects of radioactive iodine, can provide some small benefit. Public Health's concern is that KI will be seen by some as a total body anti-radiation drug rather than a drug which protects only the thyroid gland. As a result of this misconception, we are concerned that people will leave their best protection (shelter) to go to the pharmacy to buy this medication. The chances that the pharmacy will be open are small as are the chances that KI can be found there.

Ventura County will **not** be supplying KI to the residents of our county. However it is available without a prescription over the internet and at some pharmacies. It is inexpensive and it has a long shelf life. KI can be purchased for as little as $4. For it to be most effective, KI must be taken <u>before</u> exposure to the radioactive iodine present in fallout. That means it could be taken after the confirmation that there has been a nuclear explosion nearby and that legitimate government sources state that the fallout cloud is likely headed your way. (Diminishing benefit can be seen with KI usage out to 4 hours following exposure to fallout.) The adult dose is 130 mg by mouth to be repeated each day radiation exposure is a risk. This should not be for more than one to three days. For children 4 to 18 years, the dose is 65 mg; age one month to 3 years 32.5 mg; and for children less than 1 month of age 16.25 mg mixed with a liquid such as low fat milk.

Who should or should not take KI when the public is told to do so:

Children are most susceptible to the dangerous effects of radioactive iodine. The FDA and the World Health Organization (WHO) recommend that children from newborn to 18 years of age all take KI unless they have a known allergy to iodine.

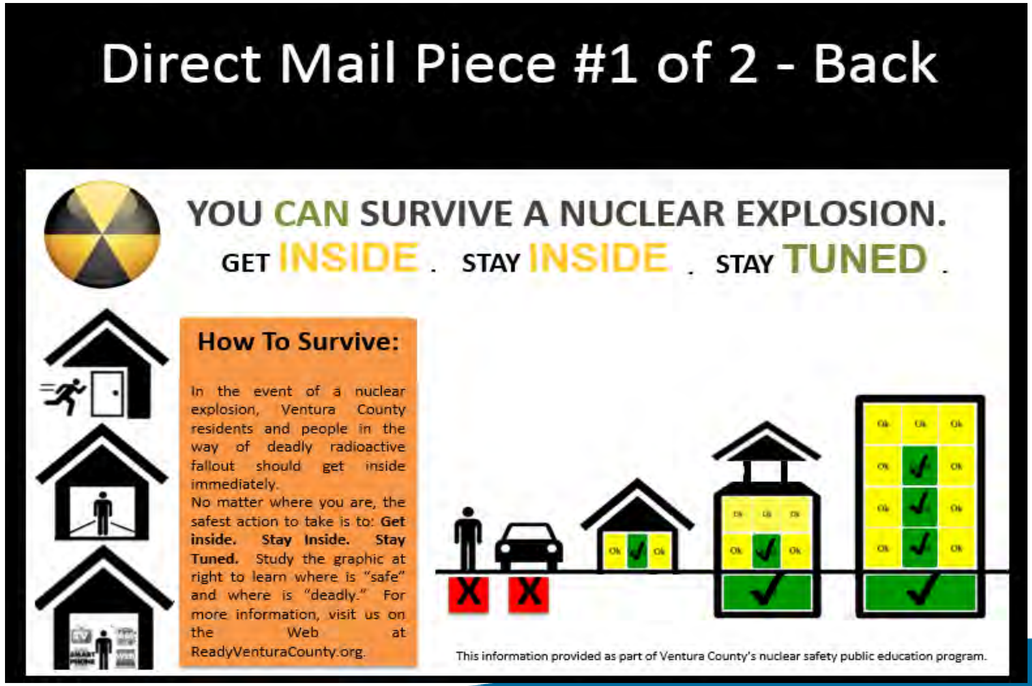
Women who are breastfeeding should also take KI according to the FDA and WHO, to protect both themselves and their breast milk. However, breastfeeding infants should still be given the recommended dosage of KI to protect them from any radioactive iodine that they may breathe in or drink in breast milk.

Young adults between the ages of 18 and 40 have a smaller chance of developing thyroid cancer or thyroid disease from exposure to radioactive iodine than do children. However, the FDA and WHO still recommend that people ages 18 to 40 take the recommended dose of KI. This includes **pregnant and breast-feeding women**, who should take the same dose as other young adults.

Adults over the age of 40 have the smallest chance of developing thyroid cancer or thyroid disease after an exposure to radioactive iodine, but they have a greater chance of having an allergic reaction to the high dose of iodine in KI. Because of this, they **are not recommended** to take KI unless a very large dose of radioactive iodine is expected. People should listen to announcements from emergency management officials for recommendations after an incident.

VENTURA COUNTY PUBLIC HEALTH

A mailer



VENTURA COUNTY
PUBLIC HEALTH

Just-in-time pocket guidance

Get Inside. Stay Inside. Stay Tuned.

(1) Duck & cover if you see a flash: Stay down behind cover for at least two full minutes. Any type of cover could prevent serious burns and injuries from flying and falling debris such as broken glass. Keep your eyes closed during the bright light to prevent blindness.

(2) Get Inside. Stay Inside. Stay Tuned. Shelter-in-place by going underground or to the center of a middle floor of a nearby, stable, large building. If at home, go a ground floor room the farthest from outside. Close windows and doors. It may be necessary to shelter for 24 to 48 hours or even longer. Keep disaster kits containing food, water, medications, and other supplies in your vehicle, at work, and at home (see reverse side). Maintain communications (Rule 5).

(3) Radioactive Fallout could look like sand, salt, smoke, or even ash that will fall and accumulate on the ground and horizontal surfaces. The direction of the fallout cloud spread depends on surface AND upper level winds. Stay upwind especially if it is daylight and you can see the direction of the fallout cloud. Any visible fallout represents immediate danger and exposure to even small amounts, only detectable by radiation monitoring instruments, should be avoided. You can avoid radiation exposure if you Get Inside. Stay Inside. Stay Tuned. Shut off ventilation, air conditioning and close chimneys.

(4) Radiation levels from deposited fallout decrease rapidly in the hours after detonation. As a rule of thumb, if fallout deposition is complete by 1 hour after detonation, the radiation level at 7 hours drops to 10% of the radiation level at 1 hour, and the radiation level at 2 days drops to 1% of the radiation level at 1 hour. However, depending on wind and weather, fallout deposition miles from a detonation may continue or even begin after 1 hour, and the radiation level may rise at first before dropping off.

(5) Maintain communications with the local authorities by monitoring the radio, TV, or the Internet. Follow the directions of local authorities.

(6) Protective equipment for the public: Fallout contamination will collect on outer garments and exposed body parts. Masks or improvised breathing protection (several layers of cloth) may be used during fallout cloud passage.

(7) Contamination removal: To avoid bringing fallout contamination into your shelter or home, most contamination can be removed by taking off the outer layer of clothes, wiping exposed hair and skin areas, and/or by taking a shower.

(8) Orderly evacuation of your shelter-in-place location when told by authorities it is safe to leave the area. Do not leave your shelter to pick up children. Children will be sheltered at their school/care location and evacuated as directed by authorities. Follow the directions of emergency responders. Stay off the road, unless you are told specifically what routes are open and flowing.

(9) Hazard avoidance: Unless threatened by fire or building collapse, avoid outdoor exposure during the first minutes and hours after the fallout arrives. It is safe to consume food and beverages that were not outside during the fallout cloud passage.

(10) Stay in control: By following the above rules, you will know the proper actions to take and will not panic during a nuclear emergency.

Disaster Kit Contents

Adapted by Ventura County Public Health from: Homeland Security Committee of the Health Physics Society – http://hps.org/hsc/

A first-aid kit with bandages, gauze, tape, tweezers, antibiotic ointment, pain medication, and cleaning wipes	Three day* supply of nonperishable food (canned or freeze-dried) for each family member
Hand-cranked radio so that you can hear disaster reports	Battery-operated cell phone charger
Battery-operated or hand-cranked flashlight	Three day* supply of bottled water per person
Nylon or plastic tarp / Mylar blankets	Multipurpose tool / Work gloves
Matches / Extra batteries	Duct tape / Extra Clothing
Items for special needs, e.g., infants, elderly	Prescription medication*

*A 2-week supply of your disaster kit contents is even better.

For more information visit our website at www.readyventura.org or call 800-781-4449.

You may also email us at nuclearsafety@ventura.org

VENTURA COUNTY PUBLIC HEALTH

Frequently asked questions

Frequently Asked Questions (FAQs) Regarding Nuclear Explosions For Ventura County Residents and Guests

What is an Improvised Nuclear Device (IND)?

INDs are nuclear weapons. They are about the size of, or smaller than, the atomic bomb used over Hiroshima in World War II. They are one one-thousandth the size of nuclear bombs that were put on the heads of intercontinental ballistic missiles during the Cold War era. An IND is a small, untested, makeshift device that could be detonated anywhere, most likely in a highly populated urban area. Compared to traditional military-grade nuclear weapons, INDs are more compact, mobile, less reliable, and can be detonated without warning. Recent modeling conducted by the Department of Energy indicates that a significant amount of city-level destruction would result if one of these INDs were detonated. The mobility of an IND combined with growing capabilities of terrorists to build these weapons raise concern for the likelihood of a possible explosion somewhere in the world.

What are the effects of an IND explosion?

The effects associated with an IND explosion fall into two categories: "prompt effects" and "delayed" effects.

The *prompt effects* are the instantaneous results of the explosion, occurring within the first minute following explosion. At the moment of the blast, the heat of an enormous fireball vaporizes all matter within the immediate blast zone. This area would correspond to about five city blocks out from the center of the blast. The vaporized material is thrust upward by the intense heat of the fireball, creating the distinctive mushroom cloud associated with a nuclear explosion. The explosion causes a crushing shockwave that is capable of toppling buildings, breaking windows, and hurling objects of all sizes with great force. Upon explosion, an IND produces energy in the form of heat and light. The intense light can cause flash blindness and the thermal pulse may cause materials and skin to burn. The explosion would also release ionizing radiation. Finally, the blast releases a limited Electro-Magnetic Pulse (EMP) that interferes with or prevents the operation of electronic devices.

The primary *delayed effect* from an IND nuclear explosion is fallout, which is generated when the dust and debris excavated by the explosion are combined with radioactive fission products produced in the nuclear explosion and are drawn upward by the heat of the blast. As the cloud rapidly climbs through the atmosphere, the highly radioactive particles combine and drop back down to earth as the cloud cools.

What are the main dangers of an IND?

The prompt effects associated with an IND explosion would be greatest nearer the center of the blast. The primary hazard from fallout does not occur from breathing the particles, but from exposure to the radiation given off after particles settle on the ground and buildings. This can cause serious health effects and even death, depending on severity and length of exposure. A higher concentration of these radioactive particles falls near the blast zone; severity decreases with distance from the blast. Although highly dependent on weather conditions, the most dangerous concentrations of fallout particles (i.e., potentially fatal to those outside) occur within 10 miles downwind of the event and are clearly visible as they fall, often the size of sand, table salt, or ash.

Despite the catastrophic effects an IND would have, it is important to note the smaller scale of an IND incident. In most urban areas, a majority of the population will be outside the immediate blast area and, therefore, able to be helped or provide assistance to others in need.

What preparations can I make for an IND explosion?

Preparing a Shelter in Your Home

- The safest place in your home during an emergency involving radioactive material is a centrally located room or basement. This area should have as few windows as possible. The farther your shelter is from windows and outside walls, the safer you will be. In California, very few homes have basements. While unpleasant, the crawl space under a house is a reasonable place to occupy to minimize exposure to radioactive fallout.
- Preparation is the key. Store emergency supplies in the shelter area. An emergency could happen at any time, so it is best to stock everything that you need in advance.
- Every 6 months, check the supplies in your shelter. Replace any expired medications, food, or batteries. Also, replace the water in your shelter every 6 months to keep it fresh.
- Make sure that all family members know where the shelter is and what it is for. Caution them not to take any items from that area. If someone "borrows" items from your shelter, you may find that important items are missing when they are most needed.
- If you have pets, prepare a place for them to relieve themselves in the shelter. Pets should not go outside during a radiation emergency because they may track radioactive materials from fallout into the shelter. Preparing a place for pets will keep the radioactive materials from getting inside the shelter.

The reception by the community

Excellent!

What to do?

To advance level of knowledge of “Get Inside. Stay Inside. Stay Tuned”:

- Movie theater PSAs
- Explore ways in which social media can best be used

What else to do?

To promote local preparedness:

FEMA and the Surgeon General must step up

- Clarify that nuclear preparedness is a local responsibility
- Have useful materials that locals can use and modify
- Attach financial rewards for local accomplishments
- Clarify that the county Health Department, with local OES assistance, is responsible and is the lead

Find a visible media champion

What else to do, continued?

To increase local nuclear emergency preparedness:

- Place more reliance on local resources like churches, synagogues and mosques for food, water, clothes and shelter
- Run exercises that are visible to the public, even if they involve road closures for brief periods
- Carefully analyze the impact of social media in terms of how it can mislead the public both in terms of falsely calling a loud explosion a nuclear event and the beneficial and harmful role it can play as the event progresses. How can this be shaped and controlled?

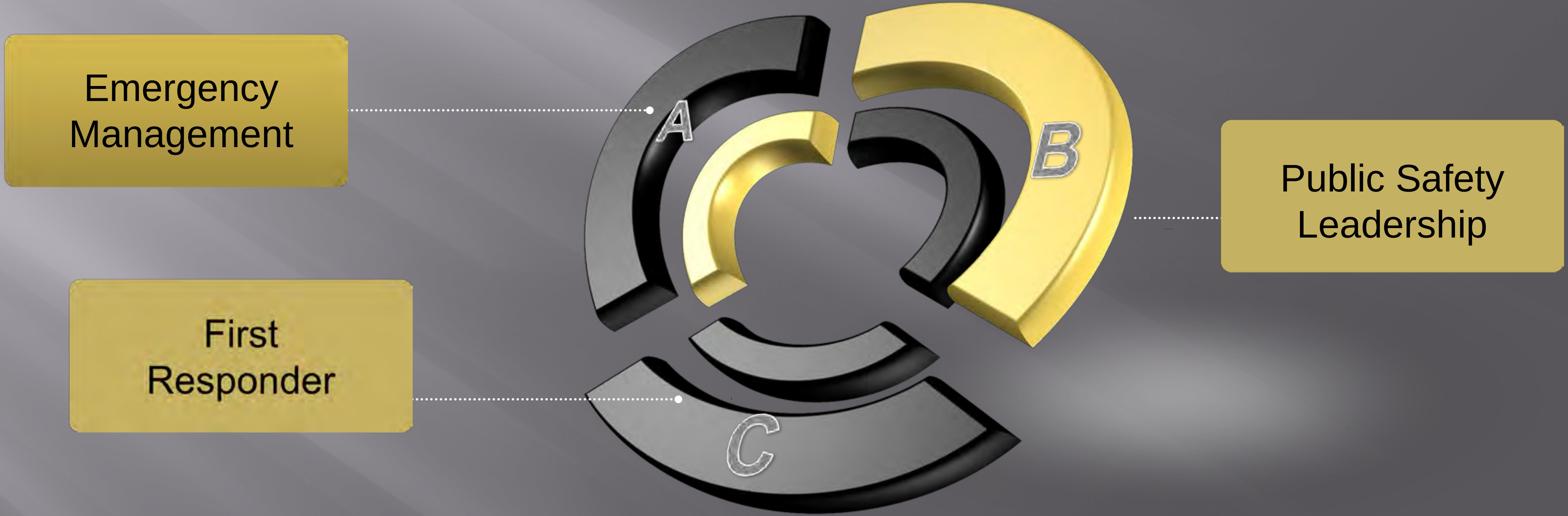
DOE/NV/25946--3144

RADIOLOGICAL/NUCLEAR PREPAREDNESS IN THE FIRST RESPONDER COMMUNITY

Chief David A. Pasquale, retired

This work was done by National Security Technologies, LLC, under Contract No. DE-AC52-06NA25946 with the U.S. Department of Energy.

Key Partners Within Response Community

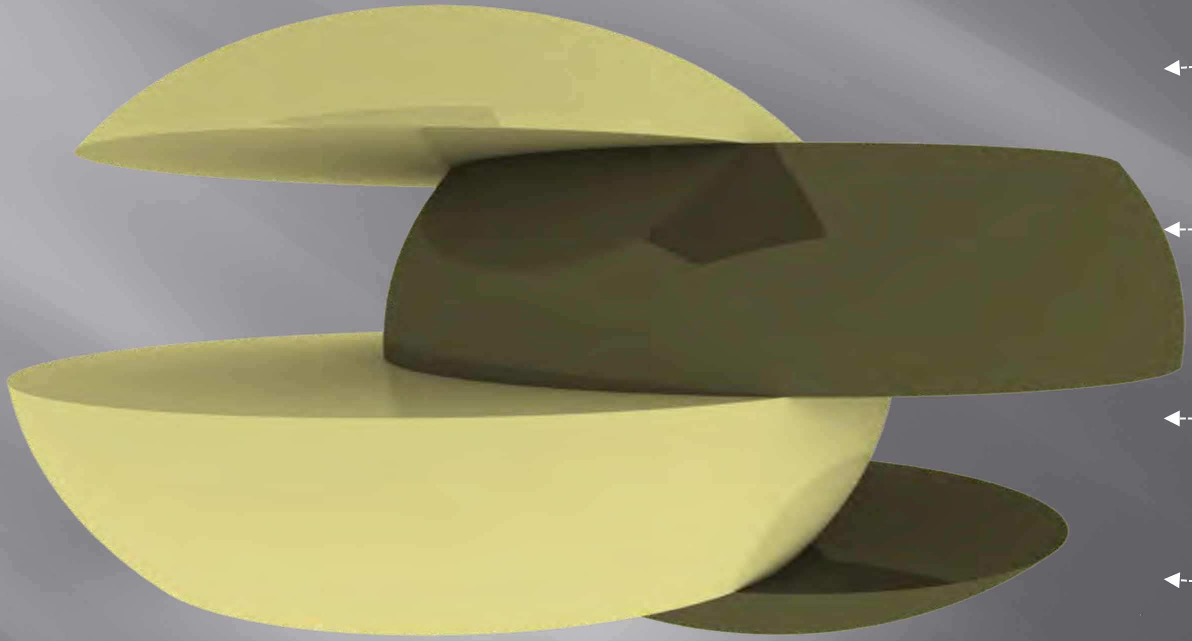


Local Leadership=Capability

Emergency Management

Primary Functions

Advisor to Chief Executive—Facilitator—Whole Community



Grant Funding

Coordination Partnerships

Training Exercise

Plan, Policy Assessment

THIRA

Public Safety Leadership

- Determine the operational direction, goals and tempo of their agencies
- Driving force behind their agencies policy, values and capabilities
  - Standard Operating Procedures (SOPs)
  - Maintaining compliance with regulatory requirements and national standards
- Provide for health and welfare of personnel

"Get your personnel home to their families at the end of shift"

PUBLIC SAFETY ADMINISTRATORS AND COMMAND STAFF

National standards, guidance and regulations used to develop SOPs

- **A** The National Fire Protection Association (NFPA)
- **B** Occupational Safety and Health Administration (OSHA)
- **C** Environmental Protection Agency, Protective Action Guide (PAG)
- **D** Radiation Emergency Medical Management Department of Health and Human Services
- **E** CDC—Emergency Preparedness and Response, Radiation Emergencies

First Responder

"Boots on the Ground"

Law Enforcement, Fire, EMS

- Training requirements have expanded
- Training Standard for Hazmat
  - NFPA 472
- Includes Annex D: For Operations Level personnel assigned to radiological incidents
- 94% prefer to learn from fellow experienced first responders

By the Numbers

- **31%** of agencies have sufficient funds to train personnel for radiological/nuclear WMD incidents
- 37% have sufficient survey equipment for all apparatus
- 54% of first responders say their agencies have developed SOPs and guidelines for a radiological incident –Only 50% have identified action levels for operations

A Nation Not Yet Prepared

Success Story

- National Wildfire Coordination Group (NWCG)
- Provides collaboration mechanism to the nation
- Develops, maintains, and communicates interagency standards
- Provides over 90 courses for wildland fire operations from boots on the ground to command level
- One curriculum for the entire nation

Coordination—Federal—State—Local

Path Forward

- NWCG concept using NFPA standards
- NCRP Leadership and guidance in standards making process
- Better integrate competencies, behaviors and tasks required for radiological response into the NFPA standards for hazmat and WMD response

A Retrospective Look at Rad Resilient City, 2011 Preparedness Checklist to Save Lives following a Nuclear Detonation

Monica Schoch-Spana, PhD

JOHNS HOPKINS BLOOMBERG SCHOOL of PUBLIC HEALTH | Center for Health Security

Overview

- What was the Rad Resilient City (RRC) checklist?
- In what context did it develop?
- Where and how was it received?
- What lessons emerged from the RRC rollout?
- What steps could advance nuclear preparedness now?

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What was Rad Resilient City?

- Undertaken in 2010-2011 by the then-named Center for Biosecurity of UPMC, with initial input from the Nuclear Threat Initiative
- Inspired by the StormReady program of National Weather Service: 5 guidelines for localities to prepare the EM infrastructure *and* wider populace for extreme weather events
- Undergirded by recent federal studies that suggested many lives could be saved post-detonation of an improvised nuclear device (IND) through adequate protection against radioactive fallout
- With expert advisor input, developed a handbook with stepwise guidance on how to build an integrated fallout preparedness system, beginning with broad stakeholder engagement and public education

Checklist for Fallout Preparedness

- ❑ 1. Obtain broad community backing for nuclear preparedness
- ❑ 2. Conduct pre-event public education on protective behaviors
- ❑ 3. Have building owners/operators rate shelters & teach others
- ❑ 4. Hone ability to deliver public warnings post-incident
- ❑ 5. Establish rapid system for mapping dangerous fallout zone
- ❑ 6. Develop capabilities for a large-scale, phased evacuation
- ❑ 7. Integrate, test, and train on all preparedness elements

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Political Context for RRC Development

"Two decades after the end of the Cold War, we face a cruel irony of history – the risk of a nuclear confrontation between nations has gone down, but the risk of nuclear attack has gone up."

– President Obama, Opening Plenary Session of the Nuclear Security Summit, April 13, 2010

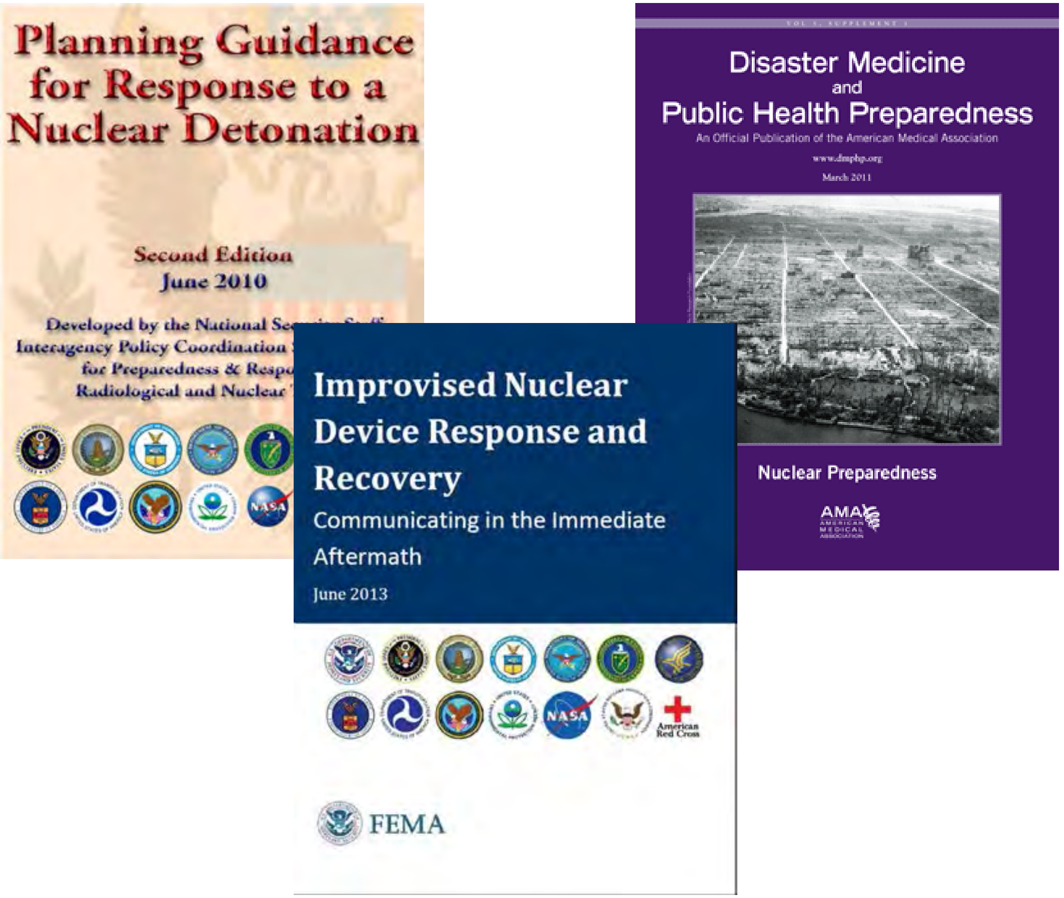
"Nuclear terrorism is the most serious danger the world is facing."

– Mohamed El Baradei,
former Director General, International Atomic Energy Agency;
Winner, 2005 Noble Peace Prize, February 1, 2009

"We judge that, if al-Qa'ida develops chemical, biological, radiological, or nuclear (CBRN) capabilities and has operatives trained to use them, it will do so."

- *Annual Threat Assessment of the Intelligence Community for the Senate Armed Services Committee*;
Director of National Intelligence, Dennis C. Blair, February 2, 2010

Technical Context



Where and How was RRC Received?

- Briefed at 21 venues, from National Press Club rollout (Sept 2011) to International EMS/Disaster Management Conf (April 2013)

- Presented at national professional conferences (e.g., IAEM, PHP, NREPC, NCRP, CRCPD, NLC, BOMA), Congressional seminar, and several mid-Atlantic fora on public health & safety

- Audiences included emergency managers, public health officials, building owners/managers, disaster researchers, radiation professionals, contingency planners, Congressional staffers, local elected officials, and disaster relief volunteers

Reactions to RRC

- Government officials at all levels, emergency managers, health officials, care providers, and building owners welcomed the tool
- Enthusiasm for Checklist motivated by fact that:
  – Trusted NGO was willing to take "political hit" for taboo subject
  – Technical information was translated into action steps

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“You all have done a wonderful job on this project, and as an end user, all I can say is a big and hearty ‘thank you’!”

— Special Advisor, Emergency Preparedness and Response, Inova Health System

“I just got my copy of the Preparedness Checklist. Have just skimmed it and it looks like a really useful document. We will make use of it as we move forward. Thank you and your team for taking the time to help us begin to assess the gaps between risk and capability and between reality and generational fears.”

— Director, Office of Preparedness and Response
State Department of Health and Mental Hygiene

“What you all are doing is very vital to our nation.”

— Director, Disaster Services
American Red Cross Northeast Area

Johns Hopkins Bloomberg School of Public Health | Center for Health Security

"In *World at Risk*, we expressly recommended the development of 'a publicly available checklist of actions each level of government should take to prevent or ameliorate the consequences of WMD terrorism. Such a checklist could be used by citizens to hold their governments accountable for action or inaction.' The Rad Resilient City project has answered this call to action."

— Senator Bob Graham (D-FL), Chairman
Senator Jim Talent (R-MO), Vice Chairman
Bipartisan WMD Terrorism Research Center;
Congressional Commission on the Prevention of WMD Proliferation and Terrorism

Lessons from the Rollout Period

- Most local emergency management structures were not positioned to reverse people's fatalistic thinking nor to execute a nuclear preparedness plan that included public outreach and education

- Many leaders were unable to advocate preparedness, stymied by the belief that discussing a taboo topic was politically risky, as was spending scarce monies on such a low probability event

- Rad Resilient City was a beginning: interested users desired even more granular, operational guidance as well as a complete, "ready-to-go" public education campaign

RRC Users Today – County X

- County X had a "perfect storm" for community nuclear preparedness
  - Perceived credible threat – location outside a high value target city
  - Local champion who made the issue a personal and professional priority
  - Public-private partnership for disaster preparedness that took up the issue
  - Grant support (FEMA) to convene community meetings and produce educational materials
  - Actionable information on shelter-in-place transmitted in visually compelling form
  - Strategic focus on schools (county inspired statewide planning for sheltering-in-place)
  - Peer-to-peer assistance (Ventura County) - not having to recreate the wheel
- What would help advance their local efforts even more today?
  - Major federal campaign on the value of sheltering-in-place following a nuclear attack
  - Local follow through on earlier efforts, including engagement of new county executive

RRC Users Today – State Y

- State had a strong radiation preparedness record revolving around nuclear power plants and wanted to expand to address RDD and IND scenarios
- RRC (talk plus handbook) adopted as means to raise awareness about IND scenario among state’s county public health preparedness coordinators
- Final assessment was that RRC “didn’t take” due to:
  - Low probability: IND not in current hazard and vulnerability assessments plus overall perception that things like an IND detonation can’t actually happen
  - Issue inertia: lack of awareness among responders, emergency managers, and health authorities about IND scenario and fallout hazard
- National level steps that could advance local nuclear preparedness
  - Make readiness for IND scenario a priority; don’t downplay effects
  - Build IND and RDD awareness into mandated EPZ exercises

RRC Users Today – City Z

- RRC used as resource to inform planning for nuclear response and recovery, but to operationalize the entire checklist would be monumental effort
- Advance public education judged as essential for life-saving in an actual event, but hard to pull off
  - Worry over being seen as fear-mongering or as hiding something from the public ("what do you know that you aren't telling us?!")
- Low-probability IND scenario competing for attention with other hazards that are familiar, regularly occurring, and/or less complex
- What could help prompt community readiness for IND fallout scenario?
  - An exercise that demonstrates just how bad the impacts would be without adequately preparing the populace and the emergency management infrastructure for the fallout hazard
  - Well-placed champions who could advance the issue in the mayor's office and in their respective agencies

Potential Insights from Disaster Literature on How to Advance Nuclear Preparedness

- Sociological study of motivational factors for household disaster preparedness actions (Wood et al 2012)
  - Enlist average people in sharing what they have done to prepare with others who have not done much; people take cues from individuals just like them
  - Emphasize what actions people should take and how they offer benefit; avoid scare stories and scientific probabilities
  - Create a dense information environment: rely upon multiple disseminators to distribute a consistent message across many communication channels
- Political scientific study of disasters (e.g., Birkland 1997)
  - Sudden attention grabbing events like disasters ("focusing events") open up a window of opportunity to advance an agenda that is typically not top of mind

Possible Steps Forward

- Capitalize on peer pressure, knowing people base own actions on social cues from others
  - Create "model" cities: preparedness grants to support jurisdictions who are willing to lean into the issue
  - Mobilize "model" citizens: educate responders and volunteers (VOADs, MRCs, CERT teams) already comfortable with low probability, high impact mindset
- Leverage power of exercises to mimic the hazard, underscore value of preparedness, and build muscle memory
  - Employ EPZ exercises as natural context for follow on education regarding RDDs and INDs
  - Support IND exercises by model cities; use window of opportunity to reach people on the sidelines (e.g., Gotham Shield 2017 as teachable moment)
- For ongoing mass education, spotlight the personal protective action, not the IND detonation, knowing that people want clear answers on what to do
  - Focus on "high probability, high impact" protective actions that cut across threat scenarios
  - Advance a multi-hazard, shelter-in-place campaign (teach people times to go inside and/or stay put)
  - Balance evacuation drills with shelter-in-place drills

Theme #1: The federal government is effective at creating guidance and a systematic preparedness process, but not so at engaging and implementing it at the state and local level for technical hazards like radiation.

- NCRP has offered guidance and solutions to these complexities, some of it was adopted in Federal guidance, <u>much of it is still not visible to the response community</u> (a relatively new end user for NCRP)
- Enlist average people in sharing what they have done; people take cues from individuals just like them
- Emphasize what actions people should take and how they offer benefit; avoid scare stories and scientific probabilities

Theme #2: Preparedness at the Local Level is driven by local leadership and champions who see the problem through a “different lens” who have to overcome significant institutional, political, and social barriers associated with preparing for radiological events.

- More empowerment of the State and local champions is needed as well as support of initiatives by Federal resources
  - Expand relationships with Public Safety Leadership
- Expand visibility of existing NCRP guidance for the users to integrate and promote incorporation into both Federal guidance and standards used by the response community (e.g., National Fire Protection Association Guides)
  - Guidance needs to be a routine attribute in the fire and police academies

Dennis Mileti's Golden Rule

Director, Natural Hazards Research and Applications Information Center
University of Colorado at Boulder

Both empirical research and seasoned observation support the golden rule of public education for hazards: ***all the sophisticated materials and behavior modification techniques do not have the force of one good disaster to change both what people think, their behavior, and even public policy, at least in the short-term***. During the well-known "window of opportunity" that opens following a disaster, abundant information from various sources in the affected locale will increase the chances for changing what people think and their behavior. This is also the case for people and communities that were not directly impacted by that disaster but, "experienced" it over the media.

Theme #3: There is a limit to the amount of general preparedness and public information that can be absorbed in the absence of a perceived threat. Occasionally, events lead to a heightened concern that offers a window of opportunity for a “learning moment.”

- Anticipate and learn how to identify windows of opportunity
- Develop “right sized” information and preparedness tools
- Identify information targets and distribution mechanisms in advance
- Create a dense information environment: multiple disseminators distributing a consistent message across multiple communication channels

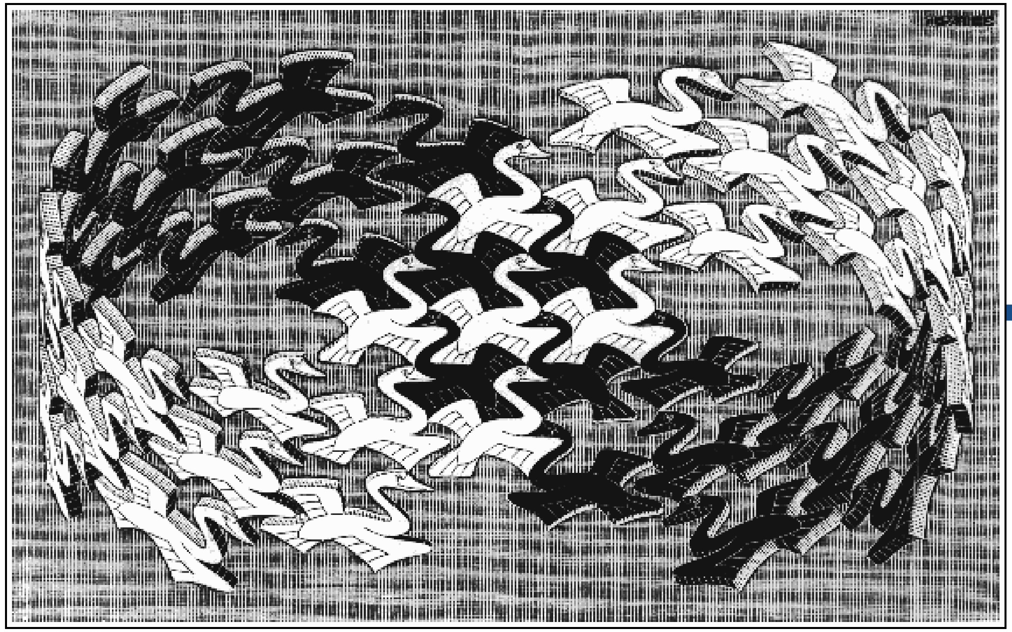
NCRP
SCIENTIFIC AUTHORITY SINCE 1929 • CONGRESSIONALLY CHARTERED •

First Receiver Gaps

Cullen Case Jr., CEM, CHEP, *National Marrow Donor Program*

- Senior Manager, Logistics and Emergency Preparedness for NMDP/BeTheMatch
- Program Manager, Radiation Injury Treatment Network
- Divemaster
- Imperial Spider Slayer
- 2016 Best Cook in the household

- Are we better prepared than 9/11?



http://psych.hanover.edu/Krantz/art/figure.html

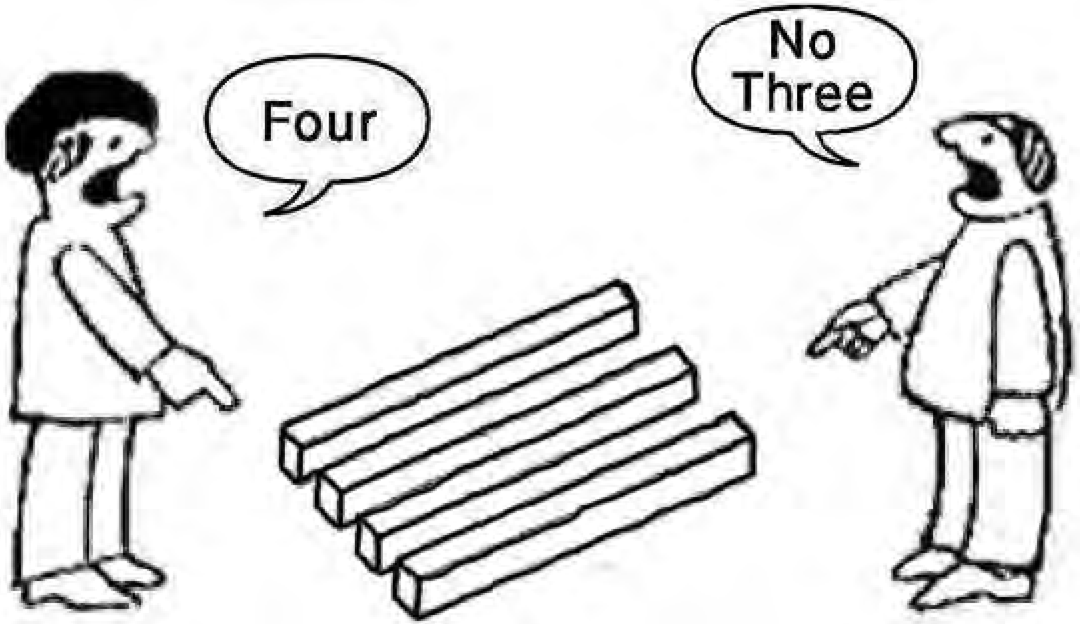
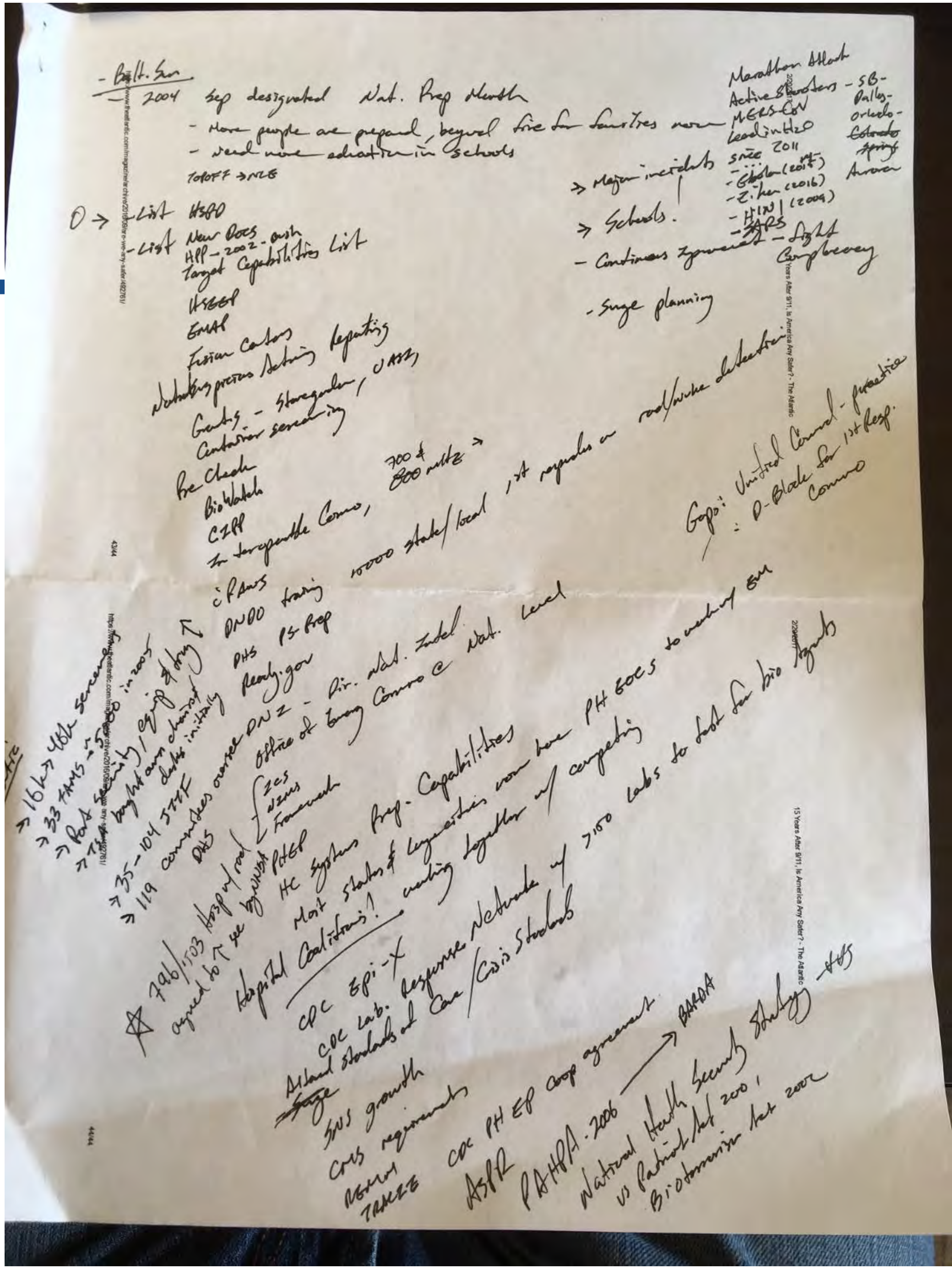


Image From; http://www.smallstepsbigchanges.com/3-perspective-hacks-cheat-sheet-living-reality-real/#axzz4aC4nIlRz (accessed 3/2/17)

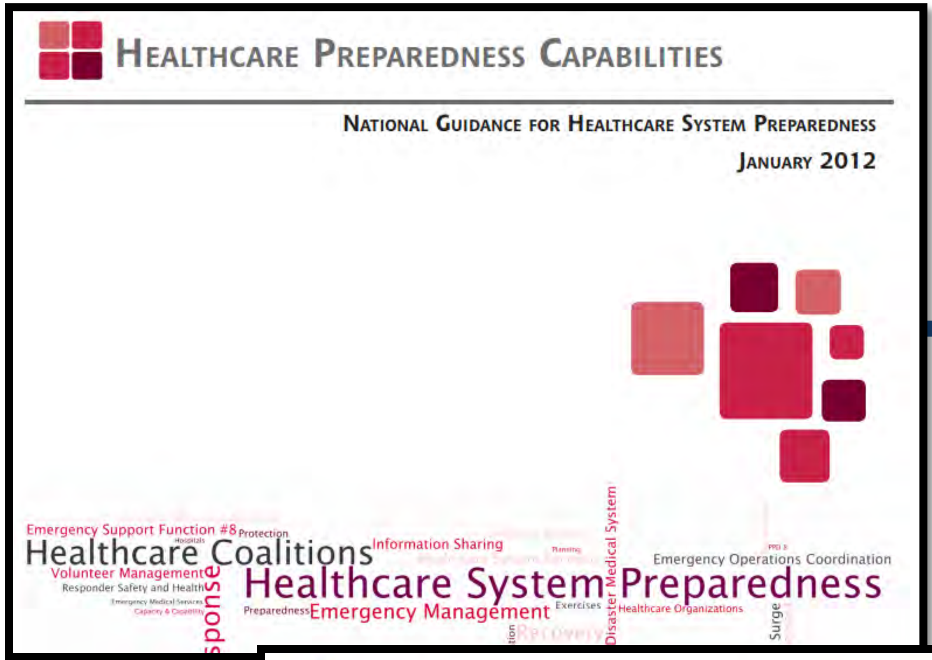
http://deskpapers.eu/infusions/photodb/index.php?item=70794

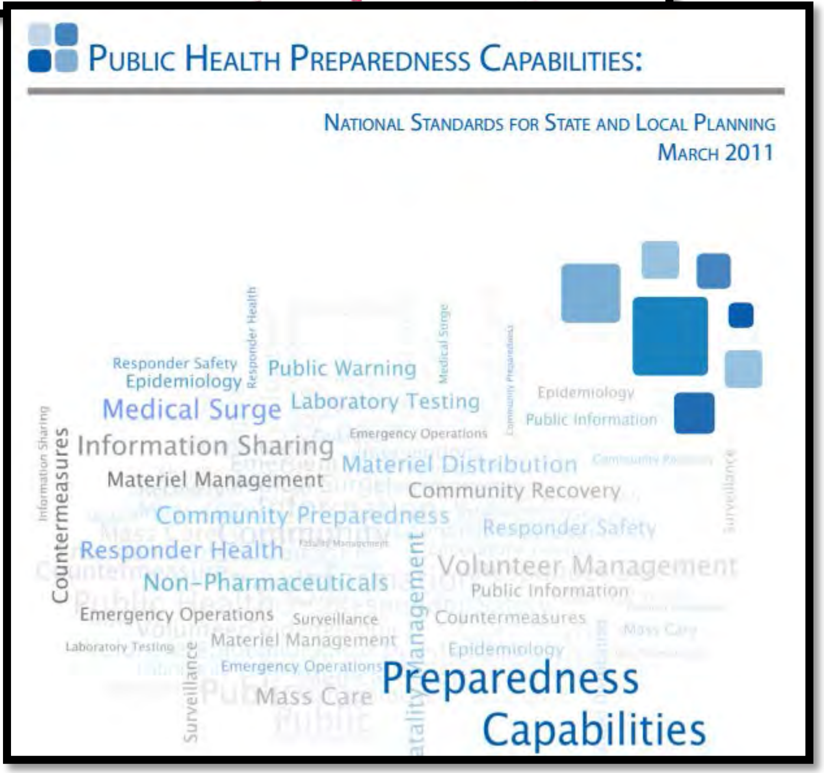
- Are we better prepared than 9/11?

