Regarding the contaminated water including radioactive materials with high concentration that flowed out from Unit 2 of Fukushima Dai-ichi Nuclear Power Station

April 25th, 2011
Nuclear and Industrial Safety Agency

Regarding the contaminated water including radioactive materials with high concentration (hereafter "the contaminated water") that flowed out from Unit 2 of Fukushima Dai-ichi Nuclear Power Station, Nuclear and Industrial Safety Agency(NISA)'s evaluation on the report submitted by Tokyo Electric Power Co. Inc. (TEPCO) on April 21st is as follows;

1. Estimates of the amount of the outflow

i. Duration of the outflow

According to the report, TEPCO found that the contaminated water was flowing out to the sea from the vertical part of the Power Cable Trench nearby the Intake Channel of Unit 2 around 9:30 April 2nd and the outflow was stopped around 5:38 April 6th. And in estimating overall amount of the contaminated water flowed out, the duration of outflow was assumed as from April 1st to April 6th for calculation.

As of April 1st, the air dose around sea surface near the Screen of Unit 2 was observed as 1.5mSv/h, which was approximately the same level as the peripheral background level. On the other hand, immediately after the outflow of the contaminated water was found on April 2nd, the air dose of 20mSv/h was observed at almost the same point, above the floor of the Screen of Unit 2 (about 4 m above the sea level).

Considering these above, it is possible to evaluate that a possibility that the contaminated water was flowing out on April 1st was low, and the assumption that the contaminated water lasted to flow out from April 1st to April 6th was sufficiently conservative.

ii. Outflow rate

From the photographs etc. of the situation of outflow, TEPCO estimates as follows;

Distance the flowed-out water dropped: 75cm

Reaching distance to landing surface: 65cm
Caliber of outflow: 3cm

Also, TEPCO applies general calculation formula of dynamics to calculate the outflow rate, resulting in approximately 4.3m^3/h.

iii. Concentration of radioactive materials

Regarding the concentration of the contaminated water flowed out, actually measured data of 5.4×10^6Bq/cm^3 of ^{131}I (Iodine), 1.8×10^6Bq/cm^3 of ^{134}Cs (Cesium) and 1.8×10^6Bq/cm^3 of ^{137}Cs (Cesium) are adopted.

iv. Estimated overall amount of radioactive materials included in the contaminated water flowed out

TEPCO's estimation of the overall amount of radioactive materials released as 4.7×10^{15}Bq by multiplying i, ii and iii above can be judged plausible.

2. Evaluation on the environmental impacts etc.

i. Regarding the amount of radioactive materials released

The estimated overall amount of radioactive materials released to the sea is 4.7×10^{15}Bq. This amount is approximately 30,000 times higher than 1.5×10^{11}Bq, which is the amount of radioactive materials released as radioactive waste water with low concentration discharged to the sea for the duration of 10 days from April 4th.

ii. Impacts on the sea etc.

As indicated below, the result of monitoring of the seawater conducted by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and TEPCO shows that the concentration of radioactive materials included in the sea water temporarily rose and then dropped due to the outflow of the contaminated water.

Furthermore, monitoring conducted so far does not result in any sign of the outflow of the contaminated water with high concentration, including ground water, other than the point confirmed this time.

Regarding the radioactive materials released into the sea, Nuclear Safety Commission (NSC) shows its view that they will be carried along by the current and spread. MEXT considers that, based on the result of spread simulation of radioactive materials into the sea, the sea water including radioactive materials stagnant near the power station will be spread towards the offshore with the complicated current off Fukushima. The result obtained this time is thought to be showing that the effect of the measure to control the outflow conducted by TEPCO and the spread of the radioactive materials by the current, as stated view and consideration above, have contributed to the decrease of the concentration of radioactive materials in the sea water.

① The vicinity of the Water Discharge Canal

During a period after April 1st which includes the time when the contaminated water flowed out according to the TEPCO's report, although a significant rise[1] in the concentration of radioactivity near the Water Discharge Canal of Units 5 and 6 and the Southern Water Discharge Canal was confirmed in Fukushima Dai-ichi Nuclear Power Station (NPS), it has a tendency to decrease gradually.

At present, various measures to control the outflow have also taken effect and the concentration of Iodine 131 and Cesium 137 have decreased to 1.6 to 2.2 times and 1.2 to 1.8 times higher than the concentration limitation in the water outside of the Environmental Monitoring Area. However, further progress needs to be carefully watched through continuous monitoring.

② 15km offshore from the coast near the facilities and the site

Although the sea water sampled from the Iwasawa coast was confirmed to indicate a significant increase[2] on April 5th, the observation on April 22nd

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[1] Maximum of 120Bq/cm^3 of ^{131}I (Iodine)(Approximately 3,000 times higher than the concentration limitation in the water outside the Environmental Monitoring Area (April 1st)) and Maximum of 68Bq/cm^3 of ^{137}Cs (Cesium) (Approximately 760 times higher (April 7th)) were confirmed. (Both observed near the Water Discharge Canal of Units 5 and 6)

[2] Maximum of 3.7Bq/cm^3 of ^{131}I (Iodine) (Approximately 93 times higher than the

showed that the concentration of either Iodine 131 or Cesium 137 had decreased to the levels almost the same as the concentration limitation in the water outside of the Environmental Monitoring Area.

Due to the stormy weather, monitoring data necessary to evaluate the impacts has been unable to be gathered at the 15km offshore from the site.

③ 30 km offshore from the site

Regarding the concentration of radioactivity of the sea water at 30km offshore measured by MEXT, although it was confirmed to rise on the surface of sea water[3] on April 15th, being presumably resulted from the impact of outflow of the contaminated water, the impact was hardly observed at lower layer.

Thereafter, regarding the concentration of radioactivity on the surface of the sea water, Iodine 131 and Cesium 137 were not detected in the sea water sampled on April 19th at all the observing points except for the observing points [6] and [8][4]. Neither Iodine 131 nor Cesium 137 was detected in the sea water sampled April 21st at all observing points.

④ Groundwater sampled within and near the site.

Referring to the concentration of radioactivity measured by TEPCO at the Sub Drain (groundwater collected and controlled within the facilities) near the turbine building, although there is no sign of the outflow of the contaminated water with high concentration, the concentrations of radioactivity of Units 1 and 2 have been progressing at relatively high values[5] since April 13th. Therefore, continuous watch is necessary. On the

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concentration limitation in the water outside the Environmental Monitoring Area) and maximum of 1.4Bq/cm^3 of ^{137}Cs (Cesium)(Approximately 16 times higher alike)

[3] At the observing point [4], maximum of 161Bq/L of ^{131}I (Iodine)(Approximately 4 times higher than the concentration limitation in the water outside the Environmental Monitoring Area) and 181Bq/L of ^{137}Cs (Cesium)(Approximately twice higher alike)

[4] At the observing point [6], 18.8Bq/L of ^{131}I (Iodine)(Approximately 1/2 times higher than the concentration limitation in the water outside the Environmental Monitoring Area) and 31.6Bq/L of ^{137}Cs (Cesium)(Approximately 1/3 times higher alike). At the observing point [8], 15.2Bq/L of ^{137}Cs (Cesium)(Approximately 1/6 times higher alike) and no Iodine 131 detected.

[5] Maximum of 610Bq/cm^3 of ^{131}I (Iodine)(observed at the Sub Drain of Unit 2 on April

other hand, water in the deep well outskirts of the West Gate is not impacted by the contaminated water.

3. Future Actions

1) Strengthening the measures to control the outflow

After confirming the outflow of the contaminated water from Unit 2, TEPCO has taken measures to control the release of radioactive materials to offshore, such as,

① Placing steel boards and silt fences on the Inlet Bar Screen of Unit 2

② Putting sandbags filled with Zeolite (radioactive material absorbent) in front of the Screen Room of Units 1 to 4, etc.

Hereafter, in addition to the measures above, TEPCO will not only steadily carry out the storage and processing of the stagnant water in order to prevent the outflow of the water contaminated with radioactive materials stagnant in the turbine buildings etc. to the outside, but also consider the measure to prevent the contamination of ground water by proceeding the investigation etc. on geology and ground water. NISA will also make confirmations necessary for its materialization and at the same time, if necessary, give directions to TEPCO about the further measures to control the outflow.

2) Strengthening the monitoring

Responding to the directions etc. from NISA considering the other day's discharge of the waste water with low concentration to the sea, TEPCO has so far taken measures such as adding measuring points one after another. However, based on the events this time, TEPCO intends to further strengthen the monitoring with addition of more measuring points and gathering soil of sea floor, etc.

