Fukushima Daiichi NPS Unit 1
Testing of Changes in Nitrogen Injection

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Tokyo Electric Power Co., Inc.

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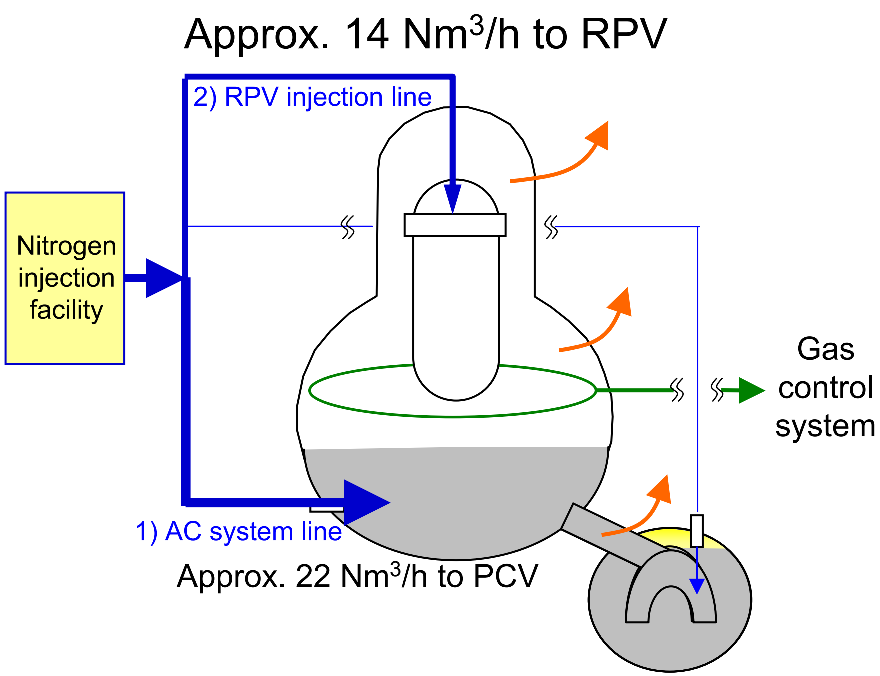
TEPCO

Purpose

Nitrogen injection state of unit 1



(Note: Nitrogen injection to units 2 and 3 PCV is not conducted at present.)

- Nitrogen injection can be reduced in terms of inert atmosphere.

