

Alaska Forum on the Environment
2017

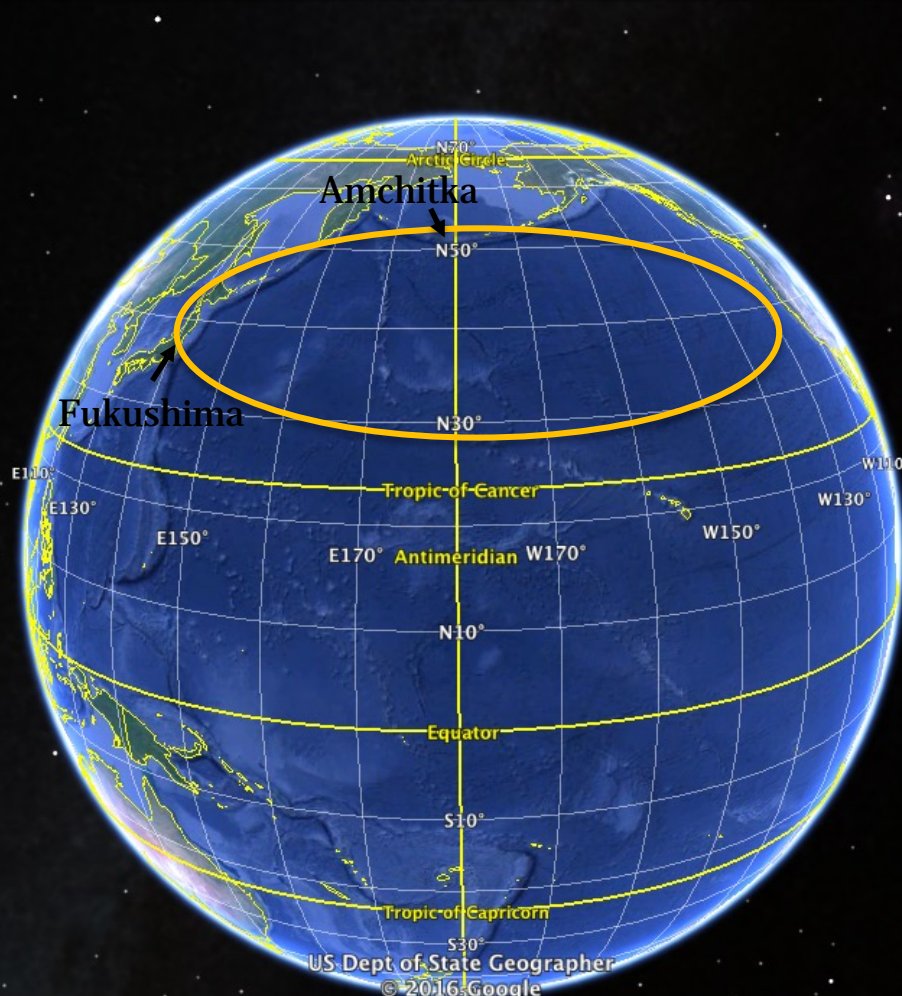
Background Radioactivity in the North Pacific Ocean

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North Pacific Ocean – Area of Interest



US Dept of State Geographer
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Google Earth

