Asian Region Mechanical Design

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Content

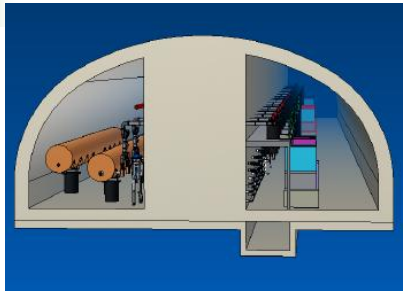
① Cooling Water System

② HVAC System

③ Plumbing System

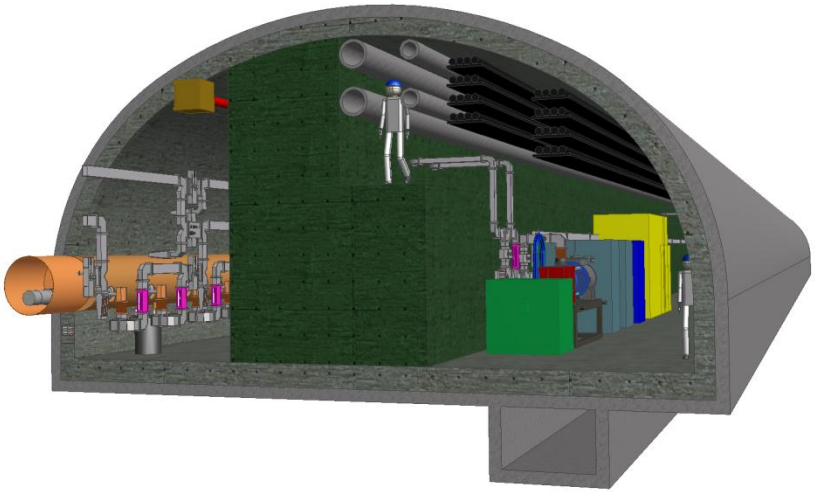
Summary

Asian Region Mechanical Design Scheme Change Image

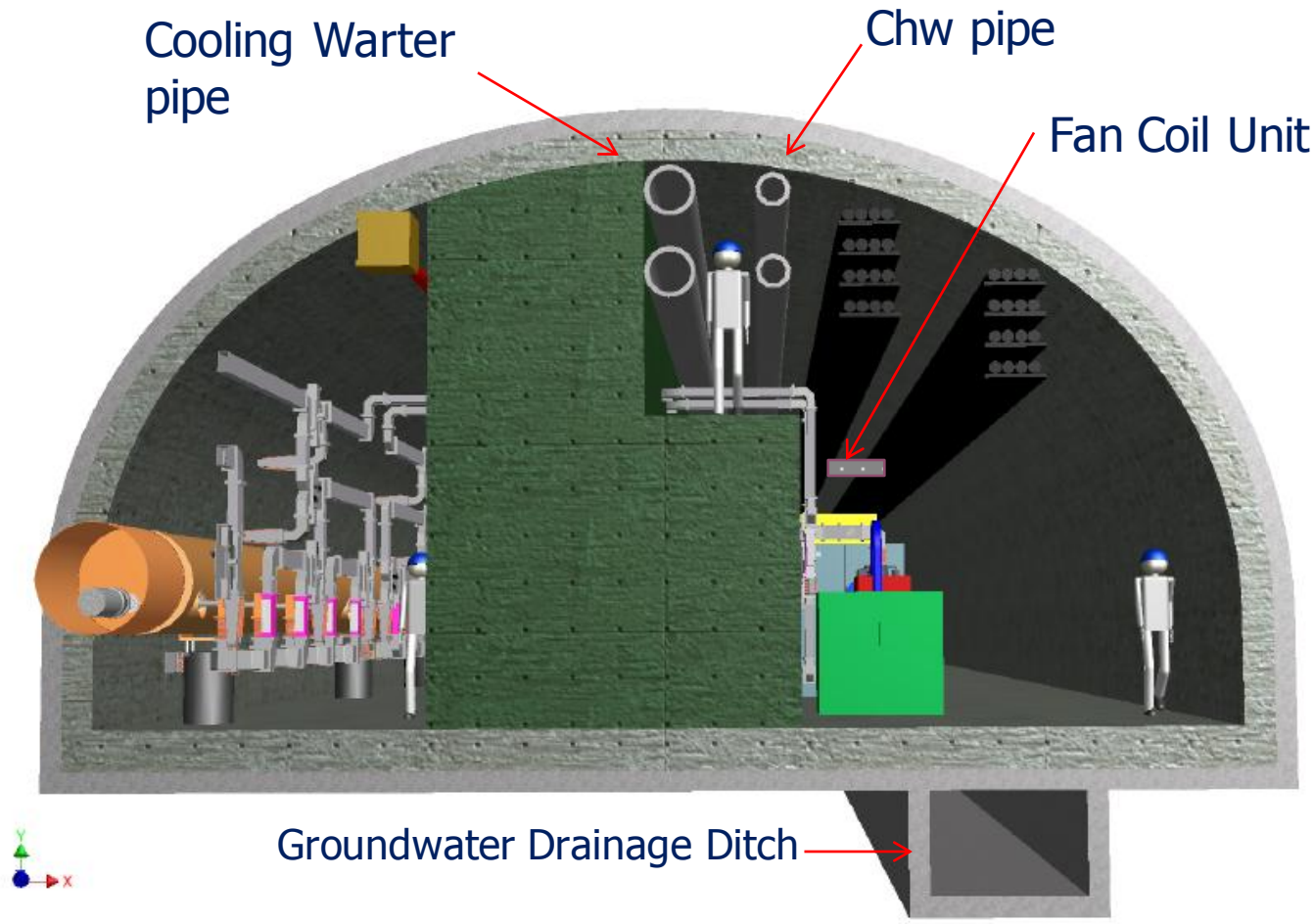


Previous Scheme
by DRFS

Latest Scheme



Asian Region Mechanical Design
New Scheme Kamaboko Tunnel



Cooling Water System
Heat Load Summary

Cooling Water Load

(MW)

LCW	AH1	AH2		AH3		AH4		PMC-0	PMB-0	PXB-0	AH5		AH6		AH7		AH8	Total
Source e-											2.88							2.88
Source e+							5.53											5.53
DR								11.86	2.09									13.95
RTML		2.93					0.33				0.33					2.93		6.51
ML		5.59	5.59	5.59	5.59	5.03						4.65	5.59	5.59	5.59	5.59		54.42
BDS							4.60				4.60							9.20
Dumps										39.95								39.95
IR(DH)										0.20								0.20
subTotal	0	8.52	5.59	5.59	5.59	5.03	10.46	11.86	2.09	40.15	7.81	4.65	5.59	5.59	5.59	8.52	0.00	132.64
Cryogenics	0	7.37		7.37		7.96		2.52		1.73	7.96		7.37		7.37		0.00	49.65
Total	0	21.48		18.55		23.45		14.38	2.09	41.88	20.42		18.55		21.48		0.00	182.29

Air + CHw Load

Air+Chw	AH1	AH2		AH3		AH4		PMC-0	PMB-0	PXB-0	AH5		AH6		AH7		AH8	Total
Source e-											1.42							1.42
Source e+							0.72											0.72
DR								0.74	0.13									0.87
RTML		0.95					0.11				0.11					0.95		2.10
ML		1.20	1.20	1.20	1.20	1.08						1.00	1.20	1.20	1.20	1.20		11.69
BDS							0.62				0.62							1.23
Dumps										0.00								0.00
IR(DH)										0.38								0.38
subTotal	0	2.15	1.20	1.20	1.20	1.08	1.44	0.74	0.13	0.38	2.14	1.00	1.20	1.20	1.20	2.15	0.00	
Total	0	3.35		2.40		2.52		0.74	0.13	0.38	3.14		2.40		3.35		0.00	18.41

