Southern Regional Disaster Response System
HHS Region 4

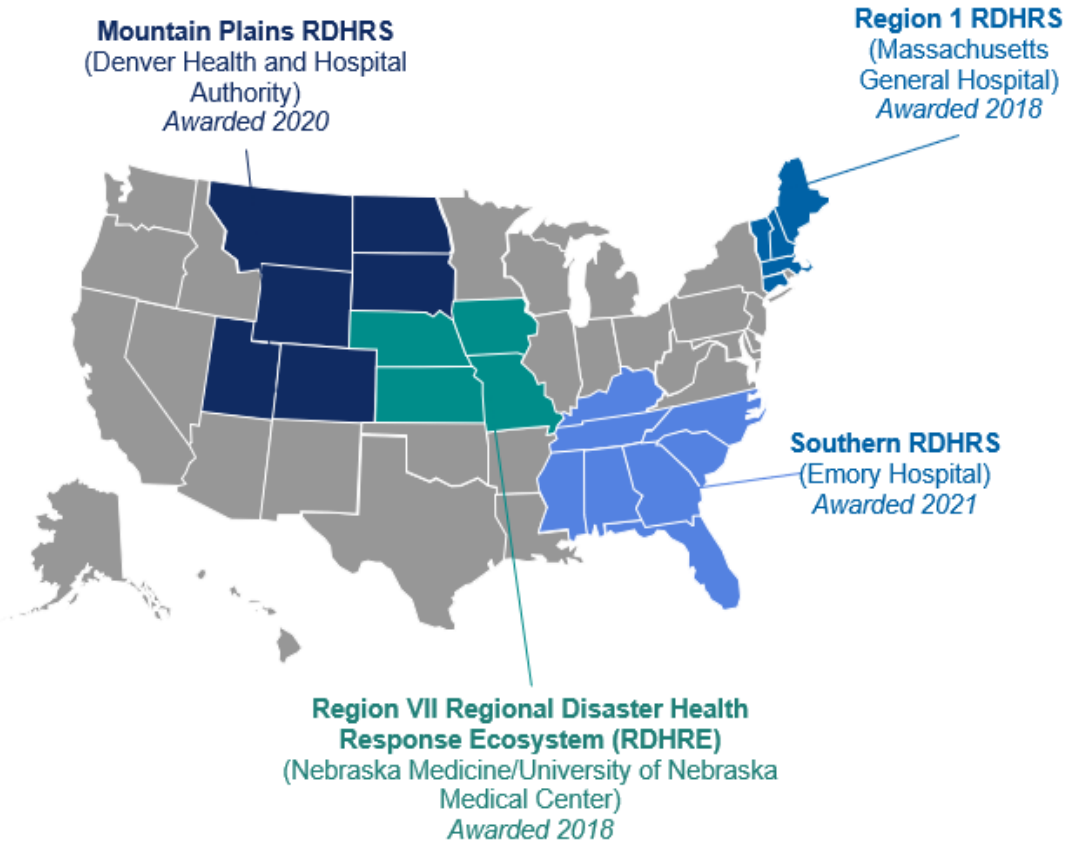
Web Series

Healthcare & Public Health Planning for a Radiological or Nuclear Emergency

Management of Victims Contaminated with Radioactive Materials

April 18, 2023

Regional Disaster Healthcare Response System



Southern Regional Disaster Response System
HHS Region 4

SRDRS Goals

4th region funded by HHS/ASPR

Complement existing preparedness and response frameworks

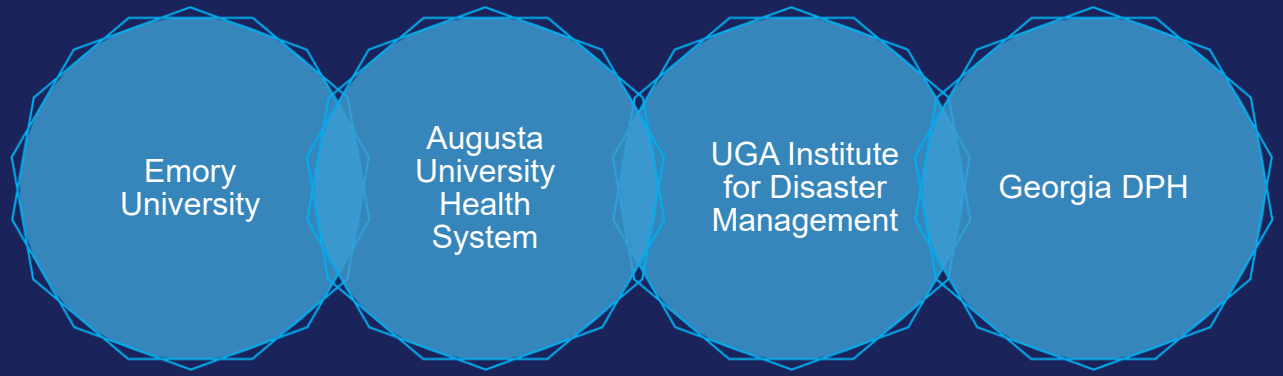
Integrating 1) clinical subject matter expertise and 2) health systems' operational expertise into existing preparedness and response structures at the local regional and state level

Building a Partnership for Disaster Health Response

Consortium partners include:

- Designated trauma centers
- Burn centers
- Pediatric specialty care centers
- A federally designated Regional Emerging Special Pathogens Treatment Center
- A Radiological Injury Treatment Network Center
- The Georgia Poison Center & R4PC3
- The National Disaster Life Support Education Consortium
- NETEC
- Health Care Coalitions

Responsible for Leading the Collaboration



In Partnership

- American College of Medical Toxicology (ACMT)
- Association of Healthcare Emergency Preparedness Professionals (AHEPP)
- Radiation Injury Treatment Network (RITN)
- Region 4 Poison Control Center Collaboration (R4PC3):
  - Alabama Poison Information Center
  - Florida Poison Information Center - Miami
  - Florida Poison Information Center - Tampa
  - USVI Poison Information Center - Jacksonville
  - Georgia Poison Center
  - Kentucky Poison Control Center of Norton Children's Hospital
  - Mississippi Poison Control Center
  - North Carolina Poison Center
  - Palmetto Poison Center
  - Tennessee Poison Center

Q&A

will be at end of the Webinar

Please type your questions into the Q&A function during the webinar and we will get to as many as we can

Disclosures & CE Information

- **Accreditation Status**
- *Emory Nursing Professional Development Center (ENPDC) is accredited as a provider of nursing continuing professional development by the American Nurses Credentialing Center's (ANCC) Commission on Accreditation.*
- **Relevant Financial Relationships**
- *ENPDC has evaluated everyone who has the ability to control content of this activity (planning committee members, subject matter experts, presenters) and found no relevant financial relationships*
- **Disclosure to Learners: Awarding Contact Hours**
- *To obtain contact hours participants must:*
- *Be present for the entire webinar (no more than 10 minutes missed)*
- *Complete the evaluation at the end (will appear in browser after webinar and be emailed in follow-up email)*
- *Certificates will be distributed after completion of the evaluation.*

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Accreditation Statement

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The Emory University School of Medicine designates this live activity for a maximum of 1.0 *AMA PRA Category 1 Credit(s)™*. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

ACCME ACCREDITED WITH COMMENDATION

Continuing Education: EMS

- **Prehospital CEU approved for 1 hr CEU - Medical**
  - KY State Office of EMS
  - GA State Office of EMS and Trauma

Web Series Hosts

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University of Georgia Institute for Disaster Management Director, Associate Professor; SRDRS Executive Director

Ziad Kazzi, MD, FAAEM, FACEP, FAACT, FACMT

Emergency Physician, Medical Toxicologist, Associate Medical Director Georgia Poison Center, SRDRS Associate Medical Director

Webinar Guest Moderator

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Emory University

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Medical Director, REAC/TS

Adela Salame-Alfie, PhD

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CDC

Webinar Speakers

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Acknowledgments

For their input

- Dr. Sue Gorman (CDC SNS)
- Dr. Steve Musolino, PHD, CHP (Brookhaven National Laboratory)

