Revision

Underground Reservoir Overview

（As of 10 AM, April 7, 2013)

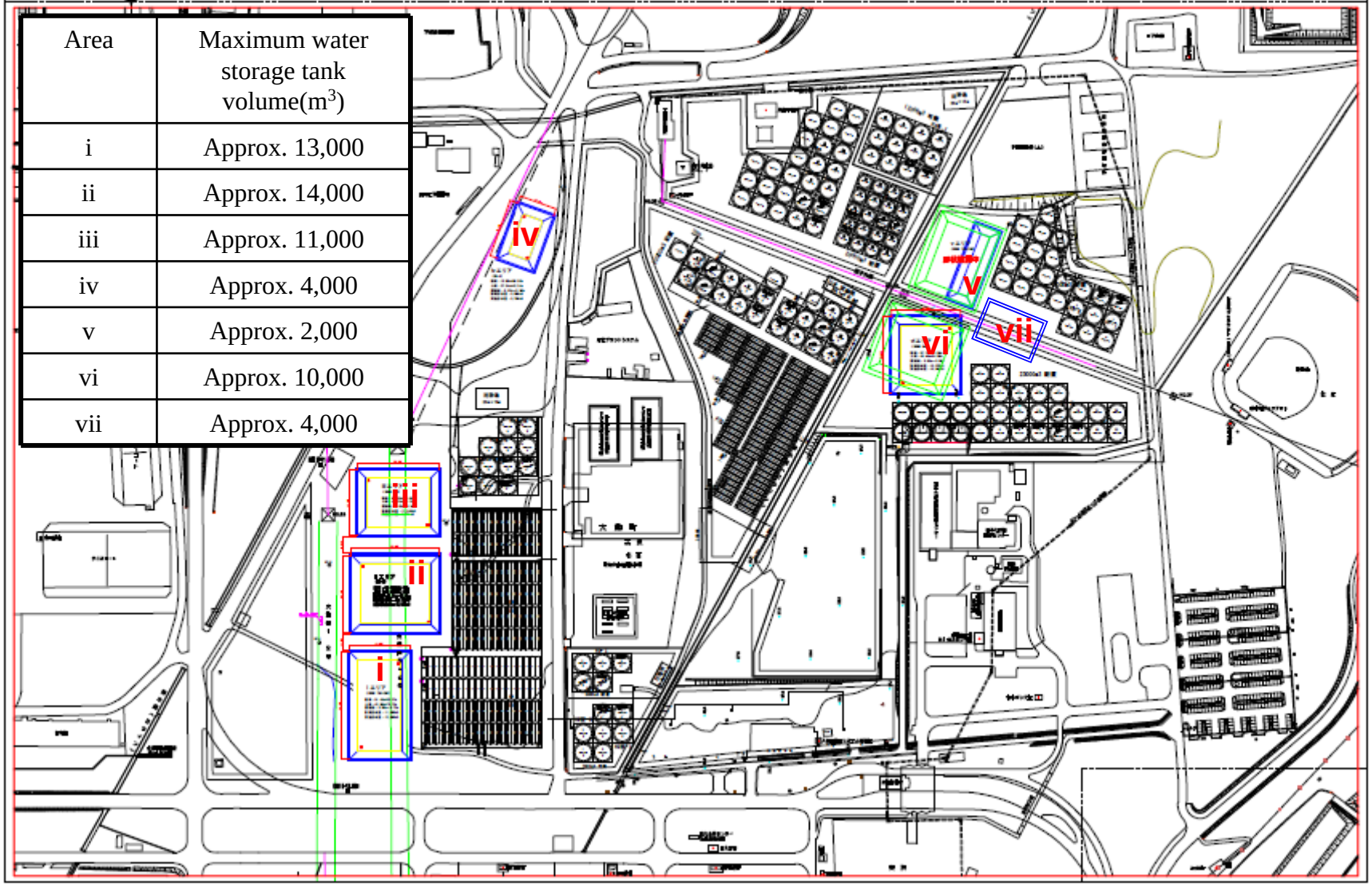
April 7, 2013

Tokyo Electric Power Company

1. Top View

Fukushima Daiichi NPS Underground Reservoir Scheme Diagram (Projection) SCALE: 1:2500

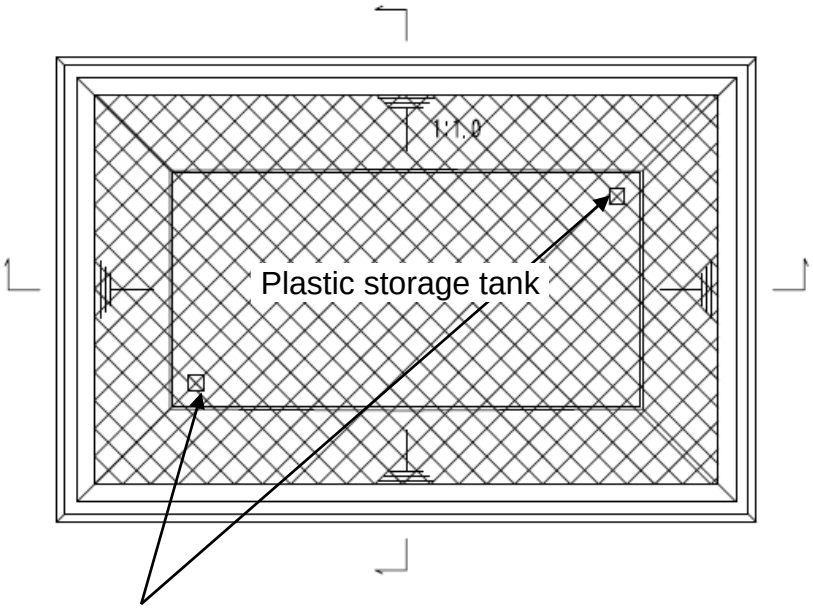
Area	Maximum water storage tank volume(m^3)
i	Approx. 13,000
ii	Approx. 14,000
iii	Approx. 11,000
iv	Approx. 4,000
v	Approx. 2,000
vi	Approx. 10,000
vii	Approx. 4,000

