Radiological Protection
NEA/CRPPH/R(2019)5
June 2022
www.oecd-nea.org

Summary Report of the Joint Symposium on Decommissioning, Reconstruction, Rehabilitation, and Food Safety: Rebuilding Post-Accident Confidence

26 March 2019
OECD Conference Centre, Paris

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NEA/CRPPH/R(2019)5

Unclassified English text only

7 June 2022

NUCLEAR ENERGY AGENCY
COMMITTEE ON RADIOLOGICAL PROTECTION AND PUBLIC HEALTH

Cancels & replaces the same document of 3 June 2022

Summary Report of the Joint Symposium on Decommissioning, Reconstruction, Rehabilitation, and Food Safety: Rebuilding Post-Accident Confidence

Co-organised by the OECD/NEA and the Japanese Ministries of Economy, Trade and Industry (METI) and Agriculture, Forestry and Fisheries (MAFF)

26 March 2019, OECD Conference Centre, Paris

This document is available in PDF format only.

JT03497039

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The mission of the NEA is:

– to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally sound and economical use of nuclear energy for peaceful purposes;

– to provide authoritative assessments and to forge common understandings on key issues as input to government decisions on nuclear energy policy and to broader OECD analyses in areas such as energy and the sustainable development of low-carbon economies.

Specific areas of competence of the NEA include the safety and regulation of nuclear activities, radioactive waste management and decommissioning, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information. The NEA Data Bank provides nuclear data and computer program services for participating countries.

Table of contents

List of figures

List of abbreviations and acronyms

CRPPH	Committee on Radiological Protection and Public Health (NEA)
DOE	Department of Energy (United States)
FAO	Food and Agriculture Organization of the United Nations
FMU	Fukushima Medical University
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
LANL	Los Alamos National Laboratory (United States)
MAFF	Ministry of Agriculture, Forestry and Fisheries (Japan)
METI	Ministry of Economy, Trade and Industry (Japan)
MPLs	Maximum permissible levels
NIHS	National Institute of Health Science (Japan)
NTMs	Non-tariff measures
SPS	Sanitary and phytosanitary (measures)
TBT	Technical barriers to trade
TEPCO	Tokyo Electric Power Company Holdings, Inc. (Japan)
WHO	World Health Organization

Public and policy overview

The Joint Symposium on "Decommissioning, Reconstruction, Rehabilitation, and Food Safety: Rebuilding Post-Accident Confidence" – organised by the Organisation for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA), along with the Japanese Ministry of Economy, Trade and Industry (METI), and the Ministry of Agriculture, Forestry and Fisheries (MAFF) – was held in Paris at the OECD Headquarters upon the request of the Japanese government. The symposium was an opportunity for Japanese authorities and experts to present the status, advancement and challenges of the Fukushima Daiichi nuclear power plant decommissioning activities, as well as the recovery and regeneration efforts that have been made in the Fukushima Prefecture since the March 2011 accident. Japanese authorities and international experts consider that, in terms of the on-site situation, the emergency phase is now over and it is time to look to the future in a planned and sustainable manner (IAEA, 2019). The Japanese government promotes and supports the "Fukushima Innovation Coast framework", which aims to revitalise the Fukushima Prefecture by establishing, in the Hama-Dori area, new industrial bases and employment opportunities – with different priority areas such as reactor decommissioning, robotics, disaster response, energy, agriculture, and forestry and fisheries.

Off-site, as in the aftermath of any disaster, one of the major components of the recovery is to restore local infrastructures. This restoration has been making steady progress over the past few years, as has work to ensure food and water safety. Today, all marketed food products from Fukushima Prefecture are well below governmental radiological standards for consumption.

The situation has not changed significantly in relation to public confidence, however, since the 2016 NEA International Workshop on Post-Accident Food Safety Science in Fukushima city. Three years later, the same problem arises: for a large part of the population, there remains a lack of trust in food products grown, fished or cultivated in the Fukushima Prefecture. This lack of trust could potentially compromise the willingness of citizens and food market stakeholders to welcome and respond to public policies aimed at rebuilding social and economic structures. For consumers, there is clearly a benefit from food of good quality, and this is an important dimension in quality of life. For farmers, producing food of good quality is a matter of pride, dignity and accountability. The symposium emphasised that it is now also a crucial matter of responsibility and solidarity for distributors and retailers to buy, sell and promote products "from Fukushima", focusing on their current and historically high food quality, rather than on extremely low radiological characteristics.

Executive summary

In 2016, the NEA International Workshop on Post-Accident Food Safety Science, held in Fukushima, Japan, suggested the need for a co-ordinated communications strategy involving farmers, fishers, distributors, consumers, experts (including universities), the Fukushima Prefecture and the Japanese central governments in order to bring stakeholders in closer contact with the efforts being made and the results being achieved.

On the request of the Japanese government, the Joint Symposium on "Decommissioning, Reconstruction, Rehabilitation, and Food Safety: Rebuilding Post-Accident Confidence" – organised by the Organisation for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA), along with the Japanese Ministry of Economy, Trade and Industry (METI), and the Ministry of Agriculture, Forestry and Fisheries (MAFF) – was held on 26 March 2019.

Objective

The overall objective of the joint symposium was to help foster an accurate, common understanding of the situation in the Fukushima Prefecture, and of the reconstruction progress being undertaken, in order to rebuild an informed domestic and international understanding of post-accident food products. To achieve this, the symposium:

- shared and discussed Fukushima progress, future plans and remaining issues with international and OECD communities;
- discussed aspects of Fukushima Daiichi decommissioning and reconstruction activities that could affect the image of food products;
- learnt from practical experience of managing radiologically contaminated food, including public and stakeholder communication to address the perception of food safety.

The results of this symposium should contribute to the ongoing consideration of the need for an international, post-accident food-safety framework to help verify the quality of food-safety efforts and to build consumer trust.

Content and findings

Eight years after the Fukushima Daiichi nuclear power plant accident, government authorities, the expert community, food market stakeholders and civil society attending the NEA joint symposium agreed that rebuilding post-accident confidence remains a real challenge.

It is worth noting that the comprehensive regulatory framework that has been developed and implemented, and its associated system of control, have resulted in very good results in terms of the levels of contamination in food and other goods. Levels are now generally far below the criteria that have been established by Japanese authorities. While this long-term vigilance will be present at each stage of production, the coherent and complete system of control that has been put in place demonstrates to consumers that public health risks related to marketed food consumption are virtually non-existent.

Despite the enormous efforts to advertise and promote these achievements at the local, national and international levels, possible improvements in terms of communication and public information are nonetheless still needed in Japan. For instance, new ways and

initiatives to encourage stakeholders to work together – producers with consumers, producers with co-operatives and distributors, experts with the population, etc. – have been very efficient at rebuilding confidence through mutual understanding between all interested parties.

