

# Remediation Challenges in Japan's Special Decontamination (Evacuation) Area

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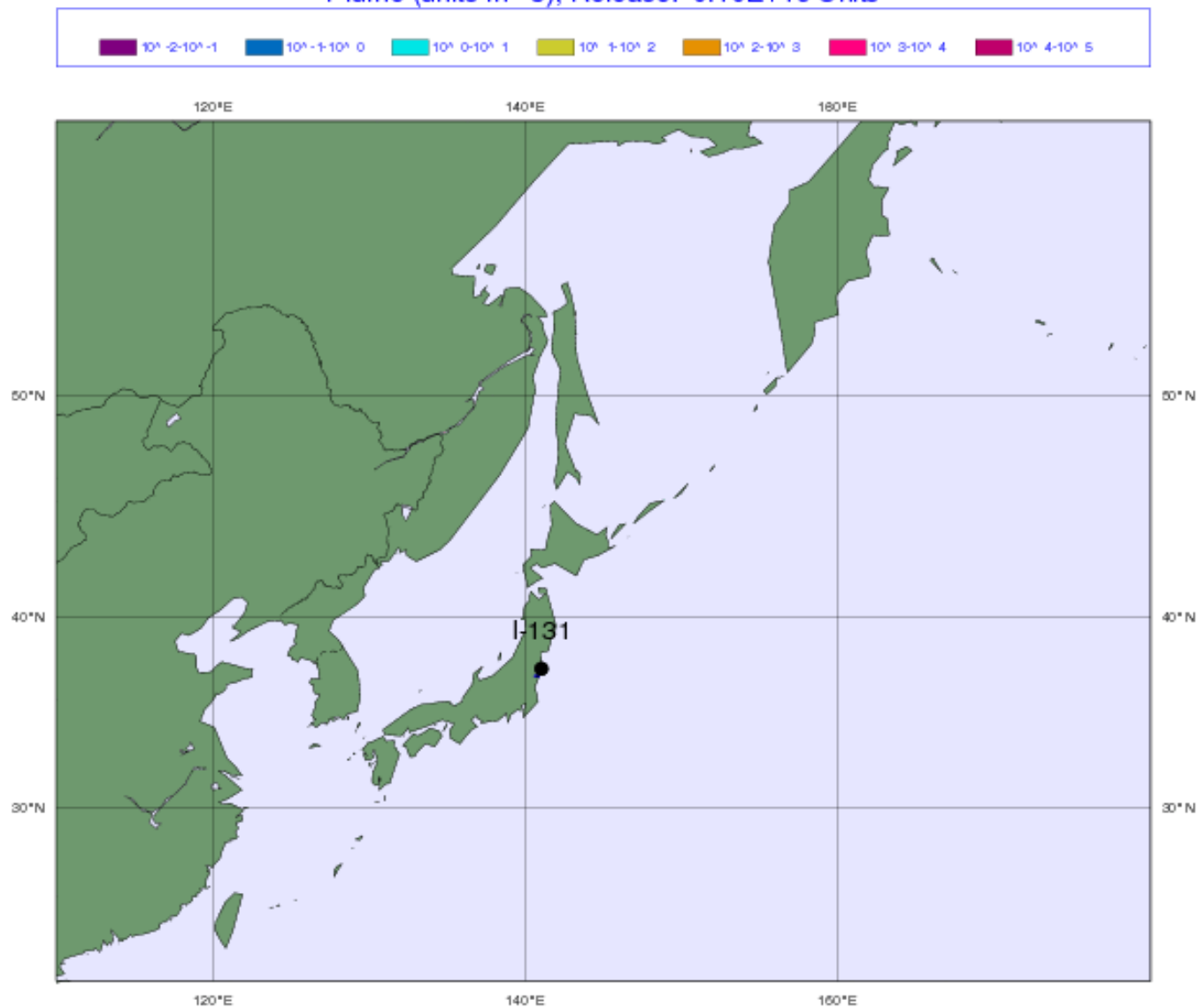


**On March 11, 2011, an earthquake and ensuing Tsunami damaged or destroyed over 1 million structures, injured over 6,000 and killed nearly 20,000 people. None of the damage, injuries, or deaths had anything to do with the Fukushima Dai-ichi reactors.**

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Plume (units  $m^{-3}$ ), Release:  $0.10E+19$  Units