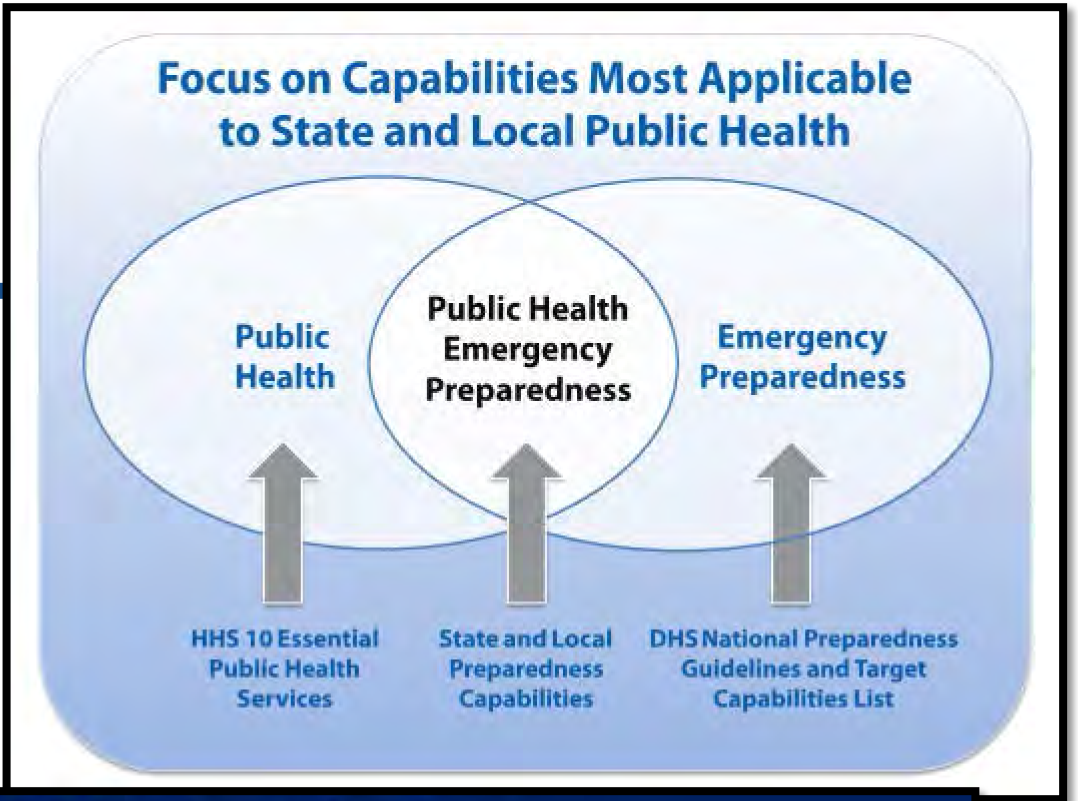


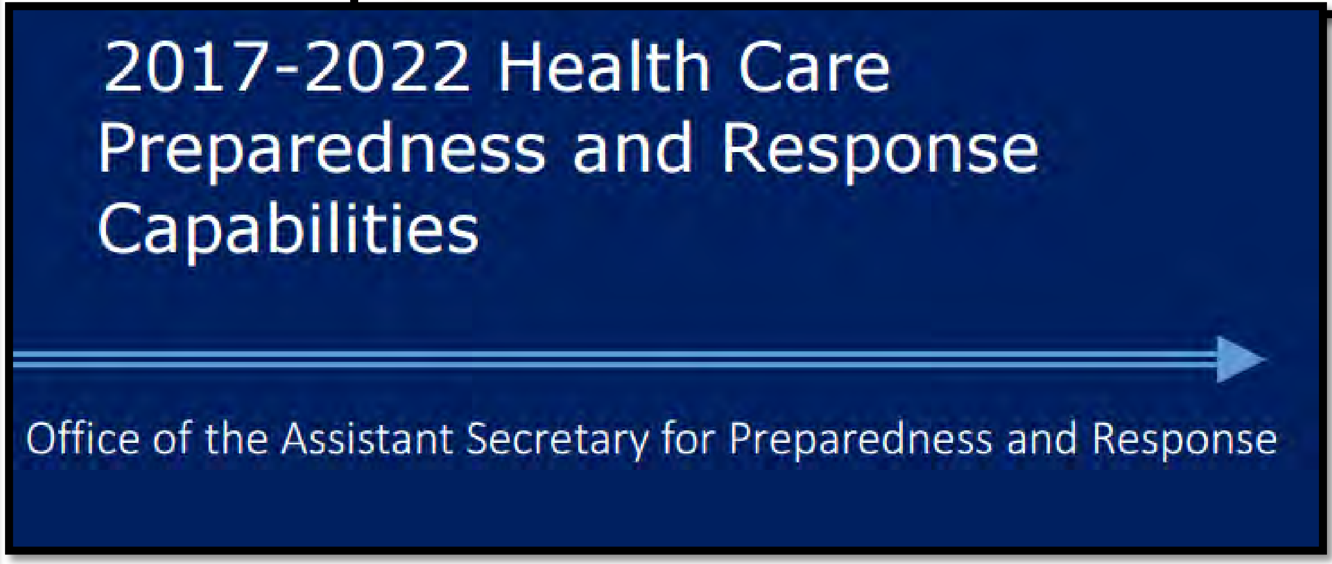
Progress since 9/11 (just a small slice)

- PAHPRA (Pandemic and All-Hazards Preparedness Reauthorization Act)
- DHHS-ASPR (2006)
- BioWatch
- BARDA (2006)
- www.REMM.NLM.GOV
- WISER
- CHEMM
- CMS Emerg. Prep requirements
- TRACIE
- ICS and NIMS
- HSEEP – standardized exercises
- EMAP – standard to measure programs
- ISO Standard
- Joint Commission Emerg. Prep Req
- Planning Guidance for Response to a Nuclear Detonation
- Medical Surge Capacity and Planning
- NIMS Implementation in HealthCare Organizations
- RDD Playbook
- State and Local Planners Playbook for Medical Response to a Nuclear Detonation
- Medical Planning and Response Manual for a Nuclear Detonation Incident: A Practical Guide
- iPaws – standardized emergency notification nationwide
- Interoperable communications progress (700 and 800 MHz)
- National Office of Emerg Commo
- DNI / Fusion Centers /
- CDCs Epi-X
- HPP (2002)
- PHEP: Healthcare Preparedness Capabilities / State level PH EOCs
- Hospital Coalitions
- NDMS under ASPR
- CDC lab response network
- Crisis Standards of Care
- Growth of SNS
- National Health Security Strategy
- Bioterrorism Act (2002)
- Grants, Grants, Grants, Grants......
- DNDO training (15,000 state and locals trained)
- Public and Industry:
- National Preparedness Month (2004)
- DHS PS-Prep


Healthcare Preparedness Capabilities
National Guidance for Healthcare System Preparedness
January 2012
Healthcare Coalitions
Healthcare System Preparedness
Emergency Management
Emergency Operations Coordination
Information Sharing
Volunteer Management
Emergency Support Function #8


Public Health Preparedness Capabilities:
National Standards for State and Local Planning
March 2011
Public Warning
Medical Surge
Laboratory Testing
Information Sharing
Materiel Management
Materiel Distribution
Community Recovery
Community Preparedness
Responder Safety
Responder Health
Non-Pharmaceuticals
Volunteer Management
Public Information
Emergency Operations
Surveillance
Countermeasures
Epidemiology
Mass Care
Preparedness
Capabilities


Focus on Capabilities Most Applicable to State and Local Public Health
Public Health
Public Health Emergency Preparedness
Emergency Preparedness
HHS 10 Essential Public Health Services
State and Local Preparedness Capabilities
DHS National Preparedness Guidelines and Target Capabilities List


2017-2022 Health Care Preparedness and Response Capabilities
Office of the Assistant Secretary for Preparedness and Response

ASPR
ASSISTANT SECRETARY FOR PREPAREDNESS AND RESPONSE

Hospital Preparedness Program: An Introduction

PROGRAM EVOLUTION

2002-2011

Facility-based equipment purchasing approach
HPP funding was disbursed directly to hospitals for purchasing equipment and supplies, including personal protective equipment, mobile medical units, and pharmaceutical caches.

2012-2016

Development of HCCs and

The Hospital Preparedness Program (HPP) enables health care systems to save lives during emergencies that exceed day-to-day capacity of health and emergency response systems.

HPP QUICK FACTS:

62 awardees – health departments within states, localities, territories & freely associated states – who support health care coalitions (HCCs)

1 year annual appropriation

98 percent of HPP awardees say that HPP has been critical to health care system preparedness

486 HCCs currently nationwide

26,271 HCC members nationwide

$255 million for each FY 2015 and 2016

Preparedness | Emergency | About ASPR | Office

Public Health Emergency
Public Health and Medical Emergency Support for a Nation Prepared

PHE Home > Preparedness > Planning > ASPR Playbooks > Radiological Dispersal Device Playb

Radiological Dispersal Device Playbook

The purpose of this playbook is to provide guidance for executive decision makers within the Depart
Human Services (HHS) in the event of an actual radiological terrorist attack in a U.S. city. Specifically
measures and options to aid the Secretary in making essential decisions and directing the HHS resp

Public Health Emergency
Public Health and Medical Emergency Support for a Nation Prepared

PHE Home > Preparedness > Planning > ASPR Playbooks > State and Local Planners Playbook > State and Local Planners Playbook for Medical Response to a Nuclear Detonation

State & Local Planners Playbook for Medical Response to a Nuclear Detonation

About this Playbook | Background Information | Action Steps

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Home > Medicare > Survey & Certification - Emergency Preparedness > Emergency Preparedness Rule

Survey & Certification - Emergency Preparedness

State Survey Agency Guidance

Emergency Preparedness Rule

Survey & Certification- Emergency Preparedness Regulation Guidance

ASPR
ASSISTANT SECRETARY FOR
PREPAREDNESS AND RESPONSE

HOSPITAL PREPAREDNESS HPP PROGRAM

NIMS Implementation for Healthcare Organizations Guidance

January 2015

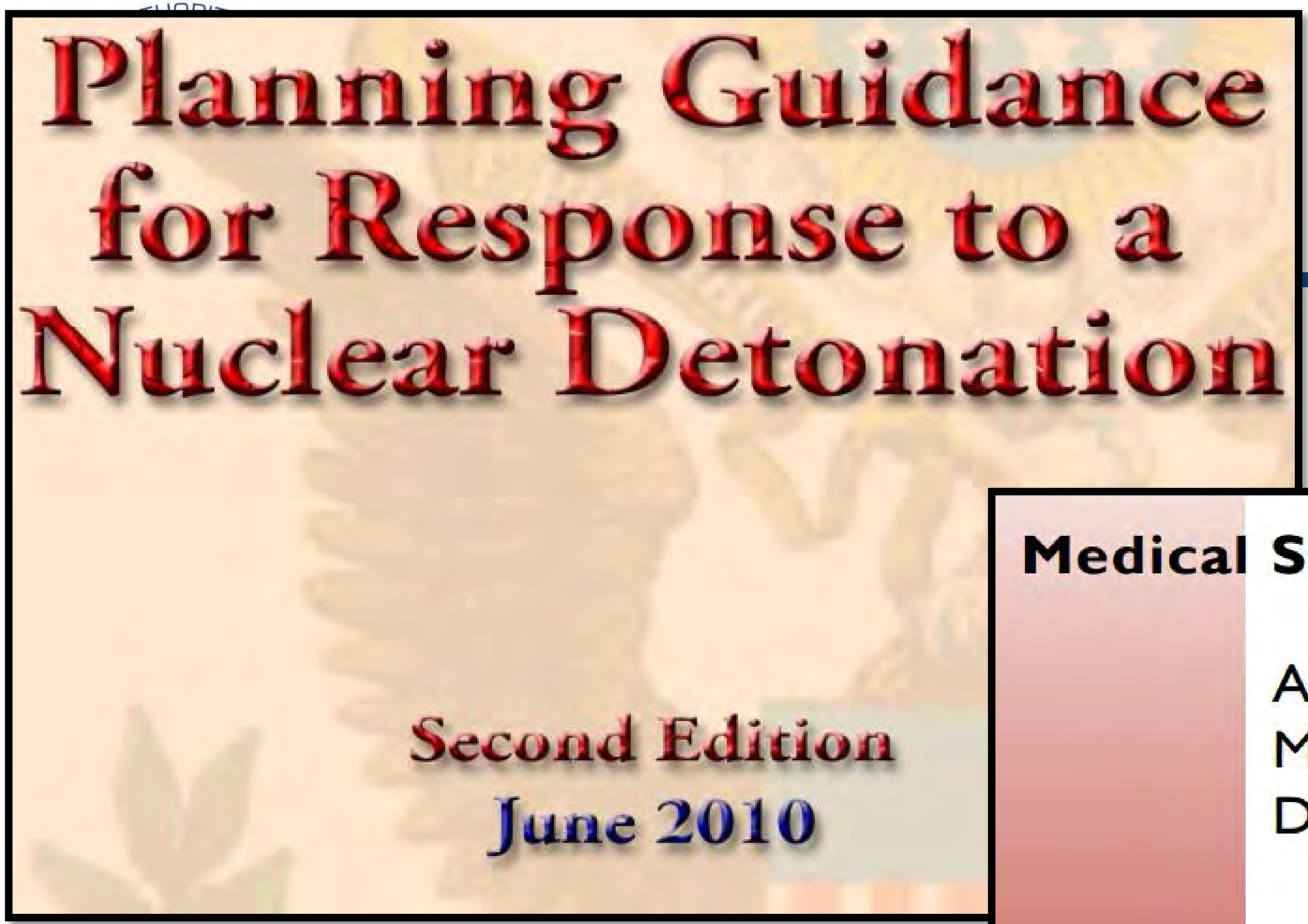
HOSPITAL PREPAREDNESS HPP PROGRAM

Healthcare
COOP & Recovery Planning

Concepts, Principles, Templates & Resources

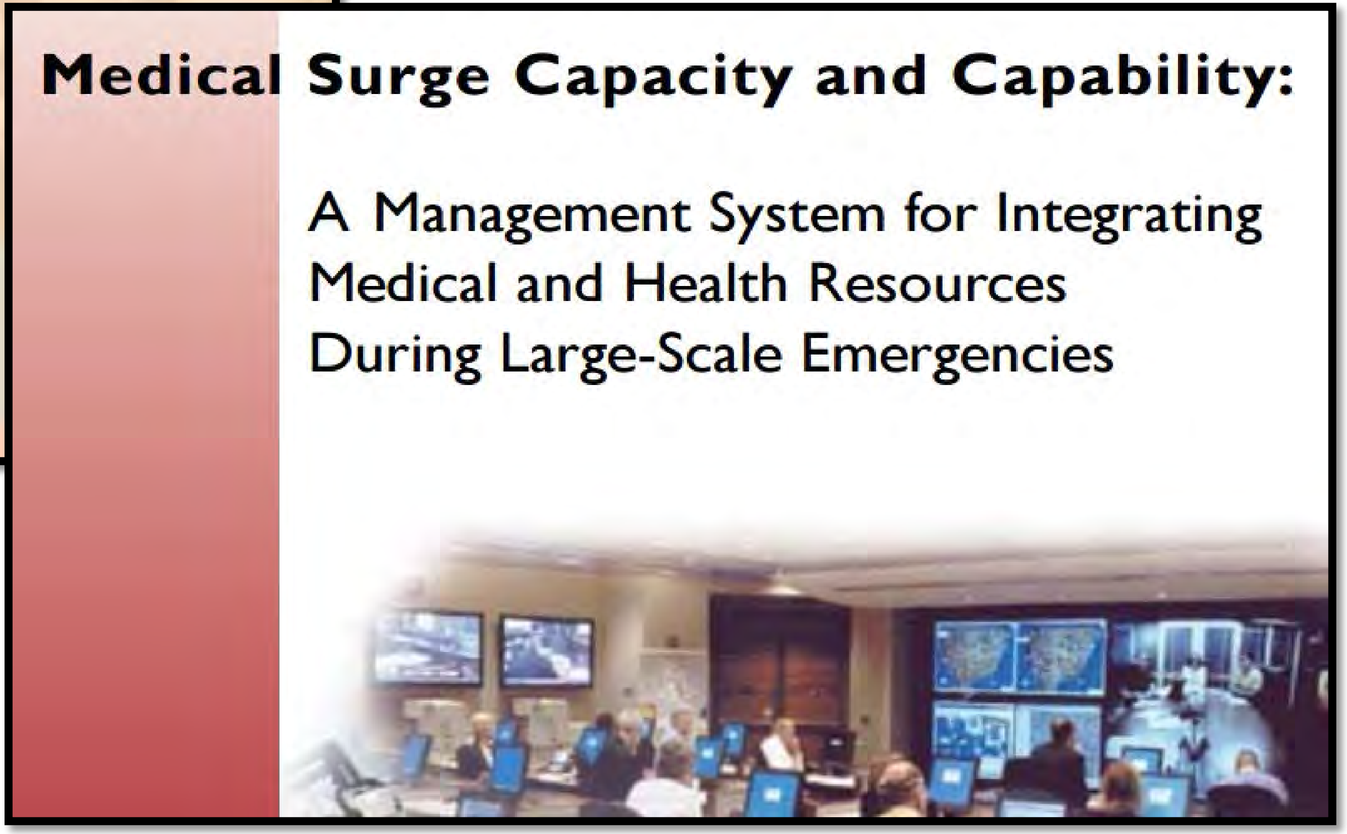
January 2015

MEDICAL PLANNING AND RESPONSE MANUAL FOR A NUCLEAR DETONATION INCIDENT: A PRACTICAL GUIDE



Planning Guidance for Response to a Nuclear Detonation

Second Edition
June 2010



Medical Surge Capacity and Capability:

A Management System for Integrating Medical and Health Resources During Large-Scale Emergencies

NIH U.S. National Library of Medicine
Specialized Information Services

WISER

Wireless Information System for Emergency Responders

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Wireless Information System for Emergency Responders

WISER is a system designed to assist emergency responders in hazardous material incidents. WISER provides a wide range of information on hazardous substances, including substance identification suppor[t] physical characteristics, human health information, and containment and suppression advice.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
ASSISTANT SECRETARY FOR PREPAREDNESS AND RESPONSE

From Hospitals to Healthcare Coalitions: Transforming Health Preparedness and Response in Our Communities

U.S. Department of Health and Human Services
Assistant Secretary for Preparedness and Response
Report on the Hospital Preparedness Program

Joint Commission
Requirement

Official Publication of Joint Commission Requirements

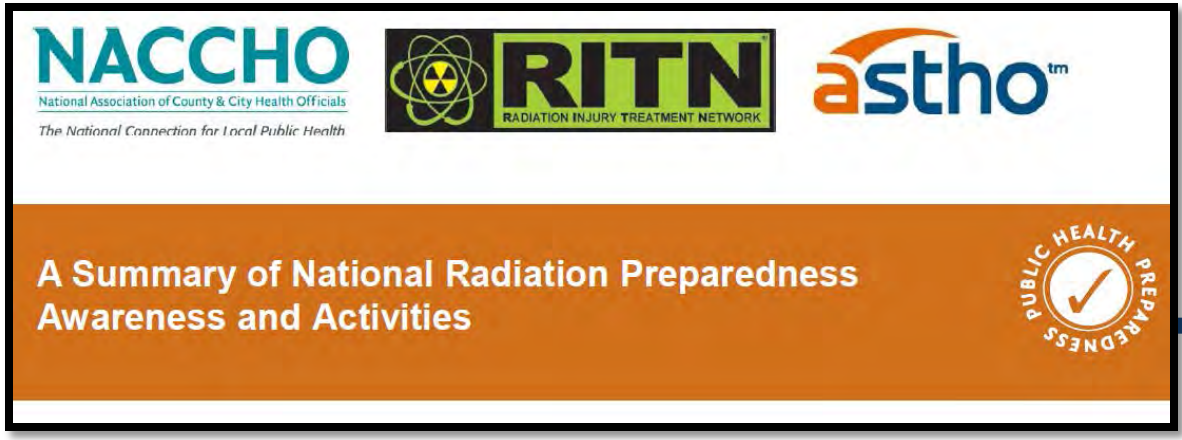
Requirements for Emergency Management Oversight

APPLICABLE TO HOSPITALS AND CRITICAL ACCESS HOSPITALS

Effective January 1, 2014

participate in reviewing emergency management reviews, or it may designate specific senior [critical access] hospital leaders to review this information.

2016 PH Survey for RITN



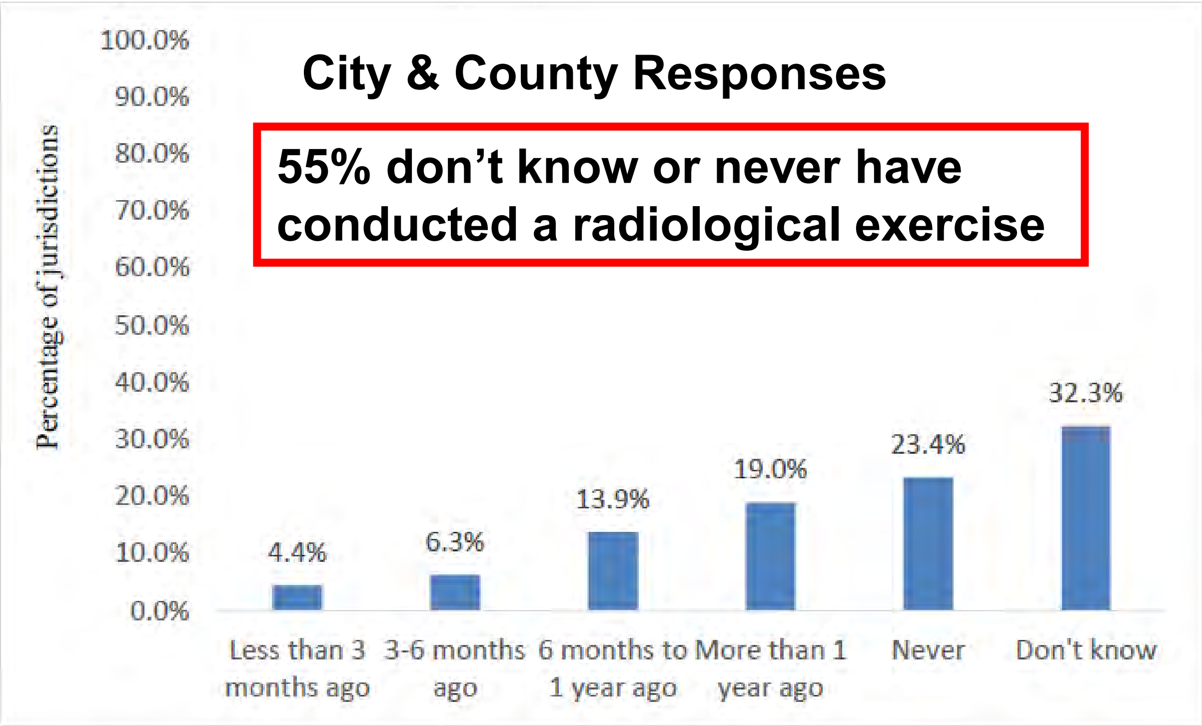


Figure 11. NACCHO survey participants' date of most recent radiological-focused exercise

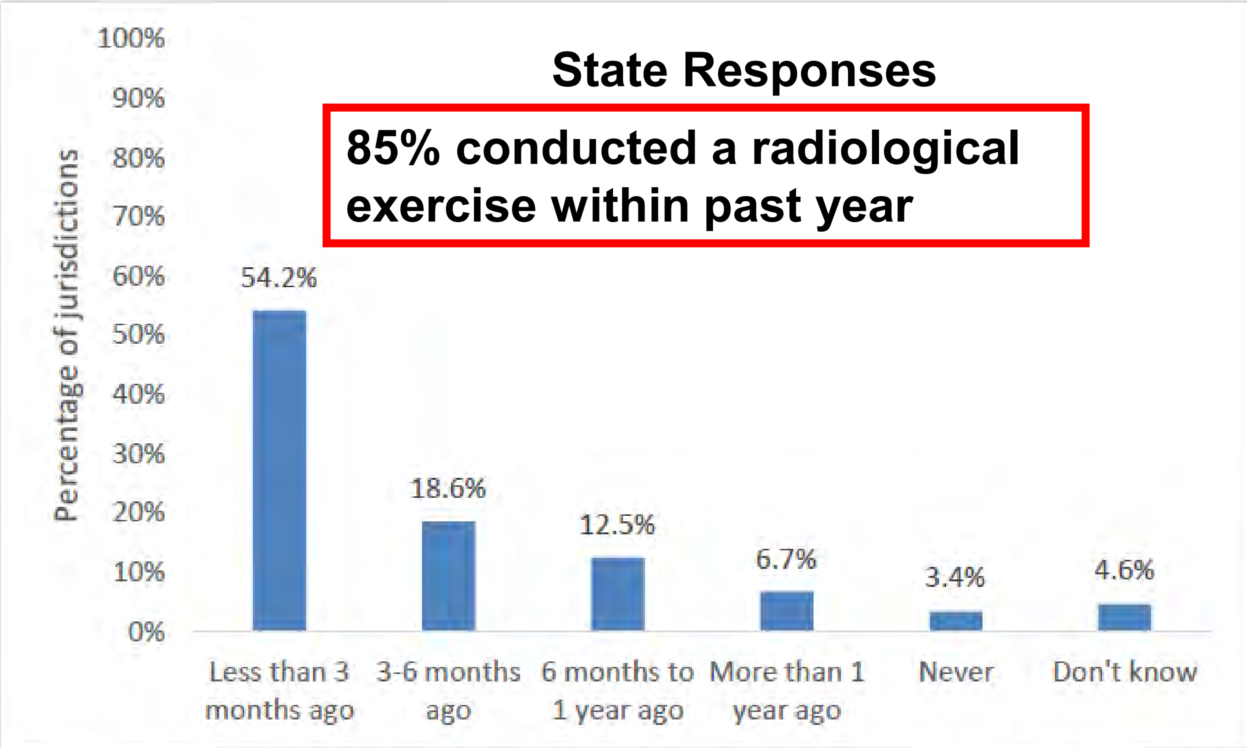


Figure 7. ASTHO's survey participants' date of most recent radiological-focused exercise

City & County Responses

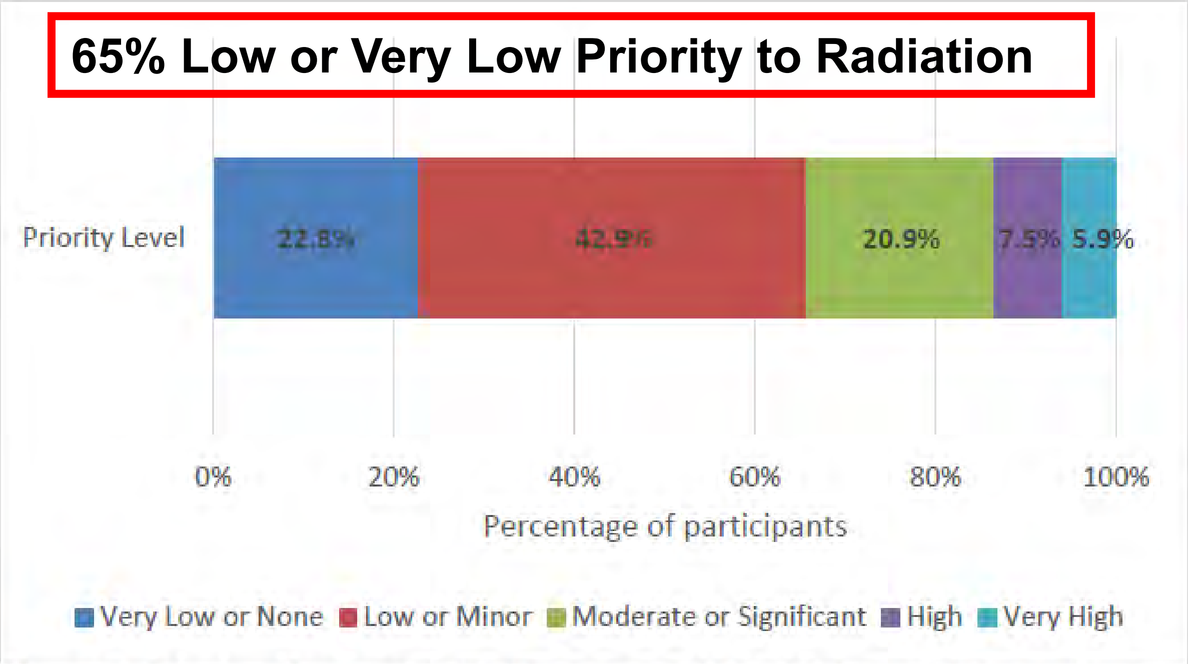


Figure 3. Priority Given to Radiation among NACCHO Survey Respondents

State Responses

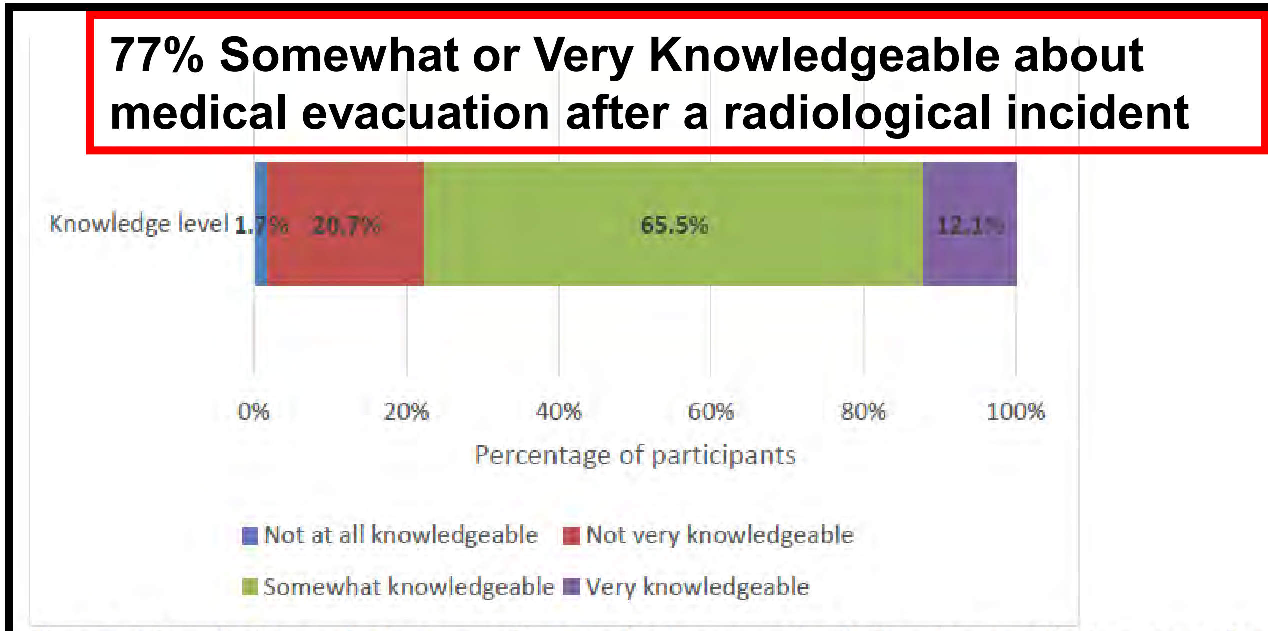


Figure 4. Level of knowledge regarding medical evacuation following a radiation event fro
ASTHO survey participants (n=58)

City & County Responses

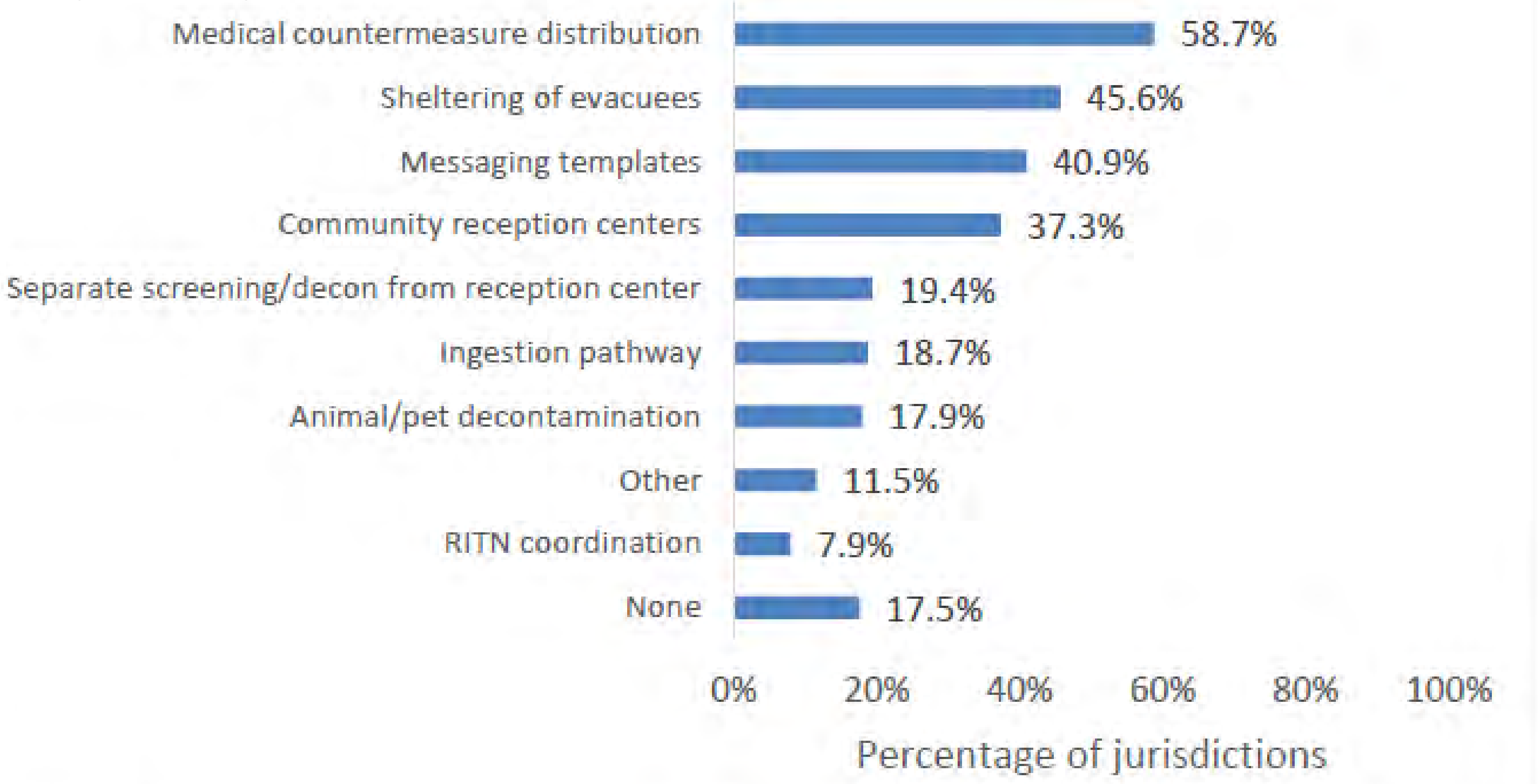


Figure 5. NACCHO survey participants' plans set in place for a radiation emergency

State Responses

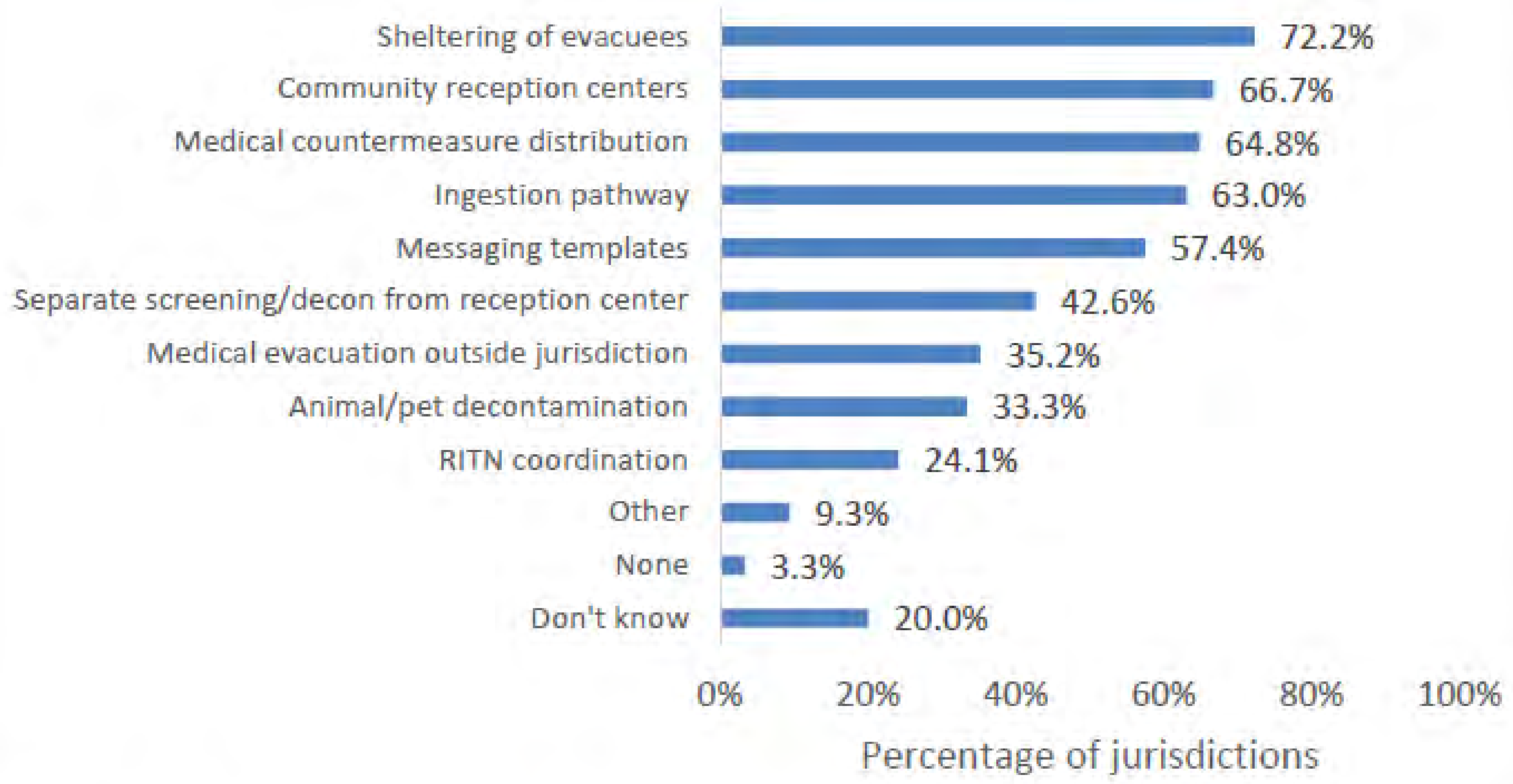


Figure 7. ASTHO survey participants' plans in place for a radiation emergency

My 2¢

1. Fight complacency through continuous improvement
2. Collaborate and look for dual purpose projects/exercises
3. Keep eye on the ball, despite constant interruptions

- Anthrax
- MERS-CoV
- Ebola
- Zika
- H1N1
- SARS
- West Nile
- Lead

- Boston Marathon
- San Bernardino
- Aurora, CO
- Orlando
- Dallas
- Sandy
- Katrina
- Eyjafjallajökull

- Joplin
- Ike
- Snowmagedon
- Virginia Tech
- Cascade Mall
- ....