In this respect, feedback on experience, from the management of existing exposure situations and trust-building approaches in comparable contexts (e.g. post-Chernobyl accident management in Europe, legacy site management in the United States) were presented during the symposium, and on many other occasions since the accident (e.g. the International Commission on Radiological Protection 2011-2018 Fukushima Dialogue Initiative Symposia, the NEA International Workshop on Post-Accident Food Safety Science [8-10 November 2016]). These experiences have shown that efforts must continue:

- to recognise the rights of residents of affected areas to enjoy a peaceful life not driven by radiological protection issues, and without changing their lifestyles too much;
- to sustain the engagement of local, interested parties and residents in rehabilitation and recovery actions (e.g. decontamination, agricultural countermeasures and conversions);
- to continue efforts to monitor individual, internal and external exposures, and to provide information and monitoring tools in order to help people to make their own judgements as residents and/or as consumers about the quality of food and their well-being;
- to create fora for ongoing dialogues among all concerned parties (producers, retailers and consumers) on issues related to foodstuff quality management;
- to feature farmers not as victims of the aftermath of the accident, but as the main actors in the recovery phase;
- to widely share locally-undertaken, successful recovery experiences, and increase the visibility of these actions in media and other communication channels, including social media;
- to morally and financially support projects and specific events lead by local actors, which aim at revitalising and restoring the good image and reputation of affected regions and their products, in an effort to create solidarity mechanisms;
- to integrate the local economy of affected areas in broader, even global, markets so as to lower the inevitable effects of stigma;
- to preserve traditional and cultural heritage, and rebuild local communities that have been undermined.

The symposium was a great opportunity to present and learn from communication experiences developed between science and communities. The pre-existence of regulatory frameworks, emergency preparedness and response plans and guidance for the establishment of decision criteria (e.g. reference values) are obviously essential for the proper management of post-accident exposure situations (especially existing exposure situations during the recovery phase). However, for (re-)building lost trust and credibility, there needs to be an agreed-upon process for discussion and decision making established from the start. In that respect, it is important to truly understand what the interested parties' concerns are and agree with them on the science-based approach to be used (for instance, the process of elaborating maximum permissible levels [MPLs] is much more important

than the numbers themselves). The compilation of all available data, which supports a consistent and trustworthy assessment, is an important step in the process, during which the involvement of, and input from, local stakeholders is essential. Stakeholders often know the riches and vulnerabilities of their territory better than the experts. The symposium was a plea for involving stakeholders in all steps along the way of the decision-making process.

Overall conclusions and perspective

The symposium presented a broad picture of the current status of post-accident Fukushima, in particular regarding decontamination, decommissioning, and food management. Case studies illustrating international approaches to post-accident food safety were presented, suggesting best practice, and the importance of state-of-the-art post-accident food management science. Key aspects worth noting are:

- On-site decommissioning activities have achieved stable and safe nuclear power plant conditions, and decontamination activities both on-site and off-site have significantly improved radiological conditions.
- Monitoring and response measures to radionuclide contamination of food in Japan are appropriate, and the food supply chain is managed effectively such that public-health risks from food consumption are virtually non-existent.
- Food monitoring results show that post-accident food management has effectively limited the radiological impact of food. Broadly, radiological impacts are lower than other large-scale radiological contamination situations.
- It is important to truly understand the radiological, social and economic concerns of interested parties, in order to agree on the science-based protective measures to be implemented.
- It is essential to involve stakeholders in all steps in protection decision-making processes in order to rebuild trust and achieve accepted, sustainable protective-action decisions.

Summary of presentations

1. On-site situation: Current status of the post-Fukushima accident and agenda of decommissioning works

a. *"Fukushima 8 years after the accident: The current situation of the nuclear power plant, surrounding areas, and confidence building" (Tatsuya Shinkawa, METI)*

b. *On-site situation: "Status and planning for the decommissioning of Fukushima Daiichi Nuclear Power Plant" (Masumi Ishikawa, TEPCO)*

Unquestionably, eight years after the catastrophic events and regrettable circumstances that led to the Fukushima Daiichi Nuclear Power Plant accident, significant progress has already been made by the Japanese people to move the plant from an emergency situation to more stabilised circumstances.

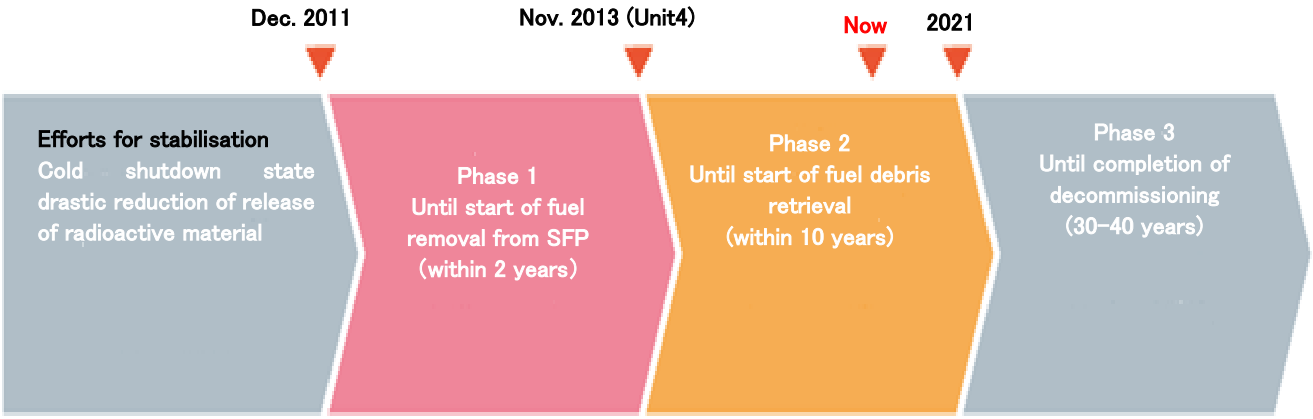
It must be remembered that the accident triggered fuel melting in three units (units 1, 2 and 3), and explosions in three – of the six – units of the plant (units 1, 3 and 4). The latter contained a spent fuel pool of unit 4 with 1 535 fuel assemblies inside, which were all removed in 2014. The removal of the spent fuel assemblies in the other three damaged units – the most critical task for risk reduction – began in April 2019, starting with unit 3.

Today, the three damaged reactor cores are being kept stable, and all reactors are now in cold shutdown condition. Plant parameters (e.g. temperatures) are stabilised at planned, manageable levels, using recirculating cooling water systems. Radioactivity levels have dropped dramatically (for example, monitoring data from sea water demonstrated that water concentration levels of radiocaesium are currently more than one million times lower than just after the accident, and below the WHO drinking water guidelines). Ambient dose rates have also decreased significantly, both inside and outside on-site buildings; as a consequence, monthly occupational doses have diminished proportionally. This has allowed the relaxation of some radiological protection measures taken after the accident by responders such as specific stringent protective clothing like wearing full- or half-face respirators everywhere and anytime, that very much constrain work activities.

