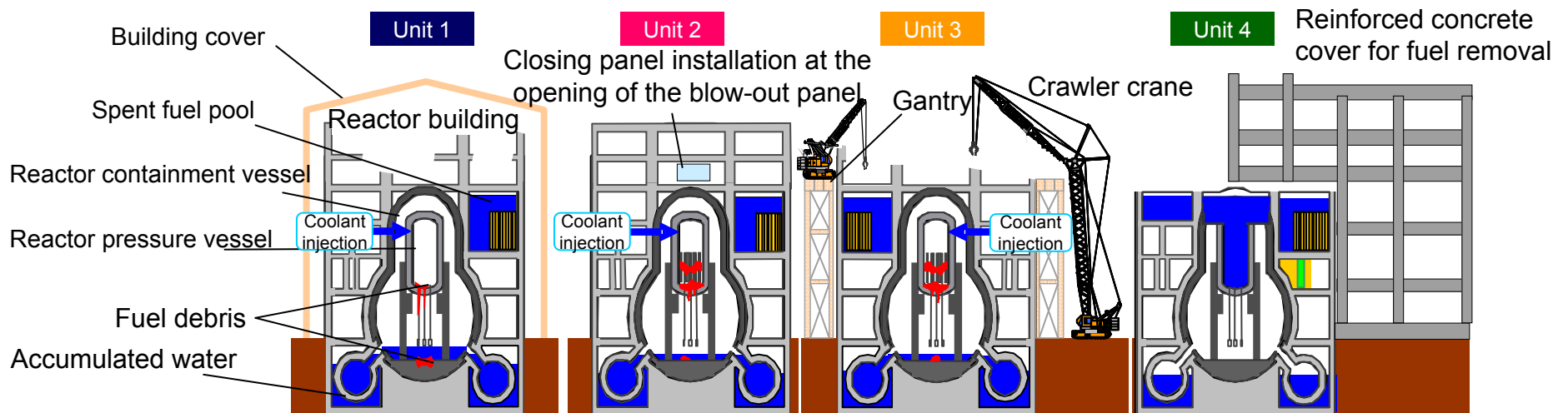

Efforts for Decommissioning of Unit 1 to 4 Reactors in TEPCO Fukushima Daiichi Nuclear Power Station

September 13, 2013

Tokyo Electric Power Company, Inc.

I. [1] Current Situation of Reactors and Fuel Pools

- The Unit 1 to 3 reactors are maintaining stable cold shutdown condition (approx. 25 to 50°C) and the temperature in the spent fuel pools of Unit 1 to 4 reactors is also under stable condition.
- Radioactive materials released amount from the Unit 1 to 3 reactors are stable at a maximum of approx. 10 million Bq/hour, which is corresponding to 0.03mSv/year at the site boundary (approx. 1/70 of the background radiation).

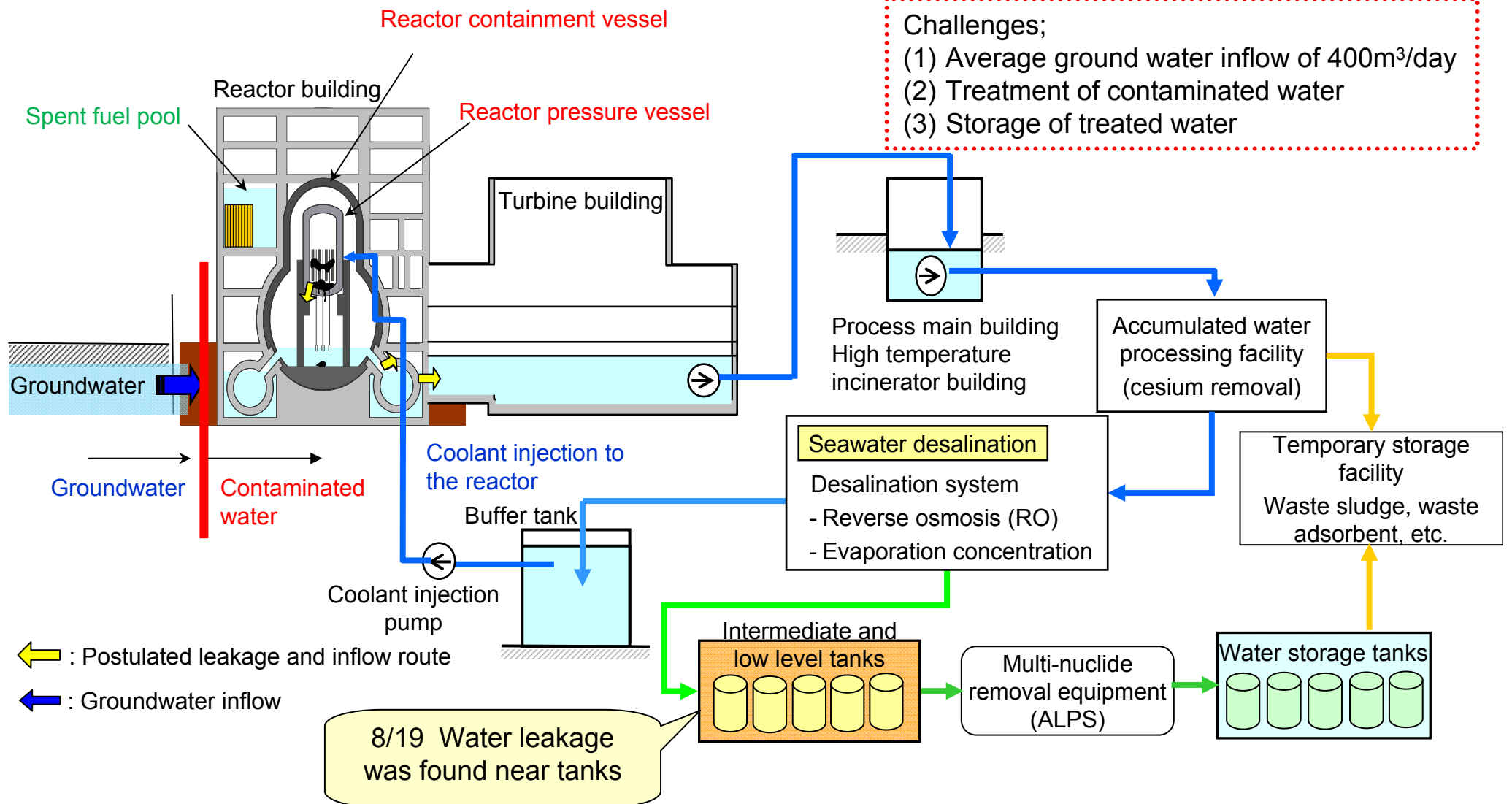


*Below is the examples of temperature data measured at some points. As of 11:00 on September 12.

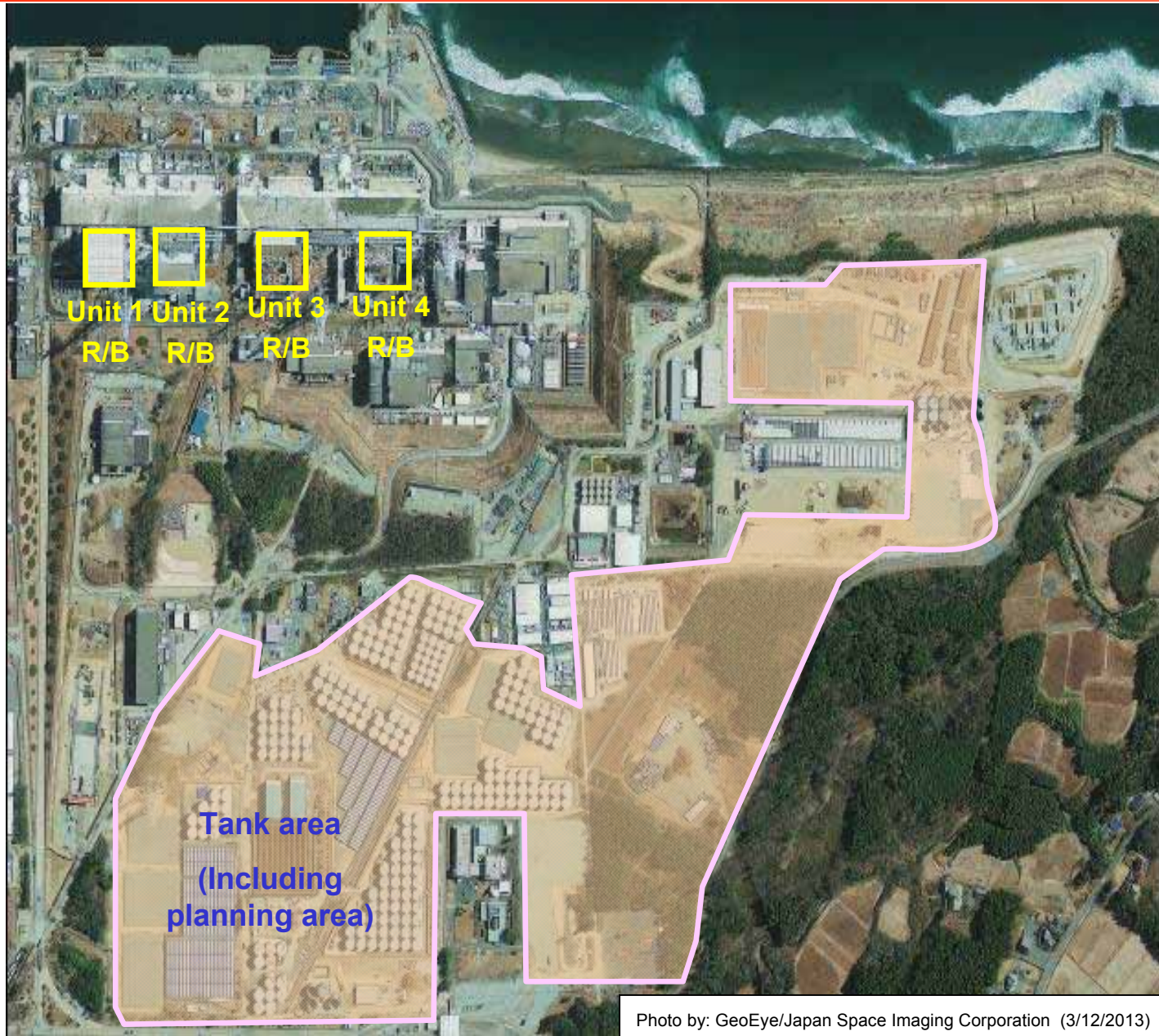
Reactors	RPV bottom temperature: 33.1°C RCV temperature: 34.0 °C	43.9°C 44.1°C	43.2°C 41.3°C	No fuel
Fuel pools	27.5°C	26.3°C	25.9°C	36.0°C

I. [2] Circulating Water Cooling System Using Accumulated Water

- Treat the accumulated water in the buildings (cesium removal, desalination) and reuse it.