Gaps to be discussed

- National Concept of Operations to unify response
- Coordinated laboratory network
- Exercise for distant community awareness of role
- Patient/survivor screening, triage and tracking
- Handling the medical surge
- Application of crisis standards of care
- Standardizing of units and terminology
- Training of medical staff

Triaging Thousands – Challenges in Survivor Screening after a Nuclear Detonation

John L. Hick, MD, *HHS/ASPR, Hennepin County Medical Center*

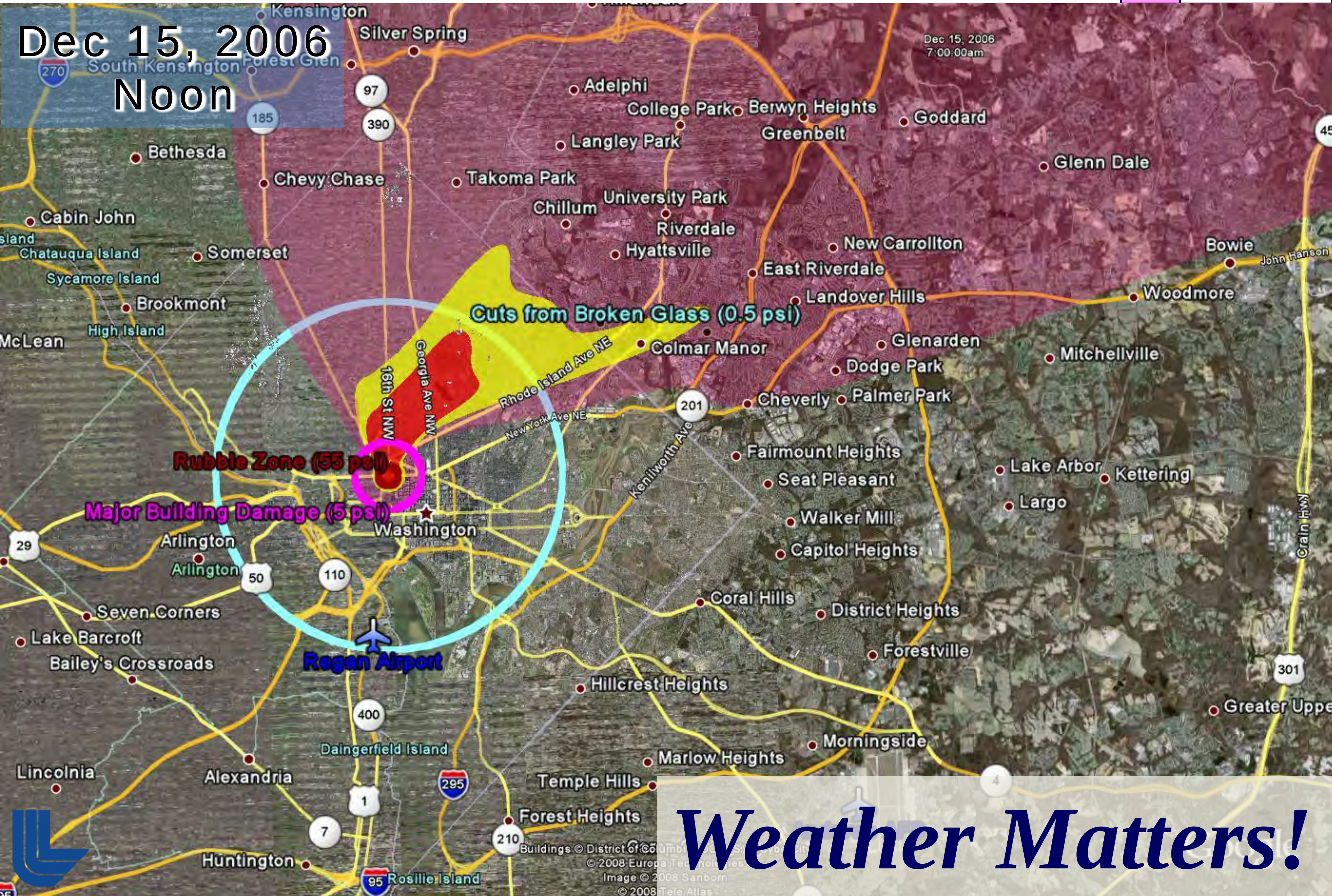
- Advisor to the Director, Hospital Preparedness Program HHS/ASPR/OEM
- Deputy Chief Medical Director, Hennepin EMS
- Medical Director for Emergency Preparedness, HCMC
- Professor of Emergency Medicine, University of Minnesota

Disclaimer

- These are my personal views and not those of the federal government or any of its agencies
- This is personal opinion and not official policy
- I do not own any nuclear weapons
- I do not have any commercial or other conflicts of interest

Illustrative Weather Variations

(red)	>300 cGy
(yellow)	>100 cGy
(pink)	>1 cGy in 2hr



Estimated number of irradiated victims

Table 4. **Mass Casualty Scenario for a Nuclear Detonation***

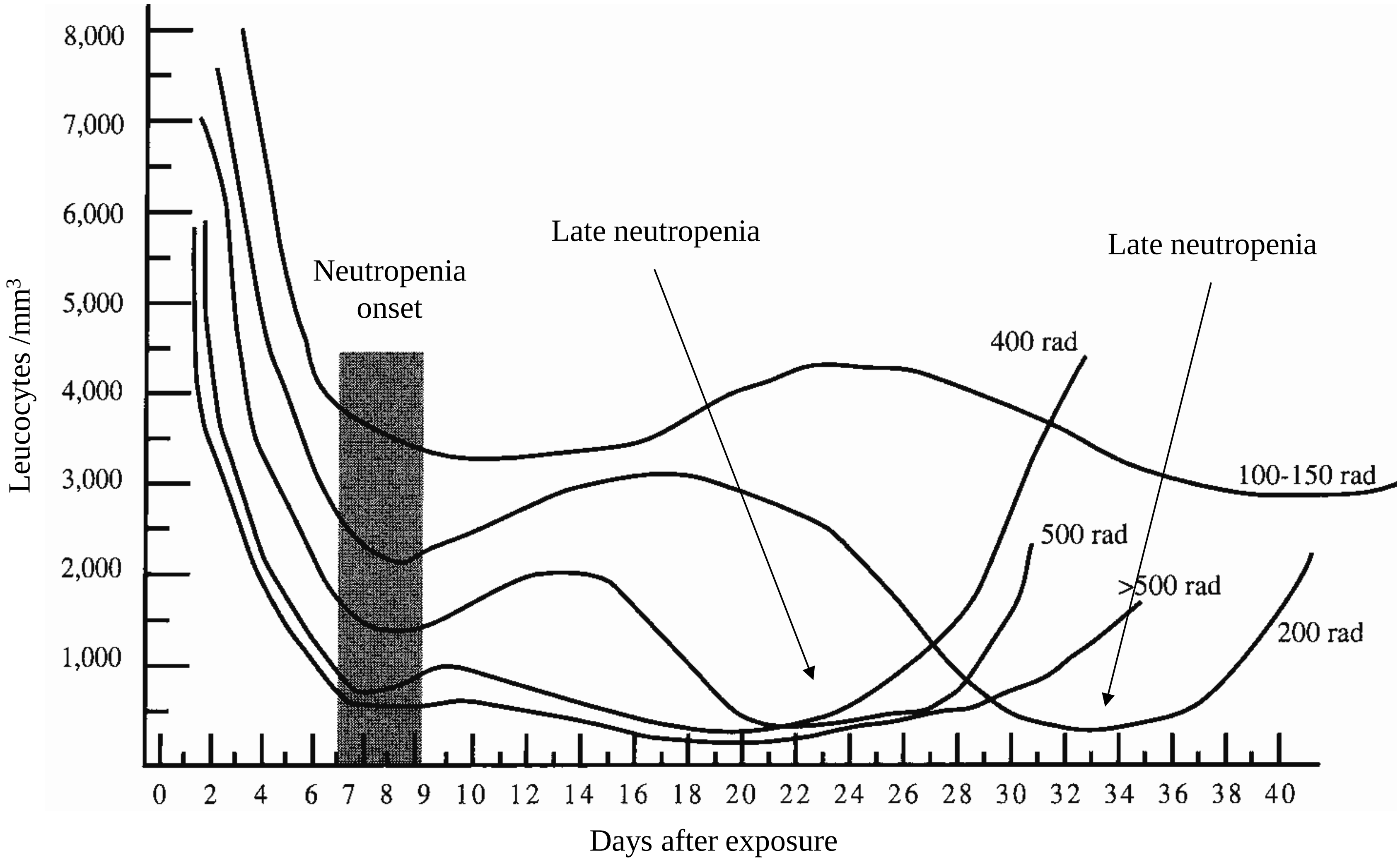
Patient Category		Radiation Dose, *Gy*	Patients, *n* 1-kiloton Detonation	Patients, *n* 10-kiloton Detonation
Combined injuries (minimal to intensive care)	20,000	All doses	1000–3000	15 000–24 000
Immediate fatalities		All doses	>7000	>13 000
Radiation fallout				
Expectant care		≥10	18 000	45 000
Intensive care		5–10	19 500	79 400
Critical care	300,000	3–5	33 000	108 900
Normal care		1–3	66 000	70 000
Ambulatory monitoring		0.5–1	82 500	139 000
Epidemiologic monitoring	600,000	0.25–0.5	106 000	147 000
Monitoring for psychosocial well-being without other injury		<0.25	>150 000	>270 000

* The table depicts projected casualty estimates based on a 1- or 10-kiloton detonation. Assumptions include a city with a population of 2 million people and casualties estimated on the basis of the Hazard Prediction Assessment Capability Program (HPAC), version 3.21 (Defense Threat Reduction Agency, Fort Belvoir, Virginia). Combined injuries consist of radiation injuries in addition to burns or blunt trauma.

Waselenko et al. *Annals Int Med* 2004

Find Shelter!

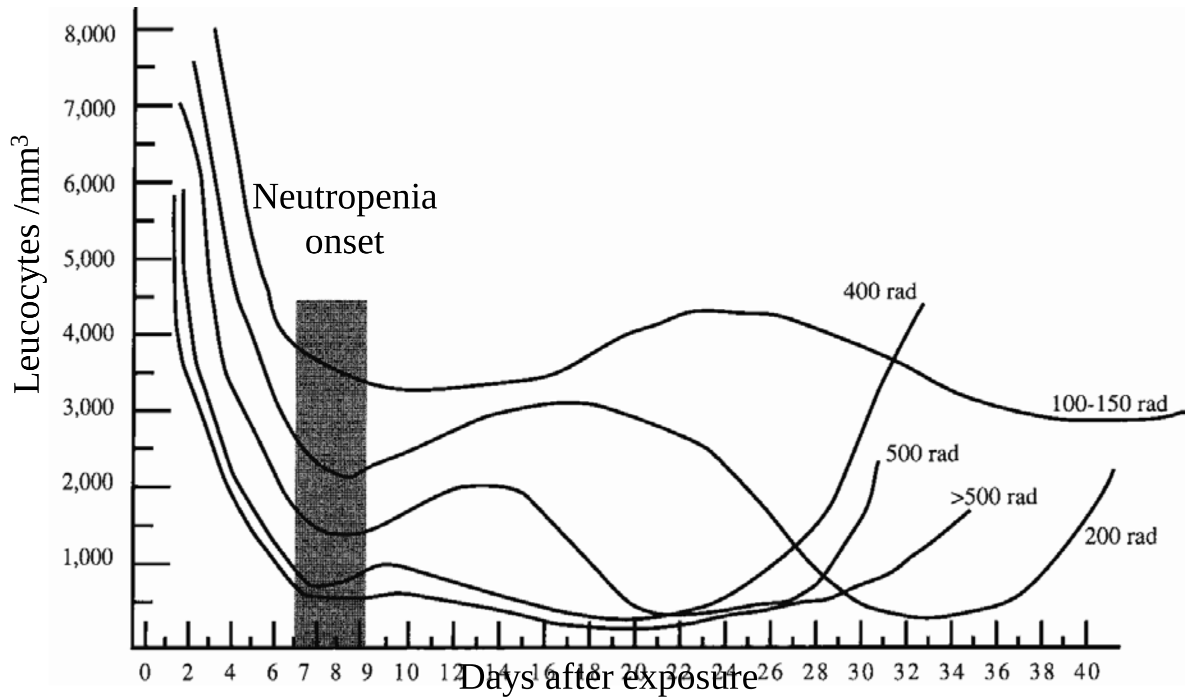
Neutropenia delay after radiation exposure



Vorobiev et al. *Stem Cells* 1997

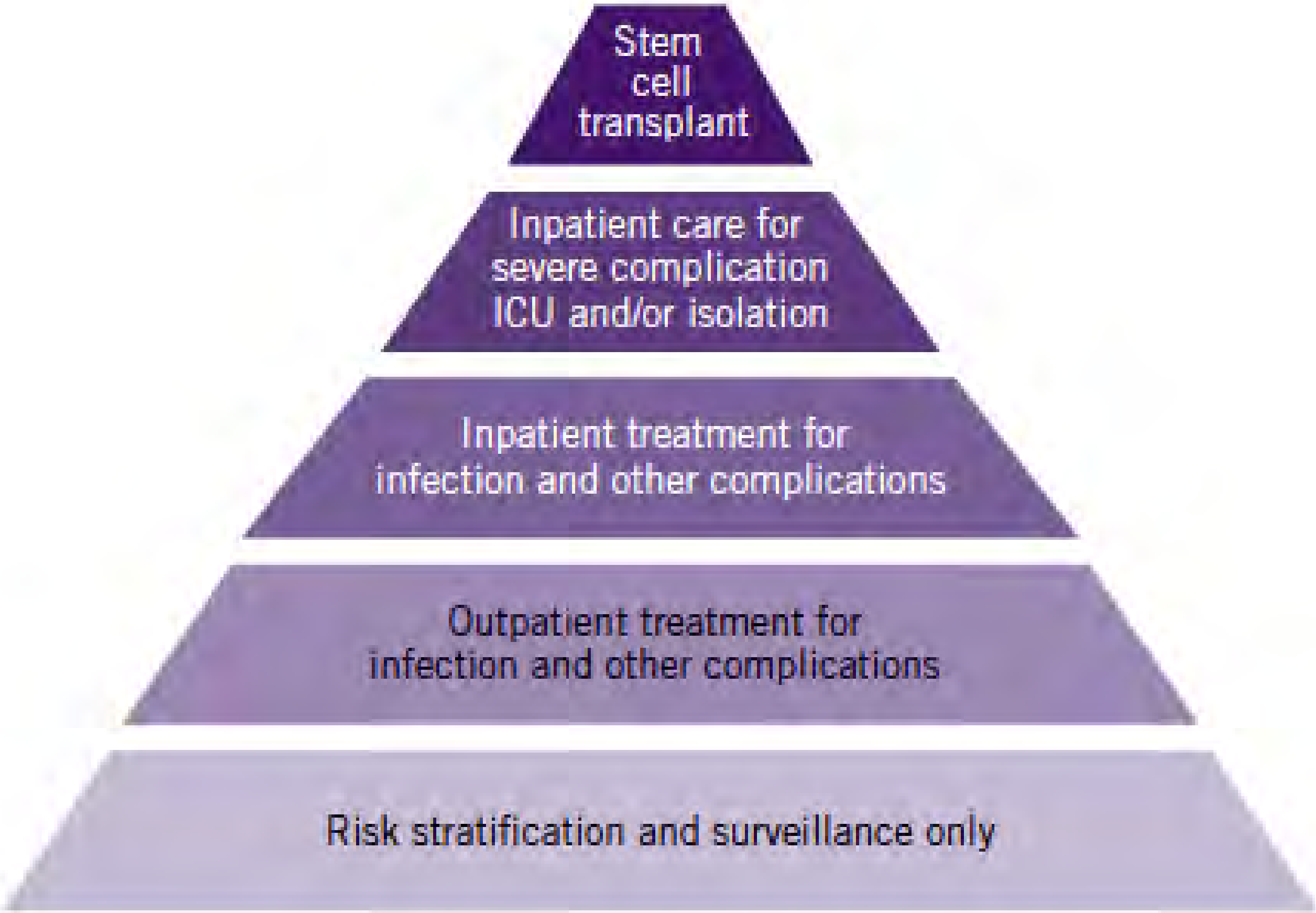
Timing of cytokine administration

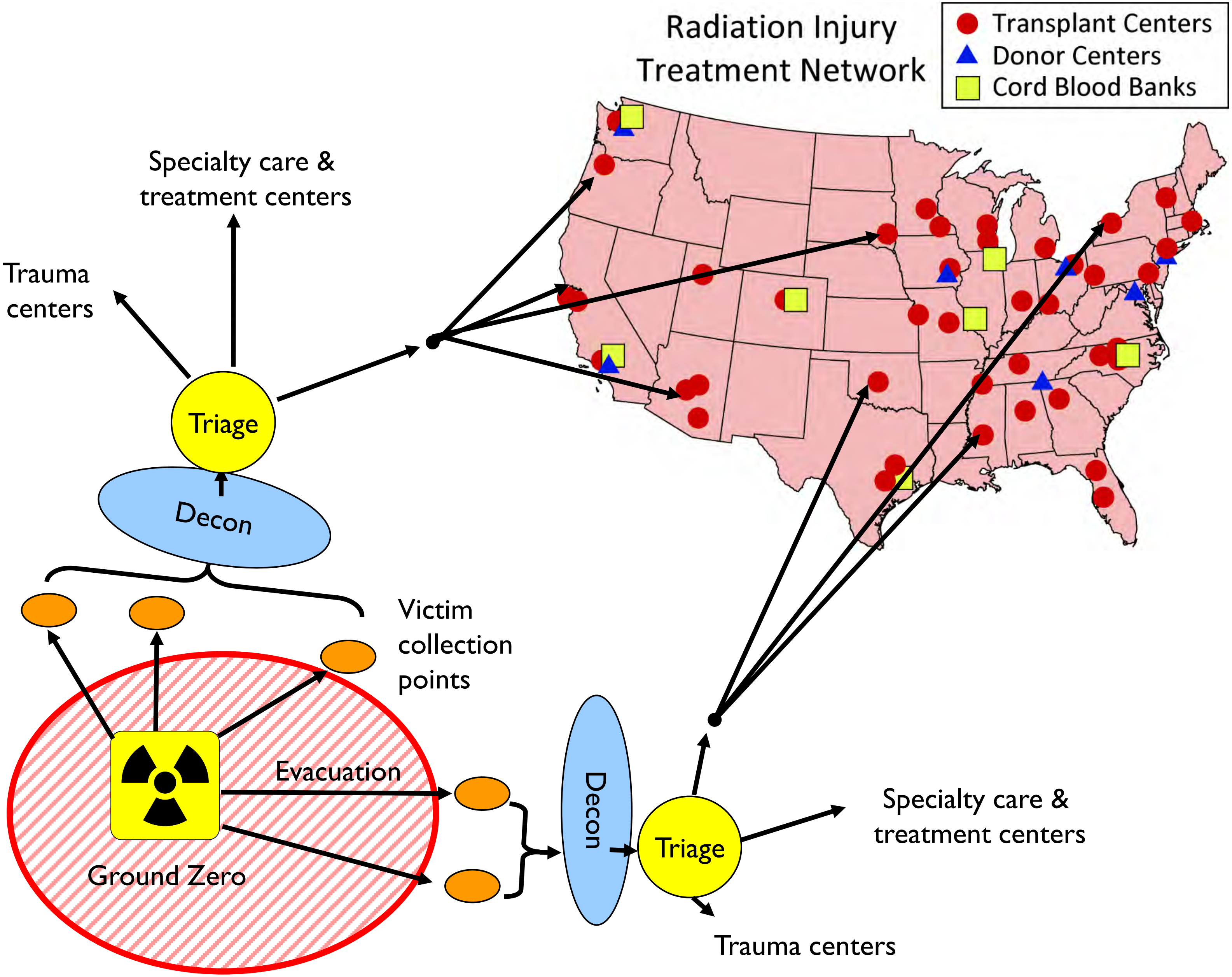
- Meta-analysis of G-CSF given after chemotherapy:
  - Reduces death from neutropenia-associated infection 45%
  - Reduces need for hospitalization
  - Reduces length of stay
  - Best response – within first 48h after irradiation



Vorobiev et al. *Stem Cells* 1997; Kuderer et al. *J Clin Onc* 2007

Acute Radiation Syndrome





Weinstock et al. *Blood* 2008

Radiation Injury Only

Radiation Dose (Gy)	Normal / Conventional	Good / Contingency	Fair / Crisis	Poor / Crisis
> 10 Likely fatal (in higher range)	Expectant / Immediate	Expectant	Expectant	Expectant
6 - 10 Severe	Immediate	Immediate	Delayed	Expectant
> 2 - 6 Moderate	Immediate	Immediate	Immediate	Immediate
< 2 Minimal	Minimal	Minimal	Minimal	Minimal

Resource availability: Normal, Good, Fair, Poor

Standard of care: Conventional, Contingency, Crisis, Crisis

Coleman CN, Weinstock DM et al. *Disaster Med Health Prep* 2011

Public Health

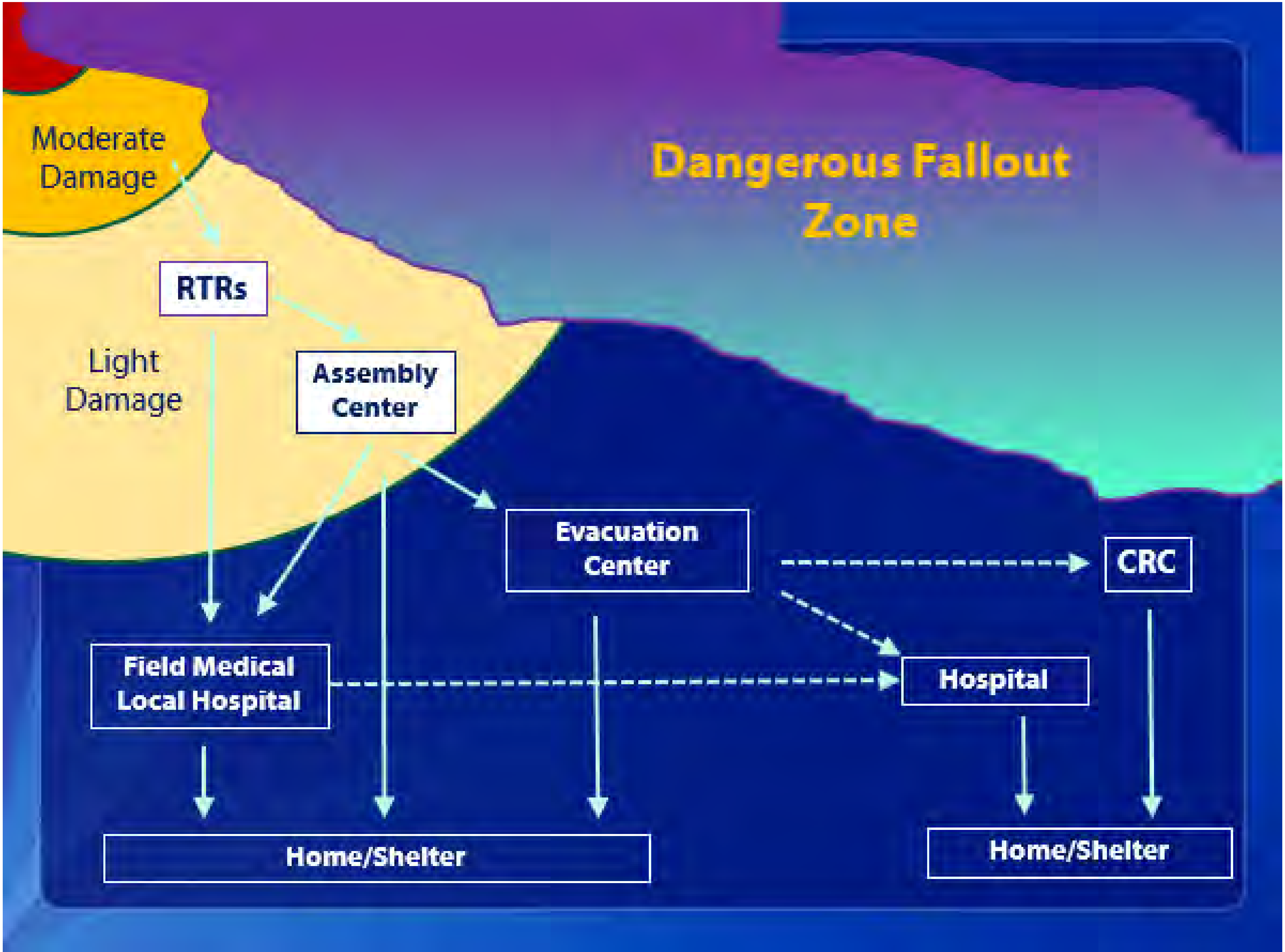
- Exposure modeling (and coordination with Feds)
- Screening and triage for GCSF
- Assembly centers – coordination with EM
- SNS receipt and distribution
- Evacuation – identify those appropriate
- Public information coordination with EM
- Behavioral health

Hours 24-48

- Screen persons at assembly centers (PH)
- Circulate treatment / assessment recommendations for fallout based on geography and symptoms (PH)
- Begin to identify patients for evacuation (PH)
- Tide at medical centers shifts to ARS victims, volume increases (EMS, Med)
- Coordinate incoming resources (EM)

Hours 48-72

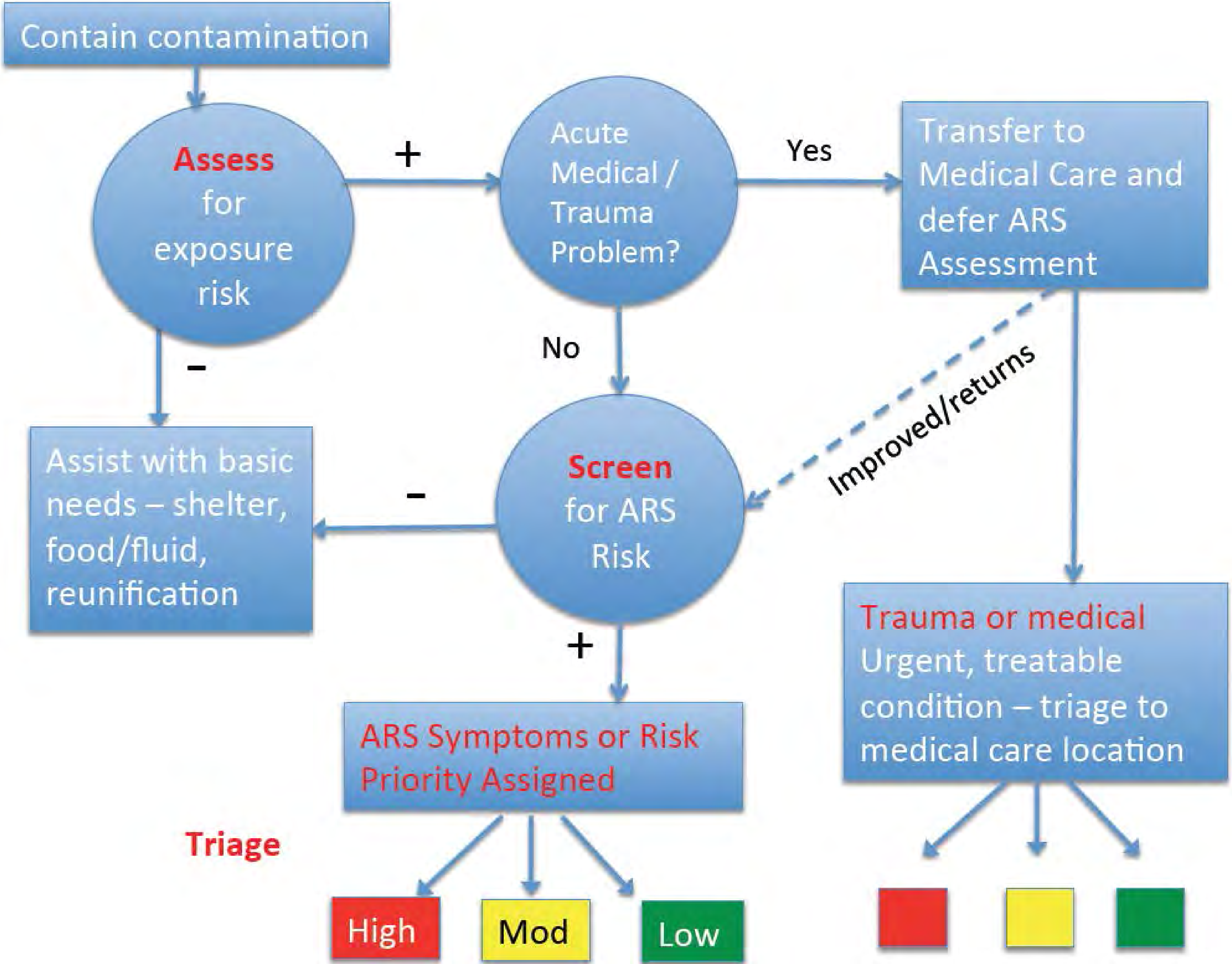
- Continue to administer GCSF as possible to hospitalized and at-risk persons (Med, PH)
- Begin evacuations of victims in latent phase of ARS (toward end of this period) – will continue for the next week (EM, PH)
- Patient volumes at medical centers continue to increase (ARS mainly) (EMS, Med)



Moderate Damage
Dangerous Fallout Zone
RTRs
Light Damage
Assembly Center
Evacuation Center
CRC
Field Medical Local Hospital
Hospital
Home/Shelter
Home/Shelter

Assembly Center – 24-48 hours after detonation

- Planned and spontaneous
- Thousands of people / site
- Decontamination / containment
- Screening / Triage
  - Countermeasures
  - Evacuation
- Family reunification
- Sheltering and food
- Medical countermeasures?
- Medical care?



Contain contamination
Assess for exposure risk
+
-
Acute Medical / Trauma Problem?
Yes
No
Transfer to Medical Care and defer ARS Assessment
Improved/returns
Assist with basic needs – shelter, food/fluid, reunification
-
Screen for ARS Risk
+
Trauma or medical Urgent, treatable condition – triage to medical care location
ARS Symptoms or Risk Priority Assigned
Triage
High
Mod
Low

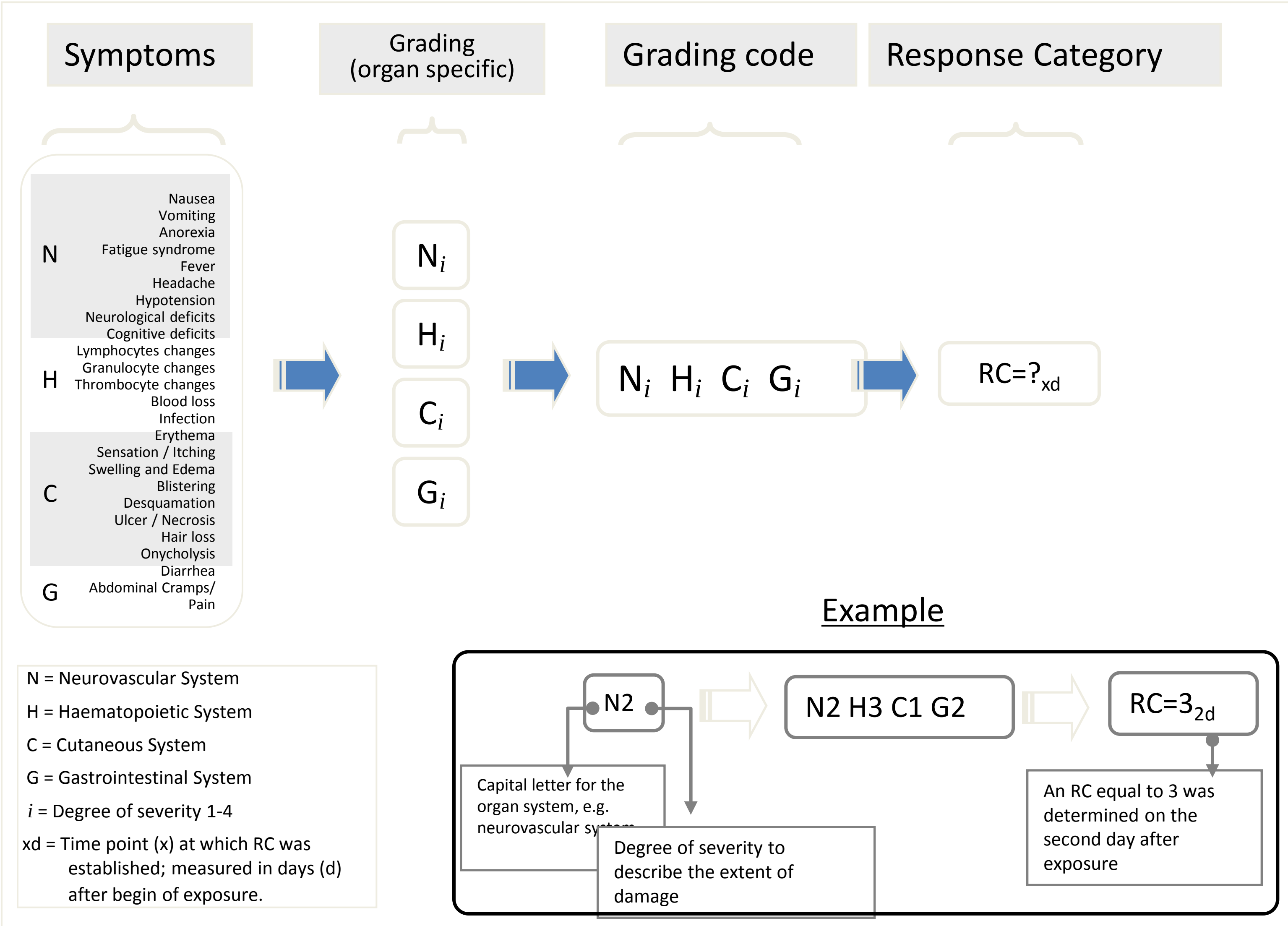
EAST Project

- CDC, HHS, FEMA, private partners
- Exposure and Symptom Triage
- Implemented at AC or wherever sorting function can be performed
- Selected key variables from common radiation triage methods
- Assume serial ALC will *not* be available
- To be used in scarce resource areas only

Goals

- Sort to high, medium, low priority for
  - Cytokine administration
  - Evacuation to areas with adequate resources
- Highest priority are *moderate* – 2-6 Gy exposure range
- Next priority are >6 Gy – based on likely degree of benefit : resource utilization
- Adjust for underlying illness / vulnerability

METREPOL dosimetry approach



Friesecke et al. *Br J Radiol* 2001

Tool

- ALC
- Vomiting time
- Vomiting / day
- IMAAC map
- Location – other map
- Diarrhea
- Headache
- Fever
- Skin burns

Nuclear Detonation Survivor Prioritization for Evacuation / Bone Marrow Cytokines

Clothing/contamination control performed

Acute medical/trauma complaints? (1) — Yes → Refer to medical care area/facility

No

Were located in/transit through damage or fallout zone? — No → Send to support services

Yes

Assess symptoms/data – major predictors listed first (e.g. ALC is best predictor, skin changes unlikely) - base cytokine and evacuation priority on column with ***majority or strongest predictive variables*** (2)

ARS Severity Prediction	**Severe ARS Predicted (>6 Gy)**	**Moderate ARS Predicted**	**Mild ARS Predicted (<2 Gy)**
ALC/lymphocyte single value estimate (3)	<500 at 48h	500-1500 at 48h	>1500 at 48h
Vomiting onset (4)	Rapid (within 1h) after exposure	Intermediate (1-4h)	Delayed > 4h
Vomiting (per day) (5)	>6 or worsening with time	Moderate 3-6	1-2 or resolved
IMAAC /official 12-24h estimated dose map (6)	>6 Gy (modify to 2-6 Gy if good shelter for 24h)	2-6 Gy (modify to < 2 Gy if good shelter for 24h)	<2 Gy
Location in damage or fallout zone (non-IMAAC map) first 12-24h	In damage or fallout zone with minimal / no sheltering	In damage/fallout zone with good sheltering (e.g. concrete)	Not in damage/fallout zone according to map
Diarrhea (stools / day)	Severe (>6)	Mild / moderate (<6)	None
Headache (7)	Severe, interferes with activities	Mild/moderate	None/minimal
Fever (unexplained)	High/sustained	Low (< 101F) or resolved	None
Skin (beta) burns (8)	Burns / blisters > 3% BSA	Burns/blisters < 3% BSA	None
Match dominant signs/symptoms in column above to suggested triage category in same column below			
GCSF/myeloid cytokine **priority** (9)	**2** – Possible benefit	**1** – Most benefit	**3** – Unlikely benefit
Evacuation **group** (10)	**2** – Second evacuated	**1** – First evacuated	**3** - Third evacuated

Complicating Medical Conditions / Vulnerability (see note 10)
Adjust evacuation priority to a *higher* color (e.g. yellow up to red) if patient has a condition for which local care is not available and that could deteriorate within 48h putting the patient at risk including but not limited to:

- Diabetes
- Dialysis / End Stage Renal Disease
- CHF (Congestive Heart Failure)
- Pregnancy
- Immunosuppression (e.g. AIDS, taking steroids/transplant meds, recent chemo)
- Severe Respiratory Disease (e.g. Asthma, COPD with disability, requiring oxygen, or daily symptoms)
- Vulnerable / at risk in current environment (e.g. pediatric, disability)

Myeloid cytokine (GCSF/other) administration (record dose/time) according to priority/availability (11)

Support – referral to resources for evacuation and basic needs coordination (12)

End notes – turn over

Footnotes

- On back of page
- Supporting info

Goal: Initial rapid triage of persons with radiation exposure (no/limited injury) to prioritize them for evacuation/ myeloid cytokine administration as not enough capacity in system to provide for all survivors
Setting: Assembly center or screening location in **resource-poor** environment after a nuclear detonation.
Process: Screen patients from highest to lowest precision predictors of ARS and assign priority. This tool is an imprecise guide and should not substitute for expert clinical and radiologic opinion when available. Use of serial ALC values for screening is optimal and should be instituted as soon as blood counts can be performed.
Outcome: One or combination of:

- Triage to acute medical care (depending on situation/severity of condition may have on-site resources to provide care or have to refer to another facility/location)
- Refer to myeloid cytokine administration/other medical support (may be co-located or separate)
- Assign priority for evacuation to area with adequate medical resources
- Refer to shelter/basic needs support

Endnotes:

1. Medical/trauma symptoms that preclude completion of assessment process. Consider oral anti-nausea/anti-diarrhea medications as needed without medical care (MC) referral during and post-assessment. Persons referred to MC may be treated and referred back for assessment or assessed in medical care area/hospital. Combined trauma/radiation injuries should be assessed by physician as worse prognosis when significant combined injury.
2. This tool is ONLY for use in severely resource-constrained environments. In areas with appropriate resources standard assessment tools (BAT, etc.) should be used. (see https://www.remm.nlm.gov/newptinteract.htm#skip)
3. Single values of ALC to predict dose are not precise. Use reference tools and nomograms as soon as possible even for single values (https://www.remm.nlm.gov/ars_wbd.htm#ldk_section)
4. Vomiting may be due to psychogenic or traumatic effects and time to onset may depend on fallout variables and NOT detonation time. Thus, caution is required when interpreting time to onset.
5. Vomiting can cause irritation of the stomach and other factors that can make the vomiting continue despite a relatively low radiation exposure. Thus, vomiting should be assessed in light of other signs and response to any medical treatment already provided.
6. In damage or dangerous fallout zone during first 12-24 h per IMAAC or other official mapping. Exposure likely significantly less than IMAAC predicted values if good quality (concrete / steel) sheltering for 24h
7. Headaches (HA) can be due to many things including lack of sleep, stress, trauma, and other factors. However, a severe HA in conjunction with other symptoms is likely radiation-related.
8. Radiation related burns occur from direct contact with highly radioactive fallout particles or flash burns from the initial explosion. Absence of skin changes does *not* have predictive value but the presence of skin burns, sloughing, or blistering that is **not** due to thermal burns is a poor prognostic indicator. Estimate 1% body area as the size of the patient's palm.
9. Myeloid cytokines (e.g. GCSF) may not be available in a quantity sufficient for treating all candidates. Priority reflects degree of benefit based on prognosis. Refer to scarce resource triage tool for further information (see http://www.remm.nlm.gov/triagetool_intro.htm)
10. Evacuation priority is based on prognosis as well as resource demands and assumes that medical care in the area is inadequate. Higher priority for evacuation (e.g. yellow patient moves up to red group) may be assigned if underlying medical conditions could be potentially life-threatening if untreated for > 2d. Vulnerable adults, pregnant women, or children at risk in current environment may also receive higher priority for evacuation. In some cases, experienced providers may *lower* the evacuation priority based on low chance of survival in which case palliative care and scheduled re-evaluation and re-triage should be provided
11. Myeloid cytokine administration may be co-located with other assembly center functions or located at another site. Administration should be tracked – both on a card that remains with the victim and in a retainable/sharable database.
12. Support functions should include re-unification/communication support, shelter and basic needs facilitation, facilitation of evacuation, and provision/referral for mental health and medical services. Some of these may be co-located at the assembly center and others at separate sites. Support functions should be provided after screening

Limitations, etc.

