Prepare for the Unthinkable: Enhancing Citizen Preparedness for a Radiation Disaster

Facilitator's Guide

August 2011

Prepared by:

Italo Subbarao, DO, MBA
Jim Lyznicki, MS, MPH
Lauren Walsh, MPH

Designed by:
Jessica Sempek, MS

© 2011 American Medical Association. All rights reserved.

This project was supported by Sub-Award Agreement Number 89 administered by the Association of State and Territorial Health Officials. Points of view or opinions in this document are those of the author and do not represent the official position or policies of the Association of State and Territorial Health Officials.


AMA
AMERICAN
MEDICAL
ASSOCIATION

Table of Contents

Introduction **1**

Administration Page **1**

Duration 1
Scope Statement 1
Resources 2
Suggested Instructor to Participant Ratio 2
Reference List 2

Preparing for the Session **4**

Slide-by-Slide Facilitator's Guide **6**

This page intentionally left blank.

Prepare for the Unthinkable: Enhancing Citizen Preparedness for a Radiation Disaster

Introduction

It is recommended that you review this guide before you present the radiation disasters training session to a group in your community. The guide explains the purpose and goals of this session, things you need to do before the session, the schedule and outline, and resources required to facilitate the exercises included in the training.

Administration Page

Duration

30 minutes – 1.5 hours

Scope Statement

The program is part of a standardized disaster health education program administered by the American Medical Association (AMA). The program aims to attain national all-hazards preparedness goals by providing critical medical and mental health information to enable individual citizens to play a more effective role in local disaster planning and response, and ensure their integration into the overall emergency response system. The overarching goals of the program are to build individual and community readiness and resilience to disasters by providing knowledge and skills to minimize injury, illness, and death, as well as increase individual motivation to become more engaged in local volunteer initiatives.

This instructor-led course seeks to empower individuals by providing the information and skills they need to protect their health and safety in a radiation event. Informed individuals are better able to understand their personal responsibilities (eg, to self-decontaminate and to listen for direction from public health and medical personnel). They know where to turn for up-to-date information about an evolving incident and when and where to seek medical attention; and have the means to take action to help others in need of assistance.

The AMA courses can collectively help achieve national all-hazards preparedness goals by enabling community groups and individual citizens to participate more effectively in local disaster response and ensure their integration into the overall emergency response system. Citizens learn how to: (1) recognize potential life-threatening situations and act appropriately, while protecting personal health and safety; (2) contact and interact with the local emergency medical and public health systems; (3) make timely decisions with limited resources and data; (4) access disaster health preparedness information and resources; and (5) become more involved in local preparedness and response efforts through additional education and training, as well as participation in volunteer initiatives such as the Citizen Corps, Medical Reserve Corps, and American Red Cross.

Resources

For a complete list of the required materials and resources needed to conduct this session, please refer to the "Preparing for the Session" section found on page 4.

Suggested Instructor to Participant Ratio

1:50

Reference List

American Medical Association (AMA)—The AMA is a national professional organization for all physicians, serving as a leader of the medical profession. Through active advocacy at all levels of the private and public sectors, the AMA works to protect the patient-physician relationship, which is at the heart of medicine.

Website: http://www.ama-assn.org

American Public Health Association (APHA)—The APHA is the oldest and largest organization of public health professionals in the world. The APHA is concerned with a broad set of issues affecting personal and environmental health, including federal and state funding for health programs, pollution control, programs and policies related to chronic and infectious diseases, a smoke-free society, and professional education in public health.

Website: http://www.apha.org

American Red Cross—The Red Cross helps communities prepare for emergencies and keeps people safe every day. Each year, the Red Cross responds immediately to more than 70,000 disasters. These disasters include apartment fires, natural and man made disasters, explosions, and more.

Website: http://www.redcross.org

Centers for Disease Control and Prevention (CDC)—The CDC is the lead federal agency for protecting the health and safety of people at home and abroad, providing credible information to enhance health decisions, and promoting health through strong partnerships. The CDC serves as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and education activities designed to improve the health of the people of the United States.

Website: http://www.cdc.gov

Citizen Corps—The Citizen Corps was created to help coordinate volunteer activities to make communities safer, stronger, and better prepared to respond to any emergency situation (e.g., crime threats, terrorism, and disasters). The Citizen Corps is coordinated nationally by the DHS. In this capacity, the Department of Homeland Security (DHS) works closely with other federal entities, state and local governments, first responders, emergency managers, the volunteer community, and the White House Office of the USA Freedom Corps. Currently, there are about 2,300 Councils serving 223 million people, which is about 78% of the population.

Website: http://www.citizencorps.gov

Department of Homeland Security (DHS)—The DHS was established after the terrorist attacks against the United States on September 11, 2001 to coordinate 22 previously disparate domestic agencies into one department. Its first priority is to protect the nation against further terrorist attacks. Component agencies analyze threats and intelligence, guard US borders and airports, protect our critical infrastructure, and coordinate the response to future emergencies.

Website: http://www.dhs.gov

Medical Reserve Corps (MRC)—The MRC Program reports directly to the U.S. Surgeon General. The MRC aims to improve the health and safety of communities across the country by organizing and utilizing public health, medical, and other volunteers who donate their time and expertise to prepare for and respond to emergencies. Volunteer MRC units accomplish this mission by supplementing existing emergency and public health resources during local emergencies. The Medical Reserve Corps is dedicated to establishing teams of local volunteer and public health professionals to contribute their skills and expertise. These volunteers will help the communities when something happens, such as an influenza pandemic. The Medical Reserve Corps is a partner program with Citizen Corps.

Website: http://www.medicalreservecorps.gov

National Association of County and City Health Officials (NACCHO)—NACCHO represents local health departments. It provides community and environmental health programs to towns and cities, for example. NACCHO helps local health departments provide key programs and services.

Website: http://www.naccho.org

U.S. Nuclear Regulatory Commission (NRC) - The NRC was created as an independent agency by Congress in 1974 to enable the nation to safely use radioactive materials for beneficial civilian purposes while ensuring that people and the environment are protected. The NRC regulates commercial nuclear power plants and other uses of nuclear materials, such as in nuclear medicine, through licensing, inspection and enforcement of its requirements.

Website: http://www.nrc.gov/

Preparing for the Session

The Facilitator Guide follows the PowerPoint slide sequence used to deliver the session. Before arrival at the presentation site, ensure access to a computer and LCD projector, with the capacity to run PowerPoint 2003 or PowerPoint 2007 and a recent version of Adobe® Flash Player; cables to connect the computer to the projector; and a projection screen. Before the session, practice opening the presentation (select **Slide Show** from the PowerPoint **View** menu). Practice moving through the slides and talking through the content. The Facilitator Guide provides most of the information needed to deliver the presentation. If available, use a white board, chalk board, or flip chart to write down ideas or questions generated by the group for use in future presentations.

Download Presentation Materials

The current program provides the following materials to facilitate presentation of the radiation disaster session:

- PowerPoint slide deck (42 slides): Five slides (slides 5, 7, 9, 20, and 29) contain instructor-controlled animation, which can be activated by clicking the left mouse button, the down arrow, or the page down button. Numerous other slides have automatic animation, which does not require the instructor to "click" to advance. This will be denoted in the "Special Instructions" section of the Slide-by-Slide Facilitator's Guide. You may want to practice running the animations before your session using the computer you will have available during the session.
- Instructor Guide
- Program Evaluation Form

Review the Online Module

Information about accessing the web-based training module is available from the AMA website at http://www.ama-assn.org/go/ndls or from the NDLSF website at http://www.ndlsf.org.

Gather Information about Local Resources

This training program is about preparing communities to act in a radiation disaster. For people to feel prepared, they need to know about the resources they will have available. These resources include:

- Local radiation response plan, if there is one.
- Local sources of information, such as the health department, emergency management agency, and mayor's office, as well as local radio and TV stations
- Local emergency response systems, such as the local 911 or 411 system
- Local community groups with established communication networks (such as places of worship, schools, and interest groups)

Gather Information about National Resources

The Facilitator Guide includes a list of websites of national organizations such as the American Medical Association (AMA), the American Red Cross, and the Centers for Disease Control and Prevention (CDC). Visit these sites before you present the session. In addition, plan on printing (or copying) the sheet and then distributing it to participants during the session. It is also extremely important to have knowledge about your local radiation response plan and to be able to provide necessary details regarding some issues such as whether your local public health system has a hotline.

Deleted: public health influenza plan

Set Up the Agenda

Prepare an agenda listing the topics that will be covered in this session. If appropriate for your group, you can fill in the length of time you expect to spend on each topic as well as the overall length of time of the session.

You may want to practice the session and time yourself to ensure you know how long it will take.

Suggested agenda
Introduction (2 to 3 minutes)
Didactic presentation (30 to 45 minutes)
Summary (2 to 3 minutes)
Evaluation (10 minutes)
Group exercise (20 minutes) - optional

Instructor Tips and Knowledge

You need to present only very basic information about radiation, which is provided as instructor notes in this guide. It is also useful to have a reasonable understanding of the local community radiation event response plan, if one exists, to assist with addressing specific issues related to your community.

It is strongly recommended that the presentation be presented jointly by a representative from the local public health agency and a local healthcare professional (eg, physician, nurse). If you are not a health professional, it is recommended that you ask a local doctor, nurse, or public health official to help deliver the presentation or be available to help answer questions from the audience.

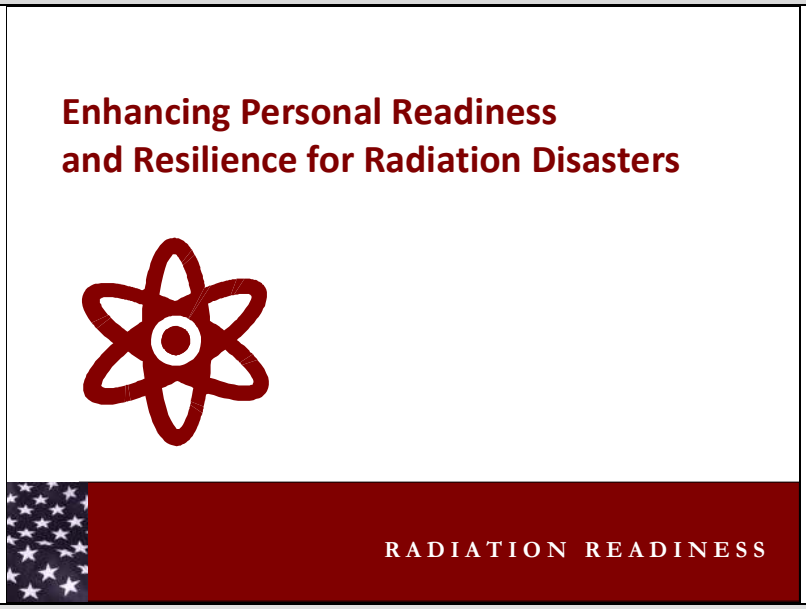
Adult Learners

Being an effective instructor requires an understanding of how adults learn best. Adult learners are self-directed and should be involved in the learning process. Engage them in discussion often, and relate theories and concepts to experiences they may have had.

Adults are also very goal-oriented. Discuss with the participants their reasons for participating in the course, and make an effort to tie in the lessons with their learning objectives. Because adult learners are often quite practical and think of things from an implementation point-of-view, describe to them how these lessons can be applied so that they can better perform in a disaster situation.

Finally, be sure to show respect to your students. They bring a breadth of experience and knowledge to the classroom, and should be allowed to voice their opinions during class.

Slide-by-Slide Facilitator's Guide

Prepare for the Unthinkable (slide 1)

Purpose: Title slide for the session
Special instructions: Have this slide displayed as the group gathers. This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.
Script: None

Prepare for the Unthinkable (slide 2)

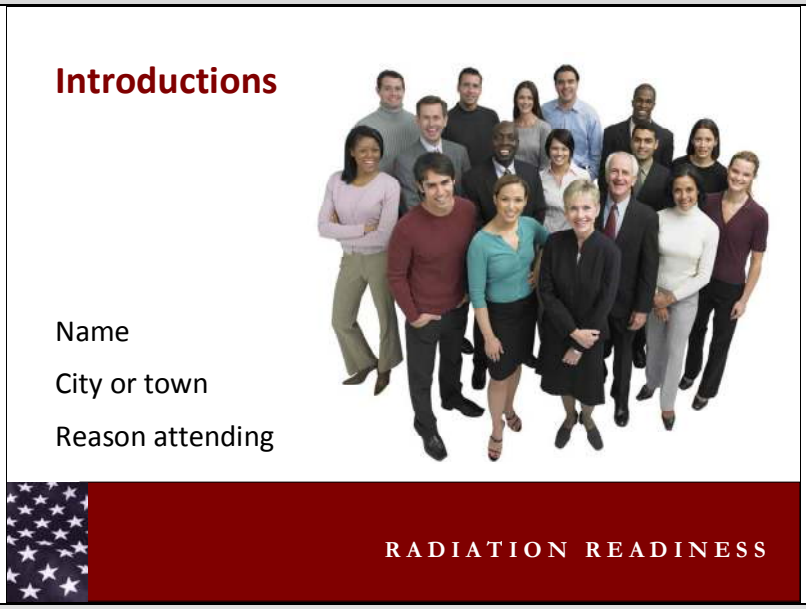
This project was supported by Sub-Award Agreement Number 89 administered by the Association of State and Territorial Health Officials. Points of view or opinions in this document are those of the author and do not represent the official position or policies of the Association of State and Territorial Health Officials.

