

Annual Meeting Report (2017) of Working Group 30 on Assessment of Marine Environmental Quality of Radiation around the North Pacific

The 2017 business meeting of Working Group on Assessment of Marine Environmental Quality of Radiation around the North Pacific (WG30/WG-AMR) was held in Vladivostok, Russia, from 09:00 to 18:00 on September 23, 2017. Co-Chair of the WG 30, Prof. Yusheng Zhang (China) welcomed all of the members and observers to the meeting and made the opening address. Fourteen participants, including nine WG 30 members from four member countries (except Russia and USA) attended the meeting (Annex 1).



Left: Participants of the 2017 business meeting of the WG 30. Right: Participants in the meeting.

AGENDA ITEM 1 -- Adopting the meeting agenda

First of all, the agenda for the 2017 business meeting of the WG 30 (Annex 2) was discussed and adopted without revision by the WG members.

AGENDA ITEM 2 -- Overview and update of WG 30

Prof. Yusheng Zhang made a presentation entitled “Overview and update of the WG 30”, giving an introduction on the progress of WG 30 since the last business meeting held during the PICES-2016 annual meeting in San Diego, USA.

AGENDA ITEM 3 -- Member **country reports**

Each member country of the WG 30 provided an overview of the research that they had conducted in the past year following the WG work plan.

Canada

The large discharge of radioactivity into the Pacific Ocean off Japan from the 2011 Fukushima Dai-ichi nuclear reactor accident generated considerable concern about potential impacts on marine biota in the eastern North Pacific. Time series measurements of ¹³⁴Cs and ¹³⁷Cs in seawater on Line P documented the initial arrival of the Fukushima signal by ocean current transport at a location 1500 km west of British Columbia, Canada in June, 2012, about 1.3 years after the accident. Between 2012 and 2015 the Fukushima radioactivity signal continued to increase in surface water on Line P and eventually began to level off at probable maximum values in 2016-2017 as documented by biannual monitoring surveys. Although radioactivity contamination of fish off Fukushima was initially severe, analyses of biological samples performed under the auspices of the InFORM monitoring program off British Columbia have revealed little evidence of elevated radioactivity levels in fish or other biota. These results, based on both measurements and biological modeling studies are a consequence of the low Fukushima radionuclide levels in seawater and the low biological half-lives of several months for Cs in fish. Although the ecosystem impacts off British Columbia associated with radioactivity releases from Fukushima have been minimal, the communication of these results to the public and general community acceptance of their veracity has been a challenge requiring many public lectures, scientific publications and considerable media outreach, thereby providing a cautionary note for studies of future ecosystem threats associated with grim anthropogenic drivers.

China

To improve the understanding on the transport of radioactive pollutants released from the FDNPP accident in the Northwest Pacific and their potential impact, two monitoring cruises were conducted by the Third Institute of Oceanography, SOA of China from the second half year of 2016 to the first half year of 2017. More than 80 stations were sampled for seawater samples. The

marine biota samples were also collected in part of the stations. ^{137}Cs , ^{134}Cs , $^{110\text{m}}\text{Ag}$, ^{90}Sr and other important artificial radionuclides were measured. By the end of June 2017, the main monitoring results were as below.

In surface water layer, ^{134}Cs signals were found in 7 stations out of 47 stations with the range of ND (not detected) to 0.76 Bq/m^3 . At the depth of 100m, 9 stations with the range of ND to 0.65 Bq/m^3 ; At the depth of 200m, 5 stations of all the 47 stations were found containing ^{134}Cs with the range of ND to 0.37 Bq/m^3 . As for the 300m layer, 11 stations were found with the detectable ^{134}Cs , from ND to 0.51 Bq/m^3 . At the depth of 500m and 1000m, the detectable ^{134}Cs stations were 5 and 7, respectively, with the highest activities of 0.77 Bq/m^3 and 0.69 Bq/m^3 . At the depths of 1500m and 2000m, ^{134}Cs were both not detectable. As for ^{137}Cs , it was almost detectable at each depth. The highest value of each depth was around 4 Bq/m^3 . At the depth of 500m depth, the highest ^{137}Cs value was 4.25 Bq/m^3 . But at the depth of 1000m to 2000m, ^{137}Cs could not be found in most stations with the highest value of less than 0.5 Bq/m^3 . As for the distribution of ^{90}Sr in the water column, all the content level varied in a relative small range of less than 2 Bq/m^3 comparing with ^{137}Cs . For the biota samples, there were only two stations having enough samples to be measured. The activity levels of these samples were both 0.02 Bq per kilogram fresh weight, within the background level before FDNPP accident.

