

# Radioactive Waste at Fukushima Daiichi NPS

March 6, 2014

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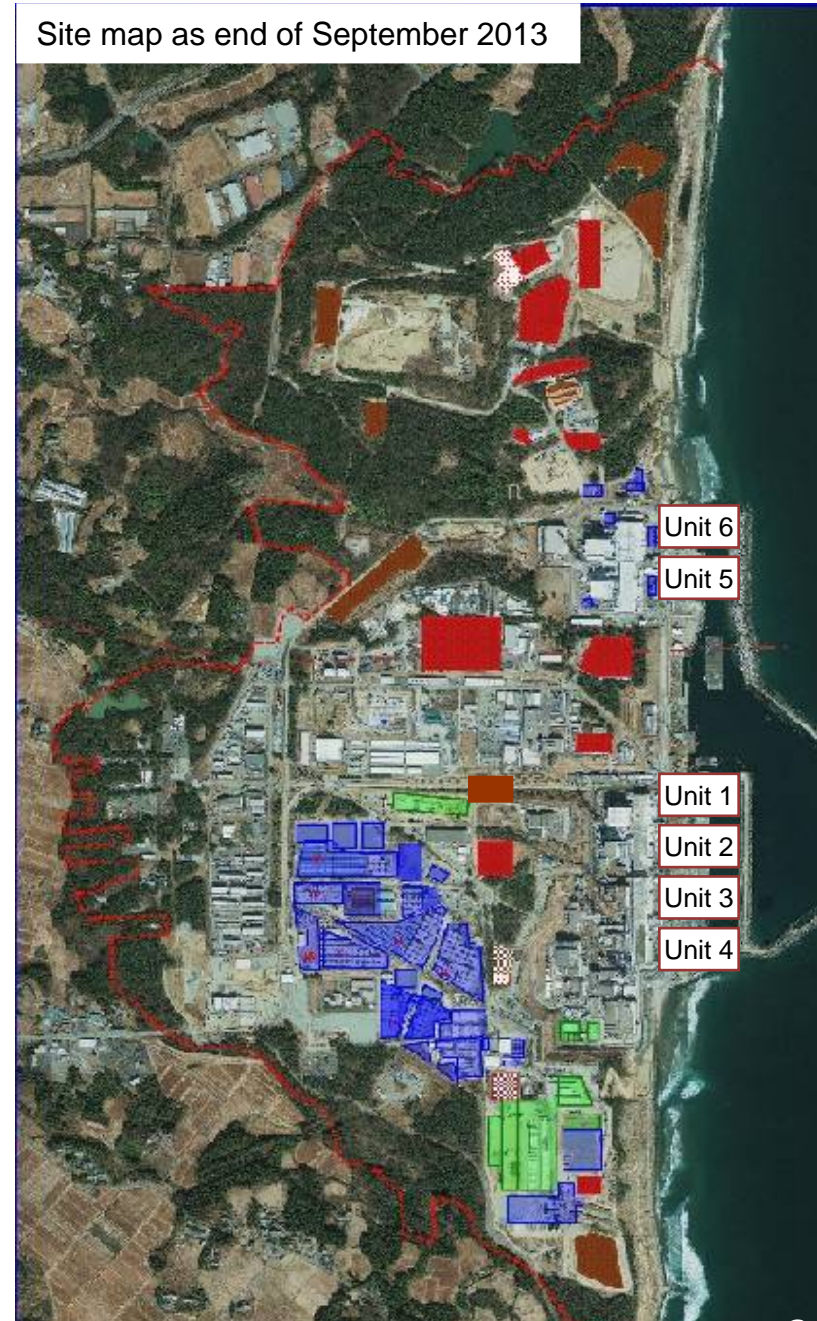
International Research Institute for Nuclear Decommissioning