For their contribution to science, preparedness, and public health

- CDC www.emergency.cdc.gov\radiation
- National Council on Radiation Protection and Measurements www.ncrponline.org
- Radiation Emergency Assistance Center/Training Site (REAC/TS) https://orise.orau.gov/reacts/index.html
- Advanced Hazmat Life Support www.ahls.org

Management of Victims Contaminated with Radioactive Material

Webinar # 5

Southern Regional Disaster Response System
HHS Region 4

Scenario (Video from the CDC)

Clinical Case

- 50-year-old man self-evacuated from the stadium and presents to your emergency department
- Due to the large number of victims, he is being evaluated 16 hours after the explosion
- He complains of pain in his right arm since he was thrown back into a glass door
- News from the stadium confirm the radionuclide used in the dirty bomb was Cesium-137

Clinical Case

- His primary survey and vital signs are normal
- He has no visible contamination on his clothing, skin, or hair
- Prior to disrobing, limited radiation survey screening in triage reveals he is contaminated with radioactive material over his head, chest, and feet
- The GM-detector reads at approximately 1 cm from the surface, contamination at the level of 20 times the background level

Personal Protective Equipment

Dosimetry

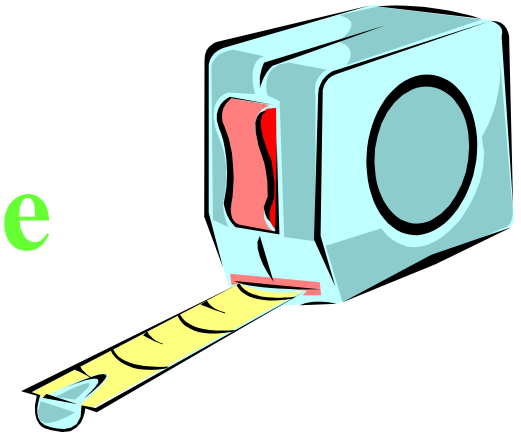

JOHNSTON 7
CURIE M
ICN
ICN


ON
OFF
103
THIS SIDE FACES
YOUR BODY
NO. 12883

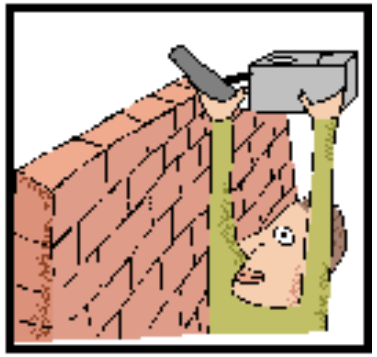
Radiation Self-Protection

Time

Distance



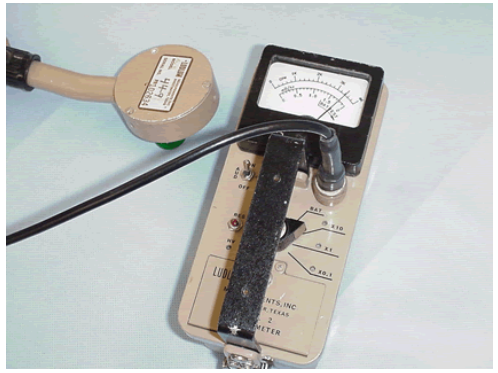
Shielding



Potential Radiation Hazard

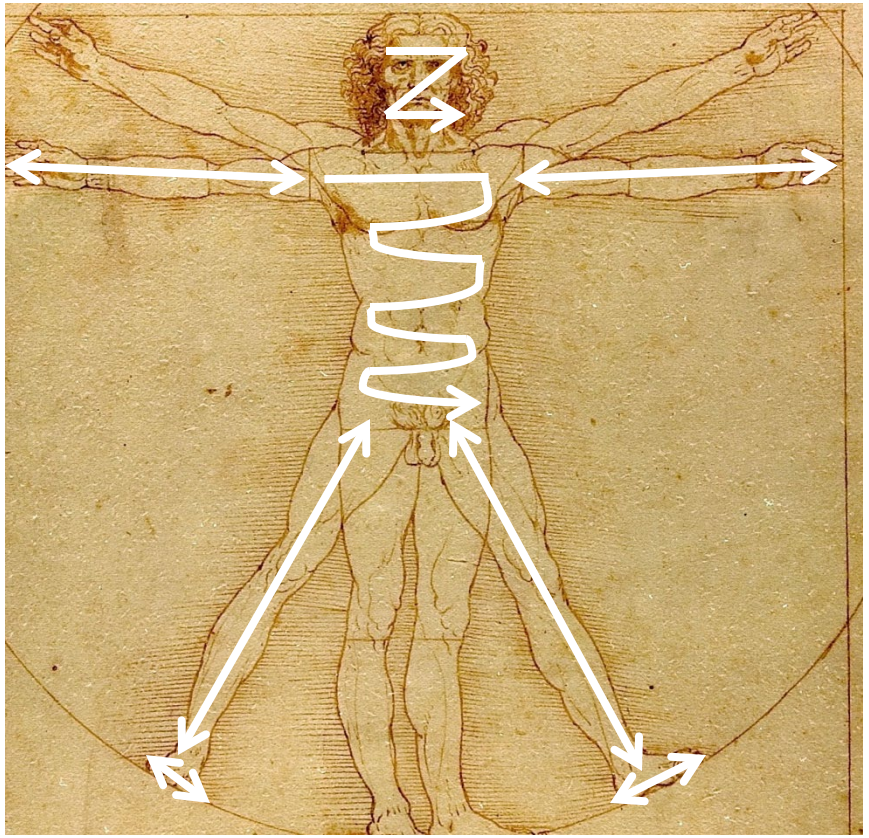
- Explosive event may result in highly radioactive shrapnel
- Time – Distance – Shielding for radiation self-protection
- Use of forceps

Assessment of External Contamination with a Radiation Detector



“Pancake” Geiger-Müeller Detector (GM or Geiger Counter) and digital detectors

Screening & Surveying Pattern



Anterior

Follow similar pattern on all surfaces of patient's posterior

Priorities

Perform life-saving interventions before a formal radiation detection survey & decontamination

Decontamination

- Reduction or removal of radioactive material from the patient's body surface
- Removal of clothing may reduce radioactive contamination by up to 90%
- Additional decontamination is accomplished by physical means (e.g., washing)
- Clothing and personal effects should be bagged and handled as possibly radioactive

Clinical Case

- You ask him to remove his clothes and to shower
- Repeat radiation survey:
  - Decrease in contamination over previously identified areas to 4 times the background level