Total 200MW

200.7

Cooling Water System

3 Types of Cooling Tower

A: Closed-circuit Type (Air-cooled)

B: Closed-circuit Type (Water cooled)

C: Open Type (Water cooled)

- IN RDR, we adopted Air-cooled type Cooling tower
- Makeup water Issue in Mountainous area

Cooling Water System
3 Types of Cooling Tower

Makeup water for 200MW cooling

- WE (Evaporation)=288m3/h
- WC (Carry over) =47m3/h
- WB (Blow down) =241m3/h

Total
=WE+WC+WB
=576m3/h

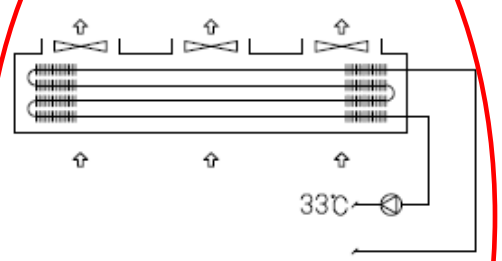
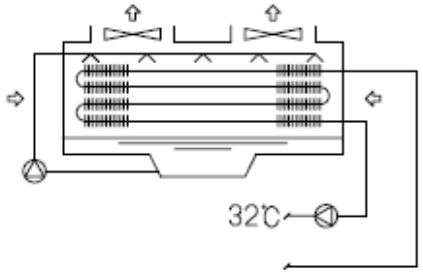
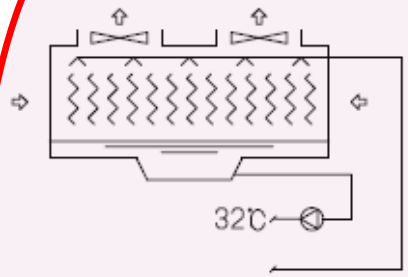
Reservation of Makeup water

Groundwater

=1m3/km/min*30km*60min/h

=1,800m3/h

Cooling Water System
Comparison of Cooling Tower Type

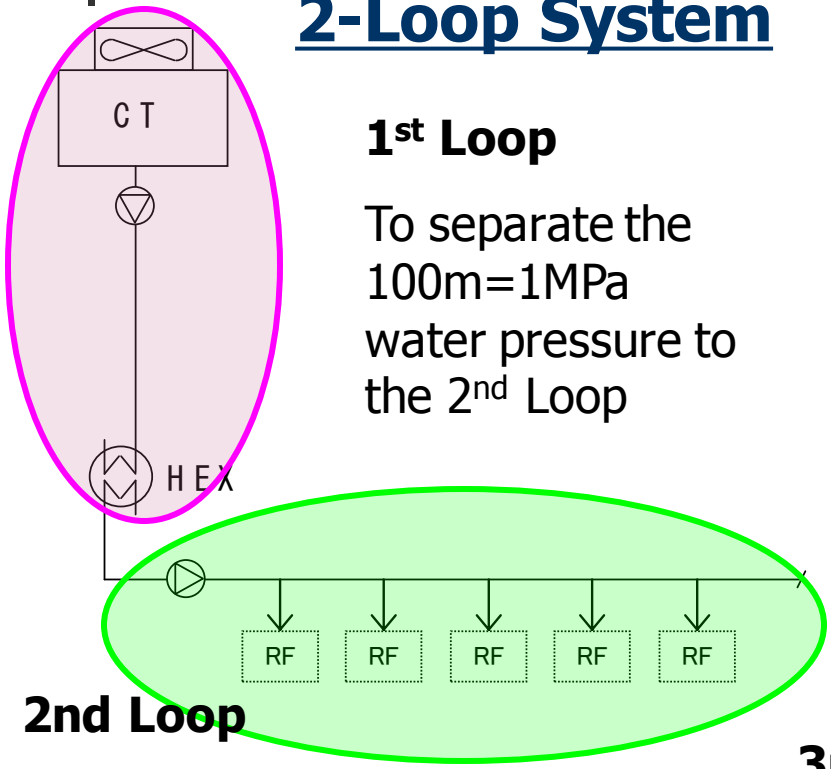
TYPE	A Closed-circuit Air-cooled Type	B Closed-circuit Cooling Tower	C Open Type Cooling Tower
			
UNIT SIZE (6MW UNIT)	59m × 10m	22m × 4m	12m × 4m
SPACE (for 200MW)	14,160m2	5,870m2	3,200m2
NOISE (6MW UNIT)	95dB(A)	80dB(A)	75dB(A)
UNIT COST (for 200MW)	9,330M¥	1,810M¥	370M¥

