< Reference >

Nov. 5, 2011

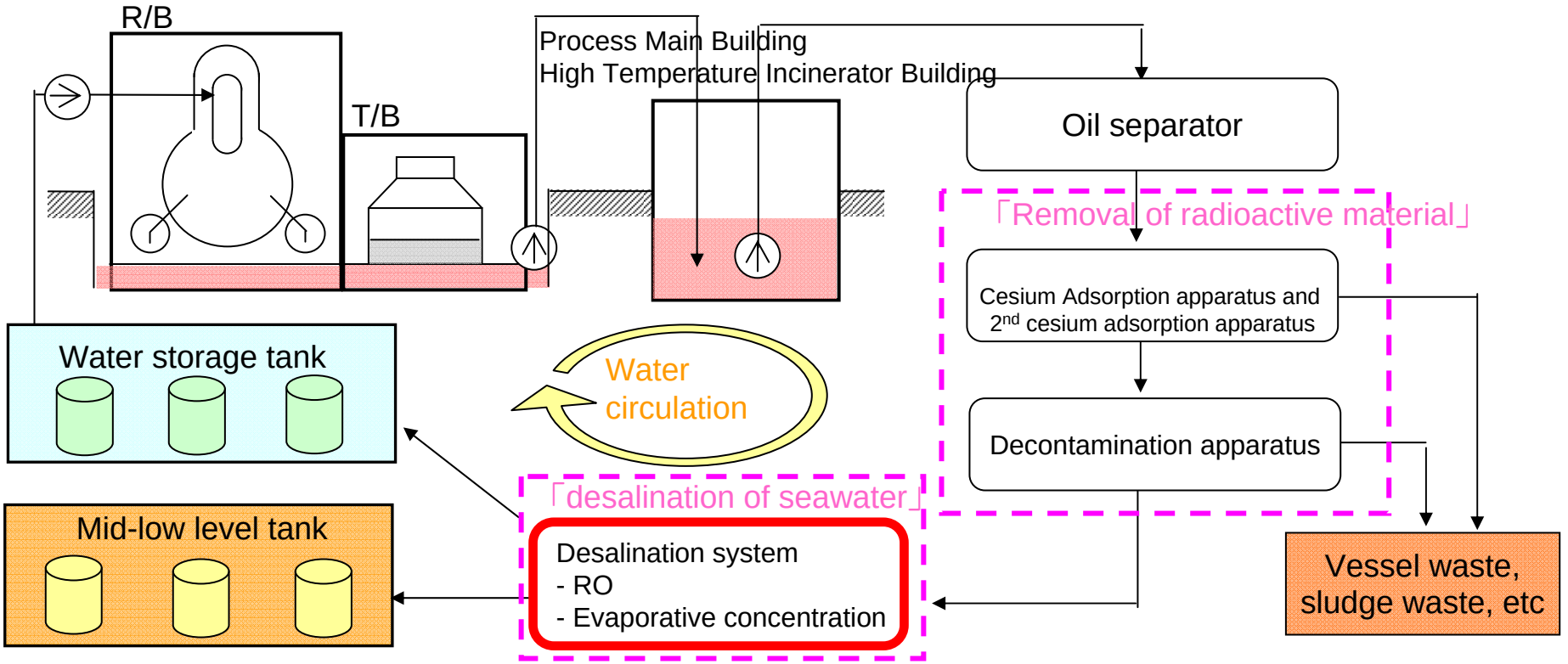
Tokyo Electric Power Company

Recovery and processing of radioactive accumulated water at Fukushima Daiichi Nuclear Power Station

