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A Concept of Disposal Canister & Handling System for DBD

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DBD Key Technologies/Challenges

Depth (km)	Rock	Temp. (°C)	Hydrostatic Pressure (Mpa)	Hydraulic Conductivity (m/s)	Ground Water	Disposal Environ.
3~5	Granite	130 – 170	57 (Brine W.)	10^{-16} ~ 10^{-19}	Shallow GW - Deep GW	Reducing

Technologies	Technical Challenges
▪ Drilling technology for large diameter deep borehole	▪ Depth 3~5 km, Large Dia. (40–60 cm)
▪ Investigation technology for very deep geology	▪ Depth 3~5 km ▪ Site Characterization
▪ **Disposal concept development technology**	▪ **DBD Canister, Sealing, Disposal system** ▪ **Operation Technologies**
▪ System performance/Safety assessment technology	▪ Performance Criteria, ▪ Safety Assessment Scenarios
▪ Demonstration technology	▪ Demonstration Test : In-situ Test

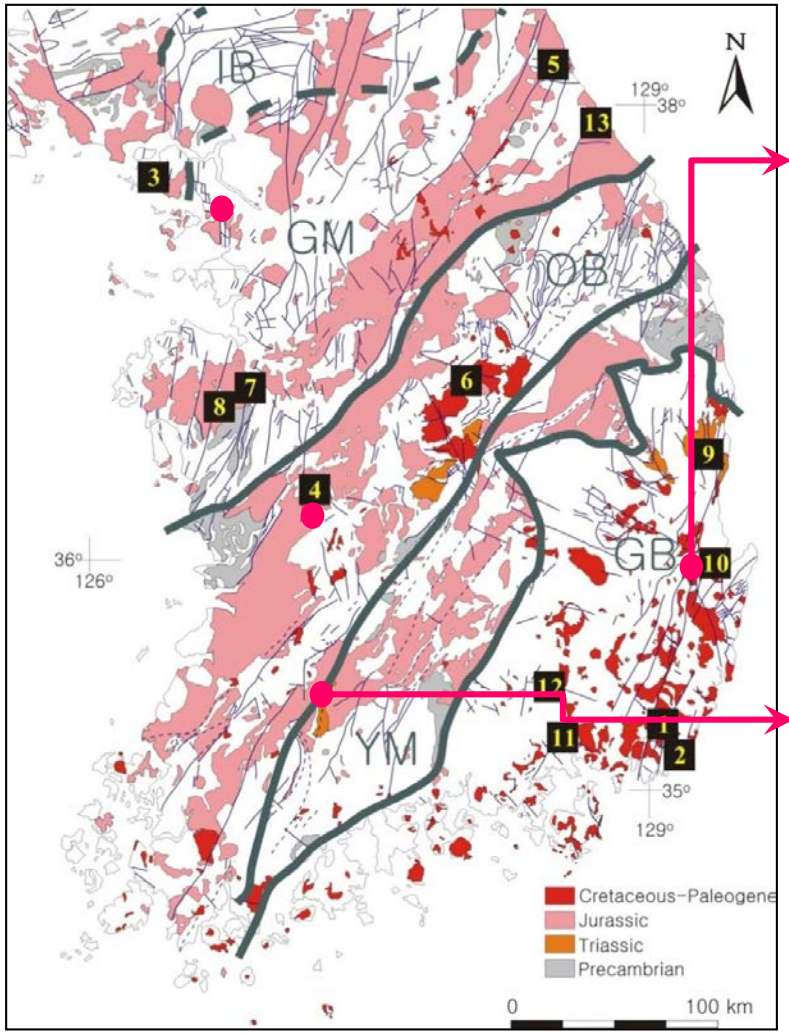
Contents

1 Outline of DBD Study in KAERI

Item	Progress	Remark
Preliminary Review of Geological data	• Data from Geothermal project	
Preliminary DBD Concept	• Development of a DBD system concept - a DBD Disposal container concept - a DBD Sealing and Plugging concept - a DBD system concepts	
Analyses & etc.	• Preliminary performance & safety assessment • DBD system thermal analyses • Borehole spacing analyses • Manufacture of SiC inner vessel of disposal container - 1/10th of real size • Canister handling system & sealing experiment	

