EPA Superfund Radiation Risk Assessment and How You can Help: An Overview

Video Program Script

2/16/05

The program begins with shots of Superfund radiation sites while we hear various voices from community members.

Voices of community people: There's a Superfund site with radioactive waste near my home. Am I exposed to radiation from this site?

Will the radioactive contaminants at the Superfund Site make me sick?”

Is the water that comes out of my tap safe to drink?

Are the playgrounds clean enough to be safe for my children?"

What about the food I eat? Is it free of radiation ?

Shots of EPA contractors collecting samples in community and working at

RAD site are shown as the narrator begins.

Narrator: In communities across the country people are asking important questions about their health and the environment. They want to know what radiation risks they face. Assessing radiation risk is an important part of the Environmental Protection Agency's Superfund process.

Shots of Superfund / community meetings are shown as the narrator continues.

Narrator: We're listening. We've heard that you want to become more involved in the radiation risk assessment process. In fact, we want and need your involvement. Your knowledge can help us prepare the most thorough radiation risk assessment. Together we can evaluate the radiation risk of the Superfund Site in your community.

Barry Breen appears on camera and makes a statement.

"Hello! My name is Barry Breen. I'm one of the people in charge of EPA's radiation and toxic waste cleanup program, created to make communities safer places to live. In this video we will describe the

Superfund Radiation Risk Assessment process — what it is, how it works and most importantly, how you can be involved.

I hope that this video will further your discussions with EPA. I know that at the conclusion of this video you will have a better understanding of EPA's Superfund Radiation Risk Assessment process and how you can be involved in that process."

A full screen title reading, "Superfund Radiation Risk Assessment And How You Can Help: An Overview," appears. Following the title and animated graphic highlighting the 4 steps of the Radiation Risk Assessment process appears.

Narrator: Radiation risk assessment has four parts. The first is **Data Collection and Evaluation,** during which we gather information about radioactive chemical elements, also known as radionuclides, at the site. A radionuclide is an unstable atom that emits radiation in the form of particles or energy in an effort to become more stable. This process is known as radioactive decay.

This information is used in the next parts: **Exposure Assessment**, or how people could be exposed to the radionuclides at the site and **Toxicity Assessment**, determining the harmful effects of the

radionuclides.

All of this information is combined in the last part: **Risk Characterization**. In risk characterization we describe the risks to people from radionuclides that contaminate the site.

Shots of site work are shown as the narrator continues.

Narrator: The risk characterization is then used to make decisions about how to best clean up the site.

An on camera sound bite from an EPA radiation risk assessor (Colleen Petullo) is shown.

Colleen Petullo: Community involvement is tremendously important in the EPA risk assessment process. There are members of the community that are very knowledgeable about the area, the site and what had gone on maybe at the facility. There are members of the community that may have worked at the facility, they know what has gone on at the facility, they know actually what's going on in the community that could have affected the facility or the facility affecting the community. So by bringing the

community into the process, number one, we gain local information. We may gain institutional knowledge or institutional memory for what happened at the site or offsite or near the site that could impact the risks associated to the general public that are near this site.

The 4 step radiation risk assessment animation appears again. The Data Collection and Evaluation portion of the graphic moves full screen as the narrator continues.

Narrator: During Data Collection and Evaluation, EPA has to find out what happened at the site and what radioactive contaminants may be left.

Shots of site sampling and shots of old photographs and maps are shown as the narrator continues.

Narrator: We begin by collecting information. For instance, we'll look at old photographs, maps and documents of the site. We use special equipment to help us find areas that may be contaminated. For large areas, we may use equipment mounted on a van or

helicopter. For smaller areas we will walk over the site with handheld instruments. Such instruments indicate where radioactive contamination may exist. In and around these areas we collect samples of things like soil, air, water, fish and garden vegetables. Anything that might contain radioactive contaminants could be surveyed. It's important for us to collect samples in the right places so that we don't miss any radionuclides. Because many of the same radionuclides that could contaminate a Superfund site also occur naturally, we may choose to take samples in uncontaminated areas so that the local background concentrations can be determined. Understanding background helps us to determine which radionuclides will require the most focus in the investigation.

Shots of EPA personnel talking to community members are shown as the narrator continues.

Narrator: We also talk to you, because people who live near a Superfund site with radioactive contamination often know things we couldn't learn anywhere else.