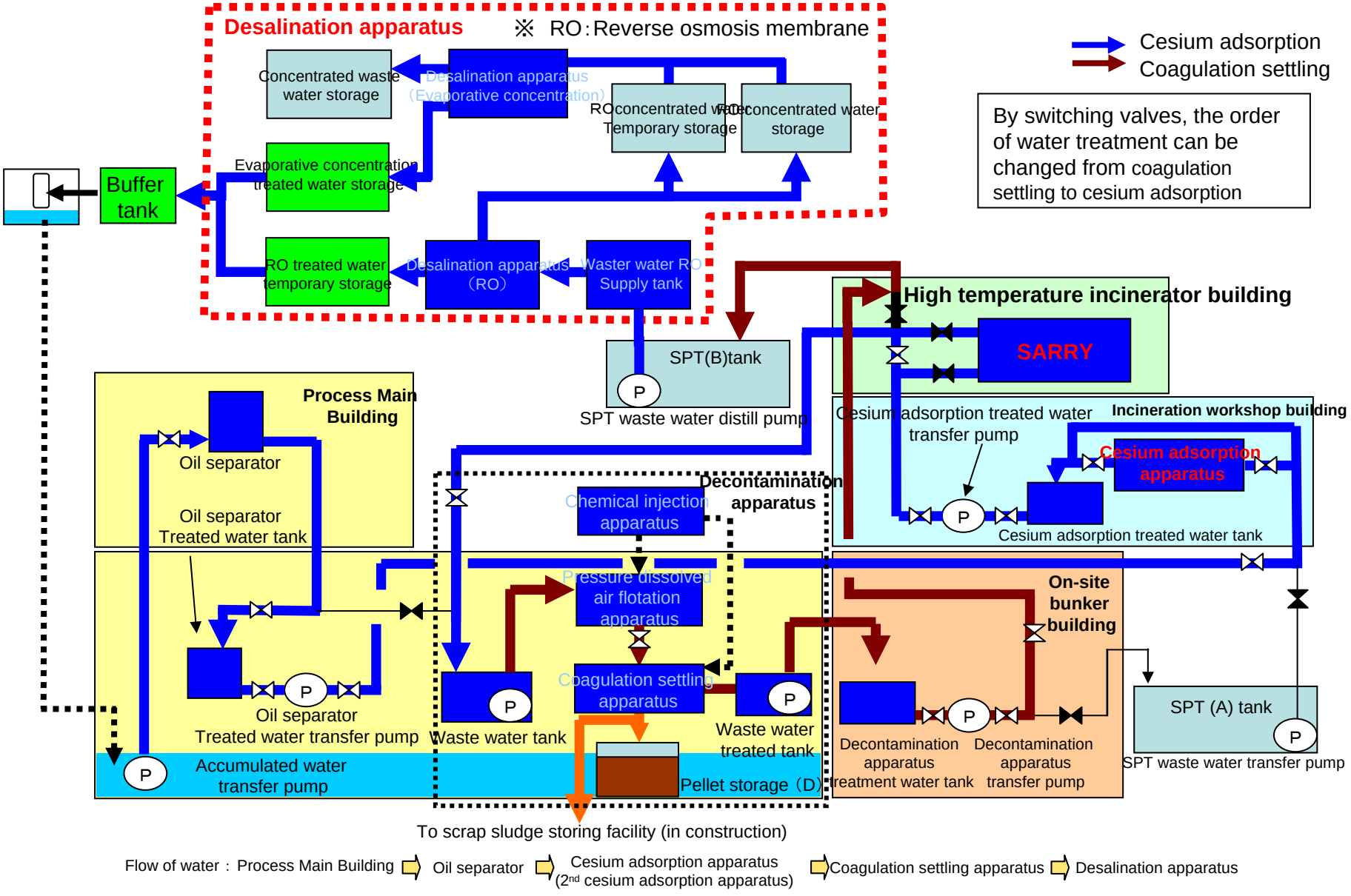
～Mechanism of water treatment (desalination)～

Overview of water treatment (desalination)

- A process where salt is removed from accumulated water (radioactivity has already been removed), and freshwater is produced to be used for reactor water injection. This limits more water accumulating due to reactor water injection.
  - Limits production of accumulated water → Treated accumulated water is used for reactor water injection for reuse.
  - Limits instruments corrosion → removal of salt



