International Workshop
Harmonization of Approaches to Assuring Safety within National Radioactive Waste Management Policies and Strategies

A Common Framework for the Safety of Radioactive Waste Management and Disposal

IAEA
Cape Town, South Africa
2-6 July, 2007

Regulatory Approaches to Safe Storage and Disposal of Radioactive Waste in Korea

July 2007

Kyung-Woo CHOI
kwchoi@kins.re.kr

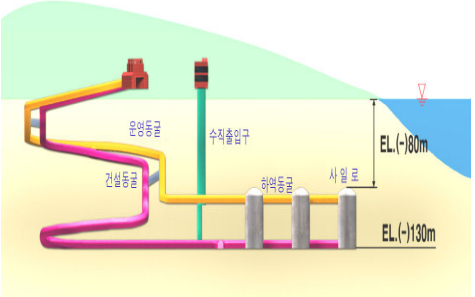
Korea Institute of Nuclear Safety

Contents

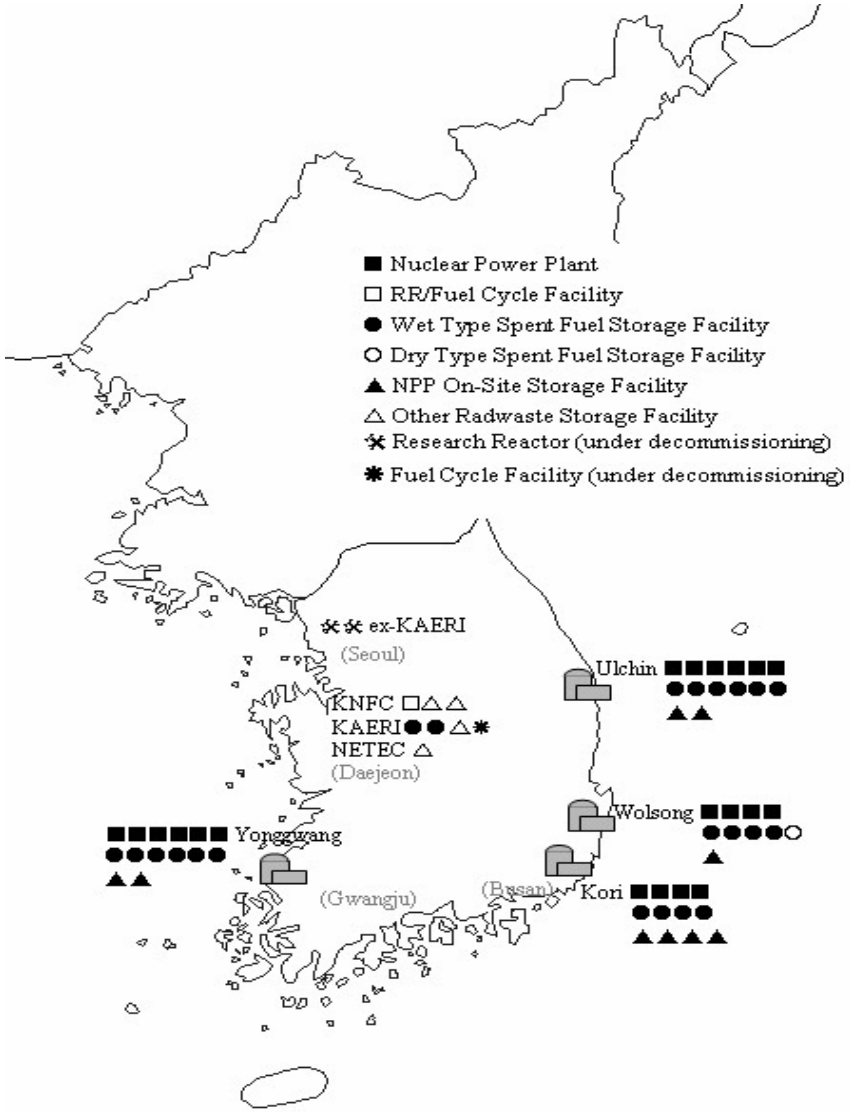
- Overview
- Regulatory Framework for RW Disposal
- Recent Status of Licensing LILW Disposal Facility
- Summary

PART I

Overview



Nuclear Facilities Profile



(as of Feb. 2006)

Type	No.
■ NPP In operation Under construction	 20 4
▲ On-Site Storage Facility	9
Spent Fuel Storage Facility ● Wet type ○ Dry type	 20 1
□ Fuel Cycle Facility	2
△ Other Radwaste Storage Facility	4
Research Reactor ✱ operation 🛠 under decommissioning	 1 2

- ***18.7 GWe (total electric power capacity in 2005)***
- ***Nuclear Share : over 40 %***

National Policy for RWM (1)

Resolution of the AEC at the 249th Meeting (Sep. 30, 1998)

