Frequently Asked Questions

We updated our Frequently Asked Questions in January 2014 because of an increase in public inquiries about ocean contamination from the Fukushima reactors. Now, nearly three years after the massive earthquake and tsunami led to meltdowns and releases of radioactivity from the Fukushima Dai-ichi nuclear power plant in Japan, many people have expressed concerns about the arrival of trace amounts of radioactivity in Pacific Ocean currents. The research is clear that there was a substantial amount of radioactive materials released into the ocean, and that these are being dispersed and transported through the ocean and may be detectable in California beginning sometime in 2014 [Rossi et al. 2013, Deep-Sea Research]. There have been questions raised about what this will do to the coastal environment and food supply here in California.

This topic is subject to ongoing research, but the basic answer is that because the levels are expected to be very small, there will be no harmful effects on the ocean or people in our state. Below are the answers to more specific questions, answered to the best of our current knowledge.

Questions

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1. What was released at Fukushima?

The meltdowns at the Fukushima Dai-ichi nuclear power plant in March 2011 led to the releases of radioactive steam into the air and radioactive water into the ocean. The largest radioactivities released were iodine-131, cesium-134, and cesium-137. Iodine-131 has a half-life of 8 days, so it has long since decayed away. The two isotopes of cesium have half-lives of 2 years (Cs-134) and 30 years (Cs-137), meaning that some amounts of them can still be in the environment.

The releases of radioactive steam led to the dispersal of small amounts of radioactive material around the world during the spring of 2011. At UC Berkeley we tested air, rainwater, and foods and were able to measure trace levels in California. All experts agree that the levels seen in our state were not a health concern.

The releases of radioactive water into the ocean have been dispersed and transported by the Pacific Ocean currents. Researchers have calculated that trace levels of radioactivity should be detectable near the California coast sometime in 2014. All experts again agree that the levels will not be a health concern.

2. Are fish caught off California safe to eat?

Trace amounts of radioactive isotopes have been observed in tuna that was caught off the coast of California in August 2011 that can be linked to the Fukushima reactor releases [Madigan et al. 2012, PNAS]. To date, there have not been detections in other kinds of fish that can be attributed to Fukushima. The doses from radioactive cesium seen in tuna are dwarfed by the doses from naturally occurring isotopes in fish such as potassium-40 and polonium-210 [Fisher et al. 2013, PNAS].

Some recent measurements (fall 2013) of fish purchased at Bay Area retail locations can be seen in the following paper: Smith et al. 2013.

3. Is seaweed from California safe to eat?

Trace levels of iodine-131 from Fukushima were detected in California kelp in 2011, soon after the releases from Fukushima [Manley and Lowe 2012, Environ. Sci. Technol.]. The radioactive signature of iodine-131 was small but detectable. At UCB we have tested several other kinds of seaweed over the last three years but have not seen radioisotopes that can be traced to Fukushima. We are now involved in the new Kelp Watch 2014 initiative, a major effort to sample kelp along the California coast and search for any trace levels of radioisotopes from Fukushima. To date, no radioactive cesium that can be attributed to Fukushima has been observed.

4. What do my Geiger counter readings mean?

Some have asked about their own Geiger counter measurements, or measurements they have seen on the internet showing what appear to be large variations in radioactivity obtained with handheld devices. At the low levels of background radioactivity that we encounter in daily life, large variations are normal, and are even expected. In order to understand what these readings mean we need to understand what information a Geiger counter can produce:

What is a Geiger counter?

Most Geiger counters are gas-filled radiation detectors that detect two types of particles: gamma and beta radiation. Radiation interacts in the gas to ultimately produce a single 'click' or pulse when radiation is detected, this type of detector does not give additional information about the interaction, only that it occurred.

What information is provided by this detector?

This detector is a typical 'search meter' in that it indicates the presence of radiation and can provide limited information about where a source is or how far away it might be. In a number of small, constrained scenarios these meters can give severely limited information about how much radiation is present or what kind of particles are being emitted.

What is CPM?

Counts per minute (CPM) is simply the number of radiation interactions in the detector in 1 minute. This unit is helpful in a search scenario where one can grossly find radiation sources by comparing CPM readings in different locations. Unfortunately the number of cases where additional relevant information can be extracted from these readings are very few. For example it is impossible to answer questions like "Is this radiation due to Fukushima?" from these counters, the detector does not produce the information necessary to do this.

What is a 'normal' reading from a Geiger counter in CPM?

This answer is unfortunately complicated. The 'normal' reading can vary based on the physical size of the detector, the type and pressure of the gas used to detect radiation, the distance from the ground at which a reading is take, etc. Not to mention that the readings depend on what the detector is measuring! This is unfortunate as these detectors are typically cheap enough for individuals to own but provide very low quality/quantity of useful data.

