Committee for monitoring and evaluating the specified nuclear facilities (provisional translation) (9th meeting)
Reference 1-3

Hot Test Performed on the Multi-nuclide Removal Equipment

April 19, 2013

Tokyo Electric Power Company

TEPCO 東京電力

Hot Test

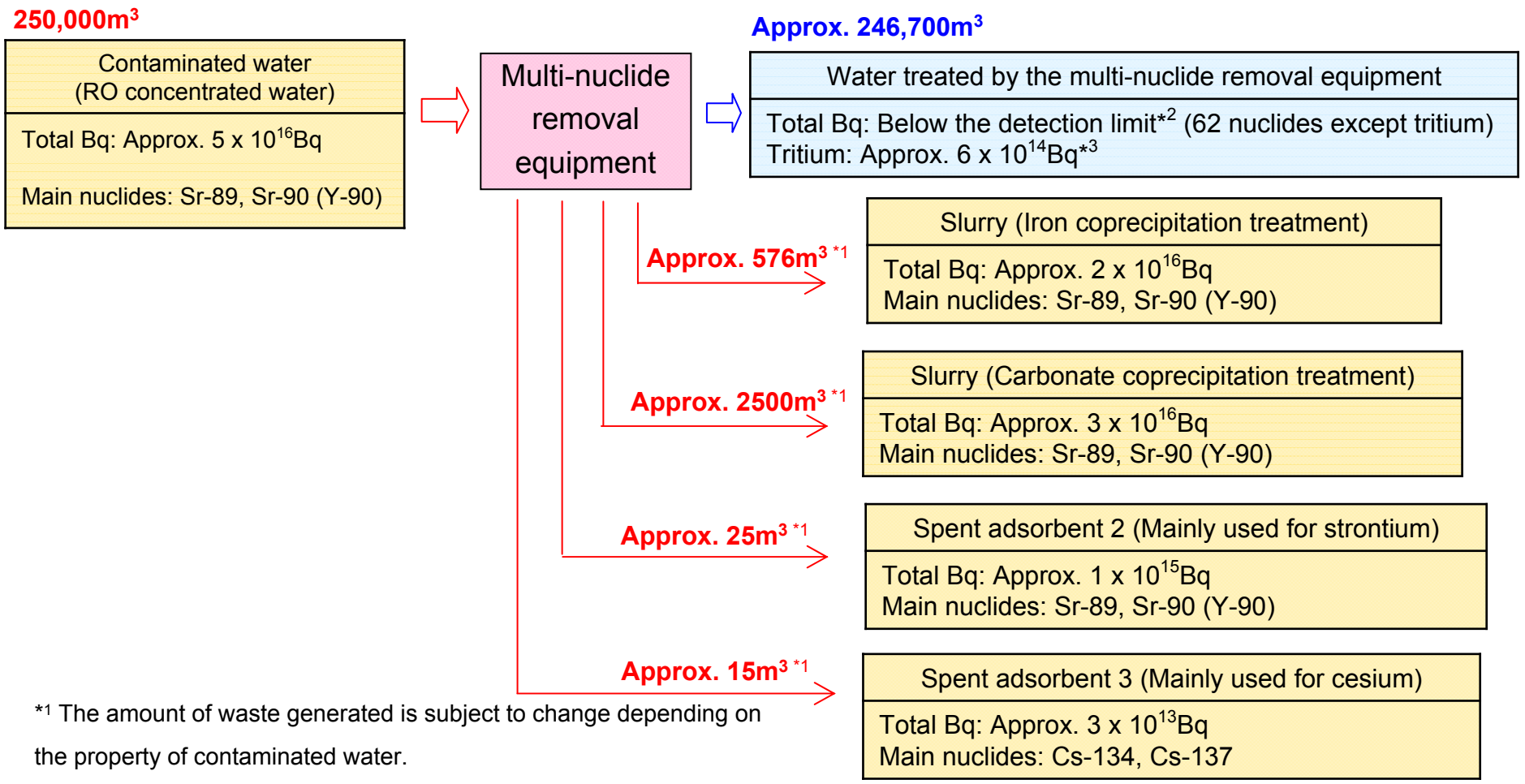
- In response to the leakage from the underground reservoirs, the purification of contaminated water will be promoted through early implementation of hot test on systems B and C for the purpose of mitigating risks of contaminated water.
- Though the hot test on system A of the multi-nuclide removal equipment was temporarily suspended due to incorrect operation, etc., the test is steadily progressing.
- Though the hot test on systems B and C was initially planned to be discussed after evaluating the results of system A hot test, the test for systems B and C will be implemented ahead of schedule for the purpose of mitigating risks of contaminated water.