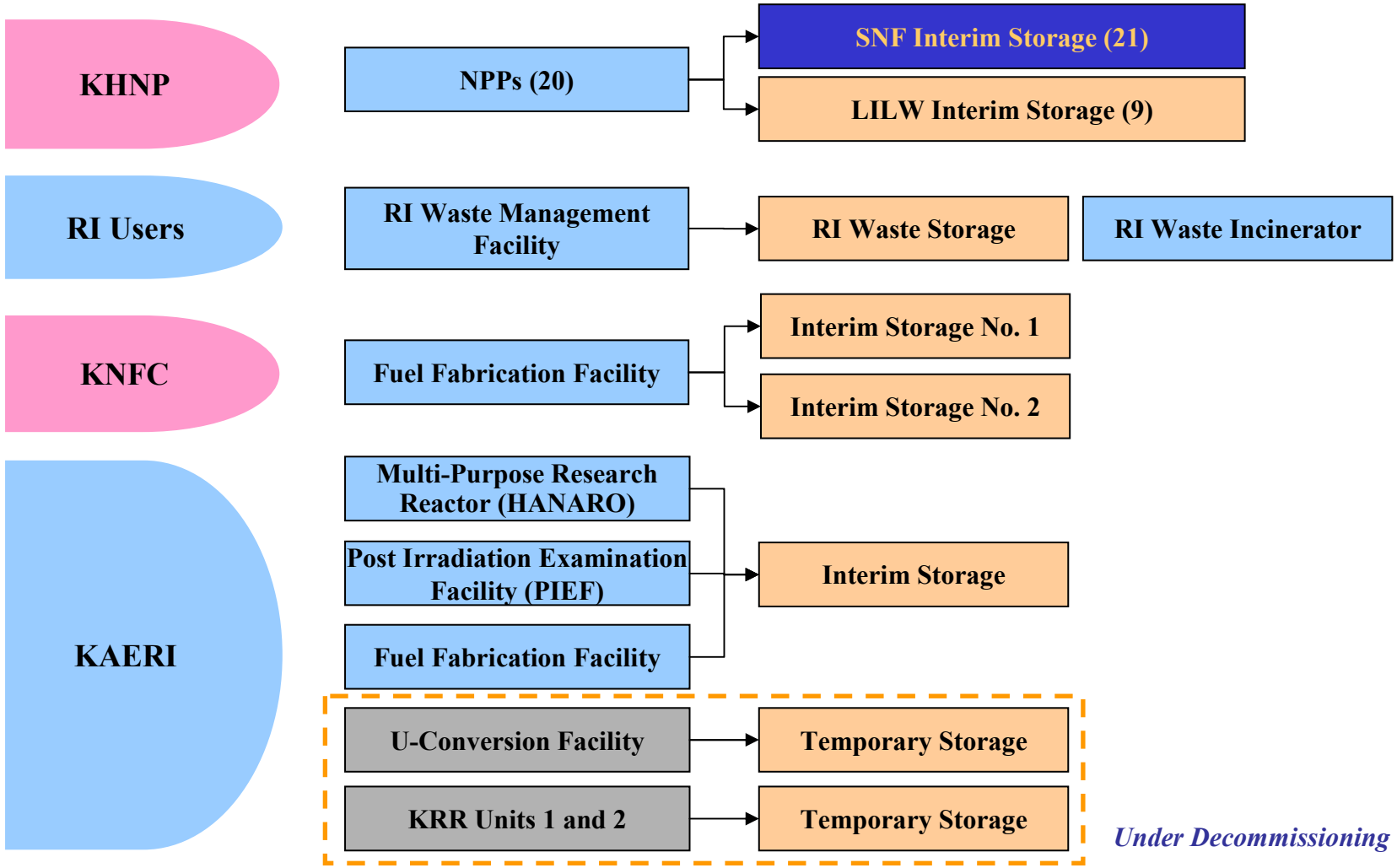
- **Fundamentals**
  - Direct control by the government
  - Top priority on safety
  - Minimization of waste generation
  - "Polluter pays" principle
  - Transparency of siting process
- **Implementation Plans**
  - **LILW Repository**
    - Near surface or rock-cavern repository (by 2008)
    - Capacity : 800,000 Drums (100,000 Drums at the 1st stage)
  - **SNF Interim Storage → recently changed**
    - Dry or wet-type centralized interim storage (by 2016)
    - Capacity : 20,000 MTU (2,000 MTU at the 1st Stage)

National Policy for RWM (2)

Resolution of the AEC at the 253rd Meeting (Dec. 17, 2004)

- **Management of LILW**
  - The LILW are stored at the radioactive waste storage facilities on NPP sites or at the radioisotope storage facilities and then shall be disposed of in a near surface repository or rock cavern repository.
  - The construction and operation of one or two radioactive waste disposal facilities shall be accomplished by 2008.
- **Management of SNF**
  - The national policy for spent fuel management will be decided later on in the view of the domestic and international technology development.

Major RW Management Facilities



Inventory of RW

(as of December 2006, 200L-Drum Equivalents)

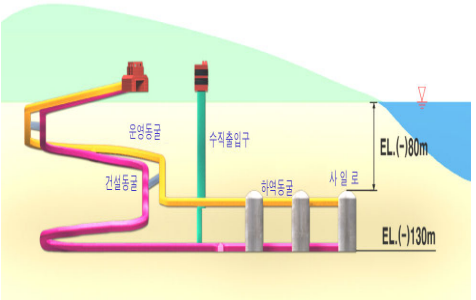
Site / Facility		Capacity	Cumulative Amount
Operating NPPs	Kori	50,200	35,560
	Yonggwang	23,300	16,454
	Ulchin	17,400	12,877
	Wolsong	9,000	6,035
	Sub Total	99,900	70,926
Other Operating Facilities	Research Facilities	16,018	12,563
	Fuel Fabrication Facilities	8,900	6,380
	RI Waste Storage Facility	9,750	5,199
	Others	-	7,183
	Sub Total	-	31,325
Facilities Under Decommissioning	KRR Units 1 and 2	-	942
	Uranium Conversion Facility	-	276
	Sub Total	-	1,218
TOTAL		-	103,469

Definition and Classification of RW

- Definition (Atomic Energy Act)
  - Radioactive materials or materials contaminated with them which are the object of disposal, including spent fuel
- Classification System (MOST Notice No. 2002.23)
  - LILW
    - Long-lived α-emitters ($T_{1/2}$ > 20 years) : < 4,000Bq/g, or
    - Heat Generation Rate : < 2 kW/m^3
  - HLW
    - Other Radwastes except LILW
  - Criteria for Clearance (MOST Notice)
    - < 0.01 mSv/y of individual dose, and
    - < 1 person-Sv/y of collective dose
    - Case-by-case authorization based on specific impact assessment