# Waste Storage Volume

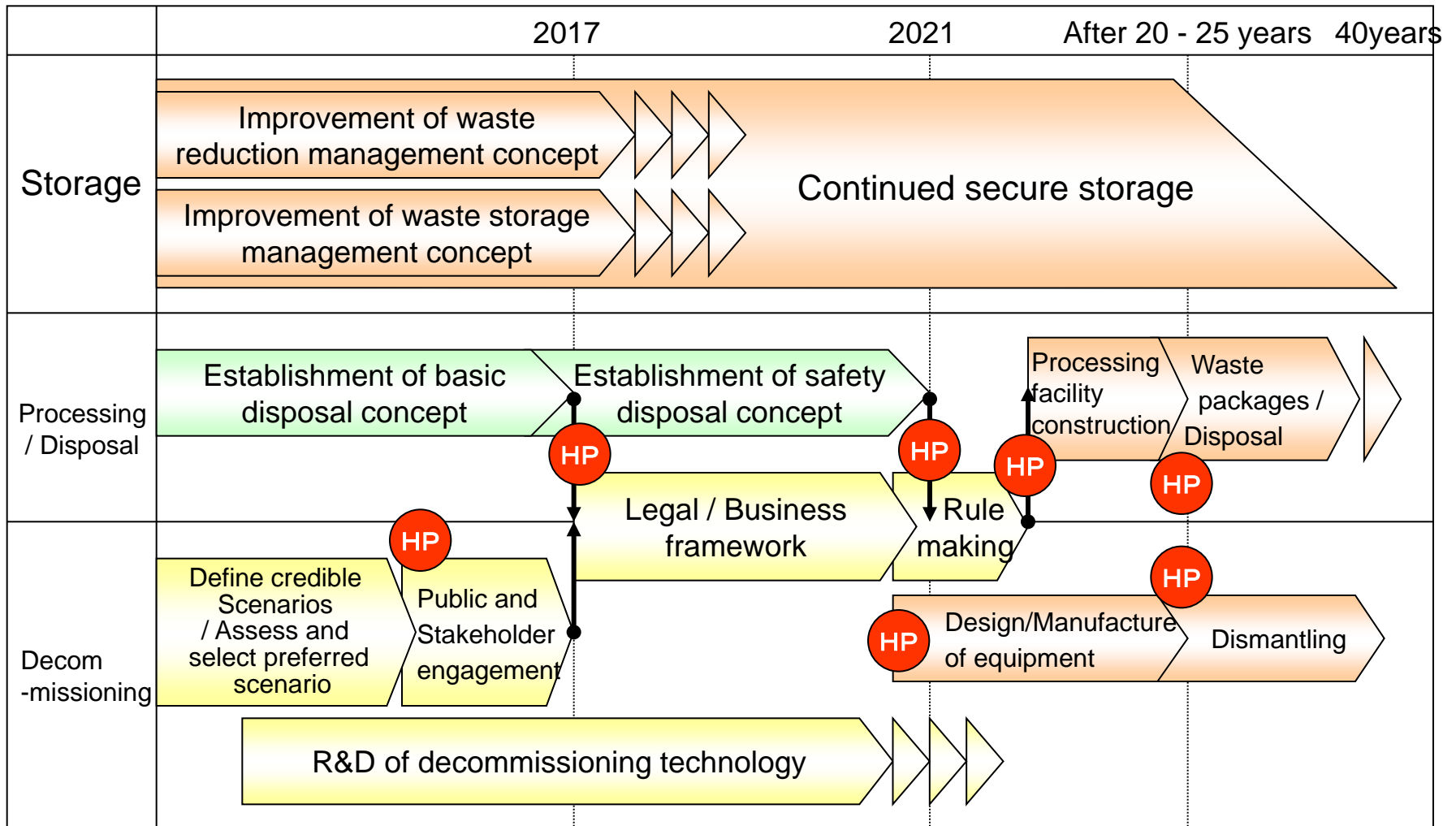
Key	Waste	Storage Volume
	Contaminated / Treated water (Water storage tanks)	500,000 m <sup>3</sup>
	Secondary waste from contaminated water treatment	745 vessels
	Miscellaneous	71,000 m <sup>3</sup>
	Felled trees	71,000 m <sup>3</sup>
	Contaminated soil	Under evaluation

Contaminated / Treated water, Secondary waste as of 21 January 2014  
 Miscellaneous waste and Felled trees as of 30 November 2013

