



Offsite Characterization and Remediation Associated with the Fukushima Daiichi Accident

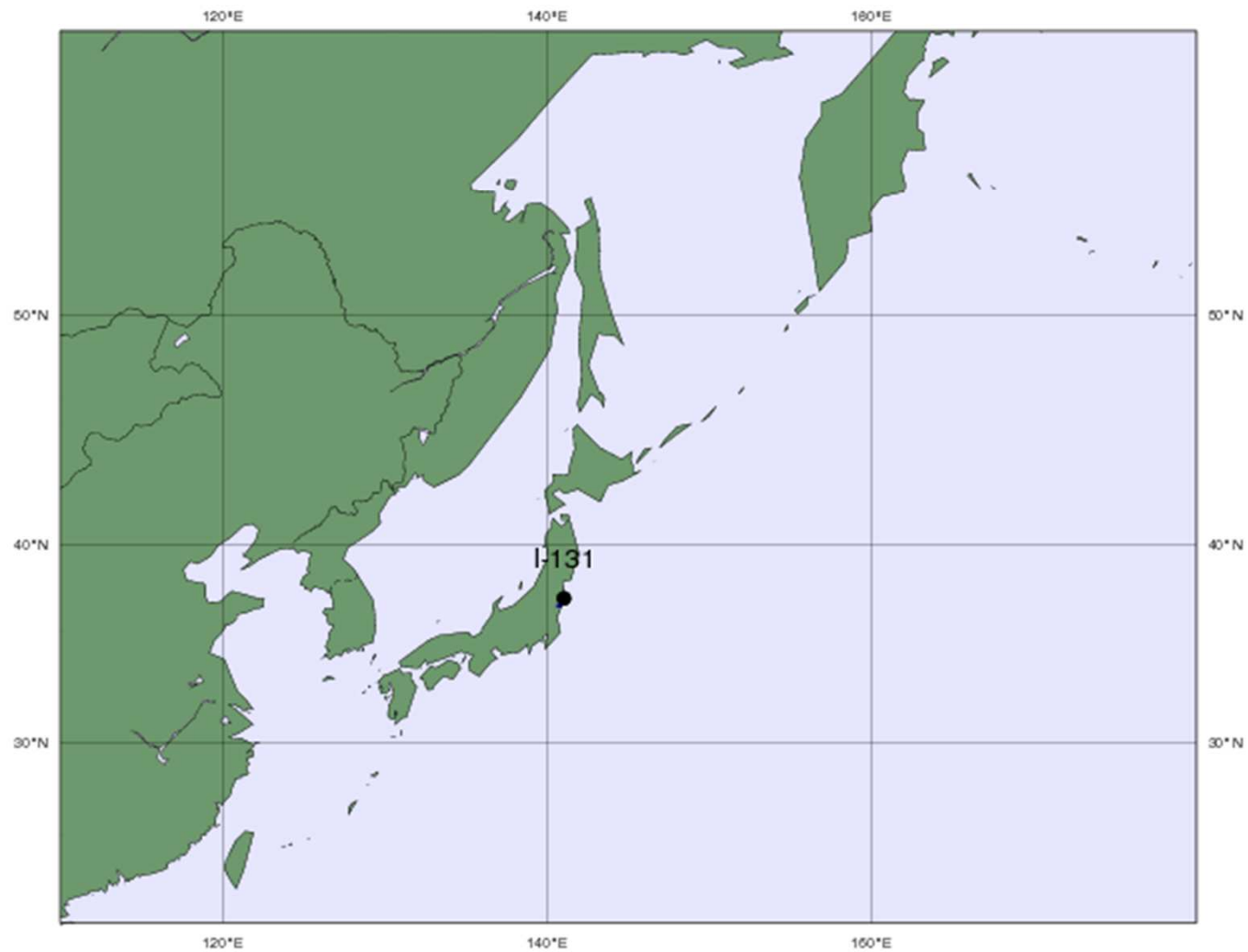
A horizontal bar consisting of two segments: a dark blue segment on the left and a light teal segment on the right.

