

# Japan's Challenges regarding Decommissioning

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# Introduction

- ✓ Decommissioning poses new challenges to the regulatory bodies, such as resources allocation for a long term, catching up new concepts, methods and technologies.
- ✓ IAEA Safety Requirement SSR 2/1 requires “Special consideration shall be given at the design stage ... to the incorporation of features to facilitate radioactive waste management and the future decommissioning ...”.
- ✓ As for Fukushima Dai-ichi, significant steps of progress have been made, but TEPCO still faces number of difficult challenges.
- ✓ Investigation inside the containment vessel was conducted recently in Unit 2 of Fukushima Dai-ichi.



## Power reactor decommissioning

- ✓ 62 power-producing reactors
  - 24 PWRs, 35 BWRs, GCR, ATR, SFR
  - 3 BWRs under construction.
- ✓ 17 units service terminated
  - 4 PWRs, 10 BWRs including 6 units in Fukushima Dai-ichi, GCR, ATR, SFR
- ✓ On-going decommissioning except Fukushima Dai-ichi
  - 4 units in 3 sites
  - Hamaoka #1, #2 (BWR), Tokai (GCR), and Fugen (ATR)
- ✓ “Decommissioning Plan” submitted
  - 6 units in 5 sites
  - Mihama #1, #2, Ikata #1, Genkai #1 (PWR)
  - Tsuruga #1, Shimane #1 (BWR)
- ✓ Permanent shutdown decided recently
  - Monju (SFR)



## Recommendation from the IRRS mission

- ✓ *Recommendation:* NRA should establish requirements relating to **consideration of decommissioning during all life stages** of nuclear and radiation facilities ...
- ✓ Draft amendments to “the Reactor Regulation Act” require licensees to: (excluding Fukushima Dai-ichi)
  - Submit “**Decommissioning Policy**” prior to the approval of “**Decommissioning Plan**” within 3 months after the amendment comes into effect, and
  - Periodically review and update it.
- ✓ The policy shall include the information such as:
  - Estimated amount of radioactive waste to be generated
  - Estimated cost / financial arrangements
- ✓ The bill was decided by the Cabinet and submitted to the Diet in February 2017.



## Recommendation from the IRRS mission (cont'd)

- ✓ *Recommendation:* NRA should establish requirements relating to ... **criteria for the release of sites** at the end of decommissioning
- ✓ Discussion on the criteria for the release of sites has been started under an NRA's team including external experts.
- ✓ IAEA documents, USNRC's 10 CFR Part 20 Subpart E, NUREG-1575 (MARSSIM), etc. are being reviewed.
  - The MARSSIM provides information on planning, conducting, evaluating, and documenting building surface and surface soil final status radiological surveys for demonstrating compliance with dose or risk-based regulations or standards.

MARSSIM: Multi-Agency Radiation Survey and Site Investigation Manual



# Monju and TRP

- ✓ Monju (Prototype sodium fast reactor)

NRA made an exceptional consideration for the decommissioning of Monju, and asked JAEA to prepare “Decommissioning Plan” including the process of fuel dismantling.

According to JAEA, unloading of fuel assemblies from the core will take 5.5 years at least. NRA and JAEA discuss possible acceleration of the process.

- ✓ TRP (Tokai Reprocessing Plant)

In order to reduce the existing risk, vitrification of high-level liquid waste should be completed before the decommissioning of components and facilities.

According to JAEA, the decommissioning of the plant takes ~70 years.

