

Technologies for contaminated water treatment and remote handling systems

**WM2017 Session 34; Fukushima Daiichi NPP- Focus on 1F
On-Site Decommissioning and Waste Management**

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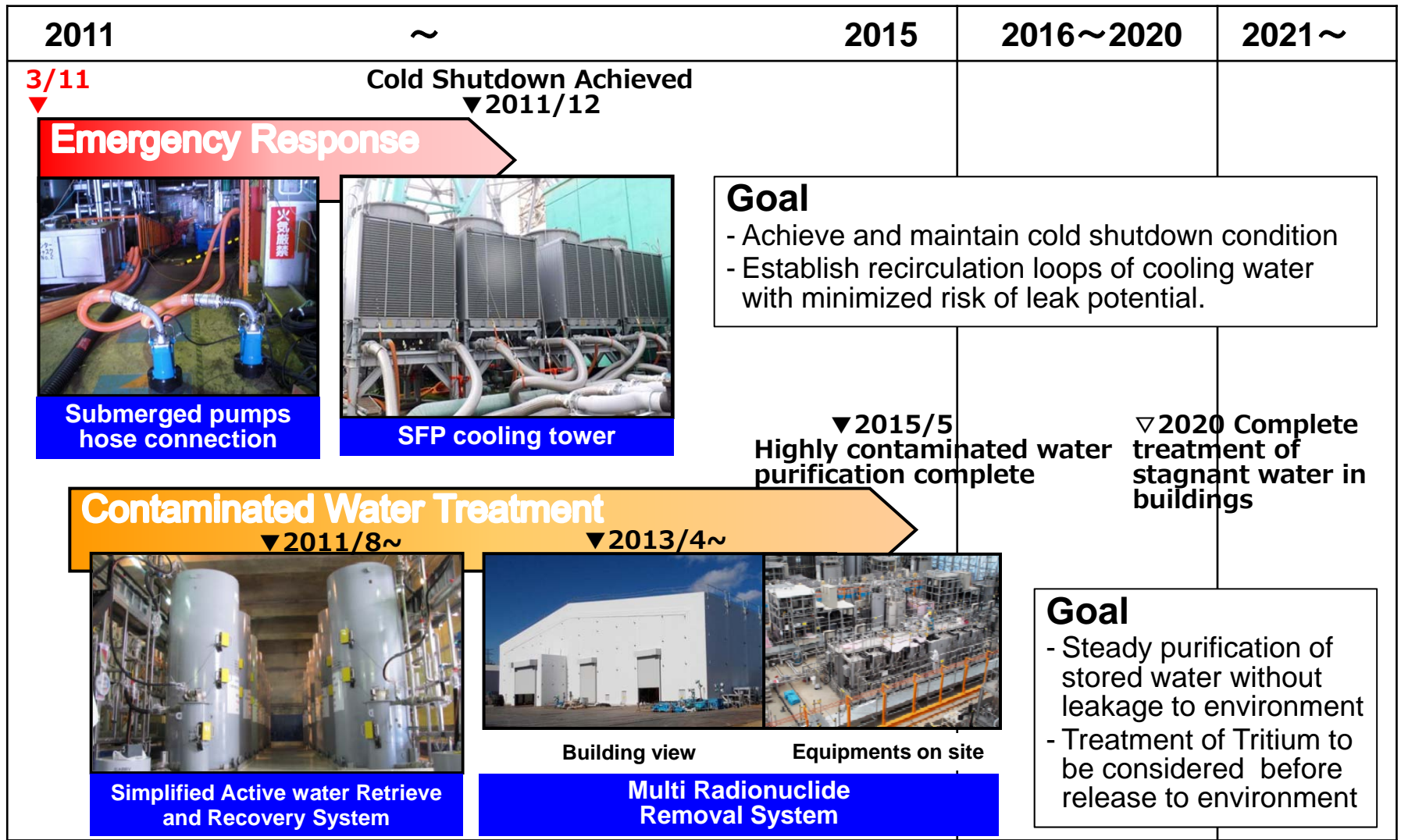
Nuclear Energy Systems & Solutions Division

