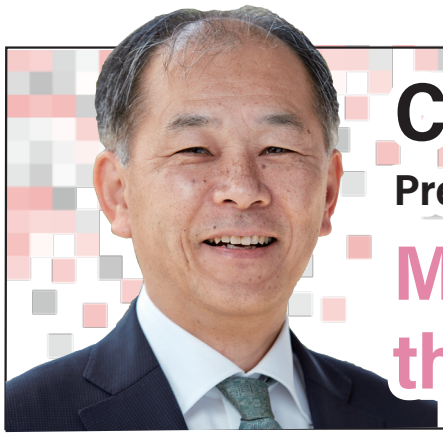
NIES Letter FUKUSHIMA
No.2
2018



Chiho Watanabe

President, National Institute for Environmental Studies

Message for the beginning of the fiscal Year

Deepening our understanding of the relationship between disasters and the environment, and exploring ways of better preparing for disasters and dealing with their consequences

The National Institute for Environmental Studies (NIES), the only national research institute in Japan to cover all aspects of environmental research, is headquartered in the city of Tsukuba, Ibaraki Prefecture. The Institute was established in 1974 and initially focused on developing countermeasures to environmental pollution ("kougai") in Japan. In 1980s, the Institute added the global environmental issues to its research agenda with particular emphasis on the Asian region. In addition to basic environmental research, NIES has been conducting various research and related activities aiming to solve urgent global, national and regional environmental issues; to name a few, among these are climate prediction based on satellite observation, a longituidinal, nationwide environmental epidemiological survey of 100,000 mother-child pairs, participation in international environmental initiatives such as IPCC* and COP**, and preservation and provision of precious biological and environmental samples. Recently, NIES has set out research on adaptation to climate change as represented by global warming and extreme weather events, and on invasive species such as *fire ants* that made news headlines last year.

NIES Fukushima Branch, established two years ago, is NIES's first full-scale activity base outside Tsukuba headquarter. It conducts research to aid both recovery from disaster and environmentally sustainable reconstruction of the region affected by the Great East Japan Earthquake and by the accident of Fukushima Daiichi Nuclear Power Plant. Through this research, it aims to gain deeper understanding of the disaster-environment relationship, which should lead to better preparation for disasters and better management of their consequences. To meet these ends, the Branch is carrying out initiatives throughout Fukushima Prefecture, integrating NIES's diverse research capabilities. These initiatives range from waste treatment, environmental transportation/fate and ecosystem impacts of substances including radioactive ones, to community development based on new forms of energy production and consumption. They are deemed world front runners in terms of research content, interdisciplinarity, and collaboration between researchers and local communities. We cordially appreciate your continued understanding and support for the Fukushima Branch.(Chiho Watanabe, President, NIES)

* the Intergovernmental Panel on Climate Change
** Conference of the Parties to the United Nations Framework Convention on Climate Change

ShibuShibu-kun's advice!

Why does the radiocesium activity concentration of freshwater fish remain high?

Yumiko Ishii, Researcher, Environmental Impact Assessment Section, NIES Fukushima Branch

Current radiocesium activity concentrations in freshwater fish

This spring marks the seventh year since the Fukushima Daiichi Nuclear Power Plant accident. Over time, radiocesium activity concentrations of seafood from Fukushima Prefecture have steadily declined. The results of monitoring radiocesium activity concentration in fish are posted on the website of the Fisheries Agency (http://www.jfa.maff.go.jp/e/inspection/index.html), and not a single marine fish exceeding the Japanese regulatory limit of 100 Bq/kg has been reported since April 2015. Progress is being made in efforts to reopen Fukushima fisheries, with the list of fishing trial fish species being revised in 2017 to include all seafood, excluding some species for which shipping is restricted. The radiocesium activity concentration of freshwater fish is, however, higher than that of marine fish, with some species such as yamame (masu salmon), iwana (white-spotted char), ayu (sweetfish), and ugui (Japanese dace) being subject to shipping restrictions and voluntary restraint on angling depending on watershed. Therefore, while marine products on the market can be consumed without any concern, people should be careful about consuming wild-caught freshwater fish in areas with high radiocesium deposition.

There are two reasons why radiocesium activity concentrations in freshwater fish remain higher than those in marine fish. First, while radiocesium was dispersed and diluted in seawater, it remains in bioavailable form in freshwater environment. It is known that most of the radiocesium found in fish is derived from their diet species. In rivers and lakes, the activity concentration of radiocesium of fallen leaves and riverbed algae is high, and this radiocesium is incorporated into the food chain by organisms feeding on these sources, eventually accumulating in freshwater fish. Second, the rate of radiocesium excretion of freshwater fish is lower than those of marine fish. This is caused by differences of physiological characteristics between freshwater fish and marine fish. Freshwater fish maintains higher ion concentration inside their body than those in the surrounding water by taking up and retaining ions, in contrast to marine fish, which live in seawater that has a higher ions than their bodies and actively excrete ions. When, then, will the concentration of radiocesium in freshwater fish have declined to a level at which people can eat them again without cause for worry?

