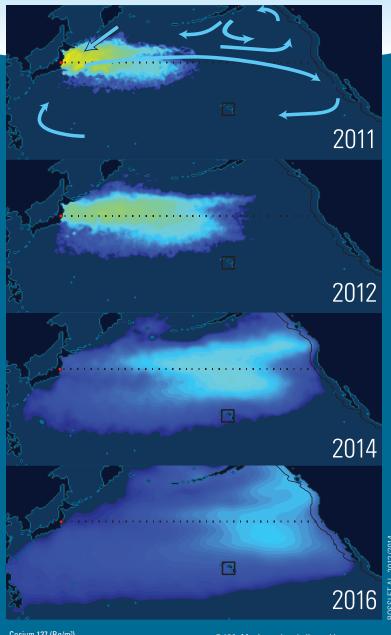
How fast will radioactivity spread?

Radioactive material released into the ocean from the Fukushima Dailchi nuclear power plants are spread by ocean currents and diluted by seawater along the way.



How can we be sure?

Since 2011, scientists—with the help of interested citizens—have been sampling seawater across the Pacific to track the spread of radioactive isotopes released from Fukushima.





If you would like to join the growing group of interested citizen-scientists who are helping collect samples, or if you can help fund analysis of our growing collection of samples, please visit our website:

ourradioactiveocean.org

Find more information at: www.whoi.edu/cmer

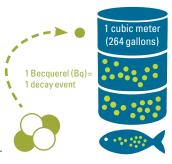
How radioactive is our ocean?

A guide to natural and man-made sources of radiation in the environment post-Fukushima



What is radiation?

Radiation is caused by unstable atoms breaking down and emitting high energy particles. The number of these events per second is called a Becquerel (Bg). The total number of Bg is often reported per cubic meter of (264 gallons) of seawater or kilogram (2.2 pounds) of fish.



Fukushima contaminants of concern

Cesium-134

Half-life: **Z** vears Cesium-137



30 years

Strontium-90



29 vears

Radioactivity in the ocean

Proportion of total radioactivity released (in PBg) that ended up in the ocean (area of each circle below the waterline).

Global nuclear weapons testing, 1950s-60s

950

Cesium-137

Uranium-238 37.000

Chernobyl

85

Strontium-90 0.001

Three Mile Island

0.00004

Fukushima

15-30

Naturally occurring in the ocean

> Potassium-40 15,000,000

One $PBq = 10^{15}Bq = 1,000,000,000,000,000Bq$

Radiation dose and exposure



Lifetime risk of cancer is evident (annual)



EPA dose limit for one individual (annual)



Average dose from natural radiation in food (annual)



Swimming in ocean every day on the West Coast (annual)

1,000,000 Sieverts



Temporary radiation sickness



~400.000

Maximum dose immediately outside Fukushima reactors (per hour)



10.000

Average full body CT scan

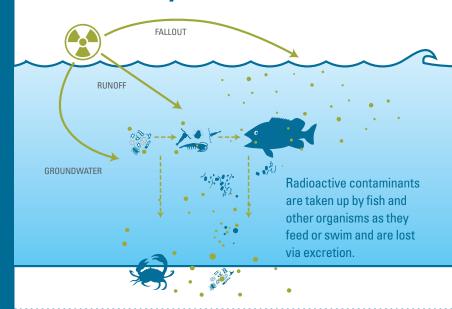


Flight from New York to LA (total)



Dental x-ray

Radioactivity in marine life



Radioactivity in fish

Cesium-137

Taken up in muscles/organs

Time it takes to flush out radioactive **WEEKS** contaminants.

Strontium-90

Taken up in bones

YEARS

Seafood caught above radiation limits*

*Limits set by Japan (100 Bg/kg) and US (1000 Bg/kg) for fish sold in those countries.



All fish contain trace levels of cesium-137 from nuclear weapons testing. Additional cesium from Fukushima closed fisheries in some areas of coastal Japan in 2011.