Progress of Landside Impermeable Wall freezing

(Phase 2 of the first stage)

July 28, 2016



Tokyo Electric Power Company Holdings, Inc.

Landside Impermeable Wall

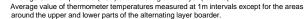


- O The purpose of the Landside Impermeable Wall construction lies not in freezing soil to form an underground wall but in keeping groundwater from flowing into the reactor/turbine buildings and preventing new contaminated water from being generated.
- O By closing less than 95 percent of the mountain side of the Landside Impermeable Wall in Phase 2 of the first stage, it is expected that the amount of groundwater flowing into the areas around the reactor/turbine buildings will be reduced. This will help keep groundwater from being contaminated during the first stage.
- O Throughout the first stage, how freezing of the Landside Impermeable Wall has progressed will be checked by monitoring the difference in groundwater levels inside and outside of the wall and the amount of groundwater pumped up by the subdrain and groundwater drain systems and the well point system.

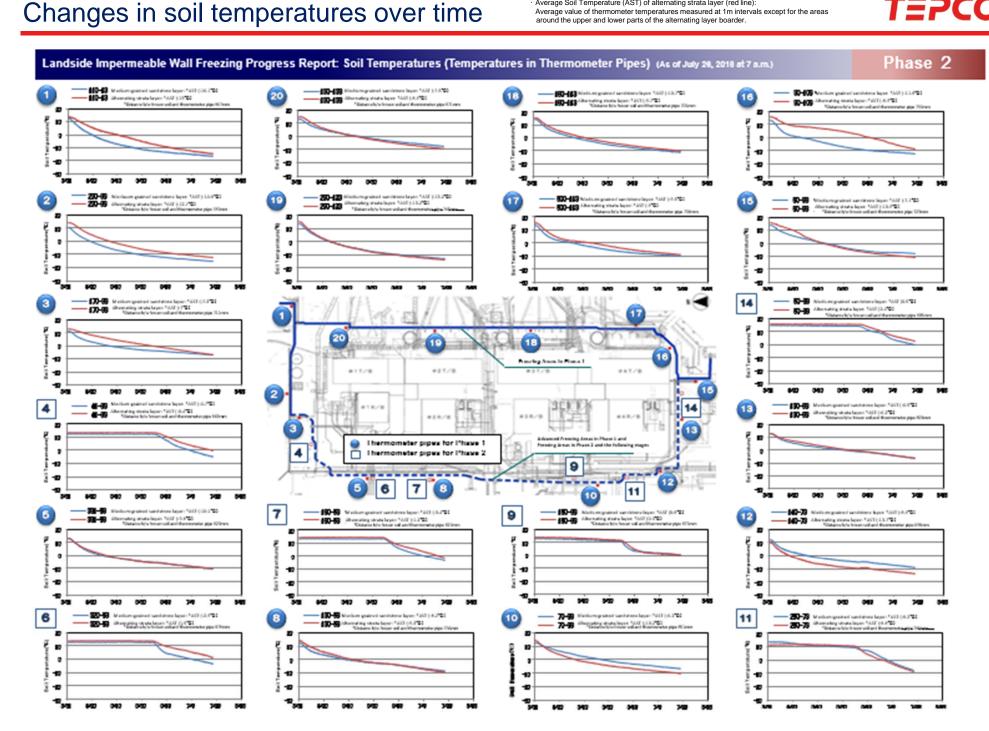
· Average Soil Temperature (AST) of medium-grained sandstone layer (blue line): average value of thermometer temperatures measured at 1m intervals except for the areas

between ground surface and Ground Level 2m and the areas around the first muddy layer boarder.

· Average Soil Temperature (AST) of alternating strata layer (red line):

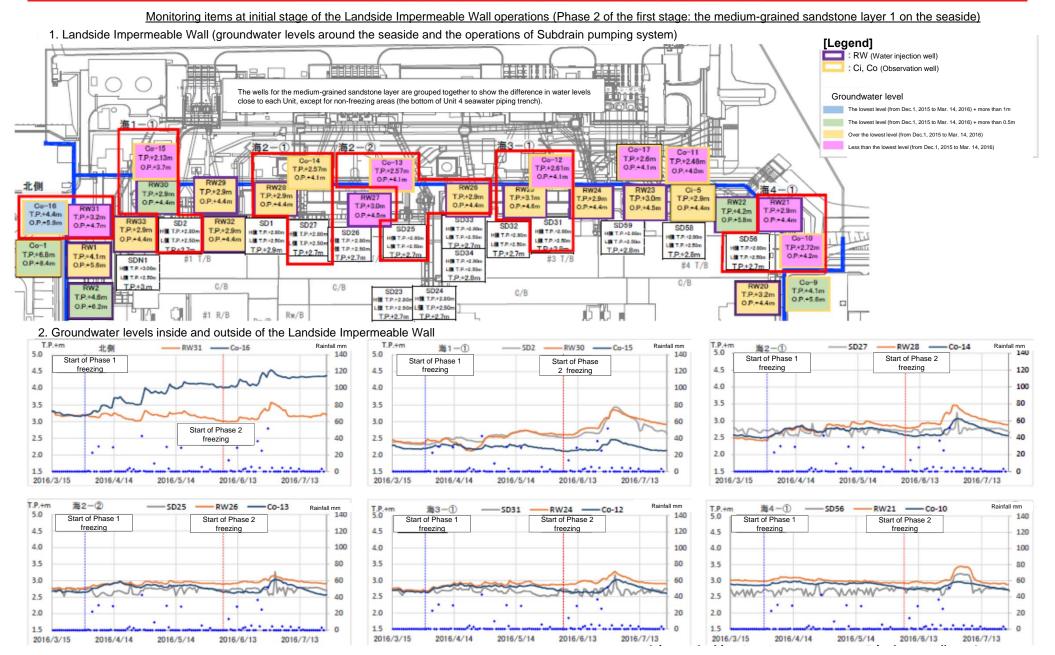






(in the medium-grained sandstone layer 1 on the seaside)





