

CDC's need for reference materials to validate analytical methods for Public Health exposure assessments after a radiological or nuclear incident

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After a Radiological Incident, Public Health Officials Will Need to Answer the following:

- **What** are people exposed to or contaminated with
- **Who** was exposed
- **How much** exposure or contamination did each person have

The decision to medically treat people will depend on our ability to rapidly and accurately identify and quantify internal contamination

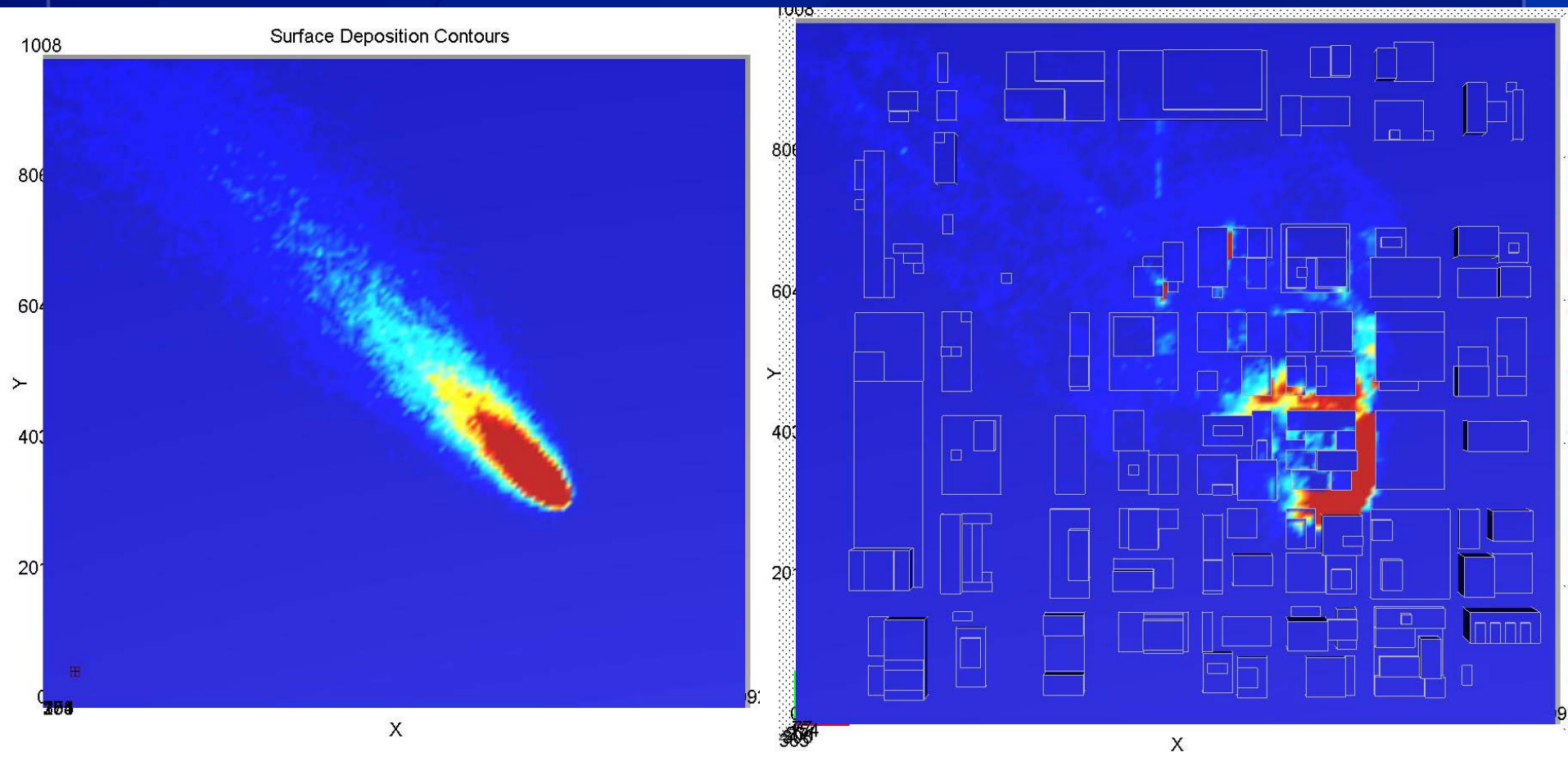
Radiation Diagnostics

- **Biodosimetry**: Use of clinical and laboratory observations to estimate radiation dose received after radiation exposure. (**HHS/BARDA method R&D**) *Most effective for estimating injury due to irradiation [shine] (IND, RED or NPP).*
- **Bioassay**: Any procedure used to determine the nature, location or retention of radionuclides in the body (*contamination*) by direct (*in vivo*) measurement or by indirect (*in vitro*) analysis of material excreted or otherwise removed from the body (**CDC methods**). Generally used for the purpose of estimating intake and committed dose. *Most effective for estimating injury due to inhalation or ingestion after a RDD, IND or NPP fallout.*

The Boston Marathon

What if,
It had been an RDD
("Dirty Bomb")?

