<Reference>

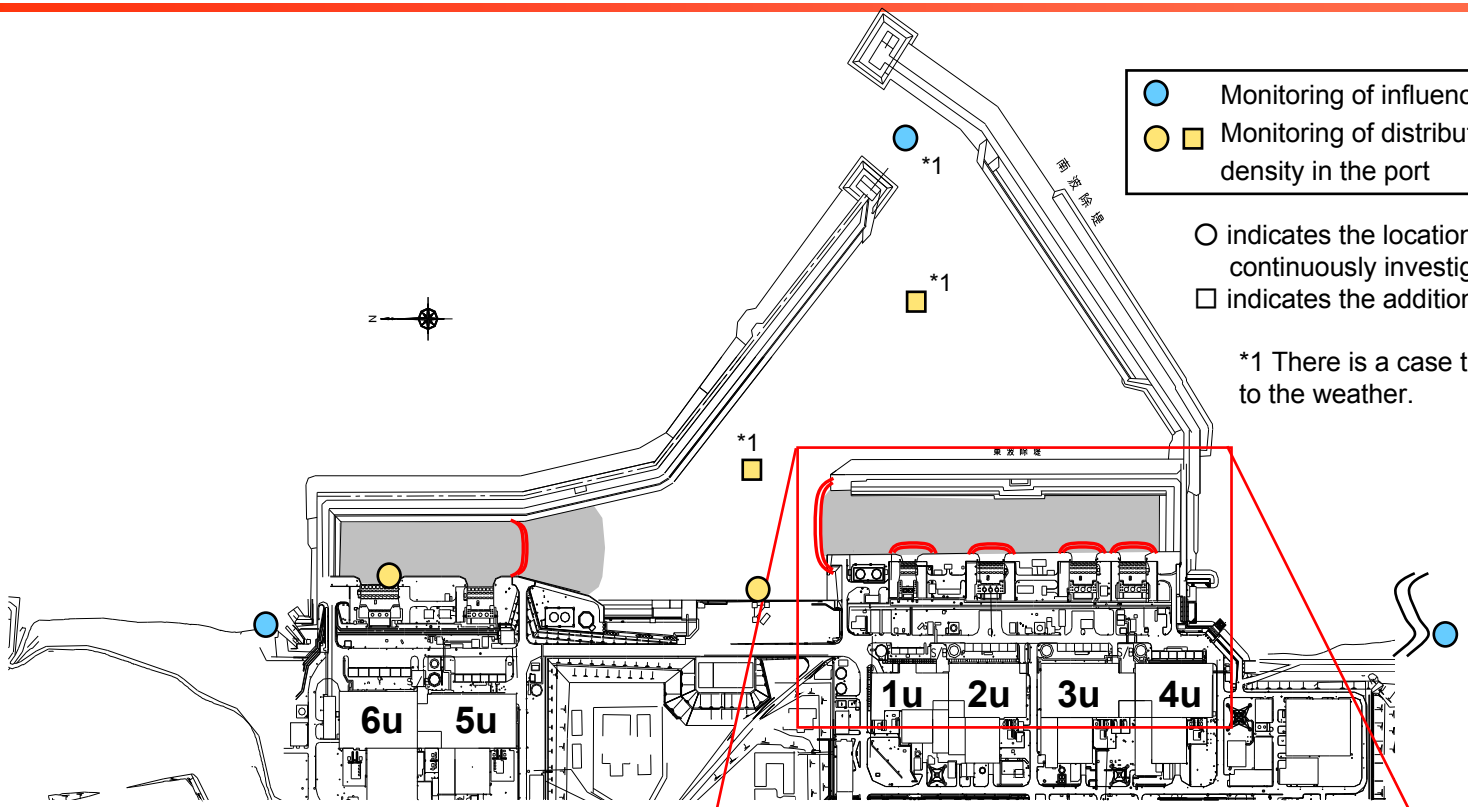
Condition of the Radioactive Density in Groundwater and Seawater at the East Side of the Turbine Buildings at Fukushima Daiichi Nuclear Power Station

July 5, 2013

Tokyo Electric Power Company

TEPCO 東京電力

Monitoring Plan (Sampling Locations)



Monitoring of influence on the sea

Monitoring of distribution of radioactive density in the port

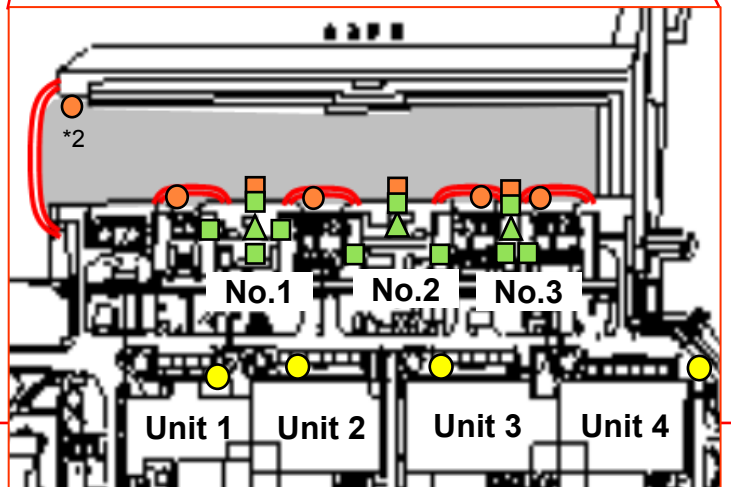
○ indicates the location which has been continuously investigated.
□ indicates the additional investigation point.

*1 There is a case that we cannot sample due to the weather.

Monitoring of influence in the port

Monitoring of groundwater density

Monitoring of sub-drain (groundwater)



○indicates the location which has been continuously investigated.
△ indicates the location which was investigated this time.
□ indicates the additional investigation point.
*2 Investigation point will be changed according to the progress of the water shielding wall construction at the sea side.
The number and location of the investigation point around the underground reservoir No.2, 3 are subject to change depending on the site condition.