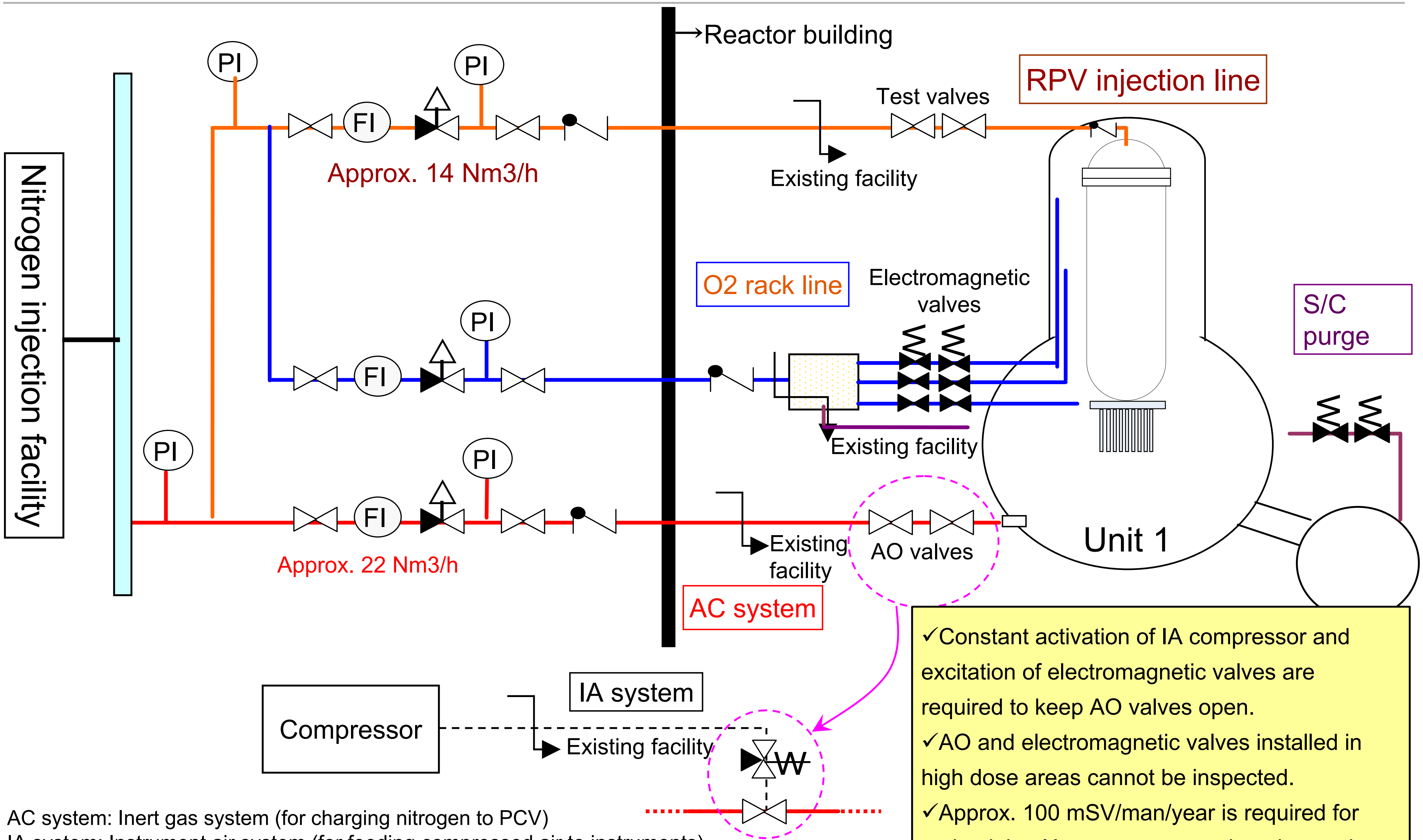
Issues on nitrogen injection in unit 1

- The amount of nitrogen injected to PCV has not been reduced due to an observed tendency of the partial rise of ambient temperature in PCV with a reduced amount of nitrogen.
- Because of difficulties in inspecting isolation valves in the PCV injection line, injection from more reliable line is an issue (for the necessity of prior understanding of effects of halting injection from ① AC system on operation).

Action

Conduct tests by changing the amount of nitrogen **to understand effects** of halting injection to PCV **on the rise of PCV ambient temperature in advance** and check **the possibilities of switching to ② RPV injection line.**

[Reference] Schematic illustration of nitrogen injection system for unit 1



✓Constant activation of IA compressor and excitation of electromagnetic valves are required to keep AO valves open.
✓AO and electromagnetic valves installed in high dose areas cannot be inspected.
✓Approx. 100 mSV/man/year is required for maintaining IA compressor such as inspection.

AC system: Inert gas system (for charging nitrogen to PCV)
IA system: Instrument air system (for feeding compressed air to instruments)

Outline of Nitrogen Injection Change Tests

Objectives

➢Check results of stepwise changes of nitrogen injection to PCV to RPV injection line while maintaining gas balance.

➢Cancel tests when "the time to reach 80ºC in reference to the temperature rise per six hours" is less than 24 hours in accordance with Article 138 of the safety regulation, PCV ambient temperature LCO*,

* "There shall be no marked temperature rise in general."
(The time to reach 100ºC in reference to the temperature rise per six hours shall be 24 hours or over.)