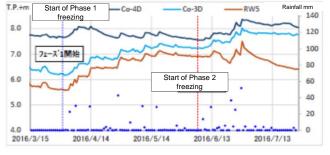
(in the medium-grained sandstone layer 2 on the landside)

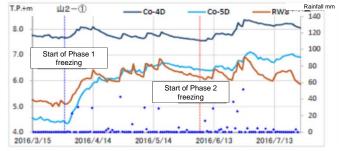


Monitoring items at initial stage of the Landside Impermeable Wall operations (Phase 2 of the first stage: the medium-grained sandstone layer 2 on the landside)

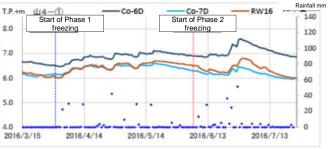
3. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system) [Legend] SD52 H種 T.P.+3.05 The wells for the medium-grained sandstone layer are grouped together to HET.P.42.00 SD22 L催 T.P.+2.75 RW (Water injection well) include two wells outside the non-freezing area and one well inside, for LE T.P.+2 504 H# T.P.+2.00 T.P.+5.2m LE T.P.+2.50m each Unit. T.P.+2.7m Ci, Co (Medium-grained sandstone layer) T.P.+2.5m SD8 #1 T/B SD51 SD21 LET.P.+2.75e **Ⅲ** T.P.+2.80 HM T.P.+2.00 SDN15 SDN3 Groundwater level C/B LE T.P.+2.50n LIST P.+2.50v HIR T.P.+3.00 HM T.P.+3.25n SD40 T.P.+5.1m TP+27m L# T.P.+2.50 L# T.P.+2.75m SDN14 **∰** T.P.+2.80 Landside Subdrain the lowest level + more than 2m (権 T.P.+3.25c T.P.+5.2m SD20 T.P.+3.2m SDN13 # T.P.+2.50 (値 T.P.+3.00 Landside Subdrain the lowest level + more than 1m SDN7 H籍 T.P.+2.00 ₫ T.P.+2.50: **₫** T.P.+3.00c T.P.+3.7m HE T.P.+3.25 LM T.P.+2.50 值 T.P.+2.50m T.P.+4.9m I andside Subdrain over the lowest level #3 R/B L億 T.P.+2.75e TP+43m TP+47n L催 T.P.+2.75 T.P.+2.7m O.P.+8.3m SDN5 Landside Subdrain less than the lowest level SD45 SDN11 SDN12 ## TP.+3.25 SDN8 SD19 # T.P.+2.8 H# T.P.+0.00 值 T.P.+2.75n Ci-2 HM T.P.+0.00x H 第 T.P.+2.00e Ci-1 SDNR SDN10 TP+5.2m L值 T.P.+2.50 LE T.P.+2.50 LIST P.+2.50m LIE T.P.+2.50s Co-8 TP+7.0m TP.+7.2m HIR T.P.+0.00s HIR T.P.+3.00 T.P.+5.m T.P.+5.7m O.P.+6.7m TP+5.m T.P.+3.4m T.P.+5.6m O.P.+8.5m LM T.P.+2 50m LIET.P. +2.50e TP+50v O.P.+7.1m T.P.+5.m RW17 RW9 T.P.+7.6m TP.+7.1m T.P.+6.4m T.P.+6.7m OP+78m TP+6.0m O.P.+7.4m OP.+8.2n O.P.+7.4m OP.+8.2n T.P.+7.0m T.P.+5.5m T.P.+5.9n O.P.+8.5m O.P.+7.0m O.P.+8.2n O.P.+7.4m RW14 Co-7D Co-3D Co-4D T.P.+6.1m T.P.+6.0m T.P.+7.8m Ci-3 Co-6D OP+7.6n O.P.+7.5m O.P.+9.3m O.P.+9.6m T.P.+6.9m T.P.+5.8m O.P.+8.4m T.P.+6.9m O.P.+7.3m O.P.+8.4m 山1-① $\pm 4 - 1$ 山2-①

4. Groundwater levels inside and outside of the Landside Impermeable Wall









The data of groundwater levels as of 12 p.m. on July 26.

(in the alternating strata layer and the fine- and rough-grained sandstone layer 1 on the seaside)

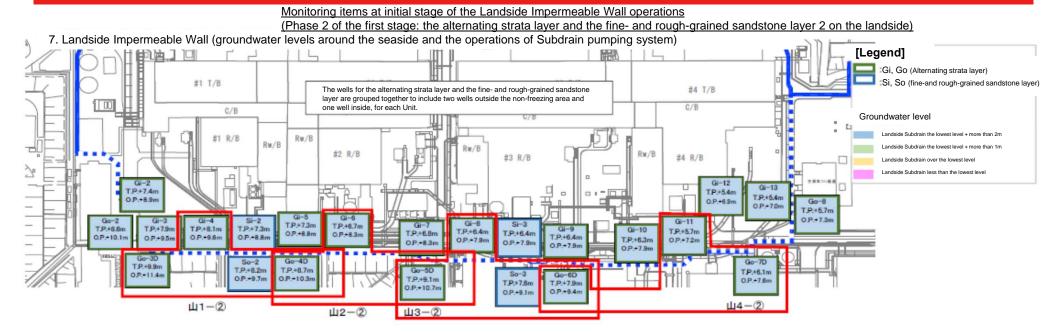
Monitoring items at initial stage of the Landside Impermeable Wall operations



