Information (13:30), January 29, 2020

To All Missions (Embassies, Consular posts and International Organizations in Japan)

Report on the discharge record and the seawater monitoring results at Fukushima Daiichi Nuclear Power Station until December, 2019

The Ministry of Foreign Affairs wishes to provide all international Missions in Japan with a report on the summary of decommissioning and contaminated water management, the discharge record and seawater monitoring results with regard to groundwater pumped from the subdrain and groundwater drain systems, as well as, bypassing groundwater pumped during the month of December at Fukushima Daiichi Nuclear Power Station (NPS).

1. Summary of decommissioning and contaminated water management

In December, the summary of monthly progress on decommissioning and contaminated water management of Fukushima Daiichi NPS was issued shown in Appendix 1. For more information, please see the following URL:
https://www.meti.go.jp/english/earthquake/nuclear/decommissioning/index.html#cs

2. Subdrain and Groundwater Drain Systems

In December, purified groundwater pumped from the subdrain and groundwater drain systems was discharged on the dates shown in Appendix 2. Prior to every discharge, an analysis on the quality of the purified groundwater to be discharged was conducted by Tokyo Electric Power Company (TEPCO) and the results were announced.

All the test results during the month of December have confirmed that the radiation levels of sampled water were substantially below the operational targets set by TEPCO (these operational targets are well below the density limit specified by the Reactor Regulation). The results of these analyses were also confirmed by third-party organization (Tohoku Ryokka Kankyohozen Co.).

In addition, TEPCO and Japan Atomic Energy Agency (JAEA), at the request of the Government of Japan, regularly conduct more detailed analyses on the purified groundwater. The results of JAEA's latest analyses confirmed that TEPCO's analyses were accurate and verified that the radiation levels of sampled groundwater was substantially below the operational target (see Appendix 3).

Moreover, TEPCO publishes the results of analyses conducted on seawater sampled during the discharge operation at the nearest seawater sampling post from the discharge point (see Appendix 4). The results show that the radiation levels of seawater remain lower than the density limit specified by the Reactor Regulation and significant change in the radioactivity has not been observed.

3. Groundwater Bypassing

In December, the pumped bypassing groundwater was discharged on the dates shown in Appendix 5. Prior to every discharge, an analysis on the quality of the groundwater to be discharged was conducted by TEPCO and the results were announced.

All the test results during the month of November have confirmed that the radiation levels of sampled water were substantially below the operational targets set by TEPCO (these operational targets are well below the density limit specified by the Reactor Regulation). The results of these analyses were also confirmed by Japan Chemical Analysis Center.

In addition, TEPCO and JAEA, at the request of the Government of Japan, regularly conduct more detailed analyses on the groundwater. The results of JAEA's latest analyses confirmed that TEPCO's analyses were accurate and verified that the radiation levels of the sampled groundwater were substantially below the operational target (see Appendix 6).

Moreover, TEPCO publishes analysis results on seawater sampled during the discharge operation at the nearest seawater sampling post from the discharge point (see Appendix 7). The result shows that the radiation levels in seawater remain lower than the density limit specified by the Reactor Regulation and significant change in the radioactivity has not been observed. The analysis had been conducted once a month until March 2017. Since April 2017, it is conducted four times a year because there has been no significant fluctuation in the concentration of radioactive materials in the sea water, and no influence on the surrounding environment has been confirmed.

The sampling process for analyses conducted this month is the same as the one conducted in the information disseminated last month. Results of the analyses are shown in the attached appendices:

(For further information, please contact TEPCO at (Tel: 03-6373-1111) or refer to the TEPCO's website:
http://www.tepco.co.jp/en/nu/fukushima-np/handouts/index-e.html)

Contact: International Nuclear Cooperation Division,
Ministry of Foreign Affairs, Tel 03-5501-8227

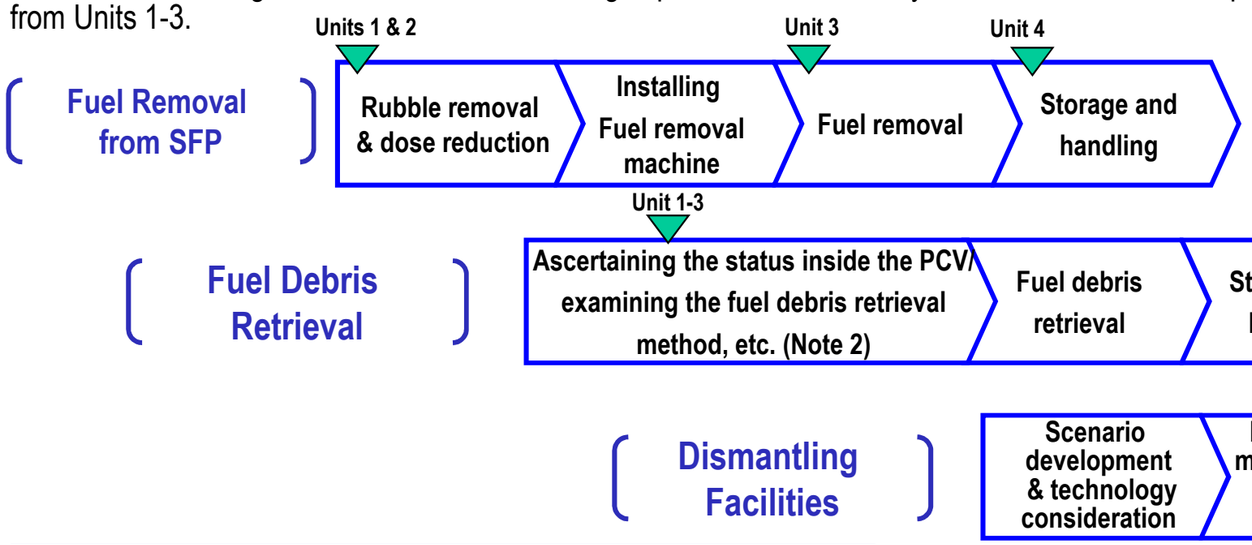
Summary of Decommissioning and Contaminated Water Management

Appendix 1
December 19, 2019

Secretariat of the Team for Countermeasures for Decommissioning and Contaminated Water Treatment

Main decommissioning work and steps

Fuel removal from the Unit 4 SFP was completed on December 22, 2014 and removal from the Unit 3 SFP has been underway since April 15, 2019. Dust density in the surrounding environment is being monitored and work is being implemented with safety first. Work continues sequentially toward the start of fuel removal from Units 1 and 2 and debris (Note 1) retrieval from Units 1-3.