Shots from a community where a radiation Superfund site is located are shown as the narrator continues.

Narrator: For instance, at a number of thorium gas mantle sites around the country, affected communities helped identifly potentially contaminated areas. The mantles were used in gas powered lamps in homes before the discovery of the electric light. During processing, the mantles were dipped in Thorium Nitrate, which is radioactive substance.

At a Mantle manufacturing sites in Chicago area, members of the community helped in anumber of ways. They supplied old maps and photos, as well as extensive local knowledge.

On camera interview with USEPA OSC Verenta Simon.

Verenta Simon: The community helped out in showing where there were possible places that could have been impacted and that possibly would have been overlooked, just because we're not that familiar with the area. There are many places that are undeveloped and unless you know to go down that particular street, or to look behind that particular area, you're not going to notice it.

Narrator: With leads from the community, EPA researchers could

conduct more detailed investigation at city libraries and sites around the community, which lead to a more thorough risk assessment.

Shots of sampling for radiation and processing samples in lab are shown as the narrator continues.

Narrator: Once we know where to sample, we have to make sure we take the samples properly. We follow strict procedures to make sure that we know exactly where each sample comes from and that the integrity of the sample is maintained from the time it is collected until it is analyzed in the laboratory.

We take these measures because we want data that we are confident gives the most accurate representation of the site. In the radiation risk assessment, we can only use data that have been collected and analyzed according to these procedures

Shots of EPA radiation risk assessor working at a computer with data collected from the site.

Narrator: The result of all the sampling and lab work is a list of

radionuclides found at the Superfund site, their location and their concentrations. Radionuclide concentrations are usually expressed differently from other chemical contaminants. Instead of measuring how much of a chemical is present, radioactivity is presented in units that are related to how fast the radionuclide is decaying. For example chemical soil contamination is presented in milligrams per cubic meter, micrograms per cubic meter, or parts per million. However, radioactive soil contamination is often reported in picocuries per gram. A picocurie is a measurement of radioactive decay.

At this point we don't know if the levels of these radioactive contaminants are harmful. The rest of the risk assessment will be a process of determining which and in what concentrations these radionuclides could be harmful.

The 4 step radiation risk assessment animation appears again. The Exposure Assessment portion of the graphic moves full screen as the narrator continues.

Narrator: The next part is "Exposure Assessment," which evaluates and quantifies the exposure of people near radiation

contamination at the contaminated site.

Shots of "RAD" signs around site along with an animated graphic illustrating how different types of radiation enter the body are shown as the narrator continues . Also: cartoon showing an alpha particle ejected from a nucleus and stopped by a piece of paper; cartoon showing a beta particle ejected from a nucleus and stopped by thin book; cartoon showing a gamma ray emitted by the nucleus and penetrating a brick wall, and a box and line diagram showing the uranium-238 decay chain that animates highlighting the various alpha, beta, and gamma emitting radionuclides in the series.

Narrator: We find out how people can be exposed to the radionuclides at the site, and how much they can be exposed to. This is important because radiation that can't reach you can't hurt you.

Radionuclides can cause harm when they are taken into the body through inhalation, ingestion, absorption, or penetration. Radiation exists in three main types: alpha, beta, and gamma. Alpha emitting radionuclides are of greatest concern when inside the body

because all of their energy is absorbed in a small volume of tissue. Beta particles cause less damage internally, but unlike alpha, they can penetrate the outer layer of skin and cause harm. Some radionuclides can cause harm when the exposure is external to the body because the gamma radiation that is emitted can pass through human tissue and cause internal radiation exposure.

Many radionuclides emit more than one type of radiation, such as alpha, beta and gamma. The decay of alpha and beta radiation is often accompanied by gamma ray emission. At some Superfund sites, the radionuclides we encounter, such as uranium, radium and thorium, may be part of a decay series, when the parent radionuclide decays into successive radionuclides until finally a stable element is finally reached. A radiation risk assessor must evaluate all of the decay products and their radiations that may be present at a site.

An on camera statement from EPA radiation risk assessor, Larry Jensen is shown.

Larry Jensen: process of risk assessment is so very important because it helps us to establish where the risk is and who is at risk

and the degree of risk. So we need to do that assessment to determine is it young children, pregnant women, older people that, the general public, the people we want to focus on.