Deposition Patterns

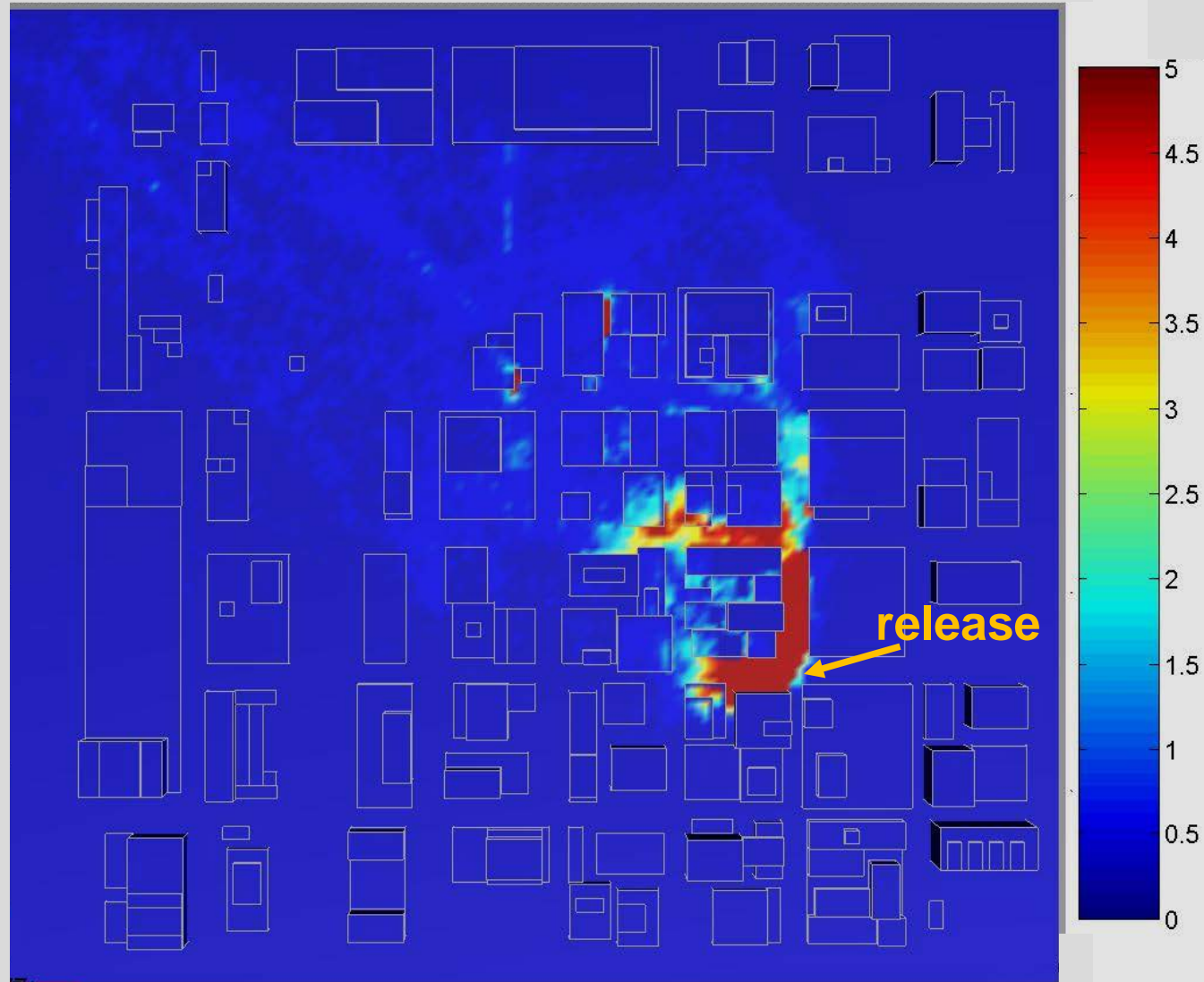


Without buildings

With buildings

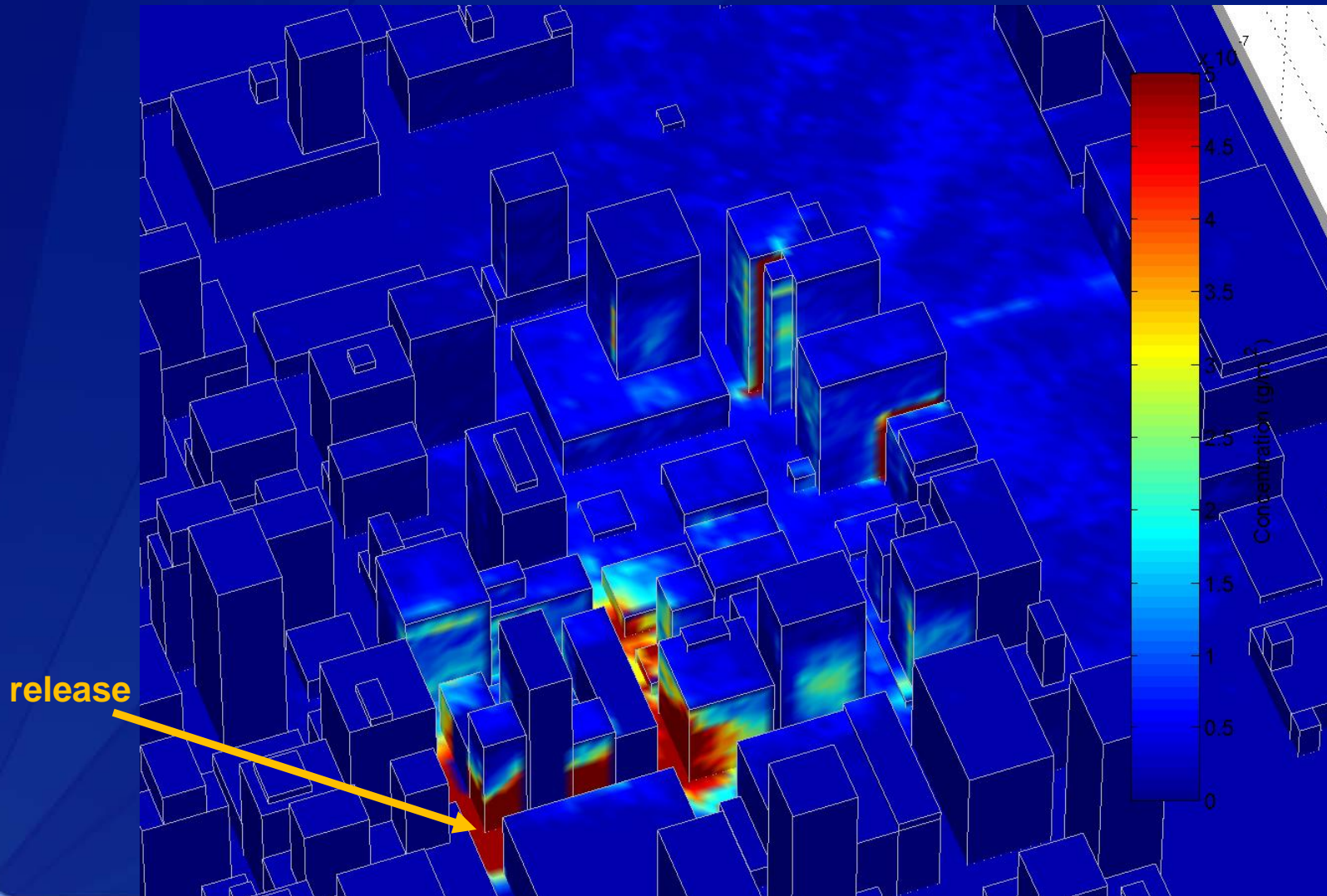
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Deposition Patterns



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Deposition Patterns in 3D



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Assessment: Epidemiology

- Epidemiologic activities
 - Epidemiologic investigation (e.g., Litvinenko)
 - Identify scope of event
 - Identify persons affected
 - Assess radiation hazard to affected persons