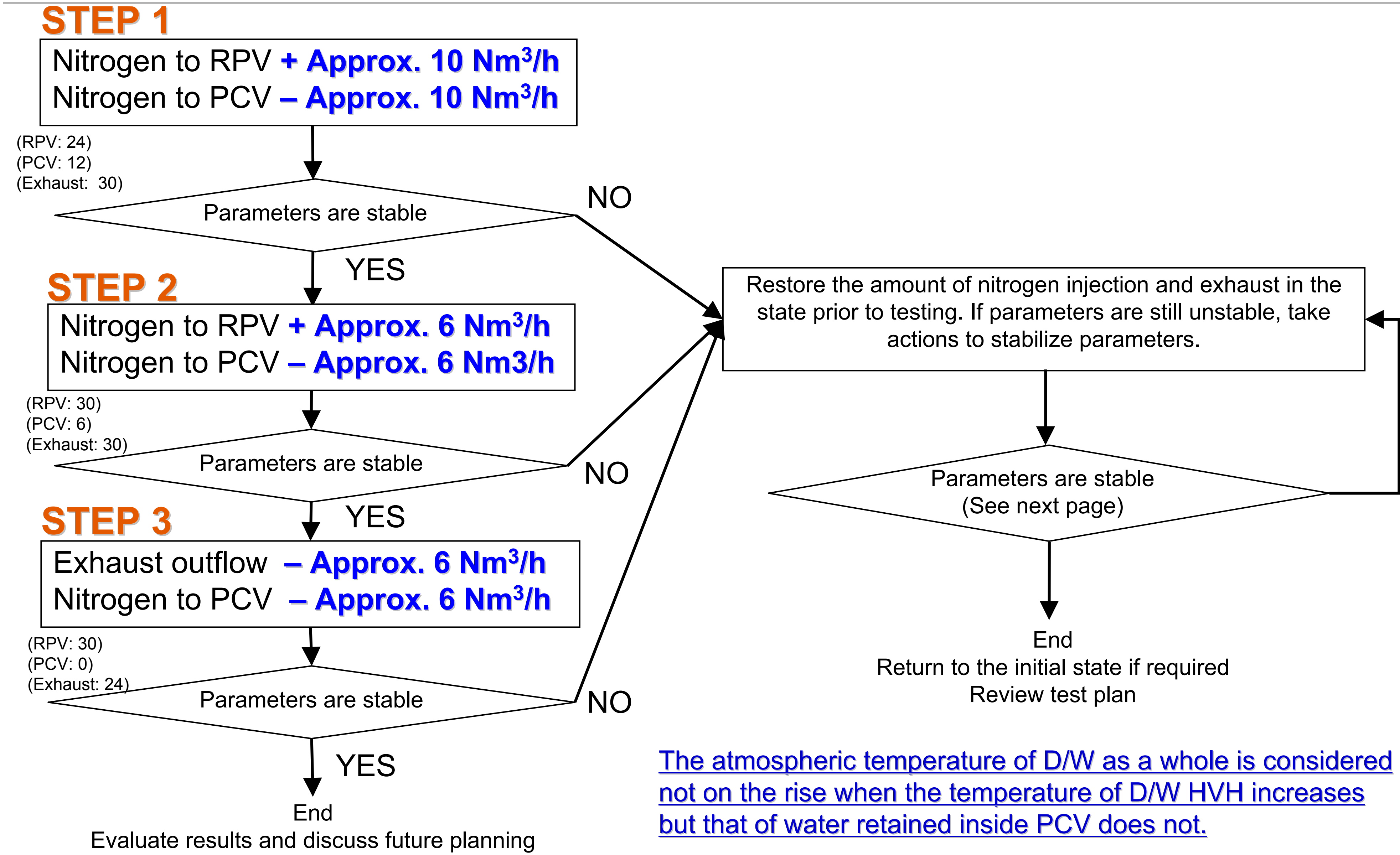
<Current condition>	STEP 1	STEP 2	STEP 3
RPV 14 / PCV 22	RPV 24 / PCV 12	RPV 30 / PCV 6	RPV 30
Exhaust 30	Exhaust 30	Exhaust 30	Exhaust 24

(The values are readings in Nm^3/h)

✓Maintain gas balance in view of correlations between the local temperature rise and "nitrogen injection – exhaust."

✓Increase the amount of nitrogen injected into RPV in expectation of gas flow from RPV to Pedestal to D/W (with an upper limit of 30 Nm^3/h on the flowmeter).

Flow of Nitrogen Injection Change Tests



<u>The atmospheric temperature of D/W as a whole is considered not on the rise when the temperature of D/W HVH increases but that of water retained inside PCV does not.</u>

