

Events and highlights on the progress related to recovery operations at Fukushima Daiichi Nuclear Power Station

July 2019

Section 1: Summary of updates from July 2018 through June 2019

1.1: Decommissioning and Contaminated Water management

Since the last report, there were progresses on the decommissioning and contaminated water management as below. For details please refer to section 2.

1. Investigation touching the deposits inside the Unit 2 PCV

On February 13, an investigation touching the detected deposits inside the PCV was conducted to determine their characteristics (hardness, fragility, etc.).

This contact investigation confirmed that the pebble-shaped deposits, etc. could be moved and that hard rock-like deposits that could not be gripped may exist. In addition, images, radiation dose and temperature data that would help determine the contour and size of the deposits which could be collected by moving the investigative unit closer to the deposits.

The results of this investigation will be utilized in the internal investigation in the 2nd half of FY2019, examination of the retrieval method.

2. Start of fuel removal from the Unit 3 Spent Fuel Pool

From April 15, removal of 514 spent fuel assemblies and 52 non-irradiated fuel assemblies (a total of 566 assemblies) stored in the Unit 3 spent fuel pool started. Seven non-irradiated fuel assemblies were then loaded in the transportation container and transportation to the common pool was completed on April 23. After reviewing fuel removal on this occasion, improving the procedures as required and providing more training, fuel removal (for the second time onward) will be implemented.

3. Completion of the Frozen-soil wall

An operation to maintain the Frozen-soil walls (land-side impermeable walls) and to prevent the frozen soil from thickening further continued from May 2017 on the north and south sides and started from November 2017 on the east side, where frozen soil of sufficient thickness was identified. The scope of the maintenance operation was expanded in March 2018.

In March 2018, the Frozen-soil walls were considered completed, except for a portion of the depth, based on a monitoring result showing that the underground temperature had declined below 0°C in almost all areas, while on the mountain side, the difference between the inside and outside increased to approx. 4-5 m.

Multi-layered contaminated water management measures, including subdrains and facing, have kept the groundwater level stable. Consequently, a water-level management system to isolate the buildings from the groundwater was considered to have been established. The Committee on Countermeasures for Contaminated Water Treatment, held on March 7, 2018, clearly recognized the effect of the land-side impermeable walls in shielding the groundwater

and evaluated that the land-side impermeable walls had allowed a significant reduction in the amount of contaminated water generated.

A supplementary method was implemented for the unfrozen depth and it was confirmed that the temperature of this portion had declined below 0 C by September 2018. From February 2019, maintenance operation started at all sections.

4. Completion of the replacement of flanged tanks with welded-joint tanks

Replacement of flanged tanks with more reliable welded-joint tanks is underway.

Strontium-treated water stored in flanged tanks was purified and transferred to welded-joint tanks. The transfer was completed in November 2018. Transfer of ALPS-treated water was completed in March 2019.

5. Separating the connecting part between Unit 1 and 2 (Water management)

To reduce the risk of stagnant water leaking from buildings, water levels in the Unit 1-4 buildings are being lowered sequentially. The connecting part between Unit 1 and 2 was separated on September 13, 2018. Separation of the connecting part between Unit 3 and 4 was completed in December 2017. Based on these results, the milestone (a main target process) of “separating the connecting parts between Unit 1 and 2, and between Unit 3 and 4 (by the end of 2018)” in the Mid- and Long-Term Roadmap was achieved. This separation allowed for stagnant water management by unit. Water levels in buildings will continue to be lowered sequentially toward completion of stagnant water treatment in buildings within 2020.

6. Reducing generation of contaminated water through multi-layered measures

Multi-layered measures are implemented to reduce the inflow of rainwater and groundwater into buildings. Multi-layered contaminated water management measures, including land-side impermeable walls and subdrains have kept the groundwater level low stable, and have kept the groundwater level higher than the water level of the reactor building. The increase in contaminated water generation during rainfall is being suppressed by repairing damaged parts of building roofs, facing onsite, and other measures.

Through these measures, the generation of contaminated water was reduced from approx. 470 m³/day (in FY2014) to approx. 170 m³/day (in FY2018).

The groundwater level around Unit 1-4 Reactor Buildings will continue to be maintained at a low level through steady operation of land-side impermeable walls and subdrains. In addition, measures to prevent rainwater inflow, including repairing damaged parts of building roofs and facing, continue to further reduce the generation of contaminated water.

7. The 4th IAEA peer review mission

Japan received the 4th visit of the review mission team from the International Atomic Energy Agency (IAEA) during the period November 5-13 (after three and half years from the 3rd mission in February 2015). The main findings and conclusions in the summary report of the review mission: “The IAEA Review Team considers that significant progress has already been accomplished to move Fukushima Daiichi from an emergency situation to a stabilized situation. Many improvements have been recorded since the previous mission in 2015.” 17 Acknowledgements and 21 Advisory Points are provided.

1.2: Monitoring results

There were no significant changes in the monitoring results of air dose rate, dust, soil, seawater, sediment and marine biota during the period from May 2018 to June 2019. For details please refer to section 3.

1.3: Off-site decontamination

The Ministry of the Environment (MOE) completed the whole area decontamination in the Special Decontamination Area (SDA) as planned, where Japanese government is responsible for decontamination, at the end of March 2017. The decontamination conducted by the municipalities in the Intensive Contamination Survey Area (ICSA) was also completed in March 19th, 2018. This means that the whole area decontamination based on the Act on Special Measures was completed, excluding “Difficult-to-Return Zones” (DRZ). For details please refer to section 4.

1.4: Food products

Monitoring and inspections of radioactive materials in food are continuously conducted, and restrictions of food distribution and removal of these restrictions are taken based on monitoring results. Restrictions of several agricultural products were lifted during the period from February 2018 to April 2018.

According to the monitoring results of fishery products in marine fish species, from May 2018 to April 2019, the excess ratio* was 0.009% (One sample is exceeding 100 Bq/kg out of 11,435 samples (total)). In freshwater fish species, the excess ratio was 0.2 % (Five samples are exceeding 100 Bq/kg out of 2,083 samples (total)). For details please refer to section 5.

*excess ratio: (Number of samples containing more than 100 Bq/kg) / (Total number of samples)

1.5: Radiation protection of worker

The Ministry of Health, Labour and Welfare (MHLW) has provided guidance on the prevention of radiation hazards to workers engaged in the decommissioning works at Fukushima Daiichi Nuclear Power Station (NPS) or decontamination and related works; as well, the Ministry has taken relevant and necessary measures such as provision of long-term healthcare for emergency workers. For details please refer to section 6.

Section 2: Decommissioning and contaminated water management at Fukushima Daiichi NPS

2.1: Basic strategies

1. Basic Policy for the Contaminated Water Issue at the Tokyo Electric Power Company (TEPCO)'s Fukushima Daiichi NPS (September 3, 2013)

(Summary)

http://www.meti.go.jp/english/earthquake/nuclear/decommissioning/pdf/20130903_01a.pdf

2. Preventive and Multi-layered Measures for Decommissioning and Contaminated Water Management (December 20, 2013)

http://www.meti.go.jp/english/earthquake/nuclear/decommissioning/pdf/20131226_001.pdf

3. Mid-and-Long-Term Roadmap towards the Decommissioning of TEPCO’s Fukushima Daiichi Nuclear Power Station (revised on September 26, 2017.)

https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/pdf/20170926_01a.pdf

2.2: Mid-and-Long Term Roadmap

Decommissioning work at Fukushima Daiichi NPS has been conducted by following the milestones described in the “Mid-and-Long Term Roadmap” with prioritising the safety.

The whole process of the decommissioning takes 30 to 40 years, and volume of tasks are gigantic. Therefore, the Government of Japan and TEPCO prioritized each tasks and set the goal to achieve.