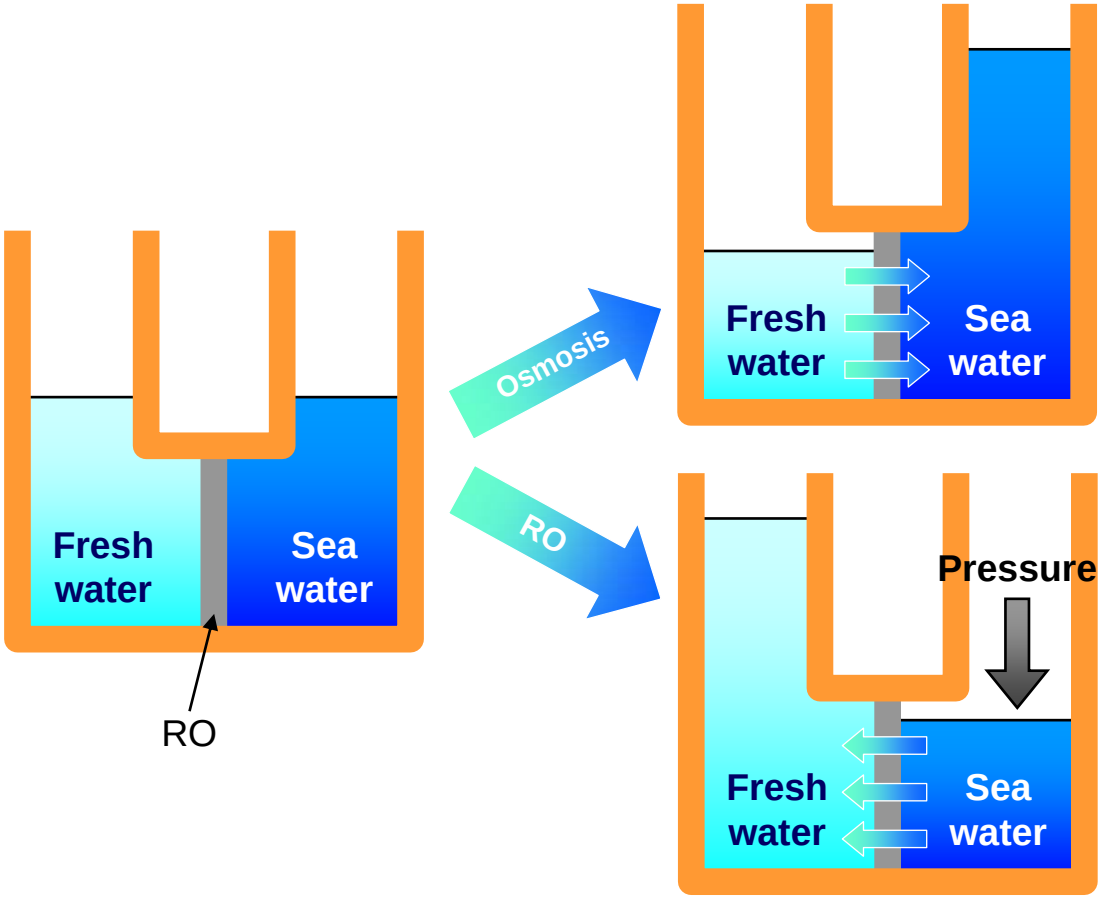
System structure of desalination apparatus



Removal of salt (Reverse osmosis membrane (RO) method)

Removal of salt by RO method

- Removes salt in accumulated water by using the nature of reverse osmosis membrane; enables water to pass but does not allow others such as ion and salt to pass the membrane.
- Production rate of freshwater and concentrated salt water is approx. 4:6.