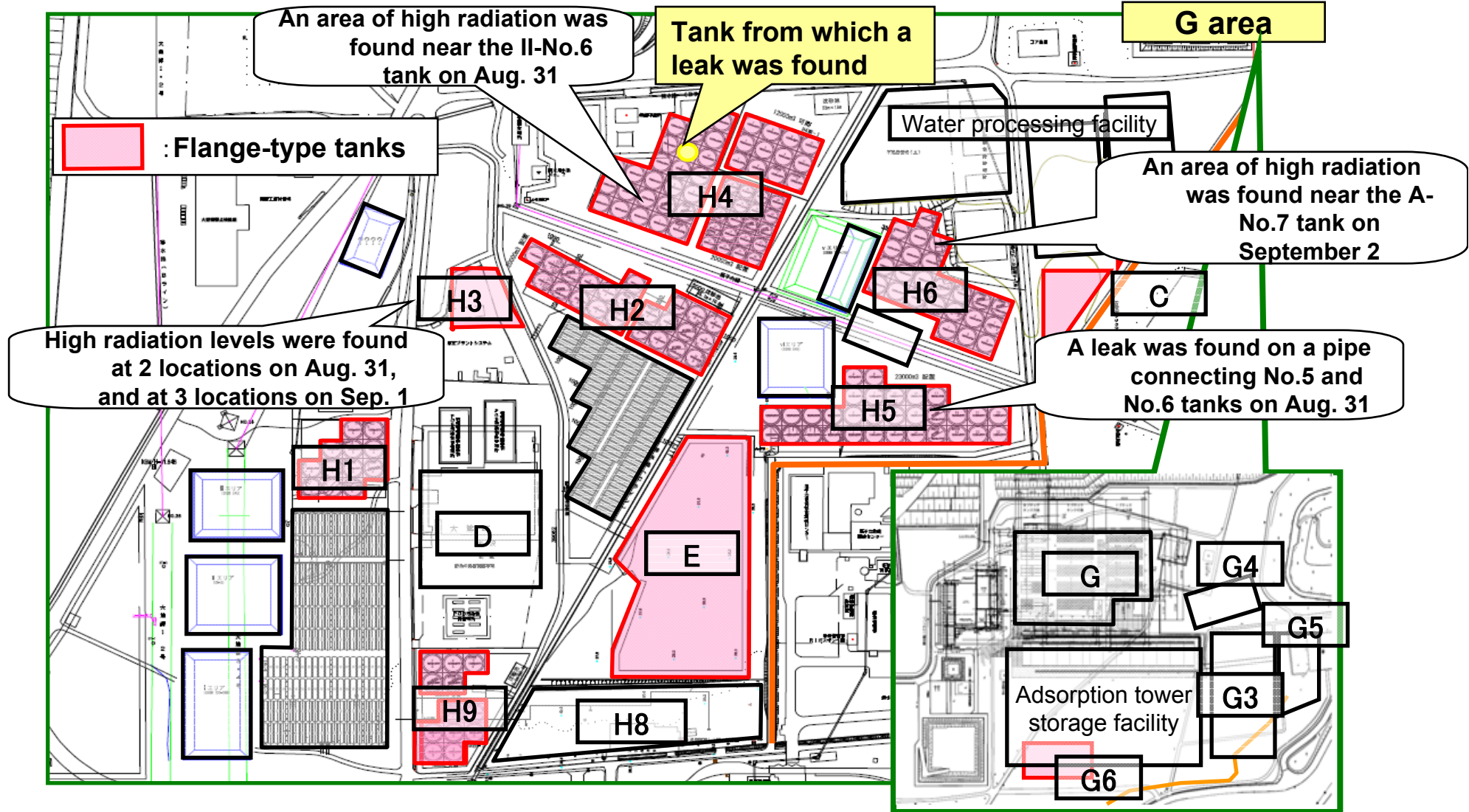


I. [2] Tanks Installation Area



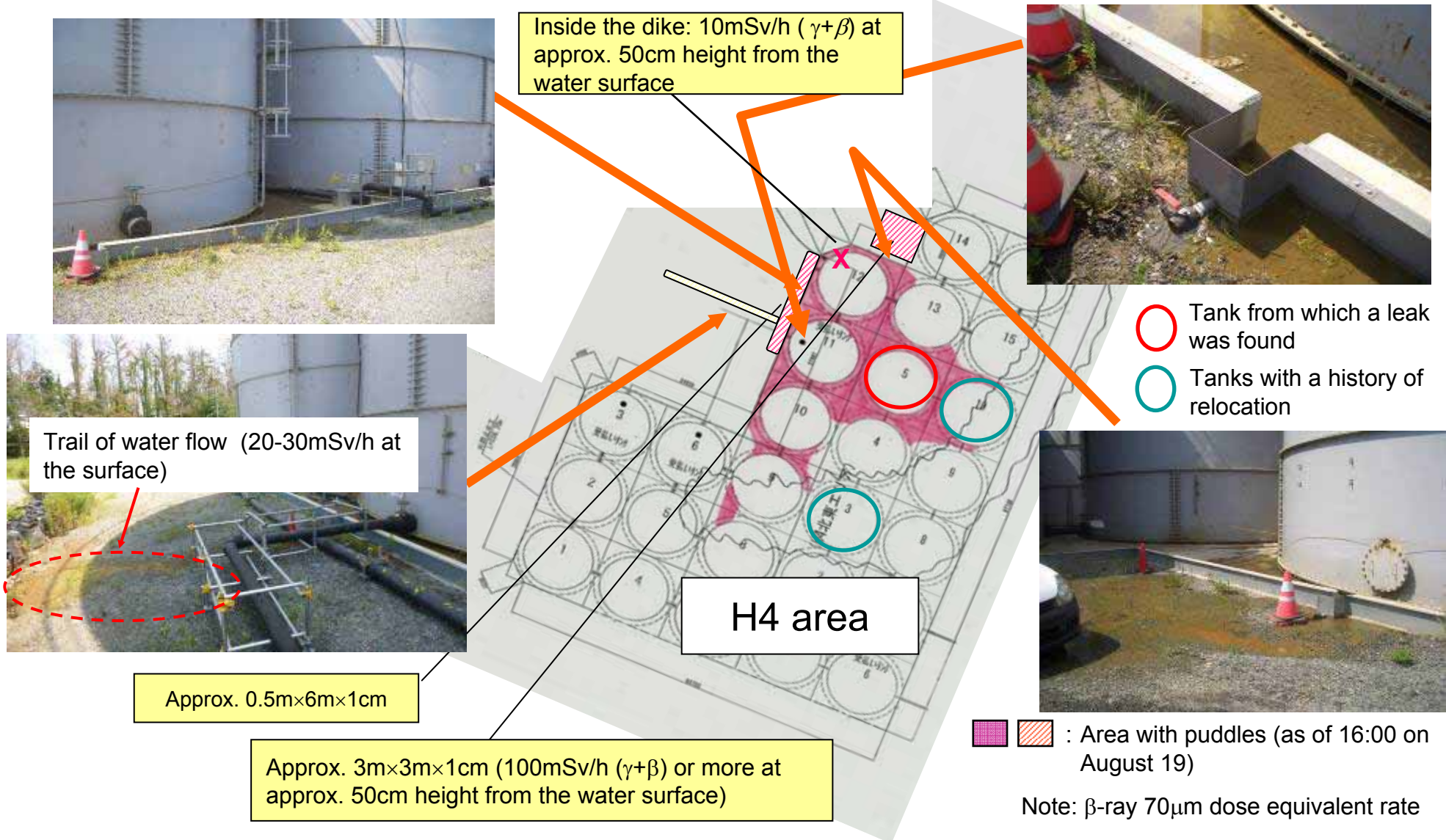
I. [2] Inspection of Tanks of the Same Type

Contaminated water leakage from a flange-type tank in H4 area was found. Among the approx. 930 storage tanks for contaminated water from Unit 1 to 4 reactors, approx. 300 tanks of the same type have already been installed.



I. [2] Leakage from a Tank

Puddles were found near the steel tanks (flange-type) on August 19, 2013. It was found that water levels at one of the tanks had dropped (approx. 3m: equivalent to approx. 300t) on August 20, and the remaining water was transferred to other tanks (completed on August 21).



I. [3] Measures against Leaks from Tanks

(1) Full inspection of all flange type tanks

- Completed on August 22 the inspection of all bolted (flange-type) tanks for the storage of contaminated water from Unit 1 to 4 reactors as with the tank from which a leak occurred (No.5 in H4-I-area).
- Not confirmed the puddles or leaks from tanks and dikes.
- Found two (2) points where high-level of dose was detected locally around the tank foundation in H3 area. The water levels were maintaining the same as when the water was accepted, and also the leaks were not found. Transfer of tank water in the days ahead is under planning.

(2) Water transfer from tanks which were "relocated after installation" as with the tank from which a leak occurred

- The tank from which a leak occurred (No.5 in H4-I area) was, after once installed in another area (H1), decomposed and relocated in the current area (H4) because of the foundation ground subsidence.
- Implement water transfer from two (2) tanks with the same history of relocation Water transfer from one of the two (No.10 tank in H4-I area) was completed on August 27, and the remaining one (No.3 tank in H4-II area) is in preparation.

(3) Contaminated soil recovery

- Started implementation from August 23 of the recovery of contaminated soil in the area around the tank from which a leak occurred.
- As the recovery work is carried out with investigation of the contamination condition, completion time is not determined. However, this problem is under consideration to complete earlier.

(4) Inspection and reinforcement of dikes around the flange-type tanks

- The existence of dike contamination around flange-type tanks was inspected on August 22. No abnormality was detected in areas other than H4.
- Completed the implementation of land embankment and additional installation of leak isolation sheet over the sandbags outside the dikes of H4 area.

(5) Monitoring reinforcement

- From August 20, reinforced monitoring over the ocean-side drainage ditch leading to the ocean.
- The possibility of outflow into the ocean is under investigation now.

I. [3] Measures against Leaks from Tanks (Continuation)

(6) Patrol reinforcement

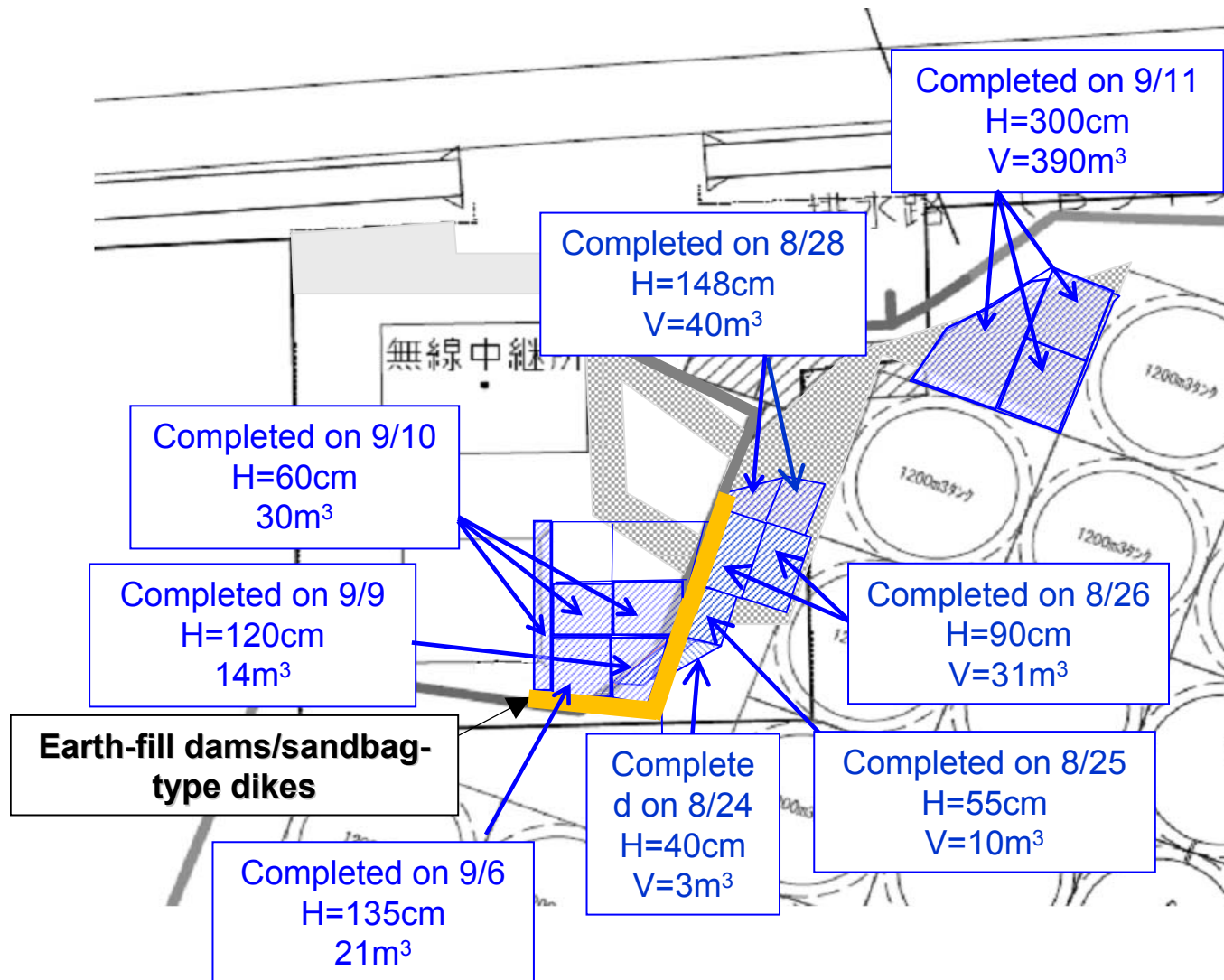
- Implement 3 patrols in the daytime with 30 staff (3 persons × 10 teams) as well as one patrol at the night with a team of 6 staff. (Patrol personnel will be increased to 60 staff or more from the approx. 10 staff in the previous system, and the frequency will be increased up to 4 times /day)
- Introduce a "Position Assignment" system under which dedicated staff are assigned to each area and comprehend the detailed situation for early detection of abnormality.
- Implement 360-degree patrol around each tank within the assigned area including its side and basement, and also inspect the existence of leaks, leak trails, puddles that imply the possibility of leaks, etc. and record the results.
- Check the existence of significant radiation dose by continuously carrying handy dosimeters and record the results. If the change of level is detected, implement detailed measurement with ion-chamber dosimeter and record the results.

(7) "Normally closed" operation for drain valves attached to dikes around the contaminated water tanks

- After contriving the rainwater management in the dikes, the operation mode for drain valves of dikes was switched to "normally closed" from "normally open" (Completed the switching operation to "normally closed" on August 28).

I. [3] Measure (3) Implementation Status of Contaminated Soil Recovery

Started removal of contaminated soil inside the sandbag-type dikes on August 23. Approx. 540 m³ of contaminated soil was collected



Excavating 300cm depth completion status



Backfilling completion status



I. [3] Measure (5) Marine Survey



(1) Sea water around the southern water discharge outlet (near the outlet of discharge channel) (Date of sampling: Sep. 11)

Cs134: Below the detection limit [Detection limit : 1.4×10^{-3} [Bq/cm³]]

Cs137: 2.7×10^{-3} [Bq/cm³]

Total-Beta : Below the detection limit [Detection limit: 2.2×10^{-2} [Bq/cm³]]

(2) Meeting point of B and C discharge channels (Date of sampling: Sep. 6)

Cs134: Below the detection limit [Detection limit: 2.0×10^{-2} [Bq/cm³]]

Cs137: Below the detection limit [Detection limit: 2.6×10^{-2} [Bq/cm³]]

Total-Beta : 1.3×10^{-1} [Bq/cm³]

