

Presented at the
Armed Forces Radiobiology Research Institute
Scientific Medical Effects of Ionizing Radiation Course
July 28 through August 1, 2008
Bethesda, Maryland

Distributed via the AFRRRI Web site
<http://www.afrrri.usuhs.mil>

The Scientific Medical Effects of Ionizing Radiation Course, conducted once a year, focuses on the latest research about the medical effects of ionizing radiation to help clinicians, health physicists, and medical planners preserve troop health in the face of radiological/nuclear terrorism or warfare.

For additional information about AFRRRI training opportunities, contact AFRRRI Military Medical Operations at 301-295-9150 or press the "Request info about: MEIR courses" button on [this web page](#). To view more AFRRRI information products, go to [this web page](#).

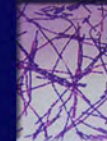
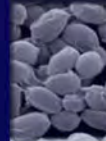
For questions or more information about the content of this presentation, contact the presentation author.



Population Monitoring – Practical Consideration in a Radiation Emergency

Armin Ansari, PhD. CHP

**Radiation Studies Branch
Division of Environmental Hazards & Health Effects
National Center for Environmental Health
Centers for Disease Control & Prevention
Atlanta, Georgia**



Our Focus

- Terrorist Incidents Impacting Large Populations
- Even “small” incidents present significant challenges
 - London Po-210 incident

November 2006, London Po-210 International Follow-Up

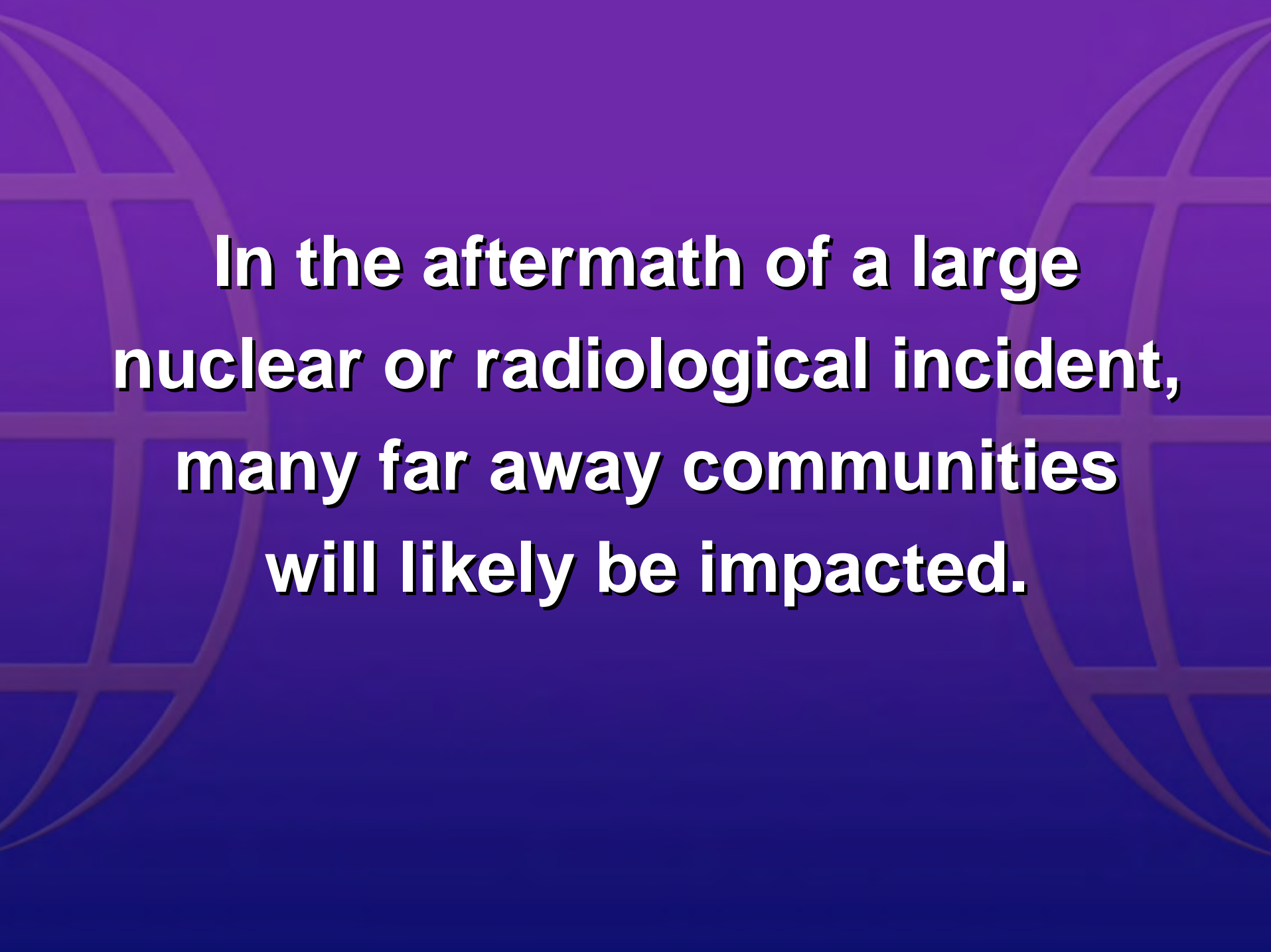


Scenario 11: Radiological Attack – Radiological Dispersal Devices

- **Casualties**
 - 180 fatalities; 270 injuries; 20,000 detectible contaminations (at each site)
- **Evacuations/Displaced Persons**
 - 10,000 evacuated to shelters in safe areas (decontamination needed)
 - 25,000 in each city are given shelter-in-place instructions
 - Hundreds of thousands self-evacuate from major urban areas in anticipation of future attacks

Scenario 1: Nuclear Detonation – 10-kiloton Improvised Nuclear Device

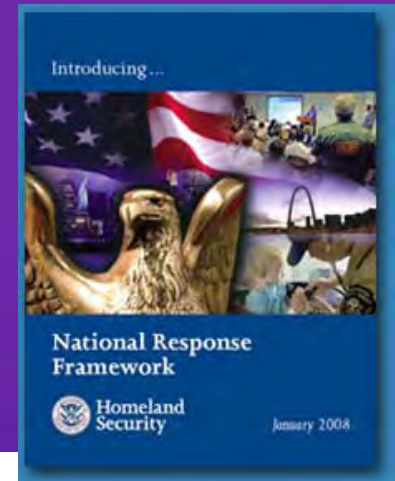
- Casualties
 - Hundreds of thousands
- Evacuations/Displaced Persons
 - 100,000 in affected area seek shelter in safe areas (decontamination needed)
 - 250,000 instructed to shelter-in-place as plume moves across region(s)
 - 1 million+ self-evacuate from major urban areas



In the aftermath of a large nuclear or radiological incident, many far away communities will likely be impacted.