＜Osmosis and Reverse osmosis (RO)＞

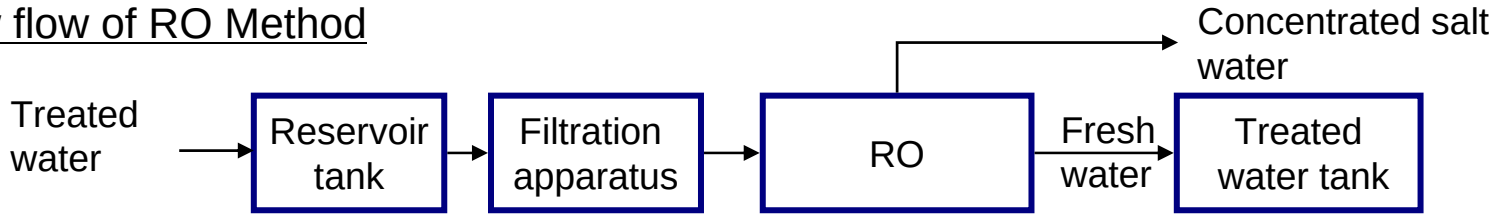
Instrument	Treated amount [m³/d]	Rate of desalination [%]	Manufacturer
RO-1A	270	approx.40	Ace Water Treatment
RO-1B	300	approx.40	Ace Water Treatment
RO-2	1200	approx.40	Hitachi
RO-3	1200	approx.40	Hitachi

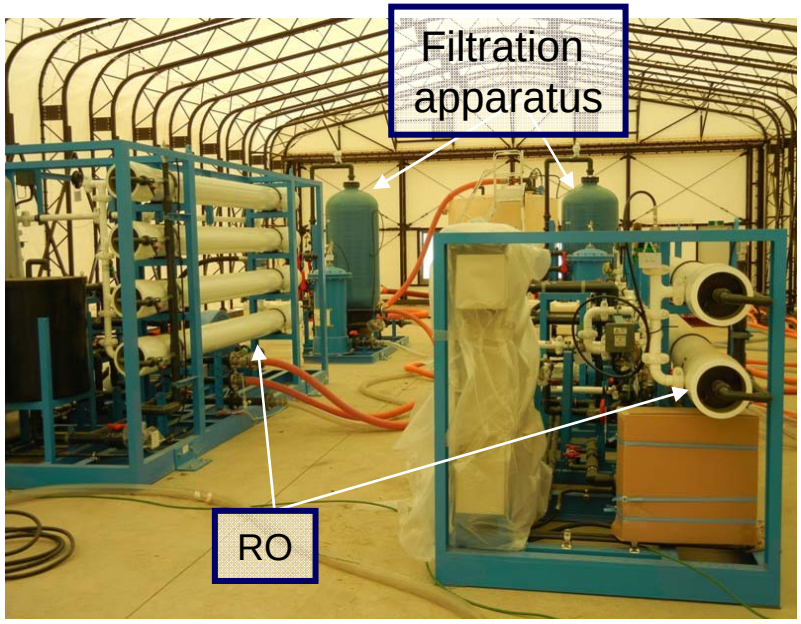
＜List of apparatus used（RO）＞

Desalination apparatus（Reverse Osmosis（RO）Method）

- Desalination apparatus (RO Method) is made from reservoir tank, filtration apparatus, RO, treated water tank.
- There are 4 sets of these, and by connecting them in parallel, treated volume can be adjusted from 11m³/h（270m³/day）to 75m³/day（1800m³/day）.

