



Remediation and Waste Management Challenges for Fukushima Offsite Recovery Efforts

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Waste Management Symposium 2014



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Acknowledgement

US Embassy Science Fellowship Mission to Support Japan's Ministry of the Environment

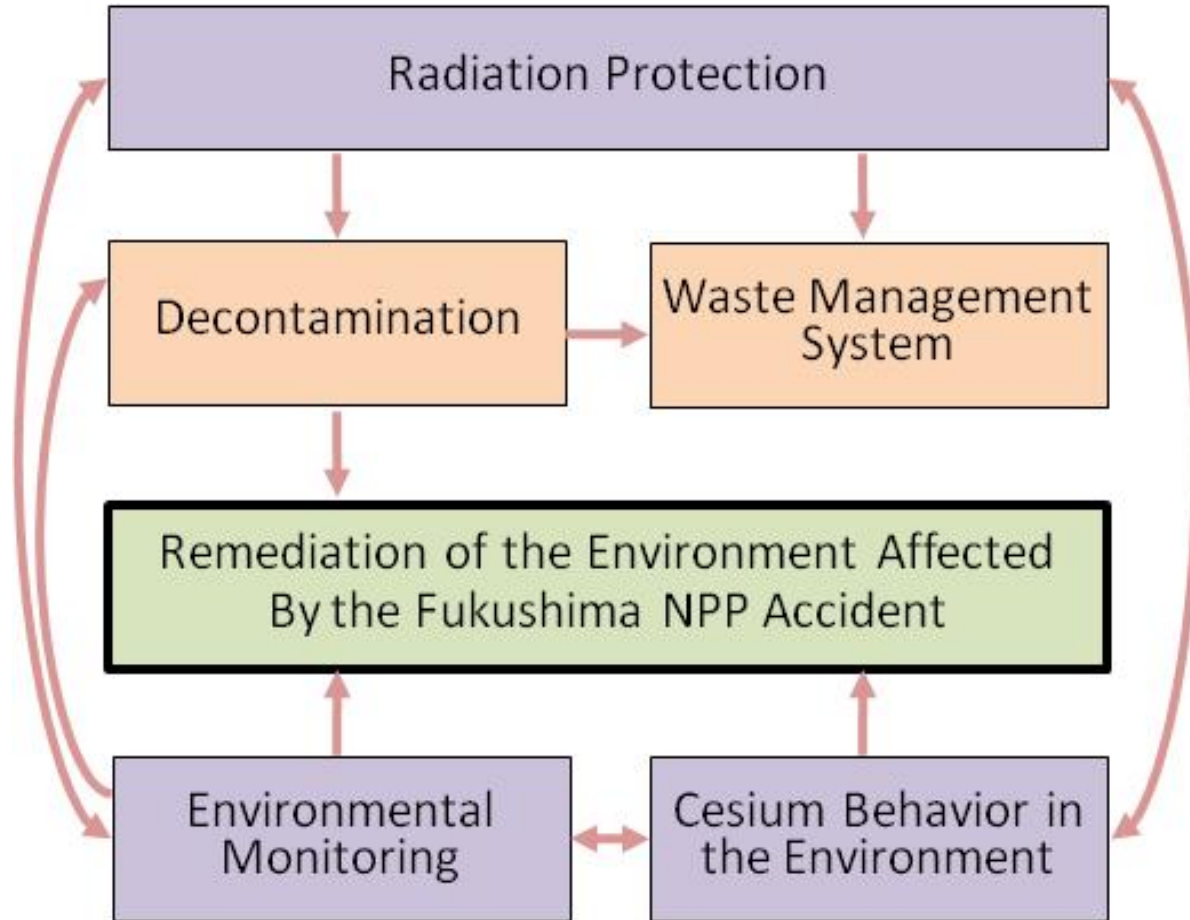
- ▶ US State Department's Embassy Science Fellowship Program was used to provide expert support to Japan's Ministry of the Environment (MOE) in its decontamination efforts in areas outside of the Daiichi nuclear plant site.
 - Sang Don Lee, US Environmental Protection Agency
 - Robert Sindelar, Savannah River National Laboratory
 - Mark Triplett, Pacific Northwest National Laboratory
- ▶ Overall intent was to draw upon US DOE and US EPA remediation experience to:
 - Share methods and lessons learned
 - Offer suggestions for enhancing Japan's off-site decontamination efforts, and
 - Identify areas for future collaboration
- ▶ Assignment duration: February – March 2013