As for the government, in accordance with the "Regarding the Plan of Strengthening Environmental Monitoring (the Nuclear Emergency Response

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13th) and Maximum of 91Bq/cm^3 of ^{137}Cs (Cesium)(observed at the Sub Drain of Unit 1 on April 20th)

Headquarters, April 22nd 2011)", related ministries shall cooperatively tackle on the impact assessment of the radioactive materials on the environment by increasing the measuring points in the coastal area and continuously carrying out the spread prediction of the radioactive materials utilizing the current prediction, and announce those results promptly.

3) Processing of the contaminated water with high concentration

A little less than 70,000t of the contaminated water with high-level radioactivity is stagnant on the basement floor of the turbine buildings of Units 1 to 3 of Fukushima Dai-ichi NPS. According to the roadmap announced by TEPCO on April 17th 2011, TEPCO shall secure sufficient storage site and install the Water Processing Facility to decontaminate and give salinity treatment to the contaminated water and then store it in the tank, in order to prevent the contaminated water with high-level radioactivity from flowing out.

NISA will continuously conduct confirmation etc. such as on-the-spot confirmation for any leakage point, in order for a highly reliable Contaminated Water Processing System to be constructed.

<Reference> Evaluation based on the results of monitoring or results of simulation conducted by institutions concerned

According to the result of monitoring of sea water or the result of simulation of radioactivity concentrations in the sea area based on the result of monitoring, radioactive materials released from Fukushima Dai-ichi NPS will gradually spread along by the current and its concentration level will also decrease.

1. Evaluation result by Nuclear Safety Commission (April 21st)

Regarding sea water, the radioactive materials released into the sea will spread by the oceanic current and considered that it will be diluted by the time absorbed by marine organisms, such as fish, algae, etc.

2. Regarding the simulation of radioactivity concentrations in the sea area (April 11th MEXT)

The oceanic currents off Fukushima are complicated and slow-flowing.

In line with those complicated currents, the water flowing out from Fukushima Dai-ichi NPS spreads in the offshore direction. IF the outflow has stopped since April 12th, there will be no sea surface with the concentration levels of iodine-131 exceeding 40Bq/L, nor with levels of Cesium-137 exceeding 90Bq/L (Cesium) by May.

In particular, the concentration of radioactivity moves towards the open sea while gradually spreading in the offshore direction of Fukushima Dai-ichi NPS. Thus, the radioactivity concentrations in the sea area 30 km off the coast of the NPP are expected to be higher during the period from April 9th till 11h than during the period from April 4th till 7th. (The actual measurements taken in the sea area monitoring conducted by MEXT on April 9th showed such tendency.)

3. Regarding the simulation of the concentration of radioactivity in the area of sea (Second edition)

(April 16th MEXT)

The oceanic current off the coast of the Southern Tohoku, including the coast of Fukushima is where the Japan Current (Black Current), the

divergent flow of Tsushima Current (Tsugaru Warm Current) and Chishima Current (Oyashio Current) meet, and generate complicated and slow-flowing.

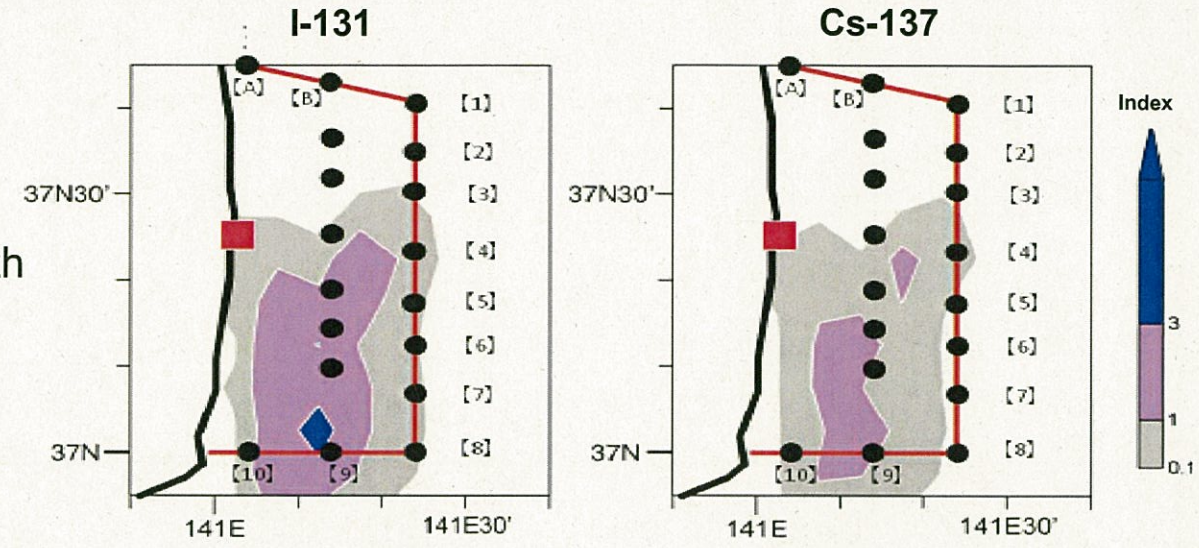
In line with this complicated oceanic current, water containing radioactive materials stagnant near NPS will spread in the offshore direction.

Especially at the offshore of Fukushima Dai-ichi NPS in mid-April, while the water containing radioactive materials are predicted to spread gradually, it is expected to move slightly southerly in the offshore direction extremely slowly. To be more specific, the calculation result shows that the water containing radioactive materials in the vicinity of the sea area 30 km off the coast of the NPS will spread its distribution range slightly southerly towards the offshore direction from April 14th till 20th. (The actual measurements taken in the sea area monitoring conducted on April 15th by TEPCO and MEXT showed such tendency.)

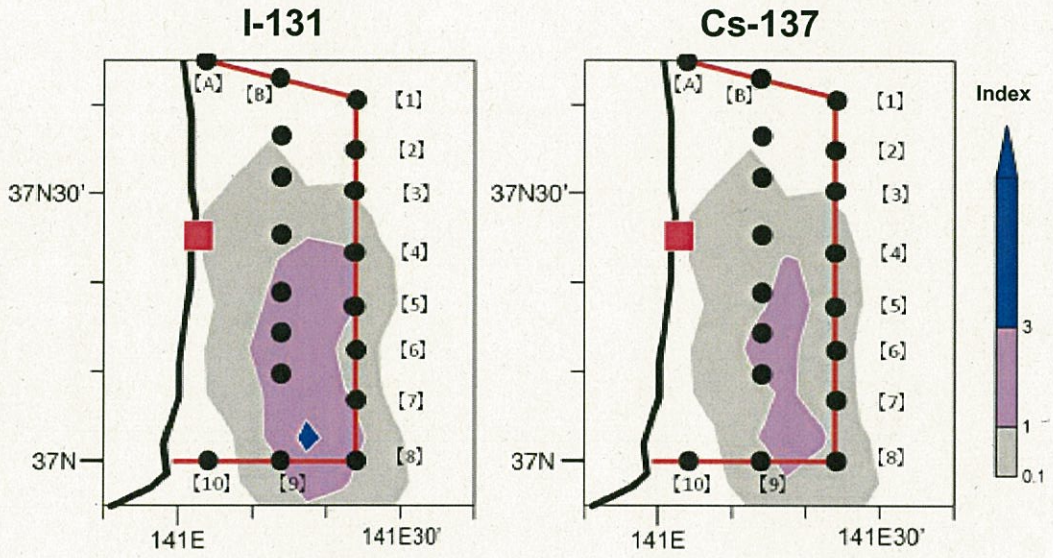
According to the assumed scenario, the concentration levels of Iodine-131 is calculated to fall below 40Bq/L (Maximum concentration level of waste water of Nuclear Plant Facilities) on April 21st and that of Cesium-137 is calculated to fall below 90Bq/L on April 17th.