I. [3] Measure (5) Marine Survey

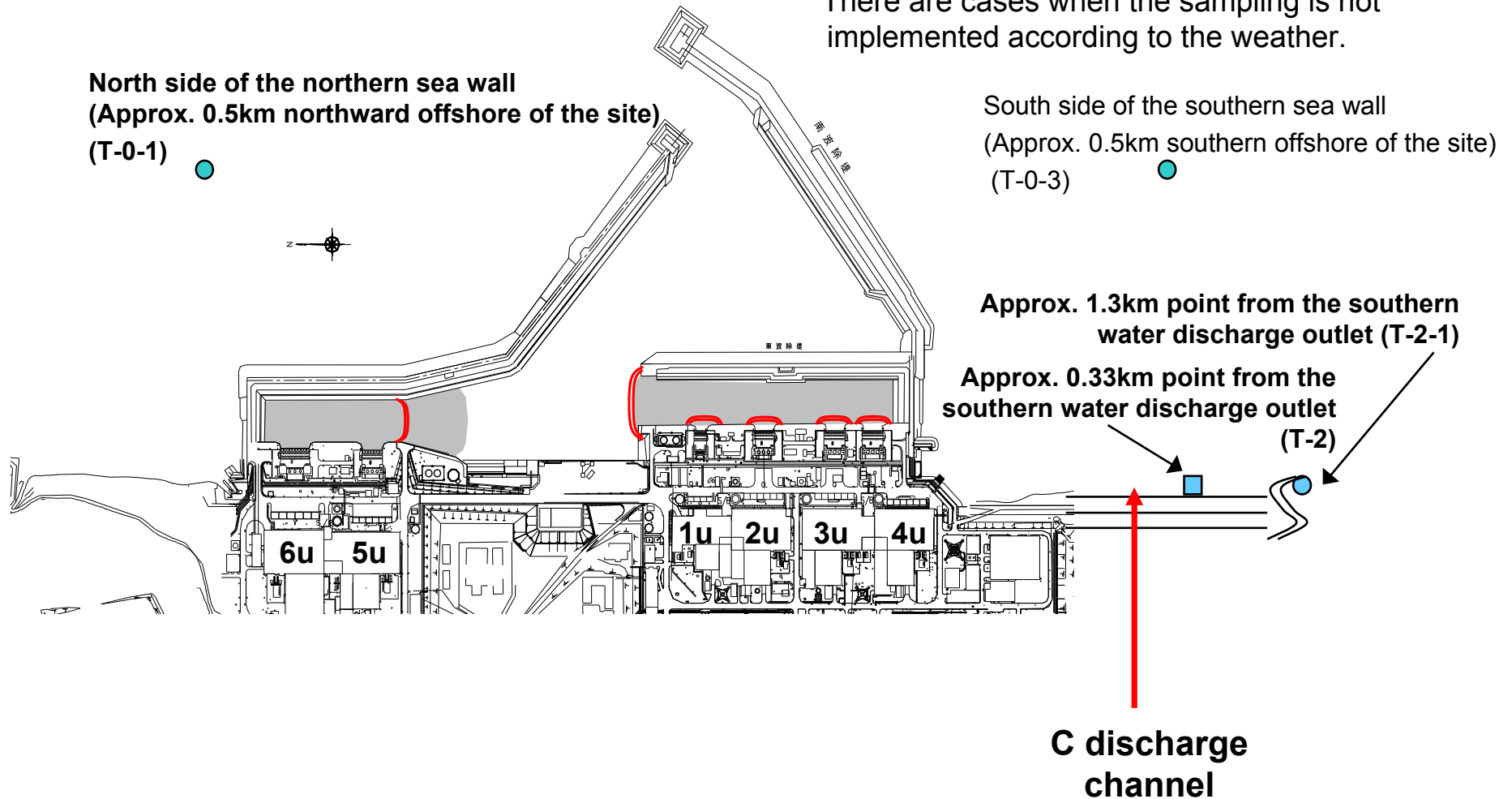
East side of the port entrance
(Approx. 1.0km offshore of the site) (T-0-2)

- Monitoring the effects on the ocean
- Monitoring the effects on the ocean (Additional)

North side of the northern sea wall
(Approx. 0.5km northward offshore of the site)
(T-0-1)

*There are cases when the sampling is not implemented according to the weather.

South side of the southern sea wall
(Approx. 0.5km southern offshore of the site)
(T-0-3)

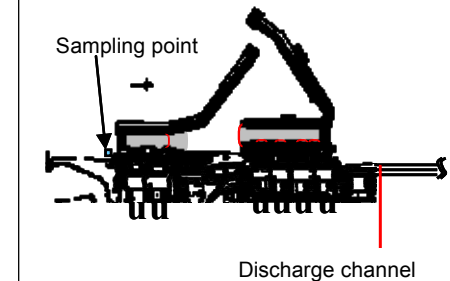
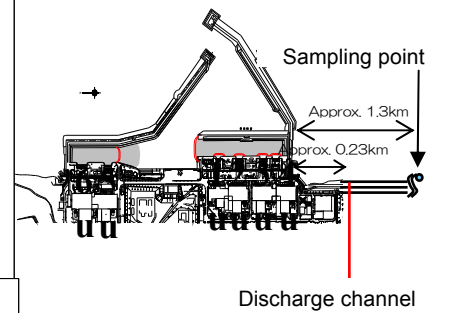
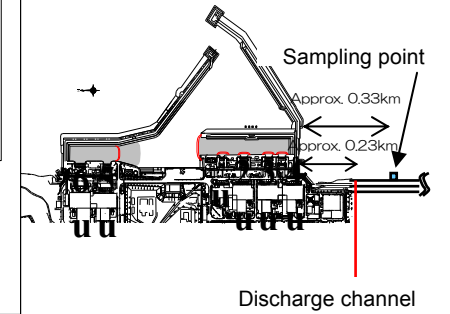
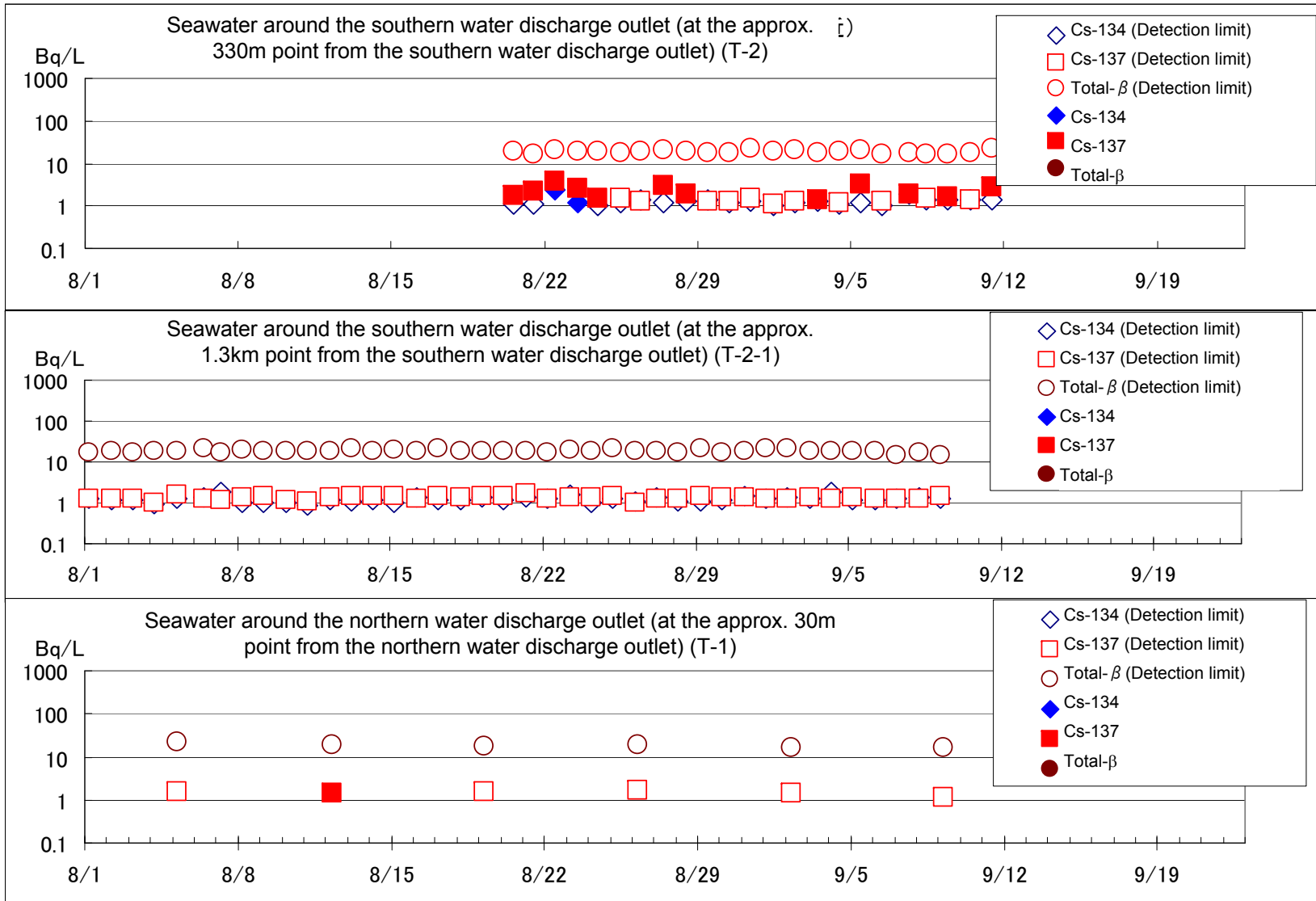


Approx. 1.3km point from the southern water discharge outlet (T-2-1)

Approx. 0.33km point from the southern water discharge outlet (T-2)

C discharge channel

I. [3] Measure (5) Marine Survey (Concentration Levels in Seawater)

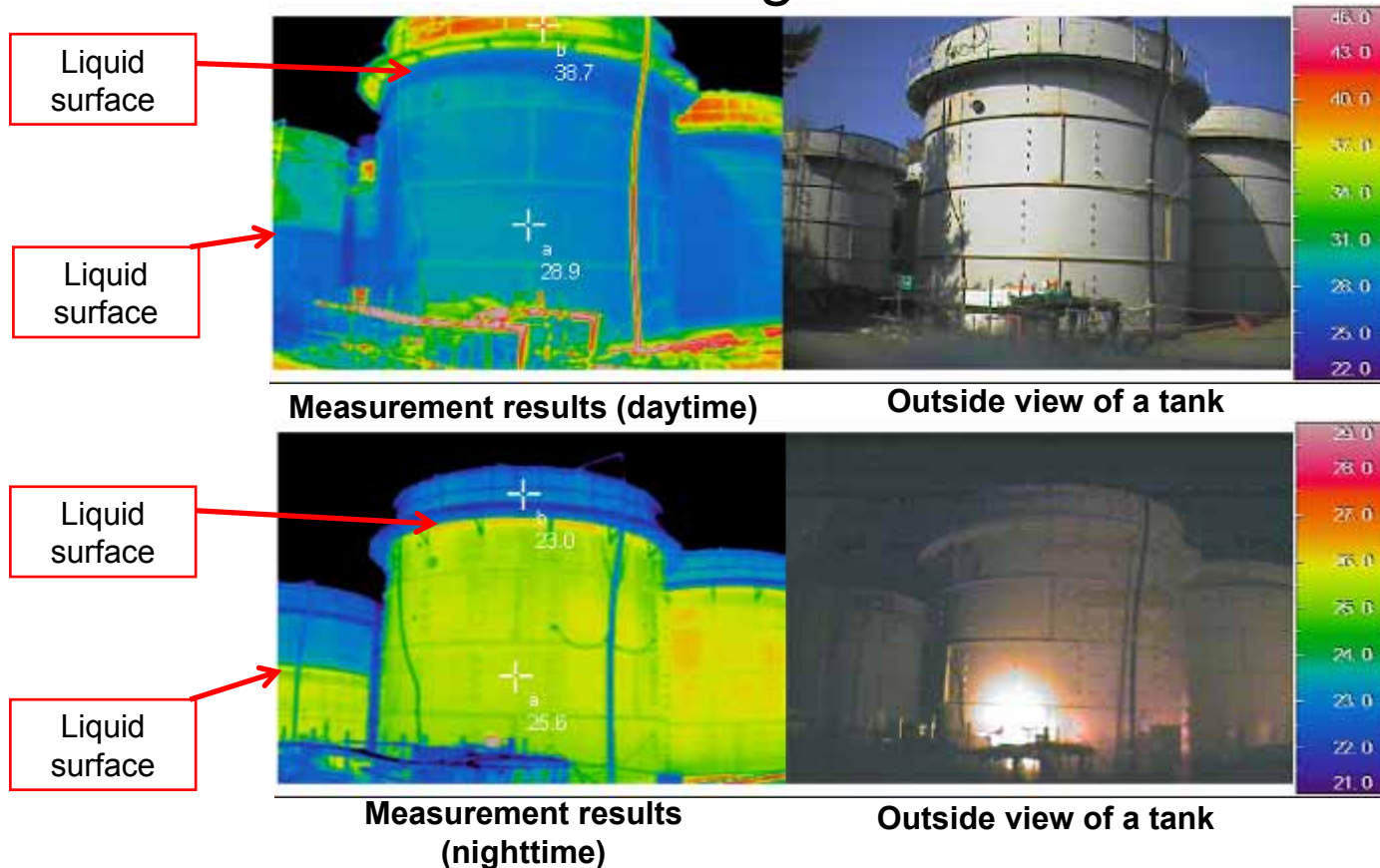


The concentration of the total β in the seawater around both of the southern and northern water discharge outlet monitored below the detection limit. Therefore, the impact to the outer sea had been minimal.

