Experience of Siting Process for Radwaste Disposal Facility in Korea

Yong-Rae LEE (Vice President)

Korea Radioactive Waste Management Corporation
Contents

1. OVERVIEW OF KRMC
2. NUCLEAR ENERGY PROGRAM IN KOREA
3. RADWASTE MANAGEMENT
4. EXPERIENCE OF SITING SELECTION FOR LILW REPOSITORY
5. SITING PROCESS OF GYEONGJU REPOSITORY
6. LILW REPOSITORY CONSTRUCTION
Chronology

Nov. 2, 2005 : Designation of the Site for a Radwaste Disposal Facility

Apr., 2006 : Request for Improvement of Radwaste from the National Board of Audit and Inspection

Jul. 18, 2007 : Validity Review of Creation of Public Organization (Ministry of Planning and Budget)

Jul. 25, 2007 : Validity Review of Fund Creation (Ministry of Planning and Budget) Regulation Law (Regulatory Reform Committee)

Sep. 27, 2007 : Submission of Bill for Creation of Corporation and Fund to National Assembly

Mar. 28, 2008 : Enactment and Promulgation Act of Radwaste Management

Jan. 1, 2009 : Establishment of KRMC
Mission & Organization

**Mission**
- Transport & Disposal of Low- and Intermediate-Level Wastes
- Interim Storage & Disposal of Spent Nuclear Fuels
- Siting, Construction & Operation of Radwaste Management Facilities
- R&D on Radwaste Disposal and SF Management
- Administration of Radwaste Management Fund

**Organization**
- HQ: 3 Divisions, Fund Management Center
- Wolsong LILW Disposal Center (Gyeongju)
- Radwaste Technology Development Center (Daejeon)

**Employee:** 247
Overview of KRMC

Organization

Head Office

이사장
CEO

Executive Vice President

홍보실
Public Relations Office

지역협력실
Community Cooperation Office

Strategy Planning Division

Radwaste Management Division

Construction Division

Affiliated Organization

전략기획실
Strategy Planning Office
방폐물정책실
Radwaste Management Policy Office
조직예산실
Organization & Budget Office
인력개발실
Human Resources Development Office
행정지원실
General Affairs Office

운영관리실
Radwaste Management Office
운영기술실
Radwaste Technology Office
안전평가실
Safety Assessment Office

사업관리실
Projects Management Office
설계실
Design & Engineering Office
건설기술실
Construction Technology Office

기금관리센터
Fund Management Center
Overview of KRMC

Operation Site

Wolsong Low and Intermediate Level Radwaste Disposal Center

Construction Management Office
공사관리팀
Construction Control Team
기전팀
Mechanical & Electrical Construction Team
토건팀
Civil & Architectural Construction Team

Operation Office
인수운영팀
Receipt & Operation Team
방사선안전환경팀
Radiation Safety & Environment Team

Radwaste Technology Development Center

Research and Development Office

KRMC
Nuclear Power Program in Korea

In Operation
- 20 Units (17,716 MW)

Under Const.
- 6 Units (6,800 MW)

Planning
- 2 Units (2,800 MW)

Daejeon Science Town: KAERI, KINS, KNF, KRMC Technology Center

LILW Repository

Yonggwang 1, 2, 3, 4, 5 & 6

Ulchin 1, 2, 3, 4, 5 & 6
Shin Ulchin 1 & 2 (Planning)

Wolsong 1, 2, 3 & 4
Shin Wolsong 1 & 2 (Under Const.)