Site map as end of September 2013



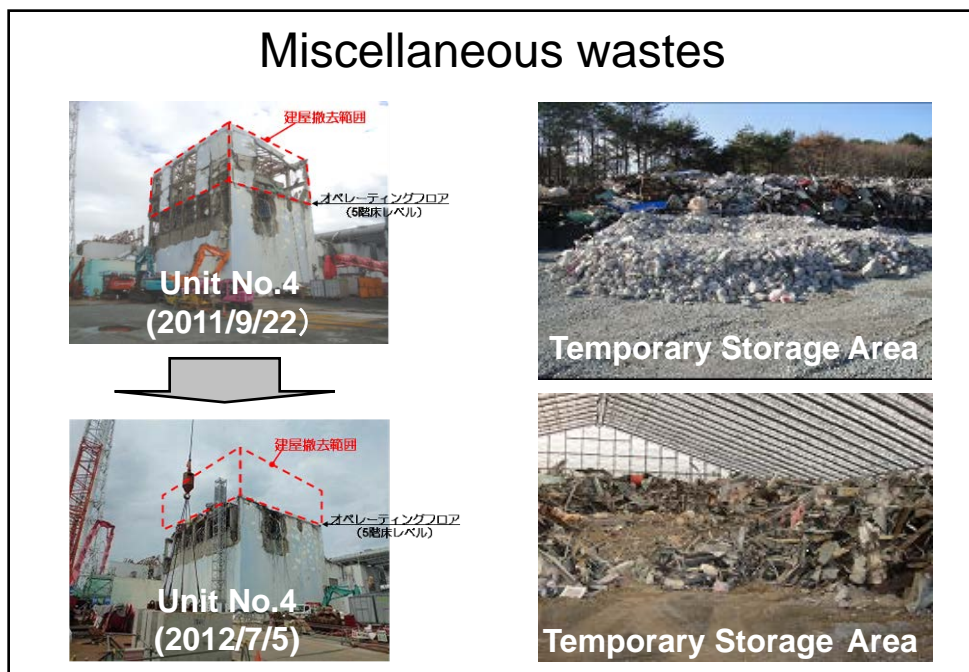
# Mid-and Long-term Roadmap for Decommissioning of Units 1 - 4 Solid Waste Management