RDR Scheme

TDR Scheme

Cooling Water System
2-Loop & 3-Loop System

2-Loop System



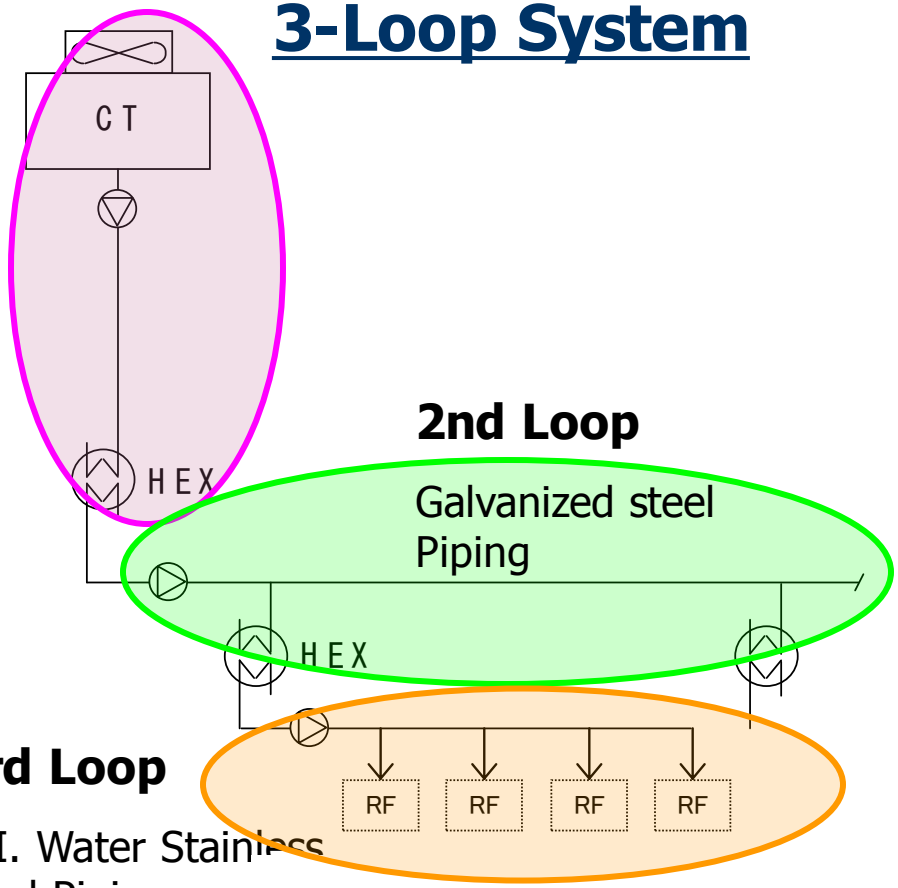
1st Loop

To separate the 100m=1MPa water pressure to the 2nd Loop

2nd Loop

D.I. Water Stainless steel Piping

3-Loop System



2nd Loop

Galvanized steel Piping

3rd Loop

D.I. Water Stainless steel Piping

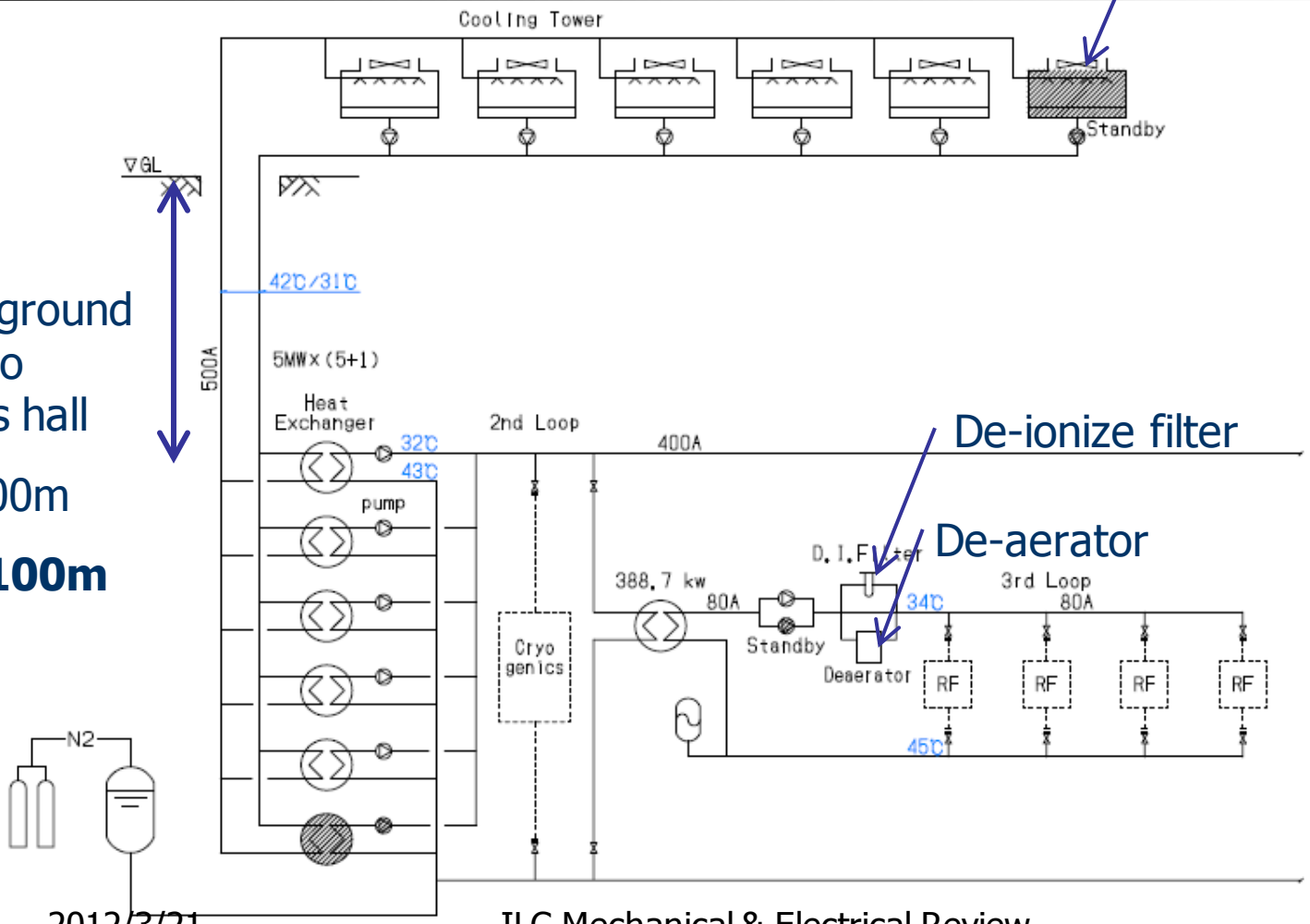
Cooling Water System
Comparison of 2-Loop and 3-Loop

	2-Loop System	3-Loop System
Cost (AH-3)	3,423M\	2,943M\
Water leakage	If there would be some troubleat the thin pipe around accelerator, 5km(total 650m3) de ionized cooling water would be run over.	
Evaluation	△	○

Cooling Water System

3-Loop LCW System (AH-3)

Stand-by (back-up)