Multi-layered measures have been taken to curb the generation of contaminated groundwater (e.g. by pumping through bypass wells, top-hill pavement, or building a frozen soil-wall around the four damaged units) and prevent leakages of contaminated water (by pumping groundwater through wells around four units to keep the groundwater level higher than that of the contaminated water inside the units, building a seaside impermeable wall, or replacing bolted tanks with welded ones).

As reported by the IAEA peer review mission in November 2018 (IAEA, 2019), the emergency is now over and the authorities are looking to the future in a planned manner. The next challenging issue is the fuel debris retrieval (internal investigations, mapping and sampling have already begun at units 1 and 2). This work will be launched by the end of 2021.

Figure 1. Decommissioning roadmap



Source: Ministry of Economy, Trade and Industry (METI), Japan (September 2017) https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/pdf/20170926_01a.pdf.

Summary

On-site situation: Current status of the post-Fukushima accident and agenda of decommissioning works

- The Fukushima Daiichi Nuclear Power Plant is stable.
- Radioactivity levels have dropped dramatically. In the sea, concentration levels are more than one million times lower than just after the accident. Ambient dose rates have also decreased.
- The next challenging decommissioning issue is fuel debris retrieval.

2. Off-site situation after the Fukushima Daiichi Nuclear Power Plant accident

Current off-site situation

c. "Fukushima 8 years after the accident: The current situation of the nuclear power plant, surrounding areas, and confidence building" (Tatsuya Shinkawa, METI)

The environmental impacts on site and in surrounding areas have been significantly reduced. In sea water, the concentration of radioactive materials (Cs-137) near the south discharge channel (monthly average) is more than two orders of magnitude (a factor of 100) lower than the guidance value recommended by the WHO guidelines for drinking water quality (<10 Bq/L) (WHO, 2017). In the air, the additional dose rate (mSv/year) at the site boundary from radioactive materials (caesium) from units 1-4 is evaluated to be negligible since 2015.

Off-site, decontamination activities were completed in the so-called "special decontamination areas" at the end of March 2017 (except the "areas where returning is difficult"). Air dose rates in residential areas and farmlands have been decreased by about 70% through decontamination and radioactive decay, and by about 50% to more than 60% in forests and on roads, respectively.

As of April 2018, evacuation orders had been totally lifted in Hirono, Naraha, Kawauchi, Tamura, Katsurao, Kawamata, Date city, and partly in Minami-Soma, Iitate, Namie and Tomioka. Returning is still considered difficult by Japanese authorities in Futaba and Okuma. The number of "evacuees" (people who lived in areas where official evacuation orders were issued) is now 24 000 (81 000 in August 2012).

Restoration of transport infrastructures, such as roads and railway, are making steady progress: the Joban expressway and national road no. 6 reopened in 2014, and only one section – Namie to Tomioka – of the JR Joban railway line will stay closed until March 2020. Many facilities, such as school, medical services (hospitals, clinics, nurseries), shopping malls and other public facilities are opening one after another. Some traditional festivals and religious events have resumed.

The Japanese government promotes and supports the "Fukushima innovation coast scheme" with new priority areas for the Fukushima Prefecture, in the areas of decommissioning (mock-up test facility), research on robotics and drones, combined – hydrogen, wind, photovoltaic – energy production (the concept of "smart cities") and modern agriculture. The efforts towards revitalisation of the Fukushima Prefecture are summarised and advertised in the short film entitled "Welcome Home, Fukushima" (METI, see references section) shown during the NEA symposium.

Summary

- Clean-up of special decontamination areas completed in March 2017 (excluding the areas where returning is difficult).
- Air dose rate in residential areas decreased by about 70% through decontamination and radioactive decay, and by about 50% to more than 60% in forests and on roads, respectively.
- Area under evacuation orders reduced (1 150 to 370 km^2) and number of evacuees reduced from 81 000 (as of August 2012) to 24 000.

- Facilities and infrastructure are being rebuild. Some traditional festivals and religious events have resumed.

Food safety issues

d. "Post-Accident Food safety management status" (Naohiko Yokoshima, MAFF);

e. "Assessment of the effectiveness of food safety measures by Japanese government" (T. Tsutsumi, NIHS);

f. EU measures as regards import of feed and food from Japan (Frans Verstraete, EC).

One of the major concerns of residents living in areas affected by catastrophes is food and water safety. Artificial or 'added' radioactivity in foodstuff is often perceived by consumers or suspected to be poisonous although natural radioactivity – potassium-40, radium-226, and uranium-238 and their progeny – is always present in food products.

After the Fukushima accident, the Japanese Ministry of Health, Labour and Welfare set the maximum levels for radionuclides in food under the Food Sanitation Act (Law No. 233 issued in 1947). The provisional regulatory values (reference levels for radiocaesium), which had been established on 17 March 2011 for drinking water, milk and dairy products (200 Bq/kg) and other foodstuff (500 Bq/kg) were then updated and enforced on 1 April 2012. The current maximum permissible levels (MPLs) that still applies to local, domestic consumption and international trade from Japan, are the following: 10 Bq/L for drinking water, 50 Bq/kg for milk and infant food and 100 Bq/kg for general food. MPLs were calculated under conservative assumptions (e.g. assuming that 50% of the individual diet is composed of products contaminated at the levels of MPLs, and by taking account of the most sensitive age category of consumers), which prevent individual ingestion doses received by drinking and eating to exceed 1 mSv/year.[1]

It has to be noted that the Japanese MPLs are consistent with and even stricter than the different maximum levels or reference values that are recommended by international organisations (WHO[2], ICRP[3], IAEA[4], FAO-WHO Codex Alimentarius[5]) for tap water and food imports following a radiological event.

On 25 March 2011, the European Commission adopted, as a precautionary measure, Implementing Regulation (EU) No. 297/2011 imposing special conditions governing the import of feed and food originating in or consigned from Japan following the accident at the Fukushima Daiichi Nuclear Power Plant, based on Article 53 of Regulation (EC) 178/2002. Regulation since then has very regularly been amended/replaced, and progressively has been significantly softened based on analytical results from the Japanese authorities and control results at import.

1. The caesium vs. strontium (or other radionuclides) concentration ratios were estimated high enough (>100) in the releases, to consider that the MPLs that have been set for caesium-137 and 134, which is the dominant long half-live radionuclide, also encompass ingestion doses due to strontium-90 (and other radionuclides such as ruthenium-106 or plutonium 238-241).
2. WHO, 2017.
3. ICRP, 2007, 2009a and 2009b.
4. IAEA, 2011, 2015 and 2016.
5. FAO, 1995.