National Response Framework

Nuclear/Radiological Incident Annex



Victim Decontamination/Population Monitoring

Incidents of National Significance and Other Radiological Incidents

- External monitoring and decontamination of possibly affected victims are accomplished locally and are the responsibility of State, local, and tribal governments. Federal resources are provided at the request of, and in support of, the affected State(s). HHS, through ESF #8 and in consultation with the coordinating agency, coordinates Federal support for external monitoring of people and decontamination.
- HHS assists and supports State, local, and tribal governments in performing monitoring for internal contamination and administering available pharmaceuticals for internal decontamination, as deemed necessary by State health officials.
- HHS assists local and State health departments in establishing a registry of potentially exposed individuals, perform dose reconstruction, and conduct long-term monitoring of this population for potential long-term health effects.

Default Thinking on Dealing with the Public



Outline

- Brief history
- Overview of the Planner's Guide
 - Scope
 - Target audience
 - Key Concepts
- Work in progress

CDC Roundtable, January 2005

- American Red Cross
- Armed Forces Radiobiology Research Institute
- Columbia University
 - Center for International Earth Science Information Network
- FRMAC – Remote Sensing Laboratory
- Hershey Medical Center
- Indian Health Services
- International Atomic Energy Agency
- National Association of County and City Health Officials
- New York City Dept. of Health and Mental Hygiene
- Science Applications International Corp.
- State of Arkansas Department of Health
- State of Georgia Emergency Medical Services
 - National Association of State EMS Directors
- State of Illinois Emergence Management Agency
- State of Iowa Department of Health
- State of Maine Health and Environmental Testing Laboratory
- University of Alabama-Birmingham
- State of Washington Department of Health
- Texas A&M University
- University of Georgia
- University of New Mexico
- U.S. Army Civil Support Team
- U.S. Department of Commerce
 - National Institute of Standards and Technology
- U.S. Department of Health and Human Services
 - Center for Disease Control and Prevention
 - Food and Drug Administration
 - Health Resources and Services Administration
 - National Institutes of Health
 - Substance Abuse and Mental Health Services Administration
- U.S. Department of Homeland Security
 - Nuclear and Chemical Hazards Branch
 - Environmental Measurements Laboratory
- U.S. Environmental Protection Agency
- U.S. NORTHCOM/SG

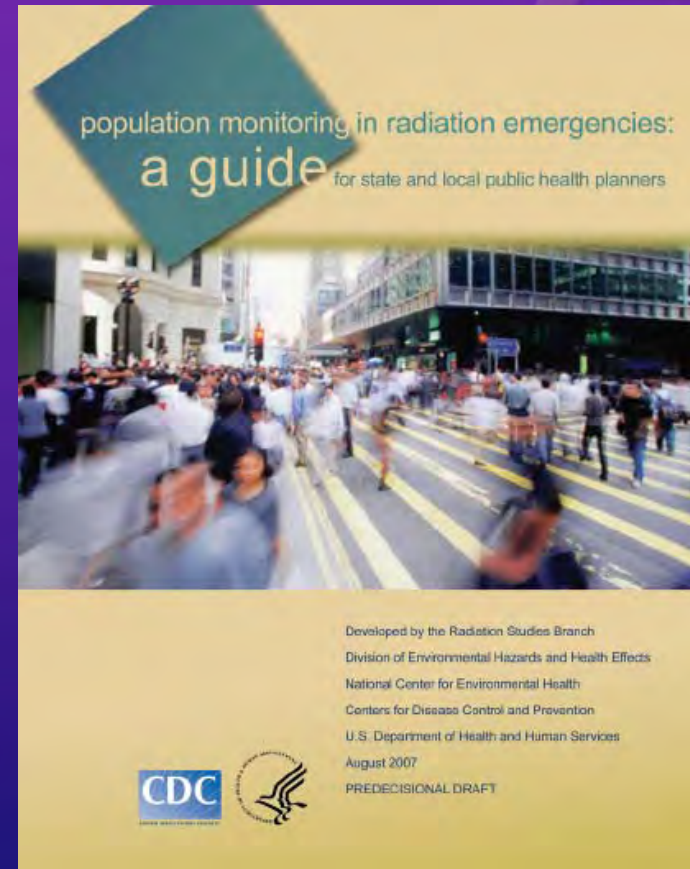
Federal Radiological Monitoring and Assessment Center Technical Advisory Group

Population Monitoring Working Group

- HHS/CDC
- HHS/FDA
- USEPA
- USNRC
- DOE/NNSA
- California Dept. of Health
- Georgia Dept. of Natural Resources
- CRCPD
- REAC/TS
- ORISE
- American Red Cross

- **Target audience:**
 - State and local public health and emergency preparedness personnel
- **Focus**
 - Terrorism Incidents involving mass casualties
- **Scope**
 - Assumes local infrastructure is intact
 - Principles apply to all radiation incidents

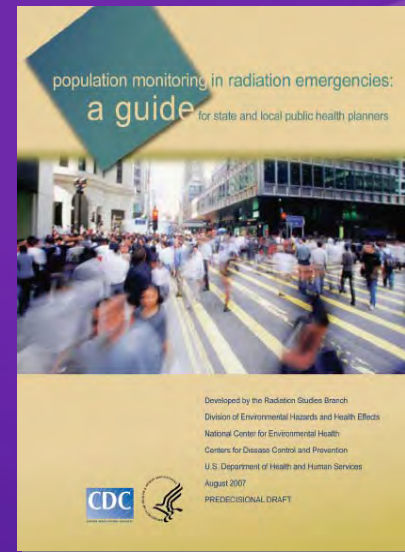
CDC Guidance



Purpose

Assist state, local, and tribal public health officials to:

- Evaluate their emergency response plans**
- Identify staffing needs, training requirements, and priorities**
- Develop further mutual assistance programs with other states**
- Allocate personnel and resources during a response**



Population Monitoring



- **Evaluate potentially-affected population for:**
 - **Immediate need for medical treatment (both rad and non-rad related)**
 - **Presence of contamination on body or clothing**
 - **Intake of radioactive materials**
 - **Removal of external or internal contamination (decontamination)**
 - **Radiation dose received and risk of health effects**
 - **Long-term health effects (needs registry)**

Other Public Health Planning Considerations

- Size of the community
- Population demographics
- All available local resources
 - Facilities for monitoring and decontaminating people
 - Agreements with local jurisdictions
 - Assistance from federal responders

States with Operating Nuclear Power Plants

- Public health planners in these states should already have local response plans for a nuclear power plant incident. These plans include population monitoring.
- Effective response to a radiological or nuclear terrorism incident requires broader planning and a different response than current plans likely include.

Guiding Principles

- The first priority is to save lives: respond to and treat the injured first.
- Contamination with radioactive materials is not immediately life-threatening.

Guiding Principles (CONT.)

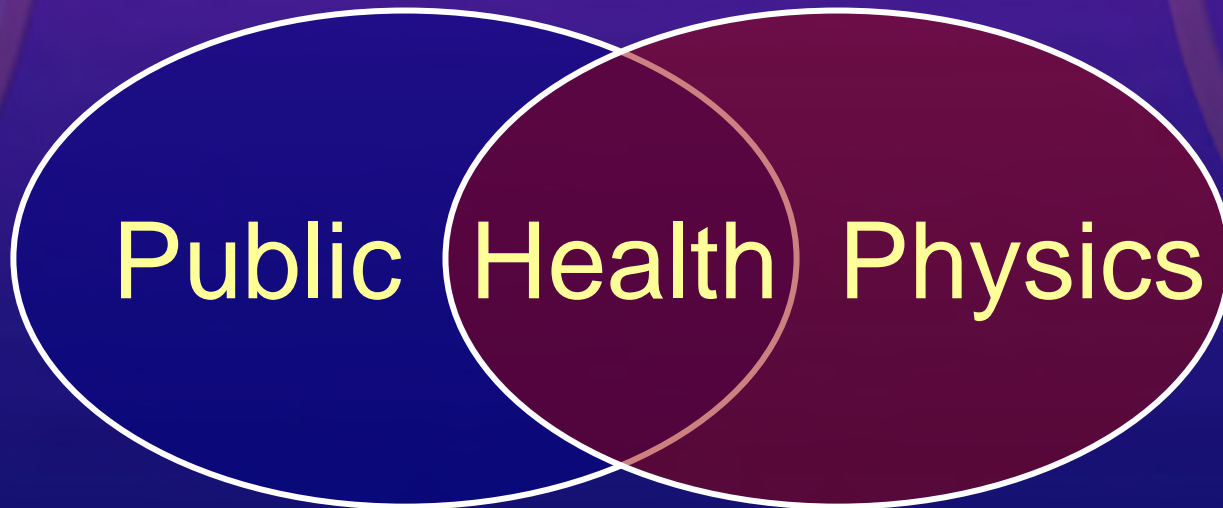
- **Initial population monitoring activities should focus on preventing acute radiation health effects.**
 - Cross contamination issues are a secondary concern
- **Scalability and flexibility are an important part of the planning process.**

Guiding Principles (CONT.)

- The radiation control program in your state is a key resource for implementing the CDC population monitoring guidance.
 - Establish relationships with other radiation experts/resources in the community (hospitals, universities, etc.)

In a radiation emergency:

- **Public health practitioners need to work closely with radiation safety professionals (health physicists)**



Joint CRCPD/CDC

“Roundtable on Communication and Teamwork: Keys to Successful Radiological Response”

June 17-18, 2008

- **Invitees**
 - **CRCPD, NACCHO, ASTHO, CSTE**
- **Purpose**
 - **Strengthen communication**
 - **Establish partnerships/Improve working relationships**
 - **Increase awareness of responsibilities in radiation emergencies**

Key Considerations

- Size of the community
- Available local resources
 - Facilities, equipment and staff for monitoring and decontaminating people
 - Agreements with local jurisdictions
 - Registered radiation volunteers
- Population demographics
- Recognize community members with special needs
- Know how to identify the affected population
- Understand the objectives of population monitoring

Objectives of Population Monitoring

1. Identify people in immediate danger.
2. Identify people who need medical treatment for contamination or exposure.
3. Recommend and facilitate practical steps to minimize risk.
4. Register people for long-term health monitoring.

CDC Planner's Guide

Content

- **Population Monitoring (*the Initial Hours*)**
 - **Contamination Screening Criteria**
 - **Radiation Survey Methodology**
 - **Clothing Services**
 - **Transportation Services**
 - **Washing Facilities**
 - **Registry**
 - **Collection of Biological Samples**
 - **Worker Protection**

Appendix C

Radiological Screening Criteria— External Contamination

- **Benchmark screening criteria described**
 - **EPA 400 PAG Manual, May 1992 (revised 2007)**
 - **FEMA-REP-21, March 1995 (under revision)**
 - **FEMA-REP-22, October 2002 (under revision)**
 - **NCRP Commentary No. 19, December 2005**
 - **CRCPD First Responder's Guide, Sept 2006**
 - **IAEA Manual for First Responders, October 2006**

Radiological Screening Criteria— External Contamination

- **CDC does not recommend setting, *a priori*, a fixed screening criterion to be applied to all people for all incidents under all circumstances.**

Screening Criteria Consideration:

- **consider range of possible circumstances, keeping in mind:**
 - **population monitoring objectives**
 - **specific radiation survey instrumentation**
 - **staffing resources and size of population**
 - **facilities and resources for offering on-the-scene monitoring and decontamination**
 - **other resources that can increase available options**
- **The planning should be done in advance, allowing for flexibility**