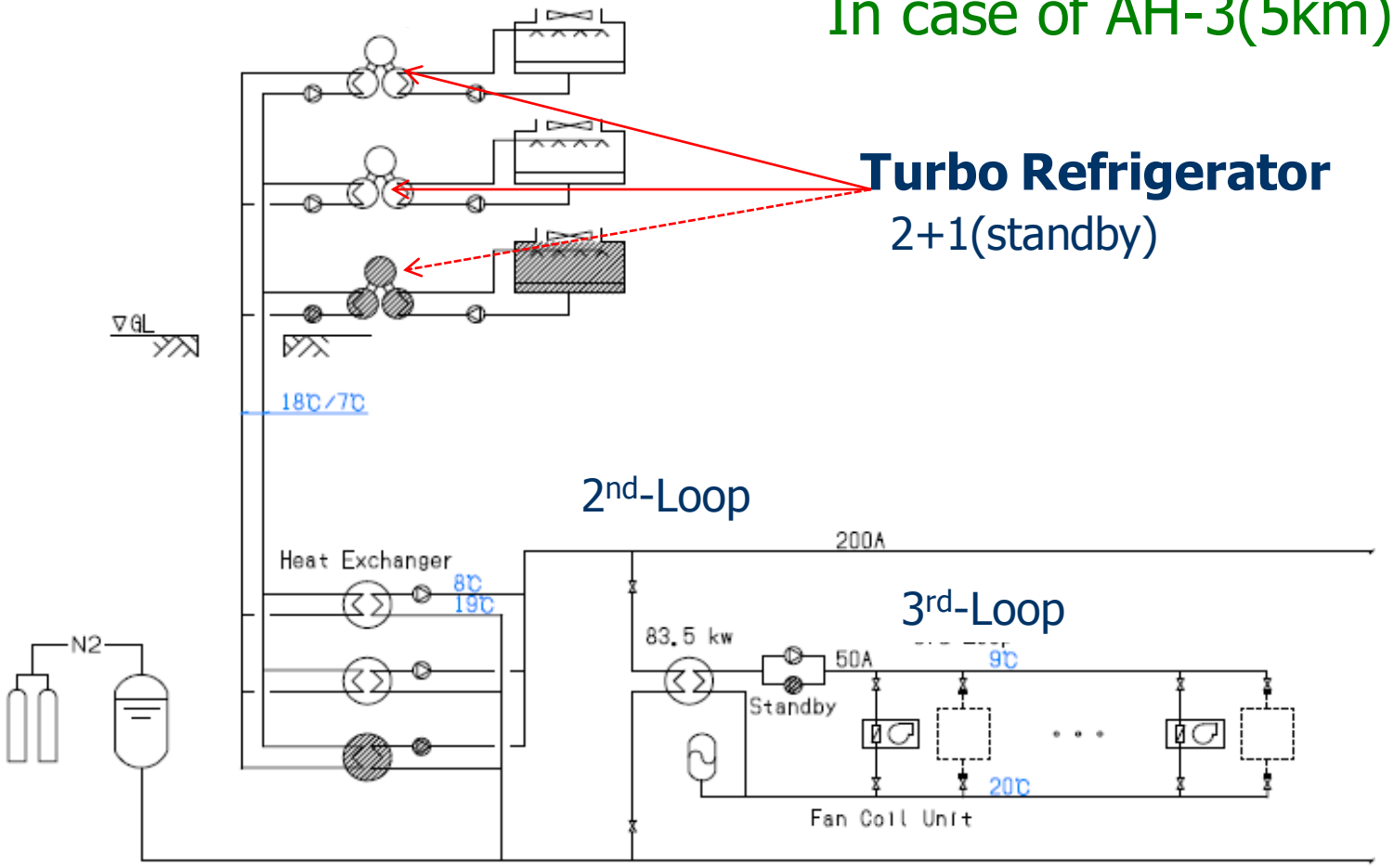
From ground level to access hall

L≒1000m

⊿H≒100m

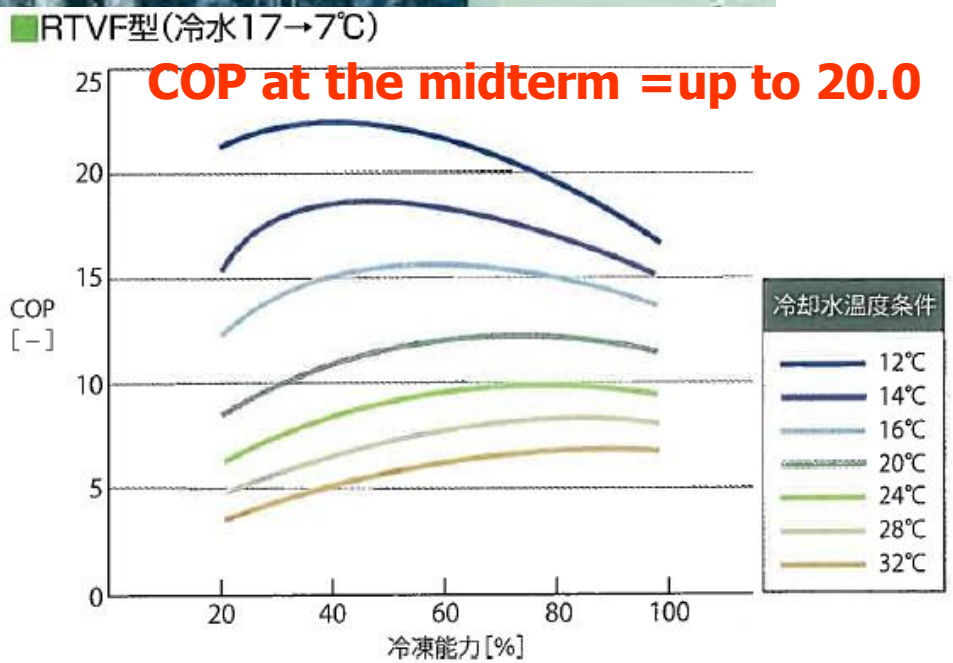
Cooling Water System
3-Loop Chw System

In case of AH-3(5km)