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- **Water Treatment Systems**
 - **Simplified Active water Retrieve and Recovery System(SARRY™)**
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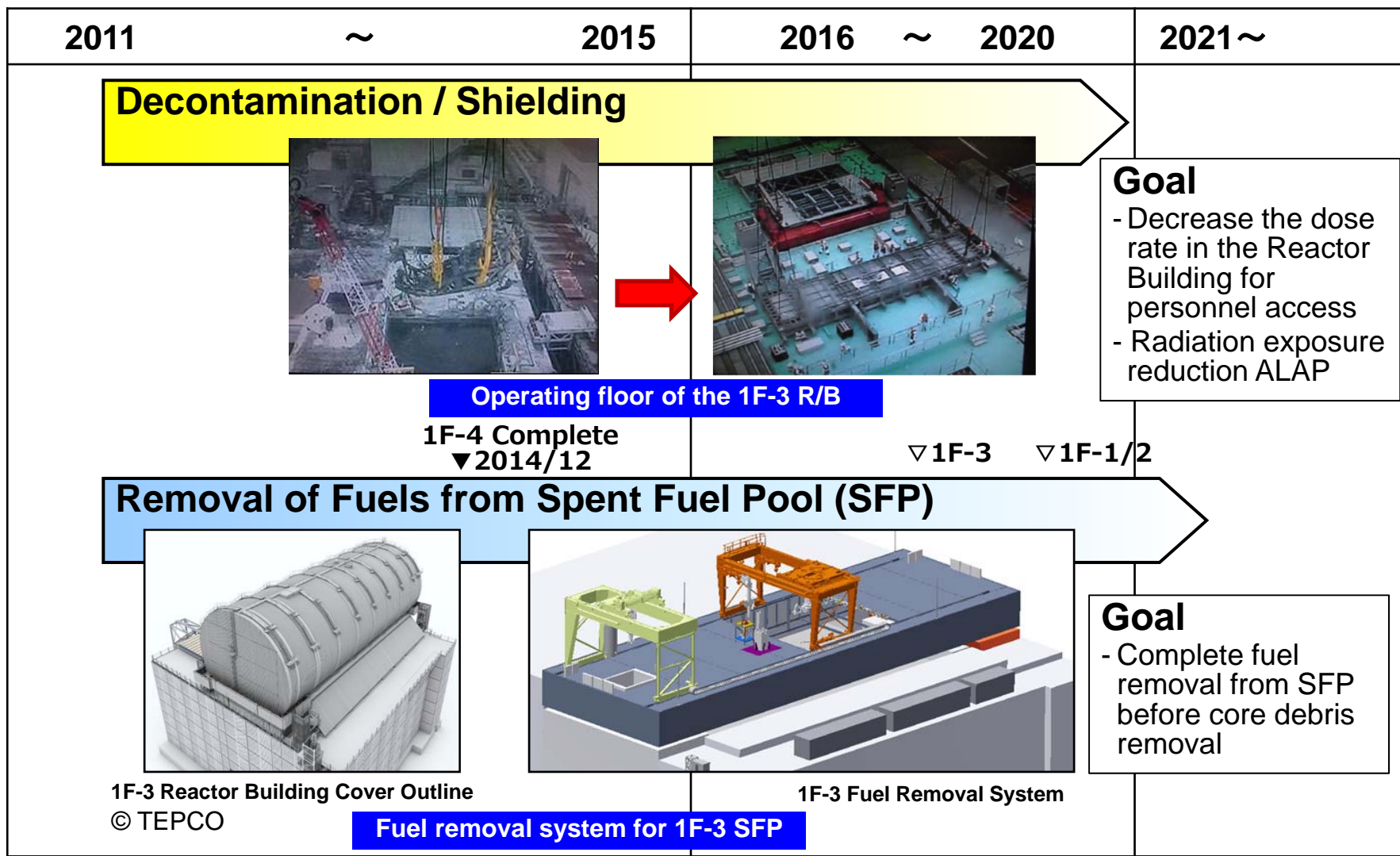
Our Activities for Fukushima Restorations (1/3)