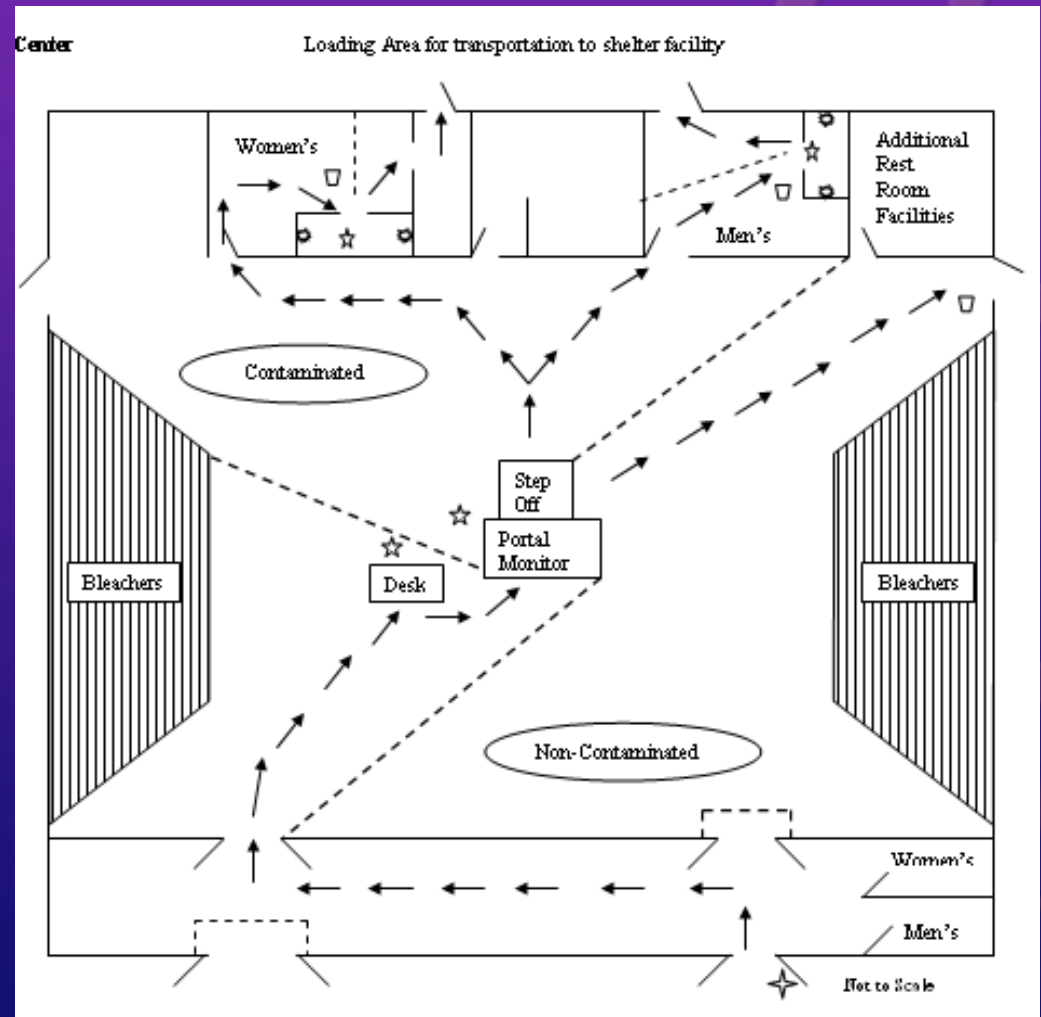
CDC Planner's Guide

Content

- **Population Monitoring (*Day 2 and Beyond*)**
 - **Setting Up Community Reception Centers**
 - **Practical Considerations for Reception Centers Operations**
 - **Pets**
 - **Monitoring for External Contamination and Conducting Decontamination**
 - **Monitoring for Internal Contamination and Conducting Decontamination**
 - **Scaling for Size of Event**

Example: Typical Reception Center for a NPP EPZ

- For monitoring large populations, conventional approach may not be best
- Use of portal monitors?
- Use of “friskers”?
- Staffing



Community Reception Centers

- **To assess people for exposure, contamination, and need for decontamination or other medical follow-up, and to register**
- **Compared to public health community planning for other incidents**
 - **Alternate Care Sites**
 - **Neighborhood Emergency Help Centers**
 - **Acute Care Centers**
 - **Point of Dispensing (POD)**

Point of Dispensing (POD)

- Mass dispensing of medication/vaccine in a public health emergency
- Natural or man-made
- Reach entire population within 48 hours
- 1000 people/hr per POD

Example

- Philadelphia Department of Public Health
- Similar planning in many other jurisdictions
- Terminology
- ICS

