Assessment on marine environmental impact from artificial radionuclides in the coastal waters of Liaodong Bay

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1. Background on Marine Radioactivity Monitoring and Assessment
Worldwide Distribution of Nuclear Power Plants (NPP)
Effect of the accident at Fukushima NPP

- Accident caused massive amount of radionuclides leaking into the sea;
- Total quantity of leaked radioactivity matter published by Japanese Authority is 630 thousand trillion Bq.
2. Status of marine radioactivity monitoring and assessment after Fukushima nuclear accident
In the early days after FNA, near-coast Cs-137 activity peaked at $6.8 \times 10^6$ Bq/m$^3$; 

In the later stages, open-water Cs-137 activity as high as 10 Bq/m$^3$.


(LIN Wuhui et.al, 2015)
Two years after FNA, Hawaii’s surrounding waters recorded Cs-137 activity range at 1~4Bq/m³, 2~3 times higher than pre-FNA level.

No radionuclide signal from FNA had been observed in the coastal waters of Korea during March to July 2011. 

(Kim C-K et.al, 2012)
Cs-137 inventory in waters to the east of Japan is 4.6 times higher than pre-FNA level.

(Ramzaev V et.al, 2014)
No radionuclide signal from FNA has been detected so far in China’s coastal waters.

(Wu J et.al, 2013)
Summary

1. Radioactive materials from FNA migrated and dispersed along horizontal and vertical directions, contamination radius kept increasing, while radionuclide activity kept decreasing due to continuous dilution;

2. The highest level of Cs-137 activity in open ocean waters is around 10Bq/m³, apparently higher than pre-FNA Cs-137 base level in North Pacific waters, which was around 1~2Bq/m³;

3. Cs-137 activity in North Pacific waters is far lower than the limit specified by different countries.
3. Radioactivity Monitoring in coastal waters of Liaodong Bay
Study area and stations

- Samples: 15 surface water, 9 surface sediment, 1 fish sample of a dominant species
- Time: May 2014

Liaodong Bay, located in Bohai sea
Results—sea water

- The level of Cs-137 in seawater is 0.69~1.53 Bq/m³
- The average level of Cs-137 is 1.02 Bq/m³
- The background range of Cs-137 in water of Bohai sea is 0.2~2.55 Bq/m³
The level of Cs-137 in sediment is 0.48~2.01 Bq/kg dry weight

The average level of Cs-137 is 1.22 Bq/kg dry weight

The background range of Cs-137 in sediment of Bohai sea is 1.2~15.75 Bq/kg dry weight
Result—Fish

Cynoglossus semilaevis （半滑舌鳎）

- The level of Cs-137 is 0.024 Bq/kg wet weight
- The background range of Cs-137 in biota of Bohai sea is 0.01~0.24 Bq/kg wet weight
Conclusions

1. Cs-134, Co-58,60 and Ag-110m is not detected in seawater, fish nor sediment;

2. The levels of Cs-137 in seawater, fish and sediment is 0.69~1.53 Bq/m³, 0.024 Bq/kg wet weight, and 0.48~2.01 Bq/kg dry weight, respectively;

3. The levels of Cs-137 in seawater, fish and sediment are all within background ranges of Bohai sea;

4. Cs-137 activity is nearly uniform throughout the study area in sediment, however it is more concentrated in water further from shore;

5. The coastal waters of Liaodong Bay have not been contaminated by artificial radionuclides.
Thank You!

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