Hot Test

Updated version of the document used in the sixth meeting of the Committee for monitoring and evaluating the specified nuclear facilities

Transfer of radioactive materials through treatment

(Calculated based on the amount of contaminated water as of April 16, 2013)



*1 The amount of waste generated is subject to change depending on the property of contaminated water.

*2 Verification test result (laboratory test)

*3 Calculated assuming the density of 2.3 x 10^3 Bq/cm^3 in 246,700m^3.

東京電力 TEPCO

Status of the Hot Test Performed on System A

- Evaluation of the capability to remove radioactive materials of system A

  - Schedule of capability evaluation

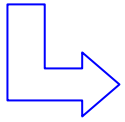
March 30: Hot test on system A was started

April 9-12: Sampling was performed for the hot test on system A

April 16: The collected samples were transported to Fukushima Daini NPS (Measurement currently ongoing)

Early May: Measurement/evaluation of γ nuclides are planned to be completed

Late May: Measurement/evaluation of Sr and all α are planned to be completed



Hold point: Evaluate the effectiveness of risk mitigation regarding the main nuclides (Sr, Cs, etc.) contained in the contaminated water.

Mid June: Measurement/evaluation of Tc, Ni, etc.* are planned to be completed

*The risks related to these nuclides are considered to be lower as their densities are less than approx. one thousandth of that of Sr-90 (1×10^5Bq/cm^3 level) which is one of the main nuclides contained in the RO concentrated water.

Though the evaluation of capability to remove nuclides by hot test requires a substantial amount of time, the effectiveness of the multi-nuclide removal equipment in risk mitigation is considered to be significant since the densities of nuclides contained in the treated water are expected to be lower than the density limits as a result of simplified analysis of treated water.

Simplified Measurement of the Water Treated by System A

Preliminary results of simplified measurement (of water treated by system A)

The measurement results of the main nuclides contained in the water treated by system A (performed at Fukushima Daiichi NPS) are as follows.

- ✓The results are below the density limits.
- ✓Compared to untreated water, DF is estimated to be about 1,000-1,000,000.
- ✓Though small amounts of Cs-137(Ba-137m), Co-60, Ru-106 (Rh-106) and Sb-125 (Te-125m) were detected, the densities are not far beyond the detection limits (ND value). *Nuclides with radioactive equilibrium are provided in the parenthesis.
- ✓The results were obtained from the treated water samples collected several days after the hot test on system A was started (treated amount: about 1,000m^3). The measurement was continued while adjusting the conditions set for the pre treatment process (iron coprecipitation and carbonate coprecipitation).
- ✓The capability to remove radioactive materials is to be examined based on detailed measurements.

Simplified Measurement of the Water Treated by System A

Unit: Bq/cm^3

Nuclides subject to analysis (Main nuclides)		Cs-134	Cs-137 (Ba-137m)	Co-60	Ru-106 (Rh-106)	Sb-125 (Te-125m)	Sr-90 (Y-90)
Radioactivity density of untreated water (measurement performed on the water collected from the tank)		Detected 3.2E+00	Detected 6.3E+00	ND (Detection limit: 6.6E-01)	Detected 1.3E+01	Detected 2.5E+01	Detected 3.7E+04
Radioactivity density of the water treated by ALPS system A	Results on April 9[*1]	ND (Detection limit: 1.7E-04)	ND (Detection limit: 2.1E-04)	Detected[*2] 2.5E-04	Detected[*2] 5.9E-03	ND (Detection limit: 4.5E-04)	ND[*3] (Detection limit: 1.1E-03)
	Results on April 12[*1]	ND (Detection limit: 2.1E-04)	Detected[*2] 4.7E-04	Detected[*2] 5.1E-04	Detected[*2] 9.1E-03	Detected[*2] 9.7E-04	Detected[*3] 1.0E-02
Density limit		6E-02	9E-02	2E-01	1E-01	8E-01	3E-02