Concentration Distribution Simulation by Japan Agency for Marine-Earth Science and Technology
（Press Release from Ministry of Education, Culture, Sports, Science and Technology（April 16th））

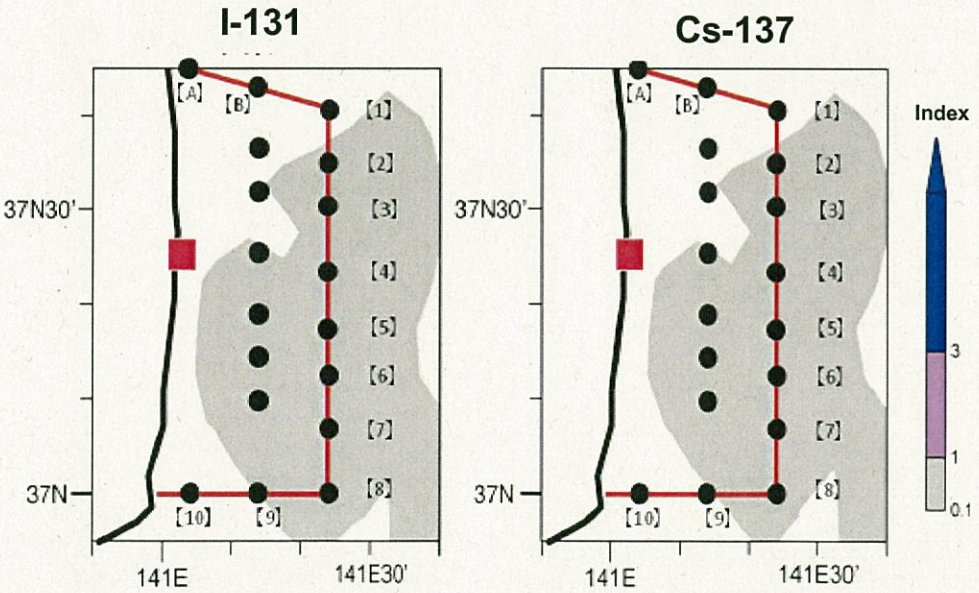
April 14th



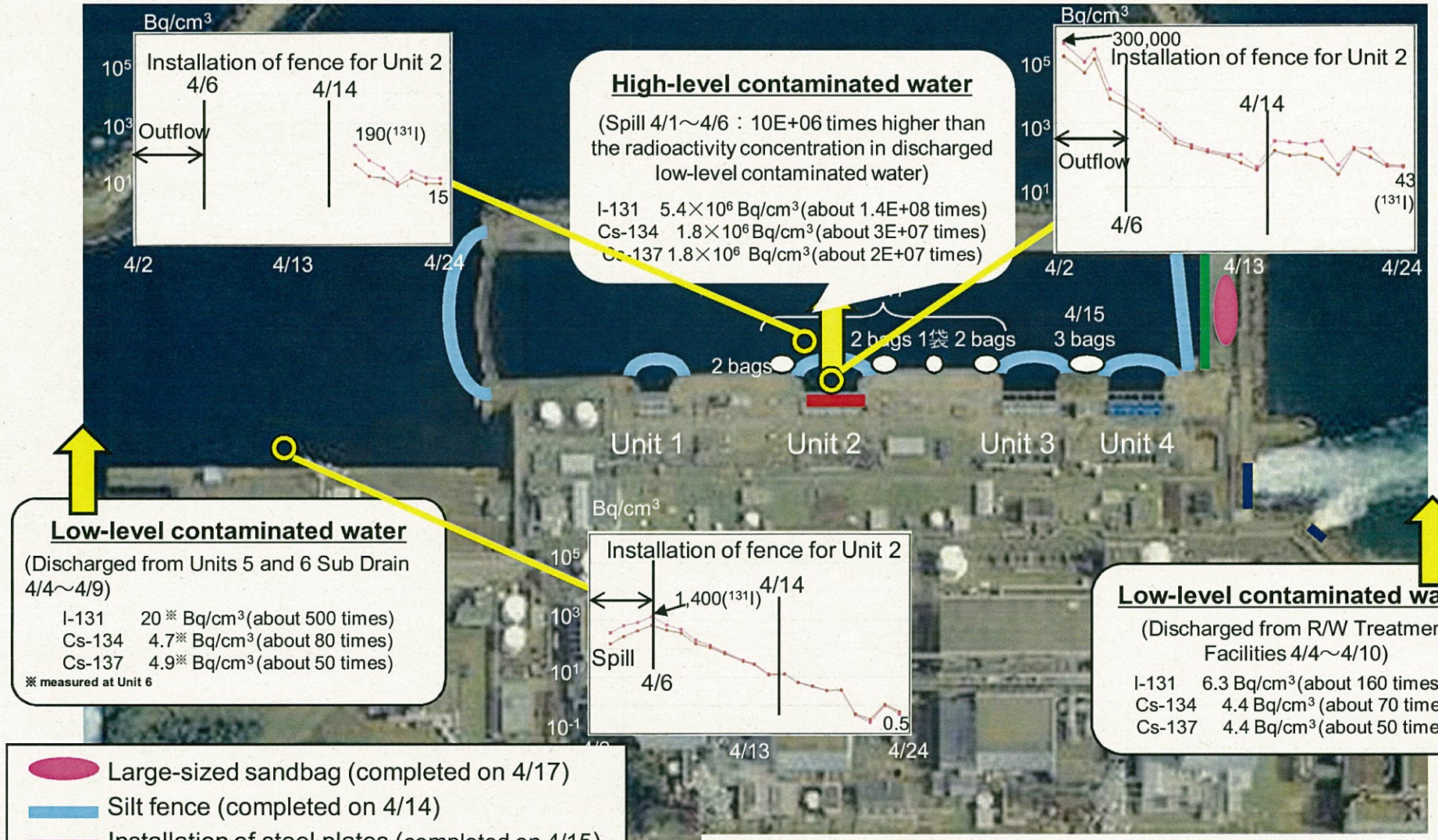
April 16th



April 20th

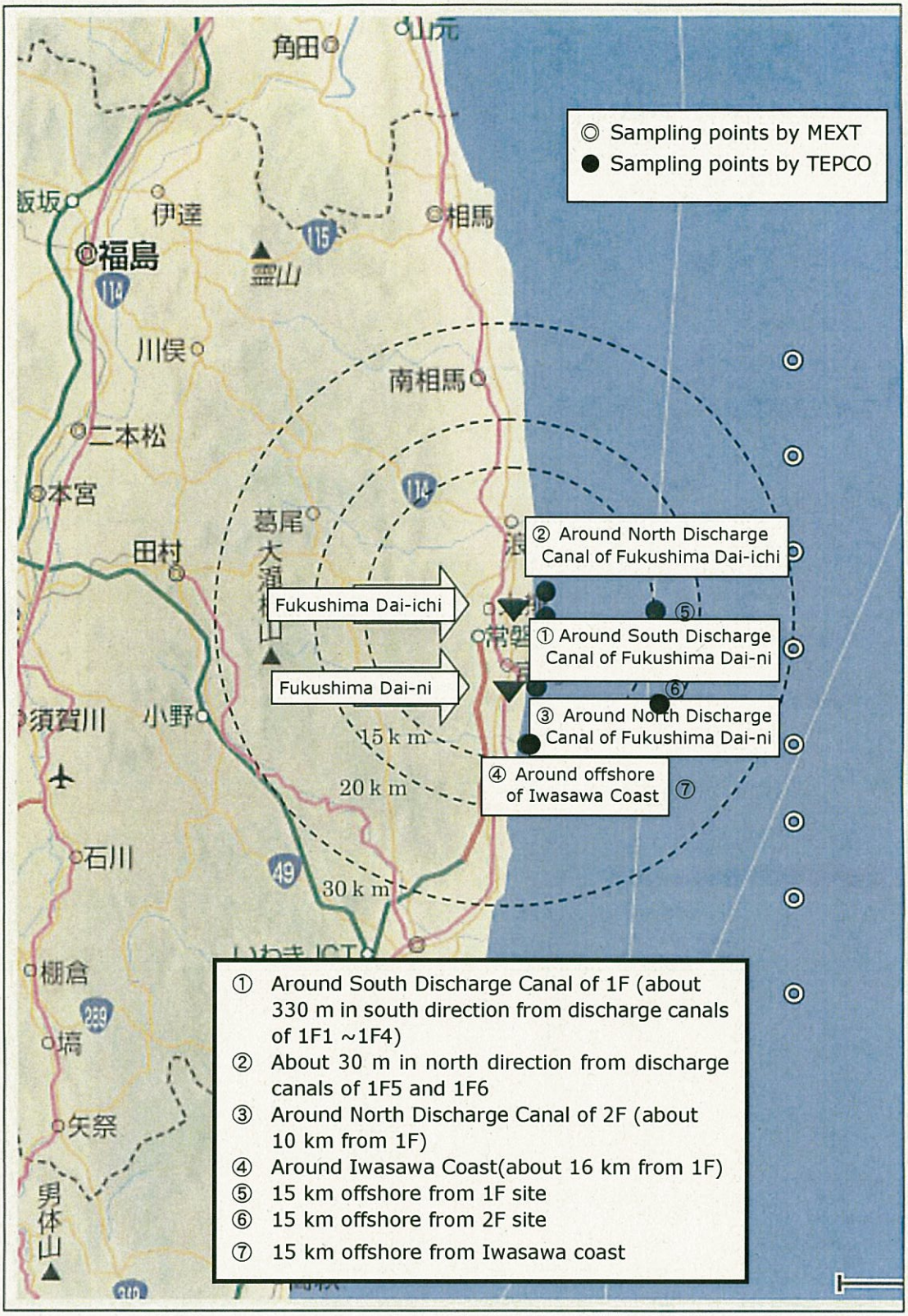


Measures for preventing spread of the liquid including radioactive materials



(Note) Radioactivity concentration in parentheses is relative value to reference value of concentration.
Reference value: ^{131}I: 4×10^{-2}, ^{134}Cs: 6×10^{-2}, ^{137}Cs: 9×10^{-2} (Bq/cm^3)