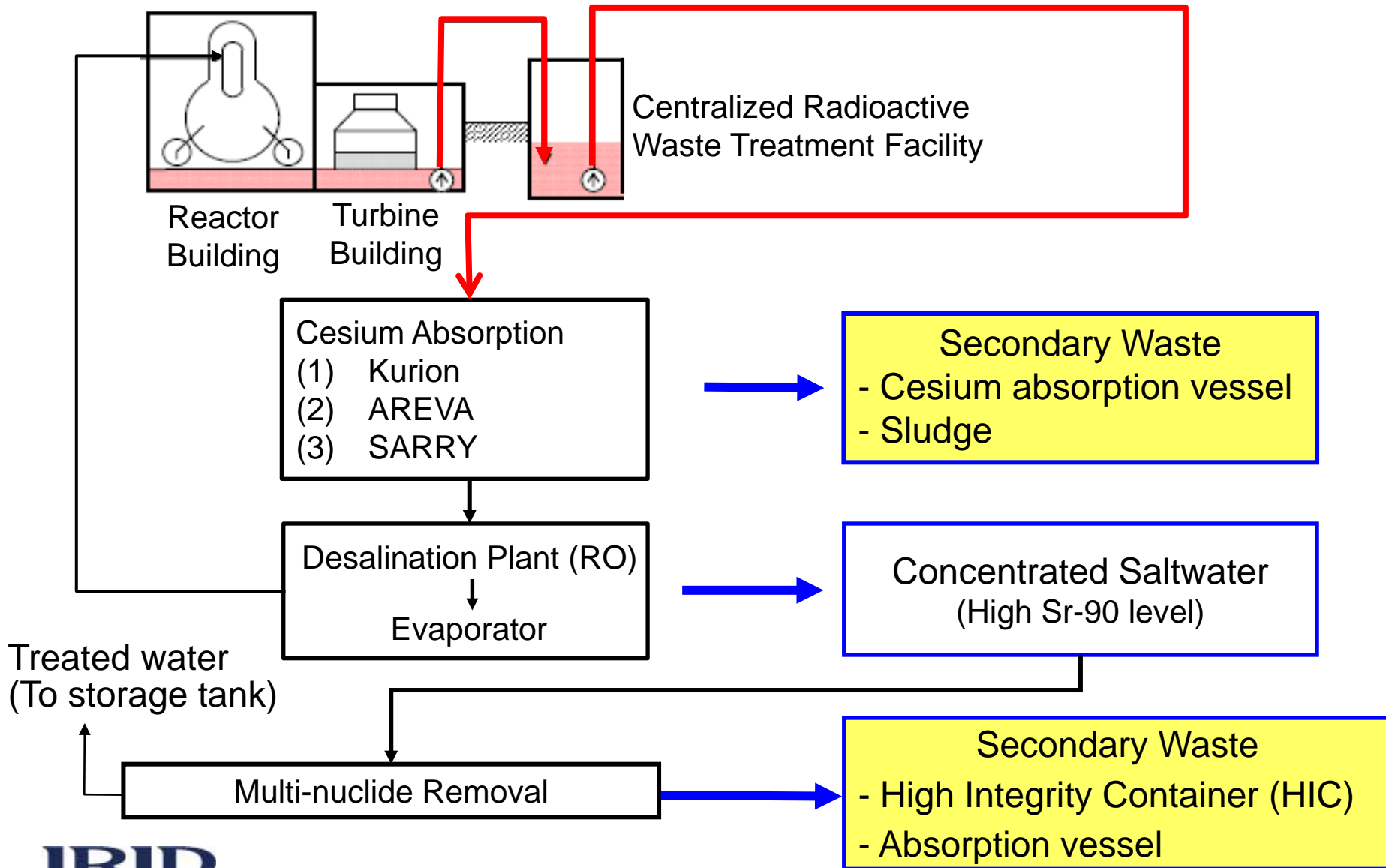
**HP** = Hold Point

# Solid Waste from Fukushima Daiichi Accident

- Various types of radioactive waste such as miscellaneous radioactive wastes and secondary waste from water treatment, have been generated.
- Numerous trees were felled in a wide area for installation of water tanks and for temporary storage of miscellaneous waste and felled trees.
- These wastes have been temporarily stored in a dedicated area following segregation, dispersion prevention countermeasures and radiation shielding.



# Water Treatment System--Configuration



# Cesium Absorption Vessel (Secondary waste)



## Kurion

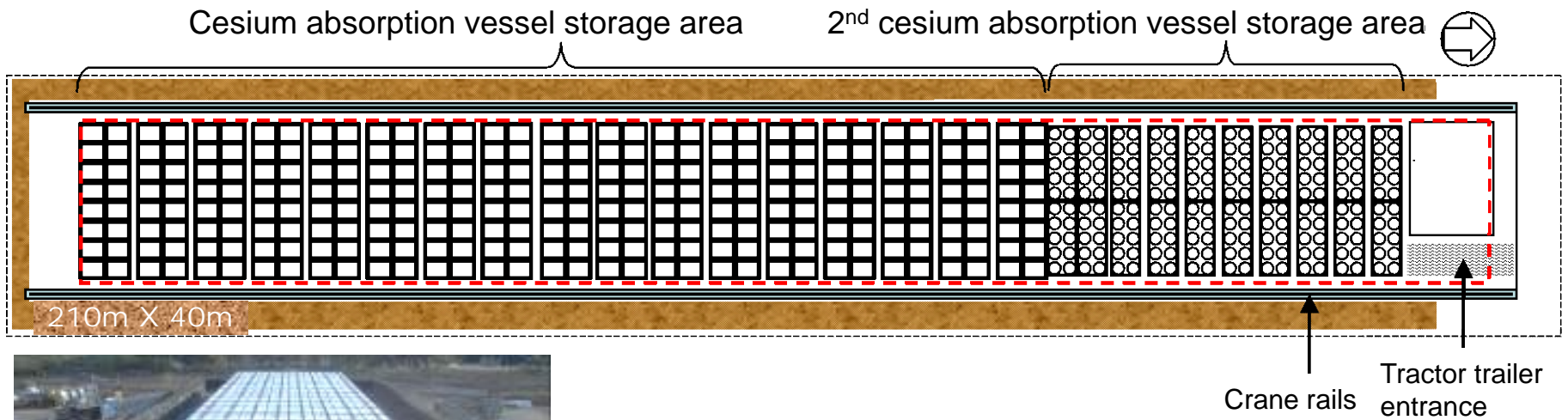
- Weight: Approx. 15 tons
- Outer diameter: 1.4m
- Height: Approx. 2.4m
- Zeolite-filled stainless steel container shielded within carbon steel container.



## SARRY

- Weight: Approx. 24 tons
- Outer diameter: 1.4m
- Height: Approx. 3.6m
- Zeolite-filled stainless steel container shielded within carbon steel container.
- Shielding container is double-layered with lead.

# Temporary Storage Facility for Secondary Wastes



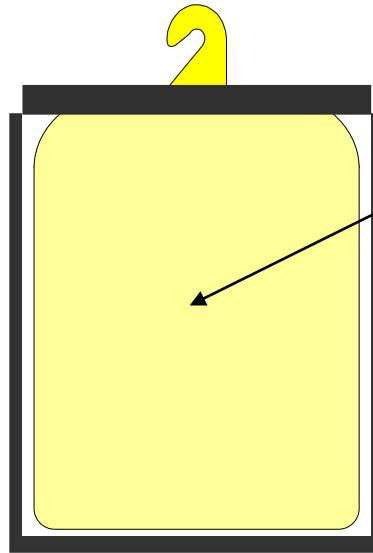
# Multi-nuclide Removal System (Secondary Waste)

## ■ High-integrity container (HIC)

- For storage of used absorbent and slurry
- Made of polyethylene with superior hardness, durability, radiation resistance and chemical resistance (durability period is assessed to be over 20 years)
- Absorbent is dehydrated to increase holding efficiency



HIC with Reinforcement



### HIC:

- Polyethylene
- Outer diameter: approx. 1.5m
- Height: Approx. 1.8m
- Thickness: Approx. 11mm
- Capacity: 2.86m<sup>3</sup>

### Reinforcement:

- Stainless Steel
- Side thickness: approx. 10mm
- Bottom thickness: approx. 20mm

## **Waste generation prediction (Treated volume @ 500m<sup>3</sup> / day)**

- ◆ HIC : Approx. 821 units / year
- ◆ Columns : Approx. 6 units / year



# Miscellaneous Radioactive Waste Storage Conditions

Miscellaneous radioactive waste is categorized by surface radiation level, and then transferred for temporary storage.



