March 2019

Fisheries Agency of Japan

Summary for understanding the monitoring inspection of radioactive materials

We can get more detailed information from the websites and pamphlets.

Results of the inspection of radioactive materials in fishery products are available on the website of the Fisheries Agency. Pamphlets discussing various questions concerning radioactive materials in fish from a scientific perspective are also available on the website of the Japan Fisheries Research and Education Agency.

Website of the Fisheries Agency (in English): http://www.jfa.maff.go.jp/j/housyanou/kekka.html

Website of the Japan Fisheries Research and Education Agency:
FAQ for Radioactivity and Fish (in Japanese)
http://www.fra.affrc.go.jp/bulletin/radioactivity_pamphlet2018/cover_index.html

This pamphlet is prepared as part of the promotion project for the monitoring survey of the effect of radioactive materials in FY2018.
Let's learn about fisheries in Fukushima

Preface

The accident at the Tokyo Electric Power Company’s Fukushima Daiichi Nuclear Power Station in March 2011 resulted in the leakage of radioactive materials and led to concerns over the contamination of fishery products.

To ensure food safety, the standard limits for radioactive materials in food are established and relevant prefectures conduct the monitoring inspections based on the guideline, "Concepts of Inspection Planning and the Establishment and Cancellation of Items and Areas to which Restriction on Distribution and/or Consumption of Foods concerned Applies" (revised on March 23, 2018) developed by the Nuclear Emergency Response Headquarters (whose director-general is the Prime Minister).

The Fisheries Agency is systematically conducting monitoring surveys for radioactive materials for marine and freshwater fishery products in East Japan to ensure the safety of fishery products and to promptly provide correct information concerning radioactive materials in such products.

Preface/Table of Contents

Let’s learn about fisheries in Fukushima

Structure of the monitoring inspection for radioactive materials in food

Framework of the monitoring inspections

Process of the actual inspection

Finding from the monitoring inspections

Concentration of radioactive cesium in marine fish species

Results of the analysis of radioactive cesium in marine fish species

Excess ratio for the standard limit (marine fish species)

Changes in radioactive cesium concentration in major marine fish species

Concentration of radioactive cesium in freshwater fish species

Results of the analysis of radioactive cesium in freshwater fish species

Excess ratio for the standard limit (freshwater fish species)

Changes in radioactive cesium concentration in major freshwater fish species

Column
Preface

The accident at the Tokyo Electric Power Company’s Fukushima Daiichi Nuclear Power Station in March 2011 resulted in the leakage of radioactive materials and led to concerns over the contamination of fishery products.

To ensure food safety, the standard limits for radioactive materials in food are established and relevant prefectures conduct the monitoring inspections based on the guideline, “Concepts of Inspection Planning and the Establishment and Cancellation of Items and Areas to which Restriction on Distribution and/or Consumption of Foods concerned Applies” (revised on March 23, 2018) developed by the Nuclear Emergency Response Headquarters (whose director-general is the Prime Minister).

The Fisheries Agency is systematically conducting monitoring surveys for radioactive materials for marine and freshwater fishery products in East Japan to ensure the safety of fishery products and to promptly provide correct information concerning radioactive materials in such products.

Table of Contents

Preface/Table of Contents ..............................................................1
Let’s learn about fisheries in Fukushima........................................2
Structure of the monitoring inspection for radioactive materials in food .... 3  
  Framework of the monitoring inspections ......................................3  
  Process of the actual inspection ...................................................4
Finding from the monitoring inspections
Concentration of radioactive cesium in marine fish species
  Results of the analysis of radioactive cesium in marine fish species .......5  
  Excess ratio for the standard limit (marine fish species)......................6  
  Changes in radioactive cesium concentration in major marine fish species ...6
Concentration of radioactive cesium in freshwater fish species
  Results of the analysis of radioactive cesium in freshwater fish species .... 7  
  Excess ratio for the standard limit (freshwater fish species) ...............8  
  Changes in radioactive cesium concentration in major freshwater fish species ...8
Column .............................................................................................9

Let’s learn about fisheries in Fukushima!

Shipped fish are confirmed to be safe.

Trial fishing operations and sales of catches with a lower radioactive level have been conducted since June 2012 to examine evaluations at shipped markets and gain basic information needed to resume fishery operations in Fukushima prefecture.

Meetings are held to discuss which fish species are to be captured.
Fishermen catch fish determined in the meeting.
Samples extracted from the catch are tested for radioactive materials to ensure safety.
All fish are to be shipped only after their safety is confirmed.
Fish ensured to be safe are sold in the market.