Cooling Water System

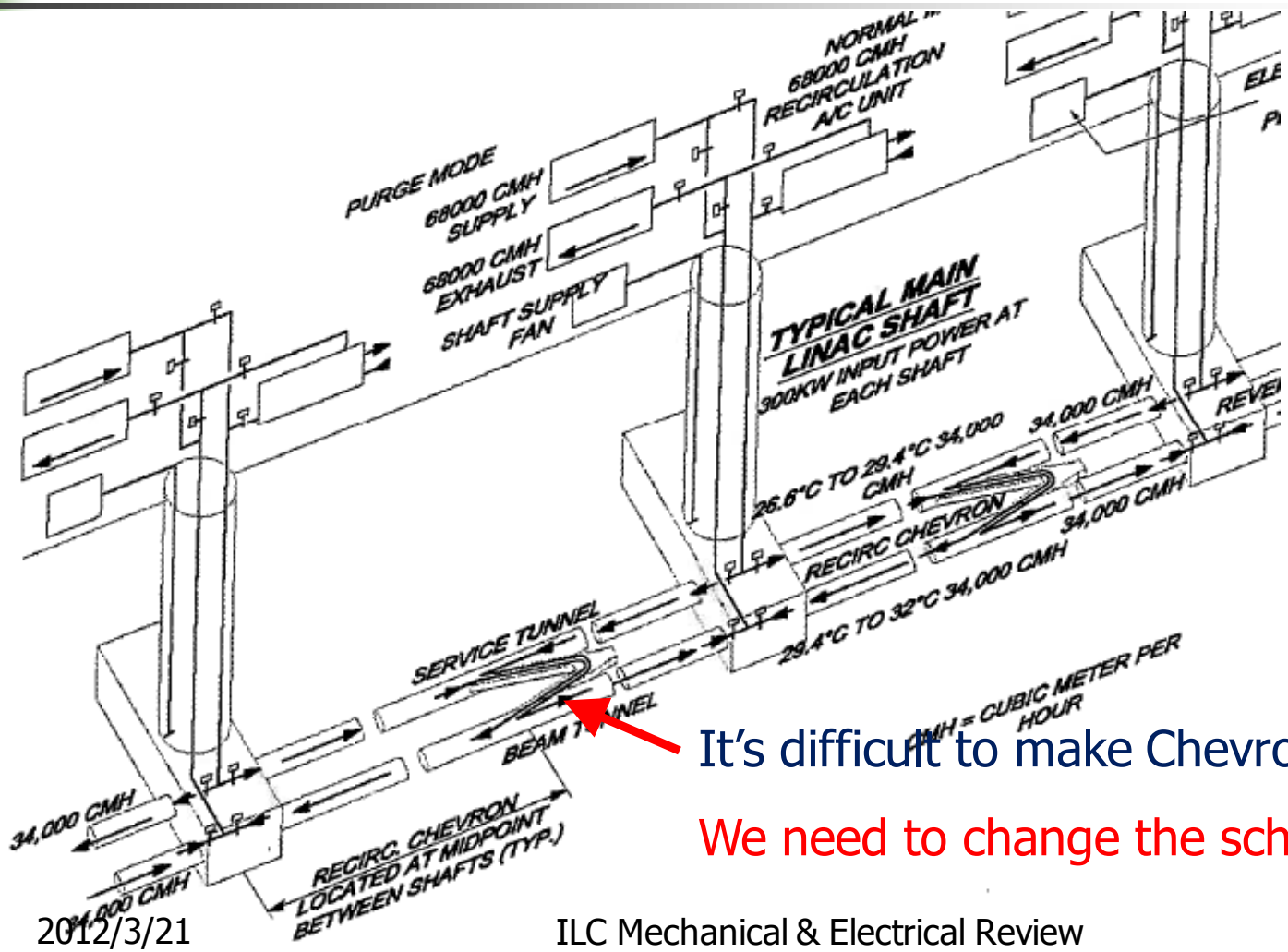
Inverter turbo refrigerator



COP (Coefficiency Of Performance)
rating point =7.0

HVAC System

Tunnel Ventilation System in RDR

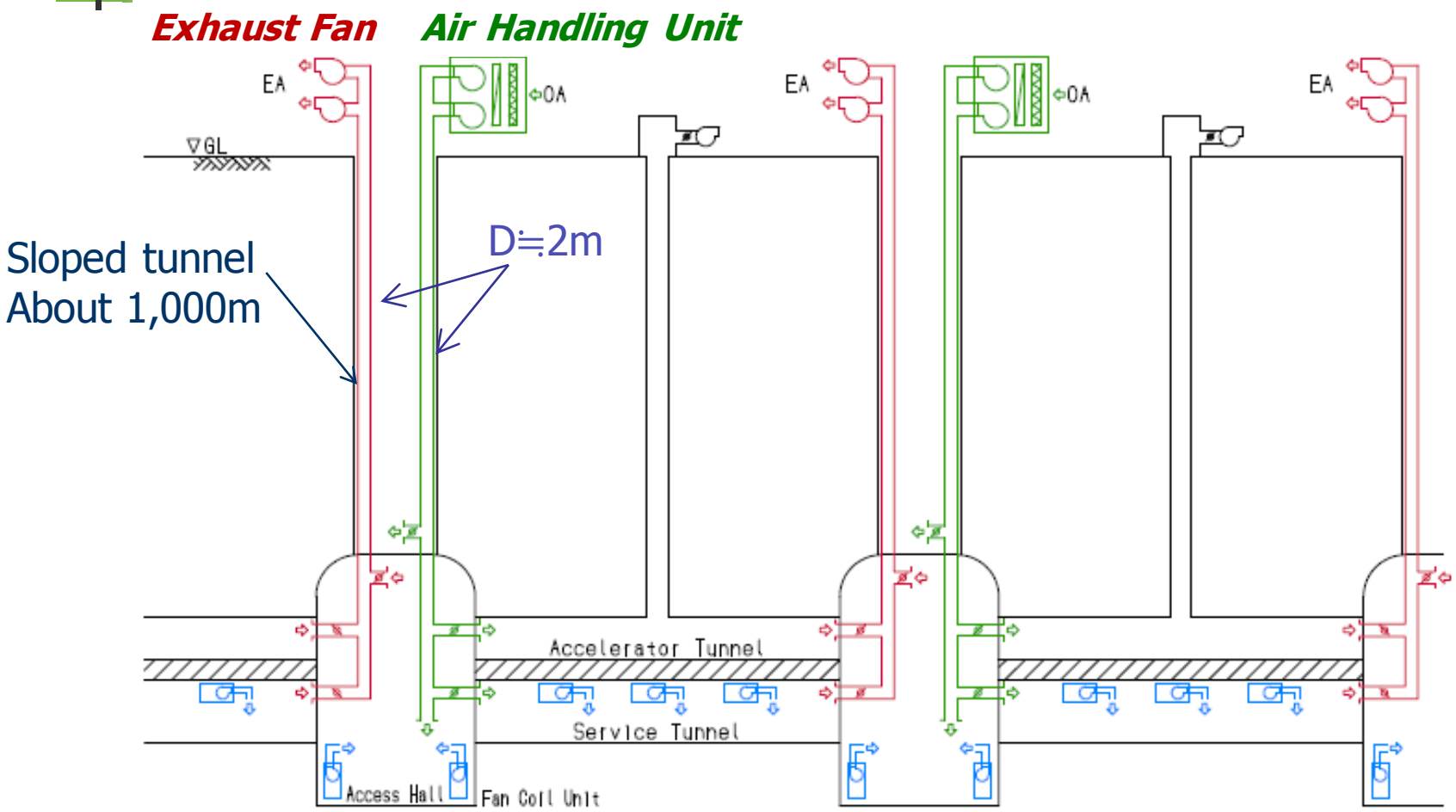


It's difficult to make Chevron

We need to change the scheme

HVAC System

Tunnel Ventilation System

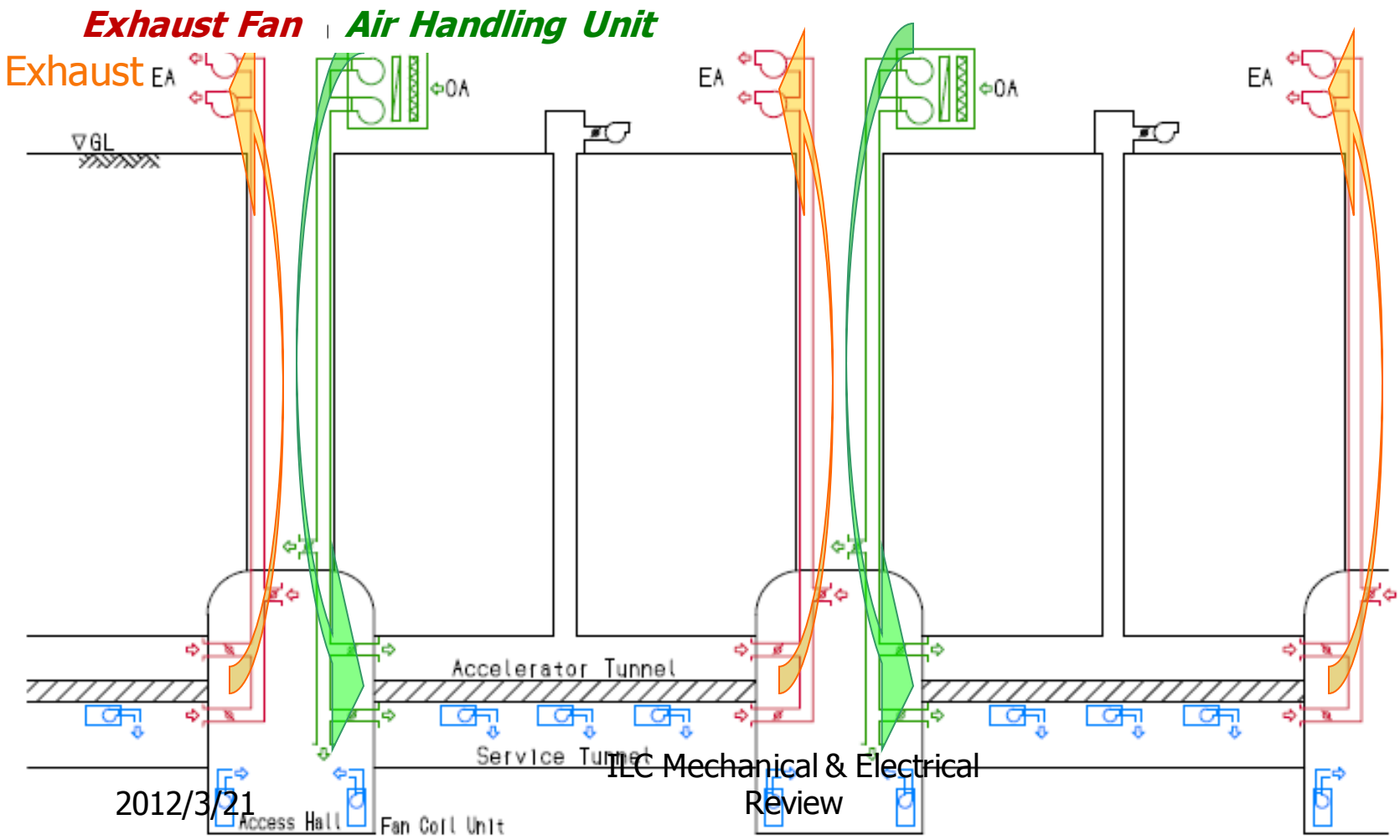


HVAC System

