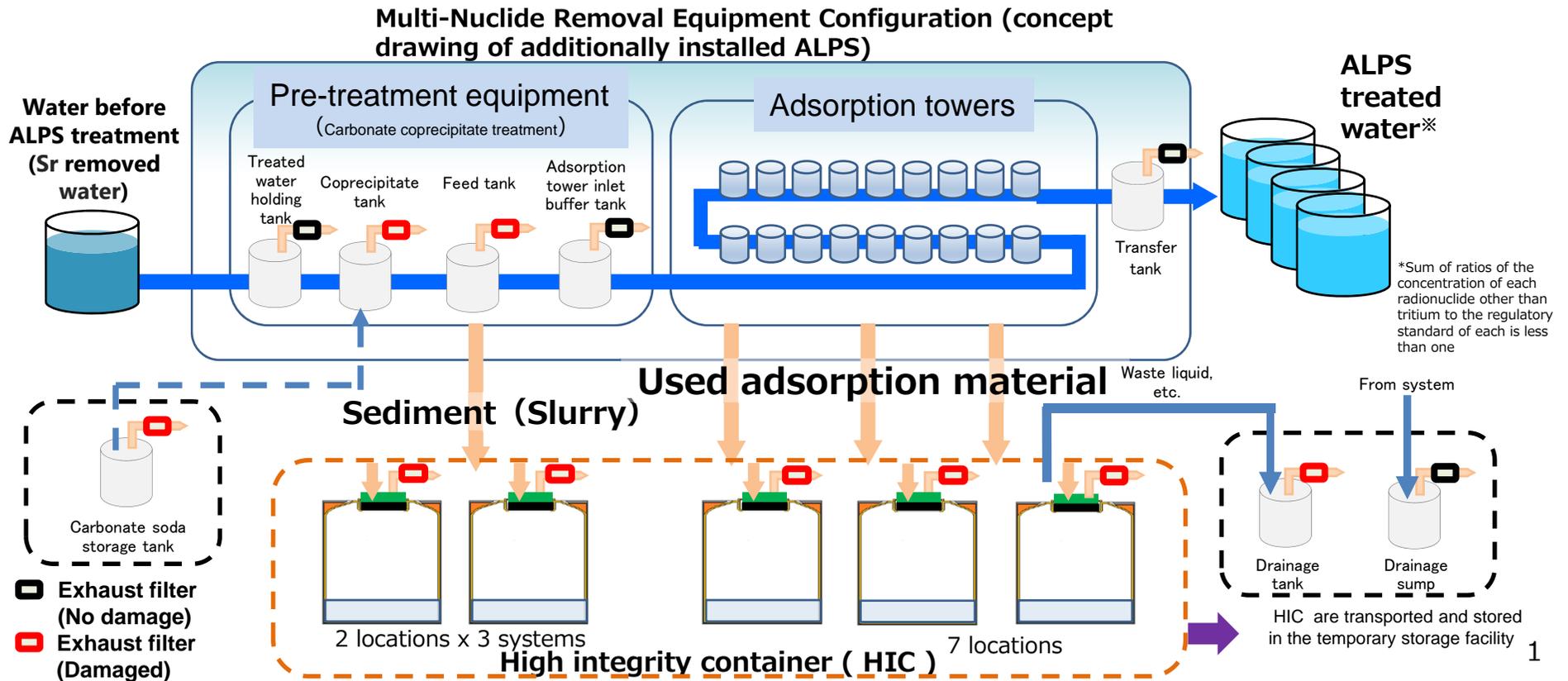


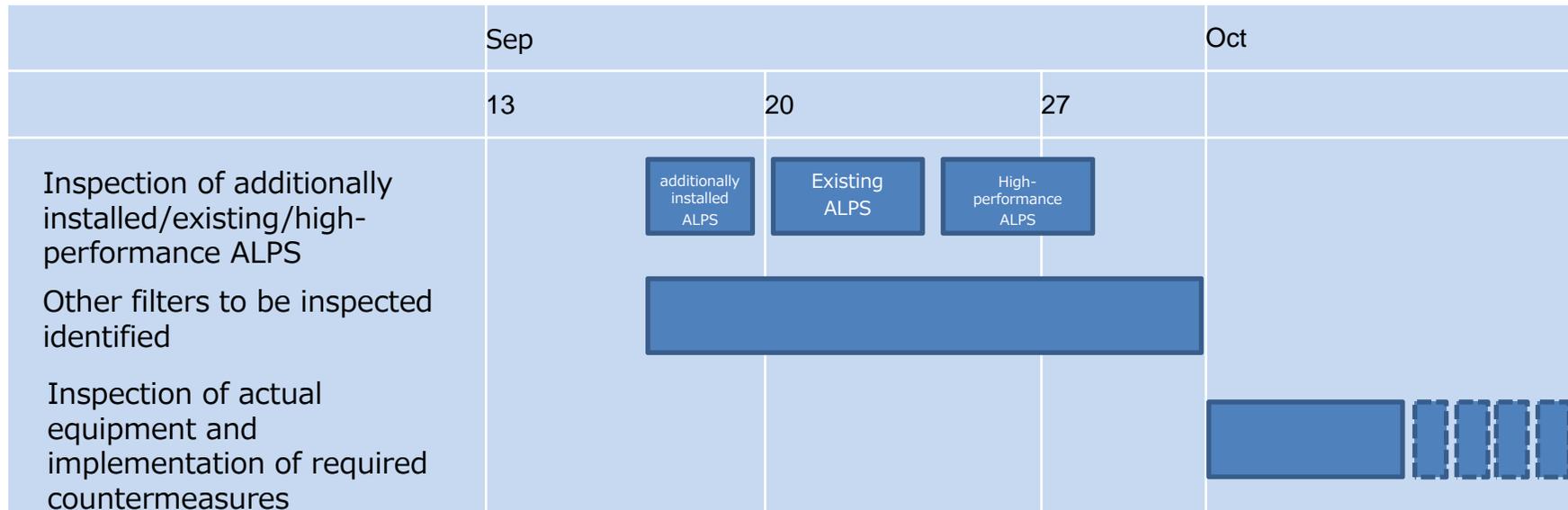
# Multi-nuclide removal equipment (ALPS) and high integrity container (HIC) exhaust filters (Update)

- The slurry transfer device exhaust filters (HIC filters) in multi-nuclide removal equipment that were found to be damaged remove dust from exhaust when pressure inside the HIC is released in the course of transferring slurry (containing radioactive materials) generated during the water purification process, and used adsorbent materials, into the high integrity containers (HIC).
- Damage was found in a total of 25 locations (Existing ALPS: 12 locations; Additionally installed ALPS: 13 locations) when the aforementioned exhaust filters were replaced due to condensation at exhaust outlets (July through October 2019), and at the time no steps were taken to ascertain the cause of the damage.
- There are also exhaust filters inside the exhaust pipes used for ventilation in conjunction with fluctuating water levels inside the tanks in the ALPS system (existing ALPS: 28 locations, additionally installed ALPS: 18 locations). These exhaust filters will also be inspected. Refer to Pages 3~4 information on the inspection status
- These exhaust filters are ancillary equipment separate from pre-treatment equipment used for purification and adsorption towers, and damage to these exhaust filters has had no impact on ALPS purification performance, nor treated water.
- A detailed investigation will be conducted and permanent countermeasures put in place based on the results



# Inspection of other exhaust filters in light of the damage found to HIC exhaust filters

- In light of the damage found to high integrity containers (HIC) exhaust filters, other filters used at the Fukushima Daiichi Nuclear Power Station that should be inspected will be identified (by September 30). The identified exhaust filters will be inspected and appropriate measures shall be taken, such as replacing them with substitute filters if necessary.
- The above inspections will begin with ALPS water purification equipment. The inspection of additionally installed ALPS and necessary measures, such as filter replacement, etc., have been completed by September 20 after which inspections will be performed at existing ALPS and high-performance ALPS.
- An inspection of the exhaust filters in other equipment separate from ALPS facilities (PCV gas management equipment, etc.) shall also be implemented in the same matter.



