

## U.S. EMBASSY SCIENCE FELLOWS SUPPORT TO JAPAN: OBSERVATIONS AND COMMENTARY ON REMEDIATION OF THE AREAS OFF-SITE FROM THE FUKUSHIMA DAIICHI REACTORS

### INTRODUCTION

Following the Tōhoku earthquake and tsunami on March 11, 2011, Japan's Daiichi nuclear power plant suffered damages resulting in the release of radiological contamination. This release is the largest nuclear disaster since the Chernobyl disaster of 1986 and only the second disaster (along with Chernobyl) to be rated Level 7 (the highest level) for safety significance on the logarithmic International Nuclear Event Scale.<sup>1</sup>

Japan was profoundly impacted. The radioactive material settled around the Daiichi plant and caused major contamination over large areas of the Fukushima Prefecture. The contamination level (predominantly Cs-137 and Cs-134) was high enough to require decontamination of the surrounding areas to protect human health and the environment. Fourteen nearby cities were evacuated (Figure 1 right picture), and more than 100 cities beyond those will require remediation (Figure 1 left picture).

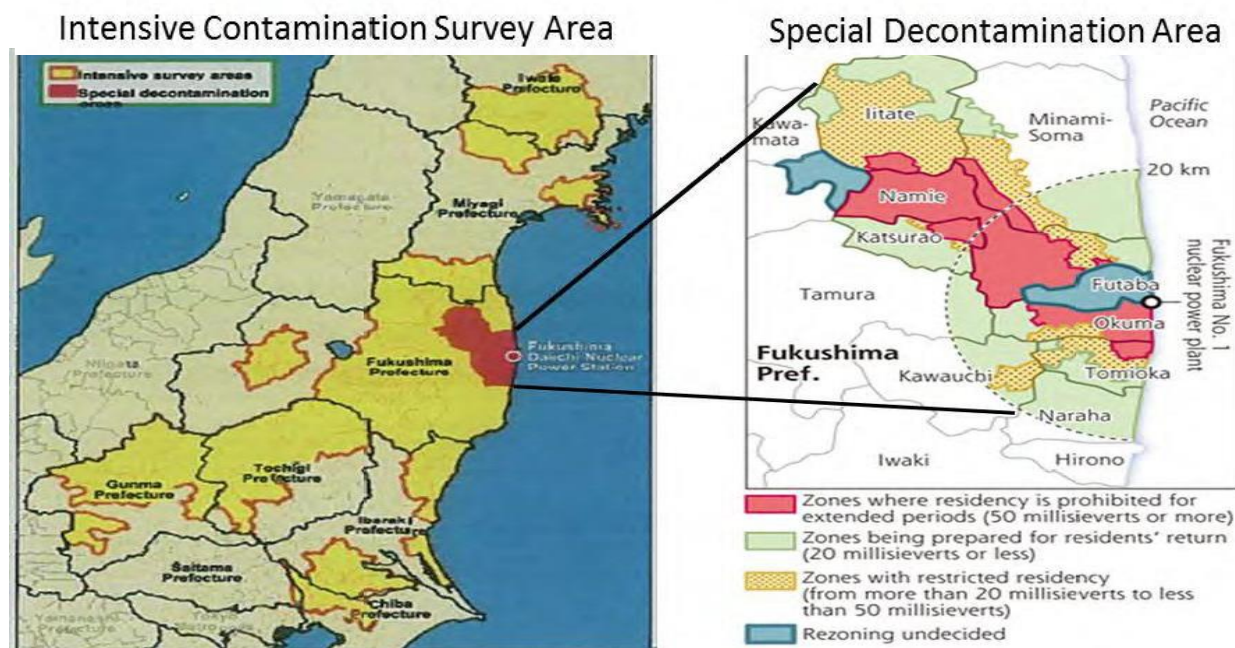


Figure 1. Status of the evacuated areas, featuring new evacuation zones to be formed after reorganization of restricted zones on April 2, 2013.

The Government of Japan (GOJ) has been facing the enormous challenge to remediate areas affected by the nuclear incident and has charged its Ministry of the Environment with the off-site remediation under the Act on Special Measures. The Ministry has been pursuing various programs to assess the radiation exposure of the population in the contaminated areas and to effectively decontaminate these areas.

## EMBASSY SCIENCE FELLOWS

At the request of the Ministry, the U.S. Department of State, through its Embassy Science Fellow (ESF) Program, provided assistance to the GOJ through subject matter experts in radiological decontamination, one from the U.S. Environmental Protection Agency (EPA) and two from the U.S. Department of Energy national laboratories. The experts provided recommendations on the continued GOJ's off-site remediation activities. The fellows are Dr. Sang Don Lee from EPA, Dr. Robert Sindelar from Savannah River National Laboratory and Mark Triplett from Pacific Northwest National Laboratory. The ESF mission period was February 4 through March 29, 2013. As a team, the ESFs collected resources (e.g., strategic plan, technical reports, policies) relevant to the GOJ's remediation efforts by meeting with national and local government officials, visiting remediation sites, and meeting with primary decontamination contractors.