Measurement conditions (Cs, Co, Ru and Sb): Ge semiconductor detector, 2L, 30,000 seconds

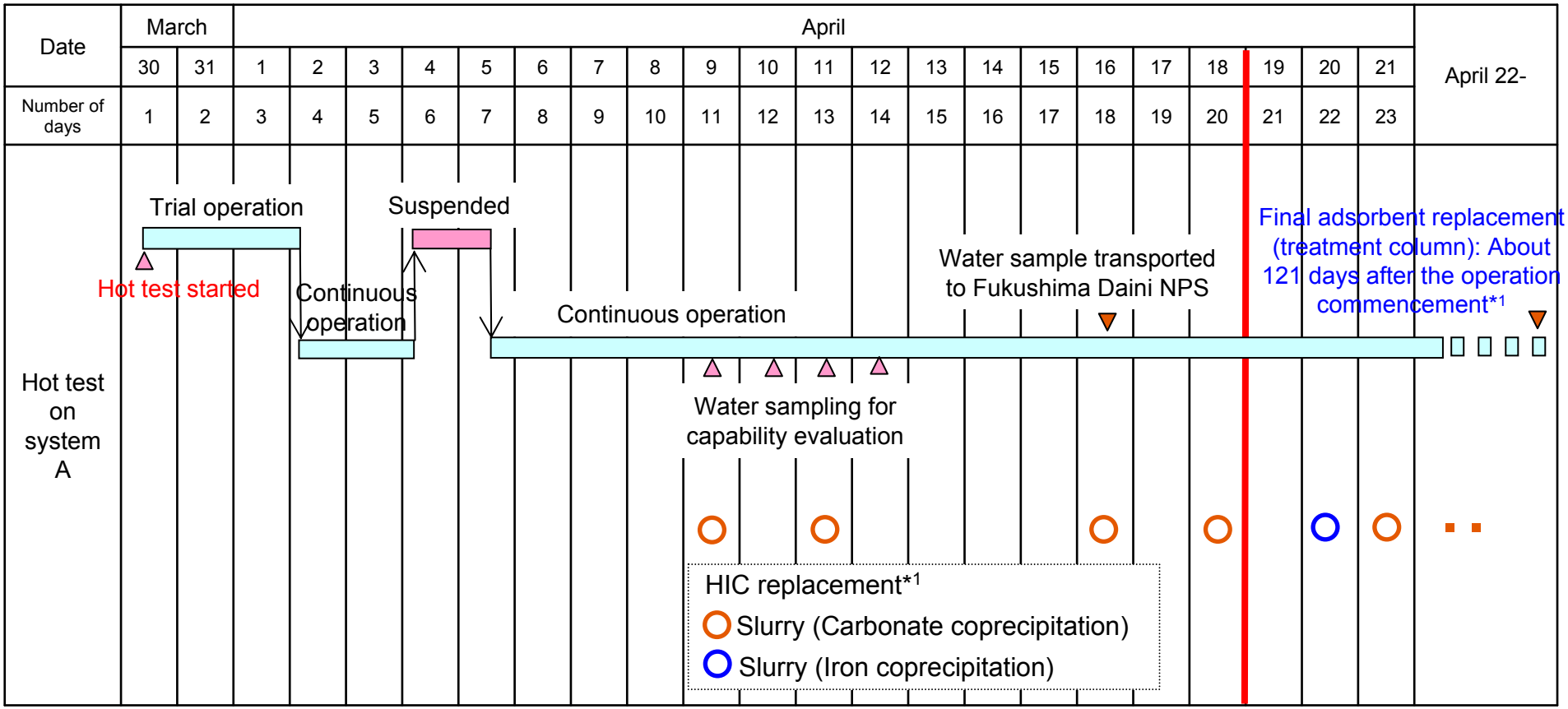
[*1] Samples on April 9 and April 12 were collected while the system was under continuous operation (the operational status is the same for both cases).

