放射能除染のための国際シンポジウム

International Symposium on Decontamination of Radioactive Materials

日時：平成 25 年 6 月 7 日（金）9:30 - 16:00

場所：タワーホール船堀 大ホール

主催　環境放射能除染学会

共催　環境省

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1. 日本における環境中の除染の取り組み
Progress on Off-site Cleanup Efforts in Japan

Masaru Moriya (Former Head of Fukushima Decontamination Team, Fukushima Office for Environmental Restoration, Ministry of the Environment)

The Ministry of the Environment, Government of Japan initiated its decontamination work program in Fukushima Prefecture as from January 2012. The work is mandated by the Act on Special Measures Concerning the Handling of Radioactive Pollution, and it covers 11 municipalities of Fukushima Prefecture, which had the restricted zone and deliberate evacuation zone. The work program is based on the Road Map for Decontamination issued in January 2012. The actual start and pace of decontamination work differs among the 11 municipalities, due to a couple of difficulties faced with those municipalities. The work is well advanced in Tamura City, Naraha Town and Kawauchi Village. But the Government has not yet formulated the decontamination implementation plan for Tomioka Town and Futaba Town. The other 6 municipalities are at a certain point between the both ends of advancement. Enlarged decontamination of forest areas and cleaning of paddy fields for rice production is among the important issues. Now that the restricted zones and deliberate evacuation zones are almost reclassified for future people's return, life infrastructure recovery and decontamination need to be advanced systematically and jointly.

2. 放射能の環境動態
Behaviour of radionuclides in the environment

Toshimasa Ohara (Director, Center for Regional Environmental Research, National Institute for Environmental Studies, Japan)

The radionuclides emitted from the Fukushima Daiichi Nuclear Power Plant adversely affect human health through the contamination of air, water, soil, and food. It is therefore very important to understand the current status of radioactive contamination, the dynamics of radionuclides in multimedia environments, and the impacts on human, wildlife and ecosystem health. From this perspective, we are implementing integrated studies consisting of the

following research items.

(1) Measurement of environmental dynamics

- ✓ Measurement of radionuclides in the atmosphere to reveal nuclide composition and size distribution of radioactivity
- ✓ Measurement of radionuclides to determine deposition, circulation and removal of the nuclides in the forest, lake, marshes and river environment

(2) Multimedia environmental modelling

- ✓ Estimation of atmospheric diffusion and deposition of radionuclides
- ✓ Application of a multimedia environmental fate model to predict long term scenario of radionuclide fate in the terrestrial and aquatic environment

(3) Ecosystem impact evaluation

- ✓ Evaluation of the impact of low level radioactivity on wild animals, fungi and plants

(4) Long term human exposure estimation

- ✓ Measurement of individual doses
- ✓ Exposure model constructed using the ambient and personal doses

(5) Analytical method development

- ✓ A rapid and sensitive measurement method for dissolved Cs
- ✓ An ultra-trace determination of I- 129 by an accelerator mass spectrometry

3. チェルノブイリ事故による立入制限地域における浄化試験：浄化の効率およびその長期安定性について(仮訳)

Decontamination tests in the recreational areas affected by the Chernobyl accident : efficiency of decontamination and long-term stability of the effects

V. Ramzaev, A. Barkovsky, A. Mishine (Federal Scientific Organization "Saint-Petersburg Institute of Radiation Hygiene after Professor P.V. Ramzaev" of Federal Service for Surviellance on Consumer Rights Protection and Human Well-being, Saint-Petersburg, the Russian Federation)

The presentation is based mainly on the published results of two large-scale experiments, which had been carried out by the Danish-Russian group of researches in the Bryansk region in Russia in 1995 and 1997, and the long-term monitoring (1995–2012) of decontaminated and untreated areas. It was the objective of this work to examine the possibilities for reducing the external doses

by decontamination in the remote period (~ 10 years) after the accident. Two recreational areas (Novie Bobovochi and Muravinka), which consisted of sets of wooden and brick summer houses in forest-grassland surroundings, were selected for the tests. Before the intervention began, absorbed gamma-dose rates in air in the area were 850±90 nGy/h (outdoor) and 390 ± 30 nGy/h (indoor) in Novie Bobovichi (1995), whereas they were 1000 ± 90 nGy/h (outdoor) and 430 ± 30 nGy/h (indoor) in Muravinka (1997). The decontamination activities included: (a) removal of a topsoil layer around three houses at each place; (b) addition of uncontaminated sand; (c) decontamination or renewal of roofs of four houses. The obtained values of the gamma-dose rate reduction factor were 0.20 (outdoor) and 0.34 (indoor) in Novie Bobovichi, and 0.17 (outdoor) and 0.27 (indoor) in Muravinka. The long-term monitoring of the treated recreational areas did not demonstrated an existence of significant re-contamination of cleaned ground plots within the time period of 15–17 years after intervention.