Overview flow of RO Method



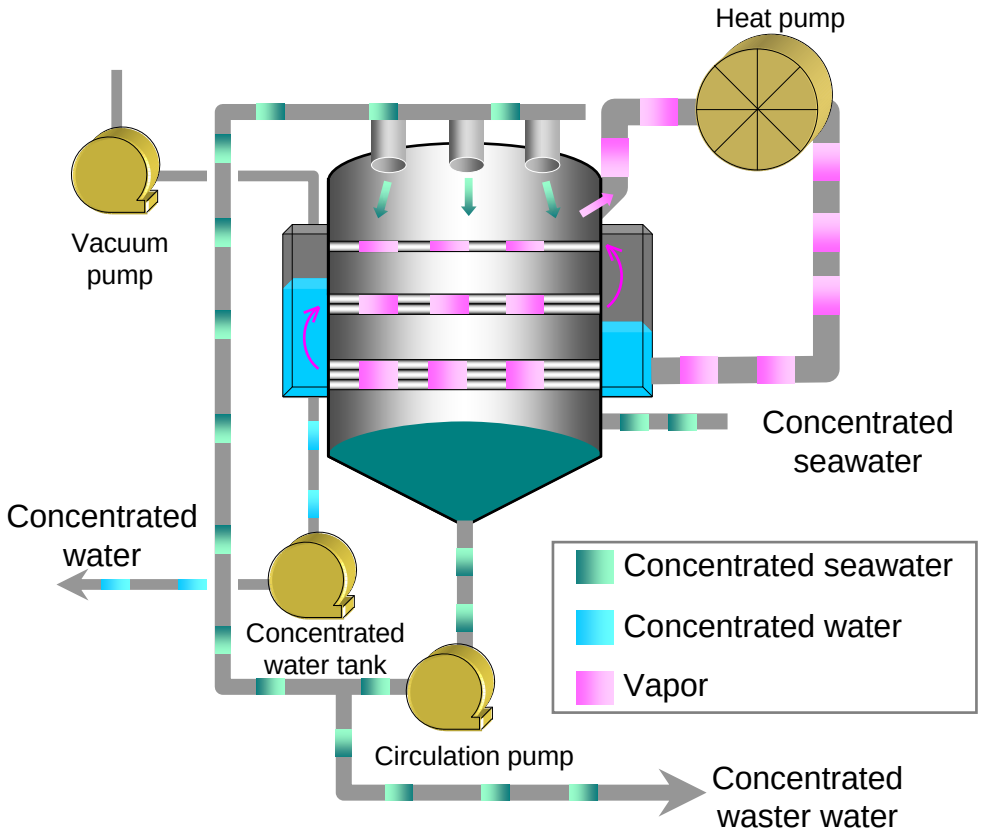


＜Desalination apparatus (RO module)＞

＜ Desalination apparatus (Filtration apparatus)＞

Removal of salt (Evaporative Concentration Method)

- Removal of salt by evaporative concentration method
  - Heats and evaporates the concentrated salt water concentrated by RO method, and separates concentrated water (freshwater) and concentrated waste water.
  - The production rate of freshwater and concentrated waste water, varies between two types; approx. 3:7, and approx. 7:3.



＜Example of evaporative concentration method＞

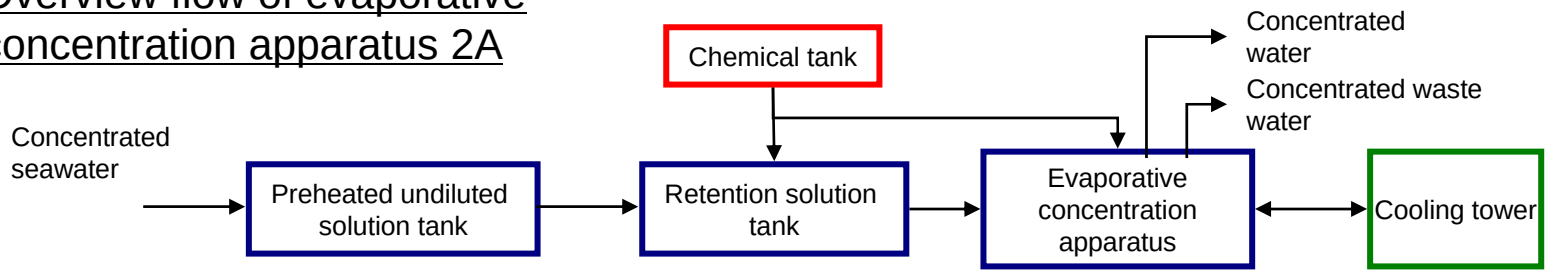
apparatus	Treatment amount [m^3/d]	Desalination rate [%]	Manufacturer
Evaporative concentration -1A	12.7	approx. 30	AREVA
Evaporative concentration -1B	27	approx. 30	AREVA
Evaporative concentration -1C	52	approx. 30	AREVA
Evaporative concentration -2A	80	approx. 30	Toshiba
Evaporative concentration -2B	80	approx. 30	Toshiba
Evaporative concentration -3A	250	approx. 70	Toshiba
Evaporative concentration -3B	250	approx. 70	Toshiba
Evaporative concentration -3C	250	approx. 70	Toshiba