■ Short Term Activities



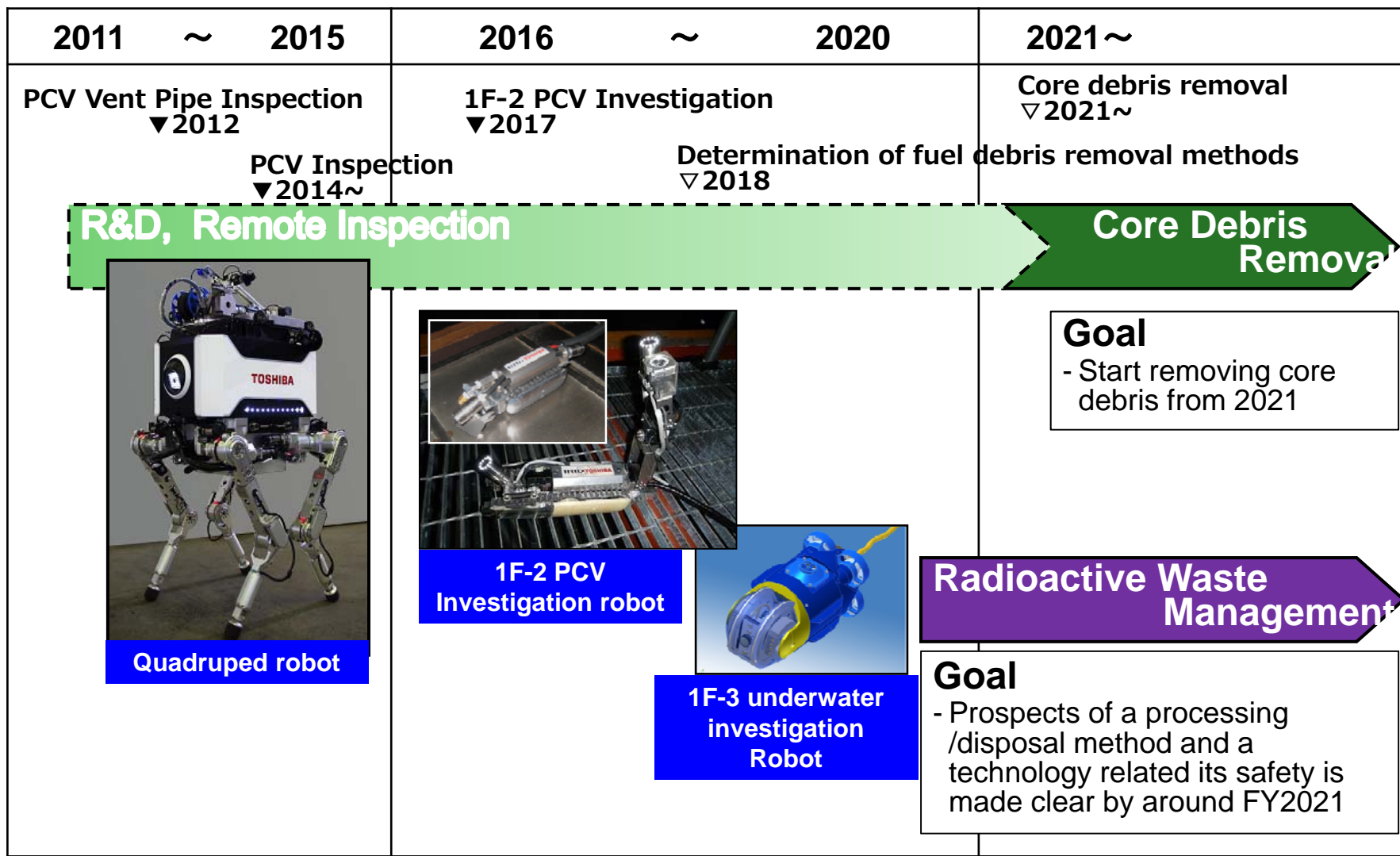
Our Activities for Fukushima Restorations (2/3)

Mid Term Activities



Our Activities for Fukushima Restorations (3/3)

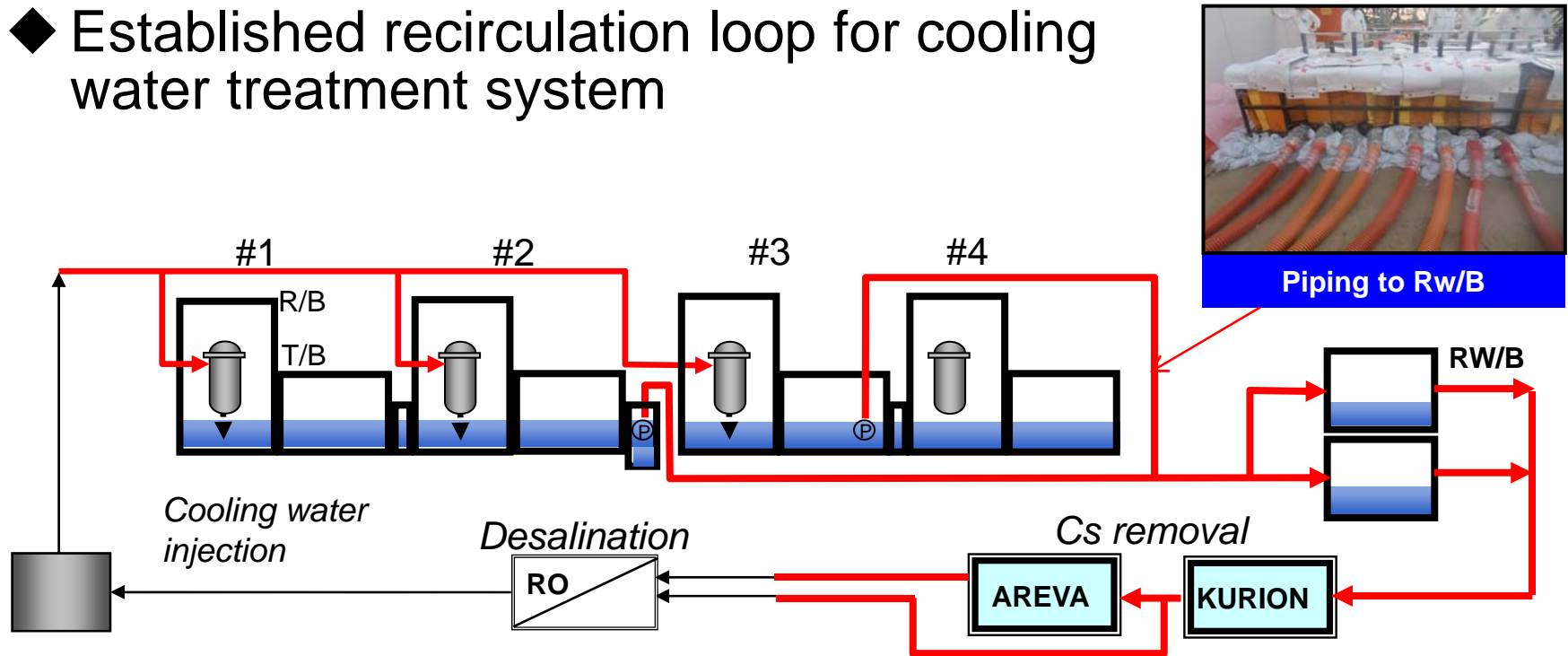
■ Long Term Activities



Establish the 1st Water Treatment System

■ Highly contaminated water accumulated in T/B

- ◆ Urgent water transfer required to Rw/B
- ◆ Established recirculation loop for cooling water treatment system



