

Efforts for the Restoration at Fukushima Daiichi Nuclear Power Plants with US Industries

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Masahiko Kobayashi

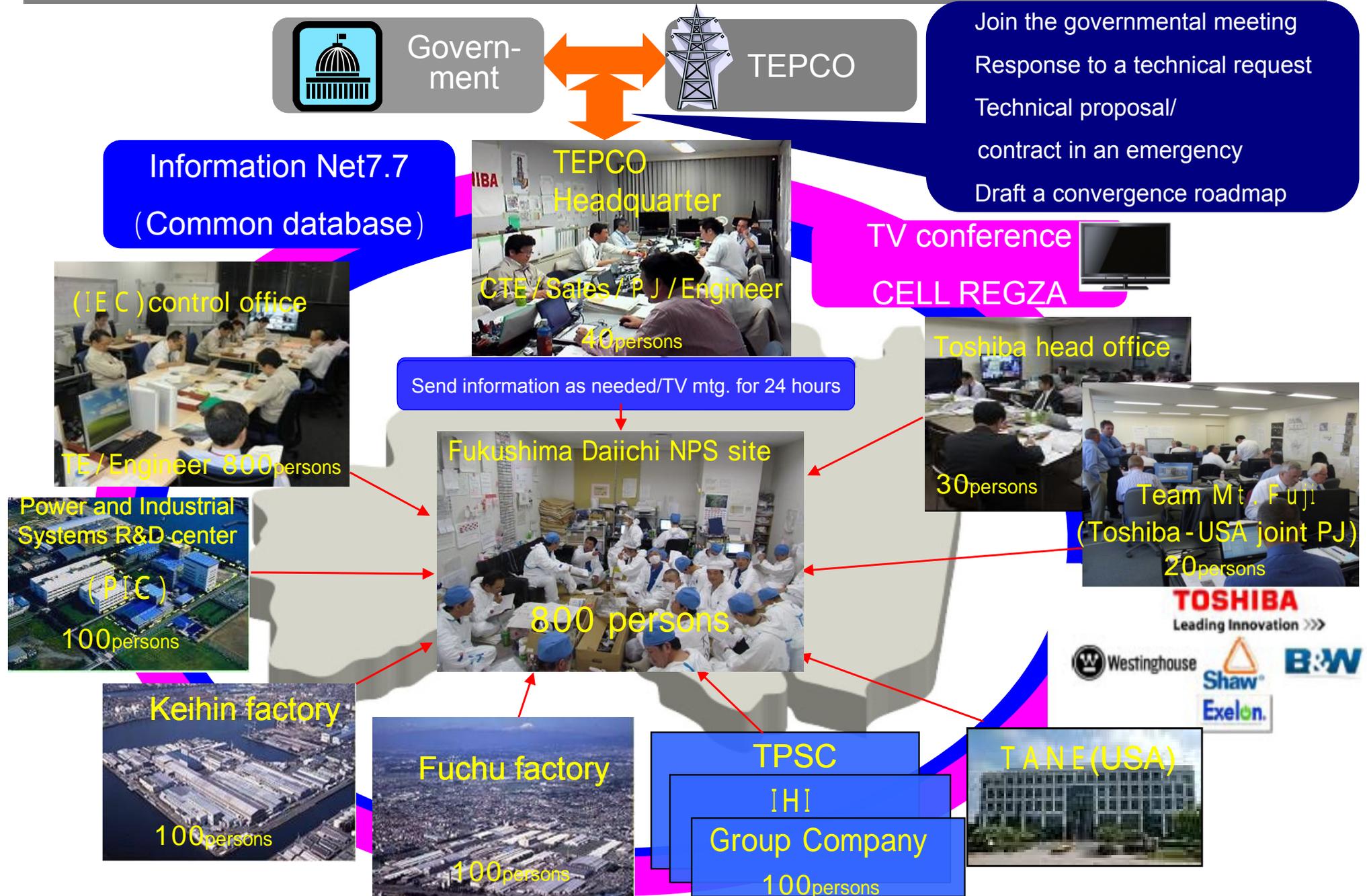
Senior Fellow, Nuclear Energy Systems & Services Division