Purpose: Title slide for the session

Special instructions: Have this slide displayed as the group gathers and you begin your welcome.

Script: None

Introductions (slide 3)

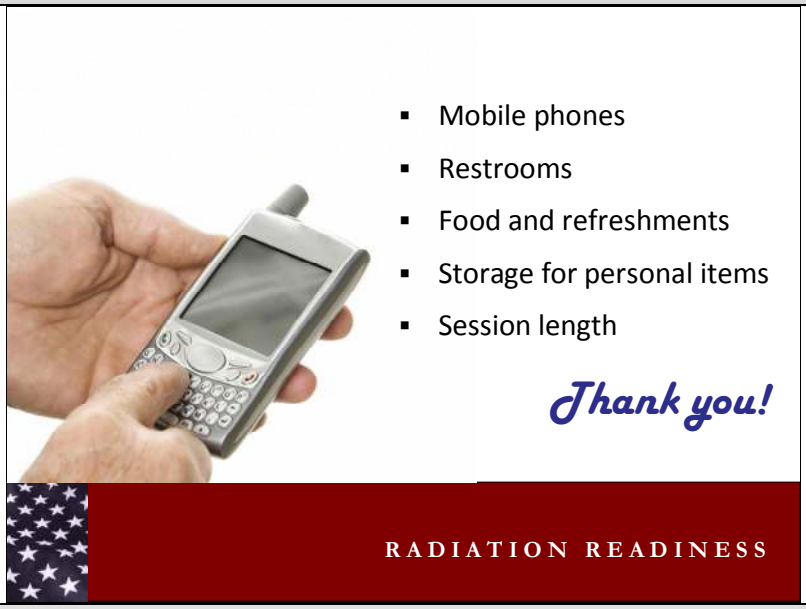


Purpose: Introductions

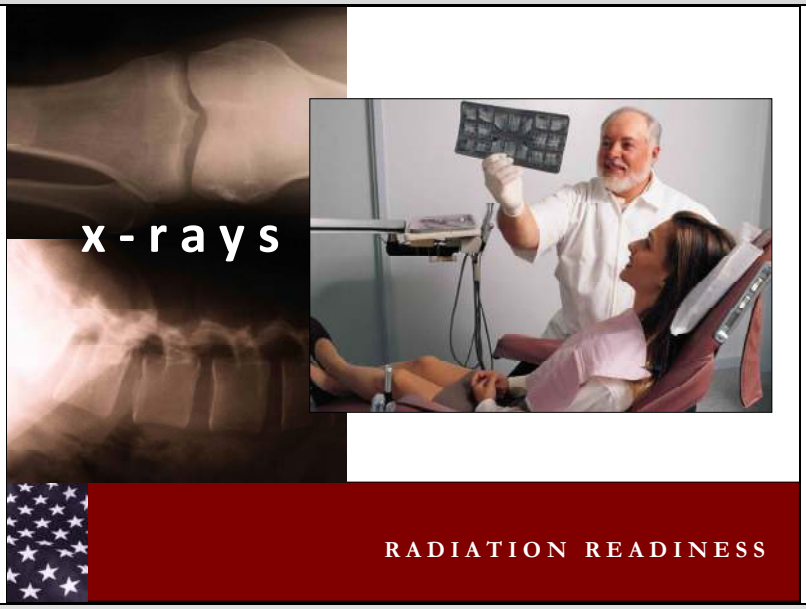
Special instructions: If name tags are used, ensure everyone has one as introductions begin.

Script:

- Introduce yourself and tell the participants a little bit about you.
- Make it interesting! If you have assisted in a disaster event, mention it.
- Segue into how the information they are about to learn in this class was crucial for not only your safety, but also for those around you.
- Ask participants to quickly introduce themselves and tell the class what brings them here today.

Housekeeping (slide 4)

Purpose: Housekeeping items
Special instructions: Locate nearest emergency exits, restrooms, break areas, etc., prior to beginning the session. Be sure to point out the nearest emergency exits as well. This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.
Script: None

Radiation Basics (slide 5)



Purpose: A general overview of radiation.

Special instructions: This slide has instructor-prompted animation. Please "click" once to view an additional image.

Script:

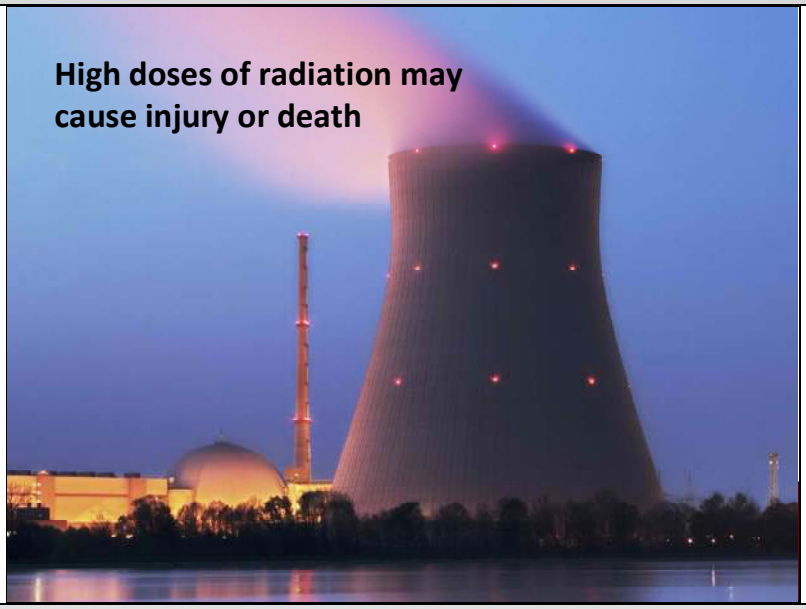
Radiation Basics

We will begin by discussing some general facts about radiation so that you better understand what is a risk to you and what is not.

First, **radiation affects all of us, every day, just as a result of us being on this planet**. All living things have evolved with exposure to naturally occurring radiation from the earth and sun. This is normal and not harmful. Our bodies are used to this kind of exposure.

Most of us have also encountered human-created radiation, such as that received from medical and dental x-rays. When used by an experience professional in a controlled environment, this type of exposure is also not likely to be harmful to you.

Radiation Basics (slide 6)



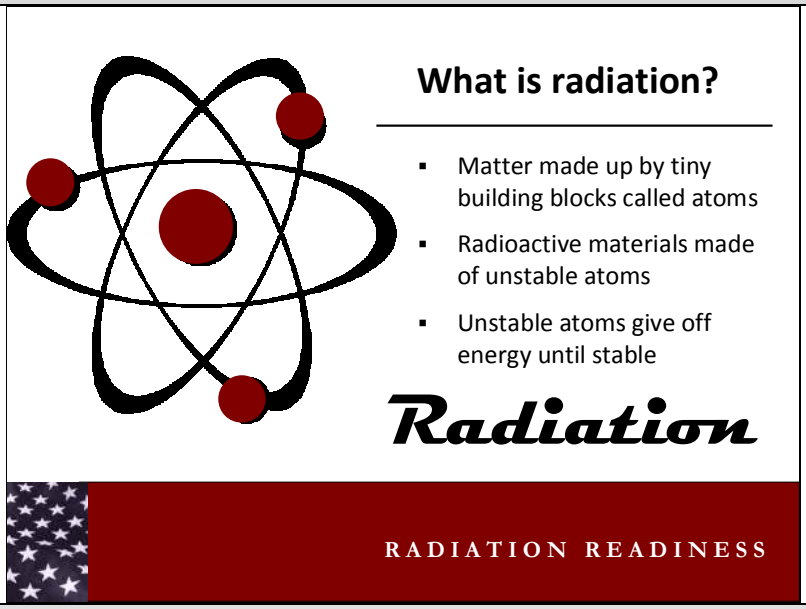
Purpose: To explain the correlation between length of time exposed and increased risk of adverse health effects.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

The longer a person is exposed to radiation, the greater the effect. Prolonged exposure can lead to serious illness or even death. However, the amount of natural radiation you are exposed to from the environment is not enough to be harmful to your health. Similarly, most people will not be exposed to medical use radiation in quantities high enough to cause damage.

What Is Radiation? (slide 7)



Purpose: A basic introduction to the science of radiation.

Special instructions: This slide has instructor-prompted animation. Please "click" twice to prompt the additional animations.

Script:

Let's talk just a bit about what radiation actually IS. This is a very simple overview of the properties of radiation and what makes it potentially dangerous to you.

Radioactive materials are composed of atoms that are unstable, which causes them to give off a form of energy that travels in waves or particles. An unstable atom gives off its excess energy until it becomes stable. These emissions are called radiation, or more accurately, ionizing radiation.

Different types of radiation exist – "radiation" is just a general term for all these different types. Not all of the types have the energy to damage your DNA. High energy radiation, or ionizing radiation, is the type used in medical x-rays and radiation therapy for cancer. This type can damage your cells. Non-ionizing radiation, or low energy radiation, is the kind you are exposed to every day from the sun, microwaves, cell phones, and TV screens. This type is not the same as the ionizing radiation you may get from an x-ray in a hospital. It is very low energy and is not likely to severely damage your cells and DNA.

Not all high energy (ionizing) radiation is the same. There are different kinds of high energy radiation, called alpha particles, beta particles, and gamma rays, each with a different

strength, but for the purposes of this course we will not go into detail about these types.*

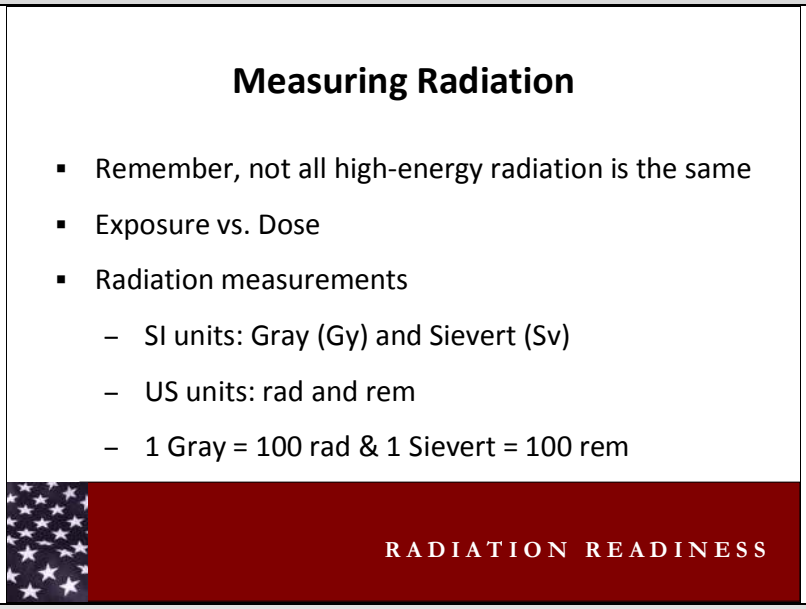
If asked to explain/for your reference:

Alpha (α) particles can be stopped by a thin layer of light material, such as a sheet of paper, and cannot penetrate the outer, dead layer of skin. They do not pose a hazard as long as they are outside the body. Radioactive materials that emit alpha particles are an internal hazard if ingested or inhaled.

Beta (β) particles travel only a few feet in air and can be stopped by a thin sheet of aluminum. Beta particles can penetrate the outer layers of skin and are both an external and internal hazard. Beta radiation travels only a short distance in tissue, depending on its energy, and can be a significant source of dose to the skin.

Gamma (γ) radiation is very difficult to shield against. Unlike alpha or beta particles, gamma rays are electromagnetic energy similar to x-rays. Concrete, lead, or steel is needed to shield sources of gamma rays. High-energy gamma radiation can penetrate deeply into tissue. Most radioactive materials with current commercial applications emit high-energy gamma rays.

Measuring Radiation (slide 8)



Purpose: A simplified explanation of how we measure radiation doses, along with the difference between 'exposure' and 'dose'.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

Measuring Radiation

Radiation physics can be very confusing since we use a lot of funny words to describe a lot of different amounts of things we can't see. We will not go into a lot of detail regarding measurements of radiation, but we want you to understand a couple key concepts. If anything gets confusing, please raise your hand and let me know.