# ALPS exhaust filter inspections performed in light of damage found to HIC exhaust filters (1)

- In addition to the HIC exhaust filters that were found to be damaged, an inspection of exhaust filters used inside ALPS equipment (Additionally installed ALPS: 18 locations, Existing ALPS: 28 locations) began on September 17.
- Exhaust filters located in similar environments to damaged HIC exhaust filters (environments subjected to mist and air blows) ※<sup>1</sup> were prioritized for inspection, and an inspection of exhaust filters in drainage tanks ※<sup>2</sup> that also fit these conditions (Additionally installed ALPS: 1 location out of the aforementioned 18 locations, Existing ALPS: 1 location out of the aforementioned 28 locations) was performed.
- The inspections found no damage with existing ALPS drainage tank exhaust filters. However, since some damage was found on the same exhaust filters in additionally installed ALPS (Max Approx. 15mm×Approx. 5 mm) the filters were replaced on September 18 as a provisional countermeasure.

※ 1 : Refer to P.13 “Exhaust filter inspection status” and P.17 “Assumed cause of HIC exhaust filter damage”

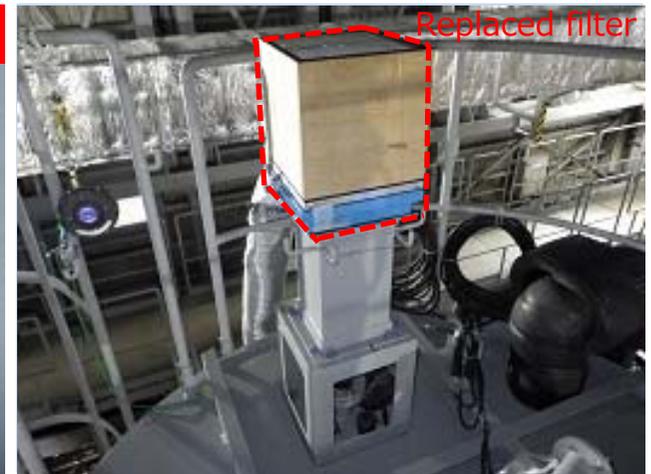
※ 2 : Tank for receiving surplus water generated when adsorbent material is expelled (Damage was found to the exhaust filters of the aforementioned tank according to inspection records from two years ago. Refer to the photos on page 14)



Existing ALPS drainage tank exhaust filter



Additionally installed ALPS drainage tank exhaust filter



Replacing filters in additionally installed ALPS drainage tanks

# ALPS exhaust filter inspections performed in light of damage found to HIC exhaust filters (2)

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## <Additionally installed ALPS>

- When an inspection of the remaining 17 exhaust filters in additionally installed ALPS was performed on September 18 and 19th, damage※<sup>4</sup> was found to exhaust filters in three locations: The carbonate soda storage tank 1, ※<sup>1</sup> coprecipitate tank A※<sup>2</sup> and feed tank A※<sup>3</sup>
- The damaged exhaust filters were replaced by September 20 as a provisional countermeasure. No damage was found to other exhaust filters in additionally installed ALPS (14 locations)

⇒As of September 20, the inspection of all 18 locations of exhaust filters other than the HIC exhaust filters in additionally installed ALPS had been completed, and damage had been found in four locations.

## <Existing ALPS>

- Excluding the drainage tank exhaust filters, the 27 remaining exhaust filters in existing ALPS are being inspected, and as of September 20 the inspections in a total of 10 locations had been completed. Damage was found in one location in the carbonate soda storage tank .

⇒As of September 20, inspections in 11 out of a total of 28 locations on the exhaust filters other than the existing ALPS HIC exhaust filters have been completed, and damage has been found in one location.

Inspections of the remaining 17 locations are expected to be completed by September 27.  
(The five exhaust filters in high-performance ALPS will be inspected by September 27)

※ 1 : Carbonate soda storage tank 1 (Tank for feeding chemicals used in pretreatment equipment)

※ 2 : Coprecipitate tank (Tank for mixing chemicals fed from the carbonate soda storage tank with system water)

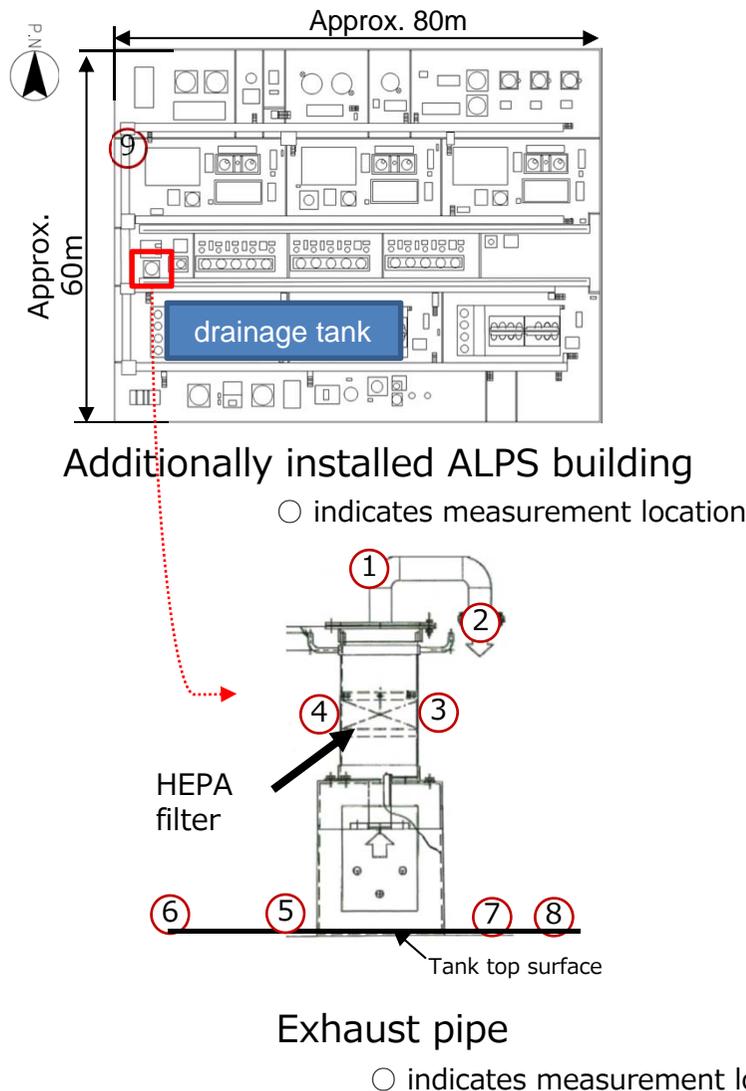
※ 3 : Feed tank (Tank for feeding carbonate slurry generated in the coprecipitate tank to the cross-flow filter.)

※ 4 : Carbonate soda storage tank 1 : Approx. 200mm×Approx. 10mm、Coprecipitate tank A: Approx. 100mm×Approx. 50mm、  
Feed tank A: Approx. 200mm×Approx. 40mm

Refer to P. 8~9 for photos of exhaust filter conditions

## (Reference) Surface contamination measurement results for the area around the exhaust pipes for additionally installed ALPS drainage tanks

- Surface contamination measurements from the additionally installed ALPS drainage tank exhaust pipe, where exhaust filter damage was found, and the surrounding area do not indicate that contamination spread from the exhaust pipe, which is assumed to be the source of the contamination.