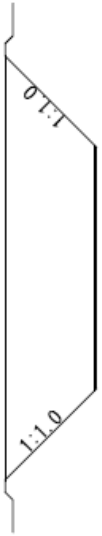


2. Structural Diagram

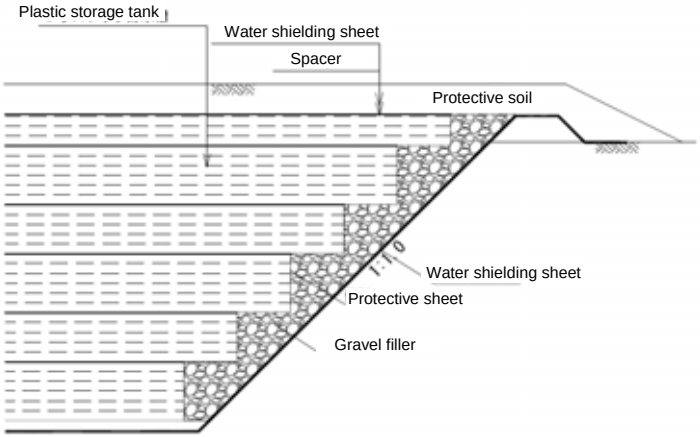
Underground Reservoir Standard Diagram

Standard Plan



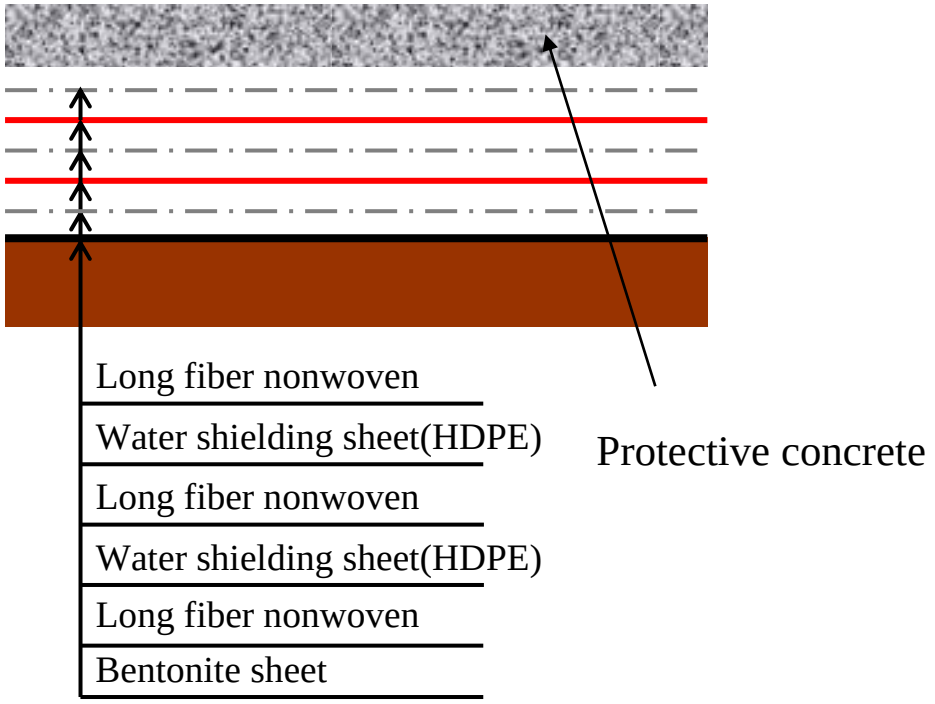


Standard Section

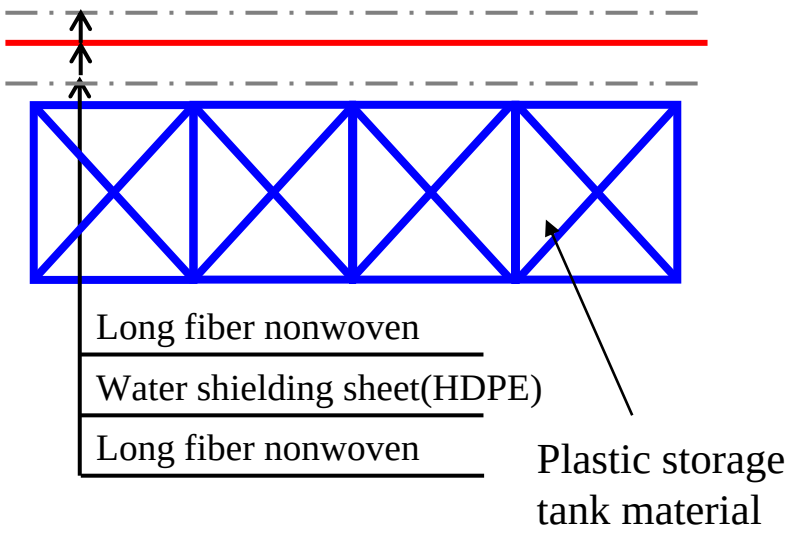


3. Structure Details

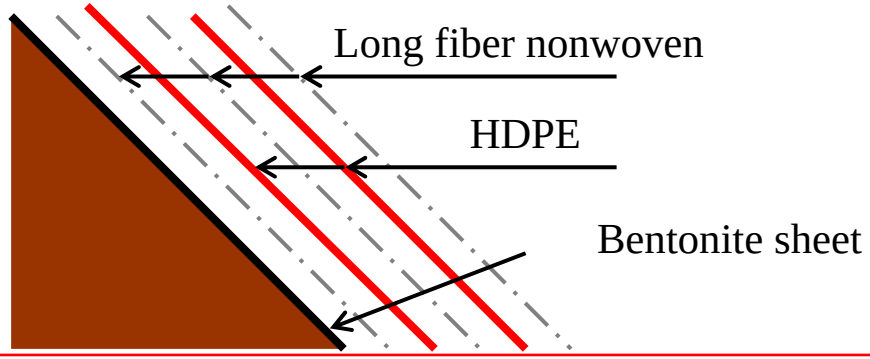
Bottom sheet structural diagram



Top sheet structural diagram



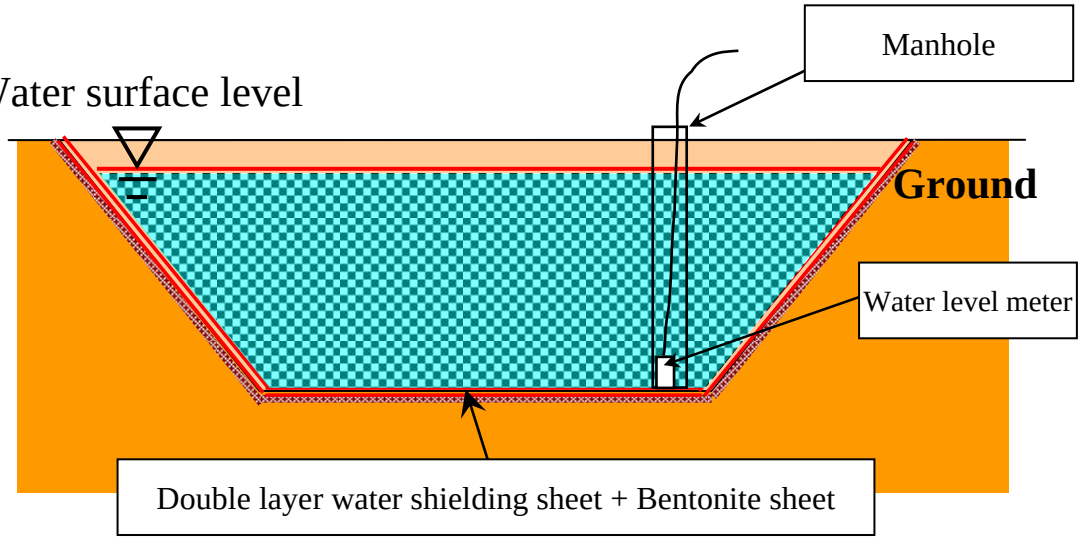
Structural diagram of slope sheets



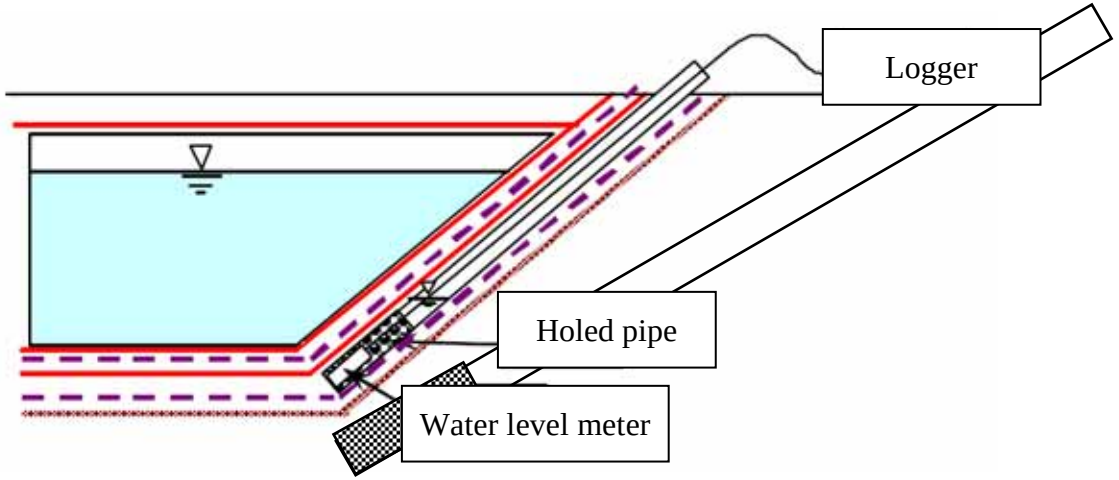