■ After equipment supply from overseas companies, piping installation 4,100m with 3,000 welding points

T/B: Turbine Building
 Rw/B: Radioactive Waste Building
 RO: Reverse Osmosis Cs: Cesium

Installation of the 2nd Water Treatment System

■ Simplified Active water Retrieve and Recovery System

- ◆ Increase stability and redundancy of Cs removal
- ◆ Design and manufacturing collaborated with SHAW* and related companies in U.S.
*: Currently CB&I
- ◆ Ready for operation within only 2.5 months from proposal under severe conditions

■ Major characteristics

- ◆ High performance media to achieve high DF
- ◆ Sufficient shielding in vessels for workers
- ◆ Stable operation by simplified system



Simplified Active water Retrieve and Recovery System

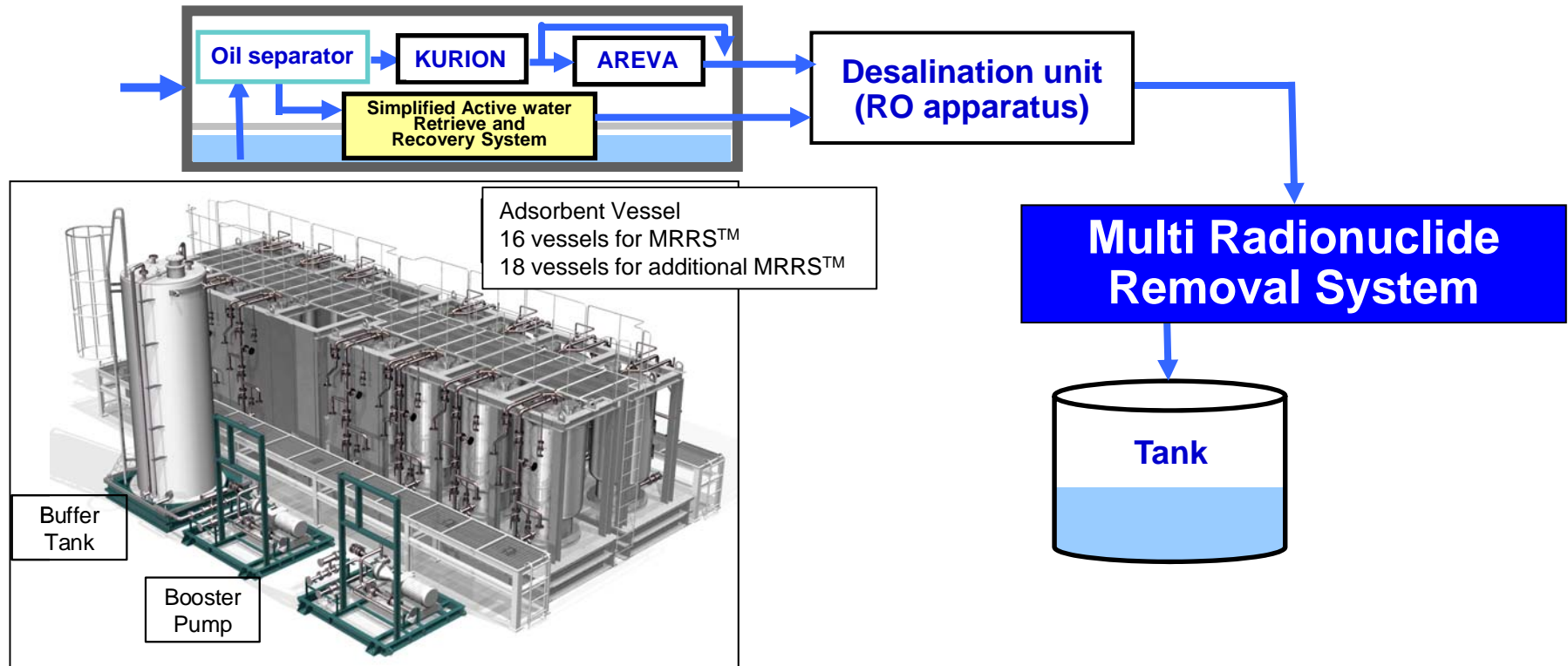
Treated more than 1,200,000 m³ contaminated water

