Report on the Decommissioning Initiatives at the Fukushima Daiichi Nuclear Power Station

October 5, 2018

TEPCO

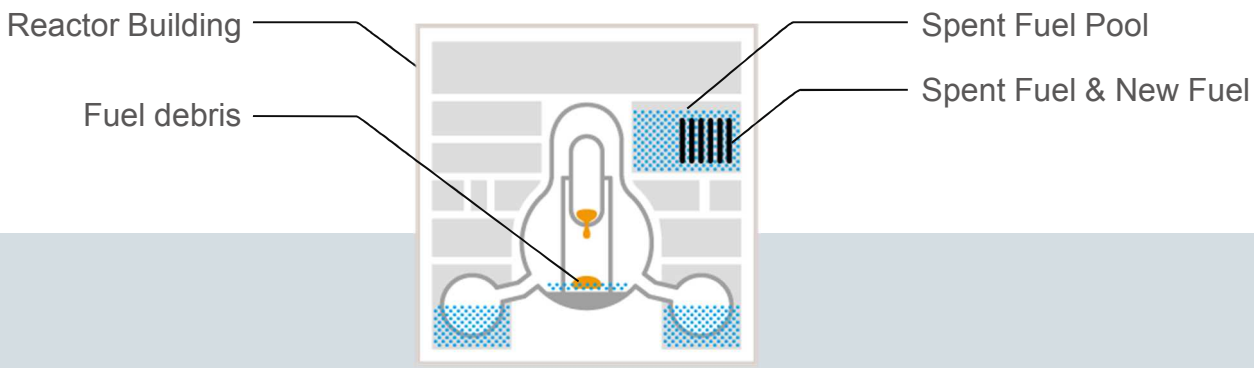
Overview of Decommissioning Work at the Fukushima Daiichi Nuclear Power Station

1 Work of fuel removal from spent fuel pool P.3 - 10

2 Work of removing fuel debris P.11 - 15

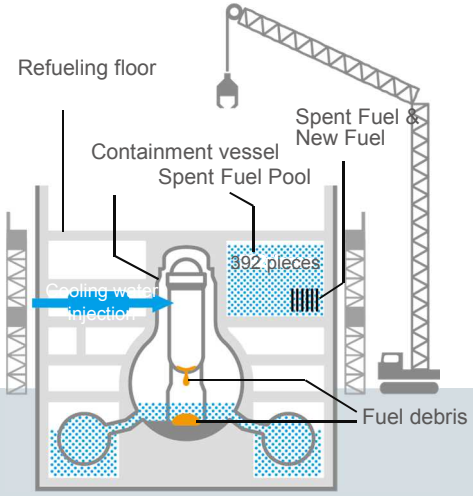
3 Contaminated water countermeasures P.16 - 23

4 Other initiatives P.24 - 28



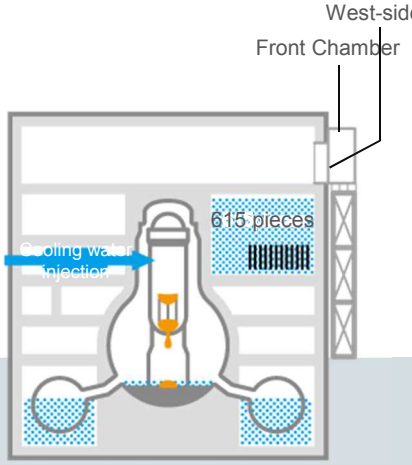
Current situation at Units 1 - 4

Unit 1



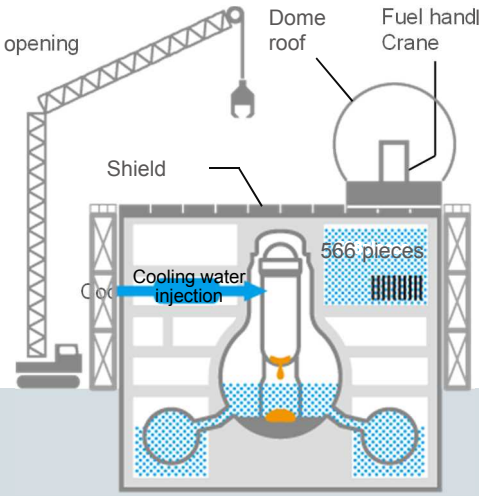
Work of removing debris from the operating floor, etc. is carried out in preparation for fuel removal from the spent fuel pool.
Moreover, additional internal investigation of the containment vessel and its analysis is being carried out in preparation for removing the fuel debris.

Unit 2



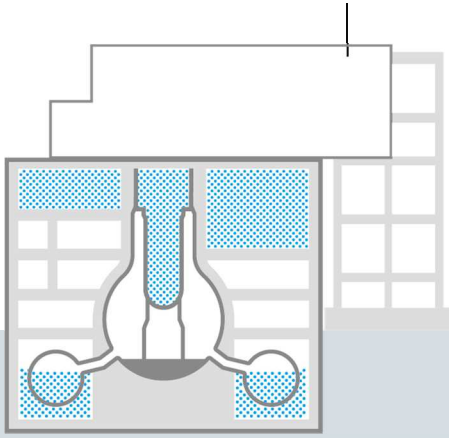
An opening has been set up on the west-side of the building for extracting the fuel from the spent fuel pool. The investigation of the operating floor has been started. Moreover, additional internal investigation of the containment vessel and its analysis is being carried out in preparation for removing the fuel debris.

Unit 3

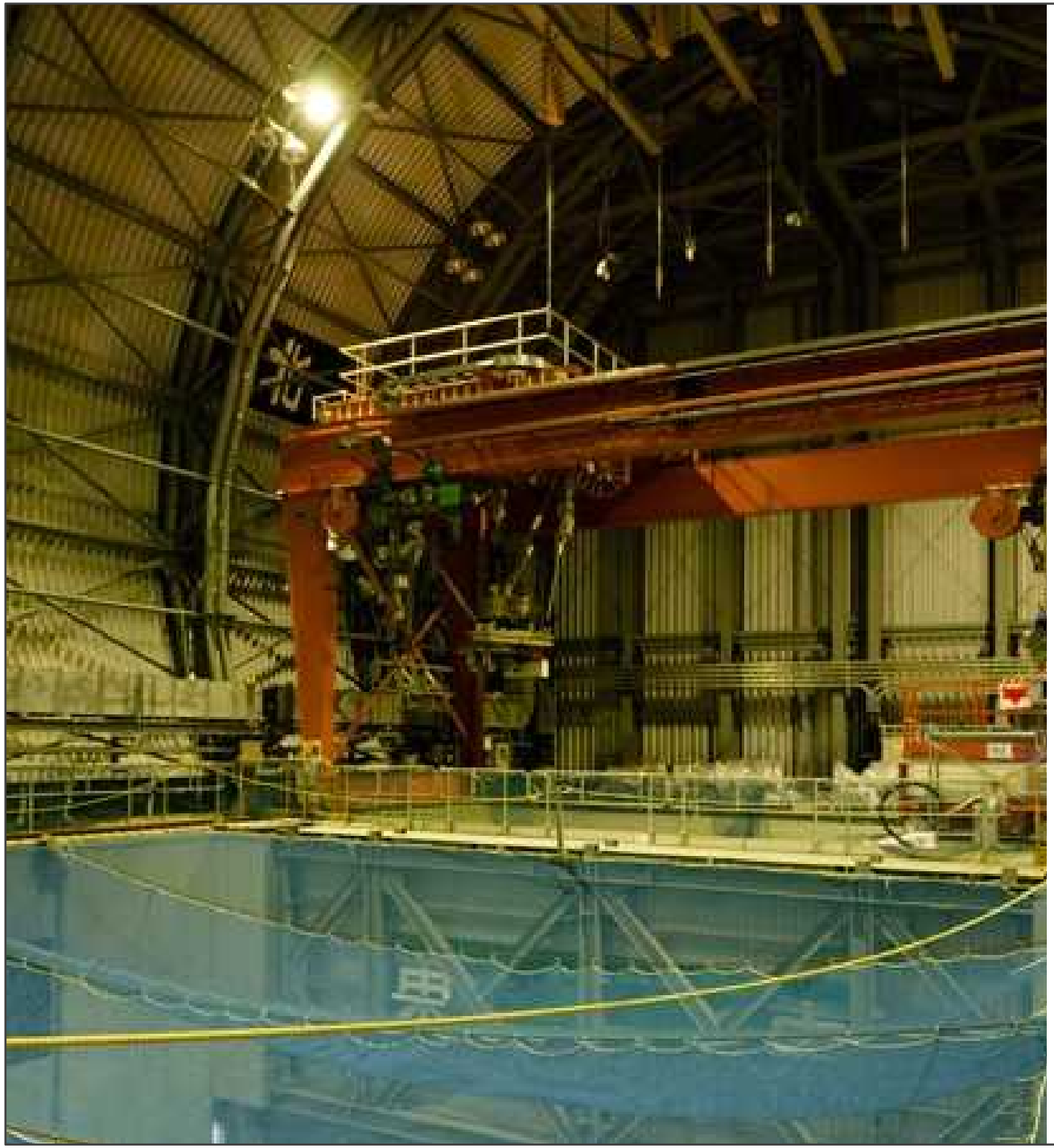


Installation of equipment such as the fuel handling machine in preparation for fuel removal from the spent fuel pool has been completed. Trial runs of the fuel handling machine and cranes are being carried out. Moreover, the necessity of additional internal investigation of the containment vessel in preparation for removing the fuel debris is being examined.