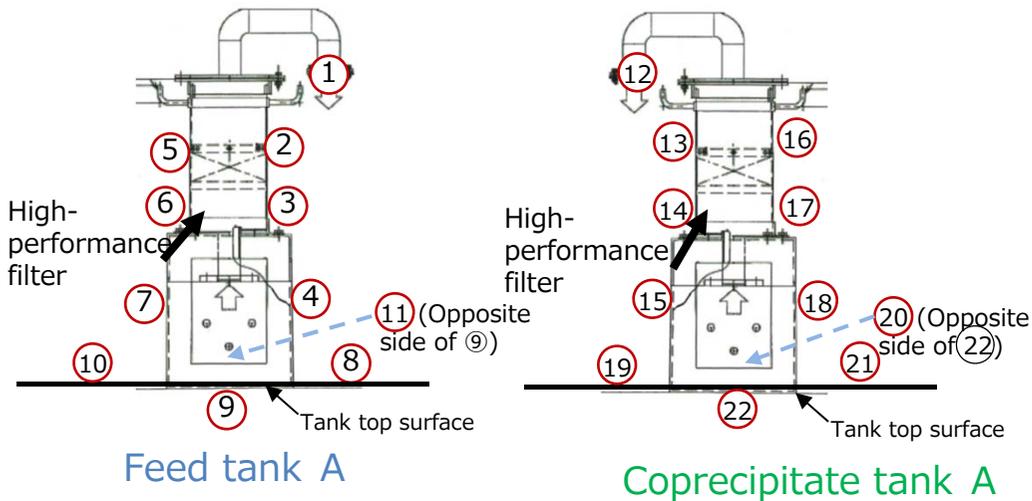
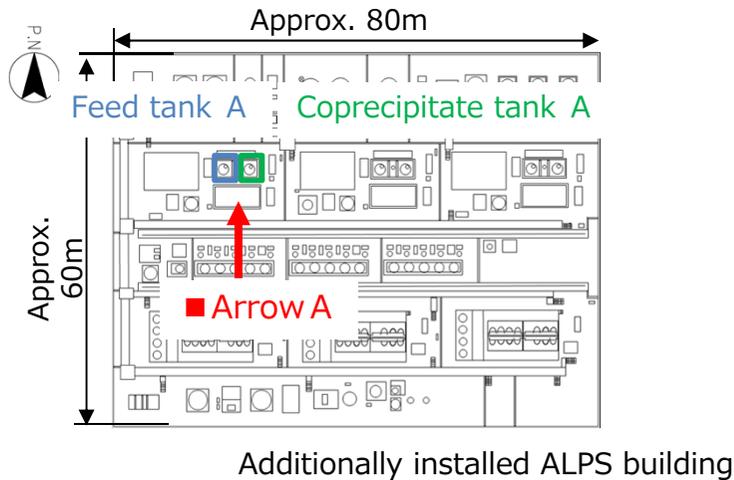
### Surface contamination measurement results (β) Sampling date: Sep. 18, 2021

Background: 200cpm

Sampling point	Measurement [cpm] (Gross value)	Sampling location
①	750	Outer surface of exhaust pipe
②	2,000	Inside surface of exhaust pipe outlet
③	1,700	Side
④	400	Side opposite from exhaust pipe
⑤	1,500	Tank top
⑥	2,400	Tank top
⑦	6,000	Tank top
⑧	2,000	Tank top
⑨	200	Door

(Reference) Surface contamination measurements of the area around the exhaust pipes for additionally installed ALPS Feed tank A and coprecipitate tank A

- Surface contamination measurements taken from the exhaust pipes for feed tank A and coprecipitate tank A, where exhaust filter damage was found, and the surrounding area indicate that the source of the contamination is most likely the exhaust pipes.



Arrow A Location of surface contamination measurements from around exhaust pipes

Surface contamination measurement results (β)  
Sampling date: Sep. 19, 2021

Feed tank A

Background: 200cpm

Sampling point	Measurement [cpm] (Gross value)	Sampling location
1	50,000	Inside surface of exhaust pipe outlet
2	3,500	Top of side
3	5,000	Middle of side
4	45,000	Bottom of side
5	900	Top of side opposite from exhaust pipe
6	2,000	Middle of side opposite from exhaust pipe
7	5,000	Bottom of side opposite from exhaust pipe
8	85,000	Tank top
9	6,500	Tank top
10	2,600	Tank top
11	5,000	Tank top

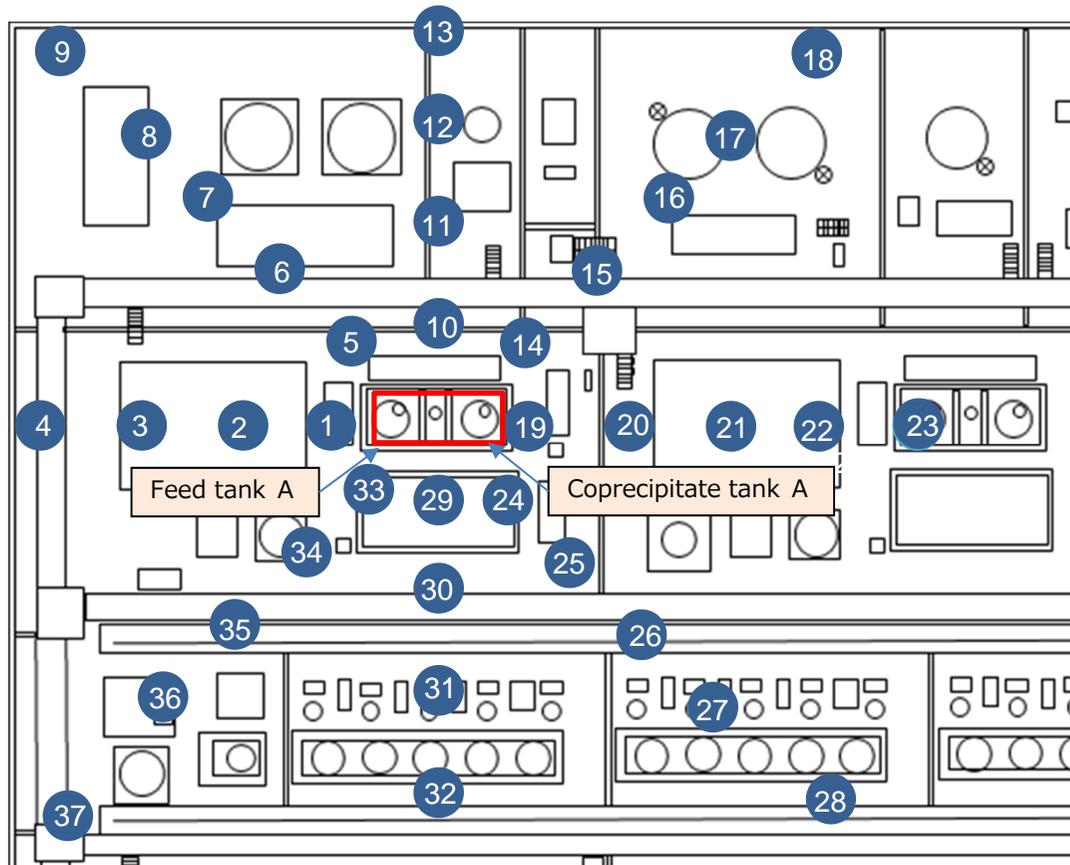
Coprecipitate tank A

Sampling point	Measurement [cpm] (Gross value)	Sampling location
12	85,000	Inside surface of exhaust pipe outlet
13	18,000	Top of side
14	7,500	Middle of side
15	20,000	Bottom of side
16	10,000	Top of side opposite from exhaust pipe
17	7,000	Middle of side opposite from exhaust pipe
18	3,500	Bottom of side opposite from exhaust pipe
19	70,000	Tank top
20	20,000	Tank top
21	25,000	Tank top
22	9,000	Tank top

(Reference) Surface contamination measurement results from inside the additionally installed ALPS building

- Surface contamination measurements were taken from around feed tank A and coprecipitate tank A where damage to exhaust filters was found in order to examine the extent of the spread of contamination from the exhaust pipe. Since workers wear the same shoes to move within the area a certain amount of contamination was found on the floor, but only several hundreds CPM of contamination was found in elevated areas suggesting that contamination did not spread past the area around the tank.