Steve Rima, CHP, CSP
**Vice President, AMEC Environment &
Infrastructure**

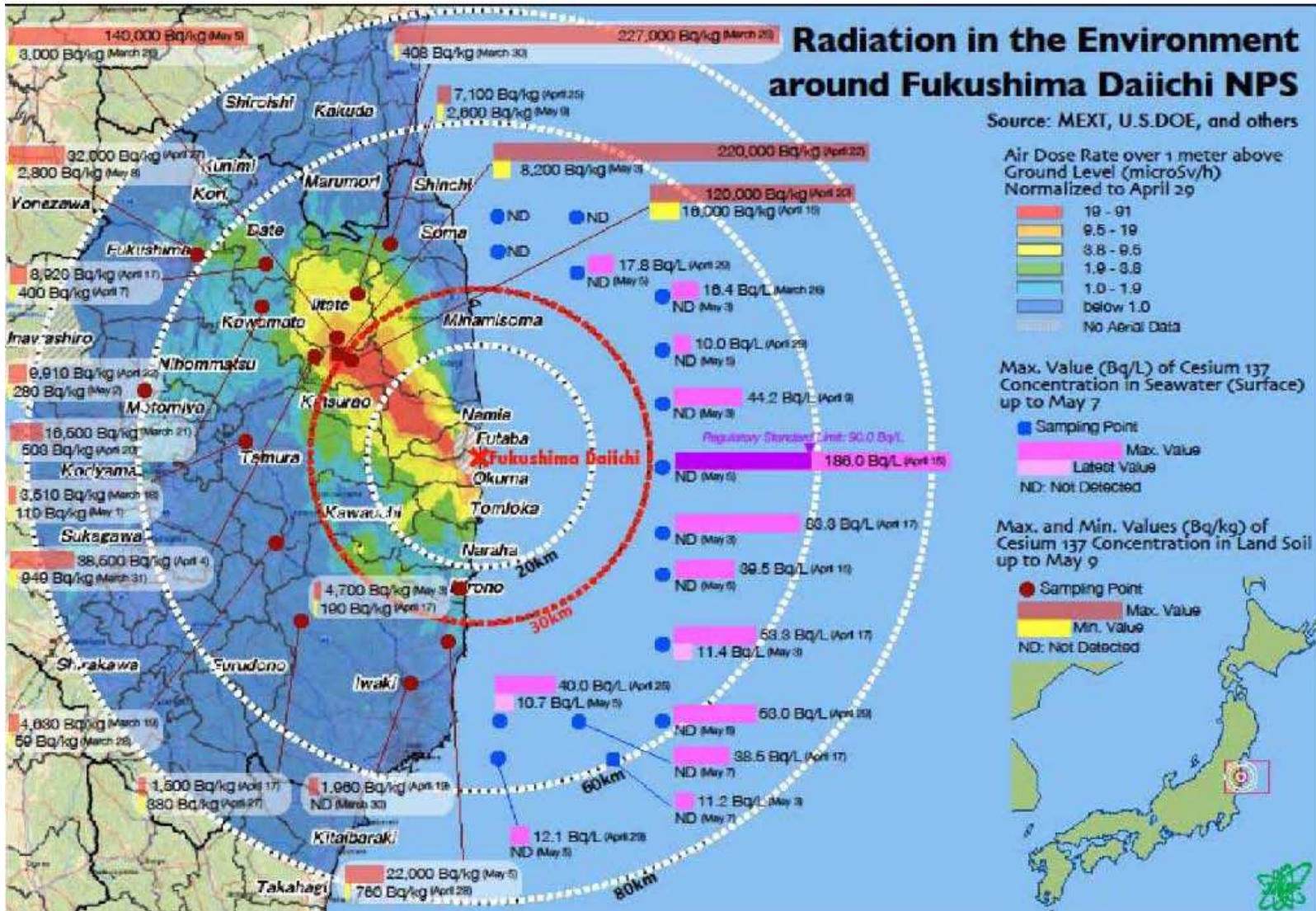
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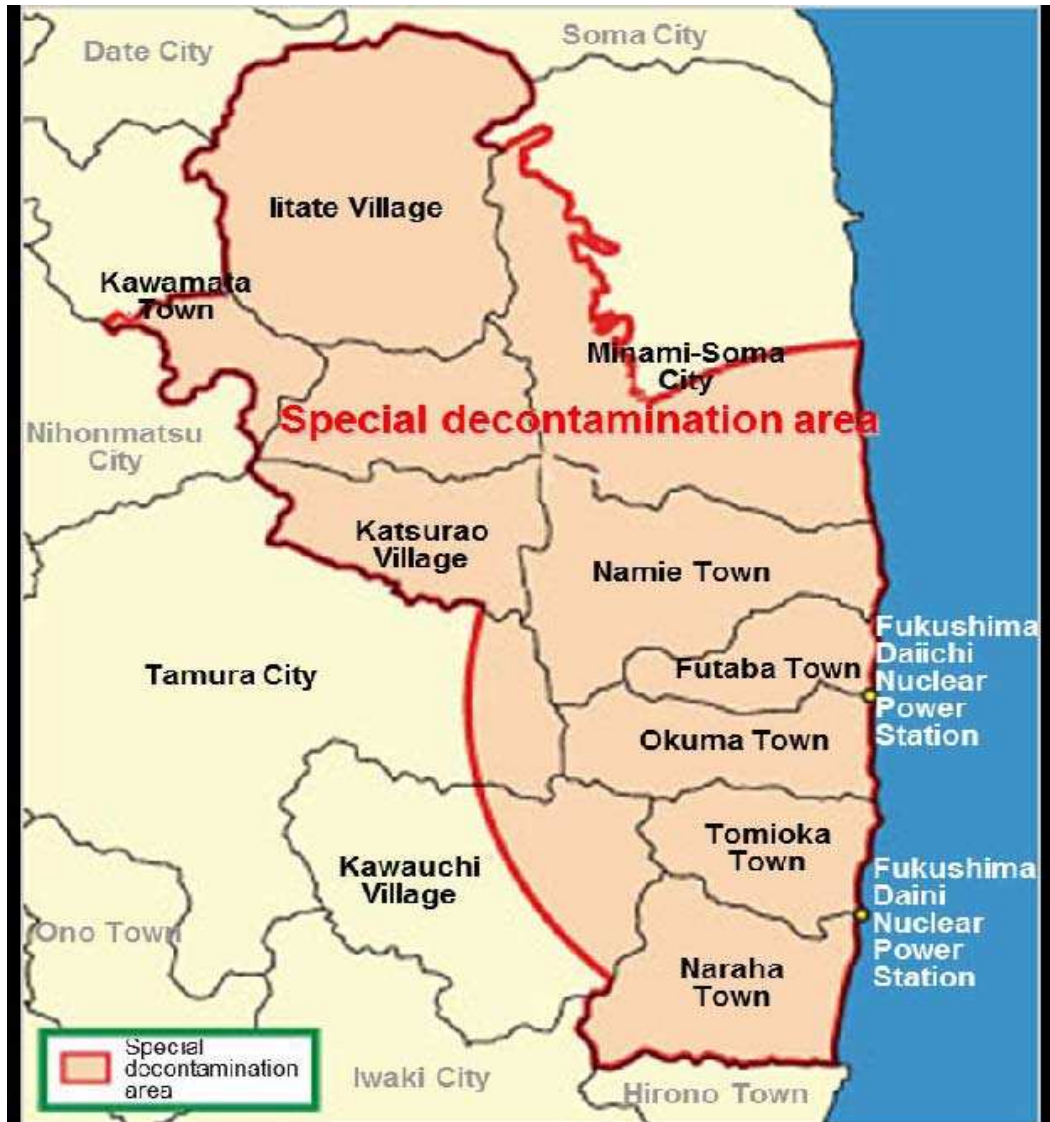
Plume (units m^{-3}), Release: $0.10\text{E}+19$ Units