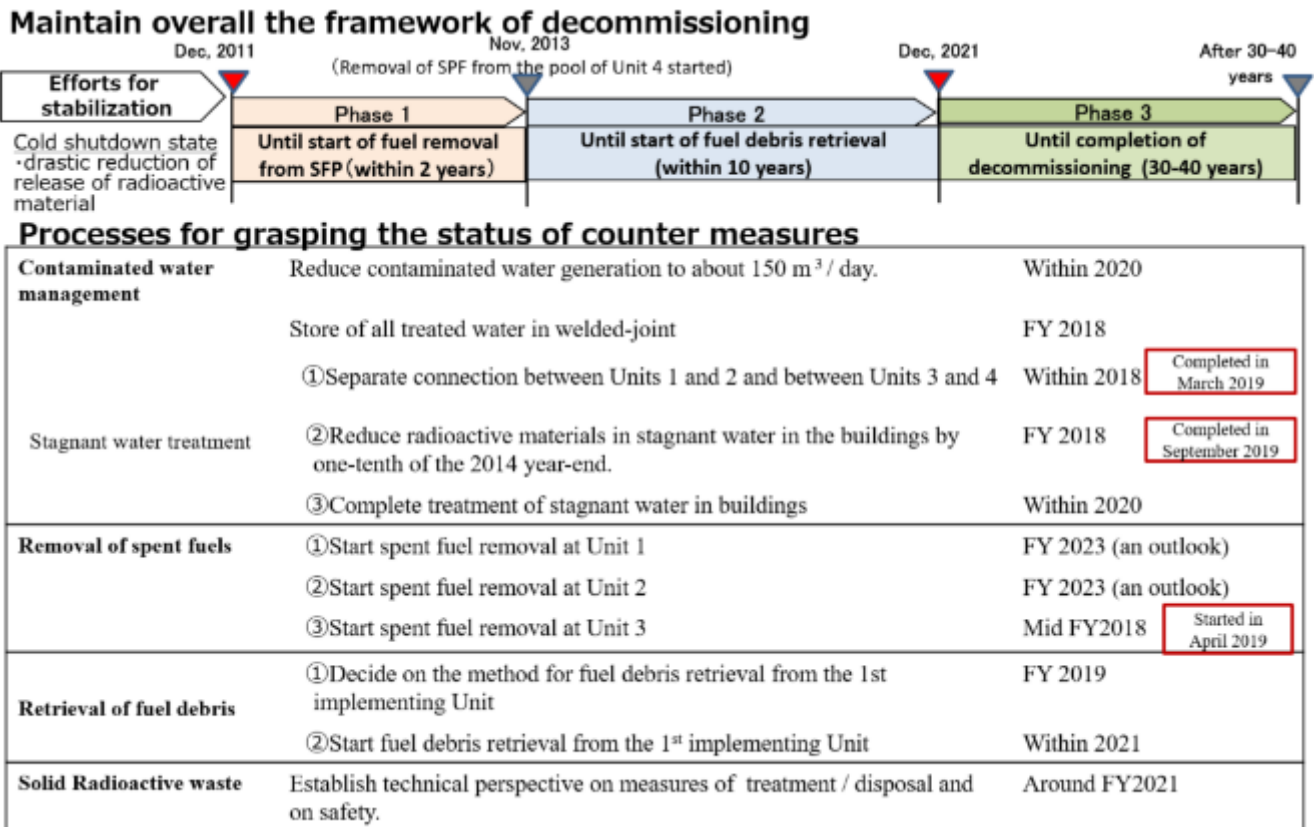
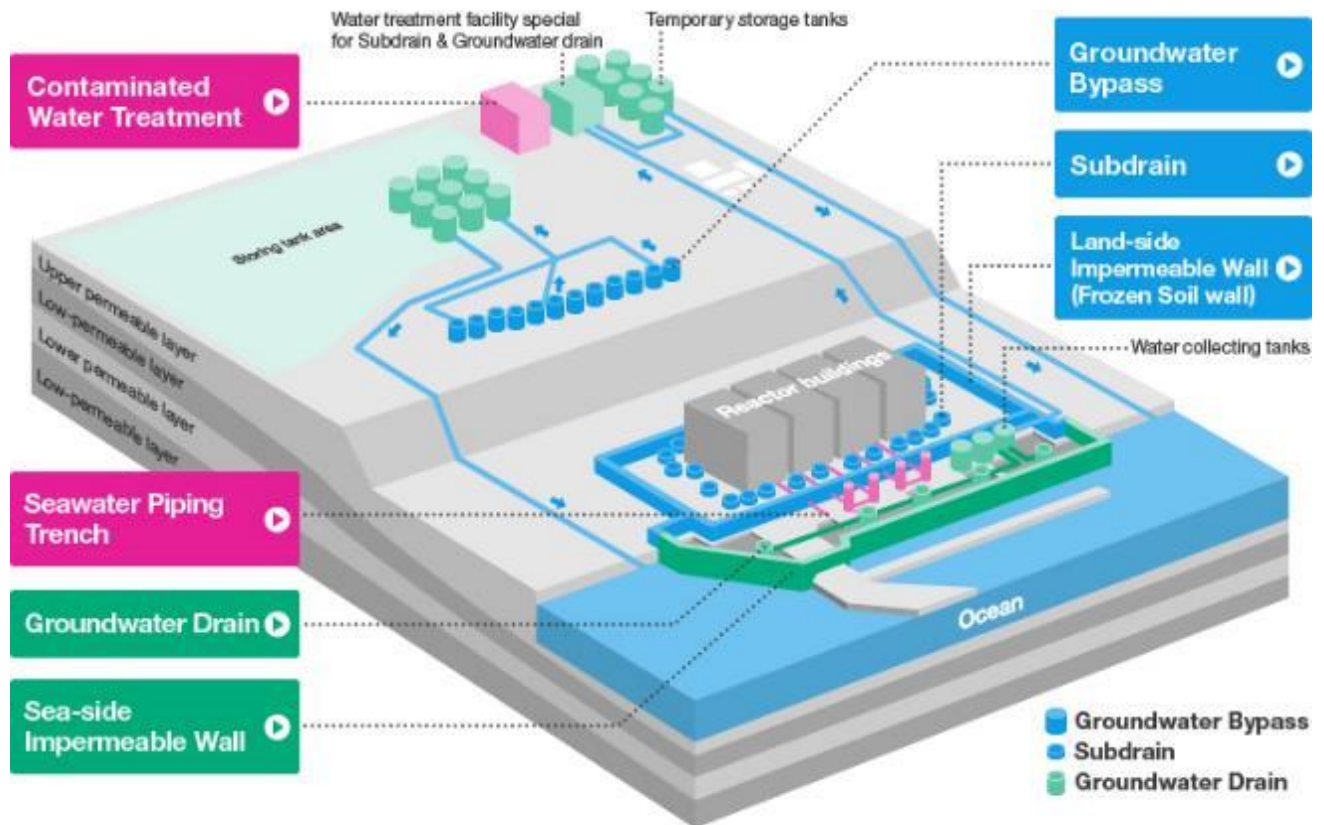


Figure. Milestones described in the “Mid-and-Long Term Roadmap”

2.3: Mid-and-Long Term Roadmap

1. Major initiatives for water management

The preventive and multi-layered measures against contaminated water issue are implemented based on the three principles; “Removing contamination sources”, “redirecting ground water from contamination source” and “Preventing leakage of contaminated water”.



Source: TEPCO

(1) Groundwater bypass

(a) Objective

The groundwater bypass function is to isolate water from contamination by pumping it and reducing its inflow into the reactor buildings.

(b) Mechanism

Clean groundwater is pumped from the wells installed on the mountain-side area of the reactor buildings and then discharged into the port area after confirming that water quality met the operational targets.

(c) Recent situations

Up until June, 25 2018, 475,857m³ of groundwater had been released to the ocean. The pumped-up groundwater was temporarily stored in tanks, released after TEPCO and a third-party organization had confirmed that the quality met the operational targets. The pumps are inspected and cleaned as necessary to operate appropriately.

The result of sea area monitoring shows that the radiation level of seawater outside the port area remains low enough compared to the density limit specified by the Reactor Regulation and significant change in the radioactivity has not been observed.

TEPCO's website related to groundwater bypass:

<http://www.tepco.co.jp/en/decommission/planaction/groundwater/index-e.html>

Detailed analysis results regarding the water quality of the groundwater being pumped out for by-passing at Fukushima Daiichi Nuclear Power Station (published by Ministry of Economy, Trade and Industry (METI))

https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/pdf/20190627_01a.pdf

(June 28, 2019)

https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/pdf/20190627_01a.pdf

(May 31, 2019)

https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/pdf/20190425_01a.pdf

(April 25, 2019)

(2) Subdrain and groundwater drain systems

(a) Objective

The subdrain system function is to redirect clean groundwater from contamination by pumping it and reducing its inflow into the reactor buildings, and thus reducing generation of contaminated water.

The groundwater drain system function is to prevent leakage of contaminated groundwater by pumping it before flowing into the port.

(b) Mechanism

Groundwater that contains slight radioactivity is pumped from the wells installed in the vicinity of the reactor buildings (called subdrain) and the wells installed in the bank protection area (called groundwater drain) and then treated through special purification equipment to meet the stringent operational targets set by TEPCO. The purified groundwater is discharged into the port area after passing water quality inspections.

(c) Recent situations

The operation of the subdrain and groundwater drain systems started in September 2015. The effects of the subdrain system are measured by two markers: the water level of the subdrain, and the difference between the water level of the subdrain and that of the reactor buildings.

Up until June 25, 2019, 699,715 m³ had been drained after TEPCO and a third-party organization had confirmed that the quality met the operational targets. The result of sea area monitoring confirms that the radiation level of seawater outside the port area remains low enough compared to the density limit specified by the Reactor Regulation, and no significant change in the radioactivity level has been observed.

TEPCO's website related to the subdrain and the groundwater drain systems:

<http://www.tepco.co.jp/en/decommision/planaction/sub-drain/index-e.html>

Detailed analysis results regarding the water quality of the groundwater pumped up by sub-drain and purified at Fukushima Daiichi NPS (published by METI)

https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/pdf/20190627_01b.pdf

(June 28, 2019)

https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/pdf/20190531_01b.pdf

(May 31, 2019)

https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/pdf/20190425_01b.pdf

(April 25, 2019)

(3) Land-side impermeable wall (Frozen soil wall)

(a) Objective

The installation of the land-side impermeable wall aims to redirect clean groundwater from contamination. This will be achieved by surrounding the reactor buildings with an in-ground frozen barrier and blocking groundwater from flowing into the buildings.

(b) Mechanism

An approximately 1,500 meters long wall, composed of frozen pipes driven into the ground, surrounds the Unit 1-4 reactor buildings. The barrier will be formed around the buildings to block groundwater inflow by supplying chilled brine (a freezing material) through the pipes and freezing the soil.

(c) Recent situations

An operation to maintain the land-side impermeable walls and prevent the frozen soil from thickening further continued from May 2017 on the north and south sides and started from November 2017 on the east side, where frozen soil of sufficient thickness was identified. The scope of the maintenance operation was expanded in March 2018.

In March 2018, construction of the land-side impermeable walls was completed, except for a portion of the depth, based on a monitoring result showing that the underground temperature had declined below 0 C in almost all areas, while on the mountain side, the difference between the inside and outside increased to approx. 4-5 m. The 21s Committee on Countermeasures for Contaminated Water Treatment, held on March 7, 2018, evaluated that together with the function of subdrains, etc., a water-level management system to stably control groundwater and isolate the buildings from it had been established and had allowed a significant reduction in the amount of contaminated water generated.

A supplementary method was implemented for the unfrozen depth and it was confirmed that the temperature of this portion had declined below 0 C by September 2018. From February 2019, maintenance operation started at all sections.

The groundwater level in the area inside the land-side impermeable walls has been declining every year. On the mountain side, the difference between the inside and outside increased to approx. 4-5 m. The water level in the bank area has remained low (T.P. 1.6-1.7 m) compared to the ground surface (T.P. 2.5 m).

TEPCO's website related to the land-side impermeable wall:

<http://www.tepco.co.jp/en/decommision/planaction/landwardwall/index-e.html>

(4) Sea-side impermeable wall

(a) Objective

The installation of the sea-side impermeable wall aims to prevent leakage of contaminated water into the ocean. This was achieved by installing a wall to block groundwater from flowing into the port area, and thus protecting the marine environment against pollution.

(b) Mechanism

A wall, approximately 780 meters long and composed of 594 steel pipes with a diameter of 1.1 meters and a length of 30 meters, was installed around the bank protection area near the reactor buildings. The groundwater flowing from the site is blocked by the wall and pumped by the subdrain and the groundwater drain systems. Consequently, the wall prevents groundwater from flowing into the port area and also reduces the risk of contaminated water flowing into the ocean in case of any leakage.

(c) Situations

In October 2015, the sea-side impermeable wall construction was completed. It has been confirmed that the radiation level of seawater inside the port area substantially decreased. In addition to the operation of the subdrain and the groundwater drain systems, the completion of the wall marks major progress in water management at Fukushima Daiichi NPS.