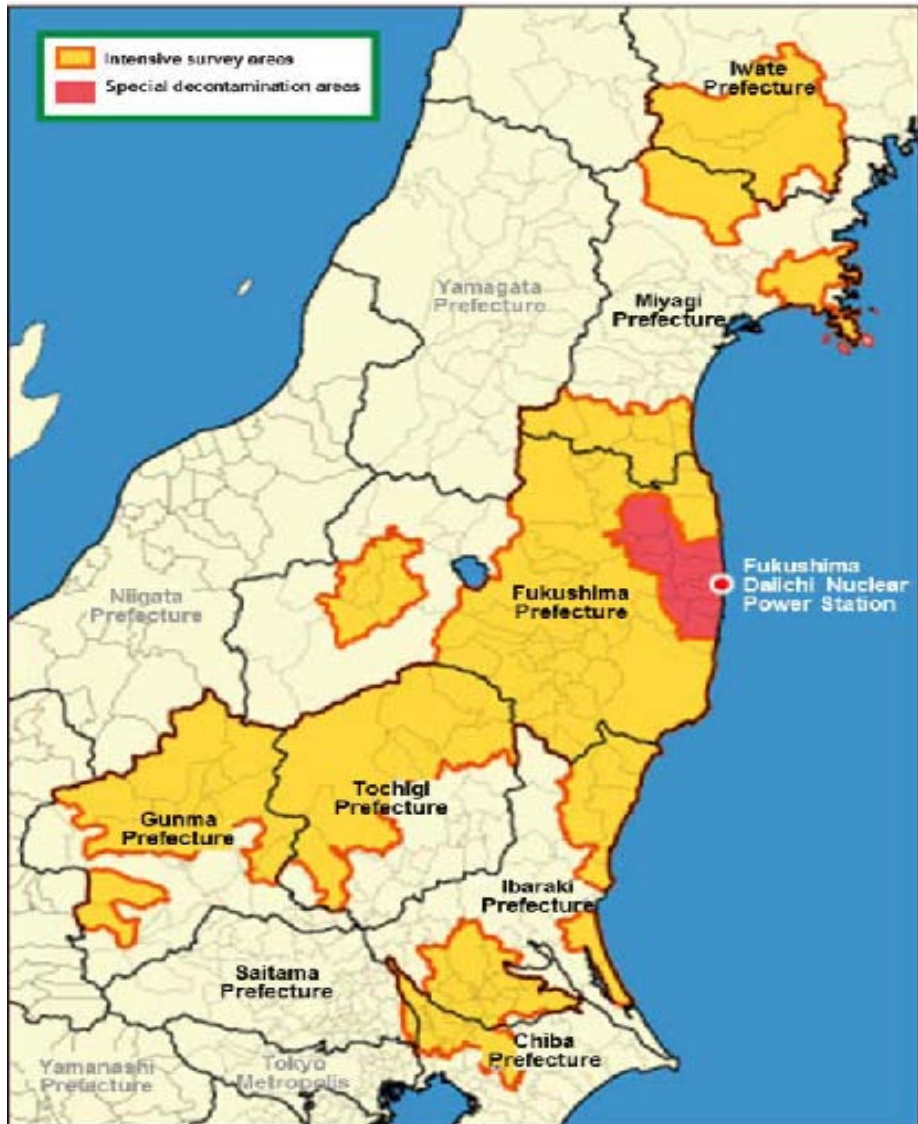
# Special Decontamination (Evacuation) Area



- Includes 11 municipalities <20 km from the NPP, or where annual cumulative dose is >20 mSv (2,000 mrem ).
- Cs-137 concentrations exceed 200,000 Bq/kg (5.4 nCi/g), primarily in top few cm of soil
- Air dose rates up to 91 microSv/h (9.1 mrem/h)
- Approx 1,300 sq km



# Intensive Contamination Survey Area



- 104 municipalities in 8 prefectures where an air dose rate of over  $0.23 \mu\text{Sv}/\text{hour}$  (equivalent to over  $1 \text{ mSv}/\text{year}$ ) was observed, were designated.
- Decontamination is implemented by each municipality. The national government will take the necessary financial and technical measures.



