



# NEWSLETTER

FALL 2016

## Letter from the Editor

Dear CoP Members,

The nation's 55 poison centers (PCs) receive calls from the public and medical providers asking for information or guidance about exposures to a wide array of harmful substances, including radiation. Because radiation-related calls are not frequent, poison center professionals benefit from education on topics like ionizing radiation exposure, radiological contamination issues, and medical countermeasures for radiological-related illness. The Centers for Disease Control and Prevention (CDC) developed a training in response to poison center requests for more education about radiation emergencies to better equip PCs to handle radiation related calls during an emergency event. The training is also beneficial for other first responders, doctors, nurses, or pharmacists who play an important role in radiation emergency preparedness. This aim of this newsletter is to introduce this training and to provide general information on radiation and radiological exposures. We also describe how PC data can be used for public health surveillance during radiation emergencies.

This is my last PC PH COP newsletter as the CoP Administrator. My fellowship year has been completed, and I am moving to Chicago to be closer to family and pursue other career opportunities. It has been a pleasure to work with the CoP. Thank you all for learning and growing with me. Royal Law will be taking over as the CoP Administrator. If you have any questions regarding the CoP please contact Dr. Royal Law ([RLaw@cdc.gov](mailto:RLaw@cdc.gov)). If you have any questions regarding radiation emergency preparedness and response or the training, please contact Dr. Art Chang ([AChang@cdc.gov](mailto:AChang@cdc.gov)).

Sincerely,

**Rebecca Lyons, MPH**

Community of Practice Administrator

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National Center  
for Environmental Health  
Agency for Toxic Substances  
and Disease Registry

*The findings and conclusions in this newsletter are those of the author(s) and do not necessarily represent the official position of the CDC/ATSDR.*

# Radiation Emergency Training

In August 2012, CDC brought together PC professionals from across the United States for a training session on radiation emergency preparedness that was followed by a discussion of potential roles PCs have after this type of disaster. A summary of the discussion can be found in the box below.

SUMMARY OF KEY POINTS OF DISCUSSION	
Poison Centers (PCs)	National Poison Data System (NPDS)
<ul style="list-style-type: none"> <li>PCs have limited experience with managing contamination by radioactive material or exposure to ionizing radiation and few have guidelines for managing either of these conditions</li> <li>PCs' main role during a radiation emergency is to provide accurate information to callers</li> <li>PCs can also assist in several roles including:                             <ul style="list-style-type: none"> <li>Dissemination of important coordinated? public health messages</li> <li>Caller triage and medical management</li> <li>Performance of follow up activities</li> </ul> </li> <li>PCs should be an important partner in unified public health (PH) messaging and risk communication after and emergency</li> <li>PCs can act as a resource to provide information about use of radiation medical counter measures</li> </ul>	<ul style="list-style-type: none"> <li>NPDS is better suited for tracking a known radiation emergency than for detecting covert events</li> <li>NPDS can be extremely useful for situational awareness during incidents by helping guide public health response and messaging</li> </ul>
IMPROVEMENT ACTIVITIES	
<ul style="list-style-type: none"> <li>Increase radiation health training and education opportunities for poison center personnel</li> <li>Consolidate and share currently available resources across organizations</li> <li>Develop a set of recommendations, toolkits, and public messaging FAQs for response to radiation emergencies</li> </ul>	

For more information on this discussion, see the [summary report](#) or the 2014 article *On the Role of Poison Centers in Radiation Emergency Preparedness and Response Activities: Findings of the "Radiation Emergencies Public Health Roundtable" (Atlanta, GA—August 2012)*.

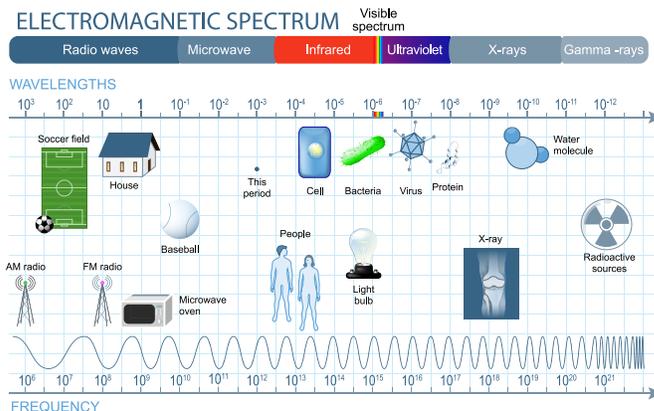
As a follow up to this discussion, the CDC created an online, free radiation health training for poison center professionals. The goal of the training is to prepare PC staff to prepare and respond appropriately and share vital information in the event of a radiation emergency. The training can self-led or used as instructor-led courses. Healthcare and other emergency professionals can find this information useful as well. CME, CPE, CEN, or CUE opportunities available upon successful course completion.

