

# Status Update on the Fukushima Cleanup Experience on assignment to U.S.NRC

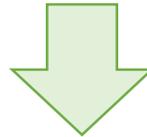
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# Overview

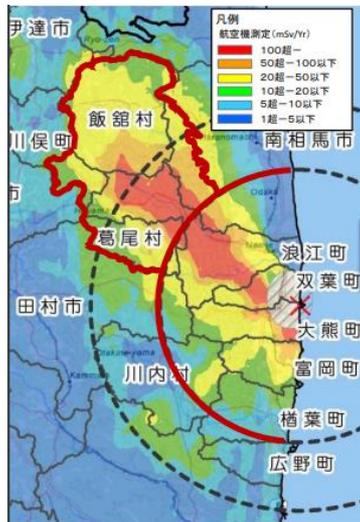
Sandia National Laboratories (SNL) and NRC staff have developed a draft document summarizing the technical bases for most of the input parameters used by MACCS for offsite consequence analysis.



- Perform technical review of draft MACCS input parameter technical basis document
- Review publicly available literature on Fukushima offsite cleanup experience to provide insights for evaluating models for offsite cleanup .

# Overview of decontamination

## - 1. Evacuation in the early phase -



Establishment of Evacuation Areas (As of April 22, 2011: Establishment of areas immediately following the accidents)<sup>2)</sup>

### 2011.3.11

- Great east Japan earthquake
- Nuclear emergency declared

### 2011.3.11-12

- Evacuation order issued for areas within 20 km radius of Fukushima Daiichi
  - Area expanded stepwise from 2, 3, 10 to 20 km.
  - Evacuation order to area within 10 km radius of Fukushima Daini was also issued.
  - Sheltering order was issued to area within 20-30 km of Fukushima Daiichi on Mar. 15.

### 2011.4.22

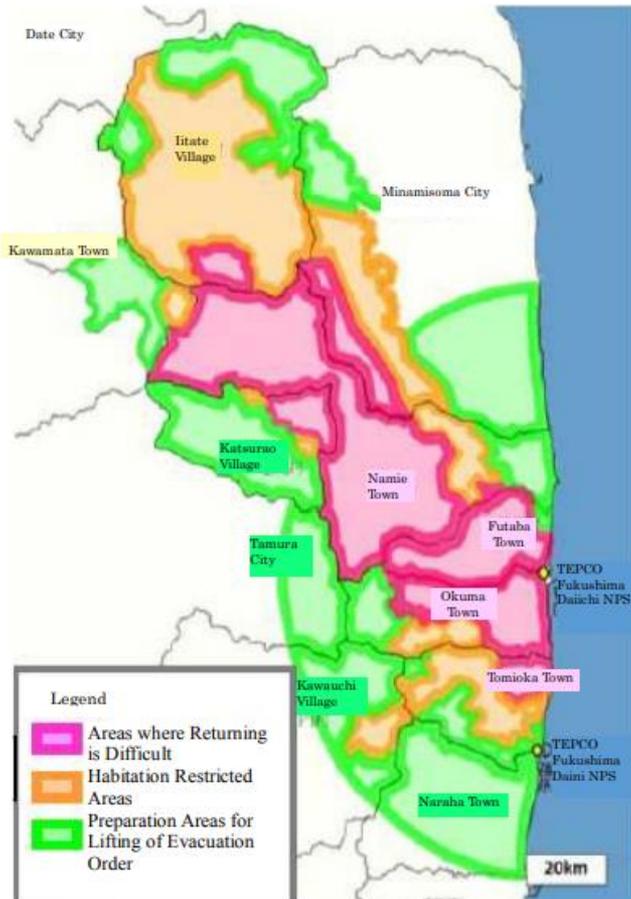
- Deliberate evacuation order issued for designated areas beyond 20 km based on radiation dose
  - Areas where the annual cumulative radiation dose one year after the occurrence of an accident may exceed 20 mSv/y

1) Cabinet office, "Review of Areas Under Evacuation Orders" (October 2013) (in Japanese)

2) Ministry of Environment, "Decontamination Projects for Radioactive Contamination Discharged by Tokyo Electric Power Company Fukushima Daiichi Nuclear Power Station Accident" (March 2018)

# Overview of decontamination

## - 2. Revision of areas under evacuation orders -



Establishment of Areas under Evacuation Orders (As of August 2013)<sup>1)</sup>

**Areas where Returning is Difficult (ARD)**

- Areas where the annual cumulative radiation dose may not fall below 20 mSv/y within five years of the accident and areas where the annual cumulative radiation dose exceeds 50 mSv/y