Surface contamination measurement results (β)  
 Sampling date: Sep. 20, 2021 Background: 180cpm



Additionally installed ALPS building

Sampling locations	Floor measurement (cpm) Gross value	Elevation measurement (cpm) Gross value	Sampling location (Elevated)
1	700	250	H steel
2	1200	580	Single pipe
3	410	270	Fireproof tarp
4	340	210	H steel
5	600	500	Bottom of walkway
6	700	300	Control panel
7	650	280	Pipe support
8	420	210	Insulation
9	300	210	Wall surface
10	950	390	Bottom of walkway
11	500	200	Control panel
12	1000	270	Outer tank wall
13	1700	250	Wall surface
14	1000	310	Bottom of walkway
15	370	500	Curtain
16	450	200	Control panel
17	700	230	Outer tank wall
18	500	200	Wall surface
19	1600	210	pH meter skid
20	650	200	Tarp
21	700	400	Instrument
22	780	180	Single pipe
23	200	200	Power panel
24	370	250	Power panel
25	800	180	Column
26	350	220	Column
27	310	260	Power panel
28	600	270	Column
29	610	330	Wall surface
30	260	270	Column
31	450	200	Control panel
32	600	200	Column
33	1500	230	Outer tank wall
34	700	540	Control panel
35	210	230	Column
36	600	300	Power panel
37	250	180	Column

# (Reference) Additionally installed ALPS Exhaust filter conditions 1/2



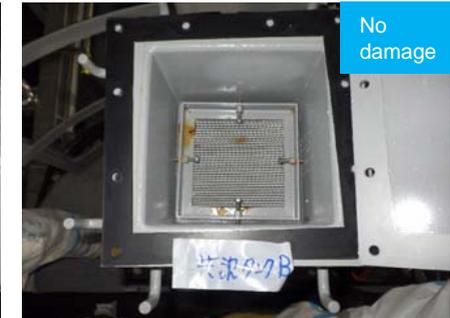
Additionally installed ALPS treated water receiving tank 1



Additionally installed ALPS treated water receiving tank 2



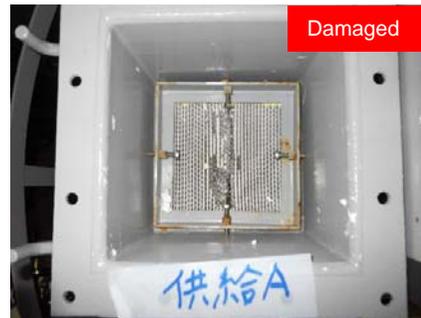
Additionally installed ALPS System A Coprecipitate tank



Additionally installed ALPS System B Coprecipitate tank



Additionally installed ALPS System C Coprecipitate tank



Additionally installed ALPS System A Feed tank



Additionally installed ALPS System B Feed tank



Additionally installed ALPS System C Feed tank



Additionally installed ALPS buffer tank A



Additionally installed ALPS buffer tank B



Additionally installed ALPS buffer tank C



Additionally installed ALPS transfer tank 1

## (Reference) Additionally installed ALPS Exhaust filter conditions 2/2



Additionally installed ALPS transfer tank 2



Additionally installed ALPS Carbonate soda storage tank 1



Additionally installed ALPS Carbonate soda storage tank 2



Additionally installed ALPS drainage sump 1



Additionally installed ALPS drainage sump 2

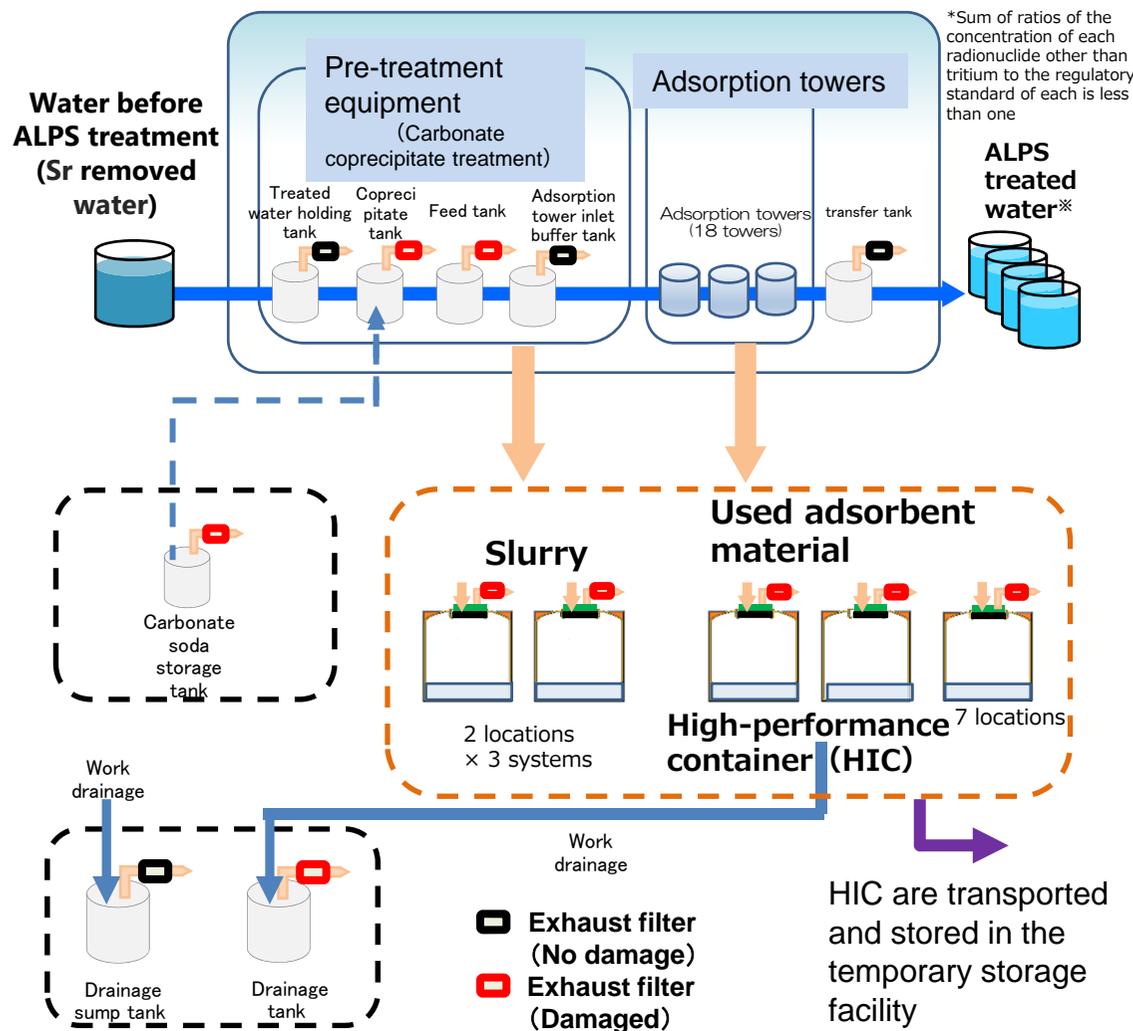


Additionally installed ALPS drainage tank  
(Reposted)

Exhaust filters used inside ALPS equipment other than the HIC exhaust filters (Total: 13 locations) photographed from the downstream side (Total: 18 locations)

# (Reference) Additionally installed ALPS Inspection results for exhaust filters other than HIC exhaust filters

## Additionally installed ALPS system configuration



No	Equipment	Exhaust filter visual inspection	Smear results* (Near exhaust filter outlet)
1	Treated water receiving tank1	No abnormalities	Corresponds to BG
2	Treated water receiving tank2	No abnormalities	Corresponds to BG
3	Coprecipitate tank A	Damaged	9500cpm
4	Coprecipitate tank B	No abnormalities	Corresponds to BG
5	Coprecipitate tank C	No abnormalities	Corresponds to BG
6	Feed tank A	Damaged	14000cpm
7	Feed tank B	No abnormalities	500cpm
8	Feed tank C	No abnormalities	Corresponds to BG
9	Adsorption tower inlet buffer tank A	No abnormalities	Corresponds to BG
10	Adsorption tower inlet buffer tank B	No abnormalities	800cpm
11	Adsorption tower inlet buffer tank C	No abnormalities	Corresponds to BG
12	Transfer tank 1	No abnormalities	600cpm
13	Transfer tank 2	No abnormalities	Corresponds to BG
14	Carbonate soda storage tank 1	Damaged	Corresponds to BG
15	Carbonate soda storage tank 2	No abnormalities	Corresponds to BG
16	Drainage tank	Damaged	1700cpm
17	Drainage sump tank 1	No abnormalities	700cpm
18	Drainage sump tank 2	No abnormalities	700cpm