Target species of the trial fishing operation:
All marine fish species

(Except for fish species subjected to the instruction of restriction on distribution by the director-general of the Nuclear Emergency Response Headquarters)
Note 1: scorpion fish, ocellate spot skate, cherry salmon, brassblotched rockfish, and Stimpson’s hard clam (as of March 14, 2019)
Note 2: The fishery products for shipping are limited to those that are below 50 Bq/kg for radioactive cesium level (the voluntary limit of Fukushima Prefectural Federation of Fisheries Co-operative Associations) (cf. the standard limit of the Japanese government: 100 Bq/kg)
(Except for fish species subjected to the instruction of restriction on distribution by the director-general of the Nuclear Emergency Response Headquarters)

Landing
Olive flounder landed
Fish auction

It has been eight years since the accident, and safety has been confirmed in almost all fish species.
Structure of the monitoring inspection for radioactive materials in food

**What does the standard limit mean?**

In Japan, the standard limit for radioactive materials in general foods is set at 100 Bq/kg. This is lower than the strictest value (120 Bq/kg) of all thresholds for all age groups, which are set by taking into account differences in preferences and amount of food consumption among different age groups and sexes. The level of the standard limit ensures that the lifetime effect of radioactive materials in food is sufficiently low as to be safe even when a person continues to eat the food (1 milli-sievert or less per year). This standard limit is safe for all age groups including infants.

Source: Compiled based on The Story of Food and Radioactive Materials (Ministry of Health, Labour and Welfare and others)

Framework of the monitoring inspections

- Monitoring areas
- Target species
- Frequency

If the radioactivity level exceeds the standard limit?

A voluntary suspension or restriction on distribution will be implemented regarding distribution of the relevant fish species. **Fishery products exceeding the standard limit would not be distributed to the market.**
Structure of the monitoring inspection for radioactive materials in food

What does the standard limit mean?

In Japan, the standard limit for radioactive materials in general foods is set at 100 Bq/kg. This is lower than the strictest value (120 Bq/kg) of all thresholds for all age groups, which are set by taking into account differences in preferences and amount of food consumption among different age groups and sexes. The level of the standard limit ensures that the lifetime effect of radioactive materials in food is sufficiently low as to be safe even when a person continues to eat the food (1 milli-sievert or less per year). This standard limit is safe for all age groups including infants.

Source: Compiled based on The Story of Food and Radioactive Materials (Ministry of Health, Labour and Welfare and others)

Framework of the monitoring inspections

- Monitoring plan is developed mainly by local governments
  - Monitoring areas
  - Target species
  - Frequency

If the radioactivity level exceeds the standard limit?

A voluntary suspension or restriction on distribution will be implemented regarding distribution of the relevant fish species.

Fishery products exceeding the standard limit would not be distributed to the market.

Process of the actual Inspection

1. Receipt of fishery products
   - Fishery products sent from local ports are received, and checked for catch location and species.

2. Measurement of body length and weight
   - Edible parts of the fish (mainly muscle) are thoroughly minced for the test.

3. Preparation of mince
   - Edible parts of the fish (mainly muscle) are thoroughly minced for the test.

4. Place into an analytical beaker
   - Fishery products are inspected following the appropriate process.

5. Analysis
   - The concentration of radioactive materials per kilogram (Bq/kg) for the edible portion is obtained as the result of the measurement.

Discussion on left items and development of plans.
Concentration of radioactive cesium in marine fish species

Results of the analysis of radioactive cesium in marine fish species

Immediately after the nuclear power station accident, about 30% of samples in Fukushima prefecture exceeded the current standard limit (100 Bq/kg). Since then, the number of samples exceeding the standard limit tends to decrease with the passage of time. In Fukushima prefecture, one sample exceeding the standard limit was detected in January 2019 for the first time after three years and 10 months of no such cases. In prefectures other than Fukushima, no sample has exceeded the standard limit since September 2014.

<table>
<thead>
<tr>
<th>Year</th>
<th>Fukushima Prefecture</th>
<th>Other Prefectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>1,997 (1.7%)</td>
<td>112 (0.8%)</td>
</tr>
<tr>
<td>2012</td>
<td>5,479 (4.7%)</td>
<td>9,866 (7.6%)</td>
</tr>
<tr>
<td>2013</td>
<td>7,666 (6.6%)</td>
<td>9,528 (7.4%)</td>
</tr>
<tr>
<td>2014</td>
<td>8,705 (7.4%)</td>
<td>8,992 (7.0%)</td>
</tr>
<tr>
<td>2015</td>
<td>8,633 (7.4%)</td>
<td>7,745 (6.1%)</td>
</tr>
<tr>
<td>2016</td>
<td>8,842 (7.6%)</td>
<td>7,086 (5.5%)</td>
</tr>
<tr>
<td>2017</td>
<td>8,559 (7.4%)</td>
<td>6,317 (5.0%)</td>
</tr>
<tr>
<td>2018</td>
<td>5,028 (4.3%)</td>
<td>4,767 (3.7%)</td>
</tr>
</tbody>
</table>