- Not validated
- Not binary – more of a risk matrix than a decision tool
- Limited predictive value compared to serial ALC
- But…
  – Better than ad hoc decisions
  – Provides planning and implementation structure
  – Provides a level of fairness and consistency

All-of-Nation Planning Approach to Medical Preparedness and Effective Response

C. Norman Coleman, *National Cancer Institute*

- Associate Director, Radiation Research Program
- Senior Investigator, Molecular Radiation Therapeutics Laboratory, Radiation Oncology Branch
- Senior Medical Advisor, Office of the Assistant Secretary for Preparedness and Response

Disclaimer

- These are my personal views and not those of the federal government or any of its agencies
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- I have no conflict of interest

Outline

- The scope of a nuclear detonation
  - No-notice, huge need
  - Worry about a “second” hit- what can we (my city) deploy?
- The key question for response: “What do I DO!!??”
- How does one logically marshal resources
  - Co-locate patients (victims), diagnostics, MCMs, expertise
- Model for both planning and use in real time
  - And have common “map” for all states to use

Infrastructure and great numbers of people affected

Injury type	Category	High-consequence # people
Mechanical trauma (ISS)	mild (1-9)	80,000
	moderate (10-14)	121,000
	severe (≥ 15)	143,000
Thermal burn (% TBSA)	moderate (10-30)	1,000 – 3,000
Ionizing radiation (cGy)	mild (75-150)	72,000
	moderate (150-530)	41,000
	severe (530-830)	12,000
	expectant (>830)	47,000
Combined injury	radiation: > 150 cGy; trauma/burn: mild-sev	45,000

Adapted from Knebel et al., 2011, Disaster Med Public Health Preparedness, 5: S20-S31
For scenarios up to 10-kT in major US cities

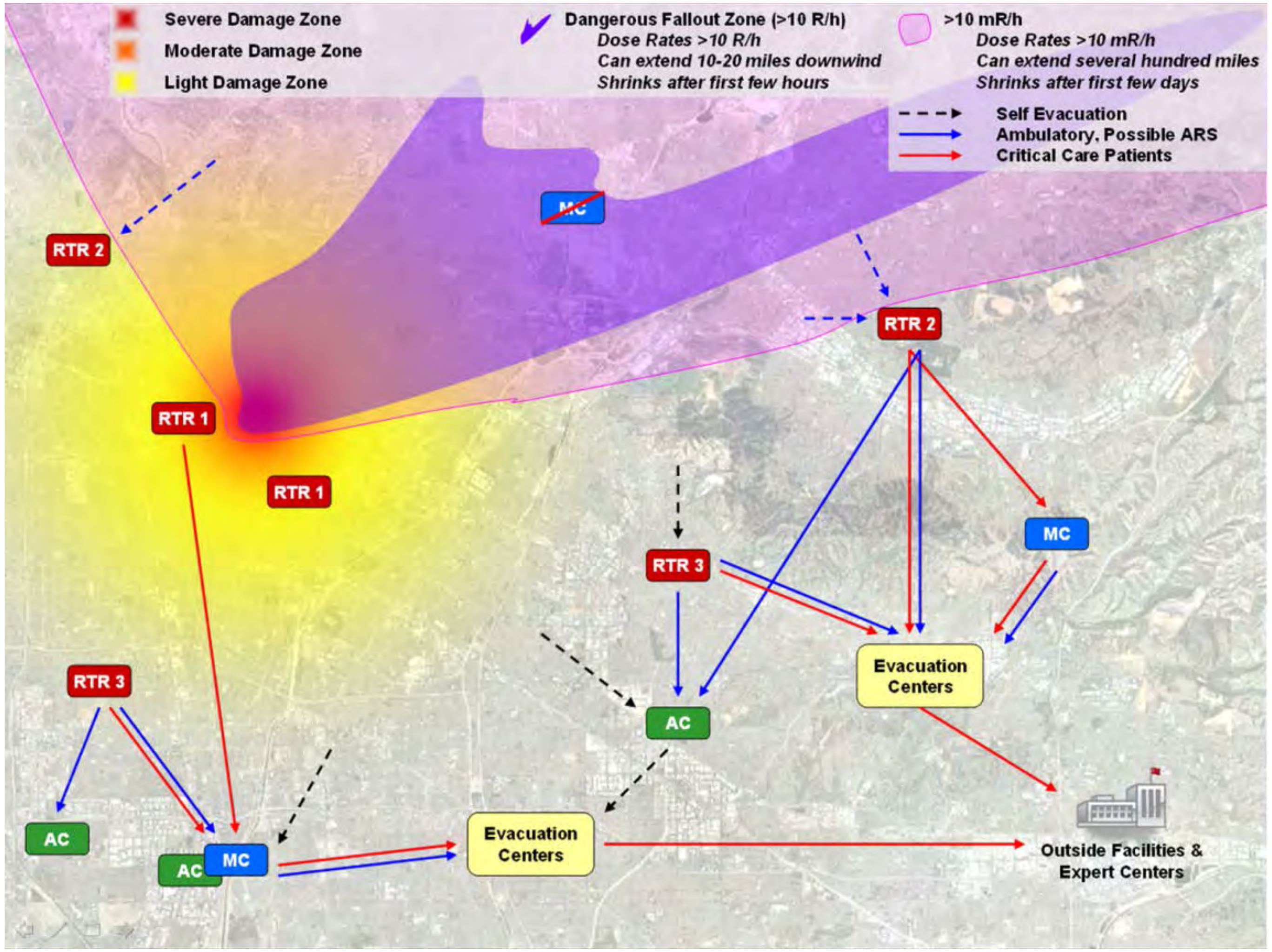
Medical and public health resources overwhelmed

- E.g., hospital beds: nationwide US: ~900,000* --- 20% = ~180,000
- E.g., burn beds: nationwide US: 1,895** --- 20% = ~380

Injury type	Category	High-consequence # people
Mechanical trauma (ISS)	moderate (10-14)	121,000
	severe (≥ 15)	143,000
Thermal burn (% TBSA)	moderate (10-30)	1,000 – 3,000
Ionizing radiation (cGy)	moderate (150-530)	41,000
	severe (530-830)	12,000
	expectant (>830)	47,000
Combined injury	radiation: > 150 cGy; trauma/burn: mild-sev	45,000

* American Hospital Association: http://www.aha.org/research/rc/stat-studies/fast-facts.shtml
** American Burn Association: http://www.ameriburn.org/BCRDPublic.pdf

Capabilities to provide effective response challenged



http://www.remm.nlm.gov/RTR.htm

Radiation Triage, Treatment, & Transport Sites (RTR1, RTR2, RTR3)

Assembly Centers (AC)

Medical Centers (MC)

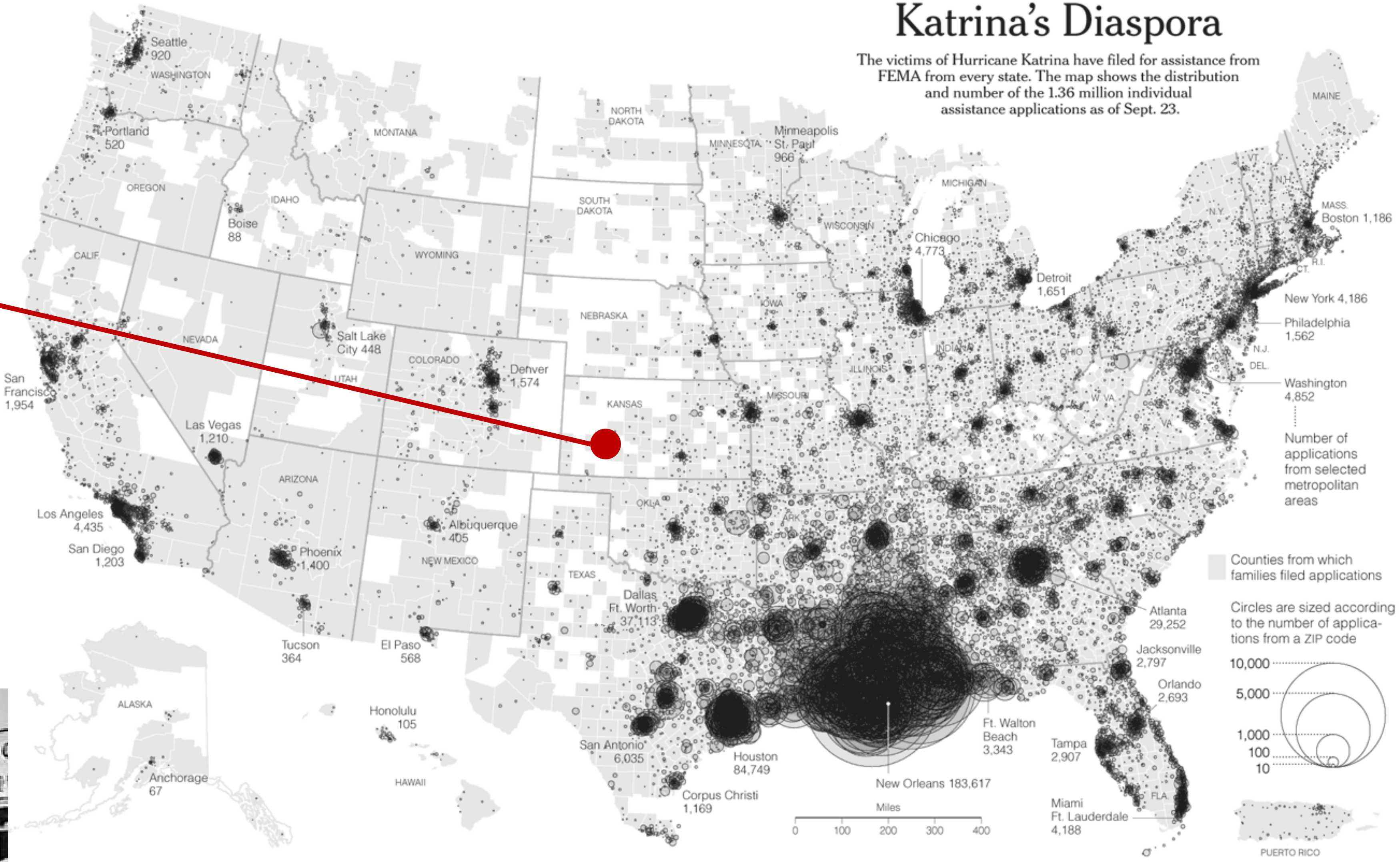
Evacuation Centers

An incident occurs in Washington DC (1)

1. Activate regional plan
2. Estimate direction of plume from high altitude winds
3. DC, Maryland, Virginia mobilized
4. NYC calls- what should we send in?
5. CDC SNS- where do we ship MCMs? All or some?
6. RITN- Diagnostics and RX network- we're ready, what do we expect?
7. People start heading out of town- all directions.
8. Chicago, Denver, Seattle, Houston call- what should we send and expect?
9. Threat comes in about potential West Coast incident? How will that impact resource availability?
10. San Francisco, Dallas, Miami call in- what should we do?

Huge and pretty rapid diaspora getting' outta DC and "gettin' into Dodge"

Source: New York times - October 2, 2005



ASPR: Resilient People. Healthy Communities. A Nation Prepared.

An incident occurs in Washington DC (2)

11. Pharmacy chains call in- where should we send cytokines?
12. Lab chain- calls- send us blood samples, we'll give you good discount.
13. NORTHCOM- calls in- where should we deploy airlift and shelters?
14. Cytokine vendor calls- where should we send VMI? Should we make more?
15. Pittsburgh now at capacity- where should we direct oncoming wave?
16. Phones switched on "Your call is important to us, please leave a message and we'll get back to you with definitive advice as soon as we can…."
17. Major decision-makers and communications team go on TV to provide instructions, expecting advice from "experts"!
18. Global partners offer help- where do you need back up help or MCMs?
19. Cable news is buzzing with "experts" all giving [different] instructions
20. Your shift ends…

Nuclear Incident Medical Enterprise (NIME) (Health Phys 2015)

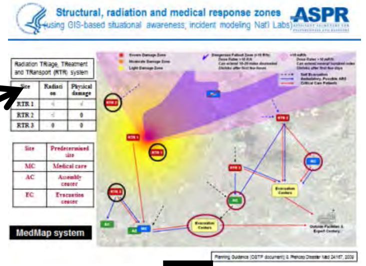
Blue text are the gaps

	Decision making & Communication	Organizing response	Triage	Medical management	Medical care
Response tools & capabilities	Decision-makers guide Communication guidance	Playbooks RTR- triage system Victim tracking	Integrated Clinical Diagnostics System Population monitoring	Medical Countermeasures (MCM) SNS, VMI & UMI	NDMS VA system RITN & Cancer Centers
Planning & response resources	REMM- Radiation Emergency Medical Management GEOhealth- Planning and situational awareness CONOPS Concept of Operations				
Underlying public health & medical concepts	SME support & availability Risk Communication	Medical-decision management model PAGs	Scarce resources triage Biodosimetry- POC & HTS	Radiation medicine MCM Requirements	Product Development BARDA, NIAID, DoD, Industry
Scenario & impact (physical & medical)	NUCLEAR SCENARIO and national & international impact Scenario Modeling BARDA-ADS, DHS, DTRA, AHRQ Planning Guidance for Response to a Nuclear Detonation Interagency Collaboration White House (OSTP)				
Coordination	Non-federal partners: State, Local, Tribal, Territorial partners PHEMCE: ASPR, WG's; CDC International partners, GHSI				
Science base	**Radiation sciences:** NIAID-CMCRs; NCI,NIH; AFRRI; NLM, RABRAT (multiagency) ←→ Academia				

"GEOhealth" enhancement:
National/global CONOPS on a larger scale

We're doing

Local

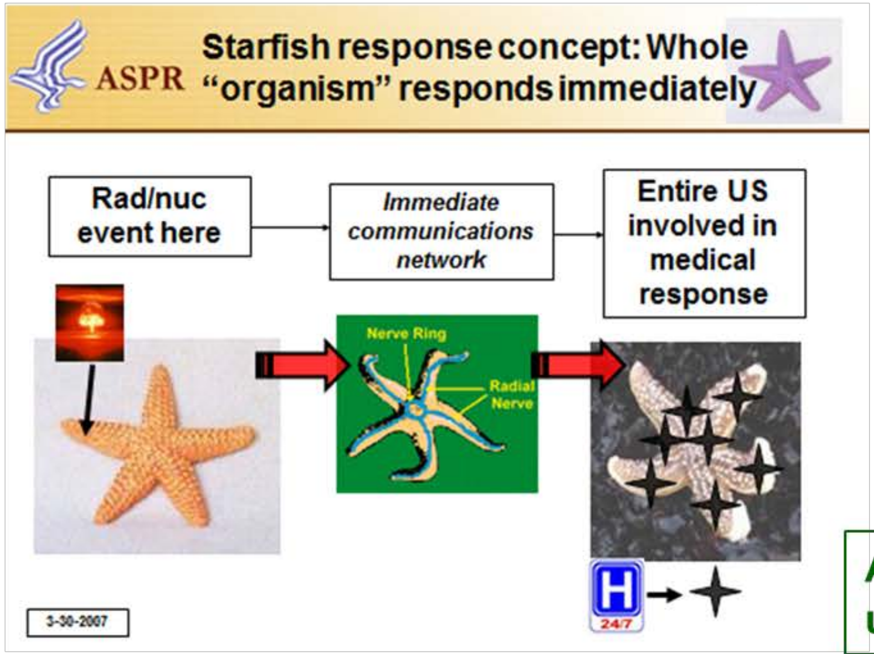


Need to extend detailed planning and CONOPS to national level and with global partners

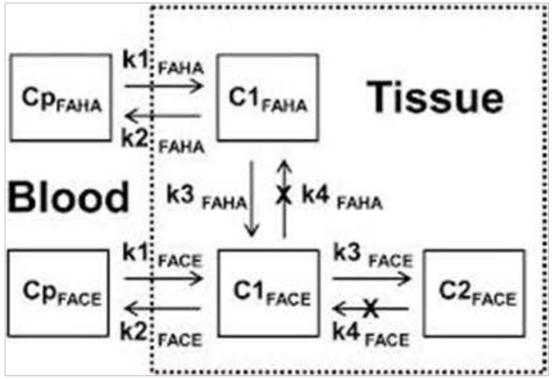
National CONOPS would involve Canada and Mexico (build into model) and eventual participation. Canada is already a participant in biodosimetry networking.

Builds on *pioneering* ASPR MedMAP
and systems approaches widely used

- An extension of and significant *enhancement* to MedMap using GIS-type data and information. (avoid the "perfect is the enemy of the good" concept)
- A *systems solution **of*** **dynamic adaptation** as the situation changes and the ability to rapidly *modify an entire response paradigm* when a diagnostic or MCM is developed with new capabilities
- It is how biological- living- systems respond and adapt



Pharmacokinetic pharmacodynamic (PK/PD) models



Also, systems biology nodal type of models used for molecular pathway analysis

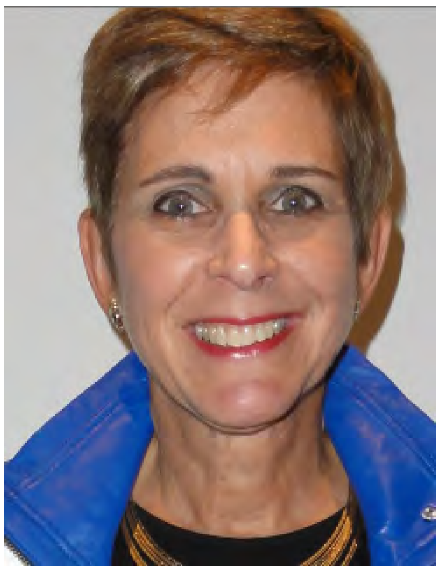
Gaps from Session 3

#1. Advanced preparedness for whole country with a "National CONOPS" including laboratory network for hematology, chemistry and dosimetry. This will be developed with buy in from all key players and will be essential to the resiliency of the nation. This CONOPS must educate and exercise so that distant communities understand their role in a catastrophic disaster like a nuclear detonation for which the entire nation's resources will be brought to bear.

[And it is sufficiently generic to be applied to All Hazards. It will take time and investment, of course.]

The Unmet Need to Engage/Train/Prepare the Medical Community for Mass Casualty Radiation Incidents

Judith L. Bader, MD
U.S. Department of Health & Human Services



- NCI Radiation Oncologist: retired
- Senior Medical Advisor, HHS
  Office of Assistant Secretary for Preparedness and Response
- Managing Editor, “Radiation Emergency Medical Management - REMM” website (https://www.remm.nlm.gov), sponsored by ASPR

Disclaimer

- My views, not those of DHHS or any of its agencies
- Not official policy
- No conflicts of interest

Outline

- The “unmet need” problem: parameters
  - Who
  - What
  - When
  - Where
  - Why
- Issues: Engage, Train, Prepare
- Gaps and possible fixes

Who: Medical Community

Fed, State, Local Leadership

First Responders

First Receivers

Expert rad clinicians: e.g. RITN

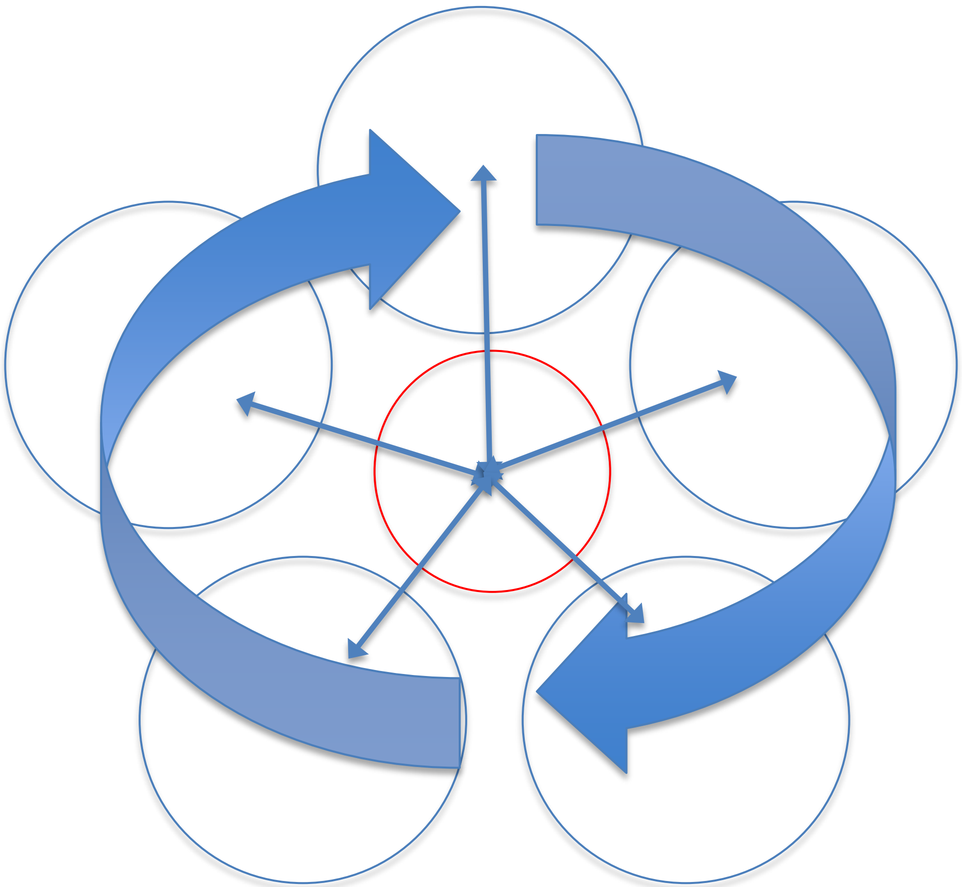
Surge clinicians: non-rad expert

Ancillary
Support Personnel

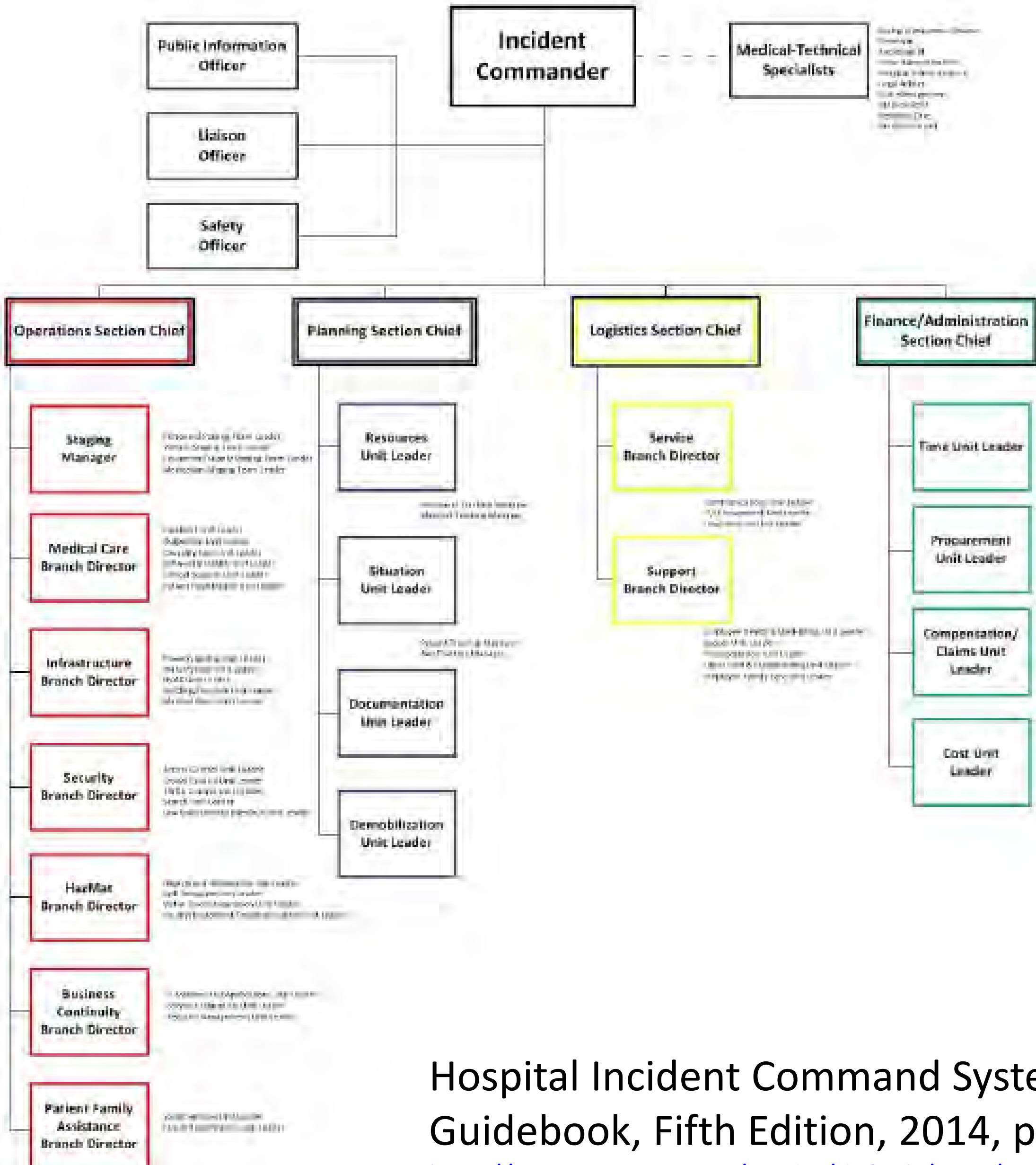
Partners: rad safety, etc.

Local health departments

Decedent Affairs



Who: Hospital Incident Management Team



Hospital Incident Command System: Guidebook, Fifth Edition, 2014, page 45
http://www.emsa.ca.gov/media/default/HICS/HICS_Guidebook_2014_11.pdf

What (to know varies)(1/2)

- What kinds of incidents are there?
- Different kinds of radiation
- Difference between exposure and contamination
- What is ARS?
  - How to diagnose and treat?
- What is external vs. internal contamination?
  - How to diagnose and treat?

What (to know varies)(2/2)

- General principles
  - How to protect myself while doing my job
  - How to protect my family
  - How to tell who is affected/at risk and NOT at risk
  - Are there clinical algorithms? Are there MCMs? Get MCMs?
  - What do affected people need first/fast
  - Prioritize care in large mass casualty
  - Deliver care in austere circumstances
  - Monitor affected and concerned over time
  - Minimize fear – tailored risk communication
  - Know the Hospital Incident Command System
  - Radiation units: international units vs. common units
  - Find the truth and whom to ask
- WHAT DO I DO?

When: Phases of an Incident

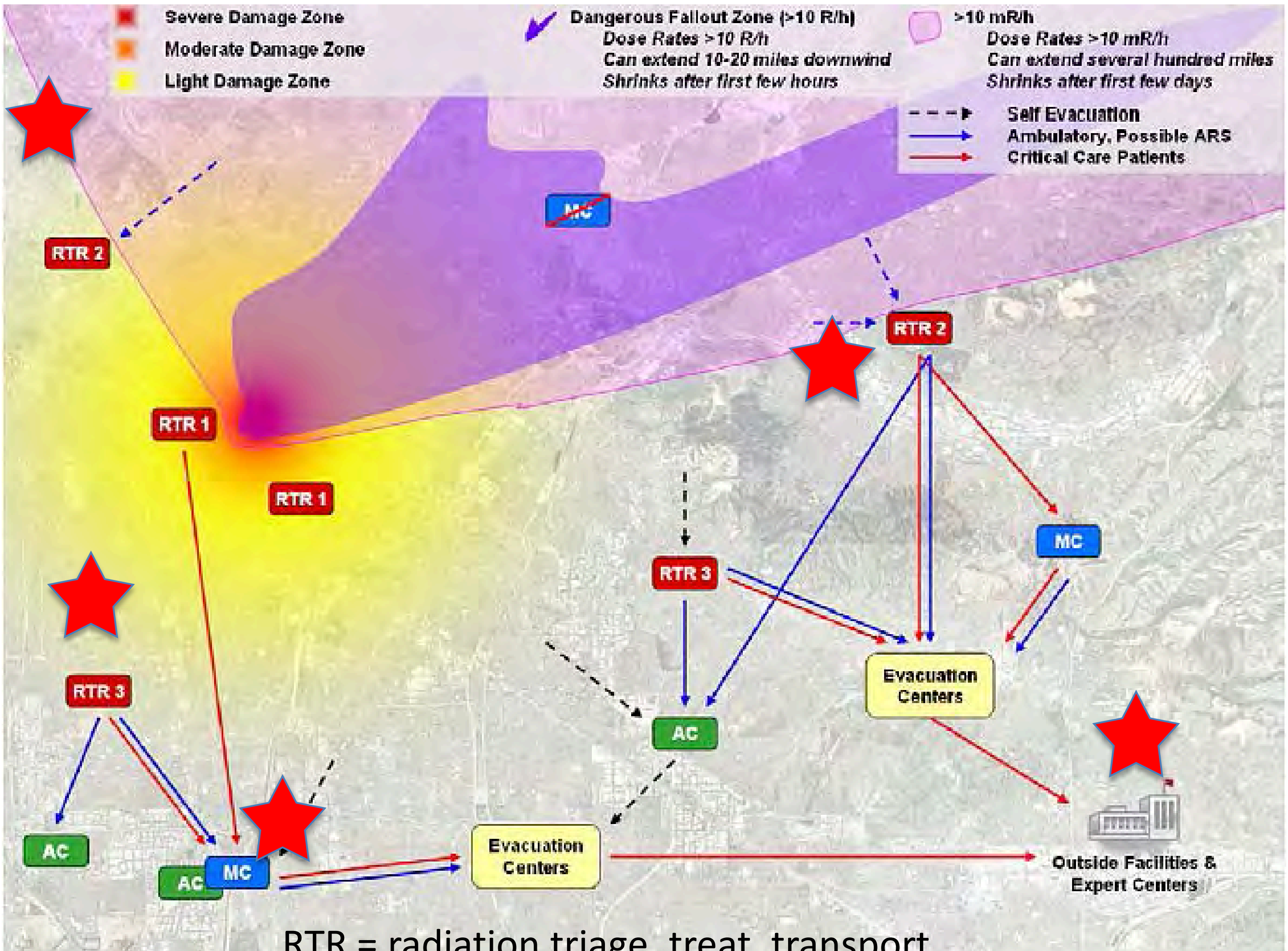
1			2			3
Primarily Pre-Incident			Begins when an Incident Occurs or Upon Notification			Sustained Operations
1a	1b	1c	2a	2b	2c	3a
Normal Operations	Increased Likelihood or Elevated Threat	Near Certainty or Credible Threat	Activation, Situational Assessment, and Movement	Employment of Resources and Stabilization	Intermediate Operations	Long-Term Recovery Operations

As incident progresses…..needs, tasks, assets, protocols change:
what to do, where to do it, who is available

Where: work in many venues

- Management and Administration venues
  - Federal, state, regional, local
  - Incident Command System: EOC
  - Hospital Incident Command: EOC
- Care centers
  - Fixed facilities: Primary, secondary, tertiary
  - Private offices: Routine clinical care venues
  - State and local health departments
  - Emergency surge centers: RTRs, CRC, AS, NDMS etc

Where: work in many venues



RTR = radiation triage, treat, transport

Why
(do we need major medical training effort)?

- Incidents could be HUGE
- "Whole of (medical) community" needs to engage
  - Includes local, regional, state and national assets
  - Local/regional assets especially in first 72 hours
- Can't afford to waste assets
  - Stuff, Staff, Space

Engagement is a problem (1/2)

- Most medical responders / support personnel know little about radiation and may not want to know more
- Many concerns
  - Radiation is dangerous
  - Afraid to respond
  - Need to be with my family
  - No one knows what to do
  - No way to fix it
  - Feds job to fix it, not mine
  - I don't trust authorities
  - I am not required to help
  - I don't know what to do

Engagement is a problem (2/2)

- Too busy with other responsibilities
  - Costs money/time to train/can’t go elsewhere
  - Subject too complicated to understand
  - So much else “they” make me do
  - Am not required to know this
  - Re-certification is onerous too
- Existing content experts are not reaching many students

Training: who does it now, numbers?

- AFRRI
- REAC/TS
- RITN
- CDC
- Fed, State, locals, prof societies: highly variable
- How is training organized?
  - **Pull** training: user has to go get it; time, money, interest
  - **Push** training: premier "teachers" offer it, but have small capacity and budget, especially for civilians

MEIR Course: “Medical Effects of Ionizing Radiation”

- 3 - day, face to face graduate level instruction
  - Physical properties of radiation
  - Radiation effects on the human body
  - Medical management of radiation injury
  - Operational management of radiological incidents
  - Radiological instrumentation and measurements

http://www.usuhs.edu/afrri

MEIR Course: Statistics FY 2016

- Conducted 28 face-to- face 3 day courses in 20 states, District of Columbia, Okinawa
- Conducted 10 face-to-face specialized training programs ranging from civil support to hospital management of radiological incidents in 3 states
- Trained over 1250 DoD affiliated personnel
- Provided global outreach through our online distance learning program

REAC/TS Courses, Meetings and Workshops (2016)

Location	Number	"Students"
On-Site (In House)	10	250
Off-Site (CONUS):		
Courses	13	1,100
Meetings/Workshops	7	
Off-Site (OCONUS):		
Courses	4	370
Meetings/Workshops	7	1,600
Silent Thunder	6	450
Total	47	5,870

Type of Education and Trends

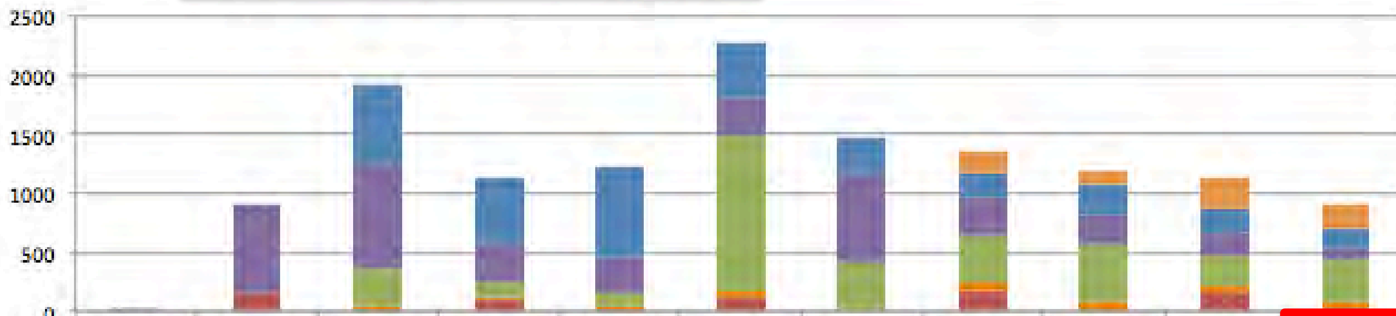
- REAC/TS is approved by the ACGME to award CME-Category 1 credits and by states to award CEUs for participation in its educational courses.
- All education is face to face.
- REAC/TS has a tradition of educating US and foreign experts who have then gone on to develop their own training programs. As part of its "educate the educator" program, REAC/TS continues to aid other groups in developing their own training programs, thereby amplifying its impact in educating the emergency response workforce in the US and throughout the world.
- The percent students attending on-site REAC/TS courses with an MD degree peaked in 2013 at 35% and has declined each year to 20% in 2016. This recent decline may reflect development of successful edcuation/training programs by other organizations such as the CDC, RITN and IAEA.
- Student evaluations of their educational experience at REAC/TS are a vital asset for exceeding their expectations in continuing revisions of course materials.
- REAC/TS has supported and continues to strongly support the development of a comprehensive e-curriculum to meet the needs of educating and training civilian and military healthcare providers throughout the US.

RITN

RADIATION INJURY TREATMENT NETWORK

RITN Training & Education

Grand Total = 13,579



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Other RITN Web Courses								192	120	267	217
Grandrounds			677	564	763	460	314	203	259	208	164
Basic Rad Tng	30	752	895	320	301	322	744	316	242	180	99
Outreach Presentation			317	139	112	1322	394	389	498	261	347
REAC/TS			38	26	46	45	26	84	77	71	58
AHLS										1	28
Biennial Conference		149		92		125		175		150	

https://ritn.net/

CDC

- No data provided on courses "completed for CME"
- Well used and respected web site
- Public health focus

Prepare: what users say they want

- Tell me at the time, not now
  – Just in time
  – Just what I need to know to do my job and be safe
- Tell me simply
  – One page
  – Job sheet

Prepare: includes Learn, Practice, Certify, Repeat

- Use online platform(s) for content learning
  - Low or no cost; easy to use; updatable info
- Practice working in teams, with equipment, at venues
  - Participate in exercises, not just table tops
- Implement Lessons Learned
  - Continuous improvement
  - Update with new knowledge

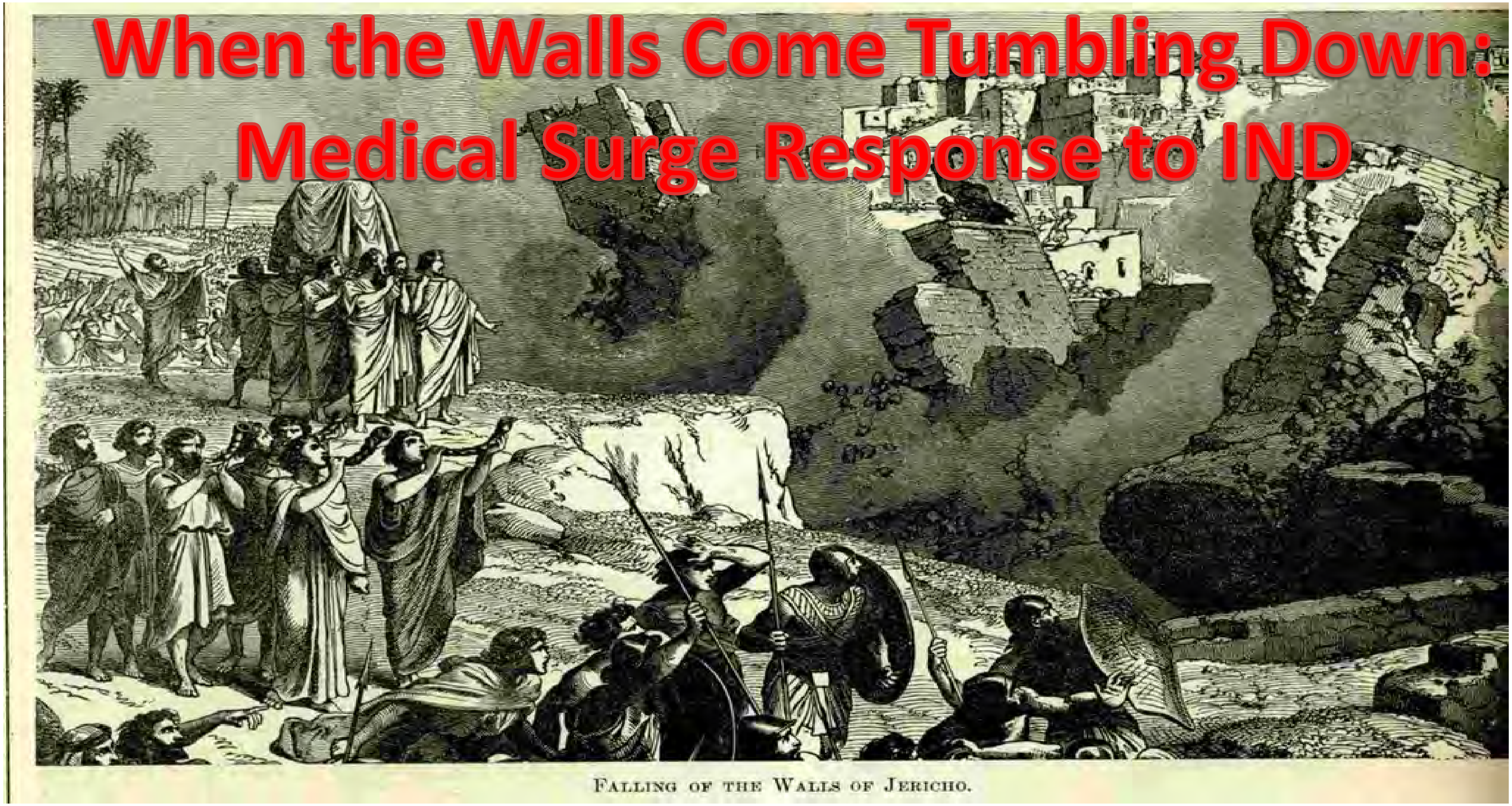
Gaps (1/2)

- BEFORE THE INCIDENT:
  - Need training and re-certification for large cadres : experts, surge & support personnel
  - Need tiers of training CUSTOMIZED to target response role
  - Need support: no federal entity paying to “create” large scale, customized training
  - Need engagement of professional medical societies and medical schools
  - Need supplement to currently required training, e.g., NPPs, isotope users in hospitals, industry, border protection, military –civilians clinicians not currently engaged
  - How much training is enough for each cadre?
  - Repeat how often?

