Radiation Protection Status in the NPP of Fukushima

2021.06.03　ISOE meeting

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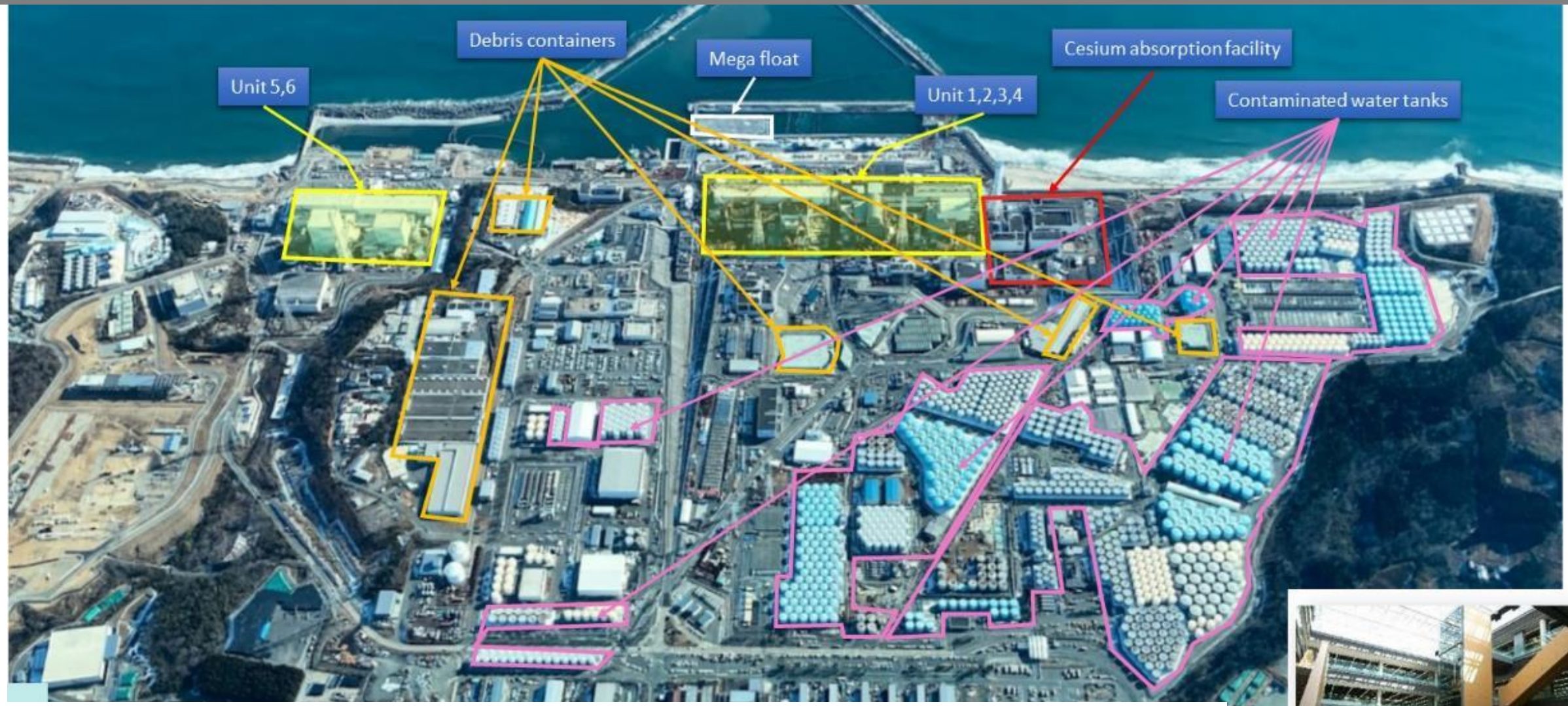
Current situation at FDNPS



As you can see, a large area is devoted to contaminated water tanks and debris storage.

Debris/solid waste containers

・Waste with a surface dose rate of less than 30 mSv/h will be collected outdoors (including in tents)

・Wastes with a surface dose exceeding 30 mSv/h are to be stored in containers and then in solid waste storage.