Monitoring Plan (Analysis Item, Frequency)

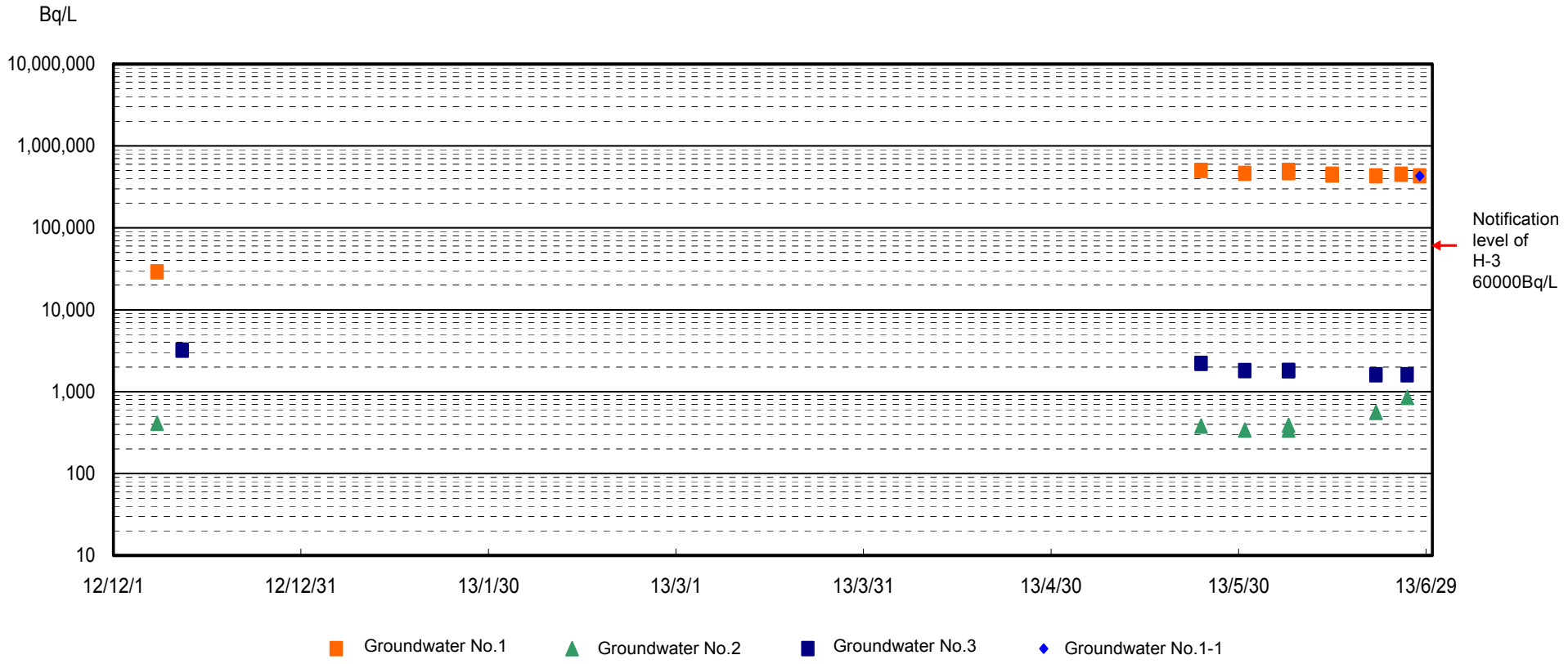
Area	Sampling location	Current analysis item and frequency				Contents of the change[*4]			
		γ ray	Tritium (3H)	All β	Sr-90	γ ray	H-3	All β	Sr-90
Around Unit 1-4 water intake channel	Between the water intake channel of Unit 1 and Unit 2 (surface layer)	-	-	-	-	1 time a week (3 times a week[*5])	1 time a week (3 times a week[*5])	1 time a week (3 times a week[*5])	1 time a month
	Between the water intake channel of Unit 1 and Unit 2 (lower layer)	-	-	-	-				
	Inside the silt fence of Unit 1	1 time a day	-	-	-	1 time a day	1 time a week	1 time a week	1 time a month
	Inside the silt fence of Unit 2								
	North side of Unit 1-4 water intake channel[*1]	1 time a day	1 time a month	1 time a week	2 times a month	1 time a day	1 time a week	1 time a week	1 time a month[*6]
	Outside the silt fence of Unit 1	1 time a day	-	-	-	1 time a day	-	-	-
	Outside the silt fence of Unit 2								
	Between the water intake channel of Unit 2 and Unit 3 (surface layer)	-	-	-	-	1 time a week	1 time a week	1 time a week	1 time a month
	Between the water intake channel of Unit 3 and Unit 4 (surface layer)					1 time a week	1 time a week	1 time a week	1 time a month
	Inside the silt fence of Unit 3	1 time a day	-	-	2 times a month	1 time a day	1 time a week	1 time a week	1 time a month[*6]
	Inside the silt fence of Unit 4								
	Outside the silt fence of Unit 3	1 time a day	-	-	-	1 time a day	-	-	-
	Outside the silt fence of Unit 4								
	South side of Unit 1-4 water intake channel								
In the port	In front of shallow draft quay	1 time a day	-	-	-	1 time a day	1 time a week	1 time a week	1 time a month
	In front of Unit 6 water intake channel	1 time a week	-	-	-	1 time a week	1 time a week	1 time a week	-
	West side in the port[*2]	-	-	-	-	1 time a week	1 time a week	1 time a week	-
	East side in the port[*2]								
	Port entrance[*2]	Non-regular[*3]	-	-	-	1 time a week	1 time a week	1 time a week	1 time a month
Around the north/south discharge channel	North side of Unit 5,6 discharge channel	1 time a day	1 time a month	1 time a month	1 time a month	1 time a day	1 time a week	1 time a week	1 time a month
	Around the south discharge channel	1 time a day	1 time a month	1 time a day	1 time a month	1 time a day	1 time a week	1 time a day	1 time a month
Land area (sea side of Unit 1-4 Turbine Building)	Underground reservoir No.1 (includes additional boring)	-	-	-	-	1 time a week (2 times a week[*5])	1 time a week (2 times a week[*5])	1 time a week (2 times a week[*5])	1 time a month
	Underground reservoir No.2 (includes additional boring)	-	-	-	-	1 time a week	1 time a week	1 time a week	Only for the first time
	Underground reservoir No.3 (includes additional boring)								
	Unit 1 sub-drain	3 times a week	2 times a year	2 times a year	2 times a year	3 times a week	2 times a year	2 times a year	2 times a year
	Unit 2 sub-drain	3 times a week	1 time a month	1 time a month	1 time a month	3 times a week	1 time a month	1 time a month	1 time a month
	Unit 3 sub-drain	3 times a week	2 times a year	2 times a year	2 times a year	3 times a week	2 times a year	2 times a year	2 times a year
	Unit 4 sub-drain								