# Fukushima Dai-ichi





## NRA on Fukushima Dai-ichi

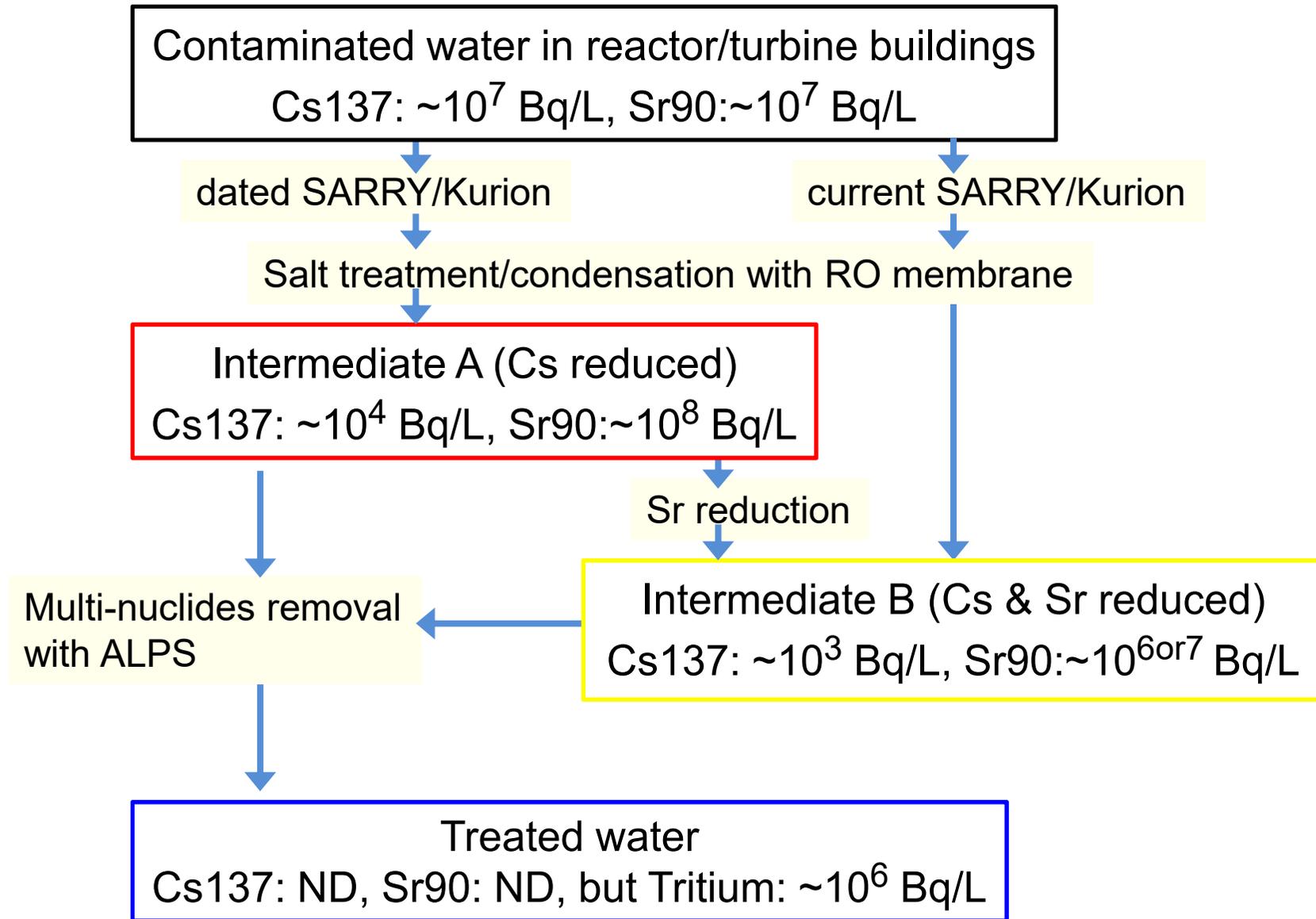
- ✓ According to the amended Nuclear Regulation Act, the NRA designated the Fukushima Dai-ichi Nuclear Power Station as “Disaster-experienced Nuclear Power Plant” on November 7, 2012, which needs special measures to prevent further disaster and to ensure nuclear security.
- ✓ The NRA requested TEPCO to prepare an implementation plan regarding decommissioning processes for Units 1 thru 4, maintaining shut-down status for Units 5 and 6, monitoring plant status for Units 1 thru 6, physical protection, and others.
- ✓ In order to address risk concerns plainly, the NRA produced “Measures for Mid-term Risk Reduction” on February, 2015, and revised it regularly.