Gaps (2/2)

- DURING THE INCIDENT:
  - JUST-IN-TIME INFORMATION geared for the incident & responder’s sophistication, role, location
  - ACCURATE information must be provided QUICKLY by respected authorities, especially about risk to responders, risk to general public, and what do I do?
  - Engage advice of experts: ? create and expand “medical ROSS”
  - Implement consistent use of international units vs. common units
- UPTAKE
  - LOTS OF GOOD INFO AND TRAINING AVAILABLE, BUT MINIMAL UPTAKE
  - TRAINING MAY NEED TO BE REQUIRED; HOW?

When the Walls Come Tumbling Down: Medical Surge Response to IND



FALLING OF THE WALLS OF JERICHO.

Dan Hanfling, MD
Special Advisor, Department of Health and Human Services, Assistant Secretary for Preparedness and Response
Contributing Scholar, Johns Hopkins Bloomberg School of Public Health, Center for Health Security

Key Points

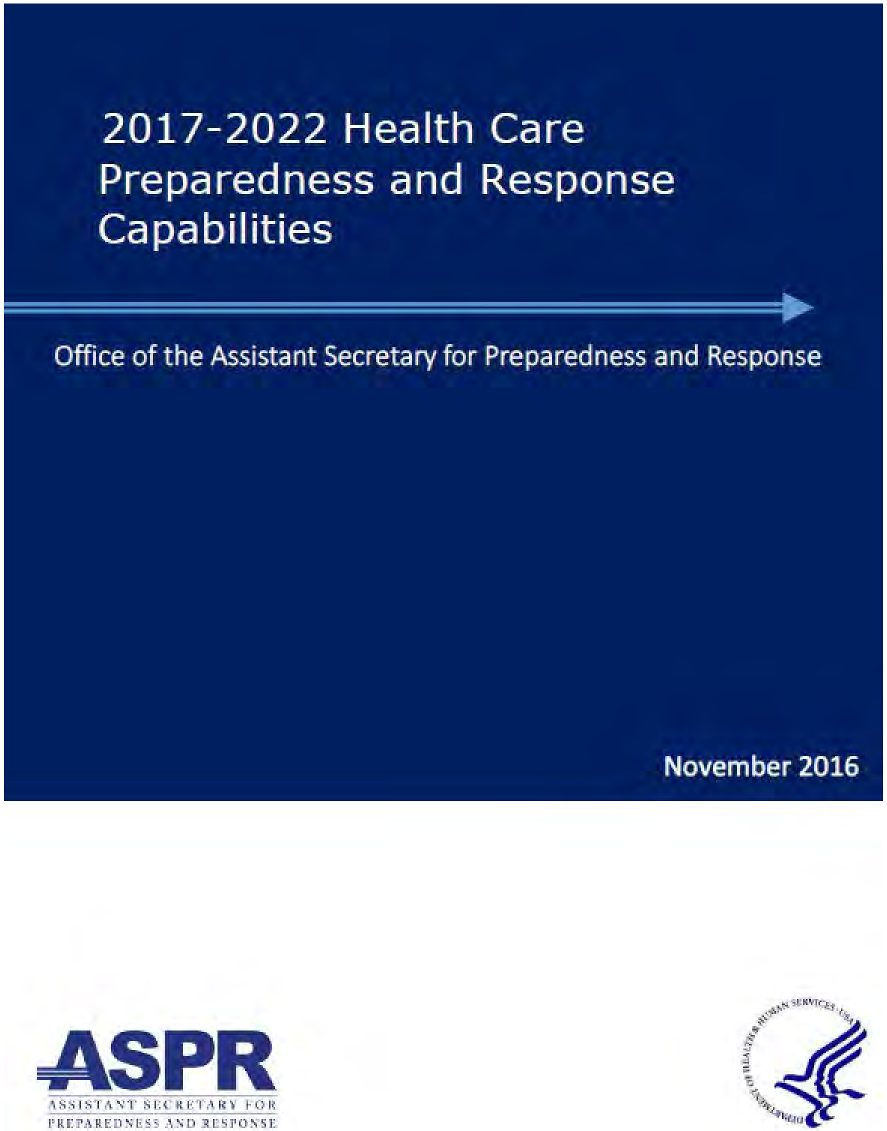
- Understand the current state of medical preparedness – existing gaps in radiation response surge planning
- Recognize there are significant challenges in the management of combined injuries
- Promote the application of Crisis Standards of Care principles to help move planning forward

Photo: Clay Lipsky

Gaps in Healthcare Capabilities

- This audience:
  – Health Security = National Security
- The larger audience:
  – Job Security (MDs, RNs, Techs) = Customer Service
- Citizens who are cared for by "Dr. Google"

Gaps in Healthcare Capabilities


2017-2022 Health Care Preparedness and Response Capabilities

Office of the Assistant Secretary for Preparedness and Response

November 2016

ASPR

ASSISTANT SECRETARY FOR PREPAREDNESS AND RESPONSE

Activity 5. Provide Surge Management during a Chemical or Radiation Emergency Event

To ensure successful surge management, HCC members must be prepared to do the following:

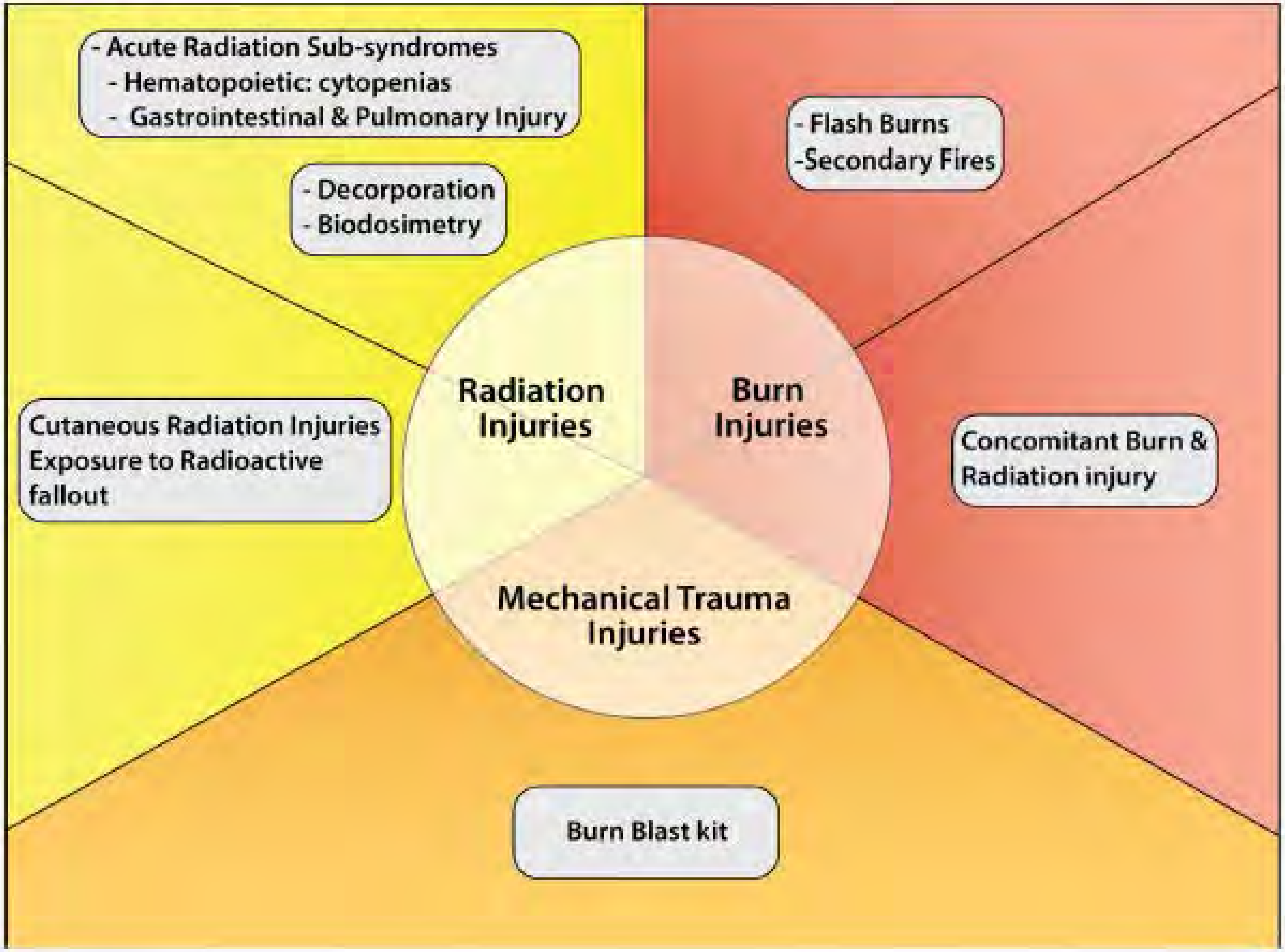
- Provide wet and dry decontamination by personnel trained and equipped according to the OSHA First Receiver Guidance and the National Planning Guidance for Communities Patient Decontamination in a Mass Chemical Exposure Incident: National Planning Guidance for Communities
- Ensure involvement and coordination with regional HAZMAT resources (where available) including EMS, fire service, health care organizations, and public health agencies (for public messaging)
- Distribute and administer available antidotes, including mobilization of CHEMPACKs when necessary
- Screen to differentiate exposed from unexposed patients, especially in radiation emergency events
- Develop a process for radiation triage, treatment, and transport (RTR response)

Combined Injuries

Blast: overpressure + shockwave = Trauma
Thermal: thermal pulse + ignited fires = Burns
Radiation: prompt+ fallout = Acute radiation syndrome, cutaneous radiation injury

Photo: Clay Lipsky

Medical Consequences: IND Detonation



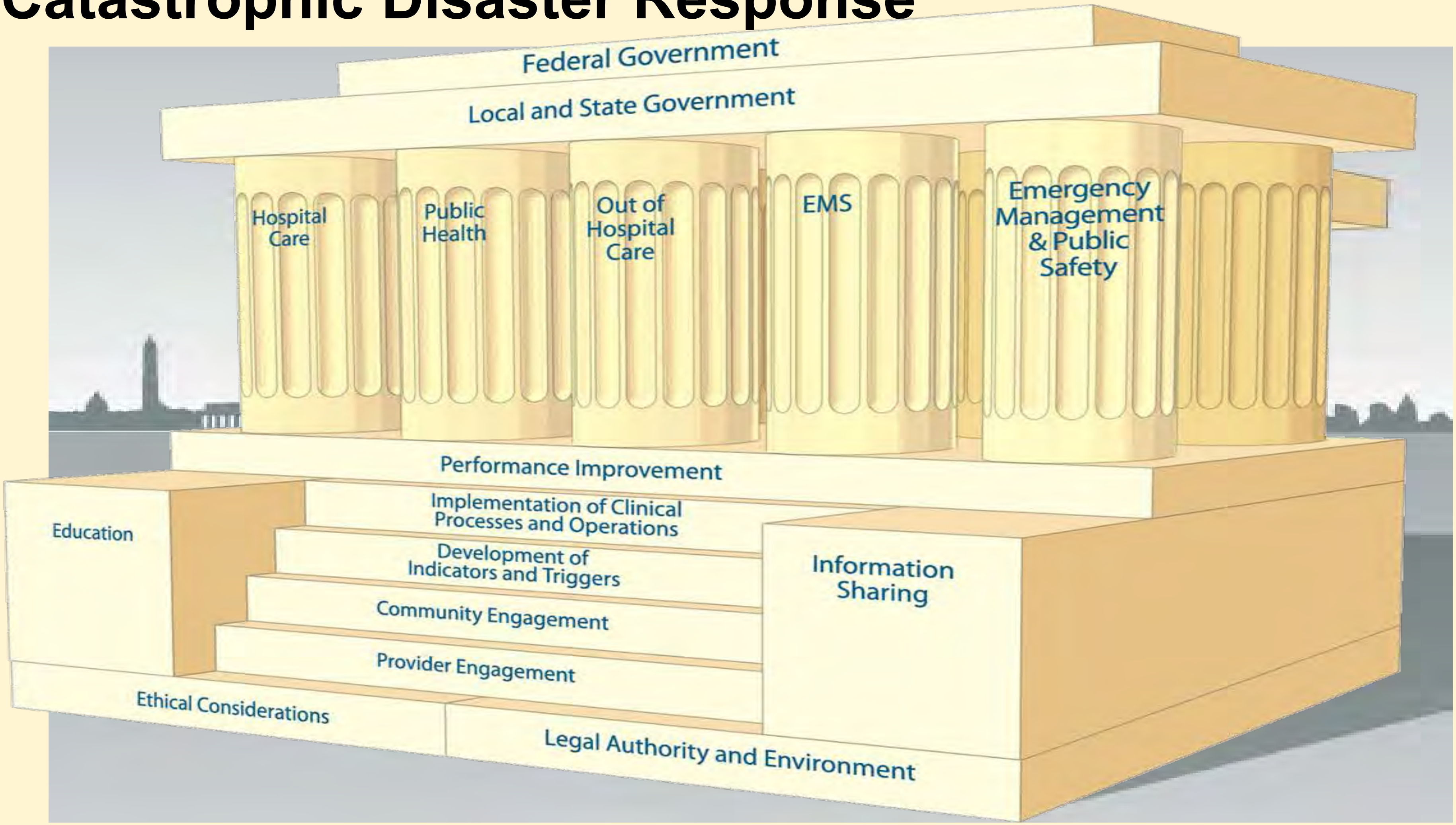
ASPR
ASSISTANT SECRETARY FOR PREPAREDNESS AND RESPONSE

"Participants expressed a need for additional information, strongly disagreed with aspects of current response guidance, and in some cases indicated they would not carry out current protocols."

Becker SM, Middleton SA, *Improving hospital preparedness for radiological terrorism: perspectives from emergency department physicians and nurses*. Disaster Med Public Health Prep. 2008 Oct;2(3):174-84


Crisis Standards of Care

Conceptualizing a Systems Framework for Catastrophic Disaster Response



INSTITUTE OF MEDICINE
OF THE NATIONAL ACADEMIES

Advising the nation • Improving health

Published in final edited form as:
Disaster Med Public Health Prep. 2011 March ; 5(0 1): S32–S44. doi:10.1001/dmp.2011.17.

Radiation Injury After a Nuclear Detonation: Medical Consequences and the Need for Scarce Resources Allocation

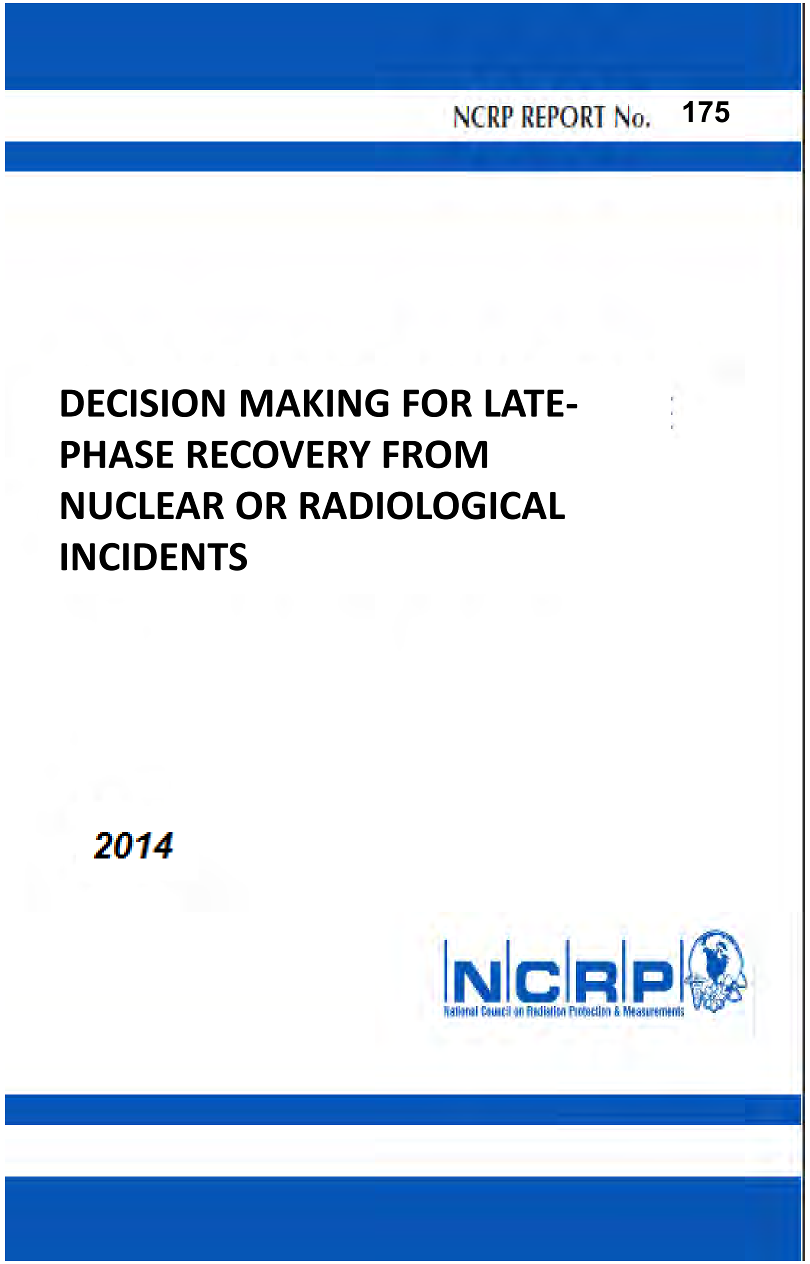
Dr. Andrea L. DiCarlo, PhD, **Commander Carmen Maher, MA, CDR-USPHS**, **Dr. John L. Hick, MD**, **Dr. Dan Hanfling, MD**, **Dr. Nicholas Dainiak, MD**, **Dr. Nelson Chao, MD**, **Dr. Judith L. Bader, MD, CDR-USPHS**, **Dr. C. Norman Coleman, MD**, and **Dr. David M. Weinstock, MD**

total irradiated people at their institutions. Strategies to increase bed availability and extend staff and resources could increase surge capacity 10-fold but would require changes in operating standards.[90] Considering the large number of irradiated casualties anticipated after a nuclear detonation (Figure 1), many centers across the country in addition to those in RITN will be asked to participate in the management of casualties with ARS.

Progress and Possibilities

Jill A. Lipoti, *Rutgers University* &
Gerilee W. Bennett, *Federal Emergency Management Agency*

- Assistant Teaching Professor, Department of Human Ecology
- Elected to the Council in 2001, and has served on the Board of Directors, PAC 5, PAC 7, and SC 5-1 which produced NCRP Report No.175


NCRP REPORT No. 175

DECISION MAKING FOR LATE-PHASE RECOVERY FROM NUCLEAR OR RADIOLOGICAL INCIDENTS

2014

NCRP
National Council on Radiation Protection & Measurements

S.Y. Chen,
Chairman **SC 5-1**

Illinois Institute of Technology

General principles for late phase decision-making

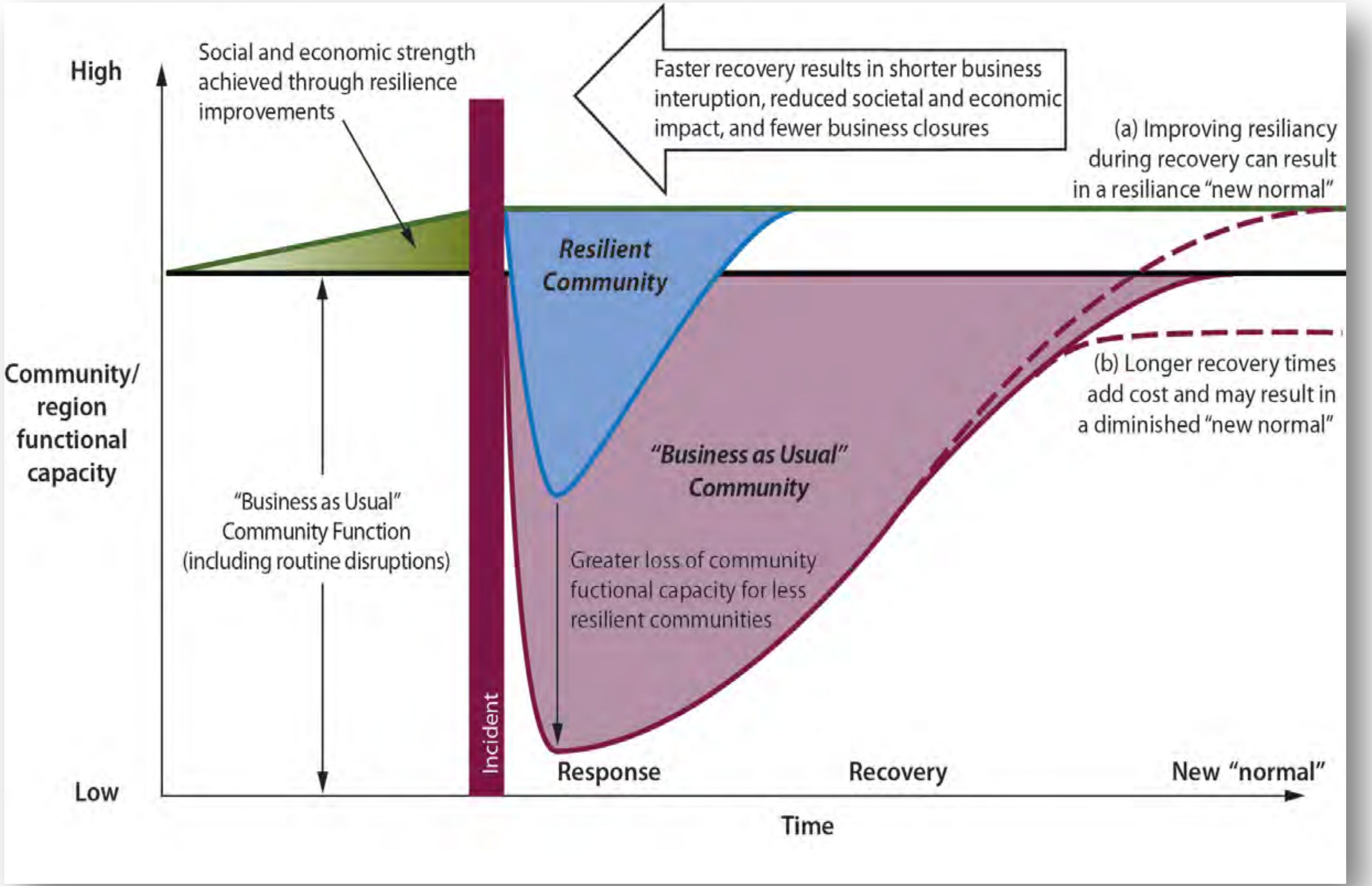
Expected late phase issues and recommendations

Optimization—balanced strategy

Partnering with stakeholders in decision making

(Source: NCRP)

Late-phase recovery: a challenging journey back to new normality



New Normality

Model: Dr. Mary Ellen Hynes, DHS (2001); Blair Ross, ORNL; CARRI 2008 ©

Resilience - definition

- The capacity of a system to absorb disturbance, undergo change, and retain the same essential functions, structure, identity, and feedbacks
- Combination of **resource robustness**
  - Financial support, sufficient human resources, relevant technologies, and a sound organizational structure
- And **adaptive capacity,** the ability of groups to:
  - Remember experiences,
  - Learn, innovate, and reorganize resources to adapt to changing conditions
  - Connect with others to communicate lessons learned.

NCRP 175 Recommendations

- Recommendation 1: National Strategy Promoting Community Resilience
- Recommendation 2: Late-phase response integration into emergency planning
- Recommendation 3: Site-specific optimization
- Recommendation 4: Stakeholder engagement and empowerment
- Recommendation 5: Communication Plan
- Recommendation 6: Adaptive and Responsive Cleanup Strategies
- Recommendation 7: Research and Development
- Recommendation 8: Continuous Adaptive Learning

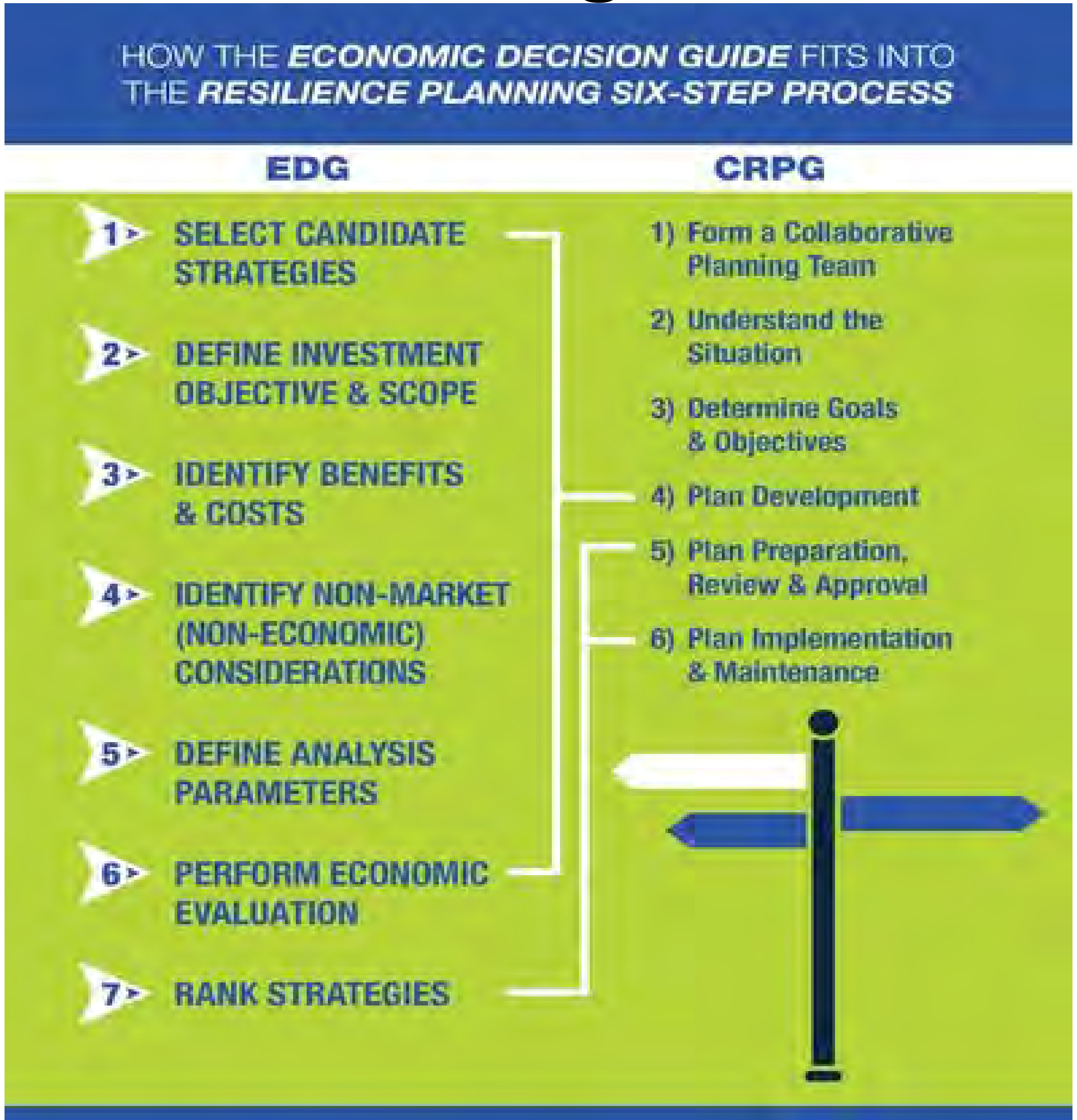
Recommendation 1: National Strategy Promoting Community Resilience

A comprehensive national strategy should be developed that focuses on promoting community resilience as the most favorable preparedness approach for responding to and recovering from major nuclear or radiological incidents involving widespread contamination.

NIST Community Resilience Planning Guide, May 2016

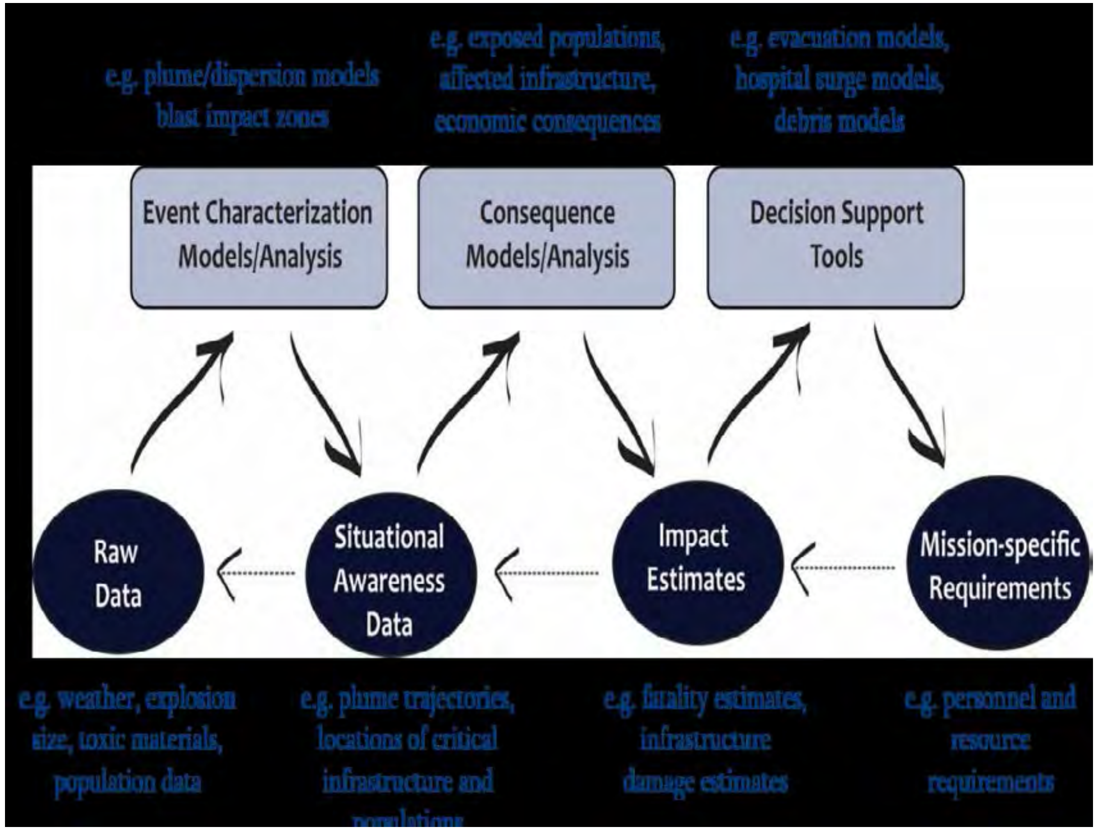
Economic Decision Guide for Buildings and Infrastructure Systems

- Companion document
- Analyses the “resilience dividend”
- Presents the business case for resilience
- “If the hazard never occurs, are there day-to-day benefits that accrue?”



Recommendation 2: Late-phase response integration into emergency planning

Late-phase response following a major nuclear or radiological incident involving widespread contamination should be integrated into national, state and local government emergency response planning and regularly included in response exercises.



Nuc/Rad Incident Annex, October 2016

Annex provides practical relevant guidance

Example: Public Self-Decontamination

- Shortfall of capability to support public gross decontamination
- Survivors who have changed clothing and footwear, and washed their heads and hands should be considered not contaminated.

Are they really more resilient?

Only way to tell is to conduct exercises.

Currently, just being involved in "resilience planning" seems beneficial to municipalities, especially when the insurance and reinsurance industries have been more actively pushing municipalities to think about the impacts of future coastal hazards. The question remains: are municipalities really more resilient or do they just think they are?

-- NJ Adapt

Exercising Recovery

Arizona Recovery Tabletop 2015

Southern Exposure 2015

Gotham Shield 2017

Southern Exposure 2015

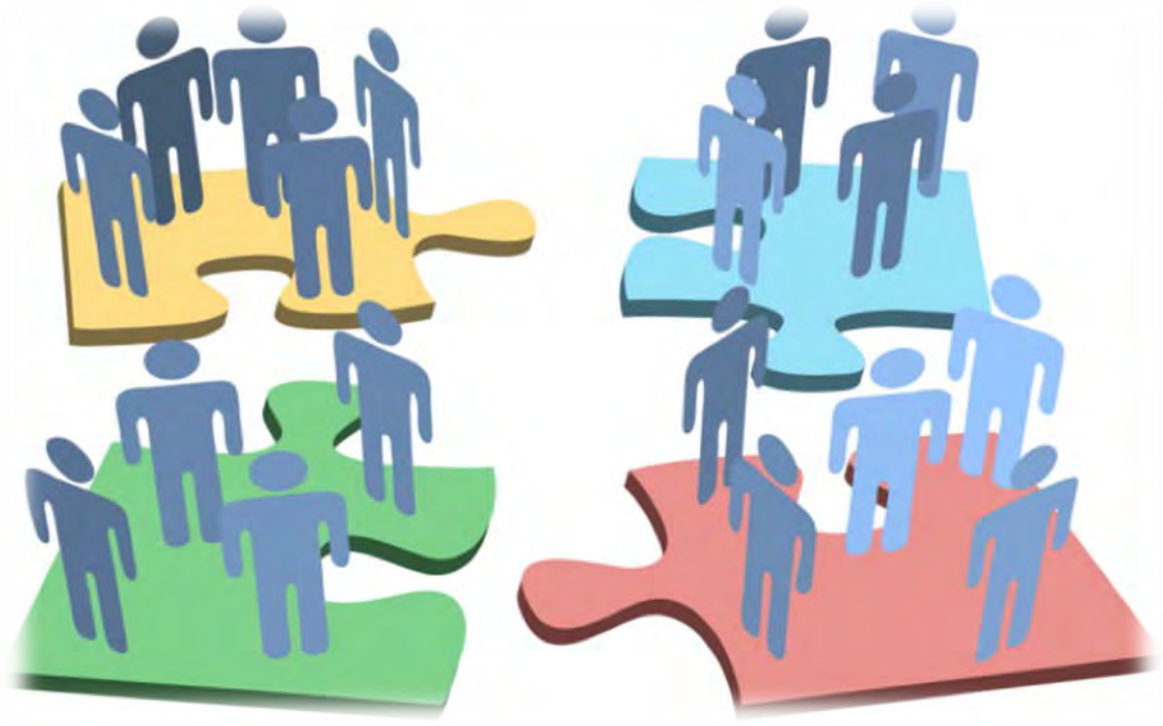
Image Credit: Jim Melvin / Clemson University

NCRP proposal for exercise templates

1. Develop tabletop methodology with rad/nuc database
2. Hypothetical computer generated information about pre-recovery environment and tasks
3. Decision-making sequences and options leading to remediation and rehabilitation
4. Templates for stakeholder input regarding options and implementation
5. Participants analyze results and ramifications for the options chosen
6. Re-iterate variations

Recommendation 3: Site-specific optimization

Site-specific optimization for managing widespread contamination from radioactive material should be fully embraced to maximize community benefit.



Annex references NCRP #175 for decision-making processes

References stakeholder process recommended by NCRP

"The National Council on Radiation Protection and Measurements Report No. 175 provides detailed guidance for late phase remediation planning and decision making."

- Technical Working Group
- Stakeholder Working Group

Annex does not set standards

Decon/Clearance standards

There is no universally accepted radiation level to inform long-term recovery.

Instead, a process should be used to determine acceptable criteria based on the societal objectives for expected land uses and the options and approaches available

Recommendation 8: Continuous Adaptive Learning

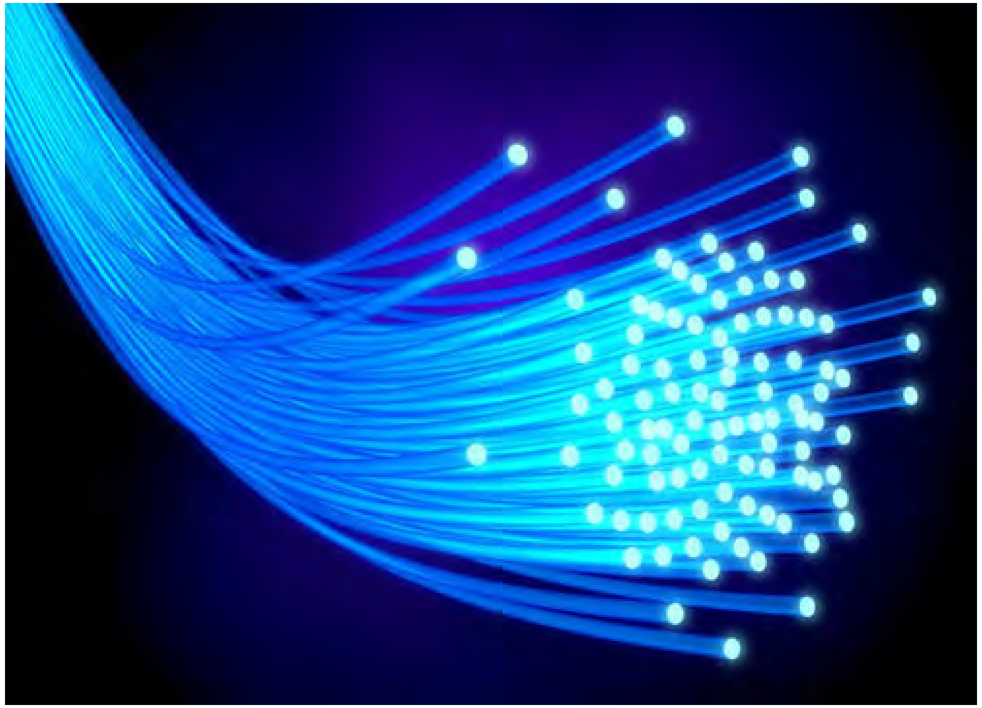
NCRP recommends:

- To promote continuous and adaptive learning, a mechanism should be established to integrate new information and lessons learned from past incidents into the strategies for late-phase recovery.

All Hazards Approach

Looking at the larger picture of resiliency and recovery efforts, beyond rad/nuc...

Multi-hazards approach



Improvement of understanding of interdependence of infrastructure

- Example: Post-Hurricane Sandy copper wiring replaced with fiber optic—not vulnerable to flooding.
- This improved resilience in the communication system is useful for resilience for a radiation event

Interdependence of infrastructure

NIST – Community resilience for the built environment

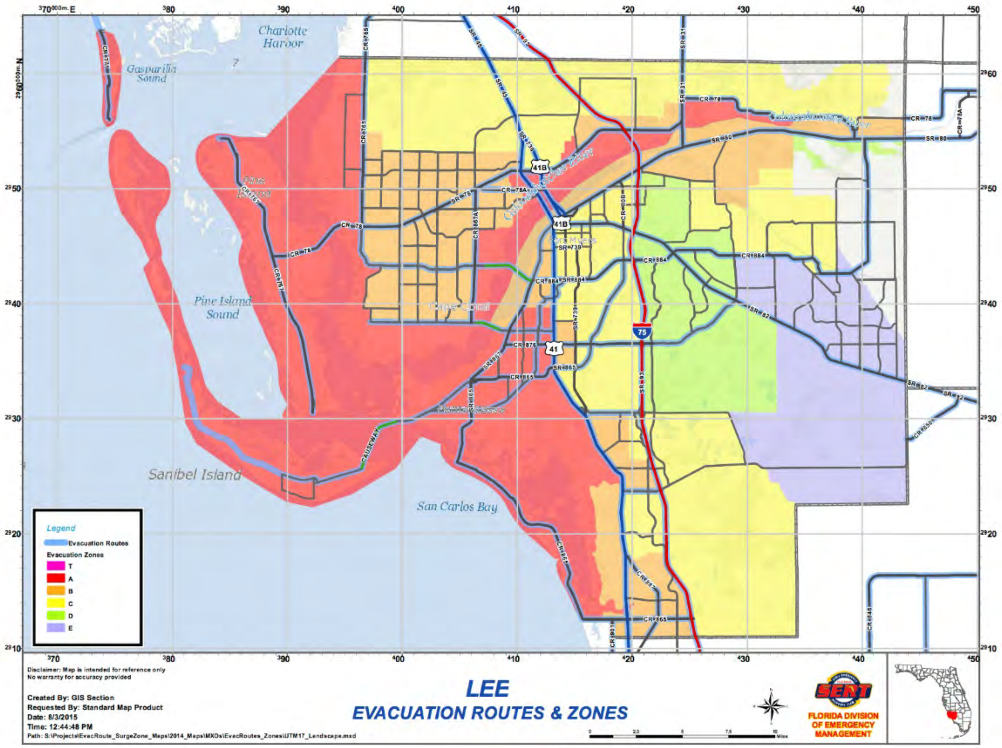
- The resilience topics covered by the new portal are: buildings and structures, communications, community resilience, disaster planning, economics, energy, environment and natural resources, social equity, transportation, and water and wastewater.

Realization by planners in response to resiliency efforts for storm surge

- *Vulnerabilities and consequences can be economic, environmental or social.* ***Damages to some places or assets can be more consequential than to others.*** *(NJ Adapt)*

After repeated flooding events, FEMA funds have been used to buy out homes rather than rebuild.

“Blue Acres” is one way to reduce risk.