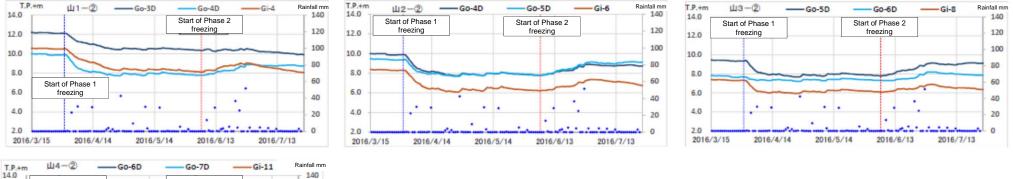
(Phase 2 of the first stage: the alternating strata layer and the fine- and rough-grained sandstone layer 1 on the seaside) 5. Landside Impermeable Wall (groundwater levels around the seaside and the operations of Subdrain pumping system) [Legend] Gi, Go (Alternating strata layer) The wells for the alternating strata layer and the fine- and rough-grained sandstone layer are grouped Si, So (fine-and rough-grained sandstone layer) together to show the difference in water levels close to each Unit, except for non-freezing areas (the bottom of seawater piping trench for each Unit) Groundwater level The lowest level (from Apr. 1 to Apr. 11, 2016) + more than 1m The lowest level (from Apr. 1 to Apr. 11, 2016) + more than 0.5m Over the lowest level (from Apr. 1 to Apr. 11, 2016) T.P.+3.5n T.P.+2.6m T.P.+2.8a T.P.+2.9m Less than the lowest level (from Apr. 1 to Apr. 11, 2016) OP+48e O.P.+4.4m OP+44m O.P.+4.5n O.P.+5.0n OP.+4.2m T.P.+5.8n G-16(H25J[2]) O.P.+7.3n TP.+4.1m T.P.+3.6m Gi-21 T.P.+3.2m T.P.+3.5m T.P.+3.4m T.P.+3.4n O.P.+5.1m T.P.+5.0m O.P.+4.6n O.P.+4.8m O.P.+4.6m O.P.+4.8n O.P.+4.9n O.P.+5.0n O.P.+6.6m OP+44m 海3-(2) #1 T/B #2 T/B #3 T/B T.P.+8.0 O.P.+7.1m #4 T/B O.P.+9.5n TP.+4.8n C/B C/B OP+560 C/B T.P.+7.6m O.P.+7.0m So-4 TP+4.3m T.P.+5.3m OP.+5.8n Groundwater levels inside and outside of the Landside Impermeable Wall Rainfall mm ----- Gi-23 ----Go-20 Rainfall mm ---- Gi-19 -Go-14 6.0 140 6.0 140 6.0 140 Start of Phase 2 Start of Phase 1 Start of Phase 2 Start of Phase 1 5.5 5.5 5.5 120 120 freezing 120 freezina freezing freezino 5.0 5.0 5.0 100 100 100 4.5 4.5 4.5 80 80 80 4.0 4.0 4.0 60 60 60 Start of Phase Start of Phase 2 3.5 3.5 3.5 freezing 40 40 40 3.0 3.0 3.0 20 20 2.5 2.5 2.5 2016/3/15 2016/4/14 2016/5/14 2016/6/13 2016/7/13 2016/3/15 2016/4/14 2016/5/14 2016/6/13 2016/7/13 2016/3/15 2016/4/14 2016/5/14 2016/6/13 T.P.+m 海2-(4) Rainfall mm 海3-(2) Rainfall mm 海4-(2) Rainfall mm T.P.+m 140 140 6.0 140 Start of Phase 2 Start of Phase 1 Start of Phase 2 Start of Phase 1 Start of Phase 2 Start of Phase 1 5.5 5.5 5.5 freezing freezing 120 freezing freezing 120 120 freezing 5.0 5.0 5.0 100 100 100 4.5 4.5 4.5 80 80 80 40 4.0 4.0 60 60 60 3.5 3.5 3.5 40 40 40 3.0 3.0 3.0 20 2.5 20 2.5 20 2.5 2.0 2.0 2016/3/15 2016/4/14 2016/5/14 2016/6/13 2016/7/13 2016/3/15 2016/4/14 2016/5/14 2016/6/13 2016/7/13 2016/6/13 2016/7/13 2016/3/15 2016/4/14 2016/5/14

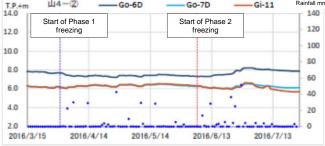
(in the alternating strata layer and the fine- and rough-grained sandstone layer 2 on the landside)