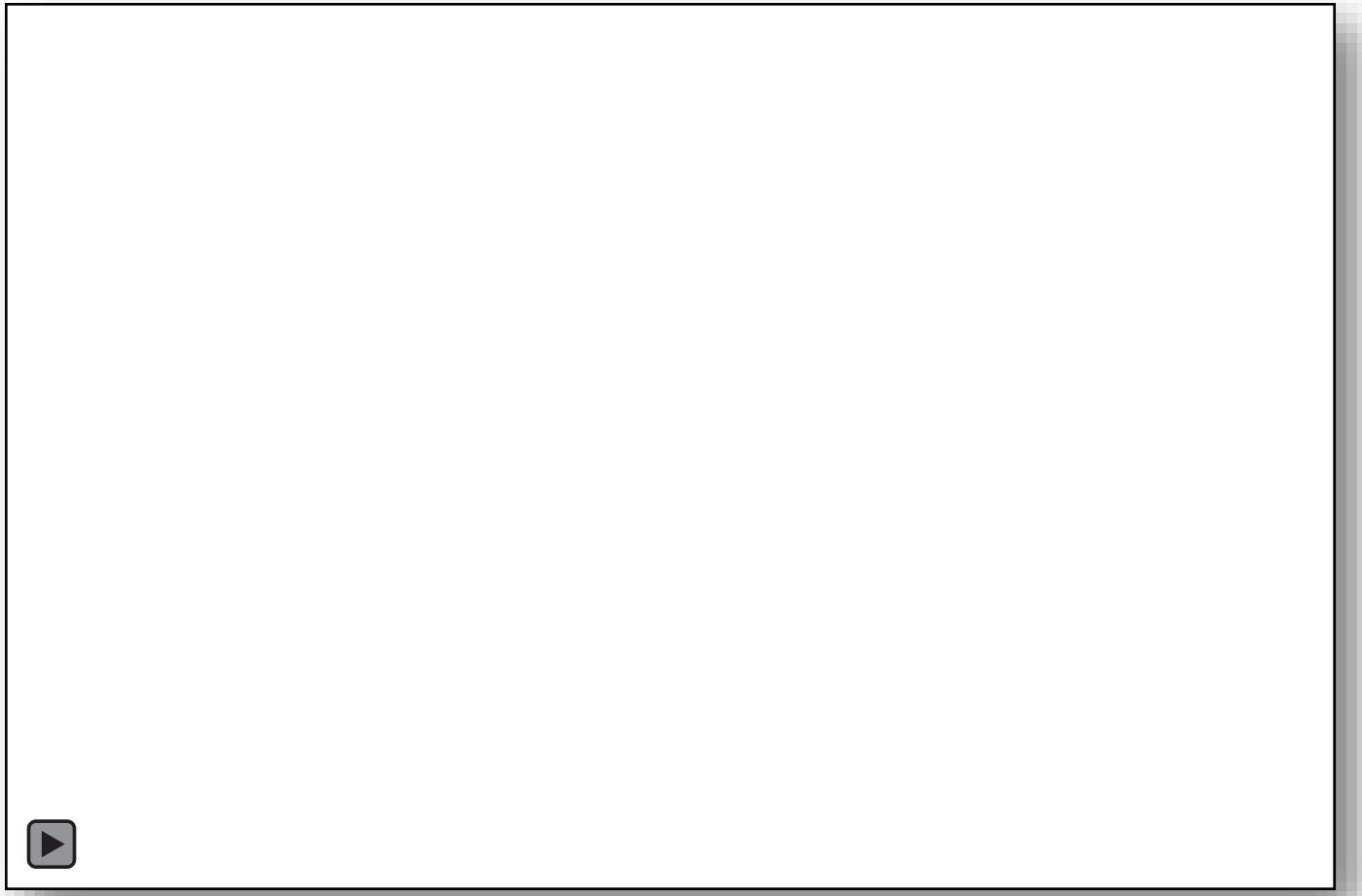
Clinical Case

- The Radiation Safety Officer advises you to stop decontamination and to proceed with trauma and medical assessment using level D PPE

Clinical Case

- Assessment reveals no fractures or other traumatic injuries except a 4 cm superficial laceration over the dorsal aspect of his right proximal arm
- Has he become internally contaminated with ceisum-137 by inhaling the dust at the scene?
- Radiation survey over the wound does not reveal contamination of the wound with radioactive material

External & Internal Contamination via Inhalation

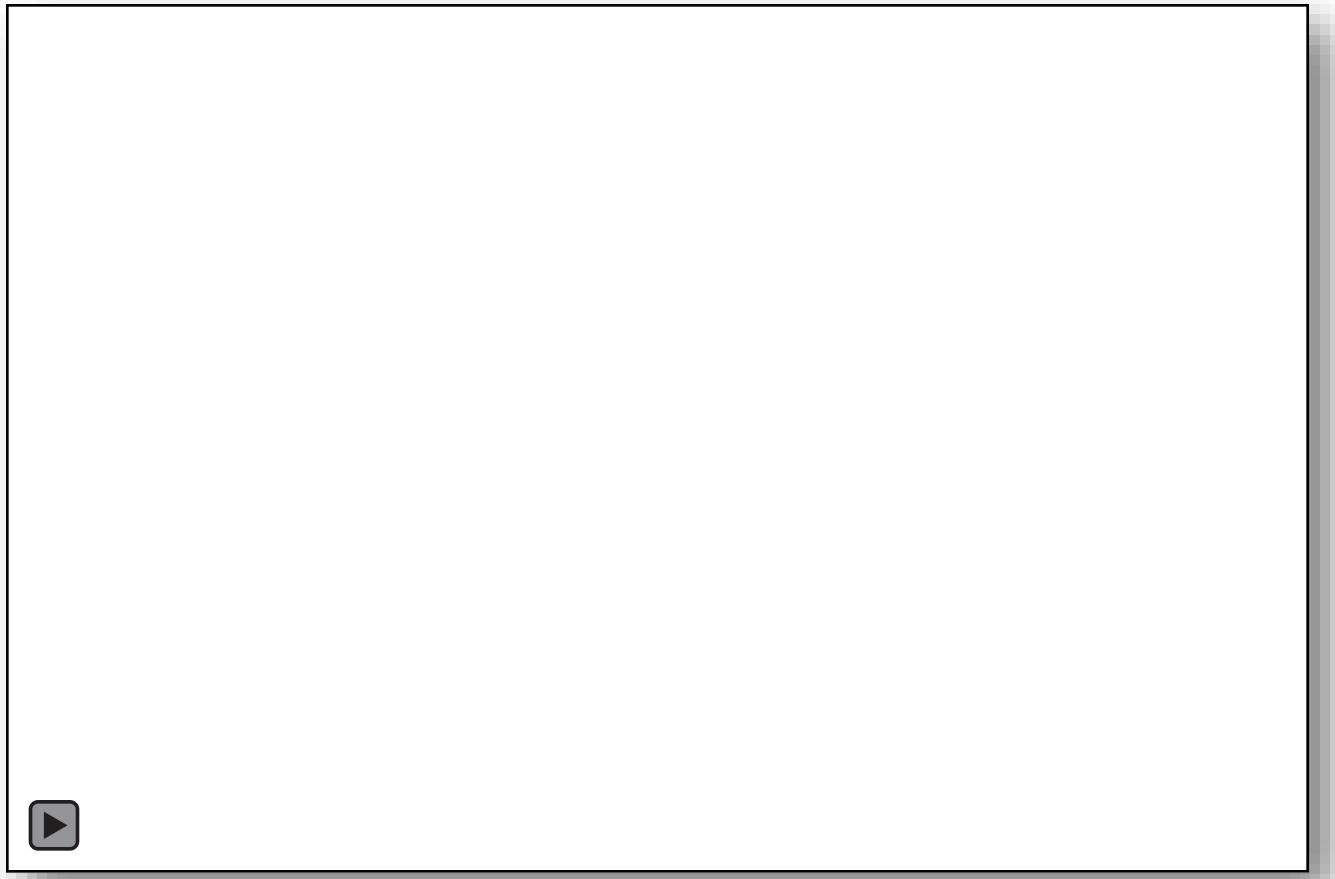


U.S. Department of Health & Human Services
REMM RADIATION EMERGENCY MEDICAL MANAGEMENT

Internal Contamination via Ingestion

U.S. Department of Health & Human Services
REMM RADIATION EMERGENCY MEDICAL MANAGEMENT

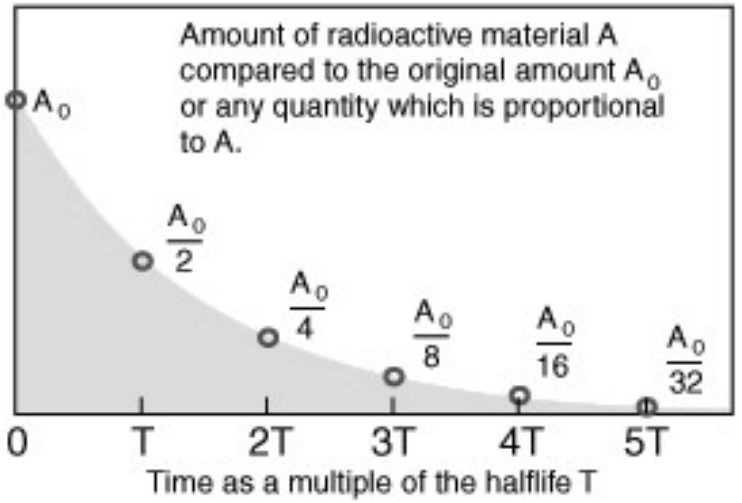
External & Internal Contamination via Shrapnel & Open Wound

