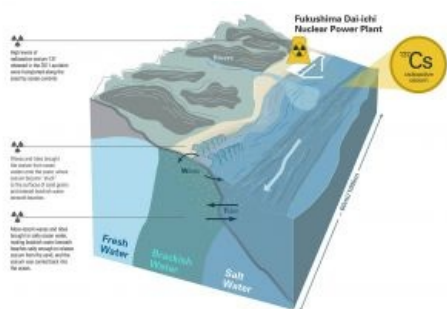


# Ocean Currents Transported Radioactive Caesium from Fukushima Disaster



Scientists have found a previously unsuspected place where radioactive material from the Fukushima Dai-ichi nuclear power plant disaster has accumulated: in sands and brackish groundwater beneath beaches up to 60 miles away. The sands took up and retained radioactive caesium originating from the disaster in 2011 and have been slowly releasing it back into the ocean.

The scientists concluded this in a study published 2 October 2017 in the Proceedings of the National Academy of Sciences. But this new and unanticipated pathway for the storage and release of radionuclides to the ocean should be taken into account in the management of coastal areas where nuclear power plants are situated.

## Transported by ocean currents

The research team—Virginie Sanial, Ken Buesseler, and Matthew Charette of Woods Hole Oceanographic Institution and Seiya Nagao of Kanazawa University—hypothesise that high levels of radioactive caesium-137 released in 2011 were transported along the coast by ocean currents. Days and weeks after the accident, waves and tides brought the caesium in these highly contaminated waters onto the coast, where caesium became “stuck” to the surfaces of sand grains. Caesium-enriched sand resided on the beaches and in the brackish, slightly salty mixture of fresh water and salt water beneath the beaches.

But in salt water, caesium no longer “sticks” to the sand. So when more recent waves and tides brought in salty seawater from the ocean, the brackish water underneath the beaches became salty enough to release the caesium from the sand, and it was carried back into the ocean.

The scientists estimated that the amount of contaminated water flowing into the ocean from this brackish groundwater source below the sandy beaches is as large as the input from two other known sources: ongoing releases and runoff from the nuclear power plant site itself, and outflow from rivers that continue to carry caesium from the fallout on land in 2011 to the ocean on river-borne particles. All three of these ongoing sources are thousands of times smaller today compared with the days immediately after the disaster in 2011.

## Samples from beach sands

The team sampled eight beaches within 60 miles of the crippled Fukushima Dai-ichi Nuclear Power Plant between 2013 and 2016. They plunged 3- to 7-foot-long tubes into the sand, pumped up underlying groundwater, and analysed its caesium-137 content. The caesium levels in the groundwater were up to 10 times higher than the levels found in seawater within the harbour of the nuclear power plant itself. In addition, the total amount of caesium retained more than 3 feet deep in the sands is higher than what is found in sediments on the seafloor offshore of the beaches.

Caesium has a long half-life and persists in the environment. In their analysis of the beaches, the scientists detected not only caesium-137, which may have come from the Dai-ichi plant or from nuclear weapons tested in the 1950s and 1960s, but also caesium-134, a radioactive form of caesium that can only come only from the 2011 Fukushima accident.

The researchers also conducted experiments on Japanese beach samples in the lab to demonstrate that caesium did indeed “stick” to sand grains and then lost their “stickiness” when they were flushed with salt water.