Freezing started for the Landside Impermeable Wall at Fukushima Daiichi Nuclear Power Station

＜Reference＞
March 31,2016
Tokyo Electric Power Company
KAJIMA CORPORATION

- On March 31, 2016, at 11:20 a.m., TEPCO switched on the first refrigerator system and started freezing the soil around the reactor and turbine buildings as scheduled.
- The areas to be frozen this time are the entire seaside line and a part of the landside line (the north side and advanced partial freezing areas). This is freezing work scheduled to be conducted in Phase 1 of the first stage.
- In Phase 1, the entire seaside line is scheduled to be closed. This closure will block the flow of groundwater into the revetment area and raise the groundwater level around the reactor and turbine buildings, thereby reducing the risk of leakage of accumulated water in the buildings which could be caused by the inversion of the water levels inside and outside the buildings. In Phase 2, 95 percent of the total landside line will be closed. The closure will allow reduction of the amount of groundwater flowing into the reactor and turbine buildings and prevention of groundwater from being contaminated.
- To make the landside impermeable wall work, TEPCO will thoroughly conduct groundwater level management, putting safety first, so that leakage of accumulated water in the buildings due to the inversion of the water levels inside and outside the buildings can be prevented.
- In the first stage, TEPCO will collect data necessary to move on to the second and third stages and evaluate them in order to check how freezing has been progressing.

Freezing of the landside impermeable wall was financed by the Ministry of Economy, Trade and Industry, and the costs were covered by a FY 2013 subsidy for the contaminated water management project .

Freezing started for landside impermeable wall at Fukushima Daiichi Nuclear Power Station