Exposure and Dose

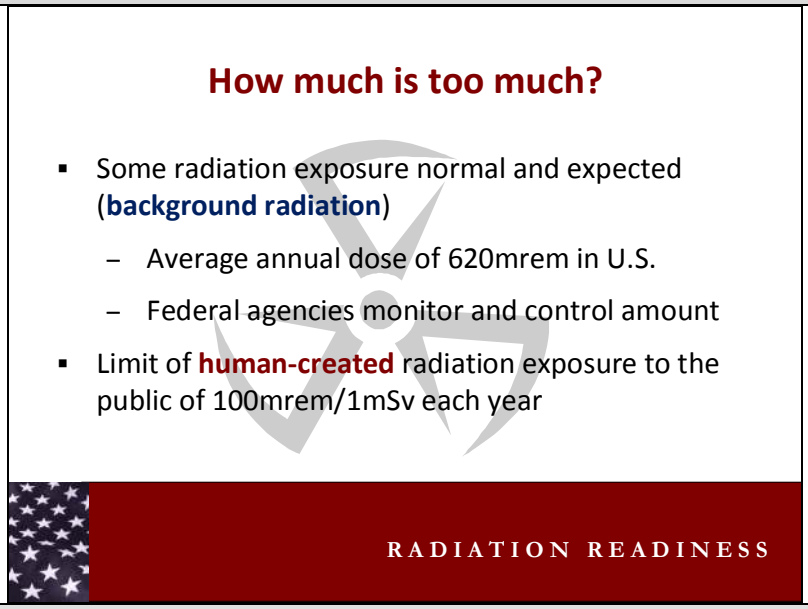
'Exposure' and 'dose' are two terms used to describe how much radiation is around you and how much your body takes in. **Exposure** is the amount of radiation being given off by the radioactive material and directed at your body. **Dose** is the amount of radiation that your body actually absorbs. You can be **exposed** to radiation without actually taking in a **dose**, for example if you have protective equipment on, or if the radiation is not high-energy enough to get through your skin.

Measurements. There are two different ways that radiation is measured. One is used by the international community and is known as SI (which stands for Standard International units). The other is used here in the United States. Think of this as similar to using Celsius instead of

Fahrenheit or meters instead of feet. It is just two different ways to measure the same things.

- In SI units (international units), we use the Gray and the Sievert.
  - Put very simply, the Gray is how much your body absorbs. That is, it is the amount of radiation put into your tissues. In US units, this same thing is called a “rad”.
  - Now you remember that not all radiation is the same, and that some is stronger or higher energy than others. Put very simply, the Sievert (in SI units) or the “rem” (in US units) takes into account the different radiation strengths by multiplying the number of Grays (or rads, because remember those are the same) by their strength.

How Much Is Too Much? (slide 9)



Purpose: An explanation of the quantity of radiation people are exposed to each year, and the sources it comes from. The point is that people are subjected to doses of radiation daily, which is natural and normal. We must limit our exposure from other man-made sources.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

How Much is Too Much?

Keep in mind that some radiation exposure is normal and expected in your everyday life.

- The average person in the United States will get a dose of about 620mrem or 6.2 mSv of *natural, background radiation* annually. However, we do want to keep exposure down to levels that are "as low as reasonably achievable" (ALARA)
- Background radiation exposure is controlled in the U.S. by Federal Agencies such as the Environmental Protection Agency, the Nuclear Registry Commission, and the Department of Energy. Each state also has one or more radiation control programs.

The NRC requires that *human-created radiation* exposure for individual members of the public be limited to 100mrem/1mSv annually.

How Much Is Too Much? (slide 10)

Purpose: An explanation of the quantity of radiation people are exposed to each year, and the sources it comes from. We must limit our exposure from other man-made sources.

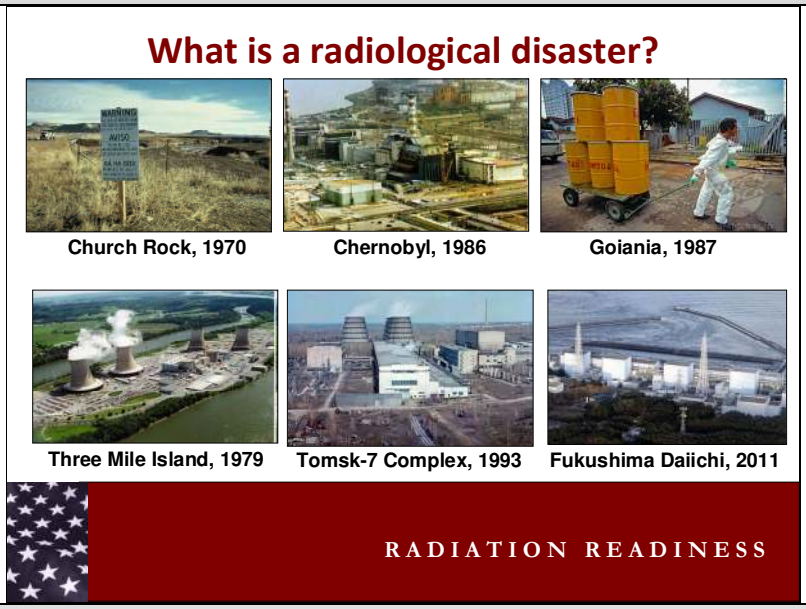
Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

How Much is Too Much?

Here are common sources of exposure. You can see that a dental x-ray gives a dose of about 4-15mrem, which is just a small portion of the 100mrem allotted for safe dosage by human-created radiation exposure. A mammogram, however, gives a dose of 70mrem, which is a large portion of the 100mrem allotted for safe dosage by human-created exposure.

What is a Radiologic Disaster? (slide 11)



Purpose: What makes a radiologic disaster? An overview of radiation disasters that have happened in the U.S. and abroad in the last 50 years.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

What is a Radiologic Disaster?

Okay, now that we understand a little bit more about what radiation is, how we are exposed to it, and how much is too much, let's talk about radiologic disasters. We know that we are exposed to radiation every day, and we now know that small amounts of radiation are not necessarily harmful to our health. But, what happens when we are exposed to large amounts of radioactive material, or if we are exposed to small amounts over a long period of time?

- When large amounts of radioactive materials are released into communities, it is called a radiologic disaster. Radiologic disasters may cause panic and environmental contamination, but do not necessarily cause injury to large numbers of people. This is different from a nuclear disaster, which involve large numbers of deaths and many severe injuries.
- Although these occurrences are rare, they DO happen. These are some examples of major radiologic disaster events, and the kinds of health hazards that are associated with them:

- **March 2011 Fukushima Daiichi Plant**: An 8.9 magnitude earthquake and subsequent tsunami overwhelmed the cooling systems of an aging reactor along Japan's northeast coastline. The accident triggered explosions at several reactors at the complex, forcing a widespread evacuation in the area around the plant.
  Read more:
  http://www.time.com/time/photogallery/0,29307,1887705,00.html#ixzz1UpRv6MtW

- **April 1993 - accident at the Tomsk-7 Reprocessing Complex**: The accident in the Siberian city of Tomsk took place after a tank exploded while being cleaned with nitric acid. The explosion released a cloud of radioactive gas drifting from the Tomsk-7 Reprocessing Complex.
  Read more:
  http://www.time.com/time/photogallery/0,29307,1887705,00.html#ixzz1UpT4dpGD

- The **Soviet submarine K-431** (not shown) was a Soviet nuclear-powered submarine that had a reactor accident on August 10, 1985. An explosion occurred during refueling of the submarine at Chazhma Bay, Vladivostok. Ten fatalities and 49 other people suffered radiation injuries.

- **Goiania Accident, September 13, 1987:** More than 240 people were exposed to radiation when a junkyard dealer in Goiania, Brazil, broke open an abandoned radiation therapy machine and removed a small highly radioactive cake of cesium chloride. Children, attracted to the bright blue of the radioactive material, touched it and rubbed it on their skin, resulting in the contamination of several city blocks which had to be demolished.
  Read more:
  http://www.time.com/time/photogallery/0,29307,1887705,00.html#ixzz1UpTXm6WD

- **Chernobyl Accident, April 26, 1986**: The Chernobyl disaster is considered to be the worst nuclear power plant disaster in history. On the morning of April 26, 1986, reactor number four at the Chernobyl plant exploded. More explosions ensued, and the fires that resulted sent radioactive fallout into the atmosphere. Four hundred times more fallout was released than had been by the atomic bombing of Hiroshima.
  Read more:
  http://www.time.com/time/photogallery/0,29307,1887705,00.html#ixzz1UpThygIU

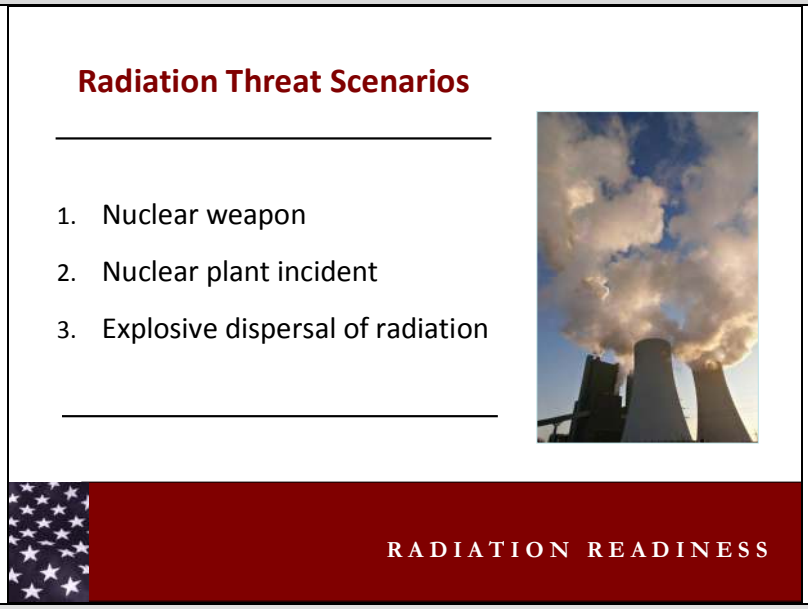
- **August 19 1985 – Soviet submarine K-431 accident** (not shown)**:** During refueling in Vladivostok, Russia, the Echo II class submarine suffered an explosion, sending a radioactive cloud of gas into the air. Ten sailors were killed in the incident and 49 people were observed to have radiation injuries.
  Read more:
  http://www.time.com/time/photogallery/0,29307,1887705,00.html#ixzz1UpW1ZxWB

- **March 28, 1979 – Three Mile Island:** The partial meltdown of the Three Mile Island Unit 2 nuclear power plant was the most serious accident in the history

of U.S. nuclear power plant operating history, despite the fact that it led to no deaths or injuries.
Read more:
http://www.time.com/time/photogallery/0,29307,1887705,00.html#ixzz1UpW8IFOj

- **December 18 1970 – Yucca Flat** (not shown)**:** After the Baneberry test, involving the detonation of a 10 kiloton nuclear device underneath Yucca Flat in Nevada, the plug sealing the shaft from the surface failed and radioactive debris vented into the atmosphere. Eighty six workers at the site were exposed to radiation.
  Read more:
  http://www.time.com/time/photogallery/0,29307,1887705,00.html#ixzz1UpWQzrDw
- **1979 - Church Rock uranium mill spill in New Mexico, USA**: when United Nuclear Corporation's Church Rock uranium mill tailings disposal pond breached its dam. Over 1,000 tons of radioactive mill waste and millions of gallons of mine effluent flowed into the Puerco River. Local residents used river water for irrigation and livestock and were not immediately aware of the toxic danger. In terms of the amount of radiation released the accident was comparable in magnitude to the Three Mile Island accident of the same year and has been reported as the largest radioactive accident in U.S. History.
- **October 1957 - Windscale fire, UK:** (not shown)The incident occurred when the graphite core of a British nuclear reactor caught fire near Cumberland. The fire resulted in a release of a significant amount of radioactive contamination. It would come to be known as the worst reactor accident until Three Mile Island.
  Read more:
  http://www.time.com/time/photogallery/0,29307,1887705,00.html#ixzz1UpWtrh00

Radiation Threat Scenarios (slide 12)



Purpose: An explanation of ways radiation disasters occur.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

Radiation Threat Scenarios

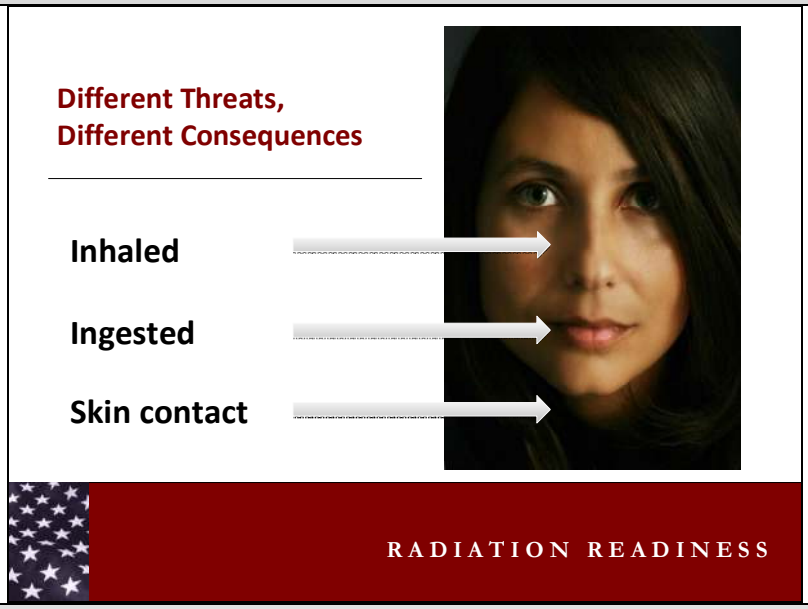
The possibility of a radiation disaster here in the United States is very real. In the previous slide, you saw several examples of major radiation disasters in the past 30-40 years. There have been other, smaller events as well.