←Measurement of tritium (3H) and all β will be performed "3 times a week" for a while due to the rising trend of tritium (3H).

←Measurement of γ ray, tritium (3H) and all β will be performed "2 times a week" for a while at the underground reservoir No.2 due to the rising trend of all β.

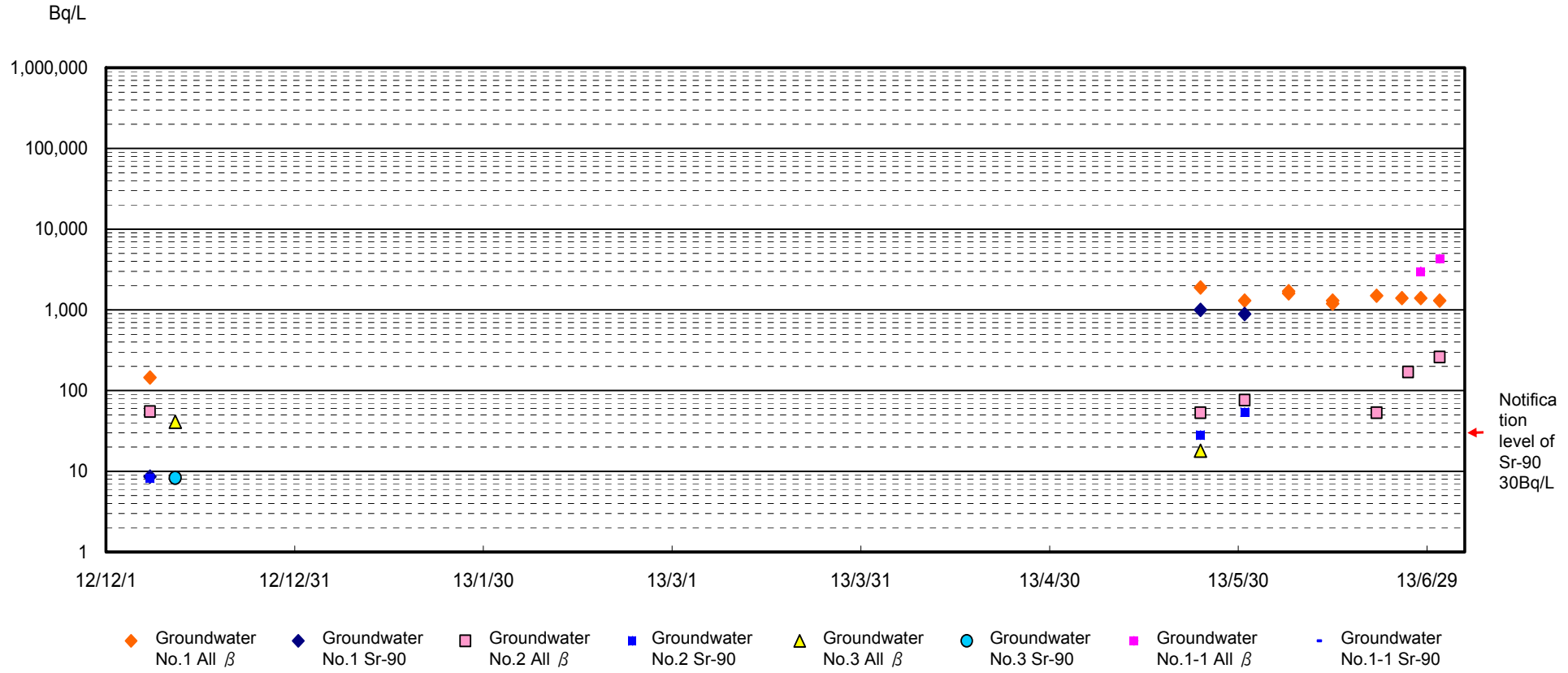
*1 Sampling point will be changed according to the progress of the water shielding wall construction at the sea side.
*2 There is a case that we cannot sample due to the weather.
*3 Sampling and measurement will be performed in case vessel enters the water intake channel.
*4 Measurement of γ ray, 3H and all β will be performed in order to monitor leakage to the sea. Measurement of strontium will be performed in order to compare with the notification level and to evaluate the exposure dose.
*5 Monitoring will be enhanced until ground improvement at the bank protection between the water intake channel of Unit 1 and Unit 2 will be finished.
*6 All β will be substituted for the monitoring of strontium taking analysis capacity into consideration.