As of January 31, 2019

(FY)
Results of the analysis of radioactive cesium in marine fish species

Immediately after the nuclear power station accident, about 30% of samples in Fukushima prefecture exceeded the current standard limit (100 Bq/kg). Since then, the number of samples exceeding the standard limit tends to decrease with the passage of time. In Fukushima prefecture, one sample exceeding the standard limit was detected in January 2019 for the first time after three years and 10 months of no such cases. In prefectures other than Fukushima, no sample has exceeded the standard limit since September 2014.

Excess ratio for the standard limit

For three years since FY 2015, as mentioned above, no sample has exceeded the standard limit. In FY 2018, one sample exceeding the standard limit was detected and the excess ratio was 0.01%.

Changes in radioactive cesium concentration in major marine fish species

Some samples of surface-layer fish (e.g., juvenile Japanese sand lance and whitebait) and demersal fish (e.g., olive founder) exceeded the current standard limit (100 Bq/kg) immediately after the nuclear power station accident, but the number of such samples and the concentration of radioactive cesium detected has promptly decreased with the passage of time. Currently, radioactive cesium levels are significantly below the standard limit for samples except in the one case mentioned above (ocellate spot skate, a demersal fish).
Concentration of radioactive cesium in freshwater fish species

**Results of the analysis of radioactive cesium in freshwater fish species**

Immediately after the nuclear power station accident, many freshwater fish species exceeded the current standard limit (100 Bq/kg). Since then, the number of samples exceeding the standard limit tends to decrease with the passage of time.

As of January 31, 2019

**Fukushima prefecture**

<table>
<thead>
<tr>
<th>Year</th>
<th>Exceeding 100 Bq/kg</th>
<th>Below 100 Bq/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>173</td>
<td>372</td>
</tr>
<tr>
<td>2012</td>
<td>88</td>
<td>567</td>
</tr>
<tr>
<td>2013</td>
<td>57</td>
<td>626</td>
</tr>
<tr>
<td>2014</td>
<td>27</td>
<td>911</td>
</tr>
<tr>
<td>2015</td>
<td>7</td>
<td>628</td>
</tr>
<tr>
<td>2016</td>
<td>4</td>
<td>697</td>
</tr>
<tr>
<td>2017</td>
<td>8</td>
<td>742</td>
</tr>
<tr>
<td>2018 (FY)</td>
<td>5</td>
<td>837</td>
</tr>
</tbody>
</table>

**Other prefectures**

<table>
<thead>
<tr>
<th>Year</th>
<th>Exceeding 100 Bq/kg</th>
<th>Below 100 Bq/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>114</td>
<td>482</td>
</tr>
<tr>
<td>2012</td>
<td>2,560</td>
<td>2,573</td>
</tr>
<tr>
<td>2013</td>
<td>2,214</td>
<td>1,781</td>
</tr>
<tr>
<td>2014</td>
<td>23</td>
<td>1,530</td>
</tr>
<tr>
<td>2015</td>
<td>7</td>
<td>1,300</td>
</tr>
<tr>
<td>2016</td>
<td>7</td>
<td>1,031</td>
</tr>
<tr>
<td>2017</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>2018 (FY)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

The number of samples exceeding the limit is gradually decreasing.
Concentration of radioactive cesium in freshwater fish species

Results of the analysis of radioactive cesium in freshwater fish species

Immediately after the nuclear power station accident, many freshwater fish species exceeded the current standard limit (100 Bq/kg). Since then, the number of samples exceeding the standard limit tends to decrease with the passage of time.

Changes in radioactive cesium concentration in major freshwater fish species

The number of samples of wild IWANA (char) and YAMAME (land-locked cherry salmon) exceeding the standard limit is substantially decreased compared to immediately after the accident. At the same time, no samples of cultured IWANA and YAMAME have exceeded the standard limit.
Cooperation with the International Atomic Energy Agency (IAEA)

The IAEA and Japanese laboratories measured radioactive materials using the same specimens extracted from fishery products and the measurement ability of the Japanese laboratories was examined (i.e. proficiency test). As a result, the methodology for radioactive material measurement practiced by Japanese laboratories were confirmed to be appropriate and have a high level of accuracy and competency.