(Note 1) Fuel assemblies having melted through in the accident

Unit 1: Fuel removal scheduled to start in FY2023
Unit 2: Fuel removal scheduled to start in FY2023
Unit 3: Fuel removal scheduled to start around mid-FY2018*
Unit 4: Fuel removal completed in 2014

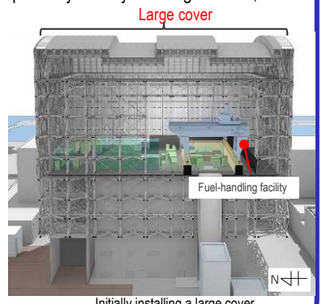
* Fuel removal started from April 15, 2019.

(Note 2)
The method employed to retrieve fuel debris from the first unit will be confirmed in FY2019.

Fuel removal from the spent fuel pool

Toward fuel removal from the Unit 1 spent fuel pool, investigations have been implemented to ascertain the conditions of the fallen roof on the south side and the contamination of the well plug. Based on the results of these investigations, "the method to initially install a large cover over the Reactor Building and then remove rubble inside the cover" was selected to ensure a safer and more secure removal. Details of the selected method will be designed and the process of fuel removal will be refined.

<Reference> Progress to date
Rubble removal on the north side of the operating floor started from January 2018 and has been implemented sequentially. In July and August 2019, the well plug, which was misaligned from its normal position, was investigated and in August and September, the conditions of the overhead crane were checked. Based on the results of these investigations, as the removal requires more careful work taking dust scattering into consideration, two methods were examined: installing a cover after rubble removal and initially installing a large cover over the Reactor Building and then removing rubble inside the cover.



Initially installing a large cover for fuel removal (image)

Three principles behind contaminated water countermeasures

Countermeasures for contaminated water are implemented in accordance with the following three principles:

1 **Remove** contamination sources

① Purification using Multi-nuclide removal equipment and other measures
② Removal of contaminated water from the trench (Note 3)

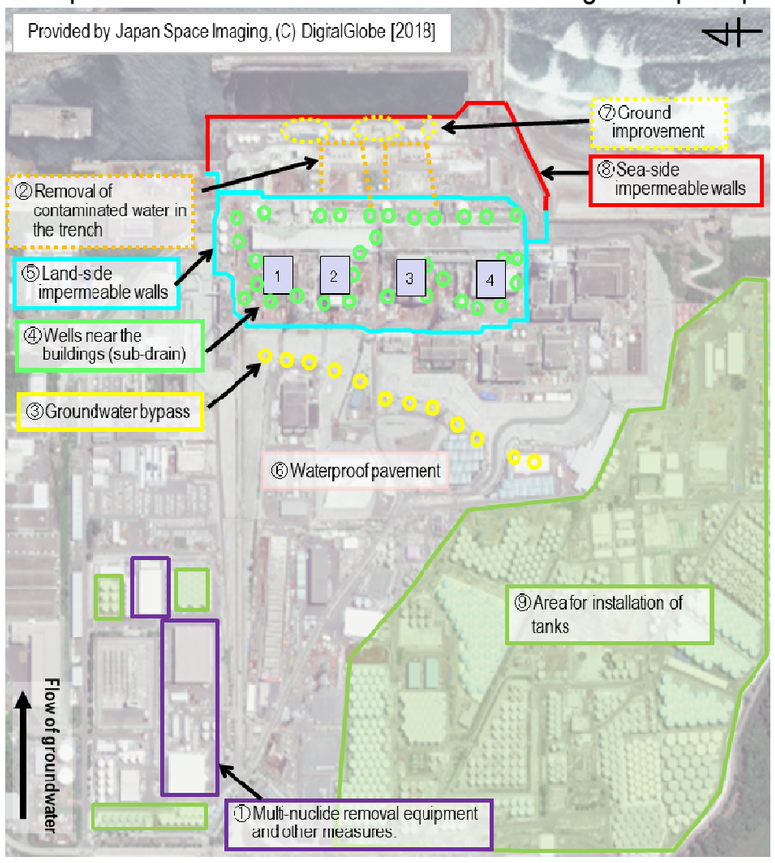
(Note 3) Underground tunnel containing pipes.

2. **Redirect groundwater** from contamination sources

③ Pump up groundwater for bypass
④ Pump up groundwater near buildings
⑤ Land-side impermeable walls (frozen-soil walls)
⑥ Waterproof pavement

3. **Prevent leakage** of contaminated water

⑦ Enhance soil by adding sodium silicate
⑧ Sea-side impermeable walls
⑨ Increase the number of (welded-joint) tanks



Multi-nuclide removal equipment (ALPS), etc.

- This equipment removes radionuclides from the contaminated water in tanks and reduces risks.
- Treatment of contaminated water (RO concentrated salt water) was completed in May 2015 with multi-nuclide removal equipment, additional multi-nuclide removal equipment installed by TEPCO (operation commenced in September 2014) and a Japanese Government subsidy project (operation commenced in October 2014).
- Strontium-treated water from equipment other than ALPS is being re-treated in ALPS.


(High-performance multi-nuclide removal equipment)

Reducing the generation of contaminated water through multi-layered measures

- Multi-layered measures are implemented to suppress the inflow of rainwater and groundwater into buildings.
- Multi-layered contaminated water management measures, including land-side impermeable walls and subdrains, have stabilized the groundwater at a low level. The increase in the amount of contaminated water generated during rainfall is being suppressed by repairing damaged portions of building roofs, facing onsite, etc.
- Through these measures, the generation of contaminated water was reduced from approx. 470 m^3/day (in FY2014) to approx. 170 m^3/day (in FY2018).
- The groundwater level around Unit 1-4 Reactor Buildings will remain limited by steadily operating land-side impermeable walls. In addition, measures to prevent the inflow of rainwater, including repairing damaged parts of building roofs and facing, continue to reduce the generation of contaminated water still further.


Inside the land-side impermeable wall


Outside the land-side impermeable wall

Replacing flanged tanks with welded-joint tanks

- Flanged tanks are being replaced with more reliable welded-joint tanks.
- 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.


(Installed welded-joint tanks)

Progress Status and Future Challenges of the Mid-and-Long-Term Roadmap toward Decommissioning of TEPCO Holdings Fukushima Daiichi Nuclear Power Station (Outline)

Progress status

◆ The temperatures of the Reactor Pressure Vessel (RPV) and Primary Containment Vessel (PCV) of Units 1-3 have been maintained within the range of approx. 20-30°C[*1] over the past month. There was no significant change in the density of radioactive materials newly released from Reactor Buildings into the air[*2]. It was concluded that the comprehensive cold shutdown condition had been maintained.