2 DBD System Concept – Review of Geologic. Data

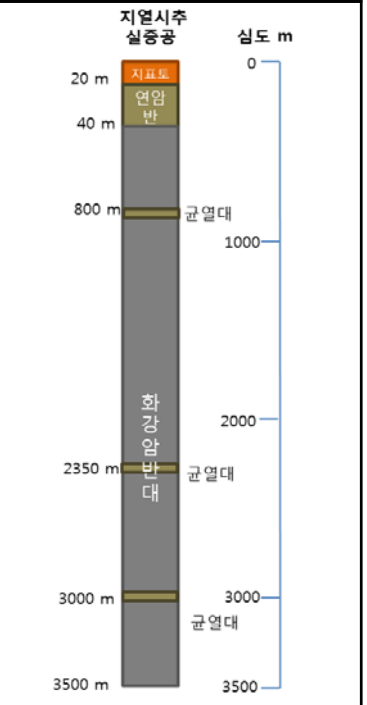
Korean Peninsular Geology



Pohang Site

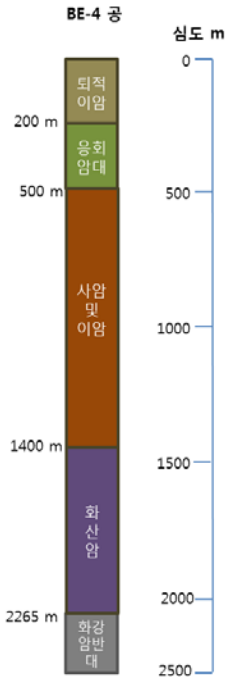
Kwangju Site

Kwangju



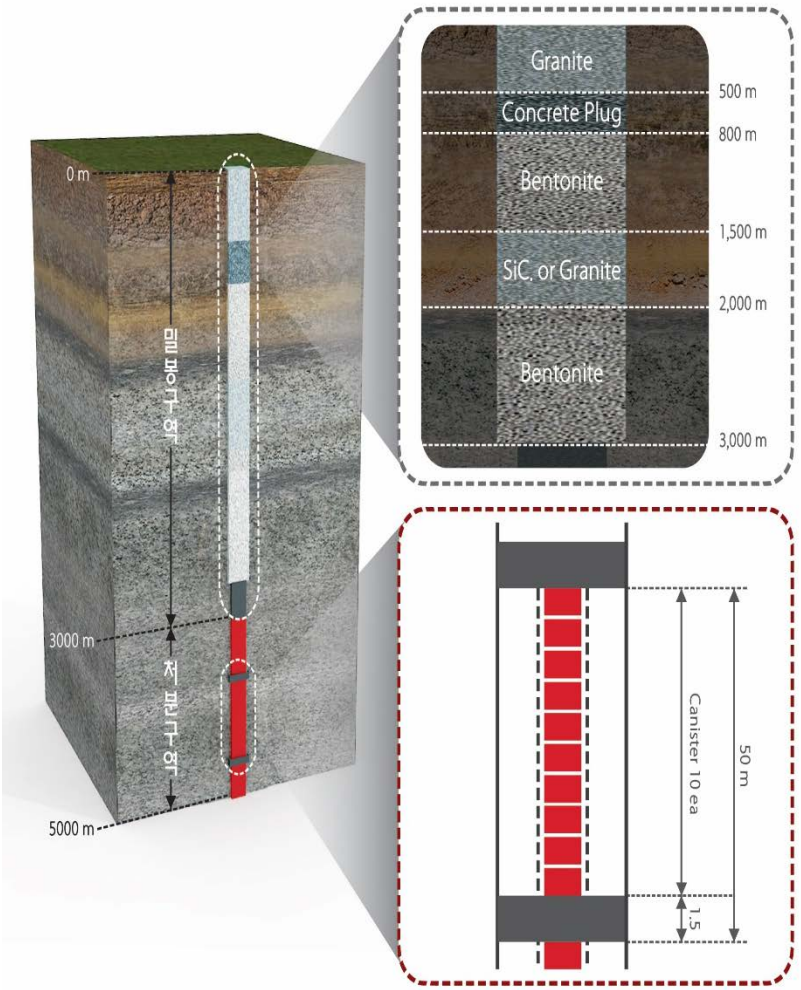
- Surface 15 °C
- D. 3.5 km: 98°C
- **25 °C/Km**

Pohang



- Surface: 17 °C
- D. 2 km: 85 °C
- **35 °C/Km**

2 DBD System Concept



◆Sealing area (3,000 – 0 m)