TEPCO's website related to the sea-side impermeable wall:

<http://www.tepco.co.jp/en/decommission/planaction/seasidewall/index-e.html>

(5) Completion of waterproofing and closure work of seawater piping trench

Highly concentrated contaminated water was generated because of the accident and it became stagnant inside the seawater piping trench of Unit 2, 3 and 4. In order to prevent the risk of the contaminated water leaking into the ocean, the stagnant water was removed and the seawater piping trench was waterproofed.

The work at Unit 2 was completed in 2017, following the work at Unit 3 and 4, which was completed in 2015. The stagnant water inside the seawater piping trench is 0 m³ in each unit.

(6) Progress status of stagnant water treatment in buildings

To reduce the risk of stagnant water leaking from buildings, water levels in the Unit 1-4 buildings are being lowered sequentially. The connecting part between Unit 1 and 2 was separated on September 13, 2018.

Separation of the connecting part between Unit 3 and 4 was completed in December 2017. Based on these results, the milestone (a main target process) of "separating the connecting parts between Unit 1 and 2 and Unit 3 and 4 (by the end of 2018)" in the Mid- and Long-Term Roadmap was achieved. This separation allowed for stagnant water management by unit. Water levels in buildings will continue to be lowered sequentially toward completion of stagnant water treatment in buildings within 2020 (for buildings other than the Unit 1-3 Reactor Buildings, to which circulation water injection is provided).

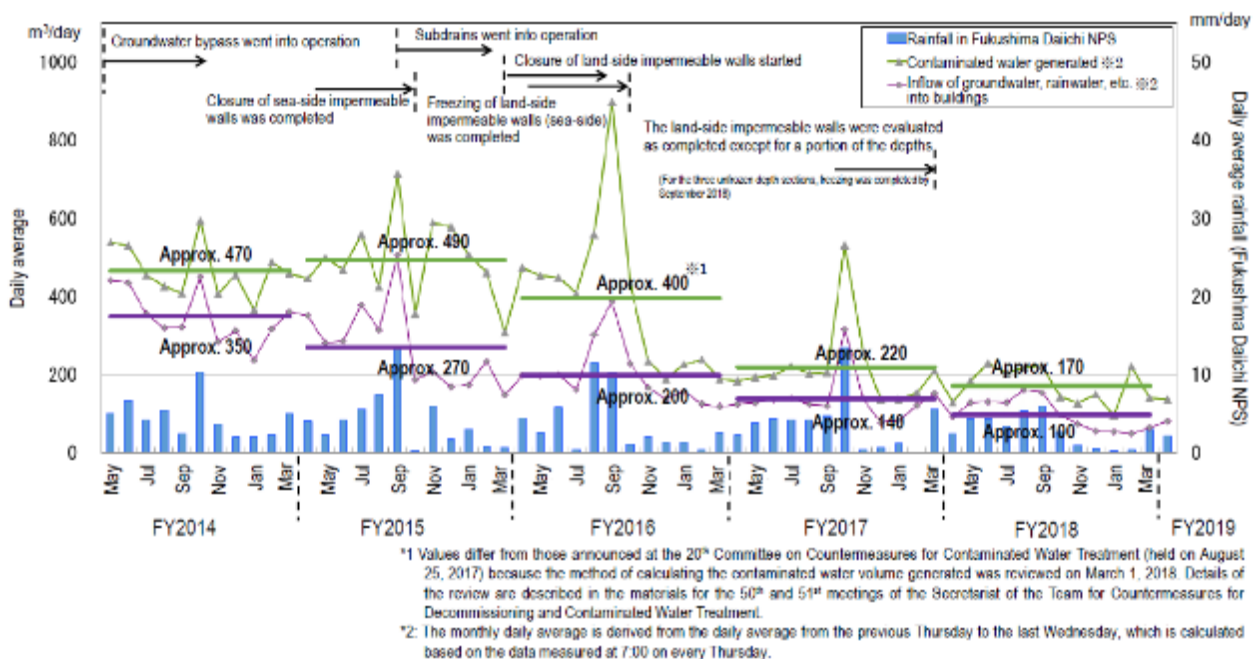
(7) Contaminated water generated

Multi-layered measures, including pumping up by subdrains and land-side impermeable walls, which were implemented to control the continued generation of contaminated water, reduced the groundwater inflow into buildings.

Following the steady implementation of measures (groundwater bypass, subdrains, land-side impermeable walls, etc.), the inflow of the groundwater and rainwater into buildings reduced from approx. 350 m³/day (the FY2014) to approx. 100 m³/day (the FY2018), though it varied depending on rainfall.

Subsequently, the generation of contaminated water was reduced from approx. 470 m³/day (in FY2014) to approx. 170 m³/day (in FY2018).

Measures will continue to further reduce the volume of contaminated water generated.



2. Purification treatment of contaminated water

(1) Objective

The purification treatment of contaminated water aims to remove sources of contamination.

(2) Mechanism

Contaminated water that accumulated at the site of Fukushima Daiichi NPS is treated at multiple facilities including Multi-nuclide Removal Facility (Advanced Liquid Processing System = ALPS). In this process, after the concentration of caesium and strontium in the contaminated water is reduced, ALPS removes most of the radioactive materials except tritium.

(3) Recent situations

As of May 23, 2019, the volumes treated by existing, additional and high-performance multi-nuclide removal equipment were approx. 409,000, 554,000 and 103,000 m³, respectively.

To reduce the risks of strontium-treated water, treatment using existing, additional and high-performance multi-nuclide removal equipment has been underway. Up until May 23, 2019, approx. 592,000 m³ had been treated.

TEPCO's website related to purification treatment of contaminated water:

<http://www.tepco.co.jp/en/decommission/planaction/alps/index-e.html>

ALPS treated water, which was treated by ALPS to remove most of the radioactive materials except tritium is stored in tanks located on the hill at the site. The total amount of the ALPS treated water is approx. 1.04 million ton as of June 2019.

The subcommittee dealing with water treated with multi-nuclide removal equipment was established in September 2016. The subcommittee performs comprehensive study on how to deal with water treated with multi-nuclide removal equipment, including the societal point of view based on the knowledge from Tritiated Water Task Force Report published in June 2016 by the Tritiated Water Task Force. The 12th subcommittee was held in December 2018.

3. Fuel removal from the reactor buildings

(1) Basic information

At the time of the accident in March 2011, the nuclear power plant operator of Unit 1, 2 and 3 were unable to maintain cooling of the reactor cores due to power loss. This resulted generation of a huge amount of hydrogen gas from the melted fuel. The pressure in the containment buildings continued to increase from accumulation of hydrogen that eventually caused hydrogen explosions in Unit 1, 3 and 4, causing structural damage. However, since November 2011, the nuclear power plant operator has been maintaining these units in a stable condition with no significant release of radioactive material to the environment.

The most important tasks in the decommissioning process are the fuel removal from the spent fuel pools and retrieval of fuel debris (melted and solidified fuel) from the Primary Containment Vessels (PCV). Currently, various measures are being implemented in order to make progress toward these goals, including removal of rubble accumulated in the buildings and investigation of the condition inside the PCV by using state-of-the-art technologies.

(2) Unit 1

In July 2015, TEPCO started dismantlement of the building cover of the reactor building as a step to start fuel removal from the spent fuel pool. In October of the same year, the removal of roof panels was completed without any significant change in radiation dose rate around the reactor building. The removal work of the roof panels proceeded carefully and anti-scattering measures were implemented to reduce spread of contamination. In September 2016, dismantling of wall panels (18 in total) started and completed in November of the same year. Installation of windbreak fences to further reduce dust scattering during rubble removal from the operating floor was completed on December 19, 2017. And the removal of the rubble on the operating floor started on January 22, 2018. No significant variation attributable to this work has been identified at the dust monitors installed on the workplace and near the boundary of the site. Before formulating a plan to remove rubble around the SFP, an onsite investigation started from July 23, 2018 and was completed on August 2, 2018. To create an access route for preparatory work to protect the SFP, etc., work to remove four sections of X-braces (one each on the west and south sides and two on the east side, respectively) started from September 19, 2018 and all planned four sections had been removed by December 20, 2018. On March 6, 2019, the creation of an access route from the west working floor was completed and the floor opening was covered to prevent small rubble falling from the operating floor during the work. From March 18, 2019, the removal of small rubble in the east-side area around the SFP started using pliers and suction equipment. From April 2, 2019, rubble removal in the same area started using a remote-controlled heavy machine.

Before retrieving fuel debris, investigation of the condition inside the PCV has commenced. From February to May 2015, TEPCO investigated inside of the PCV by using “muon”, a kind of cosmic rays, and studied the condition of fuel debris inside. In addition, in April 2015, TEPCO sent robots into the PCV to investigate and collect important information such as radiation level and temperature and also took images from inside. Based on the results of the investigation in April 2015, the status of debris spreading to the basement floor outside the pedestal was inspected using a self-propelled investigation device from March 18 to 22 2017. The purpose of the investigation was to identify the status inside the Unit 1 PCV and to make progress toward fuel debris retrieval. In this investigation, cameras and a robot were inserted into the PCV by remote control. A dosimeter and an underwater camera were suspended from

the 1st floor, where grid-like scaffold is installed, to collect information to infer the distribution of fuel debris.

The investigation identified that the existing structures such as steel or valves did not suffer severe distortion and damage. In addition, deposits of constant thickness were confirmed at the PCV bottom. There has been no effect to surrounding environment and no significant change due to the investigation was identified in the monitoring data.

As part of work to create an access route for the internal investigation of the Primary Containment Vessel (PCV), scheduled for the first half of FY2019, drilling on the outside of X-2 penetration, a penetration with doors through which workers enter or exit the PCV, started on April 8, 2019, and the inner door of the X-2 penetration, which included doors through which workers entered or exited the PCV, was drilled (for about five minutes) on June 4, 2019. Monitoring data during the work showed no significant change.

(3) Unit 2

As for Unit 2, hydrogen explosion did not occur and therefore the building escaped from being damaged. However, TEPCO concluded that it would be better to dismantle the upper part of the reactor building to facilitate the fuel removal from the spent fuel pool. Currently, TEPCO is proceeding with preparation work, such as removal of rubble around the reactor building and building scaffolding.