DF: Decontamination Factor

Further Risk Reduction by Water Treatment

■ Multi Radionuclide Removal System

- ◆ Conceptual design by EnergySolutions based on Advanced Liquid Processing System
- ◆ Detailed design and major manufacturing by Toshiba
- ◆ Removal for 62 radionuclides including Strontium from stored contaminated water



Overview of Multi Radionuclide Removal System

- ◆ Started MRRS™'s operation from April 2013
- ◆ Started additional MRRS™'s operation from September 2014
- ◆ Treated more than 600,000 m³ RO concentrated water up



Overview of MRRS™



Overview of additional MRRS™



Building view



Adsorbent vessels



Building view



Adsorbent vessels

Reference : Tepco web site

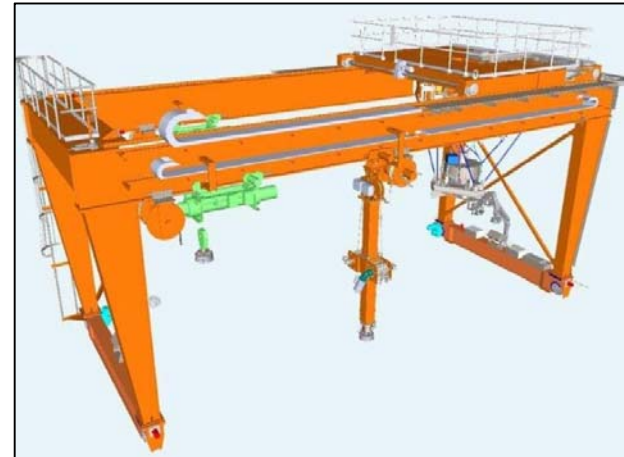
Fuel Removal from 1F-3 SFP (1/2)

■ 1F-3 Fuel Removal System

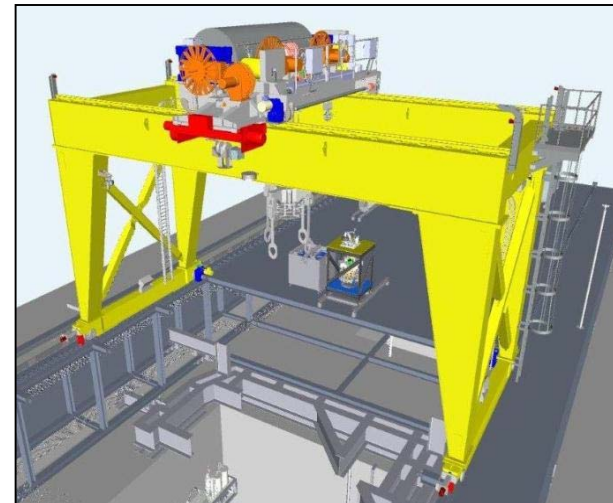
- ◆ Conceptual and basic design by Toshiba and WEC
- ◆ Detailed Design and fabrication by WEC, PaR Systems, etc.

■ Functions

- ◆ Remotely controlled Fuel Handling Machine (FHM) for fuel assemblies and rubbles removal from Spent Fuel Pool (SFP)
- ◆ Remotely controlled crane for transfer vessel handling



