

# Technical Support and Implementation for Cleanup of Fukushima Daiichi – *Groundwater Challenges*

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# Topics to be Addressed

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- **Background**
- **Groundwater Challenges**
- **Suite of Technological Solutions**
  - Source Control
  - Physical & Reactive Barriers
  - Hydraulic Control
- **Cross Cutting Actions**



# Background

- As operator of damaged Fukushima Daiichi Nuclear Power Station, TEPCO is performing the clean-up of the site
- Much has been accomplished – but large challenges still remain
- SRNL/PNNL and TEPCO technical and management teams have been actively engaged over the past two years
- SRNL/PNNL integrated team is providing technical support in a number of strategic areas via a work-for-others agreement
- Support to the complex groundwater challenges is one of those strategic areas where additional support has been requested



# Groundwater Challenges

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- **Source Control**

- A principle challenge is the complex system where groundwater is interacting with the contaminated cooling water within the lower levels of the reactor and turbine buildings, increasing the volume of contaminated water requiring treatment and storage
- Other potential sources of contaminated water (tank storage and run off) also present a ongoing challenge

- **Isolate and Minimize Impact to Harbor**

- Minimizing the potential for outflow of contaminated water into the sea is a focus

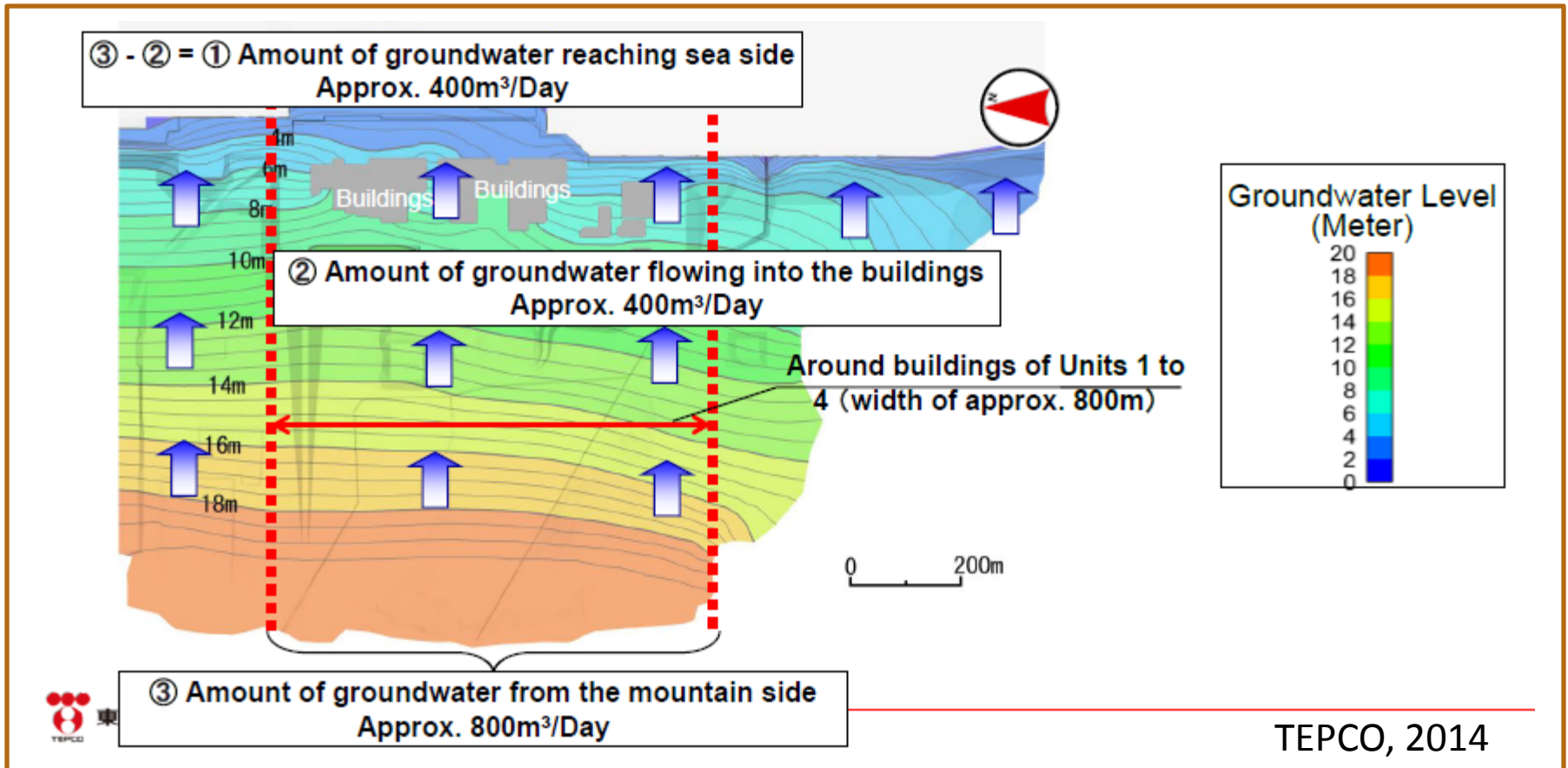
- **TEPCO Plans and Status**

- TEPCO strives to maintain transparency and openness in communicating current plans and updates on their website. Details of countermeasures for contaminated water is provided in the January 2014 presentation (TEPCO, 2014) at the following link: <http://www.tepco.co.jp/en/decommision/planaction/index-e.htm>



# Groundwater Challenges – Flow Regime

- Groundwater flow into the reactor complex is exacerbating the water treatment and storage challenge



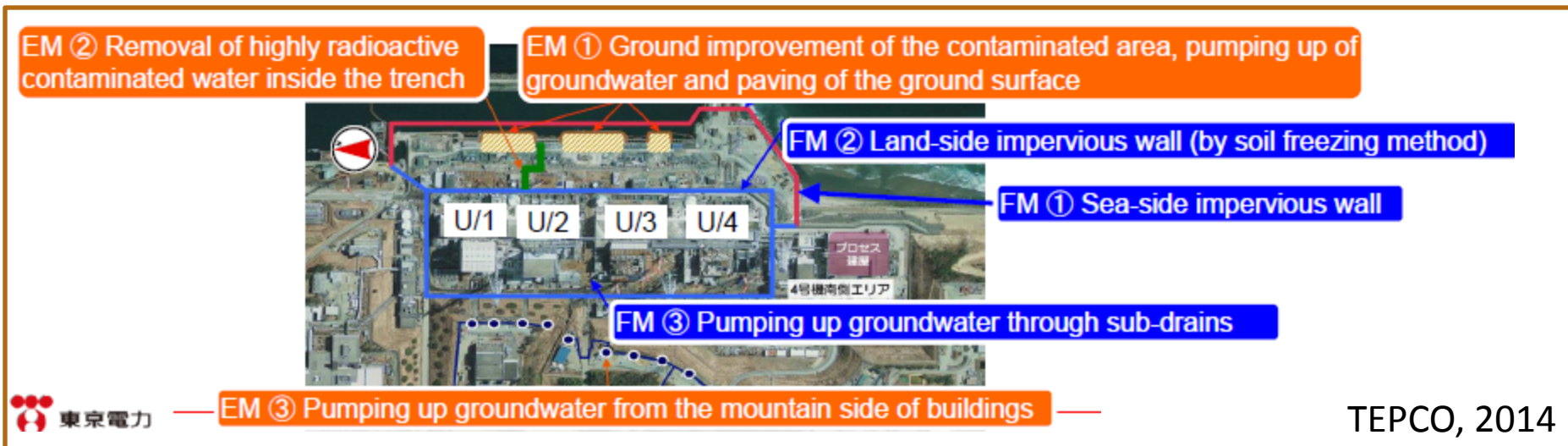
# Technological Solutions Being Developed

- **Fundamental Measures**

1. Stopping outflow to Ocean (Sea-side impervious wall – Sheet Piles)
2. Preventing further groundwater/contaminated water interactions (Land-side impervious wall – Freeze Barrier)
3. Stopping inflow of groundwater into reactor buildings (Hydraulic control – Pumping from sub-drains)

- **Emergency Measures**

1. Preventing outflow of contaminated water into the port (grout/waterglass injection) and pumping of contaminated water
2. Removing preferential sources & pathways (pumping and Isolation)
3. Suppressing increase of water into Reactor Area (Hydraulic Control - Groundwater bypass)