Power Systems Company

TOSHIBA CORPORATION



Toshiba global formation

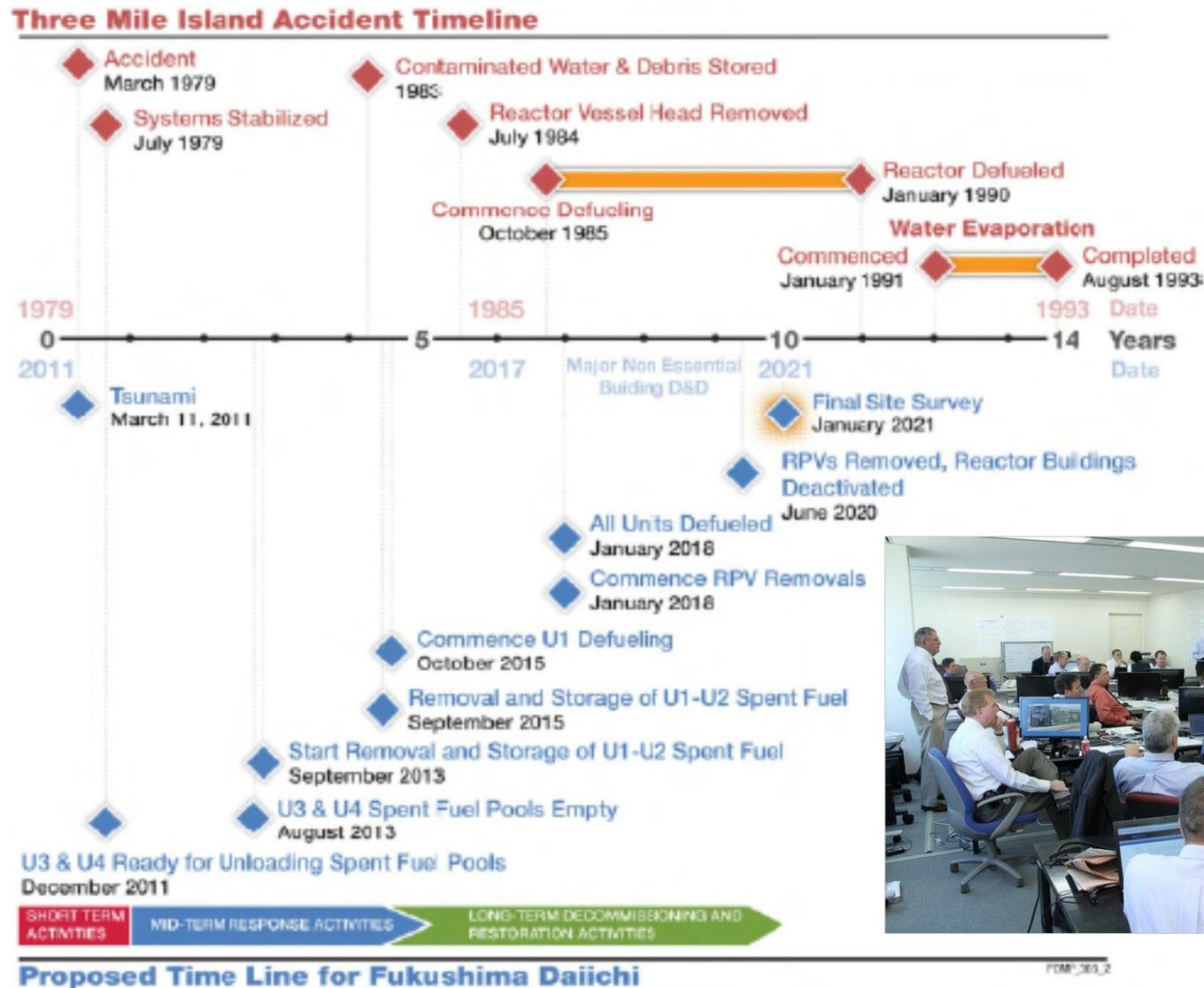


Total management plan by Toshiba - US team

Total management plan based on TMI experience
Proposed to TEPCO on April 2011

TMI
experience

Application for
Fukushima



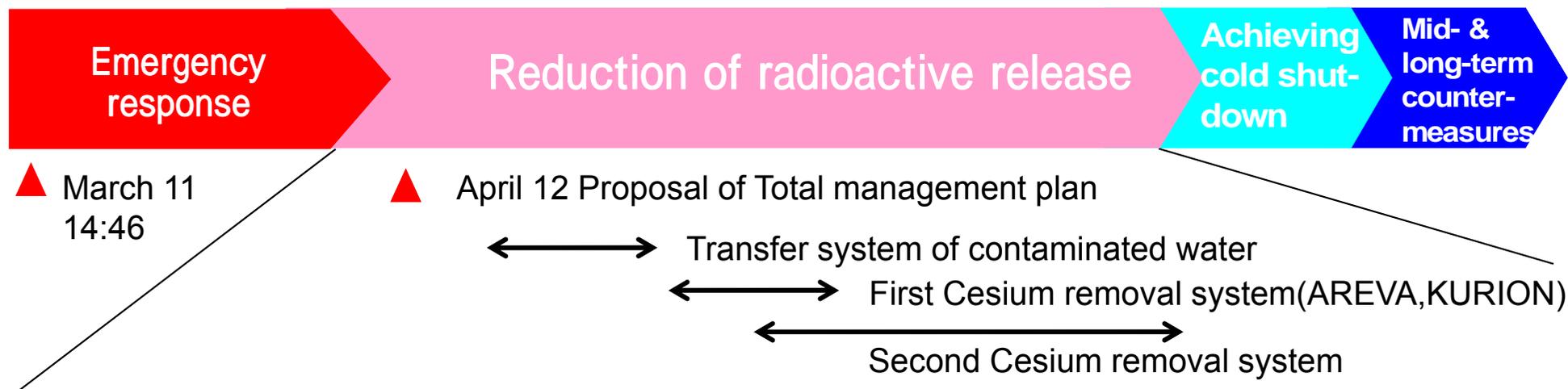
Overview of emergency response



Objective	Activities by Toshiba
◆ Recovery of electric power supply	<ul style="list-style-type: none"> • Supply and laying of cables • Supply of car batteries for I&C
◆ Core cooling	<ul style="list-style-type: none"> • Supply and connection of hoses and cables for seawater injection • Supply of 52 sets of submerged pump
◆ Avoidance of further hydrogen explosion	<ul style="list-style-type: none"> • Plan to drill holes on the R/B roof • Mock up test
◆ Cold shutdown of units 5 & 6	<ul style="list-style-type: none"> • Utilize of the last D/G, cabling and panel installation • Installation of pumps and piping