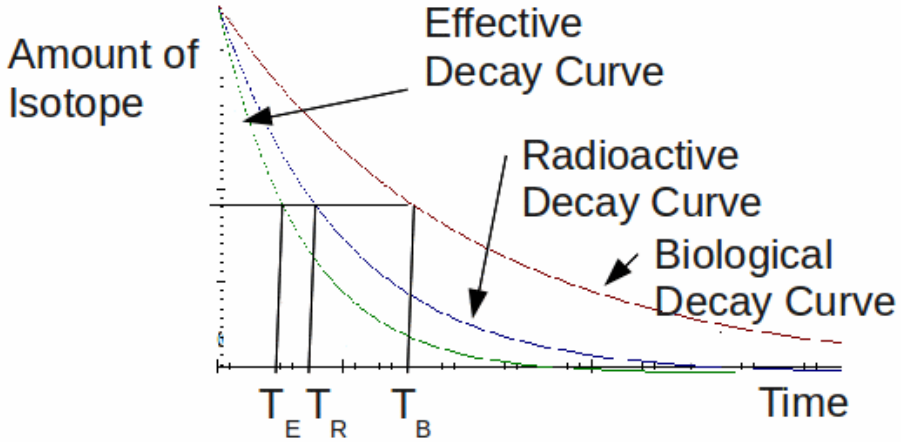


U.S. Department of Health & Human Services
REMM RADIATION EMERGENCY MEDICAL MANAGEMENT

Toxicokinetics of Internal Contamination

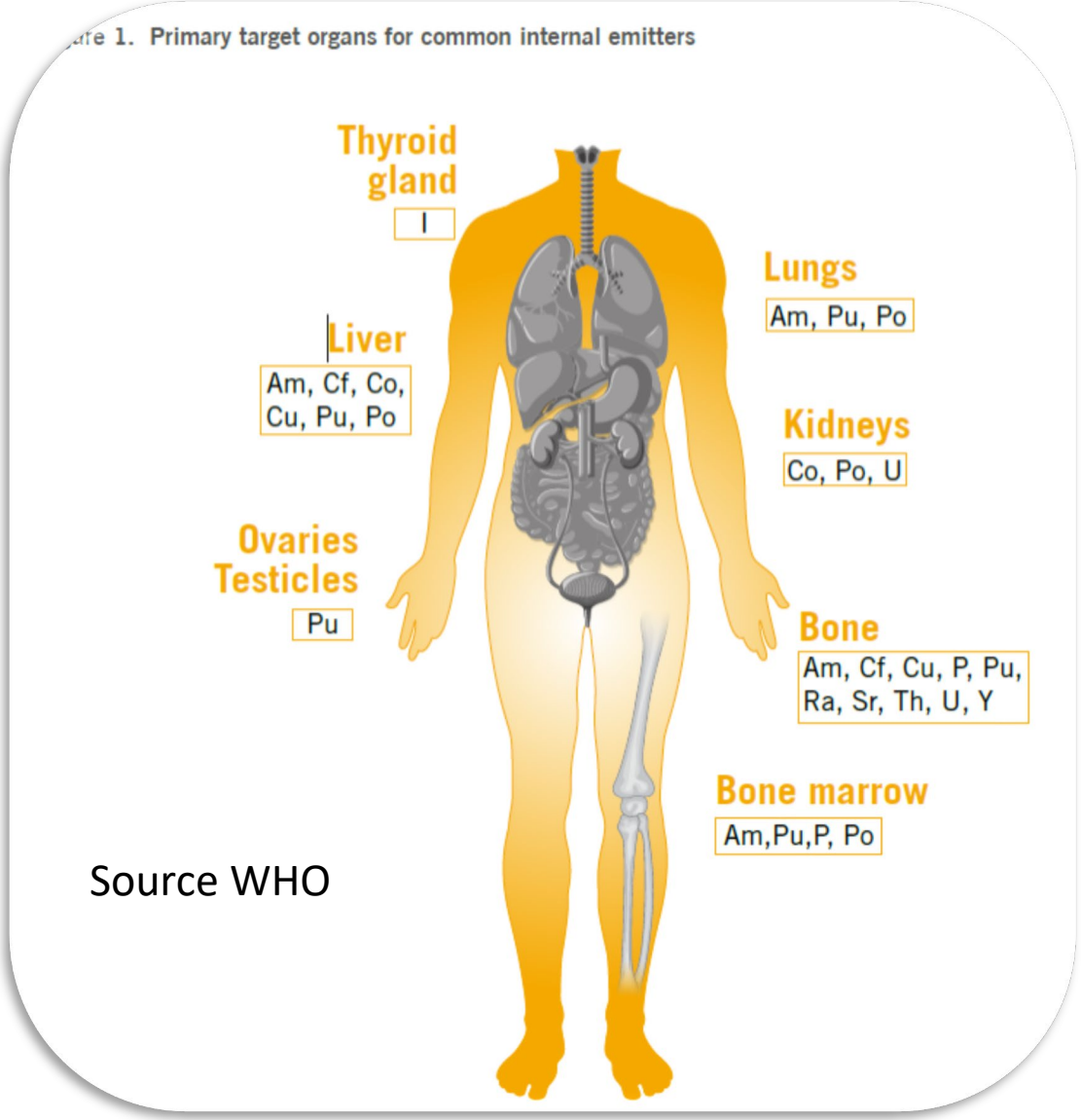
- Activity
  - Independent of mass or size
- Physical half-life
  - Radioactive decay
- Biological half-life
  - Excretion in urine, feces, etc.
- Effective half-life
  - Combined effect of decay and biological excretion
- Committed Effective Dose:
  - Dose of radiation delivered to organs or body over the residence of the radioactive material inside the body





Clinical Consequences of Internal Contamination

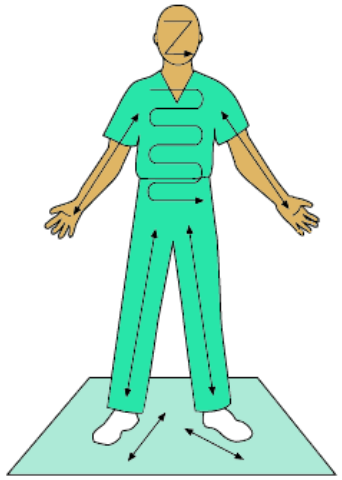
- Stochastic &/or deterministic clinical consequences
- End-organ damage
- Acute radiation syndrome
- Cancer & leukemias

