Progress and improvements of the improved ALPS (multi-nuclide removal) system

<Reference>
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Tokyo Electric Power Company

Outside view of improved ALPS building (photo taken on Sept 5 2014)

Adsorption tower of improved ALPS building (photo taken on Aug 15 2014)

Cross-flow filter (photo taken on Aug 17 2014)

- Main facilities of Unit A installed.
- Unit A is under pre-operation inspection from Sept 8. After approval, “hot testing” will be started using actual RO concentrated salt water.
- Main facilities and the roof, walls of Unit C is currently been installed.

Photo taken by TEPCO

1. Measures for happenings during hot testing

- Following measures are taken for hot testing* of the improved ALPS system.
  - Leakage prevention measures, enhanced physical barriers to contain any leaks, improved leak detection, management improvement such as change of manuals and backup facilities have been implemented to take quick response in unexpected happenings.
  - The improved ALPS system, of which the design is the same with the existing ALPS system has benefited from the experience with the existing ALPS system.

* At hot testing, where actual RO concentrated salt water is treated, initial performance is checked as well as finding errors and improving the system to enable stable operation during full-scale operation.

2. Safety measures reflecting the lessons learned from the existing ALPS system (1)

Seven large improvements were made reflecting the lessons learned from the hot testing of the existing ALPS system, enabling broad response in unexpected situations.

No.	Errors confirmed in the existing ALPS system		Improvements
	Errors	Causes	
1	Leakage from clearance where corrosion is occurring	Leakage occurred where partial corrosion of stainless steel generated at batch treatment tanks. Corrosion was also confirmed at flanges.	Rubber linings were installed in places where corrosion may occur. Gasket-shaped sacrificial anode was installed at flanges where corrosion may occur.
2	Operation suspension due to process flaw	Process flaw occurred due to the opening of a valve that does not open in usual situation while pouring medicinal solution followed by activation of liquid level signal.	Logic has been changed so that process flaw wouldn't happen.
3	Operation suspension due to defect in motor of crane to exchange HIC (waste tank)	Defect was found in one of four motors of the crane to exchange HIC.	Backup facilities were prepared to prevent long suspension.
4	Operation suspension due to overload trip of booster pump	Signal went off due to overload of two booster pumps since operation was continued in excess low flow, and the two pumps stopped.	Monitoring were strengthened to check if the operation does not continue under excess low flow.
5	Radioactive material concentration rise in outlet water due to damage in CFF (cross flow filter)	Carbonate flowed to the downstream due to damage in teflon packing of CFF.	Packing was improved to synthetic rubber
6	Operation suspension due to bleeding from sample tank manhole	No abnormality was found by inspection of connection or torque strength.	Dams were built around the facilities to avoid any leakage expansion. Patrols are conducted.
7	Operation suspension due to defect in pump of coprecipitation tank	Anchoring of deposits at pumps to conduct PH sampling turned out to be the cause.	Line to wash system with medicinal solution was installed enabling washing of system.

3. Safety measures reflecting the lessons learned from the existing ALPS system (2)

Expected defects during hot testing

➢Leakage from tanks

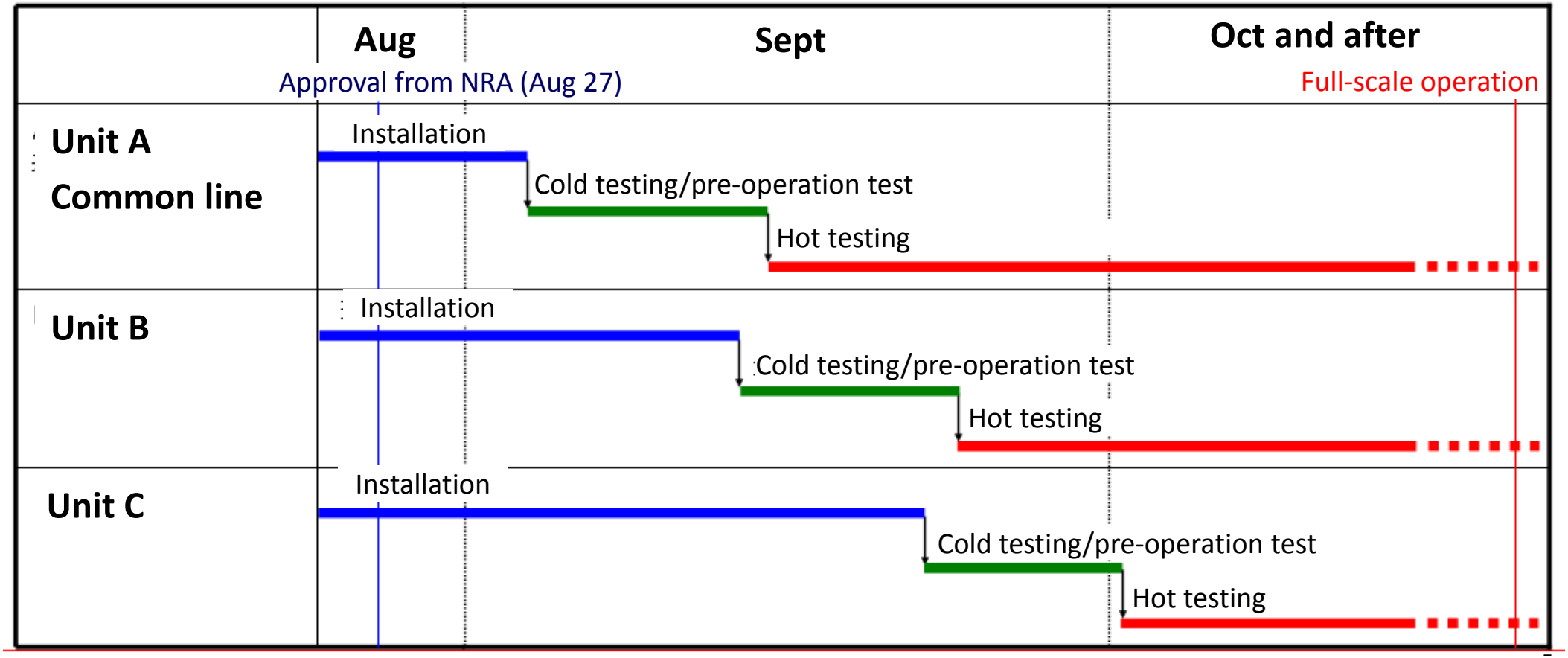
-Should any leakage occur, physical barriers, daily patrols and leak detection system will prevent any effect to the surrounding environment.

