

廃炉を知る

Steps for decommissioning at Fukushima Daiichi NPS

Learn about decommissioning

2021

SPECIAL ISSUE

Fukushima Prefecture Nuclear Safety Management Division

<http://www.pref.fukushima.lg.jp/sec/16025c/>



What is happening NOW in Fukushima.

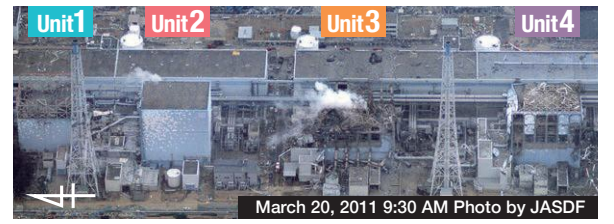
10 years from the nuclear disaster, efforts for decommissioning at Fukushima Daiichi Nuclear Power Station

We will look back on the timeline of the accident at TEPCO's Fukushima Daiichi Nuclear Power Station and the efforts made over the past 10 years toward decommissioning.

1 Timeline of the accident at Fukushima Daiichi Nuclear Power Station

2011
March 11–15

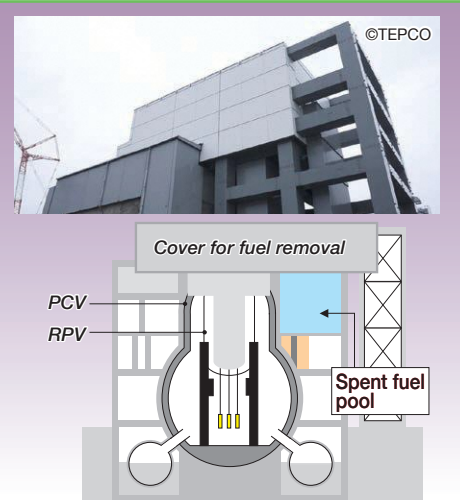
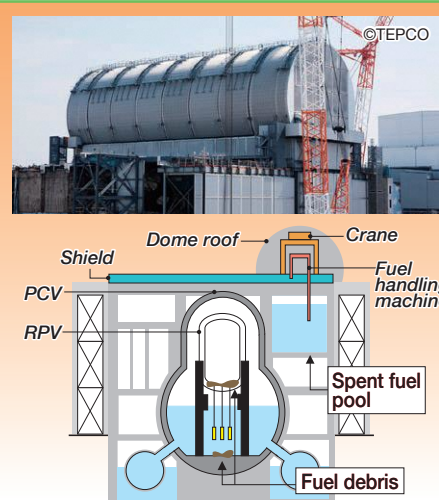
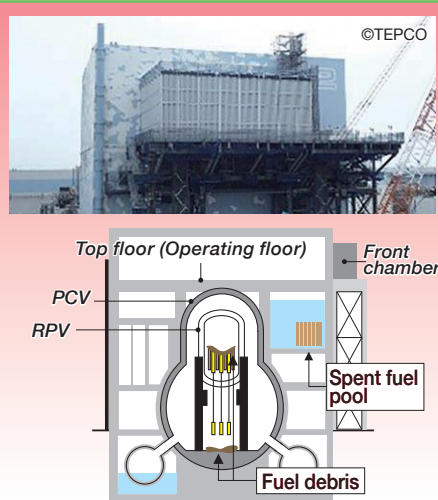
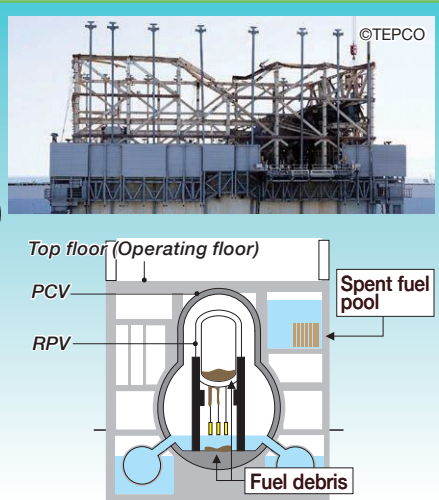
On March 11, 2011, being hit by the powerful earthquake, Fukushima Daiichi Nuclear Power Station lost its external power supply and the huge tsunami that struck afterwards created damage to the power supply equipment and cooling equipment. Due to reactor cooling problems in Units 1, 2, and 3, the nuclear fuel was damaged, and a large amount of radioactive material was released.



2011	Unit 1	Unit 2	Unit 3	Unit 4
	Powerful M9.0 earthquake occurs			
Mar 11	Reactor emergency shutdown	Reactor emergency shutdown	Reactor emergency shutdown	Not in operation (no fuel in reactor core)
	Loss of off-site power supply due to earthquake	Loss of off-site power supply due to earthquake	Loss of off-site power supply due to earthquake	Loss of off-site power supply due to earthquake
	Huge tsunami struck (maximum 15.5 m)			
Mar 12	Total loss of electricity	Loss of emergency generation	Loss of emergency generation	Total loss of electricity
	Loss of cooling/water injection function	Water injection started	Water injection started	Loss of spent fuel pool cooling function
Mar 13	Mass generation of hydrogen and core damage	Loss of water injection function	Water injection stopped	Mass generation of hydrogen and core damage
	PCV venting (release of radioactive materials)	PCV venting failure	PCV venting (release of radioactive materials)	PCV venting (release of radioactive materials)
Mar 14		Mass generation of hydrogen and core damage	Hydrogen explosion	Hydrogen inflow from Unit 3
Mar 15		Release of radioactive materials		Hydrogen explosion

Current status

10 years has changed the appearance completely.