\*Background (BG): 400cpm (2021/9/18,19)

# Additionally installed ALPS Assumed cause of damage to exhaust filters other than HIC exhaust filters

- The assumed cause of damage to exhaust filters other than additionally installed ALPS HIC exhaust filters is as follows:

## <Drainage tank>

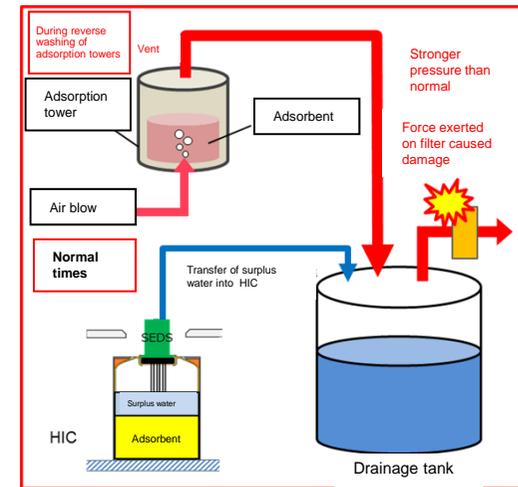
- The adsorption tower exhaust pipe and drainage tank are connected, and it is assumed that the pressure from the air blow, which contains mist used during the reverse washing of adsorption towers, damaged the drainage tank exhaust filter.

## <Coprecipitate tank/Feed tank>

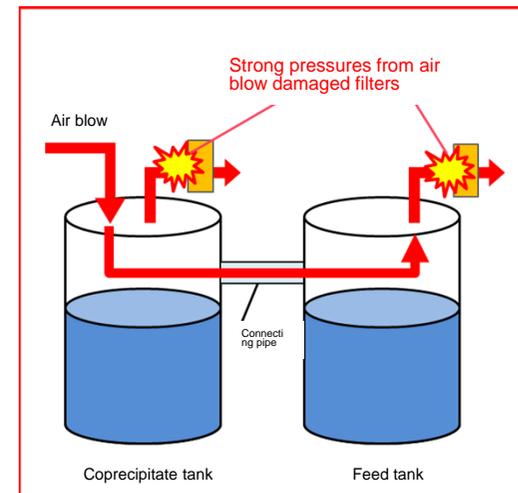
- Since this tank is filled with chemicals, it is possible that chemical deposits formed on the exhaust filters over years of use thereby clogging the filters.
- Air blows were implemented during internal cleaning of the tank in FY2016, and it is possible that the pressure from the air blows damaged the exhaust filter.

## <Carbonate soda storage tank 1 >

- Since this tank is filled with relatively concentrated chemicals, it is possible that chemical deposits formed on the exhaust filters over years of use thereby clogging the filters. And, although air blows were not implemented, it is possible that the damage was caused by the flow of air caused in conjunction with fluctuating tank water levels.



Cause of damage to drainage tank (hypothesized)



Cause of damage to coprecipitate/feed tanks (hypothesized)

# Conclusion

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## <Extended inspection>

- In light of the damage found to HIC exhaust filters, an extended inspection will be implemented. Inspection priority will be given to exhaust filters other than HIC exhaust filters in ALPS equipment.
- The number of filters to be inspected is as follows: Additionally installed ALPS: 18 locations, Existing ALPS: 28 locations, High-performance ALPS: 5 locations.
- As of September 20, the inspection of all 18 locations of exhaust filters in additionally installed ALPS have been completed, and damage has been found in four locations, and inspections in 11 out of a total of 28 locations of exhaust filters in existing ALPS have been completed, and damage has been found in one location.
- The maintenance methods for equipment filters other than ALPS filters shall be examined, and filters that should be inspected shall be identified by the end of September. Inspections will then be performed as soon as preparations have been completed.

## <Impact on daily water treatment>

- These exhaust filters are ancillary equipment separate from pre-treatment equipment used for purification and adsorption towers, and damage to these exhaust filters has had no impact on ALPS purification performance, nor treated water. Furthermore, workers have not been subjected to bodily contamination nor have they ingested contaminants, and there has been no impact on the external environment.
- As a provisional countermeasure, exhaust filters needed for operation of additionally installed ALPS were replaced with substitute filters starting on September 7 in order to continue daily water treatment in a stable manner, and operation is being continued carefully while monitoring dust concentrations. As a provisional measure the exhaust filters that were newly found to be damaged (four locations) were also replaced with substitute filters.

## <Operation and maintenance going forward>

- In light of the fact that filter damage discovered during inspections two years ago was not managed as nonconformances, the causes were not ascertained, and corrective measures, such as revisions to operation/maintenance methods and extended inspections, etc., were not implemented, we will clarify how nonconformances are to be handled.
- We will continue to ascertain the cause of damage to HIC exhaust filters and other filters, and deliberate countermeasures for this equipment while also implementing countermeasures to address operation and maintenance methods.

## (Reference) Exhaust filter inspection status (As of September 20)

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Assumed cause of damage	Filter type	Existing ALPS			Additionally installed ALPS			High-performance ALPS		
		No damage	Damaged	Inspection pending	No damage	Damaged	Inspection pending	No damage	Damaged	Inspection pending
Mist + Air blow	HIC Exhaust filters	1	11	0	0	13	0	-	-	-
	Other Exhaust filters	1	0	0	0	1	0	-	-	-
Other	Other Exhaust filters	9	1	17	14	3	0	0	0	5
Total		11	12	17	14	17	0	0	0	5
		40			31			5		

# (Reference) Conditions of filters during additionally installed ALPS exhaust filter inspection performed from July through October 2019



# (Reference) Conditions of filters during existing ALPS exhaust filter inspection performed from July through October 2019