Unit 4

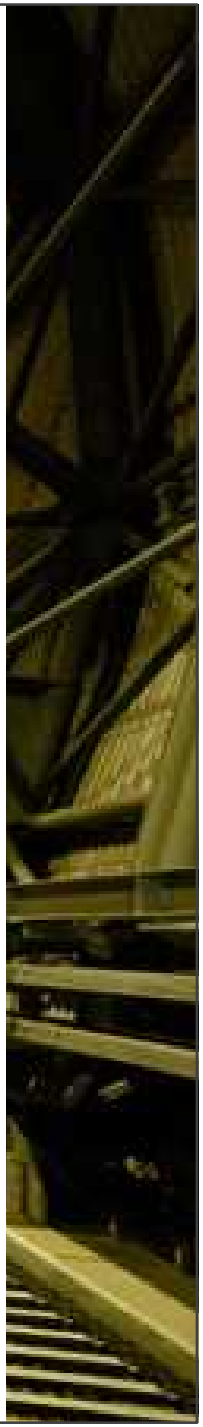


Extraction of fuel from the spent fuel pool was completed on December 22, 2014 and thus the risk arising from nuclear fuel has been eliminated.



1

Work of Fuel Removal from the Spent Fuel Pool



1 Work of Fuel Removal from the Spent Fuel Pool [TOPICS]

[Work schedule]

Removal of debris etc. → Installation of fuel removal equipment → Fuel removal → Storage & transportation of fuel

Unit 1

Work for removing debris on the southern side of the operating floor

In order to protect the spent fuel pool while carrying out work for removing debris from the southern side of the operating floor, preparations are being made so debris can be removed with the help of an X brace (X shaped steel frame). During these 3 months, training on the precision of the work procedures and training on remote operation are carried out.

Unit 2

Setting up an opening in the external wall on the western side of the reactor building

An opening was set up in the external wall on the western side of the reactor building for accessing the operating floor.

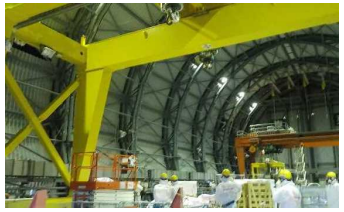
Implementing refueling floor investigations

The status of contamination of the space, floor and walls was measured remotely. Investigation of the operating floor was implemented.

Unit 3

Plan to implement training on fuel removal using actual equipment after completing the trial run

During the trial runs of the cranes there was a malfunction as a result of difference in the power supply voltage.
Components were replaced, settings were changed and equipment modifications were made. Thereafter from July 14, 2018, the trial runs have resumed and preparations for fuel removal are being carried out.



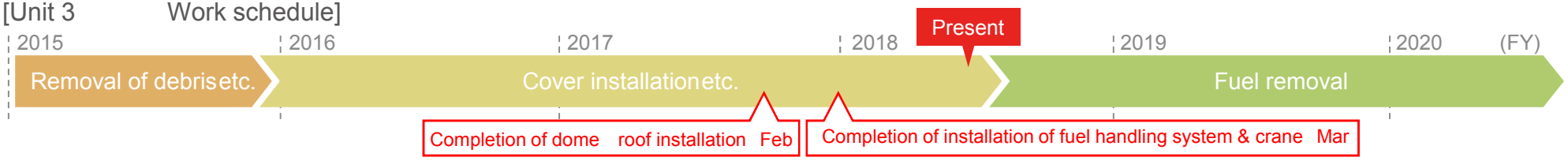
Unit 4

Fuel removal completed

Extraction of fuel from the spent fuel pool was completed on December 22, 2014.

1 Work of Fuel Removal from the Spent Fuel Pool [Unit 3]

[Unit 3 Work schedule]



Future work

Fuel removal work is being carried out giving utmost priority to safety

Fuel removal work is expected to be implemented as per the following procedures.
Further, fuel handling machine and crane will be operated remotely.

▶ Fuel removal work procedure

I. Move the fuel stored in the spent fuel pool one by one under water to the on-site transport container using the fuel handling machine.
Once there are 7 fuel assemblies in the transport container close the primary lid and wash the surface of the container.

II. Lift the transport container higher than the operating floor by means of a crane using a dedicated hoist, lower it on the surface that is about 30m under the open type hatch and close the secondary lid.

III. Load it onto the vehicle dedicated for on-site transportation and transfer it to the common pool building.

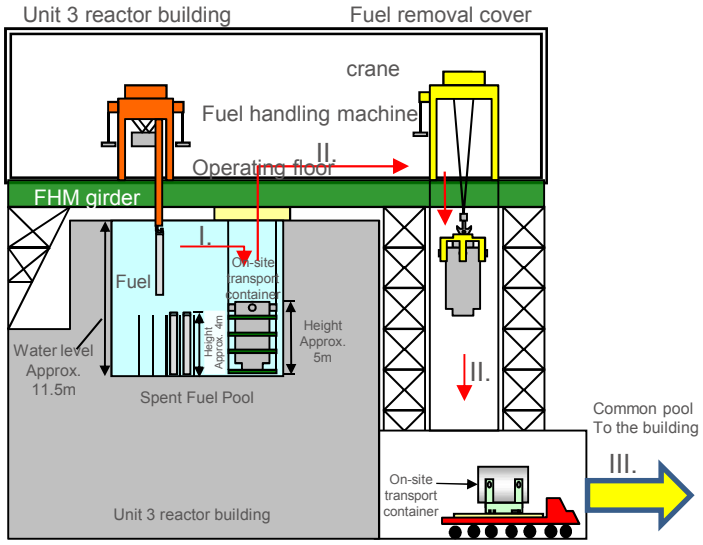


Image of fuel removal work

Main problems and status of response

3 instances of malfunction occurred with respect to the Unit 3 crane and fuel handling machine

① On May 11, 2018, during the trial run of the crane, there was malfunction in the control panel (there was abnormal noise and adhesion of soot) and the crane was shutdown. The cause was investigated, countermeasures were implemented and trail run was resumed on July 4, 2018.

② On August 8, 2018, an alarm indicating a problem related to the control system in the fuel handling machine went off during the pre-service inspection by the Nuclear Regulation Authority. Currently cause investigation continues to be implemented.

③ On August 15, 2018, when material and equipment were lifted using a crane, an alarm indicating a problem in the control system went off and the crane was shutdown. Moreover, at that time, it was found that the load being handled (approx. 50.9t) exceeded the rated capacity (50.0t). Currently cause investigation continues to be implemented.

Further, along with cause investigation and restoration, impact on the time period of starting fuel removal will be checked as well.

1 Work of Fuel Removal from the Spent Fuel Pool [Unit 3]

Future work

Implementation of training on fuel removal using actual equipment after completing the trial run

After completing the trial run, a series of work trainings pertaining to the fuel handling machine and the on-site transport container are conducted and preparations are made for fuel removal work.

▶ Overview of training on actual equipment

- A series of remote operations of the fuel handling machine from extracting the fuel from the rack to placing it in the on-site transport container are carried out using simulated fuel.
- On-site transport container is installed inside the spent fuel pool. A series of remote operations from closing the primary lid, checking to ensure that the container is sealed to lifting up the on-site transport container are carried out.
- A series of operations from lowering the on-site transport container to the ground, closing the secondary lid to loading onto the vehicle dedicated for on-site transportation are carried out (Manned operations).

Future work

Implementation of work of removing small debris from within the fuel pool

Along with training on actual equipment, work of removing small debris from within the fuel pool, which could hinder fuel removal, is carried out as well.
Small debris on top of the fuel is removed by sucking, holding and cutting, etc. with the help of tools such as manipulator, cutter or gripping device, etc.
The removed small debris is placed in storage basket containers and stored on-site.