With these limitations of the Geiger counter in mind, we can now discuss what contributes to the CPM readings. In almost all environments there will exist what background radioactivity that contribute to Geiger counter readings. Background radioactivity is due primarily to the decay of naturally occurring radioactive isotopes in soil and rocks, in concrete and other inorganic materials, and even in organic materials like our own bodies. Even the air is radioactive due to radon gas and its decay products, many of which are also radioactive. These levels can easily change from place to place as the trace amounts of these naturally occurring isotopes can change dramatically in the soil and materials around us. Increases of twofold, threefold, or even more are not unusual. World-wide, areas exist that have a hundred-fold higher dose exposure than one can find on average in the U.S.

As we have said Geiger counters are very limited in the information they provide. What one can see in measurements in the U.S. with these counters is the variation of natural radiation levels, not the increase in radiation due to the releases in Fukushima. Radioactivity that can be attributed to Fukushima requires much more sensitive and specific detectors. Fortunately, such instruments exists and are state-of-the art in nuclear instrumentation laboratories. The main difference between these detectors and Geiger counters is the ability to measure the energy of the radiation which represents a unique fingerprint of a specific radioisotope, say whether it is cesium-134, cesium-137, iodine-131, or potassium-40.

At the extremely low levels of radioactivity seen or expected from Fukushima, we require very specialized semiconductor detectors with high resolution spectroscopy to distinguish between radioactivity from Fukushima and the natural radioactive background.

5. What is natural background radiation?

Many people are surprised to find out that we are all constantly exposed to significant radioactivity from natural sources. These sources are both present from the creation of the universe and being constantly produced in our atmosphere. The levels we experience every day are low but measurable . The main

contributors to our exposure are potassium-40, the uranium-238 decay chain, and the thorium-232 decay chain, which are all naturally occurring. Potassium-40 and the uranium-238 and thorium-232 decay chains are virtually everywhere—in soil, minerals, our food, and even our bodies—and they give us both external and internal exposure to alpha, beta, and gamma radiation. The gas radon-222 deserves special mention because it is responsible for most of our exposure. Rn-222 is a noble gas that is part of the uranium-238 decay chain, and it emerges from the ground in tiny amounts. Rn-222 and its decay products, which attach to particles in the air, give us internal exposure to alpha, beta, and gamma radiation. In addition, the alpha particle emitter polonium-210 is worth mentioning as it is also part of the uranium-238 decay chain.

For more information on natural background radiation, there is a useful article on the Health Physics Society webpage.

6. Is it safe to swim in the Pacific Ocean?

Yes. The radiation levels associated with the releases in Fukushima that are expected at the Californian coast are very small, much smaller than the natural occurring radiation levels. Using the sensitive equipment we have available, we should be able to detect the levels expected by state-of-the art models [Rossi 2013, Deep-Sea Research]. However, this does not mean that these levels would be harmful. It is a big advantage to have such sensitive instruments, we can measure radioactivity well below any level that has a measurable health impact.

7. Is it safe to eat produce in California?

Yes. The consumption of produce in California remains safe. We might be able to measure small amounts of cesium in fish, crabs, and plants from the Pacific Ocean that can be attributed to the releases in Fukushima, however, these levels are expected to be very small, much less than the naturally occurring levels and will not result in any measurable health effect. Within the first days, weeks, and months after the Fukushima incident in March 2011 we were able to measure small amounts of radioactivity that we could associate with with the releases in Japan but they have dropped continuously and are now below the detection sensitivity of our instruments. But even the highest levels we ever measured were far below levels required to observe any harmful effects.

Organic produce would uptake radionuclides just as well as normal produce, since they are the same plants, just grown with differing pesticides/herbicides.

8. Should pregnant women be concerned about radiation from Fukushima?

No. The levels of radiation from Fukushima are much, much smaller than we encounter on a daily basis from natural sources and do not cause any measurable health effect on pregnant woman and the unborn.

9. Will you test a sample I am concerned about?

Our mission as a university is to educate our students and inform the public, but we are not a testing laboratory. Although we may occasionally test samples provided by the public, it will be subject to the availability of our equipment and whether it serves our educational mission.

10. Can you point me to other websites with accurate information about this topic?

This is by no means an exhaustive list, but here are some articles and sources online that we have found helpful:

Deep Sea News:

- "True Facts about Ocean Radiation and the Fukushima Disaster"
- "Three Reasons why Fukushima Radiation has nothing to do with Starfish Wasting Syndrome"
- "Is the sea floor littered with dead animals due to radiation? No."
- "All the best, scientifically verified information on Fukushima impacts"

Woods Hole Oceanographic Institution: "FAQ: Radiation from Fukushima"

Southern Fried Science: "28 fallacies about the Fukushima nuclear disaster's effect on the US West Coast"

XKCD: Radiation Dose Chart, which includes doses from natural background radiation and medical procedures

EPA: Calculate Your Radiation Dose

United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR): Radiation

FAQ

Ask a Question

Question *

Question to be answered.

Question details

Longer question text.

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This question is for testing whether or not you are a human visitor and to prevent automated spam submissions.

What code is in the image? *

Enter the characters shown in the image.

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