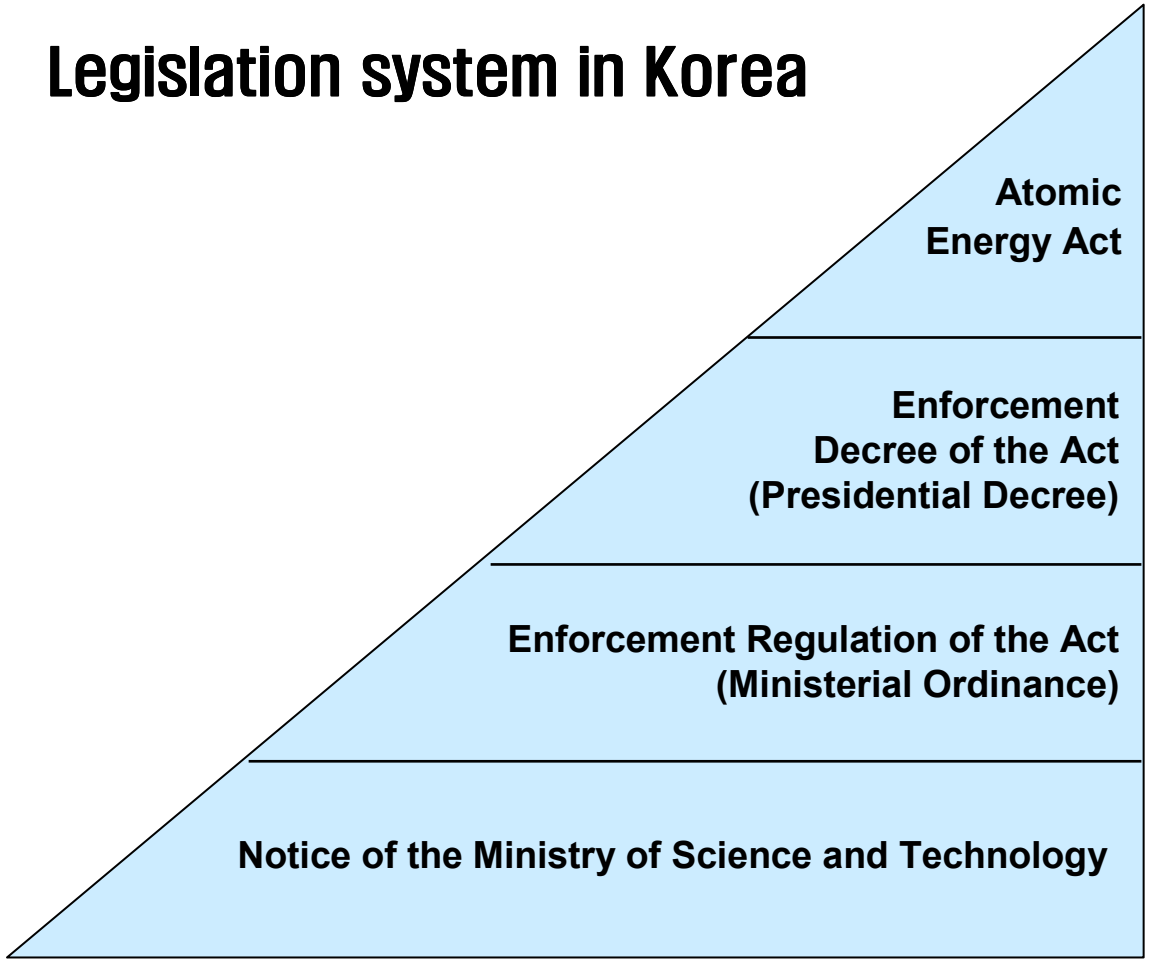
PART II

Regulatory Framework for RW Disposal



Legislation and Regulations

Legislation system in Korea



Act provides the bases and the fundamentals

Decree provides the particulars entrusted by the Act

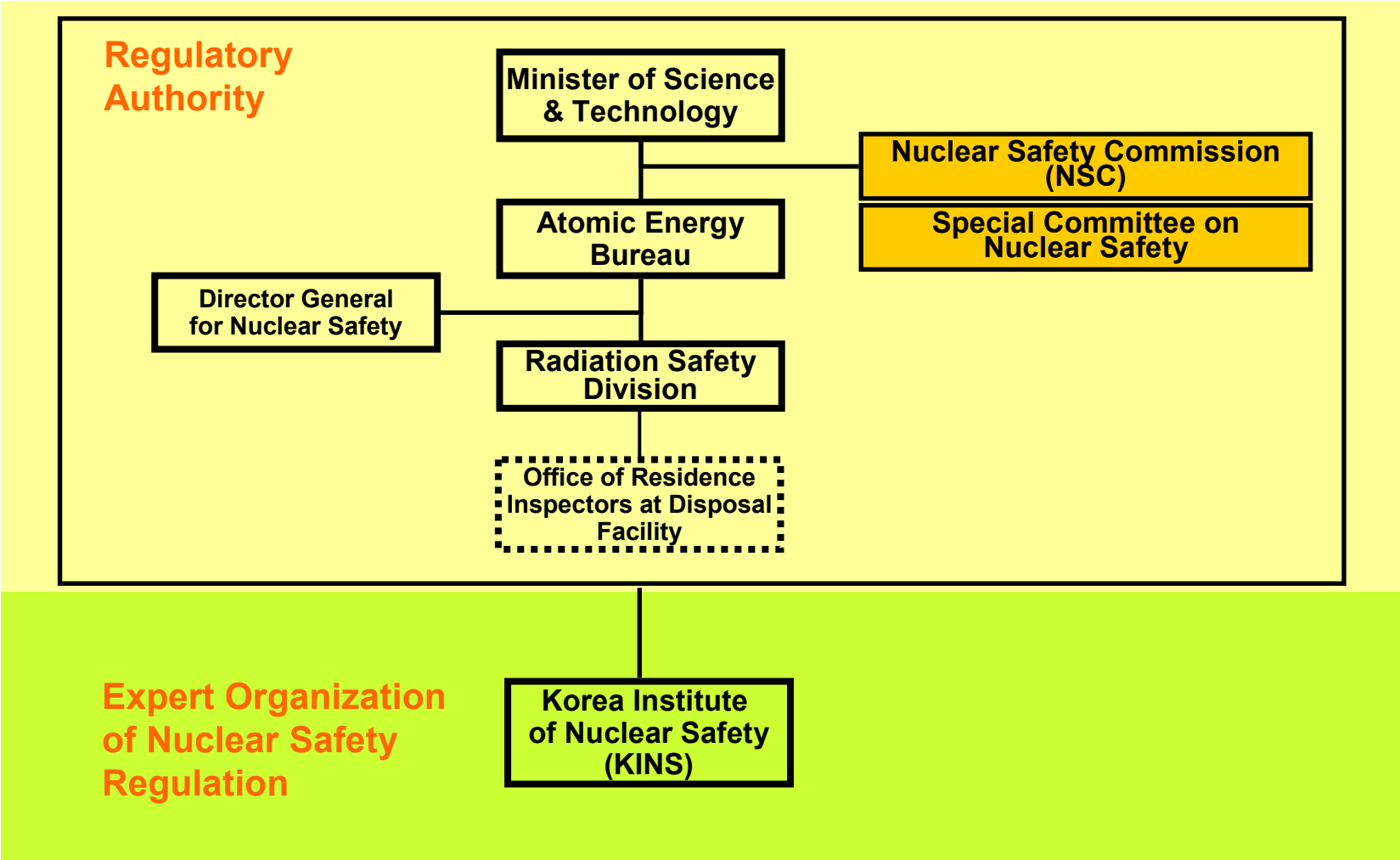
Regulation provides the technical standards and particulars entrusted by the Act and Decree