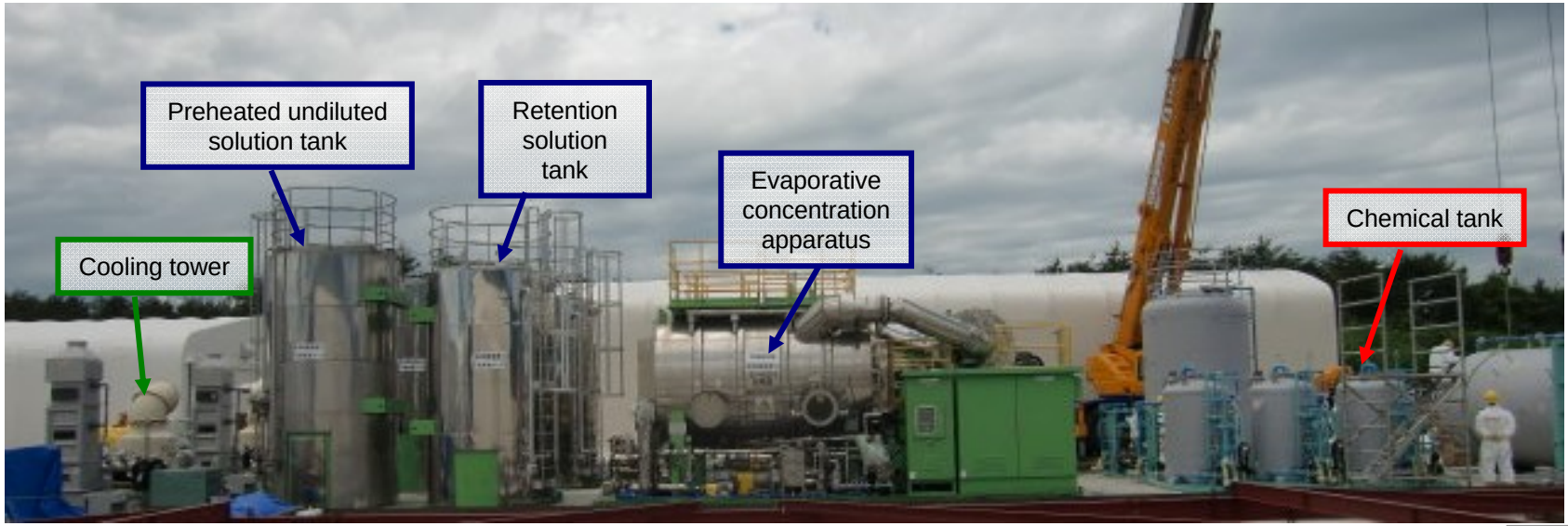
＜ List of apparatus used (Evaporative Concentration Method)＞

Desalination apparatus (Evaporative Concentration Method)

- Desalination apparatus (Evaporative Concentration Method) is made from reservoir tank, evaporative concentration apparatus, cooling tower.
- There are 8 sets of these, and by connecting them in parallel, treated volume can be adjusted from 0.5m³/h（12.7m³/day）to 31m³/day（750m³/day）.