Plastic storage tank material

4. Leak Detection System General Diagram

(1) Water level meters installed in underground reservoirs

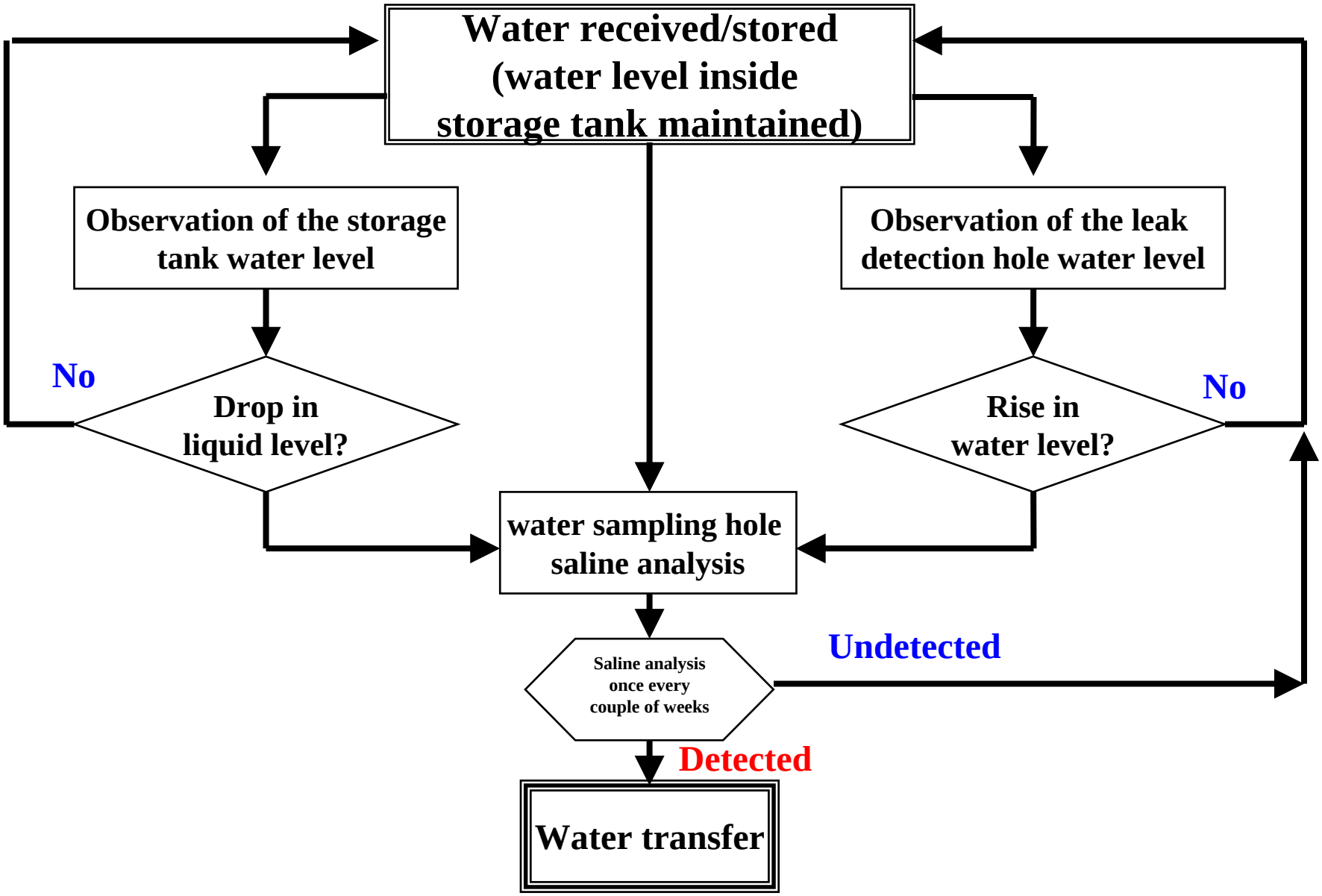


(2) Water level meter is installed in between the bentonite sheet and the water shielding sheet



5. Leak Detection Hole Construction Photo

6. Leak Monitoring Flow Chart



7. Event Time Sequence for Underground Reservoir No. 2 (1)

2013/2/1: Start of receiving of RO concentrate water

2013/3/2: Receiving of RO concentrate water completed (Full- Water level: 95%)

Leakage monitoring by chlorine ion concentration of the drain hole water starts

2013/3/27: Sampling from drain hole (northeast side)

→ All beta: ND（＜3.193 x 10^-2Bq/cm^3），
Chlorine concentration: 9ppm

2013/4/3 9:30: Sampling from drain hole (northeast side)

→ All beta: 2.076 x 10^1Bq/cm^3, Chlorine concentration 10ppm

（No changes in chlorine ion concentration, analyzed the following day to detect all beta)

2013/4/4 7:00: Water level at 94.5%

2013/4/4 10:30: Sampling from drain hole (southwest side)