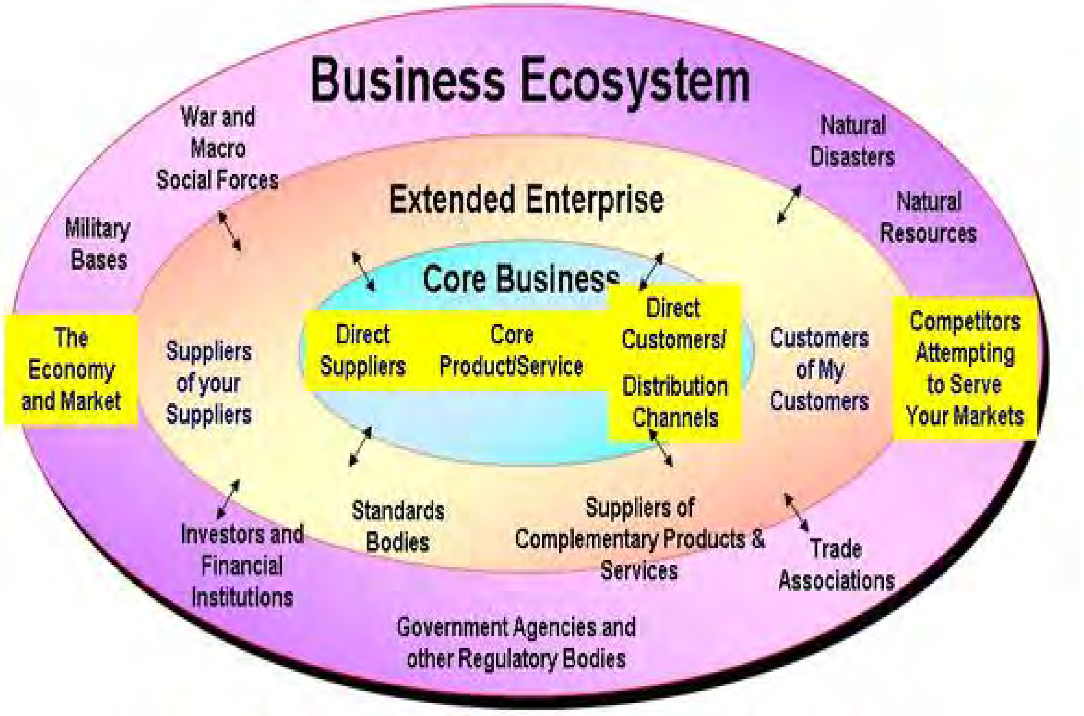


Effect on evacuation times?

- Since it is more difficult to evacuate people in flood prone areas, evacuations that may be necessary due to a rad/nuc event should be streamlined.

Business planning

Government and businesses need to cooperate on resilience plans



Risk management plans for businesses

- Continuity of Operations plans help to pinpoint interdependence with other businesses and government operations
- Critical supply chains identified with pre-planning can help recovery

Adding resilience to social systems

Principles and Framework for Boston's Resilience Strategy

1. recognizing how contemporary and historical racism have shaped the city;
2. creating a collaborative, inclusive government that includes citizens in decision-making;
3. opening up equitable economic opportunities; and
4. increasing transportation connectivity for low-income communities.

Where has emergency planning been exercised recently? Drought…

- Consider not only how drought planning increases resilience, but also how drought response might affect rad/nuc planning.
- How does water reuse affect emergency planning for rad/nuc cleanup?
- Does a desalinization plant also remove radionuclides? How does that affect disposal of residuals?

Other strategies for drought/ flooding - storm water diversion

Stormwater carries contamination

Where does it go?

Rain gardens

Do they capture radionuclides?

Is that useful for decreasing residential exposures?

Are there unintended consequences for resilience planning?

Municipal decision makers and professionals desire a more holistic approach to resilience guided by a statewide vision for planning and implementation. (NJ Adapt)

Resilient architecture for house, but is the infrastructure also resilient?

Conclusion

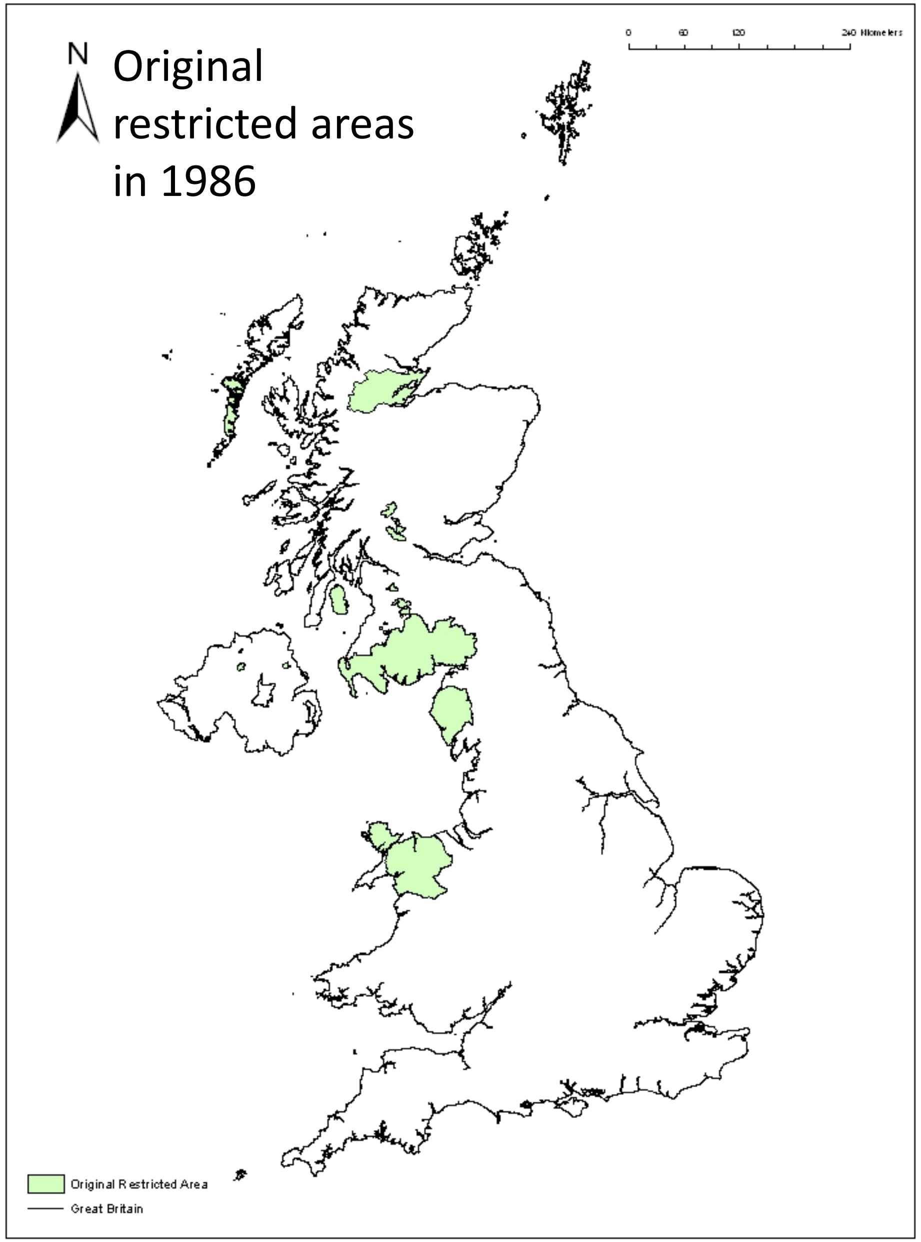
- NCRP #175 set the stage for many aspects of recovery planning
- Federal agencies and states and local governments have made strides in filling the gaps identified
- Aligning rad/nuc recovery with all hazards risk management provides the greatest opportunity for continued improvement

Contemplating Completion: Defining an Exit Strategy

John J. Cardarelli & Sara DeCair
U.S. Environmental Protection Agency

“Exit Strategy” Case Studies

- Chernobyl Accident
  - Ceasing monitoring of sheep after Chernobyl
  - EPA short videos: Factors to consider
- Liberty RadEx (RDD)
  - Community Advisory Panel
- Fukushima Accident
  - Return to routine EPA RadNET monitoring
  - Ceasing evacuation orders



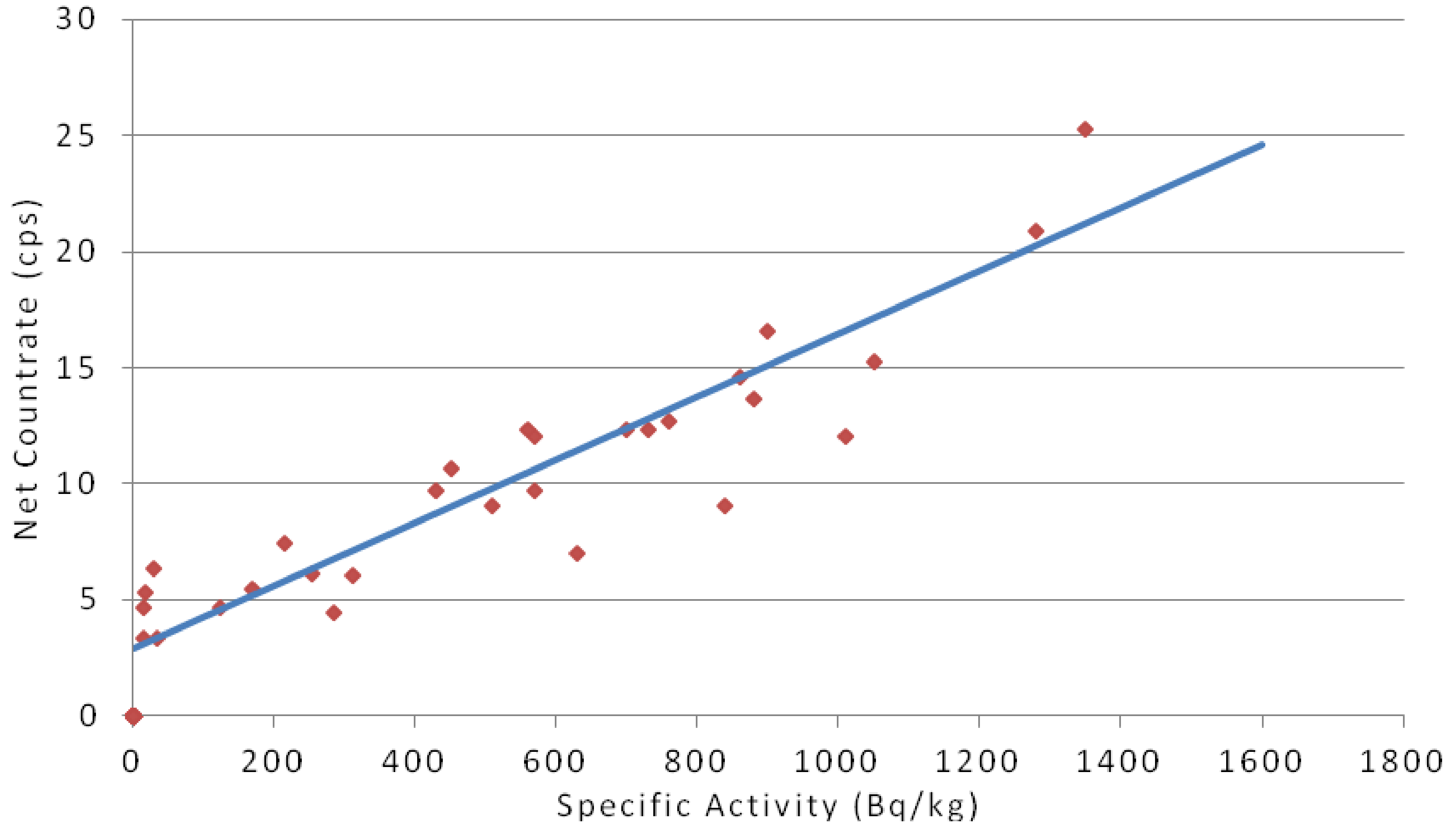
Widespread monitoring following the Chernobyl nuclear accident in 1986 identified potential food safety concerns due to levels of radiocesium in the meat of sheep grazing certain upland areas of the UK.

- Cs-137 >> Peaty Soil >> Plant Uptake >> Sheep Meat
- 9,800 farms
- 4 million sheep
- Live monitoring technique (avg of three 10-sec counts)
- 1,000 Bq/kg screening criteria (0.26 mSv/y)
  - Above this criterion, 3 month wait & clean feed
  - This limit does not establish “safe” vs. “unsafe”
  - Allows doses to be understood and put into context with established dose limits

https://www.food.gov.uk/sites/default/files/multimedia/pdfs/board/fsa120306.pdf

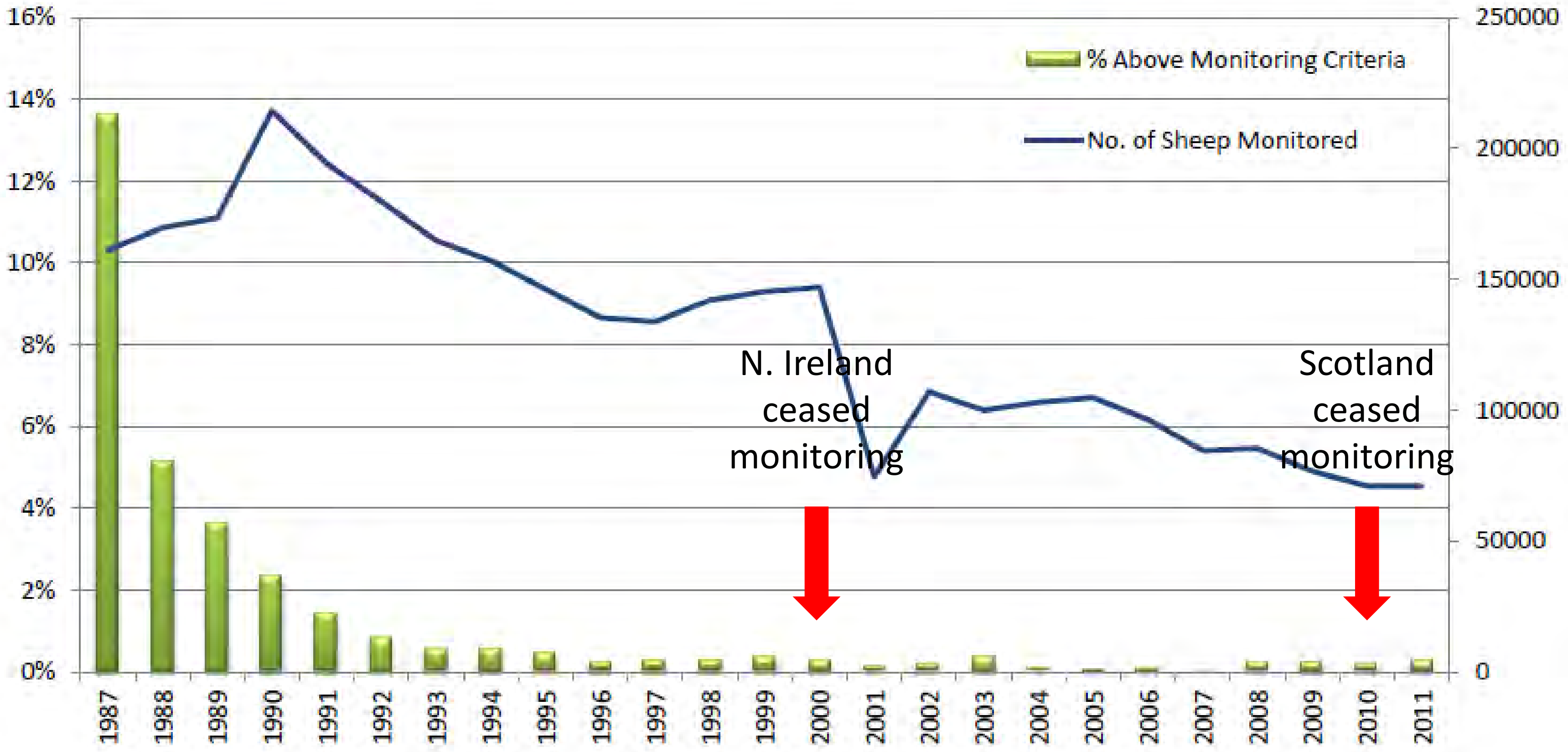
https://www.food.gov.uk/sites/default/files/multimedia/pdfs/chernobylassessment.pdf

Live Monitoring Technique



https://www.food.gov.uk/sites/default/files/multimedia/pdfs/chernobylassessment.pdf

Figure 3 - Percentage of sheep above the monitoring criteria in Wales between 1987 and 2011



In England, there were no *Mark and Release* failures since 1991, with the exception in 2004 where four sheep failed.

Exit strategy for ceasing monitoring

- Full-flock monitoring
- Summer months
- 2 years in a row
- 0 exceedances
- Risk/Dose assessment

Conclusion

"The review shows that the consumer risk is now very low and removing controls will not compromise consumer safety." (0.05 to 0.21 mSv/y)

FOR Ceasing Monitoring

"I consider that the post-Chernobyl restrictions have only been implemented for as long as they have in order to maintain the employment of those bureaucrats and civil servants involved. I shall be overjoyed to have all controls lifted and not have to waste any more of my time and tax money on this nonsense." Ms. J Graham, North Wales

"We have no objection to the controls being lifted providing that the FSA can give effective and evidenced assurances that there is no risk to consumers." The National Sheep Association

AGAINST Ceasing Monitoring

"The FSA and Welsh Assembly need to re-think this, otherwise they will have a real agricultural economic disaster on their hands, all of their own doing. Scanning should be continued for the sake of farming, as this could well be the final nail in the coffin of an already struggling farming industry." Anonymous, North Wales.

https://www.food.gov.uk/sites/default/files/multimedia/pdfs/board/fsa120306.pdf

Short videos on Chernobyl accident & Lessons Learned Factors to consider in establishing an exit strategy.

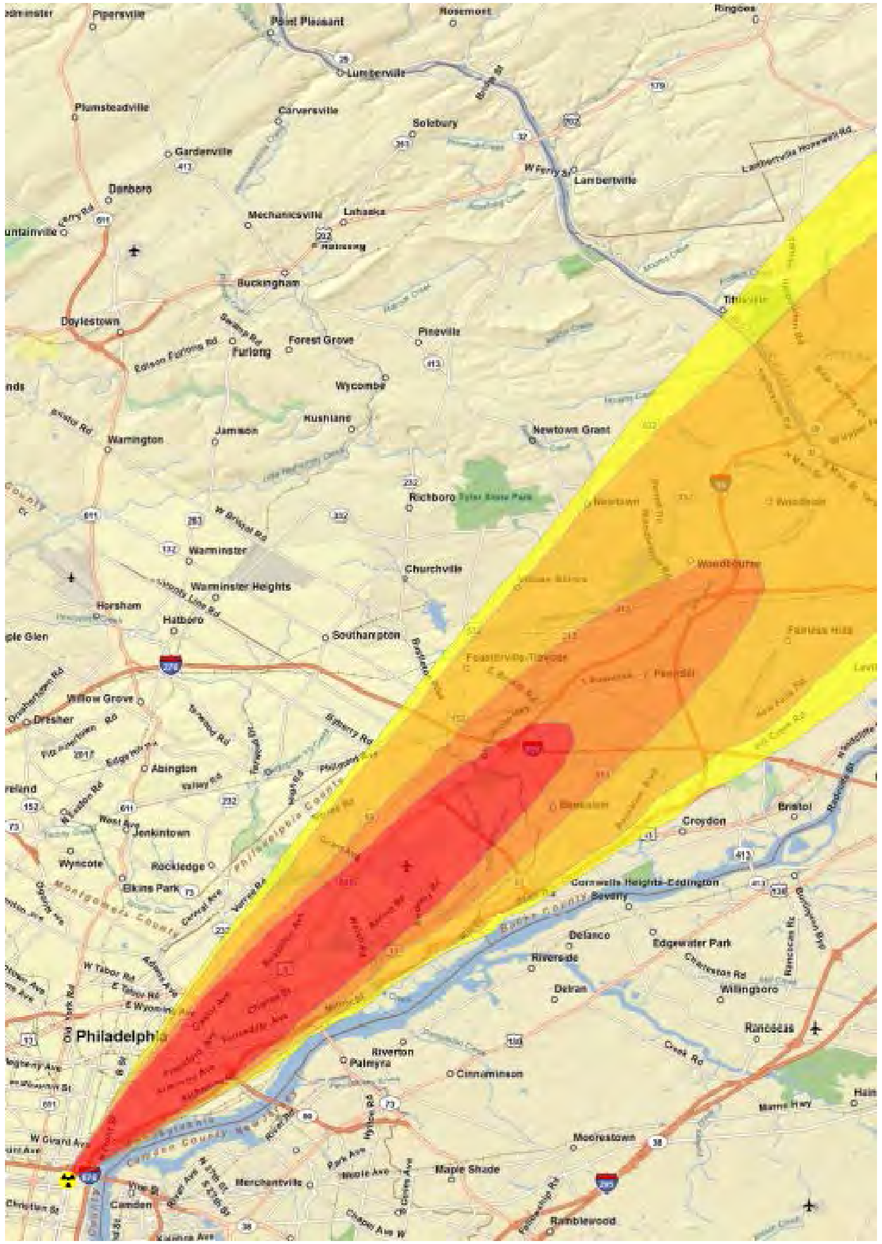
Managing the Food Supply

1. Lesson Learned
2. Radiation and Radioactivity
3. Types of Radiation Incidents
4. The Initial Response
5. Self Protection
6. Reducing Risks
7. Managing Food Supply
8. Coping with Health Concerns
9. Communication / Trust
10. US Government Preparation
11. Educational Resources

https://www.epa.gov/emergency-response/recovering-nuclear-incident-lessons-learned-chernobyl

Liberty Rad Ex

- April 2010; Cs-137 RDD
  - 1,000 participants
  - 35 Federal Agencies
  - 9 community groups
  - 14 businesses
  - 2 universities
  - 6 foreign countries
- First to focus on late-phase
- Purpose: To test federal, state, and local post-emergency response plans



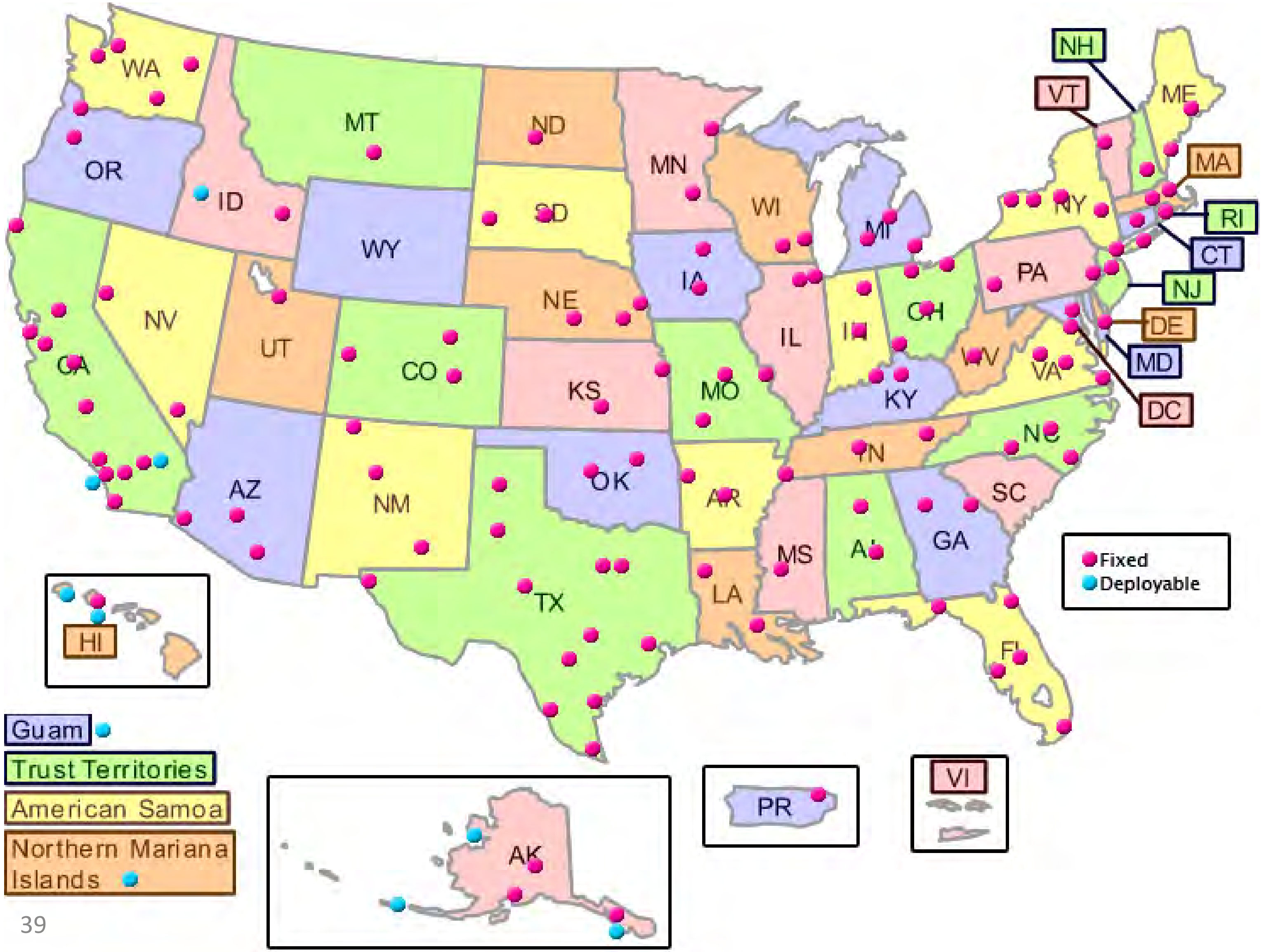
Community Advisory Panel
(key component in decision making)

- One major theme of the community panel was the need for self-help information in order to better prepare and protect themselves
- CAP members were willing to sacrifice their own self-interests if they believed the community as a whole was being served
- Worked well with the Technical Advisory Panel, shown here →

RADNET
Tracking Environmental Radiation Nationwide

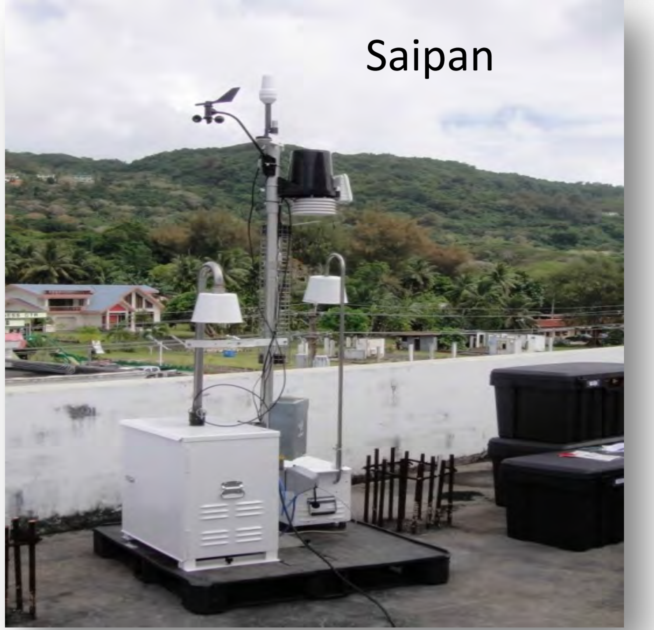
Air Monitoring Stations

https://www.epa.gov/radnet



- 130 monitors
- 50 states
- 24/7 operation
- Over time, RadNet results reveal the normal background levels of environmental radiation

RadNet Deployable Monitors: Fukushima Response



Return to regular monitoring following Fukushima

- Metric for demobilization:
  - One full set of data points showing no discernable difference from natural background
- Worked with Public Information to craft effective messaging
- Resistance to returning to normal monitoring scheme

Reoccupying areas in Fukushima (ceasing evacuation order)

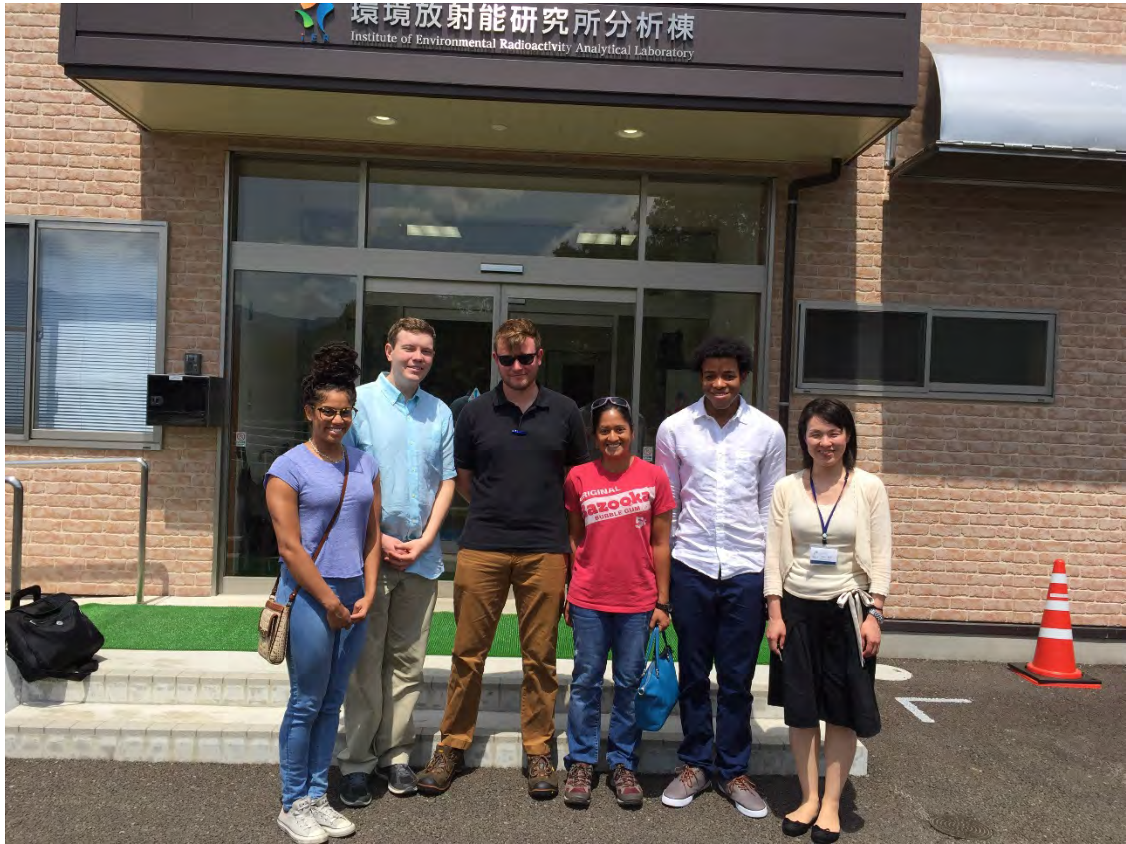
Memorandum of Understanding (MOU) between

Colorado State University, Fort Collins, Colorado USA and

Fukushima University,

Fukushima City, Fukushima, Japan

CSU has had an MOU with Fukushima University since June 2013



Reoccupying Areas in Fukushima (ceasing evacuation orders)

Key people at Fukushima University

Dr. Kenji Nanba Director, IER

Dr. Thomas Hinton, IER

Key people at Fukushima Medical University

Dr. Arifumi Hasegawa

Dr. Kenneth E. Nollet

Reoccupying areas in Fukushima (ceasing evacuation order)

The Decision Point – when risk of remaining evacuated becomes greater than the risk of return

- Remain Evacuated
  - Community Cohesion
  - Loss of infrastructure
  - Damage to economy
  - Direct costs of housing
  - Individual Health

- Return
  - Community Cohesion
  - Damaged infrastructure
  - Access to services
  - Rebuilding costs
  - **Individual Health (residual hazard)**

Reoccupying areas in Fukushima (ceasing evacuation order)

- Implications for Reoccupation
  - Risk / Dose assessments (holistic approach)

  - Infrastructure and industry degrade quickly when unmaintained and abandoned, and are very expensive to restore

  - Consider age-based limited return to areas
    - Partial return excluding children may be a socially acceptable compromise in some situations
    - May contribute to sustaining community identity, resiliency, and economic and social health

Conclusions

- Leverage All-Hazards preparedness: Provide guidance to help states and communities improve resilience to nuclear/radiological incidents by leveraging existing local disaster plans and risk management efforts.
- Exercising our good guidance on recovery would aid localities with multiple facets of disaster recovery, for all hazards
- Discussing an exit strategy with stakeholders early in the response-recovery will ease the demobilization of assets

Image credit: Fukushima University

Communications Challenges in Crisis and Transition

Shelley Laver

Agenda

- Radiation Communications Tools
- On-going Efforts
- Existing Gaps

Radiation Communication Tools

Emergency Support Function #15 – Annex N (Radiological)

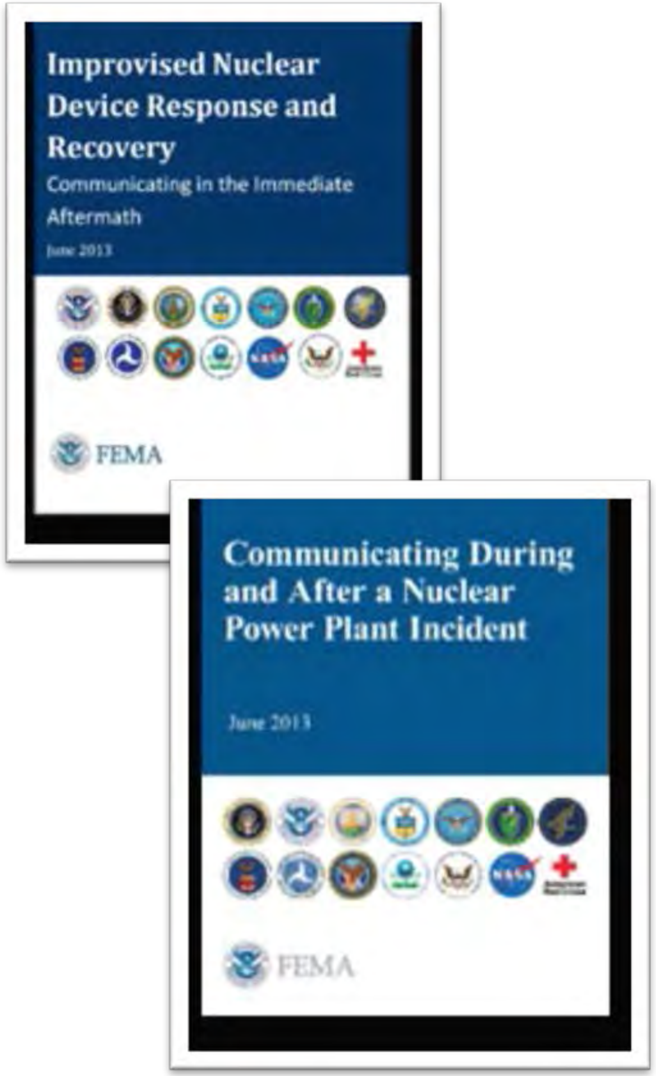
- Pre-scripted Talking Points
- CDC Infographics
- On-Line Resources

Pre-Scripted Talking Points

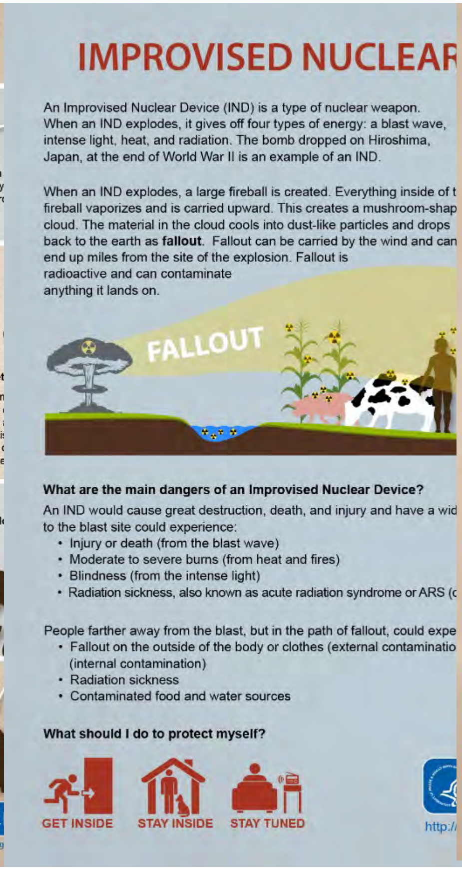
- **IND Response and Recovery: Communicating in the Immediate Aftermath**

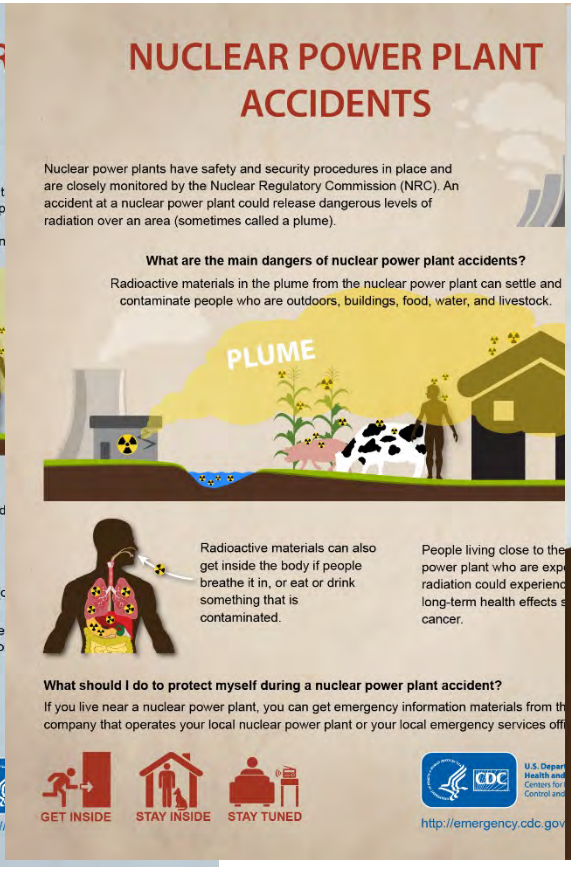
- **Communicating During and After a Nuclear Power Plant Incident**

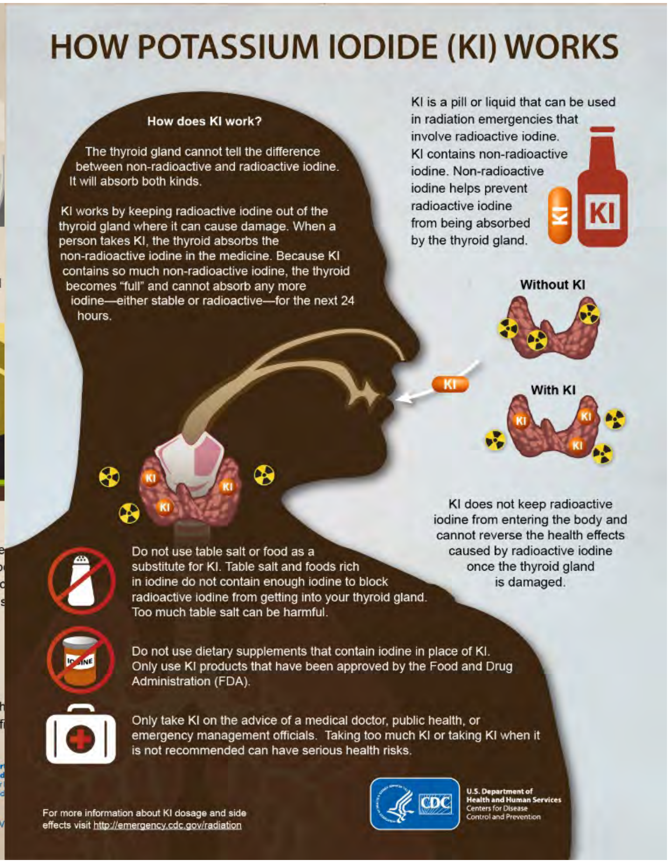
- **Communicating Radiation Risks: Crisis Communications for Emergency Responders**