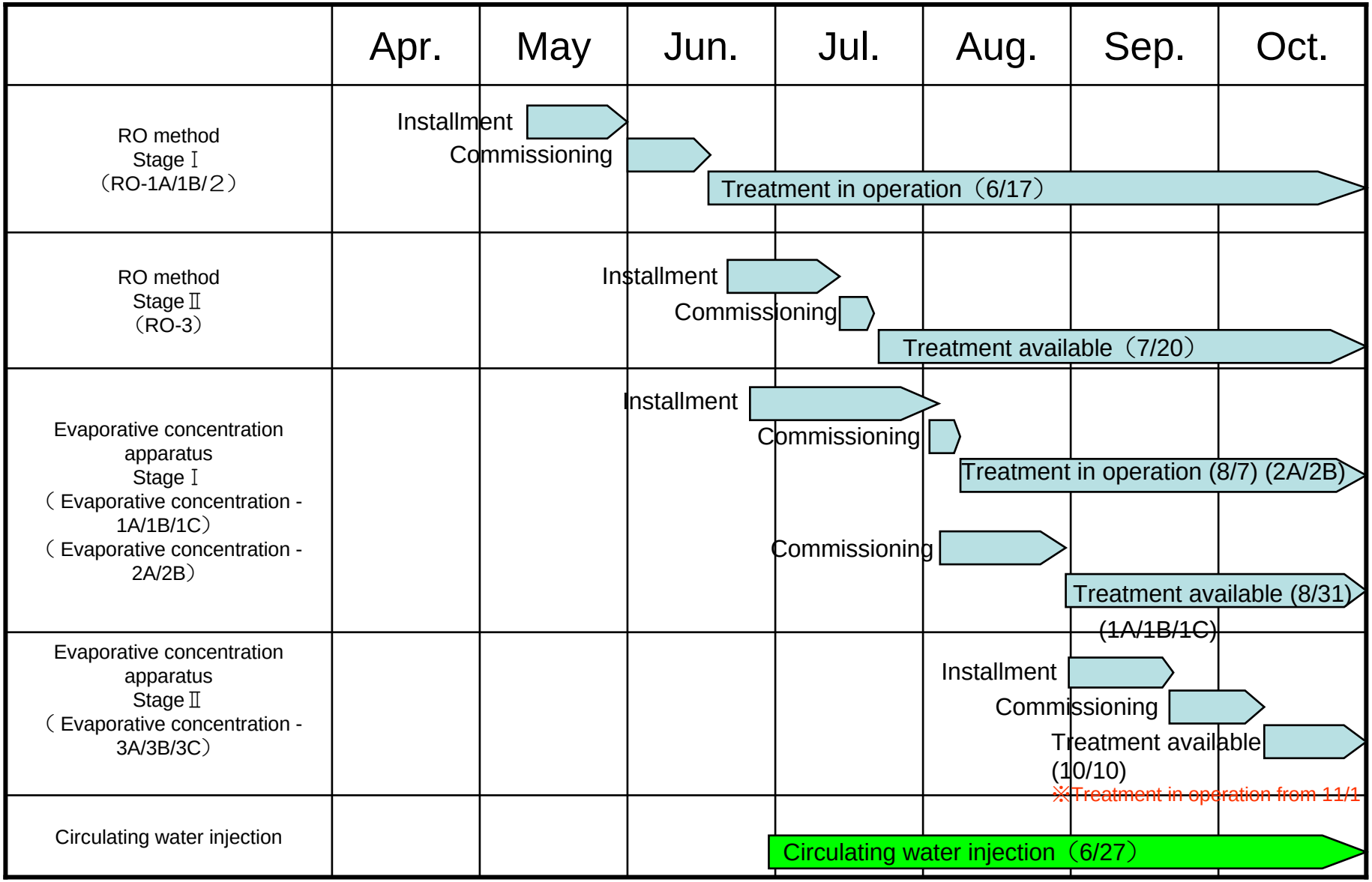
Overview flow of evaporative concentration apparatus 2A