I&C: Instrumentation and Control R/B: Reactor Building D/G: Diesel Generator

Overview of radioactive release reduction



Objective

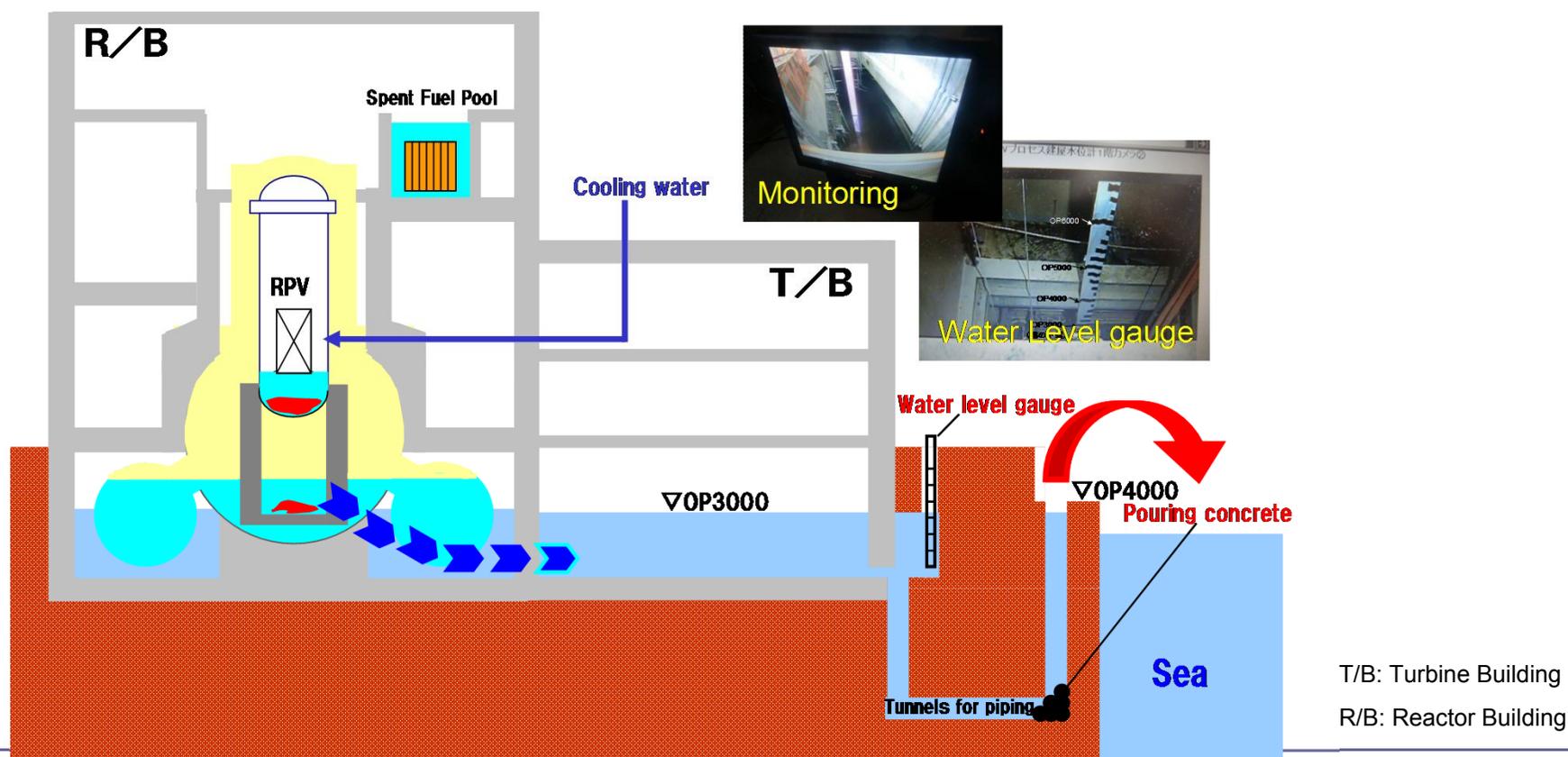
- ◆ Transfer and treatment of contaminated water