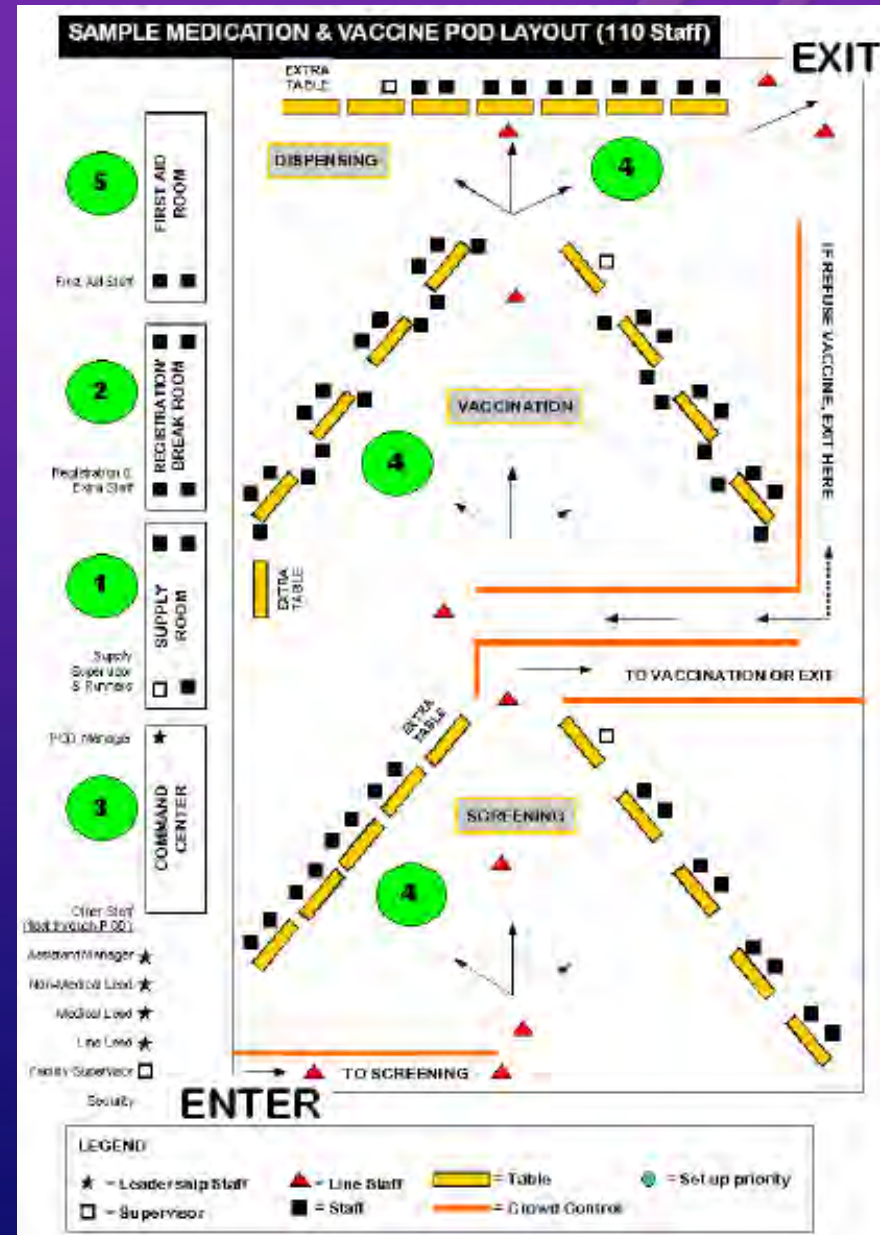
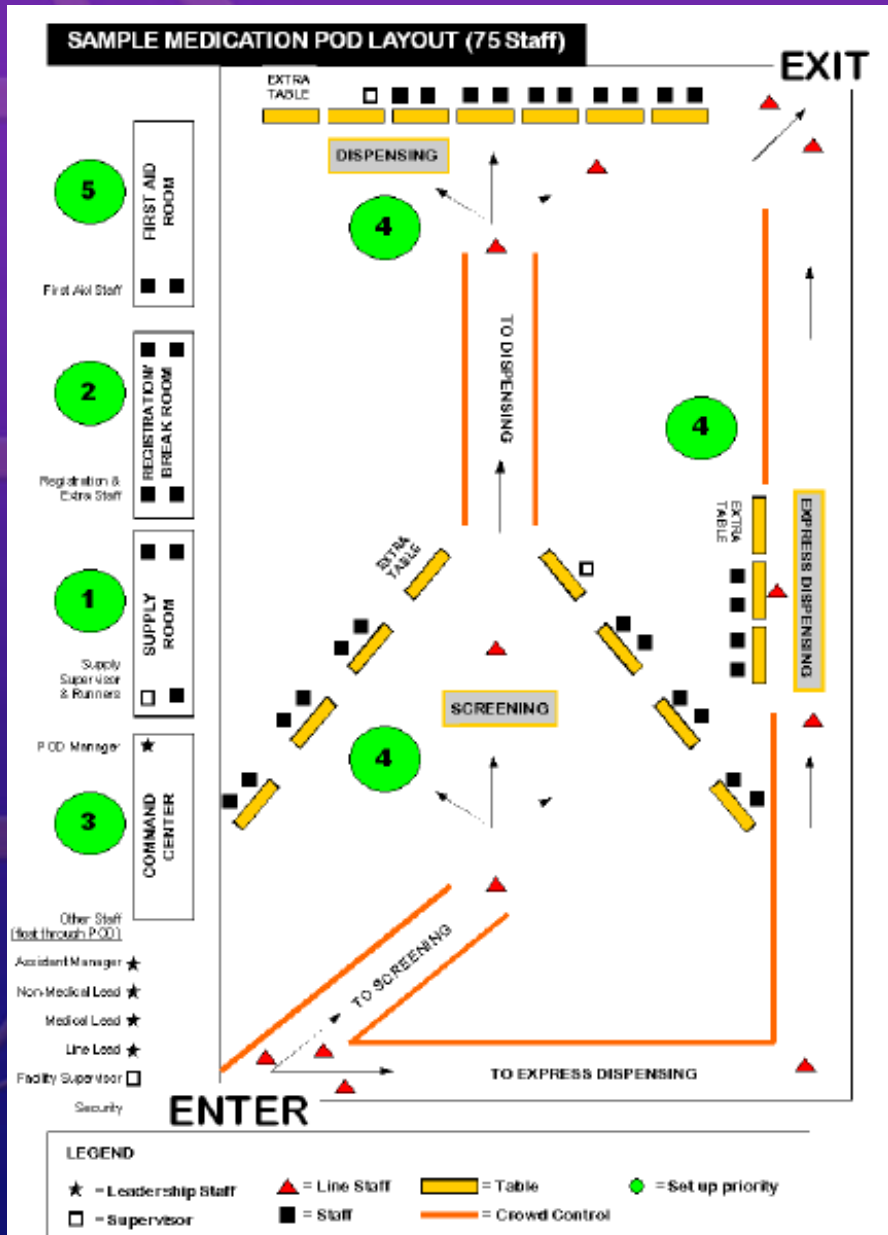
POINT OF DISPENSING (POD) OPERATIONS MANUAL