Operations started

The first machine

The second and the following machines

Photos taken on March 31, 2016
Provided by Tokyo Electric Power Company

Brief overview of the Landside Impermeable Wall

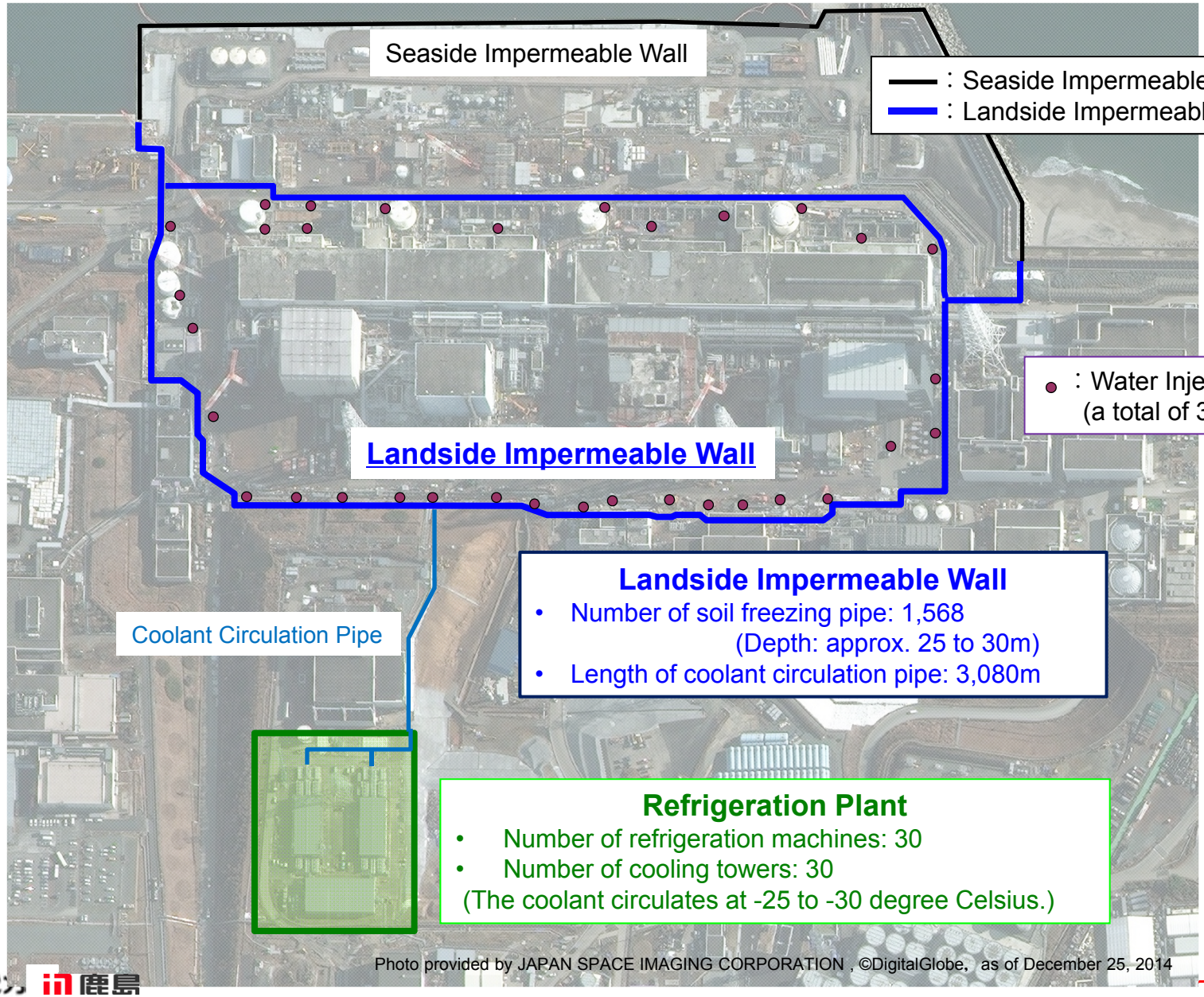
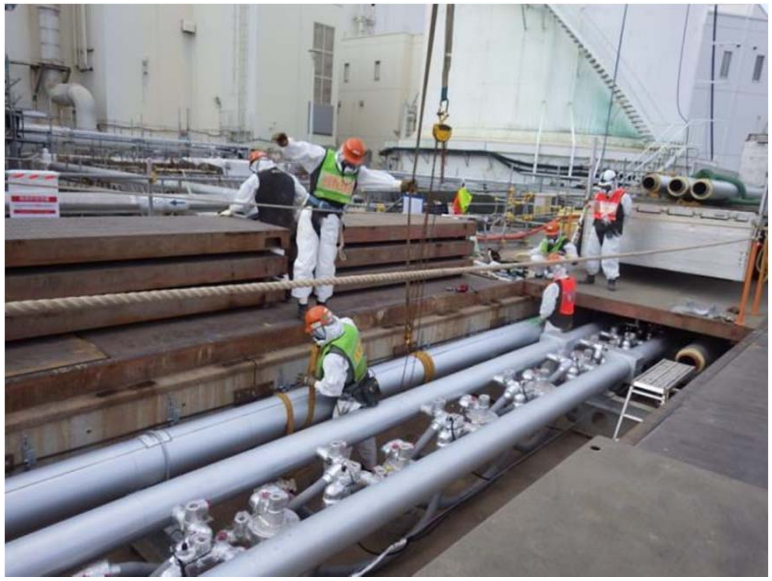


Photo provided by JAPAN SPACE IMAGING CORPORATION , ©DigitalGlobe, as of December 25, 2014

Completion of the Landside Impermeable Wall construction and its timeline

Installation completed on the west side of No. 2-4 buildings

Installation completed on the south side of No. 4 buildings



Installation completed on the west side of No. 1-2 buildings

- Timeline
  - Preparatory work for installation started on November 27, 2013
  - Installation work started on June 2, 2014
  - Preparatory work for freezing completed on:
    - Landside：September 15, 2015
    - Seaside：February 9, 2016
  - Freezing started on March 31, 2016

