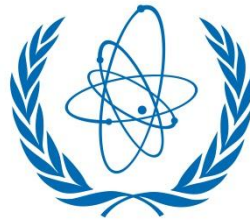


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**IAEA**

International Atomic Energy Agency

*Atoms for Peace*

## **Preliminary Summary Report**

# **The Follow-up IAEA International Mission on remediation of large contaminated areas off-site the Fukushima Daiichi Nuclear Power Plant**

**Tokyo and Fukushima Prefecture, Japan**

**14 – 21 October 2013**

## EXECUTIVE SUMMARY

In October 2011, the IAEA conducted an International Mission to Japan to support the remediation of large contaminated areas off-site TEPCO Fukushima Daiichi Nuclear Power Plant (NPP). In response to the request made by the Government of Japan, in October 2013, the IAEA organized a follow-up International Mission on remediation of large contaminated areas off-site TEPCO Fukushima Daiichi NPP (hereinafter referred to as the “Follow-up Mission” or the “Mission”) with the main purpose of evaluating the progress of the on-going remediation works achieved since the previous mission in October 2011.

The Follow-up Mission Team involved 13 international experts. Additionally, 3 experts of the Working Group 5 (Subgroup 5.2, Remediation) in charge of preparing the IAEA Comprehensive Report on TEPCO Fukushima Daiichi Accident accompanied the Mission as observers, to obtain first-hand information for the comprehensive report.

The Follow-up Mission had the following three objectives:

1. To provide assistance to Japan in assessing the progress made with the remediation of the Special Decontamination Area (not included in the previous mission of 2011) and the Intensive Contamination Survey Areas;
2. To review remediation strategies, plans and works, in view of the advice provided by the previous mission on remediation of large contaminated off-site areas; and
3. To share its findings with the international community as lessons learned.

The Mission was conducted through the assessment of information provided to the Team and professional and open discussions with the relevant institutions in Japan, including national, prefectural and local institutions. The Japanese authorities provided comprehensive information on their remediation programme. The Mission Team also visited the affected areas, including several sites where activities on remediation were conducted and some temporary storage sites for radioactive waste and soil generated in the remediation activities, as well as a survey area for the interim storage facility for radioactive soil and waste, and a demonstration facility for incineration of sewage sludge.

### Overview

The *Act on Special Measures Concerning the Handling of Radioactive Pollution* (“the Act on Special Measures”) was enacted in August 2011 and took full effect from January 2012 as the main legal instrument to deal with all remediation activities in the affected areas, as well as the management of materials removed as a result of remediation activities. The Basic Principles based on the Act were published in November 2011, thus creating an institutional framework to implement remediation activities.

According to the Act on Special Measures, the affected areas have been rearranged into two categories:

- Special Decontamination Area. This area consists of the “restricted areas” located within a 20 km radius from TEPCO’s Fukushima Daiichi NPP, and “deliberate evacuation areas” where the annual cumulative dose for individuals was anticipated to exceed 20 mSv. The national government promotes decontamination in these areas.

- Intensive Contamination Survey Area. This area includes the so-called Decontamination Implementation Areas, where an additional annual cumulative dose between 1mSv and 20mSv was estimated for individuals. Municipalities implement decontamination activities in these areas. In all these areas the average air dose rate exceeded 0.23 $\mu$ Sv/hour.

In a more pragmatic approach for the remediation programme, the Special Decontamination Area is further divided into the three following categories as shown in figure 2:

- Area 1 (Green). Estimated annual dose level is below 20mSv (and above 1mSv)
- Area 2 (Yellow). Estimated annual dose level is between 20 and 50mSv
- Area 3 (Red). Estimated annual dose level is over 50mSv, and the annual cumulative dose is expected to be more than 20mSv within five years

This Mission focused on remediation in the Special Decontamination Area, as it was not considered under the scope of the previous Mission, and on following up on progress regarding the advice provided by the previous mission to enhance remediation planning and implementation in all the affected areas.

