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INVITED TALK: Our Radioactive Ocean- establishing an ocean monitoring network after Fukushima

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Content

The triple disaster of the March 11, 2011 earthquake, tsunami, and subsequent radiation releases at Fukushima Dai-ichi were unprecedented events for the ocean and society. US and Canadian citizens became alarmed at the prospect of contaminated elements carried by ocean currents reaching the west coast of North America several years after the event. Although models suggested that radioactive cesium would be at levels well below those considered of human health concern, there was, and remains, no US Federal agencies responsible for monitoring low level ocean radioactivity. In part because of this information gap, the media was full of claims of the dire consequences as a result of Fukushima contamination, including die-off's of marine biota and potential harm to humans living and active along our west coast.

Motivated by this public concern and lack of monitoring, we launched in January 2014 "Our Radioactive Ocean" (http://OurRadioactiveOcean.org), a citizen scientist and crowd funded monitoring network to document the arrival of Fukushima cesium along the North American west coast. The response has been positive, enlisting over 450 donors who have participated in sample collection at over 250 sites, from San Diego to Alaska and Hawaii. Simple 5 gallon sampling "kits" are mailed to groups that successfully fund raise for their site, and results and photos of participants are posted to our web site to share. An internal temperature probe and salinity analyses provide oceanographic context for the radioactive cesium analyses.

We use a research method that is capable of detecting extremely low levels of cesium isotopes in seawater. It includes a Cs extraction step followed by gamma detection on a high-purity germanium well detector for between 24 and 72 hours. We regularly participate in proficiency tests with the International Atomic Energy Agency (IAEA) to ensure that our results are not just precise, but extremely accurate. Cesium-137 has a relatively long half-life (30 years), and it had been present in the ocean since atmospheric nuclear weapons testing that peaked in 1950s and 1960s. Cesium-134 is much shorter-lived (2 years), which means that any detected in seawater samples must have come from Fukushima. Because it was released in equal amounts with cesium-137, we can use its presence to determine how much contamination was released from the Fukushima Dai-ichi reactor site.

Every sample contains detectable cesium-137, with a small but growing number showing cesium-134 indicative of the Fukushima source. The highest total cesium-134+137 attributable to Fukushima was found 1,500 miles north of Hawaii, at levels well below concern for humans or marine life (10 Bq/m3). For example, swimming every day in the ocean at these levels would result in a dose 1,000 times smaller than the radiation we receive with a single dental x-ray. Not zero, but still very low. Looking ahead, levels of any Fukushima contaminants along the West Coast of North America are predicted to peak around 2015 or 2016, but at levels similar to what we are measuring in some of our samples today and lower in fact than cesium levels in the ocean in the 1960's.

A significant effort is spent on the web site explaining basic principles of radioactivity, its sources, uptake in the marine food web, transport with ocean currents, and possible health effects. Links to related media coverage, public talks and outreach materials are posted along side of interactive maps with the data and their sponsors. The more than 500,000 web views in the past 2.5 years, attests to the public concern and interest in this topic.

About the Presenter

Dr. Buesseler is a Senior Scientist at the Woods Hole Oceanographic Institution who specializes in the study of natural and man-made radionuclides in the ocean. His work includes studies of fallout from atmospheric nuclear weapons testing, assessments of Chernobyl impacts on the Black Sea, and examination of radionuclide contaminants in the Pacific resulting from the Fukushima Daiichi nuclear power plants.

Dr. Buesseler has served as Chair of the Marine Chemistry and Geochemistry Department at WHOI, and two years as an Associate Program Director at the US National Science Foundation, Chemical

Oceanography Program. In 2009 he was elected Fellow of the American Geophysical Union and in 2011 he was noted as the top cited ocean scientist by the Times Higher Education for the decade 2000-2010. He was honored by the Japan Society for the Promotion of Science with their highest level Fellowship award for overseas researchers. He is currently Director of the Center for Marine and Environmental Radioactivity at WHOI (http://www.whoi.edu/CMER), and regularly speaks to public audiences and engages citizens as part of Our Radioactive Ocean. More info at his "Café Thorium" web site (http://cafethorium.whoi.edu).

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