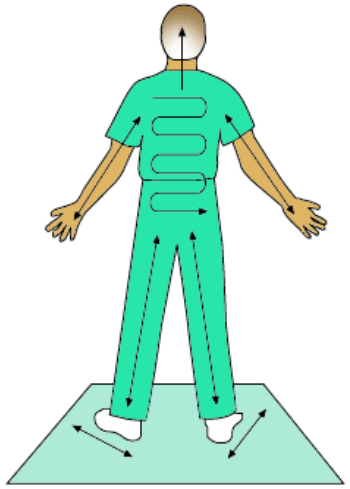


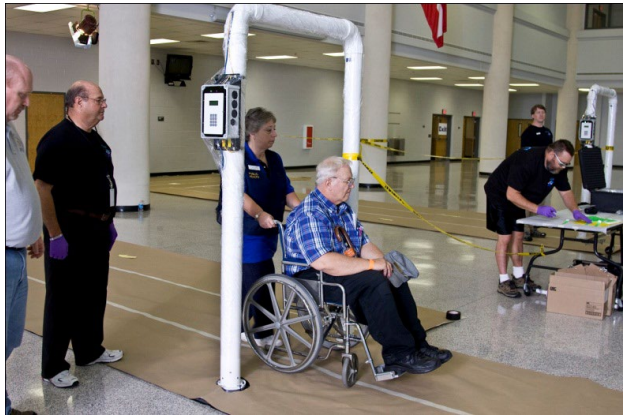
Assessment of Internal Contamination

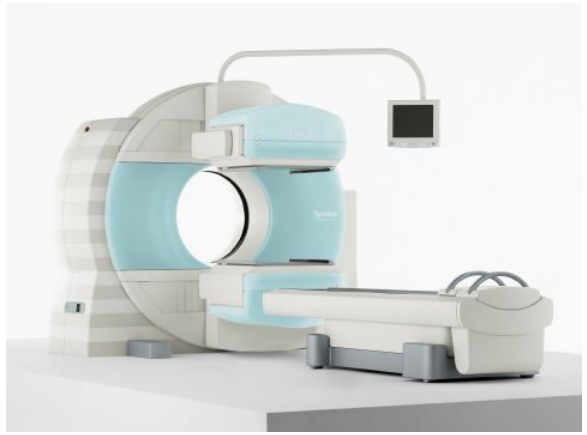
- Direct
- Indirect

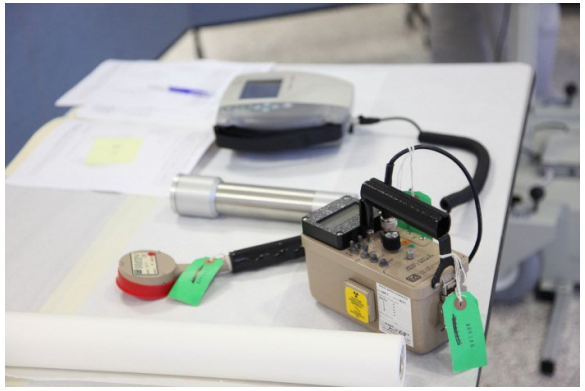
Assessment of Internal Contamination - Direct











Pitfalls – Alpha-Emitters like Polonium-210

- Detection with a GM-Counter is not possible
- Zinc sulfide alpha detector designed for detection of contamination with an alpha emitter
- Alpha particles easily shielded by water or dust
- Indirect assessments using bioassays

Diagnosis of Internal Contamination - Indirect

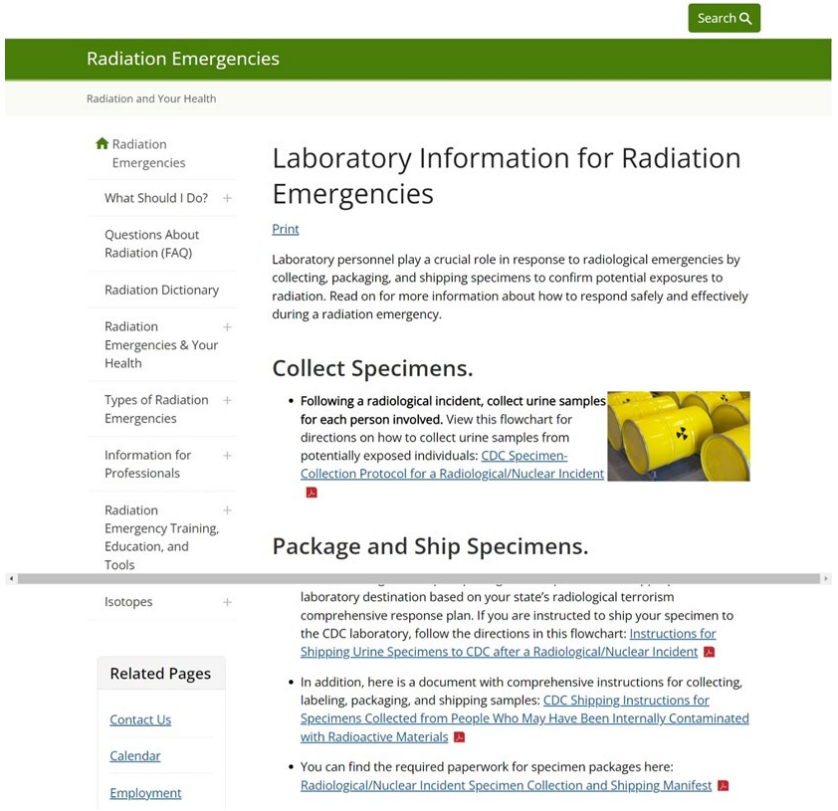
- Nasal swabs not recommended during a public health emergency

CDC Urine Radionuclide Screen (URS)

- Rapid Determination of internal contamination during emergency response
- Uses a small amount of urine from a single collection
- Measures hundreds of samples per day for more than 20 radionuclides
- Provides results within 24 hours for the first 100 samples
- Identifies and quantifies radionuclides of public health concern

Contains links to information on:

- Requesting technical assistance
- Specimen collection, packing, and shipping



Laboratory References and Resources

CDC Division of Laboratory Sciences: Radiologic Threat Agents - https://www.cdc.gov/nceh/dls/radiologic_threat_agents.html

Clinical Case Update

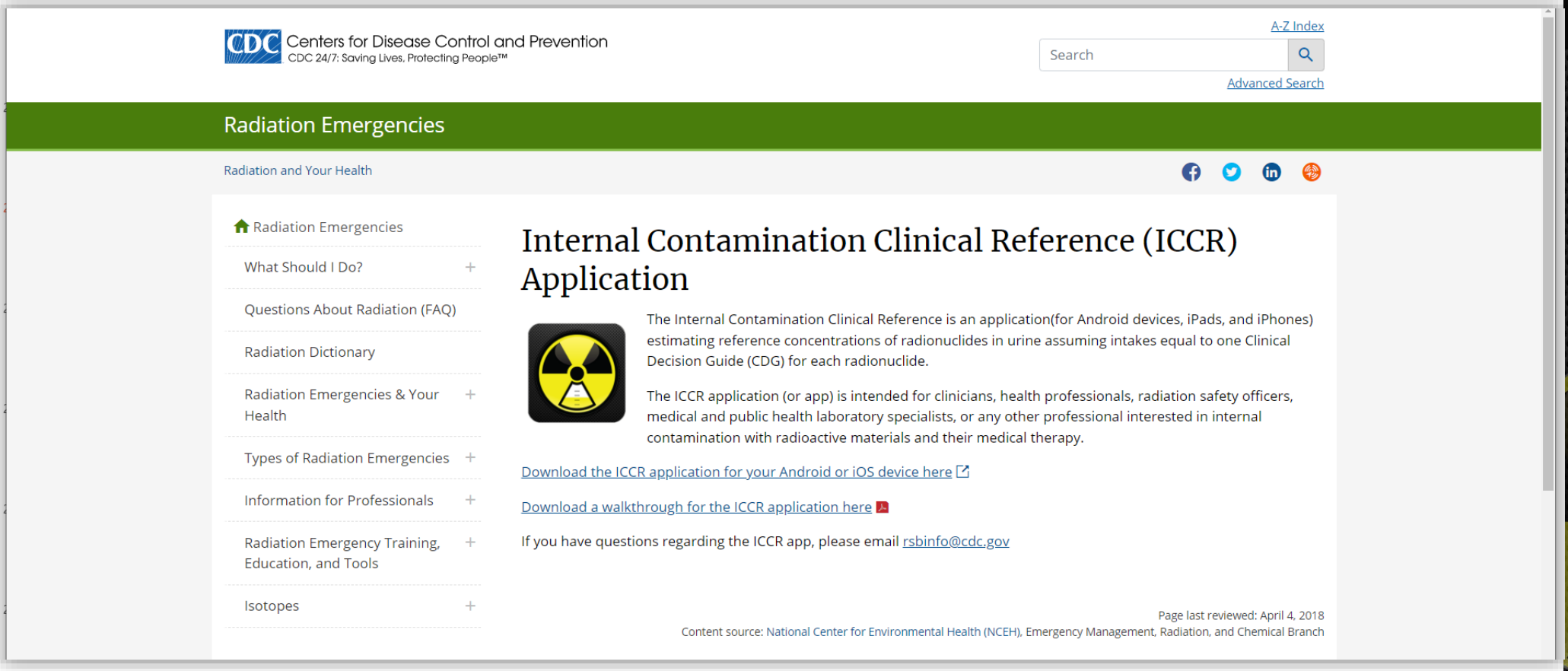
- Patient admitted to the observation area for further assessment
- Spot urine sample (100 ml) sent to a specialized laboratory (i.e., CDC) for measurement of the activity of internalized cesium-137
  - Result is $4.0 \times 10^{+5}$ Bq/L
- Prussian blue therapy would have likely been started empirically after collecting the urine sample and while awaiting the test result