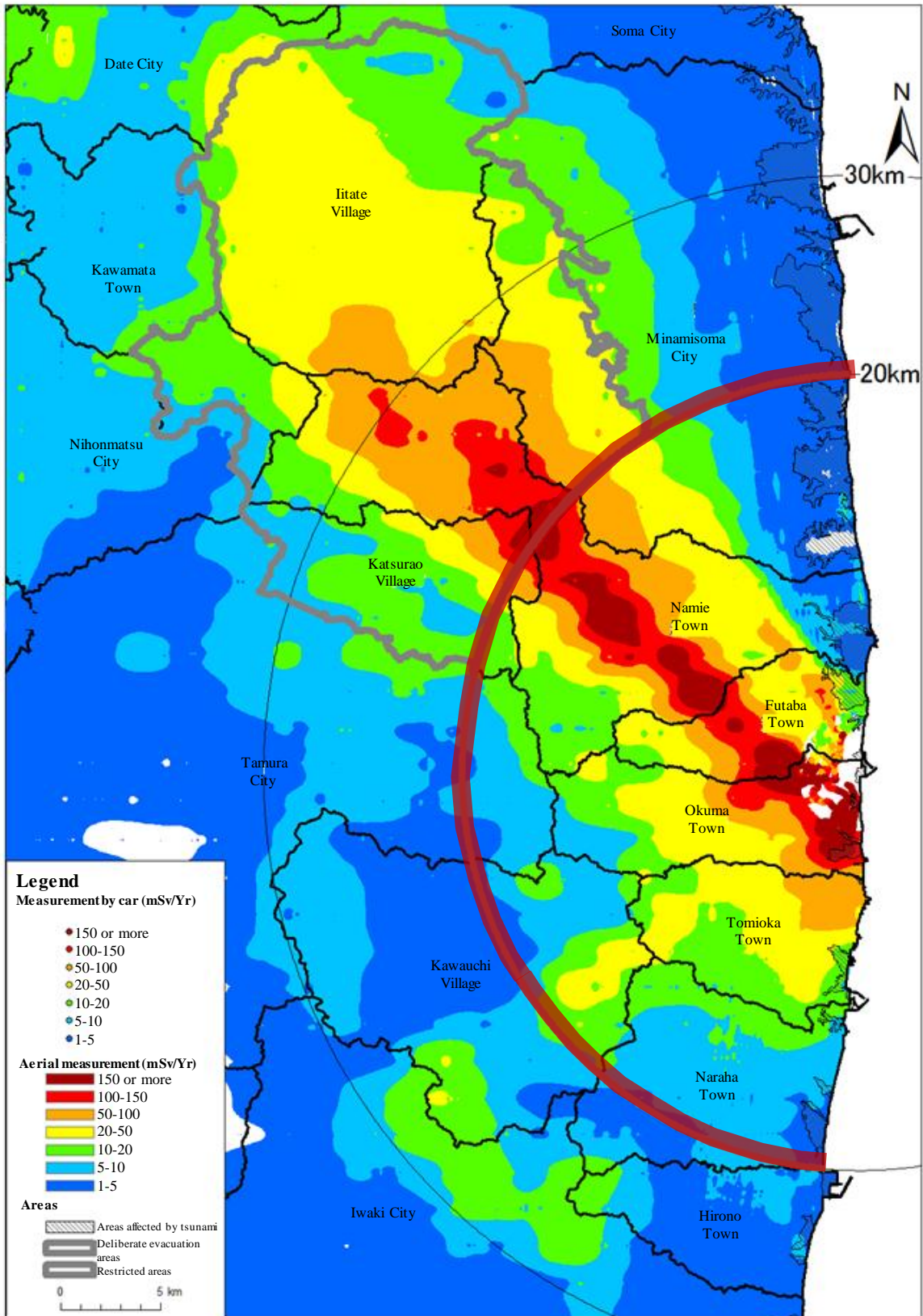


Figure 1: Restricted areas and areas to which evacuation orders have been issued around TEPCO's Fukushima Dai-ichi NPP (5 November, 2011).