FHM

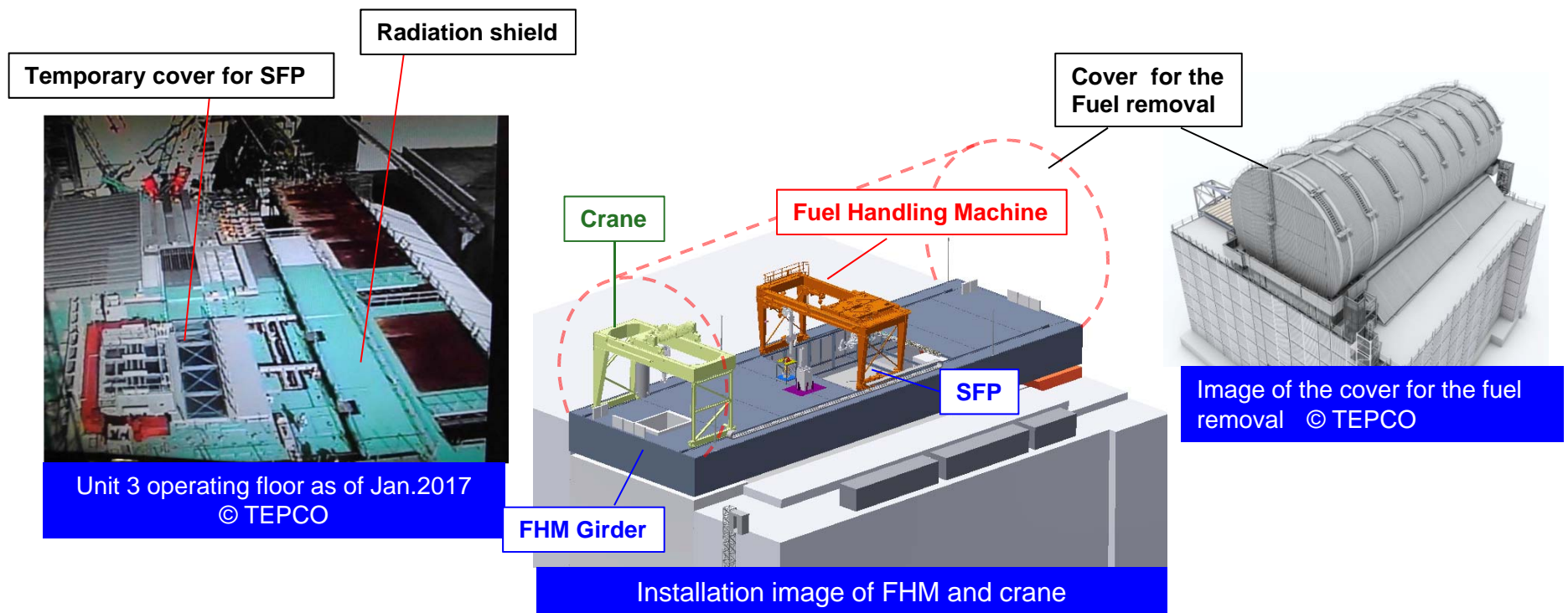


Crane

Fuel Removal from 1F-3 SFP (2/2)

■ Unit 3 Construction

- ◆ Completed installation of structures for radiation shield on the Unit 3 Reactor Building.
- ◆ Has started installation of the cover for the fuel removal on Unit 3 since Jan. 2017.

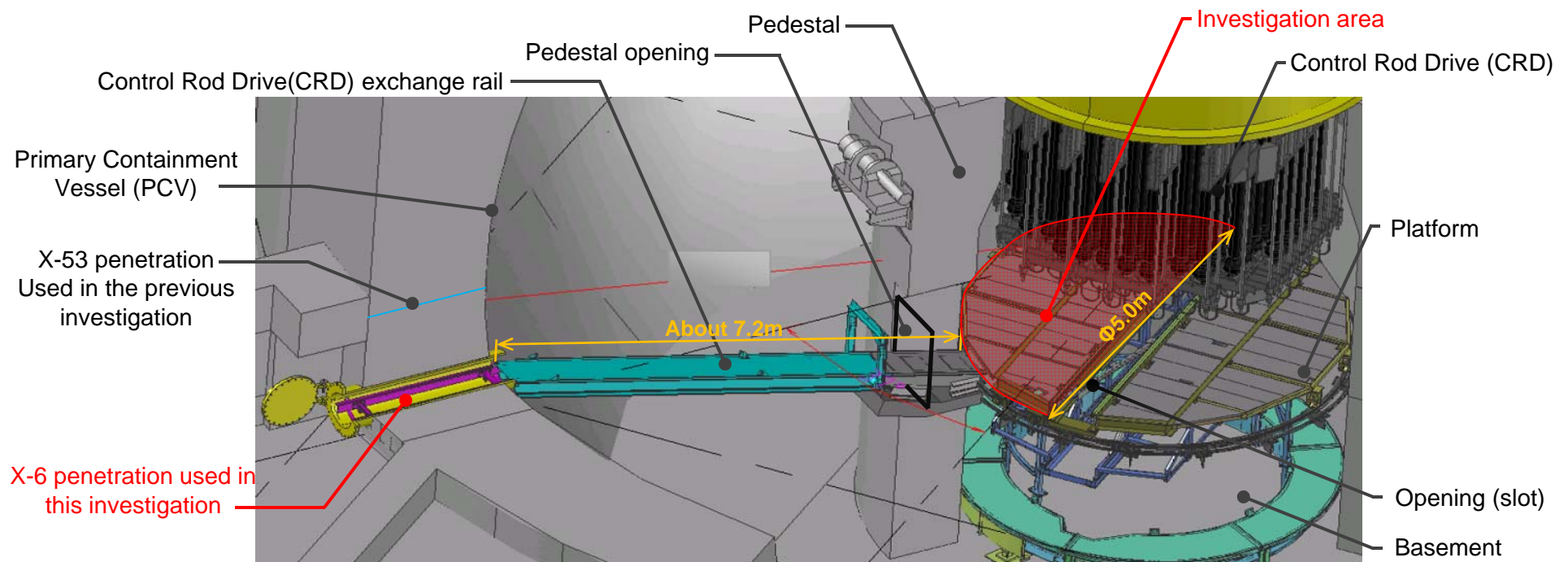


Outline of Unit 2 PCV investigation

*The contents of this presentation include the results of "Establishment of basic technology for decommissioning and safety of nuclear reactors for power generation in 2013 (technological study and research concerning forming an idea for processing and disposing of radioactive waste resulting from the accident)", a project commissioned by the Ministry of Economy, Trade and Industry, and the 2013 subsidiary for decommissioning and contaminated water measures (development of technologies for processing and disposing of waste resulting from the accident).

■ Purpose :

- 1) Obtain information (deformation of platform, etc.) for design and development of next investigation devices inside the pedestal
- 2) Inspect conditions on the platform inside pedestal, fuel debris fallen to the CRD housing, and conditions of structures inside pedestal.