8. Groundwater levels inside and outside of the Landside Impermeable Wall



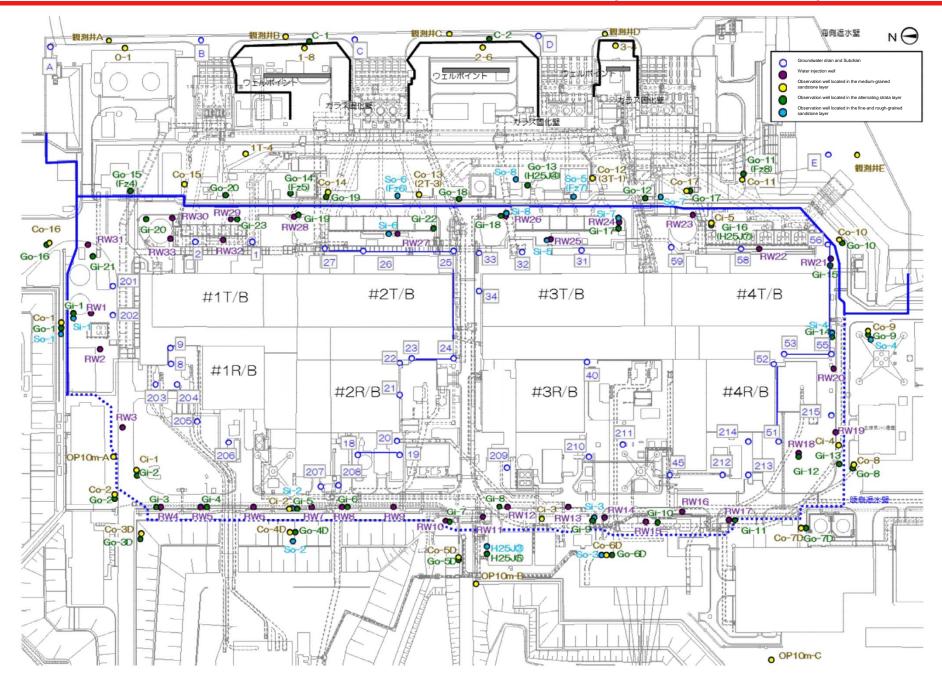


The data of groundwater levels as of 12 p.m. on July 26.

Location map of groundwater level observation wells

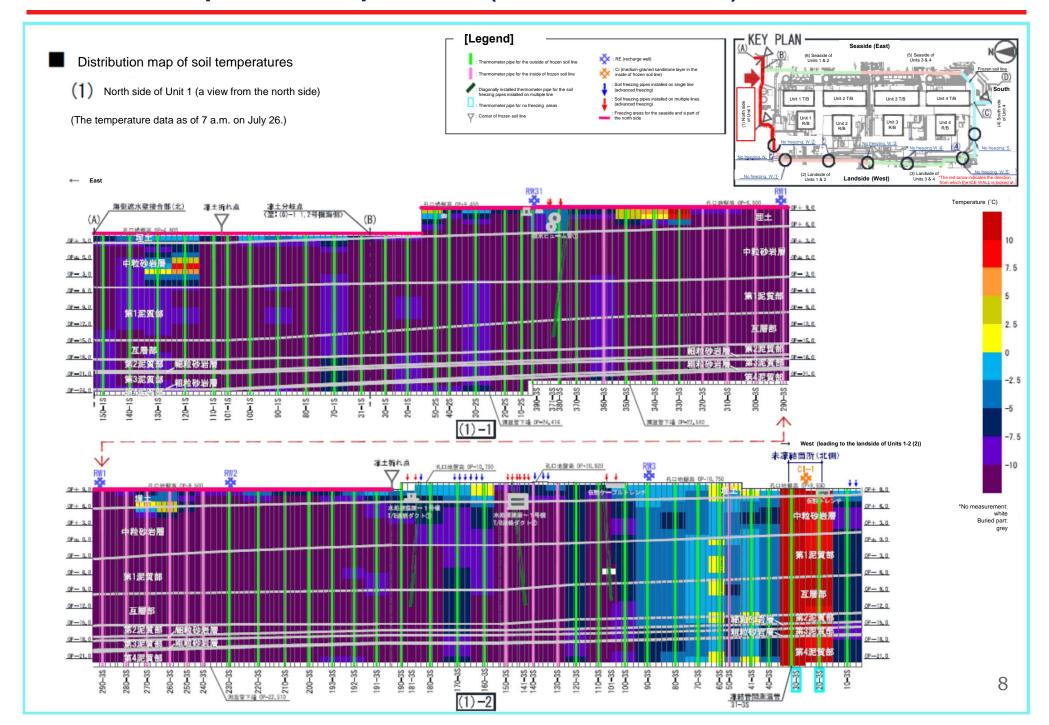
(as of June 2016) TEPCO





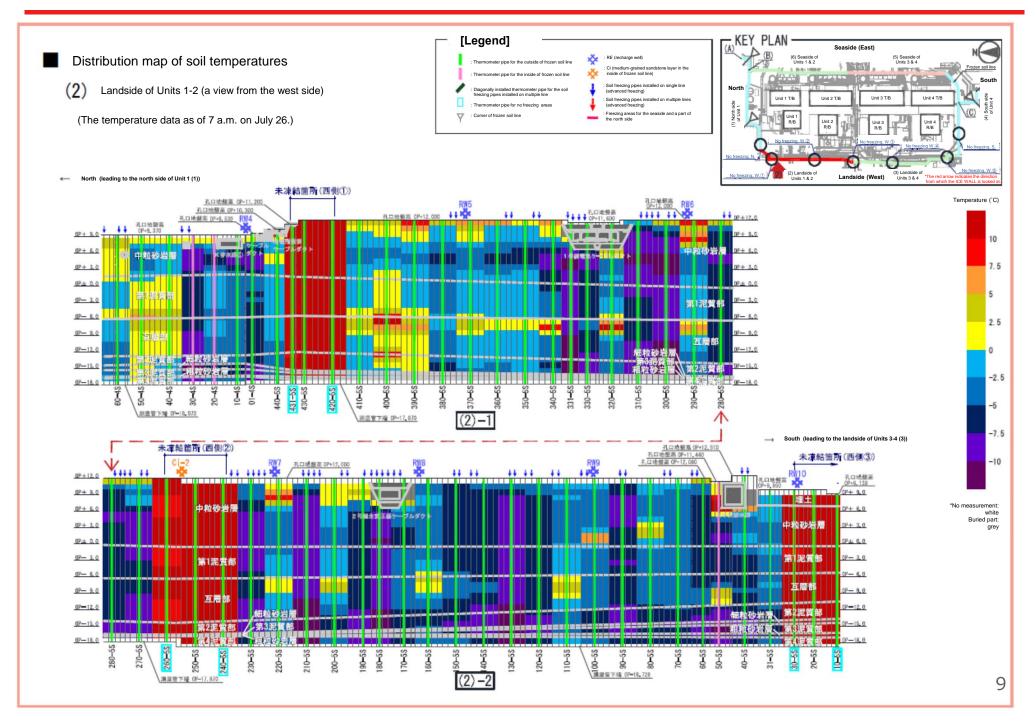
Distribution map of soil temperatures (north side of Unit1)