* 1 The values varied somewhat, depending on the unit and location of the thermometer .

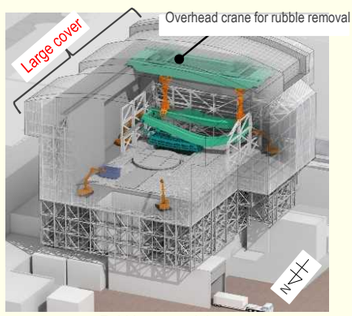
* 2 In November 2019, the radiation exposure dose due to the release of radioactive materials from the Unit 1-4 Reactor Buildings was evaluated at less than 0.00007 mSv/year at the site boundary. The annual radiation dose from natural radiation is approx. 2.1 mSv/year (average in Japan).

Selection of the method to initially install a large cover and remove rubble inside the cover for Unit 1

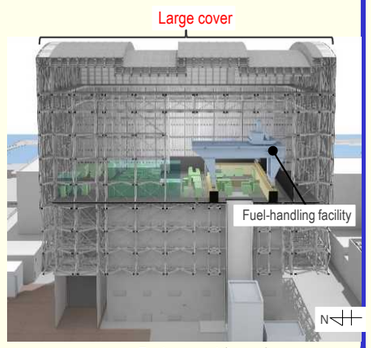
Toward fuel removal from Unit 1, two methods were examined: (i) installing a cover after rubble removal and (ii) initially installing a large cover over the Reactor Building and then removing rubble inside the cover..

Following the examination, “the method to initially install a large cover over the Reactor Building and then remove rubble inside the cover” was selected to ensure a safer and more secure removal.

Details of the selected method will be designed and the fuel removal process will be refined.



Rubble removal (image)



Fuel removal (image)

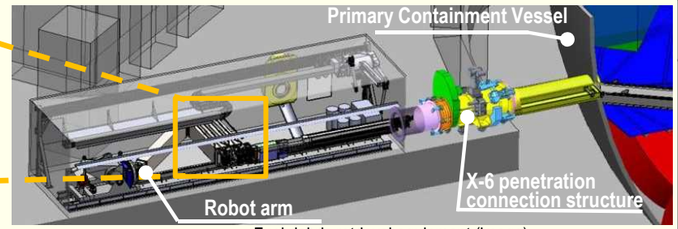
Evaluated that Unit 2 is suitable for the first implementing unit for fuel debris retrieval

For fuel debris retrieval from the first implementing unit, methods have been examined; taking the progress status in internal investigations of the Primary Containment Vessel (PCV), the status of improvement in the work environment and other factors into consideration.

The characteristics of the debris acquired by the contact investigation in February 2019 and , the status of improvement in the environment on the 1st floor of the Reactor Building for access to PCV and the engineering works with these results taken into consideration and Unit 2 was evaluated that it is suitable for the first implementing unit for fuel debris retrieval.

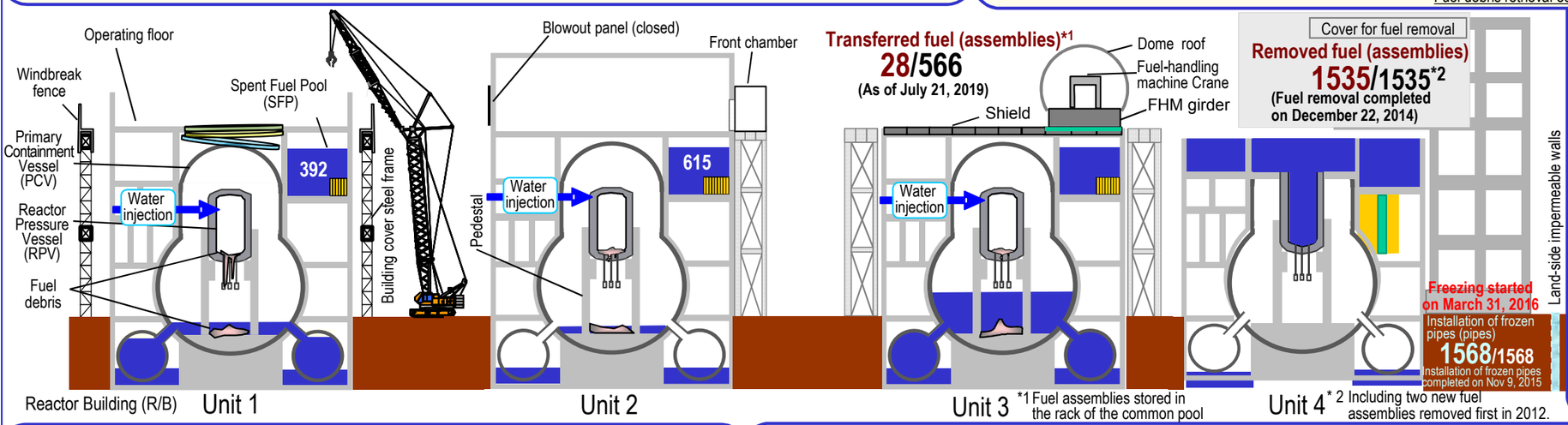
As the method, to determine, a trial retrieval using a robot arm will begin. After verifying and checking this retrieval method, the scale will be gradually expanded using equipment with the same mechanism.


Robot arm



Fuel debris retrieval equipment (image)

Experimental retrieval	Gradual expansion of the retrieval scope
Debris collection equipment	**Debris collection equipment**
 Metal brush / Vacuum container	 Gripper tool / Drilling and collection tool



*1 Fuel assemblies stored in the rack of the common pool

*2 Including two new fuel assemblies removed first in 2012.

		Unit 1	Unit 2	Unit 3
Safety	Dose at the workplace	High (approx. 600mSv/h)	**Low (approx. 5mSv/h)**	Slightly high (approx. 10mSv/h)
Safety	Containment of radioactive materials	**Slightly high airtightness**	**High air tightness (no hydrogen explosion and healthy building)**	Low airtightness
Certainty	Condition of debris	No information	**Information obtained**	**Information obtained**
Certainty	Access route	No information	**Information obtained**	**Information obtained**
Swiftness		Removal of high-dose pipes is required	**Workplace is improved**	Decrease of water level inside PCV is required

Comparison of each unit

Dismantling for the 5th block of the Unit 1/2 exhaust stack

For the Unit 1/2 exhaust stack, dismantling of the 4th block was completed on December 4 and the subdrain suspended due to interference of the work was recovered on December 6.

