

Progress of New Research Reactor Project in Korea and Radioxenon Emission Management Strategy for Fission Mo-99 Production

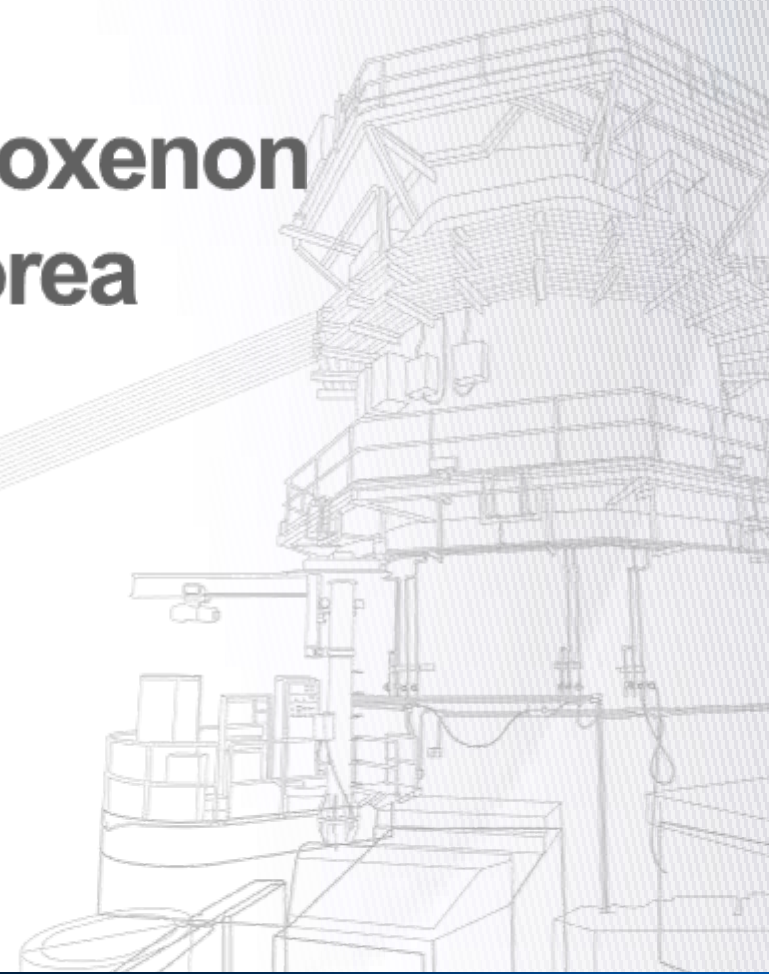


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Korea Atomic Energy Research Institute (KAERI)

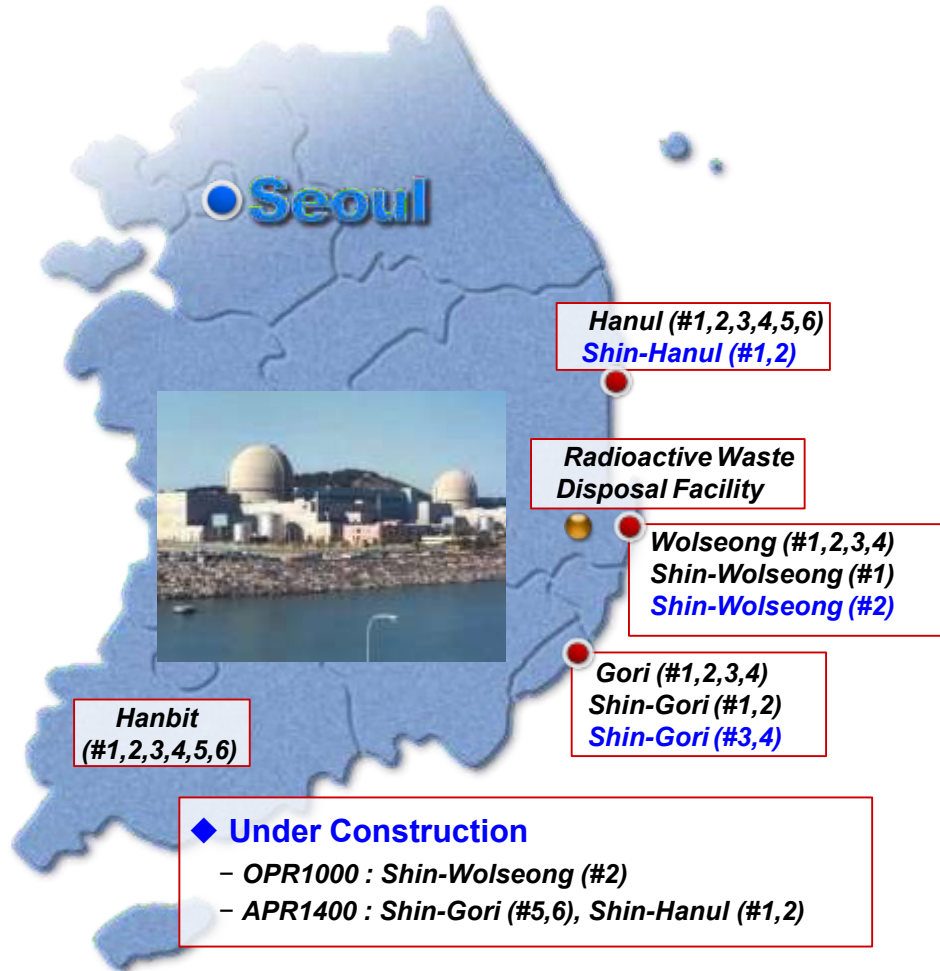


Introduction: Radioxenon Sources in Korea



NPPs in Korea

China



Japan

RI Production Infrastructures in Korea

KIRAMS – Seoul
50&30 MeV Cyclotrons



KOMAC (KAERI) – Gyeongju
100 MeV Proton Accelerator



KAERI – Daejeon

HANARO 30 MW RR (Multipurpose)