Kori 1, 2, 3 & 4
Shin Kori 1-4 (Under Const.)
# Status of LILW Waste Storage

<As of Sep. 2010 / unit: 200 Liter Drum>

<table>
<thead>
<tr>
<th>Site</th>
<th>Capacity</th>
<th>Current</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NPPs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kori (PWR)</td>
<td>50,200</td>
<td>40,566</td>
<td>81%</td>
</tr>
<tr>
<td>Yonggwang (PWR)</td>
<td>23,300</td>
<td>21,012</td>
<td>90%</td>
</tr>
<tr>
<td>Wolsong (PHWR)</td>
<td>9,000</td>
<td>10,030</td>
<td>111%</td>
</tr>
<tr>
<td>Ulchin (PWR)</td>
<td>17,400</td>
<td>16,436</td>
<td>94%</td>
</tr>
<tr>
<td><strong>Sub-Total</strong></td>
<td><strong>99,900</strong></td>
<td><strong>88,044</strong></td>
<td><strong>88%</strong></td>
</tr>
<tr>
<td><strong>KRMC(RI Waste)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9,750</td>
<td>4,465</td>
<td>46%</td>
<td></td>
</tr>
<tr>
<td><strong>KAERI(Refining &amp; Conversion Waste)</strong></td>
<td>27,268</td>
<td>15,203</td>
<td>56%</td>
</tr>
<tr>
<td><strong>KNF(Depleted U Waste)</strong></td>
<td>8,900</td>
<td>6,216</td>
<td>70%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>145,818</strong></td>
<td><strong>113,930</strong></td>
<td><strong>78%</strong></td>
</tr>
</tbody>
</table>
Status of Spent Nuclear Fuel Storage

- Spent Nuclear Fuels are stored temporarily at 4 NPP sites until 2016 as recommended by AEC in Dec. 2004
- Future national policy for spent fuel management will be decided through public participation taking into consideration of national/international trends on policy and technology development.

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<th>Site</th>
<th>Number of NPP</th>
<th>Capacity</th>
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<tbody>
<tr>
<td>NPPs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kori (PWR)</td>
<td>4</td>
<td>6,004</td>
<td>4,469</td>
</tr>
<tr>
<td>Yonggwang (PWR)</td>
<td>6</td>
<td>7,418</td>
<td>4,272</td>
</tr>
<tr>
<td>Ulchin (PWR)</td>
<td>6</td>
<td>6,572</td>
<td>3,511</td>
</tr>
<tr>
<td>Wolsong (PHWR)</td>
<td>4</td>
<td>508,752</td>
<td>319,768</td>
</tr>
</tbody>
</table>

<As of Jun. 2010 / unit: Bundle>
Experiences of Siting Process
- A Hot Potato for nearly two decades (1986-2005)


1st attempt : 1986 – 1989
- Three sites identified through literature survey

2nd attempt : 1990 – 1991
- Ahnmyeon Island selected for site investigation

3rd attempt : 1991 - 1993
- Six sites identified by SNU

4th attempt : 1993 - 1994
- Financial incentives for three sites suggested

5th attempt : 1994 - 1995
- The Gulup Island chosen by the government
Experiences of Siting Selection - A Hot Potato for nearly two decades (1986-2005)

Four Times by MOCIE / KHNP (1997 - 2004)

- 6th attempt: 2000 - 2001
  - Solicitation opened to 46 local governments
- 7th attempt: 2002 - 2003
  - Solicitation to four possible cities around NPP
- 8th attempt: 2003
  - Wido Island in Buan county was selected as a potential candidate
  - Financial incentives were offered to 7 cities

Nine attempts from 1986 had all failed

From now on,
A brief overview of each attempt for 20 years
1st Phase Site Selection Attempt

DURATION: 1986 ~ 1989

SITE: Ulchin, Youngduk, Youngil, Kyung-buk province

AGENT: KAERI / MOST

SELECTION: Comprehensive Site Selection Study

FAILURE: Strong Protests of Local Residents
- Distrust of safety
- Unilateral site survey without discussion with residents
2nd Phase Site Selection Attempt

DURATION: 1990 ~ 1991

SITE: Ahnmyeon Island, Tae-an (Chungnam province)

AGENT: KAERI / MOST

SELECTION: Political inference with local provincial government

FAILURE: Strong Protests of Local Residents
- Distrust of safety
- Closed-door administration
**3rd Phase Site Selection Attempt**