On November 6, 2018, before the investigation toward formulating a work plan to dismantle the Reactor Building rooftop, etc., work to move and contain the remaining objects on the operating floor (1st round) was completed. On February 1, 2019, an investigation to measure the radiation dose on the floor, walls and ceiling inside the operating floor and confirm the contamination status was completed. After analysing the investigative results, the "contamination density distribution" throughout the entire operating floor was obtained, based on which the airborne radiation dose rate inside the operating floor could be evaluated. A shielding design and measures to prevent radioactive material scattering, etc. will be examined. From April 8, 2019, work to move and contain the remaining objects on the operating floor (2nd round) got underway, such as materials and equipment which may hinder fuel removal work. The 2nd round included placing the remaining objects in the container and cleaning the floor to suppress dust scattering, all of which were not scheduled in the 1st round. The status of dust density, etc. is being monitored to steadily implement the work with safety first.

An investigation to capture the location of fuel debris inside the Unit 2 was conducted from March 22 to July 22, 2016. This operation applied muon transmission method of which effectiveness was demonstrated in its appliance for locating the debris inside Unit 1. These operations used a small device developed through the "Development of Technology to Detect Fuel Debris inside the Reactor" project funded by a government subsidy.

The result of the investigation indicates that high-density material which are considered as fuel debris are at the bottom of the RPV as well as the lower part and outer periphery of the reactor core. It is assumed that most of the fuel debris existed at the bottom of the RPV.

An investigation inside the Unit 2 PCV has been conducted to identify the status of debris inside the RPV pedestal (The base supporting the RPV). From 26 January to 16 February 2017, a camera and a robot were inserted closely to the RPV by remote control. The internal situation was grasped by the digital images. From the result of this investigation, fallen scaffold below the RPV and the status of deposits were identified directly for the first time. Moreover,

the actual radiation dose rate and temperature inside the PCV were measured and these are big progresses toward the decommissioning of Fukushima Daiichi NPS.

On January 19, 2018, the status below the platform inside the pedestal was investigated using an investigative device with a hanging mechanism. From the analytical results of images obtained in the investigation, deposits probably including fuel debris were found at the bottom of the pedestal.

On February 13, 2019, an investigation touching the detected deposits inside the PCV was conducted to determine their characteristics (hardness, fragility, etc.). This contact investigation confirmed that the pebble-shaped deposits, etc. could be moved and that hard rock-like deposits that could not be gripped may exist. In addition, images, radiation dose and temperature data that would help determine the contour and size of the deposits could be collected by moving the investigative unit closer to the deposits. The result of this investigation will be utilized in the internal investigation in the second half of FY 2019, examination of the retrieval method.



Image: Before and while touching the deposit at the investigation of Unit 2

During the period April 2-16, 2019, a water injection reduction test (STEP 1) was conducted. Through this test, the water injection rate into the reactor was temporarily changed for checking temperature variation, in order to take the heat release to the air into consideration. When the water injection rate was changed from 3.0 to 1.5 m³ /h, the maximum temperature increase at the RPV bottom was up by 5°C from about 20°C at the test start. It was confirmed that the overall temperature variation, including other parameters, was almost within predictions.

To optimize the emergency response procedures, a test (STEP 2) involving temporarily suspending water injection to the reactor (3.0 to 0.0 m³/h) was conducted on May 13 (and terminated on May 24). The graph below shows the changes in RPV bottom temperature during the test to suspend water injection to the reactor. The test confirmed that the temperature increase rate at the RPV bottom was at the same level of 0.2°C/h or less as predicted and that the temperatures at the RPV bottom and inside the PCV during the test also varied almost within expectations. No abnormality was detected in other parameters such as the dust density. The difference between the prediction data and the test data and the behavior variation depending on the location where the thermometer was installed will be evaluated to utilize the results in optimizing emergency response procedures.

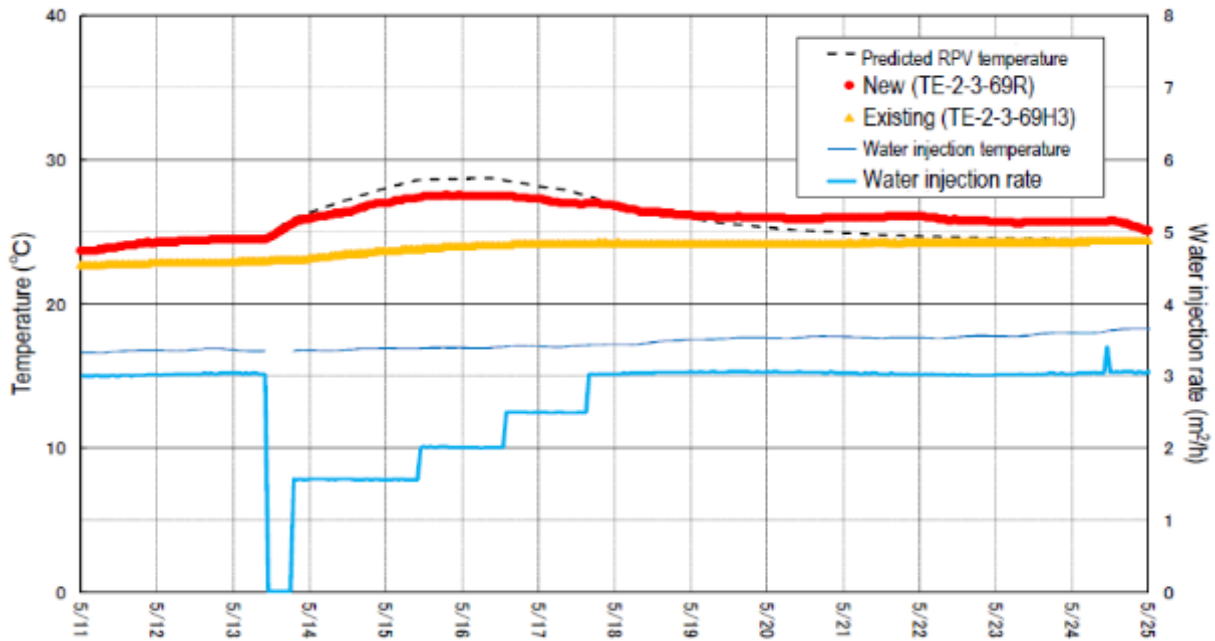


Figure. Changes in PRV bottom temperature during the test to suspend water injection

(4) Unit 3

In August 2015, TEPCO completed removal of the Fuel Handling Machine (FHM) rubble from the spent fuel pool. By the end of November, all rubble remaining in the pool was removed. An equipment to cover the upper part of the building as well as a crane has been installed since August 2017 to start removing spent fuel from the pool.

Regarding the fuel-handling machine (FHM) and crane, consecutive defects have occurred since the test operation started on March 15, 2018. On September 29, 2018, to determine the risks of defects in fuel-handling facilities, the FHM was temporarily recovered and a safety inspection (operation check and facility inspection) started. For 14 defects detected in the safety inspection, measures were completed on January 27, 2019. On February 8, 2019, a function check after cable replacement was completed.

On February 14, 2019, review of recovery measures in the event of defects, etc. was held and training for fuel removal using dummy fuel and the transport container got underway. During the training, seven defects were detected, although it was confirmed that these did not constitute safety problems that could lead to fuel, rubble, etc. falling. From March 15, 2019, the rubble removal training inside the pool started.

From April 15, 2019, removal of 514 spent fuel assemblies and 52 non-irradiated fuel assemblies (a total of 566 assemblies) stored in the spent fuel pool started. Seven non-irradiated fuel assemblies were then loaded in the transport container and transported to the common pool on April 23, 2019. The first fuel removal was completed on April 25, 2019. After reviewing fuel removal on this occasion (improving procedures and facilities), work has begun to collect the removed rubble and training on removal is being provided toward the second removal in the transport container from July 2019 and subsequent removal work. The dust density in the surrounding environment, etc. is monitored on an ongoing basis and work implemented with safety first.

Concurrent with the above activities, investigation of the current condition inside the PCV is underway. In October 2015, robots were sent into the PCV and successfully collected useful

information. The images taken by the robots confirmed that the main structure and walls inside the PCV had not been damaged.

The image inside of pedestal was acquired by using underwater ROV from 19 to 22 July 2017. As a result, in the pedestal, considered to be solidified molten materials and damage situation of some structure such as housing support and grating were confirmed. In November 2017, analysis of image data obtained in the investigation was released. It identified damage to multiple structures and the supposed core internals.

Investigation using muon cosmic ray to identify existence of fuel debris has been implemented from May to September 2017. The final report was presented and there is no large mass of fuel debris in the core of the RPV.

To understand the overall picture inside the pedestal, videos obtained while investigating inside the Unit 3 PCV in July 2017 were reproduced in 3D. Based on the reproduced images, the relative positions of the structures, such as the rotating platform slipping off the rail with a portion buried in deposits, were visually understood.

(5) Unit 4

In spite of a hydrogen explosion, the fuel assemblies of Unit 4 were not damaged, as the plant was in cold shutdown status and all the fuel had been stored in the spent fuel pool before the accident. The fuel assemblies in the pool were taken out and transferred to the common pool located within the station site. This fuel removal operation started on November 2013 and was safely completed in December 2014. Fully utilizing this successful experience, the fuel assemblies remaining in the spent fuel pools of Units 1, 2 and 3 will be removed.

(6) Unit 5 and 6

These reactors were not operating at the time of the accident, but the fuel remained in the reactor. In addition, unlike the case of Units 1, 2 and 3, the reactors of Unit 5 and 6 did not encounter power loss and the reactor cores were successfully cooled off.

Given that the conditions of the buildings and the equipment for storing the fuel are stable and risks of causing any problem in the decommissioning process are estimated to be low compared to the other Units, the fuel assemblies of Units 5 and 6 are safely stored in the spent fuel pool in each building for the time being. The following step will be to carefully remove fuel from the spent fuel pools without impact on fuel removal from Units 1, 2 and 3.

4. Waste management

As of the end of May 2019, the total storage volume of the concrete and metal rubble was approx. 271,200 m³ (+2,400 m³ compared to at the end of April with an area-occupation rate of 68%). The total storage volume of trimmed trees was approx. 134,100 m³ (slight increase, with an area-occupation rate of 76%). The total storage volume of used protective clothing was approx. 55,400 m³ (+200 m³, with an area-occupation rate of 81%). The increase in rubble was mainly attributable to tank-related construction, while the increase in used protective clothing was attributable to acceptance of used protective clothing. As of June 6, 2019, the total storage volume of waste sludge was 597 m³ (area-occupation rate: 85%), while that of concentrated waste fluid was 9,364 m³ (area-occupation rate: 91%). The total number of stored spent vessels, High-Integrity Containers (HICs) for multi-nuclide removal equipment, etc., was 4,393 (area-occupation rate: 69%).