Damaged

System A HIC 1 Exhaust filter



Damaged

System A HIC 2 Exhaust filter



Damaged

System B HIC 1 Exhaust filter



Damaged

System B HIC 2 Exhaust filter



Damaged

System C HIC 1 Exhaust filter



Damaged

System C HIC 2 Exhaust filter



Damaged

Common HIC 1 Exhaust filter



Damaged

Common HIC 2 Exhaust filter



Damaged

Common HIC 3 Exhaust filter



Damaged

Common HIC 4 Exhaust filter



Damaged

Common HIC 5 Exhaust filter



Damaged

Common HIC 6 Exhaust filter



Damaged

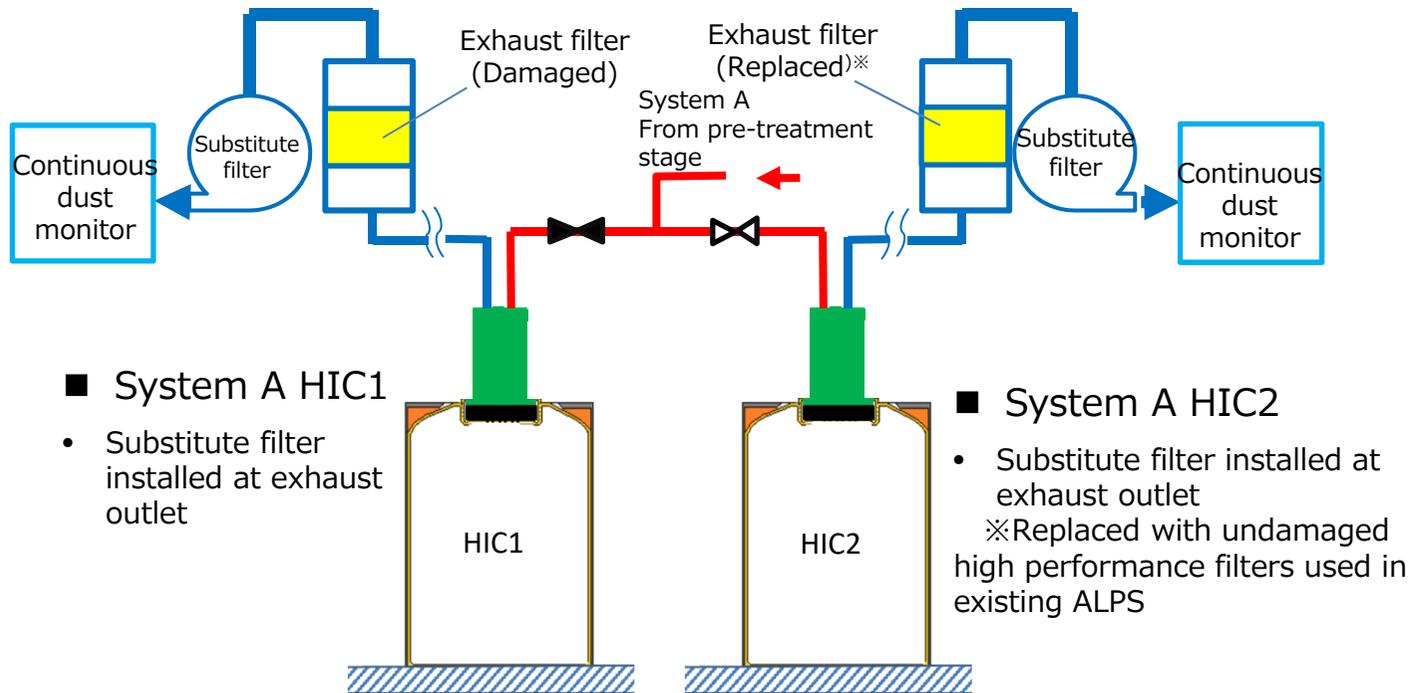
Drainage tank Exhaust filter

Photos of each exhaust filter taken from the downstream side during the inspection of HIC exhaust filters (Total: 25 locations) and exhaust filters in drainage tanks, etc. (Total: four locations) in existing/ additionally installed ALPS performed two years ago

# (Reference) Recommencement of ALPS operation

Already announced in a reference material published on September 16, 2021

- In light of the assumed cause of HIC exhaust filter damage, the following temporary countermeasures have been put in place and operation of additionally installed ALPS system A was recommenced on September 7. (In preparation to replace adsorbent materials in additionally installed ALPS system A from September 16, we installed substitute filters on additionally installed ALPS system B exhaust line, and switched over operation to additionally installed ALPS system B.)
  - Substitute filters were installed downstream of the HIC exhaust filters to mitigate the impact of mist and blown air
  - A continuous dust monitor was installed to be able to immediately detect damage to the substitute filters
- Since a long-term shutdown of ALPS would increase risks related to treated water in general, we shall carefully operate the equipment while monitoring the effectiveness of temporary countermeasures.
- Along with ascertaining the cause of the damage we shall deliberate permanent countermeasures for mist and blown air upon examining the effectiveness of temporary countermeasures, and reflect the results in the designs