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Systems Perspective for Fukushima Offsite Remediation



Embassy Science Fellow's full Report and Summary of Recommendations available at:

<http://josen.env.go.jp/en/documents/>

Key Challenges for Fukushima Offsite Remediation

- ▶ Radiation protection and repopulation
- ▶ Decontamination of forests and agricultural land
- ▶ **Remediation strategy and priorities**
- ▶ **Waste management system for decontamination waste**
- ▶ Environmental monitoring and long-term fate and transport of cesium
- ▶ Public involvement in remediation and repopulation decisions

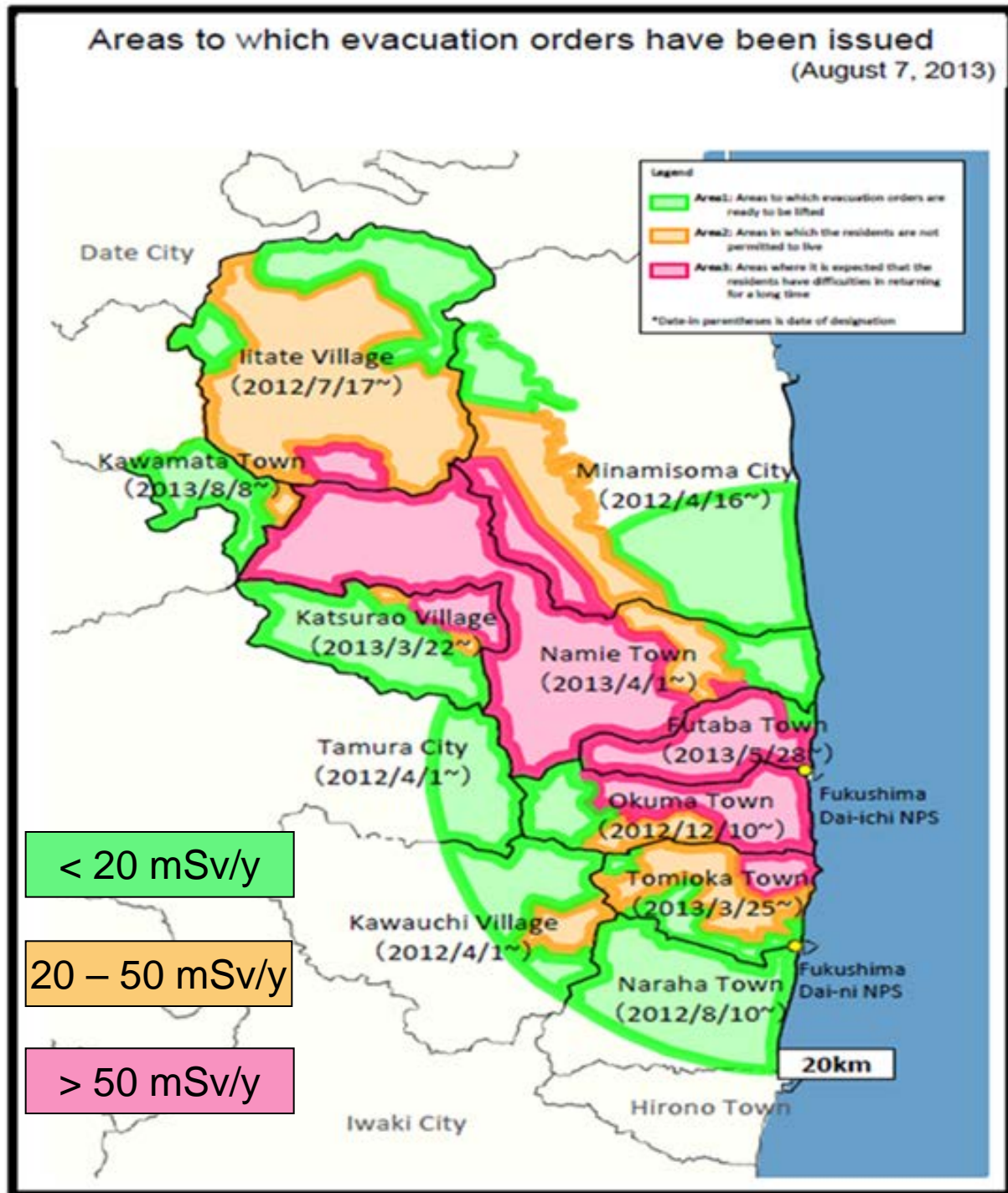


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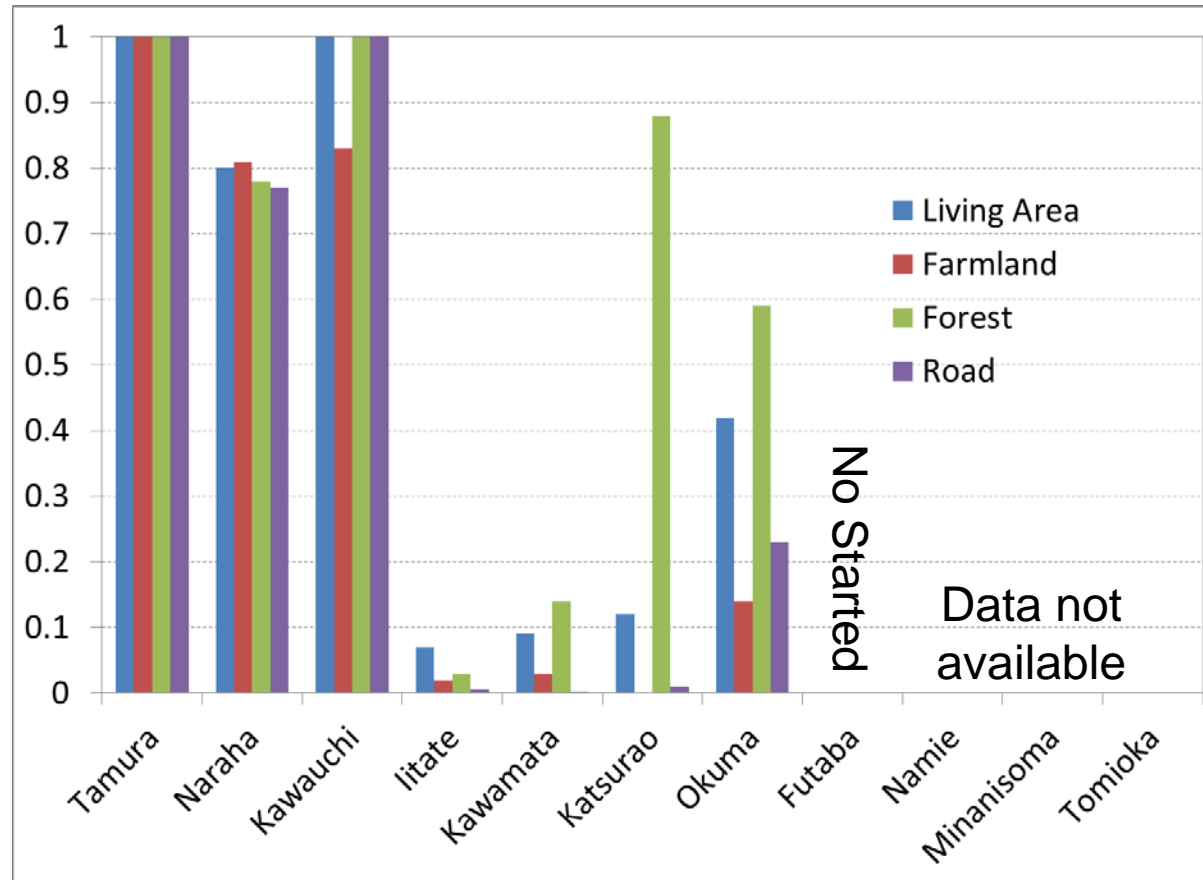
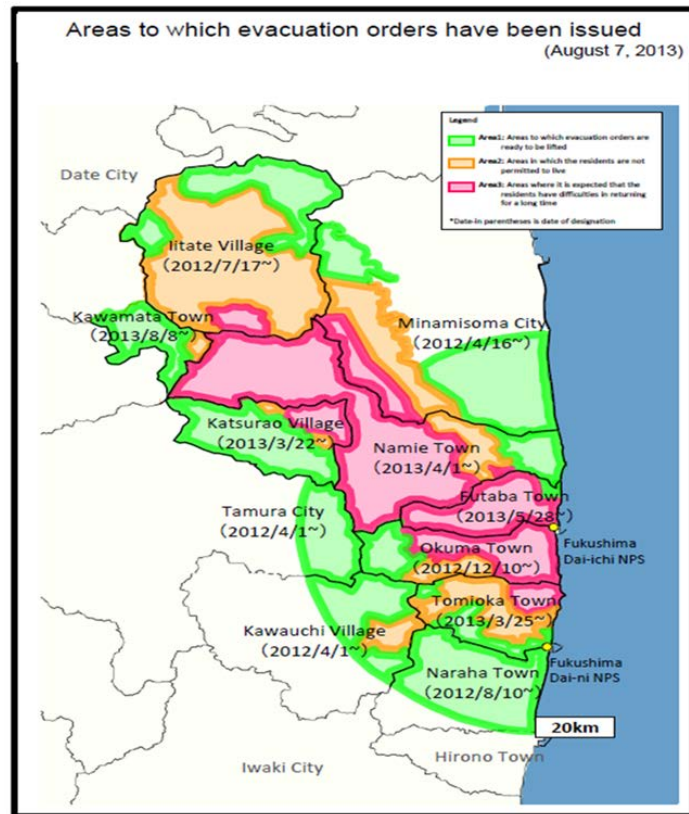
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Remediation Strategy