The third revision of the “Plan to Store and Manage Solid Waste,” which was formulated in March 2016, was issued on June 27, 2019. The estimated generation amount, etc. was reviewed based on the latest storage results and the construction plan. However, the timing to complete the temporary storage of “rubble, etc.” (excluding that for recycling or reuse) remained within FY2028, i.e. unchanged since the first issue. Solid waste will continue to be minimized and stored in buildings to reduce risks even further.

5. Working environment

In order to achieve a long-term decommissioning, it is important to ensure stable workforce (about 3,000-4,000 workers per day). TEPCO has implemented improvement of working environment such as (1) providing warm food, (2) setting up large rest area, and a convenience store, (3) developing emergency medical facilities and systems, and ensuring workplace safety which starts from the reduction of radiation exposure. By the decontamination work including pavement and contaminated water management, ordinary clothing area which does not require wearing protective clothing and full-faced mask is expanded to about 96% of the site.

6. The 4th IAEA peer review mission

Japan received the 4th visit of the review mission team from the International Atomic Energy Agency (IAEA) during the period November 5-13 (after three and half years from February 2015)

The main findings and conclusions in the summary report of the review mission: “The IAEA Review Team considers that significant progress has already been accomplished to move Fukushima Daiichi from an emergency situation to a stabilized situation. Many improvements have been recorded since the previous mission in 2015.”

17 Acknowledgements and 21 Advisory Points are provided:

[Contaminated water] The team acknowledges that through multi-layered measures to reduce the contaminated water generated and prevent leakage, the influence on the public environment has been reduced. Regarding ALPS-treated water, in consideration of the on-site tank construction plan and pretreatment TEPCO will implement before disposal, a decision on the disposition path should be taken urgently in engaging all stakeholders.

[Spent fuel removal/ debris retrieval] The team acknowledges progress in environmental preparation for spent fuel removal, particularly at Unit 3 and investigations inside the reactor of each unit toward debris retrieval.

[Waste management] The team acknowledges the progress taken in measures for storage within the site and reductions of amounts, etc. and the planning shall also include sustainability and long-term aspects such as waste management including the waste streams which will come from the decommissioning of the facilities on site.

[Communications] The Team advises to the Government of Japan and TEPCO to take a proactive and timely approach to communicating with the public on matters directly relevant to public concerns. This includes not only disclosing relevant information and data on a regular basis, but, providing the general public the information in an easy-to-understand manner, including an explanation of its potential impact on the health and safety of the workforce and public as well as the protection of the environment.

IAEA International Peer Review Mission on Mid-and-Long-Term Roadmap towards the decommissioning of TEPCO’s Fukushima Daiichi Nuclear Power Station

<https://www.iaea.org/newscenter/pressreleases/iaea-issues-final-report-on-fourth-review-of-fukushima-decommissioning>

2.4: Organizations related to decommissioning and contaminated water management

1. Fukushima Daiichi Decontamination & Decommissioning (D&D) Engineering Company

In April 2014, TEPCO established a company for the purpose of clarifying the responsibilities and authorities inside the company and streamlining the process of decision making regarding decommissioning and contaminated water management at Fukushima Daiichi NPS.

In addition, the company invited nuclear specialists from outside TEPCO, such as high rank nuclear executives of manufacturers, in order to collect and share expertise and technology of manufacturers.

This company is playing an important role on the frontline of decommissioning and contaminated water management.

TEPCO's website related to Fukushima Daiichi D&D Engineering Company:

<http://www.tepco.co.jp/en/decommision/team/index-e.html>

2. Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF)

In August 2014, Nuclear Damage Compensation Facilitation Fund, originally established in 2011 to support the compensation for nuclear damage resulted from the Fukushima Daiichi NPS accident, was reorganized into Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF).

The NDF's mission is to support decommissioning activities at Fukushima Daiichi NPS. For example, it formulates decommissioning strategies and develops plans for the research and development (R&D) program on technology necessary for decommissioning.

In August in 2018, the NDF held the 3rd International Forum on the Decommissioning of the Fukushima Daiichi NPS to listen to the local voice and provide them with easily understandable information on the decommissioning of the Fukushima Daiichi NPS and widely share the latest progress on the decommissioning work and technical outcomes with Japanese and foreign experts. The forum was attended by as many as 1264 people from 8 countries. The 4th international Forum will be held in August 3-4 in Tomioka and Iwaki, Fukushima.

NDF's booklet:

http://www.ndf.go.jp/soshiki/pamph_e.pdf

The 3rd International Forum on the Decommissioning of Fukushima Daiichi NPS:

<https://ndf-forum.com/3rd/en/>

The 4th International Forum on the Decommissioning of Fukushima Daiichi NPS:

<https://ndf-forum.com/en/>

3. International Research Institute for Nuclear Decommissioning (IRID)

In August 2013, IRID was established by 18 corporations and organizations related to R&D of technology for the decommissioning of Fukushima Daiichi NPS. In accordance with the Mid-

and-long-term Roadmap written by the Japanese government, IRID is conducting R&D on removal of fuel from the spent fuel pools, removal of fuel debris from the PCVs and disposal of radioactive wastes and gathering domestic and international expertise. Currently, methods developed by IRID are being applied to investigations into Unit 1-3 reactor buildings, such as various kinds of robots and the muon cosmic ray.

IRID's website:

<http://irid.or.jp/en/>

4. Collaborative Laboratories for Advanced Decommissioning Science (CLADS)

In April 2015, Japan Atomic Energy Agency (JAEA) established the CLADS, based on the Acceleration Plan of Reactor Decommissioning R&D for Fukushima Daiichi NPS, TEPCO, proposed by Ministry of Education, Culture, Sports, Science and Technology (MEXT). This institution is aimed at being an international hub for R&D on decommissioning and promoting cooperation in R&D and human resource development (HRD) among government, industry and academia.

CLADS main building has been established in Tomioka-machi, Fukushima in April 2017, which is a central facility of CLADS where educational and research institutions at home and abroad work together to conduct R&D on decommissioning.

CLADS is expected to collaborate on research activities with the following JAEA's centers in Fukushima. One of the centers is Naraha Remote Technology Development Center, which started operation partially in October 2015 and fully started operation in April 2016. The other center is Okuma Analysis and Research Center, which consists of Administrative Building, Radioactive Material Analysis and Research Facilities. The Administrative Building will be opened from spring 2018. The Administrative Building started operation in March 2018.

CLADS has held a series of Fukushima Research Conference (FRC) on Decommissioning Research and Development since 2015. FRC on "Materials Science for Severe Accident and Fukushima Daiichi Decommissioning Workshop 2019" was held in July 2019. Young researchers and students including foreign students participated in these conferences positively.

JAEA's website related to the CLADS:

<https://fukushima.jaea.go.jp/en/hairo/>

2.5: Related information

Measures for Mid-term Risk Reduction at TEPCO's Fukushima Daiichi NPS (Nuclear Regulation Authority (NRA)) (March 6, 2019)

<http://www.nsr.go.jp/data/000265471.pdf>

Section 3: Monitoring results

3.1: Onsite monitoring results reported by TEPCO

(1) Outline of the item

On-going monitoring of the air at the site of Fukushima Daiichi NPS has detected no significant increase in radiation levels.

Results of radioactive nuclide analysis are published for the samples of groundwater at the site and seawater at the port in order to monitor the source.

(2) Noteworthy change in data during the period from July 2018 to June 2019

The monitoring result is ND (ND indicates that the measurement result is below the detection limit). In this regard, no announcement has been made by TEPCO for this item.

(3) Monitoring result data

The monitoring results in the air at the site and the monitoring results of the seawater near the NPS as well as sampling data from sub-drain and groundwater drain are available in the following webpage

<https://www4.tepco.co.jp/en/nu/fukushima-np/f1/smp/index-e.html>

TEPCO also publishes the data on radioactive concentration in seawater measured by seawater radiation monitors as well as air dust monitors near the site boundary in real time.

https://www7.tepco.co.jp/responsibility/decommissioning/1f_newsroom/data/index-e.html

3.2: Offsite monitoring results

1. Monitoring results of air dose rates obtained within the 20 km zone around Fukushima Daiichi NPS

(1) Outline of the item

The monitoring of air dose rates within the 20 km zone around Fukushima Daiichi NPS has been conducted. The air dose rates within the 20 km zone are gradually declined with the lapse of time since May 2011 (soon after the accident at Fukushima Daiichi NPS on March 11, 2011).

(2) Noteworthy updates in the past months

As described in (1) above, the air dose rates within the 20 km zone around the NPS have been on a decreasing trend, and the monitored air dose rates were stable in June 2019. Based on these results, any further announcement was not made on this item (e.g., a significant rise of air dose rates within the 20 km zone) during this period; therefore the frequency of the implementation of monitoring by survey meter was changed to annual.

(3) Monitoring results

The following URL leads to the monitoring results of air dose rates in Fukushima prefecture including the 20 km zone around Fukushima Daiichi NPS:

<http://radioactivity.nsr.go.jp/map/ja/> (in Japanese)

<http://radioactivity.nsr.go.jp/en/list/239/list-1.html>

2. Monitoring results of dust in air and soil within the 20 km zone around Fukushima Daiichi NPS

(1) Dust

The monitoring results of dust obtained in April 2019 show that the concentrations of dust were either ND (ND indicates that the measurement result is below the detection limit) or very low. Based on the results, any further announcement was not made on this item (e.g., a significant rise of the activity concentrations obtained from dust samples) during this period.

(2) Soil

Radiation monitoring of soil is conducted as appropriate. The most recent monitoring of soil was conducted in September 2017.

(3) Monitoring results

The following URL provides the monitoring results (from April 2011 to the present) :

<http://radioactivity.nsr.go.jp/en/list/240/list-1.html>

3. Converted values and measured values of environmental radiation dose rate at 1m height from the ground surface in 46 prefectures in total other than Fukushima Prefecture

(1) Outline

The air dose rates measured using the monitoring stations located in other prefectures have mostly returned to the equal level of the air dose rates before the accident.

(2) Updates from May 2018 to June 2019

The converted and measured values were relatively stable from May 2018 to June 2019. Based on the results, any further announcement was not made on this item (e.g., a significant rise of the converted and measured values) during this period.

(3) Monitoring results

The following URL leads to the estimated and measured values, and new monitoring results are uploaded:

<http://radioactivity.nsr.go.jp/en/list/192/list-1.html>

3.3: Sea area monitoring results of seawater, sediment and biota

1. Outline

Sea area monitoring results in the area around Fukushima Daiichi NPS have indicates that the radioactivity levels obtained from the outside of the port or in the open sea have been relatively stable.