Japan Plume Map

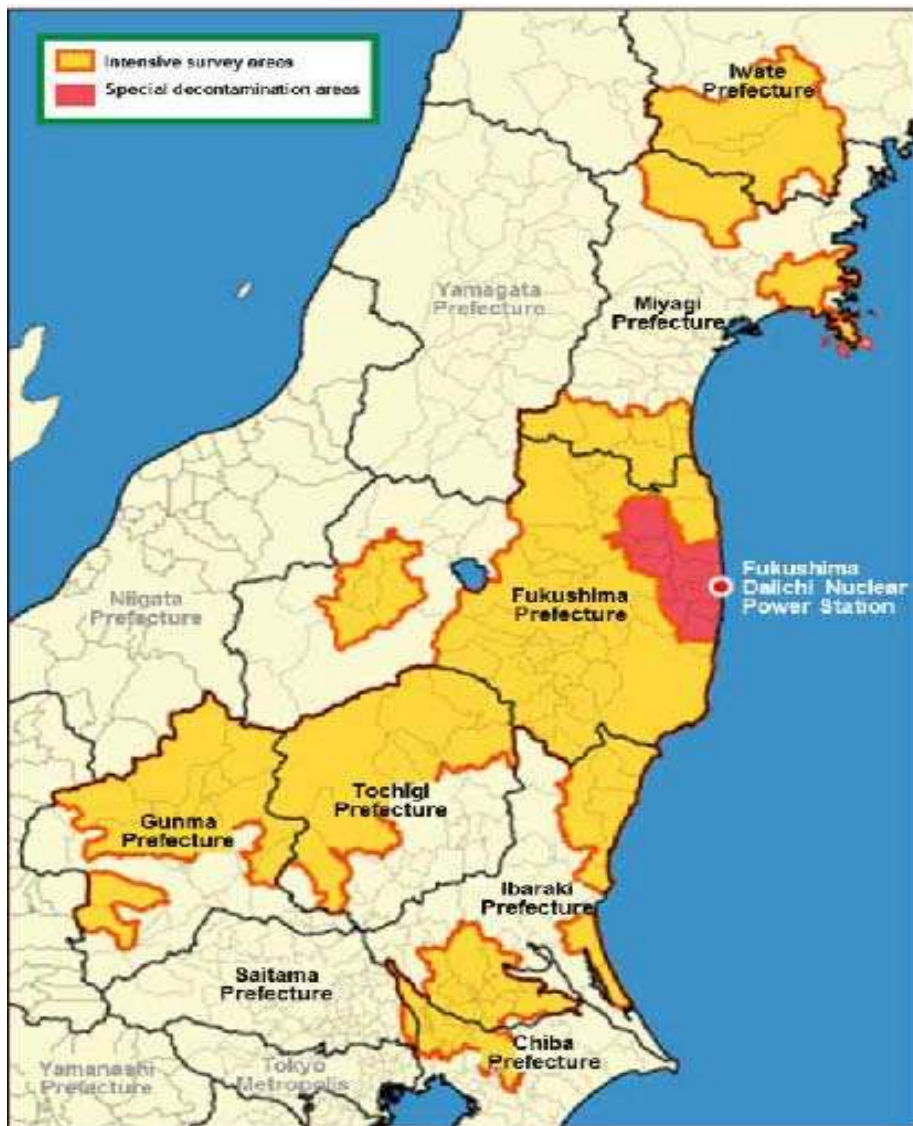


Special Decontamination Area



- 11 municipalities* in (former) restricted zone or planned evacuation zone (<20km from the NPP, or where annual cumulative dose is >20mSv).
- Decontamination is implemented by the national government.
- (*) Entire area of Naraha, Tomioka, Okuma, Futaba, Namie, Katsurao, and Iitate. Some areas of Tamura, Minami Soma, Kawamata, and Kawachi.

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.
- (*) Iwate, Miyagi, Fukushima, Ibaraki, Tochigi, Gunma, Saitama and Chiba