**Habitation Restricted Areas**

- Areas where the annual cumulative radiation dose may exceed 20 mSv/y\*

**Preparation Areas for Lifting of Evacuation Order**

- Areas that have been confirmed as having an annual cumulative radiation dose that is clearly less than 20 mSv/y\*

\*As of December 26, 2011

- Basic concept of revision was set out in December 2011
- Revision of areas completed in August 2013

1) Ministry of Environment, "Decontamination Projects for Radioactive Contamination Discharged by Tokyo Electric Power Company Fukushima Daiichi Nuclear Power Station Accident" (March 2018)

# Overview of decontamination

- 2. Revision of areas under evacuation orders -

## Requirements for lifting the evacuation order

1. It is certain that the accumulative annual dose estimated by the air dose rate is **20 mSv or less**.
2. **Infrastructure essential for everyday life** such as electricity, gas, water and sewerage, main transportation networks and communications, as well as **living-related services** such as medical care, nursing care and postal services, are generally **restored**, in addition to which decontamination with a focus on children's living environment progresses sufficiently
3. **Sufficient consultation** with the prefecture, municipalities and residents

"Basic concept and future tasks in review of the restricted areas and areas under evacuation orders after the completion of step2"  
(Nuclear Emergency Response Headquarters, Dec. 26, 2011)

# Overview of decontamination

## - 3. Area of decontamination -

Designated in Dec. 2011 (and Feb. 2012)



### Special Decontamination Area

- Mainly where evacuation order was issued
- Decontamination is implemented by the national government
- Population: 80,000, Area: 1150 km<sup>2</sup>
- Whole area decontamination (except ARD) completed by March 2017