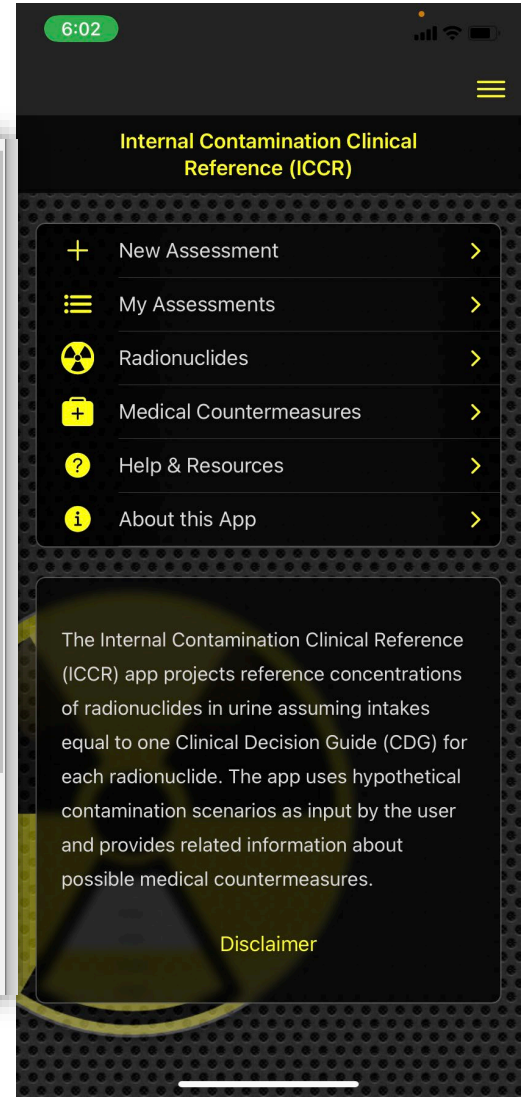
Clinical Decision Guide (CDG)

- Intended as a tool to be used to help a physician determine when a radionuclide intake (except iodine) may have clinical significance" (NCRP 2008)
- Intake (in Bq) of a radionuclide that should be treated medically to reduce the radiation dose to the patient
- The smallest quantity producing any of 3 effects in adults:
- **0.25 Sv (25 rem) (50 y effective dose) for consideration of stochastic effects [this represents about a 1.3 % lifetime risk of fatal cancer attributable to the radiation dose (ICRP, 2007)]**
- **30 d RBE-weighted absorbed-dose value of 0.25 Gy-Eq for consideration of deterministic effects to bone marrow**
- **30 d RBE-weighted absorbed-dose value of 1 Gy-Eq for consideration of deterministic effects to the lungs.**
- The values for children and pregnant females are set at 20% (one-fifth) of the adult values
- Other variables are: route of internalization, solubility of the chemical form, day of intake relative to the assessment, age and gender of the patient

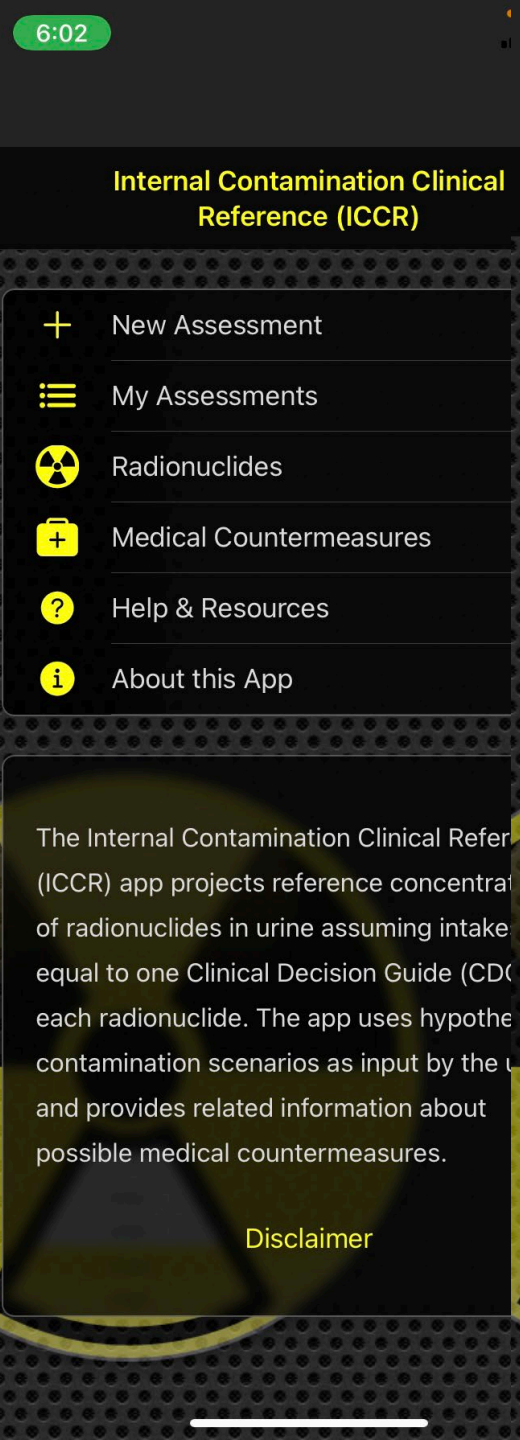
NCRP Report Number 161

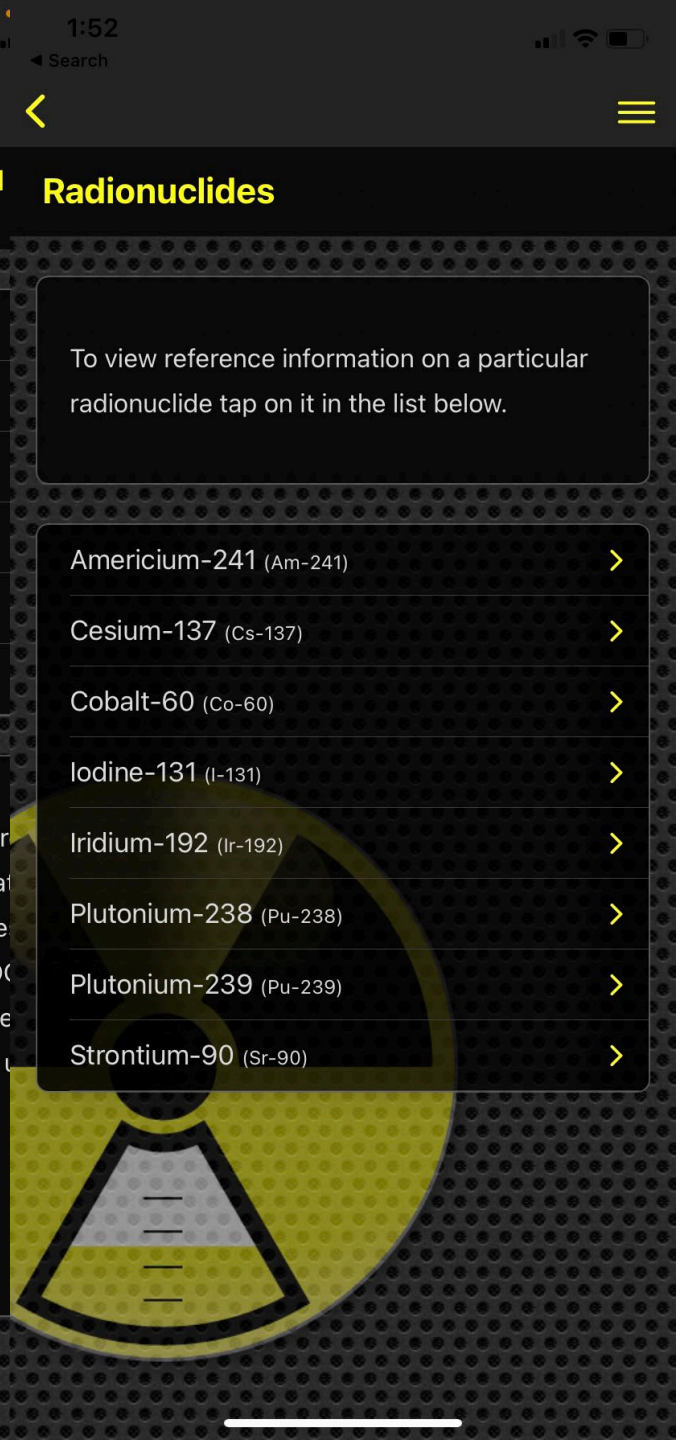
CDC Internal Contamination Clinical Reference Tool (ICCR App)