# Groundwater Solutions – Site Map



# Source control - Status

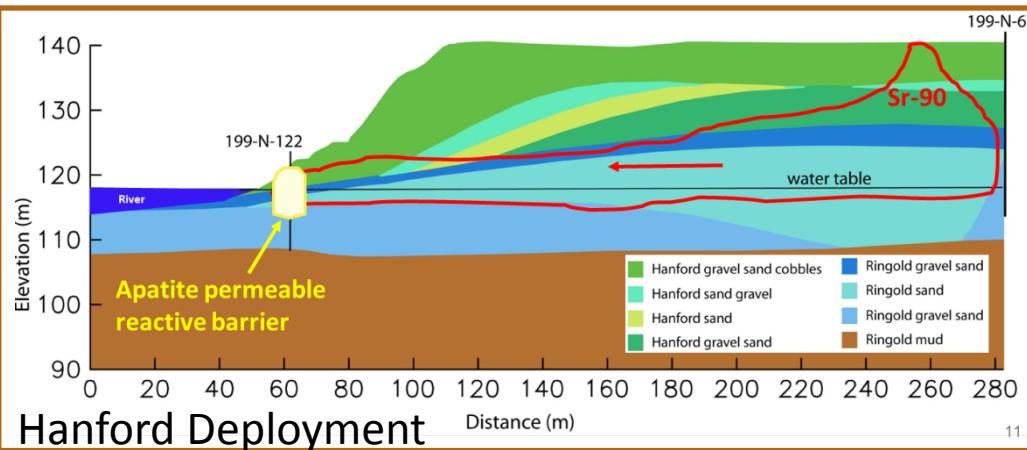
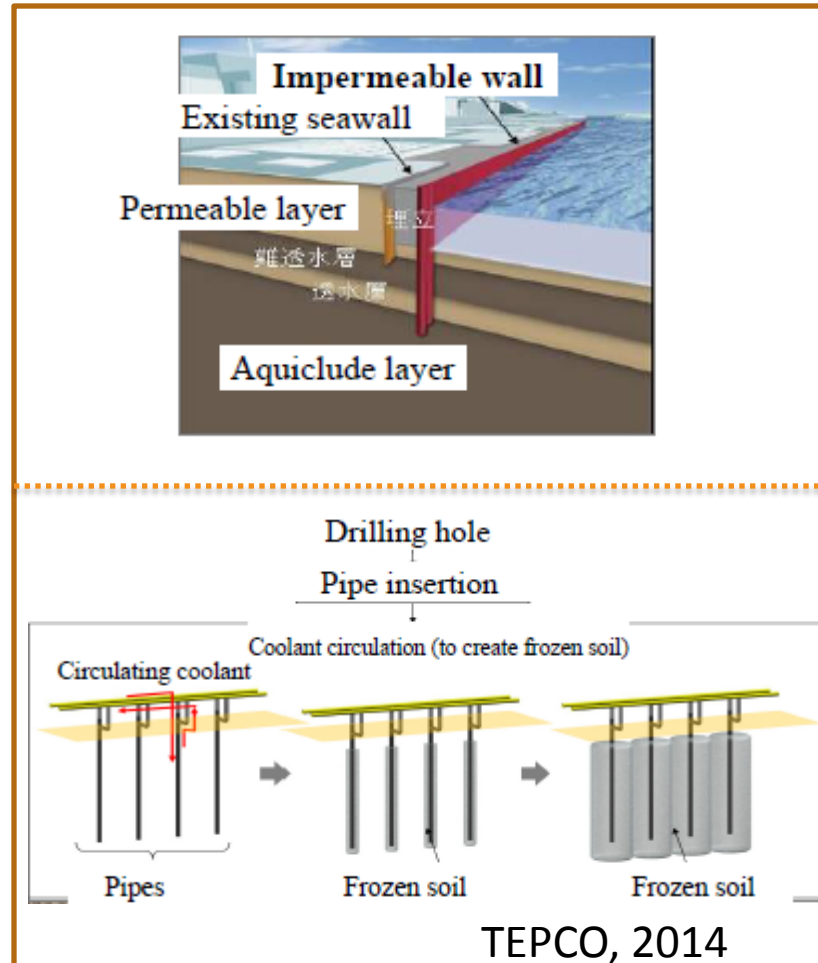
- Removal of contaminated water and isolating seawater intake pipe and cable trenches is underway
- Seaside pump and treatment of contaminated groundwater, along with stabilization of the subsurface is underway
- Second generation tank storage, revetments, leak monitoring, and runoff control efforts are underway to prevent tanked water leakages
- Efforts are underway to develop feasible alternatives for isolating Reactor and Turbine building basements