PCV: Primary Containment Vessel RPV: Reactor Pressure Vessel

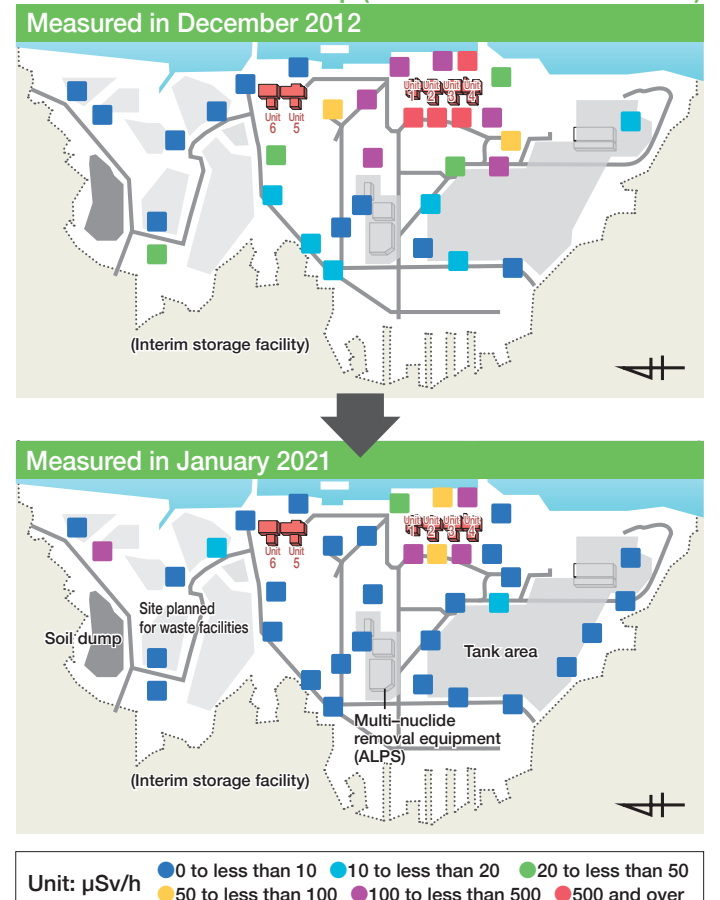
2 Efforts for reactor stabilization

2011 Apr–Dec

TEPCO has taken measures for cooling of the spent fuel pool and the reactor and reduction of the radioactive materials release. As a result, temperature of the bottom of the reactor pressure vessel in Units 1, 2, and 3 have reached under 100°C in December.

2011	Unit 1	Unit 2	Unit 3	Unit 4	Contaminated water management and other
Apr	Step 1 Steady decline of radiation dose (Apr 17–Jul 19)				<ul style="list-style-type: none"> Apr 11 Installed silt fence (to prevent diffusion of contaminated water outside the port) Jun 17 Started operation of cesium adsorption device Jun 28 Completed spraying anti-scattering agent (to prevent scattering of radioactive materials) Oct 28 Started sea-side impermeable wall construction (to prevent marine pollution)
	<ul style="list-style-type: none"> Jun 27 Reactor circulating water injection started (for fuel debris cooling) 				
Jul	Step 2 Control radioactive material release ; Significant reduction of radiation dose (Jul 19–Dec 16)				<ul style="list-style-type: none"> Oct 28 Complete reactor building cover (to prevent scattering of radioactive materials)
	<ul style="list-style-type: none"> Sep 10 Started rubble removal (to start spent fuel removal) Sep 21 Started rubble removal (to start spent fuel removal) 				
Dec	Dec 16 Transition to cold shutdown state (RPV bottom temperature approx. 100 °C or less)				

Radiation measurement map (Fukushima Daiichi NPS site)



3 Efforts for decommissioning (Mid-and-Long-Term Roadmap)

Phase 1: Dec 2011–Nov 2013

Phase 2: Nov 2013–present

In December 2011, the national government established the Mid-and-Long-Term Roadmap that defines the basic concept for decommissioning, major efforts necessary to reduce the risk of radiation, and the target processes to be implemented. Currently, the status is in the second phase of this Mid-and-Long-Term Roadmap, and continuous efforts toward decommissioning are underway.

It is in phase 2, now.