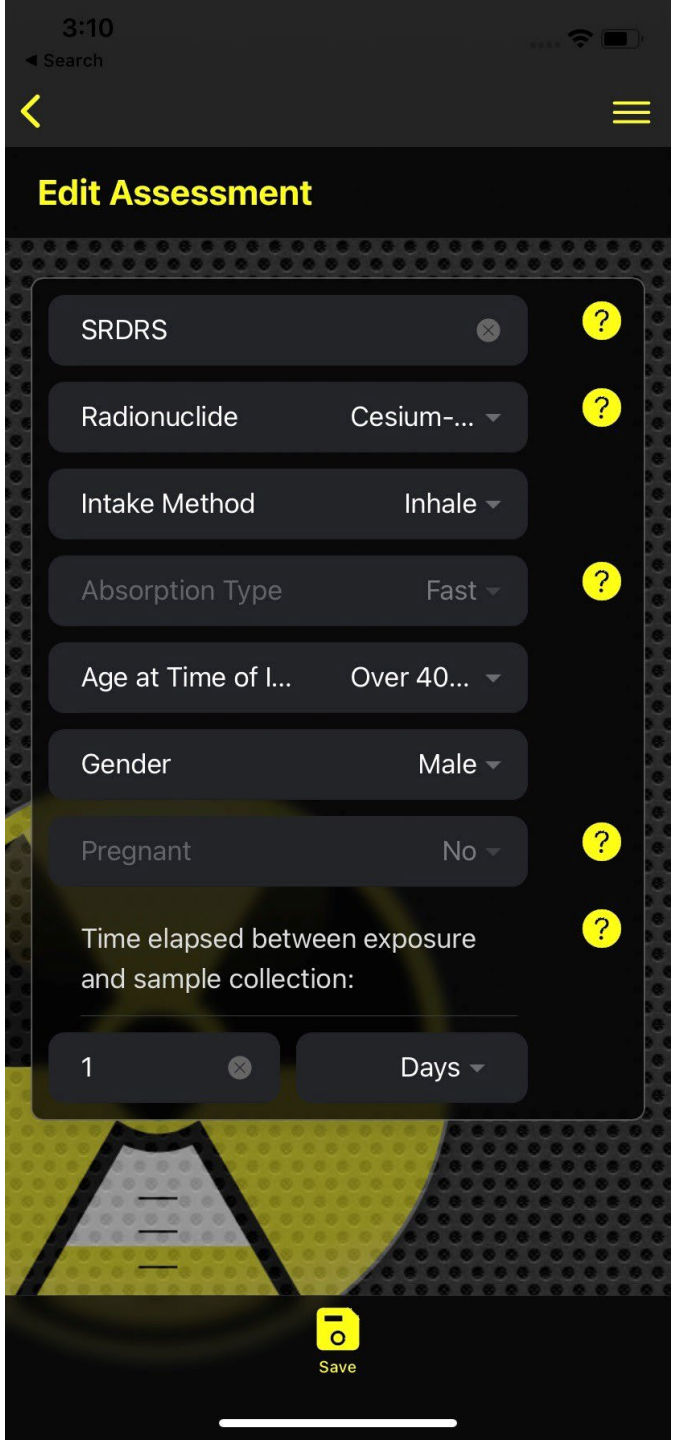




https://www.cdc.gov/nceh/radiation/emergencies/iccr.htm?CDC_AA_refVal=https%3A%2F%2Femergency.cdc.gov%2Fradiation%2Ficcr.asp


6:02
Internal Contamination Clinical Reference (ICCR)
New Assessment
My Assessments
Radionuclides
Medical Countermeasures
Help & Resources
About this App
The Internal Contamination Clinical Refer
(ICCR) app projects reference concentrat
of radionuclides in urine assuming intake
equal to one Clinical Decision Guide (CD
each radionuclide. The app uses hypothe
contamination scenarios as input by the
and provides related information about
possible medical countermeasures.
Disclaimer


1:52
Search
Radionuclides
To view reference information on a particular radionuclide tap on it in the list below.
Americium-241 (Am-241)
Cesium-137 (Cs-137)
Cobalt-60 (Co-60)
Iodine-131 (I-131)
Iridium-192 (Ir-192)
Plutonium-238 (Pu-238)
Plutonium-239 (Pu-239)
Strontium-90 (Sr-90)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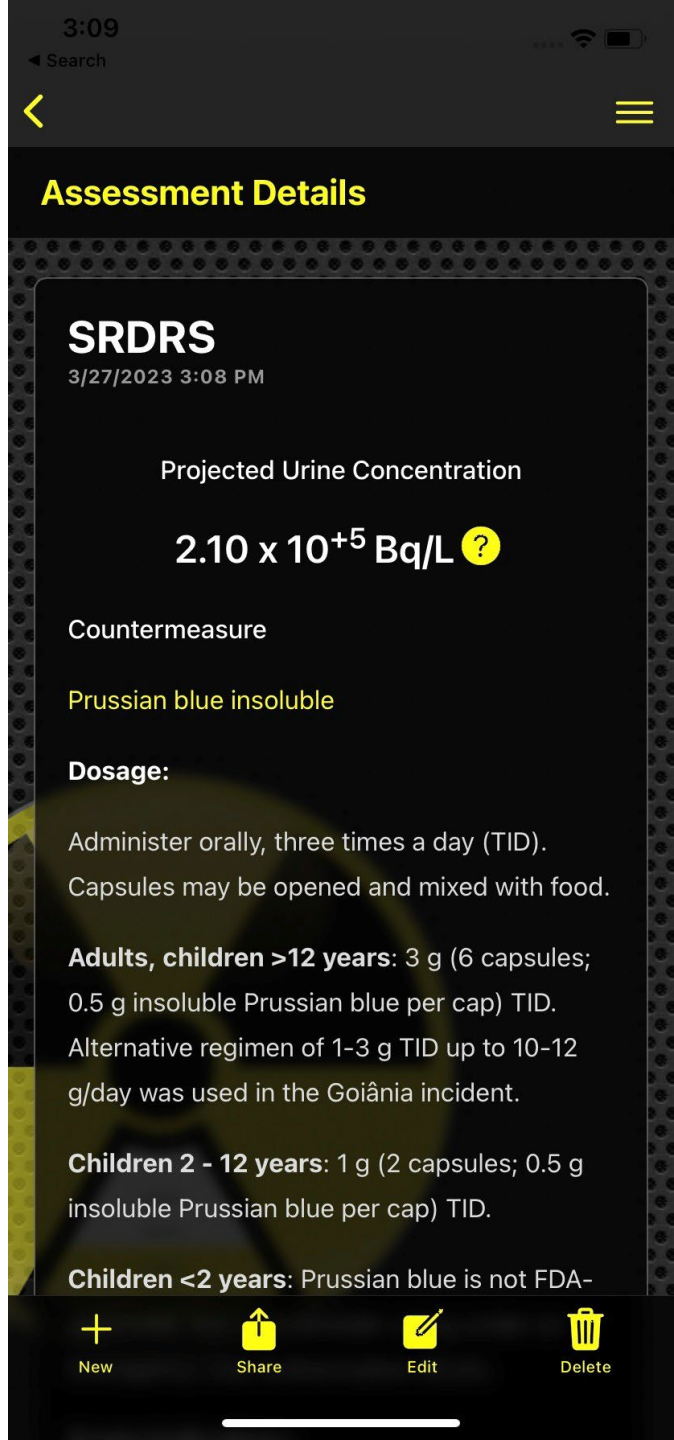
Search
Edit Assessment
SRDRS
Radionuclide
Cesium-...
Intake Method
Inhale
Absorption Type
Fast
Age at Time of I...
Over 40...
Gender
Male
Pregnant
No
Time elapsed between exposure and sample collection:
1
Days
Save