Process toward closure of the Landside Impermeable Wall

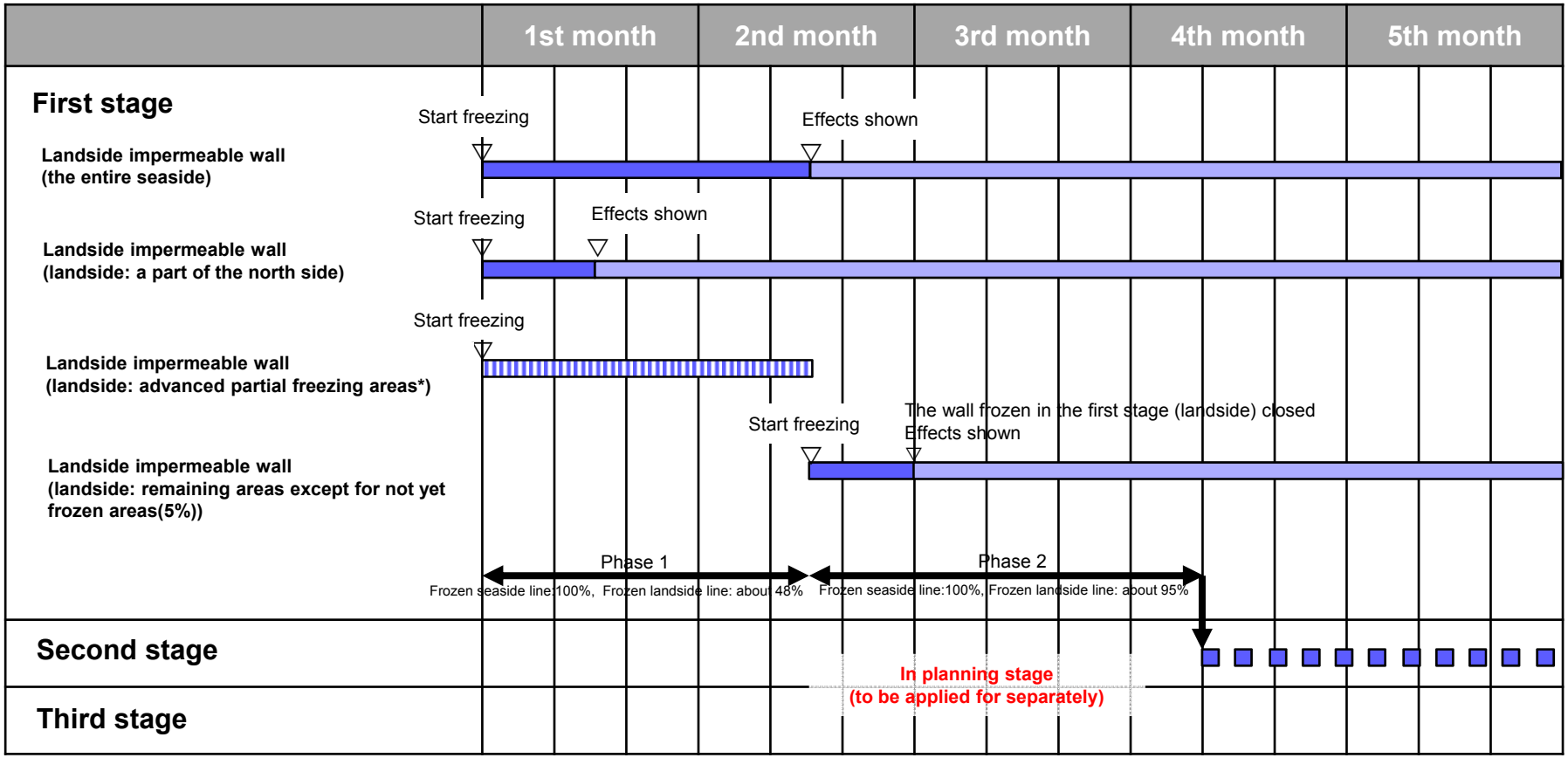
- The seaside line of the landside impermeable wall will be closed prior to closure of the landside line. The landside line will be frozen in stages, resulting in entire closure of the line.
- Closure of the landside impermeable wall will proceed in the following three stages:
  - First stage: Closure of the entire seaside line and closure in stages of the landside line have been completed (to be conducted this time)
  - Second stage: Between First and Third stages
  - Third stage: Entire closure has been completed

What is expected in the first stage

- With the subdrain system in operation, it is expected that even if groundwater level around the reactor and turbine buildings declines, the groundwater level can quickly and certainly be recovered by suspending the operation of the system. Therefore, the chances are quite slim that the water levels of accumulated water in the buildings and groundwater around the buildings are inverted.