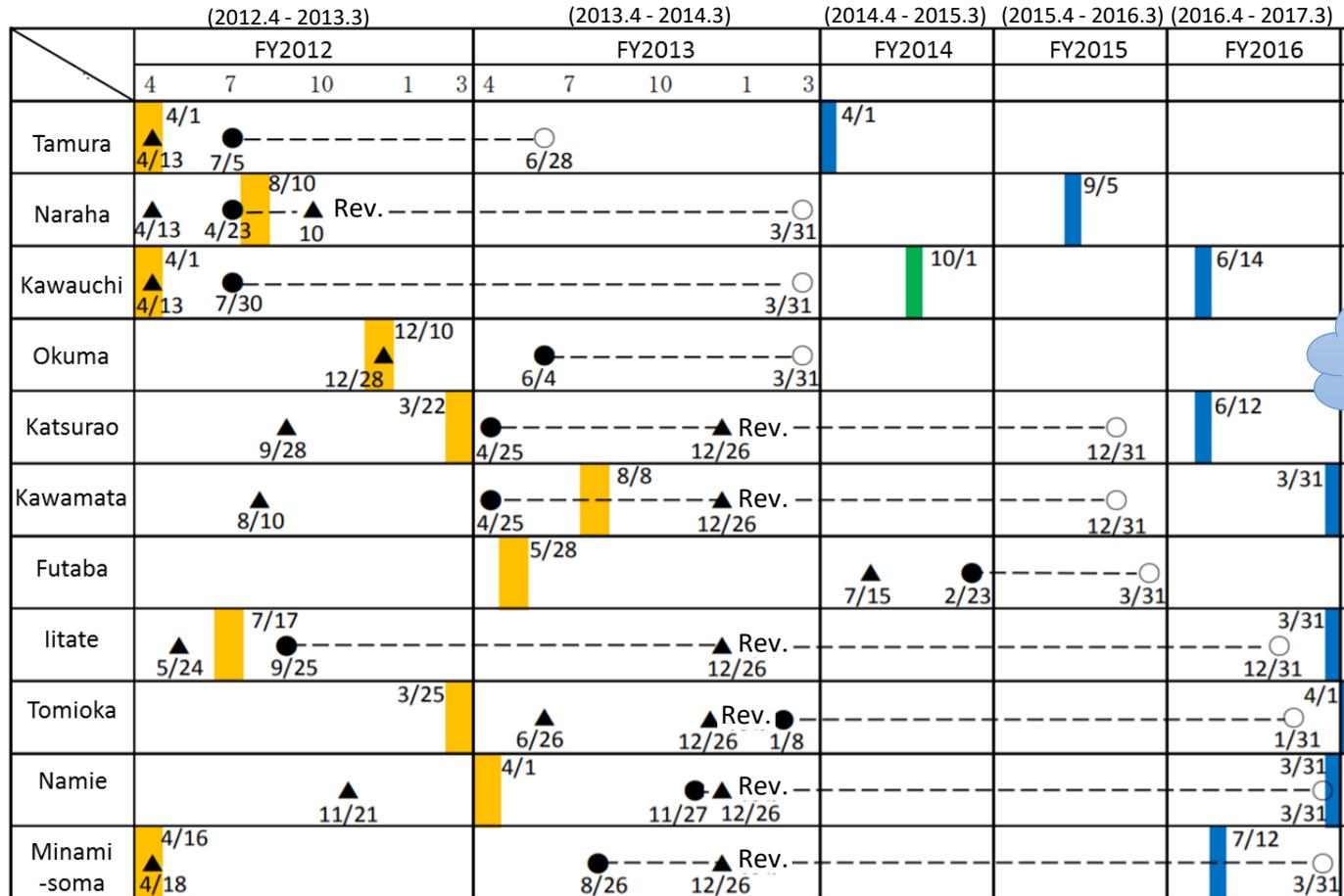


### Intensive Contamination Survey Area

- Area where dose rate was equal to or higher than 0.23μSv/h
- Decontamination is implemented by each municipality
- Population: 6,900,000, Area: 24,000 km<sup>2</sup>
- Whole area decontamination completed by March 2018

# Overview of decontamination

## - 4. Timeline for decontamination and lift of evacuation order -



Evacuation order at Okuma (excluding ARD) lifted on April. 10 2019

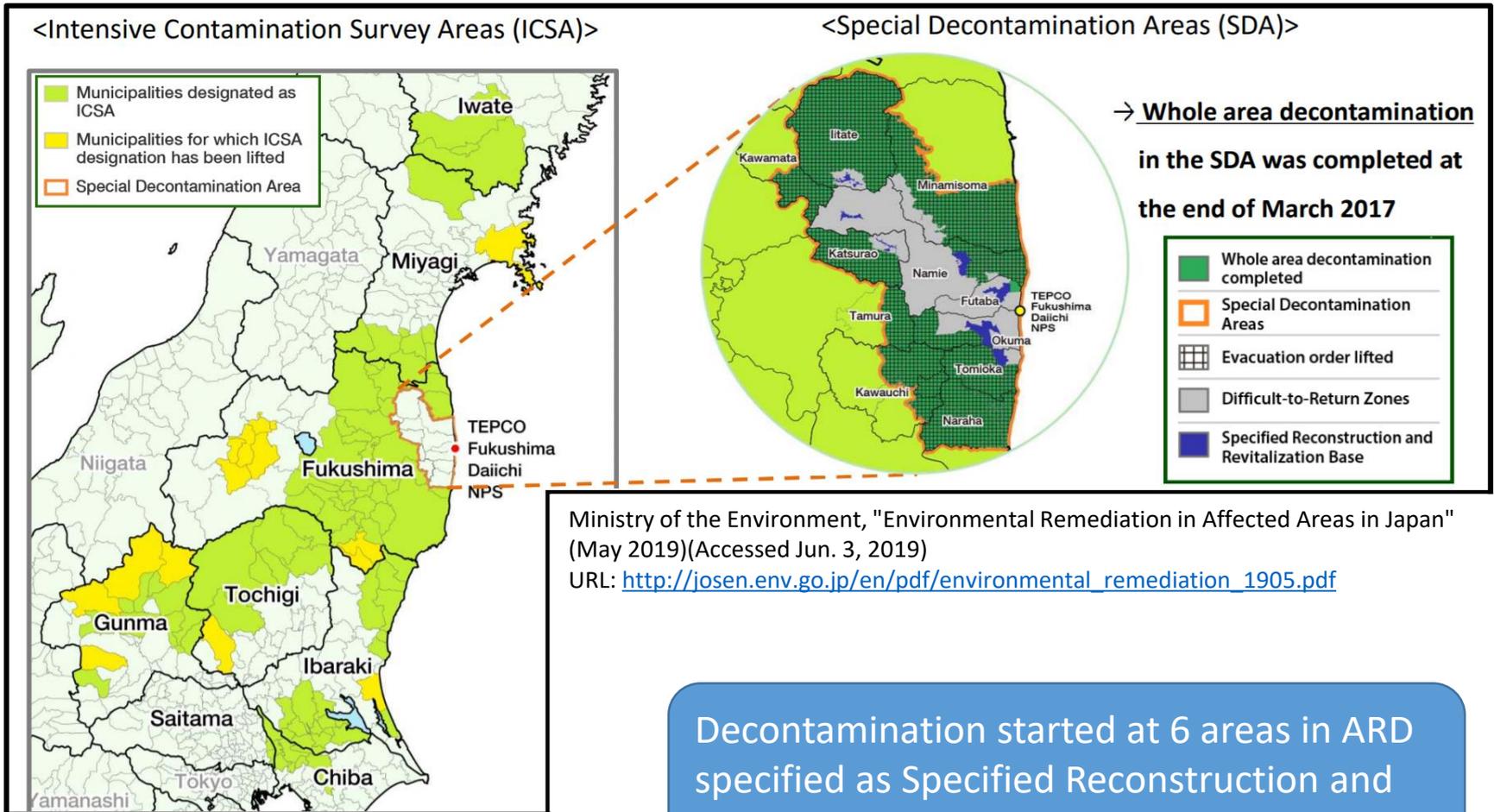
- ▲ Decontamination Plan formulated
- Whole area decontamination start
- Whole area decontamination completed
- Reorganization of evacuation zone
- Lift of evacuation order
- ▲ Rev.: revision of decontamination plan