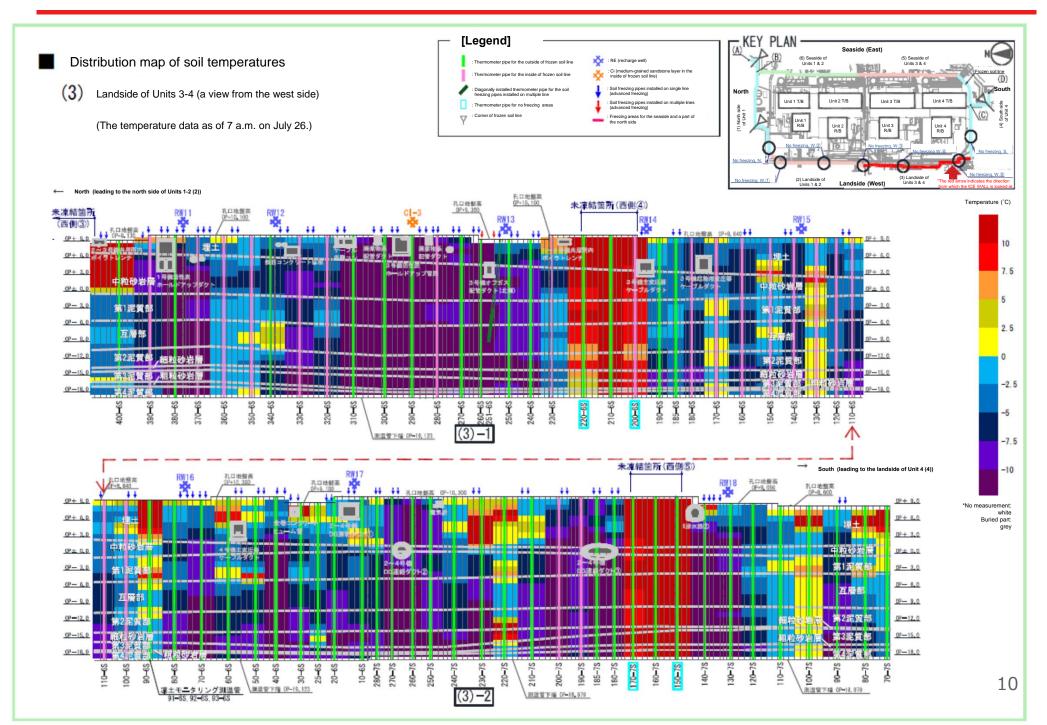
Distribution map of soil temperatures (west side of Units 1-2)





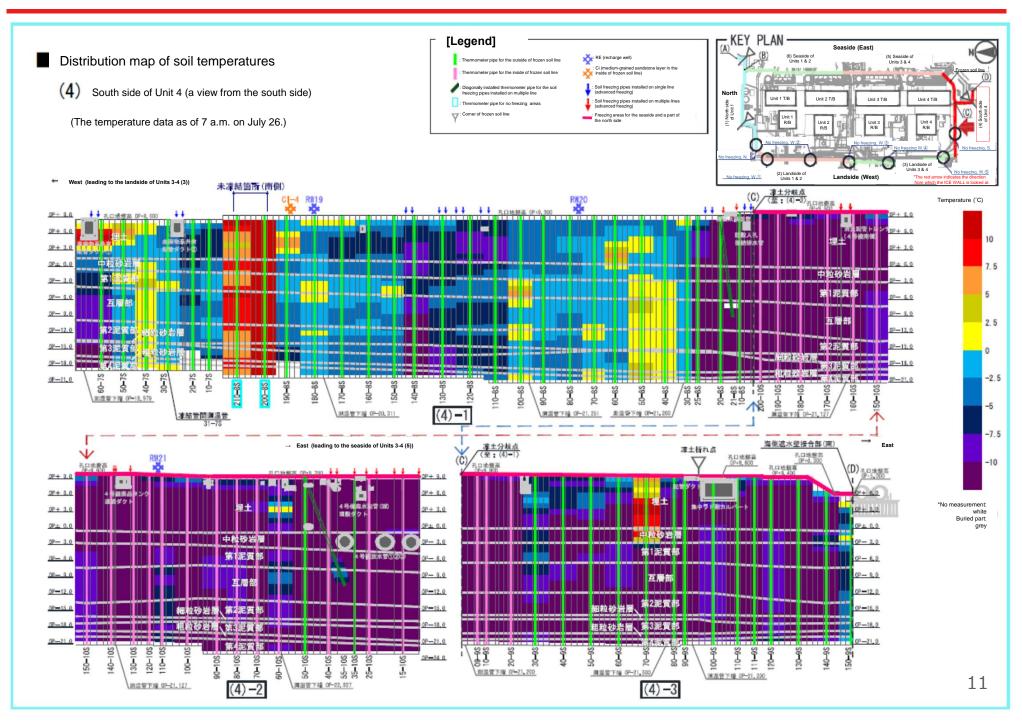
Distribution map of soil temperatures (west side of Units 3-4)