There are multiple ways that a radiation disaster could occur in the United States. **Realistic Radiation Threats in the U.S. include:**

- the detonation of a nuclear weapon
- a nuclear power plant event that unleashes a radioactive cloud
- the dispersal of radioactive materials by conventional explosives (called a dirty bomb) or other means (crash of a transport vehicle)

Any of these events could occur unintentionally or as an act of terrorism.

Radiation Threat Scenarios (slide 13)



Purpose: It is important to explain that different disasters result in different exposure consequences. Radiation can harm your body by being ingested, inhaled, or by contaminating the skin.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

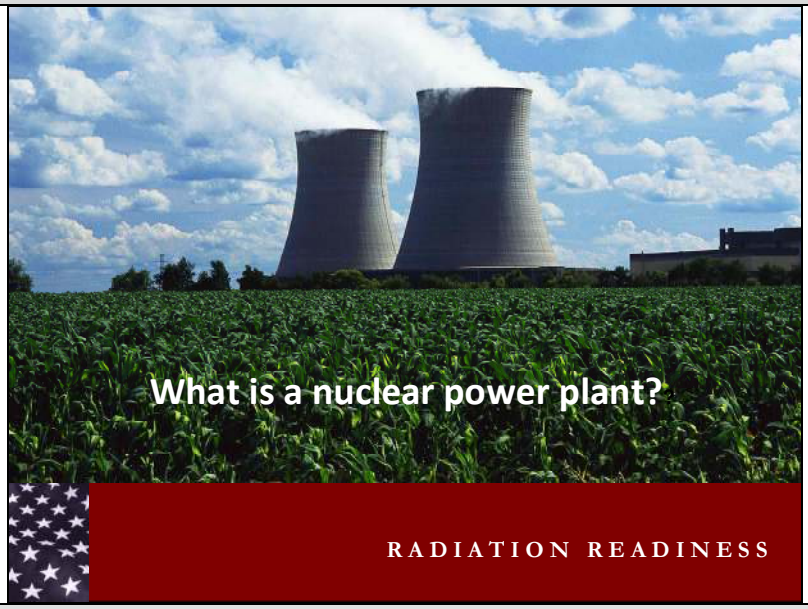
Script:

Different Threats, Different Consequences:

No matter if the radiation event occurs intentionally (ie an act of terrorism) or unintentionally (ie a result of natural disaster, crash of a transport vehicle, power plant meltdown) there will be consequences to human health. Different types of events will have different consequences.

- Exposure patterns can be very different. Radioactive materials could get into the water or food supply be ingested; an explosion could cause a mushroom cloud of gas that would be inhaled. Explosions and radioactive gasses could also deposit particles on the skin.
- **For today, we will keep things simple and just focus on one of these scenarios – a nuclear power plant event.**

Nuclear Power Plants (slide 14)



Purpose: An overview of nuclear power plants – what they do, where they are located, and how many people live near them.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

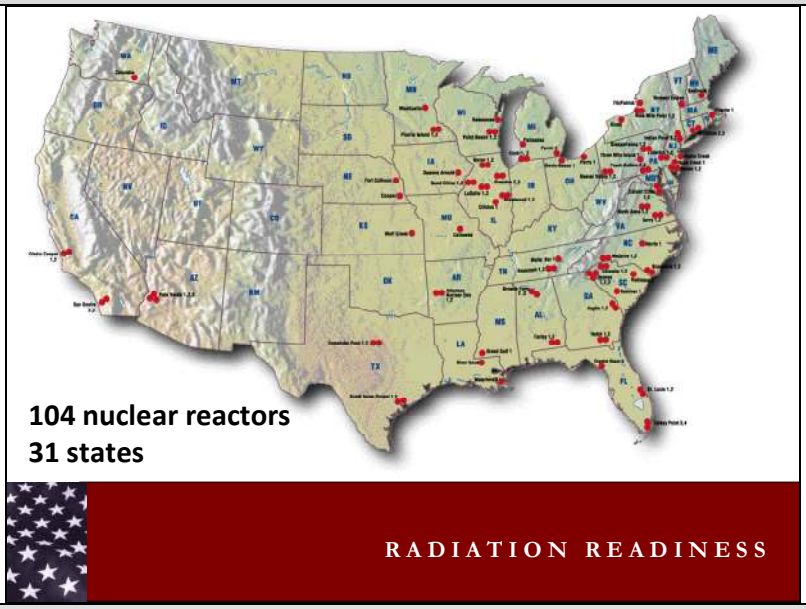
Script:

What is a Nuclear Power Plant?

In order to think about the potential danger to you if a nuclear power plant were to fail, we need to know a little bit about how plants are run and what type of radiation they are able to produce.

A **nuclear power plant** (**NPP**) is a thermal power station in which the heat source is one or more nuclear reactors. Put simply, heat is produced by breaking apart nuclear particles. This heat is transferred into water, which boils and lets off steam. The steam is fed into a turbine, which converts the steam into rotational energy, a much safer type of energy than radiation.

Nuclear Power Plants (slide 15)



Purpose: An overview of nuclear power plants – what they do, where they are located, and how many people live near them.

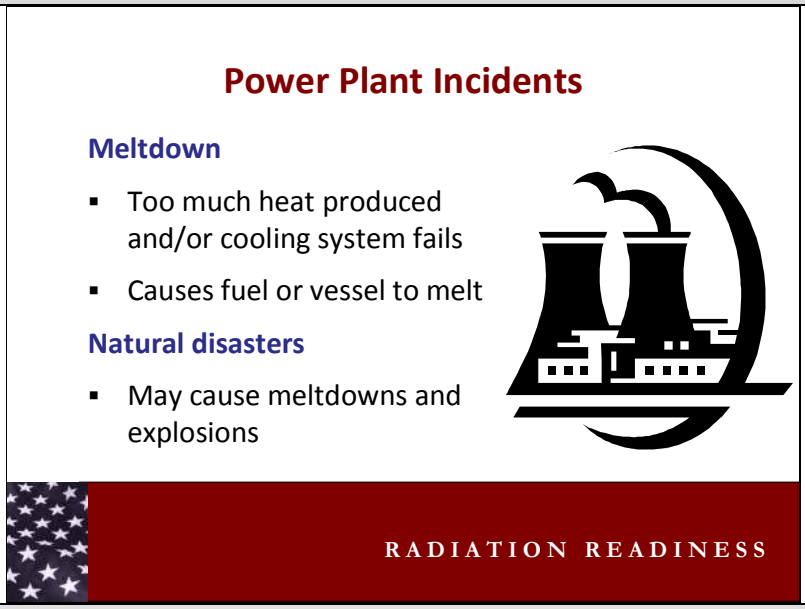
Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

Depending on where you live, there may or may not be a nuclear power plant in your vicinity. There are currently **104 nuclear power reactors in 31 states. About 120 million people, almost 40 percent of all Americans, live within 50 miles of a nuclear plant.**

Even if you do not live very close to one of these sites, remember that a large enough explosion can cause radioactive particles to be spread for hundreds of miles. Contaminated materials can also be carried by people, animals, and the wind.

Power Plant Incidents (slide 16)



Purpose: Ways in which nuclear power plants can malfunction and cause radiation disasters.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

Power Plant Incidents

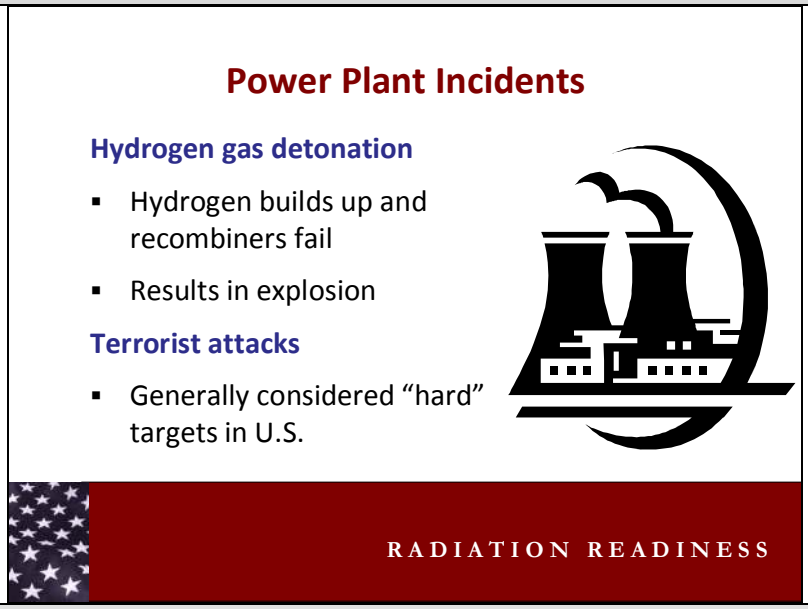
There are a few different ways that power plants can fail. The most common failure is what is known as a meltdown.

What is a Meltdown?

We said already that the nuclear power plants create heat that boils water to turn a turbine and create rotational energy. To keep the process going, cool water must be fed back into the system via a river or a cooling tower. If the unstable particles create more heat than expected, or if the cooling system fails, or if a fire starts, too much heat can be produced, causing the fuel or the vessel it is contained in to melt. This happened at least partially at the Fukushima plant in Japan.

Natural Disasters can also catalyze meltdowns and explosions, since they have the potential to damage building structure, shut down power, and cause flooding. Again, this was seen in the Fukushima incident in Japan.

Power Plant Incidents (slide 17)



Purpose: Ways in which nuclear power plants can malfunction and cause radiation disasters.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

Power Plant Incidents:

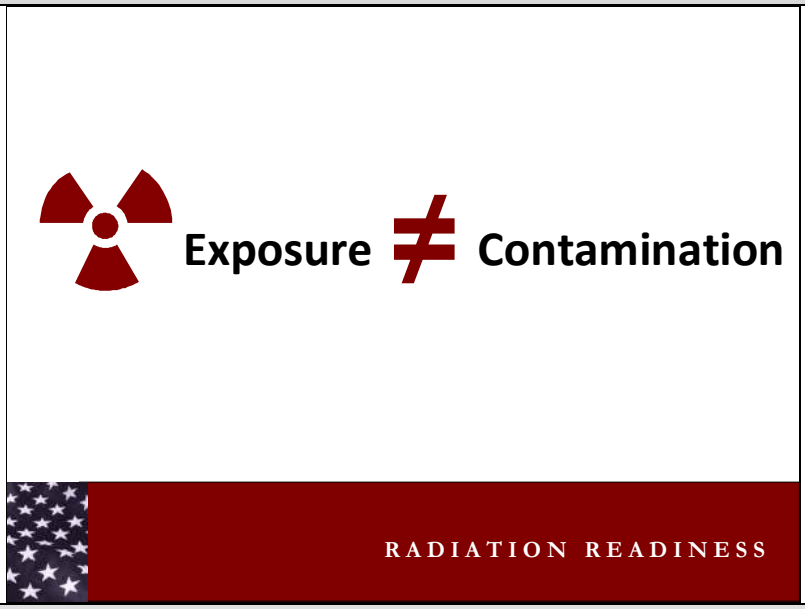
Hydrogen Gas Detonation

Another way that power plants can fail is if hydrogen gas causes an explosion. **Hydrogen Gas Detonations** occur when there is a buildup of hydrogen and the system that is meant to fix this problem fails. This also happened at the Fukushima plant in Japan.

Terrorist Attacks

Nuclear power plants are generally considered "hard targets" in the U.S. meaning they are not particularly susceptible to terrorist attacks. Attack by air is the most likely scenario, however the head of the Nuclear Regulatory Commission has said that all U.S. facilities are designed to withstand attack by an airplane.

Exposure and Contamination (slide 18)



Purpose: What it means to be 'contaminated' with radiation, as compared to 'exposed'.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

Exposure and Contamination

In a radiation event such as a power plant explosion or meltdown, people will want to know if they were exposed to radioactive material, if they have become radioactive themselves, how long they will be contaminated, how they can get it off their skin, if they are curable, and what kind of medical treatment to seek.

We will discuss some of these things today.

First, let's understand that "exposed" and "contaminated" are not the same things, much like "exposure" and "dose" are not the same things. A good way to think of this is to imagine a sealed container of radioactive baby powder. You can hold the container and be exposed to the gamma rays penetrating through the walls of the container, but not get the baby powder on your hands. Should a leak develop around the lid allowing, you may have the powder on your hands, thus contaminating you.