## Status and current concern

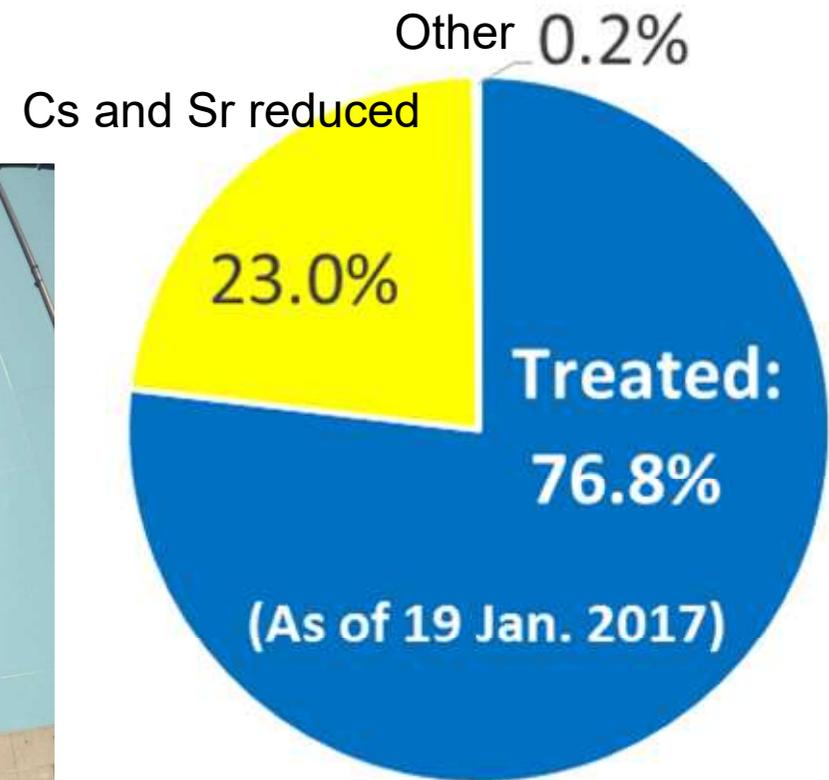
- ✓ Significant steps of progress, such as fuel removal from Unit 4 SFP, removal of heavily-contaminated water from sea-side underground trenches connected to the reactor turbine buildings on the seaward side, construction of sea-side underground impermeable wall, were made, but TEPCO still faces number of difficult challenges.
- ✓ Current concerns are;
  - Water decontamination and management of processed water,
  - Water levels management in order to reduce inflow of ground water into reactor and turbine buildings, and
  - Fuel removal from spent fuel pool of Unit 3.