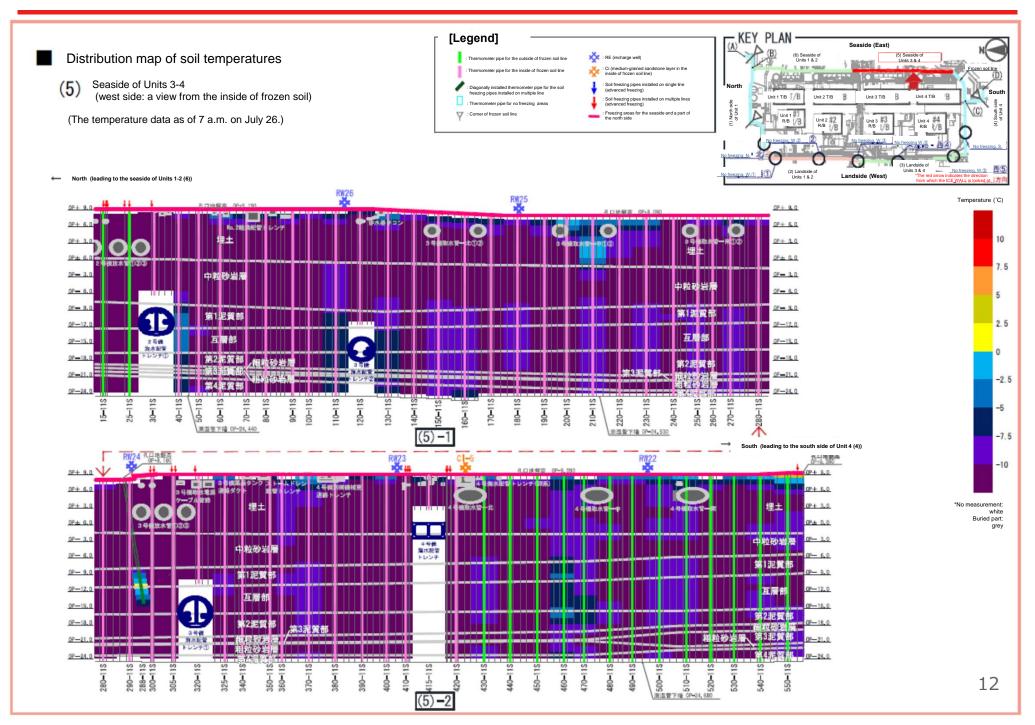
Distribution map of soil temperatures (south side of Unit 4)





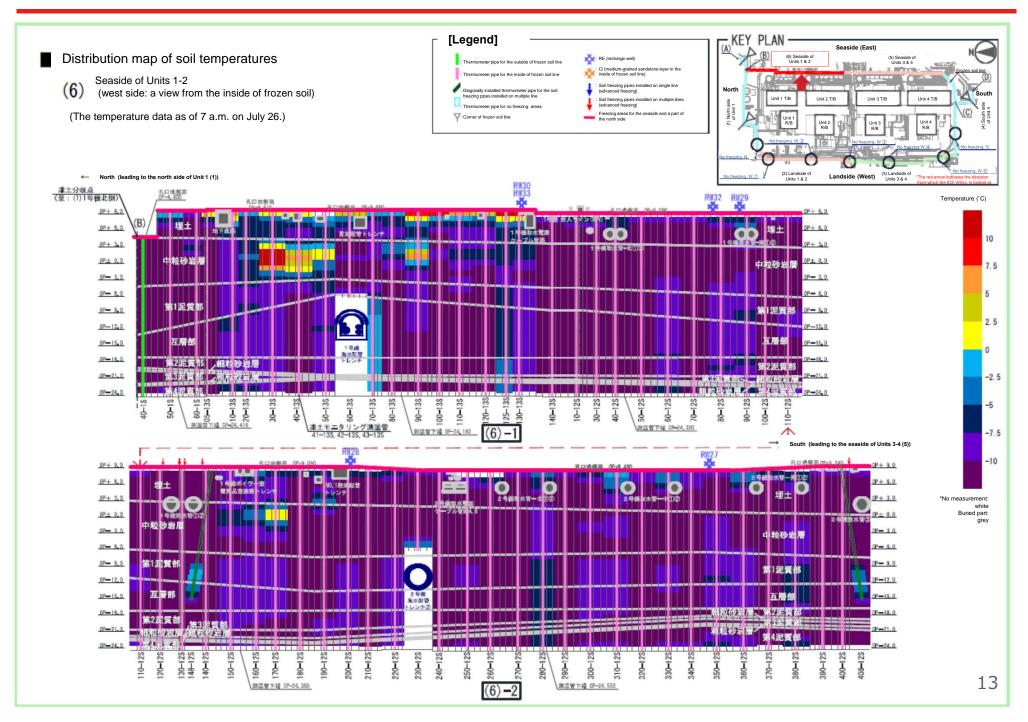
Distribution map of soil temperatures (east side of Units 3-4)