Based on the following review of work to date and refining of the whole process, dismantling is estimated to be completed around early May in 2020*

Dismantling of the 5th block started from December 16 and was completed on December 19.

* As spare dates for bad weather, trouble of equipment and other accidents are not considered, the estimated date may change.


Before dismantling


Dismantling of the 5th block was completed

Progress status in dismantling of the exhaust stack

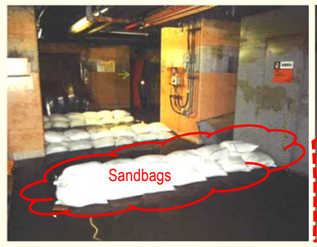
Check of the conditions of sandbags installed on the basement floor of the HTI Building

To check the conditions of Zeolite sandbags installed on the basement floor of the High Temperature Incinerator (HTI) Building as a contaminated water treatment measure immediately after the earthquake, a dose investigation using an underwater drone and a visual inspection started from December 3.

The investigation confirmed that sandbags were broken and confirmed that the maximum surface dose of sandbags within the investigative scope was 4,000 mSv/h.

Based on the investigative results, the dose effect when the basement floor is exposed will be assessed.

* The work environment for operating the underwater drone was approx. 0.1-0.3 mSv/h



Condition immediately after the earthquake

Current condition of Zeolite sandbags

Toward resumption of fuel removal from Unit 3

Measures were implemented for defects detected during the preparatory work toward resumption of fuel removal from Unit 3 and operation was checked using dummy fuel. On December 14, however, interference of cans inside the transportation cask and dummy fuel was identified.

Though the following investigation confirmed slight leaning of the FHM mast, measures, including a review of the procedures, will be implemented to complete fuel removal within FY2020.

Appendix 2

Results of analyses on the quality of the purified groundwater pumped from the subdrain and groundwater drain systems at Fukushima Daiichi NPS (made available by TEPCO prior to discharge)

(Unit: Bq/L)

Date of sampling *Date of discharge	Detected nuclides	Analytical body	
		TEPCO	Third-party organization
December 25th, 2019 *Discharged on December 30th	Cs-134	ND (0.80)	ND (0.61)
	Cs-137	ND (0.65)	ND (0.59)
	Gross β	ND (1.8)	0.36
	H-3	910	970
December 23rd, 2019 *Discharged on December 28th	Cs-134	ND (0.62)	ND (0.55)
	Cs-137	ND (0.68)	ND (0.49)
	Gross β	ND (1.9)	ND (0.32)
	H-3	880	940
December 21st, 2019 *Discharged on December 26th	Cs-134	ND (0.53)	ND (0.62)
	Cs-137	ND (0.70)	ND (0.64)
	Gross β	ND (1.8)	ND (0.33)
	H-3	930	1,000
December 20th, 2019 *Discharged on December 25th	Cs-134	ND (0.79)	ND (0.64)
	Cs-137	ND (0.60)	ND (0.59)
	Gross β	ND (1.9)	ND (0.32)
	H-3	830	900
December 19th, 2019 *Discharged on December 24th	Cs-134	ND (0.65)	ND (0.67)
	Cs-137	ND (0.75)	ND (0.45)
	Gross β	ND (1.9)	ND (0.36)
	H-3	860	940
December 18th, 2019 *Discharged on December 23rd	Cs-134	ND (0.57)	ND (0.64)
	Cs-137	ND (0.71)	ND (0.49)
	Gross β	ND (0.65)	ND (0.34)
	H-3	900	970
December 16th, 2019 *Discharged on December 21st	Cs-134	ND (0.72)	ND (0.40)
	Cs-137	ND (0.58)	ND (0.62)
	Gross β	ND (1.7)	0.36
	H-3	860	930
December 15th, 2019 *Discharged on	Cs-134	ND (0.54)	ND (0.58)
	Cs-137	ND (0.53)	ND (0.49)

December 20th	Gross β	ND (1.9)	ND (0.33)
	H-3	820	870
December 13th, 2019 *Discharged on December 18th	Cs-134	ND (0.62)	ND (0.55)
	Cs-137	ND (0.68)	ND (0.57)
	Gross β	ND (1.7)	0.39
	H-3	840	890
December 12th, 2019 *Discharged on December 17th	Cs-134	ND (0.67)	ND (0.64)
	Cs-137	ND (0.58)	ND (0.69)
	Gross β	ND (1.8)	ND (0.32)
	H-3	830	890
December 11th, 2019 *Discharged on December 16th	Cs-134	ND (0.80)	ND (0.59)
	Cs-137	ND (0.69)	ND (0.56)
	Gross β	ND (2.0)	0.48
	H-3	810	850
December 10th, 2019 *Discharged on December 15th	Cs-134	ND (0.52)	ND (0.64)
	Cs-137	ND (0.58)	ND (0.74)
	Gross β	ND (1.9)	ND (0.36)
	H-3	790	820
December 9th, 2019 *Discharged on December 14th	Cs-134	ND (0.68)	ND (0.62)
	Cs-137	ND (0.63)	ND (0.49)
	Gross β	ND (0.62)	ND (0.33)
	H-3	760	820
December 5th, 2019 *Discharged on December 10th	Cs-134	ND (0.44)	ND (0.61)
	Cs-137	ND (0.53)	ND (0.56)
	Gross β	ND (1.8)	ND (0.31)
	H-3	800	840
December 4th, 2019 *Discharged on December 9th	Cs-134	ND (0.63)	ND (0.55)
	Cs-137	ND (0.58)	ND (0.69)
	Gross β	ND (2.0)	ND (0.35)
	H-3	680	750
December 3rd, 2019 *Discharged on December 8th	Cs-134	ND (0.76)	ND (0.64)
	Cs-137	ND (0.46)	ND (0.56)
	Gross β	ND (1.8)	ND (0.33)
	H-3	810	870
December 2nd, 2019 *Discharged on December 7th	Cs-134	ND (0.62)	ND (0.57)
	Cs-137	ND (0.68)	ND (0.62)
	Gross β	ND (1.8)	ND (0.31)
	H-3	770	800
November 1st, 2019 *Discharged on December 6th	Cs-134	ND (0.62)	ND (0.47)
	Cs-137	ND (0.75)	ND (0.62)
	Gross β	ND (0.64)	ND (0.35)
	H-3	720	760
November 30th, 2019	Cs-134	ND (0.79)	ND (0.71)