(Note) Red lines in graph: ^{131}I, blue lines: ^{134}Cs, brown lines: ^{137}Cs

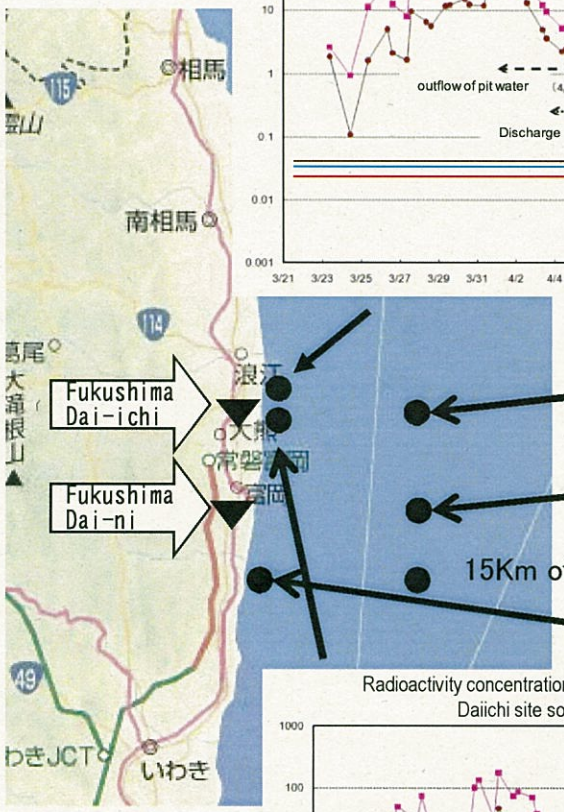


Map of investigating location at 15 km and 30 km offshore

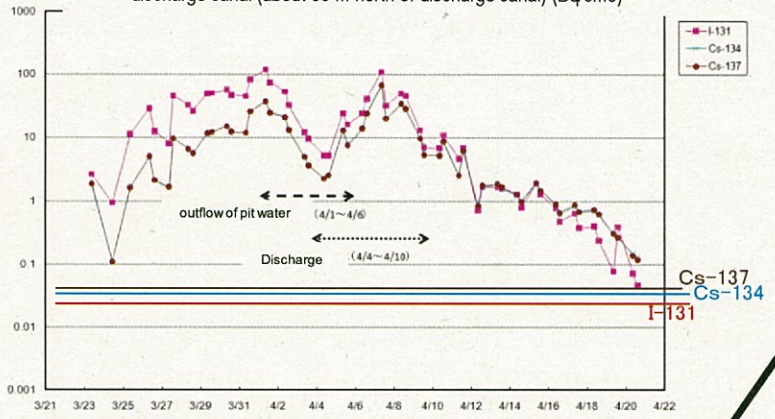
Seawater sampling points as of April 5th (15 points)
(Thereafter, sampling points were sequentially added, and the current total number of sampling points is 28, including MEXT's and TEPCO's ones.)

Results of Radioactivity Concentration Analysis of seawater sampled by TEPCO at coast near the facilities and at 15 km offshore

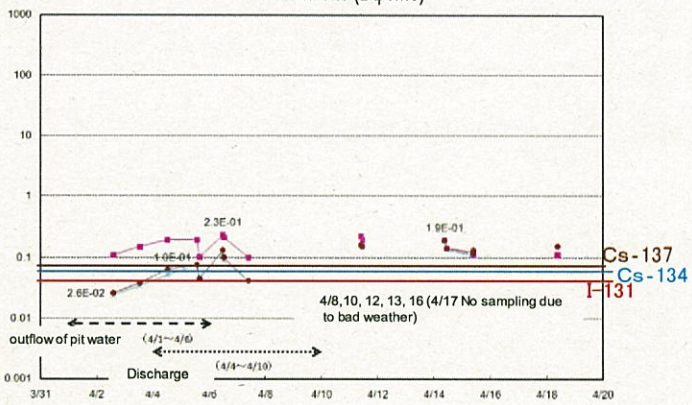
Sampling points



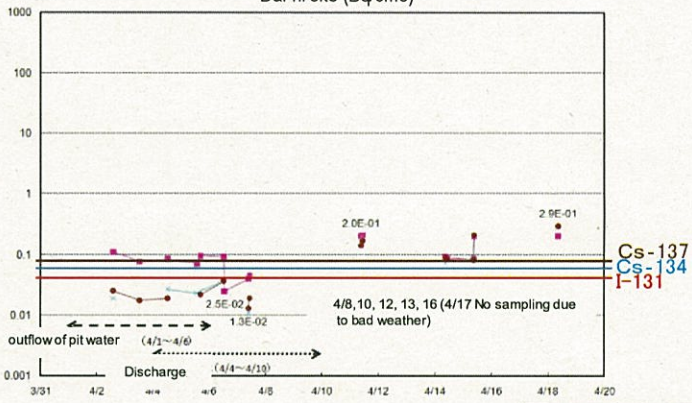
Radioactivity concentration on the north of Fukushima-Daiichi Unit 5 and 6 discharge canal (about 30 m north of discharge canal) (Bq/cm3)



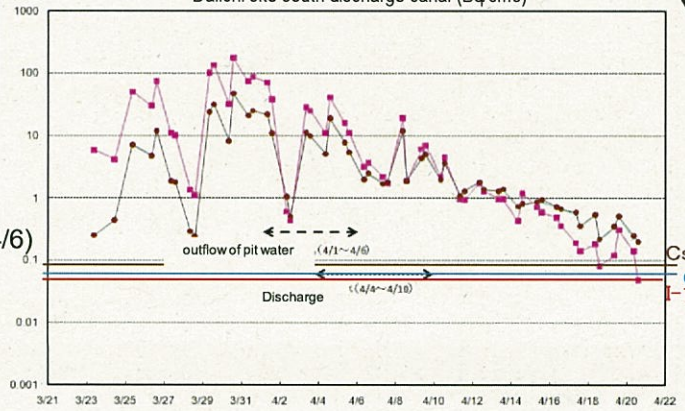
Radioactivity concentration in seawater at about 15 km offshore of Fukushima Dai-ichi site (Bq/cm3)



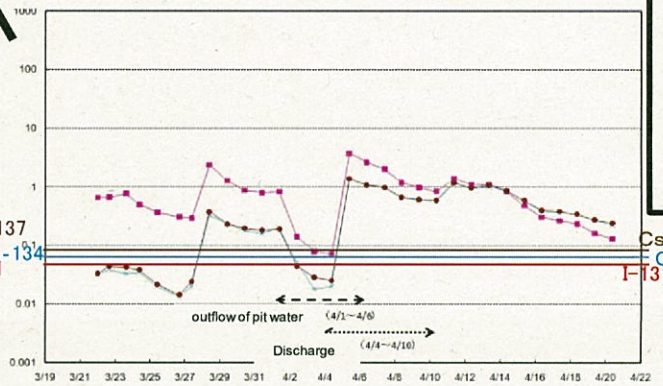
Radioactivity concentration in seawater at about 15 km offshore of Fukushima Dai-ni site (Bq/cm3)



Radioactivity concentration in seawater in the vicinity of Fukushima-Daiichi site south discharge canal (Bq/cm3)



Radioactivity concentration in seawater near Iwasawa coast (Bq/cm3)