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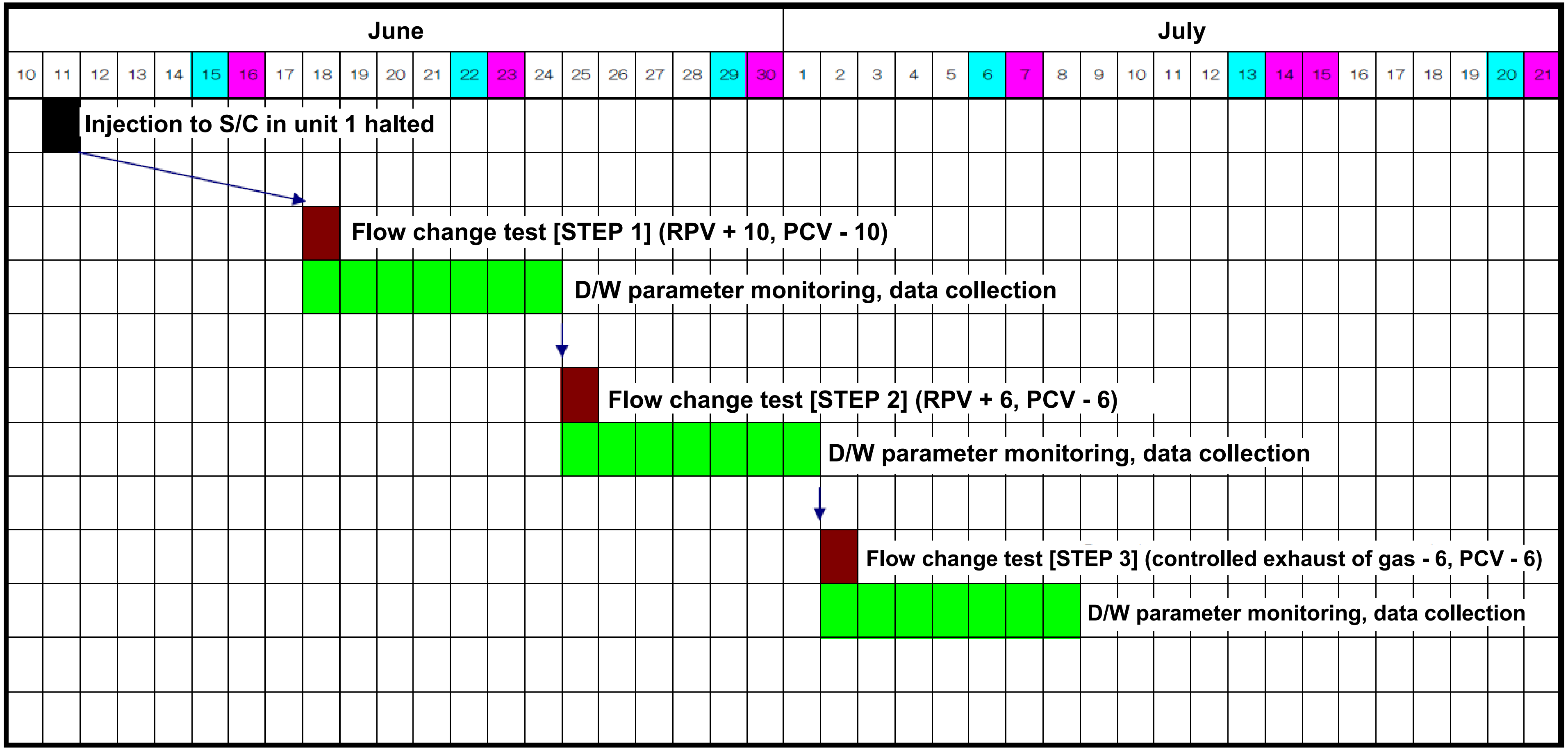
Monitoring parameters

- When to monitoring parameters (on duty, after operation, once per hour for 48 hours, then return to normal monitoring if parameters are stable)