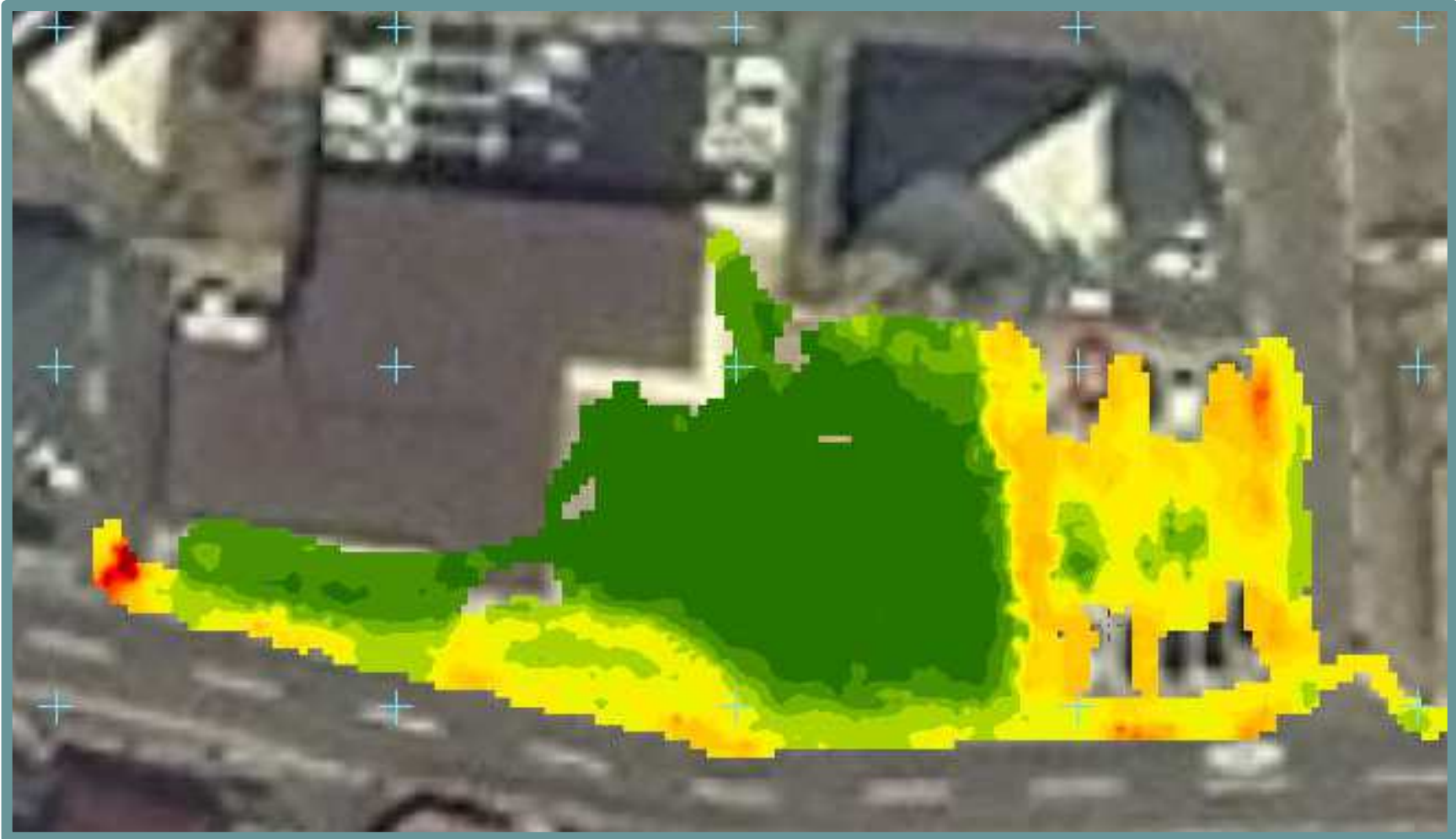
- **Approximately 1,300 square kilometers are evacuated and must be cleaned prior to return of residents**
 - Includes towns, agricultural land, forests, rivers, etc.
- **Very large volume of low level radioactive waste will be generated**
- **No permanent disposal for radioactive waste exists in Japan**
- **Some types of land, e.g. forests, mountains, cannot be cleaned without destroying them**
- **Cost effective waste minimization techniques are badly needed**