Notice provides detailed particulars for the technical standards and guidelines

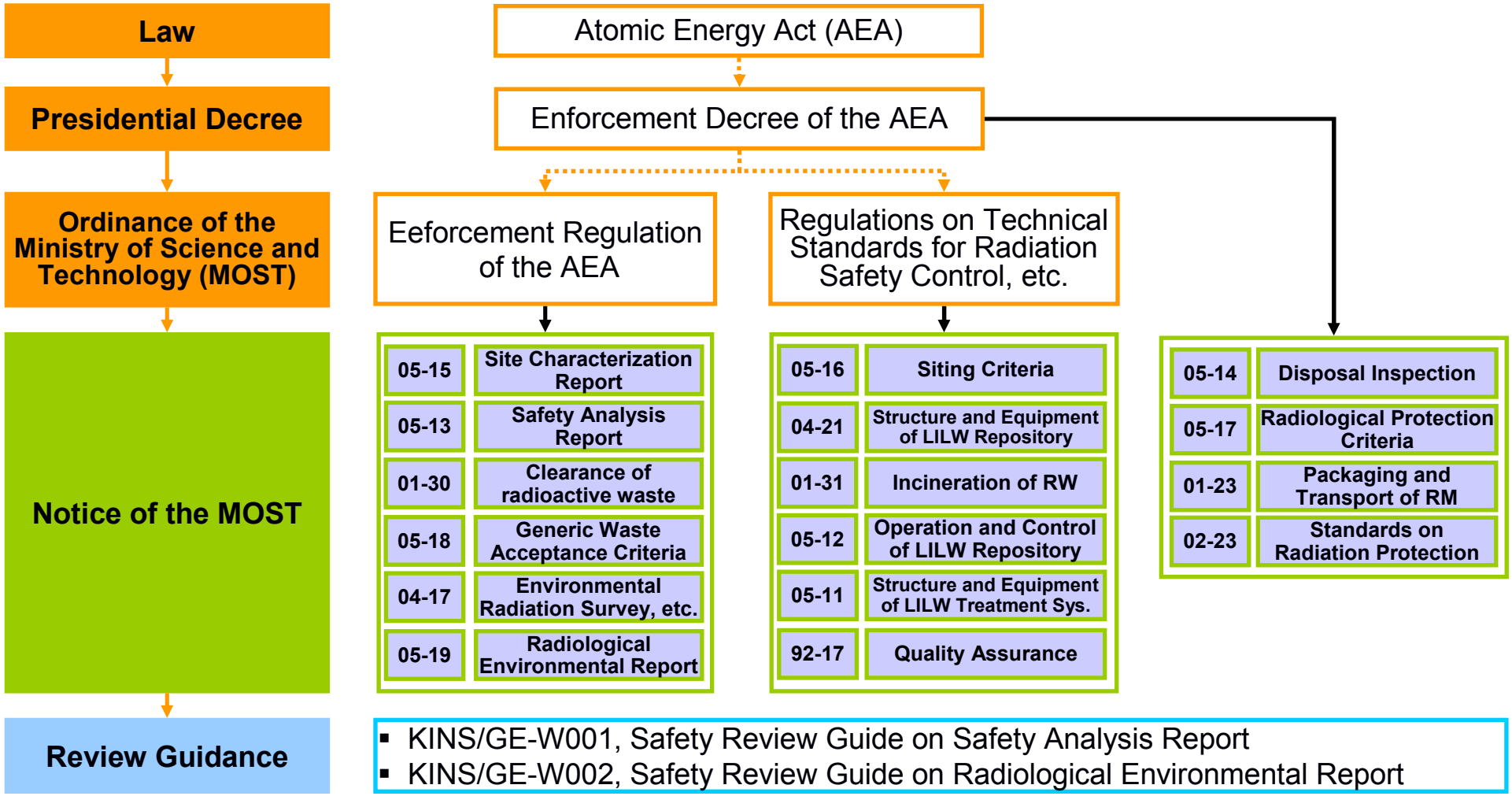
Radiological Safety Criteria on LILW Disposal

				Operation Phase	Institutional Control (Post-closure Phase)
Dose Limit (Enforcement Decree of the AEA)	Effective Dose		Workers (Avg. 20 mSv/y) Frequent Access Personnel (12 mSv/y) Public (1 mSv/y)		
	Equivalent Dose		cf. Table 1 of Enforcement Decree of the AEA		
Radiation Protection Standards (MOST Notice No. 02-23)	Facility	Liquid Effluent	Effective Dose (0.03 mSv/y) Equivalent Dose (0.1 mSv/y)	• Considered in design Stage • Compliance verification in operational phase	*Under the situation of partial closure of disposal units, Radiation Protection Standards shall be also applied to the institutional control period.*
		Gaseous Effluent	Gamma Air Dose (0.1 mGy/y) Beta Air Dose (0.2 mGy/y) Effective Dose, External (0.05 mSv/y) Skin Equivalent Dose, External (0.15 mSv/y) Equivalent Dose due to Particulates (0.15 mSv/y)		
	Site		Effective Dose (0.25 mSv/y) Thyroid Equivalent Dose (0.75 mSv/y)		
	Effluent Control Limit for discharge				
Radiological Protection Criteria (MOST Notice No. 05-17)	Natural phenomena (0.1 mSv/y)				• Mainly considered in design stage
	Unexpected disruptive events (10^{-6}/y)				
	Human intrusion (1 mSv/y)				