CDC Infographics







On-Line resources

http://www.remm.nlm.gov/

http://emergency.cdc.gov/radiation/

http://www.nrc.gov/about-nrc/emerg-preparedness.html

https://www.epa.gov/radiation

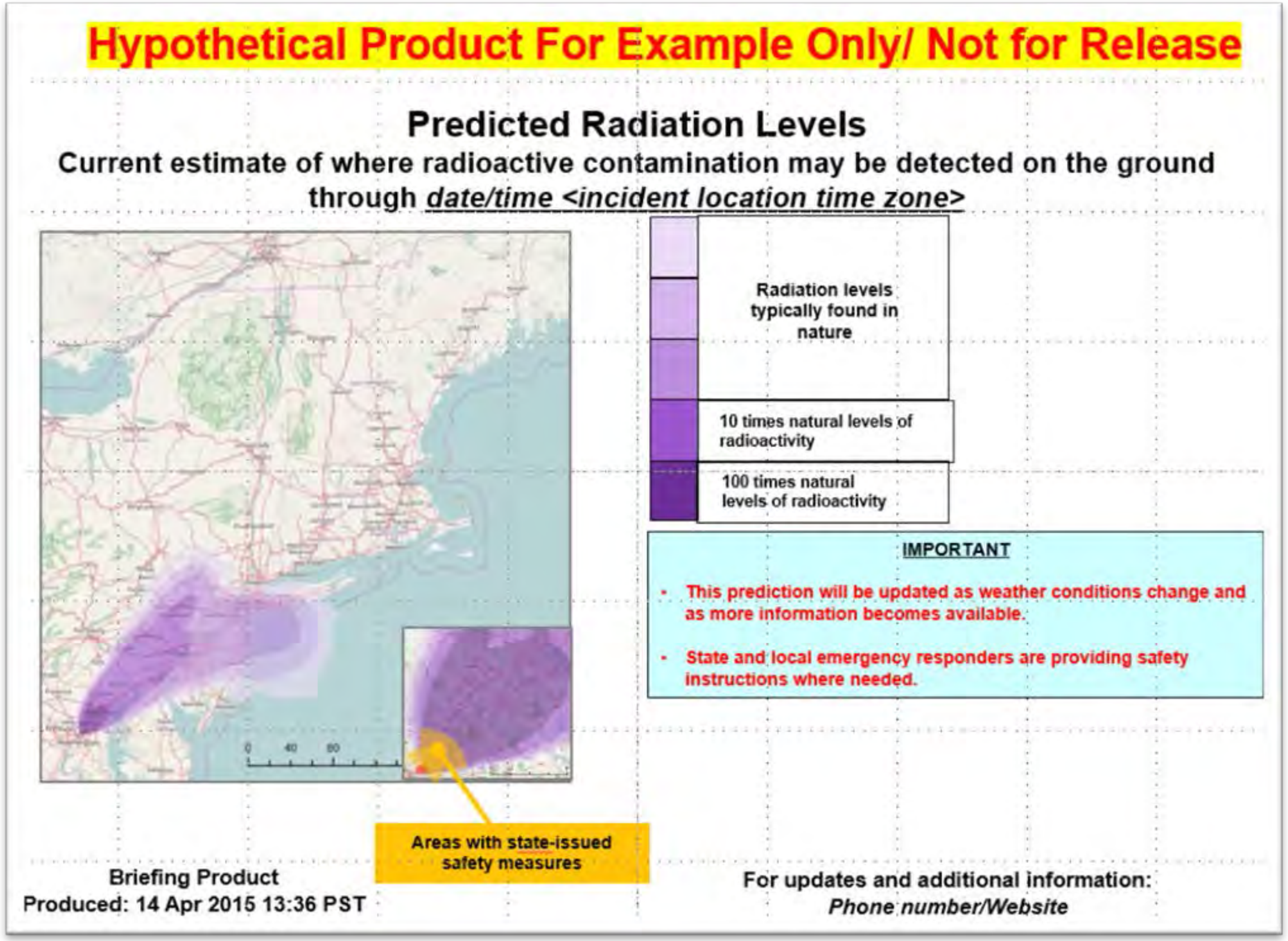
/http://nnsa.energy.gov/aboutus/ourprograms/emergencyoperationscounterterrorism

http://www.ready.gov/

On-going efforts

- Public Plume Products Working Group
- Radiation Hazards Scale

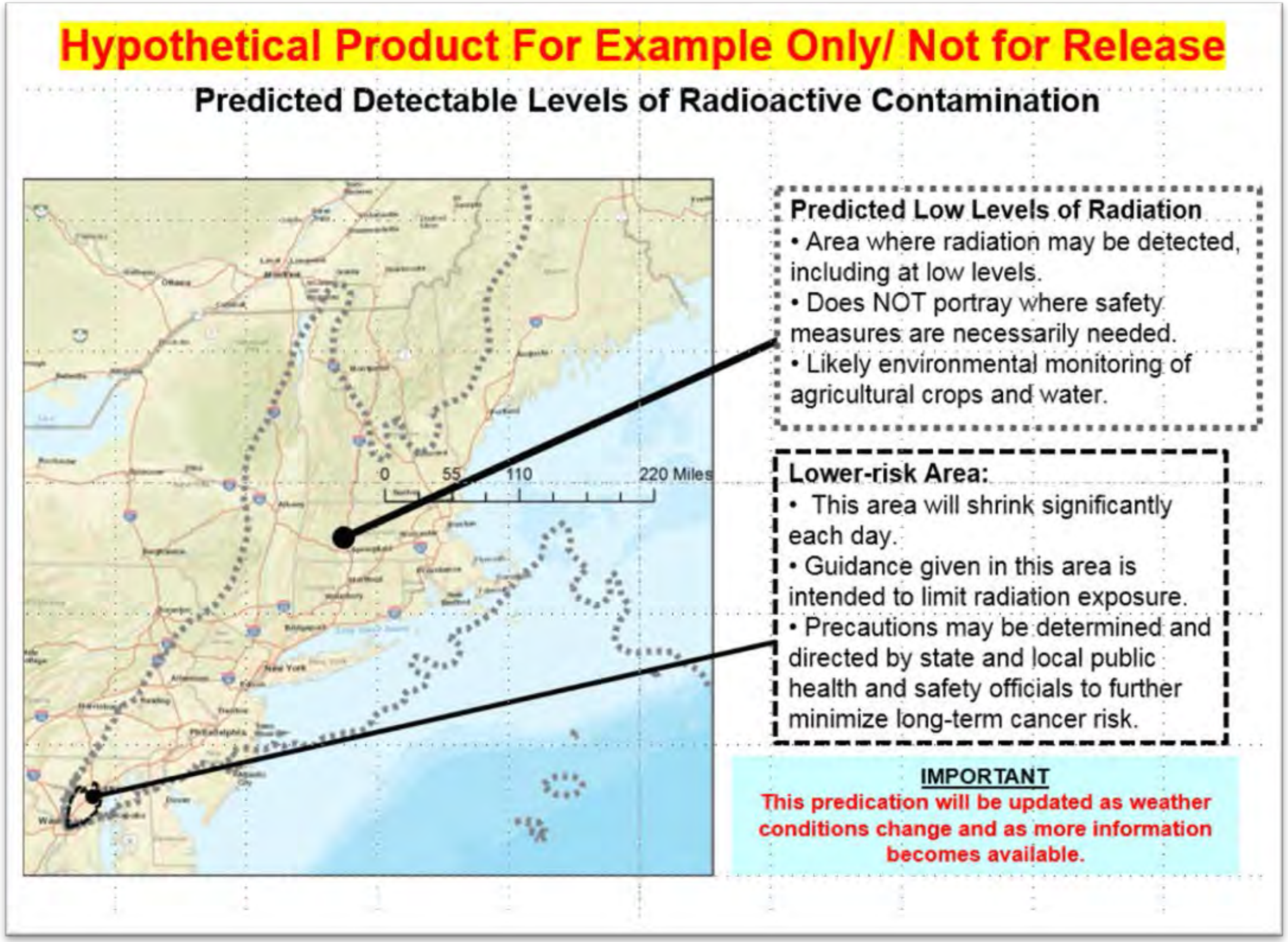
Public Plume Products Working Group



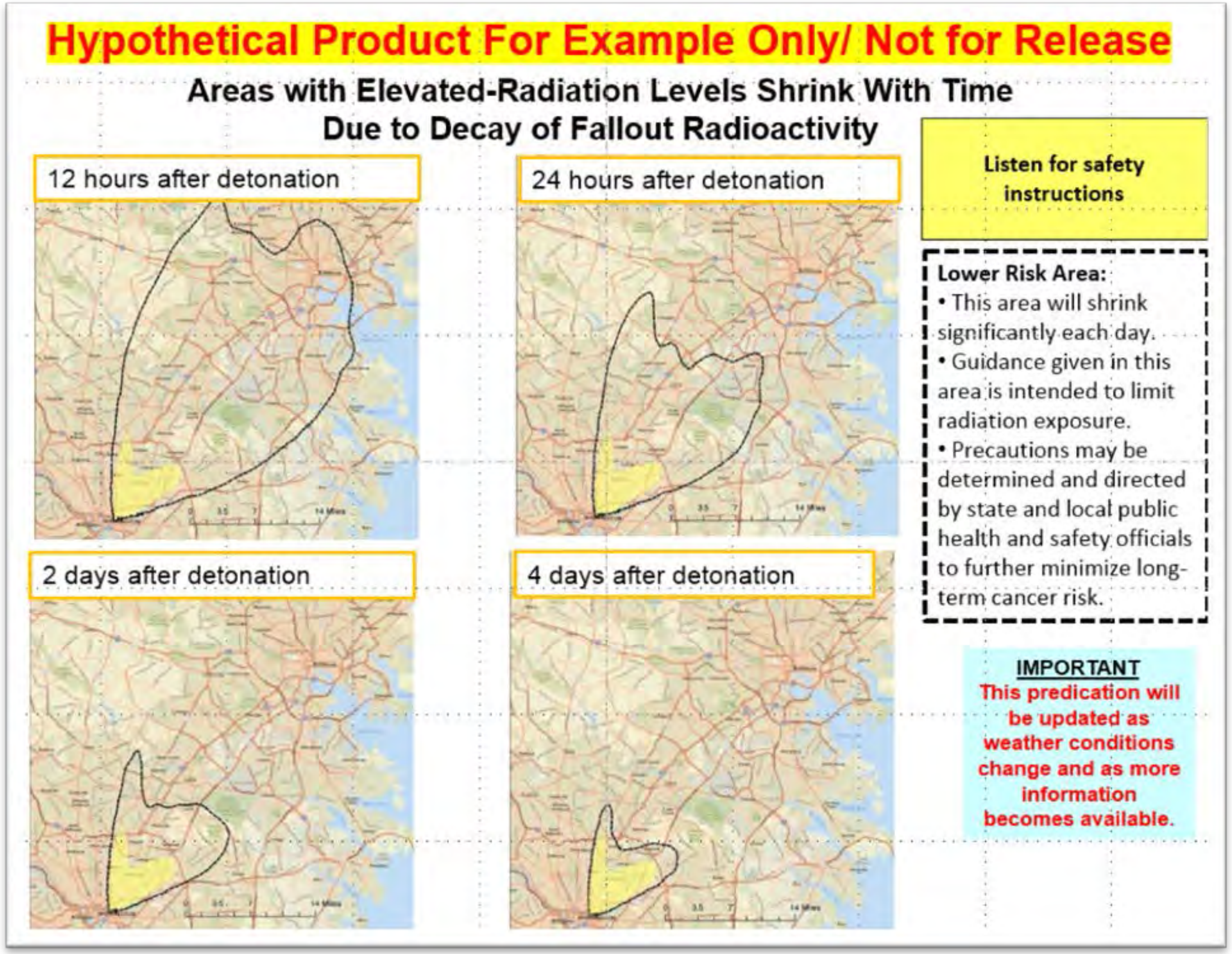
Suggested Talking Points

- This map shows the current scientific estimate of where radiation may be detected on the ground:
  - It shows radiation levels on the ground down to very low levels of radioactivity.
  - It shows that radiation levels will typically be higher close to the incident site and that we will detect decreasing radiation levels as we move away from the site.
  - The lightest colored contour on this map shows predicted levels that are small enough that specialized laboratory analysis may be needed to detect the radioactive material.
- ***CHOOSE ONE:*** The radiation levels depicted DO NOT pose an immediate health threat. ***OR*** The radiation levels OUTSIDE of the *[Stay Inside/Evacuation]* area DO NOT pose an immediate health threat.
- Additional safety precautions may be put in place to avoid unnecessary radiation exposure that may affect long-term health.
- Radioactivity may be detected outside of the area depicted on the map that may or may not be related to this incident.
- Monitoring and sampling may identify areas with higher levels of radioactivity than those shown on this product.
- This map WILL be updated as weather conditions change and as more information becomes available.
- Go to *website* for latest updates.
- This map was prepared by the federal Interagency Modeling and Atmospheric Assessment Center.

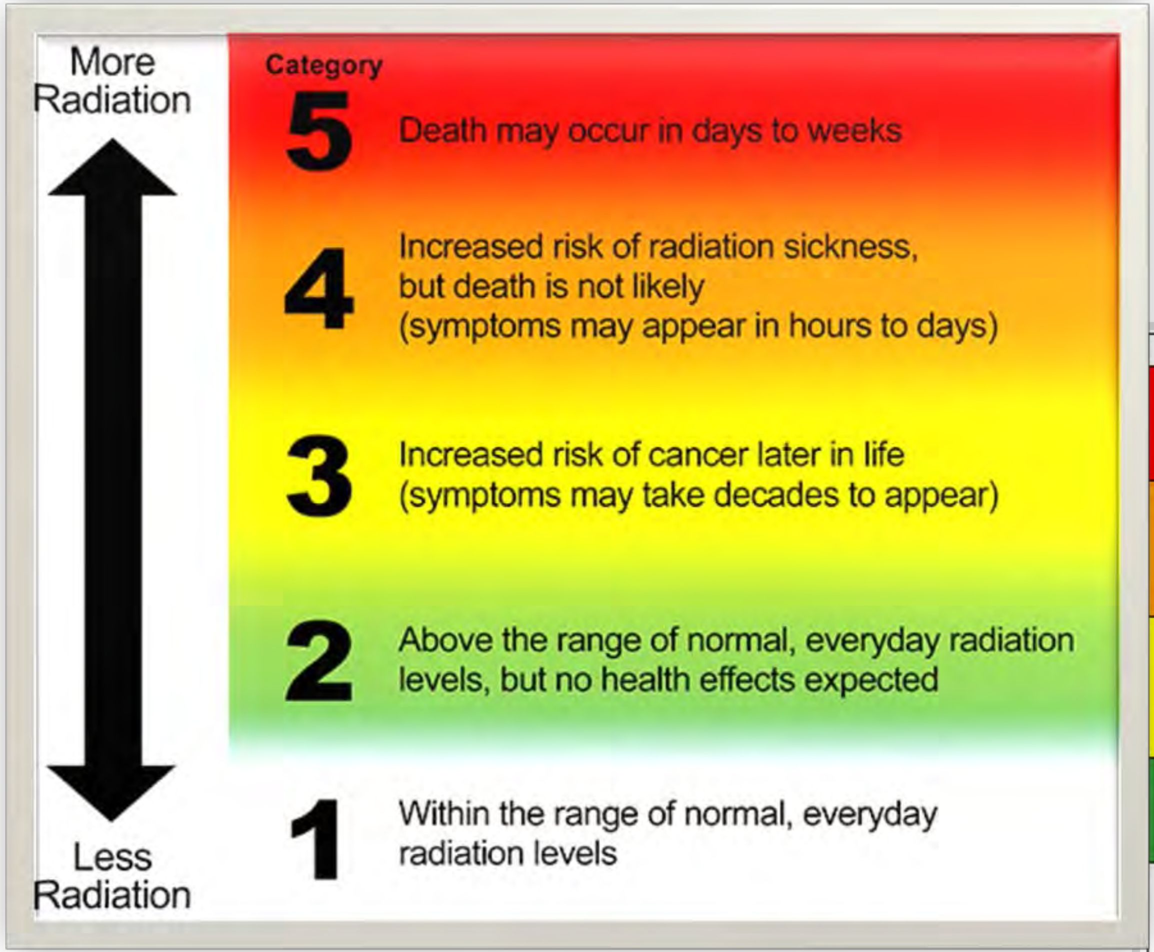
Public Plume Products Working Group



Public Plume Products Working Group



Radiation hazard scale



Category	Description
5	**Category 5** means that radiation doses are dangerously high and potentially lethal ($\geq$200 rad). High doses of radiation can cause massive damage to organs of the body and kill the person. The exposed person loses white blood cells and the ability to fight infections. Diarrhea and vomiting are likely. Medical treatment can help, but the condition may still be fatal in spite of treatment. At extremely high doses of radiation, the person may lose consciousness and die within hours. For more information, see www.remm.nlm.gov/ars_summary.htm#whatisars
4	**Category 4** means that radiation doses are dangerously high and can make people seriously ill. Radiation doses are not high enough to cause death, but one or more symptoms of radiation sickness may appear ($\geq$100 rad and <200 rad). Radiation sickness, also known as Acute Radiation Syndrome (ARS), is caused by a high dose of radiation. The severity of illness depends on the amount (or dose) of radiation. The earliest symptoms may include nausea, fatigue, vomiting, and diarrhea. Symptoms such as hair loss or skin burns may appear in weeks. For more information about the health effects of radiation, see http://emergency.cdc.gov/radiation/healtheffects.asp For more information about medical treatment of radiation exposure, see http://emergency.cdc.gov/radiation/countermeasures.asp
3	**Category 3** means that radiation doses are becoming high enough where we may expect increased risk of cancer in the years ahead for people who are exposed. Leukemia and thyroid cancers can appear in as few as 5 years after exposure. Other types of cancer can take decades to develop ($\geq$2 rad and <100 rad). Studies have shown that radiation exposure can increase the risk of people developing cancer. This increased risk of cancer is typically a fraction of one percent. The lifetime risk of cancer for the population due to natural causes is approximately 40%. The increase in risk of cancer from radiation depends on the amount (or dose) of radiation, and it becomes vanishingly small and near zero at low doses of radiation. For more information, see http://emergency.cdc.gov/radiation/cancer.asp
2	**Category 2** means that radiation levels in the environment are higher than the natural background radiation for that geographic area. However, these radiation levels are still too low to observe any health effects ($\geq$0.001 rad and <2 rad). When radiation levels are higher than what we normally have in our natural environment, it does not necessarily mean that it will cause us harm. For more information about health effects of radiation, see http://www.cdc.gov/nceh/radiation/health.html
1	**Category 1** means that radiation levels in the environment are within the range of natural background radiation for that geographic area (<0.001 rad). Low amounts of radioactive materials exist naturally in our environment, food, air, water, and consequently in our bodies. We are also exposed to radiation from space that reaches the surface of the Earth. These conditions are natural, and this radiation is called the natural background radiation. For more information about radiation and radioactivity in everyday life and how it can vary by location, see http://www.cdc.gov/nceh/radiation/sources.html

Existing Gaps

- Message for Recovery
- Identified Radiation Communicators
- Speaking with One Voice
- Government Challenges

Message for Recovery: Learning from Fukushima

- Identify appropriate spokespersons
- Create tools for them to communicate early and often on:
  - Individual Health Risks
  - Response Efforts and Clean-up actions
  - Potential Timelines – associated with returning to home/businesses

Identify Radiation Communicators

- Increase the number of skilled radiation communicators by identifying and training risk communication experts outside of government, and, likely, outside of the field of radiation protection.

Speak with One Voice

- Create a single location for the public to receive all information related to large-scale radioactive release
- Reduce the need for members of the public to "bounce" among agencies to get the information

Government Challenges during Transition Years

- Guideline Review and Refinement of Processes
- Education
- Roles for groups like NCRP

Communicating Radiation Information: Emergency Responder Perspective

NCRP Conference
March 2017

BC Bob Ingram
WMD Branch Chief

Fire Department, City of New York
CENTER FOR TERRORISM & DISASTER PREPAREDNESS

Background

- 30 years of radiation planning & response
- FDNY has a long involvement in radiation response planning
- National projects with NCRP, FEMA, NFPA, …
- Survey to broaden the view

Diversity

- Disciplines: Fire, LE, EM, HMT, Bomb, Sciences, EMS
- Ranks: Field personnel to Staff Chiefs/Directors
- Years of service: 27+ avg.
- Perception: Personal, Agency, Jurisdiction views
- Survey participant selection

Communications Issues

- Threat/Probability awareness
- Jurisdiction location
- Agency position: specialty vs. field personnel
- Detection equipment
- Health consequences
- RAD H&S data integration into response plan
- IND consequence threat vs. RDD
- Plans exist but not exercised
- Public information: Threat, risk, probability, self-help, response support, recovery

Threat/Probability Matrix

- All inclusive: transport & facility accidents, commercial use, power plants, RDD and IND
- 53% report agencies consider Rad event a low probability
- Local training not a priority for funding/time
- Specialty teams usually receive training
- Increase awareness of medical/commercial use and transport of rad materials
- Improve intel sharing mechanisms from F-S-L to inform officials and training

Jurisdiction Location Impact

- Federal programs create some awareness
  - DHS DNDO-Secure The Cities
  - Power Plants
  - Waste Transport routes
  - UASI Tier I cities receive funding and understand threat level. As funds decrease capability will decrease

Assignment within Agency

- Training for Field Personnel is limited at best
  - 50% little to “operations level only” training
  - Other 50% tiered levels of training
- Specialty assignments receive training
  - SWAT teams, HM Tech, Bomb Squads, Rad Health,
  - Interdiction teams
- Specialty training tied to federal programs
  - Nevada Test Site Consortium school, CTOS, FBI Stabilization

Detection Equipment

- Roughly 50% of agencies in survey provide detection equipment to field personnel
- Specialty assignments tend to be assigned detection equipment
- Dissemination linked to threat perception, involvement in federal programs
- Tiered equipment capabilities tied to mission and training
- Interdiction vs. Consequence equipment specifications and weak communication between two worlds

Health Consequences

- Do field personnel feel confident in their knowledge of radiation health risks?
  - More than half have no confidence
  - Small percentage express fear
  - Special assignment personnel with more training and equipment feel more confident
- One Fed source chart of health risks due to radiation exposure that can be integrated into training
- Integrate health risks into Dose Decision Points in a response plan

RAD Data Integration Into Response Plans

- Do Field Personnel understand dose and exposure information to integrate into a response plan?
  - Basic training has informed members assigned equipment on how to read instrument output and compare to a chart to make simple field decisions.
  - Most do not have an understanding of the risks beyond this basic training
  - Special assignment personnel with more training better understand the reasoning behind the guide but this is a limited size group

IND: Game Changer

- Individual confidence in a successful response dropped between RDD and IND
- Agencies more often have a RDD response plan but no IND plan
- FEMA support to UASI Tier I cities in understanding the threat, consequences, response & management challenges helpful
- DOD and FEMA IND exercises helpful
- Public information and support critical to a successful response but not available

Response Plan Exercises

- ¾ of Respondent agencies have rad response plan/SOP
- 60% have RDD response plan/SOP
- 33% report having IND plan (UASI Tier I)
- <50% report or know if the RAD plan is an interagency plan
- <50% report or know if the RAD plan has been exercised

Public Information

- 75% of respondents report that they are unaware of radiation information provided to the public
- 75% report that they are unaware of radiation protective actions being provided to the public
- All respondents do not believe that the public is adequately informed about the hazards of radiation
- All respondents **DO NOT** believe that the public is prepared to take actions during a radiation incident (RDD or IND) that would support public agencies response efforts

Recommendations

- Public information and protective action training is critical to the public and response communities
- Responder training in radiation health risks must be improved.
- Risks must be integrated into response plans and shared to all field personnel
- Public education can be incorporated into school curriculums at various levels and intensity
- Continue CERT Training

Recommendations

- Improve information sharing channels for all response disciplines on threats and probabilities
- Improve federal coordination and delivery of information to state and local levels
- Single source of federal rad/nuc information to state and local agencies
- Continued support (funding and information) to maintain and build upon current capabilities

Critical Areas for Improvement in Communications Regarding Radiological Terrorism

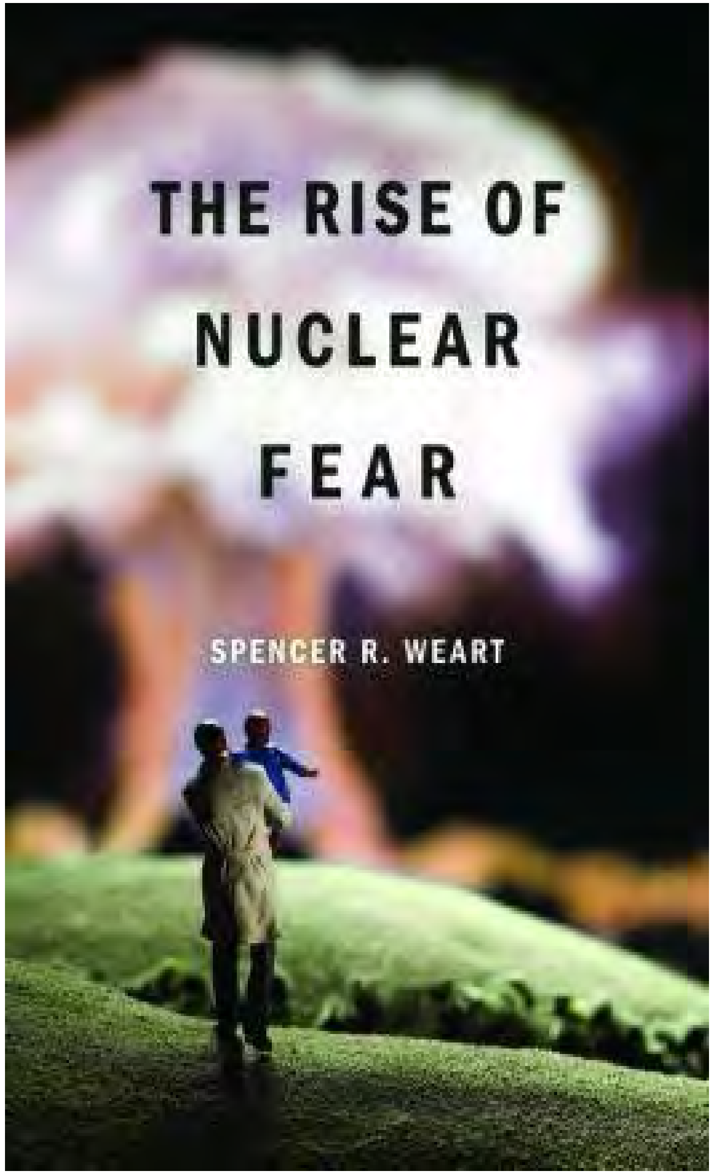
David P. Ropeik, *Harvard School of Public Health*

- Instructor at Harvard University
- Consultant on risk perception, risk communication, and risk management
- Television reporter for WCVB-TV in Boston from 1978-2000

REDUCING RADIOPHOBIA

A key gap in preparing for radiological emergencies

Phobia ***n.,*** An extreme or irrational fear of or aversion to something.



The health risk of ionizing radiation is FAR lower than commonly assumed

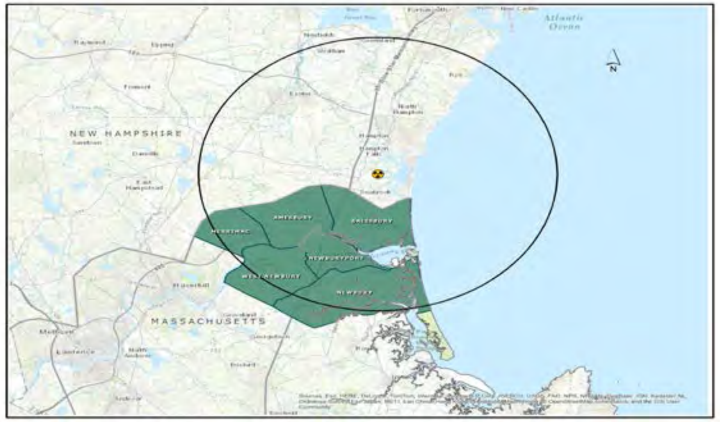
Life Span Study

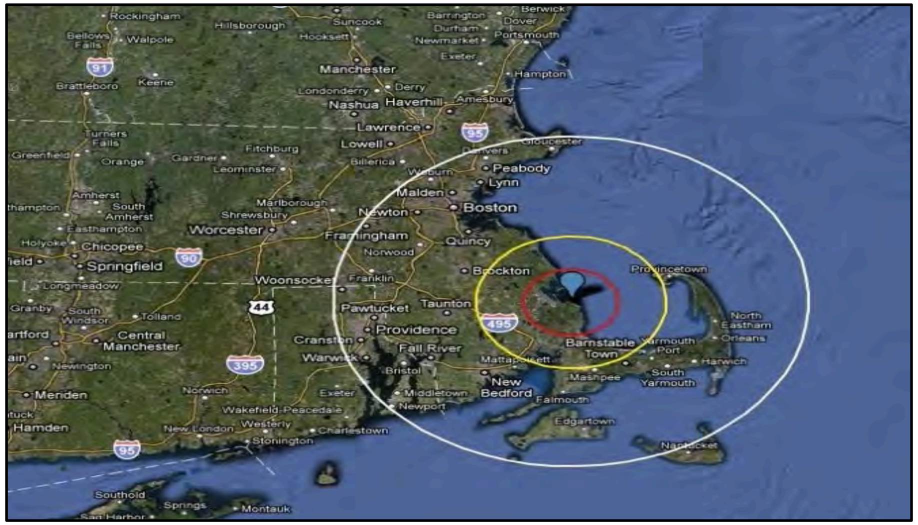
Chernobyl findings

Fukushima findings

Emergency Planning Zones

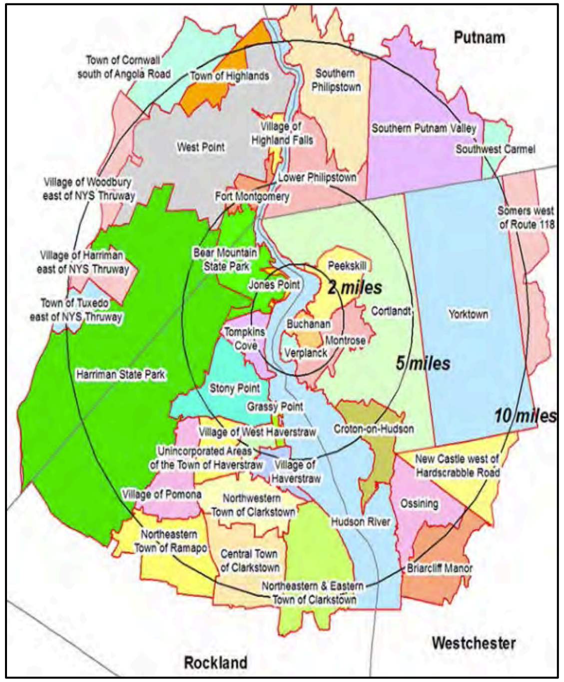
Seabrook, 10 and 50 m   Pilgrim, 10 and 50 m

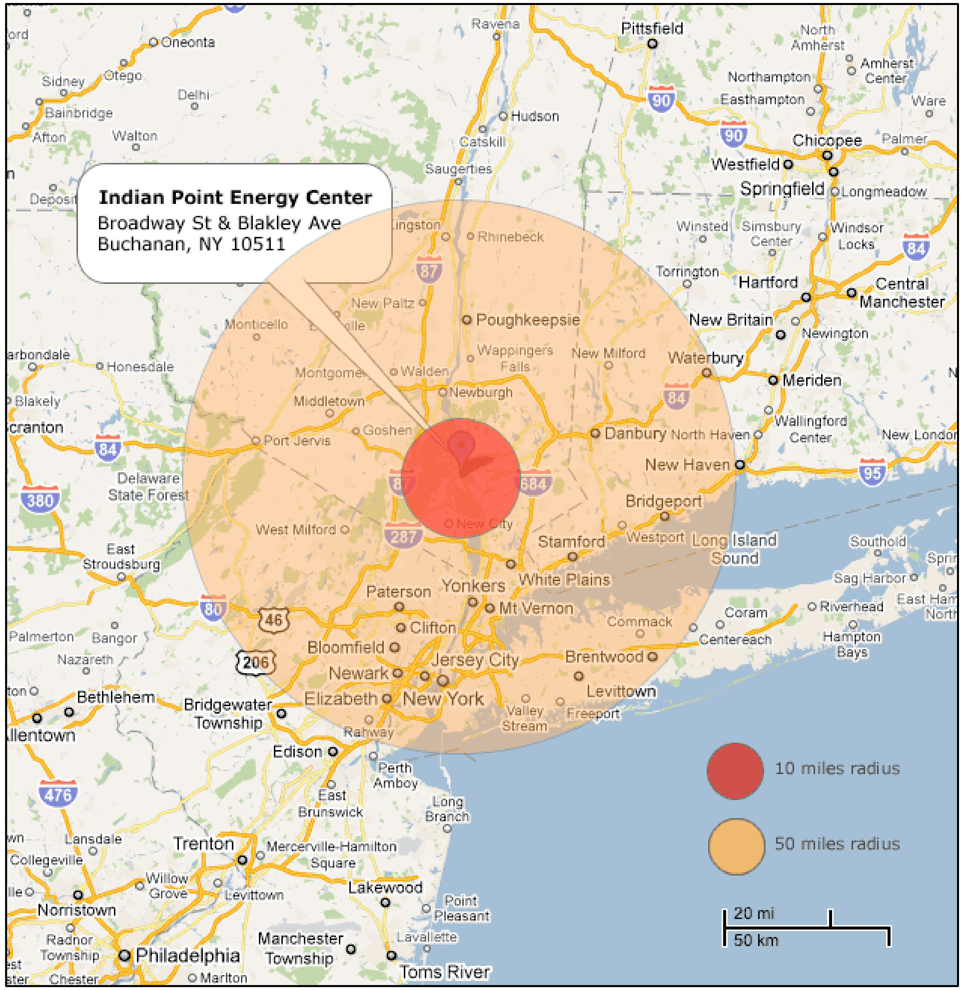




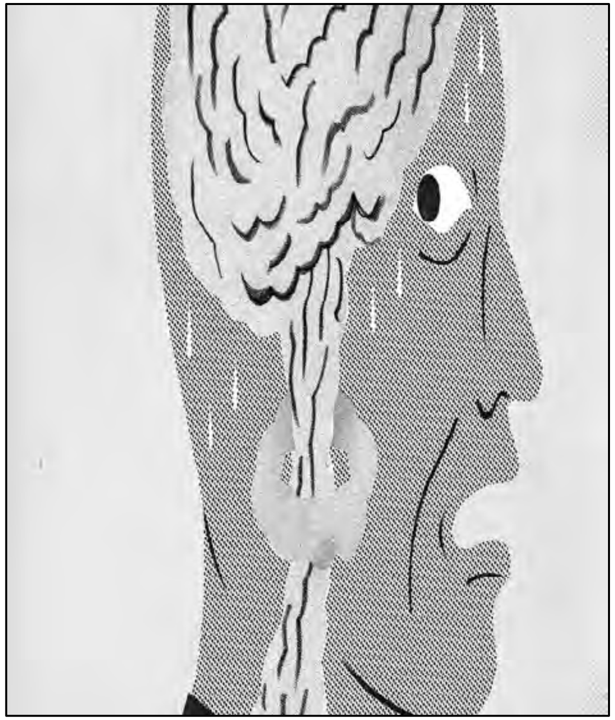
Emergency Planning Zones, Indian Point

10 miles | 50 miles





Few people, especially policy makers, know about the Life Span Study or the Chernobyl findings or the Fukushima findings.



<u>WHY NOT?</u>

Expert reluctance to reduce public radiophobia

I don't want to risk controversy, criticism, attacks on me or my work or my funding.

Expert reluctance to reduce public radiophobia

It's too complicated to explain

Dose Quantities

Absorbed dose
energy "deposited" in a kilogram of a substance by the radiation

Equivalent dose
absorbed dose weighted for harmful effects of different radiations
(radiation weighting factor w_R)

Effective dose
equivalent dose weighted for susceptibility to harm of different tissues
(tissue weighting factor w_T)

System Internationale (SI) units

Absorbed dose	**Gray (Gy)**	= 1 J/kg = 100 rads
Equivalent dose	**Sievert (Sv)**	= Gy x Wr, where Wr is a weighting factor
Activity	**Becquerel (Bq)**	one nucleus decay per second

For x-rays, Sv and Gy are interchangeable, the Wr = 1.

Non-SI units

Absorbed dose	**Rad**	= 100 ergs/g = 1/100 Gy
Equivalent dose	**Rem** ("Roentgen equivalent man") = 1/100 Sv	
Activity	**Curie**	

α alpha particles

β beta particles

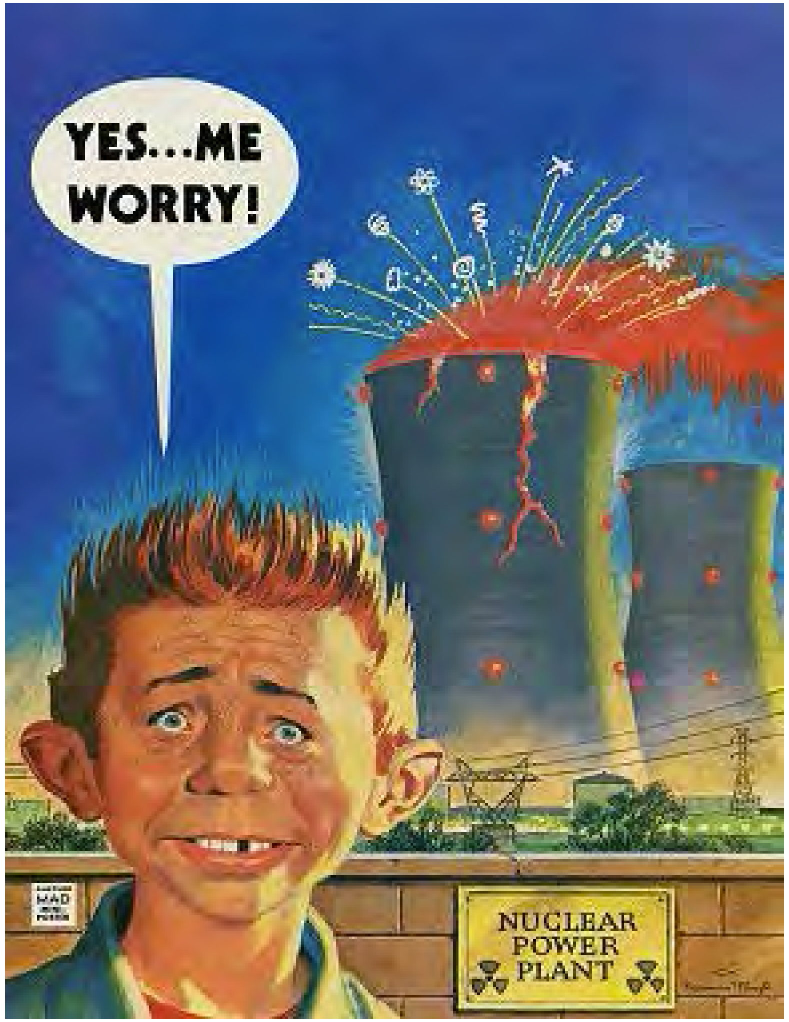
γ gamma rays

Expert reluctance to reduce public radiophobia

Communication is not my job

Expert reluctance to reduce public radiophobia

Journalism does a lousy job reporting on science



Expert reluctance to reduce public radiophobia

Tempering fear of radiation is mistaken

Solutions that address these concerns

Act together with your colleagues.

Press your professional organizations to make it a higher priority to help the public put the risk of radiation in perspective.

Identify and contact quality journalists and offer to help them.

Partner with communication experts, especial those with knowledge and experience in RISK communication.

Inform them, but defer to their expertise about how to communicate, as you would expect them to defer to yours about radiation.

The Moral Obligation of experts to help society reduce Radiophobia

Excessive fear of radiation puts the public at risk

Anyone who can help reduce that risk, and does not, is indirectly complicit in the harms that radiophobia can cause.

It IS the job of experts to inform the public.

If you don’t do it, who will?

Priority Gaps

1. Have the experts agree on simplified explanations of <u>what we do know</u> about risks of radiation exposure.

2. Create tools for the first responders to address their safety questions and concerns and empower them to amplify public health and safety messages for the public.

3. Identify appropriate spokespeople and create tools for them to communicate early and often with evacuated individuals regarding long-term cleanup and risks related to return.

4. Increase the number of skilled radiation communicators by identifying and training risk communication experts outside of government and, likely, outside the field of radiation protection.

5. Create a single location for the public to receive all information.

Bringing it All Together: Conclusions and Path Forward

Armin Ansari & Adela Salame-Alfie

Session Co-Chairs

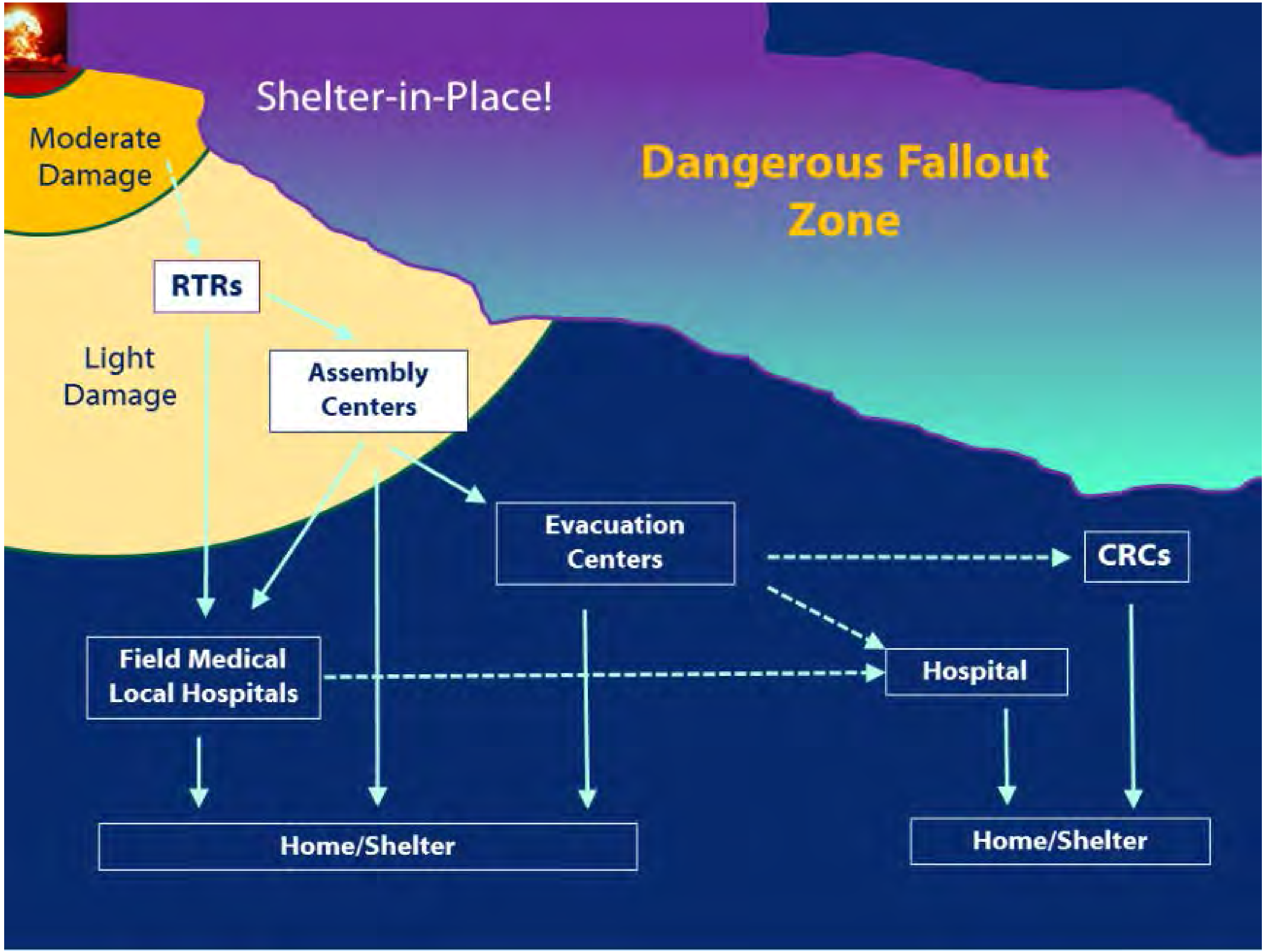
Disclaimer

The authors are solely responsible for the content of this presentation. The content does not represent the official position of their employer.