4. 放射性セシウムによる森林汚染 - チェルノブイリ事故からの教訓(仮訳)
Contamination of forests with radiocaesium - lessons from the Chernobyl accident

George Shaw (Division of Agricultural & Environmental Sciences, School of Biosciences, University of Nottingham, Sutton Bonington, LE12 5RD, UK)

Radioactive particles in the atmosphere are efficiently captured by forest canopies, especially at forest edges. This led to widespread contamination of forests as the Chernobyl cloud was transported across Europe. Contamination was highest in the vicinity of the reactor where lethal radiation doses were received by a small area which became known as the 'Red Forest'. The physico-chemical form of the particles emitted from Chernobyl was important in controlling the behaviour of radiocaesium in forests. 'Hot particles' in the 30 km exclusion zone increased the residence time of radiocaesium in the organic layers of forest soils and reduced uptake into trees. After long distance atmospheric transport the radiocaesium emitted from Chernobyl became more biologically available.

Numerous models have been constructed to describe and predict the long-term dynamics of radiocaesium in forest ecosystems and some of these were tested in

the IAEA's BIOMASS programme. The IAEA also conducted a cost-benefit study of the applicability of countermeasures to reduce radiation doses from forests and forest products. While a number of countermeasures are possible in principle, in practice the effectiveness of all but the simplest of remedial measures is open to question. Site-specific studies are needed before an effective long-term management strategy can be adopted.

5. セシウムの環境放射化学：同位体特性，底質との分配と環境中での循環(仮訳)
Cesium Environmental Radiochemistry: Isotopic Signatures, Sediment Partitioning, & Environmental Cycling

Darin Snyder[1] and Sue Clark[2] (**[1]Idaho National Laboratory and [2]Washington State University**)

Effective remediation of environmental radioactive Cs contamination requires a clearly defined goal and scientifically based remediation plan. Two specific case studies are discussed to highlight some of the characterization tools as well as the technical challenges involved in such an effort. Measurements made on the Cs isotopic composition of contaminated soils in the western United States demonstrate elucidation of the origin of radioactive contamination and the importance of the physical processes in the redistribution of contamination. Secondly, the partitioning of Cs contamination to soils and sediments can be dynamic, as demonstrated in a study of seasonal cycling of radioactive Cs in a freshwater system. Combined, these studies demonstrate the importance of initial site characterization and consideration of the complex relationship between microbiology and environmental chemistry. Four general recommendations are made: 1) Account for the redistribution of contaminated sediment (aeolian and/or fluvial) as this can be a critical process affecting remediation; 2) Develop a characterization plan that includes discrimination between recent and legacy fission product cesium; 3) Remediation plans must consider possible effects of seasonal influence on local geochemistry; 4) If fission product cesium is the primary contaminant of concern, soil treatments based on ion exchange should be considered.

6. セシウムの環境中における動態および福島における除染作業後のその長期影響評価(仮訳)

Cs Migration Behavior in the Environment and Its Long-term Assessment after Decontamination Work in Fukushima

Mikazu Yui, Kazuki Iiijima, Yukio Tachi and Shinichi Nakayama
(Japan Atomic Energy Agency)

Decontamination works due to Fukushima accident are implemented by the national government for special decontamination area (> 20 mSv/y) including 11 municipalities and by each municipality funded by the government for intensive contamination survey area (1 to 20 mSv/y) including 104 municipalities in 8 prefectures. These works are based on the Guidelines for decontamination works issued by Ministry of the environment, Japan.

Even under these circumstances, further studies are needed for optimization of decontamination works; decontamination for forest, decrease in waste generation, waste storage and disposal, possible recontamination by weather and water flow. These studies are based on understanding of Cs behavior in the environment. Cs migration behavior through water is likely dominated by sorption especially on clay minerals in the soil zone. Cs sorption on clay minerals is significantly affected by kinds of solid phases, ionic strength of aqueous solution and organic concentration. More important is reversibility of Cs sorption on natural materials. Up to now after the accident, Cs is rarely detected from aqueous phase. It means that Cs sorption is likely irreversible and Cs transport is accompanied by solid particles like clay minerals, especially in fresh waters.

We have encountered the most difficult decontamination work for the forest, which covers about 70 % of the Fukushima prefecture. The Guideline focuses on the decontamination of the forest adjacent to resident areas, which is reasonable under consideration of ecosystem conservation and disaster prevention like landslides. So, the limited forest decontamination is likely realistic based on the present expertise.

After the decontamination works, long-term investigation of Cs transport behavior from the Cs source term, the non-decontaminated forest, is important through the river -river bed-dam reservoir-estuary-system. Based on the continuous and long-term investigation, rigorous safety assessment can be possible gradually to reduce the uncertainty of the dose rate to the residents. Countermeasures to prevent Cs transport can be also possible through these

investigations. The recent topics based on these investigations are also presented.

7. 福島第一原子力発電所事故による放射性セシウムの海洋への輸送・拡散
Transport and dispersion of radiocecium from Fukushima Daiichi Nuclear Power Plant accident in the ocean

Makio Honda (Japan Agency for Marine-Earth Science and Technology)

It is estimated that about 80% of radiocesium emitted to the atmosphere from the Fukushima Daiichi Nuclear Power Plant accident were deposited on the ocean. In addition, direct discharge of radiocesium (^{137}Cs) was estimated to be about 4 PBq. Immediately after Fukushima accident, national institutions and universities have been conducting measurement of radiocesium concentrations in seawater, settling particles, marine creatures and seafloor sediment in order to verify distribution and horizontal/vertical transport of radiocesium in the ocean. In this talk, update of oceanographic investigation is reported.