3:09
Search
Assessment Details
SRDRS
3/27/2023 3:08 PM
Projected Urine Concentration
2.10 x 10+5 Bq/L
Countermeasure
Prussian blue insoluble
Dosage:
Administer orally, three times a day (TID). Capsules may be opened and mixed with food.
Adults, children >12 years: 3 g (6 capsules; 0.5 g insoluble Prussian blue per cap) TID. Alternative regimen of 1-3 g TID up to 10-12 g/day was used in the Goiânia incident.
Children 2 - 12 years: 1 g (2 capsules; 0.5 g insoluble Prussian blue per cap) TID.
Children <2 years: Prussian blue is not FDA-
New
Share
Edit
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3:09
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Assessment Details

SRDRS

3/27/2023 3:08 PM

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New Share Edit Delete

Projected Urine Concentration

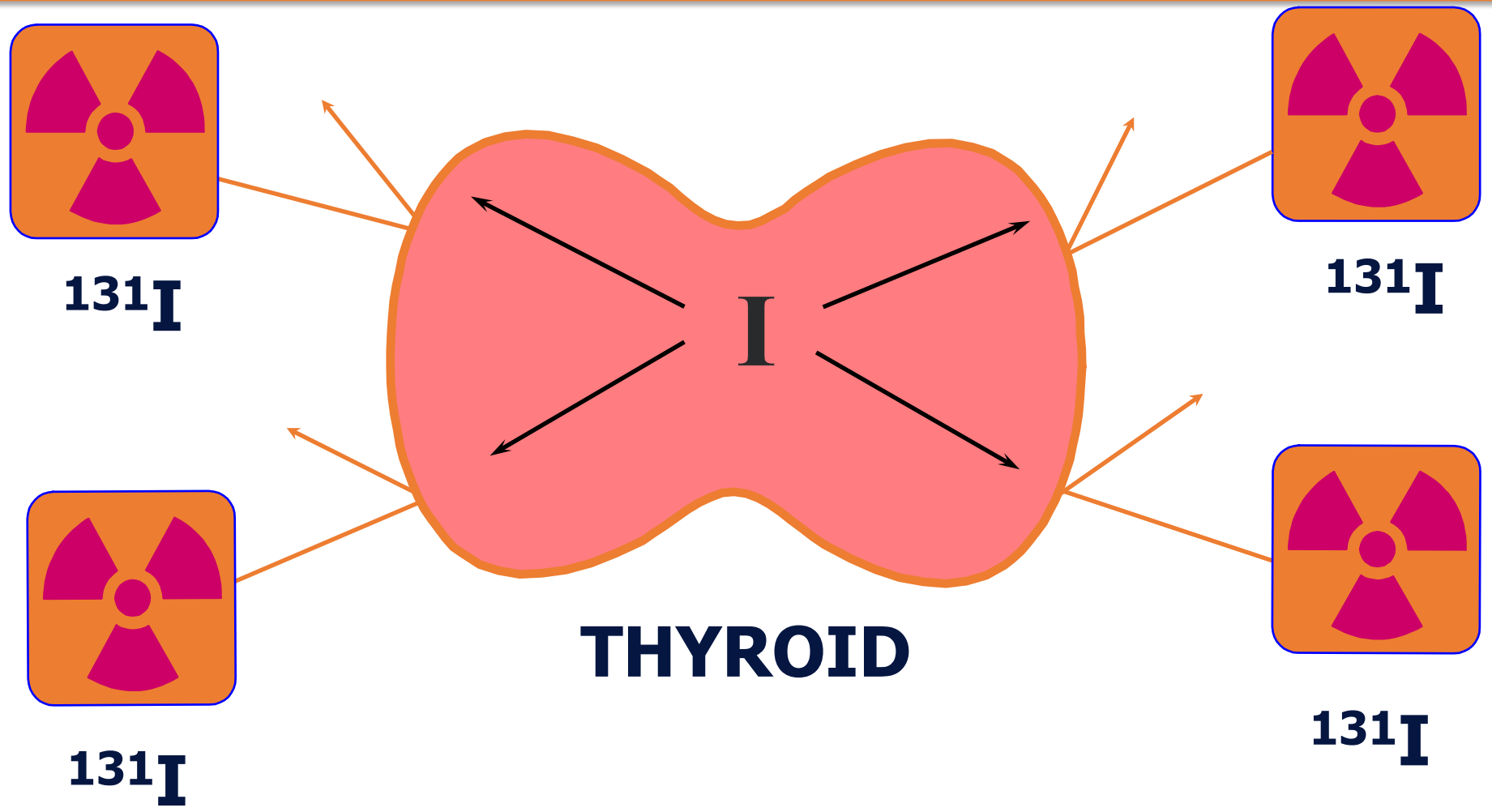
This urine concentration is the projected amount found in a spot urine sample for an intake of one Clinical Decision Guide (CDG) for the selected parameters. If a measured amount is greater than this value, given the same exposure parameters, it means that the CDG has been exceeded and further medical treatment should be considered. This may include a more detailed investigation of tissue-specific absorbed doses over different time periods or decorporation therapy using medical countermeasures.

To convert these values to the traditional unit of picocurie (pCi) per liter, multiply projected values by 27 [i.e., 1 Bq/L = 27 pCi/L].

Patient urine sample result:
4.0 x 10^{+5} Bq/L
Management:
Prussian blue 10 mg PO TID
Enrolment in radiation

Radionuclide	Medication
Iodine	KI (potassium iodide)
Transuranics such as Plutonium, Americium and Curium	Zn-DTPA Ca-DTPA
Uranium (chemical toxicity not radiation-related)	Bicarbonate
Cesium Thallium	Prussian Blue* [Ferrihexacyano- Ferrate (II)]
Tritium	Water

Internal Contamination with Radioactive Iodine



- Efficacy of KI is time-dependent
- KI should be used right before or within 4 hours of the internal contamination with radioiodine

Saturate the Critical Organ with the Stable Isotope

Additional Countermeasures in Rare Cases of ARS from Internal Contamination

- Filgrastim (FDA-approved and in the SNS)
- Pegfilgrastim (FDA-approved and in the SNS)
- Sargramostim (FDA-approved and in the SNS)
- Romiplostim (FDA-approved and in the SNS)

Long-Term Health Monitoring and its Purposes

- Medical monitoring of those who exhibited clinical symptoms
- Public health monitoring of those affected
- Access to health care for those affected
- Research on radiation health effects
- Financial compensation for victims
- Social recognition of the tragedy
- Outreach to those affected such as updates on new scientific and medical developments or new programs or policies relevant to the incident

THANK YOU

Southern Regional Disaster Response System

HHS Region 4

Q&A

Upcoming Webinar

Assessment and Management of Acute Radiation Syndrome

Dr. Ron Goans (REAC/TS) and Mr. Cullen Case (RITN)

Tuesday, May 16, 2023

3:00 PM EST

srdrs4.org/events/

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Web Series

Healthcare & Public Health Planning for a Radiological or Nuclear Emergency

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