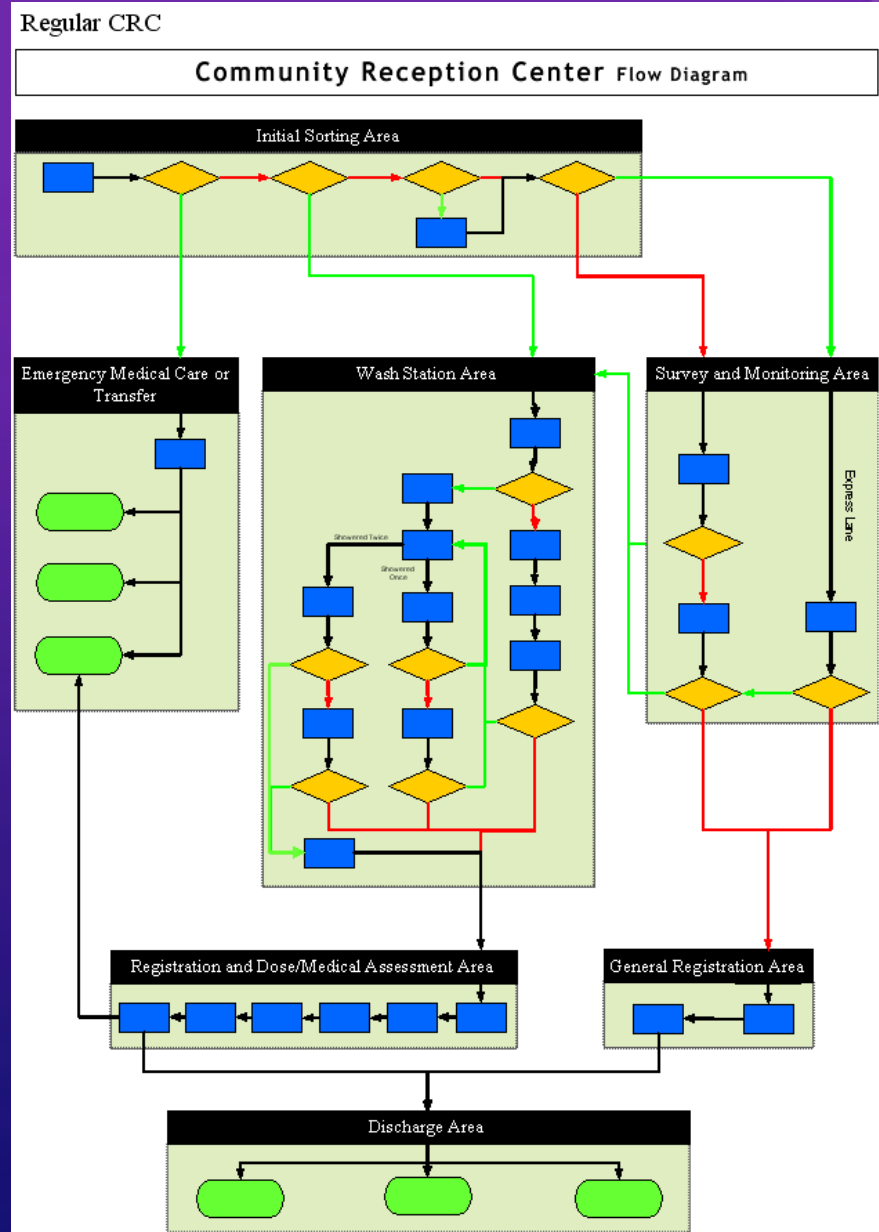
Philadelphia Department of Public Health
Division of Disease Control
Emergency Preparedness and Bioterrorism Program

