

**Radioisotope Remediation Services
Groundwater and Marine Environment
Fukushima Daiichi Nuclear Power Plant
Fukushima, Japan**

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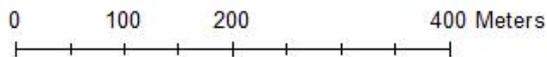
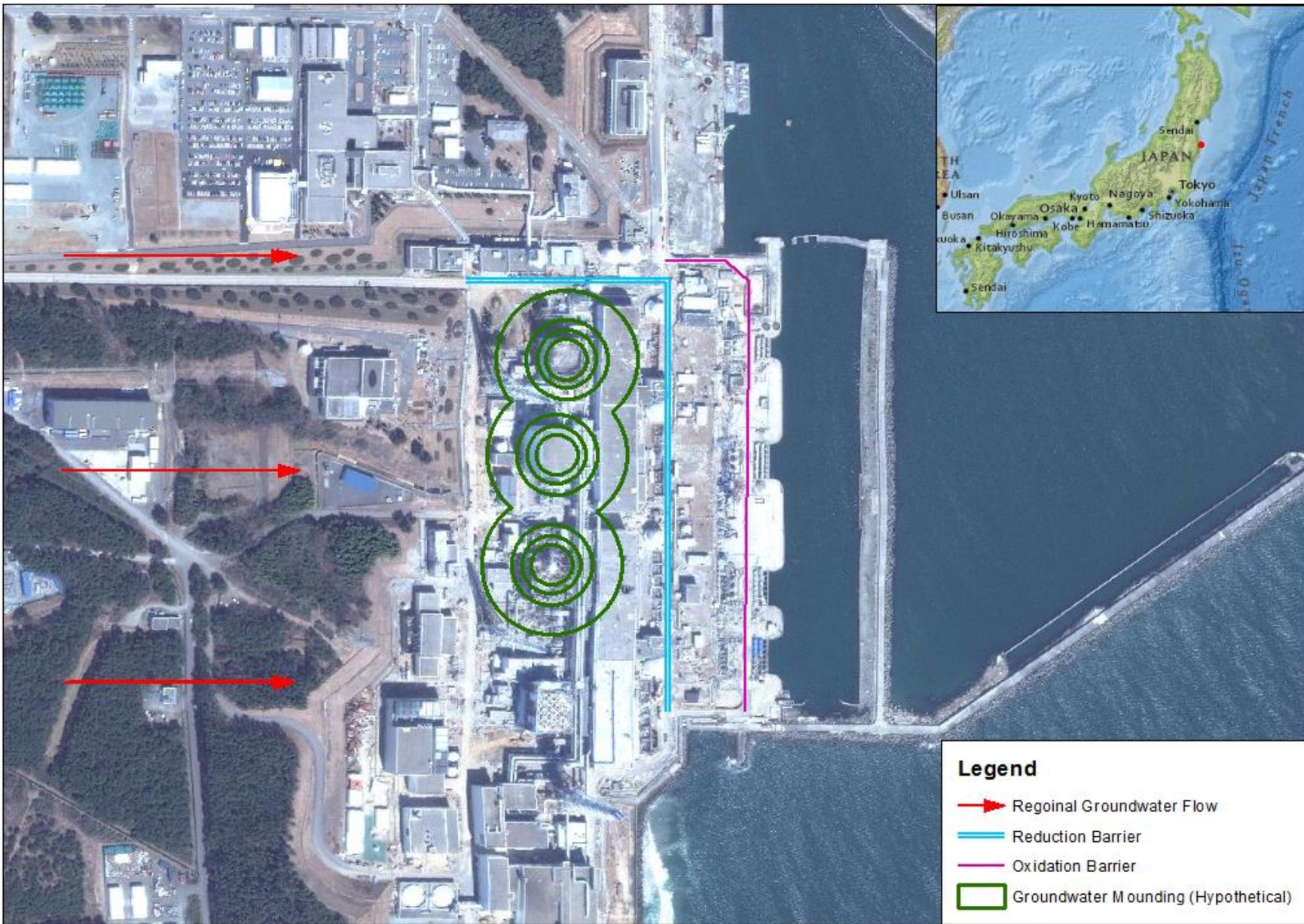


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Groundwater and Marine Environment

Concern:

- Water released from the facility has moved downward to the groundwater and is carried toward the Pacific Ocean at approximately 10 cm per day;
- Mounding of groundwater from the surface inputs increases the Hydraulic Gradient and Groundwater Velocity = moves to ocean faster;
- Radioisotopes vary in solubility which affects the migration rates in the moving groundwater;
- Reactor buildings 270 to 300 Metres from seawall. Approximately three years of travel to ocean.