I. [3] Measure (6) Water Level Management Method through Patrolling

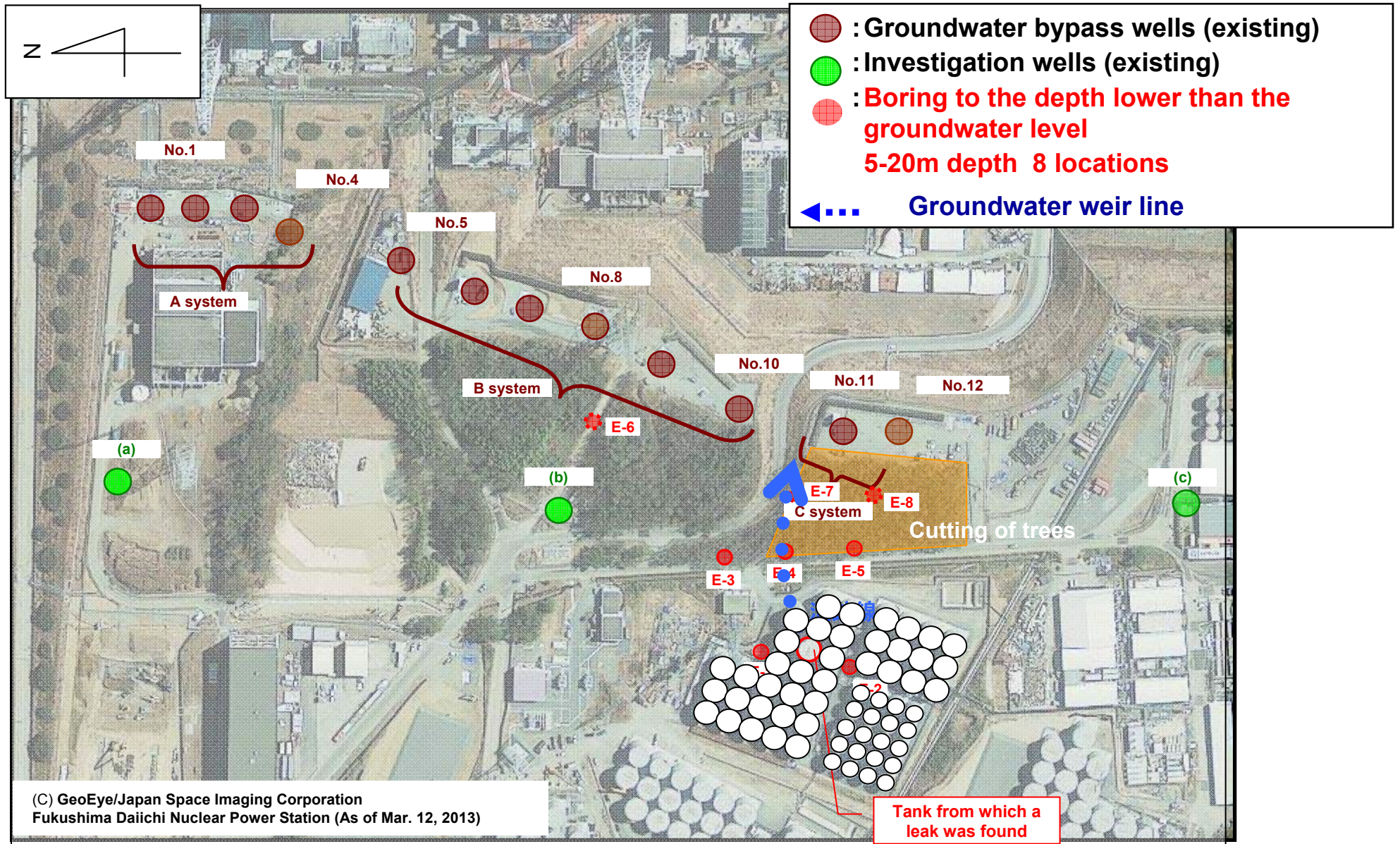
While setting priorities for all flange-type tanks, install water level gauges in order of the priority and, in the end, introduce the alarm function as well. That enables the continuous remote monitoring. For the time being, continuously implement the monitoring of water level change once per day using thermography.

Image



Note:
The correlation between the colors and temperature as the results of measurement differs between the day time and the night.

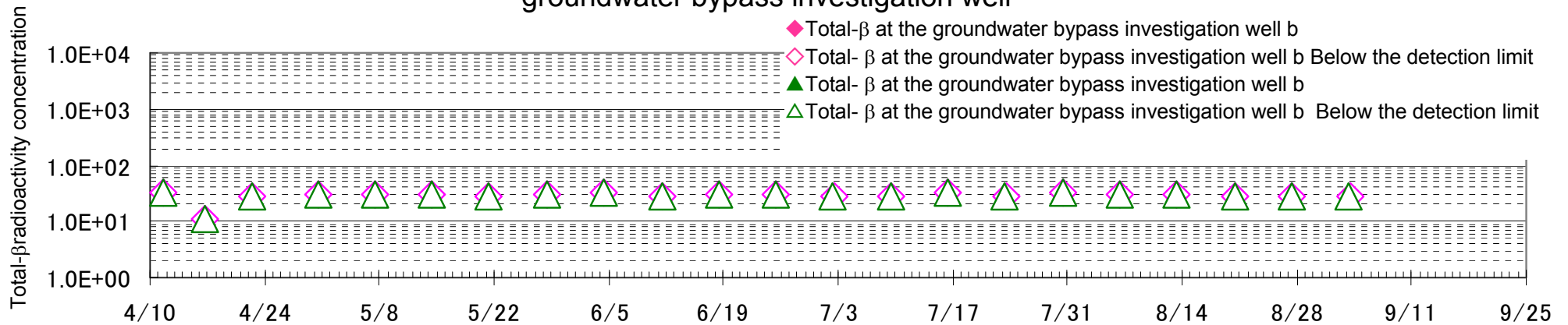
I. [3] Boring Investigation to the Depth Lower than the Groundwater Level and the Locations



I. [3] Analysis Results for (b) and (c) Investigation of Groundwater Bypass

<Total-Beta radioactivity>

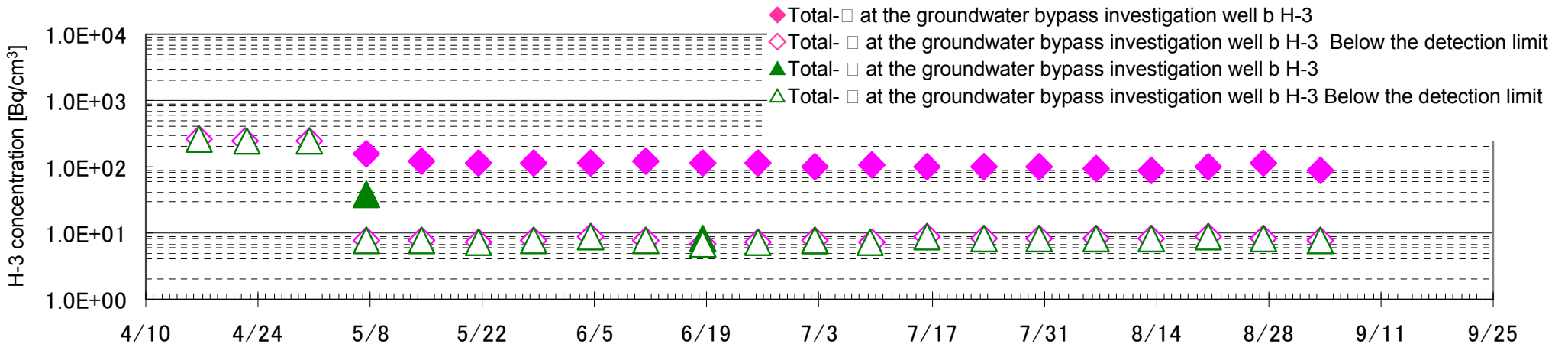
Change of Total-βradioactivity concentration at the groundwater bypass investigation well



■ After the start of continuous monitoring (Apr. 2013), total beta radioactivity is not detected. (Detection limit: approx. 0.02 Bq/cm³)

<Tritium>

Change of tritium concentration at the groundwater bypass investigation well



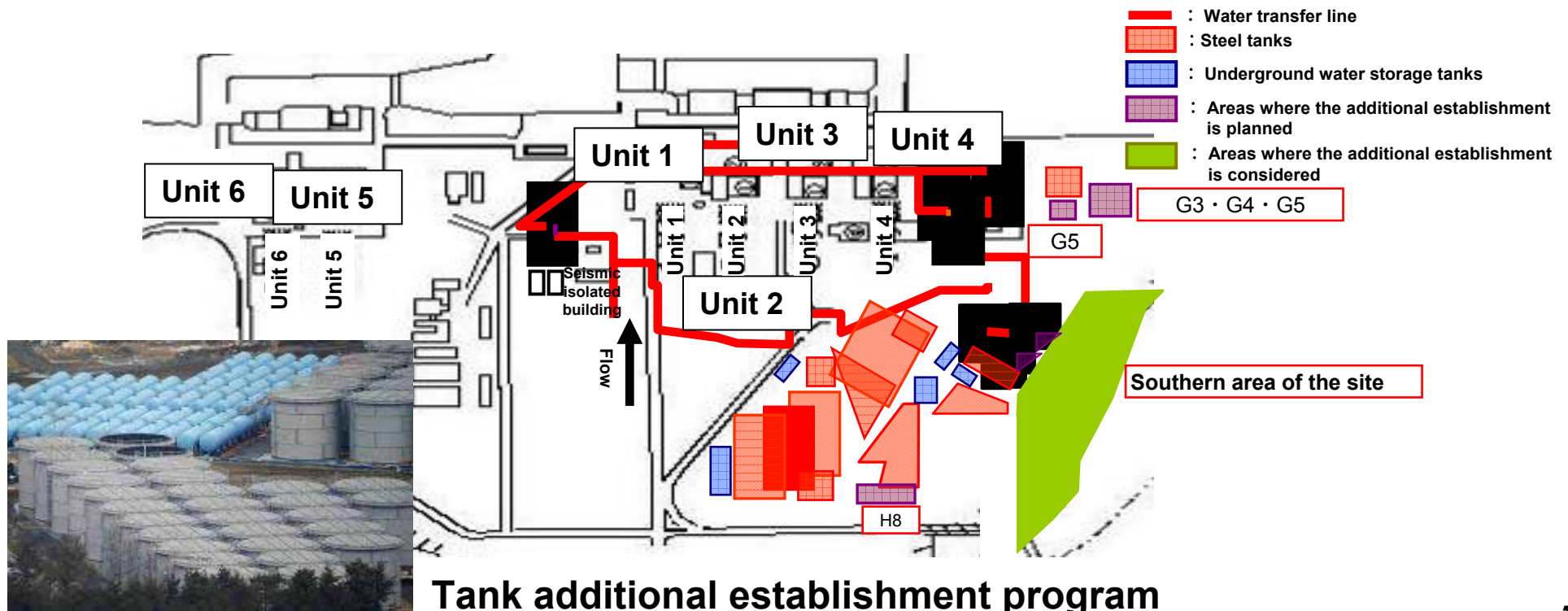
■ After the start of continuous monitoring (Apr. 2013), significant increase of tritium is not confirmed.

I. [4] Tank Additional Establishment Program

- Develop an additional establishment program by considering the tank capacity required in the medium-to long term prospect to adequately store the contaminated water which will increase to some extent regardless of the suppression measures of groundwater inflow.

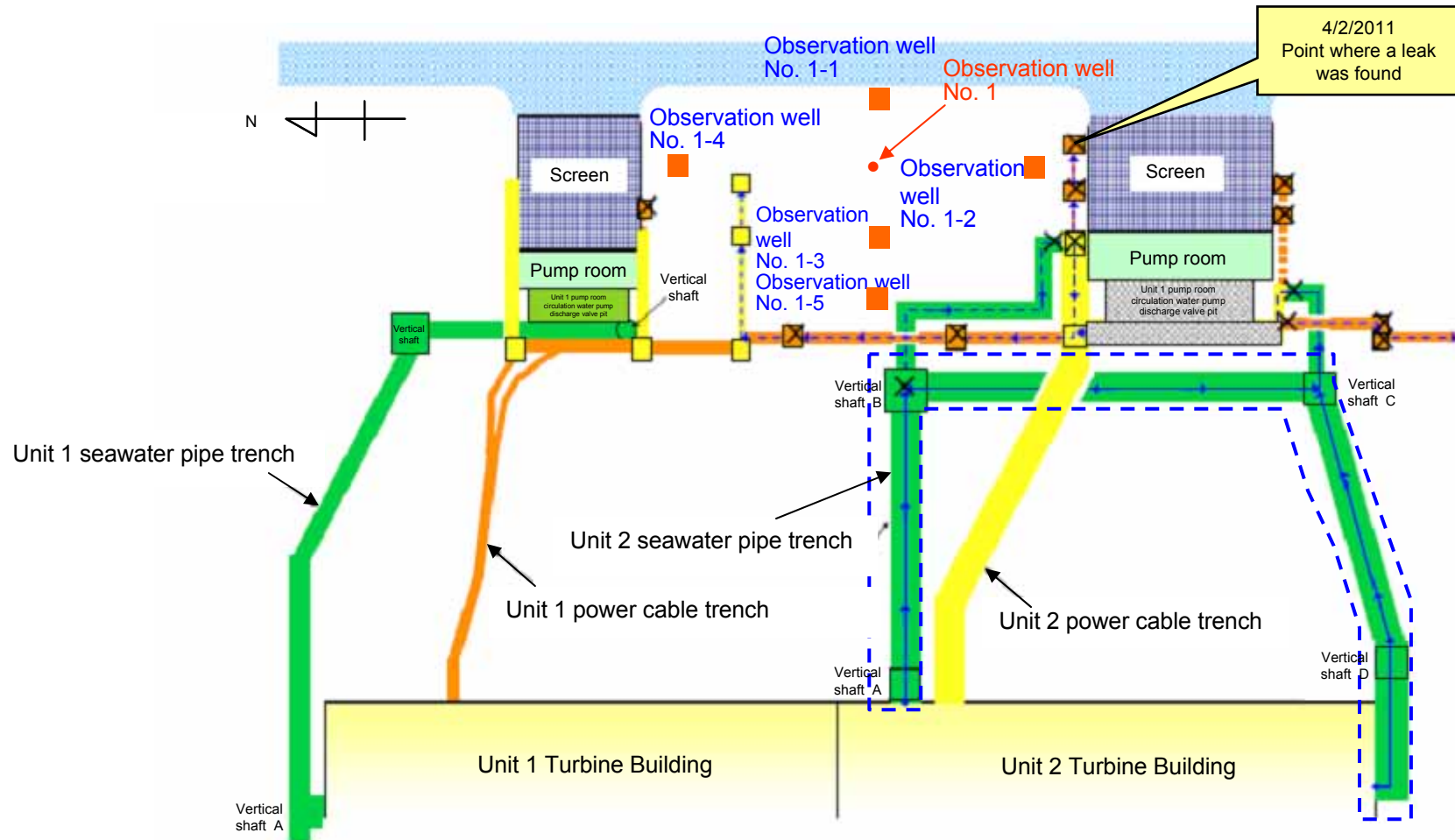
Specifically, scheduled to increase the tank capacity up to approx. 440,000m³ until October 2013, 700,000m³ until the middle of 2015, and 800,000m³ within the FY 2016 (details will be considered in the days ahead).

- Based on the leakage problems from flange-type tanks, drastic measures are also under consideration.
 - Installation of water level gauges on all flange-type tanks and introduction of centralized control system
 - Increase of welded-type tanks and replacement of flange-type tanks



II. [1] Outflow of Contaminated Water into the Ocean

Immediately after the accident, highly contaminated water under the turbine buildings was discharged into the port through the underground trenches.