Tunnel Ventilation System

Outside air

Heated or Cooled by Air-handling Unit



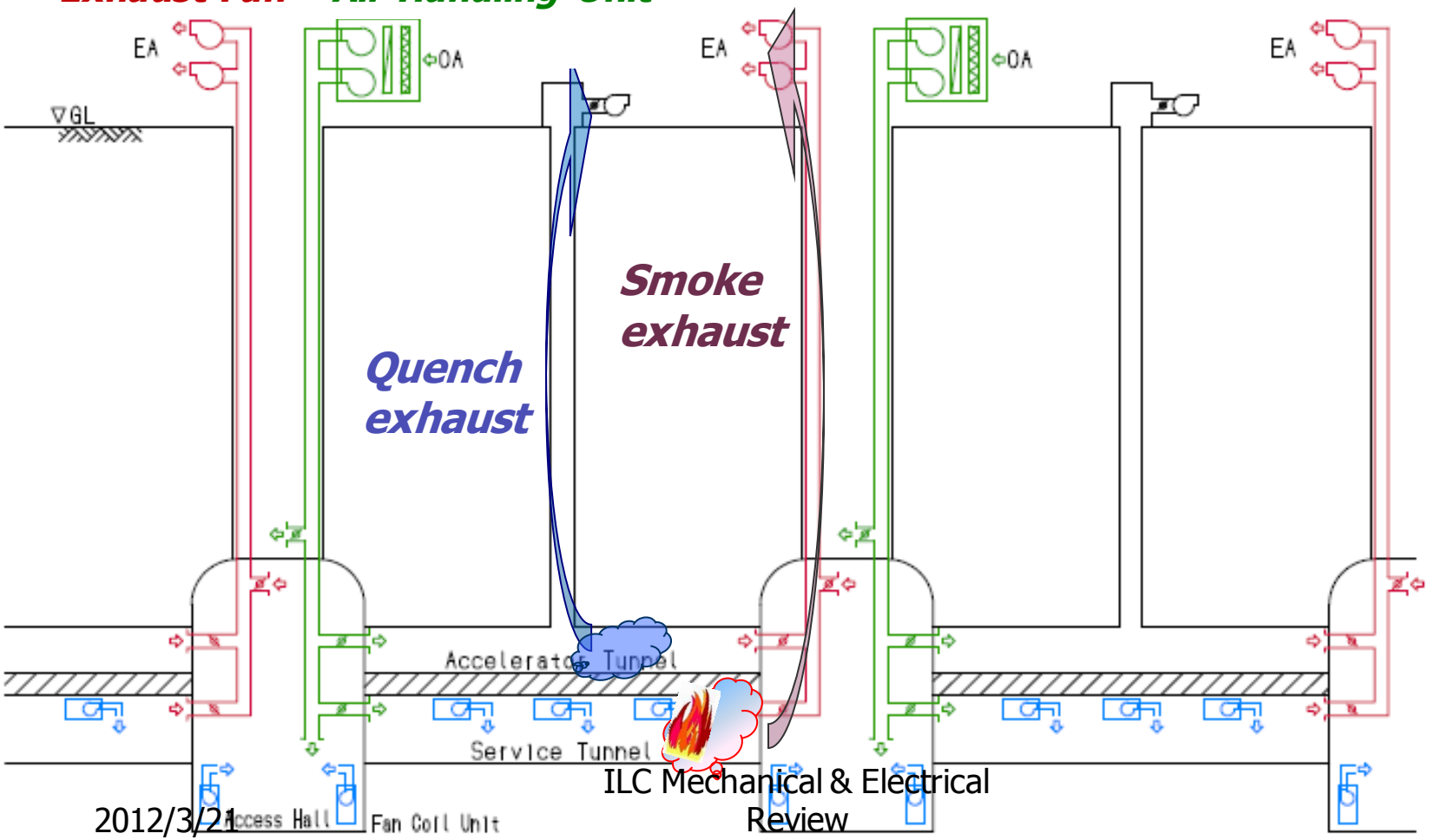
HVAC System

Tunnel Ventilation System

Fire !!

Helium Quench !!

Exhaust Fan ***Air Handling Unit***

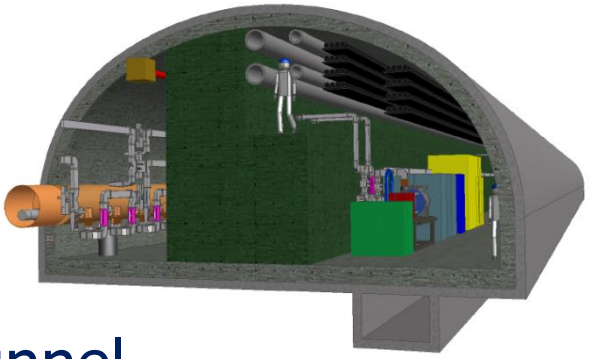


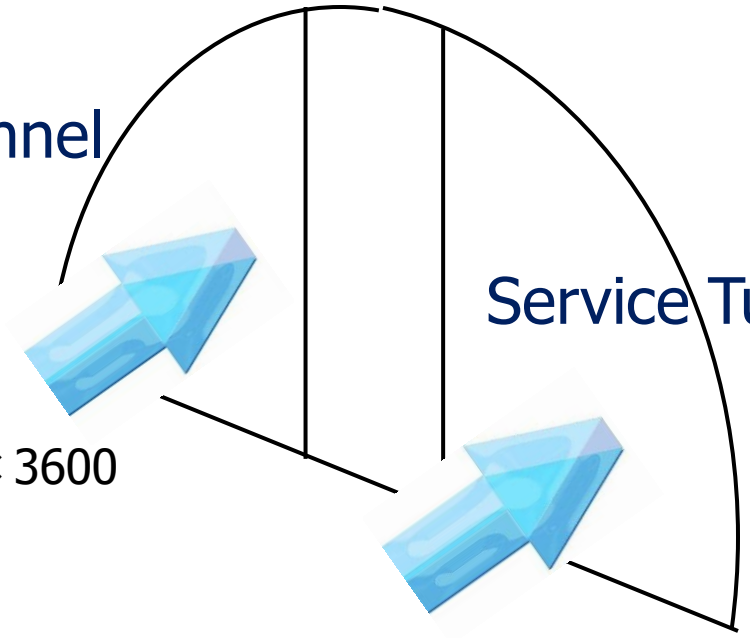
HVAC System

Tunnel Ventilation Rate

High velocity (>1.0m/s) cause vibration !