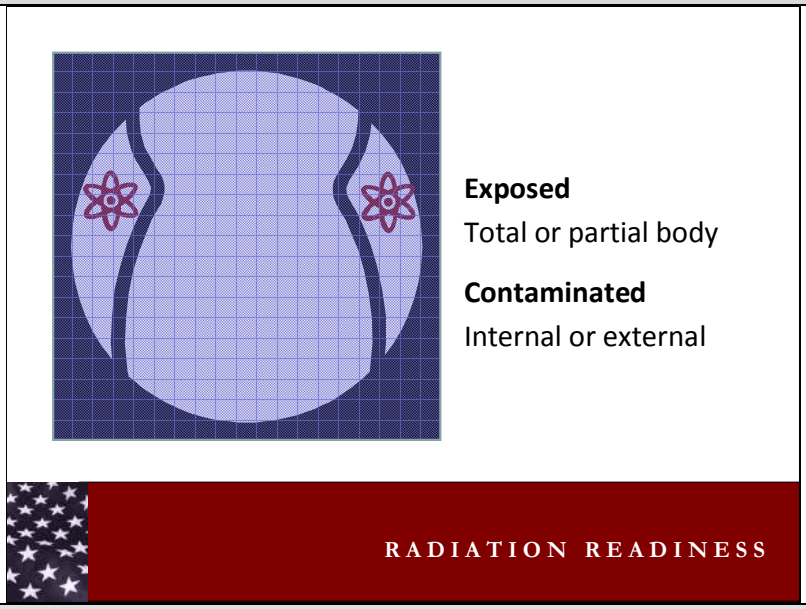
- You are **exposed to ionizing radiation** much in the same way you are exposed to light if someone shines a flashlight on you. There is no material transferred, only

energy.

- You are **contaminated with ionizing radiation** when a radioactive material gets onto the skin, or into the lungs, gut, or open wounds. Buildings, motor vehicles, and other inanimate objects can also become contaminated with radioactive particles. A person contaminated with radioactive material will be exposed until the source of radiation is removed.

This distinction is important because you may have been exposed (and therefore susceptible to health effects) without being contaminated (and therefore putting others at risk).

Exposure and Contamination (slide 19)



NOTE:

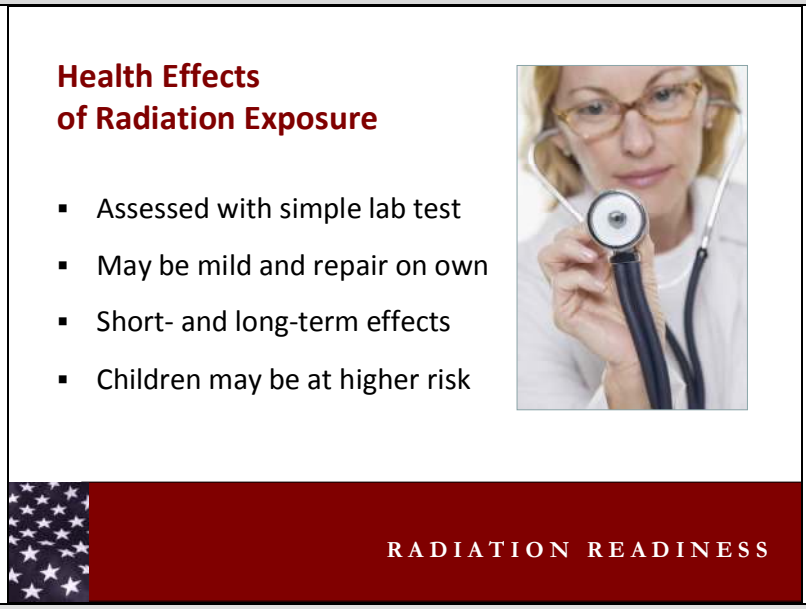
Purpose: What it means to be 'contaminated' with radiation, as compared to 'exposed'.

Special instructions: This slide has instructor-prompted animation. Please "click" once to view illustration of 'exposed' and twice to see 'contaminated'.

Script:

- Exposure is when no material is transferred, only energy.
- Contamination occurs when a radioactive material gets onto the skin, or into the lungs, gut, or open wound.

Human Health Effects (slide 20)



Purpose: Health effects of radiation exposure and contamination.

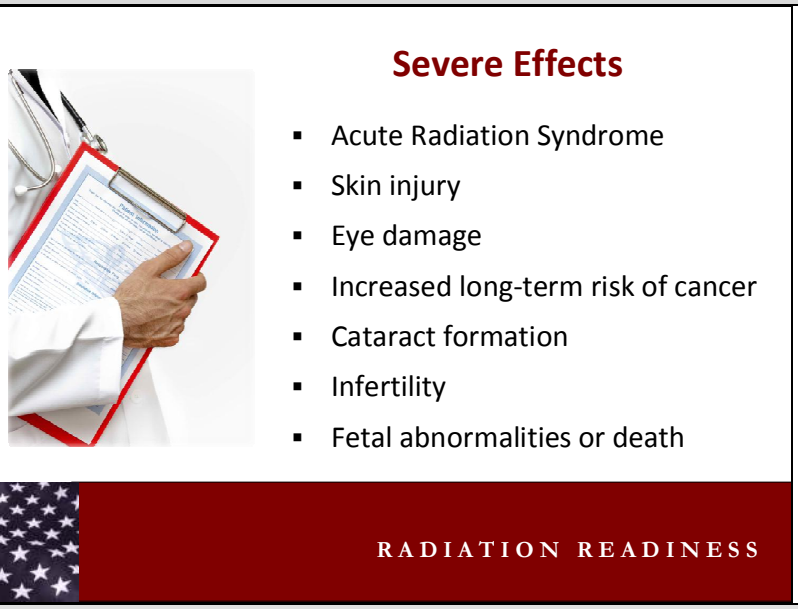
Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

Human Health Effects

- While the uncertainty of exposure and dosage effects can be very frightening, the **immediate health effects of large doses of radiation are well known** and the risk to **your health can be assessed with simple laboratory tests**.
- **Risk of long-term health effects are related to both the dose received and the rate/duration of delivery**. Extent of exposure, route of exposure, type of radiation, total absorbed dose all play a role.
- Radiation **can affect the body in a number of ways**, and the adverse effects of exposure may not be apparent for many years.
- **Effects can be mild**, **more severe.**
- **Children may be at higher risk** than adults.

Human Health Effects (slide 21)



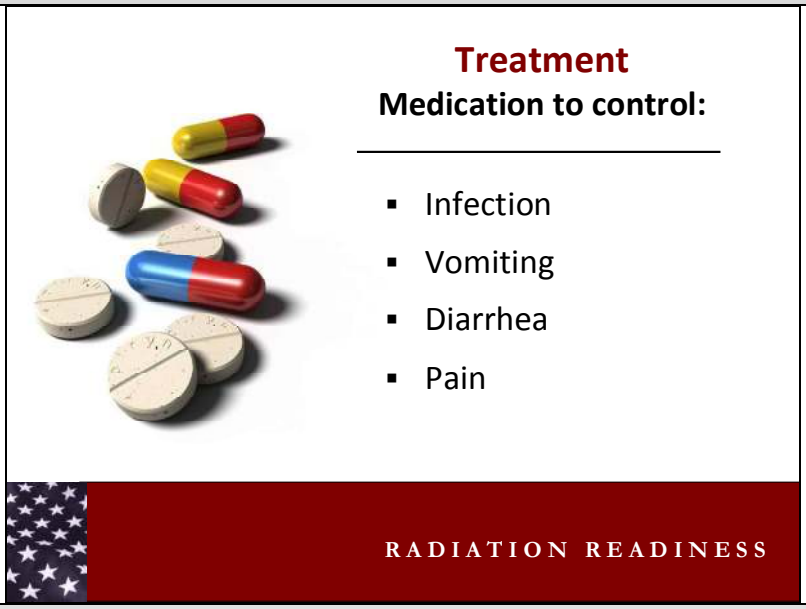
Purpose: Health effects of radiation exposure and contamination.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

- Radiation **can affect the body in a number of ways**, and the adverse effects of exposure may not be apparent for many years. **Effects can be mild**, like a reddening of the skin, or **more severe** like Acute Radiation Syndrome (ARS), skin injury, eye damage, increased long-term risk of cancer, cataract formation, or infertility.
- **Unborn fetuses are particularly susceptible to radiation injury**.

Treatment (slide 22)



Purpose: There ARE treatment options. This is a brief overview of the medical interventions available.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

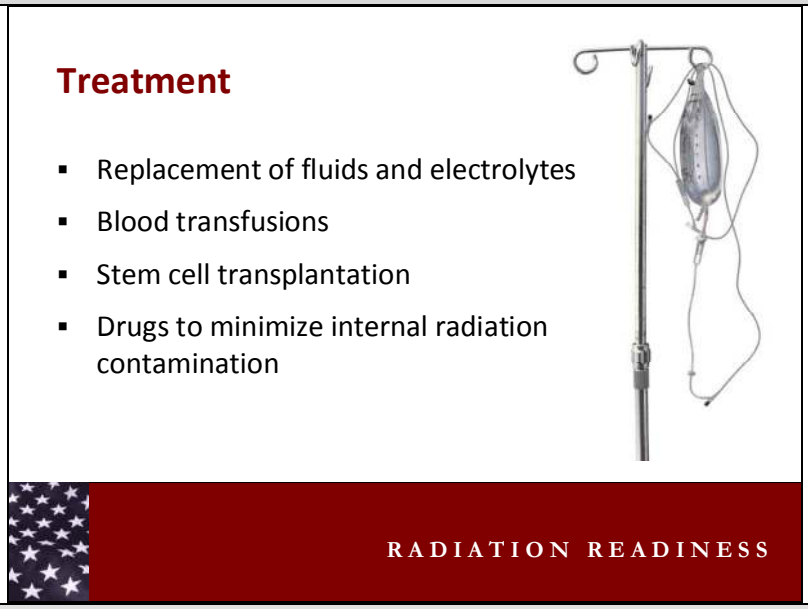
Script:

Treatment

Treatment will depend on the dose and length of exposure and the severity of injuries sustained. This list describes some of the ways you may be treated following radiation exposure:

- Medication to control infection
- Medication to control vomiting and diarrhea
- Pain management

Treatment (slide 23)



Purpose: There ARE treatment options. This is a brief overview of the medical interventions available.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

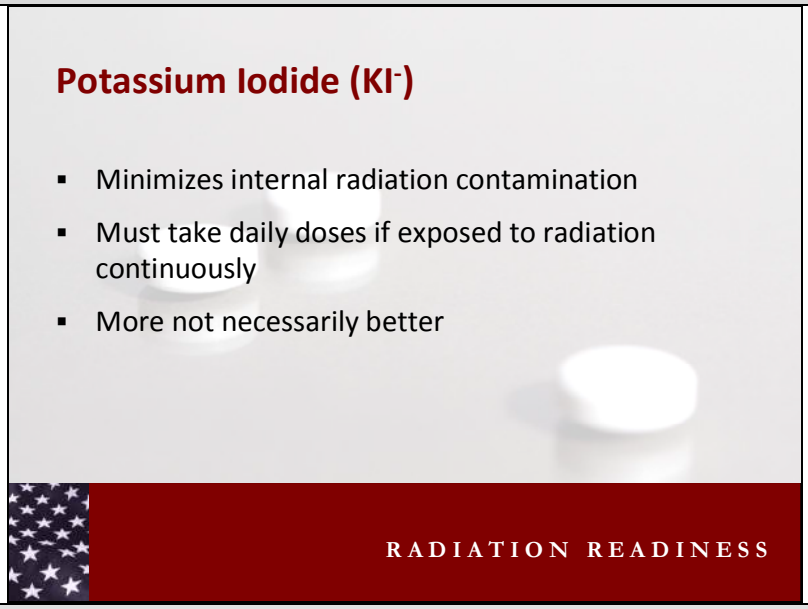
Script:

Treatment

Treatment will depend on the dose and length of exposure and the severity of injuries sustained. This list describes some of the ways you may be treated following radiation exposure:

- Replacement of fluids and electrolytes
- Blood transfusions
- Stem cell transplantation
- Drugs to minimize internal radiation contamination *(Note: we will discuss KI on next slide)*

Potassium Iodide (KI^-) (slide 24)



Purpose: Many people may have heard of a drug called Potassium Iodide, or KI^-. This page will tell you how it works, when you need it, and where to find it.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

What is Potassium Iodide, also known as "KI^-"?