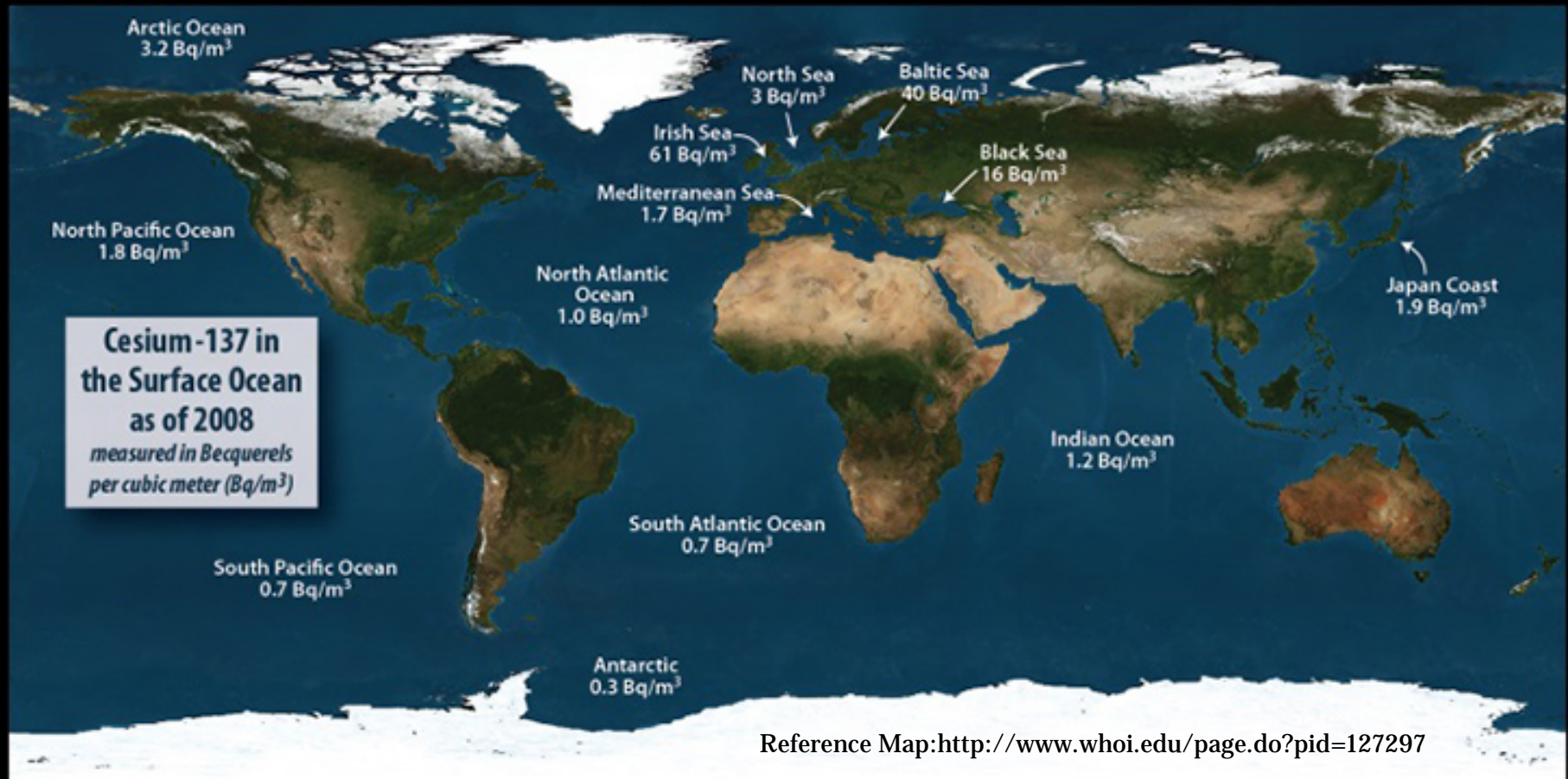
Glossary

- **Activity (of a substance):** The number of disintegrations per unit time taking place in a radioactive material. The unit of activity is the Becquerel (Bq), one disintegration per second.
- **Background radiation:** The radiation of man's natural environment originating primarily from the naturally radioactive elements of the earth and from the cosmic rays.
- **Becquerel:** A unit of activity is the Becquerel (Bq) indicating one disintegration per second. Activity of 1 Bq averages 1 disintegration per second. The following SI unit prefixes are used in this presentation - 1) kBq – 1000 disintegrations per second; 2) PBq – 10^{15} or 1,000,000,000,000,000 disintegrations per second.
- **Half-life:** The period required for half of the atoms of a particular radioactive isotope to decay and become an isotope of another element.
- **M³:** cubic meter.
- **Radioactivity:** The spontaneous decay of disintegration of an unstable atomic nucleus accompanied by the emission of radiation.
- **Radionuclide:** A radioactive isotope of an element.

Radionuclides Analyzed for in 2016 Amchitka Survey

- Sea Water
 - Radioactive Cesium
 - ^{137}Cs
 - ^{134}Cs
 - Tritium (^3H)
 - Plutonium (Depends on analysis method)
 - ^{239}Pu
 - ^{240}Pu
 - $^{239}\text{Pu}/^{240}\text{Pu}$ Ratio

Surface Ocean ^{137}Cs Pre-Fukushima



North Pacific Ocean Pre-Fukushima Activity & Accident Source Term

Fukushima Source

Pre-Fukushima (~2011)

Term to North Pacific

- Radioactive Cesium

- ^{137}Cs : 69 PBq
- ^{134}Cs : 0.0 Bq

- Tritium

- ^3H : 2930 PBq

- Plutonium

- $^{239+240}\text{Pu}$: 2.1 PBq
- $^{240}\text{Pu}/^{239}\text{Pu}$ Ratio:

- Radioactive Cesium

- ^{137}Cs : 15 – 20 PBq
- ^{134}Cs : 15 – 20 PBq

- Tritium

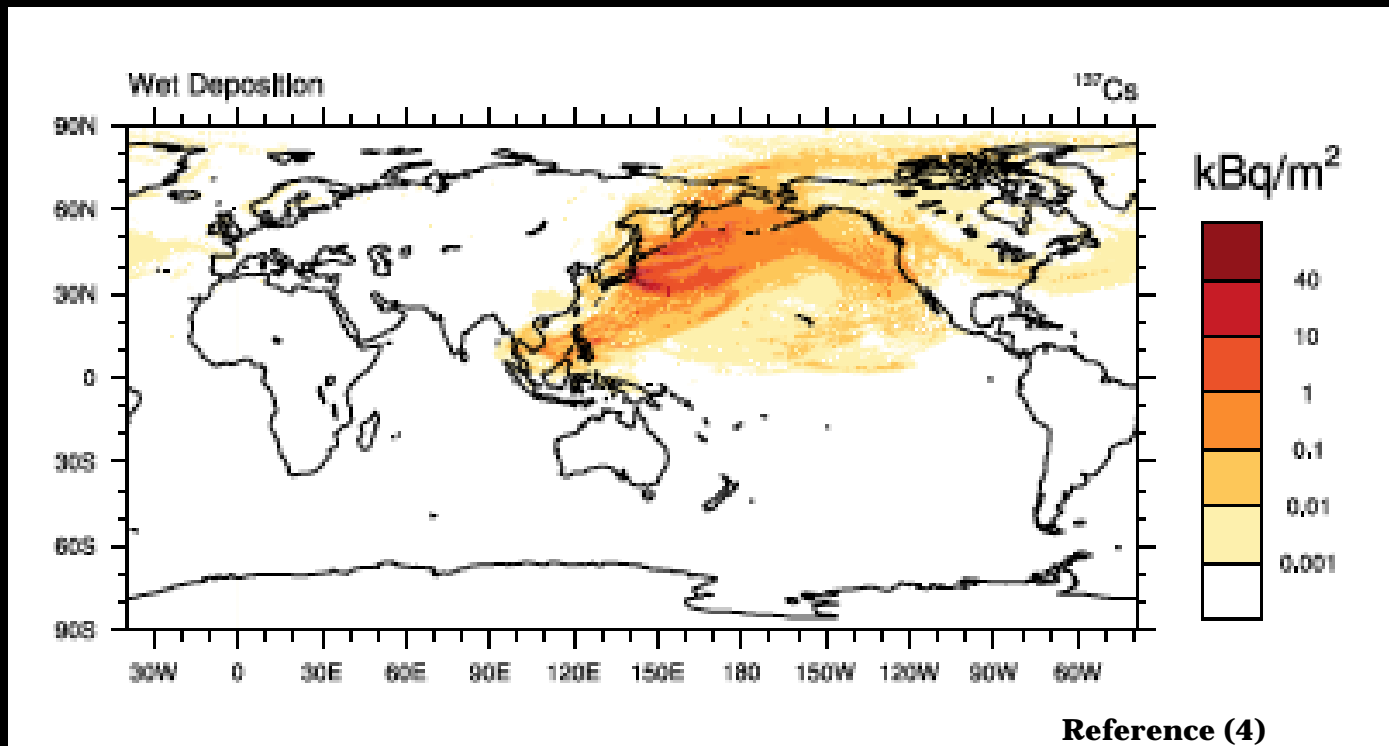
- ^3H : 0.1 – 0.5 PBq

- Plutonium

- $^{239+240}\text{Pu}$: trace¹
- $^{240}\text{Pu}/^{239}\text{Pu}$ Ratio: 0.33-2.2.

¹ - Ocean studies off the coast of Japan have so far been unable to detect Pu contamination from Fukushima.

