Fukushima: Radioactive Cancer Causing "Hot Particles" Spread all Over Japan and North America's West Coast

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Transcript

[emphasis added by GR]

Hi, I am Arnie Gundersen from Fairewinds,

I am here today to introduce professional engineer Marco Kaltofen in one of the most important videos Fairewinds Energy Education has ever produced. Three years ago, Fairewinds was one of the first organizations to talk about the "hot particles" that are scattered all over Japan and North America's west coast. Hot particles are dangerous and difficult to detect. In this video Mr. Kaltofen discusses the hottest hot particle he has ever found, and it was discovered more than 300 miles from the Fukushima Daiichi site. If Fairewinds Energy Education was a Japanese website, the State Secrets Law would likely prevent us from issuing this video. I will provide a brief summary at the end of the video.

I'm Marco Kalton. I am a civil engineer and I'm a Ph.D candidate at Worcester Polytechnic Institute. Most of my research looks at radioactive and chemical contaminants and how they wind up in house dust. And the reason for doing that is this is a very important way that the general public is exposed to things like radioactive contaminants.

In looking at indoor environments, they tend to be much more contaminated than the surroundings outside. Houses act like a trap and they tend to collect outdoor contaminants. And they expose people as much as 24 hours a day versus consider how short a time most people spend outdoors. Your exposure is actually much less. One of the nice things about social media is that we can talk to a lot of people and hook up with volunteers and volunteer and scientific organizations. And they were able to send us indoor dust samples, whether it was a vacuum cleaner bag or a sample from a home air filter or something like an appliance filter – think of an air conditioner filter or a heating and ventilation filter that people might have installed in their home. And we actually have developed a very straight-forward method for prepping all of these samples. And that way, we can compare people's exposure from one house to another.

We looked at samples in Northern Japan; we looked at samples in Tokyo; we looked at samples in the United States and Canada. We tried to get a feel for what people's actual exposure was. And that's why we went looking for hot particles. The thing about radiation exposure is, if you look at it from a legal perspective, what you're trying to do is find the average exposure that people get and then try and find some kind of safe level you can measure that against. And if you exceed that average level that you think is safe, then you have to start doing something about it; either institute some type of policy or some kind of cleanup.

The difference with our work is, while we understand there's an average concentration people get, some people get a much higher or a much lower concentration. And that depends on how many hot particles, how many radioactive dust particles from the original accident can make their way through the air into somebody's home. And if they're small enough to be ingested or inhaled, then you have to count that over and above what their average exposure could be. When you look at the two different components of people's exposure – (1) your average exposure; and (2) your exposure from hot particles, your hot particle exposure is going to be more rare, because there is a comparatively small number of hot particles that are disbursed from a site. So most people won't be exposed to any. But a few people will be exposed to one or more than one. And that exposure from the hot particle can actually be bigger than the average exposure that everyone is getting. So you have to measure both components if you really want to understand what's happening to people. So when we get a sample, we actually have a whole series of analyses that we're doing.We do some very basic analyses that give us the average exposure. We use something called gamma spectrometry. Gamma spectrometry has been around for nearly 100 years and we use that to see which isotopes, which radioactive materials are present in the sample.

Now with Fukushima, we generally see three isotopes over and over again. And two of them are Cesium 134 and Cesium 137. When we see both of them in a certain ratio we can be fairly certain we're looking at a material that's contaminated with material from the Fukushima accident. Now that's a fission product and that only comes after there's been some kind of nuclear reaction. The other thing we're looking at is Radium 226. And that's actually related to the original uranium fuel that starts the nuclear process in the first place. So those three things are what we're looking for when we're doing our test for dust sample. And if we find them, then we go on to part 2 and try and identify if hot particles are present. The way that happens is, once we've ID'd a sample that we want to take to the next level where we want to do the hot particle analysis, we actually sieve out some of the finer particles, and we spread them on a copper plate and we exposure them to X-ray film. We expose them for a week. Now this is another old technique. It's probably more than a century old. But what happens is, it identifies the places in the dust sample where there might be a small, radioactively hot particle. We can actually develop that X-ray plate and if there's a positive result from location, we just take an Exacto knife, we remove it, we put it onto an aluminum microscope slide, and it's analyzed by a scanning electron microscope. Not just any old microscope, but one that can give us an actual elemental analysis as we're going along. So imagine you're looking through the microscope. It's all done on video these days. And you can actually see all the individual particles magnified maybe as much as