## Areas to which evacuation orders have been issued (August 7, 2013)

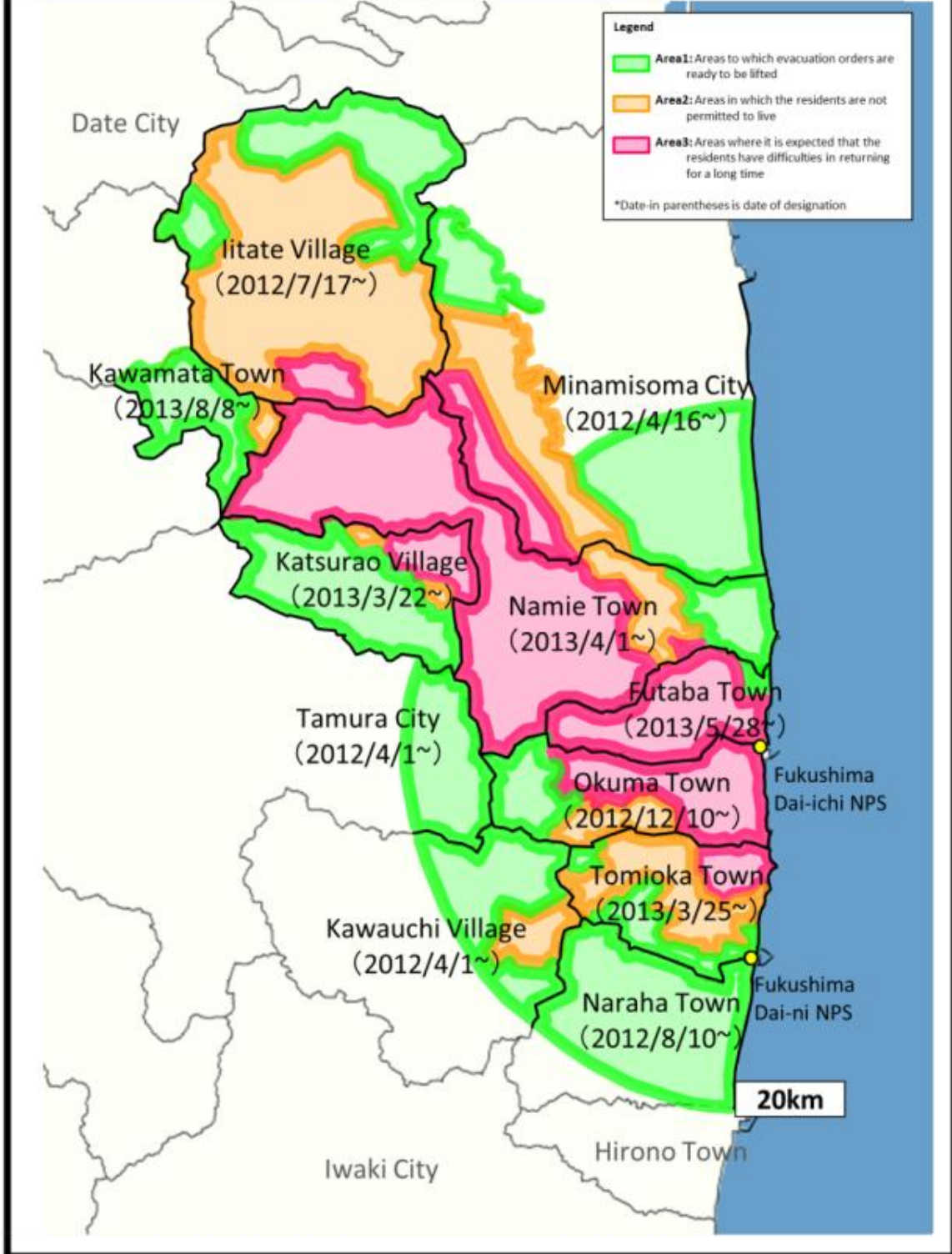


Figure 2: Current arrangement of the areas to which evacuation orders have been issued (7 August, 2013)

## **Main findings**

This report presents the main results and conclusions of the Mission.

The Team considers that the remediation of large contaminated areas represents a huge effort and recognizes that Japan is allocating enormous resources to developing strategies and plans and implementing remediation activities, with the aim of enhancing the living conditions of the people affected by the nuclear accident, including enabling evacuated people to return. The Team also considers that, as result of these efforts, Japan has achieved good progress in the remediation activities and, in general, has well considered the advice provided by the previous Mission in 2011. The Team was pleased to see good progress in the coordination of remediation activities with reconstruction and revitalisation efforts.