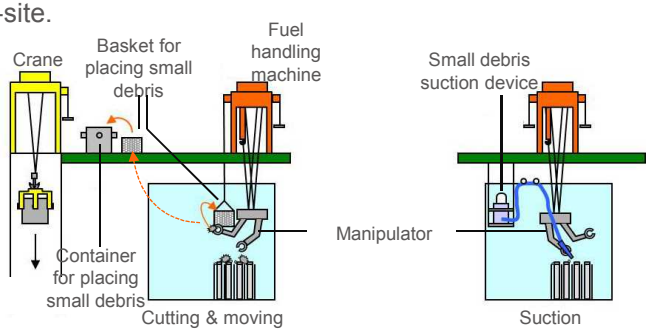


Image of the work of removing small debris

Image taken at the time of internal investigation of the pool in FY 2015

Manipulator: A device that has motor functions similar to those of the human arms and fingertips

Unit 3 Fuel Handling Equipment Malfunction

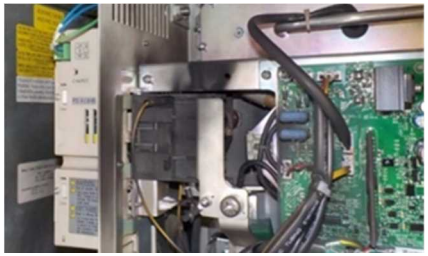
1 Work of Fuel Removal from the Spent Fuel Pool [Unit 3]

Main problems and status of response ①

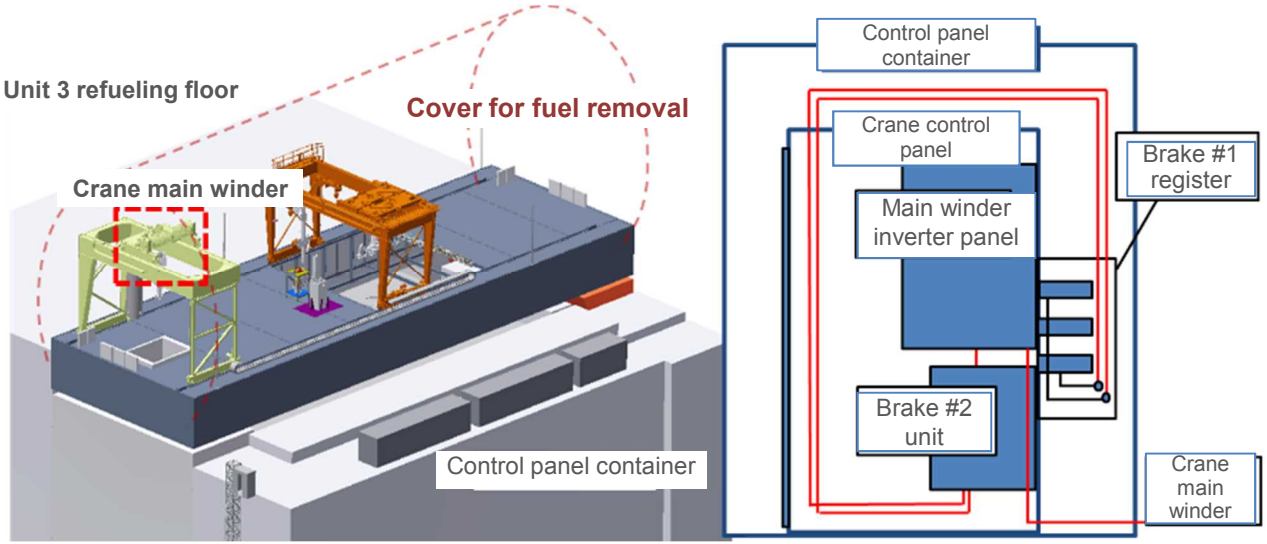
Malfunction of the crane in Unit 3

▶ Event

On May 11, 2018, during the trial run of the crane, when the load lowering stop operation was being carried out, there was a strange noise from the control panel container installed in the reactor building refueling floor and the crane shutdown. Some soot was found inside of the crane's main winding inverter which made abnormal noise., (the fire station determined it as "not a fire").
The next day, when the event was investigated, it was found that the insulator of the terminal strip in the brake register on the back side of the crane control panel and the head of the bolt had melted.



Soot inside the main winding inverter (May 11)



Picture of the inside of the brake register

Damage of the inside of the brake register (May 12)

Inverter: A device that controls the rotational speed of the electric motor by freely changing the electrical frequency of the electric motor.
Brake register: An element that receives regenerative electric power from the brake unit (#) and converts it into heat to check rise in inverter voltage.
Brake unit: When the regenerative electric power generated as a result of the winding movement of the crane exceeds a certain value, the brake unit is a path from where it escapes to the brake register.

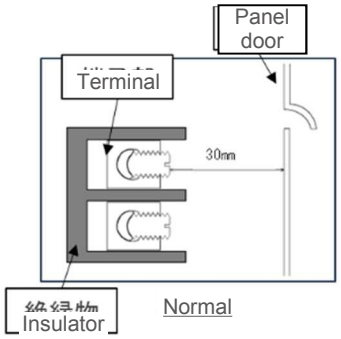
1 Work of Fuel Removal from the Spent Fuel Pool [Unit 3]

Main problems and status of response ①

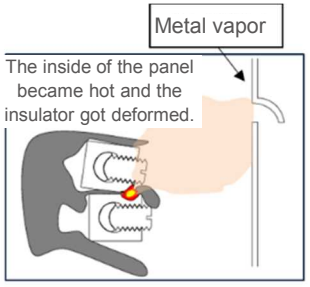
Cause projected as a result of investigation

As a result of the investigation, it was found that the parameter settings of the brake unit were low settings configured at the time of shipping from the US (settings in accordance with the power supply voltage of 380V prevalent in the US).
Hence, the continuous current flow makes the brake register and its inside panel becoming hot, which result in the deformation of the insulator of the terminal strip, and lead to a short circuit inside.
The short circuit / ground fault current must have flown from the brake register to the main winding inverter thereby damaging the inverter.

Image of the side view of the terminal strip

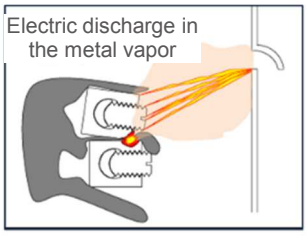


Normal



Short circuit

The terminals came in contact and led to short circuit. The terminals melted due to the short circuit generating metal vapor.



Ground fault

The current from the corner between the terminal strip and the bolt flowed through the metal vapor leading to ground fault in the panel door.

Implementation of countermeasures and resumption of trail run

After the malfunction caused investigation, the following countermeasures were implemented and the operation of the crane was resumed on July 14, 2018.

- The brake unit parameters were changed in accordance with the power supply voltage (480V) of the power station.
- The damaged component was replaced.
- The connecting part of the brake register terminal strip was improved. (The distance between the terminals was increased, The insulating material was made heat-resistant, etc.)

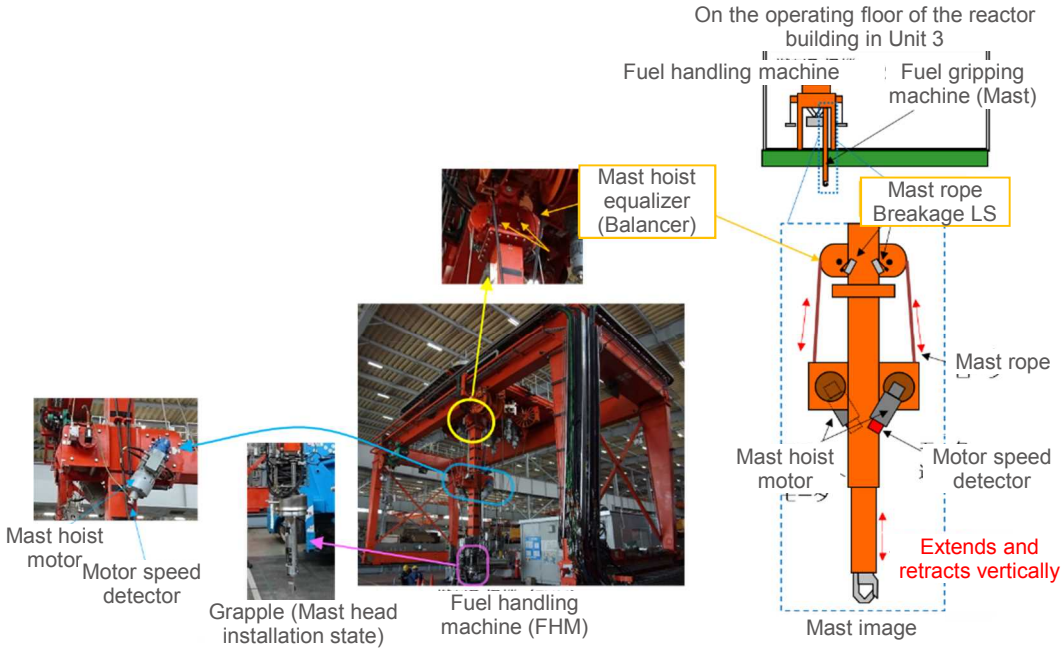
1 Work of Fuel Removal from the Spent Fuel Pool [Unit 3]

Main problems and status of response ②

Malfunction of the fuel handling machine in Unit 3

Event

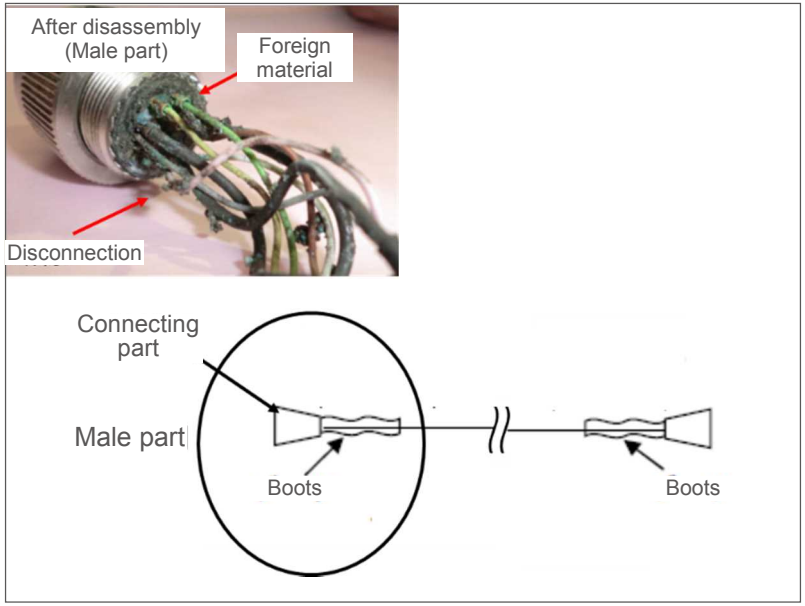
On August 8, 2018, when the Nuclear Regulation Authority was carrying out the pre-service inspection, an alarm went off indicating a problem related to controlling the mast hoist of the fuel handling machine. The system was rendered inoperative.
From the external appearance there didn't seem to be any specific problem.