And then also we need to determine what the pathways are for their risk. Is it from airborne material that blows onto their property or into there area, is it from ground water, surface water, maybe it's just coming in contact with contaminated dirt, something of that sort.

And once we have those things established, then we can begin to do a numerical calculations that help us to establish what the degree of risk is.

Shots from the community and the RAD site are shown as the narrator continues.

Narrator: You can be exposed to radiation at Superfund sites through many daily activities. By working with you, we can learn how people in your area could come into contact with the radionuclides from a superfund site.

Once we know which radionuclides are on the site and where they are, we begin determining how much of the radionuclides people might come into contact with.

We can use standard assumptions for things like the amount of air people breathe or the amount of water they drink. These assumptions are the same when we look at chemical contaminants.

Another sound bite from EPA Risk Assessor Ellery Savage is shown.

Ellery Savage: Standard assumptions are the assumptions that we have developed for consistency's sake to use in the case where we can't develop site specific information about some of the exposure parameters for that site. Wherever possible we try to develop site specific information to tailor the assessment for that site. But if we cannot, in order to keep consistency in our methodology across the country, then we will use standard assumptions on those parameters.

Shots from a community affected by a radiation site are shown as the

narrator continues.

Narrator: In other cases, we have to take into account local differences. We need to investigate how the community interacts with the regional environment. By talking with the community, we can learn about things that are unique to the area. These might be unsusal exposure pathways that aren't readily evident, such as the consumption of wild game, fish, or locally grown foods.

Shots of children and adults in community are shown as the narrator continues.

Narrator: The intake of radionuclides and exposures to external radiation can be different for different groups of people, depending on factors like their daily activities and the length of time they are in contact with the portion or portions of the site with the radioactive materials.

The 4 step radiation risk assessment animation appears again. The Toxicity Assessment portion of the graphic moves full screen as the narrator continues.

Narrator: During the next part of the risk assessment, Toxicity Assessment, we determine how toxic the radionuclides at the site are.

Shots of containers containing radioactive materials and a text graphic reading "Toxicity Assessment, What are the Potential Health Effects? How Much of the Radionuclide Cause these Health Effects?" are shown as the narrator containers.

Narrator: The toxicity of a radionuclide is its potential to cause harm and is related to the type and energy of the radiation it emits. The Toxicity Assessment answers two key questions: what potential health effects or harm can the radionuclide cause and how much of the radionuclide does it take to pose a significant risk to people?

At much higher radiation exposures than would be expected at a Superfund site, harmful effects can be produced in a relatively short time period, such as the radiation sickness seen in atomic bomb survivors. At Superfund sites, we are usually concerned with much lower exposures. Effects we are concerned with in this case are radionuclides potential to cause cancer. All radionuclides can

cause cancer. Uranium is the only radionuclide where we also worry about the non-cancer effects when we cleanup Superfund sites.

Shot illustrating how radiation is harmful in small doses is shown as the narrator continues.

Narrator: Like most other cancer causing agents, radiation is assumed to be harmful even in low doses. The risk of cancer from radiation increases as the exposure increases.

Shot of HEAST, from web site at www.epa.gov/radiation/heast/download.htm] is shown as the narrator continues.

Narrator: To find out about radionuclides' toxicity, we refer to research done on Hiroshima and Nagasaki atomic bomb survivors, medical maladministrations, and uranium miners.

The research shows what harm radionuclides could do to people and how much of the radionuclide it takes to cause harm. The findings of research are reviewed, and toxicity values for different

radionuclides are tabulated for use in radiological risk assessments. These toxicity values are available in EPA references such as the Health Effects Assessment Summary Tables, or HEAST.

The 4 step radiation risk assessment animation appears. The Risk Characterization portion of the graphic moves full screen. The 4 part graphic appears again and then each section is highlighted as the narrator reviews.

Narrator: This brings us to the last part of the Radiation Risk Assessment process, which is called Risk Characterization.

From the data collection and evaluation, we developed a list of radionuclides found at the site. From the exposure assessment we learned who is exposed, how they're exposed and how much of the radioactive contaminants they're exposed to. And from the toxicity assessment we found out how toxic these contaminants are. During the Risk Characterization, we use all of this information to calculate the risk of health effects from the site.