Through analyzing all the activities of ^{134}Cs and ^{137}Cs in seawater monitored in the Northwest Pacific by China, the overall variation trend of the maximum value and average value of ^{134}Cs and ^{137}Cs decreased with the time. ^{137}Cs highest value decreased from 826 Bq/m^3 (June 2011) to 4.11 Bq/m^3 (Oct 2015). ^{137}Cs average value decreased from 127 Bq/m^3 (June 2011) to 1.54 Bq/m^3 (Oct 2015). ^{134}Cs highest value decreased from 757 Bq/m^3 (June 2011) to 0.99 Bq/m^3 (Oct 2015). ^{134}Cs average value decreased from 112 Bq/m^3 (June 2011) to 0.06 Bq/m^3 (Oct 2015).

As for marine organisms, from the 10 cruises in the last few years, it was found that the radioactivity level of marine organisms in the Northwest Pacific also decreased with time.

In addition, China has also developed a marine radioactivity assessment method with the corresponding program and an equipment for in-suit pre-concentration and monitoring. Moreover,

the voxel model for squids was also studied. And six papers have been published.

This year is the last year of WG 30 program. Therefore, we have also spent a great much time not only to summarize our survey/monitoring results these years and write the Final Report of China, but also to compile the reports of member countries into the first version of WG 30 Final Report for initial suggestions and comments on it during the WG business meeting of this year.

Japan

In the past year, Japan continued to carry out the marine environmental radioactivity monitoring in coastal and off-shore areas. The monitoring results showed that the seawater radioactivity level has decreased to the range of background level before Fukushima accident, and none of the marine organism samples exceeded the radioactivity limit of general food in Japan. Reduction of the fishery catch caused by the FDNPP accident made the marine resources off Fukushima increase.

Korea

According to the Korean Atomic Safety Law 105 Korea Institute of Nuclear Safety (KINS) and National Fisheries Institute (NIFS) have collaborated to carry out Marine Environmental Radioactivity Survey (MERS). In 2017 regular samplings were carried out seasonally at a total of 27 stations, and monthly or bimonthly additional samplings at a total of 6 stations in the sea regions around Korean Peninsula. Instead of reporting results from the 2017 survey, long-term monitoring results have been reported in the 2017 meeting. Time variation of ^{137}Cs , ^3H , $^{239+240}\text{Pu}$ and ^{90}Sr sea water concentrations over past 23 years (1994~2016) have been reported. The mean concentration values of ^{137}Cs , $^{239+240}\text{Pu}$ and ^{90}Sr in the sea water are found to be 1.09~2.77 mBq/kg, 1.48~14.6 $\mu\text{Bq/kg}$ and 0.22~1.24 mBq/kg, respectively. Long-term variation of ^{137}Cs concentration in fish, shellfish and shellfish at 7 stations and ^{137}Cs , $^{239+240}\text{Pu}$ and ^{90}Sr concentration values in bottom sediments at 16 stations have been also reported.

Marine Radionuclide Research Group of KIOST has also secured samples of major fishery products from sea regions around Korean Peninsula. Laboratory analysis of the collected samples has been carried to investigate the levels of radioactivity contamination. A concentration factor data base has been constructed for major radionuclides such as ^{137}Cs , $^{239+240}\text{Pu}$ and ^{90}Sr .

Transport and biological fate modeling efforts of radionuclides by KIOST over the period of Dec 2011 to 2017 have been summarized with focus on the cooperation with FIO, China and IMMSP, Ukraine. In detail, recent development of two box-based fate models as well as Eulerian and Lagrangian transport models was reported. The Eulerian transport model can consider multi-fractional sediments, two-step transfer kinetics, bioturbation effects and multiple bed layers to predict depth profiles of radioactivity in water column and bottom sediments. The Lagrangian model considers single fractional sediment, one-step transfer kinetics and single bed layer. Two box-based fate models were reported. One is POSEIDON-extended BURN ver. 1 equipped with pelagic and benthic food webs and the other is Multi-target tissue fish model ver. 1 without consideration of physiological interaction between fish organs. The model results were in good agreement with measurements.