5,000, 10,000, 15,000X. And as you're scanning, you've got a joystick and a set of crosshairs. Think of a videogame. And you can zap each particle one at a time with an X-ray beam and you can actually weed out which elements are present. And when you're starting to see the radioactive elements – plutonium, Americium, uranium, radium, then you know you're getting somewhere. So we can actually, through this process, take a sample that might weigh a pound or two pounds – a half a kilo, a full kilo, and isolate as few as one or two hot particles from that entire sample. And then do a full analysis and a breakdown. And that's extremely valuable to us. It tells us a lot about what might happen if someone inhaled or ingested that particle.

All hot particles are not alike. Some are modestly elevated. They're a little bit more radioactive than their surroundings. These are awfully hard to detect. But others tend to be orders of magnitude, factors of 10 more contaminated than their surroundings. Think the Richter scale where an earthquake magnitude 5 is 100 times more powerful than an earthquake magnitude 3. That's what we're looking for with hot particles, not things that are just a little bit more radioactive, but much more.

We get those – those highly radioactive particles – even though they're small, they can give us a lot of information about where they came from because we can actually see it in the microscope. We can see how big it is, we can see what shape it is. It really gives a history of what happened to the particle. And it gives a fingerprint of where that particle came from. And the last step, if we know how big it is and we know its elemental composition and how radioactive it is, we can actually tell exactly how dangerous that particle will be if you happen to inhale it or if you happen to ingest it. You can say, well, we don't know what might happen to a particular person, we just know what the average is. Well, that's true of non-hot particle testing. But with this, we can take a hot particle and say, all right, the person in this household, if that person had inhaled this particular particle, their odds would be 7 percent or 70 percent of contracting a lung cancer or an epithelial tissue cancer or a nasal pharyngeal cancer. You can actually see which one of these is more likely once you have the photograph of the particle. So it's a time consuming analysis but it tells us a lot about what the potential hazards are. And it's a good way to diagnose which areas are going to have which times of potential health damages.

The sample that we got came from the Goya in Japan. It's 460 kilometers from the accident site. That's about 300 miles away. The hot particle was 10 microns across. That means it is 10 one-millionth of a meter across; obviously, something you're only going to see with a powerful microscope. The particle was actually in the size range of dusts that can be inhaled and then retained in the lungs. And this is important because if you're a health physicist and you're calculating the dose that you would get from this particle, you'd have to consider that this particle might actually be trapped and result in a lifetime exposure. Thing of asbestos workers who inhaled an asbestos particle and when they eventually died, from whatever reason, that asbestos particle is still in their lungs. Well, this kind of hot particle would probably do something very, very similar. The particle that we examined was a mixture of fission products from a nuclear reactor and nuclear fuels. We looked at materials like Telurium, Radium 226. We saw Cesium 134 and 137, Cobalt 60 and a whole zoo of isotopes that probably you'll never hear about on CNN but you'd have to be a physicist to understand. Let's put it this way. Eighty percent by weight of this particle was made up of pure reactor core materials. So that tells me that something that came directly from the accident, directly from the core, could escape containment and travel a very, very significant distance. So it's a long distance to travel, and what happens is the particle is so very small that it will essentially travel with whatever gas it's entrained in. The winds will blow it long distances.

What's going to happen is the further you get away from the reactor, the less likely you are to find a hot particle of this magnitude. But of course we've looked at so many samples from Japan, this just happens to be the longest distance and the hottest particle that we've found. I have to put some numbers on it.