Density Transition of Tritium in the Groundwater



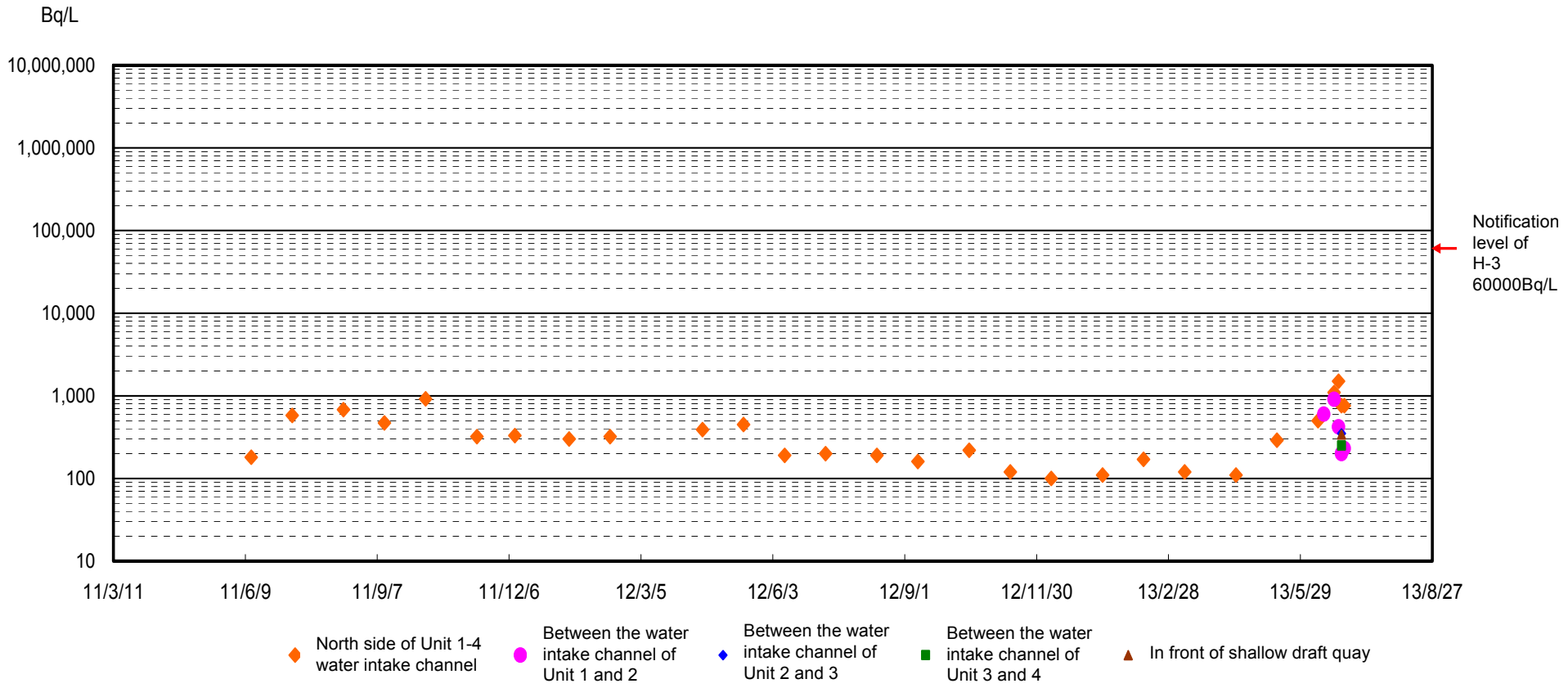
- Density of the groundwater No.1-1 is equivalent to that of the groundwater No.1.
- Monitoring of density at the groundwater No.2 will be enhanced since the rising trend has been found.

Density Transition of All β and Strontium in the Groundwater



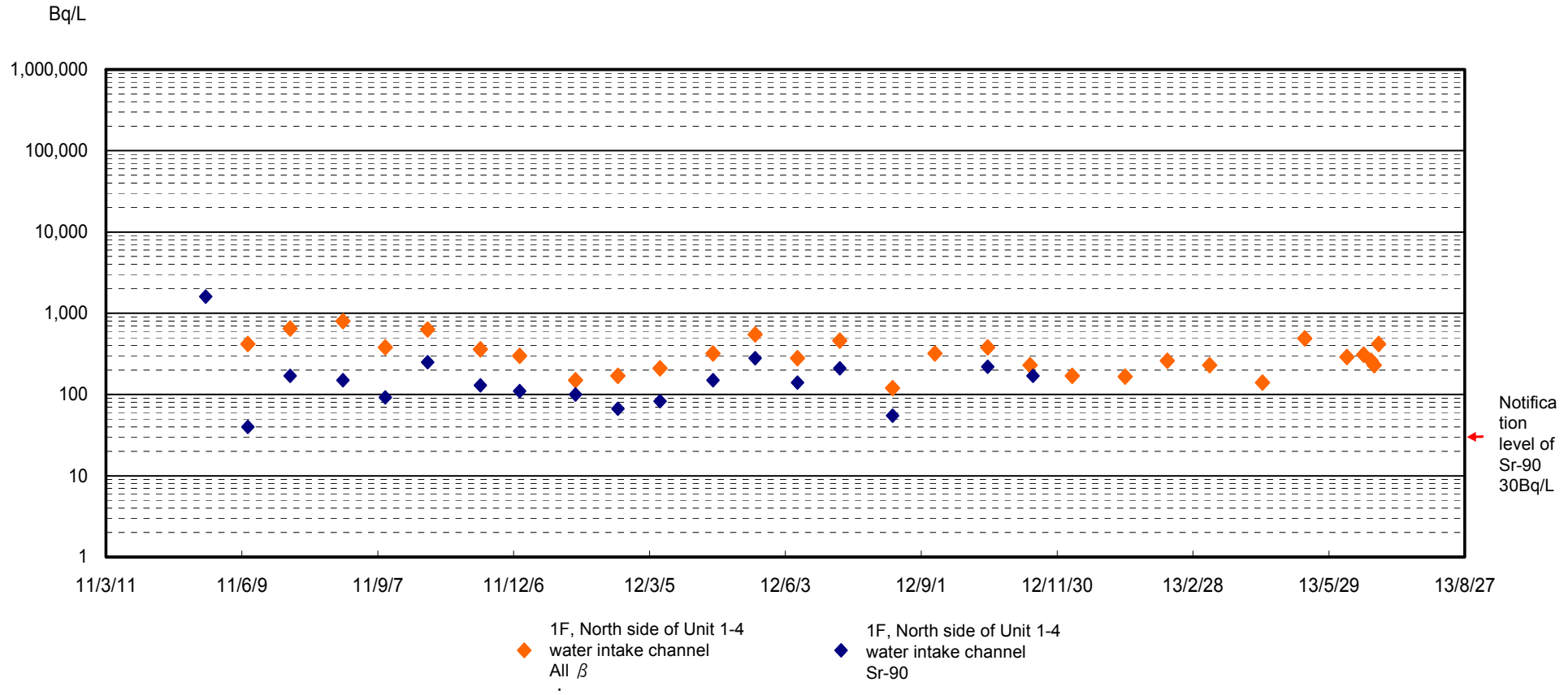
- No rising trend of density at the groundwater No.1 has been found.
- Density of the groundwater No.1-1 is evaluated to be equivalent to that of the groundwater No.1 at present.
- Monitoring of density at the groundwater No.2 will be enhanced since the rising trend has been found.