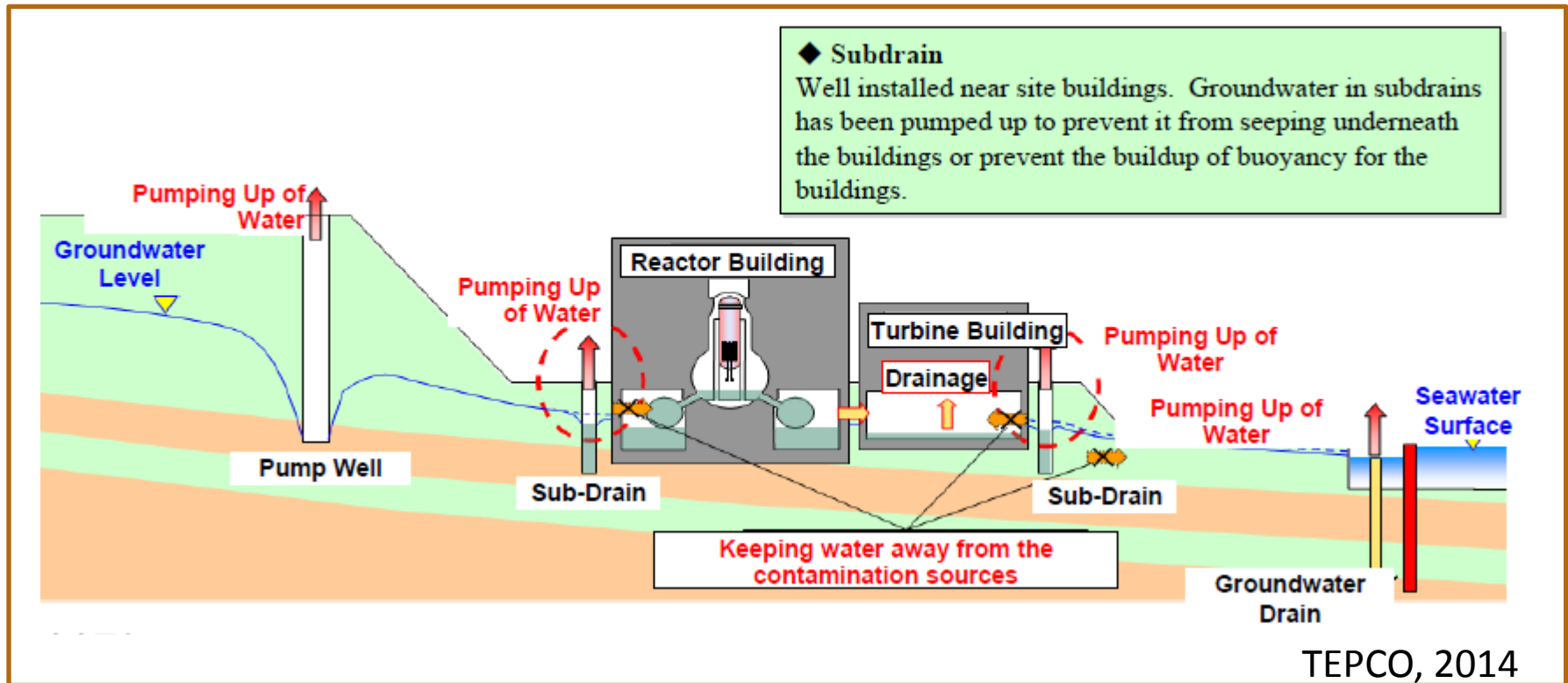
# Barriers - Status

- Sea-side Impermeable wall is under construction with a targeted completion date of Sept 2014
- A feasibility study is underway for the land side frozen soil barrier, to be completed in the next few months
- Testing is underway for potential use(s) of permeable reactive (Apatite) barriers for sequestering Sr-90



# Hydraulic Control - Status

- Design, construction and testing of systems have commenced for:
  - Groundwater bypass system
  - Sub-drain pumping
  - Pumping and treating water near harbor



# Cross-Cutting Efforts

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- TEPCO is addressing groundwater issues with a high sense of urgency
- A number of cross-cutting efforts are also being undertaken to support full implementation of groundwater countermeasures, including:
  - Site characterization plans and data acquisition
  - Site conceptual model
  - Fate and transport predictive modeling
  - Source mitigation and isolation through advanced technology (including testing and demonstration of permeable reactive barriers and freeze barriers)
  - Comprehensive monitoring plans used to understand how actions taken are affecting the overall system
- SRNL/PNNL team has been requested to provide technical assistance in a number of these areas going forward

# *In partnership with other National Laboratories, SRNL and PNNL offer assistance to Japan.*



For further information, please contact:

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