Radiocesium in fish: what the future holds

The graph on the right shows how the radiocesium activity concentration in Japanese dace in the Niida River (Iitate village, Minamisoma city in Fukushima Prefecture) has changed over time (Figure 1). As the graph shows, the fish contain both ^{137}Cs and ^{134}Cs, but to simplify matters, we will take a look here only at the concentration of ^{137}Cs. The ^{137}Cs concentration declined rapidly from immediately after the accident, and we estimate that it would have

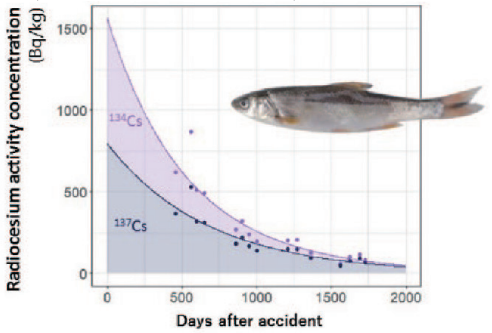


Figure 1. Radiocesium concentrations in Japanese dace in the Niida River
Based on results of the Ministry of the Environment's monitoring of radioactive substances in aquatic organisms

been halved in about 1.2 years if it had continued to decline at this speed. The time required for the concentration of radioisotopes to decline by 50% in natural environment is referred to as ecological half-life. The ecological half-life for ^{137}Cs in freshwater fish species was estimated to be 1–3 years in Fukushima Prefecture[1]. Thus, ecological half-life is much shorter than the half-life of radiocesium itself due to physical decay, which is about 30 years.

It would be nice if radiocesium activity concentration decreased at this speed, but the results of a survey carried out 12 years after the Chernobyl nuclear accident indicate that the pace of decline in radiocesium activity concentration slows down as time passes[2]. In the first few years after a nuclear accident, most of the released radiocesium into aquatic environments like rivers and lakes decreases rapidly through adhering to bottom sediment or being washed away. The rest of radiocesium remain and recycled in ecosystem for long time, and the pace at which it decreases appears to depend on how it moves within the watershed environment and aquatic ecosystem. For this reason, we anticipate that radiocesium concentration in fish in Fukushima may also decline at a decreasing pace.

Predicting fish radiocesium activity concentrations of Fukushima therefore requires an understanding of radiocesium movement in watershed and in the aquatic food chain. We will continue to conduct research that contributes to environmental restoration efforts by forecasting what the future holds for Fukushima's fish.

References

(1) Wada T., Tomiya A., Enomoto M., Sato T., Morishita D., Izumi S., Niizeki K., Suzuki S., Morita T., Kawata G. (2016) Radiological impact of the nuclear power plant accident on freshwater fish in Fukushima: An overview of monitoring results. Journal of Environmental Radioactivity, 151, 144-155

(2) Jonsson B., Forseth T., Ugedal O. (1999) Chernobyl radioactivity persists in fish. Nature, 400, 417,

Disseminating information and sharing ideas and opinions on specialized research with external organizations

Kazuo Yamada, Senior Researcher, Radiological Contaminated Off-Site Waste Management Section, NIES Fukushima Branch

Daily research and connections with outside experts

NIES Fukushima Branch is conducting specialized research on the environmental recovery and renovation of areas affected by the Great East Japan Earthquake to help build a society resilient to future disasters from the environmental perspective. We make our research results available to the general public in various ways. Most recently, the 1st Fukushima Prefecture Environment Creation Symposium was held on March 4, 2018.

In addition to reading and studying academic papers, meeting face-to-face with outside experts to share ideas and opinions is an important aspect of conducting advanced research. The nuclear power plant accident accompanying the Great East Japan Earthquake shed light on the closed nature of groups of specialists. This relates to the way in which information from specific academic fields tends to be inadequately disseminated to the general public, but the same principle applies in the opposite direction to research itself, since focusing too narrowly on a specific research field can blind one to surrounding circumstances. Here, I want to show you how experts in a specific academic field pursue their research. In specialized research fields, research outcomes gain recognition in academic circles through presentations at academic conferences and publication in relevant academic journals. However, research fields have become so specialized these days that researchers need to also make use of the latest information in fields outside their own.

For example, anyone conducting research on waste treatment aspects of environmental recovery would need to network with experts in many related fields including basic knowledge of radioactive substances, material science and technologies relating the treatment and disposal of wastes, and treatment/ disposal facility construction technologies. Researchers are currently cooperating in this way in many different fields, and here, I will introduce an example from my own particular field.