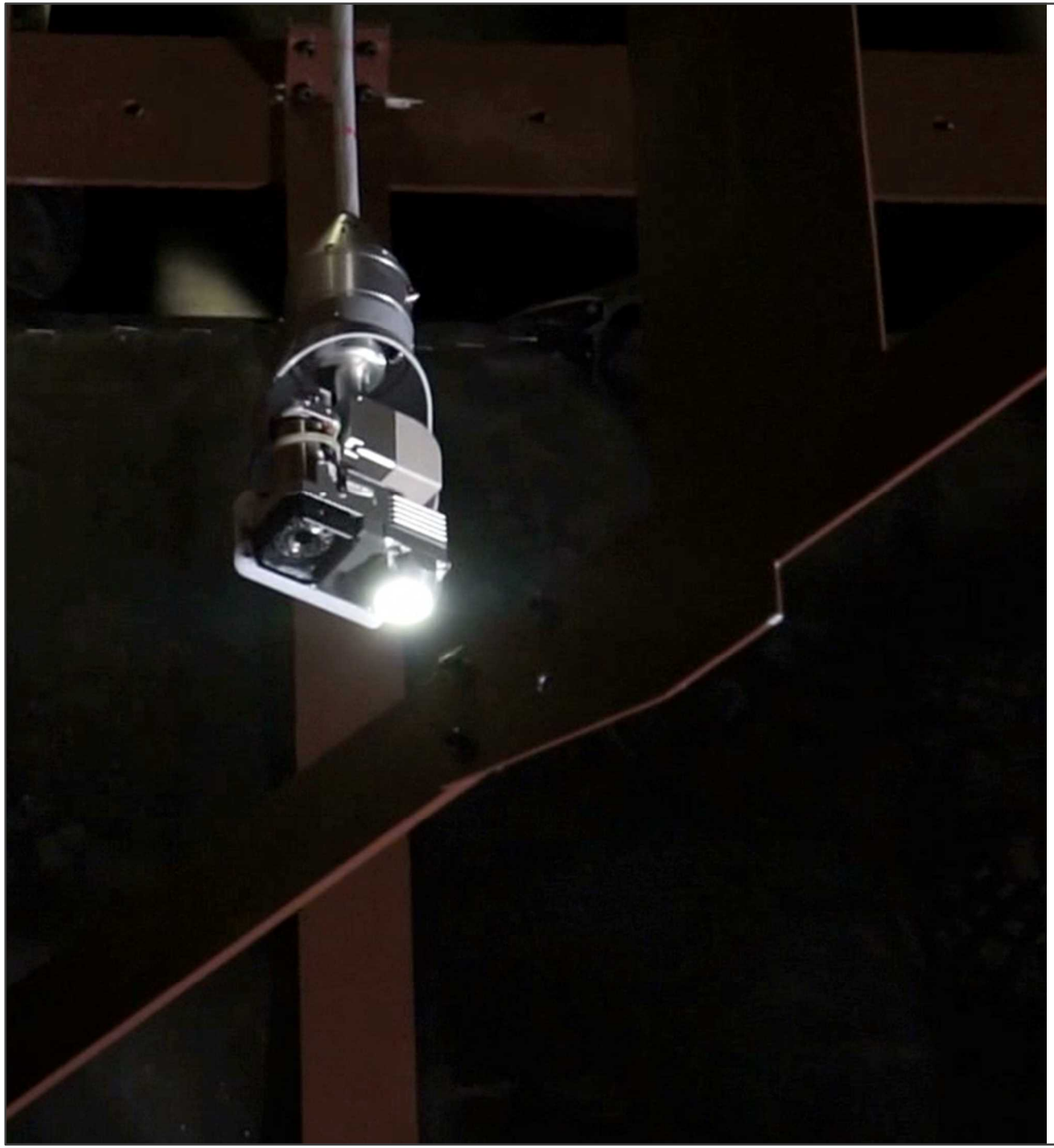
Results of the investigations so far

It was found that the cable connected to the control unit from the detector was prone to disconnection, ground fault or short circuit. Further, disconnection and problems were found within the cable connection.
Details are still being confirmed.

<Cable in which the problem was found>



Mast hoist: A device that takes hold of the fuel in the pool, lifts it and transports it. The fuel gripper moves up and down by means of a mast rope that is pulled in and pushed out by the mast hoist motor.



2

Work of removing fuel debris

2 Work of removing fuel debris [TOPICS]

[Work schedule]

The method for removing fuel debris from the first Unit finalized.

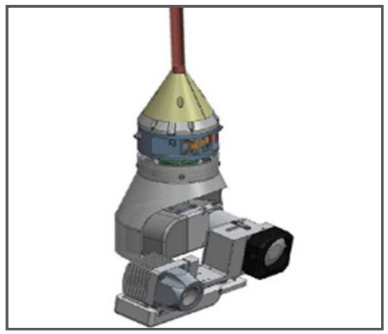
Present

2016 | 2017 | 2018 | 2019 | 2020 | 2021 (FY)

Assessing the condition inside the containment vessel / Examining the methods for the removal of fuel debris, etc.

The condition inside the containment vessel is assessed by inserting a camera / dosimeter, investigation using robots, cosmic ray muon investigation, etc. The method of removing fuel debris is considered based on the information obtained.

Investigation device for Unit 3



Investigation device for Unit 2

Courtesy: International Research Institute for Nuclear Decommissioning (IRID)

Examining methods for removal, processing and disposal of fuel debris, etc.

In response to the investigation results, a special fuel debris removal equipment is developed to remove fuel debris. Knowledge from overseas is gathered and study directed towards implementation and being carried out.

The fuel debris is planned to be stored in special type of storage bins but subsequent storage methods are currently under consideration.

Future work

Plan for investigating the inside of the containment vessel

Currently, analysis of results of investigating the inside of the containment vessels in Units 1 - 3 is being carried out. In FY 2019, during the internal investigation of the containment vessel in Units 1 and 2, sampling of small quantities of sediment deposits from the bottom of the containment vessels is planned to be carried out. By analyzing the samples, the condition of the fuel debris will be understood and the knowledge with respect to removing the fuel debris will increase. Subsequently, it is presumed that the scale of work will be increased in stages, i.e. from "small debris removal" → "large debris removal".

2 Work of removing fuel debris [Progress of investigation]

In Units 1 - 3, measurement using muon (cosmic rays with strong penetrating power) or internal investigation of the containment vessel using an endoscope camera or robot is being carried out for the purpose of removing fuel debris.

Unit 1

Results of muon measurement

- There isn't any large chunk of fuel debris in the reactor core area.

Results of internal investigation of the containment vessel

- No major damage was seen on the outer side of the pedestal.
  Moreover, sediment deposits were found at the bottom of the pressure vessel, in the piping, etc.

Investigation device for Unit 1

Unit 2

Results of muon measurement

- High density substance that is believed to be fuel debris was found at the bottom of the reactor pressure vessel. Some fuel is likely to be present in the reactor core area.

Results of internal investigation of the containment vessel

- Sediment deposits were found throughout the bottom part inside the pedestal.
  Fallen objects such as fallen grating, parts of fuel assemblies, etc. were found. The sediment deposits in the periphery were presumed to be fuel debris.

  No major damage was seen on the surface of the wall or existing structures inside the pedestal.

Investigation device for Unit 2

Unit 3

Results of muon measurement

- There isn't any large chunk of fuel debris in the reactor core area. Although uncertain, some fuel debris is likely to be remaining at the bottom of the reactor pressure vessel.

Results of internal investigation of the containment vessel

- Sediment deposits were found in several locations at the bottom part inside the pedestal. Inside the pedestal, fallen objects presumed to be structures from inside the pressure vessel such as control rod guide tube, etc., were found. From the tremors on the surface of water it is inferred that there are multiple openings in pressure vessel.
  No major damage was seen on the surface of the wall inside the pedestal.