[*2] Cs-137 (Ba-137m), Co-60 and Sb-125 (Te-125m) detected were same level as the detection limit (ND value). Ru-106 (Rh-106) detected was single digit higher than the detection limit (E-04 level). The densities of 38 out of 45 nuclides which can be measured and evaluated utilizing a Ge semiconductor detector were less than the detection limit (ND).

[*3] As for Sr-90, the data is unstable due to the measurement difficulty (Sr separation was done by a simplified filtering method). Detailed measurement is to be performed at Fukushima Daini NPS under the same conditions as the verification test (results reported at the 9th meeting of the Government-TEPCO Mid-and-long Term Response Council Working Council held in August 2012).

Status of the Hot Test Performed on System A

Schedule of the hot test on system A



*1 The replacement timing is subject to change depending on the property of contaminated water.

Status of the Hot Test Performed on System A

Evaluation of the capability of system A to maintain its capability to remove radioactive materials

- At the hot test performed on system A, it is confirmed that its capability to remove radioactive materials is maintained while treating approx. 30,000m^3 of contaminated water (equivalent to about 121 days under continuous operation with the rated flow rate of 250m^3). The cumulative amount of water treated as of April 18 is approx. 1,900m^3. The evaluation will be done after the hot test is continued until the amount of treated water reaches the specified level.

- In the case that the adsorbent replacement cycle differs from the initial estimate, the amount of waste generated (HIC) will be changed. However, as no problem has been found with HIC handling so far since system A started operation, it is assumed that HIC handling will not be affected even if the hot test for systems B and C is performed in parallel.

- Since the amount of slurry generated in the pretreatment process (which comprises the majority of the total waste) is as estimated, the change in the number of spent adsorbents is considered to have little impact.

Estimated number of HICs to be generated

Contents of HIC		HIC generated (Number of units per year)*	Ratio to the total number of HIC generated (%)*
Slurry	Iron coprecipitation treatment	147	18
	Carbonate coprecipitation treatment	635	77
Adsorbent	Adsorbents 1-6	39	5

* Assuming two systems of the multi-nuclide removal equipment in operation (500m^3/day). The total number of HICs to be generated per year is estimated to be 821. However, the number of HICs generated is subject to change depending on the property of contaminated water.

Status of the Hot Test Performed on System A

Safety Evaluation of system A (1/2)

No equipment trouble, etc. which may affect safety has not been found so far during the hot test.

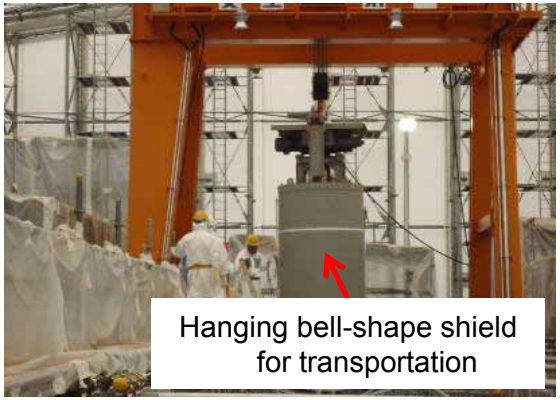
- ✓No abnormality such as leakage from the equipment has been found.
- ✓HIC replacement was performed (HICs for stage 2 slurry: 4 times): No abnormality found during the work.

First (April 9) Amount of time*: about 5.5 hours, Max. individual exposure dose: 0.03mSv

Second (April 11) Amount of time*: about 6 hours, Max. individual exposure dose: 0.03mSv

Third (April 16) Amount of time*: about 5 hours, Max. individual exposure dose: 0.03mSv

Fourth (April 18) Amount of time*: about 7 hours, Max. individual exposure dose: 0.03mSv



Multi-nuclide removal equipment installation area [HIC (before use) being stored in the hanging bell-shape shield used for transportation]

Temporary storage facility area [HIC storing waste (slurry) being handled by the crane]

*Amount of time: from when the replacement work was started to when the HIC was stored in the temporary storage facility.