Assessment: External Monitoring

❑ External screening

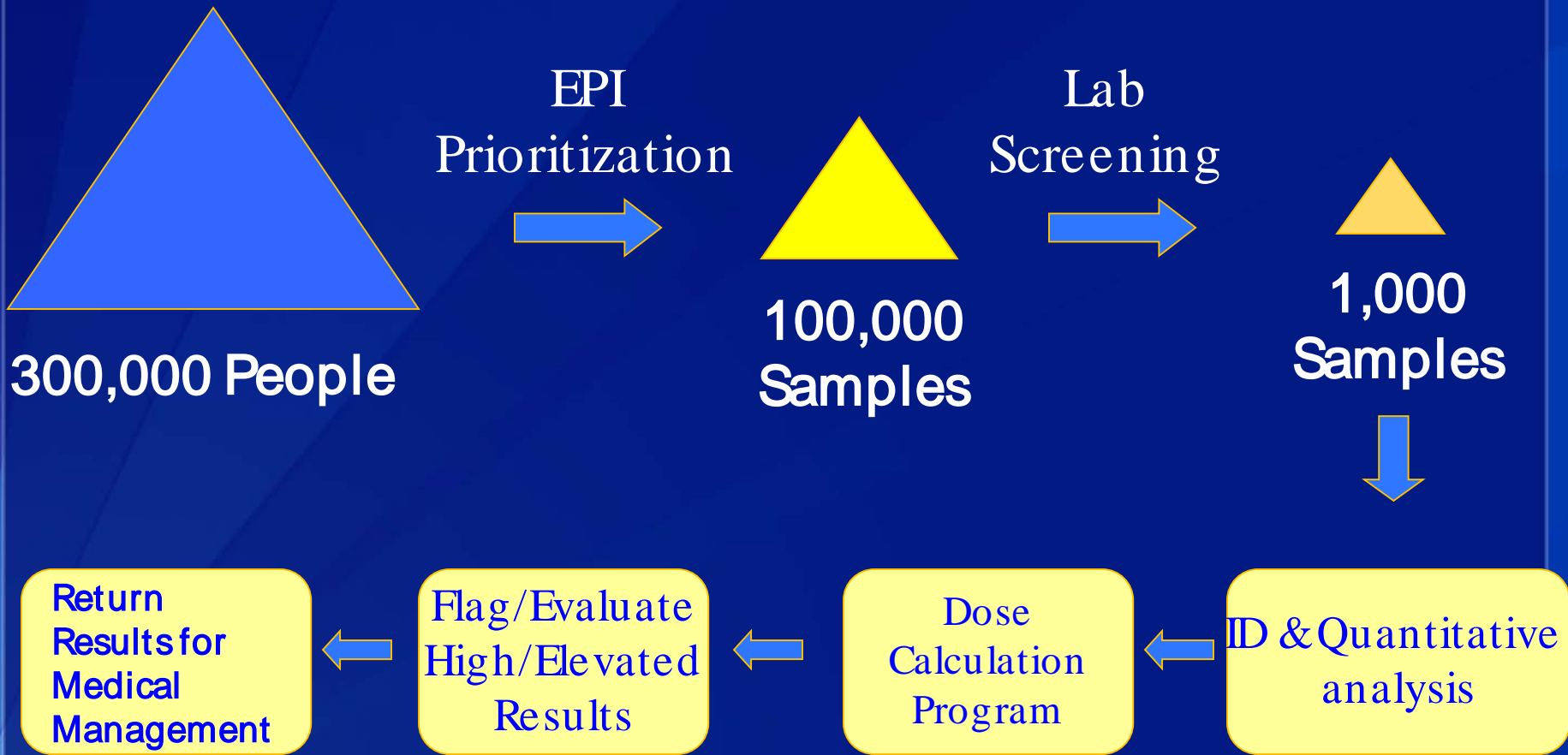
- Uses portable survey meters, portal screening
- Guides decontamination
- Responsible entity: State/local agencies

❑ CDC capabilities

- Guidance developed for state, local programs
- Very limited CDC capacity to assist/support



Rapid Response: Epidemiologic, Laboratory and Health Physics or Toxicology Coordination



Bioassay: Key Issue

Detection of Internal Contamination

Radionuclides	Urine bioassay detection	Primary radiation detection
Uranium (^{235}U , ^{238}U), Thorium	yes	alpha and beta
Strontium, Plutonium (^{238}Pu , ^{239}Pu)	yes	
Americium, Californium, Neptunium,	yes	
Phosphorus, Curium, Polonium	yes	
Cesium, Cobalt (^{57}Co , ^{60}Co), Radium	yes	Gamma rays
Iodine (^{125}I , ^{131}I), Technetium-99m	yes	
Selenium, Molybdenum, Iridium	yes	

Internal radiation screening via hand held detectors or portals is **only applicable for gamma emitting radionuclides**.