Preparing upgrade to
200 MeV or 500 MeV

ARTI (KAERI) – Jeongseup
30 MeV Cyclotron

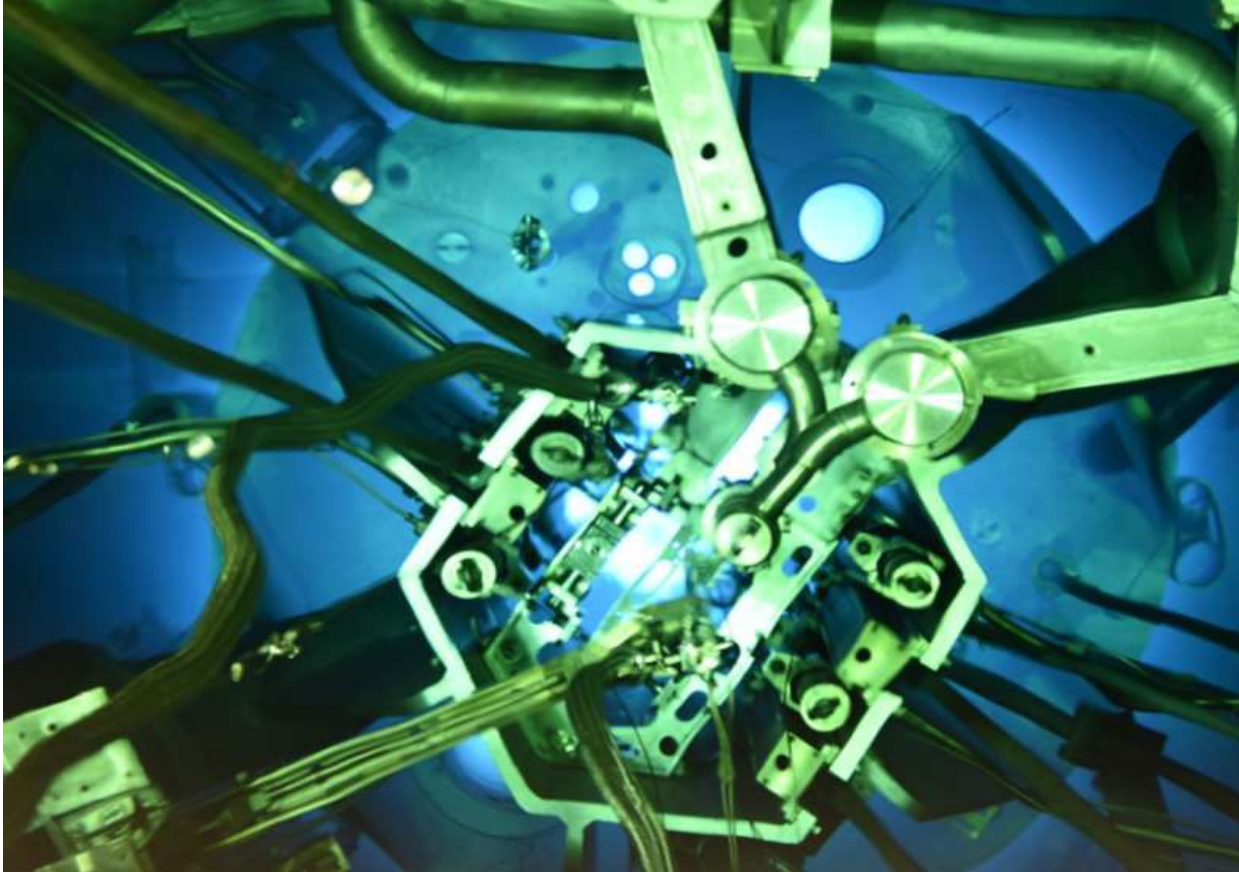


KJRR (KAERI) – Busan
15 MW RR (Isotope Production RR)



HANARO is Back !!! (May 2021)