EDITION 1
2006

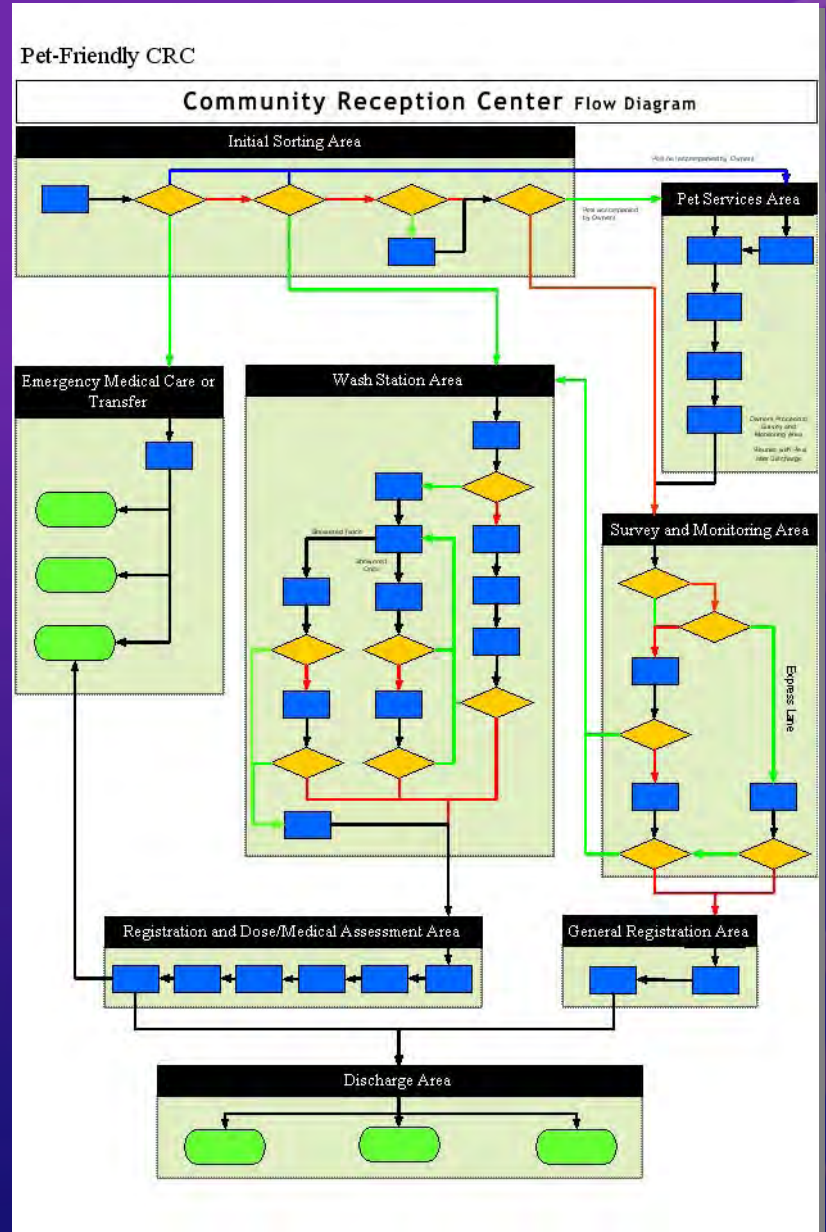
POD Design



“Regular” Community Reception Center

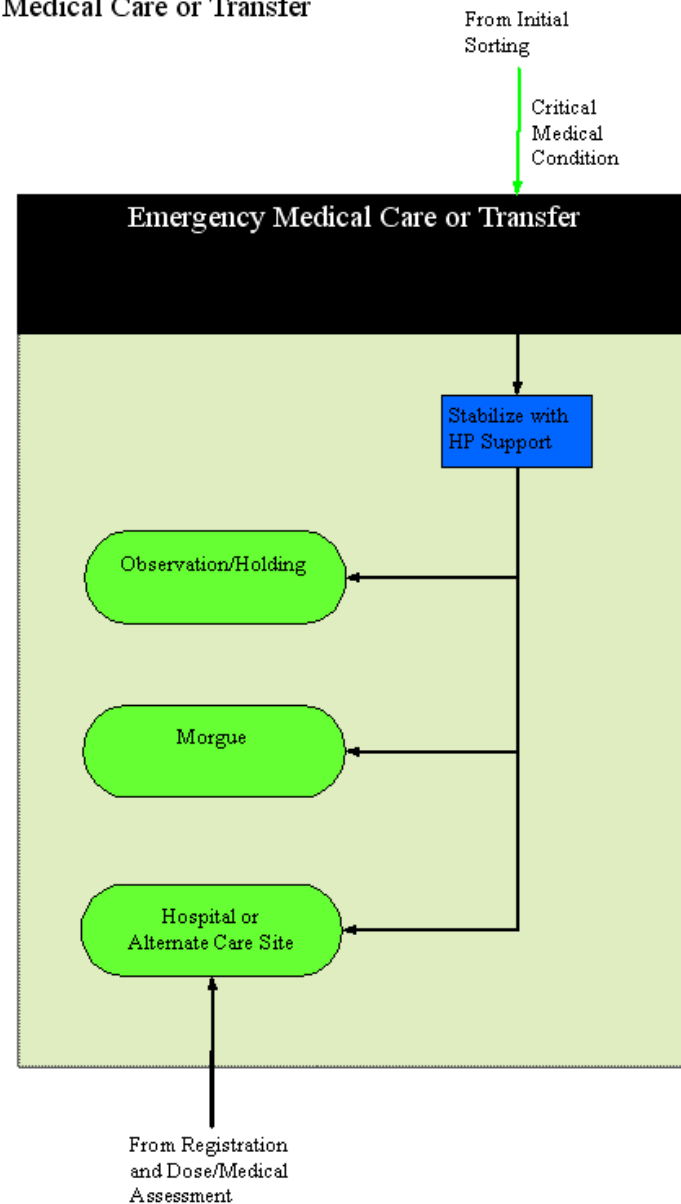


“Pet-Friendly” Community Reception Center

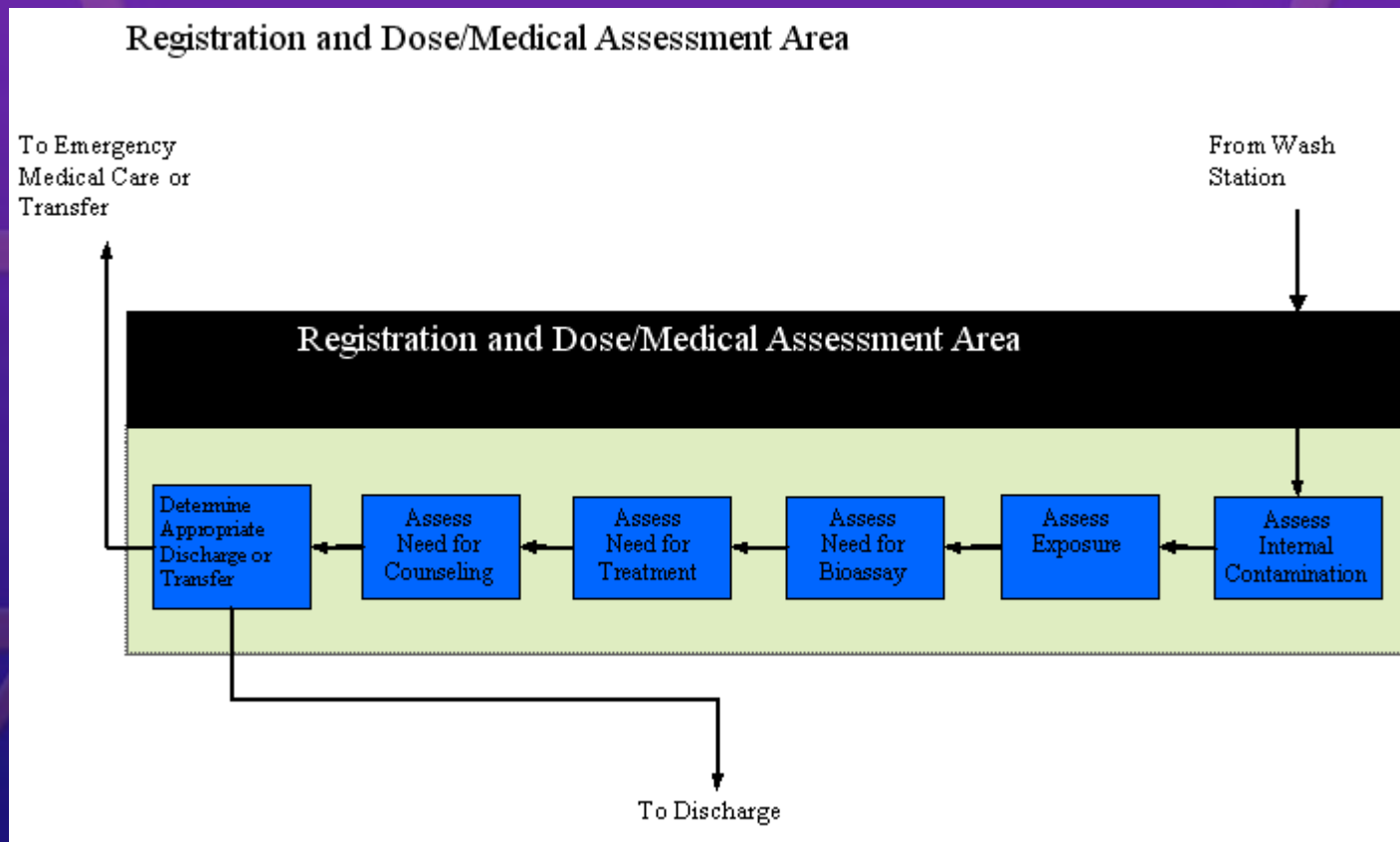


Emergency Medical Care or Transfer

Emergency Medical Care or Transfer



Radiation Dose/ Medical Assessment Area

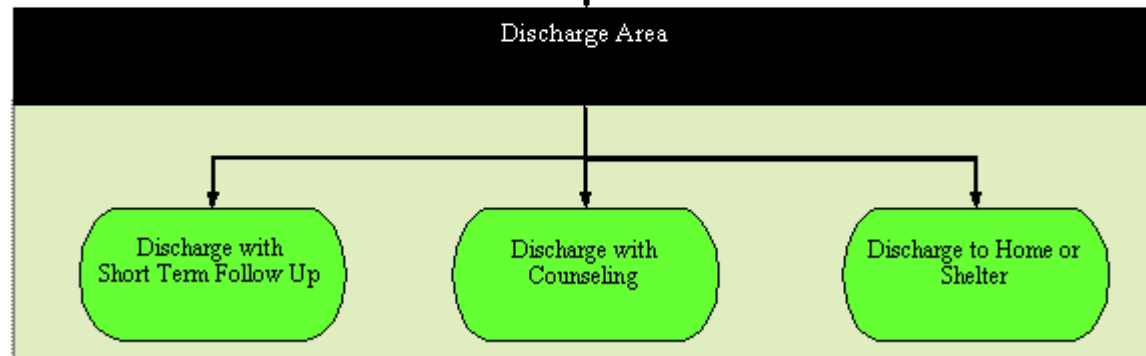


Discharge Area

Discharge Area

From Registration
and Dose/Medical
Assessment

From General
Registration



Psychosocial Issues

- Psychological assistance officer on staff for community reception centers.
- Mental health in radiation disasters training – in production!



An aerial photograph showing a vast residential area completely inundated with floodwater. The water is a deep blue color, and numerous houses, trees, and structures are visible as islands in the sea of water. In the far distance, a city skyline with several tall buildings is visible under a hazy sky. The text "What if the local response infrastructure is not intact?" is overlaid in the center of the image in a large, yellow, sans-serif font with a black outline.

What if the local response
infrastructure is
not intact?

Nuclear Scenario



- Prioritize HP support for search and rescue
- Partial decon better than delayed decon
- Greater emphasis on monitoring for ARS and providing medical care
 - At reception centers
 - At shelters

Prioritized population monitoring objectives still apply!

Nuclear Scenario



Much farther away from “ground zero”,
reception center and shelter operations
closer to RDD planning

Management of Internally Contaminated Individuals

- Depends on amount of radioactivity
- Monitoring large populations is a challenge:
 - Bioassay
 - Field screening using portable instruments
 - Hospital equipment (thyroid uptake scanner, gamma camera)
 - Ongoing work at CDC

Should We Be Concerned With Small Amounts of Radioactivity or Dose of Radiation?

- 12 Bq (disintegrations per second)?
720 dpm (disintegrations per minute)
- 5500 Bq?

<i>Dose Matters!</i>	Approx. dose (in rems)
Chest X-ray	0.03
Average annual dose from exposure to natural sources	0.2-0.3
CAT scan (whole body)	1
Recommended annual limit in occupational exposure (exclusive of medical exposures)	1 to 5 max per year
No symptoms of illness	15
No symptoms of illness; minor, temporary decreases in white cells and platelets	50
Possible acute radiation syndrome; 10% will have nausea and vomiting within 48 hours and mildly depressed blood counts;	100
Half of those exposed will die within 30 days without medical care	300-400 ¹