Change in radioactive cesium concentration in marine fishery products before the nuclear power plant accident

The concentration of radioactive cesium ($^{137}$Cs) in marine fishery products such as fish and octopus had remained below 1 Bq/kg from 1983 to 2010. Radioactive cesium was present in the environment previously due to the effect of atmospheric nuclear explosion tests conducted mainly in the northern hemisphere.

The graph above indicates the radioactive cesium levels measured in the waters around nuclear power stations in Japan. For details, please refer to “Protection of Fishing Grounds” (in Japanese) on the website of the Marine Ecology Research Institute. (URL: http://www.kaiseiken.or.jp/publish/itaku/itakusaika.html)
Cooperation with the International Atomic Energy Agency (IAEA)

The IAEA and Japanese laboratories measured radioactive materials using the same specimens extracted from fishery products and the measurement ability of the Japanese laboratories was examined (i.e. proficiency test). As a result, the methodology for radioactive material measurement practiced by Japanese laboratories were confirmed to be appropriate and have a high level of accuracy and competency.

Change in radioactive cesium concentration in marine fishery products before the nuclear power plant accident

The concentration of radioactive cesium ($^{137}$Cs) in marine fishery products such as fish and octopus had remained below 1 Bq/kg from 1983 to 2010. Radioactive cesium was present in the environment previously due to the effect of atmospheric nuclear explosion tests conducted mainly in the northern hemisphere.

What is the detection limit?

The detection limit means the lowest concentration of target material that an analytical device can detect. The value becomes lower as the sample weight and/or duration of measurement increase, meaning detection and measurement of much lower concentrations becomes possible. On the other hand, this also means the number of samples to be analyzed becomes less. Therefore, a required detection limit is maintained for the specific purpose of analysis, and the value of the detection limit is presented to clarify that the outcome of the inspection is sufficiently reliable.

Why is the detection limit different depending on the sample?

Differences in detection limits occur when performing analyses even using the same device if the weight of the sample placed into the beaker and/or the duration of the measurement are different. The inspection of radioactive materials in food is implemented in accordance with the official testing method, “Testing Methods for Radioactive Substances in Food” and “Application of testing methods for radioactive substances in food” provided by the Ministry of Health, Labour and Welfare. The detection limit is set to be well below the standard limit (100 Bq/kg).

<table>
<thead>
<tr>
<th>No.</th>
<th>Fish species</th>
<th>Prefecture</th>
<th>Radioactive cesium ($^{137}$Cs) [unit: Bq/kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>9617</td>
<td>Chub mackerel</td>
<td>Miyagi</td>
<td>Below the detection limit (&lt;0.571)</td>
</tr>
<tr>
<td>9618</td>
<td>Chub mackerel</td>
<td>Miyagi</td>
<td>Below the detection limit (&lt;2.96)</td>
</tr>
<tr>
<td>9619</td>
<td>Hilgendorf saucord</td>
<td>Miyagi</td>
<td>Below the detection limit (&lt;3.59)</td>
</tr>
<tr>
<td>9620</td>
<td>Japanese sardine</td>
<td>Miyagi</td>
<td>Below the detection limit (&lt;4.34)</td>
</tr>
</tbody>
</table>

The graph above indicates the radioactive cesium levels measured in the waters around nuclear power stations in Japan. For details, please refer to “Protection of Fishing Grounds” [in Japanese] on the website of the Marine Ecology Research Institute. (URL: http://www.kaiseiken.or.jp/publish/taku/itaku_seika.html)
Results of the inspection of radioactive materials in fishery products are available on the website of the Fisheries Agency. Pamphlets discussing various questions concerning radioactive materials in fish from a scientific perspective are also available on the website of the Japan Fisheries Research and Education Agency.

Website of the Fisheries Agency (in English): http://www.jfa.maff.go.jp/j/housyanou/kekka.html

Website of the Japan Fisheries Research and Education Agency:
FAQ for Radioactivity and Fish (in Japanese)
http://www.fra.affrc.go.jp/bulletin/radioactivity_pamphlet2018/cover_index.html

We can get more detailed information from the websites and pamphlets.

Websites and pamphlets.

Fisheries Agency Radioactive Materials

Fisheries Agency Radioactive Materials

Research and Technological Guidance Division,
Resources Enhancement Promotion Department, Fisheries Agency of Japan
1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8907 TEL: 03-6744-2030

Central Laboratory, Marine Ecology Research Institute
300 Iwawada, Onjuku-machi, Isumi-gun, Chiba 299-5105 TEL: 0470-68-5111

This pamphlet is prepared as part of the promotion project for the monitoring survey of the effect of radioactive materials in FY2018.