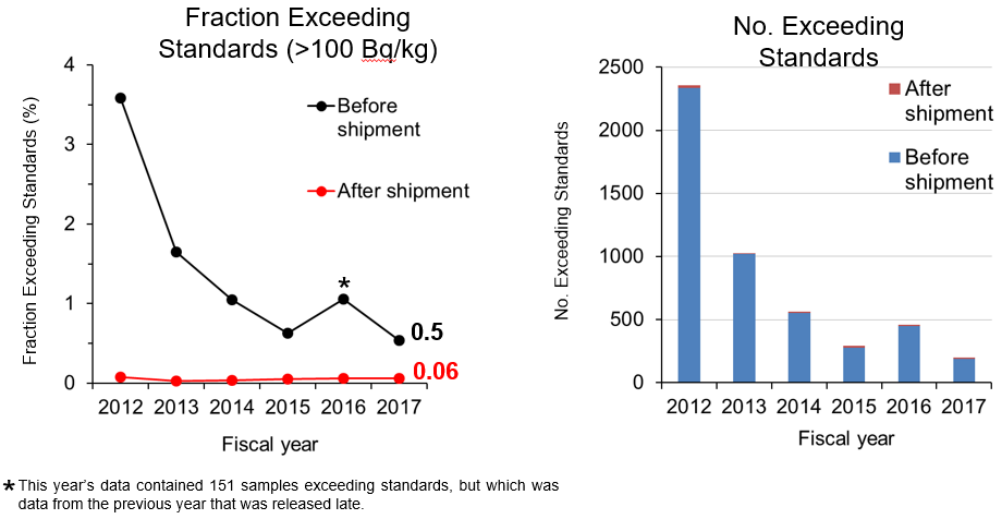
In parallel with the establishment of governmental reference criteria, and in order to prevent the distribution of food containing radioactive substances exceeding such criteria, a specific inspection system has been put in place to help assure maximum consumer safety. Monitoring tests of radionuclides in food are conducted by prefectural governments in 17 prefectures, and are based on specific guidelines set by the national government (monitoring plan and protocols, items subject to inspections).

Food items whose levels of radioactivity were found to exceed MPLs were recalled for disposal. If MPLs are exceeded in a particular product produced in a geographical area, restrictions on distribution and sales of the product are put in place on the basis of geographic production.

The proportion of samples exceeding the government-standard (100 Bq/kg) after shipment of foodstuffs was much lower than before shipment, and has remained constant at less than 0.1% since 2012. The proportion of samples exceeding the standard before shipment decreased gradually, with the 2017 rate (0.5%) being roughly one seventh that of 2012[6].

[6] Sampling is used to detect contamination or to lift already existing restrictions on the distribution of a product/crop from a certain area. Most of the test results that exceed the Japanese MPL come from the area that is already subject to restrictions. The samples are classified as pre-shipment samples even if they are not from a product intended for distribution or sale.

Figure 2. Samples exceeding the national standard before and after shipment of foodstuff (2012-2017)

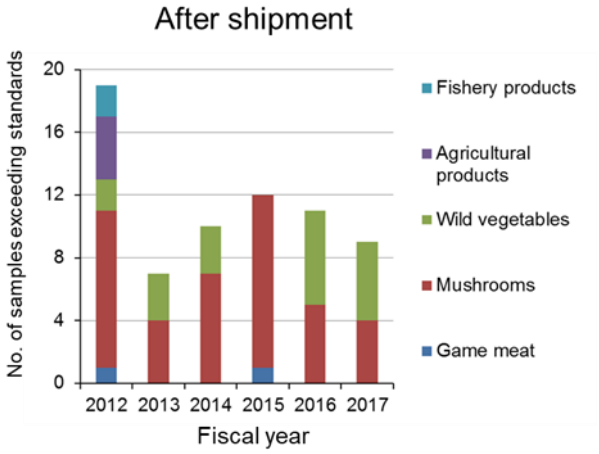


★ This year's data contained 151 samples exceeding standards, but which was data from the previous year that was released late.

Source: Division of Foods, National Institute of Health Sciences, Japan.

A few samples exceeding Japanese standards have been observed since the accident, but only for wild mushrooms, game meat, freshwater fish, and wild vegetables (before shipment). However, applying the Codex guideline level of 10 000 Bq/kg for food with small consumption rates, the excess ratio has been 0.0% for wild plants and wild edible fungi for more than 5 years (since last detection in May 2013), and around 0.1% for game meat (2 wild boars over 1 700 samples) between April 2017 and March 2018.

Figure 3. Samples exceeding standard after shipment according to food categories (2012-2017)



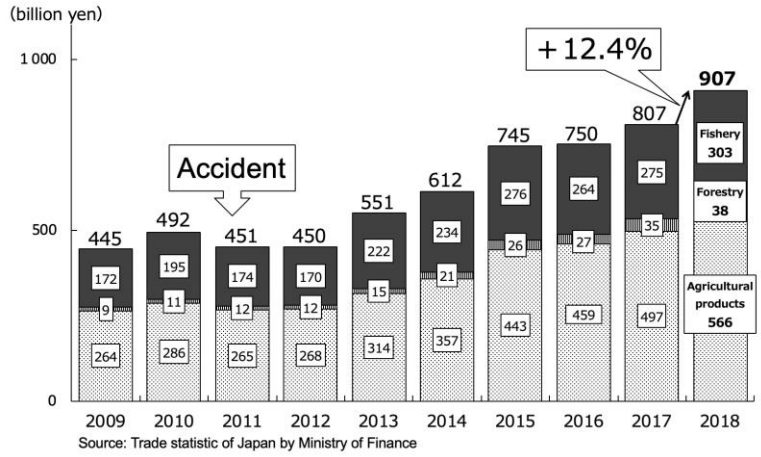
Source: Division of Foods, National Institute of Health Sciences, Japan.

Based on information made available in June 2018, the Joint FAO/IAEA Division, which uses existing United Nations (UN) resources to assist the FAO in addressing radiological safety aspects, understands that the measures to monitor and respond to issues regarding

radionuclide contamination of post-Fukushima accident food in Japan are "appropriate, and that the food supply chain is controlled effectively by the relevant authorities."

As of 20 March 2019, among the 54 countries and regions that introduced import restrictions/measures on Japanese food following the Fukushima Daiichi accident, 30 have already removed them. Japan's total export of agricultural products and food has not been much affected by the Fukushima accident, with the exception of 2011 and 2012 sales (see Figure 4 below).