Fukushima Nuclear Accident 2011 Atmospheric Deposition



North Pacific Ocean – Currents

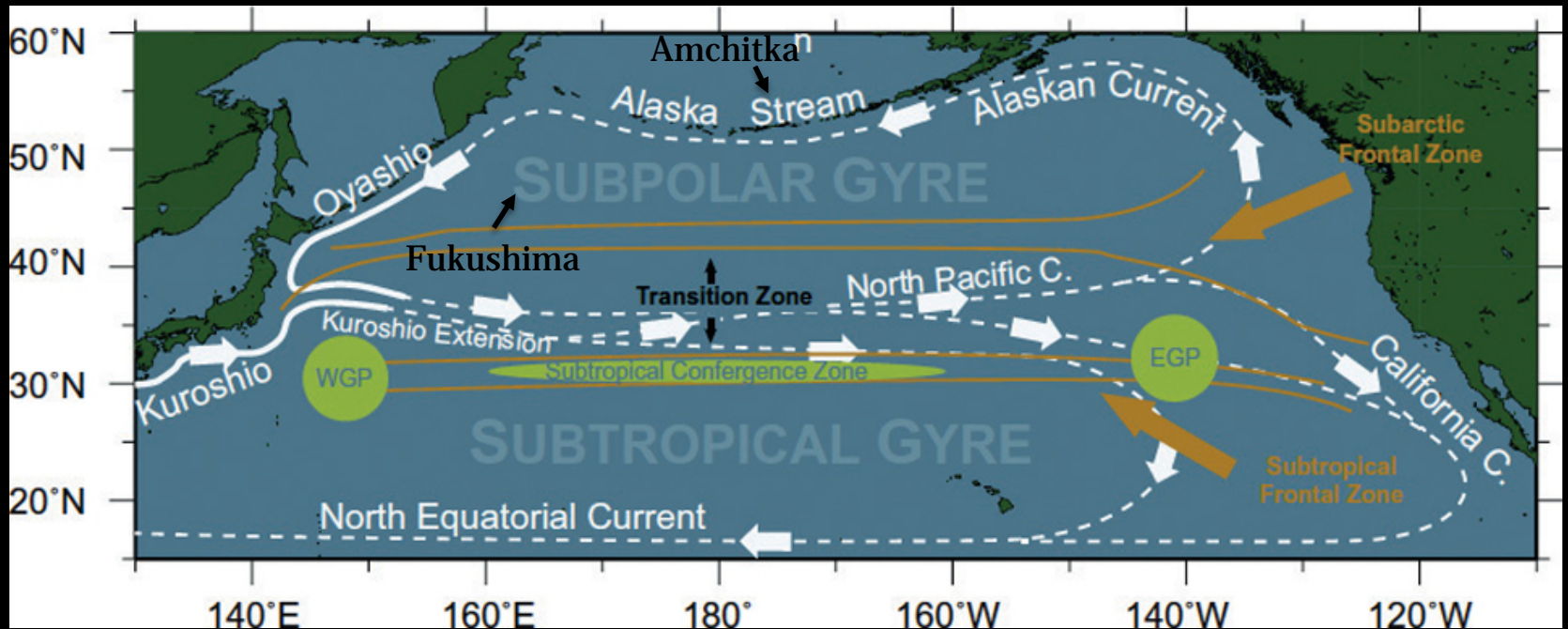
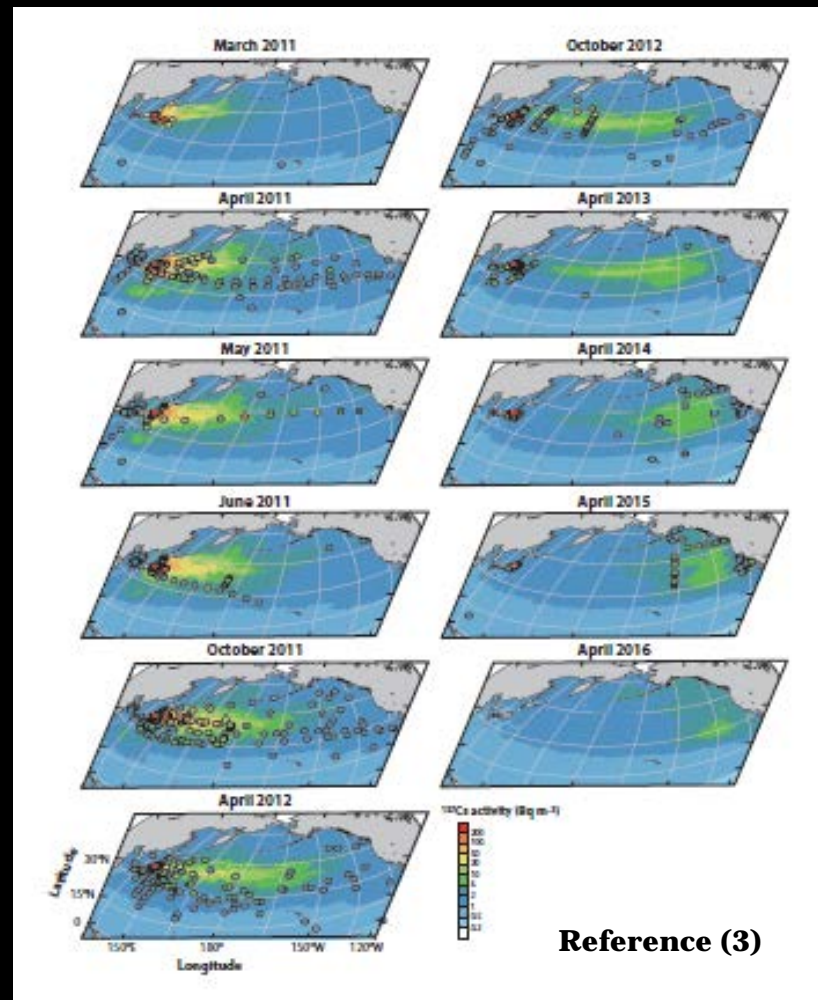