Density Transition of Tritium in the Seawater



- Monitoring of density is enhanced, since rising trend of tritium density in the seawater has been found since May though the density had shifted around 200 Bq/L.

Density Transition of All β and Strontium in the Seawater

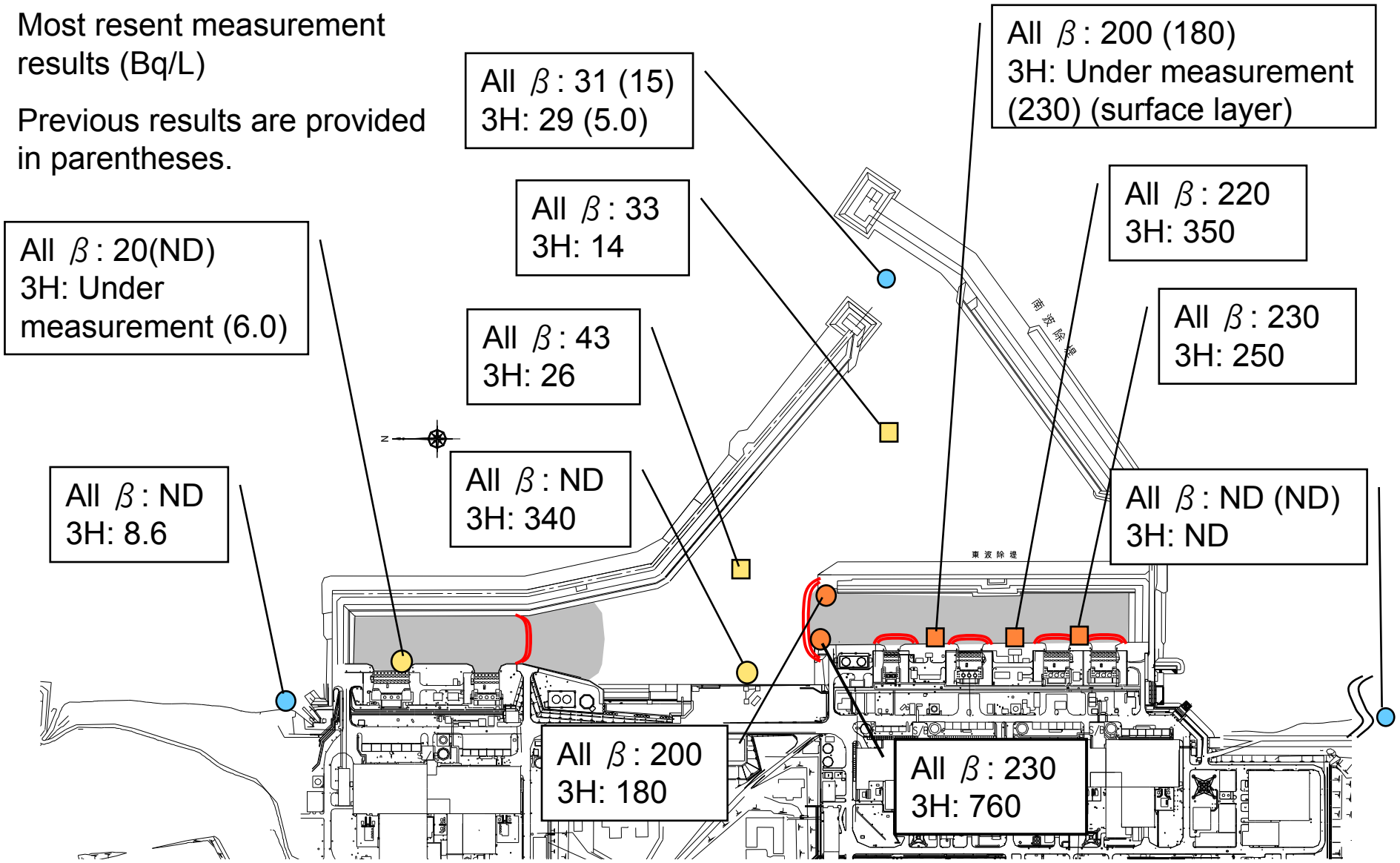


- Change of all β density in the seawater is small, and strontium density is estimated to be the same trend as all β.