Outdoor collection area



Unit 5 / 6 north side storage area

Solid waste storage building



Inside of building

Soil-covered temporary storage facility



Bottom of soil covered temp, facility

Temporary storage facility



Inside debris storage tent

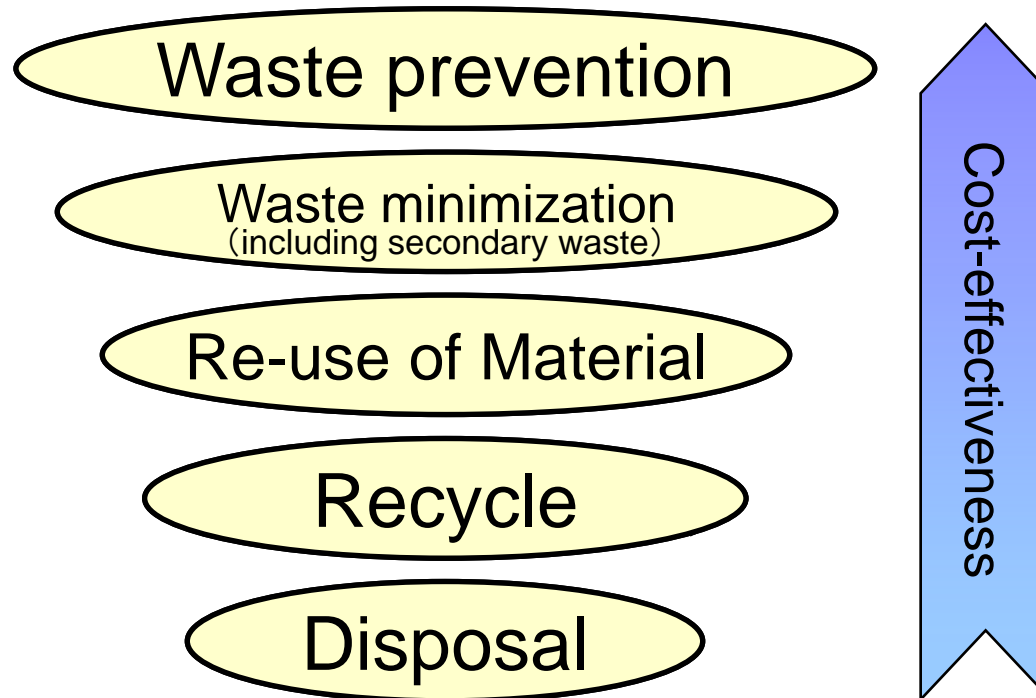
Sheet-covered storage area



Unit 5 / 6 north side storage area

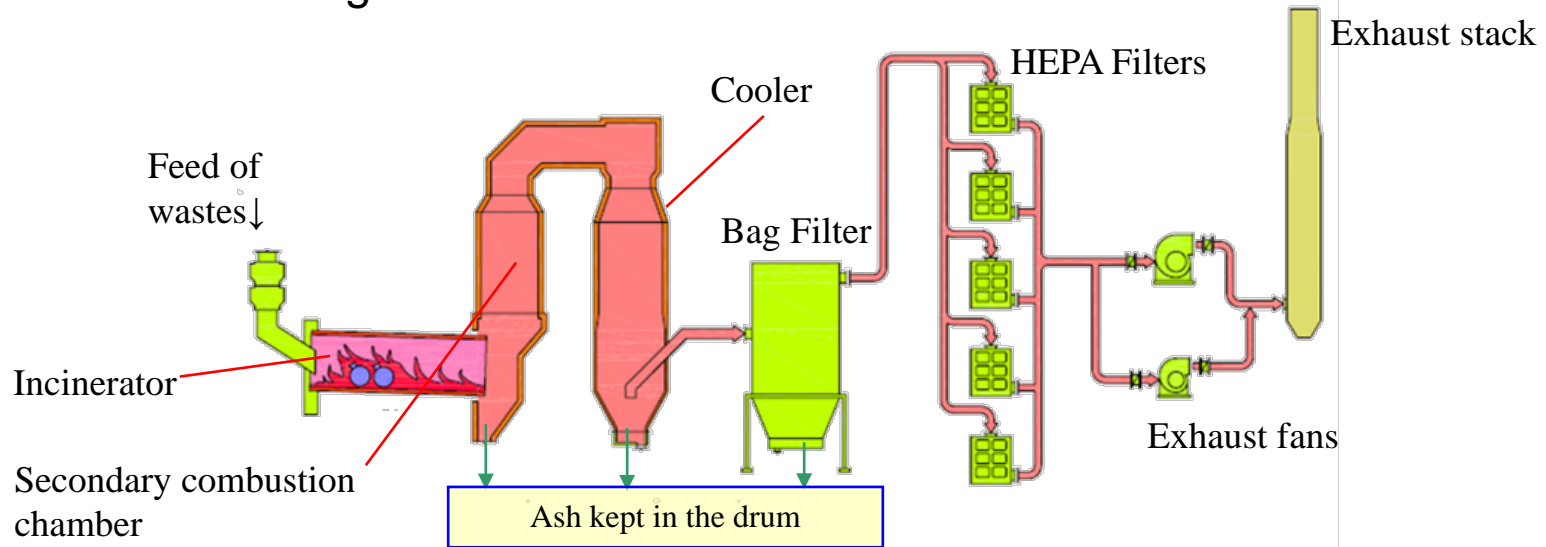
# Waste Reduction Management Concept

- Safe storage is required until waste is transported to disposal site (in 20 - 25 years).
- For solid waste, it is important to minimize waste generated from viewpoints of effective use of site, ease of management, and reduction of waste for processing and disposal.
- Concept philosophy for waste management:  
“waste prevention>waste minimization>reuse>recycling”



# Incineration

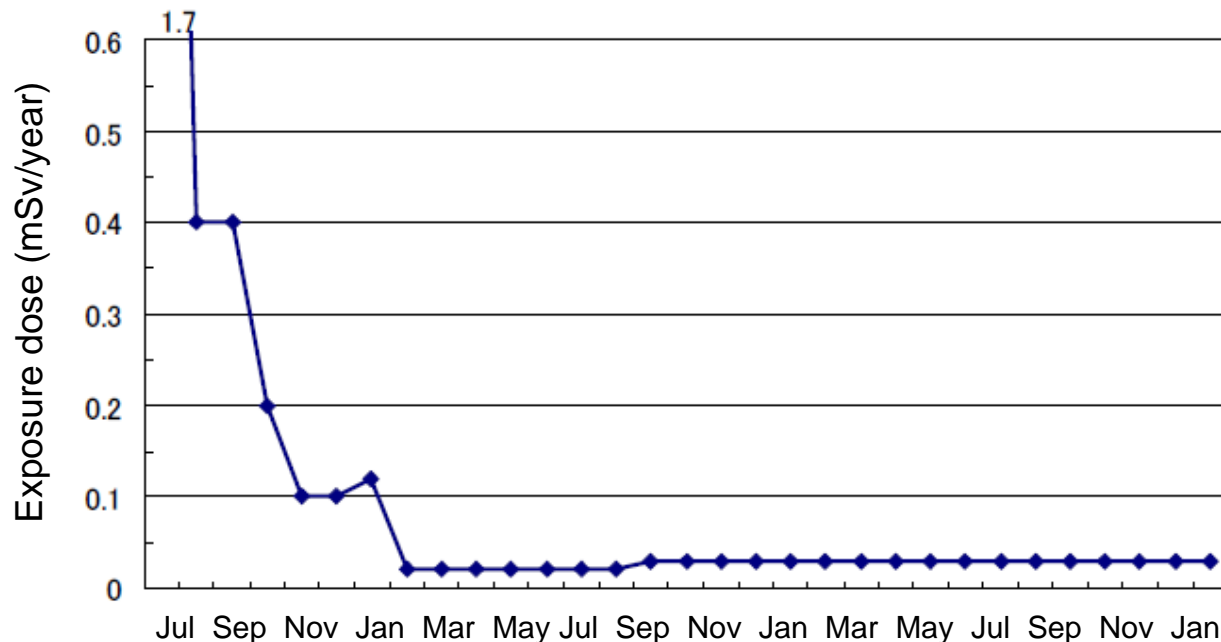
- Original radioactive waste incinerator ceased to operate following earthquake and tsunami on March 11, 2011.
- Accumulation of wastes has occurred
- TEPCO is installing new incinerators



Type	Rotary kiln
Capacity	300 kg / h × 2 units
Wastes	Combustible miscellaneous waste (Tyvek protective clothing, cloth, gloves, rags, wood, packaging material, paper, etc.), waste oil, spent resin, etc.,
Date of startup	Early 2015
Location	North side of Unit 5 & 6

# Release of Radioactive Materials from Reactor Buildings

- Radioactive materials newly released from Reactor Building Units 1 - 4 in air measured on-site boundaries were measured at approx.  $1.3 \times 10^{-9}$  Bq/cm<sup>3</sup> for both Cs-134 and -137.
- Radiation exposure dose due to release of radioactive materials was 0.03 mSv/year (equivalent to approx. 1/70 of annual radiation dose by natural radiation (annual average in Japan: approx. 2.1 mSv/year)) at site boundaries.