Figure 4. Japan's export of agricultural product and food (2009-2018)



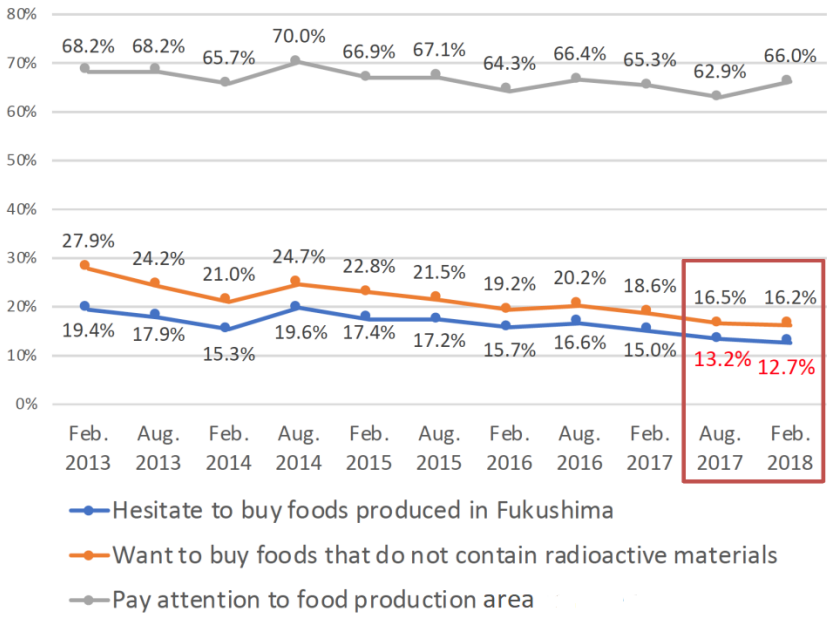
Source: Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan, based on data from trade statistic of Ministry of Finance, Japan.

According to the biannual "market basket" surveys performed in different regions of Japan by Japanese authorities, the effective ingestion dose from radioactive caesium in food (used in typical local meals) has been estimated as being far below 1 mSv/year (0.0005～0.0011 mSv/year in February-March 2018) and has remained stable for many years. The differences between doses that could be received in the three Fukushima regions (Hamadori, Nakadori, Aizu), neighbouring regions (< 200 km from the Fukushima Nuclear Power Plant) and other regions in Japan were small. The maximum dose was found in the Fukushima region (Nakadori). Overall, in foreign countries, the dose that could come from Japanese food would be even lower, given the share of Japanese food imports in total food consumption.

From these findings, it is obvious that radioactivity in food is not a health issue in the Fukushima Prefecture or elsewhere. Nevertheless, it is probably worthwhile to continue to develop monitoring strategies and management procedures to allow farmers and producers to control the radiological quality of their products in order to regain consumer confidence. A survey of Japanese consumer perception of products "made in a disaster affected area", recently conducted at the time of the presentation, shows that about 65-70% of Japanese consumers are paying little attention to their origin (this proportion has not changed much for six years). The proportion of individuals who still hesitate or refuse to buy food products they feel could be contaminated has decreased very slowly, and was at ~13% and ~16 %, respectively, in 2018. This shows that a small proportion of consumers will not change their mind in a near future about the risks of eating products from the Fukushima Prefecture.

Focus on trying to convince them otherwise would most likely require considerable effort and investment, and would be unlikely to have significant success.

Figure 5. Japanese consumers' perceptions of "Made in Fukushima"



Source: Online survey – 5 176 respondents – on the awareness related to food safety.
The Consumer Affairs Agency, 2018, Japan.

As said by a representative of a retail group, "No radioactivity inside" or "No harm" labels do not attract consumers, and could even be counterproductive. It is now the duty of distributors to promote the efforts made by producers, as well as the results achieved.

Summary

After the Fukushima accident, the Japanese government set and updated the maximum levels for radionuclides in food (MPLs) under the Food Sanitation Act, which applies to local and domestic consumption, and international trade from Japan. They are the following: 10 Bq/L for drinking water, 50 Bq/kg for milk and infant food and 100 Bq/kg for general food.

- It has to be noted that the Japanese MPLs are consistent with and even stricter than the different maximum levels or reference values that are recommended by international organisations.
- Among the 54 countries and regions that introduced import restrictions/measures on Japanese food following the Fukushima accident, 30 countries have already removed them as of 20 March 2019. In this context, considerable efforts are being made by the Japanese authorities, farmers, fishers, and distributors as follows:
    - In order to prevent the distribution of food containing radioactive substances exceeding the criteria, monitoring tests of radionuclides in food are conducted by prefectural governments in 17 prefectures, and are based on specific

guidelines set by the national government (monitoring plan and protocols, items subject to inspections).

- Food items whose levels of radioactivity were found to exceed MPLs were recalled for disposal.
- If MPLs are exceeded in a particular product produced in a geographical area, restrictions on distribution and sales of that item are put in place on the basis of geographical production.

- The proportion of samples exceeding the government-standard (100 Bq/kg for general foods) has remained constant at less than 0.1% since 2012.
- The Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture understands that the measures to monitor and respond to issues regarding radionuclide contamination of food in Japan are "appropriate, and that the food supply chain is controlled effectively by the relevant authorities."
- According to the biannual "market basket" surveys performed in different regions of Japan by the Japanese authorities, the effective ingestion dose from radioactive caesium in food (used in typical local meals) has been estimated as being far below 1 mSv/year (0.0005 ～ 0.0011 mSv/year in February-March 2018), and has remained stable for years. It is obvious that radioactivity in food is no longer a health issue in the Fukushima Prefecture or elsewhere.

3. Rebuilding confidence and rethinking the future

g. Domestic Image of Post-Accident Fukushima – Rethinking the reconstruction of food and agriculture (Yujiro Kuroda, FMU)

h. Challenges of Fukushima agriculture and marketing – Rising of Fukushima hero farmers (Daiju Takahashi, Oisix ra daichi Inc.)

i. NEA and ICRP Post Accident Food Safety Focus (Ted Lazo, NEA; Chris Clément, ICRP)

The subtitle of the symposium was "Rebuilding Post-Accident Confidence": it should be acknowledged that this challenge still remains in Japan. The fact is that a comprehensive regulatory framework has been developed and implemented, very good results in terms of levels of food contamination can be seen, and large efforts in advertising and promoting these achievements have been made. All of these are essential, but not sufficient. New ways and initiatives of engagement of stakeholders working together – producers with consumers, producers with co-ops and distributors, etc. – have also shown a very good efficiency at rebuilding confidence through mutual understanding between stakeholders. In that respect, many examples of "tools" and initiatives were given, and pointed out on different occasions (ICRP 2011-2018 Fukushima Dialogue Initiative Symposia, the NEA International Workshop on Post-Accident Food Safety Science [8-10 November 2016], etc.). This shows that such efforts are of utmost importance:

- to recognise the rights of residents of affected areas to enjoy a peaceful life not governed by radiological protection issues, and without changing their lifestyles too much;
- to sustain the engagement of local, interested parties and residents in rehabilitation and recovery actions (e.g. decontamination, agricultural countermeasures and conversions);
- to continue efforts to monitor individual, internal and external exposures, and to provide information and monitoring tools in order to help people to make their own judgements as residents and/or as consumers about the quality of food and their well-being;
- to create fora for ongoing dialogues between all concerned parties (producers, retailers and consumers) on issues of foodstuff quality management;
- to feature farmers not as victims of the aftermath of the accident, but as the main actors ("hero farmers") of the recovery phase; it is important to share their experiences, and increase the visibility of actions, in media and other communication channels, that are undertaken locally;
- to morally and financially support projects and specific events lead by local actors, which would aim at revitalising and restoring a good image and reputation of the region and its products, in an effort to create solidarity mechanisms;
- to integrate the local economy of affected areas in broader, even global, markets to lower the inevitable effects of stigma;
- to preserve traditional and cultural heritage, and rebuild communities, considering that rural farming is not always a business but often a way of living where its own roots are ("Furusato"), and to pass know-how to next generations, especially in this agricultural region of Japan (e.g. Iitate village case study). It is not just about measuring becquerels and resuming markets: for consumers, benefitting from food

of good quality is an important dimension of the quality of life; for farmers, producing food (perceived) of good quality is a matter of pride and dignity.