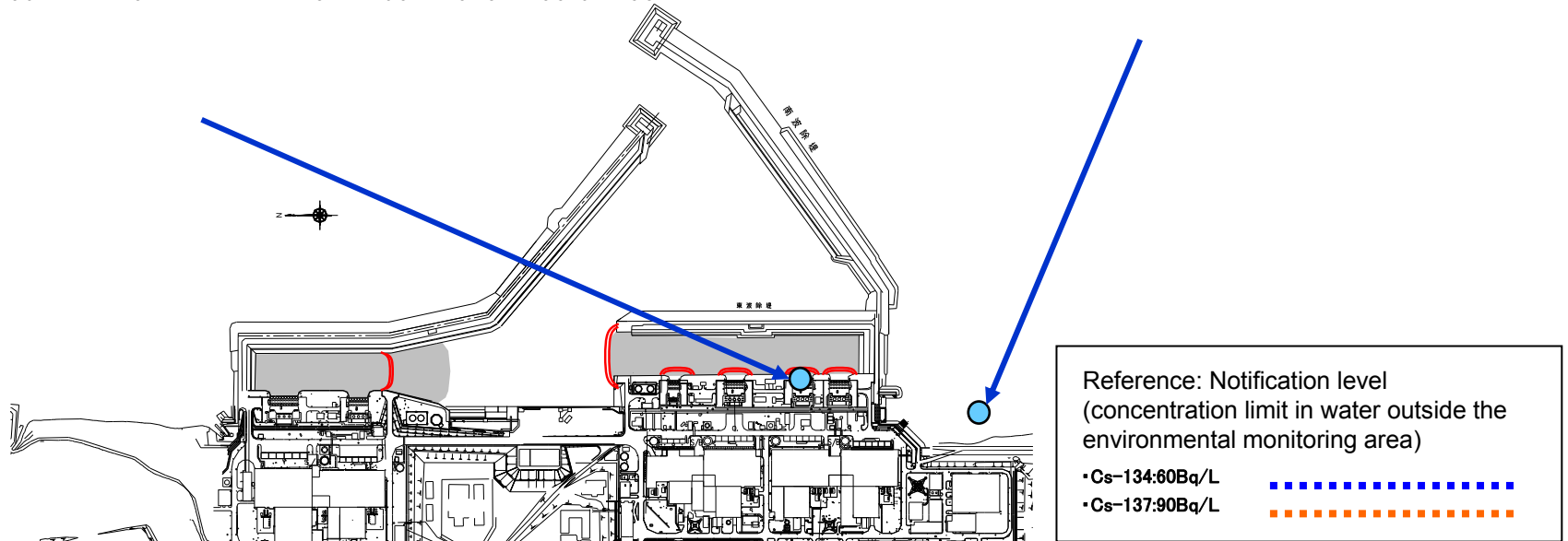
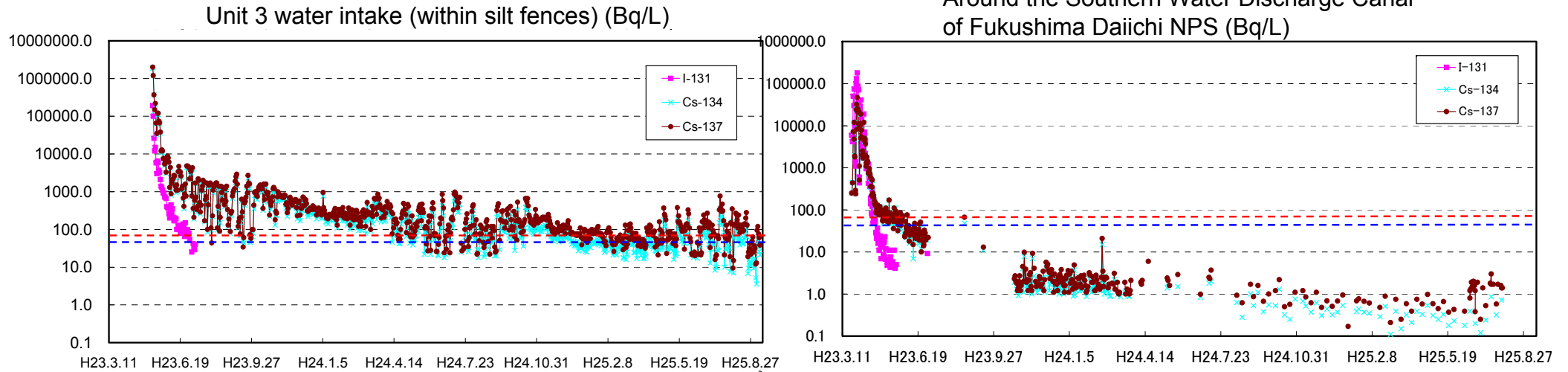


- Immediately after the accident, contaminated water accumulated in the buildings had outflowed into the ocean from water intake through trenches, etc.
 - Outflow was already stopped but contaminated water remains within the underground structure.

II. [2] Seawater Analysis Results

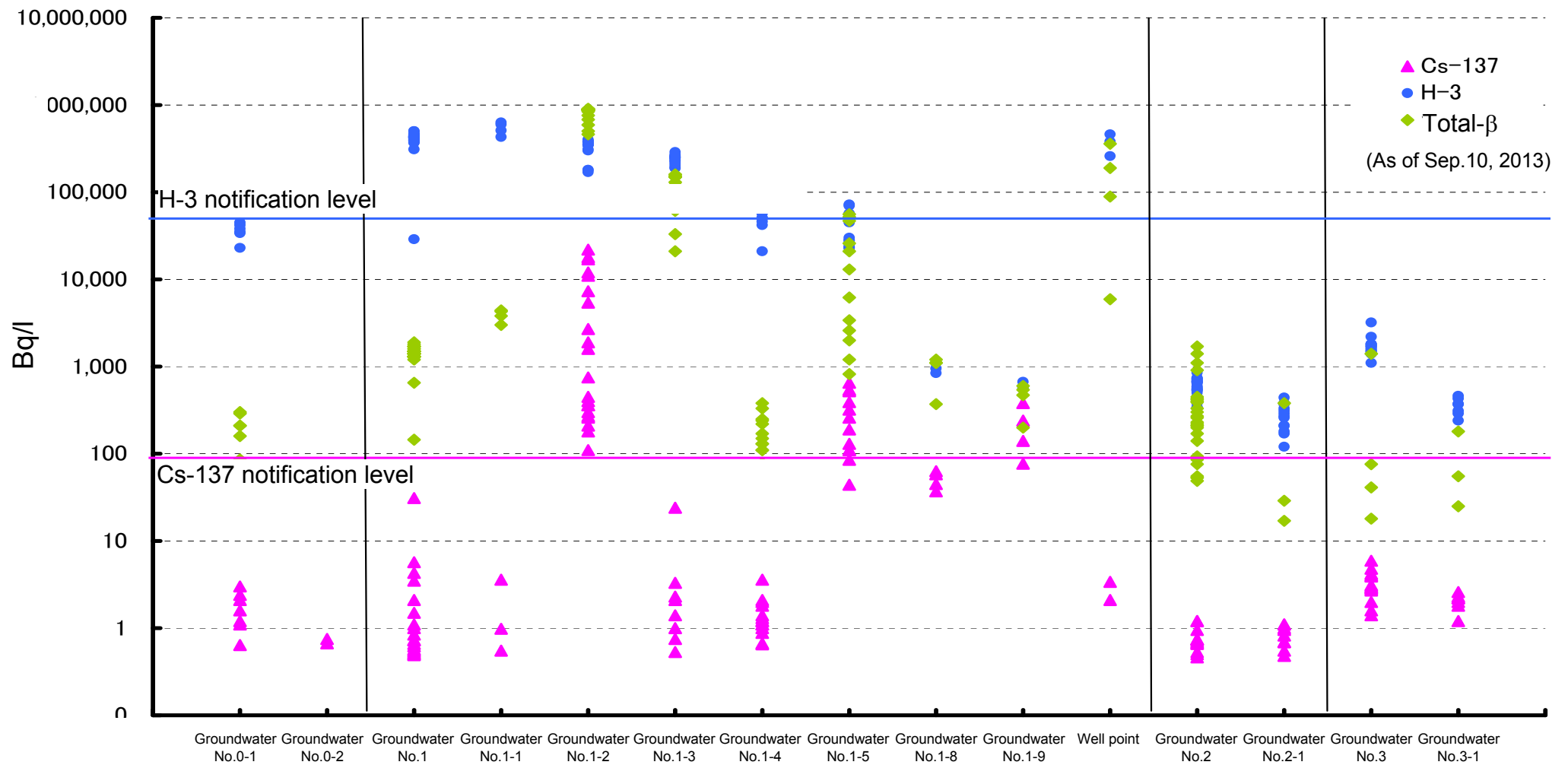
Continuously implemented the sampling of seawater within the part. The concentration was lowered gradually after the accident but it remains flat.

Cs-137 of 10-100Bq/l order is detected even now around the water intakes of Unit 1 to 4 reactors.



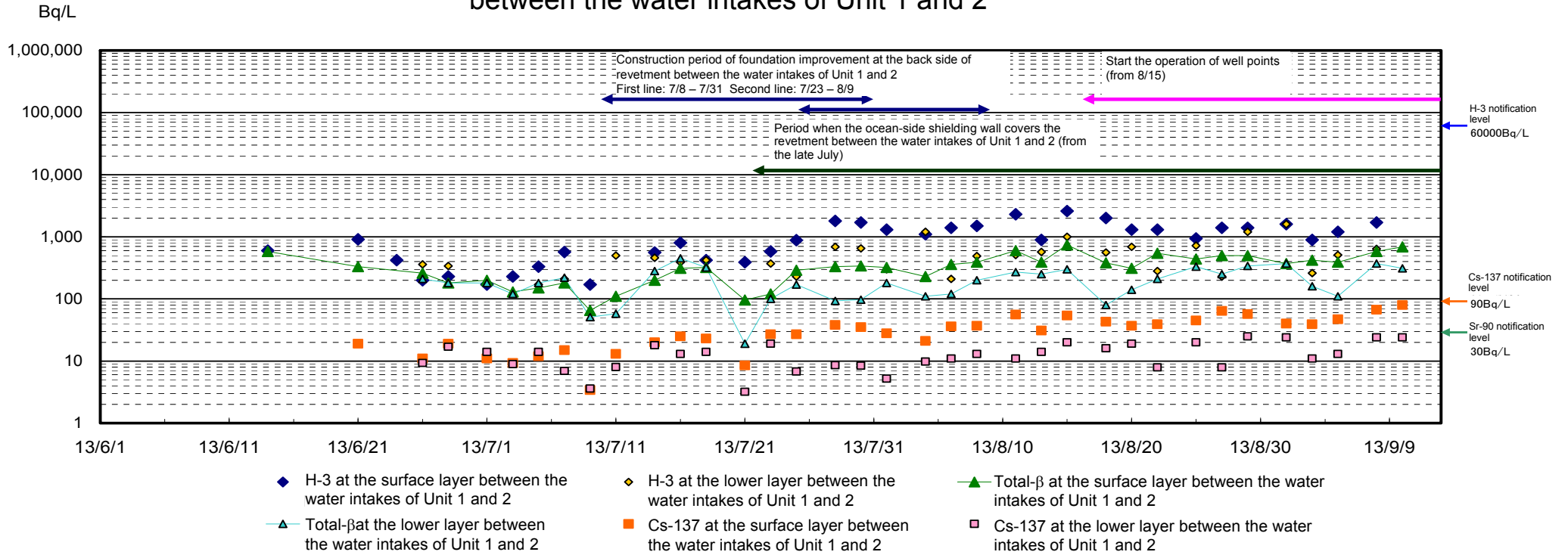
II. [2] Groundwater Analysis Results

Concentration distribution in the groundwater
(Comparison among the investigation points)