*Discharged on December 5th	Cs-137	ND (0.58)	ND (0.66)
	Gross β	ND (1.8)	ND (0.36)
	H-3	740	800
November 29th, 2019 *Discharged on December 4th	Cs-134	ND (0.76)	ND (0.92)
	Cs-137	ND (0.53)	ND (0.70)
	Gross β	ND (0.65)	ND (0.36)
	H-3	780	820
November 27th, 2019 *Discharged on December 2nd	Cs-134	ND (0.63)	ND (0.58)
	Cs-137	ND (0.63)	ND (0.67)
	Gross β	ND (1.9)	ND (0.38)
	H-3	680	720
November 26th, 2019 *Discharged on December 1st	Cs-134	ND (0.64)	ND (0.64)
	Cs-137	ND (0.63)	ND (0.70)
	Gross β	ND (2.3)	ND (0.36)
	H-3	960	1,000
November 25th, 2019 *Discharged on November 30th	Cs-134	ND (0.65)	ND (0.46)
	Cs-137	ND (0.53)	ND (0.49)
	Gross β	ND (2.0)	ND (0.34)
	H-3	650	690
November 24th, 2019 *Discharged on November 29th	Cs-134	ND (0.65)	ND (0.71)
	Cs-137	ND (0.63)	ND (0.83)
	Gross β	ND (2.0)	ND (0.33)
	H-3	640	680
November 23rd, 2019 *Discharged on November 28th	Cs-134	ND (0.54)	ND (0.59)
	Cs-137	ND (0.75)	ND (0.45)
	Gross β	ND (1.9)	ND (0.34)
	H-3	660	690
November 22nd, 2019 *Discharged on November 27th	Cs-134	ND (0.46)	ND (0.51)
	Cs-137	ND (0.58)	ND (0.62)
	Gross β	ND (1.8)	ND (0.33)
	H-3	670	700
November 21st, 2019 *Discharged on November 26th	Cs-134	ND (0.52)	ND (0.62)
	Cs-137	ND (0.68)	ND (0.69)
	Gross β	ND (1.8)	ND (0.33)
	H-3	650	700
November 20th, 2019 *Discharged on November 25th	Cs-134	ND (0.71)	ND (0.64)
	Cs-137	ND (0.53)	ND (0.71)
	Gross β	ND (1.8)	ND (0.33)
	H-3	610	670
November 19th, 2019 *Discharged on	Cs-134	ND (0.66)	ND (0.59)
	Cs-137	ND (0.53)	ND (0.52)

November 24th	Gross β	ND (0.69)	ND (0.34)
	H-3	640	680
November 18th, 2019 *Discharged on November 23rd	Cs-134	ND (0.52)	ND (0.54)
	Cs-137	ND (0.58)	ND (0.71)
	Gross β	ND (1.7)	ND (0.33)
	H-3	660	710
November 17th, 2019 *Discharged on November 22nd	Cs-134	ND (0.40)	ND (0.53)
	Cs-137	ND (0.63)	ND (0.64)
	Gross β	ND (2.1)	ND (0.28)
	H-3	710	770
November 16th, 2019 *Discharged on November 21st	Cs-134	ND (0.68)	ND (0.48)
	Cs-137	ND (0.75)	ND (0.74)
	Gross β	ND (2.0)	0.35
	H-3	690	730
November 15th, 2019 *Discharged on November 20th	Cs-134	ND (0.62)	ND (0.58)
	Cs-137	ND (0.63)	ND (0.71)
	Gross β	ND (1.8)	ND (0.38)
	H-3	660	690
November 14th, 2019 *Discharged on November 19th	Cs-134	ND (0.74)	ND (0.58)
	Cs-137	ND (0.68)	ND (0.59)
	Gross β	ND (1.8)	ND (0.37)
	H-3	610	660
November 13th, 2019 *Discharged on November 18th	Cs-134	ND (0.40)	ND (0.63)
	Cs-137	ND (0.53)	ND (0.59)
	Gross β	ND (1.8)	ND (0.36)
	H-3	610	660
November 12th, 2019 *Discharged on November 17th	Cs-134	ND (0.60)	ND (0.65)
	Cs-137	ND (0.68)	ND (0.76)
	Gross β	ND (2.0)	ND (0.32)
	H-3	660	710
November 11th, 2019 *Discharged on November 16th	Cs-134	ND (0.94)	ND (0.61)
	Cs-137	ND (0.53)	ND (0.49)
	Gross β	ND (1.9)	ND (0.33)
	H-3	730	800
November 10th, 2019 *Discharged on November 15th	Cs-134	ND (0.52)	ND (0.57)
	Cs-137	ND (0.46)	ND (0.53)
	Gross β	ND (0.64)	ND (0.34)
	H-3	710	770
November 9th, 2019 *Discharged on November 14th	Cs-134	ND (0.65)	ND (0.52)
	Cs-137	ND (0.68)	ND (0.67)
	Gross β	ND (1.9)	ND (0.34)
	H-3	690	590
November 8th, 2019	Cs-134	ND (0.44)	ND (0.62)

