Fukushima Dai-ichi: Ten years of study and insight Session #1 What happened? 4-11 March 2011

Characterization of cesium isotopic composition in offshore seawater in May 2011 after Fukushima nuclear accident

Jian Zheng[1], Liguo Cao[1,2] Tatsuo Aono[1], Masatoshi Yamada[3], Yuichiro Kumamoto[4]

[1] National Institute of Radiological Sciences, Japan [2] Shanxi Normal University, China

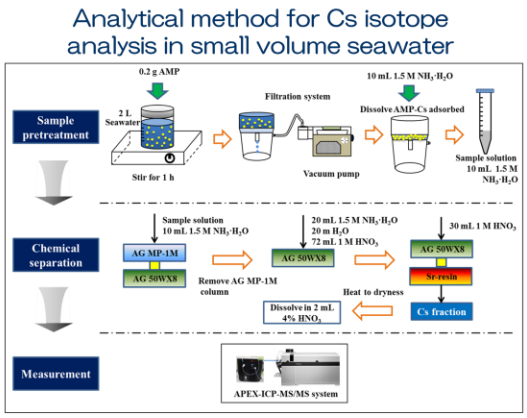
[3] Marine Ecology Research Institute, Japan [4] JAMSTEC, Japan

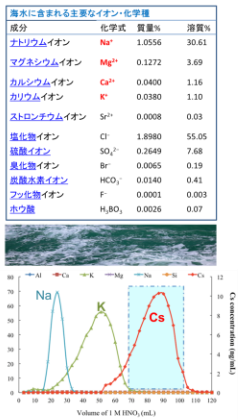
Primary author contact info: zheng.jian@qst.go.jp (Jian ZHENG)

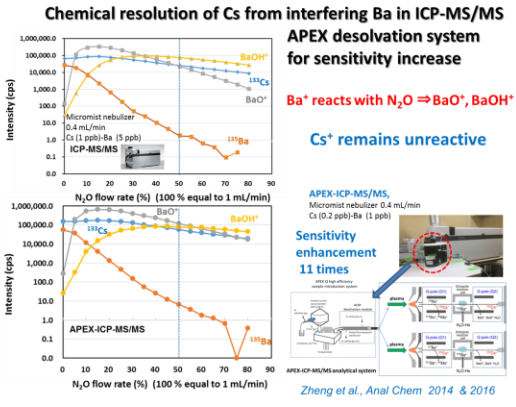
Introduction

- Since the Fukushima Daiichi nuclear power plant (FDNPP) accident in 2011, the activity ratio of $^{134}Cs/^{137}Cs$ has been widely used as a tracer for contamination source identification, for tracing the migration of released ^{137}Cs in the North Pacific and study on the mode water evolution. However, due to the short half-life of ^{134}Cs (2.06 y), this tracer will become unavailable in the future.
- The $^{135}Cs/^{137}Cs$ isotopic ratio can be considered as a new powerful tracer for long-term source identification and environmental behavior studies (Zheng et al., 2014).
- To use Fukushima accident released ^{135}Cs as new tracer for tracing the transport of released radionuclides in the Pacific Ocean and other potential oceanography studies, we recently analyzed activities of ^{137}Cs and ^{135}Cs, and Cs isotopic ratios ($^{135}Cs/^{137}Cs$, $^{135}Cs/^{133}Cs$) in Fukushima offshore seawaters collected in May 2011 using ICP-MS/MS analytical method with 2 L seawater.

Experimental







With 2 L seawater, the developed APEX-Q/ICP-MS/MS analytical system can measure accurately ^{137}Cs activity at > 0.1 Bq/L level, and ^{135}Cs concentration at > 0.05 pg/L. The developed method was validated by the analysis of IAEA-443 Seawater reference materials.

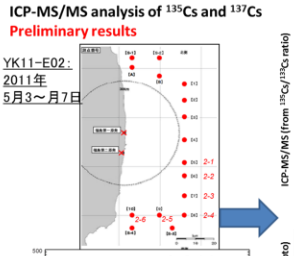
Results and discussion

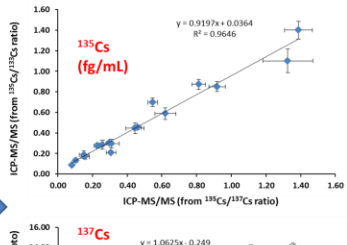
YK11-E02 2 L seawater, ^{135}Cs, ^{137}Cs analysis , in process

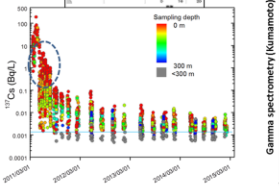
30-60 km off the FDNPP

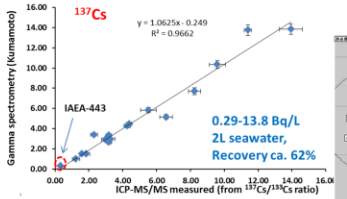
ICP-MS/MS analysis of ^{135}Cs and ^{137}Cs

Preliminary results



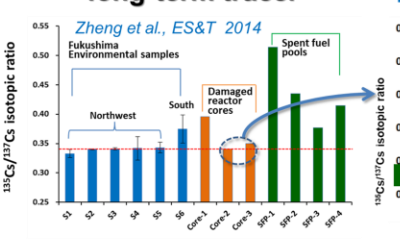




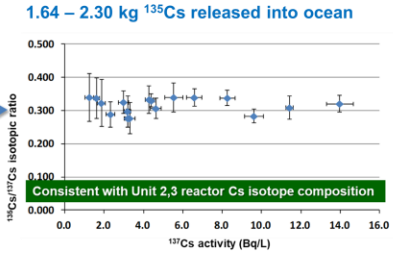


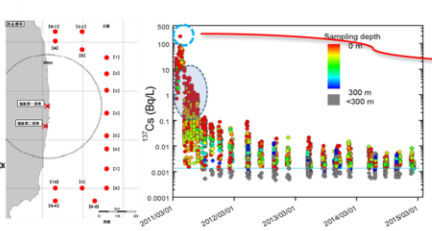
Quantification of ^{137}Cs and ^{135}Cs concentration activities can be obtained using ^{133}Cs as yield tracer

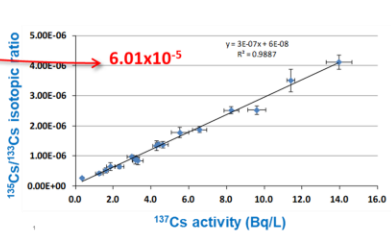
Cs isotope fingerprint in seawater (2011 May): long-term tracer



1.64 – 2.30 kg ^{135}Cs released into ocean







Conclusion: The analysis of radioCs isotopes in the source term seawater after the accident will provide an opportunity to re-construct the distributions of released radioCs isotopes in the coastal waters off Fukushima. The obtained data will be of benefit to verify the developed models for better understanding the dispersion/migration of accident-released radionuclides in the NW Pacific Ocean. it can be expected that ^{135}Cs, as a new geochemical tracer, can be widely applied in oceanography study in near future.