Investigation device for Unit 3

Courtesy: International Research Institute for Nuclear Decommissioning (IRID)

2 Work of removing fuel debris [Unit 2]

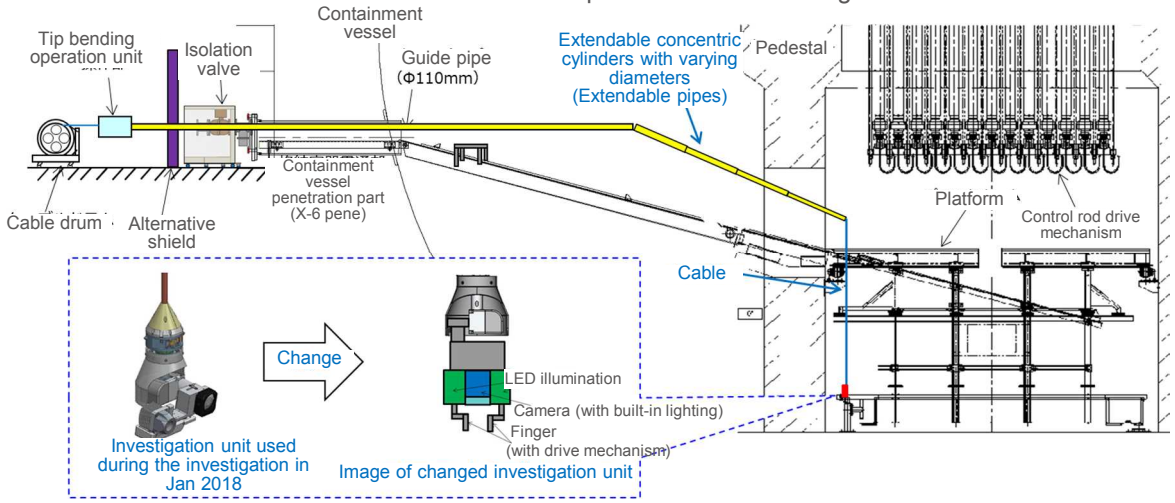
Future work

Plan for investigating the inside of the containment vessel

In order to obtain new findings for the purpose of removing fuel debris, internal investigation of the containment vessel has been planned, just like it was conducted in Unit 1.

- Investigation of the inside of the containment vessel using guide pipe (Planned to be conducted in the second half of FY 2018)

Since the properties (hardness, fragility, etc.) of the sediment deposits found at the bottom of the pedestal in Unit 2 are unknown, it is important to understand their movability in advance. Changing the tip of the investigation device used in January 2018, applying mechanical force to the sediment deposits and checking its behavior at that time is being considered.
Moreover, just like the internal investigation of the containment vessel carried out in the past, the plan is to measure the dust during the investigation and monitor to ensure that the gas does not leak out from inside the containment vessel and have an impact on the surrounding environment.



Conceptual diagram of the internal investigation of the containment vessel using guide pipe

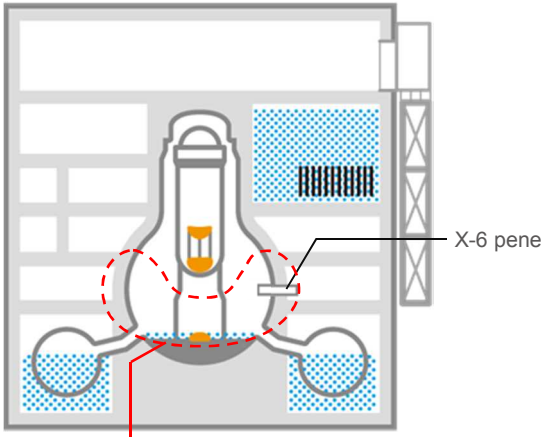


Image of the site being investigated

Future work

Plan for investigating the inside of the containment vessel

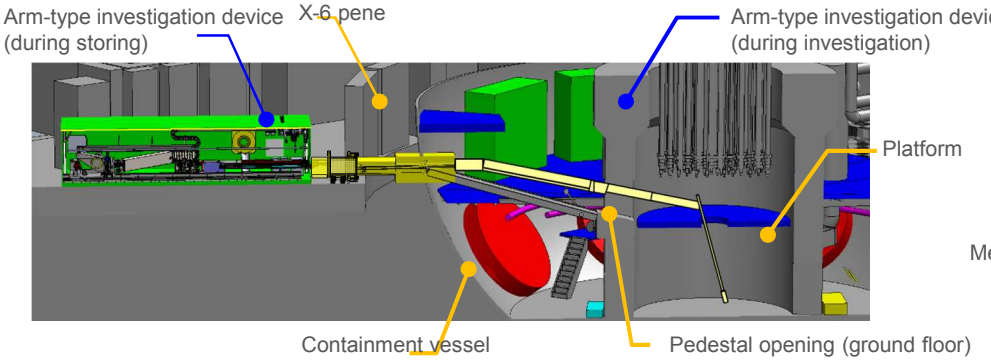
- Investigation of the inside of the containment vessel using an arm-type access & investigation device
  (Planned to be conducted during the second half of FY 2019)

The water level inside the containment vessel in Unit 2 is low. The condition is such that X-6 pene can be used. Hence considering the weight of the fuel debris, enhancement of accessibility, etc., an arm-type access & investigation device is being developed. Investigation through the access route built by means of X-6 pene is planned to be implemented in FY 2019. Measurement devices, etc. can be attached to the tip of the access & investigation device and depending on the contents of investigation, the required instruments are planned to be affixed. Moreover, just like the internal investigation of the containment vessel carried out in the past, the plan is to measure the dust during the investigation and monitor to ensure that the gas does not leak out from inside the containment vessel and have an impact on the surrounding environment.

- Plan to sample a small quantity of sediment deposits from the bottom part

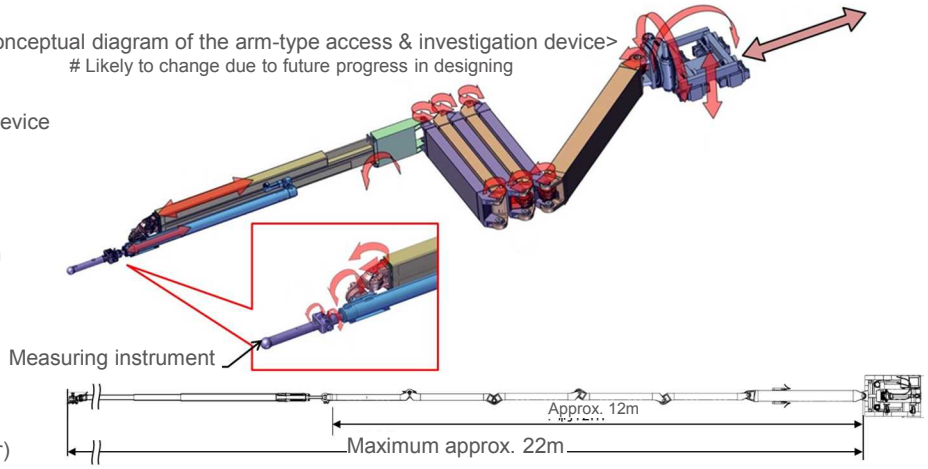
It has been planned that a small quantity of sediment deposits will be sampled from the bottom part during the internal investigation of the containment vessel. Requesting specialized agencies to analyze the collected samples is being considered.

<Conceptual diagram of the internal investigation of the containment vessel from the X-6 pene in Unit 2>



Courtesy: International Research Institute for Nuclear Decommissioning (IRID)

<Conceptual diagram of the arm-type access & investigation device>
Likely to change due to future progress in designing



Courtesy: International Research Institute for Nuclear Decommissioning (IRID)

3

Contaminated water countermeasures

3 Contaminated water countermeasures [Basic policy]

Contaminated water countermeasures are based on three basic policies and comprise of preventive and multi-layered countermeasures.

Policy 1 To eliminate the source of contamination

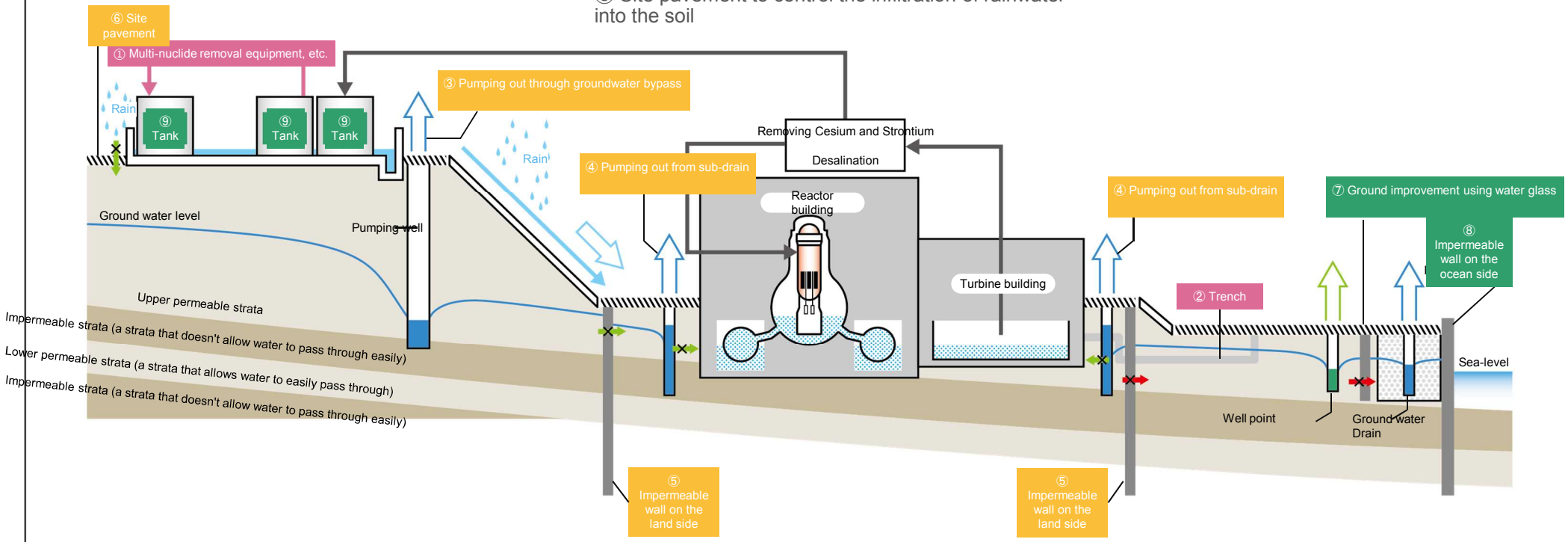
① Purifying contaminated water using multi-nuclide removal equipment, etc.
② Removing contaminated water from the trench (underground tunnel containing piping, etc.)