Another sound bite from an EPA Superfund Radiation Policy lead,Stuart Walker) is shown.

Stuart Walker: Health effects of radiation can be described as a dose of radiation expressed in millirem per year or as excess cancer risk. Some regulations that may be used on Superfund sites regulate on the basis of an acceptable dose limit, generally expressed as some millirem per year value.

Cancer risk at Superfund sites is expressed by EPA as a probability or chance that a person exposed to contaminants at the site may develop cancer. For example, 1×10^{-4} risk means that 1 out of ten thousand people exposed to radionuclides at the site have the possibility of getting cancer from that exposure. 1×10^{-6} means that 1 out of one million people might get cancer.

EPA generally considers excess cancer risk in the range of 1 out of ten thousand people to 1 out of one million people, or 10^{-4} to 10^{-6}, as a protective range for both chemical and radioactive contaminants. Most people will have less chance of getting cancer than these numbers indicate because EPA uses assumptions about exposure to contaminants that are designed to ensure that everyone at a site is protected.

Another graphic screen reading ” Radionuclides, Potential concern- Risk? – Concern” appears as the narrator explains.

Narrator: We review the list of radionuclides we found at the site, then use this information we’ve gathered to see which ones pose a potentially significant risk. The ones that don’t are dropped. The ones that do become what we call radionuclides of concern. These are the radionuclides we focus on during the cleanup. This is the same process EPA uses for chemical contaminants.

Shots of Radiation Risk Assessor working at computer along with a close-up of the screen which is the Radionuclide Preliminary Remediation Goal Electronic Calculator at: http://epa-prgs.ornl.gov/radionuclides/] is shown as the narrator continues.

Narrator: During the radiation risk assessment process, we use the best available science. But we know our knowledge is not complete and we take that into consideration.

Another sound bite from EPA radiation Risk assessor Ellery Savage is shown.

Ellery Savage: We know there are uncertainties in the risk assessment process, one of the most basic uncertainties involves the variability and the level of contamination found in one area of the site as opposed to another. Where these uncertainties exist… we are committed to using the most protective of the assumptions to protect all the segments of the folks who are exposed to those contaminants.

Shots of RAD samples being handled in a lab are shown as the narrator continues.

Narrator: The carcinogenic risk, or the radionuclide's ability to cause cancer in humans, has been widely studied and documented. Radiation can induce cancer in nearly any tissue or organ.

A Graphic build reading : "Risk Characterization. What are the Risks? What Radionuclides Pose the Risks? How Could People be Exposed? And What are the Uncertainties?" is shown as the narrator continues.

Narrator: We've now answered the key questions about the site.

What are the risks? What radionuclides pose the risks? How could people be exposed to those radionuclides? And what are the uncertainties?

Shots of Clean up activities at Superfund RAD site are shown as the narrator continues.

Narrator: We can now use this information, as well as information about risks to the environment, to develop a cleanup plan that will make the site safe for both current and future uses, protecting the health of your community.

Barry Breen returns to make a closing statement.

Narrator: "I hope this video has helped you to understand Superfund radiation risk assessment process and how you can be involved. I encourage you to talk to your EPA team. I encourage you to ask questions, and I encourage you to get involved with this important part of the Superfund cleanup process at radioactively contaminated sites. Thank you."

A graphic screen reading "If you would like to learn more about how

Superfund cleans up radioactive contamination, please read the booklet "Common Radionuclides Found at Superfund Sites." http://www.epa.gov/superfund/resources/radiation/nuclides.htm" is shown as the narrator continues.

> **Narrator:** If you would like to learn more about how Superfund cleans up radioactive contamination, please read the booklet "Common Radionuclides Found at Superfund Sites." The website for this booklet is shown on the screen.

A graphic screen reading "If you would like to learn more about risk assessment at radioactively contaminated sites, please take the Internet training course entitled "Radiation Risk Assessment: Updates and Tools." http://www.clu-in.org/conf/itrc/rads/" is shown as the narrator continues.

> **Narrator:** If you would like to learn more about risk assessment at radioactively contaminated sites, please take the Internet training course entitled, "Radiation Risk Assessment: Updates and Tools." This course was developed by EPA and State environmental officials. The website for this training is shown on the screen.

An Additional Graphic screen reading, "For more information please

contact your EPA Regional Office" and thank you credits appear before the program fades to black.