- **Objective: Demonstration of remediation technologies toward full remediation of evacuation areas**
- **Overseen by Japanese Atomic Energy Agency (JAEA)**
- **AMEC on team led by Obayashi JV**
 - **Included 114 ha (1,140,000 m²)**
 - **Demonstration of characterization, decontamination and remediation of towns, buildings and land**
 - **Included towns of Hirono, Naraha, Okuma and Kawauchi**
- **AMEC deployed its proprietary Orion *ScanPlot*SM and *ScanSort*SM technologies**
 - **Both use real-time, laboratory-quality, gamma spectroscopy in the field**

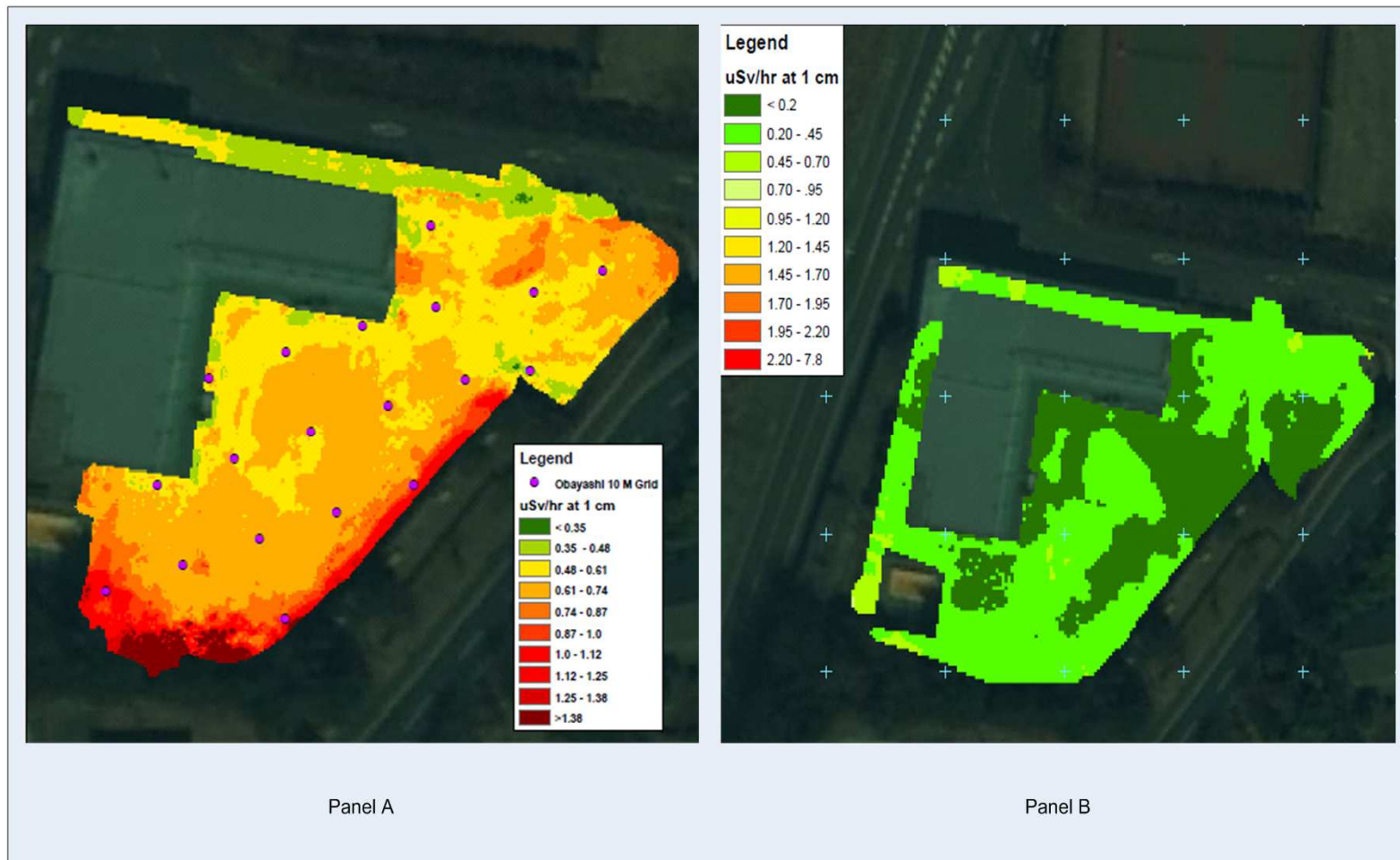
- **Definition of “clean” not yet defined.**
 - **Soil concentration limit v. dose rate above ground surface**
 - **2,000 – 4,000 Bq/kg used as sorting criteria during Demonstration Project**
 - **Concentration limit can be applied *in situ* or *ex situ***
 - **Dose rate can only be applied *in situ***