The training, which can be found at <https://www.cdc.gov/radiationtraining/RAD-Toolkit/>, was launched in early October 2016. The web-based training comprises 5 modules that cover the following topic areas:

- Types of Radiation
- Protective Measures
- Exposure and Contamination
- Decontamination and Medical Countermeasures
- Risk Communication

# Radiation Concepts

Understanding basic concepts of radiation is important in order to adequately prepare and respond to a nuclear and radiological public health disaster.



NON-IONIZING RADIATION VERSUS IONIZING RADIATION	
Non-Ionizing Radiation	Ionizing Radiation
<p><b>Non-ionizing radiation</b> is the term given to radiation in the part of the electromagnetic spectrum where there is insufficient energy to cause ionization (see right box). It includes electric and magnetic fields, radio waves, microwaves, infrared, low energy UV, and visible radiation.</p> <p><a href="http://www.who.int/topics/radiation_non_ionizing/en/">http://www.who.int/topics/radiation_non_ionizing/en/</a></p>	<p><b>Ionizing radiation</b> is a form of energy that acts by removing electrons from atoms and molecules of materials that include air, water, and living tissue. Ionizing radiation can travel unseen and pass through these materials. It is on the right side of the electromagnetic spectrum in the figure below and includes photons (high energy ultraviolet (UV) rays, x-rays, gamma rays) and particle emissions (alpha, beta, and neutron).</p> <p><a href="https://www.cdc.gov/nceh/radiation/ionizing_radiation.html">https://www.cdc.gov/nceh/radiation/ionizing_radiation.html</a></p>
RADIOACTIVE CONTAMINATION VERSUS RADIATION EXPOSURE	
Radioactive Contamination	Radioactive Exposure
<p>Contamination is the deposition of unwanted radioactive material on the surfaces of structures, areas, objects, or people where it may be external or internal. External contamination affects the external surface of the body such as the skin or hair. Internal contamination occurs when radioactive material gets inside the body through the lungs, gastrointestinal tract or open wounds. Contaminated individuals are radioactive until they receive decontamination.</p> <p><a href="https://www.remm.nlm.gov/">https://www.remm.nlm.gov/</a></p>	<p>Radiation exposure, also called irradiation, occurs when all or part of the body is exposed to penetrating radiation from an external source that emits gamma or photon radiation. During exposure, this radiation can be absorbed by the body or it can pass completely through. Following exposure, an individual is NOT radioactive because there is no contamination. An example of irradiation is a chest x-ray or CT scan.</p> <p><a href="https://www.remm.nlm.gov/">https://www.remm.nlm.gov/</a></p>



## Common Sources of Radiation Exposure

As humans, we are being exposed to radiation on a daily basis from our environment. A large proportion of our yearly radiation dose comes from naturally occurring radioactive materials that is present in the earth's crust. They include uranium, thorium and their decay products.

### Uranium

Uranium is a metal and a potentially **toxic chemical to human health**—ingestion of uranium can cause kidney damage from its chemical properties. Uranium is one of the naturally occurring radioactive materials (NORM). Others include thorium-232, potassium-40 and radon.

Natural uranium is composed of several isotopes such as uranium-238, uranium 235 and uranium-234. An isotope is a nuclide of an element having the same number of protons but a different number of neutrons. These elements occur naturally in nearly all rock, soil, and water. Uranium-238 is the most abundant form of uranium in the environment. Uranium-235 is used in nuclear fission reactions and can be concentrated in a process called “enrichment”. The process makes it suitable for use in nuclear reactors or weapons.

**External exposure** (exposure outside the body) to uranium is not as dangerous as exposure to other radioactive elements because the skin will block the alpha particles that are emitted as uranium decays.