Policy 2 To keep water away from the source of contamination

③ Pumping out ground water by means of the groundwater bypass
④ Pumping out groundwater from the well (sub-drain) in the vicinity of the building.
⑤ Installing land-side impermeable wall using the soil freezing method
⑥ Site pavement to control the infiltration of rainwater into the soil

Policy 3 To ensure that contaminated water "does not leak“ out

⑦ Ground improvement using water glass
⑧ Installing impermeable wall on the ocean side
⑨ Increasing the number of tanks (replacing existing tanks with welded tanks, etc.)



3 Contaminated water countermeasures [Target processes]

Milestones of contaminated water countermeasures in the mid- and long-term road-map (Main target processes)

Domain	Contents	Timing	Achievement status
Eliminating	Completion of re-processing using the multi-nuclide removal equipment, etc. and reducing the additional effective dose rate within the site boundary to under 1mSv/year	FY 2015	Achieved (March 2016)
	Start of preparations for determining how effluent from the multi-nuclide removal equipment should be handled in the long-term	First half of FY2016	Achieved (September 2016)
Keeping away	Keeping the quantity of contaminated water generated at about 150㎥/day	During FY2020	Dry period has been achieved (December 2017)
Keep from leaking	Storage of all water that has undergone purification with the help of the purification equipment, etc. in welded tanks	FY 2018	—
Treatment of accumulated water	① Decoupling of the connections between Units 1 & 2, and Units 3 & 4	During FY2018	—
	② Reduction of the quantity of radioactive materials in water accumulated in the buildings to about 1/10th of the quantity present at the end of FY2014	FY 2018	—
	③ Completion of the treatment of the water accumulated inside the buildings	During FY2020	—

3 Contaminated water countermeasures [TOPICS]

Policy 1 To eliminate the source of contamination

Treated water from the tank

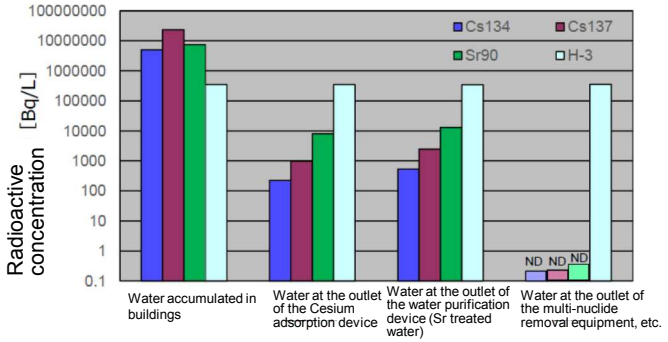
Currently, most of the radioactive substances (except tritium) included in the contaminated water have been removed such that their concentration in the water that has been treated in the multi-nuclide removal equipment and stored in the tank is sufficiently low.
For example, the concentration of Cesium 137 in the water accumulated in the building reduces to a hundred millionth in the process up to the outlet of the multi-nuclide removal equipment.

Operation of the multi-nuclide removal equipment

It has been confirmed through experiments conducted so far that the multi-nuclide removal equipment is capable of reducing the radionuclides (except tritium) contained in the water that has already been treated in the contaminated water treatment facility, to a concentration lower than the "regulatory concentration limit #1".
Currently, since the multi-nuclide removal equipment reduces the risk or dose while storing contaminated water early on, it is being operated to an extent such that it does not have an impact on the site boundary effective dose rate of 1mSv/year#2.

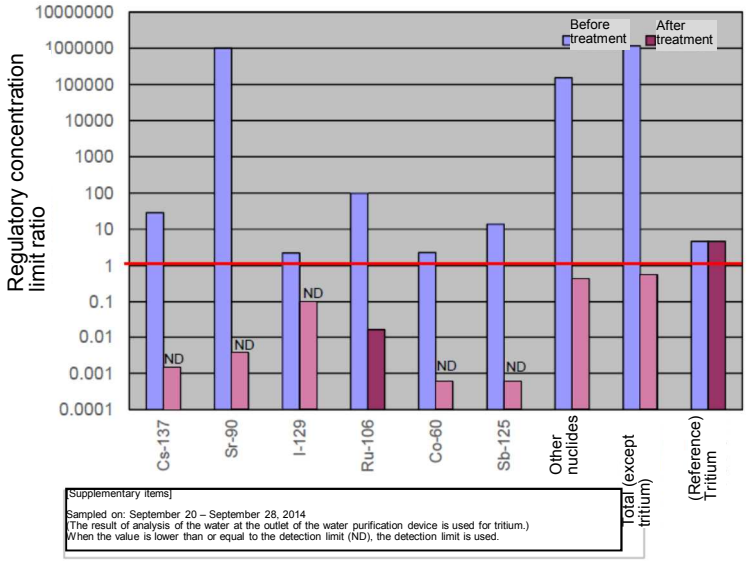
#1: Limit of concentration in water outside the surrounding monitored areas stipulated in "The official notice specifying the required matters concerning the safety of the nuclear reactor facility at TEPCO's Fukushima Daiichi Nuclear Power Station and protection of specific nuclear fuel material"
#2: According to "Matters concerning measures that must be taken with respect to TEPCO's Fukushima Daiichi Nuclear Power Station when certain specifications are provided to a particular nuclear facility", it is required that the effective dose rate of the site boundary resulting from debris or contaminated water, etc. generated after the disaster stored within the site environ be kept below 1mSv/year.

■ Effect of contaminated water treatment



Radioactive concentration of the main nuclides in the contaminated water treatment process

[Supplementary items]
Water accumulated in buildings: Concentration of water accumulated in the HTI building
However, H-3 is the concentration of water at the outlet of the Cesium adsorption device
Water at the outlet of the Cesium adsorption device: Concentration of water at the inlet of the water purification device
Sampled on: March 8, 2016
(Sr90 from the water at the outlet of the Cesium adsorption device: March 5, 2016)
Water at the outlet of the multi-nuclide removal equipment: March 21, 2016)
Water at the outlet of the multi-nuclide removal equipment: Concentration at the A system of the additionally installed multi-nuclide removal equipment.
When the value is lower than or equal to the detection limit (ND), the detection limit is shown.



[Supplementary items]
Sampled on: September 20 – September 28, 2014
(The result of analysis of the water at the outlet of the water purification device is used for tritium.)
When the value is lower than or equal to the detection limit (ND), the detection limit is used.

Properties of the water treated in the multi-nuclide removal equipment, etc. #2
(A system of the additionally installed multi-nuclide removal equipment)

#2: Performance when the device starts to be operated. The concentration of the treated water fluctuates up to a certain extent during operation.

3 Contaminated water countermeasures [TOPICS]

Tank storage and management of water processed in the multi-nuclide removal equipment, etc.

Water processed in the multi-nuclide removal equipment is stored in tanks within the site environ.
Tanks are being replaced sequentially with welded tanks to reduce the risk of leakage.
Moreover, in the vicinity of the tanks, weirs are set up to prevent the water from flowing into the site environ if by chance there is ever any leakage.
Further, patrolling of tanks and monitoring of water level (monitoring at all times), etc. are conducted constantly to be prepared in case there is leakage.

3 Contaminated water countermeasures [TOPICS]

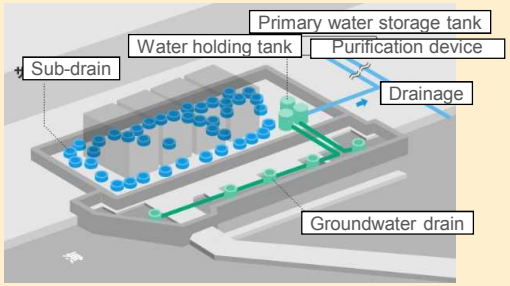
Policy 2 To keep water away from the source of contamination

Measures against increase in quantity of contaminated water generated during heavy rains such as during a typhoon, etc.

- Measures such as internal filling of trenches or installation of check valves in the drainage channel, etc. are carried out in preparation for increase in the quantity of contaminated water generated during heavy rains such as typhoon..

Reinforcement of water processing facilities such as sub-drain, etc.

- The water processing facilities, such as sub-drain, were reinforced by setting up 2 sets of purification equipment, building additional tanks, etc. In this manner, the groundwater level in the areas around the buildings is planned to be lowered with certainty.