Velocity < 0.5 m/s





0.5m/s × 12m2 × 3600

=21,600m3/h

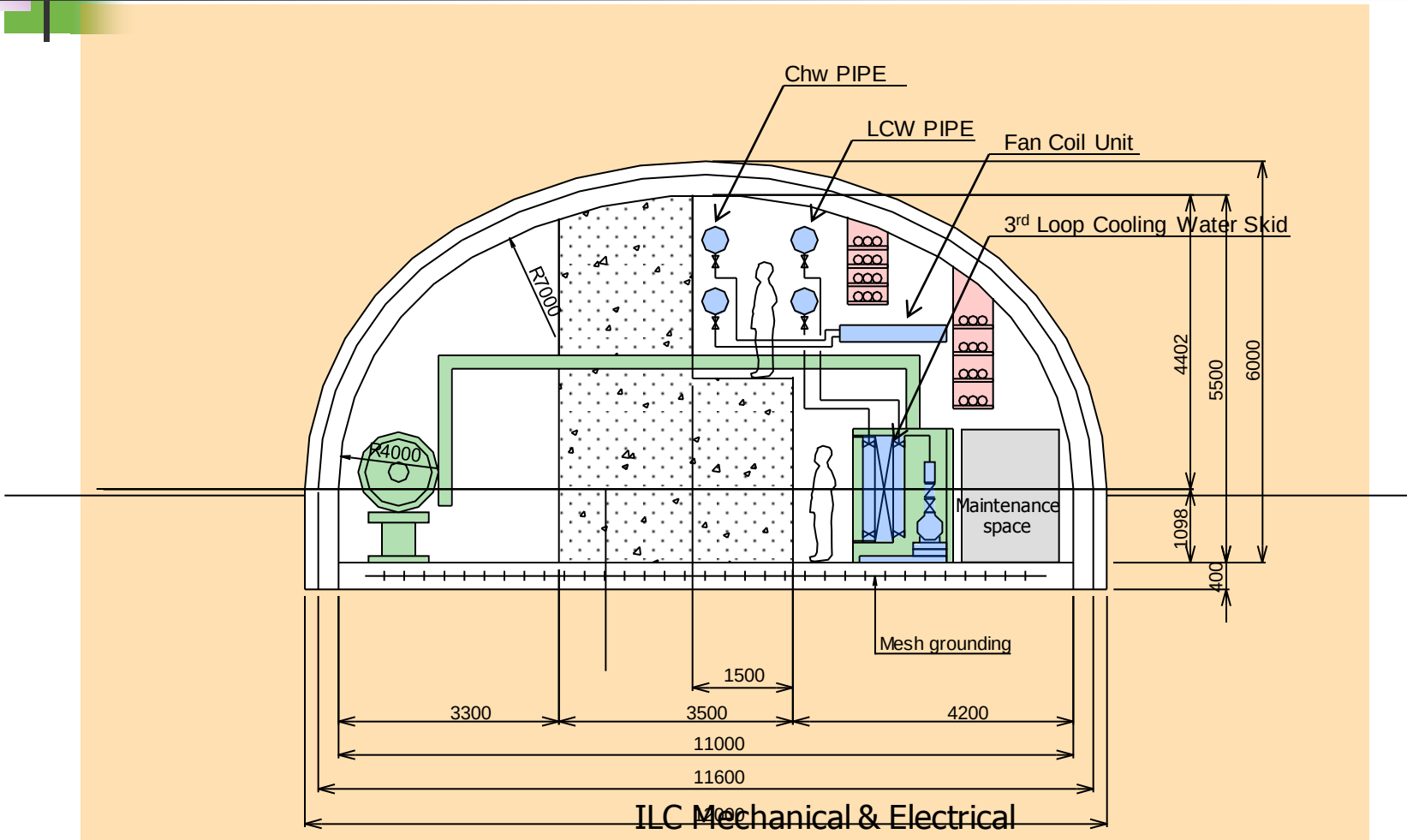
0.5m/s × 16m2 × 3600

=28,800m3/h

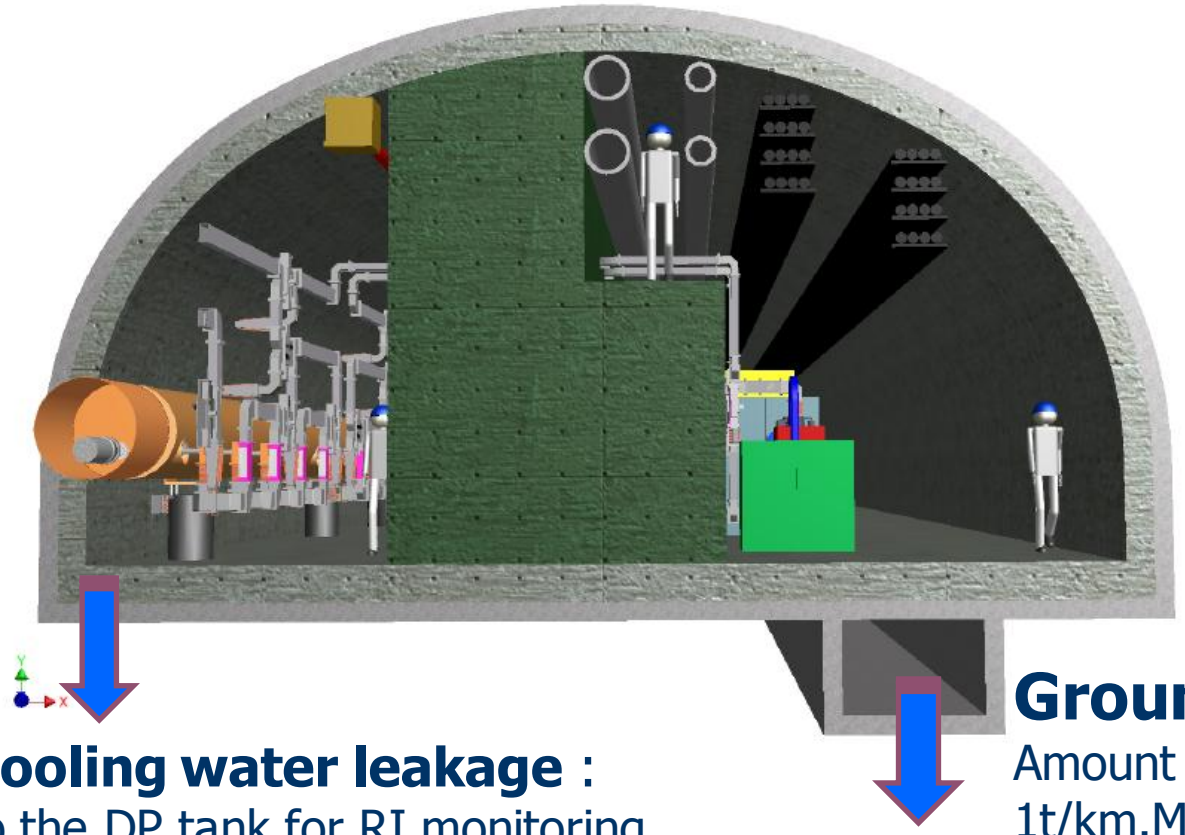
28,800m3/h ÷ (16m2 × 5000m)