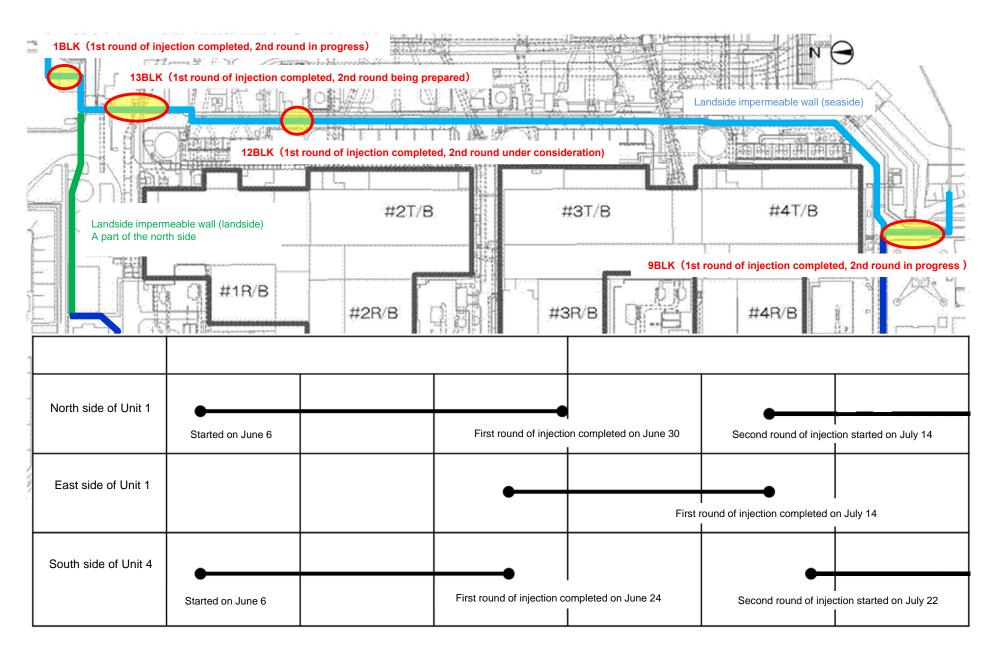


Distribution map of soil temperature (east side of Units 1-2)









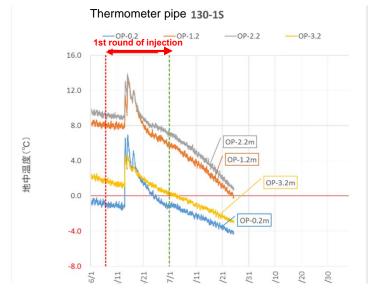
Progress of supplementary work (1BLK)



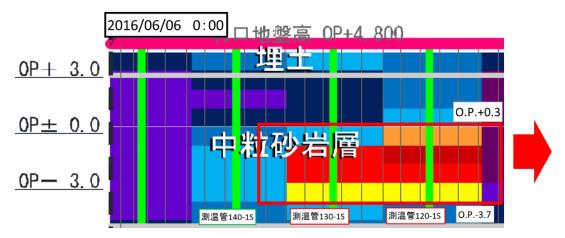
Over-time changes of the soil temperatures in the north side area of Unit 1 where the supplementary work is in progress

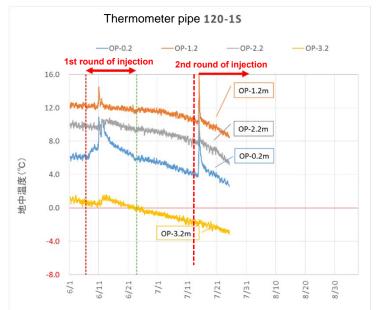
The soil temperatures temporarily increased because of water which was used to bore through the ground during the supplementary work, but it has gradually decreased. Since the soil temperature around the thermometer pipe of 120-1S has not dropped sufficiently, however, the second round of injection is currently under way. TEPCO Holdings will continue to monitor the temperature changes.

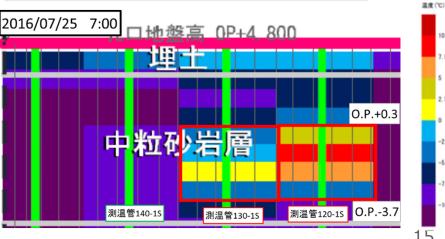
Temperature changes in the area where the supplementary work is under way



Distribution maps of soil temperatures in the area where the supplementary work is under way







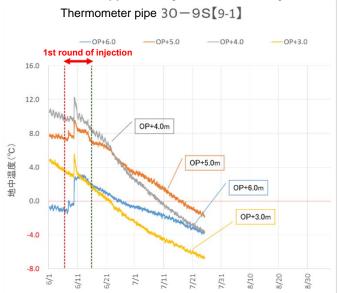
Progress of supplementary work (9BLK)

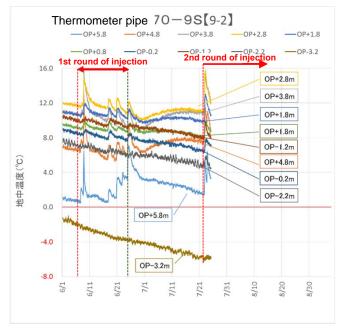


Over-time changes of the soil temperatures in the south side area of Unit 4 where the supplementary work is in progress

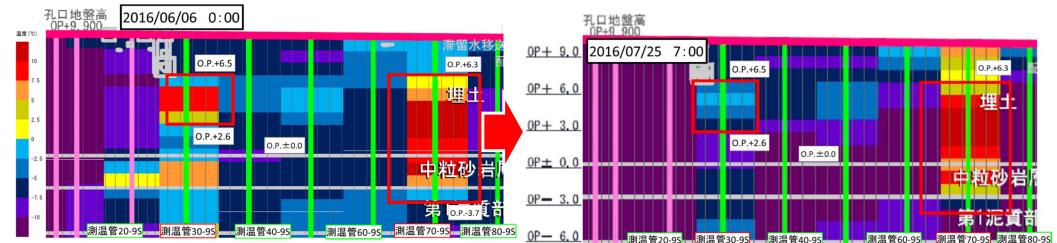
As seen in the soil temperatures in the 1BLK area, that in the 9BLK area temporarily increased because of water which was used to bore through the ground during the supplementary work. The soil temperature around the thermometer pipe of 30-9S0 has dropped to around 0 degrees Celsius, and TEPCO Holdings will continuously monitor it. In the area around the thermometer pipe of 70-9S, the second round of injection is progressing.