**DURATION**: 1991 ~ 1993

**SITE**: Gosung, Yangyang (Kangwon province)
Uljin, Youngil (Kyoungbuk province)
Jangheong (Jeonnam province)
Taean (Chungnam province)

**AGENT**: KAERI / MOST

**SELECTION**: Institute of Social Studies at SNU

**FAILURE**: Strong Protests of Local Residents
- Aggressive intervention of anti-nuclear groups
- Political issue of politicians
4th Phase Site Selection Attempt

DURATION: 1993 ~ 1994

SITE: Yangsan, Jangan (Kyungnam province) Ulchin, Gosung (Kyungbuk province)

AGENT: KAERI / MOST

SELECTION: Local Application and Participation Support of Its Regional Community for Compensation (Law of Compensation)

FAILURE: Strong Protests of Local Residents
- Distrust of safety
- Opposition of nearby residents
5th Phase Site Selection Attempt

**DURATION**: 1994 ~ 1995

**SITE**: Gulup Island (Dukjeon, Wongjin, Incheon city)

**AGENT**: KAERI / MOST

**SELECTION**: Law of Solicitation and Compensation for Radwaste Management - Consideration of Resident Acceptability

**FAILURE**: Technical problem - Discovery of capable faults into the submarine within 3 km of Gulup Island
6th Phase Site Selection Attempt

DURATION: 2000 ~ 2001

SITE: 46 Coastal Areas

AGENT: KHNP / MOCIE (KAERI → KHNP)

SELECTION: Nationwide Bid Solicitation (46 Local Governments)

FAILURE: No applications and Siting unsuccessful
- Strong arguments for and against residents
7th ~ 9th Phase Site Selection Attempt

DURATION: 2001.7 ~ 2004.11

SITE: Youngduk, Ulchin (Kyungbuk province)
Younggwang (Jeonnam province)
Gochang (Jeonbuk province)

AGENT: KHNP / MOCIE

SELECTION METHOD: Agent Selection and Bid Solicitation

1. Agent Selection: Each two of the east coast and the west coast based on technical inference
2. Bid Solicitation: Gunsan, Buan (Jeonbuk province)

FAILURE: Strong Protests of Local Residents
- Distrust of government policy
- Aggressive intervention of anti-nuclear groups
Experiences of Siting Selection

10th Phase Site Selection Attempt

**DURATION:** 2004.12 ~ 2006.1

**SITE:** Gyeongju, Youngduk, Pohang (Kyungbuk province)
Gunsan (Jeonnam province)

**AGENT:** KHNP / MOCIE

**SELECTION METHOD:** Bid Solicitation and Resident’s Voting

**SELECTION:** Gyeongju-city, Kyungbuk province

4 Success Factors of Site Selection can be summarized…
## Factor to success of radwaste site selection

<table>
<thead>
<tr>
<th>Causes of Failure</th>
<th>Factors to success of site selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disquiet about long-term safety</td>
<td>Separation of LILW and HLW</td>
</tr>
<tr>
<td>Lack of transparency of decision making</td>
<td>Organization of site selection committee</td>
</tr>
<tr>
<td>Shortage to stakeholder’s participation in decision making process</td>
<td>Free decision through resident’s vote</td>
</tr>
<tr>
<td>Lack of confidence to the proposed incentives by the government and nuclear industry</td>
<td>Enactment of a special law for hosting area support</td>
</tr>
</tbody>
</table>
Siting Process for Gyeongju LILW Repository

- Amendment of Radwaste Management Policy (2004.12)
  - Separation of LILW and HLW

- Enactment of a Special Law for Hosting Area Support (2005.3)
  - Special Support Fund: 300 billion KRW (272 million USD)
  - Local Support Fee: 637,500 KRW (580 USD)/drum (200 liter standard)
  - Moving the KHNP Head Office to Gyeongju-city
    * KHNP: Korea Hydro & Nuclear Power Corporation
      (It operates 20 nuclear power plants)