The ESF team assessed the organizational systems (used for planning, execution, and regulation of the cleanup), and the details of the technology application and the decontamination field practices.

They observed that the Ministry was adapting to the unprecedented wide-area nuclear incident and vigorously pursuing remediation of the contaminated areas to expedite return of the impacted area to the people, including:

- rapidly mobilizing resources to respond;
- seeking, developing, testing, and applying innovative decontamination methods;
- enabling local communities to have a strong role in forming decontamination plans and in siting waste storage facilities;
- providing public education materials regarding the radiation risks and the status of decontamination efforts;
- establishing open communication with the prefectural and municipal governments and with citizens regarding decontamination activities;
- engaging the international community to find the best solutions for remediation.

To accomplish their mission, the ESF team drew upon their experience with large-scale Department of Energy and EPA projects to provide information, lessons learned, and suggestions of technologies that might benefit the remediation activities in Japan. The team, through collaboration and coordination with other US government employees developed a framework for remediation of a cesium-contaminated populated region from a total systems perspective, as shown in Figure 2.

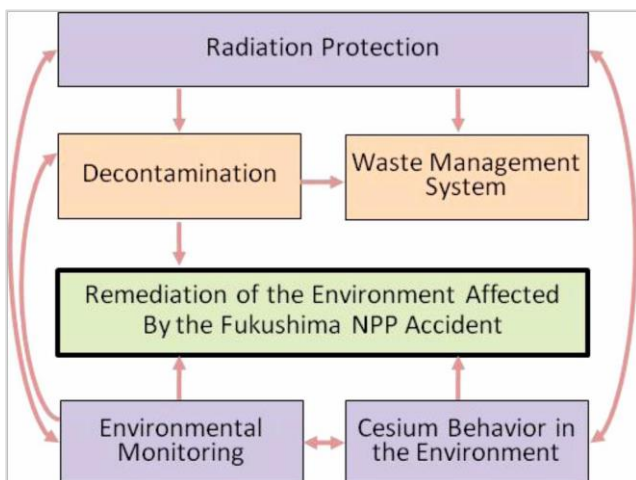


Figure 2. Program Elements for an Environmental Remediation System for a Populated Region Contaminated by Cesium

Information gathered and evaluated by the team was categorized into each of these elements. The gaps and needs addressed by this work offered a novel and more in-depth perspective on Japan's current activities related to the radioactive incident and also leads to enhanced preparedness for such incidents within the U.S.

## MORE INFORMATION

The observations and recommendations of the ESF team are documented in a report entitled, [Report of the United States Embassy Science Fellows Support to the Government of Japan – Ministry of The Environment, Observations and Commentary on Remediation of The Lands Off- Site From the Fukushima Daiichi Reactors](#), July 2013, Washington DC: U.S. Environmental Protection Agency. SRNL-RP-2013-00303. EPA/600/R-13/135.  
([http://josen.env.go.jp/en/documents/pdf/workshop\\_july\\_17-18\\_2013\\_04.pdf](http://josen.env.go.jp/en/documents/pdf/workshop_july_17-18_2013_04.pdf))

Chapter 1 of the report summarizes the: (1) extent of initial contamination, (2) status of the decontamination activities and (3) program elements of an environmental remediation system for a populated land with cesium contamination.

Chapters 2 through 8 describe the observations of the ESF team with respect to the environmental remediation program elements and offer both general and specific recommendations for improvements within the remediation program elements.

## CONTACT INFORMATION

For more information, visit the EPA Web site at [www.epa.gov/nhsr](http://www.epa.gov/nhsr). Technical Contact: [Sang Don Lee](mailto:Sang_Don_Lee@epa.gov) ([lee.sangdon@epa.gov](mailto:lee.sangdon@epa.gov)) General Feedback/Questions: [Kathy Nickel](mailto:Kathy_Nickel@epa.gov) ([nickel.kathy@epa.gov](mailto:nickel.kathy@epa.gov))

If you have difficulty accessing this PDF document, please contact [Kathy Nickel](mailto:Kathy_Nickel@epa.gov) ([Nickel.Kathy@epa.gov](mailto:Nickel.Kathy@epa.gov)) or [Amelia McCall](mailto:Amelia_McCall@epa.gov) ([McCall.Amelia@epa.gov](mailto:McCall.Amelia@epa.gov)) for assistance.

## REFERENCES

["Fukushima accident upgraded to severity level 7". \*IEEE Spectrum\*](#). April 12, 2011.

**U.S. EPA's Homeland Security Research Program (HSRP)** develops products based on scientific research and technology evaluations. Our products and expertise are widely used in preventing, preparing for, and recovering from public health and environmental emergencies that arise from terrorist attacks or natural disasters. Our research and products address biological, radiological, or chemical contaminants that could affect indoor areas, outdoor areas, or water infrastructure. HSRP provides these products, technical assistance, and expertise to support EPA's roles and responsibilities under the National Response Framework, statutory requirements, and Homeland Security Presidential Directives.