# Water decontamination



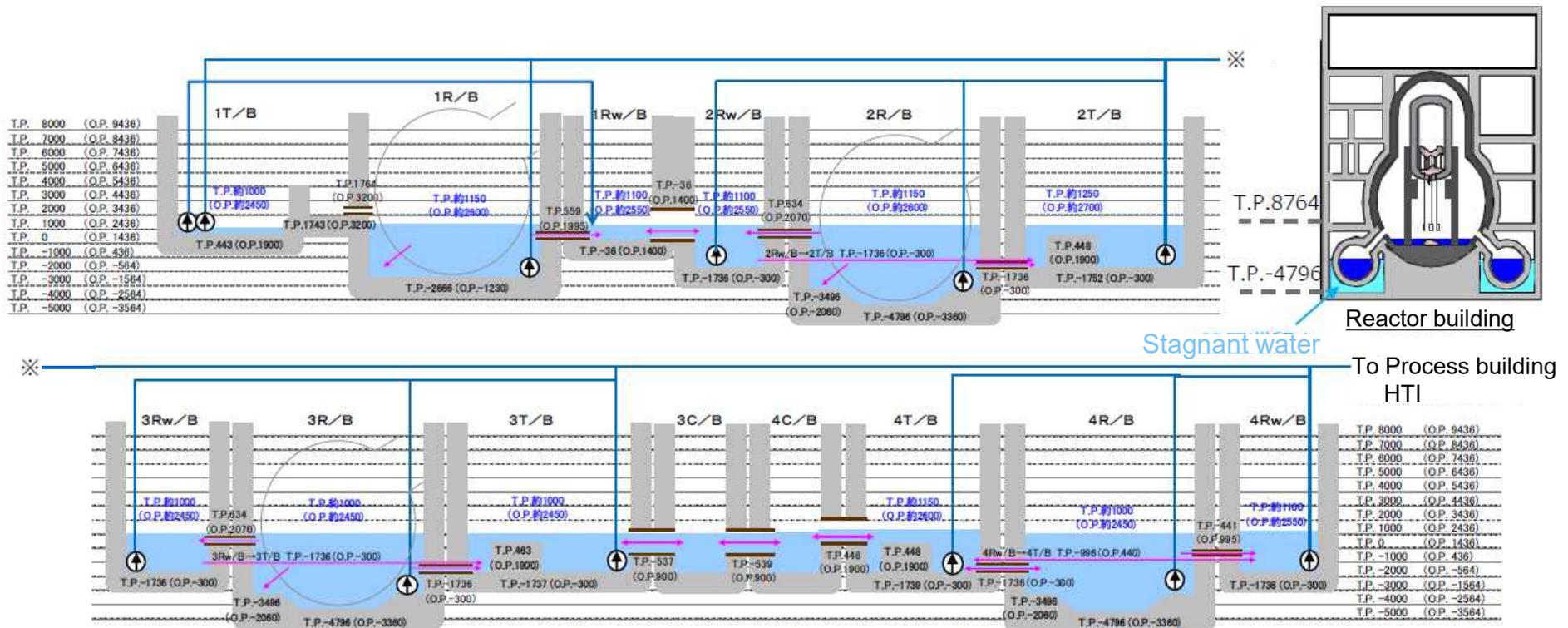
## Management of processed water

- ✓ ~1 Mt of water in 1143 tanks. (Jan. 19, 2017)
- ✓ As for management of the “Treated water” containing tritium, a committee organized by METI continues a very careful discussion on an option to be taken by TEPCO.