- Organization of site selection committee (2005.3)
  - Within 20 representatives of all levels (Science, Technology, Culture, Social, Media, Legal and Civil Group) of society

- Public Notice for New Site Selection Procedures (2005.6)
  - Public notice (‘05.6.16) → Solicitation application (~’05.8.31) → Demand resident’s vote (~‘05.9.15) → Implementation of Resident’s vote → Final candidate site selection
Siting Process for Gyeongju LILW Repository

Gyeongju-city was selected among the four volunteered local governments by the resident’s vote (Nov. 2, 2005)

The consent vote rate of four provinces

- Gyeongju-city: 89.5%
- Gunsan-city: 84.4%
- Youngdok-county: 79.3%
- Pohang-city: 67.5%

‘Bonggil-ri, Yangbuk-myun, Gyeongju-city’ designated as a LILW disposal facility site by the government (Jan. 2, 2006)

Location of LILW repository

- 20 km far from downtown in Gyeongju
- Near Wolsong nuclear power plant site
- Near 1st class tourist attraction
Incentives for Gyeongju-city

Financial Support
300 billion KRW (272 million USD) (May 2006)

Moving the KHNP Head Office to Gyeongju-city
KHNP operates 20 nuclear power plants
Janghang-ri, Yangbuk-myun, Gyeongju-city
- Expected completion date: Dec. 2014

Proton Accelerator Project
Hwachun-ri, Gunchun, Gyeongju-city
(Feb. 2006)
- Expected completion date: May 2012

Government Support for Local Community Projects
Support plan for local community projects approved by ‘Committee for Local Government Support’ (Apr. 2007)
- 55 Projects (3.2 trillion KRW (2.9 billion USD))
LILW Repository Construction

Status of LILW Disposal Facility Construction

Location
- Bonggil-ri, Yangbuk-myun, Gyeongju-city (near Wolsong NPP site)

Site Area
- 2,130,104 m²

Capacity
- 100,000 Drums (200ℓ) for the 1st Stage
  (Final Capacity: Total 800,000 Drums)

Disposal Method
- Underground Silo Type / 80m~130m below surface (1st Stage)
  * 2nd stage is considering the near-surface disposal as well as the cavern type disposal

Duration
A Bird’s – eye View of Wolsong LILW Disposal Facility

Surface Facilities

Disposal Site

Environment Friendly Complex

LILW Repository Construction
Design of the disposal facility (1st stage)

• Facility Profile

Entrance tunnels
(W 8.0m, H 7.5m)
- Operation tunnel
- Construction tunnel

Disposal caverns
- Vertical Silo
  27.3m (D) x 50m(H)
  16,700 drums/each
Operation of Underground Silo
Concept of Underground Silo after Closure
Surface Facility

- Waste Reception & Storage Building
- Waste Treatment Building
- Equipment Maintenance Shop
- Service Building
Underground Facility

- Operation Tunnel: Transportation of radwaste
- Construction Tunnel: Transportation of construction equipment and materials
- Shaft: Entrance for workers
- Silo: Final disposal of radwaste

[Portal] [Shaft Entrance]
LILW Disposal Facility Construction

- **Overall Process Rate**: 72% (Dec. 31, 2010)

- **Operation Tunnel**
  - Excavation rate: 97%, (1,378 m / 1,415 m)

- **Construction Tunnel**
  - Excavation rate: 62%, (1,216 m / 1,950 m)
Transport Ship - HJ CHEONGJEONGNURI

SPECIFICATIONS

- Length: 78.6 M
- Width: 15.8 M
- Gross Tonnage: 2,600 Ton
- Speed: 12.0 Knots
- Engine: Diesel×2 (1632 HP×2)
- Capacity: Max. 1,520 Drums

<Apr. 15, 2009>
- Painful Experiences for 20 years
- Upgraded Nuclear Industry
- NIMBY became WIMBY
- Communication, Transparency, Trust
Thank you for your attention!