Radiation Basics Made Simple

Segment 7: Environmental Impact of Radioactivity

As we discussed in a previous segment, naturally occurring radioactive materials are a normal part of our environment. So, if there are radiation emergencies or accidents that involve release of radioactive materials into the environment, they can contaminate the environment, they can contaminate the ecosystem, and radioactive materials can enter the food chain.

In order to understand and evaluate the impact of any environmental contamination, it helps to compare the levels of contamination to our normal background radioactivity. I want to show you the test results from a soil sample we had analyzed for radioactivity. This sample of soil contains Uranium 238, Thorium 232, Radium 226, Potassium 40, and Cesium 137. Now, that seems like a pretty contaminated sample, right? Would you like to know where that sample came from? Here it is. The sample came from my back yard. I collected it.

And in fact, if you were to take a sample from your back yard, you're likely to see similar results in that soil. Or if we would take a soil sample anywhere in the United States, or anywhere in the world for that matter, you're going to find the same radionuclides. The results may vary. There can be variation from place to place, but you're going to find the same radioactive material, radionuclides, in your soil sample. And why is that?

Now, remember the Uranium 238, Thorium 232 and potassium are primordial radionuclides. Those radionuclides have been there since the planet was formed, and we're going to find them everywhere. There'll be some natural variation, but we're going to find them everywhere. Radium 226 is a decay product of uranium; that is, when uranium decays to thorium, and that chain, they're going to create a number of species of radioactive materials that are naturally occurring, including Radium 226. And we're going to find it in there and a number of other ones that we just didn't analyze for.

And finally, it's Cesium 137, remember that's left over from atmospheric testing of nuclear weapons from the 1950s and 1960s. And we're going to find it everywhere. There's remnants of that, small amounts that have become part of our environment, and we can find them. So, is our backyard a dangerous place? Obviously not. My kids play there, your kids and grandkids play in your backyard; that's not a dangerous environment because of the radioactivity.

The reason I provide you with this example is to provide context, because it's important to provide such context when we're discussing radiation measurements and realize that it is a normal amount of radioactivity in the environment. So that helps us determine the severity and impact of any environmental contamination, and we can keep that context and frame of reference in mind.

Now there have been some notable radiological incidents in the past that have added contamination to our environment. The worst incident to date was the Chernobyl nuclear power plant meltdown in 1986. The resulting fire spread contamination across many parts of Eastern Europe and elsewhere.

On a smaller scale, the meltdown at the Fukushima Daiichi Nuclear Power Station in 2011 spread contamination across a large part of Northern Japan.

Another notable accident occurred in Goiania, Brazil in 1987 when two people collecting scrap metal found and opened a canister that contained Cesium 137 that came from an abandoned cancer therapy clinic. This incident produced a significant amount of local contamination that needed to be cleaned before people could move back to the area.

When we have radioactive contamination in the environment, it can affect soil, water, and air quality. It can also enter the food chain and affect humans. And here's how. Let's say you have an accident at a nuclear power plant that releases a plume, or a cloud, of radioactivity. Being outside in this plume exposes us to radiation. The plume is also a breathing hazard; when we're outside, we can breathe in the airborne contamination, and that could result in internal contamination.

As time passes, the radioactive particulates in the plume settle in the environment. We still have an external exposure hazard because they're still on the ground. We also have potential for internal contamination. Animals can consume contaminated plants and this contamination can eventually end up in our food supply. Crops could also become contaminated. Surface contamination can also enter waterways and ground water through runoff and affect sources of drinking water for humans and animals.

If we were to have a contamination incident in the United States, there are procedures in place that would go immediately into effect to identify the impacted areas, recommend steps that people can take to protect themselves and their family, and also, if necessary, place restrictions on food products that would come from those areas. The health concerns over contaminated food and water are particularly important if these foods are used continuously in diet for extended periods of time. After a radiation emergency, public health authorities would provide information about what foods are safe to eat.

So how does the environment recover? There are two processes. One is a natural process, radioactive materials decay and go away on their own according to their half-life. So radioactive decay helps reduce the amount of radioactivity in the environment. There's also the dilution and dispersion through natural weathering, but often that's not enough. Often there needs to be an active remediation, and that means active removal of soil, cleaning of other surfaces and objects, and filtering of water resources, and so on.

The environmental outlook depends on the situation. We could have full recovery and reuse in a very short amount of time. Or we might have limited use of the area. For example, we might use the land for recreational but not agriculture. In general, the environment will need a long period of time for full recovery, but recovery is possible.