- **One interesting discovery was that some property owners outside of evacuated areas have already undertaken remediation of their property**
 - **Scrape ground surface**
 - **Bury removed contaminated soil temporarily on site**

Survey of School Yard after Remediation by Owner



■ Pre- and Post-Remediation Surveys of School Yards outside evacuation zone



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



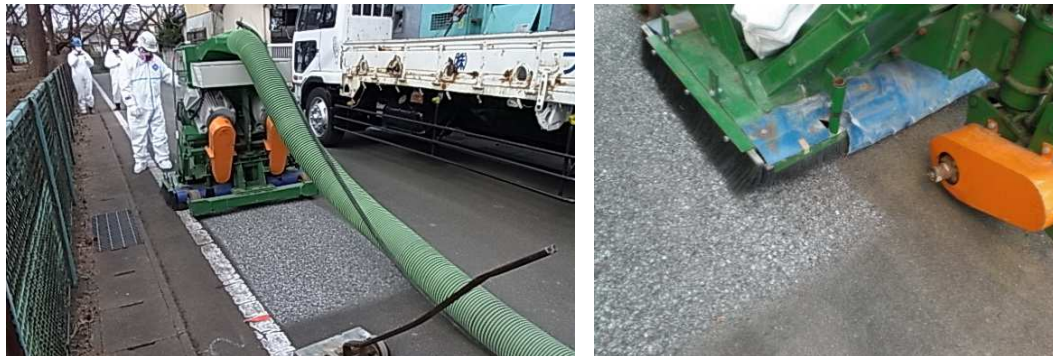
High-pressure water cleaning by vehicle for recovering functions of water drainage pavement



Cleaning of tree trunk (with water and brush)