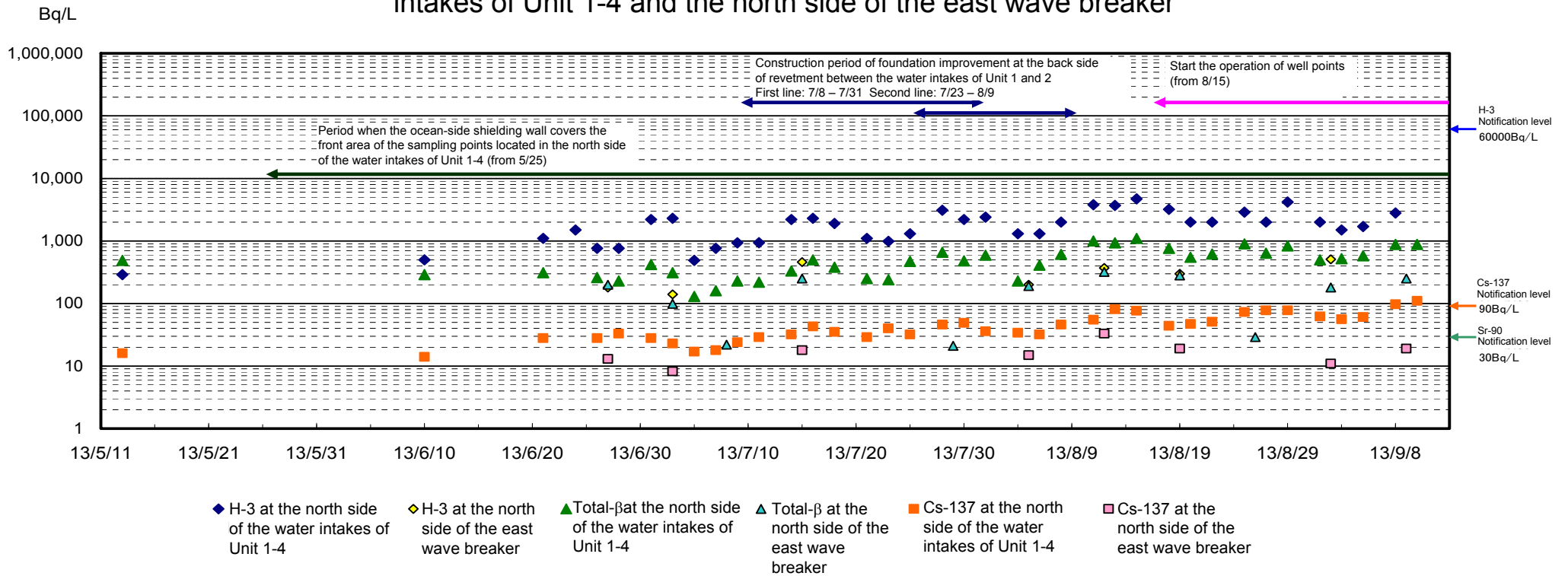
II. [2] Groundwater Analysis Results

Concentration change in the seawater
between the water intakes of Unit 1 and 2



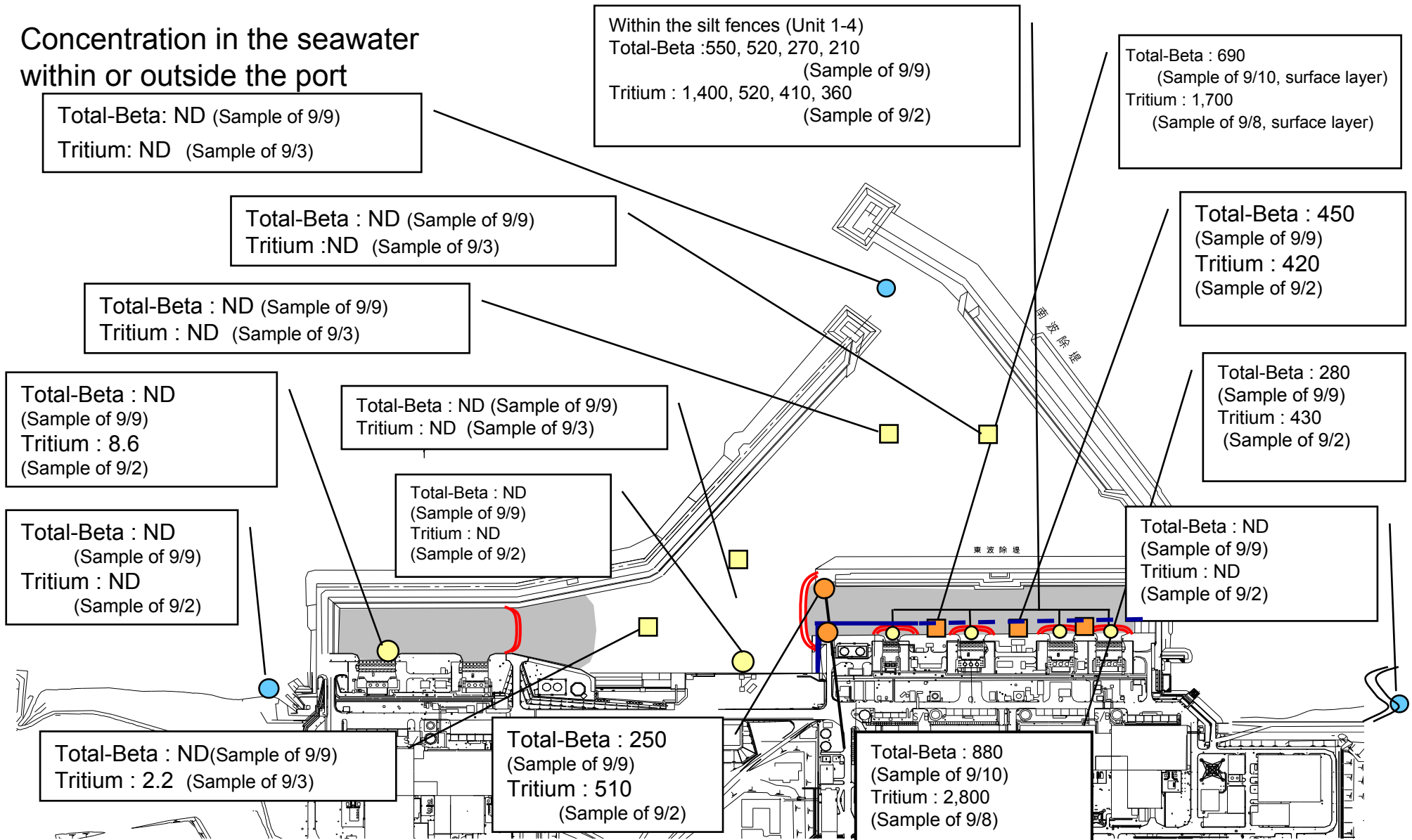
II. [2] Groundwater Analysis Results

Concentration change in the seawater at the north side of the water intakes of Unit 1-4 and the north side of the east wave breaker



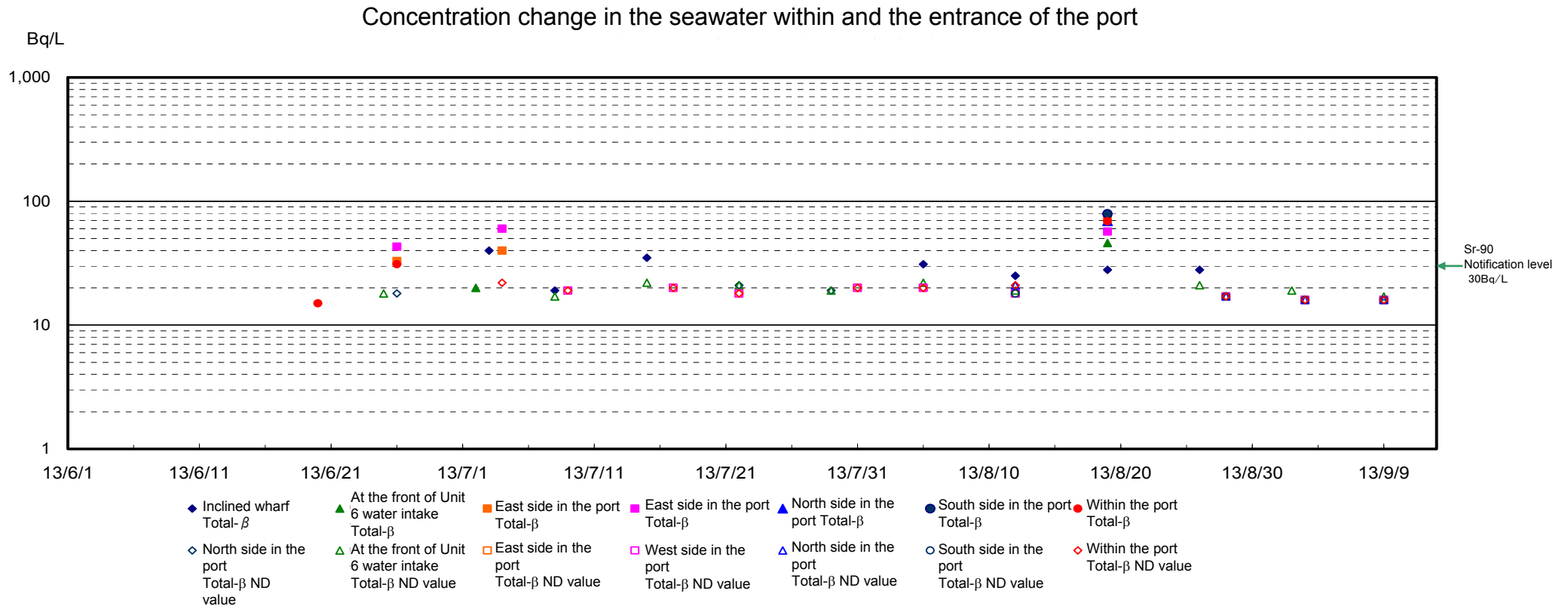
II. [2] Groundwater Analysis Results

Concentration in the seawater within or outside the port



Latest measurement results (Bq/l)
(As of Sep. 10, 2013)

II. [2] Groundwater Analysis Results



II. [3] Measures against the Contaminated Water

Based on the discussions with the government, the multi-tiered approach through emergency measures and drastic measures is now underway.

Three principles of measures against contaminated water

1. Remove the contamination sources
2. Keep water away from the contamination sources
3. Do not leak the contaminated water

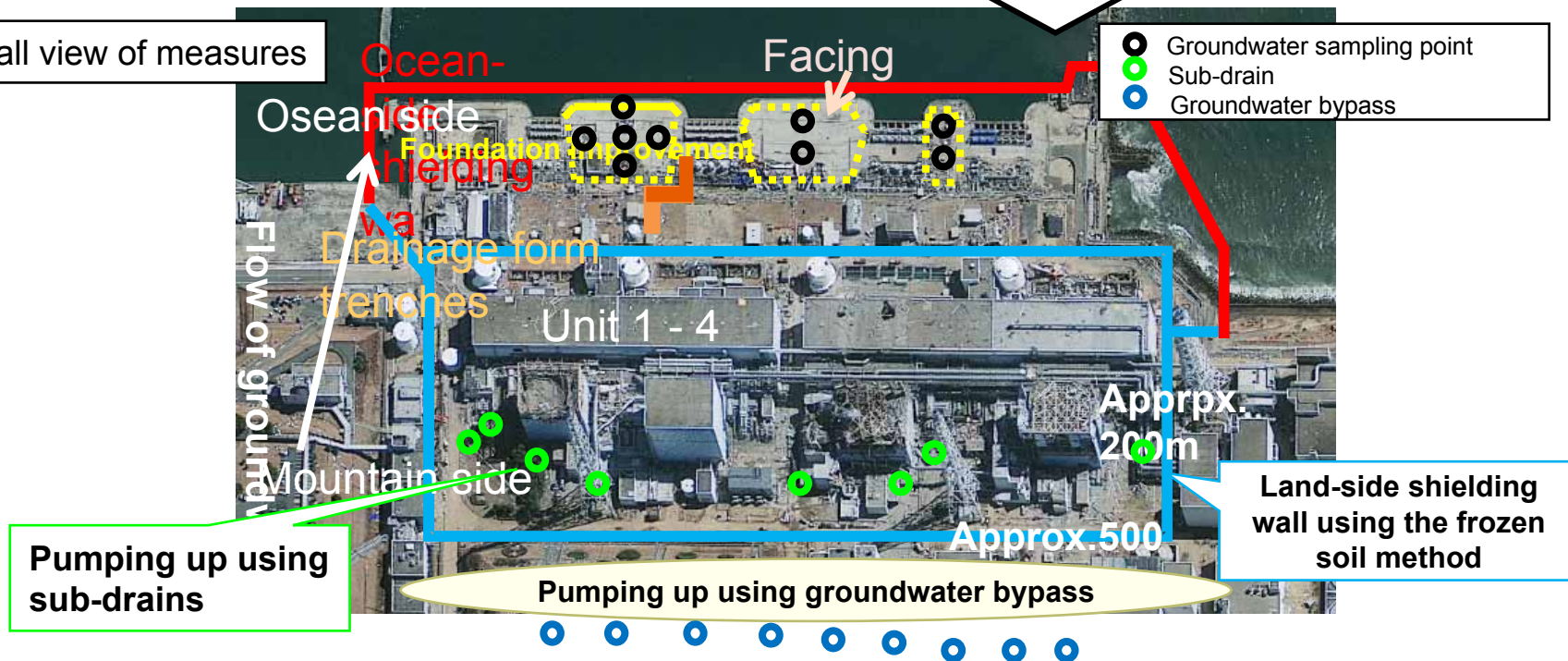
Emergency measures

1. [Additional measures] Started the removal of highly contaminated water from trenches (underground piping and spaces where the electric cables are located) (started in mid-Aug.) [Removal]
2. [Additional measures] Foundation improvement in the contaminated area with soluble glass, Pavement of land surface with asphalt, Groundwater pumping up [Keep away][Not leak]
3. Pumping up of groundwater at the mountain side (Groundwater bypass) [Keep away]

Drastic measures (over the next 1-2 years)

1. Pumping up of groundwater using sub-drains (wells around the buildings)[Keep away]
2. Installation of ocean-side shielding wall [Not leak]
3. [Additional measures] Installation of land-side shielding wall using frozen soil method [Keep away][Not leak]

Overall view of measures

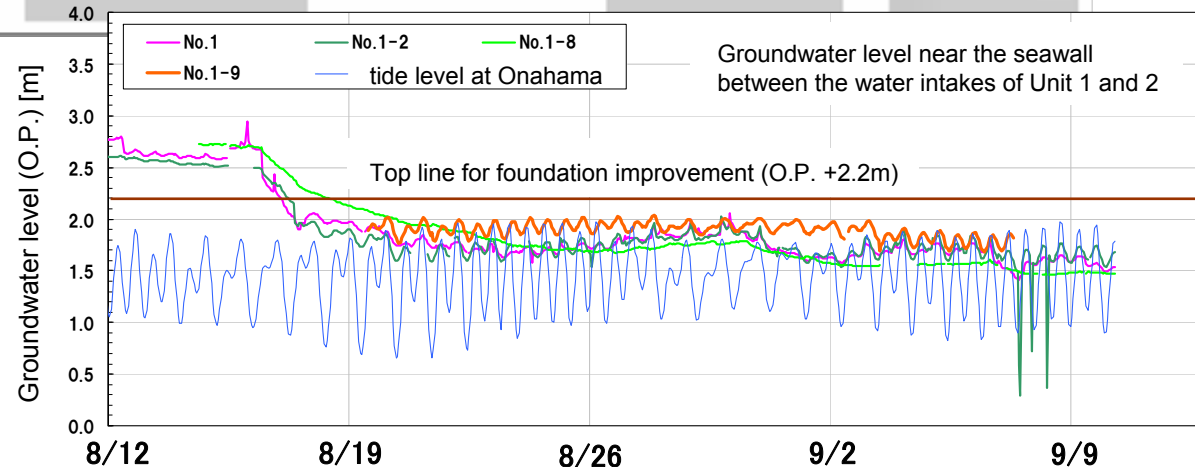
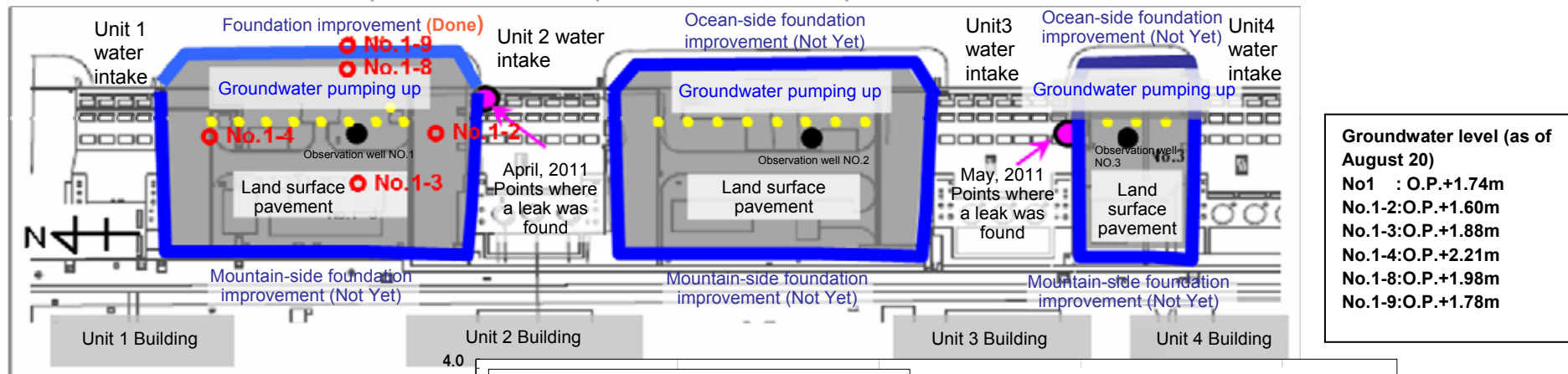


II. [3] Measures against Contaminated Water - Emergency Measures (1)

Measure (1): Outflow prevention into the port ••• Foundation improvement in the contaminated area, etc.