- » 5% operation since 2014 ~ April 2021
Iodine-131 production will resume, soon



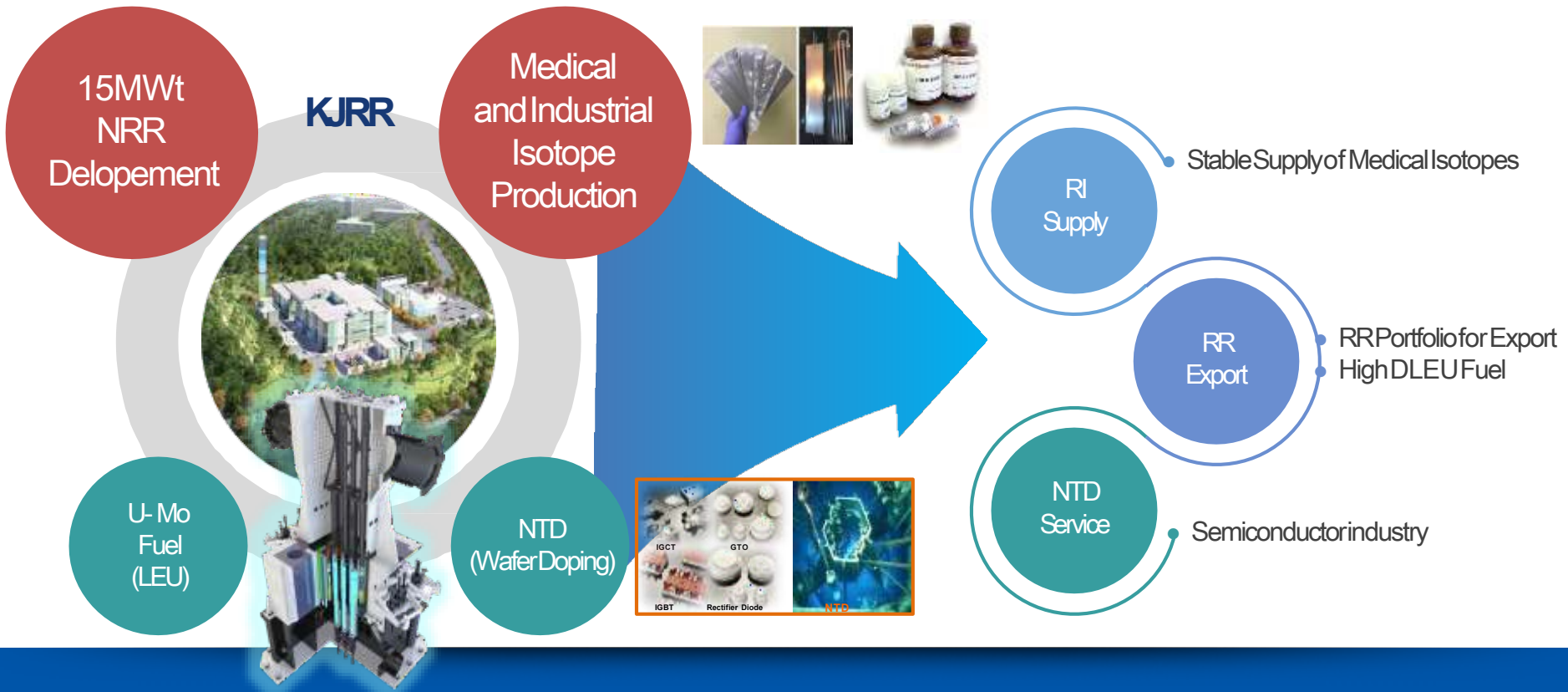
New RR Progress



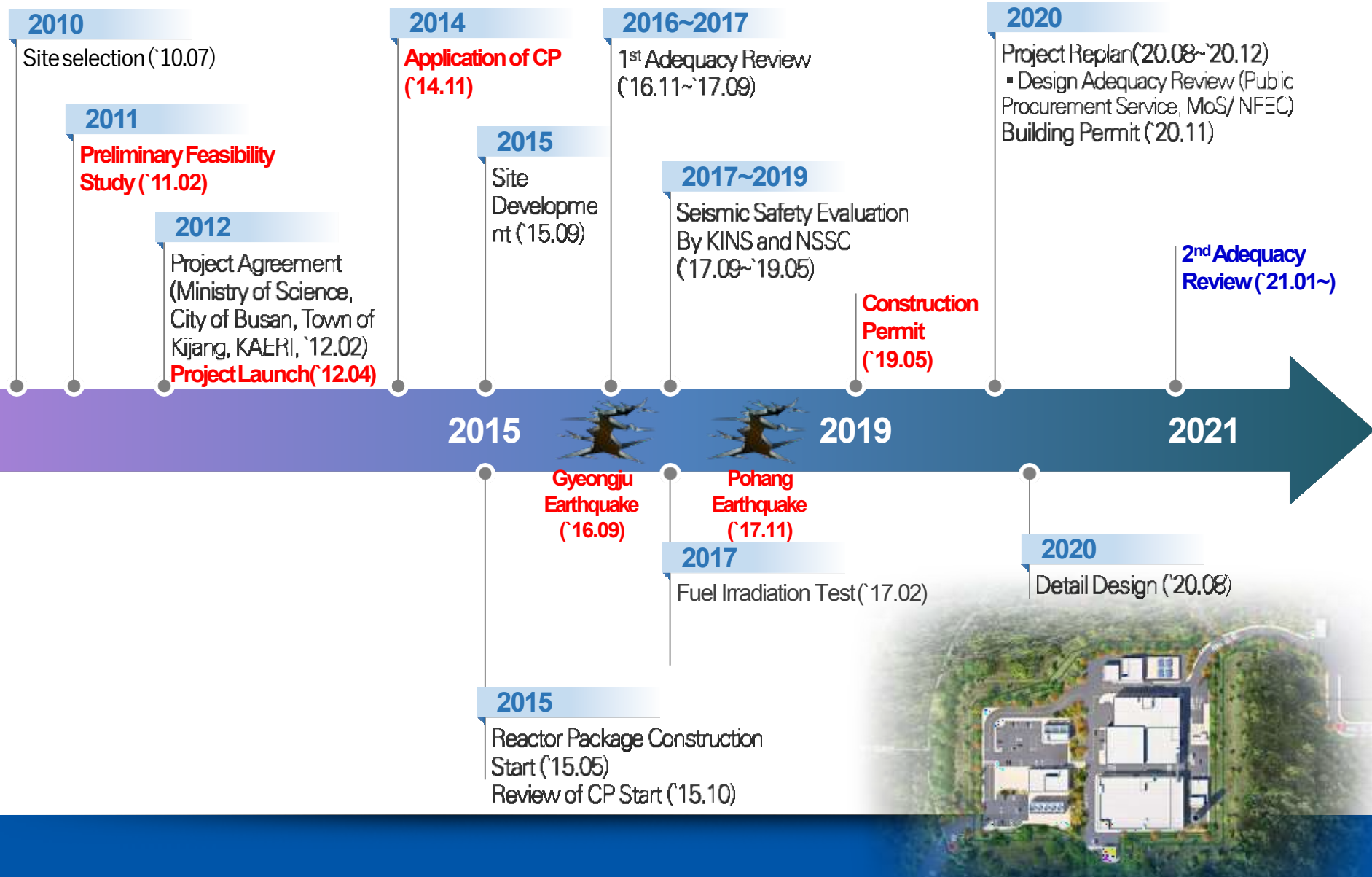
KJRR Introduction



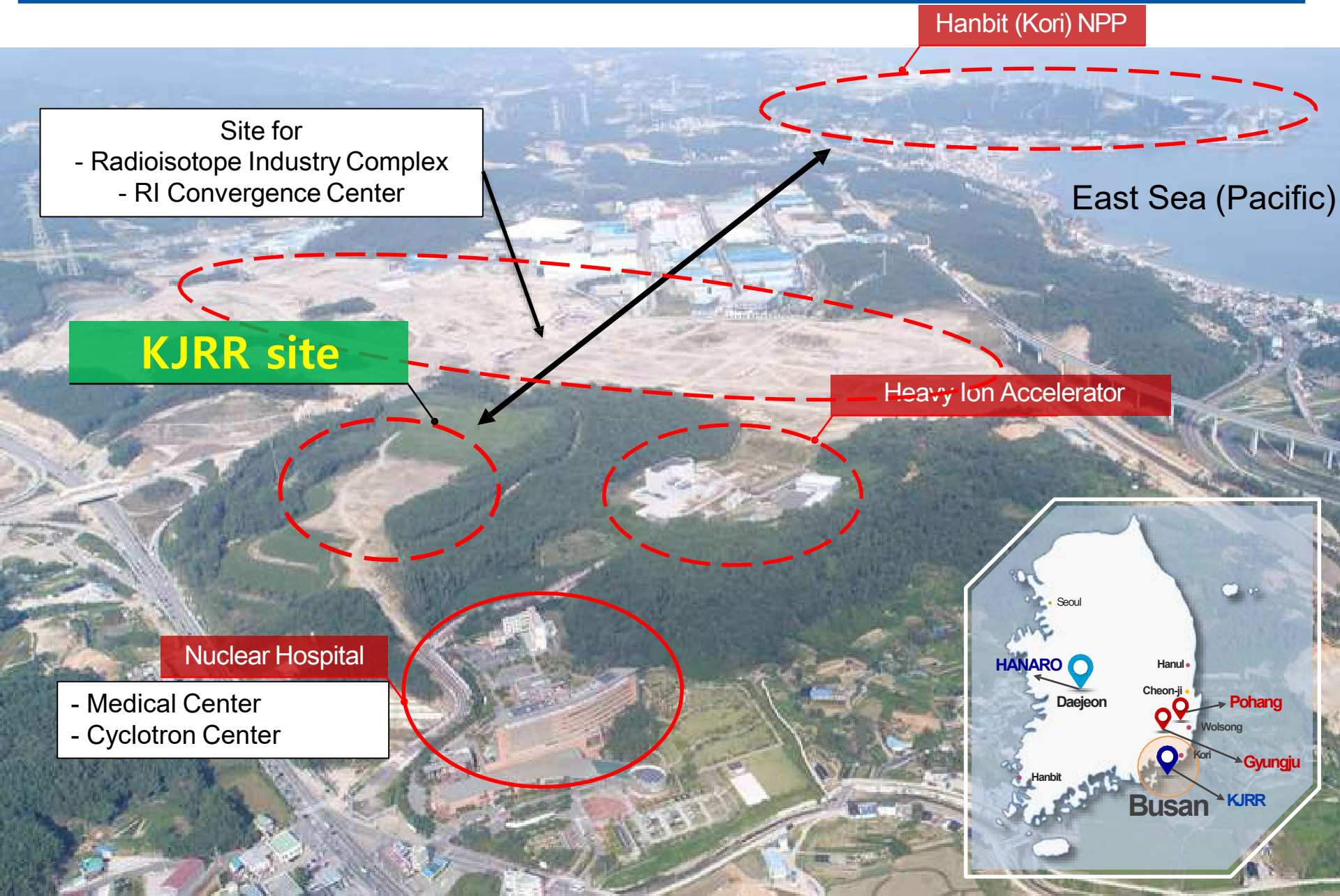
- ▶ **Stable supply of Mo-99 & RIs at home (Korea) and abroad**
- ▶ **Development of high performance of the LEU fuel**
 - High density U-Mo fuel and fission moly target
- ▶ **Development of the tech. and components for the next-G RR**
 - Different design characteristics from HANARO