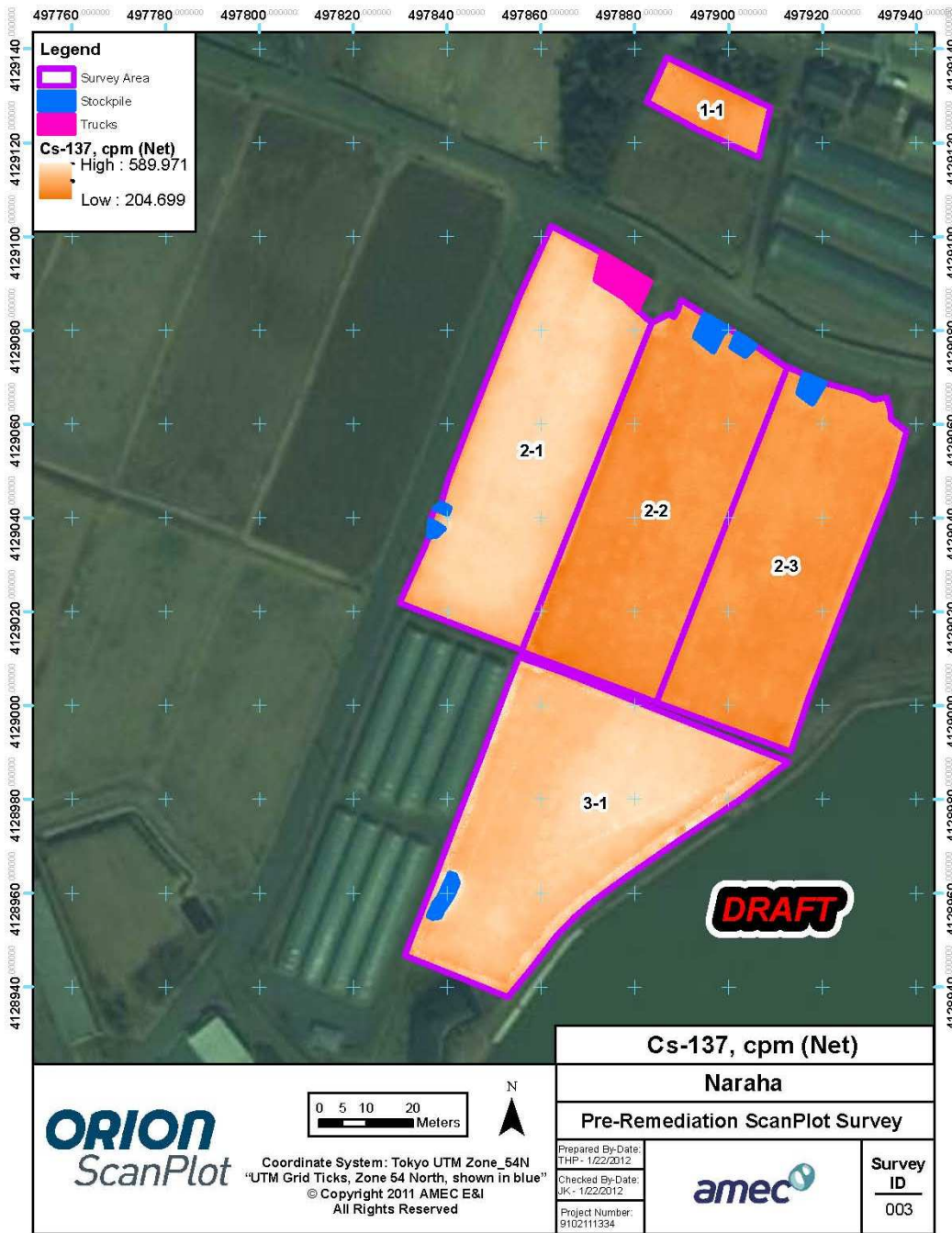


Surface grinding by shot blast



Removal of topsoil





■ ScanPlot Pre-Remediation Survey of Rice Paddy



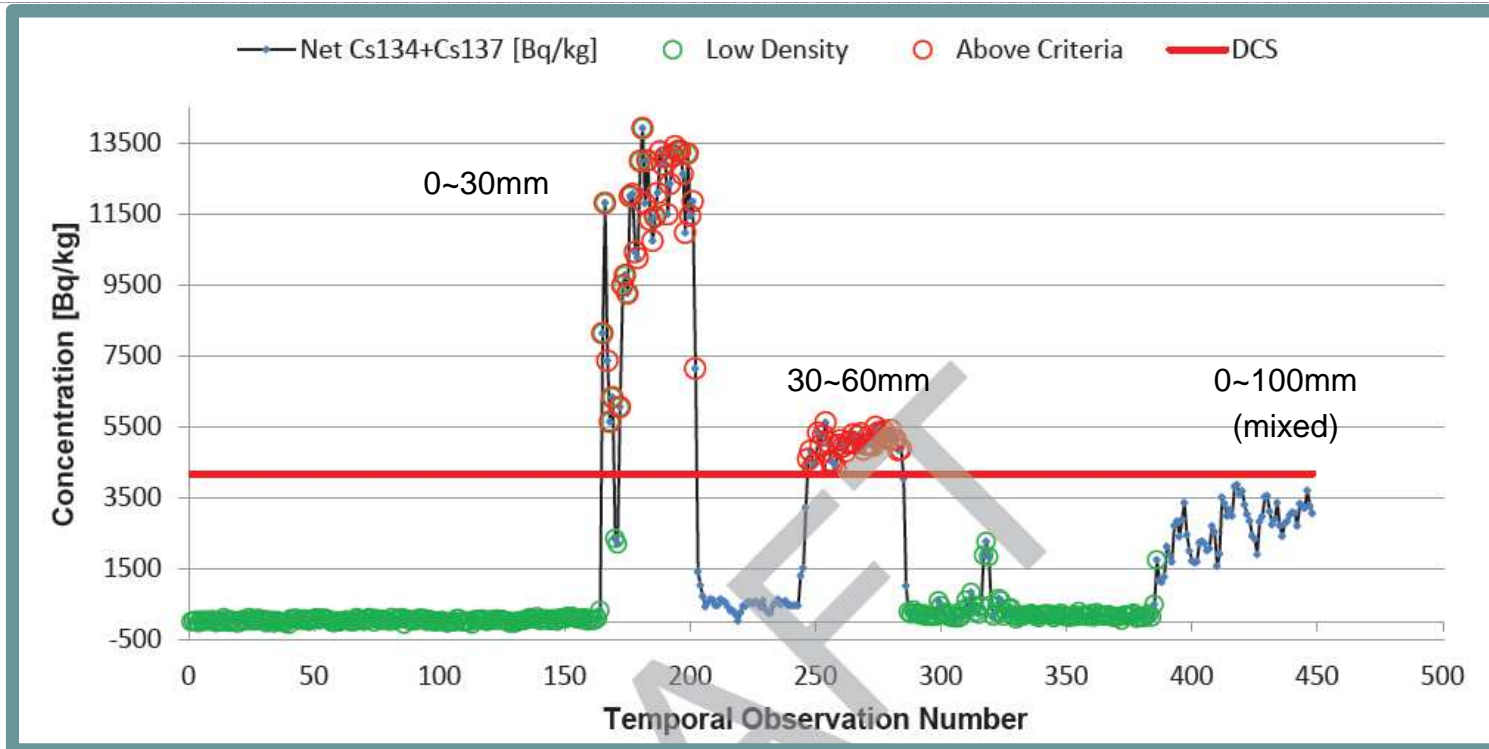
Typical Post-Remediation Radioactive Waste Storage