- Municipal-led remediation in the outer areas (white)
- National government-led remediation in the evacuated areas (green, yellow)
- Highest dose areas (red) deferred; ~6 model projects nearing completion
- Tamura City remediation completed; but citizens have not returned

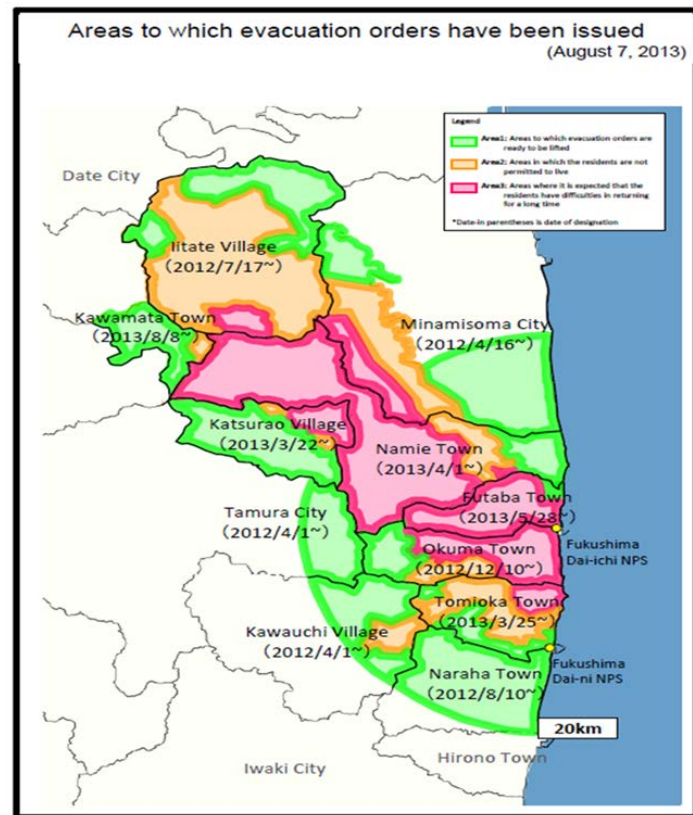


Remediation Progress in the Evacuated Areas (Yellow and Green Areas Only)