Activities by Toshiba

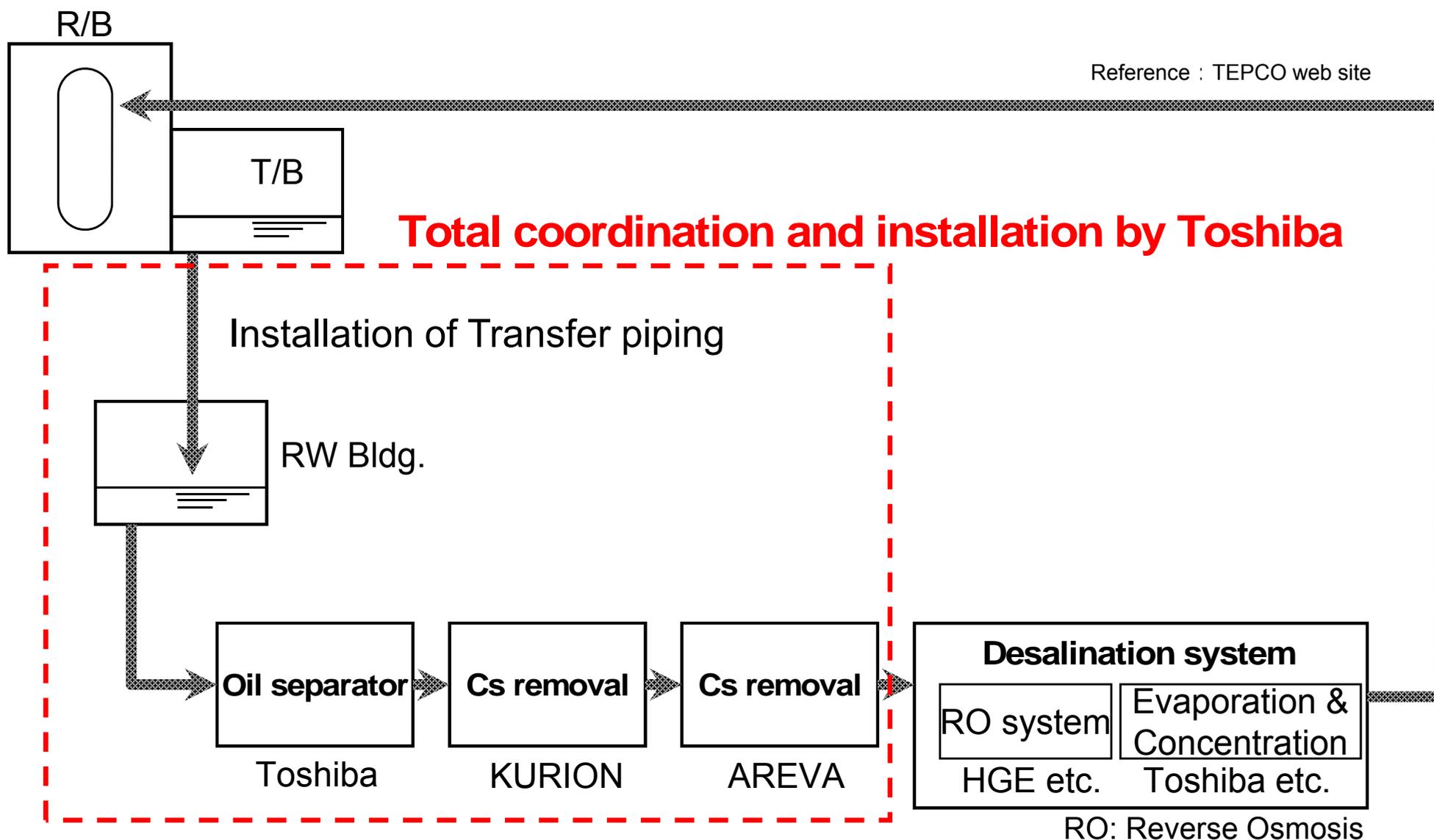
- Transfer system for contaminated water to prevent release to sea
- Total coordination for KURION and AREVA system
- Development of Simplified Active Water Retrieve and Recovery System

Prevention of contaminated water release

- Risk prediction, proposal, and urgent on-site work
 - ◆ Evaluated overflow risk of contaminated water
 - ◆ Installed water level gauge in T/B pit
 - ◆ Proposed water treatment facility based on the risk evaluation
 - ◆ Poured concrete by civil team to avoid excess release of contaminated water to sea



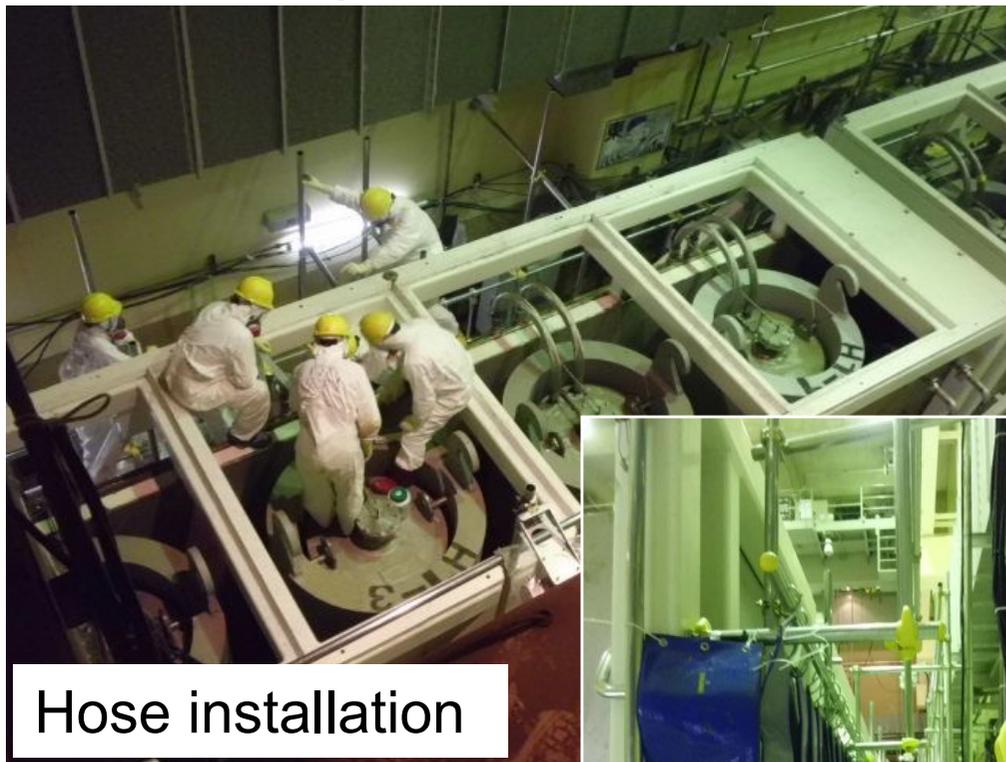
Establishment of 1st water treatment system



- R/B, T/B water level control with core cooling water circulation
- Urgent installation work within 1.5 months was required to prevent sea release