In Japan, we measure radiation in Becquerels. A Becquerel is obviously named after someone. It's named after Henri Becquerel. And a Becquerel means one radioactive disintegration per second. Now in Japan, if your food has more than 100 Becquerels in a kilogram, about 45 Becquerels in a pound, then it's not considered safe to eat. The number is a bit higher in the United States, but if we use 100 Becquerels per kilogram as a guide – it's something too radioactive to eat – this material was in the petabecquerel per kilogram range. Now you probably don't hear that prefix very often. The number we're looking at is 4 followed by 19 zeroes – that many becquerels per kilogram. That's a very, very high number and essentially, that's the kind of number you get when you look at core material. It is a tiny particle – in fact, the total number of becquerels from the particle was only about 310 becquerels for the particle. And so when we got our vacuum cleaner bag, the entire vacuum cleaner bag clicked away on our counter at 310 becquerels, which is a little higher than average for our Fukushima Prefecture vacuum cleaner bags. So we didn't think too much of it.

Although everything is done in a glovebox or in a hood, when we separated the sample in half – this is the first step in identifying if a hot particle was present – when we separated the sample in half and analyzed half the sample, you'd expect to get 155 becquerels – right? Half of 310. In fact, compared to background, we got none. So we said, all right, we'll measure the other half. The other half – none. So where'd it go? We took the entire sample and put it in. We're back to 310 becquerels. A bit of a mystery. Until we realized that the very center of the two samples – the razor knife that we'd used to collect this, had actually hit the hot particle and stuck to the razor. And so when we were able to put the razor under the microscope and carefully collect that hot particle and see just how much that was clicking away with the radiation detectors. So we short circuited the process a little bit, but that's exactly the method that you would use to try and find a hot particle. You just keep dividing your sample until you can find the part that has that high radiation emit. If you look at the black dust – and we've received samples of that (13:11) from Namie and Litate and a couple of other communities in northern Japan, this is very similar to the black sand that people see. The black sand – and this particle, too – it's an aggregate, it's a mixture. If you think of a hunk of concrete, it's actually a mix of sand and cement and small stones, that's what it looks like under the microscope.

So essentially what we're talking about is a worst case for black sand. That's what this hot particle is. So this material was vaporized during the accident. It condenses into these small particles and then they aggregate. They congeal, they collect, and they make particles big enough to be detected. They fly around in the winds. And sooner or later they hit something and they stick to it.

In the case of the Goya, the sample blew in with the outside air and appears to have just lodged somewhere into a carpet or floor material – something in the house that had been vacuum cleaned, and then collected in the vacuum cleaner bag. The good news is repeated sampling at the same location getting additional material from there, we've never found another particle like that. So it's not like there's anything about this particular house or that there's according to our data more than one of these particles in the home. It doesn't appear that there is. But it does tell me that it's worth looking at for a particular area, what's the probability of there being a hot particle present.

This has such a big impact on people's exposure, the potential health damages. So far, from our Japanese samples from Fukushima Prefecture and from Tokyo, about 25 percent of those samples contained at least a few measurable hot particles. Only one that was this hot. And this was the worst case. It doesn't represent any kind of average, but it does tell you what's possible. The bottom line is, now that I've had time to digest the entire set of samples and put the number of hot particles per sample in perspective, take this data and put it before a peer review panel at Worcester Polytechnic Institute, and prepare all this data for publication, it's good to see that it's going to be possible to find a real exposure number, where we can take the average exposures that we're used to dealing with and also add in a probability for being exposed to a hot particle, so that we can find out what the true level of potential health damage is from an accident.

It is solid scientific material like this that you will not see or hear via traditional news stories, TEPCO, or the IAEA. Fairewinds has long said that there will be significant increases in cancer in Japan as a result of the Fukushima Daiichi accident, and this video describing just one hot particle confirms our worst fears.

Thank you for viewing Fairewinds Energy Education. This is Arnie Gundersen, and I'll keep you informed.

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