*Discharged on November 13th	Cs-137	ND (0.71)	ND (0.59)
	Gross β	ND (2.0)	ND (0.33)
	H-3	720	770
November 7th, 2019 *Discharged on November 12th	Cs-134	ND (0.68)	ND (0.55)
	Cs-137	ND (0.58)	ND (0.56)
	Gross β	ND (2.1)	0.42
	H-3	700	770
November 6th, 2019 *Discharged on November 11th	Cs-134	ND (0.52)	ND (0.74)
	Cs-137	ND (0.68)	ND (0.70)
	Gross β	ND (1.8)	ND (0.35)
	H-3	760	830
November 5th, 2019 *Discharged on November 10th	Cs-134	ND (0.62)	ND (0.53)
	Cs-137	ND (0.63)	ND (0.59)
	Gross β	ND (2.2)	ND (0.35)
	H-3	720	770
November 5th, 2019 *Discharged on November 10th	Cs-134	ND (0.44)	ND (0.65)
	Cs-137	ND (0.58)	ND (0.62)
	Gross β	ND (2.2)	ND (0.35)
	H-3	790	820
November 4th, 2019 *Discharged on November 9th	Cs-134	ND (0.54)	ND (0.67)
	Cs-137	ND (0.58)	ND (0.56)
	Gross β	ND (1.9)	ND (0.37)
	H-3	570	620
November 4th, 2019 *Discharged on November 9th	Cs-134	ND (0.58)	ND (0.64)
	Cs-137	ND (0.68)	ND (0.62)
	Gross β	ND (1.9)	ND (0.35)
	H-3	660	700
November 3rd, 2019 *Discharged on November 8th	Cs-134	ND (0.83)	ND (0.60)
	Cs-137	ND (0.68)	ND (0.64)
	Gross β	ND (1.9)	ND (0.37)
	H-3	550	590
November 2nd, 2019 *Discharged on November 7th	Cs-134	ND (0.71)	ND (0.65)
	Cs-137	ND (0.68)	ND (0.56)
	Gross β	ND (2.2)	ND (0.34)
	H-3	710	770
November 1st, 2019 *Discharged on November 6th	Cs-134	ND (0.65)	ND (0.66)
	Cs-137	ND (0.58)	ND (0.69)
	Gross β	ND (0.78)	ND (0.36)
	H-3	810	870
October 31st, 2019 *Discharged on November 5th	Cs-134	ND (0.72)	ND (0.59)
	Cs-137	ND (0.63)	ND (0.64)
	Gross β	ND (2.0)	0.42
	H-3	780	850

October 30th, 2019 *Discharged on November 4th	Cs-134	ND (0.65)	ND (0.79)
	Cs-137	ND (0.68)	ND (0.80)
	Gross β	ND (2.3)	0.51
	H-3	760	830
October 30th, 2019 *Discharged on November 4th	Cs-134	ND (0.71)	ND (0.50)
	Cs-137	ND (0.63)	ND (0.69)
	Gross β	ND (2.3)	ND (0.38)
	H-3	820	860
October 29th, 2019 *Discharged on November 3rd	Cs-134	ND (0.64)	ND (0.71)
	Cs-137	ND (0.58)	ND (0.67)
	Gross β	ND (2.2)	0.41
	H-3	850	920
October 28th, 2019 *Discharged on November 2nd	Cs-134	ND (0.56)	ND (0.71)
	Cs-137	ND (0.58)	ND (0.70)
	Gross β	ND (2.0)	ND (0.38)
	H-3	910	1,000
October 27th, 2019 *Discharged on November 1st	Cs-134	ND (0.60)	ND (0.90)
	Cs-137	ND (0.58)	ND (0.80)
	Gross β	ND (2.0)	ND (0.35)
	H-3	980	1,100
October 26th, 2019 *Discharged on October 31st	Cs-134	ND (0.63)	ND (0.71)
	Cs-137	ND (0.68)	ND (0.74)
	Gross β	ND (1.8)	ND (0.37)
	H-3	910	1,000
October 25th, 2019 *Discharged on October 30th	Cs-134	ND (0.68)	ND (0.74)
	Cs-137	ND (0.58)	ND (0.74)
	Gross β	ND (0.69)	0.45
	H-3	900	960
October 24th, 2019 *Discharged on October 29th	Cs-134	ND (0.66)	ND (0.70)
	Cs-137	ND (0.71)	ND (0.49)
	Gross β	ND (1.8)	0.55
	H-3	880	950
October 24th, 2019 *Discharged on October 29th	Cs-134	ND (0.57)	ND (0.68)
	Cs-137	ND (0.53)	ND (0.66)
	Gross β	ND (2.1)	0.43
	H-3	930	910
October 23rd, 2019 *Discharged on October 28th	Cs-134	ND (0.44)	ND (0.67)
	Cs-137	ND (0.63)	ND (0.59)
	Gross β	ND (2.1)	0.39
	H-3	820	890
October 22nd, 2019 *Discharged on	Cs-134	ND (0.57)	ND (0.62)
	Cs-137	ND (0.63)	ND (0.56)

October 27th	Gross β	ND (2.0)	ND (0.34)
	H-3	890	960
October 22nd, 2019 *Discharged on October 27th	Cs-134	ND (0.55)	ND (0.65)
	Cs-137	ND (0.82)	ND (0.77)
	Gross β	ND (2.0)	0.39
	H-3	770	810
October 21st, 2019 *Discharged on October 26th	Cs-134	ND (0.62)	ND (0.62)
	Cs-137	ND (0.53)	ND (0.45)
	Gross β	ND (2.2)	0.47
	H-3	600	660
October 20th, 2019 *Discharged on October 25th	Cs-134	ND (0.70)	ND (0.64)
	Cs-137	ND (0.68)	ND (0.56)
	Gross β	ND (2.2)	ND (0.40)
	H-3	630	700
October 19th, 2019 *Discharged on October 24th	Cs-134	ND (0.74)	ND (0.61)
	Cs-137	ND (0.85)	ND (0.59)
	Gross β	ND (2.3)	ND (0.37)
	H-3	630	690
October 18th, 2019 *Discharged on October 23rd	Cs-134	ND (0.58)	ND (0.83)
	Cs-137	ND (0.68)	ND (0.70)
	Gross β	ND (0.75)	ND (0.35)
	H-3	690	750
October 17th, 2019 *Discharged on October 22nd	Cs-134	ND (0.40)	ND (0.55)
	Cs-137	ND (0.71)	ND (0.74)
	Gross β	ND (2.1)	0.39
	H-3	700	740
October 16th, 2019 *Discharged on October 21st	Cs-134	ND (0.67)	ND (0.73)
	Cs-137	ND (0.63)	ND (0.83)
	Gross β	ND (2.2)	0.51
	H-3	820	870
October 16th, 2019 *Discharged on October 21st	Cs-134	ND (0.76)	ND (0.61)
	Cs-137	ND (0.71)	ND (0.49)
	Gross β	ND (0.78)	0.39
	H-3	560	600
October 15th, 2019 *Discharged on October 21st	Cs-134	ND (0.57)	ND (0.59)
	Cs-137	ND (0.58)	ND (0.62)
	Gross β	ND (2.3)	ND (0.38)
	H-3	720	770
October 20th, 2019 *Discharged on October 14th	Cs-134	ND (0.40)	ND (0.85)
	Cs-137	ND (0.68)	ND (0.66)
	Gross β	ND (1.9)	ND (0.39)
	H-3	930	1,000