KJRR Progress



KJRR Site: Bird's Eye View



Hanbit (Kori) NPP

Site for
- Radioisotope Industry Complex
- RI Convergence Center

KJRR site

East Sea (Pacific)

Heavy Ion Accelerator

Nuclear Hospital

- Medical Center
- Cyclotron Center



Site Overview



Stack

- Site area : 130,495 m²
- Building area : 31,749 m²

RIPF

RWTF

Rx

FMPF

Utility
Building

Major Changes in Project

Project Budget

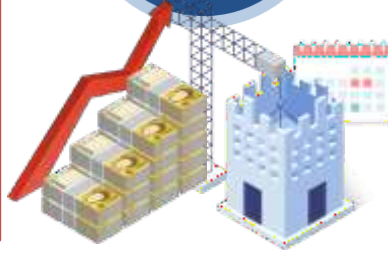
(Issues in detail design, regulation and amendment of laws)

(Present) 390M USD



→ 730M USD

Major Change



Period

(JRTR experience, Amendment of labour law etc.)

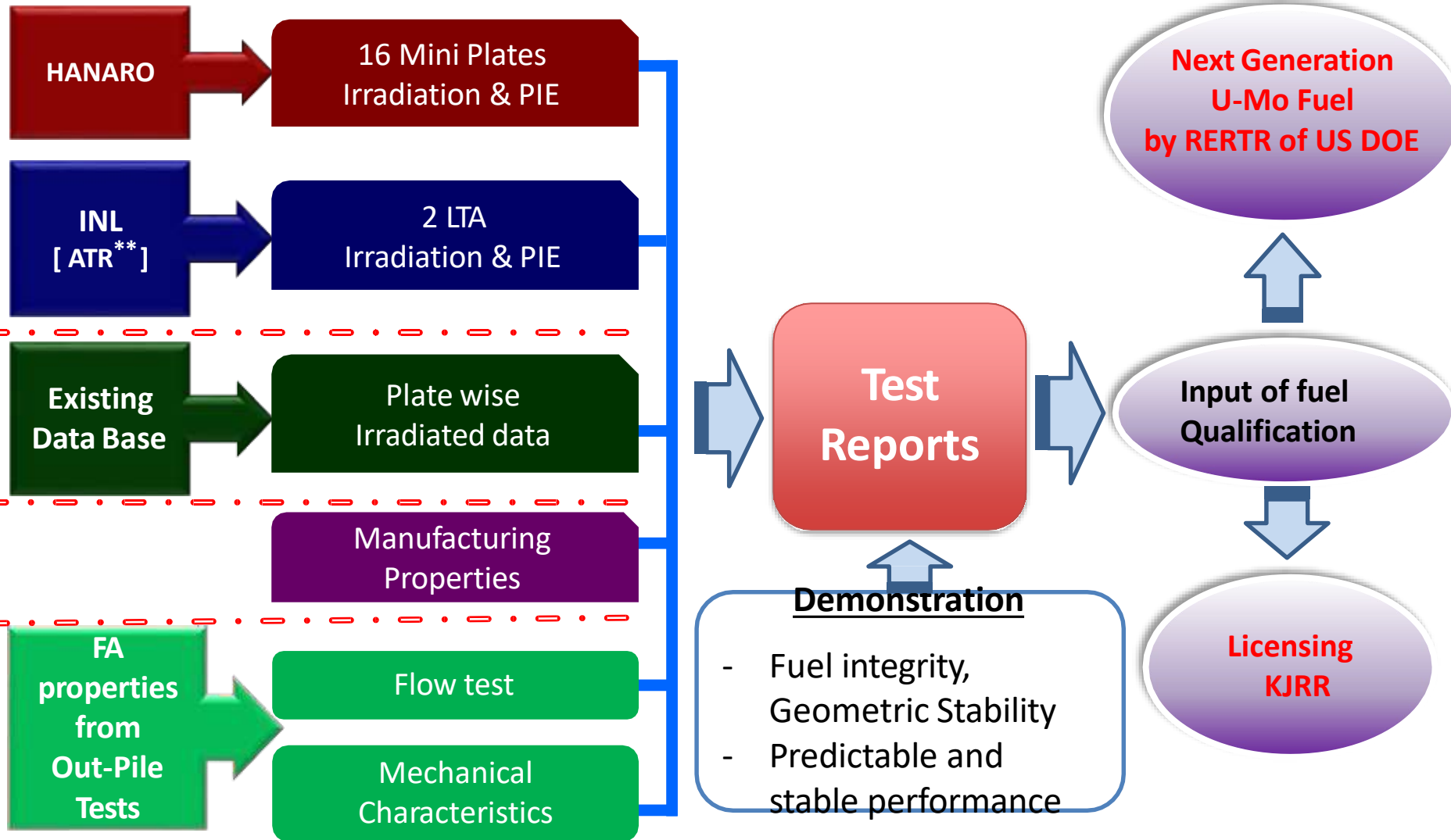
(Present) '12.4~'23.12 (11Y 9M)