Temporary Waste Storage Near Fukushima City on Ball Field

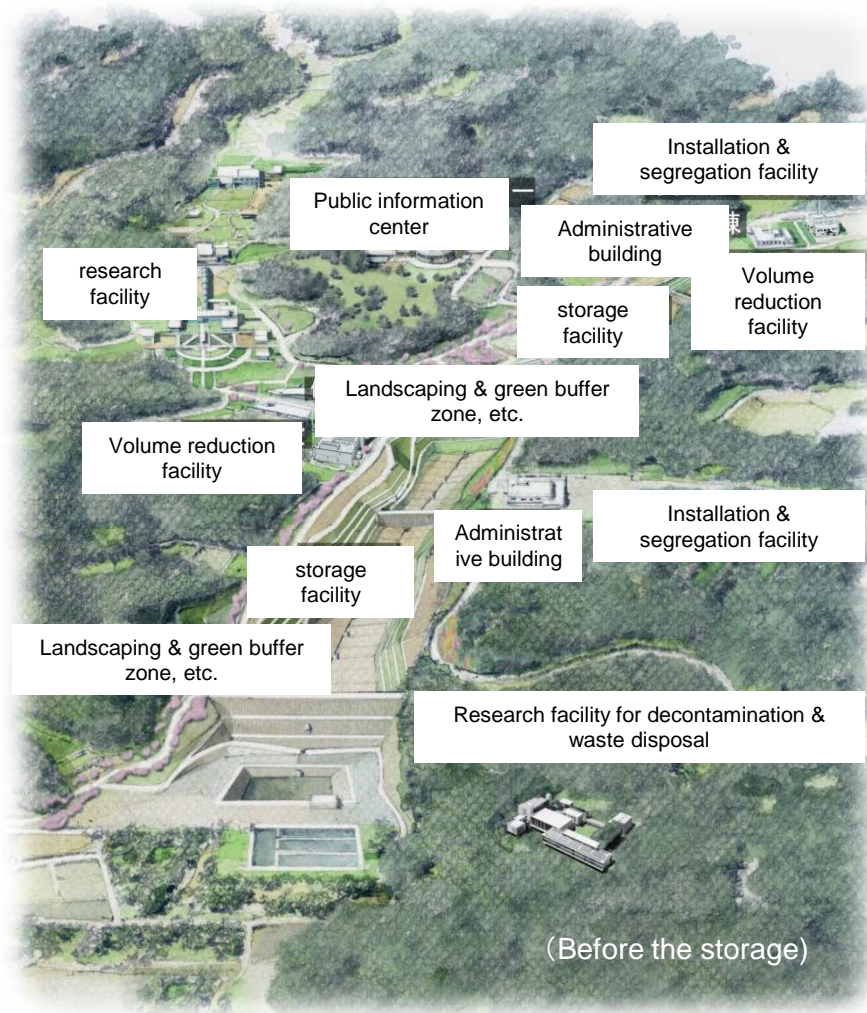


Cs137 Concentration by Depth in Rice Paddy



Soil Layer [mm] Range	Temporal Observation Numbers	Average Concentration [Bq/kg]
0 to 30	165 to 202	10918
30 to 60	247 to 283	5041
60 to 100	206 to 244	512
0 to 100 (mixed*)	386 to 448	2692

Conceptual Interim Storage Facility



- 1. Seeking more efficient/effective technology for decontamination from the perspective of cost, time, etc, including soil/waste minimization and volume reduction**
- 2. Promotion of public communication for securing temporary storage sites, interim storage facilities, etc.**
- 3. Siting and construction of up to 3 interim storage facilities – operational by Jan 2015**
- 4. Research on the behavior and environmental fate of Cesium, including the development of transport models**