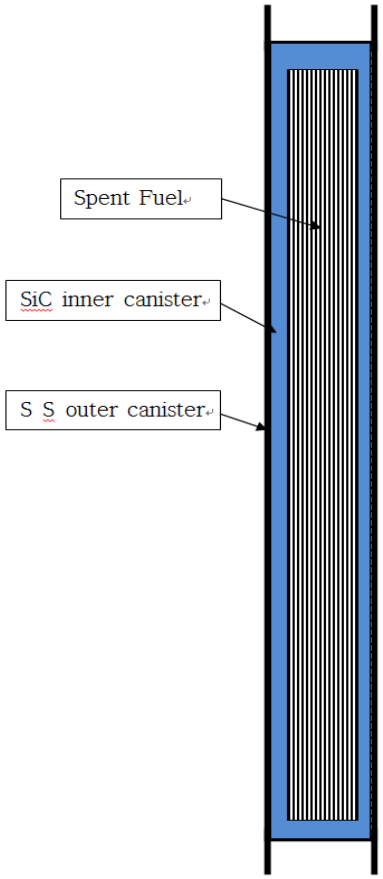
- Wall Dia. : 550 mm
- Casing Dia. : 500 mm
- Concept
  - Bentonite/SiC : Dep. 3,000 m – 1,500 m
  - Granite/Bentonite : Dep. 1,500 m – surface

◆ Disposal area (3,000 – 5,000 m)

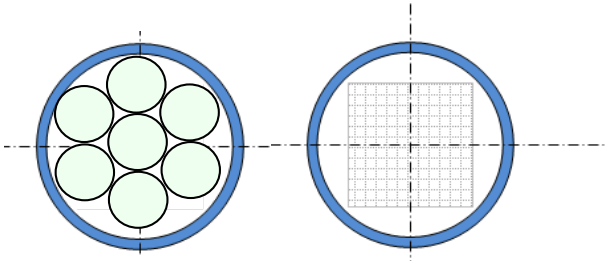
- Wall Dia. : 500 mm,
- Casing Dia. : 440 mm
- HLW Emplacement : 400 containers
- Disposal Container String
  - 10 Disposal container : 48.5 m
  - 40 Disposal container strings/borehole

3 DBD Container Concept

- **Disposal Container for DBD : Double Layered (Sic + Stainless Steel)**

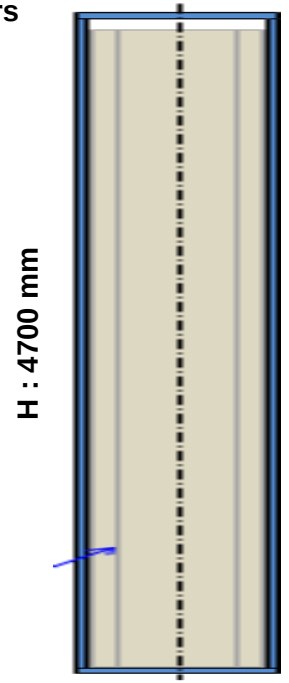


Basic Concept



CANDU
- **7 Bundles x 9 layers**
= 63 bundles/cani.

PWR : 1assembly

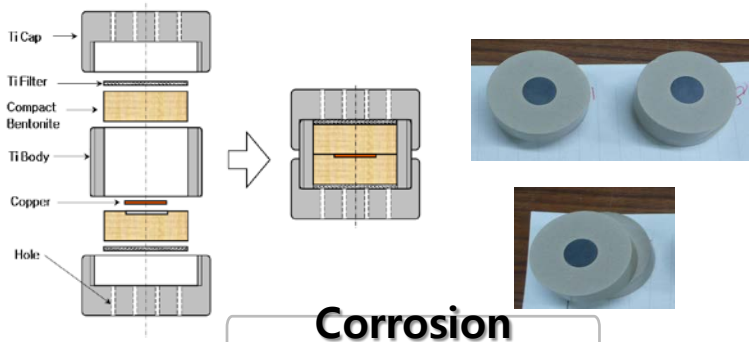


Inner Container
: Sic

OD : 344 mm

3 DBD Container Concept

- DBD Container
  - Primary Barrier in a Repository
    - To withstand the High Pressure
    - High Corrosion Resistance
  - SiC Ceramic : Inner Container
    - High Strength & Corrosion resistance & Thermal Conductivity
    - Low Diffusivity
- Corrosion Resistance test
  - In-situ long-term corrosion test
    : in KURT(KAERI Underground Tunnel)