USA

In the past year, the US has engaged in further outreach activities intended to better inform the public, especially now that there are finally reports of detectable ^{134}Cs in the coastal waters of US. Most of the monitoring has arisen via the Our Radioactive Ocean project, although a smaller water survey conducted between NOAA and OSU is nearly ready to be published. Dosimetric modeling continues, evaluating the effects of tissue type, density and elemental composition on dose conversion coefficients. A new protocol for the creation of 3D dosimetric models using exclusively open-source software and realistic polygonal meshes is underway, which should allow for better representation of fine-scale structures and allow for better collaboration between the US and other member countries on this front.

The co-chair of WG30, Prof. Yusheng Zhang, introduced the current progress of the Final Report of WG 30 – according to the outline of Final Report agreed in the WG30 Business Meeting 2016, most of the contents were submitted and integrated into the Final Report, while some contents (progress on radiological dose assessment model from US, monitoring results at NW Pacific from Japan and Russia, simulation model comparison from Korea, etc) were not submitted and integrated yet.

The WG 30 members agreed that the current section of “Expert Database” should be changed into “List of Contributing Scientists”.

The WG members also agreed the following timeframe for finalizing the report:

- WG members send revisions and comments to Dr. Wen Yu before Oct 20;
- Dr. Wen Yu integrates revisions and comments into the second draft of Final Report and send it to Dr. John Smith and Prof. Kathryn Higley before Nov 1;
- Dr. John Smith and Prof. Kathryn Higley send their revisions and comments to Dr. Wen Yu before Nov 15;
- Dr. Wen Yu sends the third draft of Final Report to WG members before Nov 22;
- WG members send their revisions and comments to Dr. Wen Yu before Nov 30.
- Submitting the Final Report to PICES secretariat before Dec 10.

AGENDA ITEM 5 -- Revision and Finalisation of Brochure of WG 30

Based on the draft version of brochure of the WG 30, the following items were agreed during the meeting:

- Information of workshops organized by WG 30 should be included.
- The TORs of WG30 should be deleted, considering it’s overlapping with the mission

statement of WG30.

- The cartoon figure should be changed.
- More text should be added to give detail information about the figures.
- Any comments/revisions regarding the brochure should be sent to Dr. Wen Yu before Nov 15.

AGENDA ITEM 6 -- **Proposal of establishing a new WG on radioactivity**

Since the lifespan of WG30 will finish at the end of 2017, a proposal of establishing a new WG on the Distribution and Environmental Evolution of Radionuclides in the North Pacific was brought out by Chinese delegation.

Dr. Wen Yu gave a presentation on the above proposal at the WG business meeting. After meeting participants discussing on the title and duty of the new WG no consensus was reached, but the meeting agreed to put the new WG proposal into the “Recommendations” section of the WG30 Final Report. The meeting agreed that further comments/revisions regarding the new WG should be sent to Dr. Wen Yu before Sep 25, and a revised proposal would be presented at the MEQ business meeting on Sep 27.

Annex 1

List of participants for WG 30 Business Meeting 2017

Country/ Committee	Members	Observers
Canada	John Smith	—
China	Yusheng Zhang (co-chair)	Jianhua He

	Wen Yu Wu Men	Jin Qiu Du
Japan	Tomowo Watanabe Takami Morita	Daisuke Ambe Toyonitsii Harii
Korea	Kyung Tae Jung Suk Hyun Kim In-Seong Han	Kyeongok Kim
Russia	—	—
USA	—	—
MEQ, PICES	—	Guangshui Na

Annex 2

WG 30 business meeting agenda of 2017

1. Revision and adoption of the draft Meeting Agenda
2. Overview and update of WG30
3. Country reports from member countries
4. Discussion on the WG30 Final Report (identification of gaps, schedule and work assignments)
5. Revision and finalisation of Brochure of the WG30
6. Discussion on the proposal for the new Working Group (title, objectives, TOR, suggested membership, etc)