2. Updates during the period from May 2018 to June 2019

As described above, the sea area monitoring results were relatively stable from May 2018 to June 2019. Based on the results, any further announcement was not made on this item (e.g., a significant rise of sea area monitoring results) during this period.

3. Related information

Sea area monitoring is classified to be conducted in 5 areas (Area 1: Sea area close to TEPCO's Fukushima Daiichi NPS, Area 2: Coastal area, Area 3: Off-shore area, Area 4: Outer sea area, and Area 5: Tokyo bay area), and this information is available under the "Monitoring of sea water", section of the NRA webpage entitled "Readings of Sea Area Monitoring". This webpage also includes monitoring results of sediment under the "Monitoring of marine soil" section, and it is also classified into 4 areas (Area 1: Sea area close to TEPCO's Fukushima Daiichi NPS, Area 2: Coastal area, Area 3: Off-shore area, Area 4: Tokyo bay area). The NRA has

been providing report on sea area monitoring results. The “Readings of Sea Area Monitoring” webpage covers various issues and the webpage’s information is periodically updated several times a week. The following URL lead to the webpage and report on sea area monitoring:

Readings of Sea Area Monitoring

<http://radioactivity.nsr.go.jp/en/list/205/list-1.html>

Sea Area Monitoring (Monthly Report)

<http://radioactivity.nsr.go.jp/en/list/295/list-1.html>

Section 4: Off-site Decontamination

4.1: Outline

The whole area decontamination in the Special Decontamination Area (SDA), where Japanese government is responsible for decontamination, was completed as planned at the end of March, 2017. The decontamination conducted by the municipalities in the Intensive Contamination Survey Area (ICSA) was also completed in March 19th, 2018. This means that the whole area decontamination based on the Act on Special Measures was completed, excluding “Difficult-to-Return Zones” (DRZ). The air dose rates in the environment have been continuously decreasing.

4.2: Interim Storage Facility (ISF)

As for the Interim Storage Facility (ISF), in which the soil generated from decontamination activities in Fukushima (hereinafter referred to as “removed soil”) will be stored intensively and safely, MOE has been processing land acquisitions to secure the necessary areas. The soil storage facility started the operation in October 2017.

In FY2019, approximately 4,000,000 m³ of removed soil and waste will be transported to the ISF. Almost all the removed soil will be delivered to the ISF by the end of March, 2022.

The following URL leads to MOE’s website, in which updated information related to the Environmental Remediation is posted.

<http://josen.env.go.jp/en/>

Section 5: Food products

5.1: Summary of testing

Food samples are routinely monitored to ensure that they are safe for all members of the public.

During the month of February 2018, 15,318 samples were taken and analysed. Among these samples, 9 samples were found to be above the limits (caesium-134+caesium-137: 100 Becquerel/kg). This represents 0.06 percent of all samples.

During the month of March 2018, 30,701 samples were taken and analysed. Among these samples, 36 samples were found to be above the limits (caesium-134+caesium-137: 100 Becquerel/kg). This represents 0.04 percent of all samples.

Restrictions are imposed on the distribution of food products, if the level of radioactive contaminants of the food product exceeds the limit (caesium-134+caesium-137: 100 Becquerel/kg). Restrictions are to be removed, when the level of radioactive contaminants of the food product is monitored to be constantly below the limit for a certain period of time. Therefore,

the products on which the distribution restrictions are newly imposed are the products whose radioactive contaminant level exceeded the limit in the past month. By the same logic, the products whose restrictions are newly removed are the products whose radioactive contaminant level has been lower than the limit for a certain period of time.

5.2: Results of monitoring food products

1. The current situation and protective measures

The fact sheet uploaded in the link below is the summary of the current situation and the measures taken by the Government of Japan:

http://www.mhlw.go.jp/english/topics/2011eq/dl/food-130926_1.pdf

2. Noteworthy updates in the past months (during the period from February 2018 to April 2018)

The lists of food products whose status regarding the restriction was changed are as follows.

(1) Products whose distribution was newly restricted in February 2018

- none

(2) Products whose restrictions were removed in February 2018

- Chestnuts produced in Nasu-machi , Tochigi prefecture.

(3) Products whose distribution was newly restricted in March 2018

- rice produced in parts of Fukushima prefecture* in 2018 (excluding rice controlled under the concept of management of Fukushima prefecture).

(4) Products whose restrictions were removed in March 2018

- wasabi (limiting to field cultivation) produced in Date-shi, which are controlled under the management policy set by Fukushima prefecture

- raw milk produced in Kawamata-machi (limiting to Yamakiya area), Tomioka-machi (*1), Namie-machi (※1) and Iitate-mura (*2) for Governor of Fukushima.

*1 Limiting to areas except “areas where it is expected that the residents have difficulties in returning for a long time” designated by the Instruction on March 7, 2013.

*2 Limiting to areas except “areas where it is expected that the residents have difficulties in returning for a long time” designated by the Instruction on June 15, 2012.

- log-grown shiitake (outdoor cultivation) produced in Hiraizumi-cho which are controlled under the management policy set by Iwate prefecture.

- log-grown shiitake (outdoor cultivation) produced in Ashikaga-shi and Takanezawa-machi which are controlled under the management policy set by Tochigi prefecture.

- wild mushrooms (limiting to late fall oyster mushroom) produced in Nishiaizu-machi and wild mushrooms (limiting to pholiota nameko, late fall oyster mushroom, brick cap mushroom and Grifola frondosa (maitake)) produced in Tadami-machi , Fukushima prefecture.

(5) Products whose distribution was newly restricted in April 2018

- none

(6) Products whose restrictions were removed in April 2018

- Fox jacopever, Rockfish (white colour, *Sebastes cheni*) and Japanese seabass captured in Fukushima offshore.

- Log-grown shiitakes (outdoor cultivation) produced in Kakuda-shi and Murata-machi which are controlled under the management policy set by Miyagi prefecture..

- Log-grown shiitakes (indoor cultivation) produced in Ibaraki-machi which are controlled under the management policy set by Miyagi prefecture

3. Monitoring results data

See the link below (new monitoring results are added once a week):

http://www.mhlw.go.jp/english/topics/2011eg/index_food_radioactive.html

4. Information focused on the safety of the fishery products

The information that is provided above in (1)-(3) cover fishery products, but in addition to this information, further detailed information is available on the Fisheries Agency's website

<http://www.ifa.maff.go.jp/e/inspection/index.html>

(1) Summary of monitoring on fishery products

The first half of the website consists of summary of monitoring on fishery products. For further information and to see the actions taken to ensure the safety of fishery products, please refer to the fact sheet uploaded in the site. This fact sheet is available in English, French, Spanish, Russian, Chinese, Korean, and Thai.

(2) "Report on the Monitoring of Radionuclides in Fishery Products" was updated by the Fisheries Agency of Japan

Since the accident at the TEPCO's Fukushima Daiichi NPS, the Government of Japan and local authorities have cooperated closely with relevant bodies to secure the safety of fishery products. With an aim to promote accurate understanding on the safety of Japanese fisheries products at home and abroad, the data and information accumulated in the inspection of the last three years was evaluated comprehensively in the previous Report, which was published in May 2014.

In October 2017, the Fisheries Agency of Japan released updated Report, which reflects latest data and recent research results. It shows that, after four years from the accident, the level of radioactive Cs in fishery products has declined substantially.

The Report is available at the following URLs:

Japanese version, full Report

<http://www.ifa.maff.go.jp/j/housyanou/attach/pdf/kekka-240.pdf>

Japanese version, summary

<http://www.ifa.maff.go.jp/j/housyanou/attach/pdf/kekka-216.pdf>

English translation, full report

http://www.ifa.maff.go.jp/e/inspection/pdf/report_on_the_monitoring_of_radionuclides_in_fishery_products.pdf

English translation, summary

http://www.ifa.maff.go.jp/e/inspection/pdf/summary_report_1_1.pdf

(3) Monitoring results data

The second half of the website consists of various monitoring results on radioactivity measured in fishery products.

Section 6: Radiation Protection of Workers

Information pertaining to radiation protection of workers involving TEPCO's Fukushima Daiichi NPP Accident is updated on the following website of the Ministry of Health, Labour and Welfare (MHLW):

<http://www.mhlw.go.jp/english/topics/2011eq/workers/index.html>

6.1: TEPCO's Fukushima Daiichi NPP

Regulations and Guidelines, etc from the MHLW on radiation protection of workers are available on the following webpage.

<https://www.mhlw.go.jp/english/topics/2011eq/workers/ri/index.html>

6.2: TEPCO's Fukushima Daiichi NPP

The status on the exposure dose, health care management and radiation protection of the workers at TEPCO's Fukushima Daiichi NPP are as follows.

1. Status of Radiation Exposure

Exposure doses of the workers at TEPCO's Fukushima Daiichi NPP are reported to the MHLW once a month. The latest monthly report is available on the following webpage:

<http://www.mhlw.go.jp/english/topics/2011eq/workers/irpw/index.html>

2. Radiation Protection

Ensuring occupational safety and health of specified skilled foreign workers for the TEPCO Fukushima Daiichi Nuclear Power Plant (Updated on May 21, 2019)

https://www.mhlw.go.jp/english/topics/2011eq/workers/ri/gr/gr_190521.pdf

Results of supervision and instruction activities for employers of decommissioning workers at the TEPCO Fukushima Daiichi Nuclear Power Plant and employers of decontamination workers in Fukushima Prefecture (in 2018) (Updated on March 29, 2019)

https://www.mhlw.go.jp/english/topics/2011eq/workers/ri/gr/gr_190329.pdf

Measures for occupational safety and health management will be enhanced at the TEPCO Fukushima Daiichi Nuclear Power Plant - A guideline was formulated - (Updated on August 26, 2015)

http://www.mhlw.go.jp/english/topics/2011eq/workers/tepco/rp/pr_150826.html

3. Long-term Health Care

Updated Information on long-term health care of emergency workers including health examination and guidelines;

"Guidelines on Maintaining and Improving Health of Emergency Workers at Nuclear Facilities, etc." is available on the following webpage. (Updated on August 31, 2015)

http://www.mhlw.go.jp/english/topics/2011eq/workers/tepcu/rp/pr_150831_attachment06.pdf

4. Good Practices in Radiation Exposure Controls

Good Practices in Radiation Exposure Dose Reduction Measures (Commissioned by the Ministry of Health, Labour and Welfare in FY2018Project) (Updated on Jan, 2018)

https://www.mhlw.go.jp/english/topics/2011eq/workers/tepcu/gre/gre_1901.pdf

5. Other Related Topics

Updated other related information on the workers at TEPCO's Fukushima Daiichi NPP:

Healthcare of Workers at the Fukushima Daiichi Nuclear Power Plant (Updated on April 25, 2019)

https://www.mhlw.go.jp/english/topics/2011eq/workers/tepcu/ort/ort_190425.pdf

Start of a weekly on-site consultation desk to address health matters of decommissioning workers, etc. (Updated on June 24, 2016)

http://www.mhlw.go.jp/english/topics/2011eq/workers/tepcu/ort/ort_160624.html

6.3: Decontamination/Remediation

The status on radiation protection of the workers engaged in decontamination and remediation of contaminated materials derived from Fukushima Daiichi NPP Accident is as follows.