Corrosion Cell

- Manufacture of SiC container

1. Forming

2. Degreasing

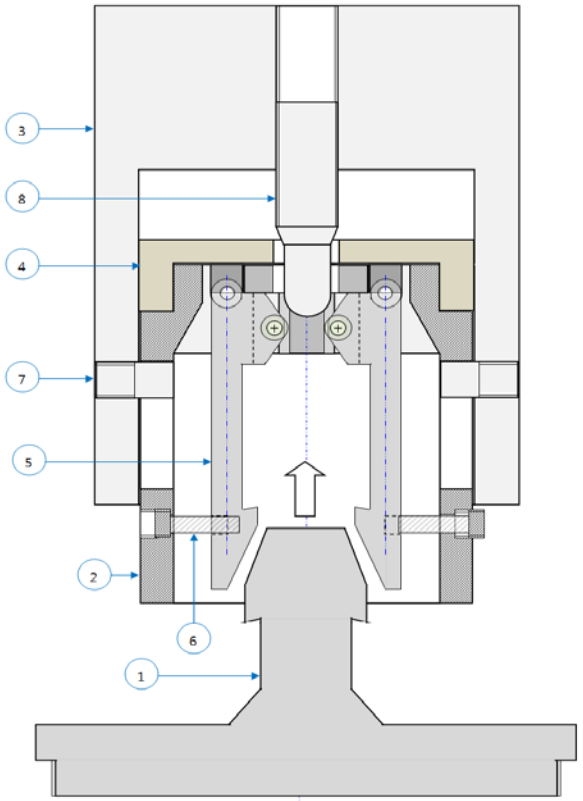
3. Sintering

4. Machining

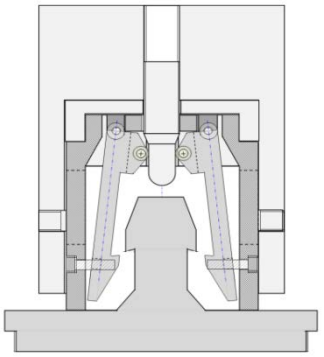
3 DBD Container Concept – Handling System

Hook Box Sliding Joint

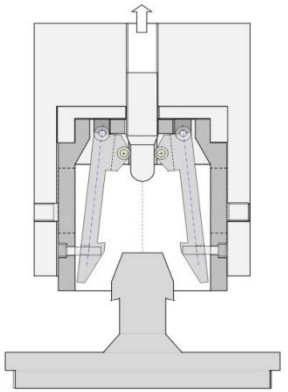
For the emplacement & retrieval



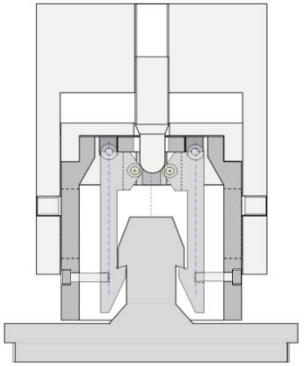
At bottom

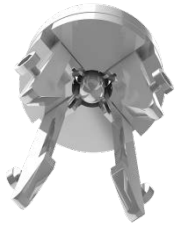


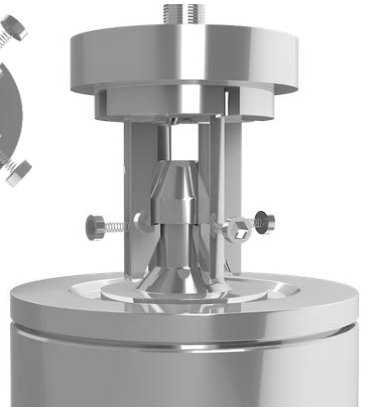
Fast up



Slow up







Cross-sectional illustration of a novel joint device
1. Wedge on top of a canister parade, 2. Hook box,
3. Joint device body, 4. Piston head of hook box,
5. Hook, 6. Hook spring, 7.Sliding joint bar, 8. Pushing bar.