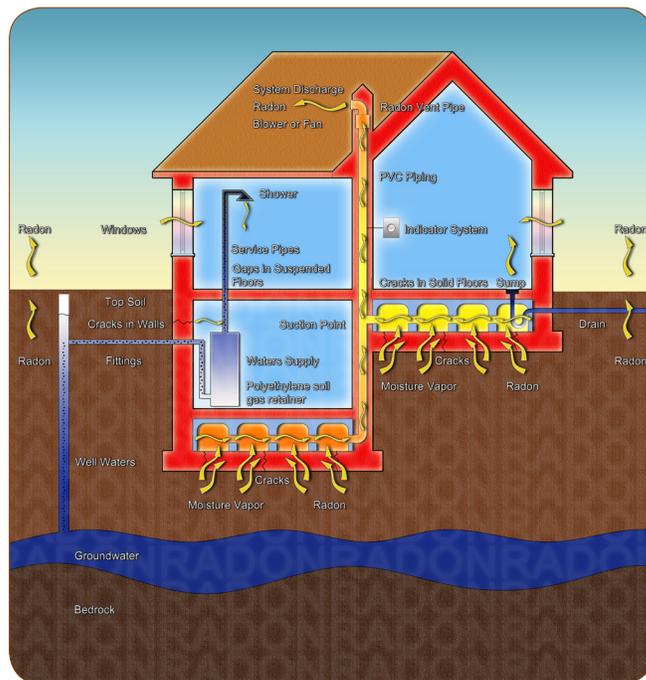
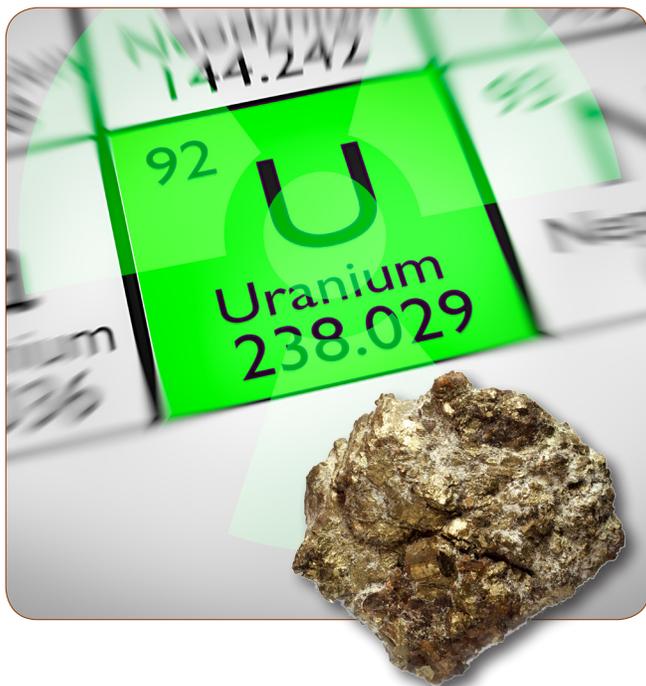
**Inhalation of uranium dust in certain occupational settings like mining** can cause lung cancer from the exposure to alpha particles and its decay products (radon).

<https://emergency.cdc.gov/radiation/isotopes/uranium.asp>

### Radon

- Radon is a radioactive gas that is odorless and tasteless
- Radon is one of the most common environmental sources of radiation and it forms when natural uranium, thorium, or radium decays or breaks down in rocks, soil and groundwater
- People are most often exposed to radon in their homes by breathing in air containing radon that has entered through cracks and gaps in buildings from the soil
- Because it comes naturally from the earth, there is always some degree of exposure regardless of location

[https://www.cdc.gov/nceh/radiation/brochure/profile\\_radon.htm](https://www.cdc.gov/nceh/radiation/brochure/profile_radon.htm)



# Types of Radiation Emergencies

## RADIOLOGICAL EMERGENCIES

### Nuclear Power Plant Accident



- The core of a nuclear reactor, like those found in nuclear power plants, contains large amounts of highly radioactive material
- Normally the radiation is not released, as it is well protected. If something goes wrong, it can become unsafe to be at the plant or nearby
- In the event of an incident at a nuclear power plant, workers, the nearby public, and the environment can be affected

### Workplace Radiation Incident



Workplaces like health care facilities, research institutions, and industrial operations may use radiation sources. A few examples include:

- Medical procedures such as cardiac stress tests which use radioisotopes (e.g., thallium, rubidium, technetium)
- Industrial radiography sources used to obtain an image to look for structural damage in buildings, bridges, etc.