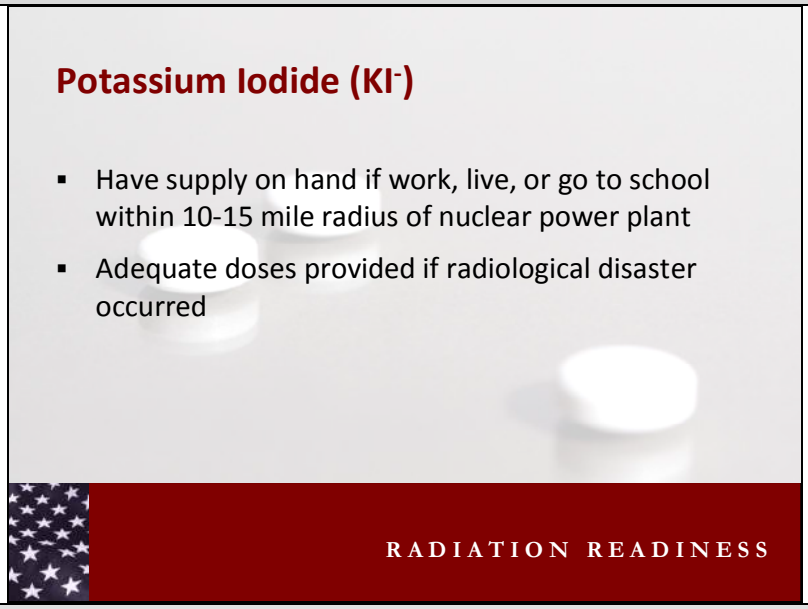
- Potassium iodide (KI^-) was approved by the Food and Drug Administration (FDA) in 1982 for use in radiologic disasters or emergencies. It **works to minimize your internal radiation contamination levels.** With timely treatment, you can greatly prevent the chance of developing thyroid cancer following a radiation disaster.
- **How it works:**
  - When a power plant releases radiation, it lets off large amounts of Iodine 131 (^{131}I or radioiodine). This affects your thyroid, a gland in your body, and can lead to thyroid cancer.**
  - Your thyroid can only absorb a certain amount of iodine. After that, you excrete the extra amount. The idea is to ingest stable iodine that is safe for your thyroid from the KI^- so that the unstable Iodine from the radiation does not get absorbed.

- KI does NOT protect against other forms of radionucleotides, such as those that may be in a “dirty bomb”.

- The protective effect of KI^- lasts about 24 hours, so it is important that you either repeat doses daily or remove yourself from exposure to the radiation.
- Because your body can only absorb a certain amount of KI^-, there is no point in taking more than what is prescribed to you. It DOES NOT increase the protective effect.

**thyroid cancer is generally treatable. With proper treatment, the five-year survival rate of thyroid cancer is 96%, and 92% after 30 years.

Potassium Iodide (KI^-) (slide 25)



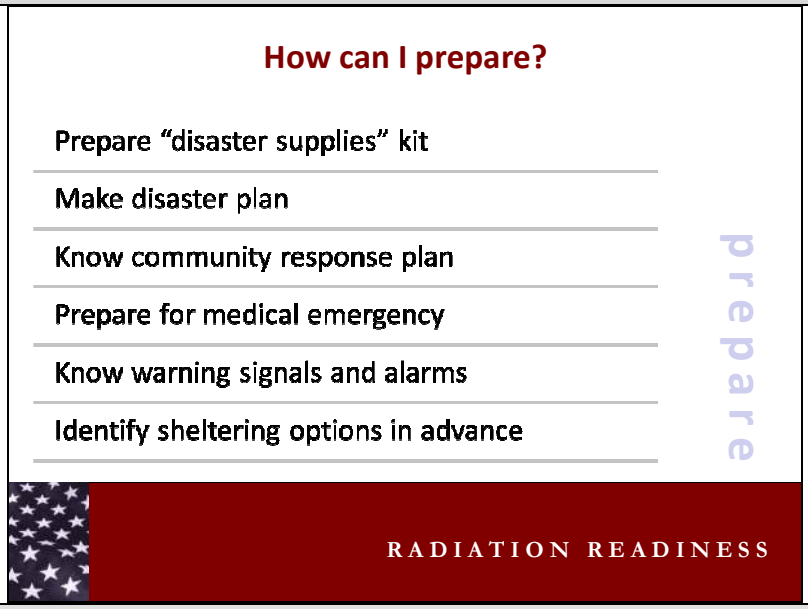
Purpose: Many people may have heard of a drug called Potassium Iodide, or KI^-. This page will tell you how it works, when you need it, and where to find it.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

- Have KI^- on hand for every member of your household if you live, work, or go to school within 10 miles of a nuclear power plant
  - Some communities near power plants provide KI^- to you free-of-charge, so check with your local or state health department or your doctor
- Adequate dosages of KI^- will be made available to you if a radiologic disaster were to occur in your area
  - Stay informed and listen for information on points of distribution of KI^- (Potassium Iodide)

How Can I Prepare (slide 26)



Purpose: This is a general overview of preparedness. The take-home message is that people who are prepared for common or anticipated disasters will be more prepared for unexpected events, such as a radiation disaster. These are some things you can do to be more prepared.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

How Can I Prepare?

Whether or not you live near a nuclear power plant, there are some things you can do now to be more prepared and aware in case something were to happen on American soil.

Being prepared for more common disasters will help you prepare for a radiation disaster.

- In any disaster you may need to evacuate in a moment's notice. You probably won't have time to shop or search for the things you need. Prepare a "go" kit with important documents, prescription medications, change of clothes, extra money, etc.
- Develop a family plan so that everyone in your household knows what to do and where to meet in case you have to evacuate. Choose a friend or relative who lives out of the area for household members to call to say they are ok.
- Also, become familiar with your community's response plan in case of a radiation

emergency. This will include evacuation routes.

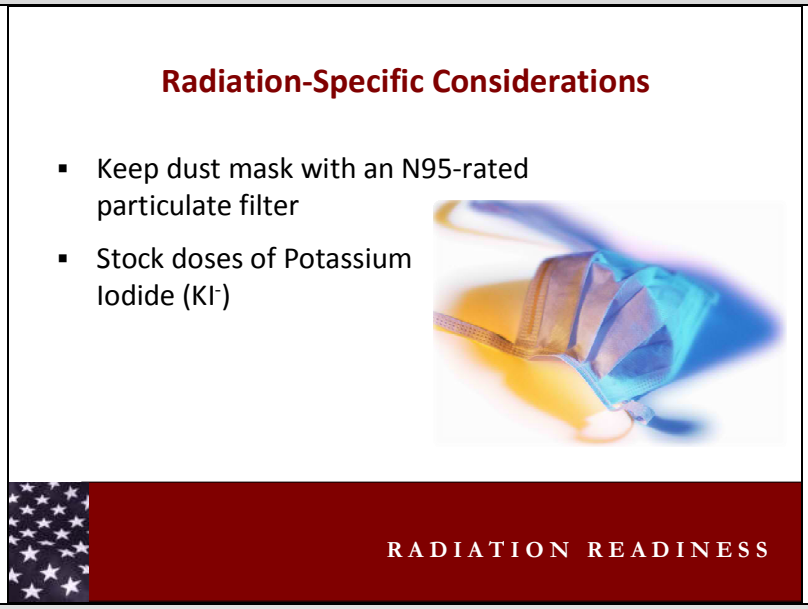
- Finally, be sure to also plan for a medical emergency. You should always wear an emergency ID bracelet or carry an emergency information card – this could save your life if you are unable to speak after a serious injury or illness. This medical identification is particularly important for people with chronic conditions such as diabetes, epilepsy, glaucoma, or hemophilia, or those who may have a serious allergic reaction to certain medications (such as penicillin) or to insect stings. Talk with your doctor about the need to wear an emergency ID bracelet or necklace or carry an emergency information card, and discuss what information should be included to inform others about your health conditions and needs.

Know warning signals and alarms used in your community. Make sure you know what the signals are, what they mean, how they will be used, and what you should do if you hear them.

Identify sheltering options in advance. Find out from officials if any public buildings in your community have been designated as radiation fallout shelters. If none have been designated, make your own list of potential shelters near your home, workplace, and school. These places would include **basements or the windowless center area of middle floors in high-rise buildings**, **as well as subways and tunnels**.

Plan for special health and medical needs. If you have a disability or special need, you may have to take additional steps to protect yourself and your household in an emergency. If you know of friends or neighbors with special needs, help them with these extra precautions.

Radiation-Specific Considerations (slide 27)



Purpose: Not all disasters are the same. Radiation events have different effects on the population, so there are extra things you can do to prepare for them.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

Radiation-specific Considerations

Radiation events are not quite the same as other disasters, and there are a few things you can do and learn in order to be prepared for this unique type of event.

- Dust masks with N95-rated particulate filters are meant to help block small-particle droplets that may contain radioactivity from reaching your mouth and nose. Especially if you live near a nuclear power plant, you should have a mask available for each person in your home.
- As discussed previously, Potassium Iodide (KI^-) can help prevent thyroid cancer. Be sure to keep several days doses for everyone in your home.

Radiation-Specific Considerations (slide 28)

Purpose: Not all disasters are the same. Radiation events have different effects on the population, so there are extra things you can do to prepare for them.

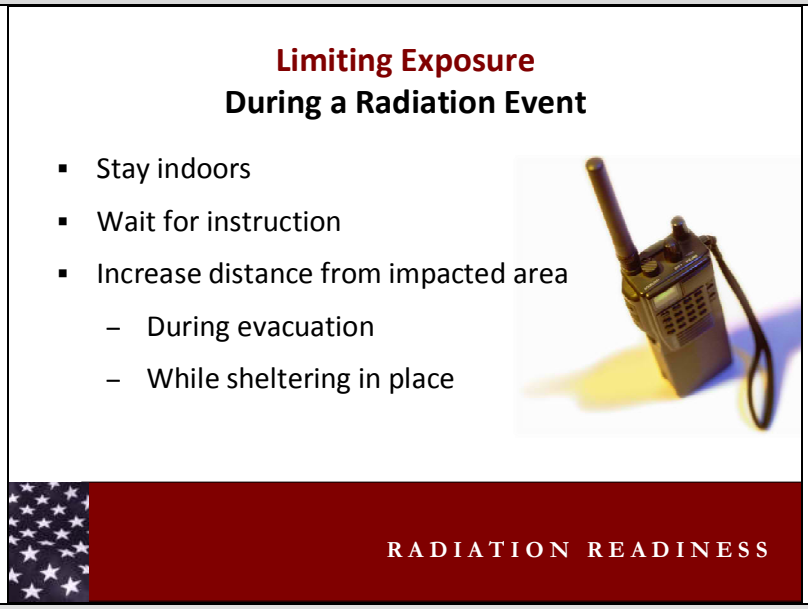
Special instructions: This slide has instructor-controlled animation. Please "click" to display an additional image.

Script:

Radiation-specific Considerations

- The safest places to shelter down are in basements or the windowless center area of middle floors in high-rise buildings, as well as subways and tunnels.
    - Look for yellow and black fallout shelter signs on public buildings (note: with the end of the Cold War, many of the signs have been removed from the buildings previously designated). Give household members clear instructions about where fallout shelters are located and what actions to take in case of attack.

Limiting Radiation Exposure (slide 29)



Purpose: This slide discusses how one can protect his/herself from radiation exposure.

Script:

Limiting Radiation Exposure

Radioactive fallout is like dust or sand. If the material falls on your skin, it may cause burns; if it falls in the food or water supplies or becomes re-suspended into the air you breathe, it might be harmful if ingested or inhaled. Once contaminated, you remain contaminated and receive radiation exposure until the source of the radiation is removed. **Precautions should be taken to limit the spread of material** to protect yourself and others from becoming contaminated.

Your first instinct may be to evacuate the area, but a**lways wait for more information and instruction before evacuating.** Decisions with the biggest lifesaving effect will likely be those made in the first minutes or hours. Sheltered individuals should stay put for at least 24 hours unless authorities provide different instructions.

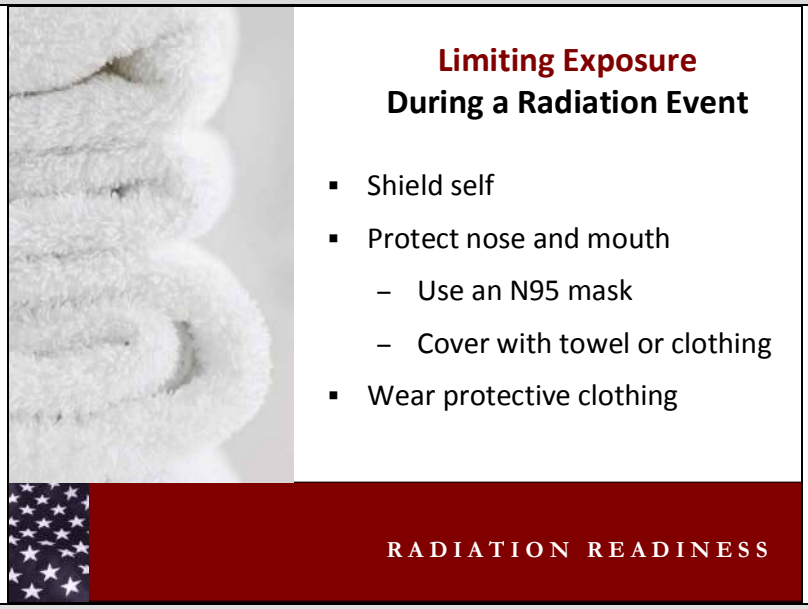
Wait for basic information regarding the presence and dose of radiation is gathered. It may be safer for you to stay indoors than to evacuate. Stay tuned to Emergency Alert System radio stations, as well as local commercial media. Local officials will be providing specific information and instructions. Listen for the specific warnings. Not all incidents result in the release of radiation. The incident could be contained and pose no danger to the public.