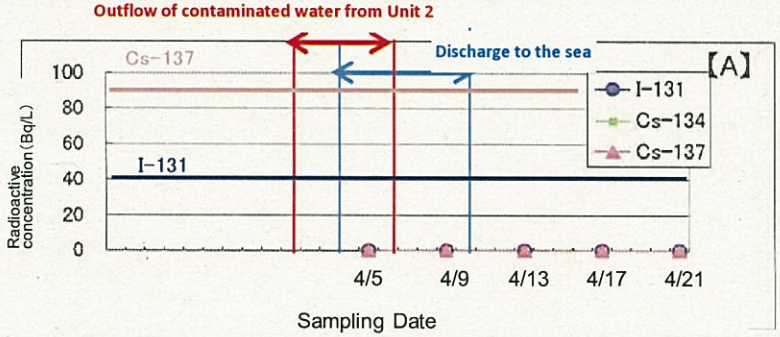
Concentration limitation in the water outside of the Environmental Momitoring Area: (Bq/cm3)

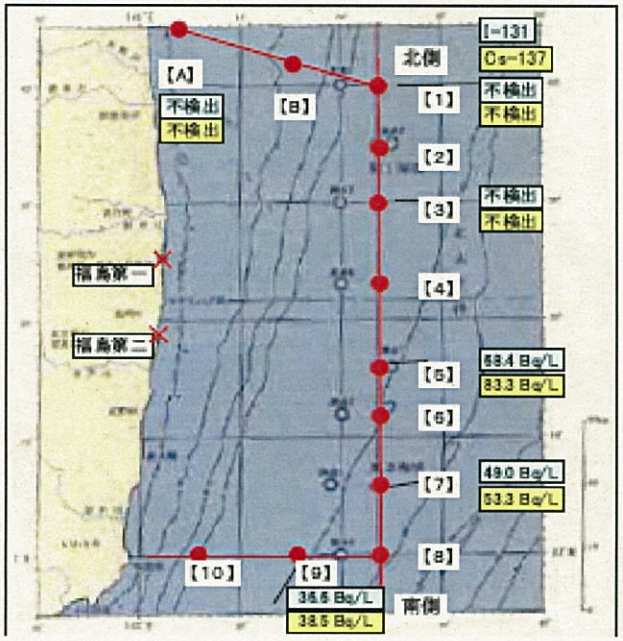
I-131: 4.0×10^{-2}
Cs-134: 6.0×10^{-2}
Cs-137: 9.0×10^{-2}

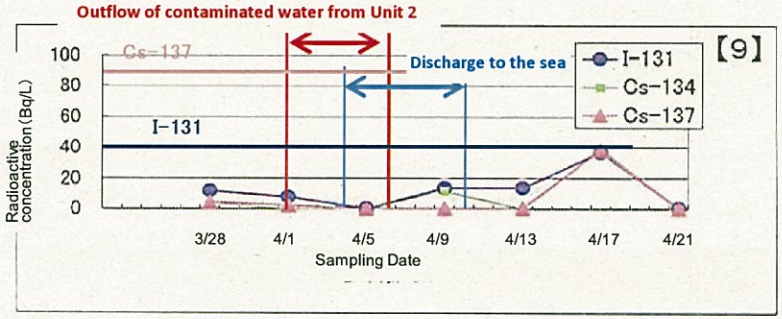
Outflow of pit water(4/1 - 4/6)

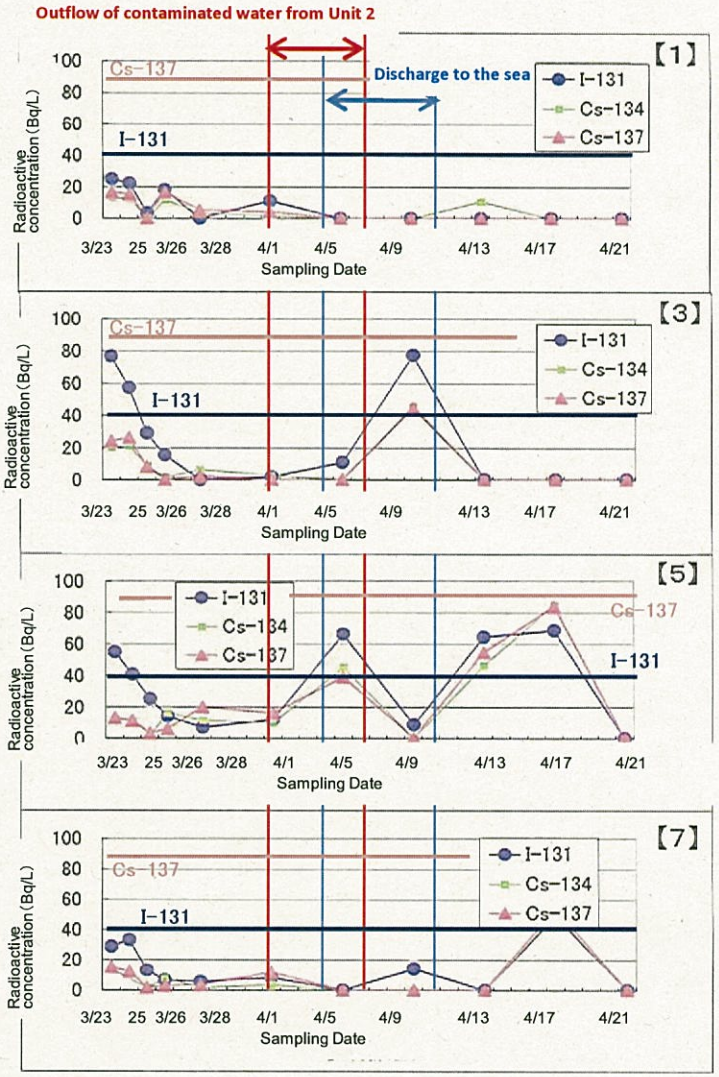
Discharge (4/4 - 4/10)

Sea area monitoring around Fukushima Dai-ichi Nuclear Power Station (30 km offshore)
Measurement results of radioactivity concentration in the sea water (surface layer) (sampled by MEXT on April 21st)





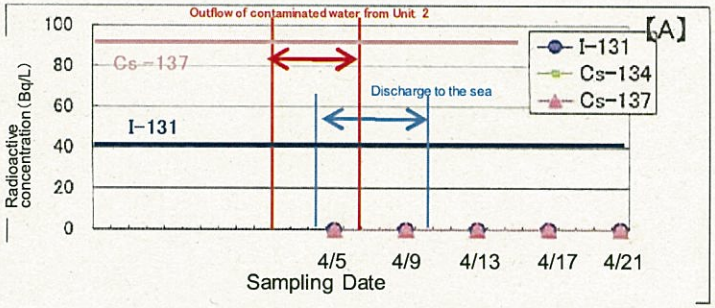


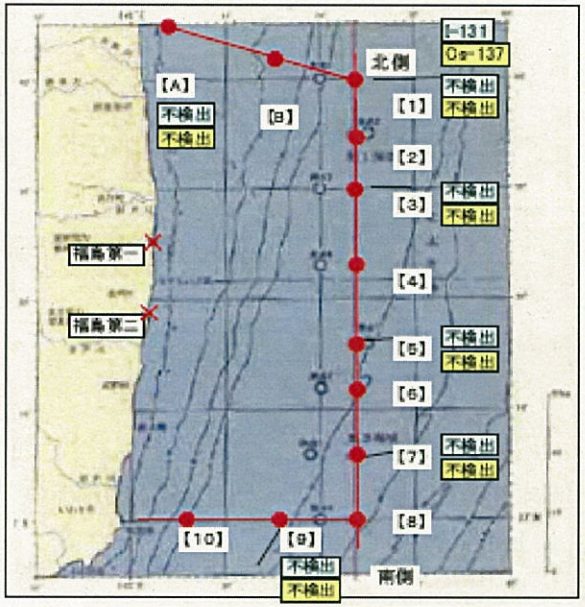


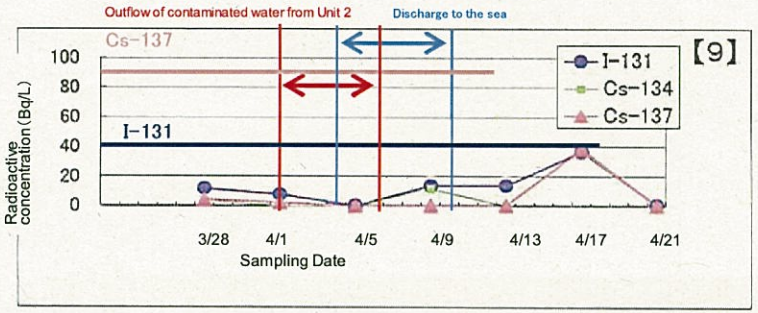
Concentration limitation in the water outside of the Environmental Momitoring : Bq/L
I-131 : 40
Cs-137 : 90