October 19th, 2019 *Discharged on October 13th	Cs-134	ND (0.49)	ND (0.74)
	Cs-137	ND (0.63)	ND (0.70)
	Gross β	ND (2.3)	ND (0.37)
	H-3	860	950
October 19th, 2019 *Discharged on October 13th	Cs-134	ND (0.58)	ND (0.46)
	Cs-137	ND (0.68)	ND (0.64)
	Gross β	ND (2.3)	ND (0.36)
	H-3	890	960
October 10th, 2019 *Discharged on October 15th	Cs-134	ND (0.70)	ND (0.69)
	Cs-137	ND (0.58)	ND (0.77)
	Gross β	ND (0.66)	ND (0.37)
	H-3	1,000	1,100
October 8th, 2019 *Discharged on October 13th	Cs-134	ND (0.66)	ND (0.68)
	Cs-137	ND (0.58)	ND (0.67)
	Gross β	ND (2.4)	ND (0.35)
	H-3	980	1,100
October 7th, 2019 *Discharged on October 12th	Cs-134	ND (0.60)	ND (0.61)
	Cs-137	ND (0.58)	ND (0.45)
	Gross β	ND (2.1)	ND (0.33)
	H-3	960	1,100
October 6th, 2019 *Discharged on October 11th	Cs-134	ND (0.68)	ND (0.61)
	Cs-137	ND (0.58)	ND (0.67)
	Gross β	ND (2.0)	0.39
	H-3	1,100	1,100
October 5th, 2019 *Discharged on October 10th	Cs-134	ND (0.56)	ND (0.62)
	Cs-137	ND (0.68)	ND (0.59)
	Gross β	ND (2.0)	ND (0.34)
	H-3	1,100	1,200
October 4th, 2019 *Discharged on October 9th	Cs-134	ND (0.67)	ND (0.71)
	Cs-137	ND (0.78)	ND (0.59)
	Gross β	ND (1.9)	0.39
	H-3	1,100	1,200
October 3rd, 2019 *Discharged on October 8th	Cs-134	ND (0.64)	ND (0.65)
	Cs-137	ND (0.58)	ND (0.71)
	Gross β	ND (2.3)	0.48
	H-3	1,000	1,100
October 2nd, 2019 *Discharged on October 7th	Cs-134	ND (0.57)	ND (0.53)
	Cs-137	ND (0.58)	ND (0.59)
	Gross β	ND (2.0)	0.46
	H-3	1,000	1,100
October 1st, 2019 *Discharged on October 6th	Cs-134	ND (0.66)	ND (0.53)
	Cs-137	ND (0.63)	ND (0.67)
	Gross β	ND (0.72)	ND (0.41)

	H-3	990	1,100
September 30th, 2019 *Discharged on October 5th	Cs-134	ND (0.52)	ND (0.57)
	Cs-137	ND (0.63)	ND (0.59)
	Gross β	ND (2.1)	ND (0.40)
	H-3	970	1,100
September 29th, 2019 *Discharged on October 4th	Cs-134	ND (0.49)	ND (0.61)
	Cs-137	ND (0.58)	ND (0.53)
	Gross β	ND (2.1)	0.46
	H-3	1,000	1,100
September 28th, 2019 *Discharged on October 3rd	Cs-134	ND (0.79)	ND (0.74)
	Cs-137	ND (0.68)	ND (0.45)
	Gross β	ND (2.1)	0.45
	H-3	910	1,000
September 27th, 2019 *Discharged on October 2nd	Cs-134	ND (0.58)	ND (0.55)
	Cs-137	ND (0.63)	ND (0.59)
	Gross β	ND (2.0)	ND (0.37)
	H-3	940	1,000
September 26th, 2019 *Discharged on October 1st	Cs-134	ND (0.48)	ND (0.57)
	Cs-137	ND (0.53)	ND (0.59)
	Gross β	ND (0.71)	ND (0.36)
	H-3	990	1,100

* * ND: represents a value below the detection limit; values in ( ) represent the detection limit.
* In order to ensure the results, third-party organizations have also conducted an analysis and verified the radiation level of the sampled water.
* Third-party organization : Tohoku Ryokka Kankyohozen Co., Ltd

Appendix 3

Result of detailed analyses conducted by TEPCO, JAEA, and Japan Chemical Analysis Center (In order to confirm the validity of analysis, the Government of Japan also requests JAEA; and TEPCO requests Japan Chemical Analysis Center to conduct independent analyses)

(Unit: Bq/L)

Date of sampling	Detected nuclides	Analytical body		
		JAEA	TEPCO	Japan Chemical Analysis Center
November 1st,2019	Cs-134	ND (0.0024)	ND (0.0047)	ND (0.0063)
	Cs-137	0.026	0.025	0.029
	Gross α	ND (0.46)	ND (3.4)	ND (1.9)
	Gross β	ND (0.46)	ND (0.78)	ND (0.50)
	H-3	960	810	850
	Sr-90	0.0023	ND (0.0046)	ND (0.0053)
October 1st,2019	Cs-134	ND (0.0033)	ND (0.0045)	ND (0.0066)
	Cs-137	0.012	0.014	0.011
	Gross α	ND (0.73)	ND (3.5)	ND (2.1)
	Gross β	ND (0.47)	ND (0.72)	ND (0.58)
	H-3	1,200	1,000	1,100
	Sr-90	ND (0.0011)	ND (0.0015)	ND (0.0056)
September 1st,2019	Cs-134	ND (0.0029)	ND (0.0042)	ND (0.0063)
	Cs-137	0.0074	0.011	0.0086
	Gross α	ND (0.66)	ND (3.4)	ND (2.0)
	Gross β	ND (0.47)	ND (0.73)	ND (0.59)
	H-3	1,100	940	1,000
	Sr-90	0.0016	ND (0.0014)	ND (0.0058)

* ND: represents a value below the detection limit; values in ( ) represent the detection limit.

Appendix 4

Results of analysis on the seawater sampled near the discharge point (North side of Units 5 and 6 discharge channel)

(Unit: Bq/L)

Date of sampling	Detected nuclides	Sampling point (South discharge channel)
December 18th, 2019 *Sampled before discharge of purified groundwater.	Cs-134	ND (0.61)
	Cs-137	ND (0.63)
	Gross β	15
	H-3	ND (1.6)
September 5th, 2019 *Sampled before discharge of purified groundwater.	Cs-134	ND (0.75)
	Cs-137	ND (0.86)
	Gross β	13
	H-3	1.9

(Reference)

(Unit: Bq/L)

Radionuclides	Operational Targets	Density Limit specified by the Reactor Regulation	World Health Organization (WHO) Guidelines for Drinking Water Quality
Cs-134	1	60	10
Cs-137	1	90	10
Gross α	—	—	—
Gross β	3 (1) ※	—	—
H-3	1,500	60,000	10,000
Sr-90	—	30	10

※ The operational target of Gross β is 1 Bq/L in the survey which is conducted once every ten days.