3 DBD Container Concept – Handling System

Emplacement of DBD container

Retrieval of DBD Container

4 Concluding Remarks

- In Korea, very preliminary concept development for Deep Borehole Disposal is being carried out.
- In this study, concepts of a DBD disposal container and a handling system for the disposal container in a borehole were developed.
- With this concept, a container of 1/10 scale was manufactured and a handling experiment was carried out.
- These results will be used as an input for the analyses of applicability for DBD in Korea.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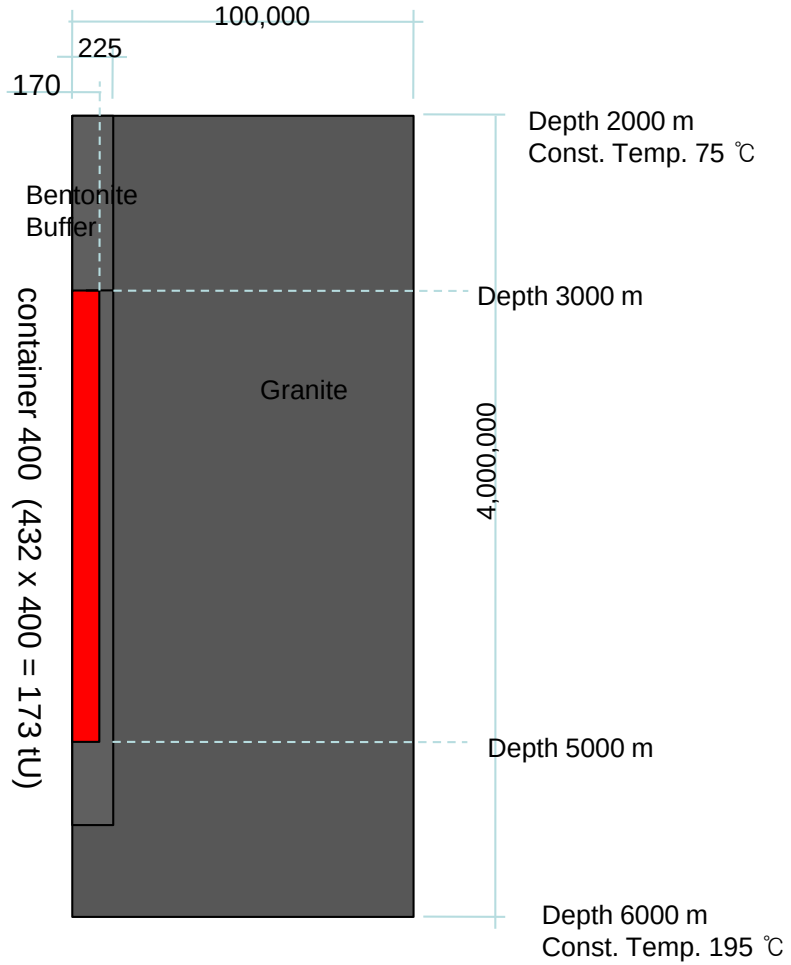
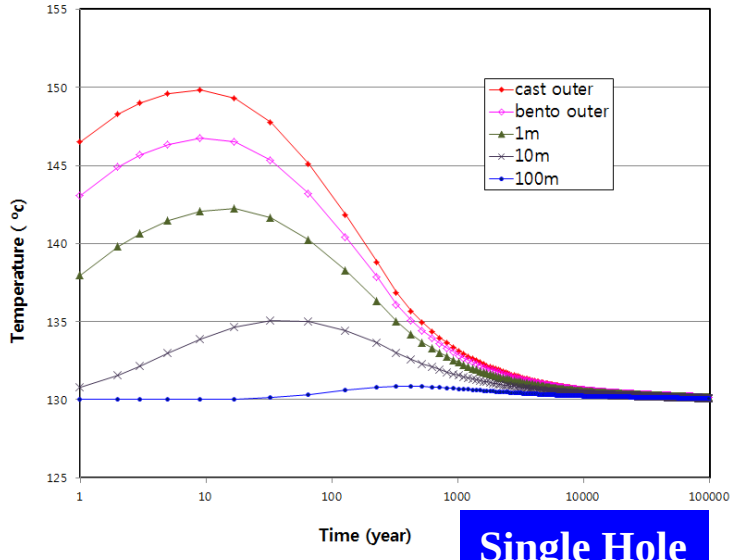
Thank You
for Your Attention !