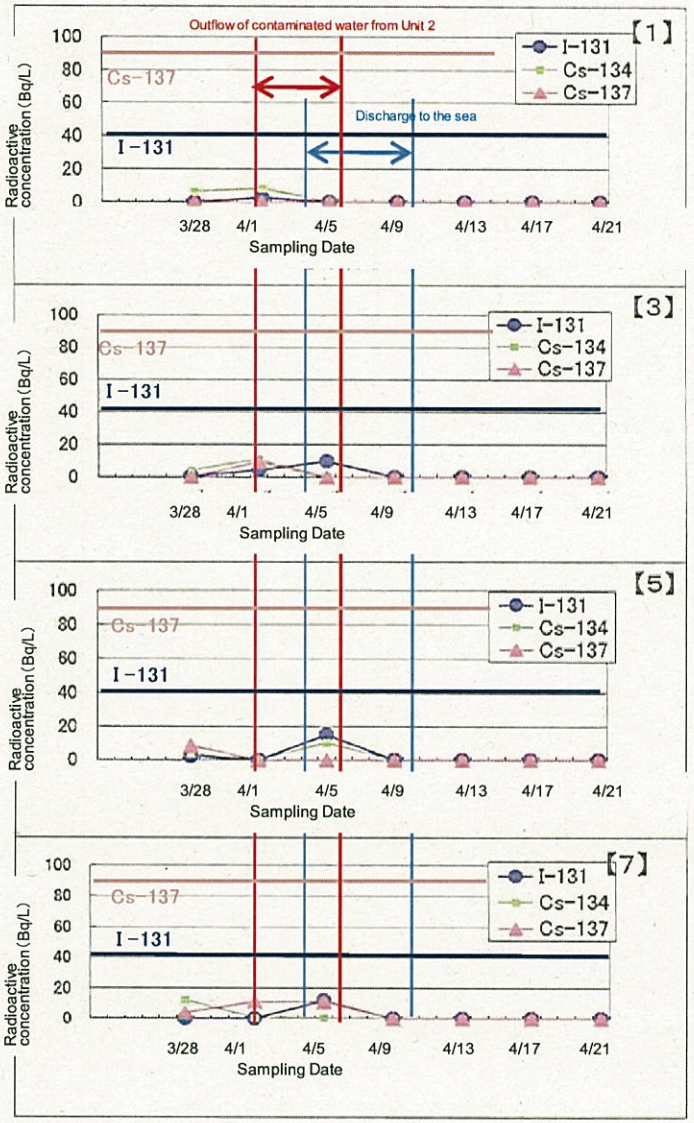
※ If a measured result is undetectable, it is indicated as 0 Bq/L.

Sea area monitoring around Fukushima Dai-ichi Nuclear Power Station (30km offshore)
Measurement results of radioactivity concentration in the sea water (lower layer) (sampled by MEXT on April 21st)





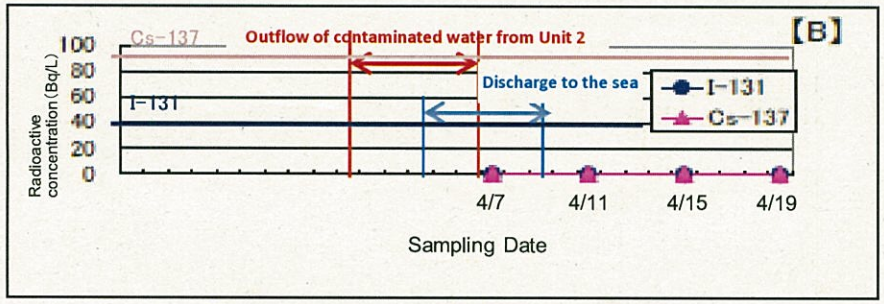


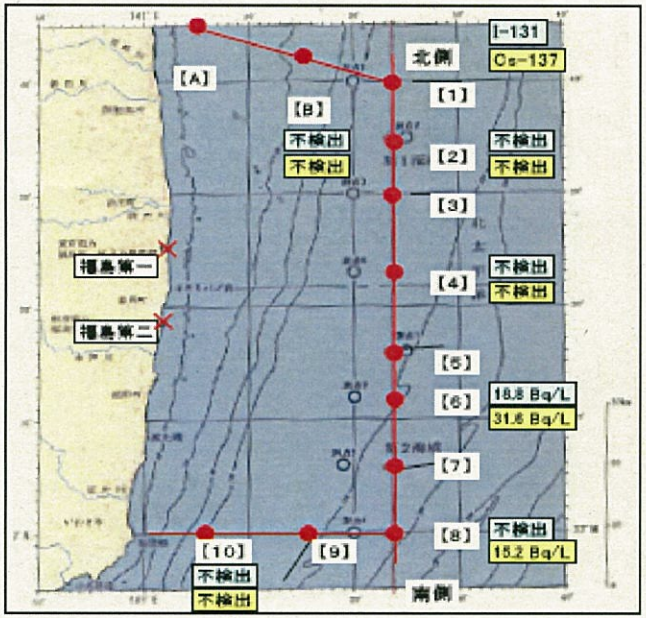


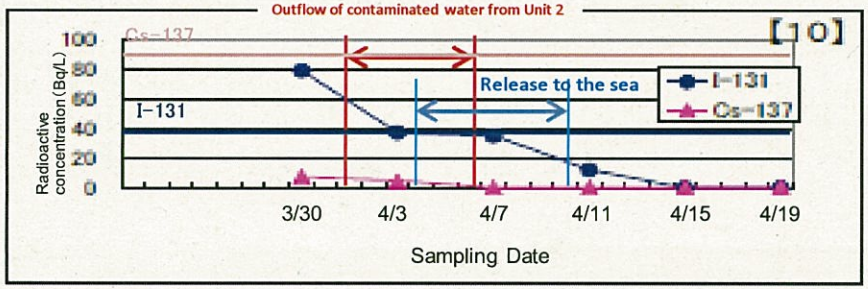
Concentration limitation in the water outside of the Environmental Monitoring Area : Bq/L
I-131 : 40
Cs-137 : 90

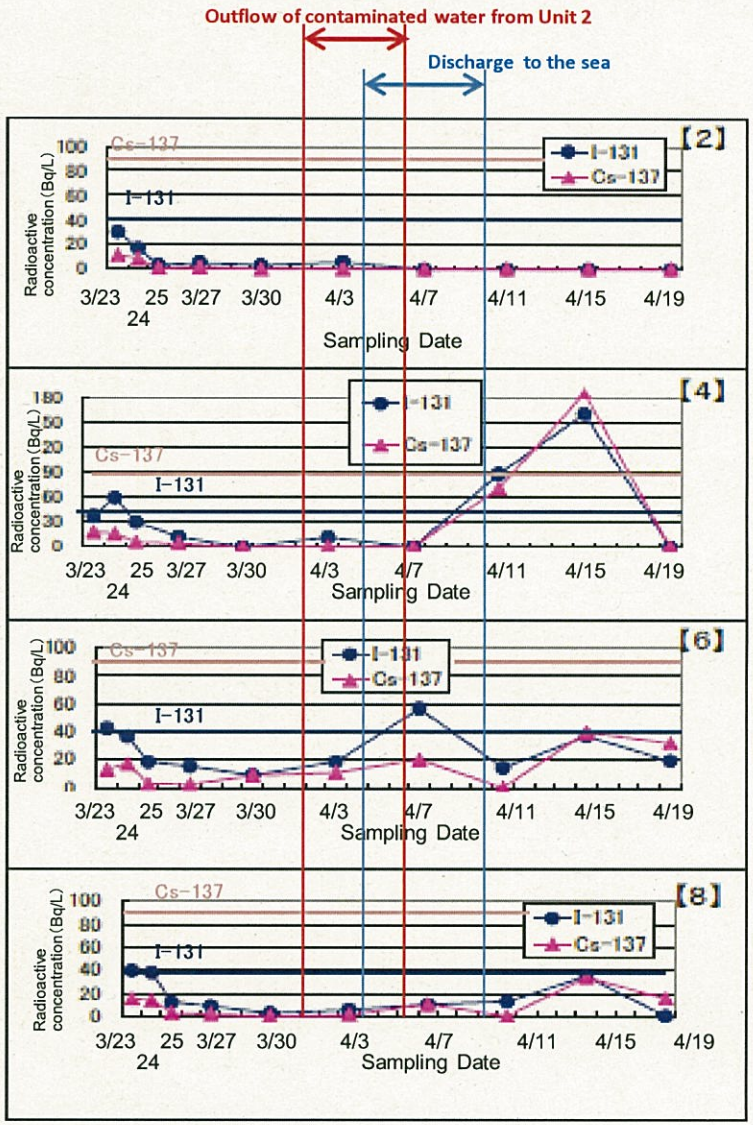
※ If a measured result is undetectable, it is indicated as 0 Bq/L.