→ All beta: ND（＜3.241 x 10^-2Bq/cm^3），
Chlorine concentration: 9ppm

2013/4/4 16:20: Sampling from drain hole (northeast side)

→ All beta: 3.528 x 10^1Bq/cm^3, Chlorine concentration: 11ppm

7. Event Time Sequence for Underground Reservoir No. 2 (2)

2013/4/5 14:30: Sampling from leak detection hole (southwest side)

→ All beta: 1.766 x 10^-1Bq/cm^3, Chlorine concentration12ppm

2013/4/5 15:00: Sampling from leak detection hole (northeast side)

→ All beta: 5.838 x 10^3Bq/cm^3, Chlorine concentration: 300ppm

（19:23 analysis completed）

2013/4/5 22:40: Leak detected from underground reservoir

2013/4/5 22:54: Leak announced via teleconference

2013/4/6 5:43: Commencement of water transfer from underground reservoir No. 2 to underground reservoir No. 1 using permanent pump

2013/4/6 9:38: Commencement of water transfer from underground reservoir No. 2 to underground reservoir No. 1 using 3 temporary pumps

2013/4/6 12:27: Transfer by 3 temporary pumps temporarily suspended to add fourth temporary pump.

7. Event Time Sequence for Underground Reservoir No. 2 (3)

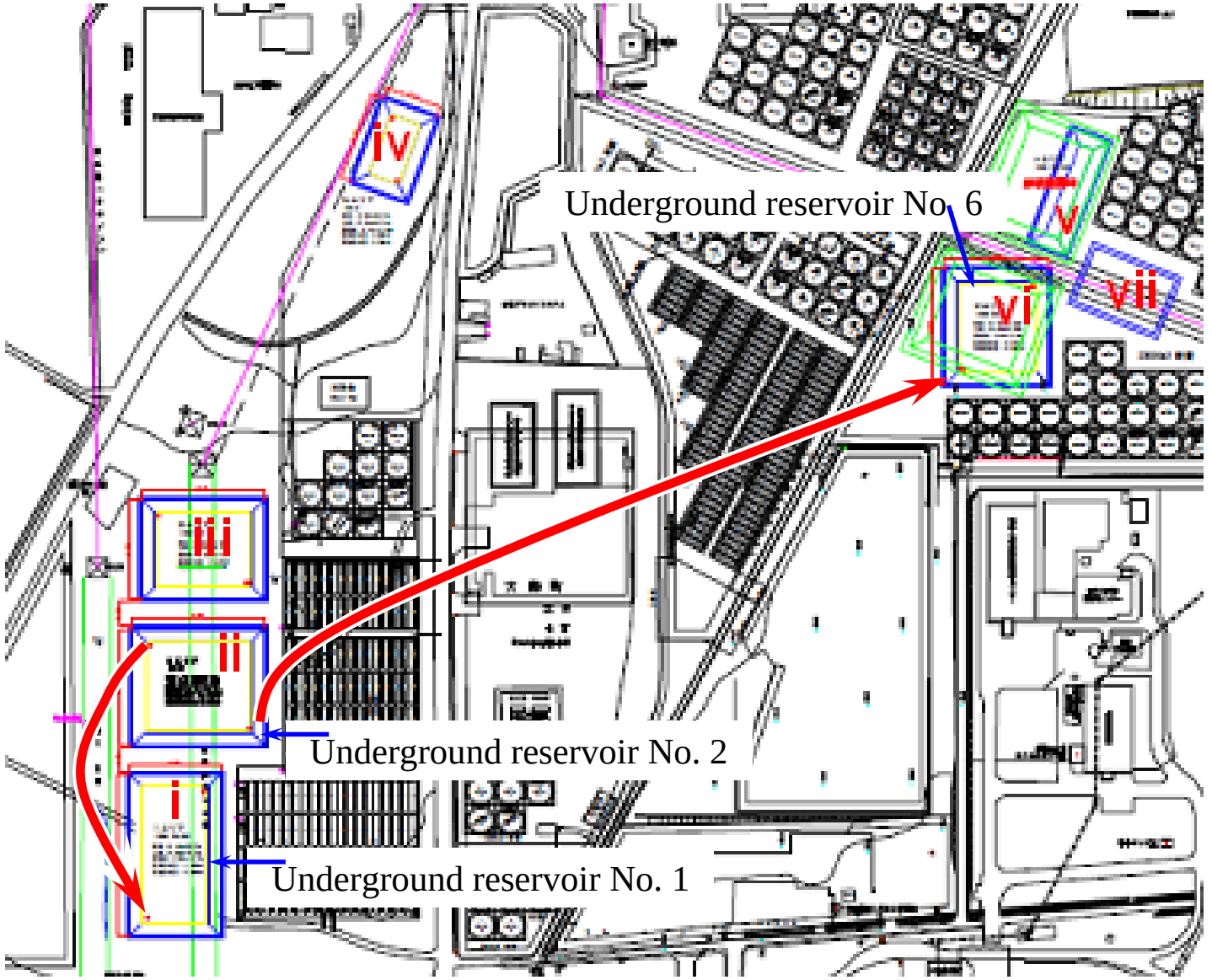
2013/4/6 12:52: Commencement of water transfer from underground reservoir No. 2 to underground reservoir No. 1 using temporary pumps