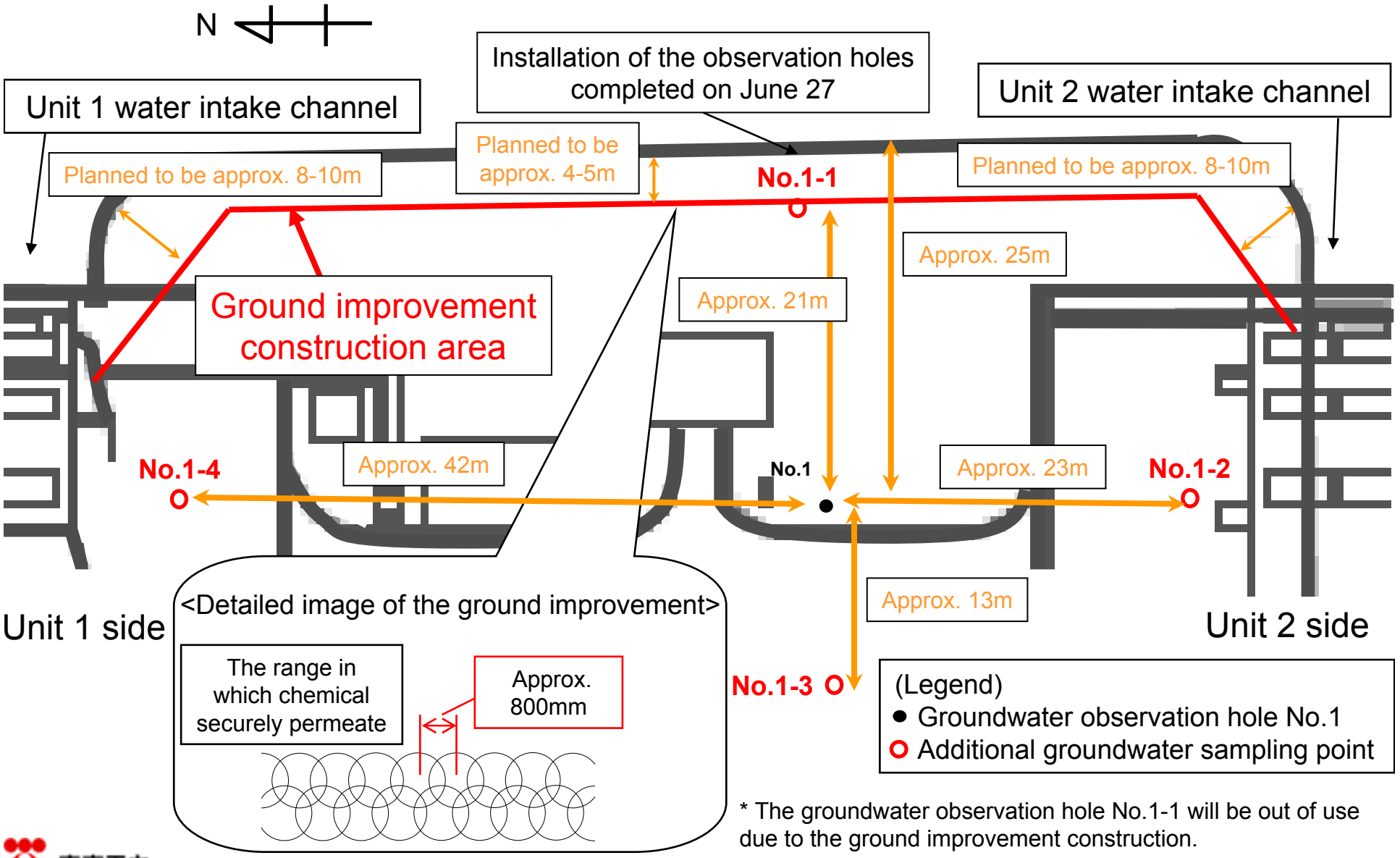
Measurement Results of the Seawater Inside/Outside the Port

Most resent measurement results (Bq/L)

Previous results are provided in parentheses.