Regulatory Framework for RW Disposal

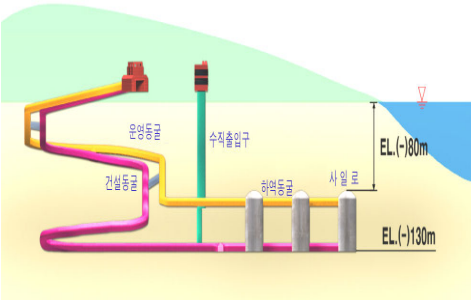


Laws and Regulations on RW Disposal



PART III

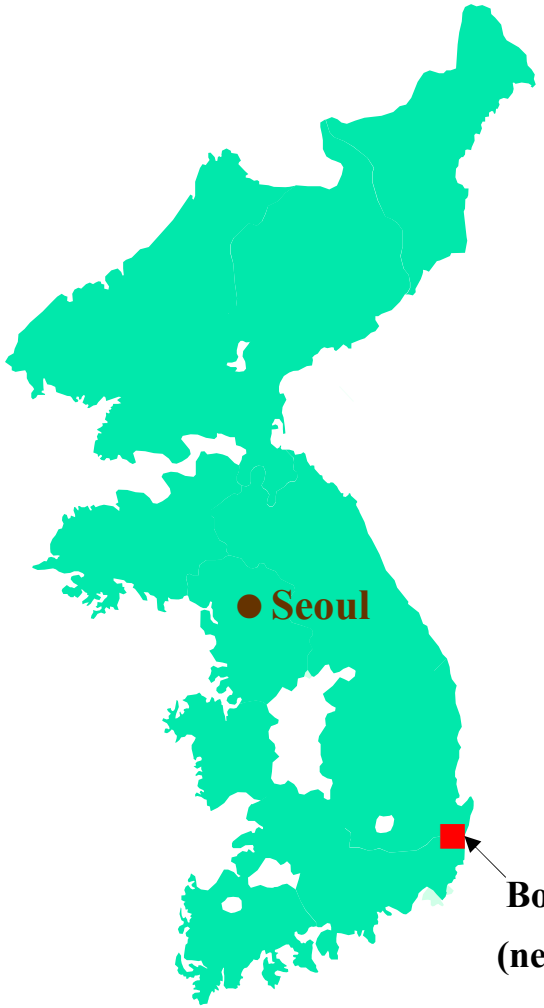
Recent Status of Licensing LILW Disposal Facility



History of LILW Disposal Program

1986	**Commencement of Radioactive Waste Disposal Site Selection by MOST/KAERI**
~	***A few candiate sites were recommended and/or selected, but all were cancelled due to finding of active fualts or residents' opposition.*** ***(e.g. Anmyun-Island, Gulup-Island, etc.)***
1997	**Radioactive Waste Disposal Site Selection Project transferred to MOCIE/KHNP**
~	***Site subscription campaigns were failed due to local government rejection despite voluntary petitions by tens of local community residents.*** ***Buan was nominated as a candidate site, but cancelled due to residents' opposition.***
2005	**Special Law for financial support for local community (Mar, 2005)**
	Applications to host the repository from 4 local communities (Aug, 2005)
	Selection of Gyeongju as a final candiate site, based on the highest vote rate in favor of hosting (Nov, 2005)
2007	**Application for construction and operation permit of the LILW repository by KHNP**

Location of Gyeongju Site



Bong-Gil Ri, Gyeongju

(nearby Wolsong NPP Site)