Increase distance from the impacted area; this can be done whether you are instructed to evacuate the area or if you are instructed to stay indoors where you are. Increasing the

distance decreases the intensity of immediate health effects from the blast, heat, and emitted radiations. The farther a person is from a source of radiation, the lower the radiation dose.

- **If ordered to evacuate,** get as far out of the area as is reasonably possible for you.
- **If ordered to shelter in place,** an underground area such as a home or office building basement offers more protection than the first floor of a building. A floor near the middle of a high-rise may be better, depending on what is nearby at that level on which significant fallout particles would collect. Flat roofs collect fallout particles so the top floor is not a good choice, nor is a floor adjacent to a neighboring flat roof.

Limiting Radiation Exposure (slide 30)



Purpose: This slide discusses how one can protect his/herself from radiation exposure.

Script:

Limiting Radiation Exposure

Shield yourself. Depending on the type of radioactivity, effective shielding could be as thin as a piece of paper (for alpha radiation) or as thick as a lead-lined wall (for gamma radiation). The more shielding between an individual and the radiation source, the less the radiation intensity.

You do not want to inhale radioactive materials. Use an N95 mask or cover the nose and mouth with a towel or clothing.

Wear protective clothing. It is recommended that exposed skin be covered but only if it does not impede evacuation or taking shelter. In this context, any clothing that covers exposed skin and the head is considered protective clothing. Thus, most fully dressed individuals would only need a hat or hood. Protective clothing has the additional advantage of facilitating decontamination by providing a layer that can be quickly removed to dispose of any fallout material that may have accumulated on a person during evacuation or prior to sheltering.

Time. The shorter the time in a radiation field, the less the radiation exposure you will receive. Most radioactive materials lose their strength fairly quickly.

If You May Be Contaminated (slide 31)

Purpose: A discussion of what to do if you think you may have radioactive particles on your clothes and/or skin.

Script:

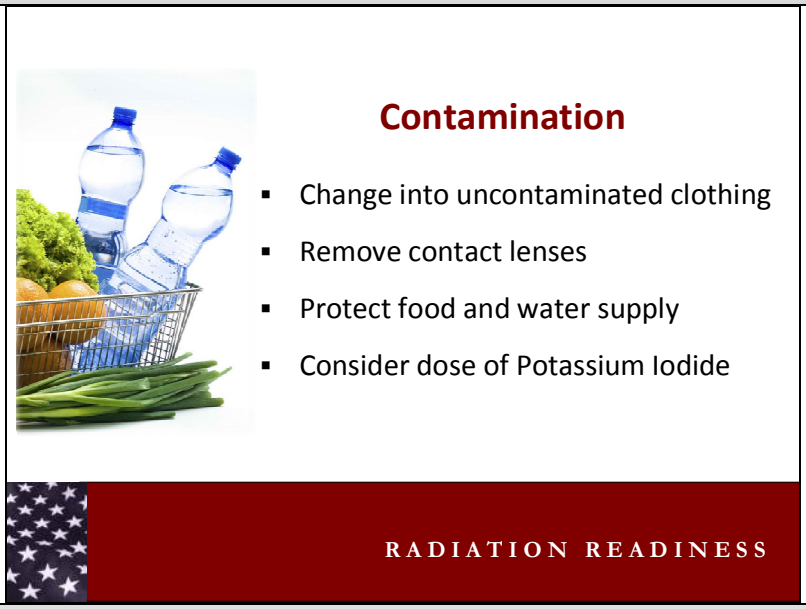
If You May Be Contaminated

What if you were outside during the fallout? What if you think you have radioactive materials on you? Hope is not lost. Remember that **your first priority is to get out of harm's way.** If you are outside, get indoors as quickly as possible. **BUT, take measures to become decontaminated before you go inside!**

Remove outer clothing before entering a building. If you were outside in the fallout, before you enter a building you should remove your outer clothing and leave it outside. If it is fast and convenient to do so, seal your clothes in a bag or container. You **should not shake off your clothes inside the house or shelter** or you may contaminate those areas as well. Removing contaminated clothing can eliminate up to 90% of radioactive contamination.

Wash all skin and hair that was exposed. When you get inside, immediately wash. Be thorough and use soap and water. You should wash all areas of your skin and hair that was exposed to the fallout. Bend forward in the shower to allow water to run off the face and do not let it into the mouth, nose, or eyes. Gently blow the nose and clean out eyes and ears once you've thoroughly rinsed. Wash out the tub or shower when done. Do not scrub hard enough to cause abrasions. Open wounds only allow contamination into the body.

If You May Be Contaminated (slide 32)



Purpose: A discussion of what to do if you think you may have radioactive particles on your clothes and/or skin.

Script:

If You May Be Contaminated

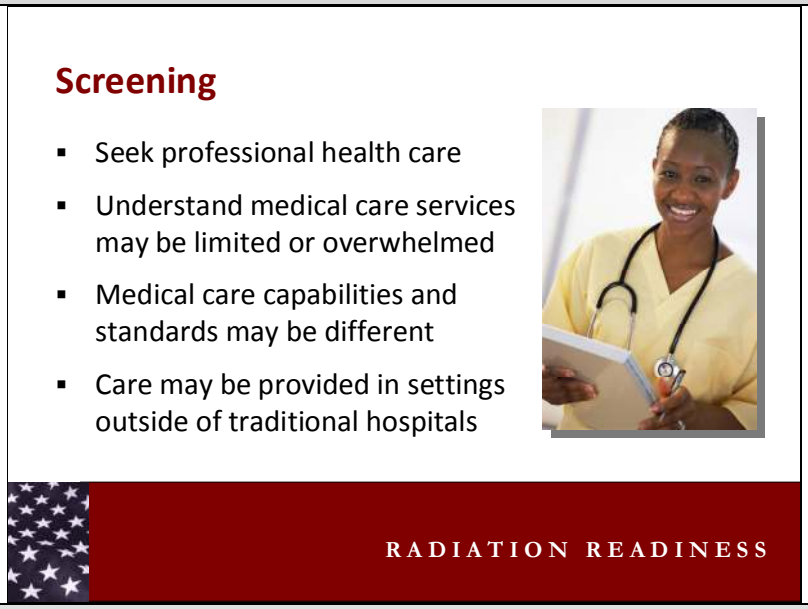
Change into uncontaminated clothing. Make sure whatever you put on was not exposed to the fallout.

Remove contact lenses. Small radioactive particles can collect on lenses, continuing your exposure.

Food and water supplies should be protected by some covering, such as in a shelter or stored in plastic containers or bags. If these outer containers become contaminated, the outer container should first be washed and the items inside then carefully removed taking great care not to transfer contamination from the outer container to the items inside. Use gloves or other hand coverings when handling potentially contaminated items.

Consider dose of Potassium Iodide

Getting Screened (slide 33)



Purpose: If you think you may have been exposed to radiation, always seek medical advice. If you think you are contaminated, be sure to self-decontaminate first, so that you do not spread the radioactive particles. This slide discusses the difference between screening for radiation externally and internally.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

Getting Screened

After taking precautions for self-decontamination, and once you've been told it is safe to leave your home or shelter, you should seek medical attention if you think you've been contaminated.

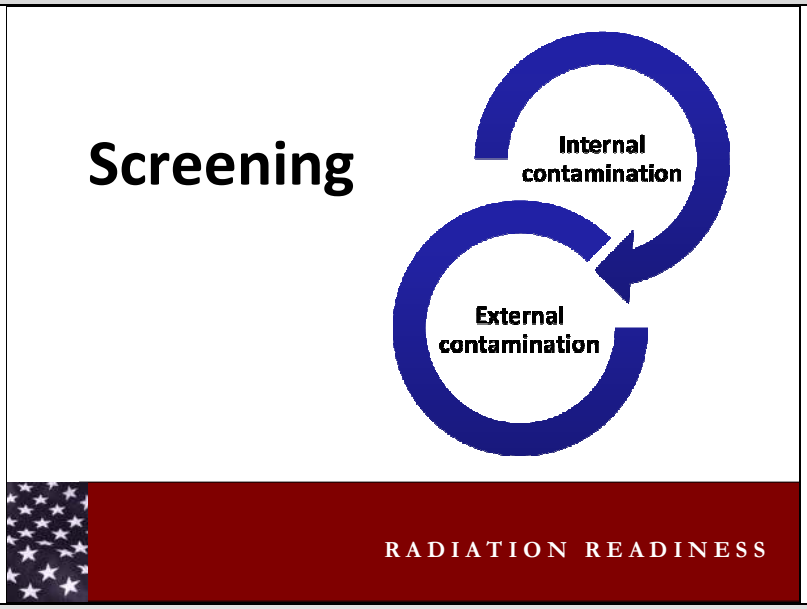
Seek professional health care and understand that medical care services may be limited or overwhelmed. Initially, when resources are scarce, assets will be committed to maximizing lives saved and relieving pain and suffering.

In a serious disaster, **medical care may be different than what is typically encountered in non-disaster healthcare settings**. **The standard of medical care that is expected by most citizens may very well have to be altered to treat large numbers of casualties** and provide the greatest good for the largest number of people. Healthcare needs may overwhelm immediately available resources, and therefore, **not all injured and ill people may receive**

full medical care.

Efforts will be devoted to providing medical care for many less critically injured or ill people in **settings outside of traditional hospitals**. These settings, called alternate care facilities, would be staffed by health professionals with community volunteer support. Alternate care facilities would be established in schools and other locations that have adequate sanitary and other support capabilities.

Getting Screened (slide 34)



Purpose: If you think you may have been exposed to radiation, always seek medical advice. If you think you are contaminated, be sure to self-decontaminate first, so that you do not spread the radioactive particles. This slide discusses the difference between screening for radiation externally and internally.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

Screening

External Contamination Screening. In a radiation emergency, large numbers of people may need to be screened for external contamination using equipment such as hand-held Geiger Mueller detectors. If the radioactive material remains on skin or clothing, it could be released to the air and inhaled, or be incidentally ingested, resulting in internal contamination. External contamination on individuals can also be spread, resulting in cross-contamination; that is, spreading radioactive materials to other places where they should not be. Cross contamination is a public health concern, although it is secondary to immediate concerns for people's health and safety.

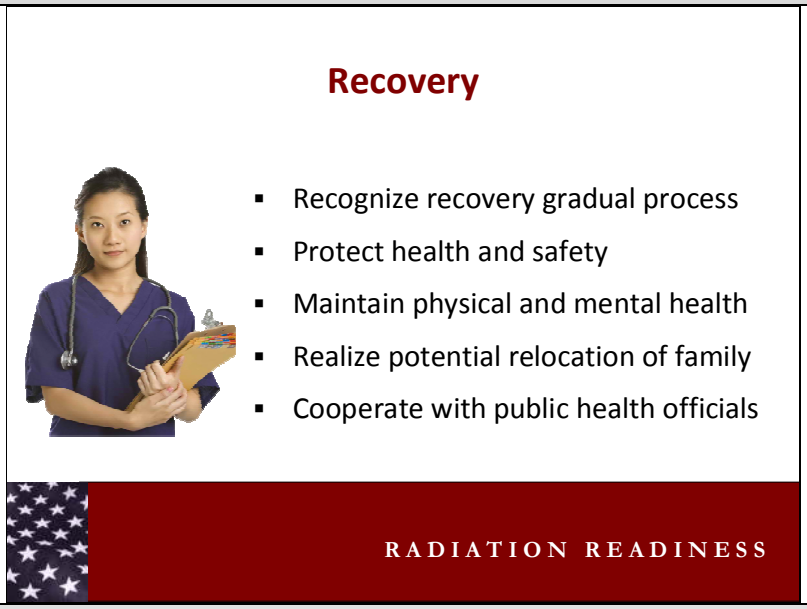
Internal Contamination Screening. As mentioned previously, internal contamination is when radioactive material enters the body through ingestion or inhalation. Some types of radioactive materials stay in the body and are deposited in different body organs. If the radiation dose is significant, the person may have an increased risk of developing cancer. Over time, the

radioactive materials are eliminated from the body in blood, sweat, urine, and feces. This could take days, months, or years, depending on the type of radioactive material.

Having accurate information about the levels of internal contamination is important in deciding whether medical treatment is warranted. Having internal contamination does not necessarily mean the person is going to experience health problems. Every day, thousands of people in the United States receive diagnostic tests that involve administering traces of short-lived internal radioactive materials on an outpatient basis, and they are released to go home after their procedures.