Temperature changes in the area where the supplementary work is under way





Distribution maps of soil temperatures in the area where the supplementary work is under way

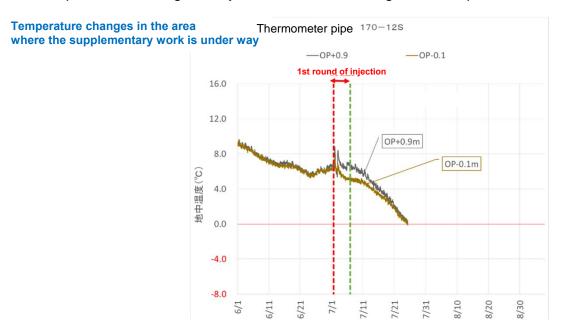


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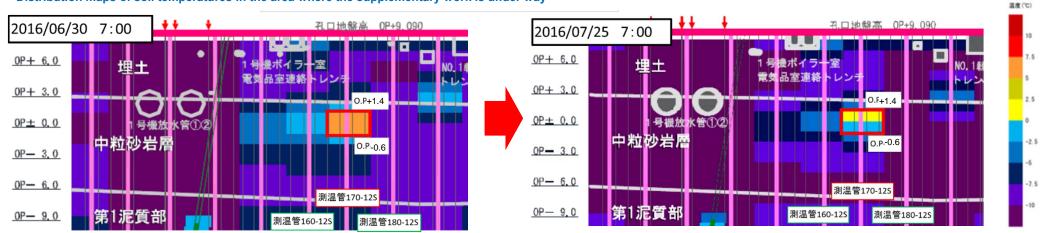


1, Over-time changes of the soil temperatures in the east side area of Unit 2 (12BLK) where the supplementary work is in progress

The soil temperatures have gradually decreased. Monitoring of the temperatures will continue.



Distribution maps of soil temperatures in the area where the supplementary work is under way

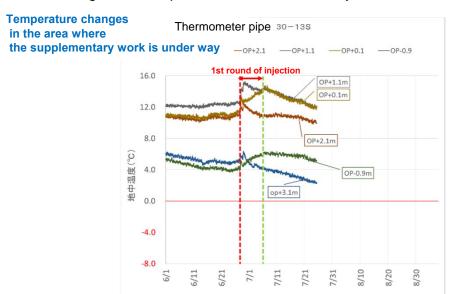


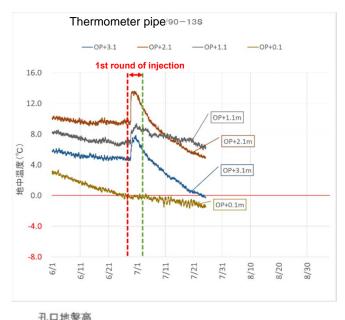
Progress of supplementary work (13BLK)



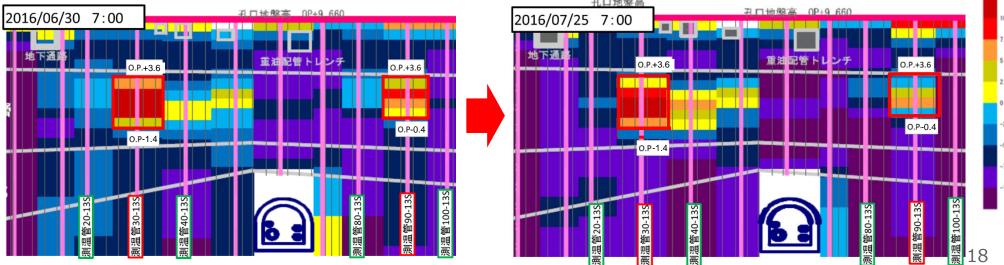
1, Over-time changes of the soil temperatures in the east side area of Unit 2 (13BLK) where the supplementary work is in progress

Since the soil temperature around the thermometer pipe of 30-13S has slowly decreased, the second round of injection is planned. Although the decrease of the soil temperatures around the thermometer pipes of 50-13S and 90-13S have been gradual but steady, monitoring of the temperatures is still under way.





Distribution maps of soil temperatures in the area where the supplementary work is under way



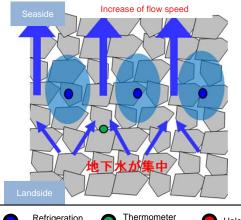


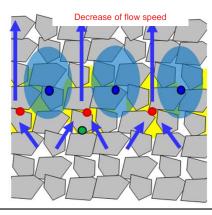
Purpose

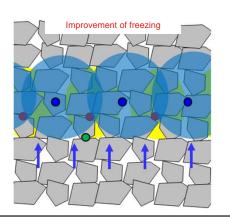
- To help further freeze soil in places where the soil temperatures have slowly dropped due to fast flowing groundwater, the speed at which the groundwater runs has to be reduced by making the permeability of the soil as low as that of soil in the vicinity of the places.
- The purpose of the supplementary work lines not in constructing different walls from the landside impermeable wall but in changing locally highly permeable soil areas into areas with low permeabilities observed in the soil of the surrounding area.

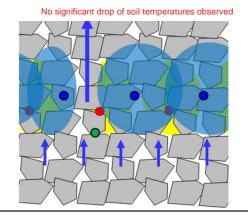
■ Process

- 1) Previous state: In places where soil have high permeability and groundwater is gushing, freezing does not proceed as scheduled.
- ②Fluids injection:
 By injecting some fluids
 into spaces in places
 where groundwater runs
 fast and lowering the
 permeability of the soil,
 the speed at which the
 groundwater flows will be
 reduced.
- ③Facilitation of freezing:
 The reduction of the speed of groundwater flow will make the soil easier-to-freeze and expand frozen area. Then, thermometer pipes will gradually start to show the effectiveness of this work.
- When the soil temperatures do not significantly drop, the second round of injection will begin. The injection will continue depending on how much the temperatures have dropped.



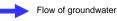














Points to freeze