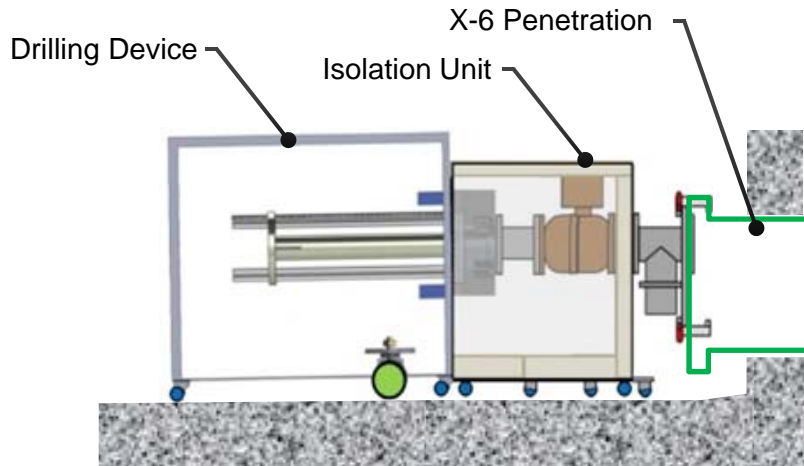


Investigation area inside the pedestal

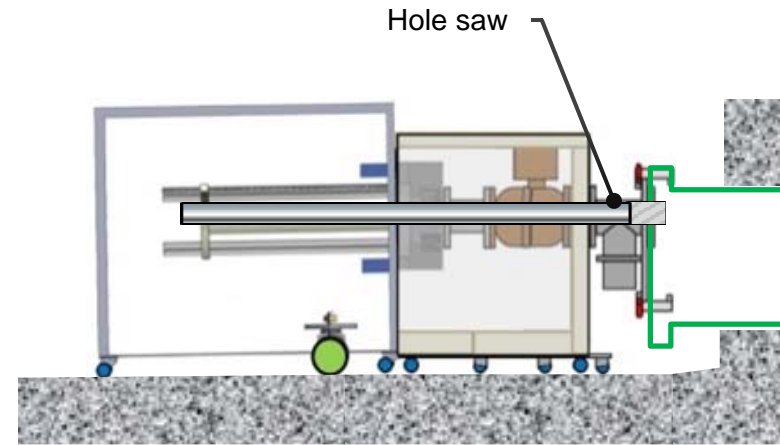
Preparation for investigation

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Setting



Holding & Release

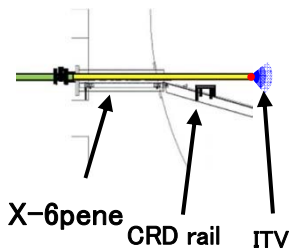


PCV inside investigation

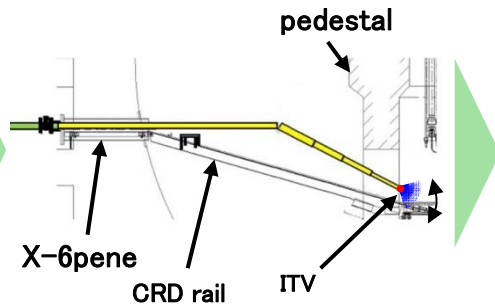
Work steps for Investigation

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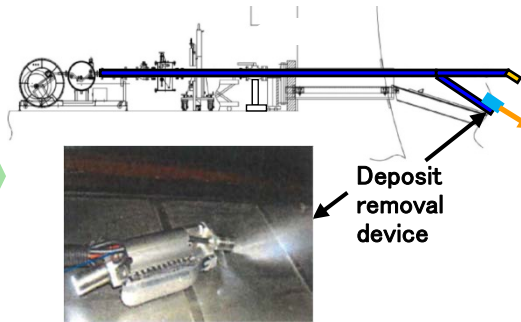
Investigation of X-6 penetration