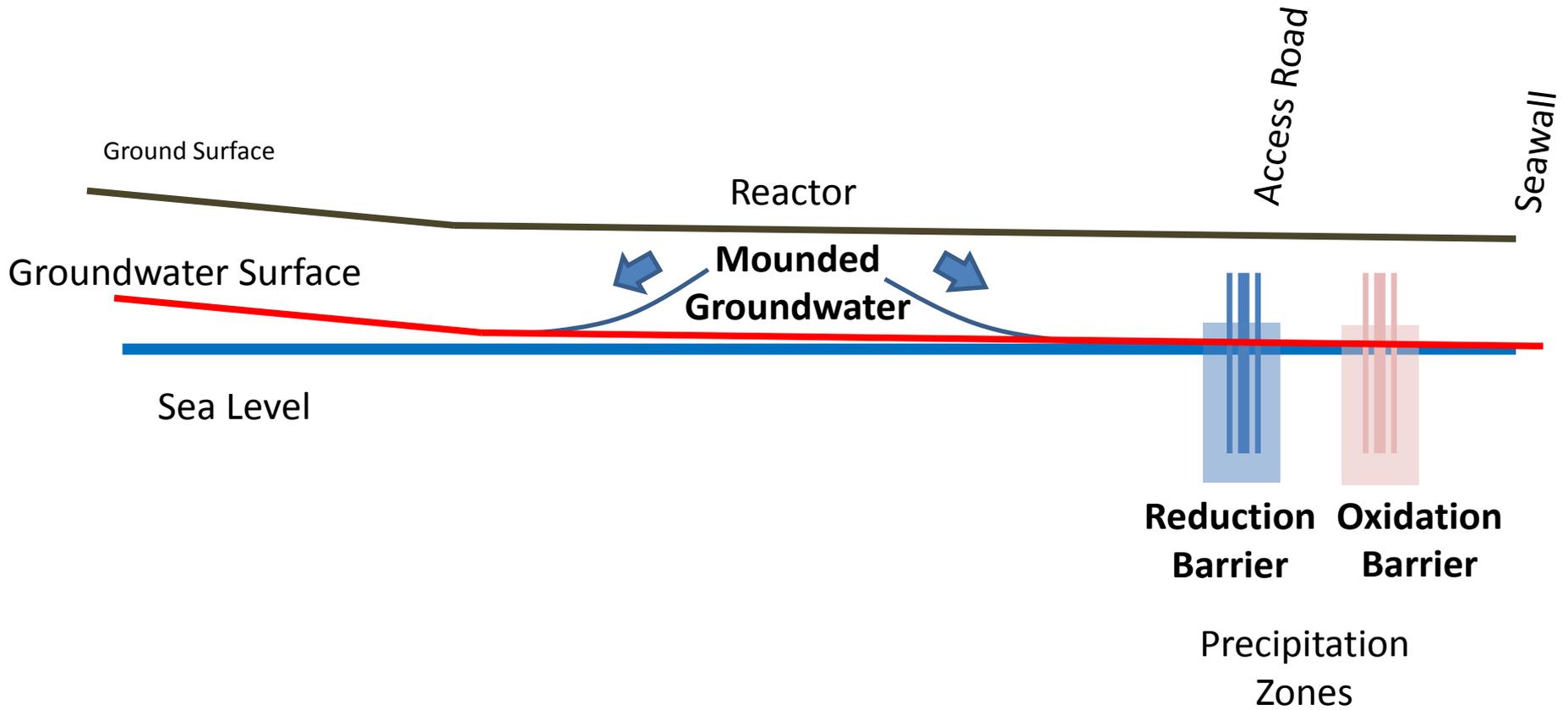
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Objectives:

- Remove radioisotopes from groundwater to decrease exposure to human health and the environment (receptors);
- Change the chemical compound structure of radioisotopes in groundwater to make them insoluble and form minerals in the ground— this is similar to natural process but are managed and much quicker than nature;
- Allow radioisotopes to decay in the ground beneath the water surface or concentrate and safely extract at a later time.