Sea area monitoring around Fukushima Dai-ichi Nuclear Power Station (30 km offshore)
Measurement results of radioactivity concentration in the sea water (surface layer) (sampled by MEXT on April 19th)





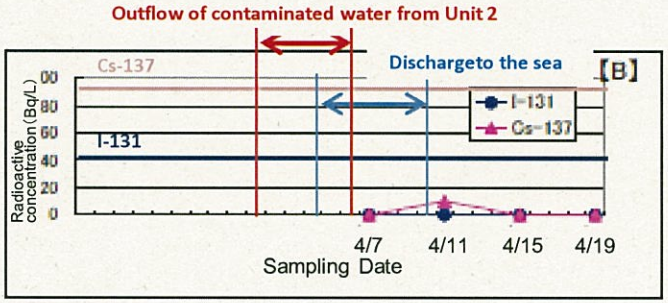


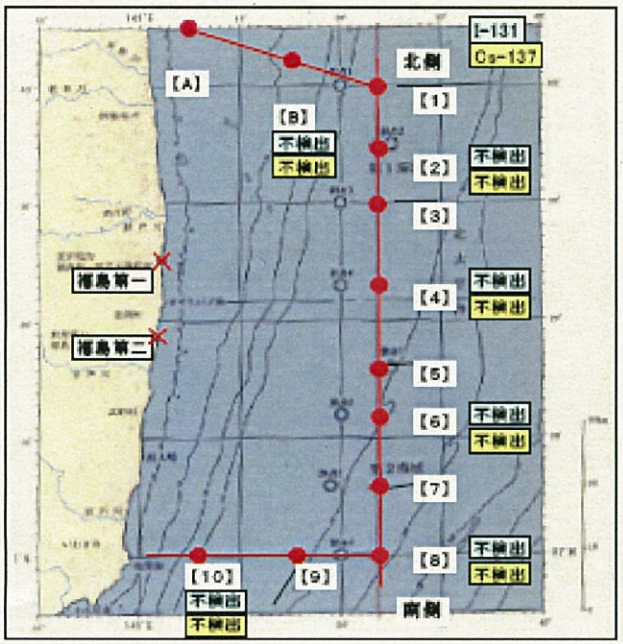


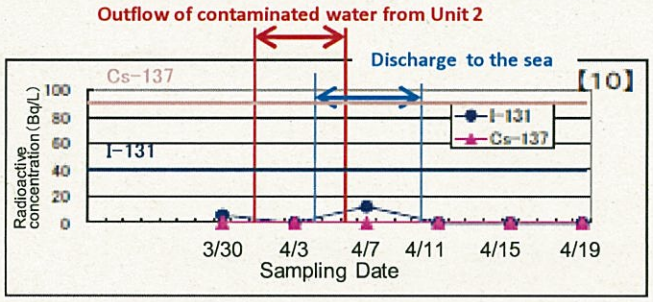
Concentration limitation in the water outside of the Environmental Momitoring : Bq/L
I-131 : 40
Cs-137 : 90

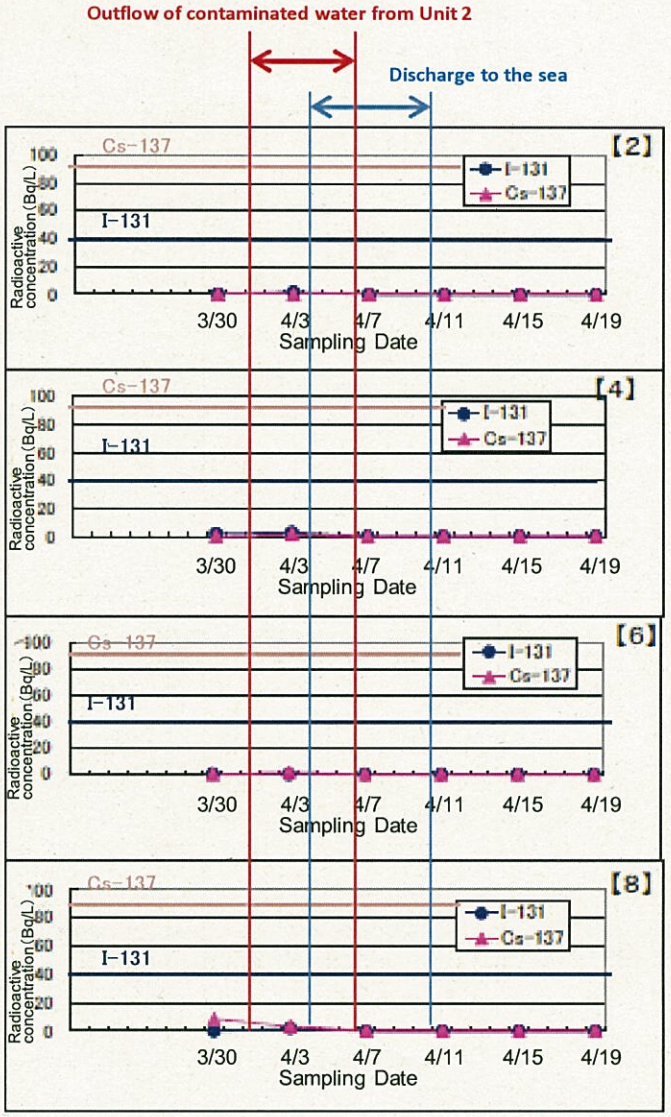
※ If a measured result is not detected, it is indicated as 0 Bq/L.

Sea area monitoring around Fukushima Dai-ichi Nuclear Power Station (30 km offshore)
Measurement results of radioactive concentration in the sea water (lower layer) (sampled by MEXT on April 19th)





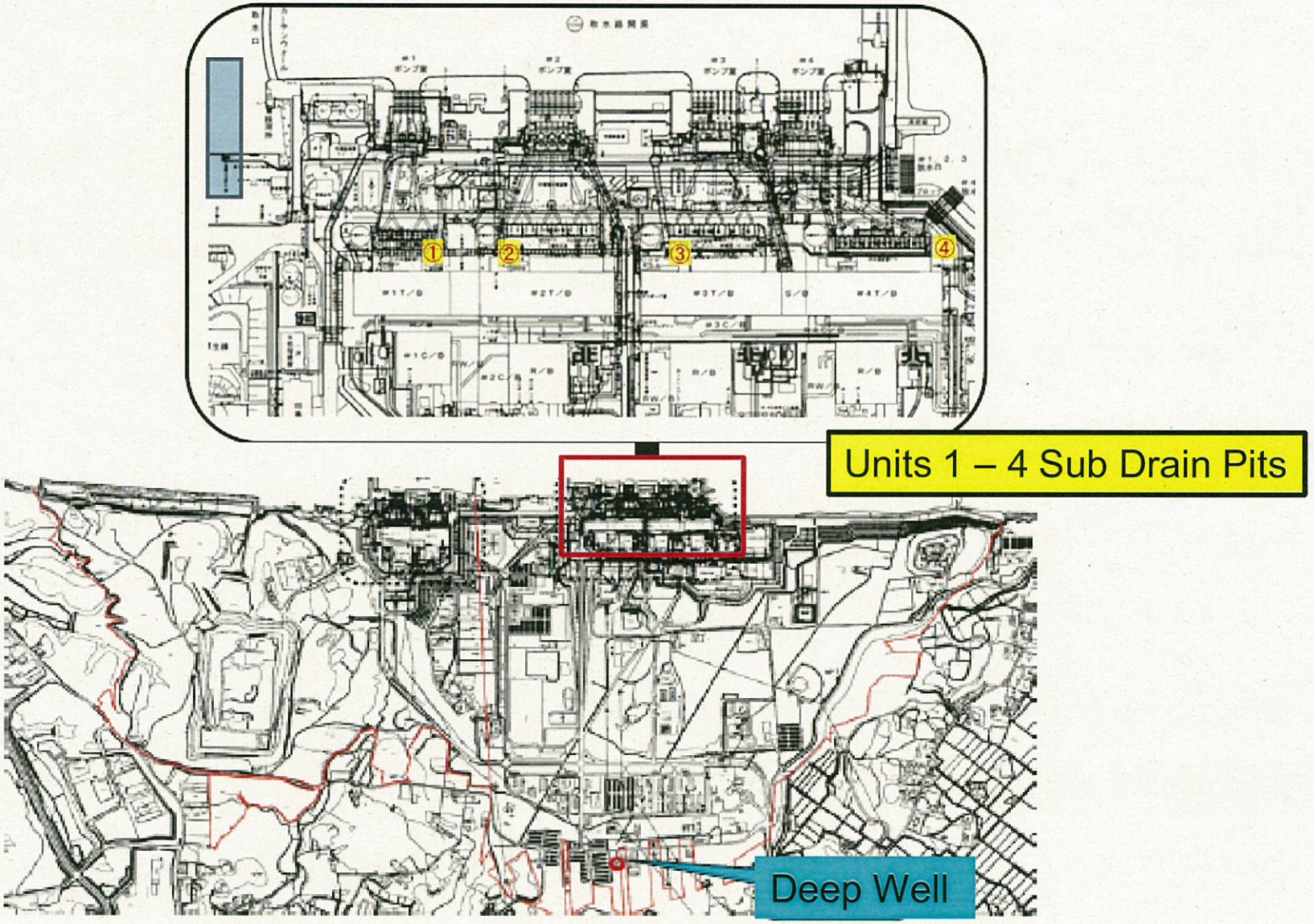




Concentration limitation in the water outside of the Environmental Momitoring Area : Bq/L
I-131 : 40
Cs-137 : 90