### State of progress of decontamination in SDA\*

\* Table adapted from Ministry of Environment, "Decontamination Projects for Radioactive Contamination Discharged by Tokyo Electric Power Company Fukushima Daiichi Nuclear Power Station Accident" (March 2018)

# Overview of decontamination

## - 5. Current situation -



# Major source of information available in English

Reference	Available information
<p>Ministry of Environment, Decontamination Projects for Radioactive Contamination Discharged by Tokyo Electric Power Company Fukushima Daiichi Nuclear Power Station Accident, (March 2018) (URL: <a href="http://josen.env.go.jp/en/policy_document/">http://josen.env.go.jp/en/policy_document/</a>)</p>	<ul style="list-style-type: none"> <li>• Overall structure of decontamination in Japan</li> <li>• Timeline, area, amount of soil removed, budget, effect, etc. of decontamination</li> <li>• References to other decontamination related documents</li> </ul>
<p>Ministry of Environment, Decontamination Guideline (2<sup>nd</sup> edition, 2013) (URL:<a href="http://josen.env.go.jp/en/policy_document/pdf/decontamination_guidelines_2nd.pdf">http://josen.env.go.jp/en/policy_document/pdf/decontamination_guidelines_2nd.pdf</a>)</p>	<ul style="list-style-type: none"> <li>• Decontamination method used</li> </ul>
<p>JAEA-Review 2014-051, Remediation of contaminated areas in the aftermath of the accident at the Fukushima Daiichi Nuclear Power Station: Overview, analysis and lessons learned, 1; A report on the "decontamination pilot project" (March 2015) (URL: <a href="https://jopss.jaea.go.jp/pdfdata/JAEA-Review-2014-051.pdf">https://jopss.jaea.go.jp/pdfdata/JAEA-Review-2014-051.pdf</a>)</p>	<ul style="list-style-type: none"> <li>• Estimation of DF, unit cost (per area) and waste generated of each decontamination method applied to different surfaces               <ul style="list-style-type: none"> <li>– Based on pilot decontamination</li> </ul> </li> </ul>
<p>Ministry of Environment, Environmental remediation (Website) (URL: <a href="http://josen.env.go.jp/en/">http://josen.env.go.jp/en/</a>)</p>	<ul style="list-style-type: none"> <li>• Update on current progress of decontamination in Japan</li> </ul>

# Summary

1. Whole area decontamination was completed and evacuation orders were lifted in most areas.
  - Except ARD
2. Results of decontamination at these areas are available.
  - Examples: Timeline for decontamination, area decontaminated, amount of waste generated, budget spent, effect of decontamination, etc.
  - Considerable effort may be required to collect and analyze the available data and generalize them for use in off site cleanup evaluation models.
3. Limited information is available on decontamination at ARD.
  - Decontamination has only partially begun at specified areas.

# Acronyms

Acronyms	Definition
ARD	Areas where returning is difficult
ICSA	Intensive contamination survey area
MOE	Ministry of Environment
SDA	Special decontamination area
SRRB	Specified reconstruction and revitalization base