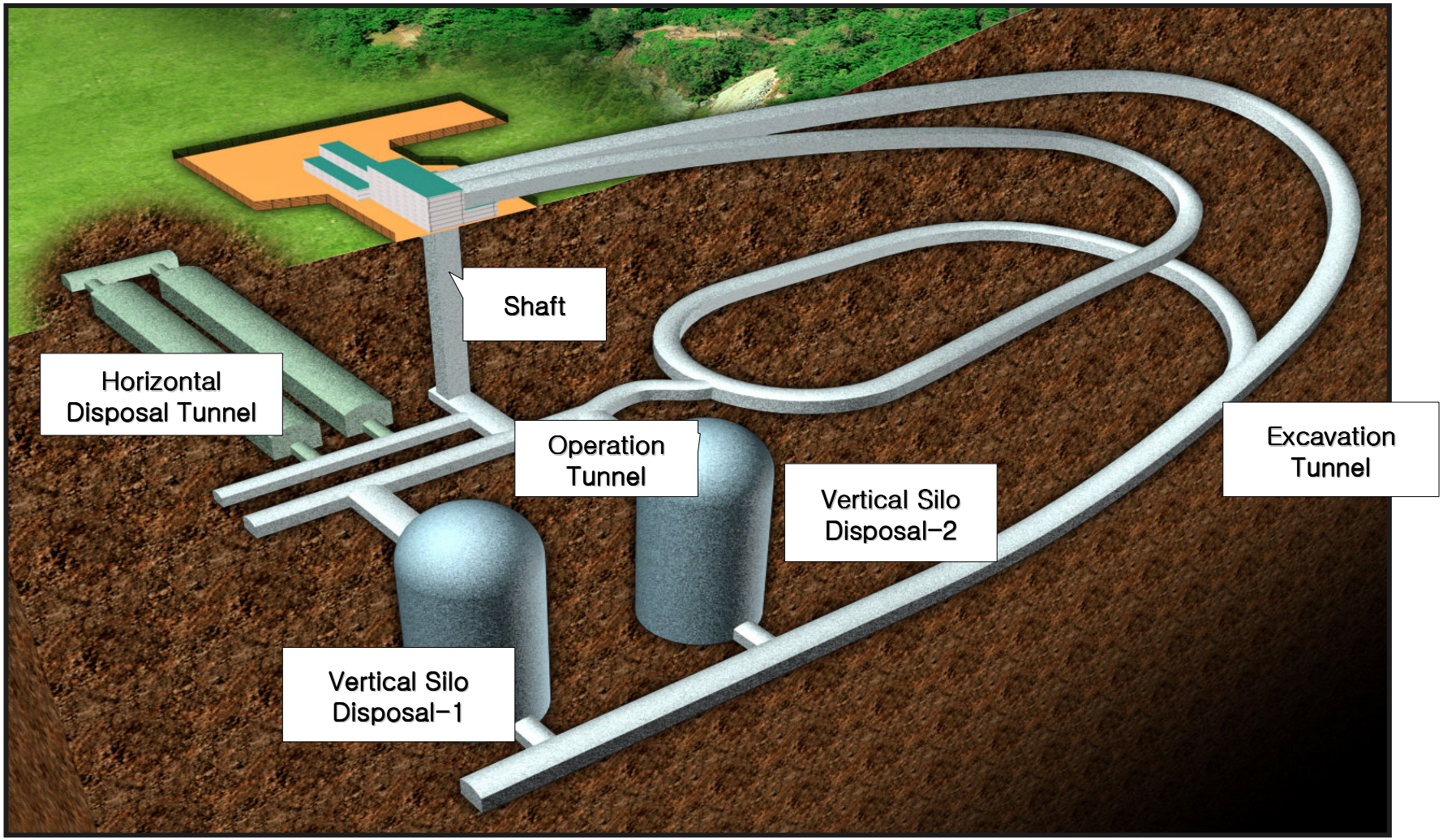
Characteristics of the Site

❑ Basic Information

- Location : Bong-Gil Ri, GyeongJu
- Area : ~ 2 million m^3
- Capacity : 100,000 Drums for the 1st Stage
  - to be expanded to dispose of upto 800,000 Drums
- Disposal Units : 6 Underground Rock Silos (for the 1st Stage)
- Geology : Mainly Sedimentary Rock intruded by Granodiorite
  - Fracture Zone were identified
- Groundwater Level : EL. 100 (West Hillock) ~ EL. 0 (East Coast)
- Geochemistry : pH 6~9, Eh -160~100 mV, DO 0~5 mg/L

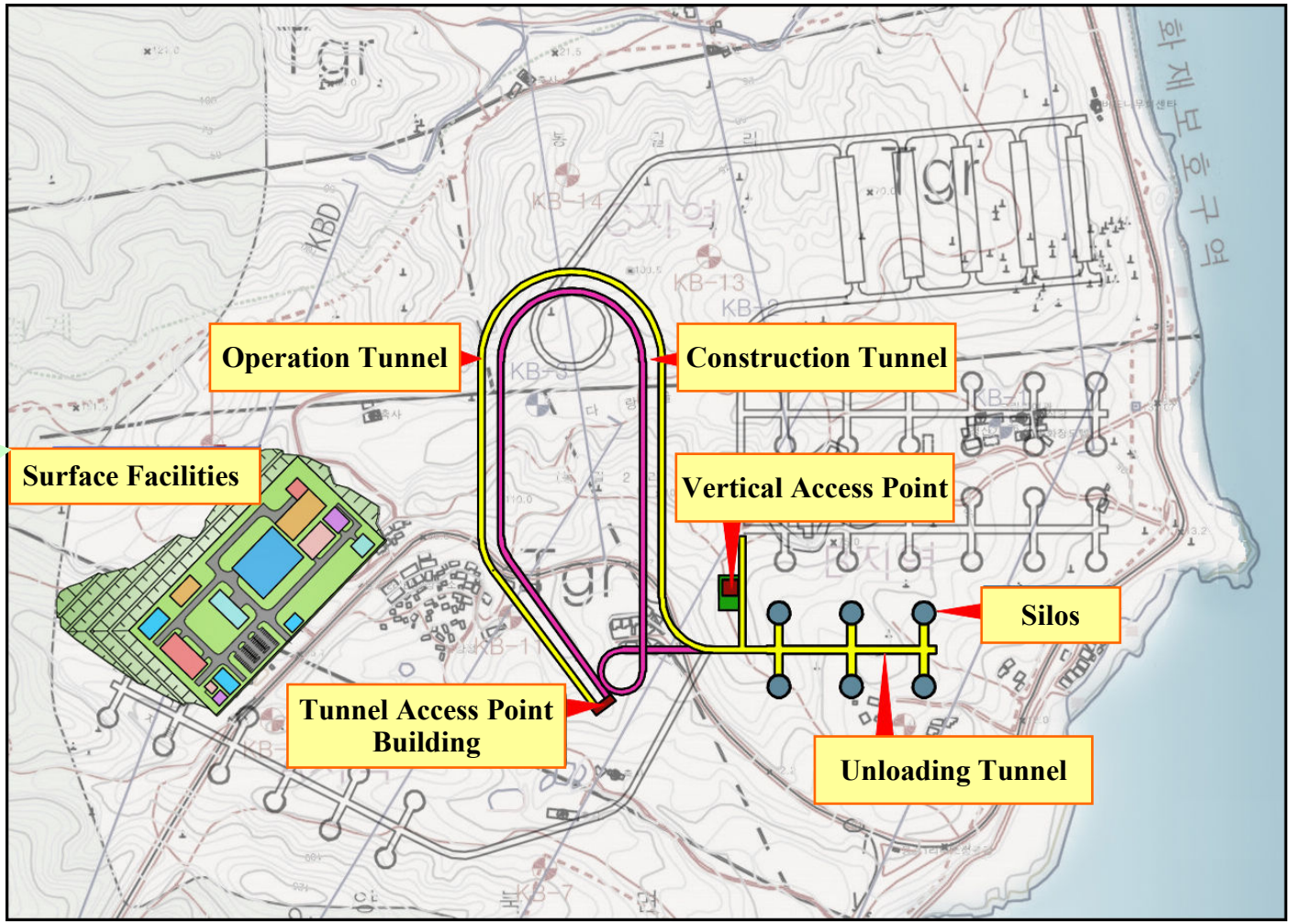
Repository Design – Rock Cavern (1)