The report also provides conclusions from the assessment of specific topics in the remediation programme, including the twelve points where the previous Mission provided advice for improvement. It highlights important progress in all areas to date and offers advice on several points where the Team feels it is still possible to further improve current practices, taking into account both international standards and the experience of remediation programmes in other countries, which will further help to increase public confidence. While Japan continues its current remediation efforts, it is encouraged to take into consideration the Mission's advice for further optimisation of remediation activities.

### **Highlights of important progress**

Highlight 1: The Team acknowledges the institutional arrangements implemented by Japan to address the remediation needs of the areas affected by TEPCO's Fukushima Daiichi accident. The Team appreciates that Japan makes enormous efforts to implement the remediation programme in order to reduce exposures to people in the affected areas, to enable, stimulate and support the return of people evacuated after the accident, and to support the affected municipalities in overcoming economic and social disruptions. The review Team recognizes the involvement of a wide range of ministries and agencies, as well as institutions of the municipalities, to support remediation by providing financial resources, technical guidance and institutional assistance.

Highlight 2: Overall, the Team has seen many examples of good practice in stakeholder involvement, with demonstrable evidence that successful communication and engagement processes are being adopted at the national, prefectural and municipal level. It is clear that in some instances, key local community figures have been motivated to lead on engagement issues, gaining the trust of their communities. National government is encouraging local authorities to conduct extensive consultations with local communities, and is respecting their outcome.

Highlight 3: The Team acknowledges that a large amount of crucial information (especially in relation to dose rates) has been produced since the accident that will help to drive decision-making processes. It is clearly important to foster confidence both in the accuracy of the information itself and in how it is interpreted, especially in terms of safety perceptions. This is particularly effective where trusted intermediaries are used, such as doctors and other independent experts.

Highlight 4: The Team believes that the Decontamination Information Plaza in Fukushima and its associated outreach activities are a valuable asset in the overall stakeholder engagement process.

Highlight 5: The Team acknowledges that the NRA has set up a team to conduct a study on 'Safety and Security Measures towards Evacuees Returning Home'. It is beneficial to continue the measurement of individual external exposure doses for Fukushima prefecture residents, to confirm the expected decreasing trend and justify the remediation decision as noted in Point 4. Some measures, not only for decontamination but for exposure reduction measures, health management and rebuilding daily life, can be undertaken after evacuation orders are lifted, until additional individual dose exposure decreases gradually towards the long-term dose reduction goal of 1 mSV/y.

Highlight 6: The Team welcomes the critical evaluation of the efficiency of the removal of contaminated material compared with the reduction in dose rate offered by different methods of decontamination, recognizing that this is an important tool in the application of decontamination methods. In addition, the Team notes a welcome change from guiding remediation efforts based on surface contamination reduction, to a reduction in air dose rates. This is leading some Municipalities to conclude that an additional 1 mSv/y is more applicable to long-term dose reduction goals.

Highlight 7: The mission Team welcomes the new approach for the comprehensive monitoring and management of data coordinated by the NRA for the purpose of assessing the status of environmental contamination.

Highlight 8: Good progress has been made in the remediation of affected farmland in the Intensive Contamination Survey Area. Furthermore, the intensive monitoring of foodstuffs has shown that much of the land can produce food below the reference level for permissible radioactivity, and that remediation measures such as the application of potassium fertilizer are effective. This result suggests that top soil removal is not necessarily the optimal solution to ensure food safety in the Intensive Contamination Survey Area.

Highlight 9: Comprehensive implementation of food safety measures has protected consumers and improved consumer confidence in farm produce, reflected in an increase in the economic value of the crops.

Highlight 10: Remediation of forests has been implemented in a limited manner by the removal of material under the trees in a 20-meter buffer strip adjacent to residences, farmland and public spaces, in response to public concern. The Mission Team acknowledges that the authorities in Japan have implemented a practical option for remediation of the forest areas.

Highlight 11: A comprehensive aquatic monitoring programme is ongoing. It includes environmental concentrations in water, sediment and suspended sediment, as well as extensive food monitoring of freshwater fish (wild and cultivated), with concentrations generally decreasing since 2011.