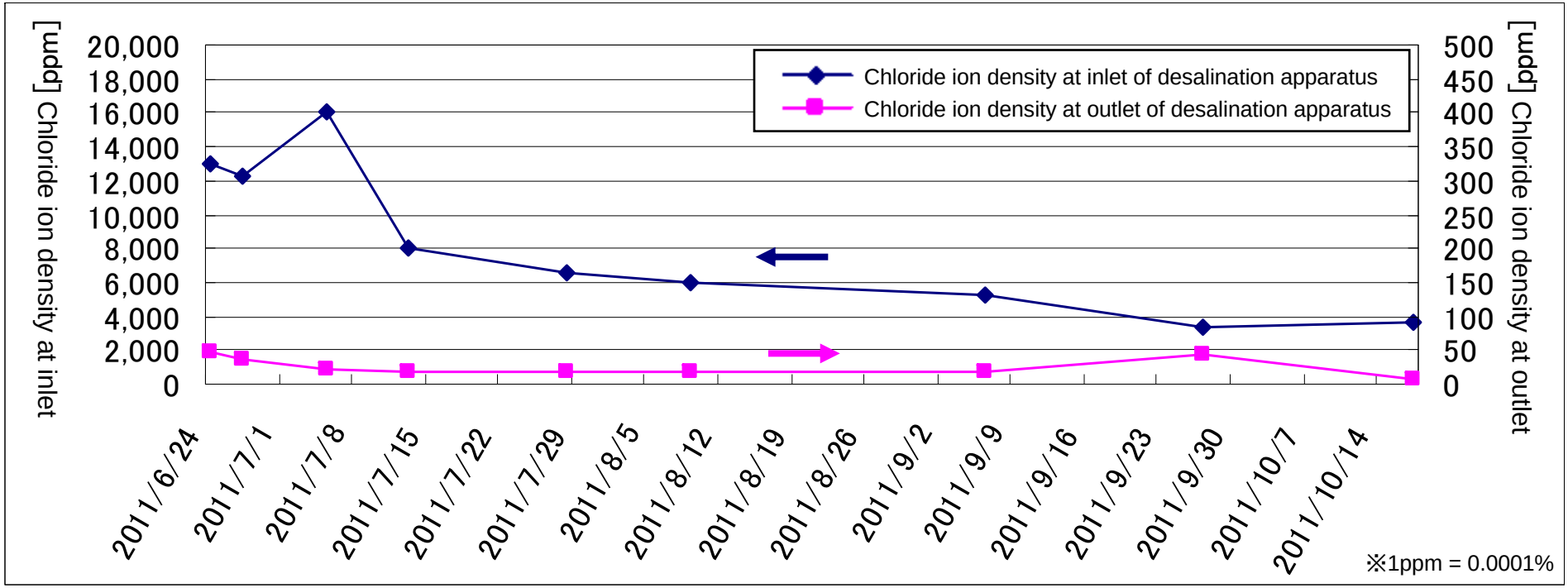
＜Evaporative concentration apparatus 2A （Overview）* It is currently covered by tent＞

Construction record of desalination apparatus



Record of removal of salt

- RO method
  - Lowered chloride ion (maximum around 1.9%) to 0.025%.
- Evaporative concentration method
  - Lowered chloride ion density of concentrated water from RO method to 0.0001%.



＜Compare of chloride ion density at inlet and outlet of RO method desalination apparatus ＞

As a result of water circulation, chloride ion of accumulated water is tends to be decreasing

Record of water treatment

■ Produced approx. 60,000m³ freshwater from approx. 140,000m³ accumulated water [as of 2011/10/31]

※Evaporative concentration method produced approx. 2,250m³ freshwater

- Jun. 17 Desalination apparatus（RO method）operation
- Aug. 7 Desalination apparatus（Evaporative concentration apparatus 2A, 2B) Commissioning completed
- Aug. 31 Desalination apparatus（ Evaporative concentration apparatus 1A, 1B, 1C）Commissioning completed
- Oct. 9 Desalination apparatus（ Evaporative concentration apparatus 3A, 3B, 3C）Commissioning completed