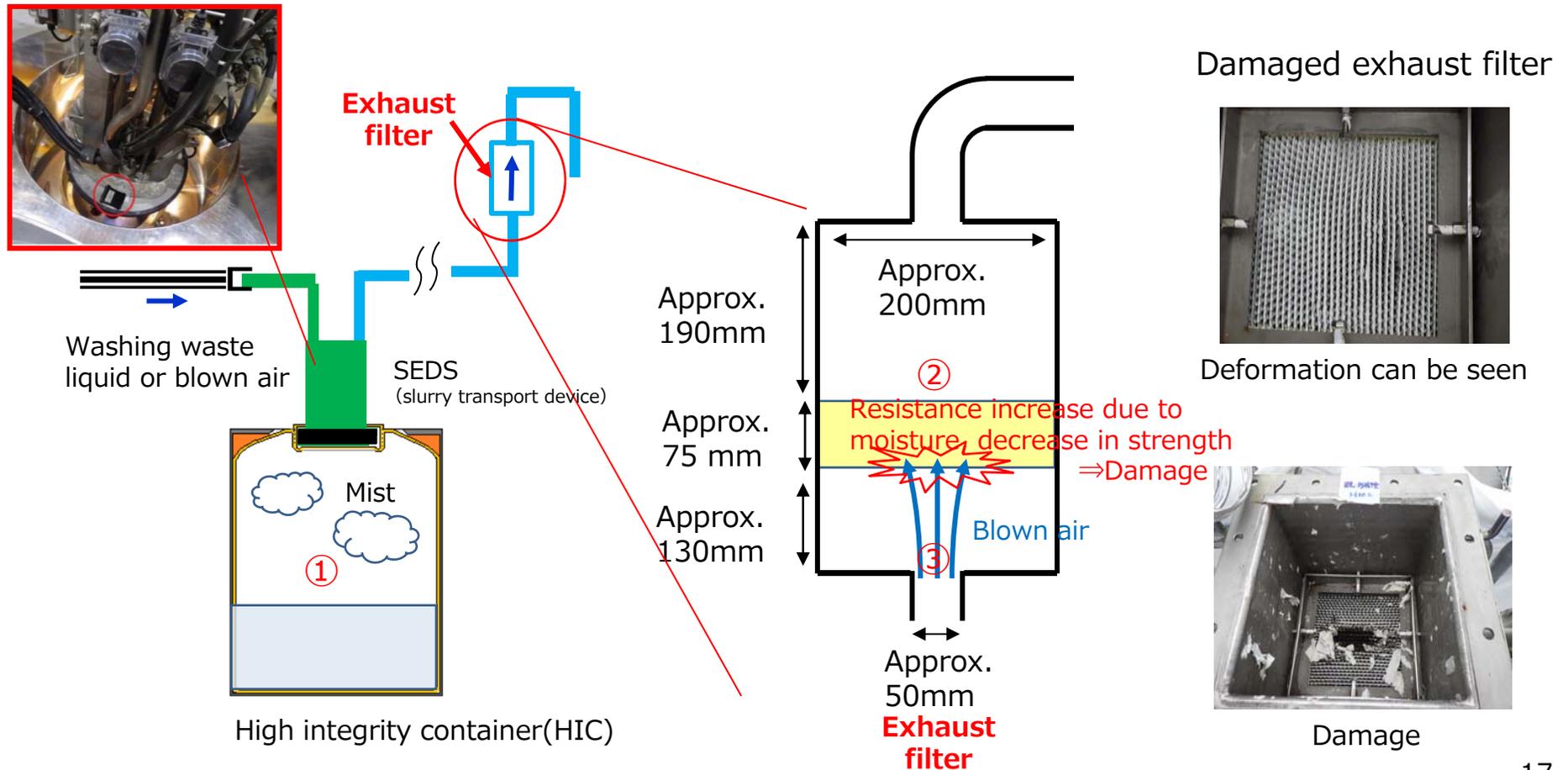


Temporary countermeasures implemented at additionally installed ALPS System A

# (Reference) Assumed cause of HIC exhaust filter damage

Already announced in a reference material published on September 16, 2021

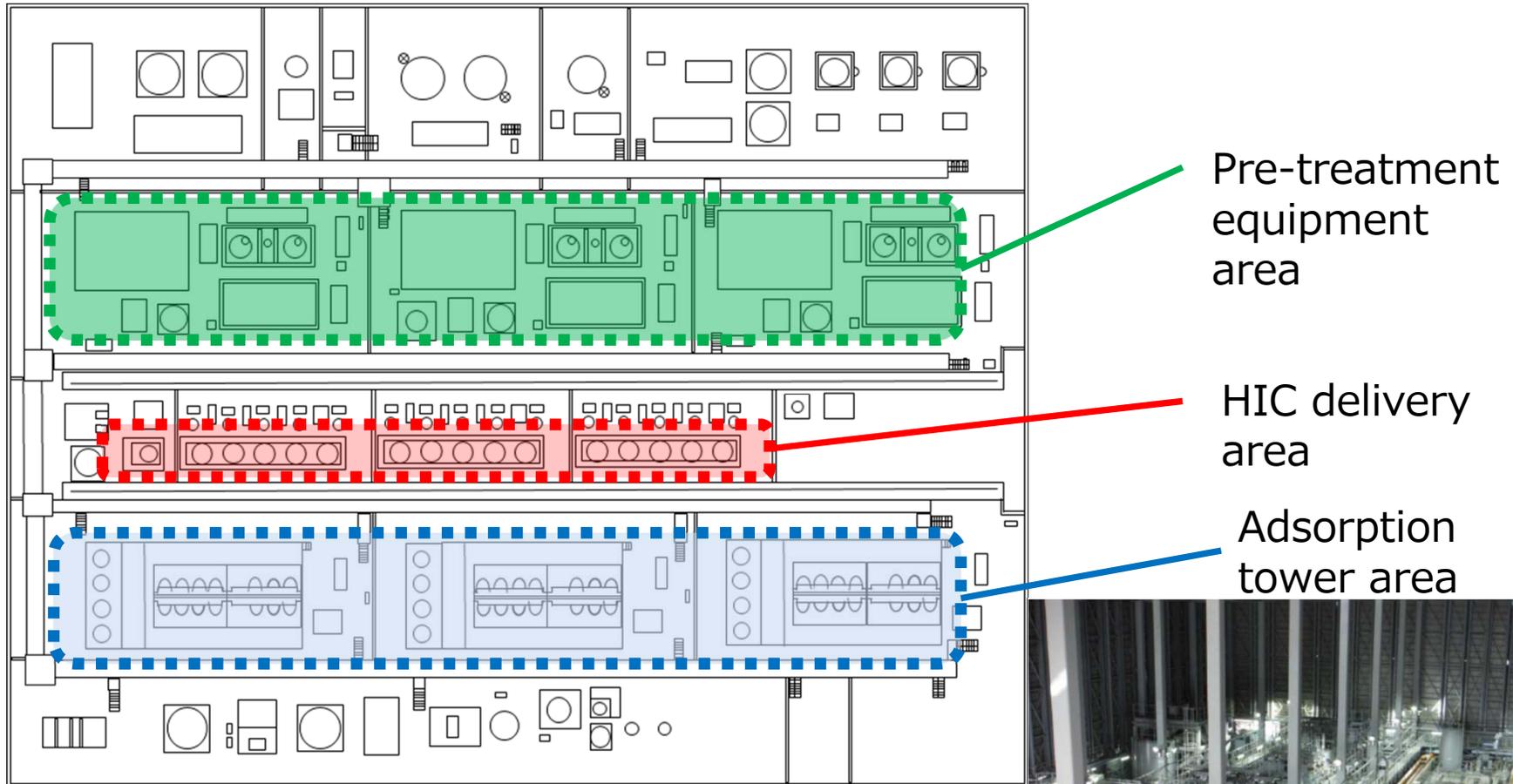
- The following is the hypothesized cause of exhaust filter damage
  - ① Mist was generated inside the HIC by washing waste liquid during the pre-treatment phase of ALPS operation or when air was blown into the system to expel adsorbents.
  - ② The exhaust filters were moistened by the mist that reached them due to the blown air thereby increasing air resistance. It is hypothesized that filter strength had also deteriorated.
  - ③ The blown air concentrated at the center of the exhaust filters caused damage.



(Reference) Overview of additionally installed ALPS building

Already announced in a reference material published on September 16, 2021)

- Outer dimensions of additionally installed multi-nuclide removal equipment: Approx. 80m×Approx. 60m Height: Approx. 17m



Pre-treatment equipment area

HIC delivery area

Adsorption tower area

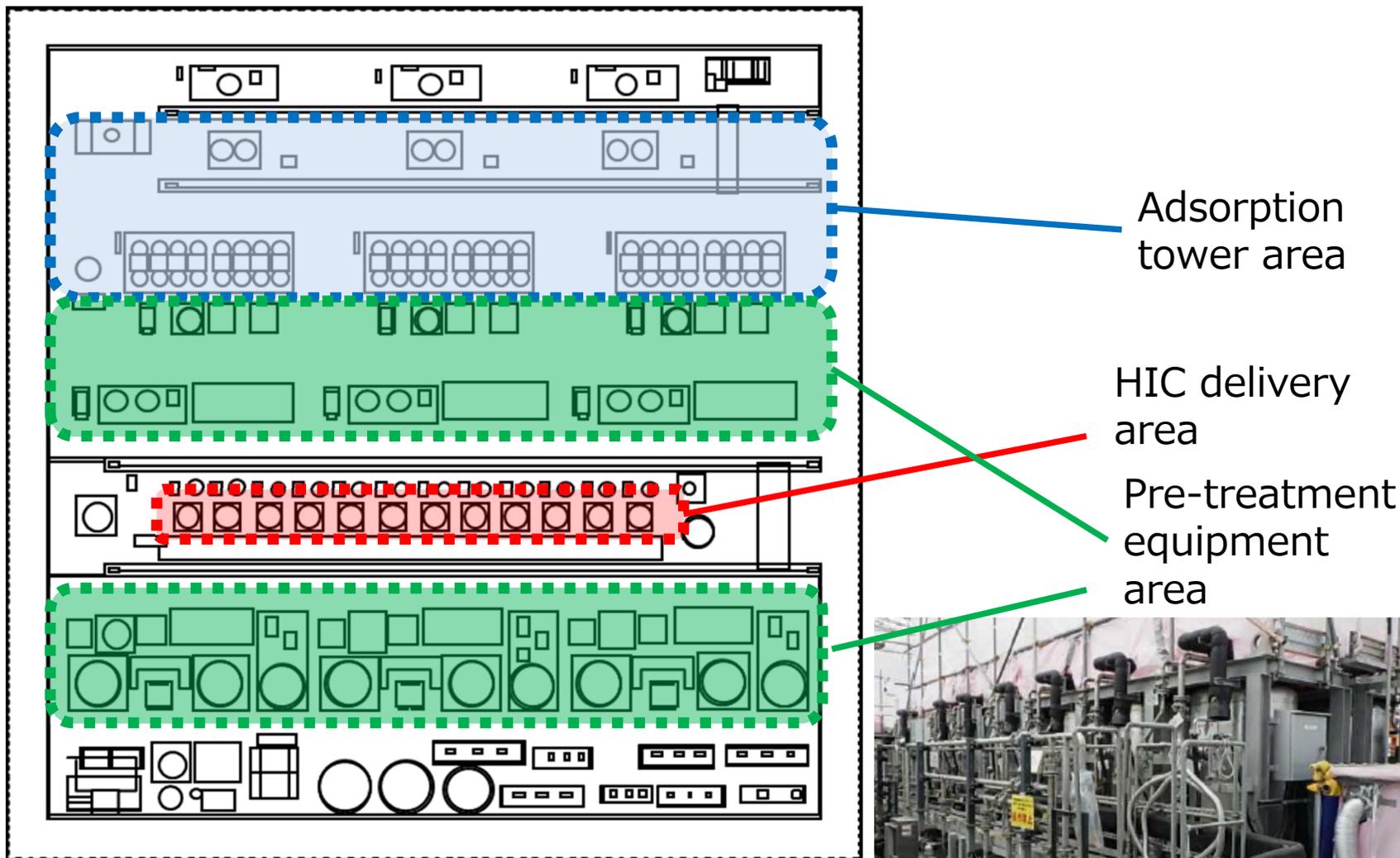
Floor layout of the additionally installed multi-nuclide removal equipment building