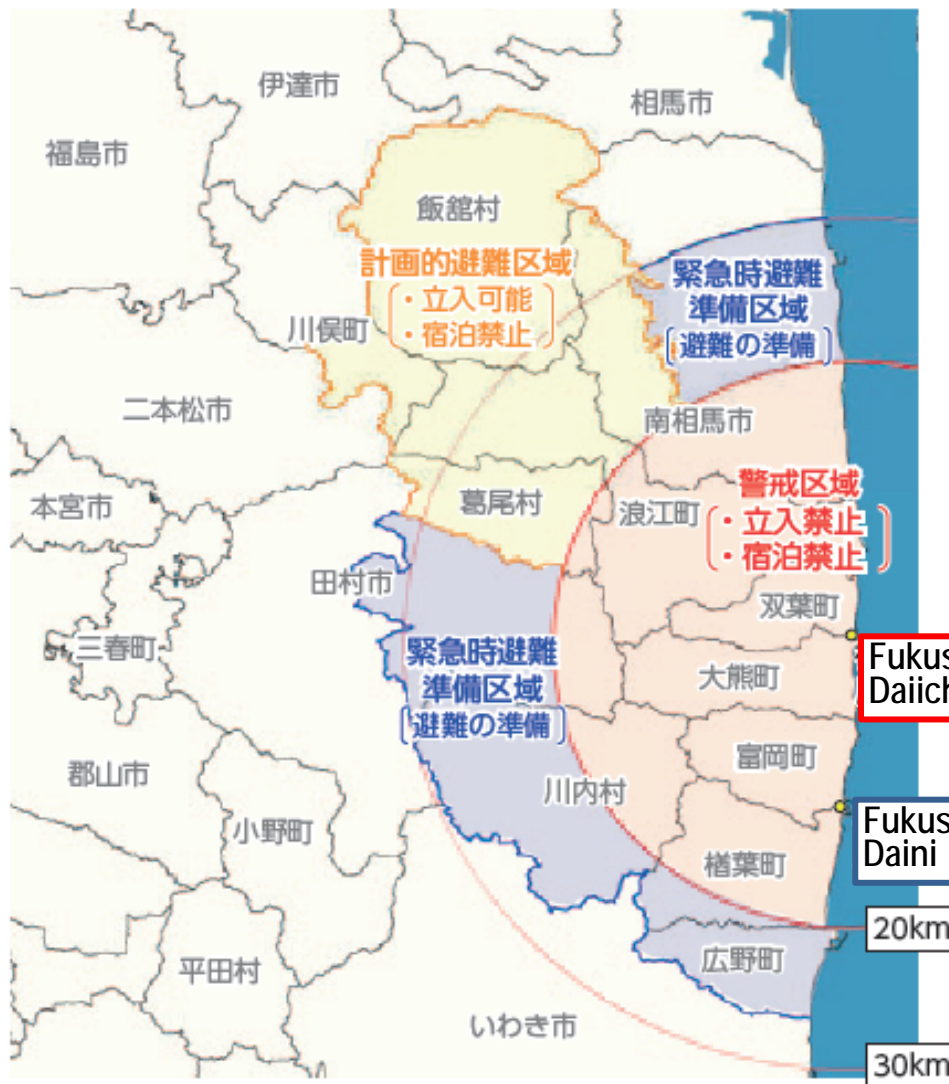
# Nuclear Fuel at Fukushima Daiichi

	Spent Fuel				Fresh Fuel (Assy.)
	(Assembly)		Weight (ton)		
	Core	SF pool	Core	SF pool	SF Pool
Unit 1	400	292	69	51	100
Unit 2	548	587	95	102	28
Unit 3	548	514	95	89	52
Unit 4	0	1,331	0	230	204
Common Pool		6,375		1,103	
Dry cask storage	9 casks	408		71	
<b>Total</b>	<b>2,808</b>	<b>11,329</b>	<b>486</b>	<b>1,960</b>	<b>496</b>