Cs removal system by KURION

Toshiba performed total coordination and installation work



Hose installation



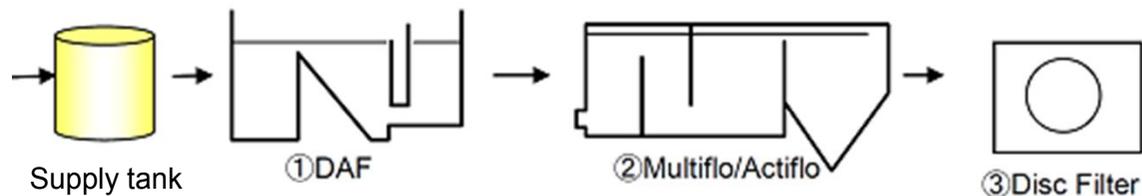
Shielding addition



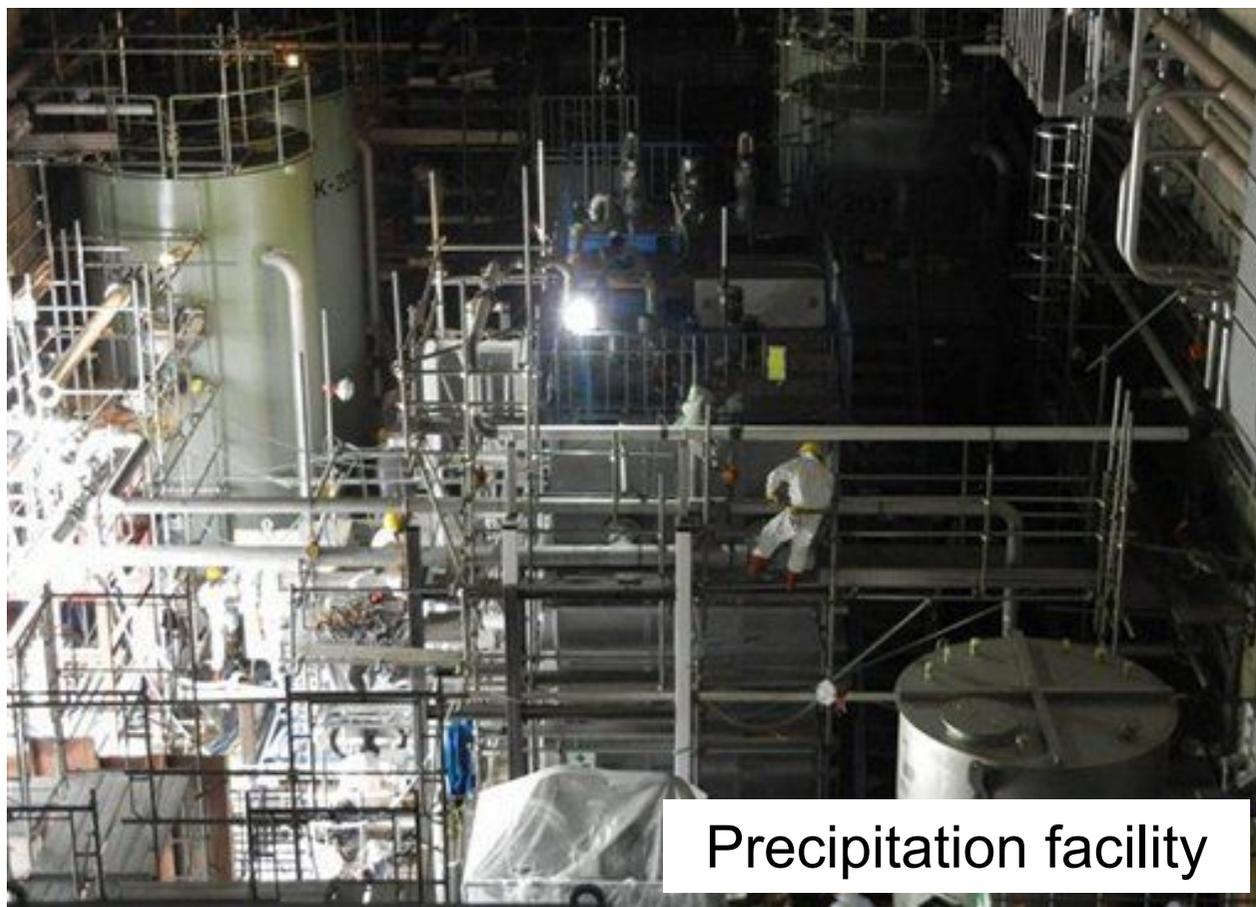
Foundation work

Cs removal system by AREVA

Toshiba performed coordination for arrangement and interface



Chemical system



Precipitation facility

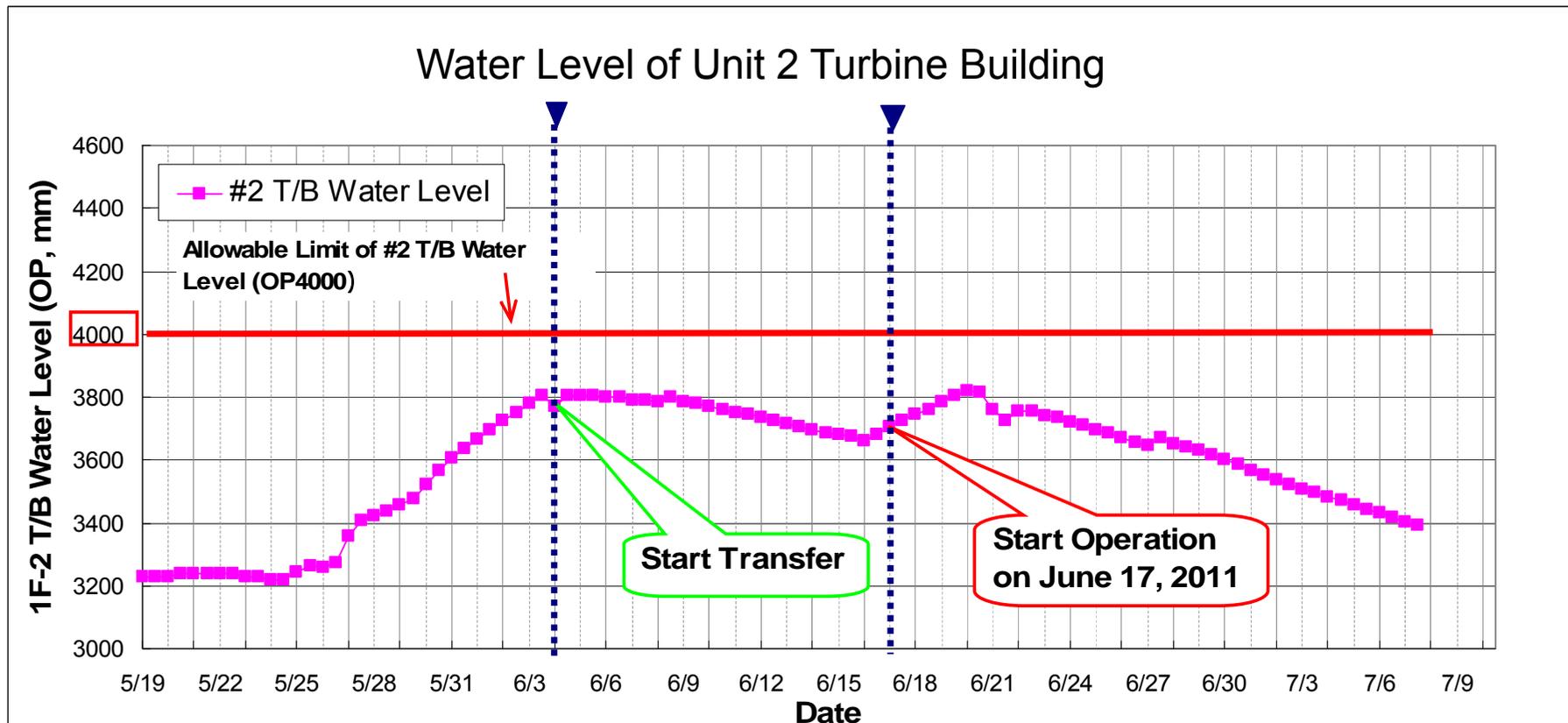
Achievement of 1st water treatment system

■ International collaboration

- ◆ KURION & AREVA systems was integrated by Toshiba
- ◆ 24-hrs-a-day work to meet schedule

■ Just two months for delivery

- ◆ Design started on April 11, and delivered on June 17



International collaboration prevented sea release of active water

2nd water treatment system

■ Simplified Active water Retrieve and Recovery System

- ◆ Toshiba proposed TEPCO to increase the stability and redundancy
- ◆ Short term design and manufacturing collaborated by SHAW* with associated company in US and Toshiba
- ◆ Ready for operation within only 2.5 months from proposal

* Current CB&I

■ Major Characteristics

- ◆ High performance media to achieve high DF
DF ; Decontamination Factor
- ◆ Shielded design for workers
- ◆ Stable operation by simplified system