Appendix 5

Results of analyses on the water quality of the groundwater pumped up for bypassing at Fukushima Daiichi NPS (made available by TEPCO prior to discharge)

(Unit: Bq/L)

Date of sampling *Date of discharge	Detected nuclides	Analytical body	
		TEPCO	Japan Chemical Analysis Center
December 20th, 2019 *Discharged on December 28th	Cs-134	ND (0.58)	ND (0.62)
	Cs-137	ND (0.74)	ND (0.46)
	Gross β	ND (0.66)	ND (0.53)
	H-3	150	170
December 16th, 2019 *Discharged on December 25th	Cs-134	ND (0.63)	ND (0.45)
	Cs-137	ND (0.63)	ND (0.53)
	Gross β	ND (0.71)	ND (0.53)
	H-3	230	240
December 10th, 2019 *Discharged on December 18th	Cs-134	ND (0.62)	ND (0.59)
	Cs-137	ND (0.71)	ND (0.41)
	Gross β	ND (0.68)	ND (0.60)
	H-3	210	220
December 5th, 2019 *Discharged on December 13th	Cs-134	ND (0.67)	ND (0.59)
	Cs-137	ND (0.58)	ND (0.46)
	Gross β	ND (0.64)	ND (0.58)
	H-3	160	180
November 13th, 2019 *Discharged on November 21st	Cs-134	ND (0.52)	ND (0.59)
	Cs-137	ND (0.53)	ND (0.55)
	Gross β	ND (0.65)	ND (0.64)
	H-3	260	280
November 6th, 2019 *Discharged on November 14th	Cs-134	ND (0.59)	ND (0.57)
	Cs-137	ND (0.63)	ND (0.52)
	Gross β	ND (0.80)	ND (0.56)
	H-3	250	260
October 30th, 2019 *Discharged on November 7th	Cs-134	ND (0.52)	ND (0.45)
	Cs-137	ND (0.58)	ND (0.38)
	Gross β	ND (0.71)	ND (0.57)
	H-3	160	180
October 23rd, 2019 *Discharged on October 31st	Cs-134	ND (0.74)	ND (0.50)
	Cs-137	ND (0.63)	ND (0.43)
	Gross β	ND (0.60)	ND (0.58)
	H-3	150	140
October 16th, 2019	Cs-134	ND (0.74)	ND (0.52)

*Discharged on October 24th	Cs-137	ND (0.58)	ND (0.52)
	Gross β	ND (0.68)	ND (0.57)
	H-3	120	130
October 9th, 2019 *Discharged on October 17th	Cs-134	ND (0.52)	ND (0.54)
	Cs-137	ND (0.53)	ND (0.48)
	Gross β	ND (0.69)	ND (0.62)
	H-3	120	130
October 2nd, 2019 *Discharged on October 10th	Cs-134	ND (0.76)	ND (0.49)
	Cs-137	ND (0.68)	ND (0.38)
	Gross β	ND (0.69)	ND (0.55)
	H-3	120	130
September 25th, 2019 *Discharged on October 3rd	Cs-134	ND (0.54)	ND (0.49)
	Cs-137	ND (0.63)	ND (0.57)
	Gross β	ND (0.74)	ND (0.64)
	H-3	120	120

* * ND: represents a value below the detection limit; values in ( ) represent the detection limit
* In order to ensure the results, Japan Chemical Analysis Center, a third-party organization, has also conducted an analysis and verified the radiation level of the sampled water.

Appendix 6

Result of detailed analyses conducted by TEPCO, JAEA, and Japan Chemical Analysis Center (In order to confirm the validity of analysis, the Government of Japan also requests JAEA; and TEPCO requests Japan Chemical Analysis Center to conduct independent analyses)

(Unit: Bq/L)

Date of sampling	Detected nuclides	Analytical body		
		JAEA	TEPCO	Japan Chemical Analysis Center
November 6th, 2019	Cs-134	ND (0.0030)	ND (0.0047)	ND (0.0067)
	Cs-137	0.0027	ND (0.0038)	ND (0.0052)
	Gross α	ND (0.48)	ND (3.1)	ND (1.9)
	Gross β	ND (0.46)	ND (0.80)	ND (0.52)
	H-3	290	240	260
	Sr-90	ND (0.0013)	ND (0.0014)	ND (0.0055)
October 2nd, 2019	Cs-134	ND (0.0030)	ND (0.0045)	ND (0.0055)
	Cs-137	ND (0.0020)	ND (0.0039)	ND (0.0053)
	Gross α	ND (0.57)	ND (3.1)	ND (2.1)
	Gross β	ND (0.46)	ND (0.69)	ND (0.67)
	H-3	140	120	130
	Sr-90	0.0014	ND (0.0015)	ND (0.0074)
September 4th, 2019	Cs-134	ND (0.0029)	ND (0.0044)	ND (0.0059)
	Cs-137	ND (0.0021)	ND (0.0041)	ND (0.0048)
	Gross α	ND (0.59)	ND (3.5)	ND (2.0)
	Gross β	ND (0.46)	ND (0.80)	ND (0.48)
	H-3	160	130	140
	Sr-90	ND (0.0011)	ND (0.0013)	ND (0.0055)

* ND: represents a value below the detection limit; values in ( ) represent the detection limit.

Results of analyses on the seawater sampled near the discharge point (Around South Discharge Channel)

(Unit: Bq/L)

Date of sampling ※conducted four times a year	Detected nuclides	Sampling point (South discharge channel)
December 18th, 2019	Cs-134	ND (0.76)
	Cs-137	ND (0.67)
	Gross β	13
	H-3	8.5
September 5th, 2019	Cs-134	ND (0.55)
	Cs-137	ND (0.68)
	Gross β	9.4
	H-3	1.5

(Reference) (Unit: Bq/L)

Radionuclides	Operational Targets	Density Limit specified by the Reactor Regulation	World Health Organization (WHO) Guidelines for Drinking Water Quality
Cs-134	1	60	10
Cs-137	1	90	10
Gross α	—	—	—
Gross β	5 (1) ※	—	—
H-3	1,500	60,000	10,000
Sr-90	—	30	10

※ The operational target of Gross β is 1 Bq/L in the survey which is conducted once every ten days.