Mid-and-Long-Term Roadmap

[Official name: Mid-and-Long-Term Roadmap towards the Decommissioning of TEPCO's Fukushima Daiichi Nuclear Power Station]

Phases defined in the Mid-and-Long-Term Roadmap

▼ Dec 2011 **Phase 1** (Until start of spent fuel removal) → ▼ Nov 2013 **Phase 2** (Until start of fuel debris retrieval) → **Today** ▼ Dec 2021 **Phase 3** (Until completion of decommissioning) → 30–40 years after Dec 2011 **Complete**

4 efforts in the Mid-and-Long-Term Roadmap

- Contaminated water management**: Efforts to suppress the amount of contaminated water generation and remove radioactive materials
- Spent fuel removal**: Efforts to remove nuclear fuel from the spent fuel pool
- Fuel debris retrieval**: Efforts to remove fuel debris from the reactor
- Waste management**: Efforts to store and manage radioactive waste generated from the decommissioning process

Unit 1

- May 2015: Started dismantling building cover
- Dec 2017: Completed dismantling building cover
- Jan 2018: Started removing rubble on top floor
- Apr 2019: Started hole drilling work for PCV internal investigation



Document provided by International Research Institute for Nuclear Decommissioning (IRID)

Unit 2

- Mar 2017: Completed installation of access gantry and front chamber
- Jul 2018: Started internal investigation on top floor
- Feb 2019: First contact with fuel debris
- Jan 2020: Completed moving and packing the equipment left on top floor
- Jun 2020: Conducted spent fuel pool internal investigation

Unit 3

- Nov 2015: Completed removing rubble on upper part of building
- Feb 2018: Completed dome roof installation
- Apr 2019: Started spent fuel removal
- Feb 2021: Completed spent fuel removal (566 assemblies)

Unit 4

- Apr 2012: Started cover installation
- Jul 2012: Completed removing rubble on top floor
- Nov 2013: Completed cover installation
- Started spent fuel removal
- Dec 2014: Completed spent fuel removal (1,535 assemblies)

Contaminated water management

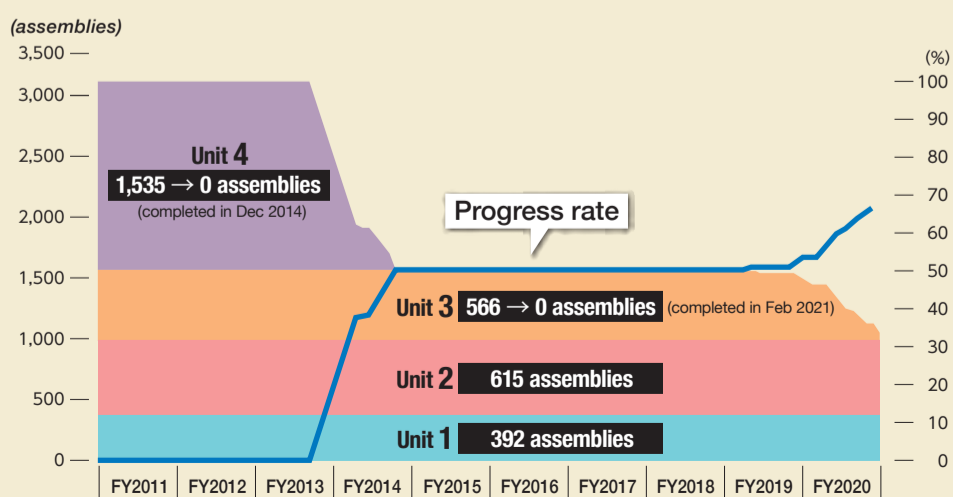
- Mar 2013: Started operation of multi-nuclide removal equipment (ALPS) (full-scale removal of radioactive material started)
- May 2014: Started groundwater bypass operation
- Sep 2015: Started sub-drain operation
- Oct 2015: Started groundwater drain operation
- Completed sea side impermeable wall construction
- Mar 2016: Started freezing land-side impermeable wall (frozen-soil wall)
- Started operation of miscellaneous solid waste incineration facility
- Feb 2018: Started operation of solid waste storage
- Mar 2018: Completed freezing land-side impermeable wall (frozen-soil wall)
- Mar 2019: Completed replace with welded-type tank

Efforts by Fukushima prefecture

- Dec 2012: Established Safety Monitoring Council
- Aug 2013: Established Prefectural Safety Assurance Conference
- Apr 2014: Assigned local representatives
- Jan 2015: Concluded a safety assurance agreement (Fukushima Prefecture, Futaba-machi, Okuma-machi, TEPCO)
- Jul 2016: Minami-soma / Naraha Nuclear Disaster Response Centre opened
- Sep 2016: Concluded a safety assurance agreement (Fukushima Prefecture, 11 surrounding municipalities, TEPCO)

Status on spent fuel removal process

At the time of the accident, a total of 3,108 nuclear fuel assemblies were stored in the spent fuel pools of Units 1 to 4. Fuel removal in Unit 4 completed in December 2014, and in Unit 3 in February 2021, leaving 1,007 assemblies today, which has decreased to one third compared to the beginning. (As of March 5, 2021)



Status on contaminated water generation control

In order to reduce the inflow of groundwater and rainwater into the reactor building, multi-layered efforts such as pumping up groundwater and creating land-side impermeable walls (frozen-soil walls) were taken, which has helped decrease the amount of newly generated contaminated water to less than one third of that of FY2014 average.