Schedule for freezing in the first stage

- There are two phases in the first stage. Checking in each phase how freezing has been progressing, TEPCO will carefully move closer towards closing the landside impermeable wall.
- In Phase 1, the following areas of the landside impermeable wall will be frozen simultaneously.: the entire seaside line, a part of the north side and advanced partial freezing areas of the landside (the areas that it is hard to freeze because the space between the freezing pipes is wider) . This means that closure of about 48 percent of the total landside line has been completed.
- In Phase 2, TEPCO will start freezing the remaining areas of the landside line except for not yet frozen areas around at the same time as the effects of the frozen seaside line start showing. With this, about 95 percent of the landside impermeable wall on the land side line has been closed



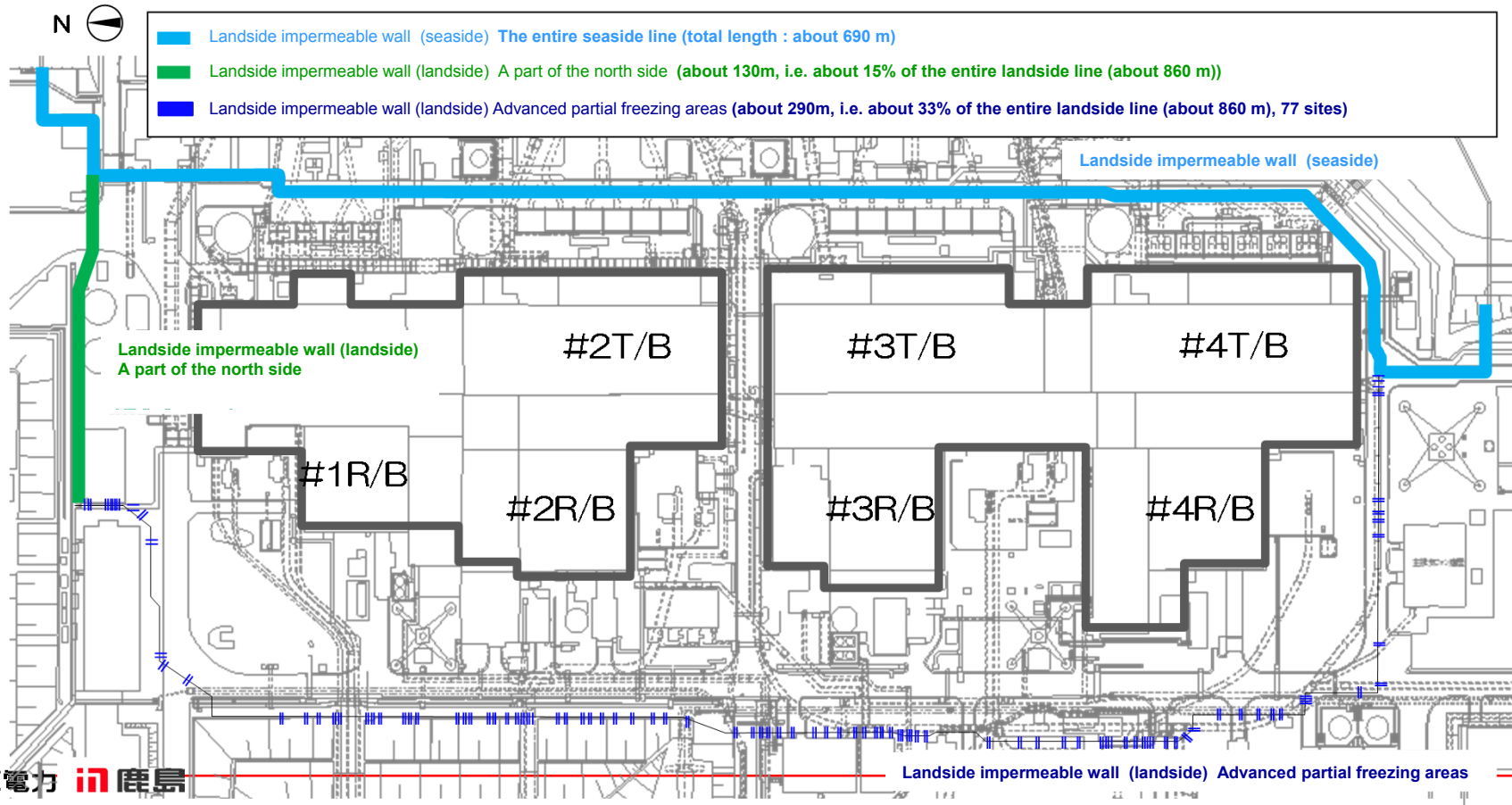
*Freezing of the advanced partial freezing areas will continue until the remaining areas except for not yet frozen areas (5%) start to be frozen.