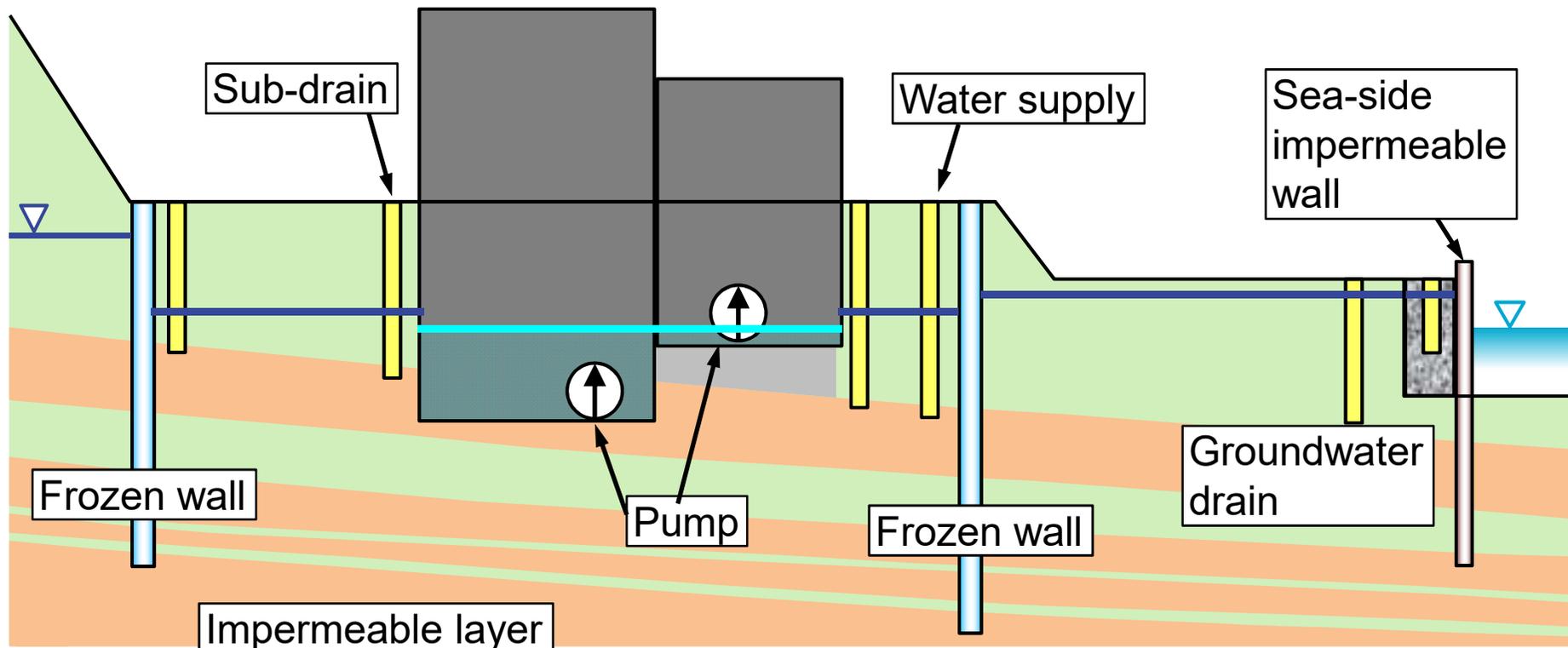
# Water stagnating in building floors

- ✓ Decontamination is an important challenge not only for water stored in tanks but also for stagnating water in reactor/turbine buildings.



# Water level control

- ✓ Water level in reactor/turbine buildings must be always lower than ambient groundwater level.
- ✓ The difference between the two levels, however, should be controlled at adequately small in order to reduce the inflow.