=**0.36N/h**

HVAC System
Typical Tunnel Section Plan



Plumbing System
Drainage System

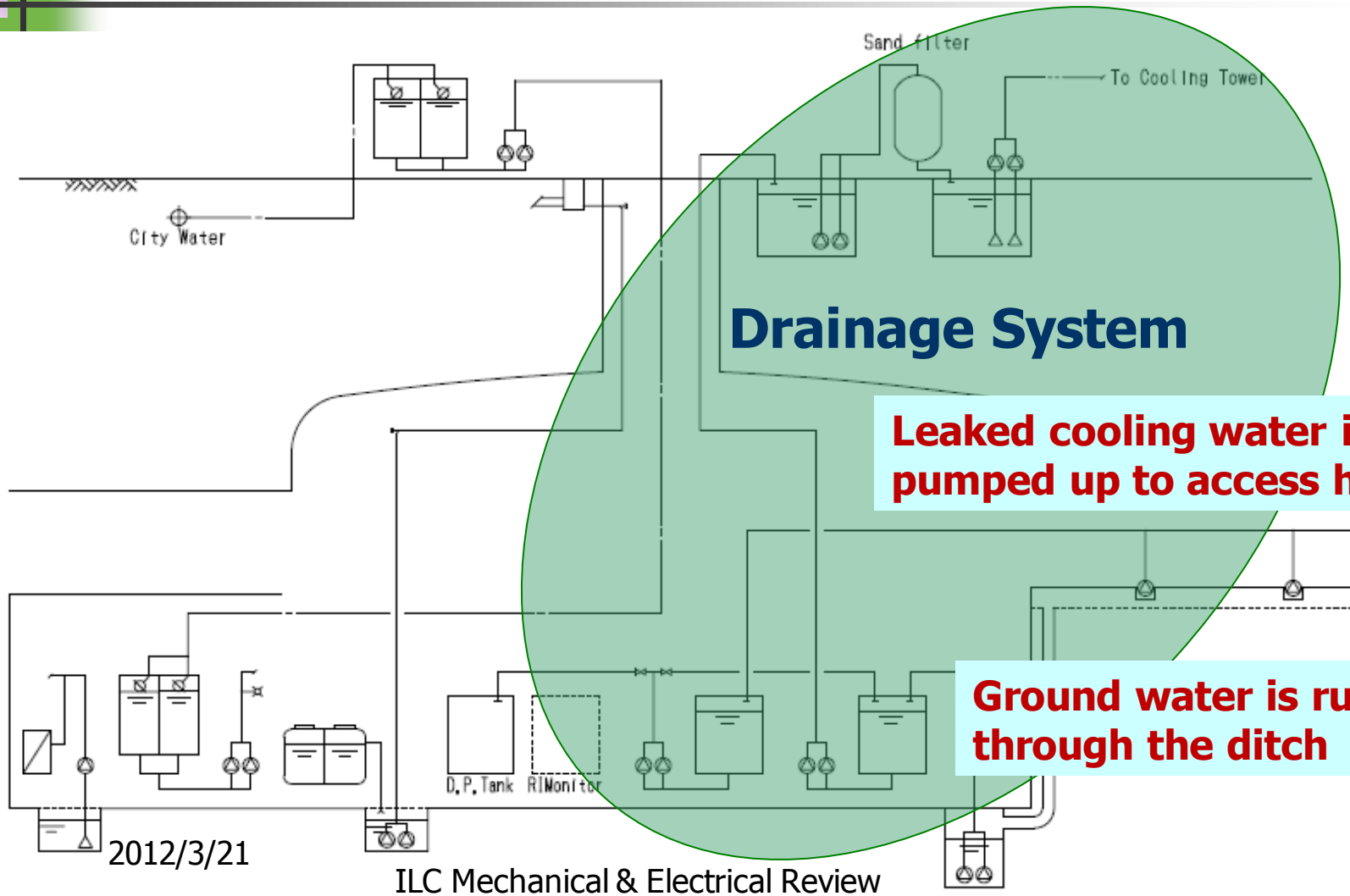


Cooling water leakage :
to the DP tank for RI monitoring

Ground water :
Amount of Springwater
1t/km.Min. →30t/min.
43,000t/day

Plumbing System

Water Supply and Drainage System



Drainage System

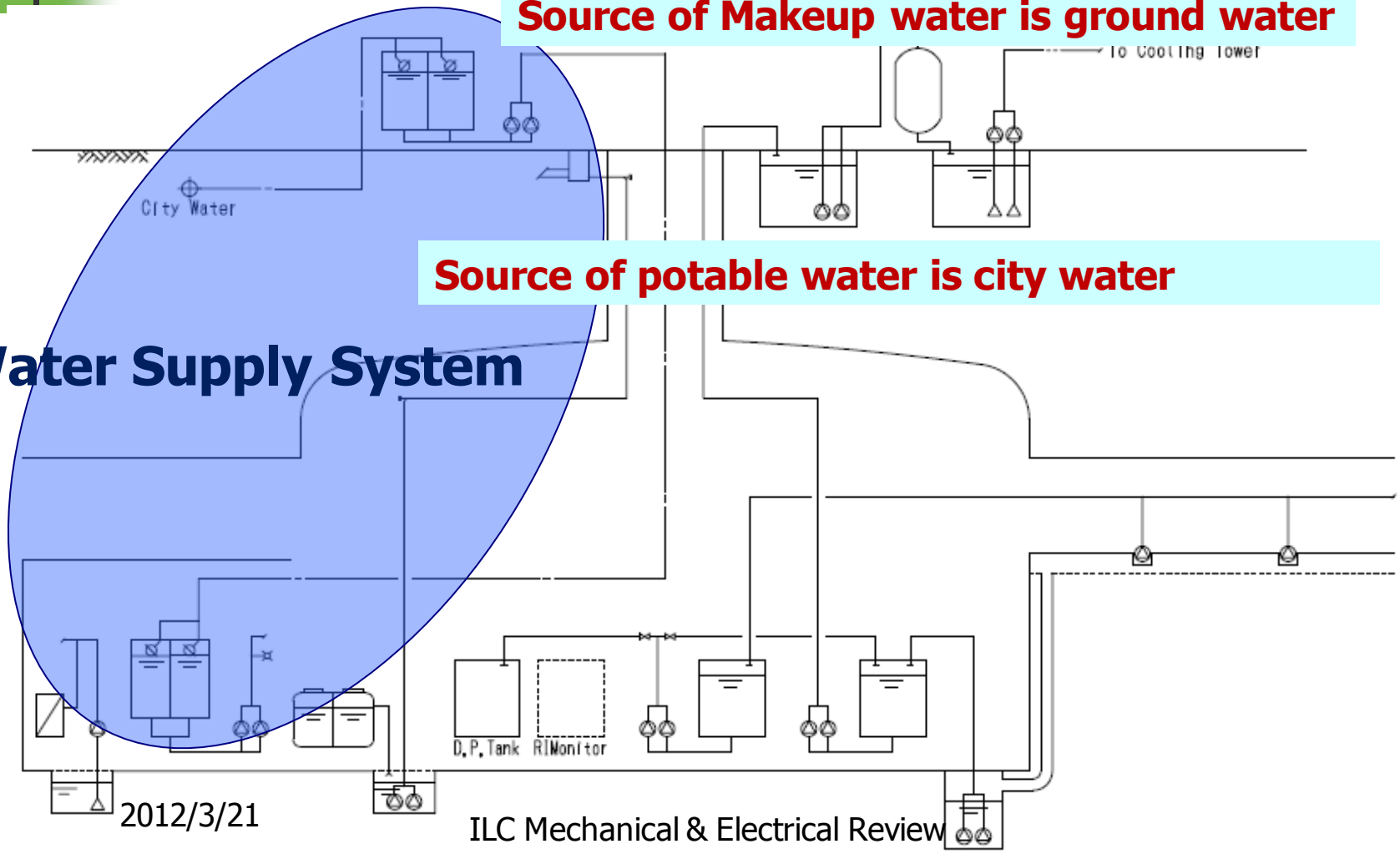
Leaked cooling water is pumped up to access hall

Ground water is running through the ditch

Plumbing System

Water Supply and Drainage System

Source of Makeup water is ground water



Source of potable water is city water

Water Supply System

Asian Region Mechanical Design

Summary (1)

Cooling Water System

- Use the open type Cooling Tower System
- Use 3-Loop System (⊿t=11℃)
- Inverter Turbo Refrigerator is used to make CHW

HVAC System

- Air Ventilation is through the Duct in Access tunnel
- Ventilation in ML tunnel is "Duct-less", 0.5m/s Velocity
- Fire Smoke is extracted to the surface through AH,AT.

Asian Region Mechanical Design

Summary (2)

Plumbing System (water supply)

- City water is used for the potable water.
- Groundwater is used for the makeup water of CT.

Drainage System

- Groundwater is flow down to the Access Hall through the Drainage ditch under the Service Tunnel.
- Leaked Cooling Water to the DP tank for RI Monitoring

We need more detailed study by the time next meeting in Korea