2013/4/6 12:57: Commencement of water transfer from underground reservoir No. 2 to underground reservoir No. 1 using 3 temporary pumps

2013/4/6 15:33: Water transfer from permanent pump temporarily suspended to switch transfer destination to underground reservoir No. 6

2013/4/6 16:10: Commencement of water transfer from underground reservoir No. 2 to underground reservoir No. 6 using permanent pump

8. Water transfer route (concept image)

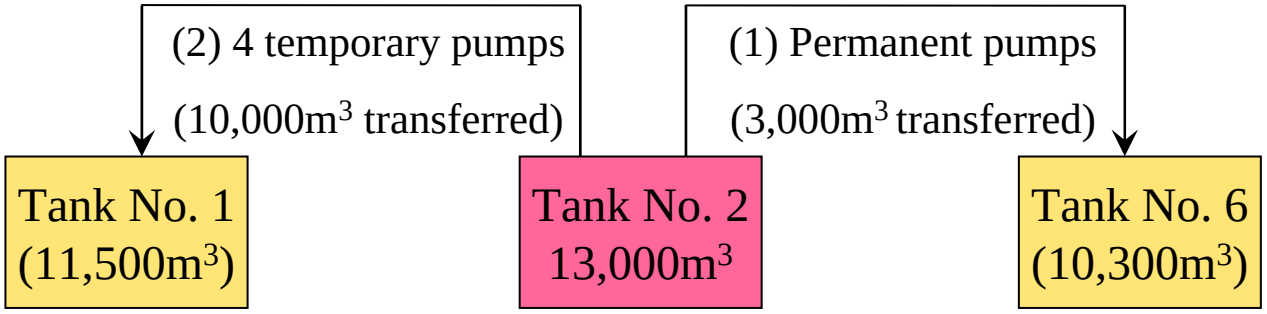


9. Number of days to process underground reservoir No. 2

■(1) Permanent transfer pump (Approx. 40m^3/h)
→Number of days required to transfer water from underground reservoir No. 2 to underground reservoir No. 6 ･･･Approx. 3.1 days
■(2) Temporary pump (Approx. 30m^3/h x 2 pumps + Approx. 48m^3/h+ Approx. 60m^3 = Approx. 168m^3/h) ※
→ Number of days required to transfer water from underground reservoir No. 2 to underground reservoir No. 1･･･ Approx. 2.5 days

※ Pump flow correction for three temporary pumps
(Correct) Temporary pump: Approx. 30m^3/h, Approx. 48m^3/h, Approx. 60m^3
(Incorrect) Approx. 20.8m^3/h x 3 pumps
The pump flow of the fourth additional 10. Pump is approx. 30m^3/h.

■Transfer by (1) and (2) will be performed simultaneously
→Number of days required to pump water from underground reservoir No. 2･･ Approx. 3.1 days from start of transfer by method (1)



10. Event Time Sequence for Underground Reservoir No. 3 (1)

2013/4/6 Underground reservoir No. 3 drain hole water sampled in wake of leak from underground reservoir No. 2

Sampled at 9:30am

All beta: 1.1 x 10^-1Bq/cm^3 (Detectable limit: 3.3 x 10^-2Bq/cm^3)

Chlorine concentration: 10ppm

2013/4/6 Additional sampling performed to determine if there is a leak from underground reservoir No. 3.

- Underground reservoir No. 3 leak detection hole water (northeast side) sampled at 9:50pm on April 6.

  Chlorine concentration: Less than 1ppm

  Iodine 131: Below detectable limits (2.7 x 10^-2Bq/cm^3)

  Cesium 134: Below detectable limits (5.2 x 10^-2Bq/cm^3)

  Cesium 137: Below detectable limits (6.7 x 10^-2Bq/cm^3)

  All beta: 1.8 x 10^-1Bq/cm^3 (Detectable limit: 3.1 x 10^-2Bq/cm^3)

- Underground reservoir No. 3 leak detection hole water (southwest side) sampled at 10:20pm on April 6

  Chlorine concentration: 350ppm

  Iodine 131: Below detectable limits (6.6 x 10^-2Bq/cm^3)

  Cesium 134: Below detectable limits (6.5 x 10^-2Bq/cm^3)

  Cesium 137: Below detectable limits (7.9 x 10^-2Bq/cm^3)

  All beta: 1.8 x 10^3Bq/cm^3 (Detectable limit: 3.1 x 10^0Bq/cm^3)

All beta isotope detection from underground reservoir No. 3 leak detection hole (northeast side) and underground reservoir No. 3 leak detection hole (southwest side). Although there has been no reduction in the water level of the aforementioned tank, there may be a small external leak in the outermost sheet (bentonite sheet).

10. Event Time Sequence for Underground Reservoir No. 3 (2)

April 7, 2013

・In addition to enhancing monitoring of the water levels in the aforementioned water storage tanks, sampling from the following locations will be performed in order to detect leaks.