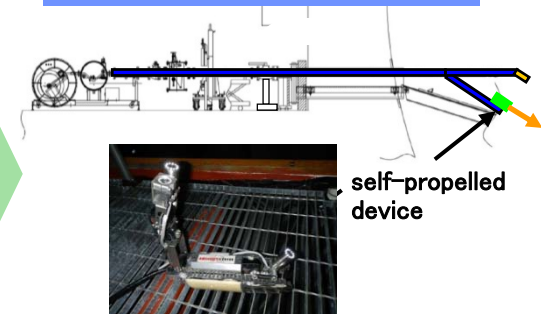
Investigation of the pedestal



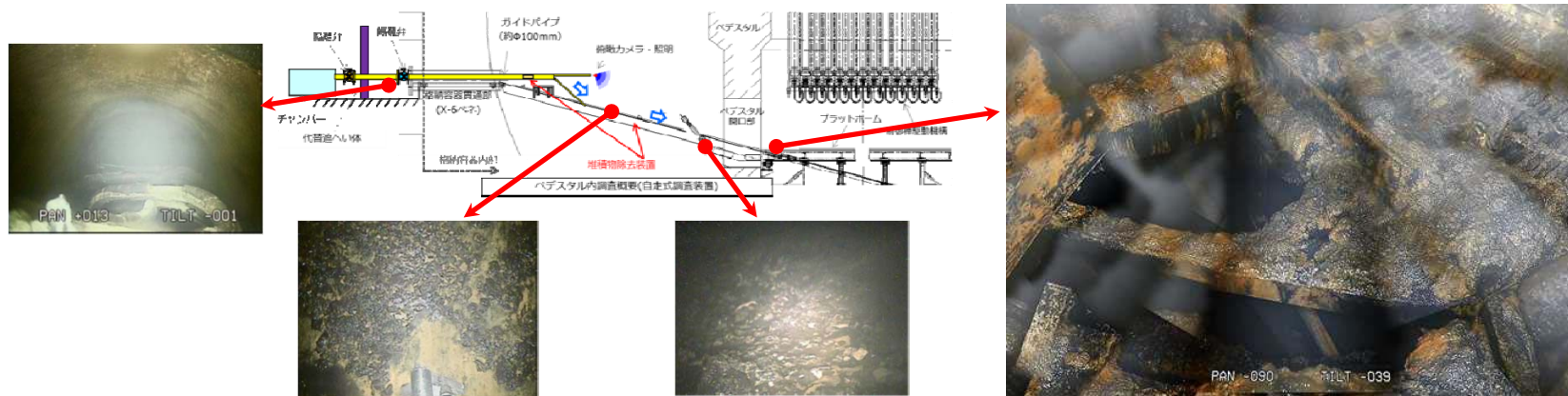
Deposit removal device



The investigation using self-propelled device



Investigation results



Outline of Muon Imaging (Scattering Method)

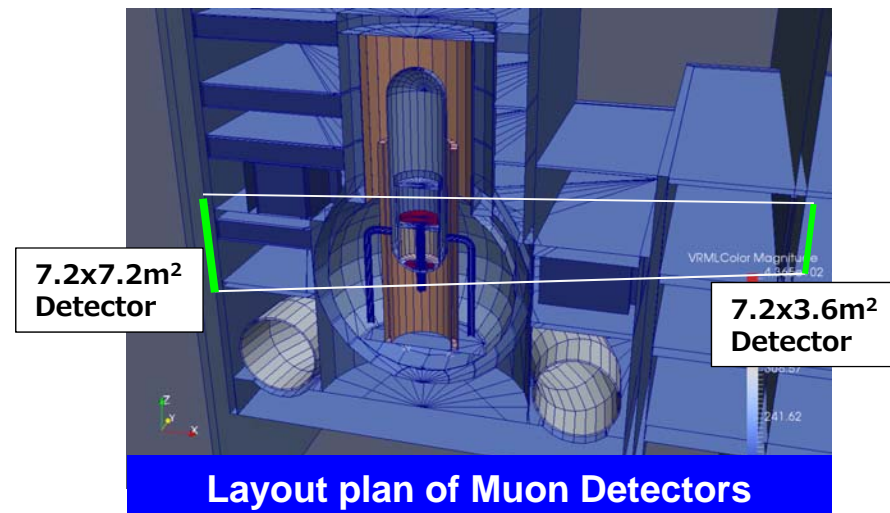
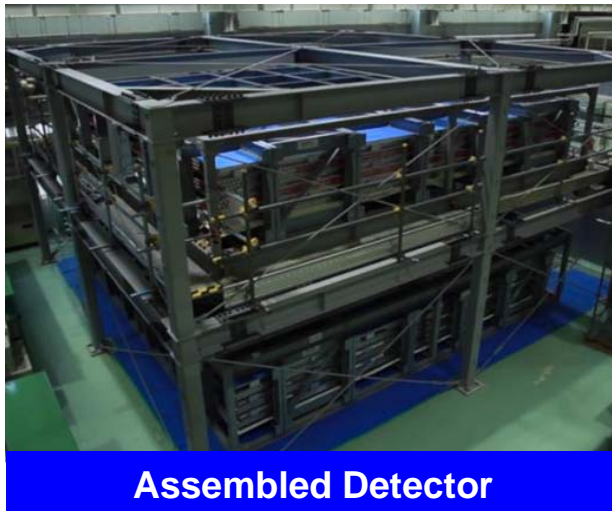
■ R&D progress

- ◆ August 2013, demonstration at Toshiba's research reactor
- ◆ June 2014, national project started
- ◆ March 2015, Muon trackers assembled at Toshiba

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■ Features

- ◆ Sensors improved for operation under high radiation environment
- ◆ Gamma-removal electronics developed



Conclusion

- Fukushima restoration activities are essential for Japanese nuclear industry
- Risk of contaminated water has been reduced significantly
- Now, preparatory works for Fuel Removal from SFP & Fuel debris Removal are in progress
- We address those activities by collaborating with Japanese government and TEPCO
- Proven technologies worldwide are highly appreciated

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