Simplified Active water Retrieve and Recovery System

Development and manufacturing

Parallel work in US and Japan



IXM manufacturing in IHI



Valve rack manufacturing in US

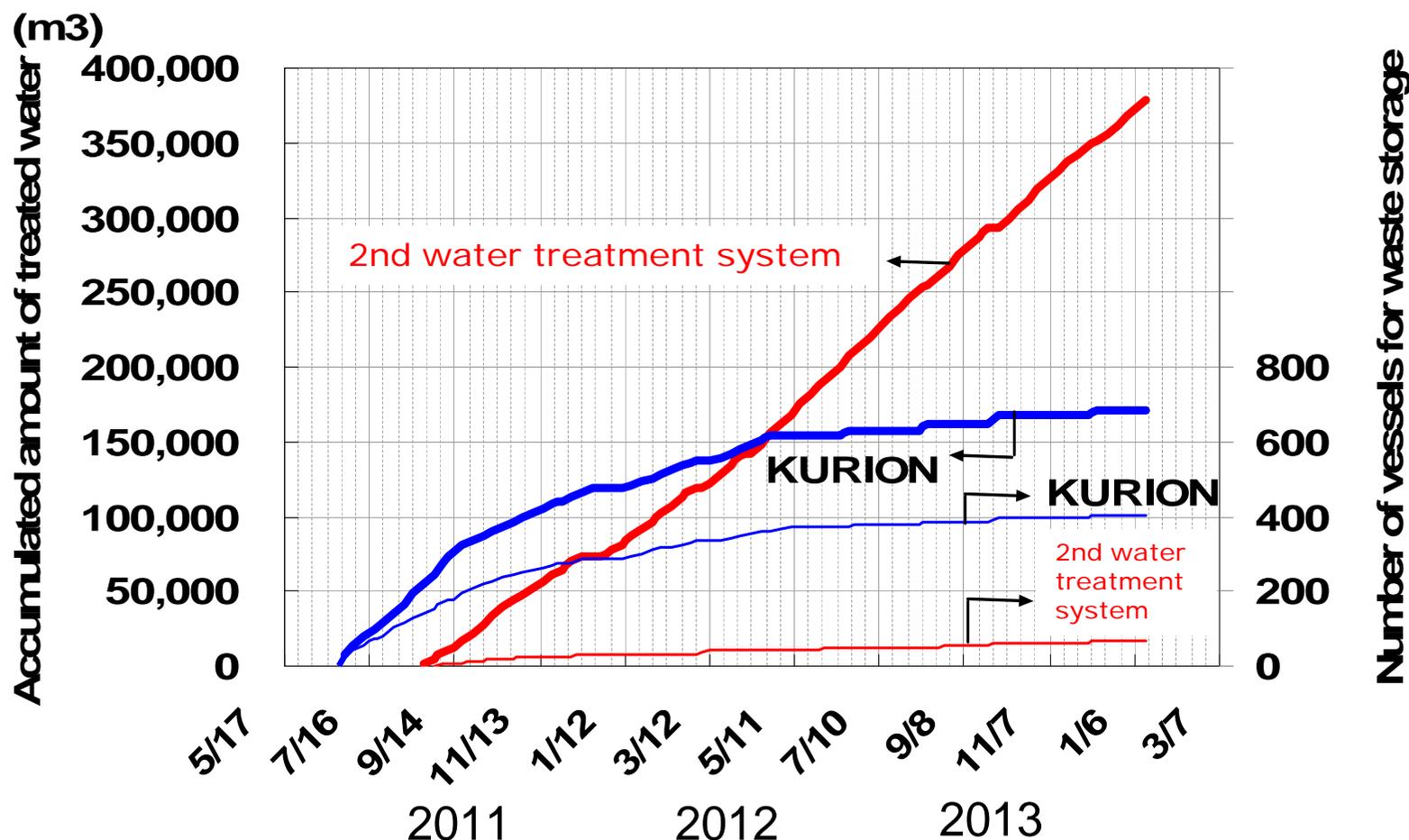


IXM manufacturing in Toshiba

Achievement of 2nd water treatment system

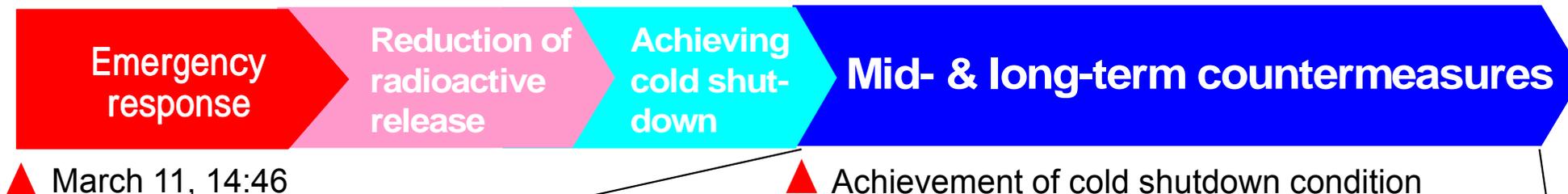
■ Achieved stable water treatment for core cooling

- ◆ Achieved stable capability for contaminated water treatment
- ◆ The system took over the main Cs removal system of Fukushima