3 General Progress – Thermal Analyses

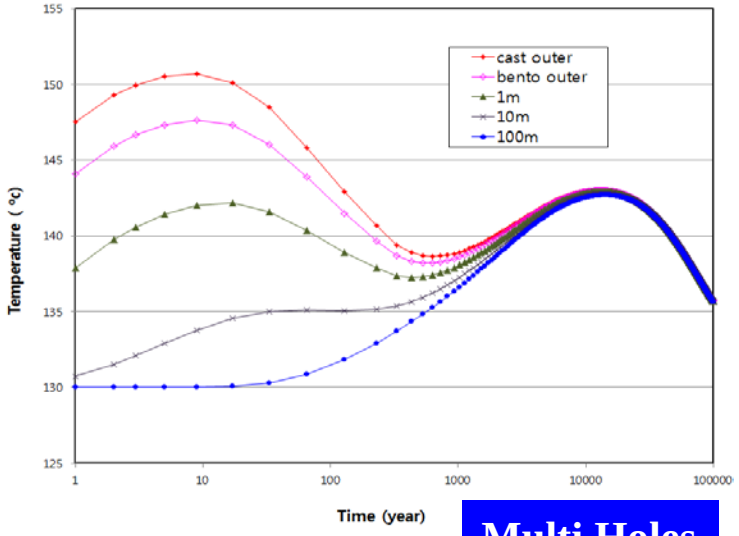
- 172 tU/Hole (400 Ass.)
- 400 W/Ass., 160 kW/hole