Image Reference - https://www.pifsc.noaa.gov/do/annualreport2011/marine_habitats_and_ecosystems.php

Ocean Locations for Some ^{137}Cs Measurements 2011 - 2016



Radioactive Cesium, Tritium and Plutonium Activity North Pacific Ocean

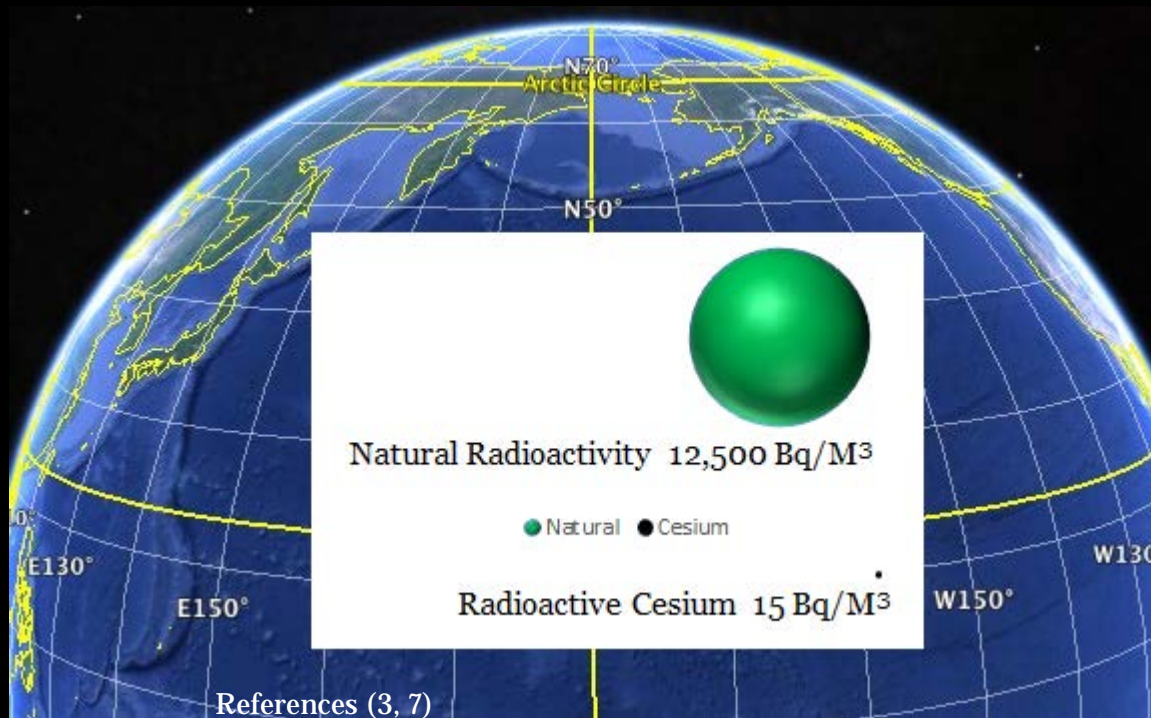
Pre-Fukushima

- Radioactive Cesium
 - ^{137}Cs : 1 – 2 Bq/M³
 - ^{134}Cs : 0.0 Bq/M³
- Tritium
 - ^3H : 0.05 Bq/L
- Plutonium
 - $^{239+240}\text{Pu}$: 0.003 Bq/M³

Post-Fukushima (2014 – 2015)

- Radioactive Cesium
 - ^{137}Cs : 1 – 10 Bq/M³
 - ^{134}Cs : 1 – 2 Bq/M³
- Tritium
 - ^3H : 0.05 – 0.2 Bq/L
- Plutonium
 - $^{239+240}\text{Pu}$: ~ 0.003 Bq/M³

Natural Radioactivity vs ^{137}Cs & ^{134}Cs in North Pacific Ocean 2016



Estimated maximum far field ^{137}Cs & ^{134}Cs concentration

Acknowledgements

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