○ **Schematic Design of Rock-Cavern Repository**

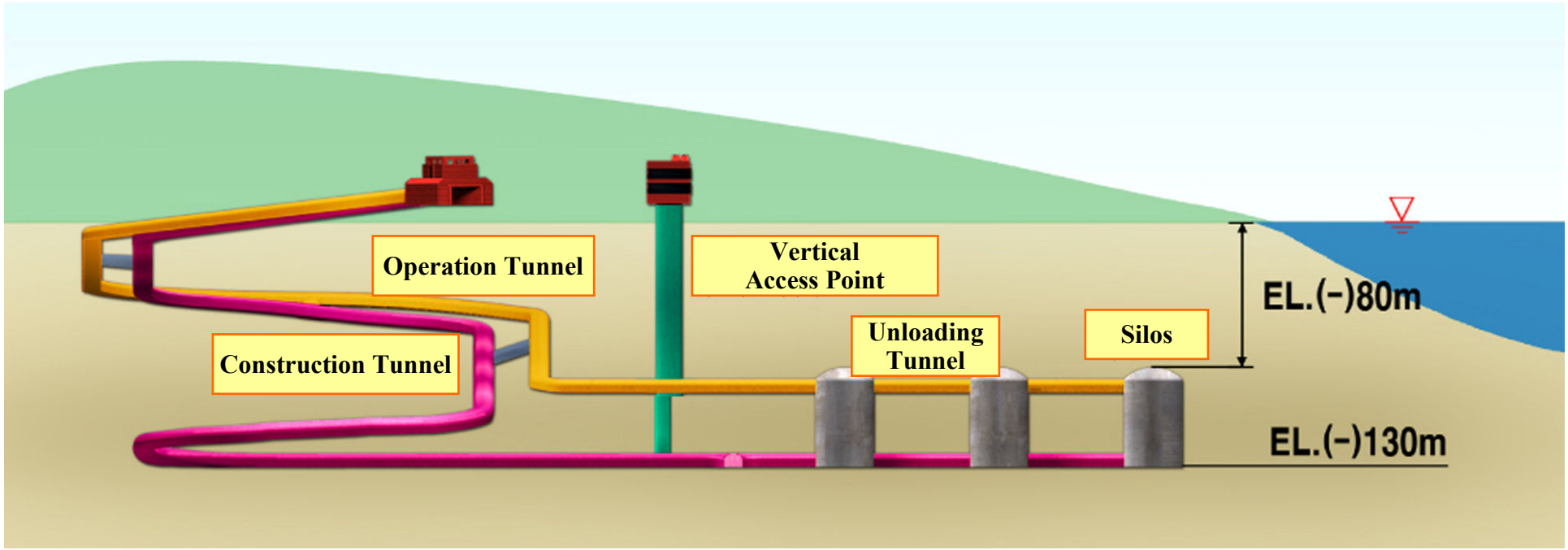


Plane Layout of the Site

- **RW Acceptance & Storage Facility**
- **RW Treatment Facility**
- **Utility Buildings, etc.**