Modified cartoon from www.otherworlds.org

Can We Pull Off the Unthinkable?

- Prevention is key!
- We will never be fully “prepared”.



Planning This Year's Program

- **What are key gaps/challenges in our ability to mount an effective response?**
- **What are we doing now to address these gaps?**
- **Do we need to realign our current efforts?**

Charge to each panel:
Suggest 3-5 specific, actionable priority initiatives

Panels

- Response Plans
- Emergency Responders
- First Receivers, Public Health
- Return, Recovery and Resilience
- Communication, Education, and Public Information

Are Existing Plans Sufficient for the Evolving Threat Environment?

- Integrate IND/RDD response capabilities & protective actions into existing state/local plans. Advocate for a strategic national approach.

- Leverage/transfer knowledge in IND preparedness planning through regional and national collaboration and link to existing plans for natural disasters.

- Create an Integrated Clinical Diagnostics System (ICDS) to enhance surge capacity and develop a national CONOPs for hematology surge (LDK), dicentrics, novel dosimetry methods and radiobioassay.

Guidance, Training and Exercises: Emergency Responders

- Create and improve engagement mechanism at the state and local level to implement federal guidance and systematic preparedness process.

- Help local preparedness leaders and champions overcome institutional, political, and social barriers associated with preparing for nuclear/radiological events.

- Recognize and be prepared to take advantage of heightened concern after real-world events to advance preparedness guidance and public information.

Guidance, Training and Exercises: First Receivers, Public Health

- Advance preparedness for the whole country by developing “national” CONOPS including laboratory network for hematology, chemistry and dosimetry.

- Make response plans realistic by addressing hospital surge capacity and scarce resources at local level.

- Use a single set of terminology, a single set of radiological units, and a centralized source of information for medical and public health community.

Return, Recovery and Resilience

- Leverage all Hazards. Provide guidance to help states and communities improve resilience to nuclear/radiological incidents by leveraging existing local disaster plans and risk management efforts.

- Exercise the "Good Guidance". Provide states and communities with user friendly tools for exercising community management of the late phase recovery of a nuclear/radiological incident.

- Strategize the Exit. Provide tools and guidance to help states and communities plan for and test the *Community Advisory Panel* and *Technical Advisory Panel* concepts to include an exit strategy.

Communication, Education, and Public Information

- Have the experts agree on simplified explanations of what we do know about risks of radiation exposure.
- Create tools for the first responders to address their safety questions and concerns and empower them to amplify public health and safety messages for the public.
- Identify appropriate spokespeople and create tools for them to communicate early and often with evacuated individuals regarding long-term clean-up and risks related to returning.
- Increase the number of skilled radiation communicators by identifying and training risk communication experts outside of government and, likely, outside the field of radiation protection.
- Create a single location for the public to receive all information.

Emerging Themes and Path Forward

- Integrate N/R preparedness plans into existing local/state plans (this is more than adding an N/R appendix).
- Promote regional and national collaborations.
- Create user-friendly tools instead of voluminous PDFs.
  - NCRP can help!
- Foster consensus on terminology and radiation risk communication.
  - NCRP can help!

Panel Discussion

Response plans

Guidance, Training and Exercises
-
Emergency Responders

Guidance, Training and Exercises
-
First Receivers, Public Health

Return, Recovery and Resilience

Communication Education, and Public Information

NCRP Vision for the Future & PAC Activities

John D. Boice, Jr.

53rd NCRP Annual Meeting
March 6–7, 2017

New Executive Director & Chief Science Officer Appointed

Dr. Kathryn D. Held

Dr. Kathryn D. Held has been selected to serve as the Council's next *Executive Director and Chief Science Officer*.

Dr. Held is an Associate Radiation Biologist in the Department of Radiation Oncology, Massachusetts General Hospital (MGH)
and
Associate Professor of Radiation Oncology (Radiation Biology) at Harvard Medical School.

Dr. Held also teaches radiation biology to radiation oncology medical and physics residents and graduate students at MGH/HMS and the Massachusetts Institute of Technology.

Dr. Held started July 25, 2016

Outline

- Ongoing Activities
- Opportunities & Vision for the Future

Seven Program Area Committees (PACs)

PAC 1: Basic Criteria, Epidemiology, Radiobiology, and Risk

PAC 2: Operational Radiation Safety

PAC 3: Nuclear and Radiological Security and Safety

PAC 4: Radiation Protection in Medicine

PAC 5: Environmental Radiation and Radioactive Waste Issues

PAC 6: Radiation Measurements and Dosimetry

PAC 7: Radiation Education, Risk Communication, Outreach, and Policy

Ongoing

PAC 1	Space Radiation & CNS
PAC 1	Bioeffectiveness of Low Energy Radiation
PAC 1	Linearity Assumption for Radiation Protection
PAC 1	Integration of Epidemiology with Biology
PAC 2	Sealed Sources
PAC 3	Dosimetry for Emergency Responders
PAC 4	CT Dose Optimization
PAC 4	Dentistry – Cone Beam CT
PAC 4	Informed Consent and Communicating Risk in Medicine
PAC 4	Medical Exposure to US Population
PAC 5	TENORM – Hydraulic Fracturing
PAC 6	Dosimetry for Workers and Veterans – Million Workers Study
PAC 7	Communicating Risks, Education and Policy
CC 1	Regulation Guidance for the Nation
CC 2	WARP – Where are the Radiation Professionals? A National Crisis
	Million Persons Study of Low-Dose Radiation Health Effects

PAC 1: Basic Criteria, Epidemiology, Radiobiology, and Risk

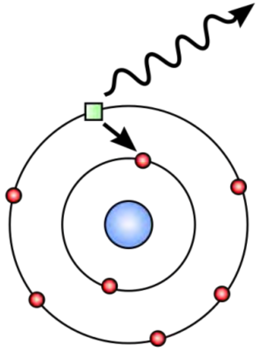
The membership of PAC 1 is:

G.E. Woloschak, *Vice President*
J. Bernstein, *Co-Chair*

E.I. Azzam	S.A. Amundson
J.S. Bedford	D.J. Pawel
P. Chang	G. Sgouros
A.R. Kennedy	R.E. Shore
A. Kronenberg	M.D. Story
E.C. Laiakis	D.O. Stram
M.P. Little	M.M. Weil
G.A. Nelson	J.P. Williams

SC 1-20: Biological Effectiveness of Photons as a Function of Energy

S.L. Simon, *Chair*
L.A. Braby
P.Y. Chang
D.T. Goodhead
S.C. Hora
D.C. Kocher
K. Mabuchi
J.S. Puskin
D. Richardson
J.D. Tucker
E. Vano



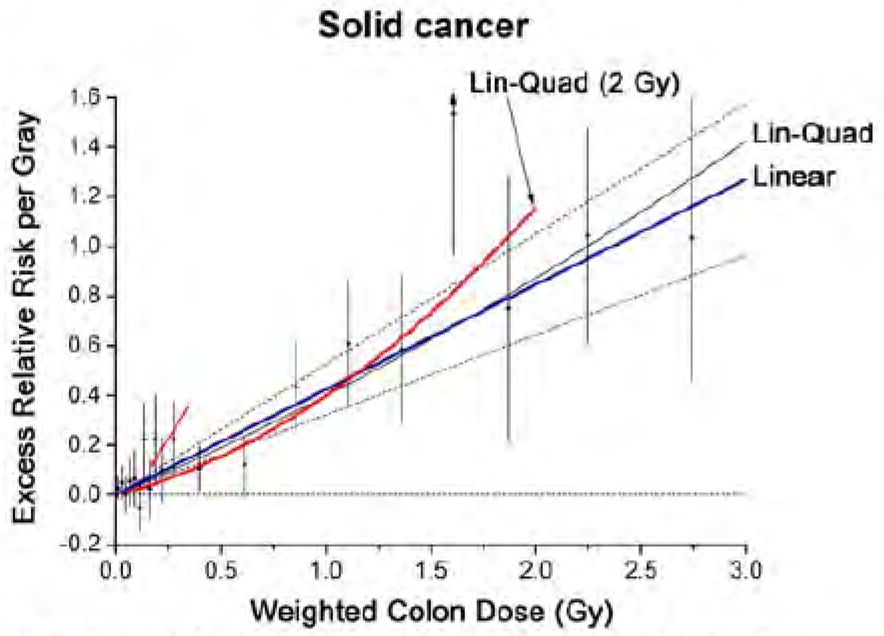
SC 1-24: Radiation Exposures in Space and the Potential for CNS Effects – Phase II

NASA Supported

SC 1-25: Recent Epidemiologic Studies and Implications for the LNT Model

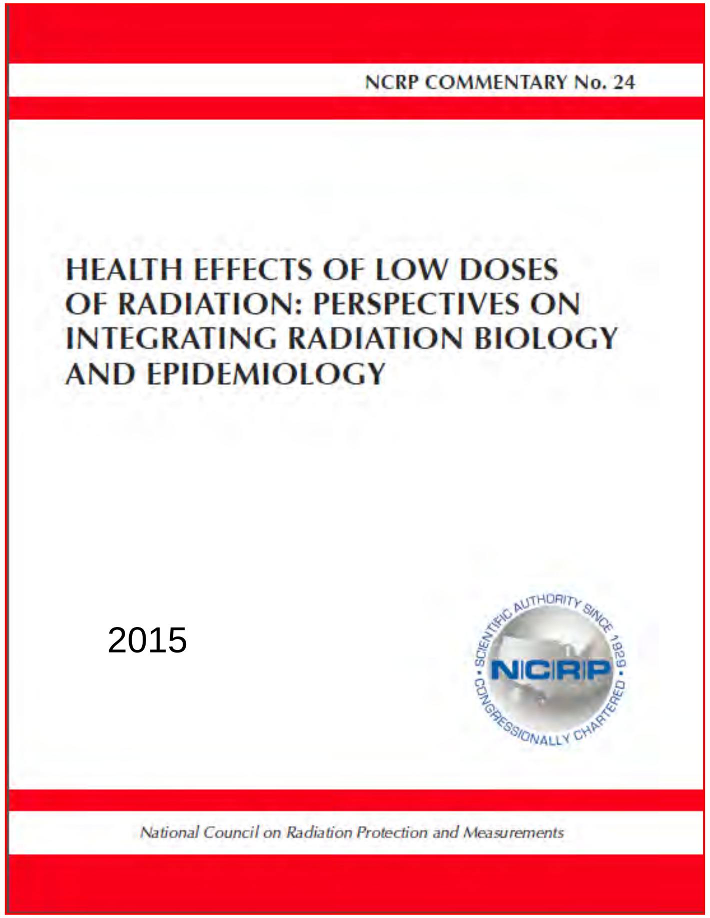
<u>Purpose</u>: SC 1-25 will prepare a commentary reviewing recent epidemiologic studies and evaluate whether the new observations are strong enough to support or modify the linear nonthreshold (LNT) model as used in radiation protection today.

R. Shore, *Co-Chair*
L.T. Dauer, *Co-Chair*
J. Boice
S. Davis
R.N. Hyer
F.A. Mettler, Jr.
R.J. Preston
J.E. Till
R. Wakeford
L. Walsh
R. Vetter, *Staff Consultant*



Graph used with permission of K. Ozasa and *Radiation Research*

SC 1-26: On Integrating Radiation Biology with Epidemiology – Phase 2 – Just Starting


NCRP COMMENTARY No. 24

HEALTH EFFECTS OF LOW DOSES OF RADIATION: PERSPECTIVES ON INTEGRATING RADIATION BIOLOGY AND EPIDEMIOLOGY

2015

National Council on Radiation Protection and Measurements

Thanks to CDC for financial support

Chair

Julian Preston

PAC 1
Opportunities

- Cardiovascular risk at low doses
- Dose and dose-rate effectiveness
- CNS risk following low-LET radiation
- Impact of biology on regulatory work

PAC 2: Operational Radiation Safety

K.H. Pryor, *Vice President*
- E.D. Bailey
- C.A. Donahue
- J.R. Frazier
- E.M. Goldin
- M. Littleton
- D.S. Myers
- J.W. Poston
- K. L. Shingleton
- G.M. Sturchio
- J. Walkowicz
- J.S. Willison
- J.G. Yusko

SC 2-7: Radiation Safety of Sealed Radioactive Sources

Purpose: To provide comprehensive guidance on the radiation safety aspects of sealed radioactive sources from "cradle to grave." Recommendations will be provided on the definition of a sealed radioactive source, including design characteristics that should be considered. Guidance will be provided in the safe handling, tracking and control of sealed sources. The report will also present a set of "lessons learned" regarding what has gone wrong with sealed sources, what caused those events, and what could be done to prevent them in the future. Example procedures for confirming inventories, leak testing, labeling, safety, training, periodic inspection, and emergency response may also be provided.

K.H. Pryor, *Chair*
E.D. Bailey
C. Donahue
J.R. Frazier
E.M. Goldin
M. Littleton
D.S. Myers
J.W. Poston, Sr.
K.L. Shingleton
G.M. Sturchio
J. Walkowicz
J. Willison
J. Yusko
J. Thompson, *Consultant*

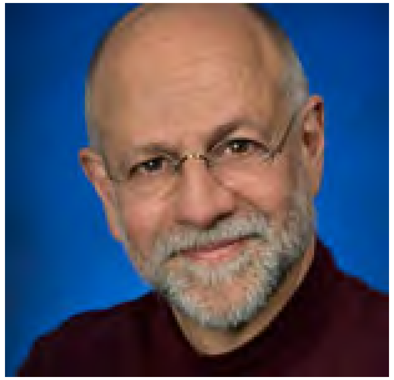
PAC 2
Opportunities

- **Safe use of handheld and portable x-ray fluorescence analyzers**
- **Update to NCRP Report No. 57, *Instrumentation and Monitoring Methods***
- **Radiation protection guidelines for industrial accelerators and irradiators**

PAC 3: Nuclear and Radiological Security and Safety

A. Ansari, *Vice President*
B.R. Buddemeier, *Co-Chair*
J.L. Bader
D.J. Blumenthal
L.L. Chi
C.N. Coleman
N. Dainiak
S. DeCair
J. Donnelly
J.R. Dynlacht
S.V. Musolino
A. Salame-Alfie
T.P. Taylor (former *Chair*)
J. Rogers, *Consultant*
B. Stevenson, *Consultant*

SC 3-1: (1) Guidance for Emergency Responder Dosimetry; (2) Implementation Guidance for Responder Dosimetry in an Emergency



PAC 3 Opportunities

- Medical response:
  - Address **biodosimetry** recommendations
  - Predict and estimate **triage** needs
- Manage the response:
  - Radiation-contaminated **fatality management**
- Characterize the incident and initial response
  - Monitor, decontaminate population in elevated backgrounds
  - Harmonize **decon and screening** criteria
  - Recommend protective and response actions for all hazards and all key phases

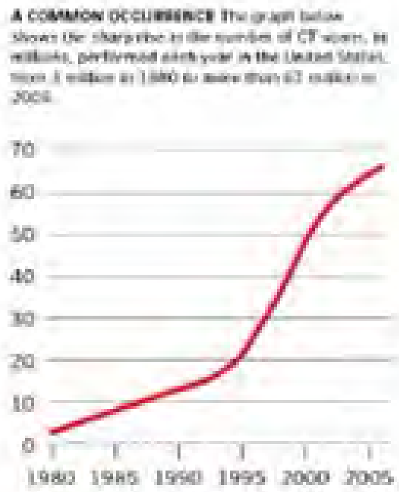
PAC 4: Radiation Protection in Medicine

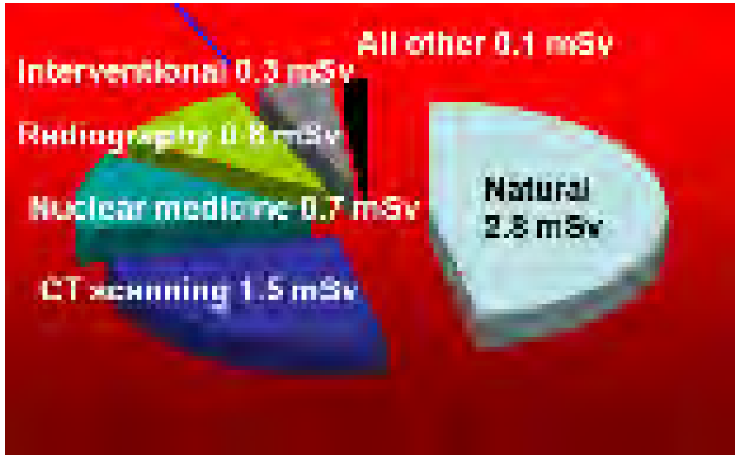
The membership of PAC 4 is:

J.A. Brink, *Vice President*
D.L. Miller, *Co-Chair*

K.E. Applegate
S. Balter
J.T. Bushberg
C.E. Chambers
L.T. Dauer
A.J. Einstein
D.P. Frush
R.E. Goans
J.E. Gray
M.K. Kalra
L.A. Kroger
E.G. Leidholdt

A.G. Lurie
M. Mahesh
F.A. Mettler, Jr.
W.D. Newhauser
E. Samei
J.A. Seibert
D.C. Spelic
S.G. Sutlief
J.E.K. Timins
L.K. Wagner
S.C. White
S.Y. Woo



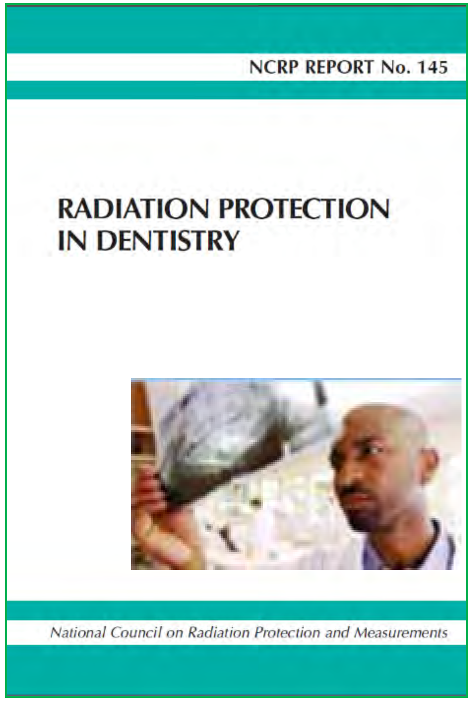


SC 4-5: Radiation Protection in Dentistry Supplement: Cone Beam Computed Tomography, Digital Imaging and Handheld Dental Imaging

<u>**Purpose**</u>: The supplement will address imaging modalities that have evolved over the past 10 y and update any existing material that needs updating. New imaging modalities include, but are not limited to cone-beam computed tomography (CBCT), digital radiography, and hand-held dental x-ray units. Other topics include the use of high-speed film (80 % of U.S. dental facilities continue to use film which requires twice the radiation dose to the patient compared to high-speed dental film) and new data from the Nationwide Evaluation of X-Ray Trends (NEXT) survey.

A.G. Lurie, *Co-Chair*
M.L. Kantor, *Co-Chair*

M. Ahmad	**R. Sauer**
V. Allareddy	**D.C. Spelic**
J. Ludlow	**E.M. Leidholdt, *Consultant***
E.T. Parks	**W.D. McDavid, *Consultant***
E.D. Paunovich	**D.L. Miller, *Consultant***
R. Pizzutiello	**J.E. Gray, *Staff Consultant***



SC 4-7: Evaluating & Communicating Radiation Risks for Studies Involving Human Subjects: Guidance for Researchers & Reviewing Bodies

J.E.K. Timins, *Chair*

J.T. Bushberg
P.A. Fleming
L.A. Kroger
E.M. Leidholdt
D.L. Miller

R.E. Reiman
J.A. Seibert
S.G. Sutlief
M.P. Grissom, *Staff Consultant*

SC 4-8: Improving Patient Dose Utilization in Computed Tomography

<u>Purpose</u>: To describe general concepts for Computed Tomography (CT) dose utilization and strategies for preventing errors in CT imaging for patients of all ages. The NCRP Report will provide an integrated set of recommendations that can be applied in routine CT practice.

M.K. Kalra, *Chair*
D.P. Frush
E.M. Leidholdt
M. Mahesh
E. Samei

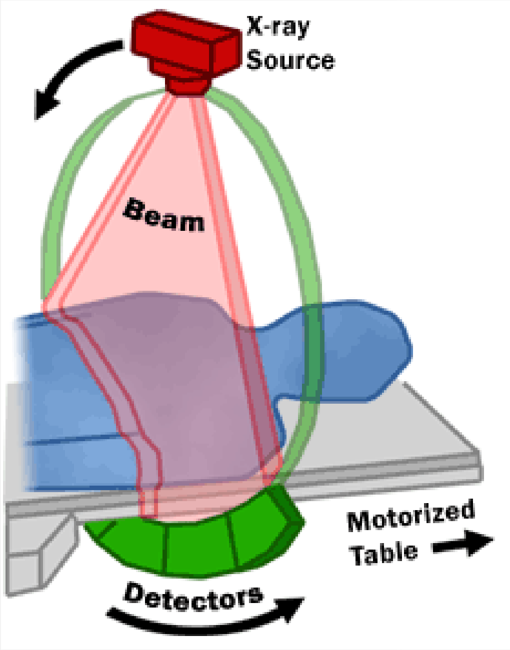


Figure 4: CT Fan Beam

SC 4-9: Medical Exposure to the U.S. Population

Purpose: To prepare a report to evaluate changes in medical x-ray exposure since NCRP Report No. 160 (2009).

F.A. Mettler, *Chair*
M. Mahesh, *Co-Chair*
M. Bhargavan-Chatfield
C. Chambers
J.G. Elee
D.P. Frush
M. Milano
H. Royal
D. Spelic
D. Miller

A. Ansari, *Technical Advisor*
W. Bolch, *Technical Advisor*
G. Guebert, *Technical Advisor*
R. Sherrier, *Technical Advisor*
J. Smith, *Technical Advisor*
R. Vetter, *Staff Consultant*

PAC 4
Opportunities

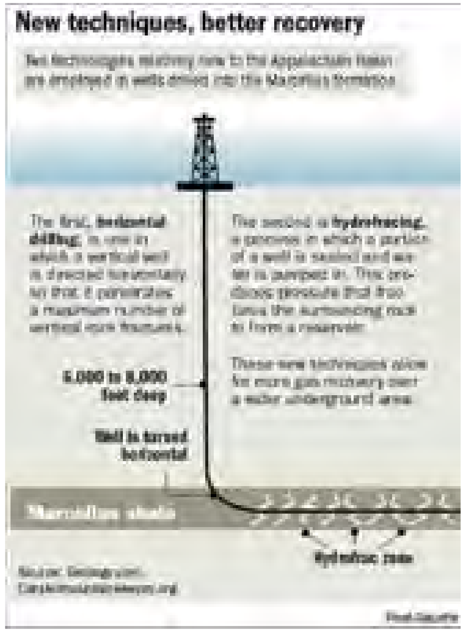
- Statement on error prevention in radiation therapy
- Effect of diagnostic and therapeutic radiation doses on implantable medical devices (*e.g*., pacemakers and insulin pumps)
- Methods and uncertainties associated with organ dose estimation in CT
- Radiation protection for PET-CT & multimodality (hybrid) imaging systems (*e.g*., PET-MRI)
- Radiation protection for allied professionals and service engineers
- Compendium of resources for medical radiation protection
- Cancer survivorship in the context of radiation protection (out of field doses in pediatric patients)

PAC 5: Environmental Radiation and Radioactive Waste Issues

The membership of PAC 5 is:

- S.Y. Chen, *Vice President*
- B.A. Napier, *Co-Chair*
- A.G. Croff
- J.D. Edwards
- R.W. Field
- K.A. Higley
- E.V. Holahan
- W.E. Kennedy
- K.A. Kiel
- J.A. Lipoti
- R.E. McBurney
- M.A. Noska
- B.A. Powell
- A. Wallo

SC 5-2: Radiation Protection for NORM & TENORM from Oil & Gas Recovery

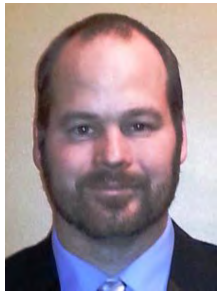


WE Kennedy, *Chair*

D Allard

M Barrie

P Egidi



G Forsee

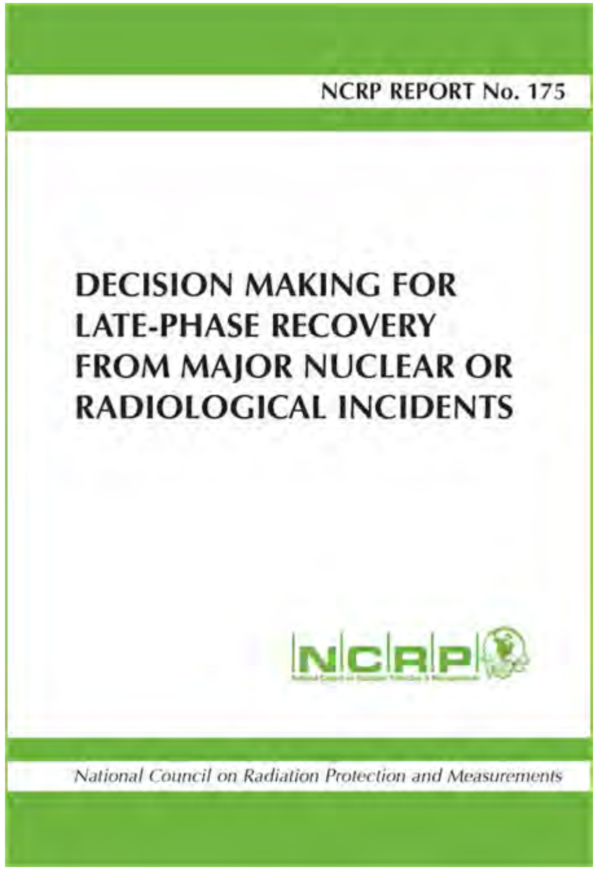
R Johnson

A Lombardo

RE McBurney

J Frazier
Staff Consultant

PAC 5
Opportunities



- Follow-on work of NCRP Report No. 175 – Waste Management from Wide-Area Contamination
- Waste management workshop (HPS Denver)
- A report on radioecology
- Characterizing radionuclides of interest to regulatory rulemaking

PAC 6: Radiation Measurements and Dosimetry

The membership of PAC 6 is:
S.L. Simon, *Vice President*
L. Bertelli
W.F. Blakely
W.E. Bolch
L.A. Braby
R.R. Brey
R.A. Guilmette
R.T. Kouzes
J.J. Whicker
R.C. Yoder
C. Zeitlin
G.H. Zeman

National Study of One Million U.S. Radiation Workers and Veterans

Robert Oppenheimer, General Leslie Groves, Enrico Fermi, Hans Bethe, Theodore Hall

- Manhattan Project 360,000
- Atomic Veterans 115,000
- Nuclear Utility Workers 150,000
- Industrial Radiographers 115,000
- Medical & other >250,000

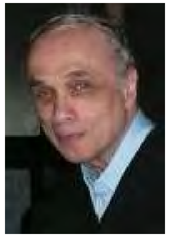
OAK (HARDTACK I), Enewetak, 8.9 MT, 28 Jun 1958

Bouville *et al.*
Health Physics Feb 2015

SC 6-9: U.S. Radiation Workers and Nuclear Weapons Test Participants Radiation Dose Assessment

A Bouville, *Chair*

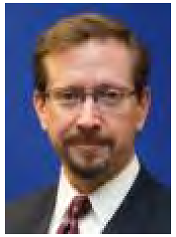
R Toohey, *Co-Chair*



H Beck

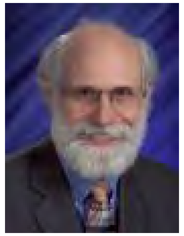
L Dauer

K Eckerman



D Hagemeyer

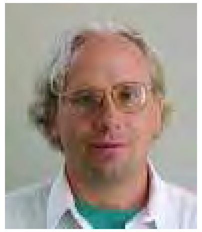
D Miller



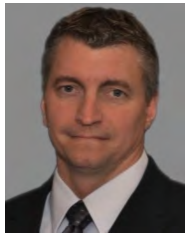
B Napier

K Pryor

D Schauer



D Stram



J Thompson

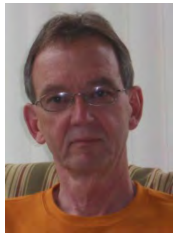
J Till

C Yoder

C Zeitlin

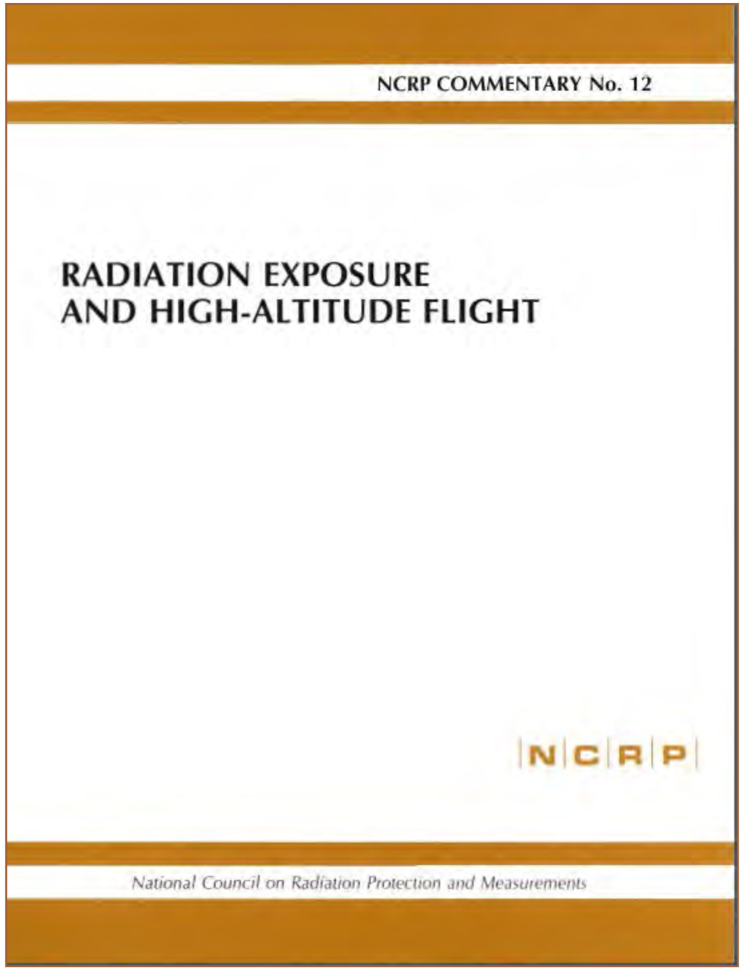
S Balter, *Consultant*

T Brock, *Consultant*

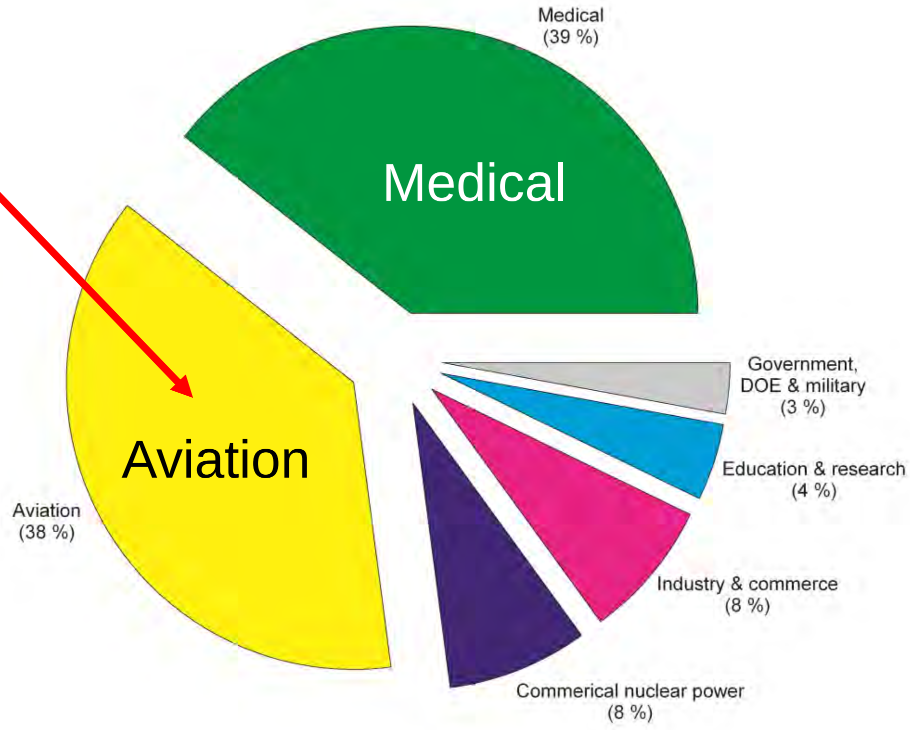


R Leggett, *Consultant*

Collective Doses for Aircrew are the Main Contributor to Collective Occupational Dose (New SC 6-10 planned this year)



Occupational Dose, NCRP Report No.160



PAC 6 Opportunities

- Dosimetry for air crew (SC 6-10 is planned)
- Practical methods for data collection for dose reconstruction following mass exposure events
- Update of NCRP Report No. 58 on radioactivity measurements
- Scientifically based regulatory framework for radiation biodosimetry
- Simulation studies of direct astronaut space exposure with simultaneous modeling of detector responses
- Improvements to microdosimetry for dosimetry in space
- Lens of eye dosimetry (following 2016 workshop & 2017 Commentary No. 26)

PAC 7: Radiation Education, Risk Communication, Outreach, and Policy

R.N. Hyer, *Vice President*
S.M. Becker
J.T. Bushberg
V. Covello
R. Johnson
P.A. Locke
C. McClurey
C.W. Miller
M. O'Brien
J.E. Till
J. Wieder
V. Siegel, *Consultant*

"People don't care how much you know until they know how much you care"

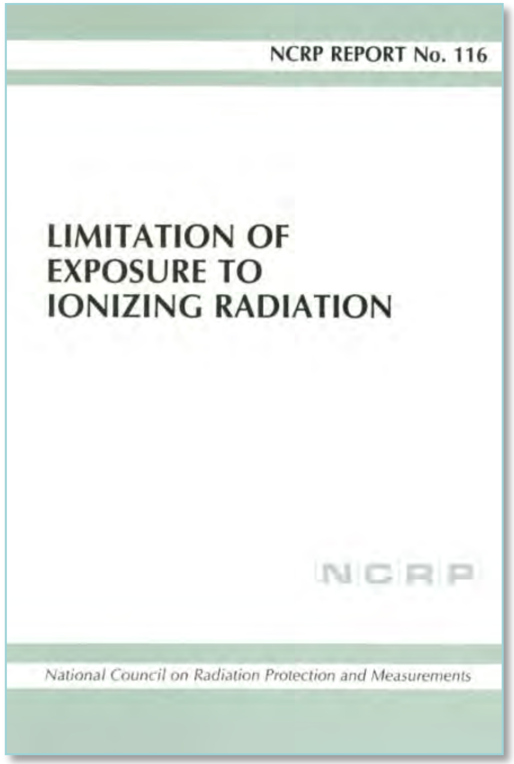
PAC 7: Liaison Activities

- CC 1 on Radiation Regulations
- SC 1-25 on LNT and Radiation Protection
- SC 3-1 on Emergency Response Dosimetry
- SC 5-2 on TENORM in the Oil and Gas Industry

PAC 7

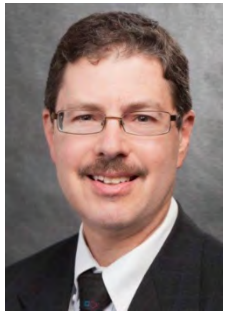
- NCRP has “communications” in the first line of its charter
- Need for lay language executive summary in every report
- Communications Fellow for NCRP
- Comprehensive review of the psychosocial effects of radiation incidents
- Comprehensive and structured approaches to communicating radiation issues

CC 1: Radiation Protection Guidance for the United States



Purpose: An NCRP report is proposed to update and expand NCRP Report 116 on Radiation Protection Guidance for the United States.

Background: Since NCRP Report 116 was published in 1993 there have been substantial advances in radiation effects knowledge as well as radiation protection understandings and culture. In these times of change, there is a pressing need to update the NCRP guidance with regard to radiation protection as it pertains to the United States.



K.R. Kase, *Chair*
D.A. Cool, *Co-Chair*

A. Ansari
J.D. Boice
J.T. Bushberg
L.T. Dauer
D.R. Fisher
P. Fleming
K.A. Higley

R.N. Hyer
W.E. Irwin
F.A. Mettler
D.L. Miller
R.J. Preston
G.E. Woloschak

J.E. Till, *Liaison PAC 7*
S.J. Adelstein, *Consultant*
R. Andersen, *Consultant*
M. Boyd, *Consultant*
M. Rosenstein, *Staff Consultant*

CC 2: Meeting the Needs of the Nation for Radiation Protection

R.E. Toohey, *Chair*
K.A. Higley, *Co-Chair*
W.D. Newhauser, *Co-Chair*

A. Salame-Alfie	W.E. Kennedy
J.L. Bader	C.A. Mitchell
D.J. Blumenthal	M.A. Noska
J.D. Boice	M. Weber
R.R. Brey	R.C. Whitcomb
S.A. Dewji	J.P. Williams
D.P. Frush	G.E. Woloschak
P. Henderson	P.R. Worthington
J.W. Hiatt	

National Council on Radiation Protection and Measurements
7910 Woodmont Avenue / Suite 400 / Bethesda, MD 20814-3095
http://ncrponline.org / http://ncrppublications.org

Where are the Radiation Professionals (WARP)?

***NCRP Statement No. 12*, December 17, 2015**

Since the discovery of x rays and radioactivity in the 1890s, sources of ionizing radiation have been employed in medicine, academia, industry, power generation, and national defense. To provide for the safe and beneficial use of these sources of radiation, the United States developed a cadre of professionals with the requisite education and experience. Unfortunately, their numbers have diminished alarmingly (AAAS, 2014; GAO, 2014; HPS, 2013; NA/NRC, 2012).

Methods

To study the decline in radiation professionals and potential national crisis, the National Council on Radiation Protection and Measurements (NCRP) sponsored a workshop in June 2013 in Arlington, Virginia to evaluate whether a sufficient number of radiation professionals exist now and into the future to support the various radiation disciplines essential to meet national needs. Attendance at this workshop included professionals from government, industry, academia, medicine, and professional societies. Presentations from over 30 groups (NCRP, 2013) resulted in the recommendations found in this Statement.

Findings

Evidence presented at the workshop revealed that the country is on the verge of a severe shortfall of radiation professionals such that urgent national needs will not be met. Factors contributing to the downturn include the economy, attrition, redirected national priorities, and decreased public funding. The magnitude of this shortfall varies with radiation disciplines and practice area. Radiation biology has already been critically depleted and other specialties are following the same downward spiral. All radiation professionals share the same goals to develop or implement scientific knowledge to protect workers, members of the public, and the environment from harmful effects of exposure to ionizing radiation. Accordingly, the workshop concluded that the current and projected shortfall will adversely affect the public health, radiation occupations, emergency preparedness, and the environment. Major shortfalls have already been observed in day-to-day operations, leaving policy development, regulatory compliance, research and development, environmental monitoring,
and under-supported mandates.
concern in mounting a response to a cata-
acks. The current concept of operations for
on professionals to serve as technical subject
f such an event. However, as the number of
ability to cope and manage a catastrophic

ssionals in broad and diverse areas such as
ment, environmental monitoring and resto-
e, nuclear medicine, radiation therapy, diag-

nates that 31 % of the federal workforce will
gineering and technical professionals eligible
urvey of the Conference of Radiation Control
use of radioactive materials and radiation-
of the technical staff in the states' radiation

the future supply of radiochemists (NA/NRC,
government will result in an inability to sup-
ct on the ability to manage the consequences
ent in the United States. The basic radiation
rise that directly and materially benefits the

If Not Now, When ?

- Failure to plan, is planning to fail – Ben Franklin
- Those who cannot remember the past are condemned to repeat it – George Santayana
- If we wait until it's too late, it will be too late – JDB

Closing Remarks

John D. Boice, Jr.

President, NCRP

2017 Annual Meeting Acknowledgments

NCRP expresses appreciation to all speakers and session chairs and to the 2017 Program Committee:

Armin Ansari, *Co-Chair*
Adela Salame-Alfie, *Co-Chair*

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- *Kimberly Gaskins* **who sang our National Anthem**
- **Joint Armed Forces Honor Guard, Washington, D.C.**

- **Air Force**
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- **Coast Guard**
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- NCRP expresses appreciation to *Dale Garbett, Jennifer Gillissen, & Romel Simon* for audiovisual services
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2018 Annual Meeting: March 5-6, 2018

Radiation Responsibility in Medical Imaging

Donald P. Frush & Lawrence T. Dauer, *Co-Chairs*

See You Next Year!