<https://www.mhlw.go.jp/english/topics/2011eq/workers/dr/index.html>

1. Decontamination/Remediation

Updated Information on decontamination and remediation including guidelines and results of labour inspection:

Results of supervision and instruction activities for employers of decommissioning workers at the TEPCO Fukushima Daiichi Nuclear Power Plant and employers of decontamination workers in Fukushima Prefecture (in 2018) (Updated on March29,2019)

https://www.mhlw.go.jp/english/topics/2011eq/workers/ri/gr/gr_190329.pdf

2. Waste Disposal

Information on waste disposal work including guidelines:

<http://www.mhlw.go.jp/english/topics/2011eq/workers/dr/index.html#wd>

3. Other Related Topics

Other related information on waste disposal work:

<http://www.mhlw.go.jp/english/topics/2011eq/workers/dr/index.html#ort>

6.4: Other Information

Statistics on Radiation Exposure Doses of Decontamination Workers and Other Items Have Been Announced.

<https://www.mhlw.go.jp/english/topics/2011eq/workers/ors/index.html>

1. Related Information

<https://www.mhlw.go.jp/english/topics/2011eq/workers/ors/index.html#ri>

2. Other Institutions

<https://www.mhlw.go.jp/english/topics/2011eq/workers/ors/index.html#io>

3. Other Institutions

Dose Statistical Data Based on the Information Registered with the System of Registration and Management of Radiation Exposure Doses for Decontamination and Related Work (2018)(by Radiation Effects Association) (Updated on Jun 21, 2019)

http://www.rea.or.jp/chutou/koukai_jyosen/H30nen/English/honbun_jyosen-2018-English.html

Section 7: Other issues on recovery operations

7.1: Public communication

1. Provision of updates to the IAEA

The Government of Japan has actively been strengthening its communication process to ensure timely dissemination of accurate information on the current status of activities onsite in multiple languages for the international community. Japan provides updates in a timely manner and all of the updates provided to the IAEA are available on this webpage:

<https://www.iaea.org/newscenter/focus/fukushima/status-update>

2. Lifting of evacuation orders

Current condition of evacuation order areas of Fukushima Dai-ichi Nuclear Power Plant (as of September 2017)

In Tamura city, the order of *Preparation Areas for Lift of Evacuation Order* was removed on April 1st2014. In Naraha town, the order of *Preparation Areas for Lift of Evacuation Order* was removed on September 5th 2015. In Katsurao village, the order of *Habitation Restricted Areas* and *Preparation Areas for Lift of Evacuation Order* were removed on June 12th 2016. In Kawauchi village, the order of *Preparation Areas for Lift of Evacuation Order* was removed on June 14th2016. In Minamisoma city, the order of *Habitation Restricted Areas* and the order of *Preparation Areas for Lift of Evacuation Order* were removed on July 12th2016. In Iitate

village, Kawamata town and Namie town, the order of *Habitation Restricted Areas* and *Preparation Areas for Lift of Evacuation Order* were removed on March 31st 2017. In Tomioka town, the order of *Habitation Restricted Areas* and the order of *Preparation Areas for Lift of Evacuation Order* were removed on April 1 2017. In Okuma town, the order of *Habitation Restricted Areas* and the order of *Preparation Areas for Lift of Evacuation Order* were removed on April 10 2019. Except for the evacuation orders Futaba town, all of the order of *Habitation Restricted Areas* and the order of *Preparation Areas for Lift of Evacuation Order* were removed by spring 2019.

As for cities, towns, and villages, where evacuation orders were removed, it was confirmed that annual cumulative dose, the total radiation dose which residents in the cities, towns, and villages would receive per year, was surely below 20 mSv, and also the reconstruction of infrastructure necessary for people's daily life and decontamination were steadily advancing. In the wake of consultation with these cities, towns, and villages and adequate explanation to the residents through briefing sessions and by other means, the above-mentioned lift of the evacuation order were determined.

<Reference>Classification of evacuation orders:

- Preparation Areas for Lift of Evacuation Order

Entry into the area is permitted. Overnight stay in the area is generally prohibited. Business activities are permitted except those to be provided for residents living inside the area.

- Habitation Restricted Areas

Entry into the area is permitted.

Overnight stay in the area is prohibited in principle. Business activities are permitted but limited in some cases.

- Areas where Returning is Difficult

Entry into the area is prohibited in principle and staying in this area is also prohibited.

3. Relevant activities in disseminating information to the public

(1) Press Conference

Recovery operations at the Fukushima Daiichi NPS including contaminated water issues are one of the major issues which the Government of Japan has been focusing on. Since progress has been made frequently, there are updates arising on a daily basis. To explain the updates to the public, the Government of Japan disseminates the relevant information through press conferences. The Chief Cabinet Secretary and the Minister of Economy, Trade and Industry are the main briefers of the press conference, but other ministers or press secretaries may also be the briefer, depending on the subject.

(2) Information delivery to media

The government has been providing relevant information for both the domestic and the foreign press including that stationed in Tokyo and for other media, using various means such as press conferences, press briefings, press tours and press releases. For example, the Fisheries

Agency has conducted a media tour to a radioactivity monitoring site for fishery products (Marine Ecology Research Institute) in order to facilitate better understanding for monitoring on fishery products.

(3) Providing information to foreign nations

Whenever there is a significant update, the Ministry of Foreign Affairs sends out a notification with relevant information to all foreign missions stationed in Tokyo. The same information is conveyed to all Japanese embassies, consulate generals, and missions. As necessary, the information would be shared with foreign nations and relevant organizations through these diplomatic channels.

In addition, the Ministry of Foreign Affairs holds briefing sessions on Fukushima Daiichi NPS issues for the foreign missions stationed in Tokyo, when there is a significant update. The information on the last briefing session is shown in the link below.

http://www.mofa.go.jp/dns/inec/page22e_000751.html

Furthermore, the Ministry of Economy, Trade and Industry (METI) has produced a short video clip on the current situation in Fukushima Daiichi NPS and a brochure “an important stories on Decommissioning.”

The video clip and the brochure are available in the following link:

<https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/index.html>

(4) Measures taken by TEPCO

TEPCO has thus far been providing briefings on the status of Fukushima Daiichi NPS. In June and October 2014, in order to supplement such briefings, it has arranged for field observation tours of Fukushima Daiichi NPS for diplomatic officials and employees of embassies to Japan.

These briefings have been conducted with the aim of facilitating a correct understanding through the expeditious communication of accurate information outside of Japan, as well as maintaining TEPCO’s accountability as the main party responsible for the accident.

The purpose of the field tours is to enable participants to observe the actual circumstances as they are at the power station by viewing and touring the actual site, in conjunction with the briefings at diplomatic missions. Moreover, TEPCO expects to utilize the network of diplomatic officials to build a new relationship, and provide a connection with TEPCO which had not been open before conducting these tours.

(5) Disseminating information to Japanese populations

In general, the information is shared with Japanese populations through the channels shown above in (1)-(2). In addition to these efforts, the Government of Japan has improved public communication by enriching the content of relevant ministries’ webpage and by hosting a local briefing session on a case by case basis. METI regularly informs the progress of the decommissioning activities and contaminated water countermeasures to Fukushima prefecture and 13 local municipalities surrounding the site through video conference and direct visits.

4. Efforts on eliminating negative reputation impact and risk communication

(1) The Strategy for the Enhancement of the Elimination of Negative Reputation Impact and Risk Communication

In December 2017, the Government of Japan formulated the “The Strategy for the Enhancement of the Elimination of Negative Reputation Impact and for Risk Communication”,

based on a thorough review of the past efforts by relevant ministries and agencies, in order to clear up negative reputation impact which lacks in scientific grounds, and unfounded prejudice and discrimination.

In addition to the risk communication with the affected people, this strategy, focusing on providing information to the general public in a simple manner, specifies objects and contents for information in order of importance, from three perspectives, that is, “Have people know”, “Have people eat” and “Have people come”, and examines concrete ways of delivering information. Under this strategy, relevant ministries and agencies cooperate in a unified manner both at home and abroad.

(a) Have people know

Inform the general public, mostly schoolchildren, their guardians, and expectant and nursing mothers, of basic points of radiation, health effects of radiation, the safety of foods and drinking water made in Fukushima, the status of the affected areas in which the recovery is in progress, etc.

(b) Have people eat

Inform retailers, distributors, consumers, embassies in Tokyo, and foreign VIPs, press, residents and tourists, of the appeal and tastiness of Fukushima products, system of ensuring the safety of foods and drinking water, the standards of radioactive substances, the control system of foods at production stage, etc.

(c) Have people come

Inform teachers, those involved with a Parent-Teacher Association, travel agencies, foreign tourists, VIPs and press, and visitors from outside Fukushima, of the attraction of Fukushima as a destination, air dose rate and the safety of foods in Fukushima, and the supports for educational travels provided by Fukushima Prefecture.

(2) The Policy Package on Radioactive Risk Communication for Evacuees Returning to Their Homes

In February 2014, the Government of Japan compiled the “The Policy Package on Radioactive Risk Communication for Evacuees Returning to Their Homes”, in order to promote the implementation of detailed risk communication in response to the concerns of individuals. Relevant ministries and agencies also work together to promote measures including the organization of follow-up meetings on the policy package, focusing on the viewpoints of (a) dissemination of accurate and easy-to-understand information, (b) continuous development of risk communication on a national scale, and (c) improving detailed risk communication.

(3) Practical measures for evacuees to return their homes by NRA

NRA formulated practical measures of radiation protection for the evacuees, who will return their homes, from scientific and technological points of view in cooperation with other governmental organizations. The practical measures continue to address the difficulties which the evacuees have been facing. It is expected that the practical measures will be helpful for the evacuees to make decisions whether they return their homes or not.