Summary

In order to rebuild confidence, initiatives of engagement of stakeholders working together will be very efficient and essential. Efforts will need to be undertaken as follows:

- to sustain the engagement of local interested parties and residents in rehabilitation and recovery actions (e.g. decontamination, agricultural countermeasures and conversions);
- to continue efforts to monitor individual, internal and external exposures, and to provide information and monitoring tools in order to help people to make their own judgements as residents and/or as consumers about the quality of food and their well-being;
- to create fora for ongoing dialogues between all concerned parties (producers, retailers and consumers) on issues related to foodstuff quality management;
- to feature farmers not as victims of the aftermath of the accident, but as the main actors of the recovery phase;
- to morally and financially support projects and specific events lead by local actors, which would aim at revitalising and restoring a good image and reputation of the region and its products, in an effort to create solidarity mechanisms;
- to integrate the local economy of affected areas in broader, even global markets so as to lower the inevitable effects of stigma;
- to preserve traditional and cultural heritage, rebuild communities and pass know-how to next generations, especially in this agricultural region of Japan.

4. International feedback in risk assessment after radiological and other hazardous events (with a focus on food safety issues)

From the perspective of lessons learnt addressing the rebuilding of confidence, several examples of international feedback in risk assessment after nuclear accidents (e.g. Chernobyl) and other radiological events were presented during the symposium. All these case studies illustrate the interest of stakeholder involvement and engagement in dose assessment, risk management and diagnosis and review of the situation all along the decision-making process, to achieve better understanding, acceptance and control.

a. "Post Chernobyl export [and reindeer meat] management experience in Norway" (M. Sneve, DSA)

The historical perspective of the establishment of specific MPLs for reindeer meat in Norway after the Chernobyl accident, shows that according to prevailing circumstances, higher than expected criteria (set in existing guidance and regulations) may be appropriate depending on such aspects as the proportion of contaminated food in the diet, or the preservation of local production embedded in traditions or essential to the economy of the entire community. Such aspects may evolve[7] as circumstances change over time. In this case, the value of preserving the Sámi people's culture outweighed the exposure of the general public.

From the beginning (end of 1986), reindeer herders were involved in the radiological characterisation of the situation, through sampling and mapping. Food authorities, farmers, reindeer herders' unions, food industries, etc. were involved in working and co-ordinating research groups on countermeasures. The compensation scheme was elaborated after negotiations with unions. Decisions to implement drastic countermeasures for reindeer herders were discussed and approved by all interested parties before their implementation (monitoring animals, clean feeding before slaughtering, changing the slaughter time, caesium binders, salt licks and rumen boli distribution to reduce caesium absorption by animals, and providing dietary advice for reindeer meat consumers).

Today, this stakeholder involvement process continues. In 2017, a risk assessment study examined the averted dose due to countermeasures, as well as the socio-cultural benefits and values (cultural heritage and social aspects) and the costs. As a result, interested parties concluded not to change MPLs again, and that there was still a need to continue whole body counting on a regular basis (once every 3 years), not only to assess the effectiveness of countermeasures but also to discuss with monitored individuals their situations, and to help them to find leeway for improvements.

7. *"The ML for radioactive caesium was initially set at 370 Bq/kg for milk and infant food, and 600 Bq/kg for all other foods, including reindeer meat. In November 1986, the ML in reindeer meat was increased from the general level for basic foodstuffs (600 Bq/kg) to 6 000 Bq/kg, because of the dramatic consequences that the Chernobyl fallout had for reindeer husbandry. From a radiation protection perspective, the increase was justified because of the low consumption rate of reindeer meat by the average Norwegian adult consumer (i.e., 400-500 g/year). In 1994, the ML was lowered to 3 000 Bq/kg."* (VKM, 2017)

b. "Post Chernobyl management experience from the UK" (C. Thomas, Food Standards Agency)

Several upland areas in Northern Ireland, Scotland, North Wales and North West England were affected by post Chernobyl accident fallout in 1986, areas where sheep farming is the main activity (about 10 000 farms were impacted). Legal restrictions were rapidly put in place: 1) prohibition of slaughtering sheep within designated areas; 2) prohibition of sheep movements out of the designated areas unless issued a "consent" (the strategy consisted of monitoring before to "mark and release" animals); 3) measures to prevent sheep meat above 1 000 Bq/kg entering the food chain.[8] This management system was maintained for about 25 years and allowed the reduction of the number of farms "under control" to 338 in 2011. At that time, it was asked whether it was justified and optimised to continue applying countermeasures; especially because monitoring is resource intensive, and there were difficulties maintaining consistency. It was decided to perform a more realistic consumer dose assessment, based on real measurements in the affected farms and considering typical farming practices. Taking into account realistic diets for representative persons in several "critical groups" ("farmer", "bulk buyer", "frequent buyer"), the dose assessment (0.05 to 0.21mSv/y) suggested that removal of controls would be a viable option. A full public consultation was held before any decisions were taken. The findings of the study were presented by the Food Standard Agency to meetings with local farmers, food industry representatives and members of the public. A communication plan was established in co-ordination with farmers, industry and the public, emphasising that risks were now very low and that by removing controls there was no increase in the risk to consumers. All controls were finally removed on 1 June 2012.

c. "Irish Experience: Managing seafood importation from the Irish Sea" (C. McMahon, Environmental Protection Agency)

For many years, the public – and especially fishers and seafood producers – worried about the Sellafield fuel reprocessing plant discharges into the Irish Sea. The comprehensive risk assessment that was performed in 2008 by the Environmental Protection Agency put annual doses from Sellafield-released radionuclides in context with other routes of exposures (medical, radon, etc.) and other risks (e.g. smoking). The Agency concluded that levels of radioactivity in seafood are detectable but they are not of radiological/health concern, and thus, there was no need to require changes in seafood consumption. Nonetheless, a monitoring programme was designed, and regular reviews are performed to ensure that it is and remains fit for purpose. Focus groups were organised to collect stakeholder responses to and understanding of information on environmental radioactivity that was provided. This supported the adaptation of the communication strategy and provision of information to the public (online reports, infographic and videos to explain dose results, public meetings to present results, dose calculator online, etc.) to more appropriately address stakeholder concerns. The main factor for building public confidence in information and decisions is the independence of the experts with whom the public interacts.