Highlight 12: The Mission Team found significant progress in the development and implementation of temporary storage facilities by Municipalities and the National Government for contaminated materials generated by on-going remediation activities. In addition, the Mission Team notes the progress made towards the establishment of interim storage facilities by the National Government with the cooperation of municipalities and local communities.

Highlight 13: The Mission Team acknowledges that incineration is being used as an effective technology for volume reduction of contaminated material, with the adoption of measures to meet emission standards for limiting public exposure.

## **Advice**

Point 1: To further improve the effectiveness of the institutional arrangements and public confidence in these arrangements, the relevant institutions in Japan are encouraged to assess the benefits that could be derived from a more active participation of the Nuclear Regulation Authority (NRA) in the review of remediation activities, with special consideration to the definition of relevant radiological remediation criteria and the review of the related safety assessments, particularly those required for the long term. The Mission Team also encourages the establishment of a mechanism and platform for learning and sharing the lessons from the development and implementation of temporary storage facilities between Municipalities, and also between Municipalities and the National Government.

Point 2: Japanese institutions are encouraged to increase efforts to communicate that in remediation situations, any level of individual radiation dose in the range of 1 to 20 mSv per year is acceptable and in line with the international standards and with the recommendations from the relevant international organisations, e.g. ICRP, IAEA, UNSCEAR and WHO. The appropriate application of the optimisation principle in a remediation strategy, and its practical implementation, requires a balance of all factors that influence the situation, with the aim of obtaining the maximum benefit for the health and safety of the people affected. These facts have to be considered in communication with the public, in order to achieve a more realistic perception of radiation and related risks among the population.

The Government should strengthen its efforts to explain to the public that an additional individual dose of 1 mSv/y is a long-term goal, and that it cannot be achieved in a short time, e.g. solely by decontamination work. A step-by-step approach should be taken towards achieving this long-term goal. The benefits of this strategy, which would allow resources to be reallocated to the recovery of essential infrastructure to enhance living conditions, should be carefully communicated to the public.

The IAEA – and very likely also the international scientific community – is ready to support Japan in this challenging task.

Point 3: The Team believes that communicating the entire remediation and reconstruction programmes, and how the various components interact (for example, trade-offs between reducing exposure and increasing waste volumes), could reduce some uncertainties and provide greater confidence in the decisions being made. Promoting a holistic view would also facilitate opportunities to plan key stakeholder engagement activities in advance, allowing the process to be proactive rather than reactive. It may be beneficial to formalise a process for sharing such initiatives between the Municipalities, in order to determine whether these could be applied elsewhere. Such an approach might result in greater public confidence and contribute to enabling more people to return to their homes outside restricted areas.

Point 4: There needs to be a continued movement towards the use of the individual doses, as measured with personal dosimeters, to support remediation decisions. As the Nuclear Regulatory Authority is planning to coordinate a study that focuses on individual dose, it is



recommended that the dose study include a background population and also tie individual dose measurements to decontamination efforts at the homes of the monitored individuals.

Point 5: The Team notes that by taking into consideration the natural processes leading to reduced availability of radiocaesium to crops, there is potential to further optimize the application of remediation measures and still produce safe foods. This will have the added benefit of conserving the nutrients in the soil and reducing the amount of removed soil that needs to be disposed of.

Point 6: The Team recommends continuing the optimization of the remediation of forest areas around residential areas, farmland and public spaces by concentrating efforts in areas that bring greatest benefit in reducing doses to the public and avoid damage to the ecological functioning of the forest where possible. The occupational hazards for remediation workers should be balanced against the benefit of the procedure in terms of dose rate and the concerns of residents. The impacts on erosion and radionuclide behaviour should be evaluated using models for radiocaesium in forests. Current research efforts by Japanese research centres are recommended to be included in this evaluation.

Point 7: The Team recommends continuing the monitoring of freshwater and marine environments, and suggests that these data be interpreted within the context of processes known to affect the concentrations of radiocaesium in water, sediment and biota. Monitoring data and further research may form the basis for consideration of site-specific remediation of affected areas.

Point 8: The mission Team encourages the responsible organization(s) to carry out appropriate demonstrations of the safety of the facilities and activities for the management of contaminated materials, in particular for long-term activities, and to allow for their independent evaluation.

## LIST OF PARTICIPANTS

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