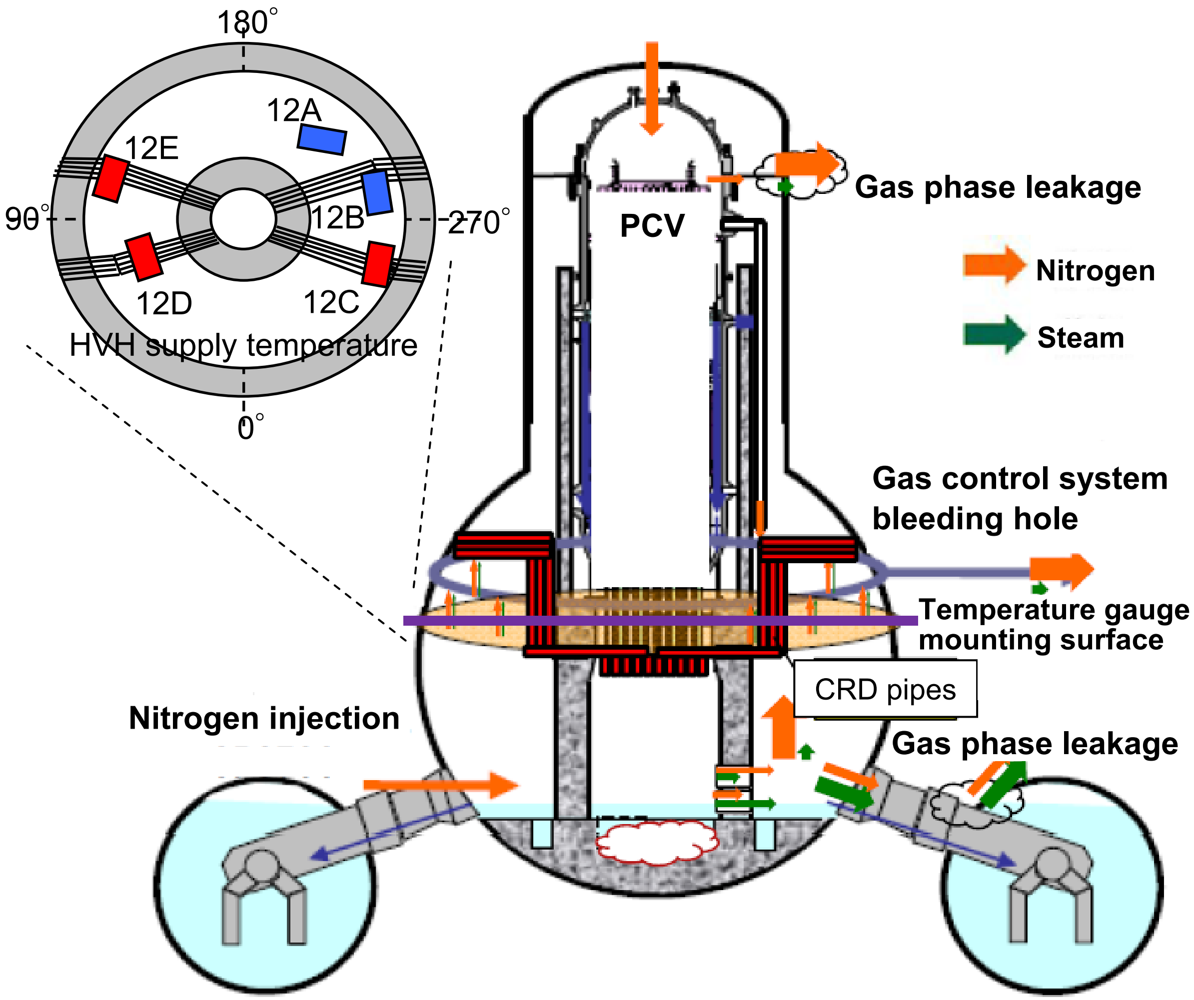
Parameter	Purpose	Criteria
・D/W HVH temperature	Check the variation of temperature readings is within the test criteria.	・Time to reach 65ºC in reference to the temperature rise in PCV per 6 hours is less than 24 hours -> Report to the person in charge. ・Time to reach 80ºC in reference to the temperature rise in PCV per 6 hours is less than 24 hours -> Restore the original state.
・D/W pressure ・Nitrogen gas (RPV, PCV) ・Gas control system exhaust	Check the gas balance of PCV as a whole (i.e. test conditions are maintained).	・Significant deviation -> Restore test conditions within 24 hours.
・PCV water temperature	Check actual temperature and heat balance.	(If any of the parameters listed above change, check the parameters in the left columns to make a comprehensive judgment of the plant state. If any of these parameters varies or reach limits, take actions according to the safety regulation.)
・Hydrogen concentration	Check abnormal temperature rise due to microscopic changes in gas flow.	
・Gas control system dust concentration ・Short half-life nuclide concentration	Check abnormalities (for the purpose of making sure whereas operations do not cause increases in exhaust or criticality).	

- Parameters for test evaluation and in-core analysis
  - Temperatures measured in PCV other than those listed above
  - External parameters including atmospheric pressure, outdoor air temperature and injected water temperature
  - Other parameters that vary significantly

Time Schedule



[Reference] Variation of HVH temperature (Presumed mechanism)



✓There may be other sources of heat in addition to the bottom of PVC, but upward flow of heat outside the pedestal that normally promotes heat convection could lower readings of adjacent HVH and SRV thermometers.

✓There is a possibility of correlation between upward flow and "injected nitrogen - exhaust = leak amount."

✓Nitrogen has virtually no capability of cooling PCV, but may affect heat convection in D/W.

✓Variation of temperatures of water retained inside PCV, at the bottom of RPV, and return HVH, etc. is generally normal, **presumably negating the rise of atmospheric temperature in D/W as a whole.**

➢Detailed mechanisms are not clarified, but injected nitrogen gas may affect heat convection due to its overall flow.