Remediation Strategy Challenges

- ▶ Resource allocation between municipal-led (white) and National government-led (green/yellow) areas.
- ▶ Completion of full scale remediation in green/yellow portions of evacuation zone.
- ▶ Recovery of economic and community infrastructure to enable citizens to return. Compensation issues.
- ▶ Viability of full-scale remediation in higher dose (red) area.



Challenge – Waste Management System

Significant gaps in the overall waste management system that is needed to store, treat and dispose of the enormous volumes of decontamination waste that are begin generated.

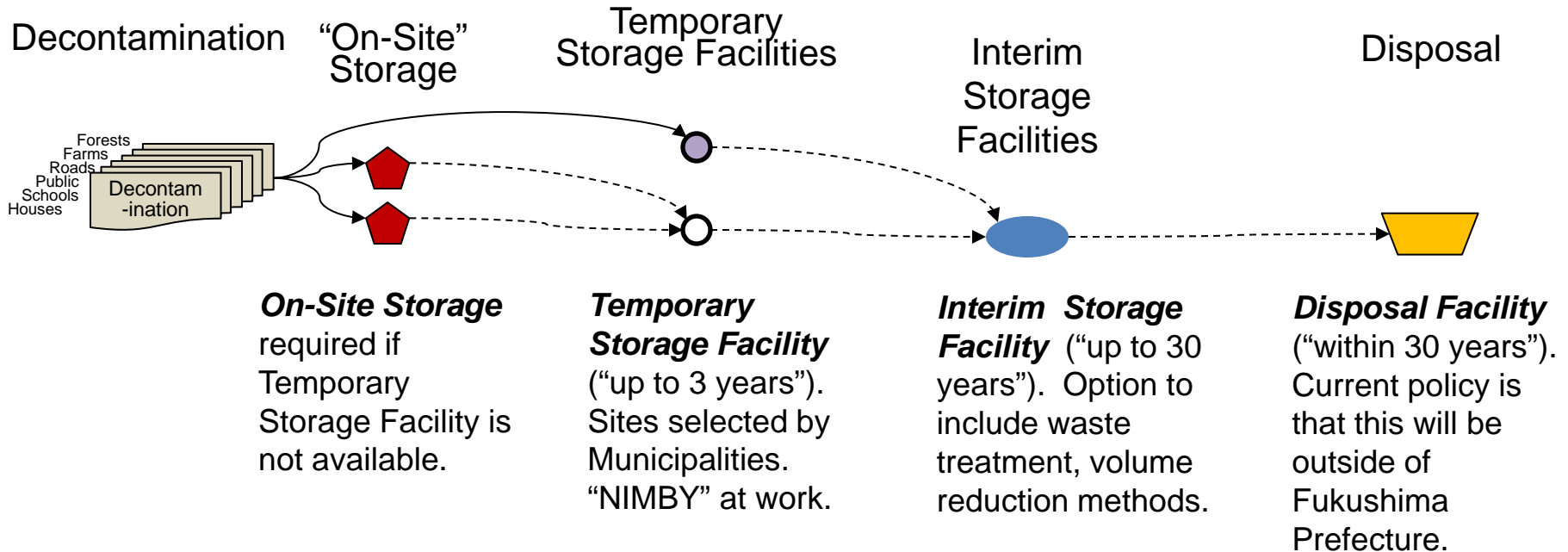
Temporary Storage (Tomioka town, public park)



On-Site Storage (Naraha town, rice field)



Management of Decontamination Waste



Temporary Storage Facility is a pre-requisite to initiating remediation in the Evacuation Areas, but not in other areas.