・Underground reservoir No.3 drain hole water southwest side Sampled at 3:15am on April 7

Chlorine concentration: 1ppm

Iodine 131: Below detectable limits（2.6 x 10^-2 Bq/cm^3）

Cesium 134: Below detectable limits（5.8 x 10^-2 Bq/cm^3）

Cesium 137: Below detectable limits（6.9 x 10^-2 Bq/cm^3）

All beta: 4.5 x 10^-2 Bq/cm^3（Detectable limit: 3.2 x 10^-2 Bq/cm^3）

・Underground reservoir No.3 leak detection hole water（pumped）southwest side

Sampled at 3:45 AM on April 7

Chlorine concentration: 380ppm

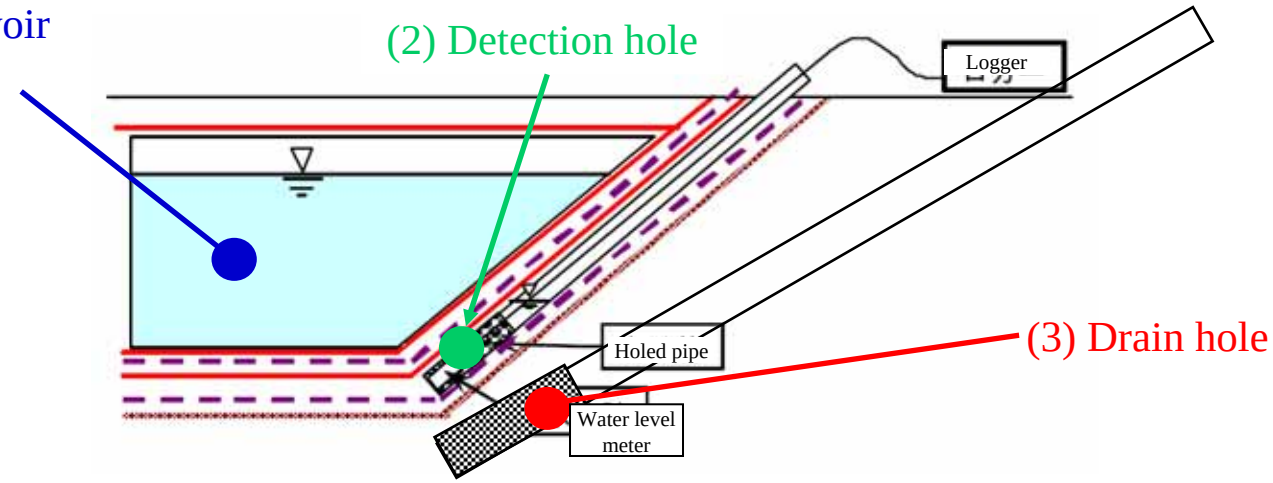
Iodine 131: Below detectable limits（5.1 x 10^-2 Bq/cm^3）

Cesium 134: Below detectable limits（6.2 x 10^-2 Bq/cm^3）

Cesium 137: Below detectable limits（8.0 x 10^-2 Bq/cm^3）

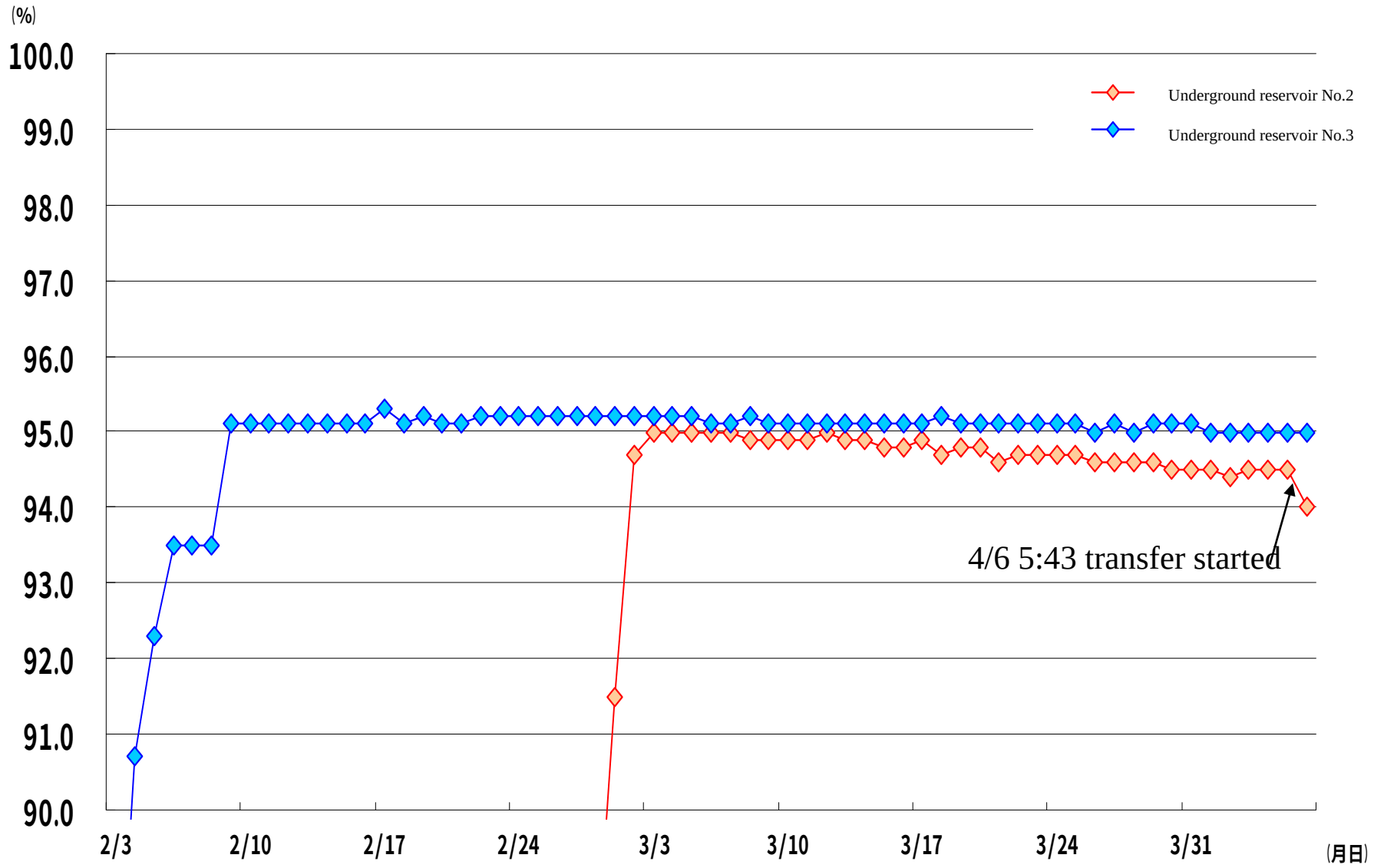
All beta: 2.2 x 10^3Bq/cm^3（Detectable limit: 3.2 x 10^0Bq/cm^3）