Status of the Hot Test Performed on System A

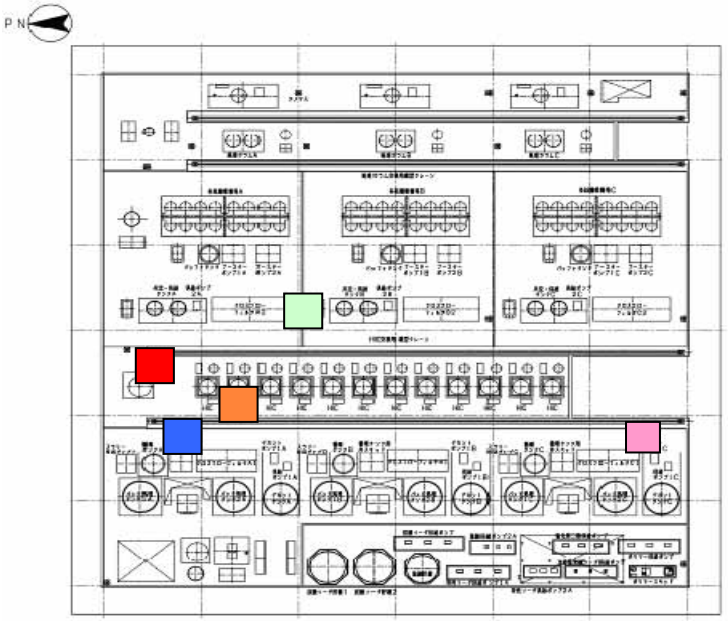
Safety Evaluation of system A (2/2)

✓ According to the radiation monitor readings in the area, the radiation dose has changed by about a few μSv/h.

- [Northeast area] Before the hot test: 1 μSv/h or less, As of April 17: Approx. 10 μSv/h
- [Southwest area] Before the hot test: 1 μSv/h or less, As of April 17: 1 μSv/h or less

The atmosphere dose around the equipment has changed below 1mSv/h.

- [Around the cross flow filter] As of April 15: Approx. 60 μSv/h
- [Around the circulation valve skid] As of April 15: Approx. 20 μSv/h
- [Around HIC] As of April 15: Approx. 10 μSv/h



Though a small increase in the atmosphere dose was found, there is no impact on the work

- : Northeast area radiation monitor
- : Southwest area radiation monitor
- : Around the cross flow filter
- : Around the circulation valve skid
- : Around HIC

Status of the Hot Test Performed on System A

■Improvement measures to be implemented in response to issues found in system A) (1/2)

Incidents which require equipment improvements (as of April 17)

1. Automatic suspension due to incorrect operation on the console screen (occurred on April 4): Reported at the 8th meeting of the Committee for monitoring and evaluating the specified nuclear facilities

Overview

When an operator engaged in trial operation incorrectly operated the console screen (touch panel) while trying to check data during continuous operation (hot test), the equipment was suspended automatically.

Cause

- ➢ The reaction scope of the touch pen used to operate the touch panel was too large due to its big tip.
- ➢ Since there was a time lag from button selection to screen transition, the tank switching button was selected by mistake at the moment of screen transition.

Countermeasures (Equipment improvement)

- ✓ A mouse will be used instead of a touch pen to ensure correct operation.
- ✓ Modification will be implemented to allow for double action instead of single action for the “select operation” switches similarly to the switches used to start/suspend the equipment.
- ✓ Modification will be made to allow for selecting the data display screen (which cannot be operated currently) and the operation screen. Data confirmation will be performed on the data display screen.

Status of the Hot Test Performed on System A

■Improvement measures to be implemented in response to issues found in system A) (2/2)

2. Change of the control logic for the caustic soda supply pump (occurred on April 12)

Overview

At the time of caustic soda injection for pH adjustment during the iron coprecipitation treatment when the equipment was under automatic operation, the pump stop signal was not activated.