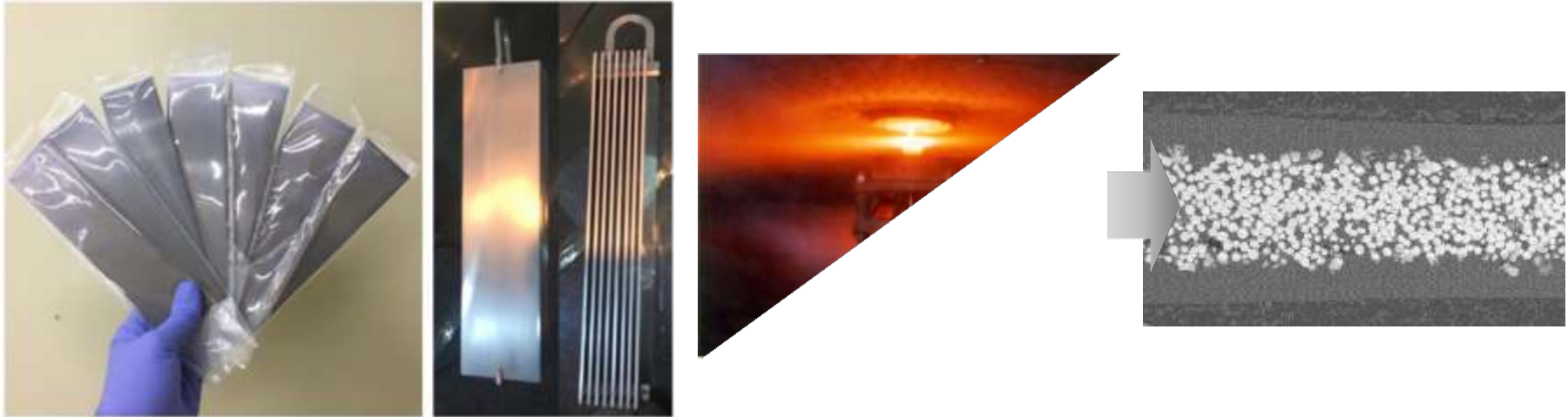
→ '12.4~'26.6 (14Y 3M)

2012	2017	2021
<ul style="list-style-type: none"> ▪ Site area: 50,000m² ▪ Building area: 15,000m² 	<ul style="list-style-type: none"> ▪ Site area: 130,495m² ▪ Building area: 31,749m² 	<ul style="list-style-type: none"> ▪ Site area: 130,495m² ▪ Building area: 31,132m²
<ul style="list-style-type: none"> ▪ Power: 20MWt 	<ul style="list-style-type: none"> ▪ Power: 15MWt 	<ul style="list-style-type: none"> ▪ Power: 15MWt

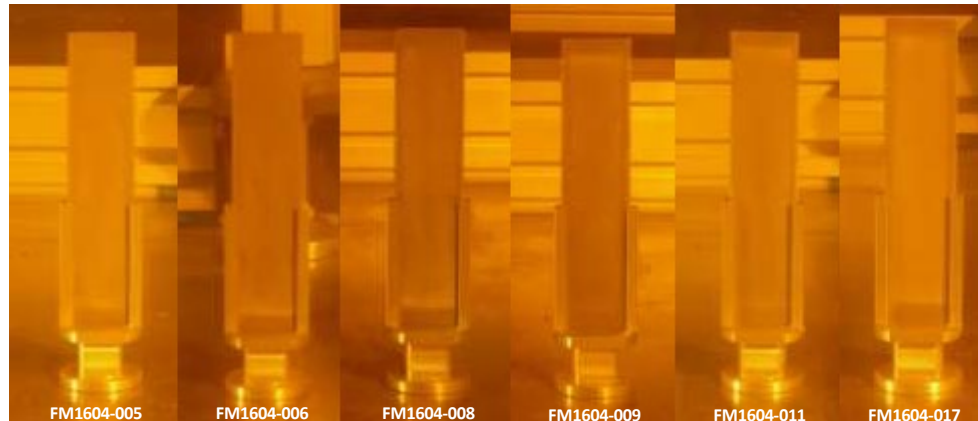
U-Mo Fuel Qualification Scheme



Mo-99 Target Development



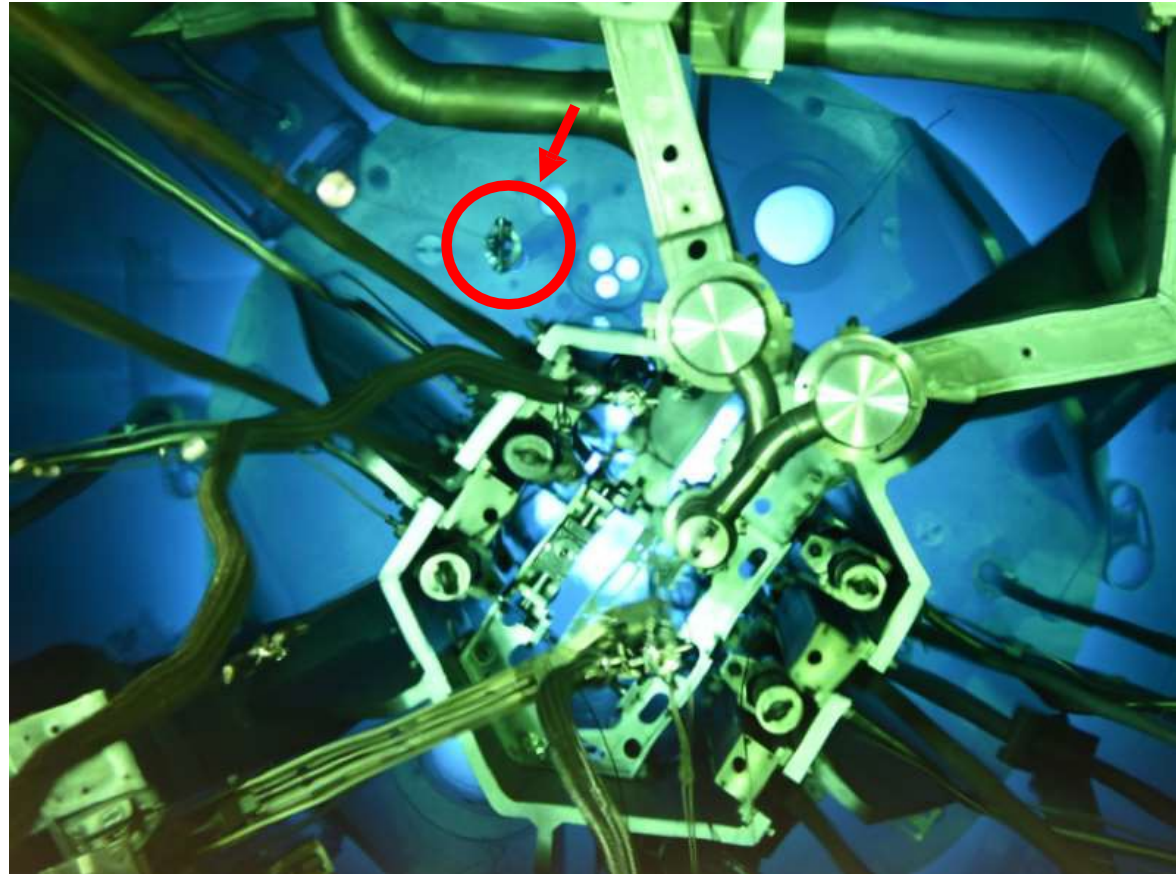
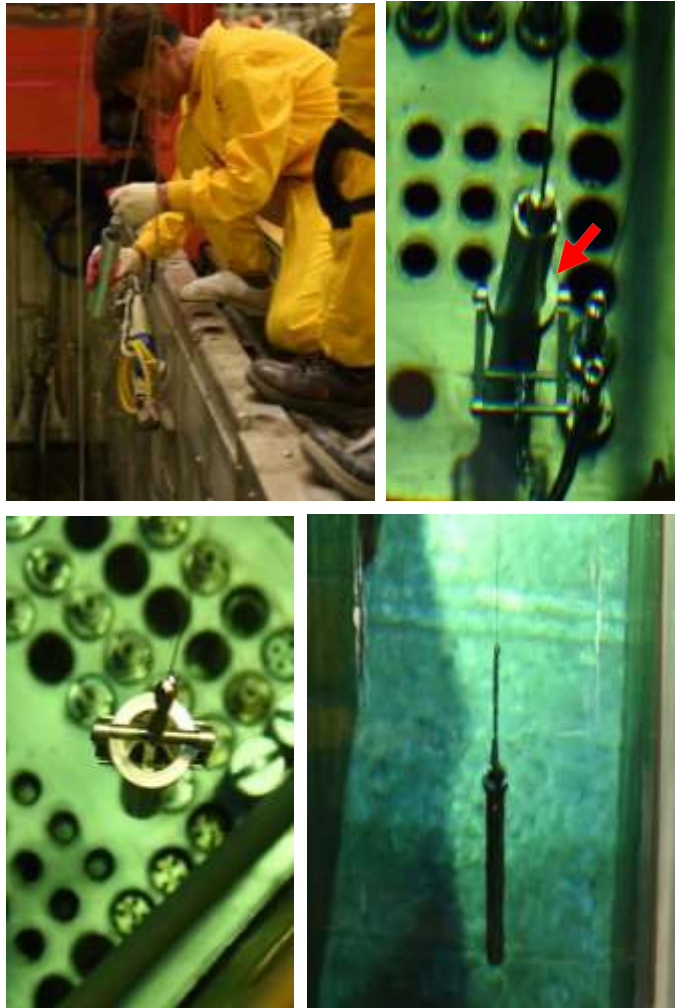
- » Medium density LEU target has been developed for the fission Mo-99 production from KJRR and ready to supply in large-scale
- » Supply to major Mo-99 producers is under discussion