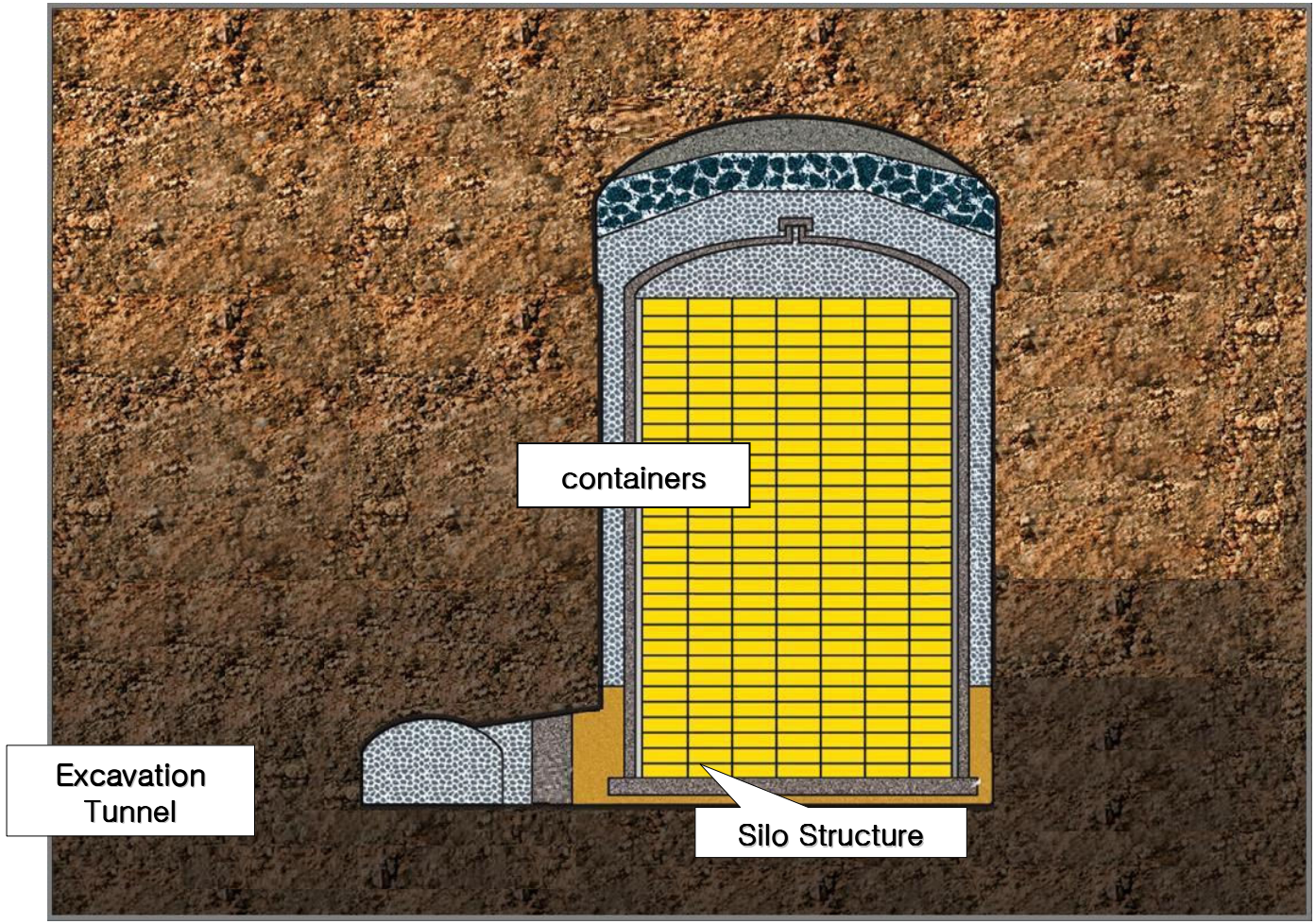


Section View of the Site

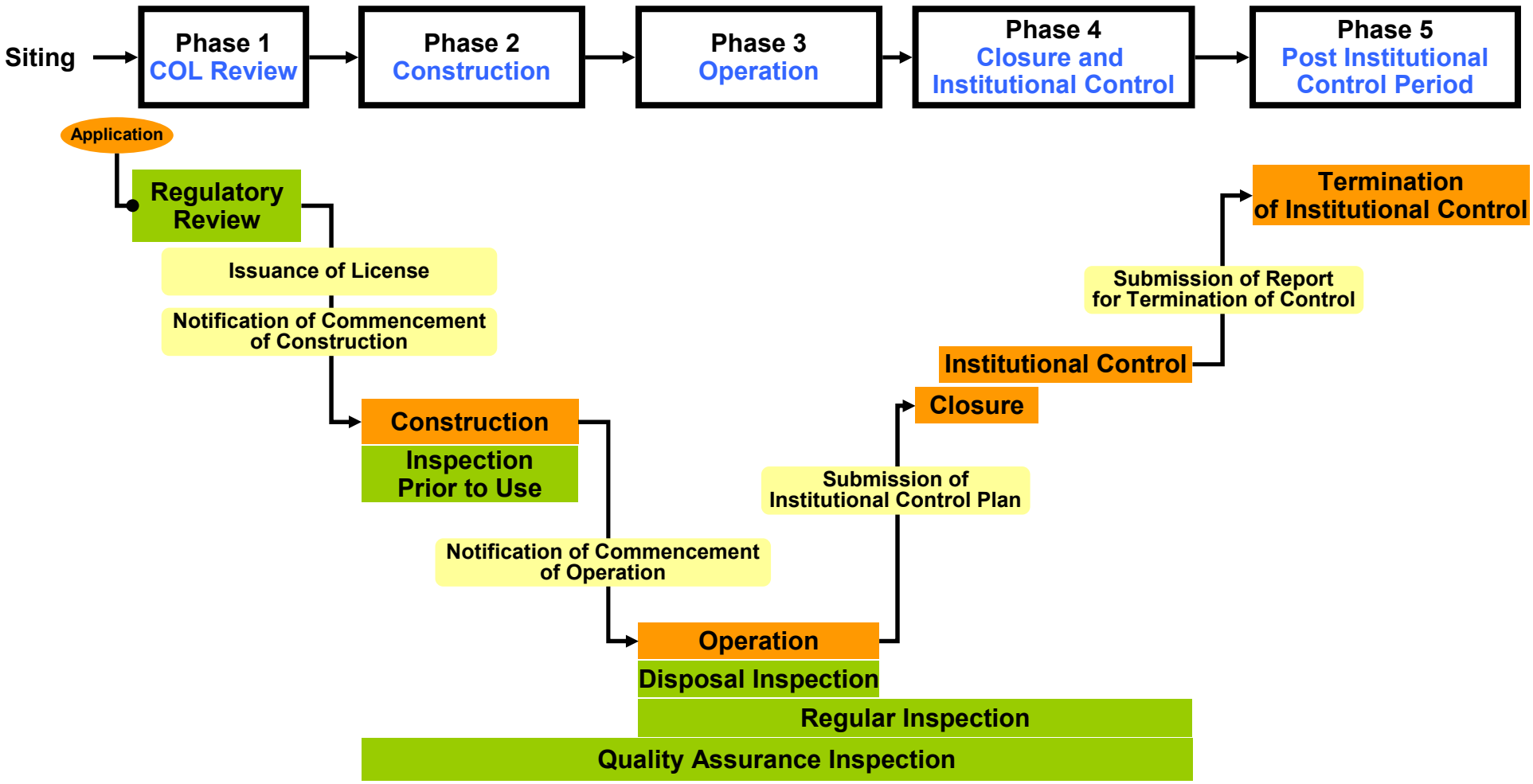


Repository Design – Rock Cavern (2)

○ **Cross-sectional View of Vertical Silo Disposal Unit**



Stepwise Regulatory System on RW Disposal



Safety Review Methods

- Docket Review
  - Review of the format, structure and essential descriptions of the licensing documents before main review
- Queries and Answers
- Request for Additional Information
- Regulatory Dialogue with Applicants
- Consultation with Outside Experts

Licensing Documents for Review

Documents Requested by the AEA

① Radiological Environmental Report

② Safety Analysis Report

③ Safety Administration Rules

④ Design and Construction Methods

⑤ Quality Assurance Program

Documents Requested by the Enforcement Regulation of the AEA

① Construction and Operation Plan

② Storage, Processing and Disposal Methods

③ Types and Volume of RW

④ Technical Capabilities regarding Construction and Operation

⑤ Equipment and Manpower

Summary

- The experiences of safe management of radioactive waste management in Korea was introduced in terms of policy and regulatory framework.
- The Atomic Energy Act simply classifies the radioactive waste into two groups, HLW and LILW.
- The LILW disposal facility (rock cavern type) is in process of licensing review.
  - It is only 100,000 drums to be disposed. The total capacity of facility is 800,000 drums.
  - The disposal method for 700,000 drums has not been decided yet.
- The harmonization approach would be necessary for the disposal method of VLLW, long-lived RW, etc.