The detail of these measures taken by NRA is available in the following link:

<https://www.nsr.go.jp/data/000067234.pdf>

7.2: Websites for your reference

Further information on each section above is available at the following websites:

The Prime Minister's Office

<http://japan.kantei.go.jp/ongoingtopics/waterissues.html>

The Food Safety Commission (FSC)

http://www.fsc.go.jp/english/emerg/radiological_index_e1.html

The Reconstruction Agency (RA)

<http://www.reconstruction.go.jp/english/>

The Ministry of Foreign Affairs (MOFA)

<http://www.mofa.go.jp/info/visit/incidents/index.html>

The Ministry of Health Labour and Welfare (MHLW)

http://www.mhlw.go.jp/english/topics/2011eq/index_food_policies.html

The Ministry of Agriculture, Forestry and Fisheries (MAFF)

http://www.maff.go.jp/e/quake/press_110312-1.html

The Fisheries Agency (FA)

<http://www.jfa.maff.go.jp/e/index.html>

The Ministry of Economy, Trade and Industry (METI)

<http://www.meti.go.jp/english/earthquake/nuclear/decommissioning/index.html>

The Ministry of the Environment (MOE)

<http://iosen.env.go.jp/en/>

The Nuclear Regulation Authority (NRA)

<http://www.nsr.go.jp/english/index.html>

The Japan Atomic Energy Agency (JAEA)

<http://www.jaea.go.jp/english/index.html>

Tokyo Electric Power Company (TEPCO)

<http://www.tepco.co.jp/en/nu/fukushima-np/index-e.html>

Fukushima Daiichi Decontamination & Decommissioning Engineering Company

http://www.tepco.co.jp/en/press/corp-com/release/2014/1235009_5892.html

Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF)

http://www.ndf.go.jp/soshiki/pamph_e.pdf

International Research Institute for Nuclear Decommissioning (IRID)

<http://irid.or.jp/en/>

The Collaborative Laboratories for Advanced Decommissioning Science (CLADS)

<https://fukushima.jaea.go.jp/english/decommissioning/>

IAEA assessment on aspects presented in the July 2019 report ‘Events and highlights on the progress related to recovery operations at Fukushima Daiichi Nuclear Power Station’

Contaminated water management (including groundwater control and reducing generation of contaminated water)

Japan reported that all portions of the frozen-soil walls have been below 0 °C since September 2018 and that maintenance operations started at all sections of the walls in February 2019.

Japan also reported that water flows between Units 1 and 2 were separated in September 2018, having already completed separation between Units 3 and 4 in December 2017. Therefore, Japan stated that the milestone in the “Mid- and Long-Term Roadmap” for the separation of the connections between Units 1 and 2 and Units 3 and 4 had been achieved and that stagnant water treatment in buildings at these Units will be completed in 2020, in line with the “Mid- and Long-Term Roadmap”.

Japan further reported that multi-layered measures had reduced the groundwater inflow into buildings. Inflow of the groundwater and rainwater into the buildings decreased from 350 m³/day (FY2014) to 100 m³/day (FY2018). Generation of contaminated water decreased from 470 m³/day to 170 m³/day over the same period.

The IAEA acknowledges the continuous efforts that have been made by Japan for controlling the groundwater level and the resulting significant decrease of groundwater inflow into the buildings in the period between FY2014 and FY2018.

Storage of ALPS treated water

Japan reported that the Advanced Liquid Processing System (ALPS) treated water continues to be stored in tanks located on the hill at the site. Replacement of flanged tanks with more reliable welded-joint tanks is underway. Water already treated to remove strontium, prior to treatment by ALPS and stored in flanged tanks, was further treated and transferred to welded-joint tanks (transfer completed in November 2018). Transfer of ALPS treated water to welded-joint tanks was completed in March 2019. The total amount of stored water is approximately 1.04 million m³ as of June 2019.

According to findings of the 4th IAEA Fukushima Daiichi Peer Review Mission¹, it is expected that the full capacity of 1.37 million m³ for the storage of ALPS treated water will be reached within the coming three to four years, assuming the current site facility planning for tank construction.

The IAEA acknowledges the updated information and refers to the first advisory point provided in the 4th Peer Review Mission report: “a decision on the disposition path for the stored ALPS treated water containing tritium and other radionuclides, after further treatment as needed, must be taken urgently, engaging all stakeholders, to ensure the sustainability of the decommissioning activities and of the safe and effective implementation of other risk reduction measures.”

¹ See <https://www.iaea.org/sites/default/files/19/01/missionreport-310119.pdf>

Fuel removal from Units 1, 2 and 3

Japan reported that the removal of small rubble in the east-side area around the spent fuel pool (SFP) in Unit 1 started on 18 March 2019 using pliers and suction equipment. In addition, rubble removal in the same area started on 2 April 2019 using a remote-controlled machine.

Japan also reported that during the period 2-16 April 2019, a water injection reduction test was conducted at Unit 2, in which the water injection rate into the reactor was temporarily reduced to check for temperature variation. Based on the results of this first test, a second test to suspend water injection for approximately seven hours was conducted during the period 13-24 May 2019. Based on the results of these two tests and using an updated heat balance evaluation, improvements will be made to the water injection strategy, including optimization of the emergency response procedures.

In addition, Japan reported on the commencement, on 15 April 2019, of the removal of 514 spent fuel assemblies and 52 non-irradiated fuel assemblies (a total of 566 assemblies), that are stored in the Unit 3 SFP. The dust density in the surrounding environment is monitored and preparatory work and actual fuel removal in this SFP are implemented with safety as the highest priority. On 23 April 2019, seven non-irradiated fuel assemblies were loaded into a transport container and taken to the common pool. The experience gained from this first fuel removal operation was used to improve procedures and facilities for removal of the remaining fuel. Training in fuel removal is being provided prior to the second fuel removal from this SFP into transport containers, that has been executed from July 2019.

The IAEA notes the water injection reduction test which was recently completed in Unit 2.

The IAEA acknowledges the ongoing progress toward fuel removal from SFPs in Units 1, 2 and 3 and takes notice of the scheduled commencement of fuel removal from the Unit 3 SFP.

Off-site decontamination

Japan provided updated progress on the transportation of removed soil and waste to the Interim Storage Facility (ISF). This update does not cover the “Difficult-to-Return Zones (DRZ)”. In addition, Japan reported² that 2.624 million m³ of removed soil and waste have been transported to the ISF as of end of March 2019, out of a total volume of 14 million m³ as per the latest projection. It is planned to deliver an additional 4 million m³ of removed soil and waste to the ISF by the end of March 2020.

The IAEA acknowledges the progress made by Japan since the last report of 2018, particularly an increased volume of transportation of removed soil and waste to the ISF, which should help reduce radiological risks in surrounding off-site areas where such soil and waste are temporarily placed.

² See <http://josen.env.go.jp/en/storage/>

Sea area monitoring results

Japan continued to report the sea area monitoring results and stated that there has been no significant change since the last report³. These monitoring results continue to be published regularly by the Nuclear Regulation Authority (NRA) of Japan and the Tokyo Electric Power Company (TEPCO). The data shows that radioactivity levels in the marine environment (seawater, sediment and biota) in the areas around TEPCO's Fukushima Daiichi NPS have not been adversely affected by decommissioning and contaminated water management activities on-site. In particular, the discharges of treated and monitored groundwater continue to have no detectable effect on the levels of radioactivity in the marine environment, which were measured in these areas during the period covered by this report.

Based on the information provided by Japan, no significant changes were observed in the monitoring results for seawater, sediment and marine biota during the period covered by this report. The levels measured by Japan in the marine environment are low and relatively stable. For the purpose of public reassurance, the IAEA encourages the continuation of sea area monitoring, particularly considering the ongoing authorized discharges of treated and monitored groundwater into the ocean.

Sea area monitoring data quality assurance

The IAEA continues to assist the Government of Japan in ensuring that the regularly updated Sea Area Monitoring programme is comprehensive, credible and transparent. To test the sampling and analytical performance of the Japanese laboratories for the analysis of radionuclides in seawater, sediment and fisheries samples, the IAEA has organised proficiency tests and inter-laboratory comparison exercises since 2014.

Seawater, marine sediment and fish samples from coastal waters in the Fukushima Prefecture were jointly collected by IAEA and Japanese experts in June 2019 for the ninth inter-laboratory comparison exercise⁴. For this exercise, two experts from the ALMERA network (Analytical Laboratories for the Measurement of Environmental Radioactivity) also participated in the sampling mission. The samples will be analysed by IAEA, participating Japanese laboratories and the two ALMERA laboratories, and the results reported before the end of 2019.

The sixth proficiency test is currently ongoing.

The results of previous proficiency tests and inter-laboratory comparison exercises, show that Japanese laboratories monitoring seawater, marine sediment and fish from near the Fukushima Daiichi NPS produce reliable data.

The IAEA considers that the extensive data quality assurance programme contributes to building confidence of the stakeholders in the accuracy and quality of the sea area monitoring data⁵.

³ See the June 2018 report 'Events and highlights on the progress related to recovery operations at Fukushima Daiichi Nuclear Power Station'

⁴ See <https://www.iaea.org/newscenter/pressreleases/iaea-experts-collect-seawater-marine-sediment-and-fish-samples-near-fukushima-daiichi-nuclear-power-station>

⁵ A report on the first three years of the inter-laboratory comparison exercise activities was published in July 2017: <https://www.iaea.org/sites/default/files/project-report270717.pdf>

Food products

As reported by Japan, a comprehensive programme is in place to monitor food, including seafood, and national regulatory limits for radionuclides of caesium remain in place. Areas where food is found to be above these limits are subject to restrictions to prevent such food from entering the food supply chain. A summary of the current situation and the measures taken by the Government of Japan is published on the website of the Japan Ministry of Health, Labour and Welfare⁶.

Based on the information provided by Japan, food restrictions continue to be revised and updated as necessary in line with food monitoring results. This indicates continued vigilance of the authorities in Japan and their commitment to protecting consumers and trade. The situation with regard to the safety of the food supply, fishery and agricultural production continues to remain stable. Monitoring foods, appropriate regulatory action and public communication are helping to maintain confidence in the safety of the food supply.

Based on the information that has been made available, the Joint FAO/IAEA Division understands that measures to monitor and respond to issues regarding radionuclide contamination of food are appropriate, and that the food supply chain is controlled effectively by the relevant authorities.

⁶ For example, in English at http://www.mhlw.go.jp/english/topics/2011eq/dl/food-130926_1.pdf