8. It has to be noted that this action level was above the MPL – 600 Bq/kg – that was established with respect to imports into the EU.

d. "Achieving acceptable, sustainable land use decision" (H. Grogan, Risk Assessment Corporation)

i. Case study no. 1 – Rocky Flats site

The Rocky Flats Environmental Technology site is a legacy site formerly used for the production of Plutonium pits for nuclear weapons, and contaminated by leaking barrels containing waste. Initially, the site was intended to be cleaned up to meet a government-designated soil criteria of 3 700 Bq/kg (100 pCi/g). As different values had been used for other site clean ups (Hanford, Johnston atoll, Palomares, etc.), this resulted in a loss of confidence in the pertinence of the values chosen.

The Department of Energy (DOE) officially established a Citizen's Advisory Board to oversee an independent calculation of radionuclide soil action levels (RSALS) for clean-up. The public requested the use of a 0.15 mSv/y dose constraint and, at the end of the clean-up process, the unrestricted use of the land (considering a 1 000y time frame). Monthly panel meetings with majority voting rules and topical public workshops were organised to discuss such topics as exposure scenarios, which model parameters to be used, and the uncertainty level to consider. As a result of this long (18 month) stakeholder consultation process, the Radionuclide Soil Action Level Panel recommended a clean-up level of ~ 1 300 Bq/kg for plutonium (the level actually used was ~ 1 800 Bq/kg). Today, the site hosts the Rocky Flats National Wildlife Refuge: it is an example of successful stakeholder dialogue in a complex situation.

ii. Case study no. 2 – Cerro Grande fire

The "Cerro Grande" fire burned ~180 km^2 in northern New Mexico over 16 days, including ~30 km^2 of the Los Alamos National Laboratory site, an area suspected to be contaminated with radionuclides and chemicals. The public was distrustful of DOE statements that there were no health risks. The DOE agreed to help fund the New Mexico Environment Department's independent assessment of the immediate and longer-term health impacts in terms of increased public exposures (doses received by the public, firefighters and emergency workers), and potential risks from radionuclides and chemicals associated with the LANL facility released as a result of the Cerro Grande Fire. It took time to consolidate data to be used to assess the impact, because different sources of information had been collected for different uses and purposes, were stored in different formats, and different databases and software were used. The essential part of this work was to build mutual confidence in the different actors involved, and agree on the data to be used.

Summary

All international case studies illustrate the interest of stakeholder involvement and engagement in dose assessment, risk management, diagnosis and review of the situation all along the decision-making process, to achieve better understanding, acceptance and control. A science-based approach is important to compile all available data to allow a consistent assessment. For example,

- In Norway, the post-Chernobyl compensation scheme was elaborated after negotiations with unions and the decision to implement the drastic countermeasures for reindeer herders were all discussed and approved by the interested parties. This stakeholder involvement process continues.

- From the Irish experience of the Sellafield fuel reprocessing plant discharges into the Irish Sea, the independence of the experts with whom the public interacts is important to build public confidence.
- In the case study of Rocky Flats site, which is contaminated by leaking barrels containing wastes, the DOE established a Citizen's Advisory Board to oversee an independent calculation of radionuclide soil action levels for clean up. Monthly panel meetings with majority voting rules and topical public workshops were organised to discuss topics such as exposure scenarios.

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- In the case study of the "Cerro Grande" fire, which burned a large area in northern New Mexico, including part of the Los Alamos National Laboratory site suspected to be contaminated with radionuclides and chemical wastes, the DOE agreed to help fund the New Mexico Environment Department's independent assessment of the immediate and longer-term health impacts in terms of increased public exposures and potential risks.

5. Post-accident actions for safety of foods and agriculture

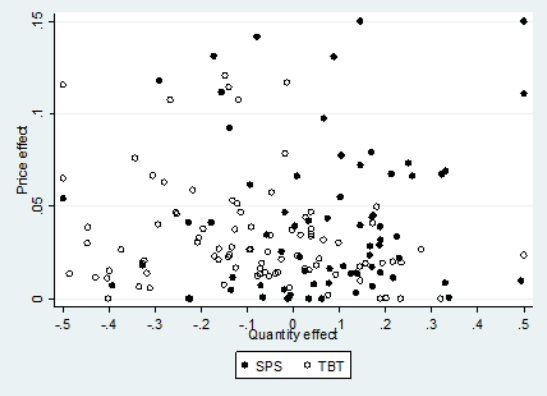
a. *Post-accident actions for safety of foods and agriculture (S. Kimura, OECD/TAD/COD)*

b. *Communicating safety of food and agriculture – the IAEA experience in Fukushima Ms Uwe Scholz – Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture*

c. *NEA Post-Accident Food Management Framework (T. Lazo, NEA/OECD)*

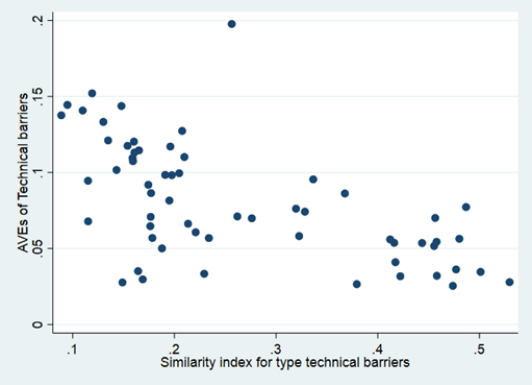
It was stated that "domestic regulations may lead non-tariff measures (NTMs) and regulatory heterogeneity can lead to increase of trade cost, however, good regulation can enhance demand, facilitate trade". Data shows the effects of SPS (sanitary and phytosanitary measures) and TBT (technical barriers to trade) to import prices and volumes. That data reveals that while the price effect increases, the quantity does not decrease. In some cases it happens that quantity increases despite the high price, which means that SPS and TBT can have demand-enhancing effects while import prices rise. This reason is that regulatory systems in the two trading countries are similar. As evidence of that, other data shows that regulatory similarity reduces trade costs. Homogeneity in regulatory systems can lead to consumer confidence and increases in trade volume.

Figure 6. Correlation of trade cost and quantity



Source: Cadot et al., 2018.

Figure 7. Correlation of Ad Valorem Equivalent (AVEs) of technical barriers and similarity index for type technical barriers



Source: Cadot et al., 2018.

In the context of post-accident situations, the IAEA recognises the necessity of improvement of communication to increase public trust of official announcements and sources of information. The IAEA launched a joint project related to mental health for medical radiation physicists, medical students and workers. This project develops medical curricula to learn how to deal with complicated communications with the public.