Policy 3 To ensure that contaminated water "does not leak“ out

Replacement of tanks

- In order to enhance the reliability of the tank, the flange tanks (made by bolting rolled steel) are sequentially replaced by welded tanks.

Flange tank

Welded tank

Treatment of accumulated water

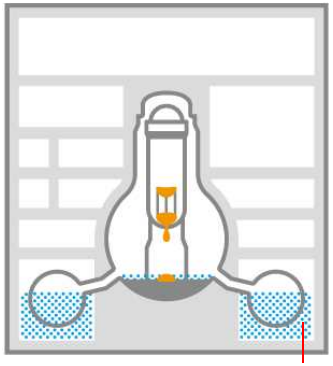
Elimination of radioactive substances from the water accumulated within the buildings

- In order to reduce the risk of leakage of water accumulated in the buildings, the quantity of radioactive substances in the water accumulated in the buildings is reduced to about half or less of what it was at the end of FY 2014.
  The plan is to reduce it during FY 2018 to about 1/10th of what it was at the end of FY 2014.

Reduction of stored quantity of accumulated water

- The water level inside the building is being lowered by pumping out the accumulated water by means of underwater pumps.
  Decoupling of the connections between Units 1 & 2, and Units 3 and 4 is planned to be carried out within FY 2018.

Reactor building



3 Contaminated water countermeasures [Policy3: To ensure that contaminated water does not leak out]

Work in progress

Replacement of tanks

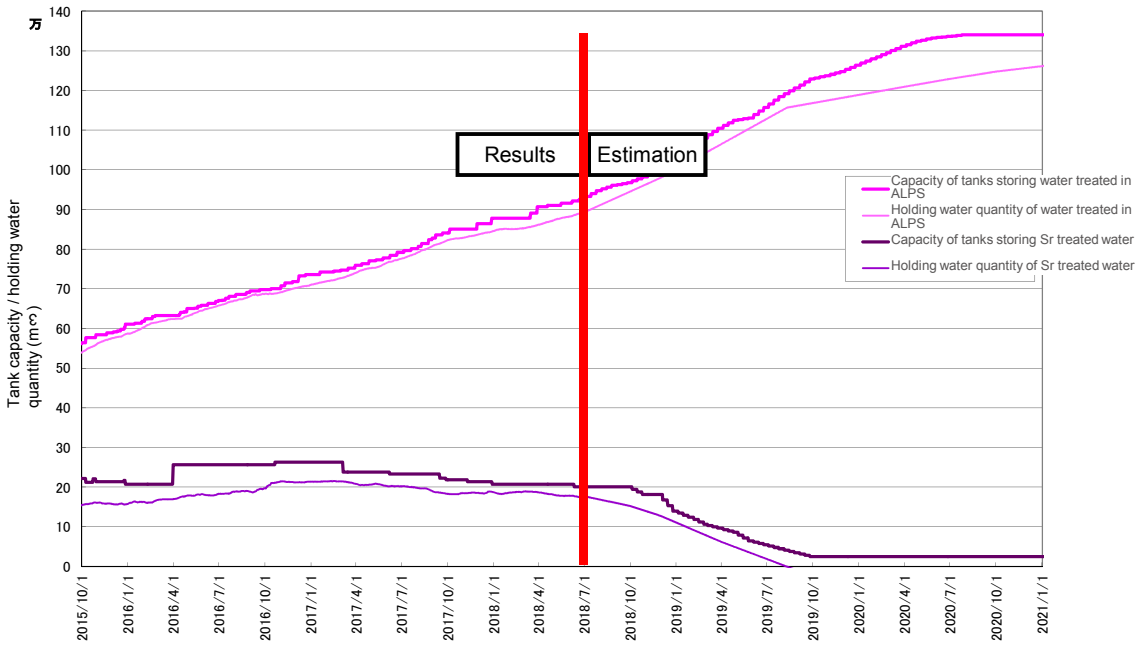
In order to reduce the risk of contaminated water leakage by enhancing the reliability of the tank, to improve the layout efficiency, or to increase the capacity by increasing the size of the tanks, the flange tanks (made by bolting rolled steel) are being sequentially replaced by welded tanks.

Regarding the flange tanks that store treated water resulting from processing of water accumulated in the buildings in Units 1 - 4, the strontium treated water #1 is processed first. The period of completion#2 of purification processing by means of multi-nuclide removal equipment changed from October 2018 to November 2018, however, as per the initial plan, all treated water #3 is scheduled to be stored in welded tanks during FY 2018.

The flange tanks that are not operational are dismantled and replaced with welded tanks sequentially while allowing enough margin in the schedule so that there is enough capacity to store the contaminated water.

Further, the flange tanks in operation are continued to be patrolled or their water level is continued to be monitored (monitoring at all times), etc. and appropriate response is taken such as implementing preventive maintenance measures against leakage, etc.

Water balance simulation



#1 ALPS: Multi-nuclide removal equipment #Sr: Strontium

#1: Water in which cesium and strontium have been reduced using cesium adsorption device or secondary cesium adsorption device

#2: Purifying strontium treated water that has been stored in flange tanks by means of the multi-nuclide removal equipment

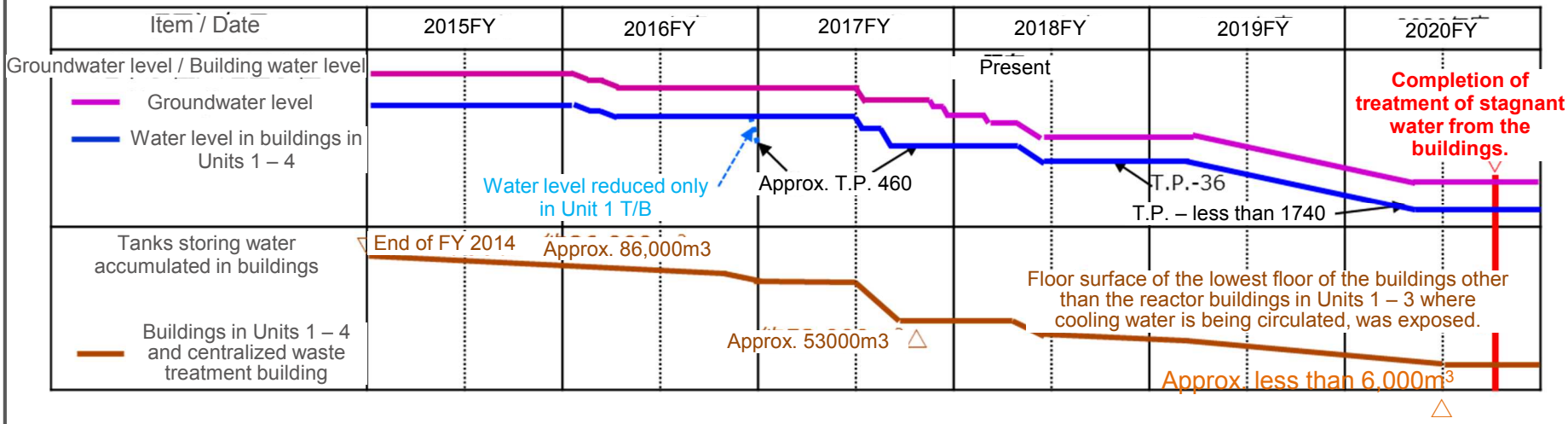
#3: Strontium treated water and water processed in the multi-nuclide removal equipment stored in the flange tanks

Work in progress

Reduction of stored quantity of accumulated water

The water level inside the building was lowered by pumping out the accumulated water by means of underwater pumps.
The level of water inside the building is being lowered along with the lowering of groundwater level resulting from sub-drains, land-side impermeable wall, site pavement, etc. in an effort directed towards completion of accumulated water treatment.

The plan is to develop a circulating cooling water system in Units 1 - 3 where cooling water is being circulated, which is disconnected from the turbine building, etc. and to lower the water level in the reactor building so as to create conditions such that the accumulated water does not flow from the reactor building to other buildings.



4

Other initiatives

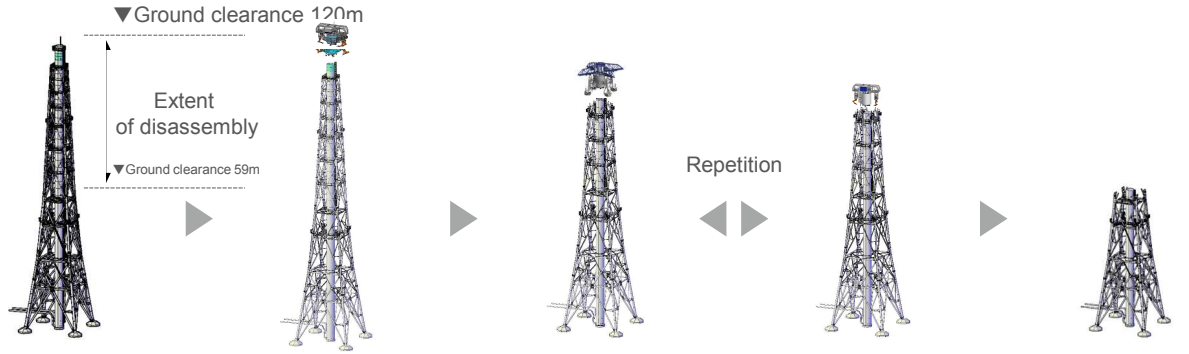
4 Other initiatives: Work of disassembling the exhaust stacks in Units 1 & 2

What is meant by work of disassembling the exhaust stacks in Units 1 & 2

the exhaust stacks in Units 1 & 2 meet the seismic resistance standards. However, based on the fact that there are locations with damage and ruptures, from the perspective of further reducing risks, the upper portion of the exhaust stacks are planned to be disassembled so as to secure increased seismic tolerance.

