

**Summary of**  
**IAEA-MOE Experts' Meeting on Environmental Remediation of Off-Site Areas after the**  
**Fukushima Daiichi Nuclear Power Station Accident**  
**Tokyo, Japan**  
**4 – 5 February 2016**

The 1st IAEA-MOE Experts' Meeting on Environmental Remediation of Off-Site Areas after the Fukushima Daiichi Nuclear Power Station Accident was hosted by the Ministry of the Environment of the Government of Japan (MOE) in Tokyo from 4 – 5 February 2016. The objectives of the meeting were i) to discuss the current status (progress, achievements, challenges and future endeavours) of environmental remediation activities taking place in off-site areas affected by the accident at the Fukushima Daiichi NPP; ii) to provide assistance to Japan, as appropriate, in considering approaches that can foster further progress with the environmental remediation works currently being undertaken or planned; and iii) to collect the extensive experience accumulated so far by the MOE in the implementation of the remediation activities with the aim of sharing relevant findings with the international community. From the side of the IAEA six experts took part in the meeting including three international experts and three internal staff members. From the Japanese side, the meeting was attended by officials of the MOE.

The meeting covered a wide range of topics and was organised in such a way that presentations from Japanese representatives were followed by presentations provided by IAEA experts. After each pair of presentations – addressing a specific pre-determined topic – discussions followed. The series of presentations given by the MOE were aimed at addressing the results of different activities implemented by the national and local governmental authorities, highlighting progress made to-date and the issues that Japan is/has been facing in conducting remediation works. The presentations made by the IAEA experts consisted of a compilation of international knowledge and good practices in each of the discussed areas.

The IAEA team noted the continued and significant efforts put in place so far by Japan in the remediation of the off-site areas and also the results achieved with this effort. It was particularly noted and acknowledged that progress has been achieved through the remediation works undertaken both in the Special Decontamination Area (SDA) and in the Intensive Contamination Survey Area (ICSA).

One of the challenges presently faced by the MOE, as a result of the remediation of the affected areas, deals with the need to manage the large amount of contaminated soil and waste generated during the remediation activities. A refined inventory of contaminated soil and waste to be treated and subsequently stored in the Interim Storage

Facility has been produced. In addition, the MOE has been investigating techniques and technologies to reduce the volume of generated soil and waste prior to disposal. The technologies that the MOE has been assessing include soil segregation (classification), chemical treatment, and heat treatment. The MOE has also been considering the recycling of the residual materials that meet the criteria that will be established to allow for this practice. One of the experts' presentations focused on technical aspects related to soil segregation methods, considerations on the overall volume reduction that can be achieved to minimize the amounts to be disposed, and the reduction of the associated cost of transportation and disposal.

It has been suggested that for those sites with potentially high amounts of contaminated soil to be dealt with as well as for the existing amounts accumulated in temporary storage sites, it would be beneficial to establish criteria (that will allow for soil recycling) prior to the clean-up activities or implementation of soil volume reduction methods (prior to permanent disposal).

The IAEA team was introduced to the English draft of the "Decontamination Report" (published by the MOE in March 2015, in Japanese). The report provides comprehensive collections of "knowledge, experiences, and lessons obtained with the decontamination efforts." It was recognized that the report is a key document to support the international community in learning from the extensive experience of Japan (thereby gaining a better perspective of the effectiveness of different decontamination approaches) as it addresses pre-existing deficits in the available international literature (particularly for urban environments) prior to the Fukushima accident. The document provides the results obtained through decontamination works applied to different types of surfaces contaminated with radioactive material in the aftermath of a nuclear/radiological accident. Several areas of further work, mostly relevant to urban environments, can be summarized as below:

- 1) Improved information about decontamination factors achieved for specific techniques applied to specific materials or classes of materials would be useful to achieve better targeted clean-up efforts.
- 2) Greater detail about the application of a specific method with a view to reproducing the obtained results and consequently permitting the application of the technique with a satisfactory degree of reproducibility.

Additional information to be gathered in future remediation activities will be invaluable to the international community if detailed information/data on the topics listed below can be addressed:

- 1) The fraction of radionuclide that is fixed onto loose particulate and that is subsequently chemically bonded onto structural materials of buildings, roadways, etc.

- 2) Distribution of radionuclides within the sewer systems, wastewater treatment plants and drinking water supplies systems.
- 3) Data to distinguish between decontamination factors measured for different types of, concretes, asphalts, composite shingles, etc.
- 4) Established Standard Operating Procedures (SOPS) and associated lessons' learned and the effect of evolving worker proficiency in decontamination performance.

The current status of remediation activities in forests as well as plans for future measures were explained by the MOE. It has been clarified that attention is being paid to the possibility of restarting forestry and other activities in forests upon the return of the evacuees. The IAEA presentation stressed that remediation works in forests require thorough consideration on the important functions of the forest ecosystem. One of the examples in this regard was the key role of forests in preventing soil erosion and subsequent radionuclide transport into downgradient environments. The IAEA presentation also highlighted the key criteria that should govern the evaluation of remediation measures in the context of justification and optimization, namely effectiveness in reducing radiation dose to local people, acceptability, costs, environmental impacts, technical feasibility, radiation protection of workers, and waste management. With all these aspects taken into consideration it was noted that the approaches used by the Japanese authorities on the decontamination of forest seemed to be in line with internationally accepted good practices. A lot of good data have been produced and this amount of information allows for a proper assessment of the main processes taking place in forest ecosystems which can inform planning of future actions.

The active discussions during the meeting highlighted the potential benefit of further activities to be implemented by the IAEA that can be useful to its Member States, e.g., the establishment of a decision supporting tool that incorporates considerations on waste volume reduction options and associated assessment of its impact on final disposal. In this regard aspects to be considered include: characteristics and inventory of the current and forecasted amounts of waste and a toolbox of available waste treatment technologies including potential recycling options.

The Waste Estimation Support Tool (WEST) developed by US EPA and any other relevant tools may be a potential platform that can support this development provided some modifications are incorporated in the existing system. The modifications include the following: i) updating decontamination information based on the available results and experience (such as effectiveness of decontamination procedures and associated waste generation), ii) extending the options of waste treatment technologies, and iii) generating a contamination map in tool-specific file format. The robustness and performance of the tool could then be verified by applying the system in areas where

decontamination works have been previously completed. Its application in the planning of future remediation activities is also a potential option that can be further explored. If the results are satisfactory, this tool could contribute to the improvement of the international community's capabilities to deal with environmental remediation works in post-accident situations.

As a final note the key role of communication of the outcomes of the remediation works to different stakeholders was once again appreciated and valued. In this regard it was noted that it is very important that relevant information is constantly transmitted to the public using appropriate and clearly defined terminology and presenting ongoing and planned activities in a life-cycle perspective, and that the views and concerns of the affected community are also captured and addressed.

In conclusion, the participants appreciated the fruitful discussions at the meeting and would welcome that the IAEA and the MOE continue to organize similar meetings on a regular basis.