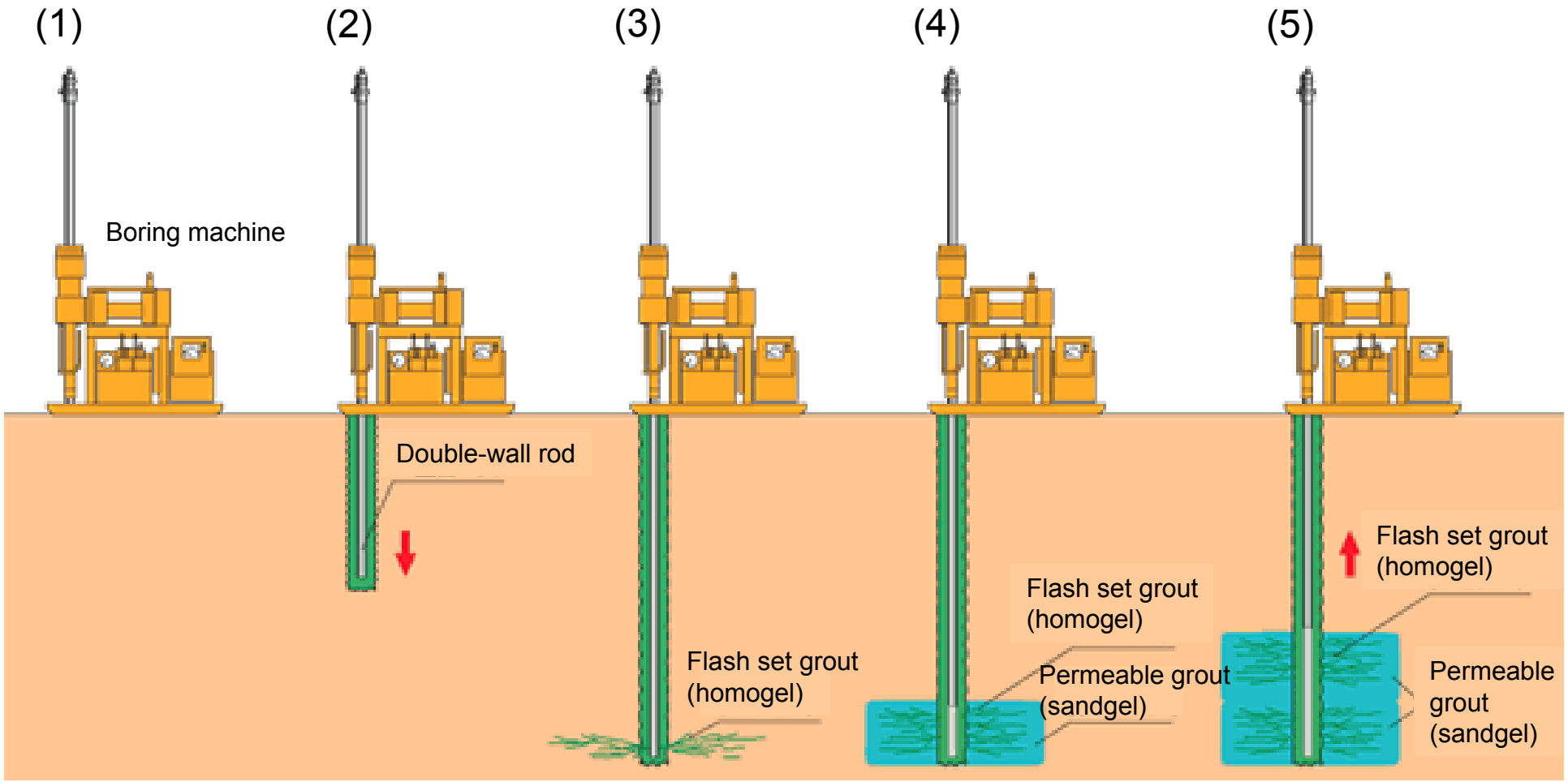


Positions of the observation holes around the groundwater observation hole No.1



* The groundwater observation hole No.1-1 will be out of use due to the ground improvement construction.

<Reference> Ground Improvement Method



*Source: Pamphlet of the Multirizer method from RAITO KOGYO CO., LTD

[Reference] Measurement Results of the Groundwater Observation Hole No.1 and No.1-1

Groundwater observation hole No.1 (Bq/L)

Sampling date	2012/12/8*2	2013/5/24	2013/5/31	2013/6/7 ①	2013/6/7 ②	2013/6/14 ①	2013/6/14 ②	2013/6/21	2013/6/25	2013/6/28	2013/7/1	2013/7/4
Sampling time	11:00 AM	4:19 PM	3:01 PM	3:45 PM	3:45 PM	2:29 PM	2:29 PM	9:01 AM	1:39 PM	5:50 PM	3:05 PM	11:50 AM
Cs-134	ND (0.59)	ND (0.45)	0.53	ND (0.42)	ND (0.40)	ND (0.37)	ND (0.37)	ND (0.36)	ND (0.39)	ND (0.40)	1.1	ND (0.64)
Cs-137	ND (0.72)	ND (0.45)	0.57	ND (0.53)	0.49	ND (0.43)	0.51	0.53	ND (0.49)	ND (0.43)	1.5	ND (0.47)
Ru-106	ND	26	19	19	21	18	19	16	20	16	ND	24
All β	150	1,900	1,300	1,700	1,600	1,200	1,300	1,500	1,400	1,400	1,300	1,500
H-3	29,000	500,000	460,000	500,000	470,000	450,000	440,000	430,000	450,000	430,000	420,000	Under measurement
Sr-90	8.6	1,000	890	Under measurement	Under measurement	Under measurement	Under measurement	Under measurement	–	–	–	–

*1 "ND" indicates that the measurement result is below the detection limit, and the detection limit of each nuclide is provided in parentheses.
*2 As of γ nuclide measurement, the amount is lower than true value since the high BG is in use.

Groundwater observation hole No.1-1 (Bq/L)

Sampling date	2013/6/28	2013/7/1
Sampling time	4:40 PM	4:05 PM
Cs-134	ND (0.41)	ND (0.44)
Cs-137	ND (0.51)	0.98
Ru-106	–	7.8
Mn-54	0.52	0.92
All β	3,000	4,300
H-3	430,000	510,000
Sr-90	Under measurement	–

[Reference] Measurement Results of the Groundwater Observation Hole No.2 and No.3

Groundwater observation hole No.2 (Bq/L)

Sampling date	2012/12/8*2	2013/5/24	2013/5/31	2013/6/7 ①	2013/6/7 ②	2013/6/21	2013/6/26	2013/7/1	2013/7/4
Sampling time	11:00 AM	4:12 PM	3:16 PM	4:05 PM	4:05 PM	5:44 PM	2:30 PM	4:55 PM	1:05 PM
Cs-134	ND (0.61)	ND (0.37)	ND (0.41)	0.47	ND (0.37)	ND (0.32)	ND (0.40)	0.48	ND (0.39)
Cs-137	ND (0.81)	ND (0.41)	0.95	0.73	ND (0.48)	ND (0.37)	ND (0.48)	0.66	ND (0.46)
Ru-106	ND	ND	ND	ND	ND	ND	–	ND	ND
All β	55	53	76	ND (18)	ND (18)	53	170	260	93
H-3	410	380	340	390	340	560	850	740	Under measurement
Sr-90	8.2	28	54	Under measurement	Under measurement	Under measurement	–	–	–

Groundwater observation hole No.3 (Bq/L)

Sampling date	2012/12/12*2	2013/5/24	2013/5/31	2013/6/7 ①	2013/6/7 ②	2013/6/21	2013/6/26	2013/7/4
Sampling time	11:00 AM	4:52 PM	3:32 PM	3:58 PM	3:58 PM	5:01 PM	3:50 PM	2:00 PM
Cs-134	ND (0.60)	0.87	1.6	0.9	0.5	1.7	0.96	1.5
Cs-137	ND (0.79)	1.4	2.7	2.0	1.6	2.9	2.9	2.8
Ru-106	ND	ND	ND	ND	ND	ND	–	ND
All β	41	18	ND (17)	ND (18)	ND (18)	ND (17)	ND (21)	ND (18)
H-3	3,200	2,200	1,800	1,800	1,800	1,600	1,600	Under measurement
Sr-90	8.3	ND (1.0)	0.25	Under measurement	Under measurement	Under measurement	–	–

*1 "ND" indicates that the measurement result is below the detection limit, and the detection limit of each nuclide is provided in parentheses.