# Problem

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- **1,300 square kilometers evacuated and must be cleaned prior to return of residents**
    - ▶ Includes towns, forests, farmland, wetlands, etc.
  - **Very large volume of potentially radioactive waste will be generated**
    - ▶ Current estimate is **22 Million Cubic Meters!**
  - **No disposal option for radioactive waste in Japan**
  - **Some types of land, e.g. forests, mountains, cannot be easily cleaned without destroying them**
  - **Cost effective waste minimization techniques are needed**
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# Issues

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- **Definition of “clean” not yet defined**
  - ▶ **Soil concentration limit v. dose rate above ground surface**
  - ▶ **2,000 – 4,000 Bq/kg used as sorting criteria during Demonstration Project**
  - ▶ **Concentration limit can be applied *in situ* or *ex situ***
  - ▶ **Dose rate can only be applied *in situ***
  
- **One interesting discovery was that some property owners outside of evacuated areas have already undertaken remediation of their property with no oversight**
  - ▶ **Scrape ground surface**
  - ▶ **Bury soil on site**

# Technology Demonstration Projects

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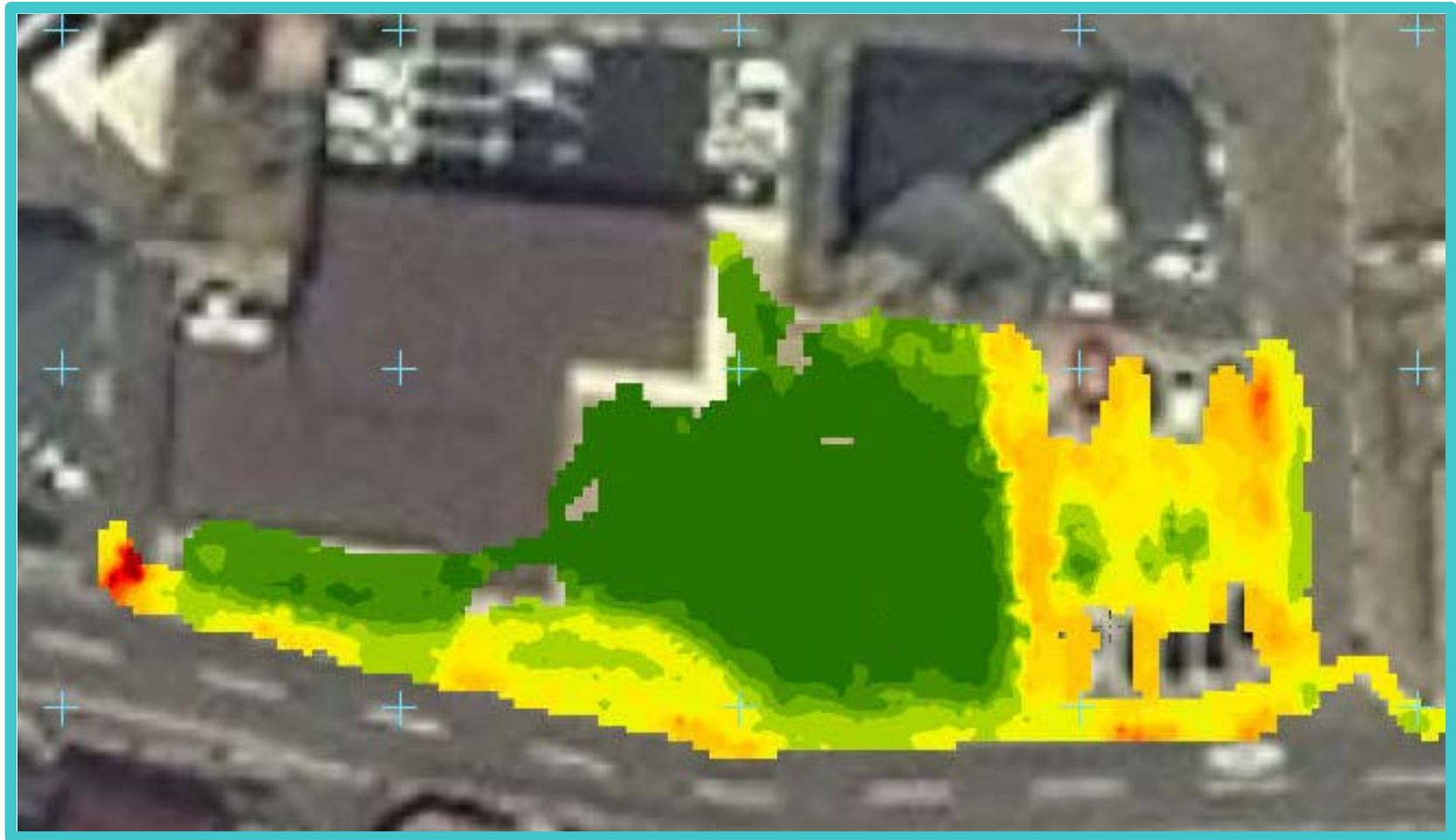
- **Objective: Demonstration of remediation technologies toward full remediation of evacuation areas**
- **Overseen by Japanese Atomic Energy Agency (JAEA) and Ministry of Environment (MoE)**
- **AmecFW on team led by Obayashi JV**
  - ▶ **Included 114 ha (1,140,000 m<sup>2</sup>)**
  - ▶ **Demonstration of characterization, decontamination and remediation of towns, buildings and land**
  - ▶ **Included towns of Hirono, Naraha, Okuma and Kawauchi**
- **AmecFW deployed its proprietary Orion *ScanPlot*<sup>SM</sup> and *ScanSort*<sup>SM</sup> technologies**
  - ▶ **Both use real-time, laboratory-quality, gamma spectroscopy in the field**