Post Irradiation Exam
At HANARO

Hot Test Production Test at HANARO (in May 2018)

» Target irradiation at HANARO, Test Production at RIPF, IMEF

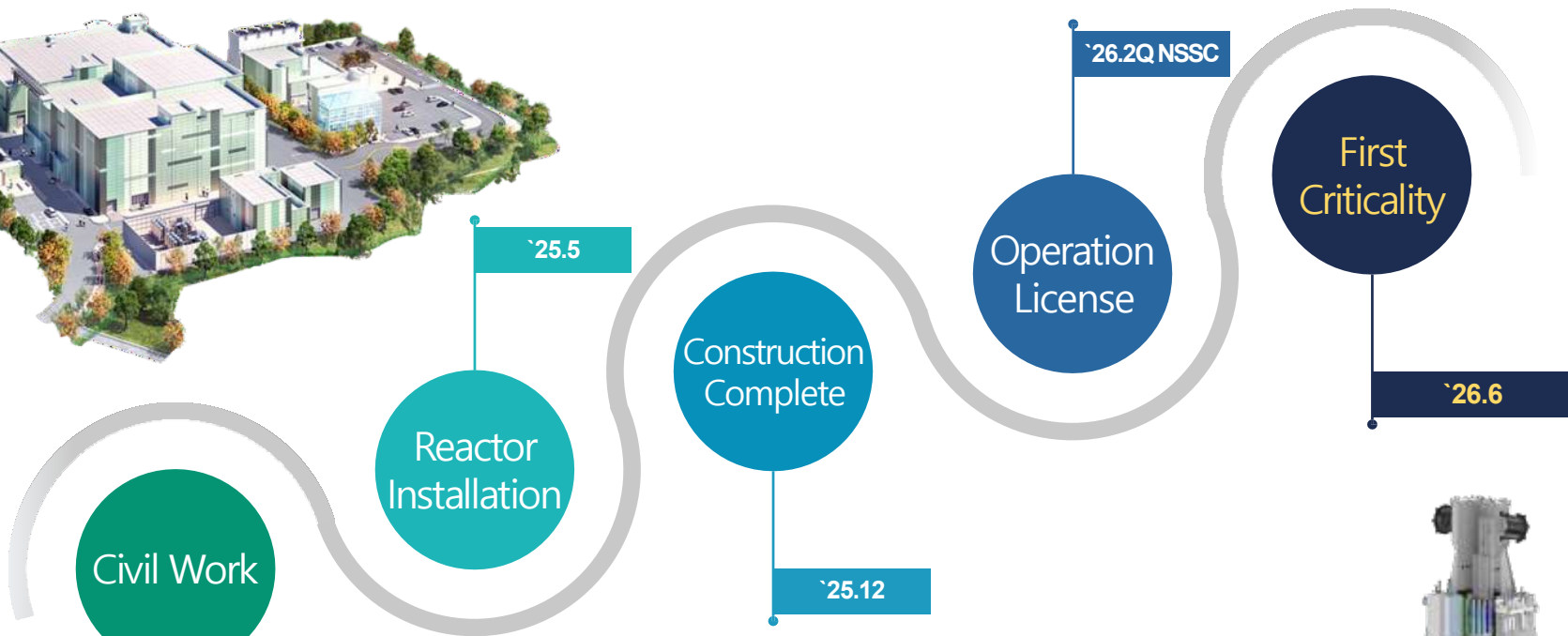


KJRR Plan

Construction ('21.4Q~'25.12)

Commissioning ('26.1~'26.5)