Example of “on-site” storage of decontamination waste at a private home in Fukushima City



- ~80% of residents in Fukushima City have chosen to bury their decontamination waste on their own property.
- Fukushima City only has 1 Temporary Storage Facility but it lacks capacity to serve most residents.



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Waste Designated for Interim Storage Facilities

Type of Waste	Estimated Quantity (1,000 m ³)
Soil of 8,000 Bq/kg or less	~10,060
Soil between 8,000 and 100,000 Bq/kg	~10,350
Soil greater than 100,000 Bq/kg	~10
Burned ash of decontaminated waste	~1,550
Other waste/debris (e.g., ash from tsunami debris) greater than 100,000 Bq/kg	~20
Total	~22,000

Distinct storage requirements and designs for each category of waste

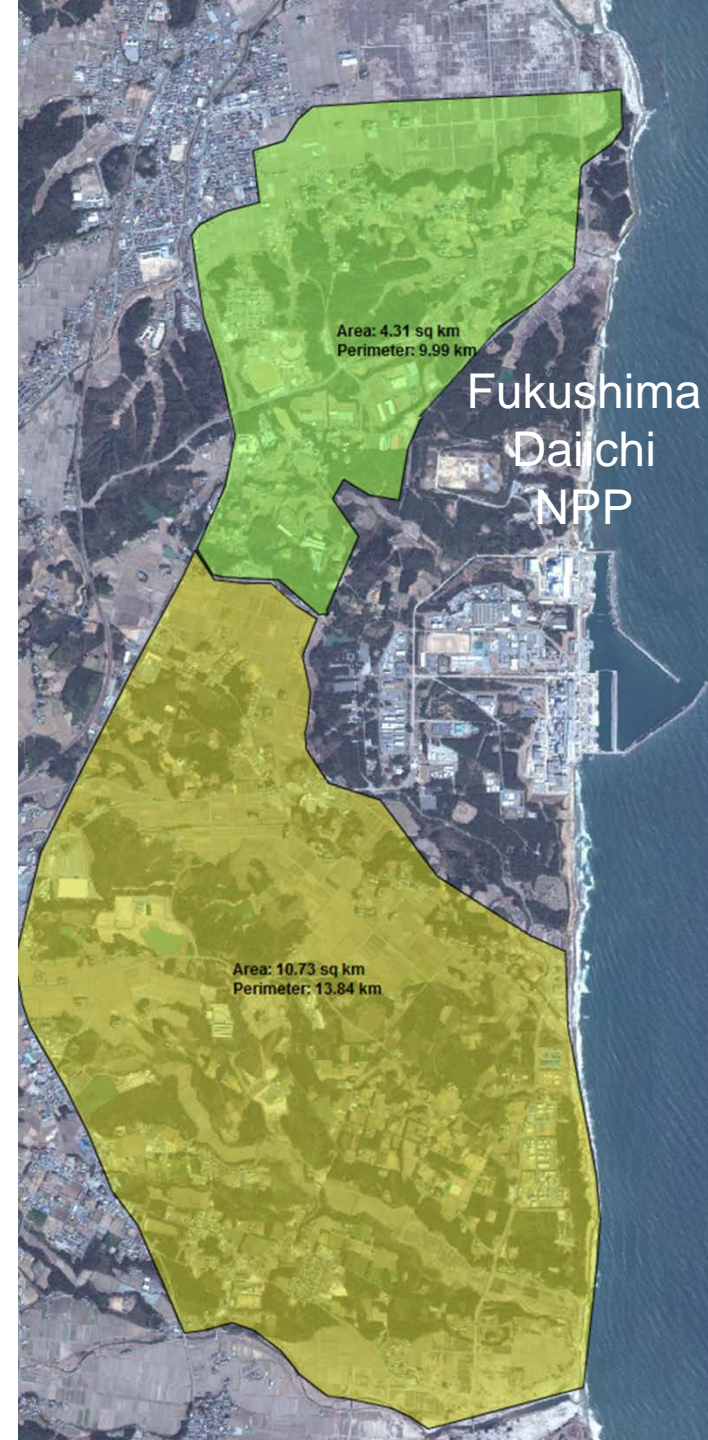
~ 3 times the current disposed volume and available capacity of Hanford's Environmental Restoration Disposal Facility (ERDF)