11. Analysis Results for Water from Each Layer



		(1) Water storage tank	(2) Detection hole	(3) Drain hole
Underground reservoir No. 2 (4/6 northeast side)	Chlorine concentration(ppm)	1,500	500	14
	All beta (Bq/cm^3)	2.9×10^{5}	6.9×10^{3}	4.3×10^{1}
Underground reservoir No. 3 (4/6 southwest side)	Chlorine concentration(ppm)	1,500	350	10
	All beta (Bq/cm^3)	2.9×10^{5}	1.8×10^{3}	1.1×10^{-1}
Underground reservoir No. 3 (4/7 southwest side)	Chlorine concentration(ppm)	1,500	380	1
	All beta (Bq/cm^3)	2.9×10^{5}	2.2×10^{3}	4.5×10^{-2}

12. Underground Reservoir （No2, No.3） Water Storage Percentage Changes



13. Drain Hole Water and Leak Detection Hole Water Analysis Results (1)

Underground reservoir No. 2	Sampling date	2013/2/20	2013/2/27	2013/2/28	2013/3/5	2013/3/6	2013/3/13	2013/3/20	2013/3/27	2013/4/3
	Water sampling time	11:05	10:05	14:00	10:00	10:40	9:50	10:00	9:20	9:30
	Chlorine (ppm)	9	8	8	10	8	8	10	9	10
	All beta (Bq/cm^3)	ND (<3.338E-02)	ND (<3.435E-02)	—	—	ND (<2.093E-02)	ND (<2.066E-02)	2.816E-01	ND (<3.193E-02)	2.076E+01
	Reference	Drain hole	Drain hole	Drain hole	Drain hole	Drain hole	Drain hole	Drain hole	Drain hole	Drain hole Northeast side

Underground reservoir No. 3	Sampling date	2013/2/20	2013/2/27	2013/2/28	2013/3/5	2013/3/6	2013/3/13	2013/3/20	2013/3/27	2013/4/3
	Water sampling time	11:00	10:10			10:50	9:50	10:00	9:20	9:30
	Chlorine (ppm)	9	7			8	8	10	10	9
	All beta (Bq/cm^3)	ND (<3.338E-02)	ND (<3.435E-02)	—	—	ND (<2.095E-02)	ND (<3.435E-02)	3.338E-02	ND (<3.193E-02)	5.902E-02
	Reference									

13. Drain Hole Water and Leak Detection Hole Water Analysis Results (2)

Underground reservoir No. 2	Sampling date	2013/4/4	2013/4/5	2013/4/5	2013/4/6	2013/4/6	2013/4/6	2013/4/6
	Water sampling time	16:20	14:30	15:00	9:20	9:25	13:56	14:17
	Chlorine (ppm)	11	12	300	8	14	500	—
	All beta (Bq/cm^3)	3.528E+01	1.766E-01	5.838E+03	4.8E-02	4.3E+01	6.9E+03	—
	Reference	Drain hole Northeast side	Leak detection hole Southwest side	Leak detection hole Northeast side	Drain hole Southwest side	Drain hole Northeast side	Leak detection hole Northeast side	Leak detection hole Southwest side

※No measurements taken due to inability to take samples required for analysis

Underground reservoir No. 3	Sampling date				2013/4/6				2013/4/6	2013/4/6	2013/4/7	2013/4/7
	Water sampling time				9:30				21:50	22:20	3:15	3:45
	Chlorine (ppm)				10				1以下	350	1	380
	All beta (Bq/cm^3)				1.1E-01				1.8E-01	1.8E+03	4.5E-2	2.2E+03
	Reference								Leak detection hole Northeast side	Leak detection hole Southwest side	Drain hole Southwest side	Leak detection hole Southwest side