amec  
foster  
wheeler

# ScanPlot<sup>SM</sup> Survey of School Yard





amec  
foster  
wheeler

# ScanSort<sup>SM</sup> in Operation in Japan



# Typical Urban Remediation Methods

**Roof: water cleaning,  
cleaning with brush**



**Wall: wiping**



**Gutter (vertical): high-pressure  
water cleaning**



**Concrete floor:  
High-pressure  
water cleaning**



**Concrete floor:  
Shot blast**



**Concrete floor:  
Surface grinding  
machine**



**Garden: removal  
of topsoil**





# Typical Urban Remediation Methods

High-pressure water cleaning by vehicle for recovering functions of water drainage pavement



Cleaning of tree trunk (with water and brush)



Surface grinding by shot blast



Removal of topsoil



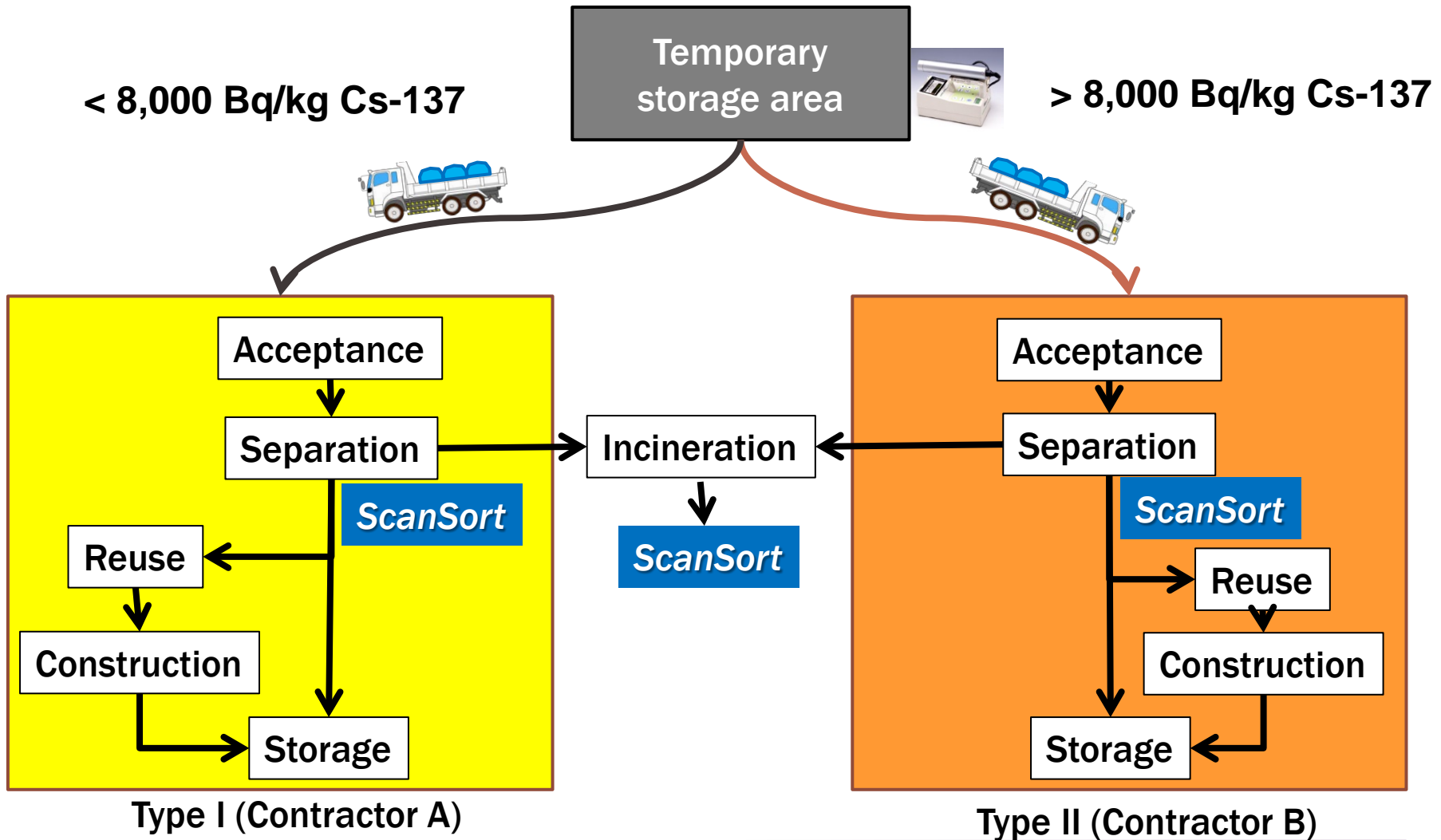


# Typical Temporary Waste Storage

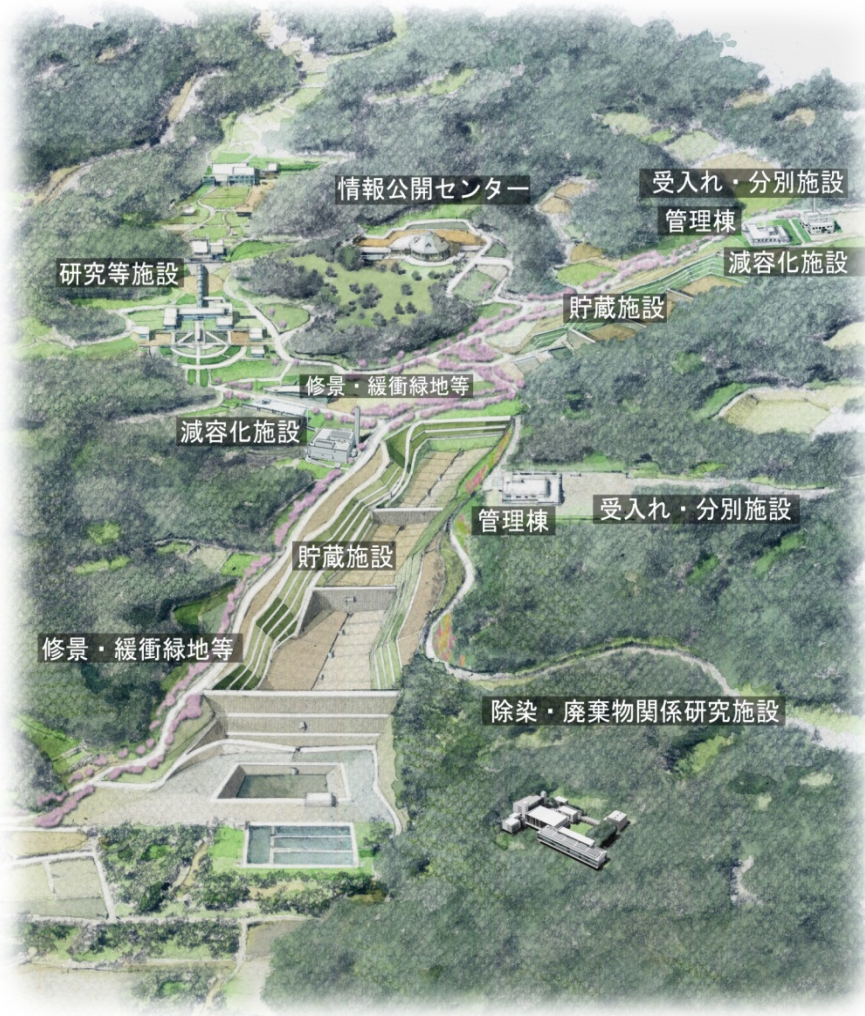




# Interim Storage Facility (ISF) Concept



# ISF Conceptual Design





# Interim Storage Facility Challenges

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## 22 Million Cubic Meters of Potentially Radioactive Waste

- ▶ 4 Interim Storage Sites
  - ▶ 5 years of operation receiving waste
  - ▶ Over 500 cubic meters of waste must be processed and sorted every hour of operation
  - ▶ Will include organics that must be sorted out and incinerated

## Designed for 30 Years of Storage

- ▶ Siting and Build of permanent disposal site during this time
  - ▶ At end of 30 years waste in ISF will be exhumed and transported to permanent disposal site
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# Challenges of Doing Business in Japan

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- ▶ **Relationships v Proposals & Contracts**
  - ▶ **Language Barrier**
  - ▶ **Currency Exchange Rate Fluctuations**
  - ▶ **Teaming with Japanese Companies**
  - ▶ **Japanese Employment and Labor Laws**
  - ▶ **Protection of Proprietary Intellectual Property**
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