Regarding public communication on food safety issues, the IAEA recommends using the Codex Guideline Level (GLs) as a reference level. However, GLs do not consider existing exposure situations and GLs are evaluated by considering only specific radionuclides. As needed, it is better to use the TECDC-1788 formula, which is the approach used to derive reference levels for radionuclide activity concentration for food and drinking water for existing exposure situations, to develop new reference levels.

Adding to the above activities by the IAEA, other projects assisting the Fukushima Prefecture authorities were begun as follows:

- research and study on radiation monitoring, including application of environmental mapping technology to develop maps to be made available to the public;
- research and study on off-site decontamination including analyses of results of environmental monitoring and exploration of exposure pathways in order to reduce or avoid exposure;
- research and study on the management of radioactive waste, including management methods of low-level radioactive waste from decontamination activities. The IAEA has a wide range of past and next phase projects.

As nuclear safety organisations around the world have worked to address important lessons of the 2011 Fukushima Daiichi accident, one area that has not thus far received sufficient attention is that of ensuring the safety of food in the aftermath of a radiological contamination event. To address this, based on post-Chernobyl and post-Fukushima experience, but with an eye towards the broad range of radiological contamination events that might occur, the NEA has developed a post-accident food safety framework encompassing national and international aspects of post-accident food management (NEA, 2014).

This framework provides a holistic method to integrate existing national and international responsibilities so as to help avoid confusion and conflict regarding the safety of food produced in a region affected by a radiological contamination event. The FOOD ASSURE framework would also provide state-of-the-art, international assessments of key scientific aspects of an affected-country's post-accident food-management processes to contribute to domestic and international confidence in food allowed on domestic and international markets.

In order to effectively implement this framework, to contribute to national and international clarity and confidence, a binding intergovernmental agreement is required. The CRPPH post-accident food management methodology recognises the responsibility of the accident-affected country to develop an accident-specific approach to food criteria and management; acknowledges the political, social and ethical rationale for a consistent approach and single criteria for domestic consumption and exportation of food; An option to further explore, could be that importing countries consider the accident-affected country's export criteria when considering allowing importation. However, more reflection is needed to align with the rights of Member states assured by the WTO Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement - WTO, 1995). It is key that any criterion be

based on scientific findings. In addition, note that urgent protective actions will generally be a higher priority focus than post-accident food management. The methodology makes the following recommendations:

Methodology assumptions

- Accidents are rare and are unique.
- Affected food products will be accident specific.
- There are a limited number of types of export food products from any affected area.
- Consumption and export criteria are a matter of national choice, will evolve with circumstances, and will take international recommendations into account.

Emergency food actions

- Agricultural activities and consumption of food produced in areas considered to be affected will be banned/restricted rapidly.
- Food distribution and export from affected areas will be banned/restricted rapidly.
- Food consumption, distribution and export will be resumed only after:
  - The accident is under control, and affected areas have been radiologically characterised.
  - National criteria and a monitoring process have been established.
- Until the above conditions are met, some importing countries may suspend food importation from the affected areas (countries).

Methodology assumptions regarding national consumption criteria

- National criteria should be based on pre-accident governmental risk assessments, appropriately addressing international recommendations.
- National criteria will need to be refined to address actual prevailing circumstances, considering:
  - What food products are affected.
  - What radionuclides have been released.
- Criteria refinement can take place during the time that the accident is being brought under control and affected areas are being characterised.
- Criteria will be developed to protect the most exposed group – those living in the affected areas.

Post-accident food-management methodology

- For affected food, national consumption criteria will be developed in easily measurable quantities:
  - Eating affected food will not cause individual radiation exposures over a specified level (e.g. in mSv/y).

  - Thus, based on an individual's assumed annual consumption of food from affected areas (e.g. in kg/y)
  - Activity concentration for consumption must be less than a calculated level (e.g. in Bq/kg, Bq/l)
- The numeric values of Codex Guideline Levels should be used as a ceiling for national consumption criteria in affected countries.
- It will be socially, politically and perhaps ethically difficult for a country to use different criteria for those living in the affected areas and those living in unaffected areas.
- Similarly, criteria for national consumption will most likely be used as export criteria.
- Additionally, and as an option for further exploration, importing countries, where lower amounts of affected food will likely be consumed, might consider the accident-affected country's criteria as a basis for their import criteria. However, this should be in line with the rights of the Member states assured by the WTO-SPS Agreement and justification should be based as far as possible on the analysis and assessment of objective scientific data for food safety and human and animal health protection (WTO, 1995).

The methodology thus uses the same consumption criteria for the local, national and international management of food from post-accident affected areas

Summary

- Trade and trade regulation issues can have significant effects on food production from affected areas.
- Communication and trusted, scientifically sound information sources are needed to help ensure informed decisions.
- Decisions regarding food safety are informed by science, but are often driven by perception and feeling.
- International understanding of the post-accident food safety framework, and international expert validation of accident-country management efforts may help to improve both domestic and international understanding and trust.

Conclusions and perspectives

The Joint Symposium on "Decommissioning, Reconstruction, Rehabilitation, and Food Safety: Rebuilding Post-Accident Confidence" – organised by the Nuclear Energy Agency (NEA), along with the Japanese Ministry of Economy, Trade and Industry (METI), and the Ministry of Agriculture, Forestry and Fisheries (MAFF) – was an opportunity to present and learn from communication experiences developed between science and communities. The pre-existence of regulatory frameworks, emergency preparedness and response plans and guidance for the establishment of decision criteria (e.g. reference values) are obviously essential for the proper management of post-accident exposure situations (especially existing exposure situations during the recovery phase). For (re-)building lost trust and credibility, however, there needs to be an agreed-upon process for discussion and decision-making established from the start. In that respect, it is important to truly understand what the interested parties' concerns are, and agree with them on the science-based approach to be used (for instance, the process of elaborating maximum permissible levels (MPLs) as much more important than the numbers themselves). The compilation of all available data, which supports a consistent and trustworthy assessment, is an important step in the process, during which the involvement of and input from local stakeholders is essential. Stakeholders often know the riches and vulnerabilities of their territory better than experts.

In summary, the symposium presented a broad picture:

- of the current status of post-accident Fukushima, in particular in relation to the decontamination status, decommissioning status and food management;
- of international approaches to post-accident food safety;
- of relevant state-of-the-art post-accident food management science.

Key aspects worth noting are:

- On-site and off-site status has significantly improved.
- Monitoring and response measures to radionuclide contamination of food in Japan are appropriate, and the food supply chain is managed effectively such that public-health risks from food consumption are virtually non-existent.
- Food monitoring results show that post-accident food management has effectively limited the radiological impact of food. Broadly, radiological impacts are lower than other large-scale radiological contamination situations.
- It is important to truly understand what the interested parties' concerns are, and agree with them on the science-based approach to be used.
- The symposium was a plea for involving stakeholders in all steps along the way of the decision-making process.

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