: From "Start freezing" to "Effects shown"
: From "growing frozen soil" to "maintaining" after "Effects shown"
: Advanced partial freezing

First stage: closure areas (Phase 1)

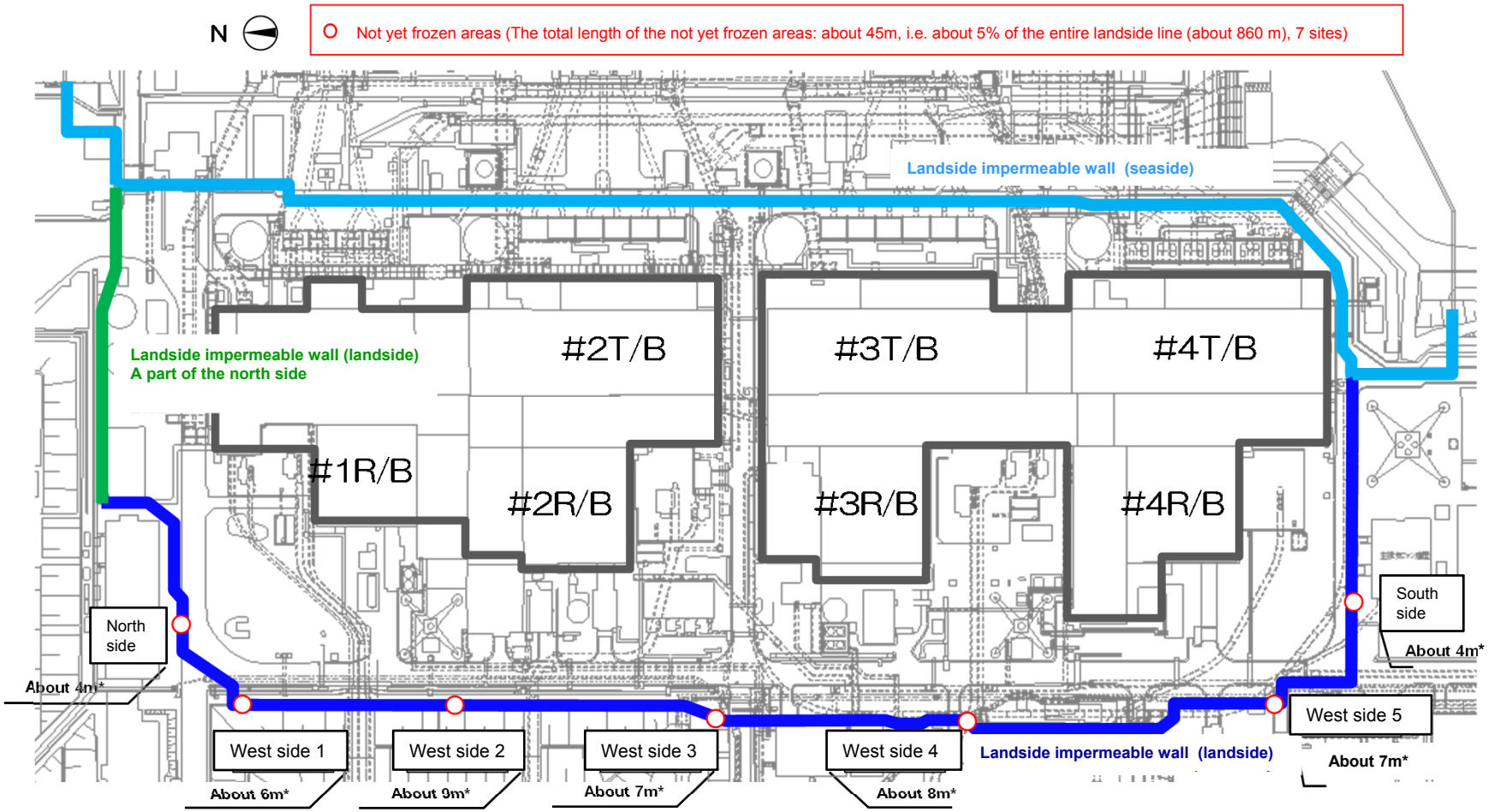
- In Phase 1 of the first stage, TEPCO will freeze the following three areas simultaneously prior to freezing of the other areas.
  The entire seaside line, A part of the north side and Advanced partial freezing areas of the landside line
  - The entire seaside line : To reduce the risk that the level of groundwater around the reactor and turbine buildings could get lower than that of accumulated water in those buildings if TEPCO starts with freezing of the landside line.
  - A part of the north side : To prevent groundwater around the Unit 1 reactor and turbine buildings from spreading
  - Advanced partial freezing areas : *By freezing areas in advance which it is expected to take more time to freeze, to complete the freezing of the areas without no chance of failure.