An incident or accident can happen if:

- Radiation sources are stored or used incorrectly
- Safety controls malfunction
- Safety procedures are not followed

### Transportation Accident



- Radioactive material is transported by trucks, rail, and other shipping methods, packed in special protective containers that are designed and tested to withstand damage
- The main dangers of transportation accidents involving radiation are contact with and exposure to radioactive material, in the event that the containers are damaged
- It is very unlikely that accidents involving transport of radioactive material will cause any radiation-related injuries or illnesses. Emergency officials have plans in place to respond safely to transportation accidents involving radioactive material

### Radiological Dispersal Device (RDD)



- A radiological dispersal device (RDD) is any device used to intentionally spread radioactive materials (an act of terrorism)
- A type of RDD that combines conventional explosives, such as dynamite, with radioactive material is called a “dirty bomb”. Most casualties from a “dirty bomb” come from the explosion itself, not from the radiological material (e.g. shrapnel, dust) it spreads
- An example of contamination from a non-explosive RDD is when the RDD (in liquid, gas, aerosol, or solid form) is dropped from a plane or put in the food or water system

### Radiological Exposure Device (RED) or “Hidden Source”



- An RED is a hidden, unshielded, sealed radioactive source that someone would place somewhere with the intent of causing harm through exposure (an act of terrorism)
- An RED causes radiation exposure, but most often does not cause contamination

## NUCLEAR EMERGENCIES

### Detonation of Nuclear Weapons



Nuclear weapons could be used in acts of terrorism to cause widespread fatalities

- Nuclear weapons are powerful and have high explosive yield
  - » Explosive yield is the amount of energy discharged when detonated
  - » Nuclear weapons cause the release of radiation both during and after the explosion
- These can be several fold more powerful than the bomb dropped over Hiroshima
- Countries with advanced nuclear technology develop and maintain nuclear weapons

### Improvised Nuclear Devices (INDs)



- INDs, are small-scale nuclear weapons that can be built from parts of stolen nuclear weapons or from scratch using nuclear material
- INDs have the ability to produce catastrophic loss of life, destruction of buildings, and contamination of widespread areas

# Public Health Surveillance for Radiation Emergencies

## Public Health Surveillance for Radiation Exposures using Poison Center Data

Since 2010, CDC and the American Association of Poison Control Centers (AAPCC) have conducted surveillance on PC data uploaded to the NPDS by the 55 US PCs for exposures and illness of potential public health significance, such as ionizing radiation. There are many different types and sources of ionizing radiation, and more information about the nature of ionizing radiation exposures would improve national surveillance activities.

Prior to 2011, the coding options for PC staff to capture ionizing radiation exposures were limited. In 2011, CDC and AAPCC worked with the company that maintains the exposure code database (TruvenHealth Analytics®) to expand radiation specific codes. This enabled greater differentiation and classification of ionizing radiation exposures, such as the type (e.g., alpha, beta, or gamma radiation), the specific non-pharmaceutical radionuclide source (e.g., uranium, cesium-137), and if a nuclear or radiological weapon (e.g., radiological dispersal device) was used. This nomenclature expansion was accompanied by in-person trainings at the 2011 North American Congress of Clinical Toxicology Conference and a recorded version was made freely available online at <http://www.orau.gov/RSB/PoisonControl/index.html>.

From January 1, 2012 through December 31, 2015, CDC identified 565 ionizing radiation exposures reported to PCs. Most calls were regarding substances characterized as “unknown type of ionizing radiation” (n=266, 47.0%), followed by X-ray radiation (n=60, 10.6%) and Uranium-238 (n=59, 10.4%).<sup>1</sup> Calls to PCs about radon, radon gas, and smoke detectors were excluded from this analysis.

## Radon Exposures Reported to NPDS

According to AAPCC Annual Reports of NPDS from 2012, 2013, and 2014, the number of annual calls to PCs regarding radon range between 51 and 76. For more detailed numbers, annual reports can be accessed on the AAPCC website at <http://www.aapcc.org/annual-reports/>.

For more information about radon, its health effects, and how to protect yourself please see “A Citizen’s Guide to Radon: The Guide to Protecting Yourself and Your Family from Radon.”

## Reference

<sup>1</sup>Royal Law, PhD; Art Chang, MD; Josh Schier, MD (2016, September). Characterizing exposures to ionizing radiation reported to poison centers, 2012–2015. Poster presented at NACCT 2016 Conference (Boston, MA).

## Additional Resources

Radiation & Your Health—CDC; <https://www.cdc.gov/nceh/radiation/>; Radiation Emergencies—CDC; <https://emergency.cdc.gov/radiation/>; Radiation Emergency Medical Management (REMM)—U.S. Department of Health & Human Services; <https://www.remm.nlm.gov/>; Radiation Emergency Assistance Center/Training Site (REAC/TS)—Managed by Oak Ridge Associated University (ORAU) for the Department of Energy (DOE); and <https://orise.orau.gov/reacts/>.

Content from <https://www.cdc.gov/radiationtraining/RAD-Toolkit/>, images—open source.