¹Hall, E.J. 2000. *Radobiology for the Radiologist*. Lippincott Williams & Wilkins.

Laboratory Analyses

- Conventional methodology
 - 24-hr urine sample
 - 3-7 days turnaround time
 - 5-40 samples/day/lab
- Improved methodology (for population screening)
 - 1-50 ml “spot” sample
 - 4-36 hours turnaround time (multiple radionuclides)
 - 100-500+ samples/day/lab

Laboratory Analyses

- **Challenges**

- Field screening and prioritization important

- Interpretation of bioassay results and inherent uncertainties

Work in Progress

- Developing a planning decision tool (software) for optimizing the design and operation of community reception centers.
- Developing protocols for use of hand-held radiation survey meters to assess internal contamination.
- Developing male, female, and child phantoms to be used for calibration of these instruments.
- Developing a prototype instrument to be used for screening of internally-contaminated patients in hospitals or reception centers (gamma-emitters only).

Emergency Field Screening for Internal Contamination

Requirements

- Simple and easy to use equipment
- Readily available, mobile, cost effective
- Dual purpose applications preferred
- Rapid (1-3 minute) screening times
- Conversions for cpm/uCi-intake at varying time after intake
- Data archiving and export

Emergency Screening for Internal Contamination

Solution

- Use thyroid uptake probes available at existing clinical facilities
- Measure efficiencies for key isotopes using phantoms
- Apply biokinetic models for time after intake
- Develop software module
- Design a portable stand
- Provide software upgrades to establish nationwide availability of resource at low cost



Radiation Instruments in Hospitals

- To screen patients for **internal** contamination
 - Thyroid Scanners
 - Feasible and practical
 - Gamma Cameras
 - Not for large numbers

An Evaluation of Hospital Radiation Detectors for Use in Screening Potentially Contaminated Individuals

www.bt.cdc.gov/radiation



Addressing Resource Issues

- Motivate the country's large health physics and medical physics community to enlist in a locally-sponsored volunteer registry.
- **Examples**
 - **Medical Reserve Corps**
(www.medicalreservecorps.gov)
 - www.servga.gov
 - Georgia's State Emergency Registry of Volunteers
 - www.servfl.com
 - Florida Emergency Health Volunteer Registry
 - www.servnc.org
 - North Carolina State Registry of Volunteers

THANK YOU

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

Radiation Studies Branch, CDC

rsb@cdc.gov

(770) 488-3800

Armin Ansari

770-488-3654

asa4@cdc.gov