The methods and equipment needed for assessing internal contamination are more advanced than the equipment required to conduct external monitoring. Collectively, internal contamination monitoring procedures are referred to as "bioassays," and in general these bioassays require off-site analysis (by a clinically certified commercial laboratory or hospital). People should be advised that it may be some time before results are available.

Recovering from a Radiation Disaster (slide 35)



Purpose: Concepts for recovering after a radiation event.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script: Recovering from a Radiation Disaster

Recovery is a gradual process. Recovering from a radiation disaster, or any disaster for that matter, is a gradual process. Remember that you are not alone and that there are people and resources out there to help you get back to where you were. Don't be afraid or ashamed to ask for help.

Protect your health and safety. Find out how to care for your safety after a disaster. Also consider health and safety issues affecting family members and friends. Be aware of new safety issues created by the incident. Watch for damaged roads, contaminated buildings, contaminated water, gas leaks, broken glass, damaged electrical wiring, and slippery floors. Inform local authorities about health and safety issues, including chemical spills, downed power lines, washed out roads, smoldering insulation, and dead animals.

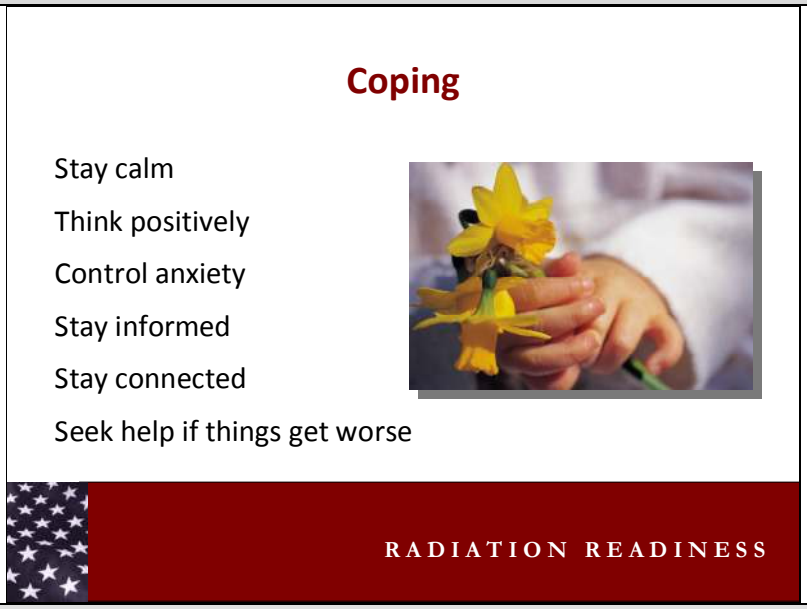
Maintain your personal health. Be aware of exhaustion. Don't try to do too much at once. Set priorities and pace yourself. Get enough rest. Drink plenty of clean water. Eat well. Wash your hands thoroughly with soap and clean water often. Seek medical treatment for any unusual symptoms, such as nausea, that may be related to radiation exposure.

Potential Relocation of your Family. Relocate outside the contaminated zone, only if

instructed to do so by public officials. Although contamination levels from a radiologic weapon are likely to be quite low, long-term exposure may be high enough in some areas that authorities will ask individuals to leave their homes or businesses for some period of time. Relocation does not need to be done quickly because it is the exposure over many years that is the concern; the relocation could happen over weeks or months. Individuals may be allowed to return within a few months if the area is to be decontaminated, but it may also be many years before individuals will be allowed to return. Individuals will have to rely on authorities for information about whether relocation is called for and how long it is likely to last.

Cooperate with public health officials. In a radiologic or nuclear disaster, it is necessary to perform long-term monitoring of exposed individuals and populations. There is a risk of cancer and delayed health effects (cataracts), which can occur even at doses insufficient to cause moderate or severe symptoms in the first days or weeks post exposure. People who have undergone external or internal radiation exposure screening should have a permanent record of the screening results and the survey instrument recording. State and local agencies will consider establishing a registry system as early as possible following a radiation emergency. This would be used to contact people who require short-term medical follow-up as well as long-term monitoring. **Cooperate with the health officials so they are better able to help you and the rest of the population.**

Coping with Radiation Disasters (slide 36)



Purpose: Concepts for recovering after *any* disaster.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script: Coping with Radiation Disasters

Experiencing a disaster can be one of the most difficult events a person can endure, and it can have both short- and long-term effects. Everyone who sees or experiences a disaster is affected by it in some way. It is normal to feel anxious about your own safety and that of your family and close friends.

Think positive. Think about your abilities and capability to handle the situation. A positive outlook can increase your ability to perform under stressful situations and increase your resistance to negative consequences.

Control anxiety. There are many ways in which people control their anxiety. Learning relaxation techniques such as deep breathing and progressive muscle relaxation can help control the negative physical and emotional response to anxiety. Do not use drugs or alcohol to help you relax as they can have a rebound effect on anxiety, making your anxiety worse once the relaxation effect has worn off. They may also impair your judgment at a critical time when you need it most.

Stay informed. After a disaster it is important to obtain accurate information about what happened and what your community needs you to do to help or be safe. Newspapers, radio,

and television are ways to get accurate local information. Do not listen to rumors as they can be misleading. Having direction after an event will likely lessen your emotional response to the event. Again, getting accurate information from reliable sources will help you know what actions and direction to take.

Stay connected. People bounce back from trauma when they feel connected and part of a team. Reconnect with loved ones, neighbors, co-workers, and others, such as through your place of worship. Attend convocations and memorial services to heal as a community.

Seek help if things get worse. Remember that feelings of anxiety and depression following a traumatic event are natural. If these symptoms continue for several weeks after the event has passed, or if these feelings begin to overwhelm you to the extent that you cannot continue your daily activities, you should consider talking to your doctor or other mental health professional. Symptoms that may indicate a need for a medical evaluation include but are not limited to:

- Changes in eating and sleeping habits
- Physical problems such as stomach upset, back and neck aches, and headaches
- Inability to focus or concentrate on routine tasks or work
- Lack of interest in previously enjoyable activities
- Extreme fear of leaving your home
- Irritability and significant mood swings
- Having flashbacks or nightmares or playing the events over and over in your mind
- Taking extreme measures to avoid the memories through the use of alcohol or other drugs
- Having extreme anxiety such as panic attacks
- Feeling hopeless, helpless, or that life is not worth living

Case Study – Chernobyl Disaster (slide 37)

Purpose: The Chernobyl disaster is introduced as a case study so that participants may see what real-life concerns and health effects they may encounter in a radiation disaster.

Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

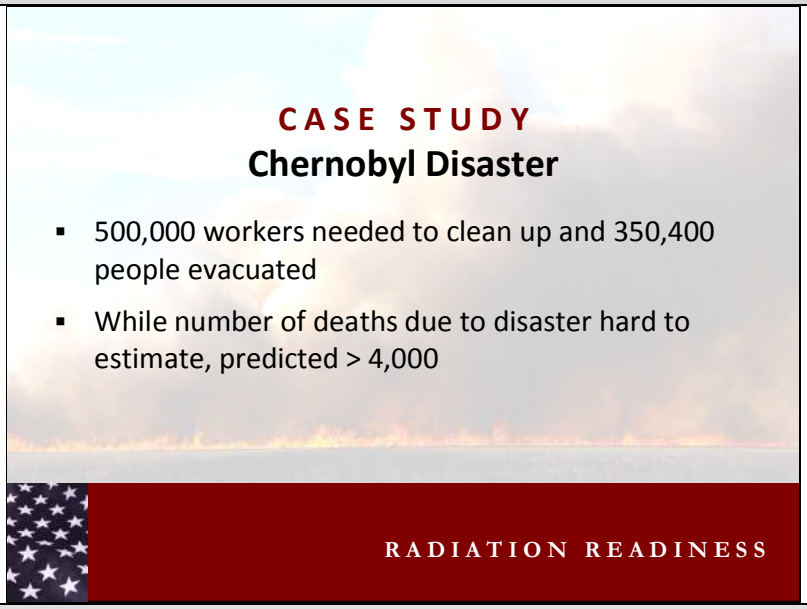
Script:

Case Study – Chernobyl Disaster

Now that you know a great deal more about radiologic disasters, let's look at a specific example of one and the types of things that occurred as a result.

- The Chernobyl disaster occurred at the Chernobyl Nuclear Power Plant in Ukrainian SSR on April 26, 1986.
- It is considered the worst nuclear power plant accident in history, and is one of only two classified as a level 7 event on the International Nuclear Event Scale (the other being the Fukushima Daiichi nuclear disaster).
- The plant experienced a power surge, which caused multiple explosions. The explosions resulted in a fire that sent a plume of highly radioactive smoke fallout into the atmosphere and over an extensive geographical area, including the city of Pripyat

Case Study – Chernobyl Disaster (slide 38)



Purpose: The Chernobyl disaster is introduced as a case study so that participants may see what real-life concerns and health effects they may encounter in a radiation disaster.

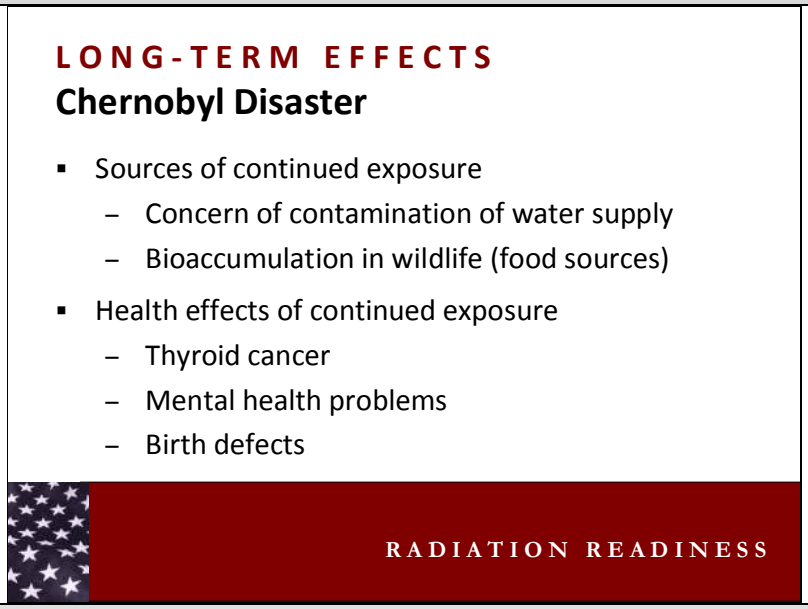
Special instructions: This slide has automatic animation. You do not need to "click" until you would like to advance to the next slide.

Script:

Case Study – Chernobyl Disaster

- The plume drifted over large parts of the western Soviet Union and Europe. From 1986 to 2000, 350,400 people were evacuated and resettled from the most severely contaminated areas of Belarus, Russia, and Ukraine. Approximately 100,000 km² of land was contaminated with fallout, the worst hit regions being in Belarus, Ukraine and Russia.
- 500,000 workers were needed to clean up
- From 1986 to 2000 over 350, 400 people were evacuated from the region
- It is difficult to estimate the number of deaths that can be directly attributed to the explosion and fall-out, but the United Nations Scientific Committee of the Effects of Atomic Radiation (UNSCEAR) has released a report estimating over 4,000. Immediate health effects included injuries from the blast and Acute Radiation Sickness. ("IAEA Report". *In Focus: Chernobyl*. Archived from the original on 17 December 2007.)

Chernobyl Disaster – Long Term Effects (slide 39)



Purpose: The Chernobyl disaster case study continued.

Script:

Case Study – Chernobyl Disaster

In addition to the health effects that can be directly attributed to the explosion itself, there were many long-term health effects. We know that radioactive particles lose their energy over time, but we also know that they can stick around for years, meaning that people can continue to be exposed or internally contaminated for years.

UNSCEAR has conducted 20 years of detailed scientific research on the effects of the Chernobyl accident and found the following:

- Because the power plant was so close to the Pripyat River, there was major concern regarding contamination of the public water supply. However, radioactivity in rivers and reservoirs in the weeks and months following the event were generally below guideline limits for safe drinking water.
- Bio-accumulation of radioactivity in fish resulted in concentrations (both in western Europe and in the former Soviet Union) that in many cases were significantly above guideline maximum levels for consumption for years following the event.
    - Of the 440,350 wild boar killed in the 2010 hunting season in Germany, over

1,000 were found to be contaminated with levels of radiation above the permitted limit of 600 bequerels, due to residual radioactivity from Chernobyl.

- Norwegian Agricultural Authority reported that in 2009 a total of 18,000 livestock in Norway needed to be given uncontaminated feed for a period of time before slaughter in order to ensure that their meat was safe for human consumption.

- In the years following the disaster, there was a marked increase in the prevalence of thyroid cancer, mental health effects, and birth defects,

Questions? (slide 40)

Purpose: Provide participants the opportunity for final questions.
Special instructions: Ask for any final questions, answer them and thank the participants for coming.
Script: None

Exercise: ***Thank you*** **(slide 41)**

THANK YOU

42

RADIATION READINESS

Purpose: Thank participants!