# (Reference) Overview of existing ALPS building

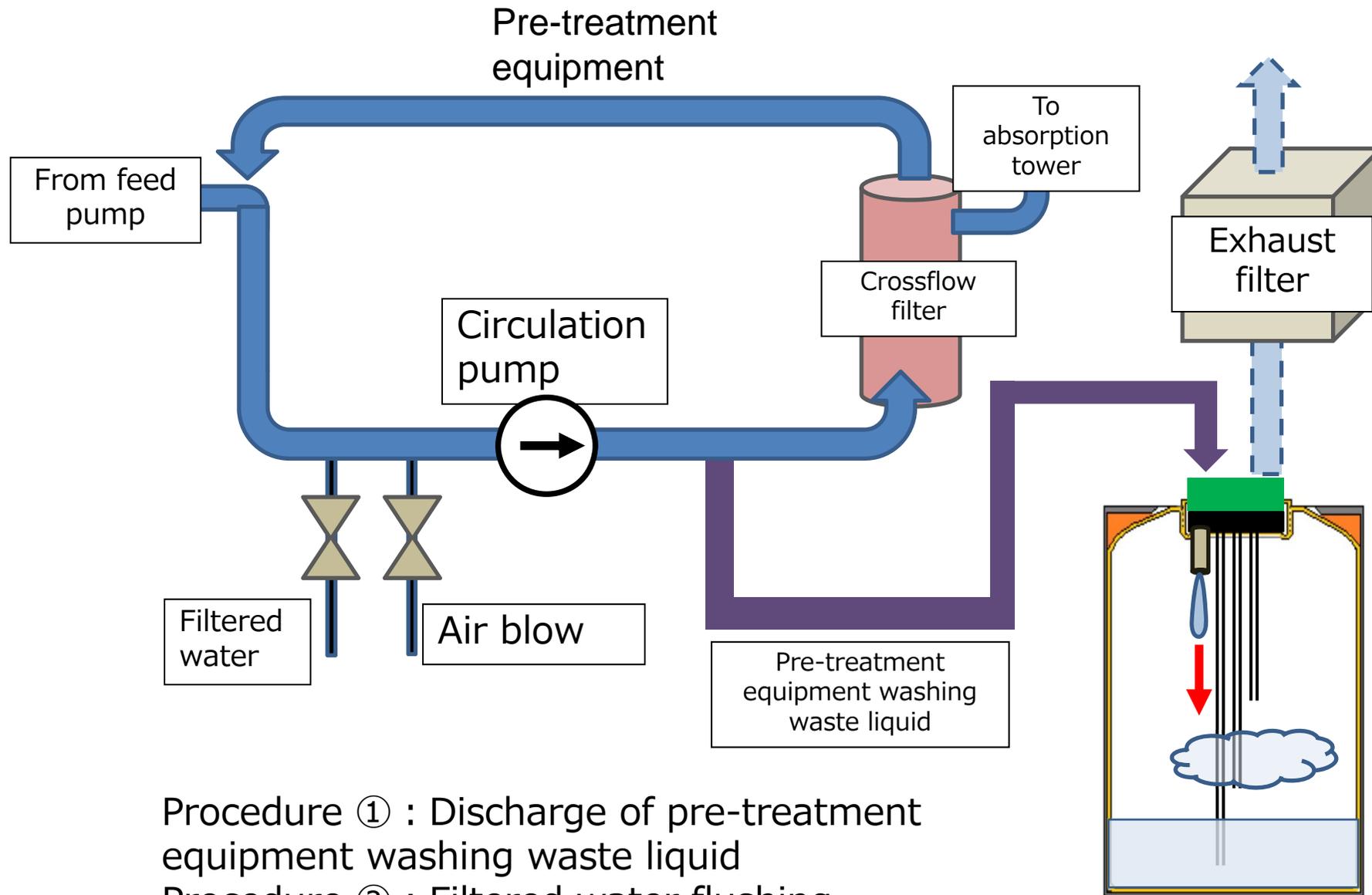
Already announced in a reference material published on September 16, 2021)

- Outer dimensions of existing multi-nuclide removal equipment: Approx. 60m×Approx. 60m Height: Approx. 19m



Floor layout of the existing multi-nuclide removal equipment building

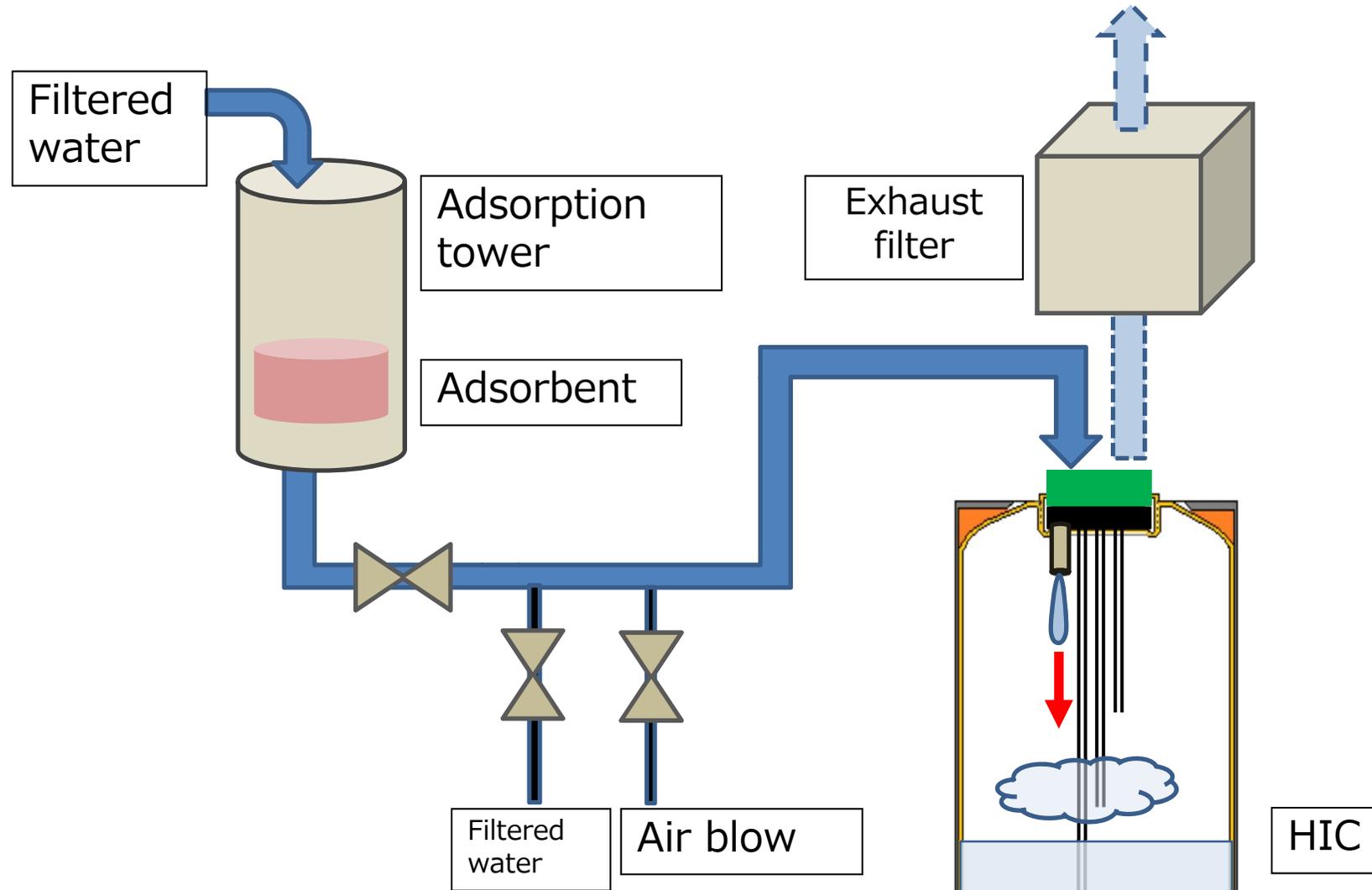




- Procedure ① : Discharge of pre-treatment equipment washing waste liquid
- Procedure ② : Filtered water flushing
- Procedure ③ : Air blow

# (Reference) Discharge of used adsorbent material

Already announced in a reference material published on September 16, 2021



- Procedure ① : Discharge of used adsorbent material
- Procedure ② : Filtered water flushing
- Procedure ③ : Air blow