Activities in Japan

Considerations are underway regarding the disposal of designated waste outside Fukushima Prefecture in strictly controlled landfills encased in concrete based on the conventional technology for specially controlled wastes such as incineration fly ash of municipal solid wastes. The regulation of this disposal facility of a concrete pit was established in 1990. Since with the progress of concrete technology, the concrete used in more conventional landfills was thought to be inadequate for these strictly controlled landfills, we enlisted the cooperation of experts in various fields to pool their ideas on the construction of the safest possible landfills from the perspective of the properties of the waste concerned, and organized their contributions into a package of technical documentation[1] .

This experience has led to the launching of a study group on concrete in relation to waste. The Japan Concrete Institute (JCI) is a specialized academic organization focusing on concrete materials. Concrete technology is highly relevant to the disposal of municipal/ industrial waste and radioactive waste. JCI accordingly established a Technical Committee on the Application of Cement and Concrete Technologies for the Disposals of Hazardous/Radioactive Wastes[2] to promote technical exchanges between researchers from many different fields of expertise.

Overseas activities

Studying the latest findings of research on current waste disposal is essential to the disposal of radioactive substances. Disposal facilities need to be more durable and have longer useful lives than conventional structures, and the movement of radiocesium also needs to be considered. In the years since the accident, many meetings of experts have been held under the auspices of the International Atomic Energy Agency (IAEA), as have editorial meetings for compiling a record of events. International conferences have also been held to present information on a vast amount of technology related to the management of radioactive waste.[3] These three-day meetings generally attract over 2000 participants from about 30 countries and feature approximately 450 presentations in a great many different fields of specialization. Internationally, the management of radioactive waste, including the remediation of sites of former plants used in atomic bomb production, the decommissioning of nuclear power plants, and disposal of radioactive waste, is a very large industry requiring complex processes involving the international application of technologies, and providing local communities with many employment opportunities.

There are also meetings where specific areas of expertise are discussed in more depth. Within an academic organization named the International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM), there is a technical committee dedicated to the discussion of how to avoid alkali aggregate reactions that are one type of reaction that cause concrete to deteriorate. The photo below is of participants in a meeting held in London. Researchers from throughout the world gather about once every six months to conduct professional discussions. Meeting with leading researchers from other countries and sharing our latest findings in this way helps to broaden our knowledge as we continue to pursue research useful to environmental recovery.

Members of an international academic committee at the Geological Society of London

References

(1)Technical documentation on concrete used in strictly controlled landfills for contaminated incinerator fly ash and other waste http://www.nies.go.jp/whatsnew/2014/20141203/20141203.html

(2)Technical Committee on the Application of Cement and Concrete Technologies for the Disposals of Hazardous/Radioactive Wastes http://www.jci-net.or.jp/~tc175fs/

(3)WM Symposia http://www.wmsym.org/

NIES Fukushima Branch

Recent events

February

Feb. 2 Professor Yoshihiko Kuroda (School of Culture-Information Studies, Sugiyama Jogakuen University) presented and discussed the wide area evacuation of residents after the Fukushima Daiichi Nuclear Power Plant accident and support of victims in local communities in a Regional Environmental Renovation Section special seminar.

Senior Researcher Masanori Tamaoki's "Visual Detection of Scarred DNA: Principle and Application" won a Best Idea Award!

Feb. 8 Senior Researcher Masanori Tamaoki won a Best Idea Award at the SAT Technology Showcase 2018.

Feb. 9 Ikumi Kitamura (a project researcher with Fukushima University's Fukushima Future Food and Agricultural Education Program) made a presentation in the 3rd Environmental Renovation and Regional Cooperation Seminar .

Dr. Kitamura presented the condition of an evacuation center in Koriyama city immediately after the disaster.

March

Mar. 2 21 members of the Fukushima Prefecture Nuclear Decommissioning and Disaster Response Robotics Study Group toured our facility.

The symposium featured a poster session and panel discussion on Fukushima Prefecture's environmental recovery and renovation.

Mar. 4 NIES and JAEA (Japan Atomic Energy Agency) made presentations in the 1st Fukushima Prefecture Environment Creation Symposium .

Mar. 23–24 We organized a tour of research sites in Fukushima's Hamadori region and elsewhere as a research collaboration site visit to develop a deeper understanding of ongoing research and consider possibilities for collaboration on research.

We visited the Soma LNG Terminal.

NIES Fukushima Branch News Letter April.2018

Date of issue April 13,2018

(Every other month bimonthly publication)

Edit / issue NIES Fukushima Branch

10-2 Fukasaku, Miharu, Tamura District, Fukushima, 963-7700, Japan

E-MAIL fukushima-po@nies.go.jp

Website http://www.nies.go.jp/fukushima/

Website

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