CDC's Urine Radionuclide Screen

Urine "Spot" Sample

Gamma Radionuclide Screen

Alpha/Beta Radionuclide Screen/Quantification

Alpha (Long Lived) ICP-MS Screen

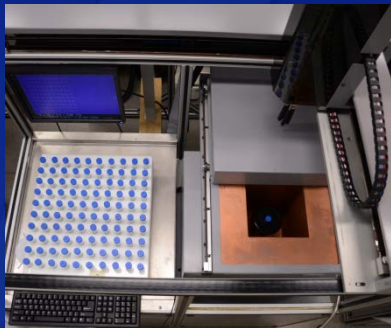


Gamma Spectrometry
Quantification

Alpha Spectrometry
Quantification

Mass Spectroscopy
Quantification

High Resolution Mass
Spectroscopy Quantification



SRM/CRM Uses at CDC

Some uses of SRMs and CRMs:

- Method Validation
- Daily QC Preparation or Validation
- CLIA Proficiency Testing (PT) Material Production or Validation (2 challenges per year at 5 levels)
- Calibration Verification (CLIA) Material Production or Validation (2 verifications per year with 5 levels across the calibration range)

QC, PT and Calibration Verification materials should be from different sources or production lots

Non-SRMs or Non-CRMs should be traceable to a SRM or CRM

SRM/CRM Levels for Bioassay: Selected examples

Radionuclide	CDG Level (Adult) Bq/L	NIST SRM	NIST Level Bq/g	Total Bq/vial
Sr-90	345,000	4239	32,000	160,000
Cs-137 Out of Stock	885,000	4233E	300,000	1,500,000
Ra-226	120	4967A	2,500	12,500
U- Total	18.0	3164	250	1,250
Pu-239	110	4330C	40	120
Am-241	115	4322C	100	500

CDG = NCRP Clinical Decision Guide

SRM/CRM Needs at CDC

- P-32
- Se-75 (Out of stock)
- Mo-99 (Out of stock)
- I-125 (Out of stock)
- I-131 (Out of stock)
- Cs-137 (Out of stock)
- Ir-192
- Po-210
- Cf-252

Radiological Event Impact

- Loss of life, mainly from blast
- Potential future cancer risk
- Psychosocial issues
- Economic impact, including area denial (due to contamination)
- Increased anxiety among citizens

Summary

- **Radiation Laboratory Methods (bioassay): Require SRMs or CRMs for validated methods**
- **Radiation Laboratory Methods (bioassay): rapidly identify and quantify specific radionuclides in people potentially contaminated in a radiological or nuclear event.**
- **Provides critical information for effective medical management of individuals by assessing risk for medical management and follow-up**
- **Provides information for population monitoring (populations and population sub-groups)**
- **Provides “negative” results for people who think that they may be contaminated, but, are not truly contaminated.**

Questions and Discussions

Thank you!

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333

Telephone: 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348

Visit: www.cdc.gov | Contact CDC at: 1-800-CDC-INFO or www.cdc.gov/info

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National Center for Environmental Health
Division of Laboratory Sciences



Backup Slides

Examples of Mass Screening/Analysis

- 1987 Goiania – ^{137}Cs - **112,000** tests
- 1995-1996 U.S. Methyl parathion – **16,000** tests
- 2001-2002 U.S. Anthrax (clinical) - **250,000** tests
- 2001-2002 U.S. Anthrax (environmental) – **1,000,000**
- 2005 NV Mercury exposure – **280** tested
- 2006 London - ^{210}Po - **800** tested

Concerned Citizen Multiplier

- 1987 Goiania – ^{137}Cs – 50 treated / 112,000 screened = **2240**
“concerned citizen multiplier” (CCM)
- 1995-1996 U.S. Methyl parathion – **16,000 CCM**
- 2001-2002 U.S. Anthrax (clinical) – 30 casualties or infected /
250,000 tests = **8,500 CCM**
- 2005 NV Mercury exposure – 1 contaminated / 280 tested =
280 CCM
- 2006 London - ^{210}Po – 1 casualty / 800 tested = **800 CCM**