	Core (Assembly)		SF pool (Assembly)	
	Spent Fuel	Fresh Fuel	Spent Fuel	Fresh Fuel
Unit 5	424	124	946	48
Unit 6	580	184	876	64

# Status of Areas Subject to Evacuation Order

( As of end of September 2011 )



( As of end of August 2013 )

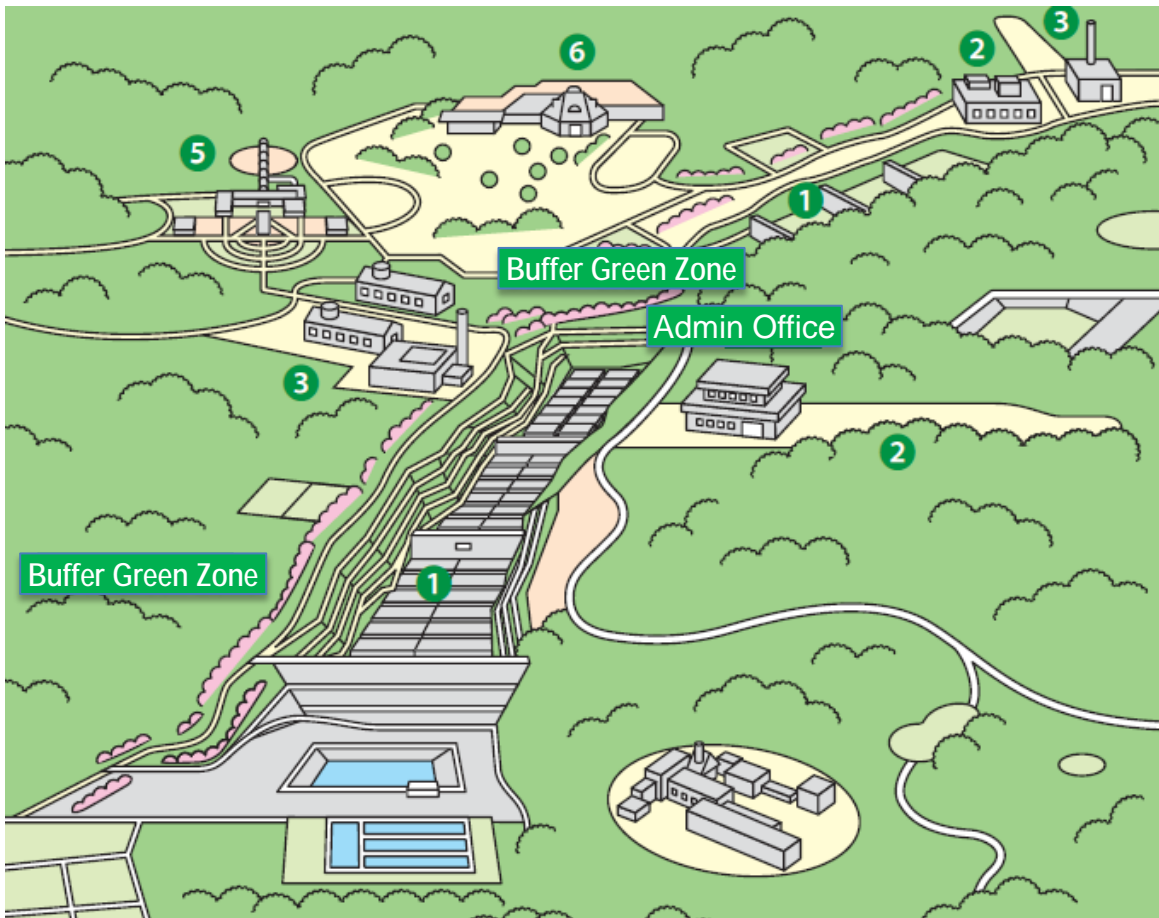


Source: Reconstruction Agency

# Interim Storage Facility to be Sited outside of NPS

## ISF Functions

1. Storage Facility
2. Emplacement & Segregation Facility
3. Volume Reduction Facility
4. 24-hour Monitoring Equipment (placed at several points, not specifically indicated in the figure)
5. R&D Facility
6. Public Information Center



Scale of entire facility (estimate)

Total storage volume ranges between 15 - 28 million  $m^3$ , which is 12 - 23 times the size of a baseball stadium (approx. 1.24 million  $m^3$ ).

# Summary

- ✓ Steadily increasing waste volume stored on site
- ✓ Need to promote dedicated R&D program for waste processing and disposal because Fukushima waste characteristics differ greatly from other radioactive wastes in Japan.
- ✓ Need to pursue safe storage until waste can be processed and transported to disposal site(s).
- ✓ Need to implement waste reduction program, with consideration to stabilized waste forms for safety.