DBD model

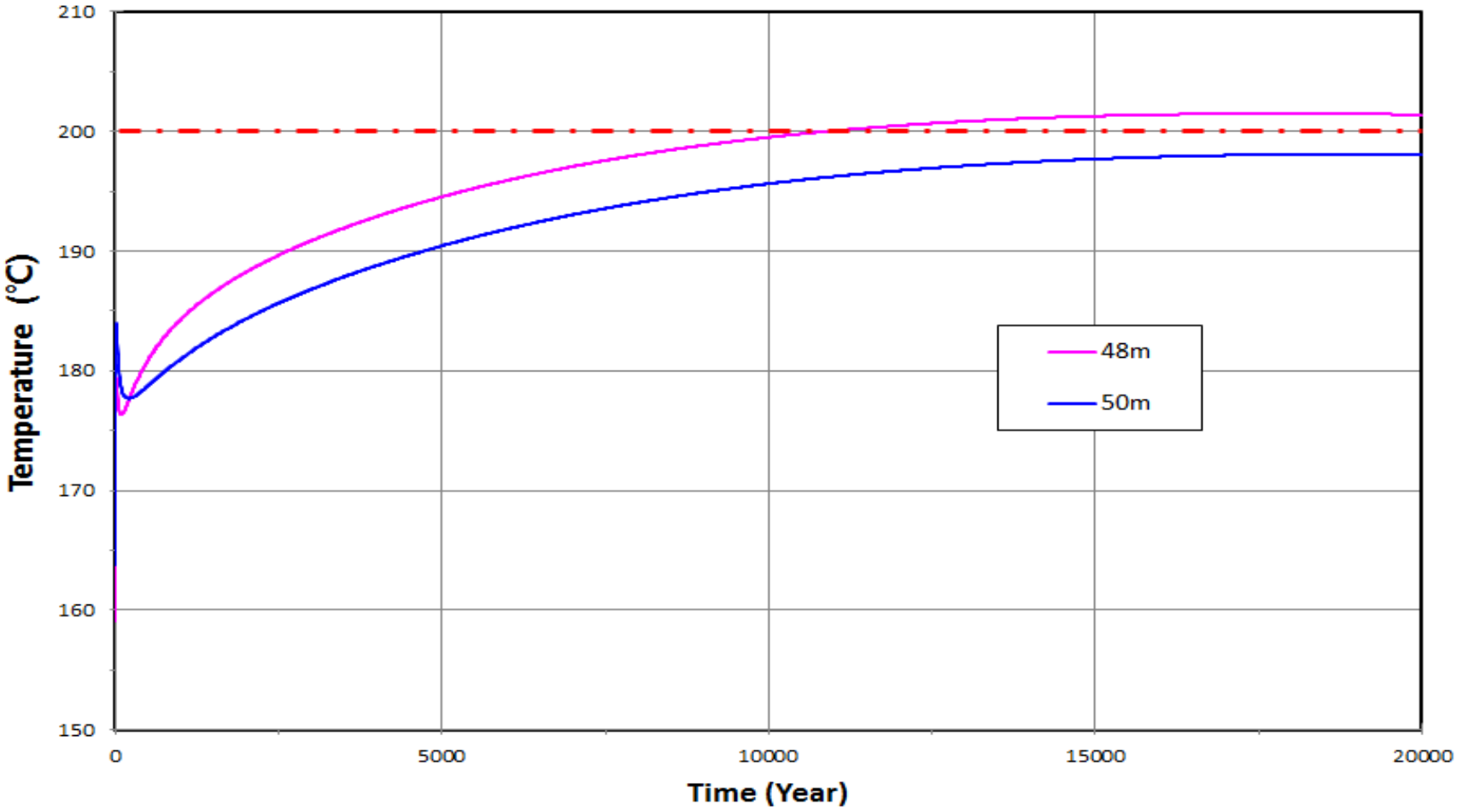


Single Hole



Multi Holes

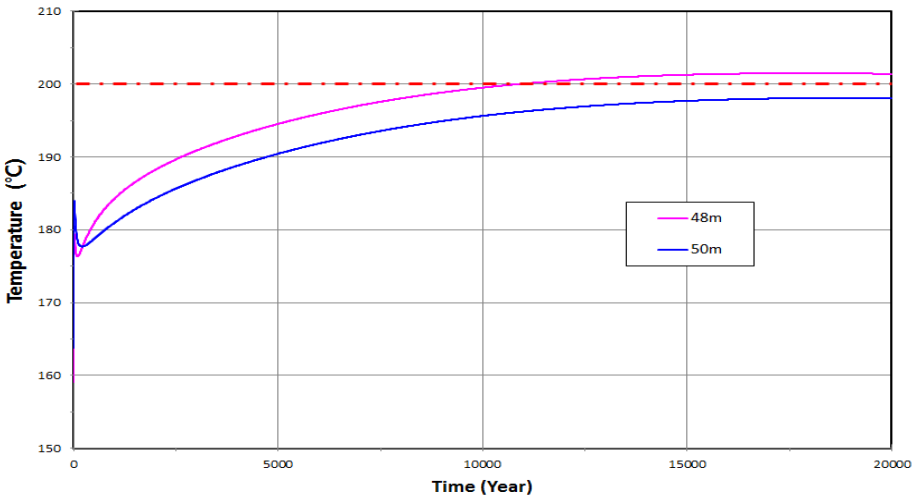
3 General Progress – Thermal Analyses (D. Zone)



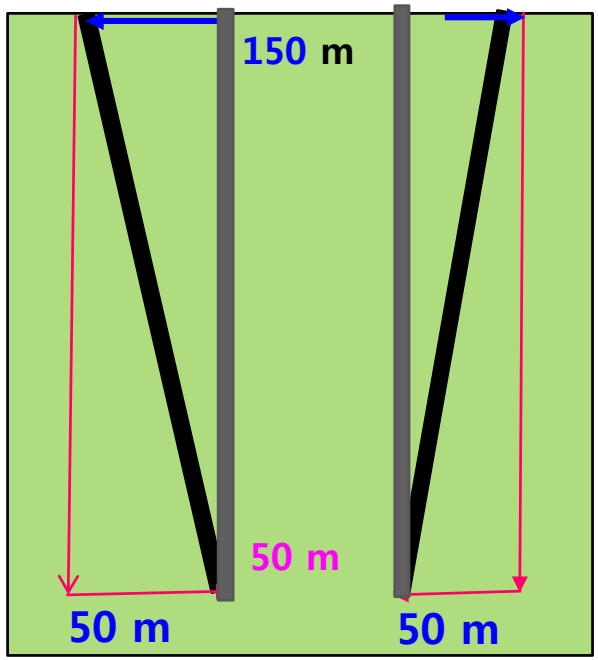
Results of Thermal Analyses at the depth of 5000m

3 General Progress – Borehole Spacing Analy.

- Concrete Bridge Plug in D. Area :
  - < 400 °F (Around 200 °C)
    : 50 m at the depth of 5000 m
- Min. Spacing at the depth of 5 km
  : 50 m
- Verticality of Deep Borehole
  : 0.6 deg –> 50 m



Thermal Analyses results at the depth of 5000m



With Current Technology

: Borehole Spacing

50 -150 m