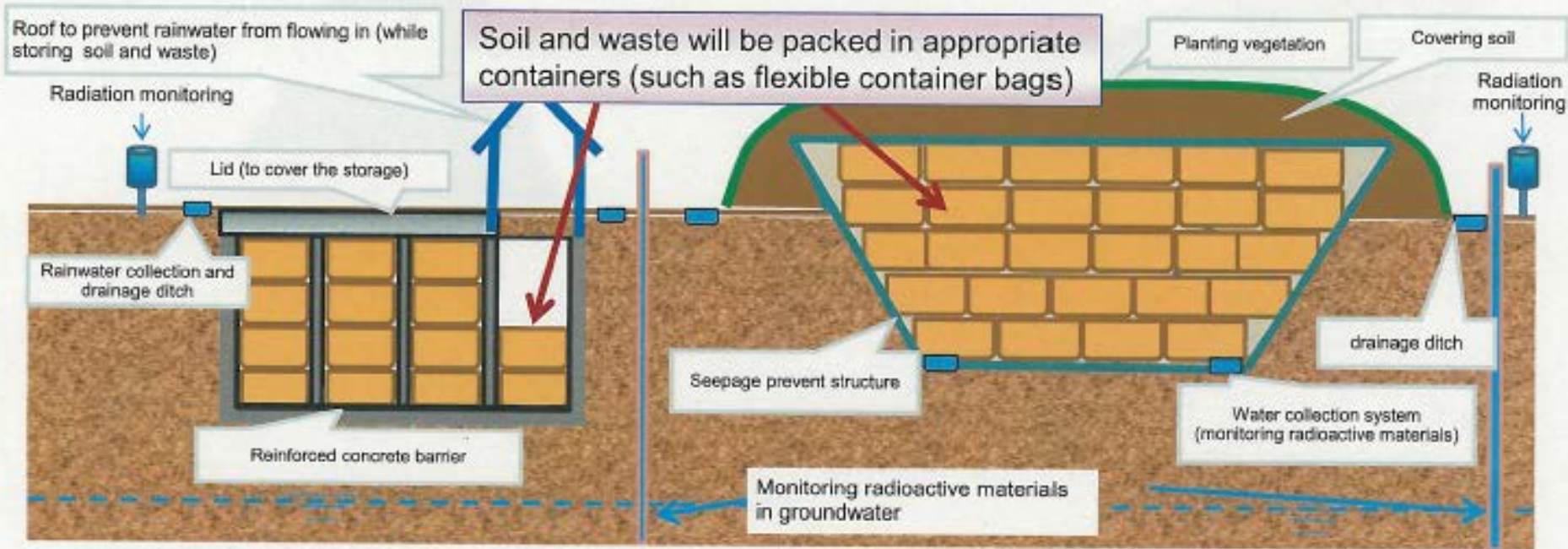
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Candidate Locations for Interim Storage Facilities

- ▶ ~15 Km² immediately adjacent to the Fukushima Daiichi NPP Site
- ▶ Futaba and Okuma towns; Naraha town?
- ▶ In addition to 3 types of storage facilities, plans contemplate:
 - Separation and volume reduction
 - Analytical laboratories
 - Screening facilities
 - Water treatment facilities
- ▶ Requires acceptance by community and prefectural governments.
- ▶ Requires acquisition of land from owners.
- ▶ Final disposal contemplated to occur outside of Fukushima Prefecture



Interim Storage Facility Design Concepts are being Developed



Waste Management Challenges



- ▶ 1,000s of storage locations
- ▶ Interim Storage Facility
- ▶ Transportation
- ▶ Volume reduction
- ▶ Final disposal