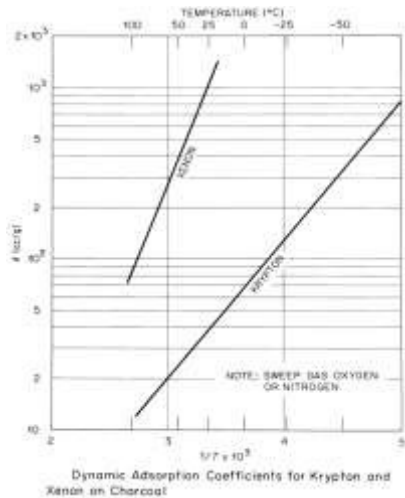
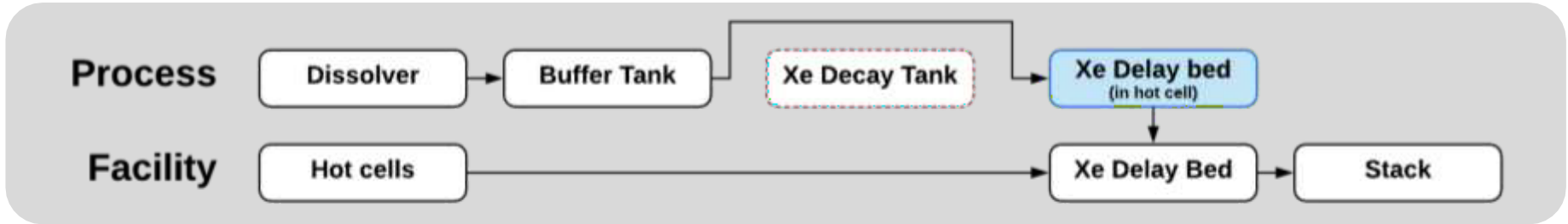
First Criticality ('26.6)



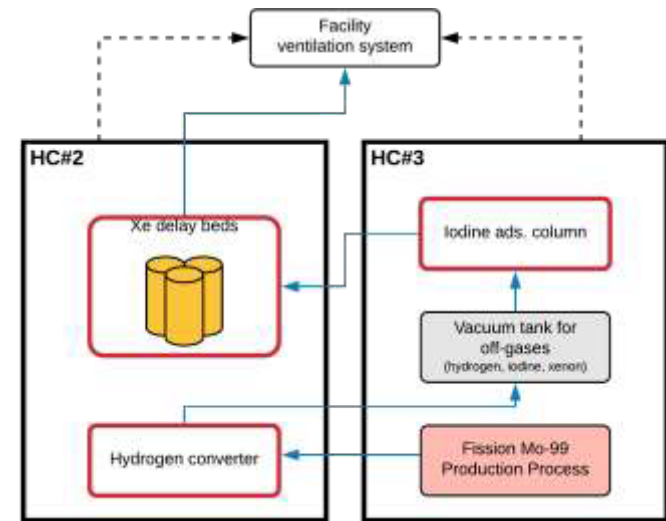
Development of Xe Mitigation Strategy for KJRR



Radioxenon Mitigation System



Replace of decay tanks



» Efficiency improvement of the radioxenon emission mitigation using low-temperature-operable delay bed

Radioxenon Mitigation System

» Radioxenon emission from FMPF in KJRR (expected)

- 1 batch calculation: 8 target plates, 7 days irradiation, 1 day cooling

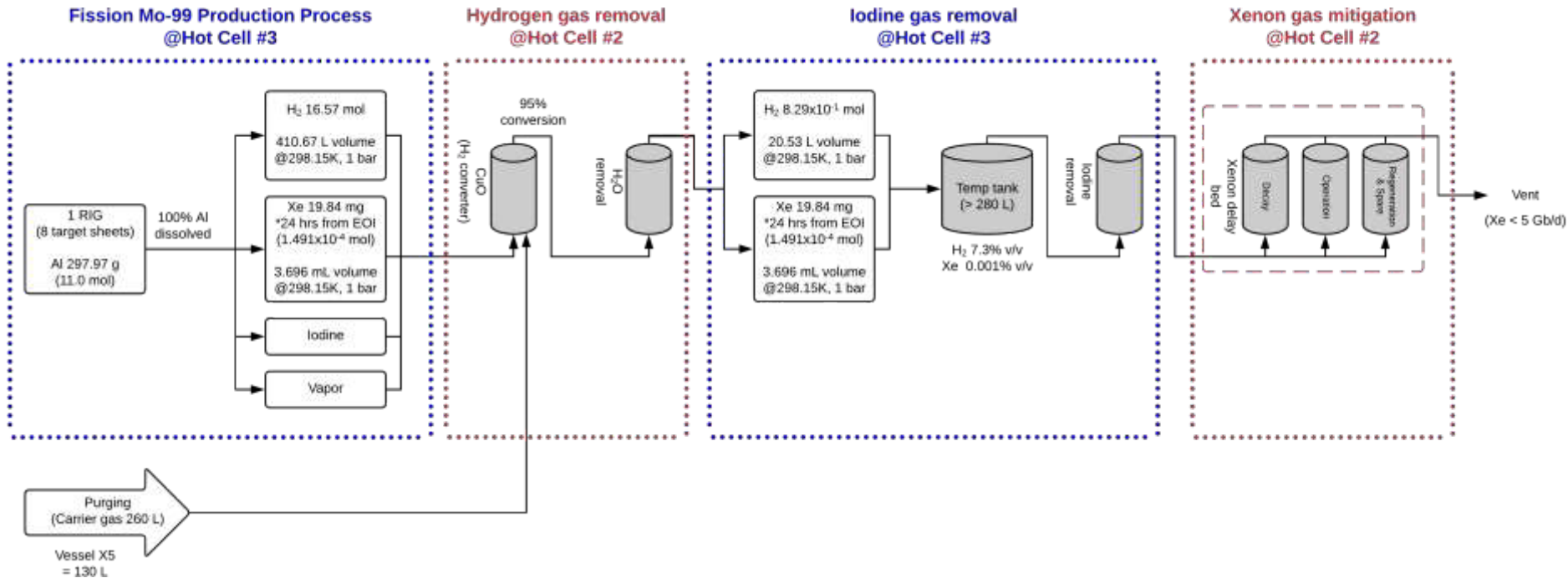
from KJ-810-KC-384-004 (rev. 2), 2020-08-28

Nuclide	Activity for a FM target ¹⁾ (Ci)	Chemical quantity (moles)	Mass (mg)	Volume ²⁾ (mL)
Xe-131m	3.164E+00	2.869E-07	3.759E-02	7.113E-03
Xe-133	3.539E+03	1.422E-04	1.892E+01	3.526E+00
Xe-133m	1.490E+02	2.509E-06	3.336E-01	6.219E-02
Xe-135	1.388E+03	4.049E-06	5.466E-01	1.004E-01
Xe-135m	7.986E+01	6.495E-09	8.768E-04	1.610E-04
sum	5.159E+03	1.491E-04	1.984E+01	3.696E+00

1) After 24 hours from EOI(End of Irradiation)