US and Toshiba collaboration enabled the rapid completion

Overview of mid- & long-term countermeasures



Objective

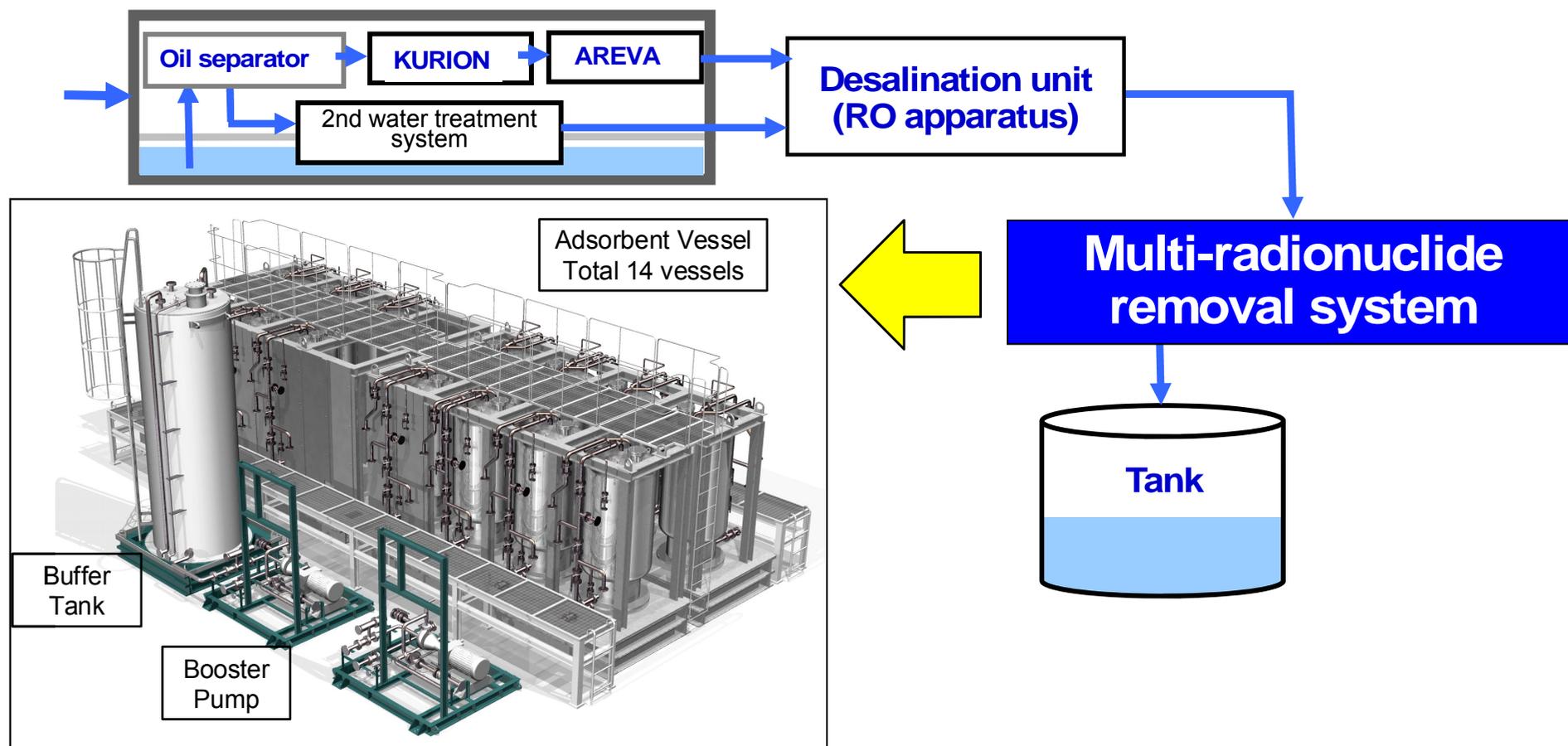
Activities by Toshiba

◆ Removal of radionuclides by water treatment	• Development of multi radionuclides removal system
◆ Spent fuel removal from SFP	• Development of fuel handling machine
◆ Measure for PCV leakage	• Investigation and development of repair tools
◆ Removal of core debris	• Development of debris handling tools

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 from stored contaminated water



Overview of Multi Radionuclide Removal System

- ◆ Started hot test operation from the end of March 2013
- ◆ Treated more than 45,000m³ RO concentrated water



Site installation



Building view



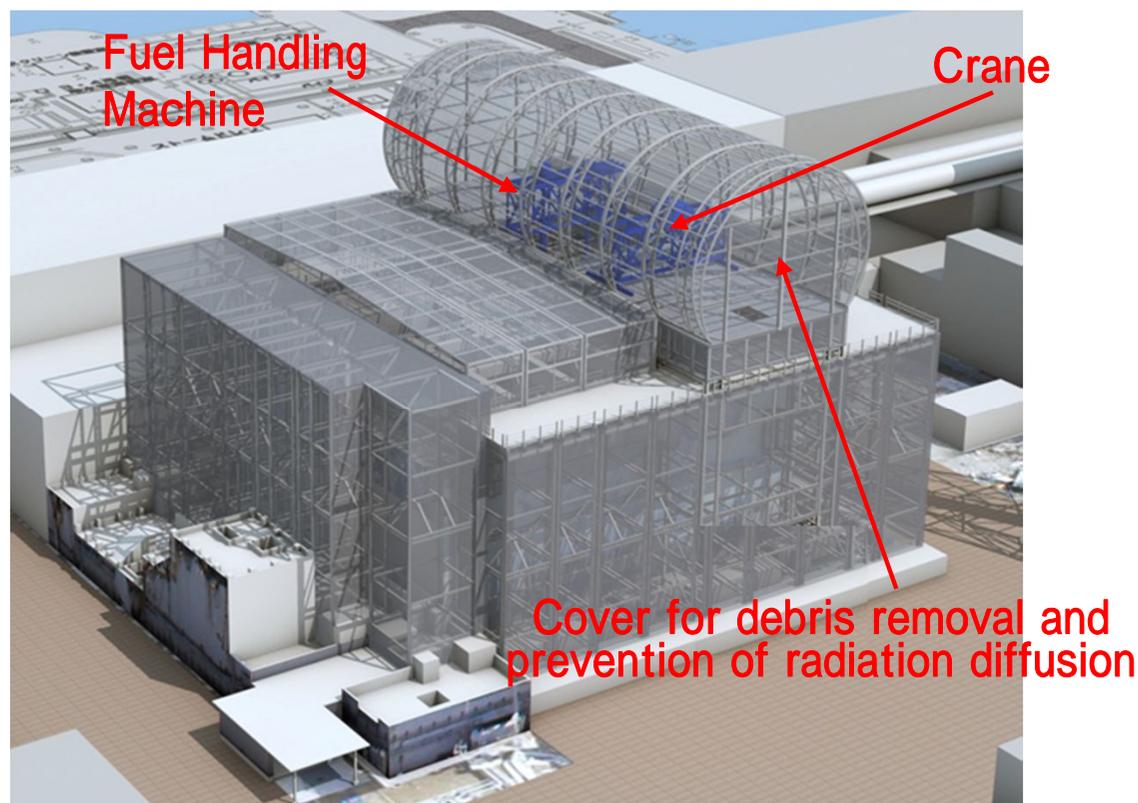
IX columns

Reference : Tepco web site

Spent fuel removal from SFP (Unit 3)

Spent fuel removal system

- ◆ Collaborate with US team (Westinghouse and associated companies) which have TMI project experience
- ◆ Development of remote fuel handling machine, crane and transfer vessel
- ◆ Removal work to be started from 2015 JFY



Fuel Removal System for Unit 3

For future collaboration with US industries

■ Lesson learned from Fukushima project

- ◆ Collaboration with US industries by firm technologies enabled to achieve successful results within the short term.
- ◆ Verification to customize for Fukushima is very important.
 - Lab. and mockup testing for media, equipment in Japan
 - Thermal and Structural analysis based on nuclear plant technology
- ◆ Division of the roles considered schedule, site fabrication, operation and maintenance is very important.
 - Site work basically should be done by Japanese
 - Consideration for long term maintenance including consumables, parts, software and so on.
- ◆ High cost of US partners sometimes could be a issue.

■ For further collaboration with US industries

- ◆ Excellent proven technology, speed and cost competitiveness are very important for further collaboration in Fukushima.
- ◆ Toshiba expects to widely collaborate in each project satisfied these requirements such as remote decontamination and repairs.

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