

Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Distinguished Professor of Earth and Planetary Sciences, UC Santa Cruz.

#258 March 18, 2018

The Fukushima Disaster—Seven Years Later

Hard to believe but it's been seven years (March 11, 2011) since a massive 9.0 magnitude earthquake off Japan generated a huge tsunami, which very quickly hit the coastline of Japan. That water washed as far as six miles inland and reached elevations up to 128 feet above sea level.

How far is six miles inland along the Monterey Bay shoreline? If that same tsunami hit the Pajaro River mouth area it would cross Highway 1 after three miles and still be going strong. A few miles further and then virtually the entire city of Watsonville would have been flooded. In Santa Cruz a similar wave would have washed up the San Lorenzo River, through the downtown area and by the Highway 1 bridge, it would still have only traveled two miles and had a lot of momentum left.

Six miles inland is a long way and 128 feet above sea level is a lot of water, which is why over 18,000 lives were lost in Japan. However, to be absolutely perfectly clear, we live in a totally different geologic setting than Japan.

We have the well-known Monterey Submarine Canyon right offshore, but it is not a trench. The canyon is a submarine drainage system, much like a river on land. A trench is where two large tectonic plates come together generating very large

earthquakes and tsunamis. We have one of those offshore extending from Cape Mendocino to Vancouver Island, but not here.

The tsunami from Japan seven years ago did reach Santa Cruz about 8 hours later after crossing 5000 miles of Pacific Ocean. It had the greatest impact here on the small craft harbor where damages to facilities and boats reached about \$28 million. Because of the warning system in place, however, there were no injuries, although one man standing out on a northern California beach taking photographs drowned.

At the Fukushima Daiichi nuclear plant the waves overtopped a 33-foot high seawall protecting the backup cooling facility, which flooded and disabled the system. This led to the loss of cooling water, overheating of the nuclear fuel, meltdown and explosion, and the uncontrolled release of radiation into the adjacent ocean that is still taking place.

The Japanese power company that operated the nuclear plant had completed an in-house study three years earlier that raised the possibility of tsunami-waves up to 10.2 meters (33 feet) high and the need to better protect the plant from flooding. Company officials, however, insisted that such a risk was unrealistic and didn't take the warning seriously.

For those living along the US west coast, the concern expressed most commonly in the months following the disaster was whether the radiation released into the ocean from the plant was going to be a public health danger.

A major effort has been underway for the last seven years to halt the release of radioactive material from the reactors into the adjacent ocean. These were logical

concerns because there is a system of surface currents that connect the ocean off Japan to the waters off the California.

What begins as the Kuroshio Current (often called the Japanese Current) that flows along the coast of Japan, and transitions to the North Pacific Drift as it moves slowly across the North Pacific. Off the US/Canada border it splits into the Alaska Current that heads north into the Gulf of Alaska and the California Current, which heads south along the coast of California. This the highway for any radioactivity in the water coming from Japan.

A chemical oceanographer from Woods Hole Oceanographic Institution began analyzing Pacific Ocean water samples shortly after the March 11 nuclear plant meltdown. It wasn't until November 2014, three and a half years later, however, that trace amounts of radioactivity (cesium-134) were detected in US coastal waters that could be used to fingerprint Fukushima. While high levels of radiation were documented in the ocean off Japan almost immediately, movement of that radiation 5000 miles across the North Pacific to the west coast turns out to be a relatively slow journey with the cesium decomposing and being dispersed and diluted.

Ken Buesseler, the oceanographer from Wood Hole who has been conducting the study, has continued analyzing water samples collected by ships crossing the Pacific. I'll give you an update in two weeks, but the short story is that there is no public health risk from the radioactivity from Fukushima in our ocean backyard.