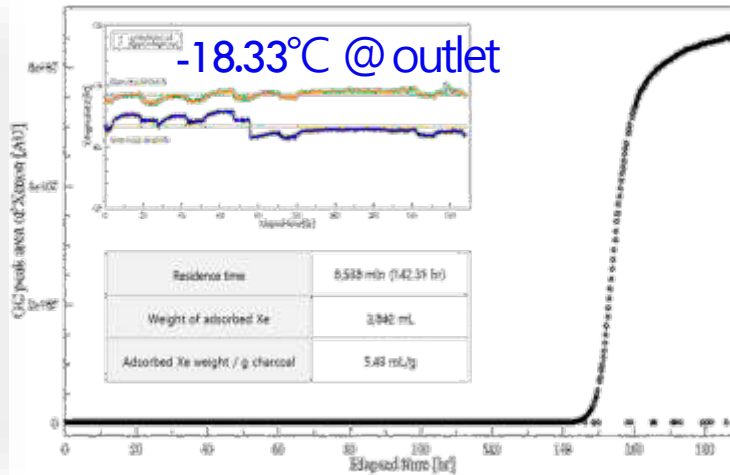
2) at SATP condition (298.15K, 1 bar)

Radionuclide Mitigation System

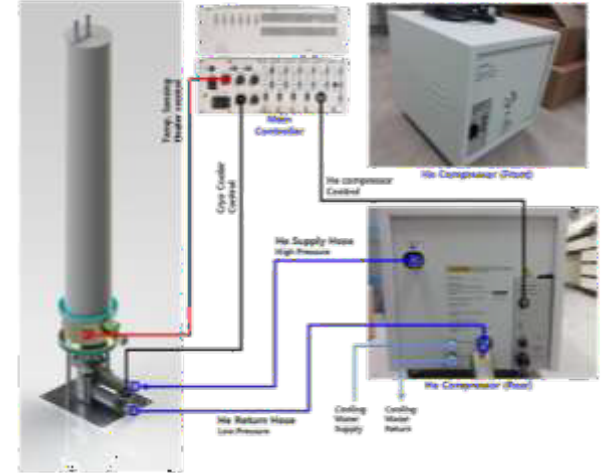


Radioxenon Mitigation System

» Mitigation performance at the low temp.



» Cryocooled design



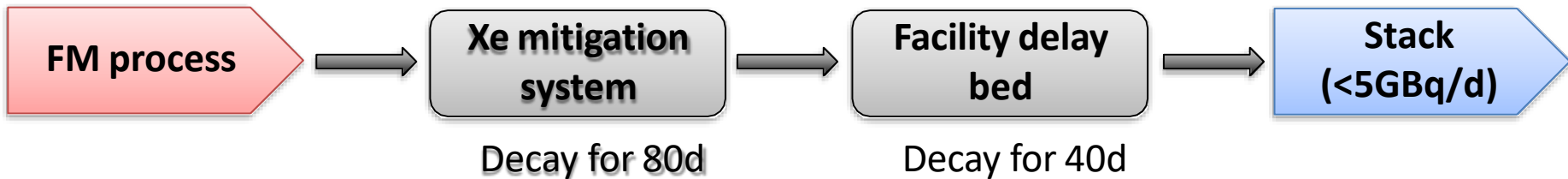
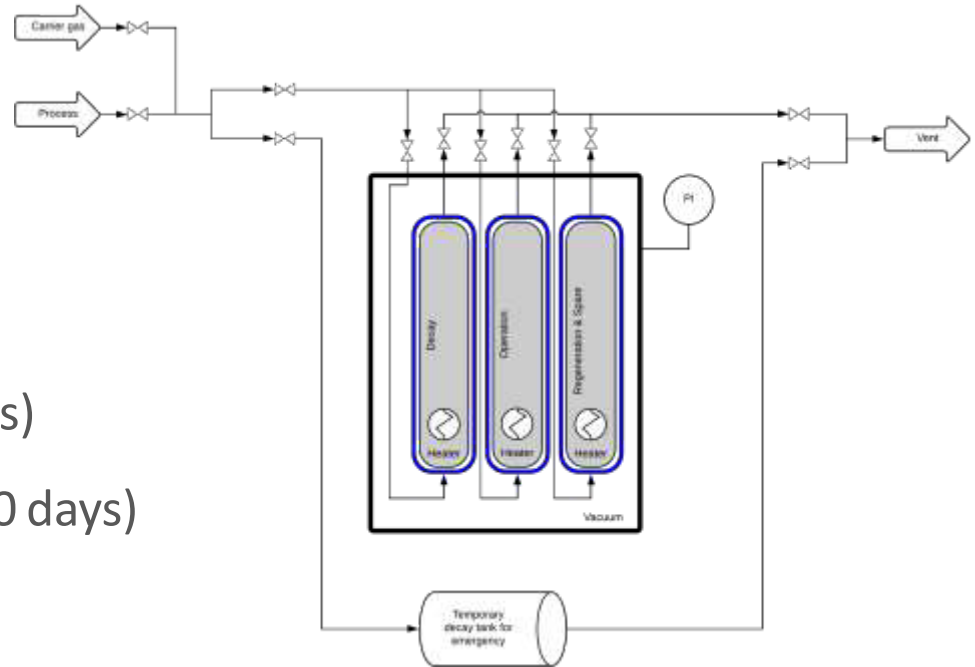
- Capacity for 36 batches with with $\varnothing 86 \times 840$ bed dimension
- Retention over 6 weeks (Assumption: 6 batches for a week)

Radionuclide Mitigation System

» Liquid cooled design

» 3 beds operation

- 1 - Operation (hold-up for 40 days)
- 2 - Decay (close & hold-up for 40 days)
- 3 - Regeneration



Summary

- **2.5Y delay in KJRR project**
 - Aiming construction starts 4Q 2021, First criticality 2026.6
- **KJRR project is under 2nd Adequacy Review to increase project budget**
- **Progress in U-Mo fuel, LEU Target, Facility Design etc.**
- **Development of Xe mitigation strategy for KJRR**
 - Chilled charcoal column for process off-gas
 - Delay beds for Hot Cell exhaust
 - STAX needs further political discussion in upper level (Ministry of Foreign Affair, NSSC etc.), due to the data sharing..

WOSMIP ? World's Biggest Sandwich !

Posted by u/Lokimonoxide 1 year ago

138k
I'm in Gunpo, South Korea. I found a guy in Montevideo, Uruguay on Reddit, the exact opposite side of the world. Today we made an Earth Sandwich, 8AM for me, 8PM for him. I love the Internet.

imgur.com/mah3BR...



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Noble Gas Monitoring and Mitigation



Medical Isotope Production

Thank You for Your Attention !!!



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