➢Radioactive material concentration rise in outlet water of various filters

-Contamination will be prevented by conducting sampling from sampling tanks before transferring treated water to the tank areas.

<Reference> Future schedule (Improved ALPS)

- Approval from NRA: Aug 27 2014
- Pre-operation inspection: Since Sept 8 2014
- Hot testing (Unit A) start: After approval of inspection
- Inspection and hot testing of Units B and C will be conducted as well.
- Full-scale operation will be after confirming performance in hot testing and installing the three sampling tanks. [Target set in FY2014 (around December)



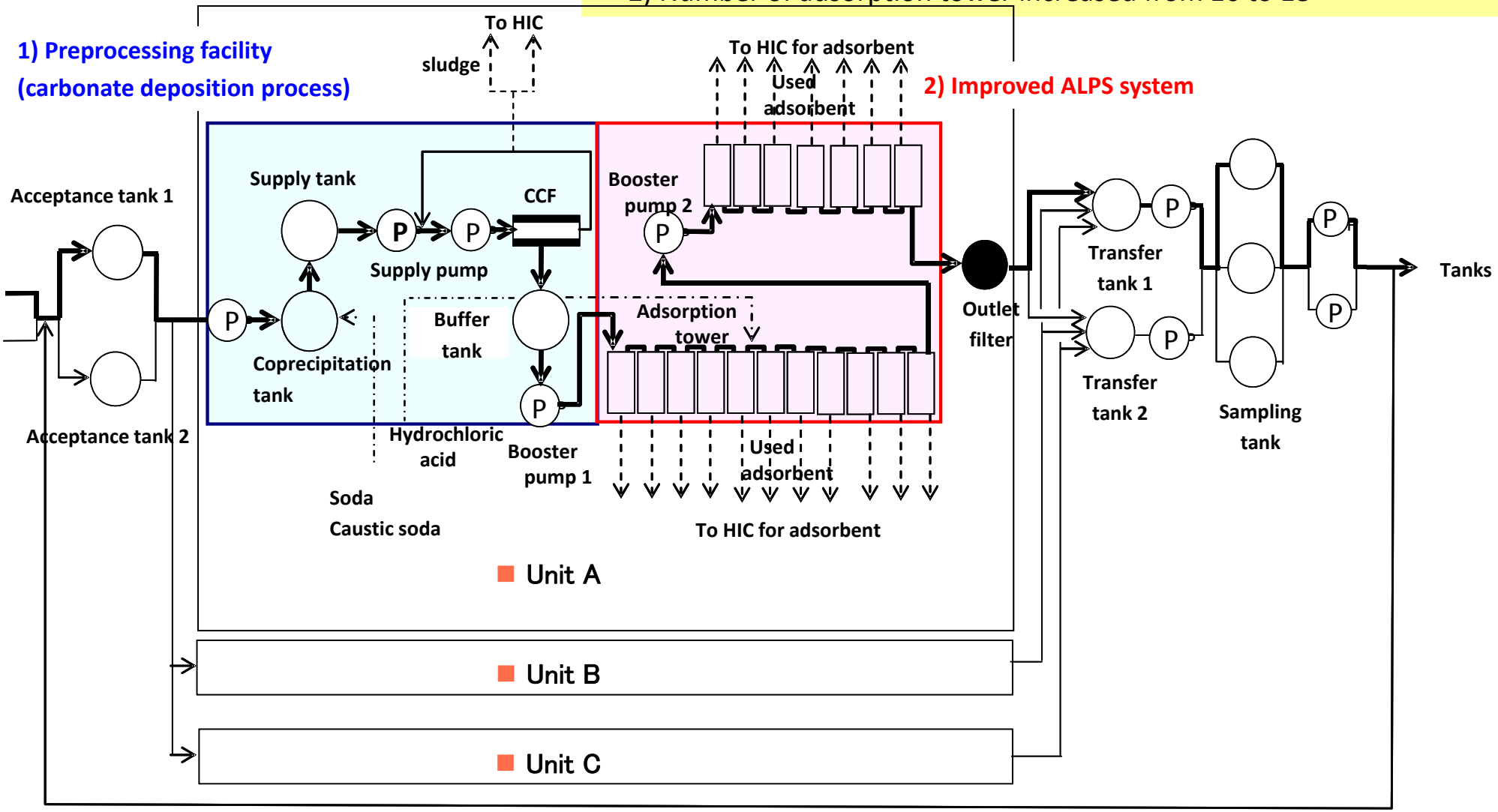
Schedule due to change reflecting the situation of construction etc.

<Reference> System diagram

Improved ALPS system

Difference between the existing ALPS system

- 1) Preprocessing and steel coprecipitation were taken and treatment conducted at adsorption tower
- 2) Number of adsorption tower increased from 16 to 18



*All units are the same design.