*2 As of γ nuclide measurement, the amount is lower than true value since the high BG is in use.

[Reference] Measurement Results of between the Water Intake Channel

Between the water intake channel of Unit 1 and Unit 2 (Bq/L)

Sampling date	2013/6/14	2013/6/21	2013/6/24	2013/6/26 Surface layer	2013/6/26 Lower layer	2013/6/28 Surface layer	2013/6/28 Lower layer	2013/7/1 Surface layer	2013/7/1 Lower layer	2013/7/3 Surface layer	2013/7/3 Lower layer
Sampling time	1:20 PM	11:00 AM	6:00 PM	4:55 PM	4:55 PM	11:34 AM	11:36 AM	6:04 AM	6:04 AM	6:15 AM	6:15 AM
Cs-134	–	9.4	–	6.2	6.2	8.5	7.5	4.9	5.7	5.3	3.0
Cs-137	–	19	–	11	9.3	19	17	11	14	9.3	8.9
All β	–	330	–	260	210	180	180	200	180	130	120
H-3	600	910	420	200	360	230	340	170	ND(120)	Under measurement	Under measurement
Sr-90	–	Under measurement	–	–	Under measurement	–	–	–	–	–	–

Between the water intake channel of Unit 2 and Unit 3 (Bq/L)

Sampling date	2013/6/26	2013/7/3
Sampling time	6:51 AM	6:30 AM
Cs-134	8.8	6.0
Cs-137	18	14
All β	220	140
H-3	350	Under measurement
Sr-90	Under measurement	–

Between the water intake channel of Unit 3 and Unit 4 (Bq/L)

Sampling date	2013/6/26	2013/7/3
Sampling time	6:47 AM	6:38 AM
Cs-134	9.9	7.3
Cs-137	23	16
All β	230	130
H-3	250	Under measurement
Sr-90	Under measurement	–

* "ND" indicates that the measurement result is below the detection limit, and the detection limit of each nuclide is provided in parentheses.

[Reference] Measurement Results of the North Side of the Water Intake Channel

North side of Unit 1-4 water intake channel (Bq/L)

Sampling date	2013/1/14	2013/2/11	2013.3.11	2013/4/15	2013/5/13	2013/6/10	2013/6/21	2013/6/24	2013/6/26	2013/6/28	2013/7/1	2013/7/3
Sampling time	7:00 AM	6:32 AM	6:27 AM	6:12 AM	5:59 AM	6:01 AM	6:18 AM	5:50 PM	6:13 AM	6:27 AM	6:26 AM	6:08 AM
Cs-134	3.5	3.7	31	ND (2.5)	9.2	7.3	12	–	18	15	13	13
Cs-137	5.7	10	56	6.0	16	14	28	–	28	33	28	23
All β	170	260	230	140	490	290	310	–	260	230	420	310
H-3	110	170	120	110	290	500	1100	1500	760	760	2200	Under measurement
Sr-90	–	–	–	–	–	–	Under measurement	–	–	–	–	–

North side of the East Seawall Break (Bq/L)

Sampling date	2013/6/27	2013/7/3
Sampling time	9:50 AM	6:50 AM
Cs-134	6.1	3.3
Cs-137	13	8.2
All β	200	99
H-3	180	Under measurement
Sr-90	Under measurement	–

* "ND" indicates that the measurement result is below the detection limit, and the detection limit of each nuclide is provided in parentheses.

[Reference] Measurement Results of Inside the Port

In front of shallow draft quay (Bq/L)

Sampling date	2013/6/26	2013/7/3
Sampling time	6:06 AM	6:03 AM
Cs-134	ND (1.8)	1.9
Cs-137	2.3	5.6
All β	ND (18)	40
H-3	340	Under measurement
Sr-90	Under measurement	–

In front of Unit 6 water intake channel (Bq/L)

Sampling date	2013/6/25	2013/7/2
Sampling time	7:15 AM	6:25 AM
Cs-134	ND (3.3)	ND (1.7)
Cs-137	ND (2.1)	2.6
All β	ND (18)	20
H-3	6.0	Under measurement
Sr-90	–	–

West side in the port (Bq/L)

Sampling date	2013/6/26
Sampling time	2:25 PM
Cs-134	ND (2.5)
Cs-137	3.3
All β	43
H-3	26
Sr-90	Under measurement

East side in the port (Bq/L)

Sampling date	2013/6/26
Sampling time	2:22 PM
Cs-134	ND (2.4)
Cs-137	ND (2.4)
All β	33
H-3	14
Sr-90	Under measurement

* "ND" indicates that the measurement result is below the detection limit, and the detection limit of each nuclide is provided in parentheses.

[Reference] Measurement Results of Inside/Outside the Port

Port Entrance (Bq/L)

Sampling date	2013/6/20	2013/6/26
Sampling time	1:18 PM	2:19 PM
Cs-134	ND (1.3)	ND (1.9)
Cs-137	ND (1.2)	3.7
All β	15	31
H-3	5.0	29
Sr-90	Under measurement	–

North side of Unit 5,6 discharge channel (Bq/L)

Sampling date	2013/6/21	2013/6/26	2013/7/3
Sampling time	7:25 AM	11:25 AM	6:55 AM
Cs-134	1.8	ND (1.9)	ND (1.2)
Cs-137	2.1	3.3	1.2
All β	–	ND (22)	ND (17)
H-3	–	8.6	Under measurement
Sr-90	–	Under measurement	–

Around the south discharge channel (Bq/L)

Sampling date	2013/6/21	2013/6/26	2013/7/3
Sampling time	7:15 AM	11:15 AM	5:10 AM
Cs-134	ND (1.0)	ND (1.1)	ND (1.2)
Cs-137	2.0	ND (1.3)	ND (1.2)
All β	ND (19)	ND (22)	ND (18)
H-3	–	ND (2.9)	Under measurement
Sr-90	–	Under measurement	–

* "ND" indicates that the measurement result is below the detection limit, and the detection limit of each nuclide is provided in parentheses.