Cause

The control logic was set not to activate the pump stop signal when pH reaches the specified level right after the caustic soda supply pump is started.

Countermeasures (Equipment improvement)

The control logic will be changed to prevent the mismatch of the conditions of caustic soda supply pump suspension (the same will be implemented for systems B and C).

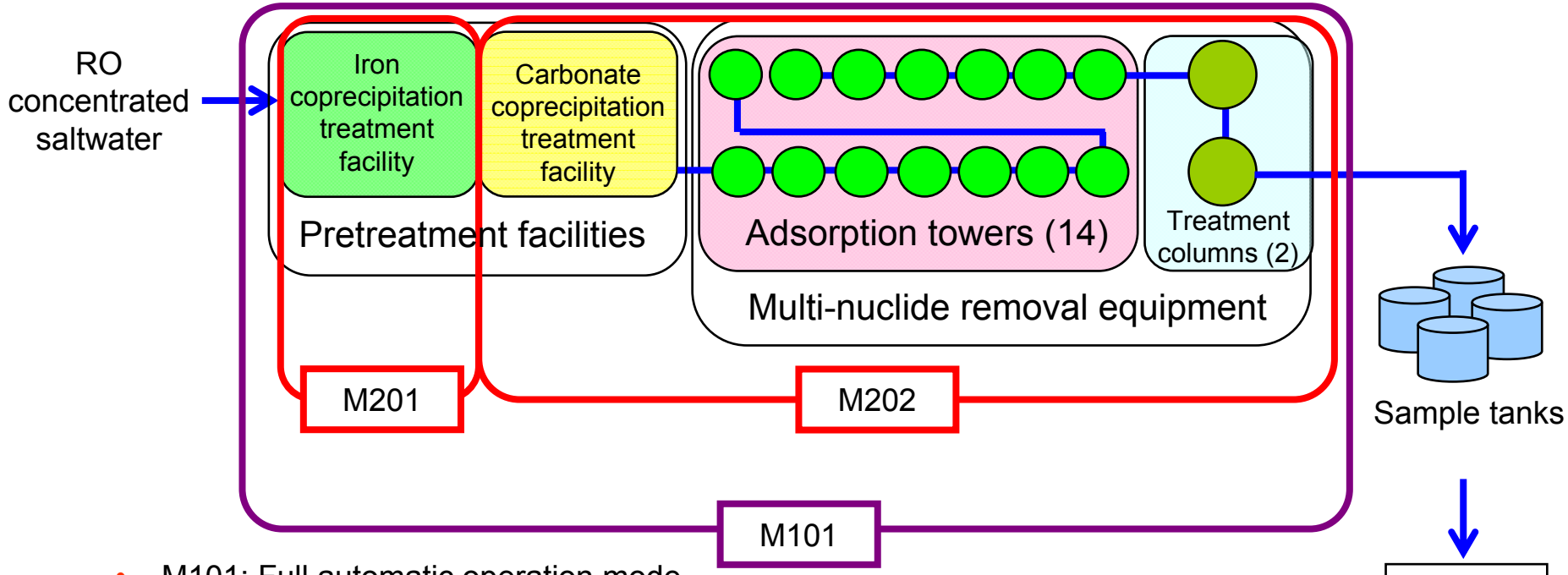
The necessary improvement measures will be implemented before the hot test for systems B and C.

Hot Test Performed on Systems B and C

Method of the hot test to be performed on systems B and C

The hot test will be performed in the following manner similarly to system A.

1. RO concentrated saltwater receiving test
2. System operation (201, 202)
3. System operation (M101)
4. Evaluate the capability to remove radioactive materials



- M101: Full automatic operation mode
- M201: To the iron coprecipitation treatment facility
- M202: From the carbonate coprecipitation treatment facility to the treatment columns

Schedule towards the Hot Test for Systems B and C (Draft)

Schedule towards the hot test for systems B and C (draft)

Necessary improvement measures in response to the issues found during the hot test performed on system A (equipment suspension due to incorrect operation, etc.) will be implemented before starting the hot test for systems B and C.