[Keep water away] [Never cause leakage]

- ✓ At the seawall between water intakes, improve the ocean-side foundation by injecting chemicals to prevent the outflow of groundwater into the port, while improving the mountain-side foundation to prevent the inflow of groundwater into the contaminated area.
- ✓ Pump up the groundwater dammed by the foundation improvement in order to prevent the overflow.*
(Started the pumping up between the ocean-side water intakes of Unit 1 and 2. Groundwater levels at the observation wells are almost below the top line for foundation improvement (O.P. +2.20m) as of August 20)
- ✓ Pave the land surface with asphalt in order to prevent rainwater penetration. * To turbine buildings through vertical shafts



<Foundation improvement work>

II. [3] Measures against Contaminated Water - Emergency Measures (2)

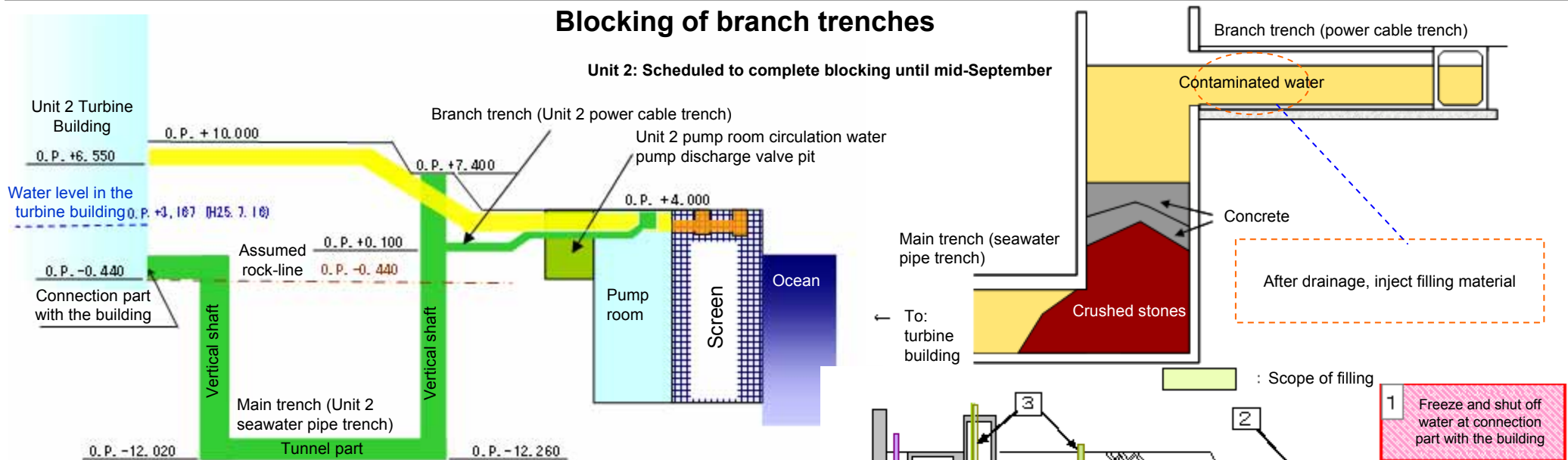
Measure (2): Contamination source removal •••Removal of highly contaminated water in trenches [Removal]

- ✓ In order to remove the highly contaminated water remaining in the trenches, drain the contaminated water from the branch trench and inject filling material, and drain the contaminated water in the main trench as well after purification. *

*To turbine buildings

Blocking of branch trenches

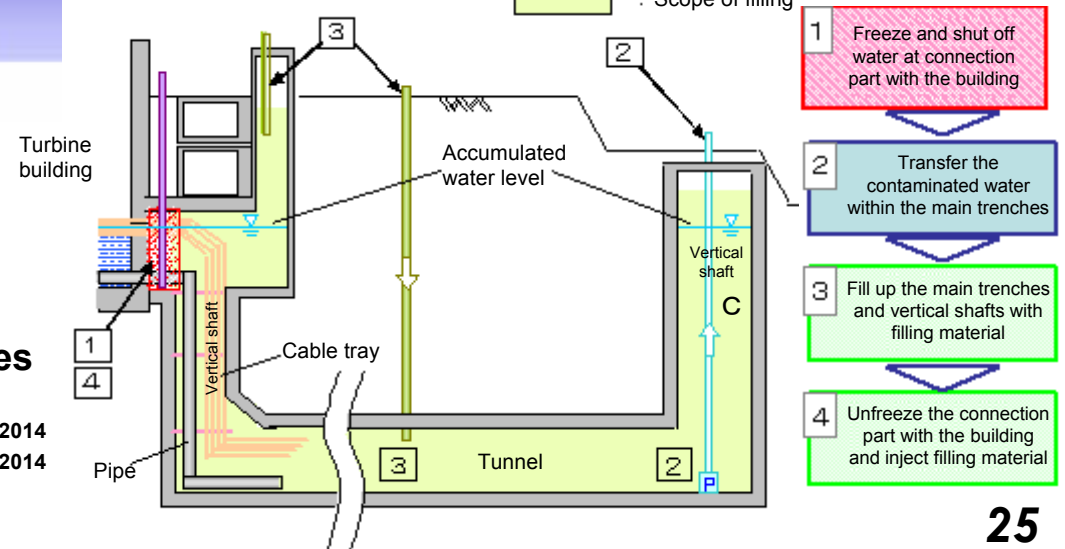
Unit 2: Scheduled to complete blocking until mid-September



Trench structure (Example of Unit 2)

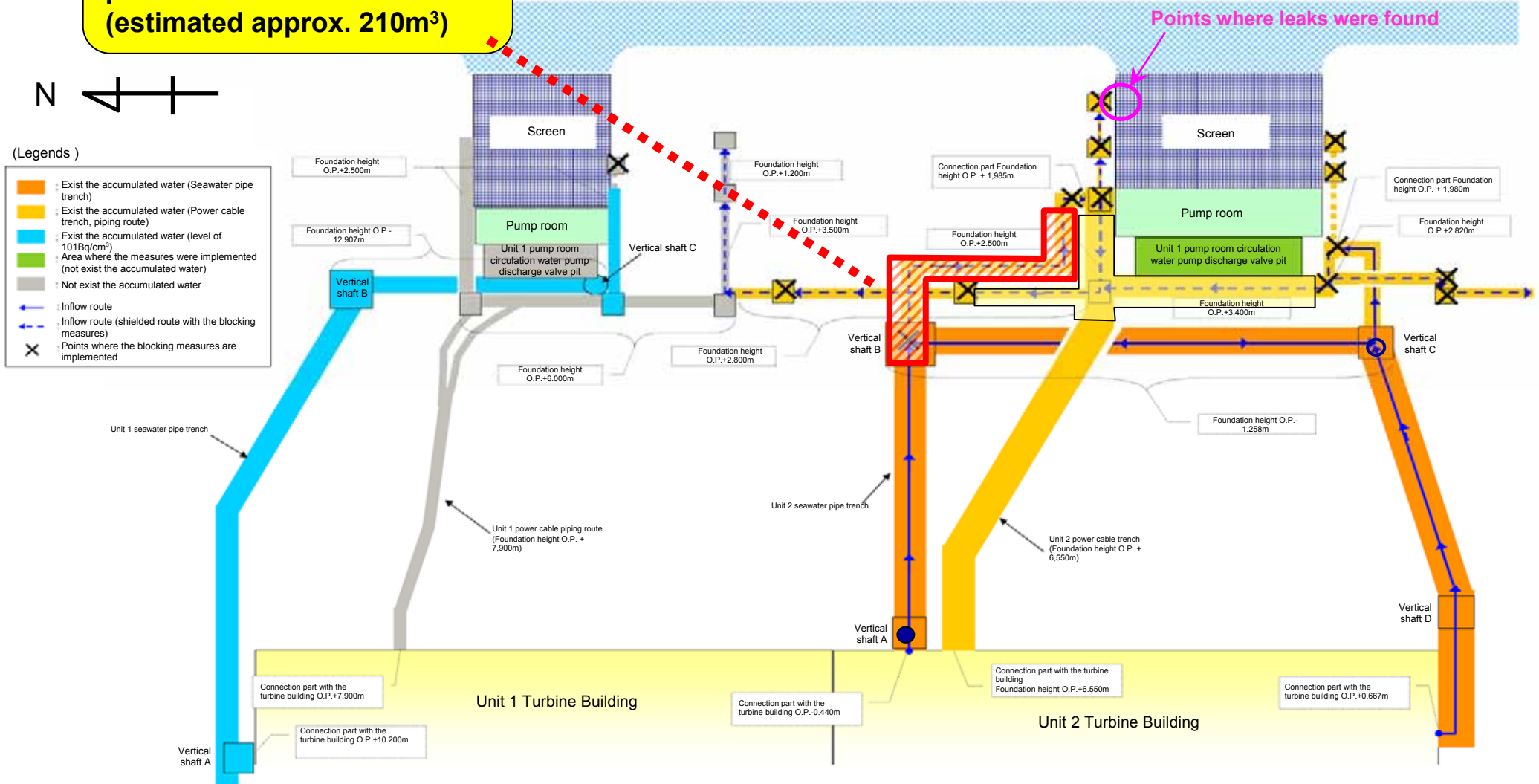
Drainage from main trenches

Unit 2: Scheduled to start shutting off water on January, 2014
Unit 3: Scheduled to start shutting off water on January, 2014

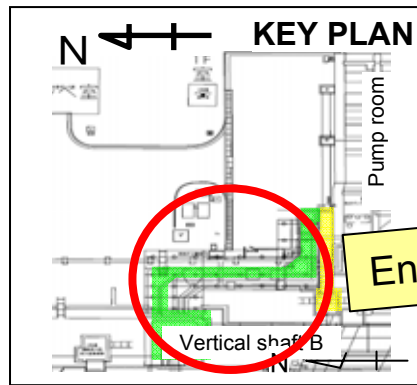


II. [3] Implementation Status of Blocking Work for the Unit 2 Branch Trench

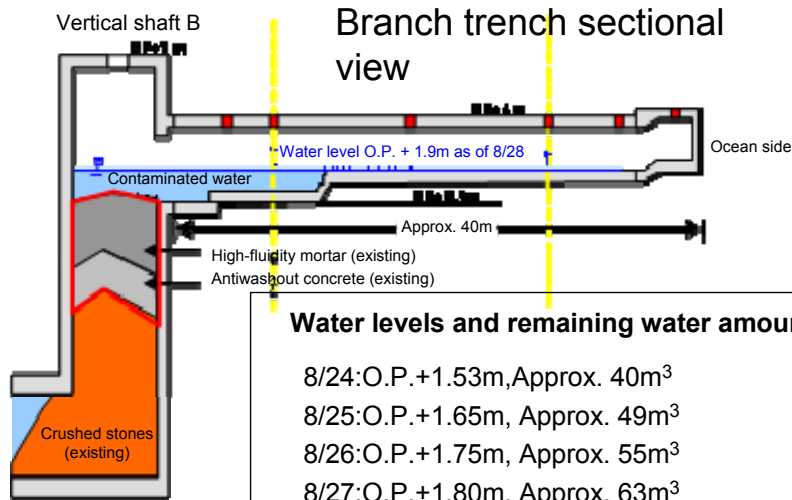
Water accumulated in the Unit 2 vertical shaft B and power cable trenches (estimated approx. 210m³)



II. [3] Implementation Status of Blocking Work for the Unit 2 Branch Trench



Enlarged



Water levels and remaining water amount in the trench after the water transfer

- 8/24: O.P. +1.53m, Approx. 40m³
- 8/25: O.P. +1.65m, Approx. 49m³
- 8/26: O.P. +1.75m, Approx. 55m³
- 8/27: O.P. +1.80m, Approx. 63m³
- 8/28: O.P. +1.90m, Approx. 72m³

Water level is increasing by approx. 10 cm per day
Water amount is increasing by approx. 10m³ per day