    *It takes more time to freeze areas where the interval between the installed refrigeration pipes is wider (in the case of several pipes having been inserted, etc.) compared with “ordinary” areas where the interval is about 1m. Therefore, if both areas started to be frozen simultaneously, it is expected that it would be harder to freeze the former areas because more groundwater would flow into the areas, leading to a situation where it would be much harder to freeze. In order not to let it happen, TEPCO freezes the areas prior to freezing the “ordinary” areas.



First stage: closure areas (Phase 2)

- Following the freezing of the entire seaside line, a part of the north side and advanced partial freezing areas of the landside line, TEPCO will freeze remaining areas of the landside line except for 7 not yet frozen areas in Phase 2. During the freezing, the company will make sure that underground will flow into areas between the closed landside impermeable walls and the reactor and turbine buildings.



* The number indicates the total length of each not yet frozen area.

Groundwater level management inside and outside of the reactor buildings in the first stage

- As groundwater level management inside and outside each reactor building to prevent accumulated water inside the building from leaking, TEPCO carries out management in the first stage similar to the following on-going three.
  - 「Ensuring that accumulated water in the reactor and turbine buildings and water in the subdrain system have different water levels」
  - 「Managing the level of accumulated water in the reactor and turbine buildings」
  - 「Managing the levels of groundwater in the subdrain system」
- In case that in the subdrain system, alarms showing that water level have dropped go off, TEPCO will check how the pumps are working, and when they are operating, suspend pumping of groundwater. To ensure that accumulated water in the reactor and turbine buildings and water in the subdrain system have different water levels, the company will also analyze and assess the flow of the groundwater and take necessary actions after judging whether urgent measures need to be taken.

① 「When water levels locally declined」

- Water will be injected into the water injection wells around the subdrain system. If the situation does not improve, the areas where water is injected will be expanded.

② 「When urgent measures need to be taken」

When the situation mentioned in ① above does not improve, or alarms showing that water level have dropped go off in wide areas of the subdrain system, necessary measures will be chosen out of the following to be implemented. By implementing several measures at the same time, the different water levels will be maintained or the declined water levels will be recovered.

- Transferring accumulated water in the reactor and turbine buildings
- Suspending supply of brine into the landside impermeable wall (landside line)
- Removing part of the landside impermeable wall (landside line)
- Other urgent measures: increasing the amount of water injection and expanding areas where water is injected, spraying water over the ground around the reactor and turbine buildings, and identifying the causes and taking measures against them (stopping water, improving the ground, etc.)