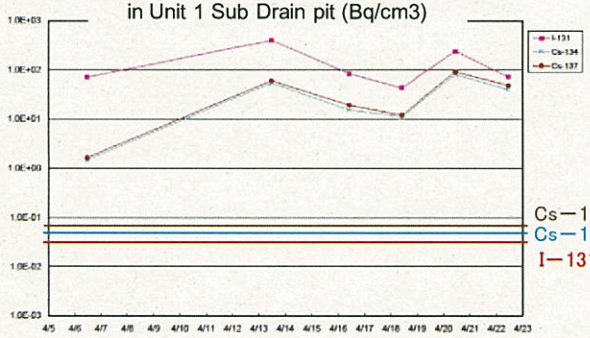
※ If a measured result is undetectable, it is indicated as 0 Bq/L.

Locations of Sub Drain Pits of Fukushima Dai-ichi NPPs Units 1 – 4 and Deep Well

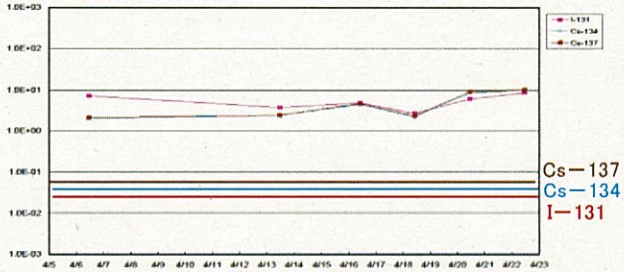


Results of radioactivity concentration measurement of Fukushima Dai-ichi Units 1 – 4 Sub Drain Pits and Deep Well

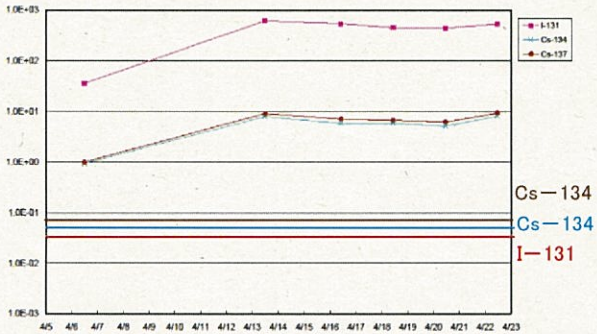
Radioactivity concentration
in Unit 1 Sub Drain pit (Bq/cm3)



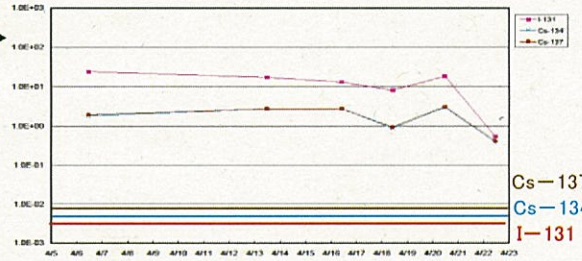
Radioactivity concentration
in Unit 3 Sub Drain pit (Bq/cm3)

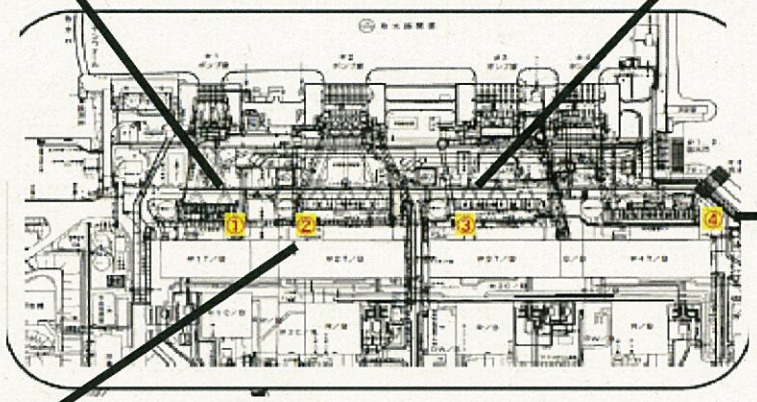


Radioactivity concentration
in Unit 2 Sub Drain pit (Bq/cm3)

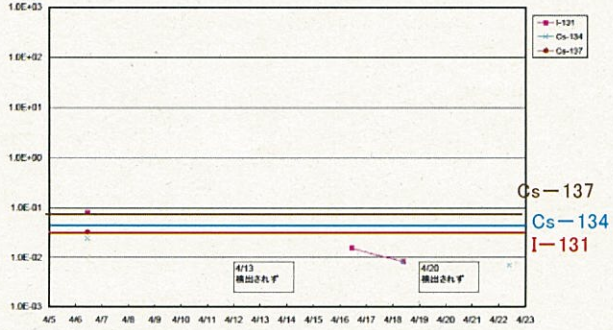


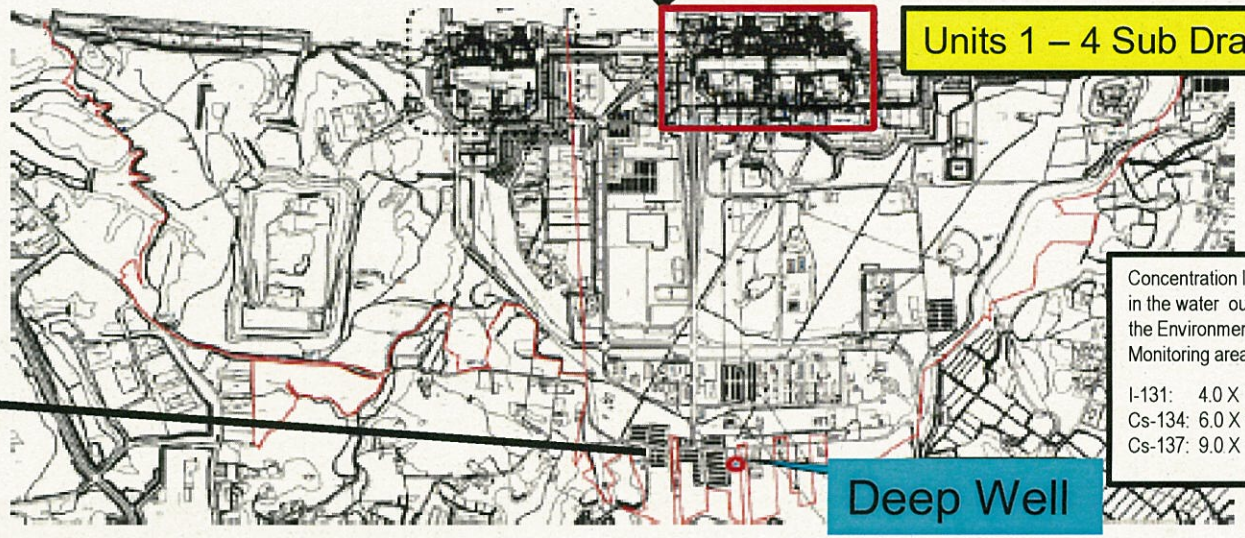
Radioactivity concentration
in Unit 4 Sub Drain pit (Bq/cm3)





Radioactivity concentration
in deep well (Bq/cm3)





Concentration Ilimitation in the water outside of the Environmental Monitoring area (Bq/cm3)

I-131: 4.0×10^{-2}
Cs-134: 6.0×10^{-2}
Cs-137: 9.0×10^{-2}