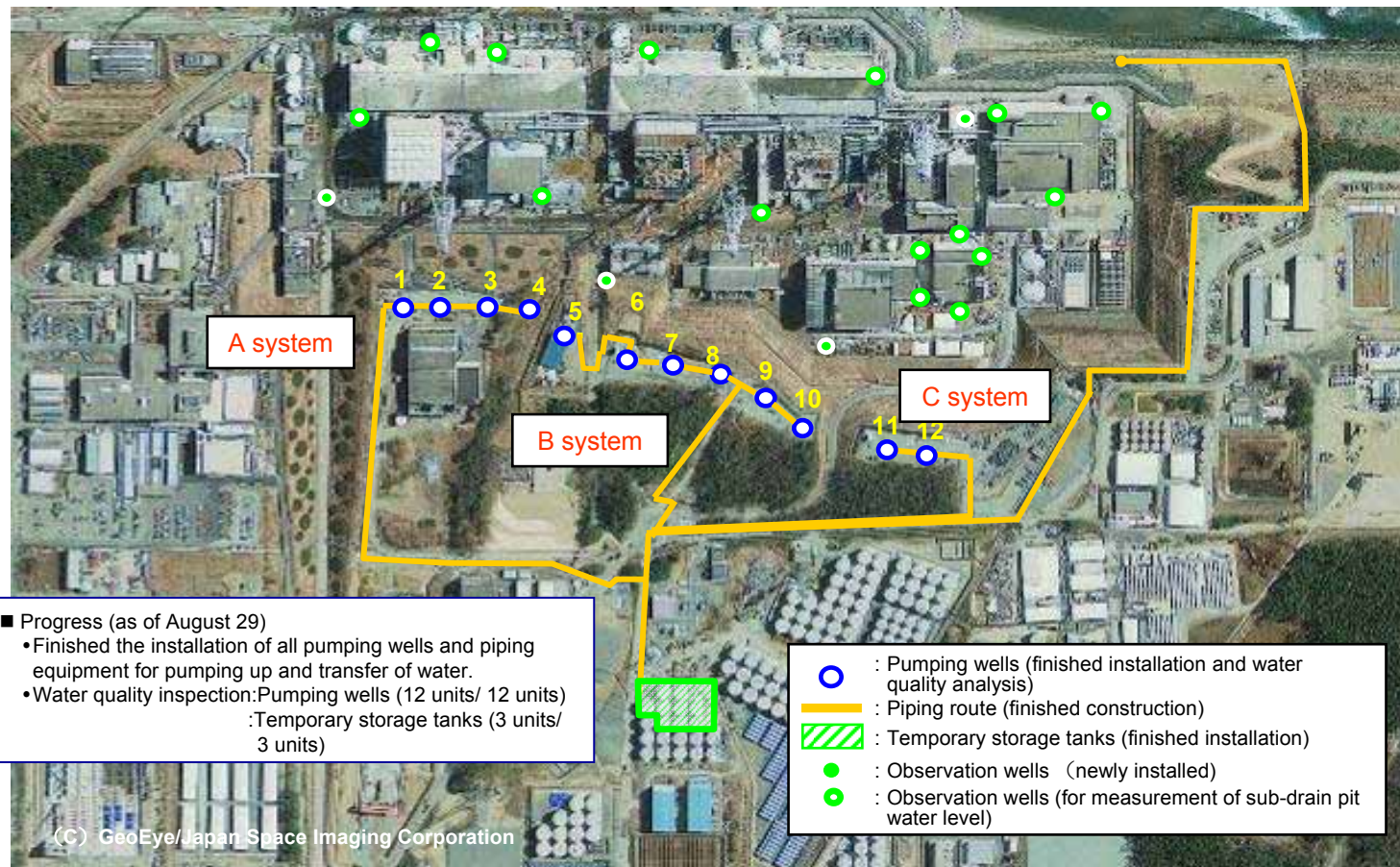
Excavate 6 holes(φ200) on the upper part of the branch trench for the filling material injection

[Work process]	August														September			October						
	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	First	Middle	Late	First	Middle	Late
Transfer of water accumulated in the branch trench																								
Installation of transfer line to the turbine building																								
Transfer of water to the turbine building																								
Blocking of the branch trench																								
● Power cable trench (Foundation of the seawater pipe)																								
Installation of plant and pipes																								
Excavation of holes for filling material injection (Daytime work)																								
Injection of the filling material (Nighttime work)																								

II. [3] Measures against Contaminated Water - Emergency Measures (3)

Measure (3): Suppressing of contaminated water increase ●●● Pumping up of groundwater at the mountain-side of the reactor buildings (groundwater bypass) [Keep water away]

- ✓ The groundwater bypass plan has been designed to reduce the amount of water flowing into the buildings by pumping up and bypassing groundwater at the mountain side of the buildings.
- ✓ Implement the quality inspection of the groundwater from the pump wells, as well as the water in the temporary storage tanks where the pumped groundwater is stored. In the A system, it was verified that the radioactivity density of the water is below the detection limit or significantly low. As regards the B and C systems, quality inspection of water in the temporary storage tanks is currently underway.



<Installation of the pumping wells, etc.>



Sealed structure is adopted for the pumping wells



Installed the dedicated pipes and tanks

II. [3] Measures against Contaminated Water - Drastic Measures (1)

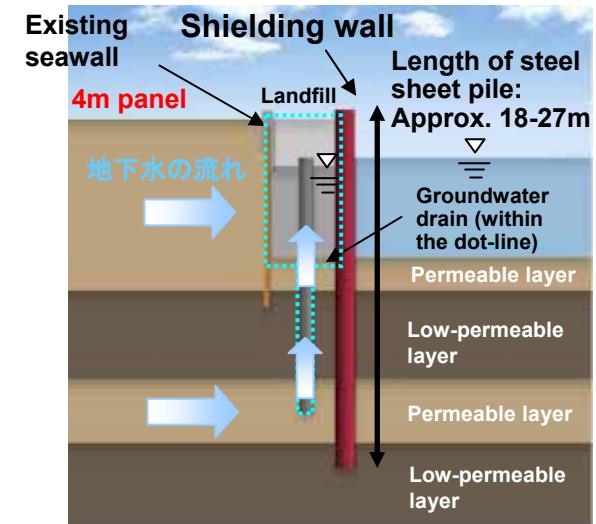
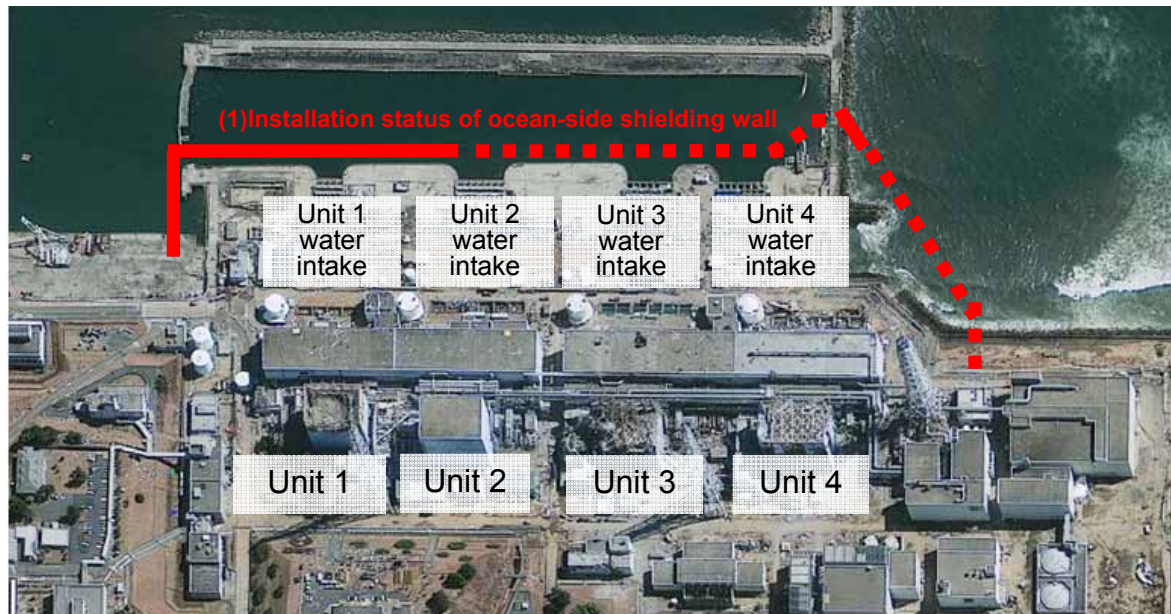
Measure (1): Prevention of outflow into the ocean ••• Installation of ocean-side shielding walls [Not leak]

- ✓ Started construction from May, 2012 at the ocean-side of the seawall, aiming for the completion on September, 2014.

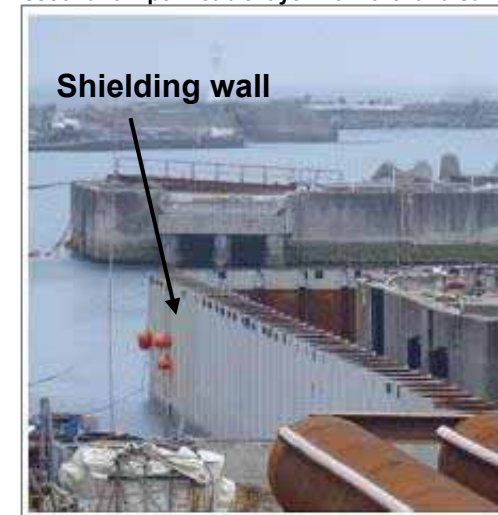
Progress of ocean-side shielding wall construction :Advanced drilling on the rock ground where the steel sheet piles are to be drilled. (100% as of August 31)

Drilling of the steel sheet piles (47% as of September 5)

→Currently finished the construction to near the Unit 2 water intake canal, and scheduled to complete in September, 2014.



* Drill the steel sheet piles to reach the depth of second low-permeable layer from the land surface.

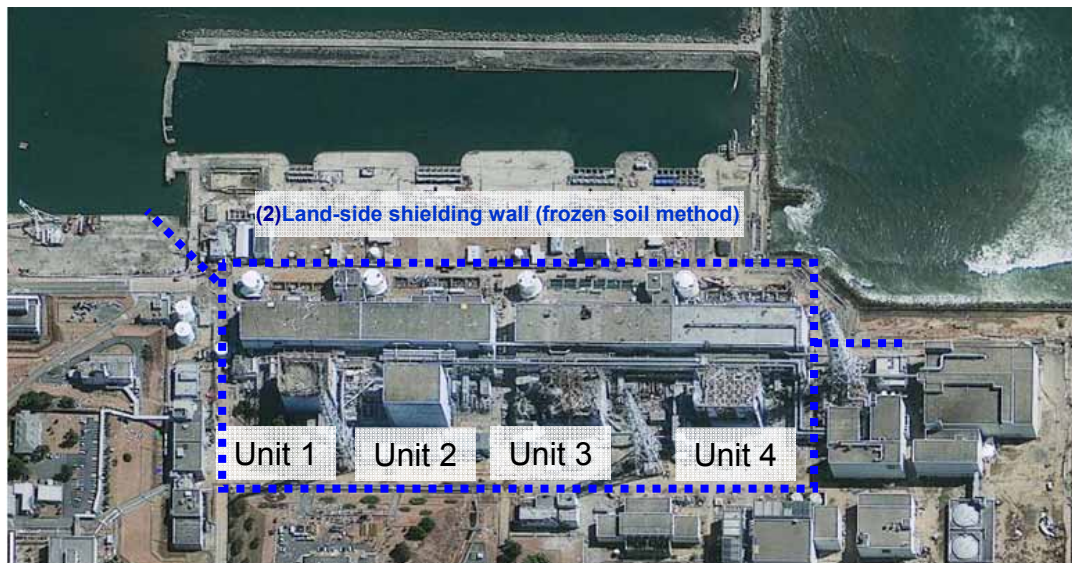


II. [3] Measures against Contaminated Water - Drastic Measures (2)

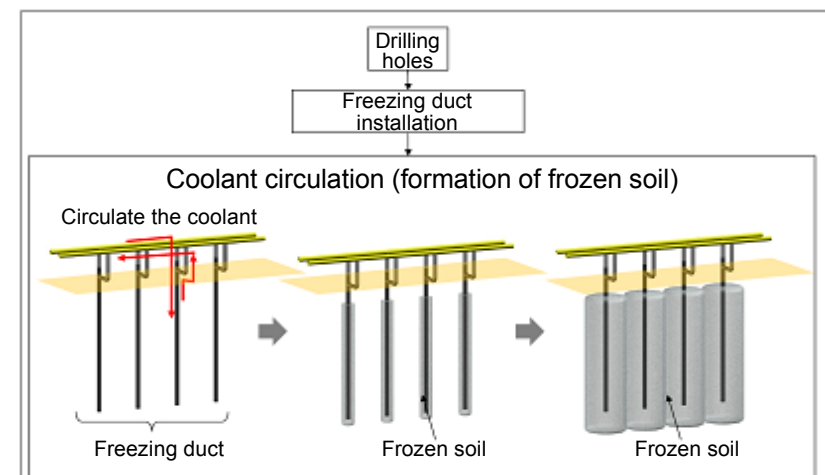
Measure (2):

Suppressing of contaminated water increase and prevention of outflow into the port •••Installation of land-side shielding wall [Keep water away] [Never cause leakage]

- ✓ Install the shielding walls around the reactor buildings to suppress the contaminated water increase caused by the inflow of groundwater into the buildings.
- ✓ Implement the water level management to prevent the outflow of water accumulated in the reactor buildings.
- ✓ Scheduled to verify the achievement level of the technological target within 2013.
- ✓ Implement the feasibility study until the end of 2013, and then start the construction immediately after the preparation is made. Scheduled to start operation in the first half of FY 2015.



<Construction procedure for frozen soil walls>



II. [3] Measures against Contaminated Water - Drastic Measures (3)

Measure (3):

Suppressing of groundwater inflow into the reactor buildings ••Pumping up of groundwater from the sub-drains [Keep water away]

- ✓ Sub-drain is a facility to lower the water levels around the buildings by pumping up groundwater.
- ✓ By lowering the groundwater levels around the buildings, suppress the inflow of groundwater into the reactor buildings as well as the outflow to the seawall.