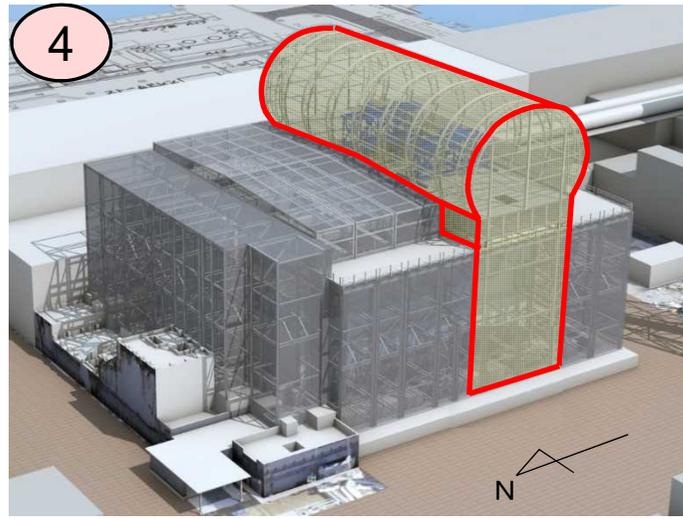


# Spent Fuel Removal

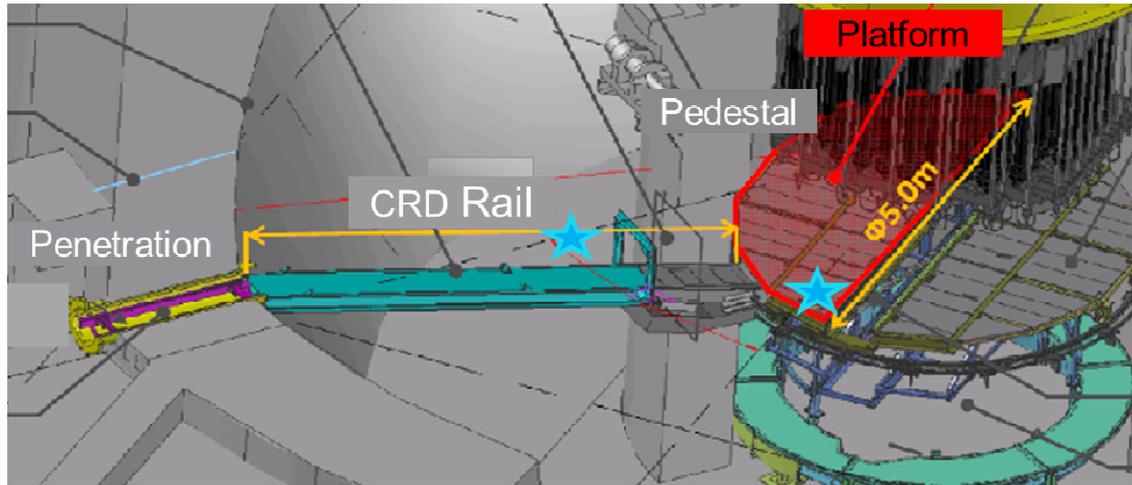
- ✓ Fuel removal from spent fuel pool of Unit 4 was completed on December, 2014. This corresponds to ~49% reduction of spent fuel assemblies in spent fuel pools of Units 1 thru 4.
- ✓ Fuel handling system is under construction in Unit 3.

Unit	1	2	3	4
Capacity	900	1240	1220	1590
<b>SFA</b>	<b>292</b>	<b>587</b>	<b>514</b>	<del>1331</del>
FFA	100	28	52	<del>204</del>
Total	392	615	566	<del>1535</del>

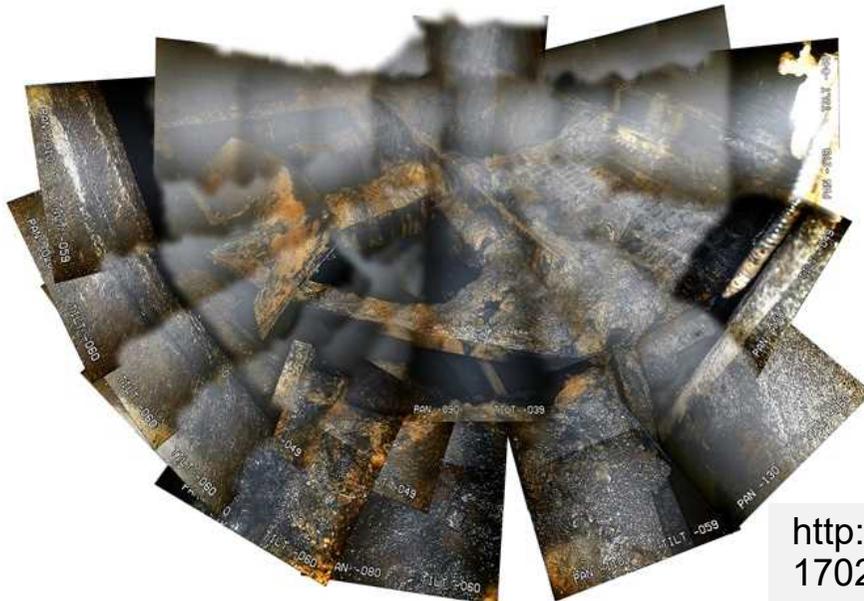
# Fuel-handing system for Unit 3 SFP



# Unit 2 CV investigation



[http://www.tepco.co.jp/en/nu/fukushima-np/handouts/2017/images/handouts\\_170215\\_01-e.pdf](http://www.tepco.co.jp/en/nu/fukushima-np/handouts/2017/images/handouts_170215_01-e.pdf)



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## Closing remarks

- ✓ Decommissioning as well as waste storage, transport and disposal becomes more and more important worldwide. Bilateral and/or multilateral information exchange and discussion would be of help.
- ✓ In order to keep reducing the risk existing at the Fukushima Dai-ichi, the NRA should regulate and promote the decommissioning processes at the same time.
- ✓ An important challenge is to maintain harmonization between the implementation/acceleration of the decommissioning and the protection of people and the environment during the processes.