Overview of the work of disassembling stacks in the units

The work of disassembly is carried out in an unmanned manner using a stack shell disassembling device and steel tower disassembling device that can be operated remotely, thereby placing importance on reducing the exposure of workers.



Verification test for the purpose of disassembly work

Fabrication of the exhaust stack shell disassembling device and the steel tower disassembling device was completed on August 24, 2018. The verification test for implementing the work remotely was started from August 28 using the simulated stack facility.

The verification test will be completed in December 2018 and thereon the preparation work (curing the surrounding area, assembling the disassembling device, etc.) within the power plant premises is planned to be started.

Stack shell disassembling device

Steel tower disassembling device (for the main pillar)

Simulated stack facility

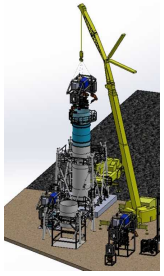
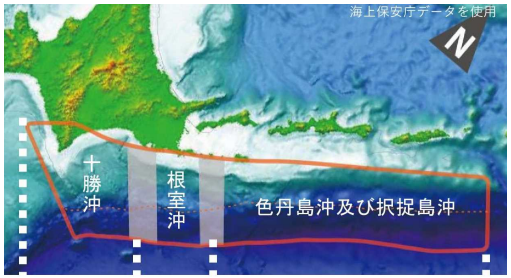


Image of the verification test

4 Other initiatives: Measures against tsunami associated with an earthquake along the Kuril-Kamchatka Trench

What are earthquakes along the Kuril-Kamchatka Trench?

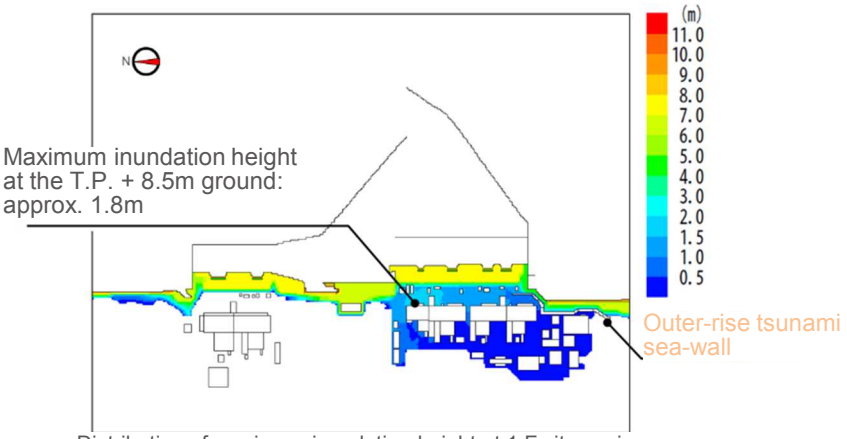
On December 19, 2017, the Headquarters for Earthquake Research Promotion had announced that a massive earthquake with its seismic source along the Kuril-Kamchatka Trench off the coast of the Kuril islands, is likely to occur in the near future.



Impact on the Fukushima Daiichi Nuclear Power Station

[Flooding due to tsunami]

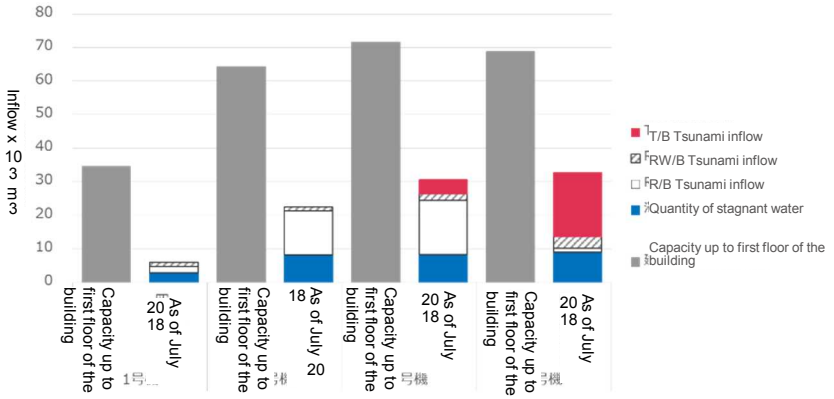
Since the earthquake along the Kuril-Kamchatka Trench is believed to be connected to the norther part of the Japan Trench (northern part of Sanriku offshore), although smaller than the 3/11 tsunami, it is believed that there will be an upsurge of a massive tsunami leading to maximum inundation of about 1.8m in front of Units 1 and 2.



Distribution of maximum inundation height at 1 F site environ

[Outflow of contaminated water due to the rip current]

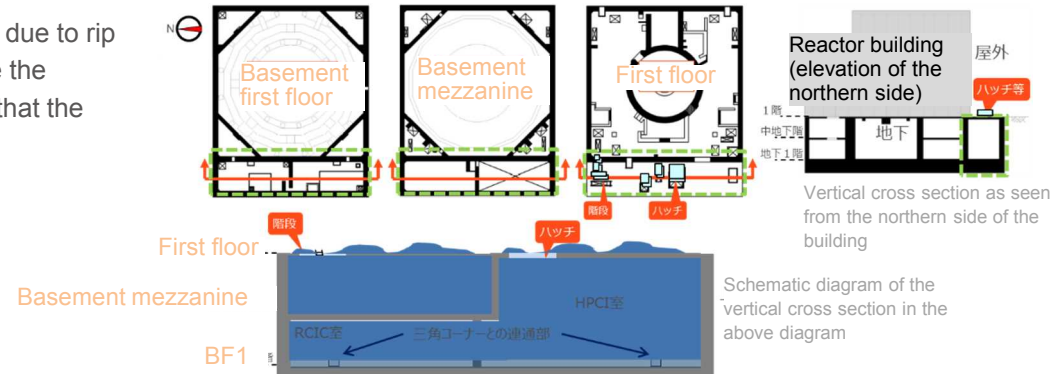
Although outflow due to rip current is not likely to occur on the whole, with respect to the portion that is directly connected to the underground portion where the accumulated water remains, outflow due to rip current is likely from the hatch or staircase outside the building.



4 Other initiatives: Measures against tsunami associated with an earthquake along the Kuril-Kamchatka Trench

Tsunami countermeasures ①

From the perspective of preventing outflow of accumulated water due to rip current, the schedule for covering hatches and staircases outside the buildings in Units 2 and 3 at 11 locations has been shortened so that the procedure will be finished by the first half of FY 2020.

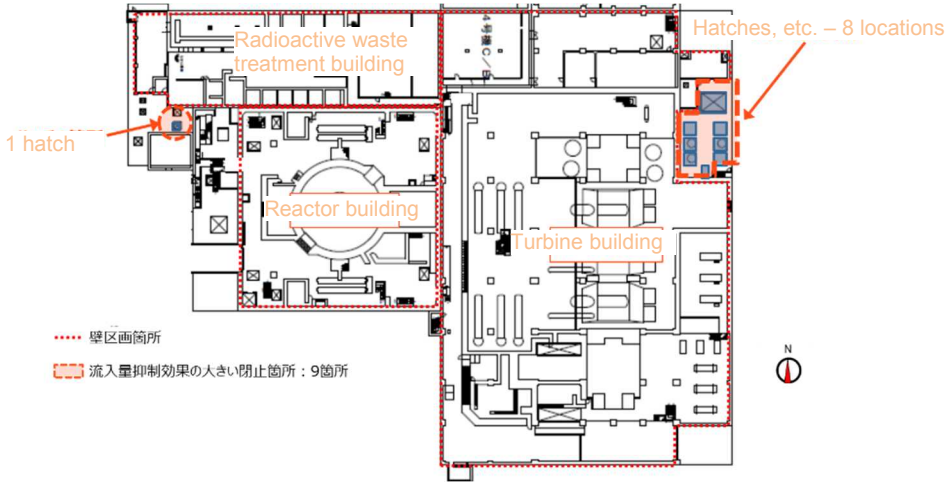


Vertical cross section as seen from the northern side of the building

Schematic diagram of the vertical cross section in the above diagram

Tsunami countermeasures ②

Considering prevention of outflow of accumulated water resulting from a tsunami similar to the 3/11 tsunami, hatches, etc. at 9 locations in the turbine building, etc. in Unit 4 will be closed targeting completion by the first half of FY 2020.



4 Other initiatives: Measures against tsunami associated with an earthquake along the Kuril-Kamchatka Trench

Tsunami countermeasures ③

In response to the Kuril-Kamchatka Trench tsunami, controlling flooding into the reactor buildings, etc. and preventing increase of accumulated water in association with inflow into the buildings or extending the existing outer-rise tsunami sea-walls and installing sea-walls as independent safety measures for reducing the tsunami, induced damage of important equipment, are being considered.