Vertical Profile



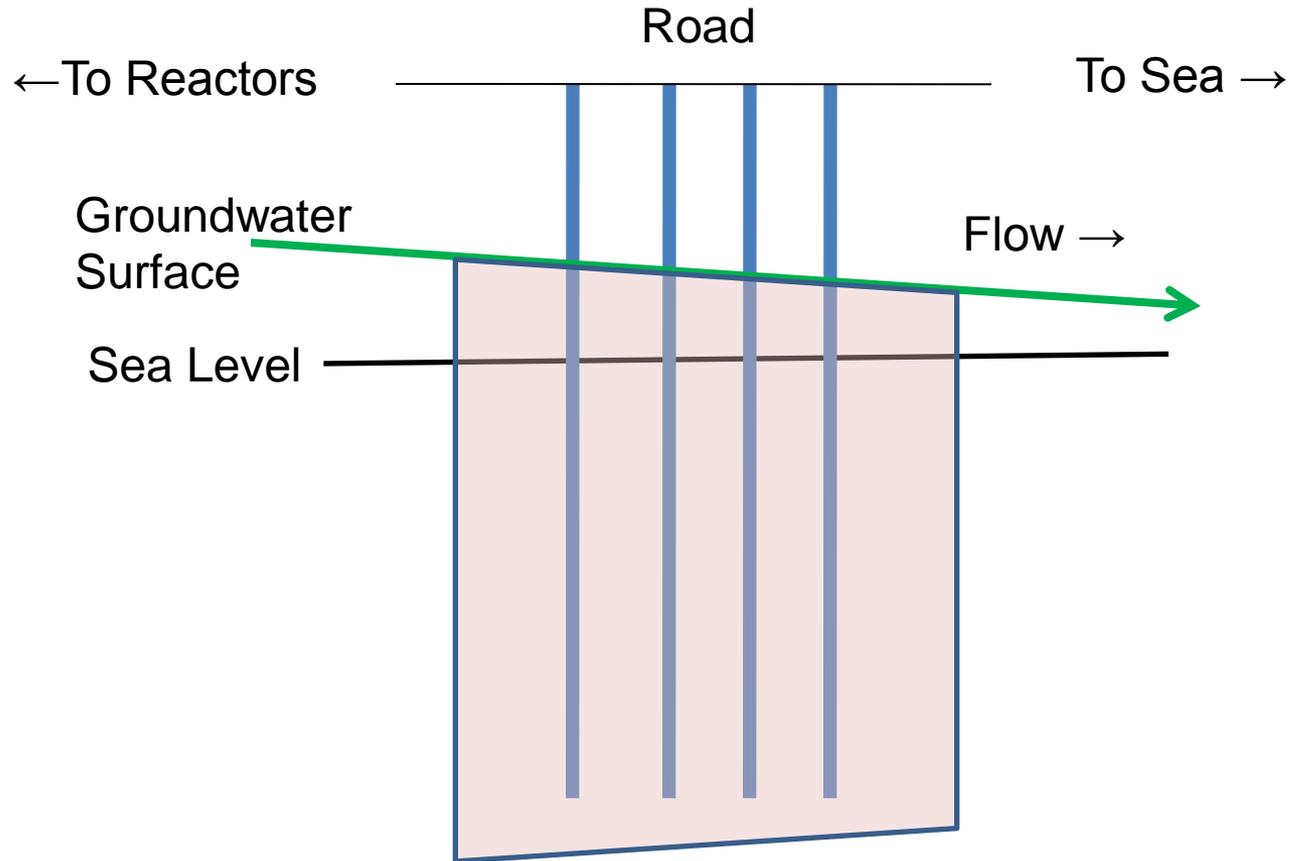
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Method:

- Turn the dissolved radionuclides into solid minerals through changes in the chemical structure. This will stop their movement toward the ocean;
- Uranium is made insoluble by adding electrons (reducing). This is the process by which natural “roll-front” type uranium deposits are formed;
- Manganese is made insoluble by removing electrons (oxidizing). This is the process by which natural sedimentary oxide manganese deposits are made.

Treatment Well Diagram



-  = Zones of Metal Precipitation
-  = Treatment Wells

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Proposal:

- Use of a combined reduction and oxidation barrier can decrease the concentrations of radioisotopes moving toward the ocean;
- Installation and operation of the barrier system could commence in less than 60 days;
- Operation and maintenance would not require significant exposure to workers as the mineralized radionuclides would remain underground until decayed or intentionally removed.

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Questions?

Thank you.