・The number of containers stored in the storage area is about 85,000, with about 54,000 debris (about 47,000 combustible and 7,000 non-combustible) and about 31,000 used protective clothing, etc

Volume reduction processing

・It is extremely difficult to grasp all the contents of the containers because some of them have been there since immediately after the accident

Contaminated water tanks

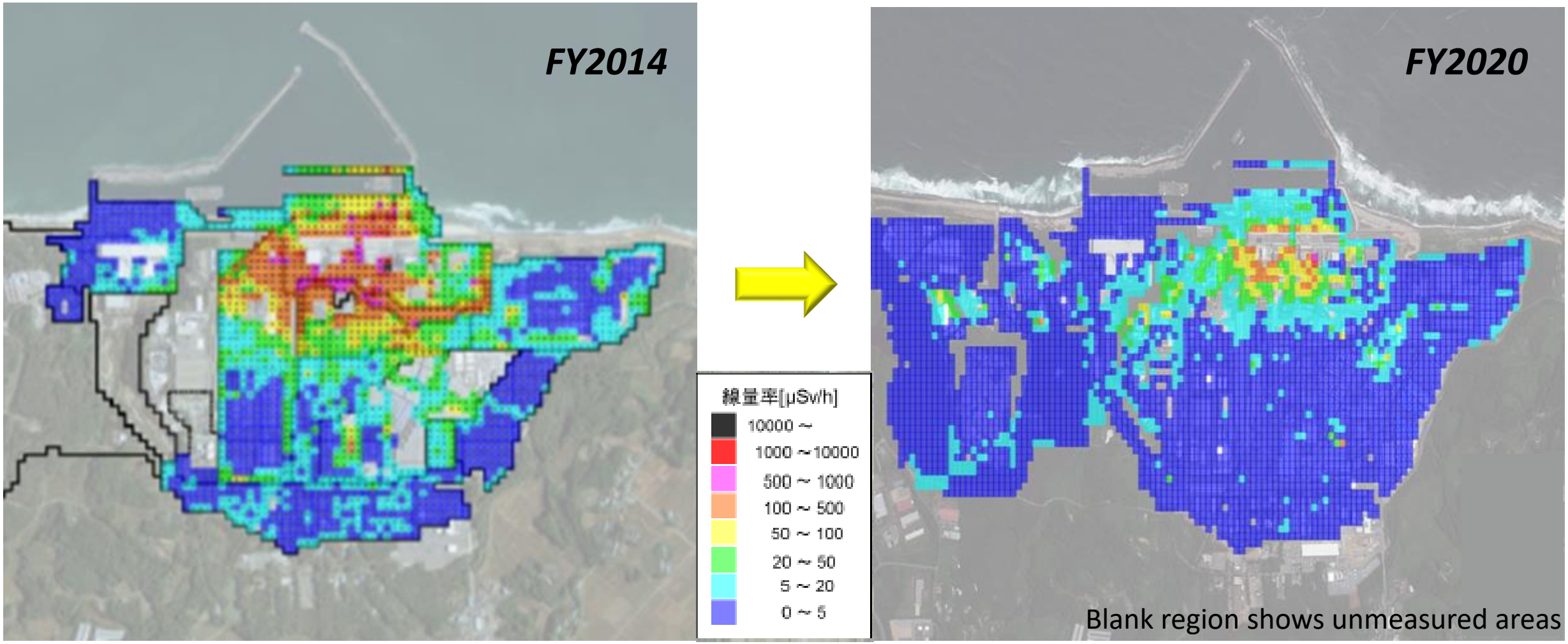
- As of April 2021, the number of contaminated water tanks is 1047
- Volume of water stored in the tanks is approx. 1.25 million m^3
- Tritium average concentration in the water is approx. 620kBq/L
- Total amount of the Tritium is approx. 780 TBq

In case of marine discharge

- The tritium concentration at the time of discharge into the sea will be determined on the basis of the operational standard for the “groundwater bypass” and the “sub-drain” (1,500 Bq/L).

-regulation:60 kBq/L-

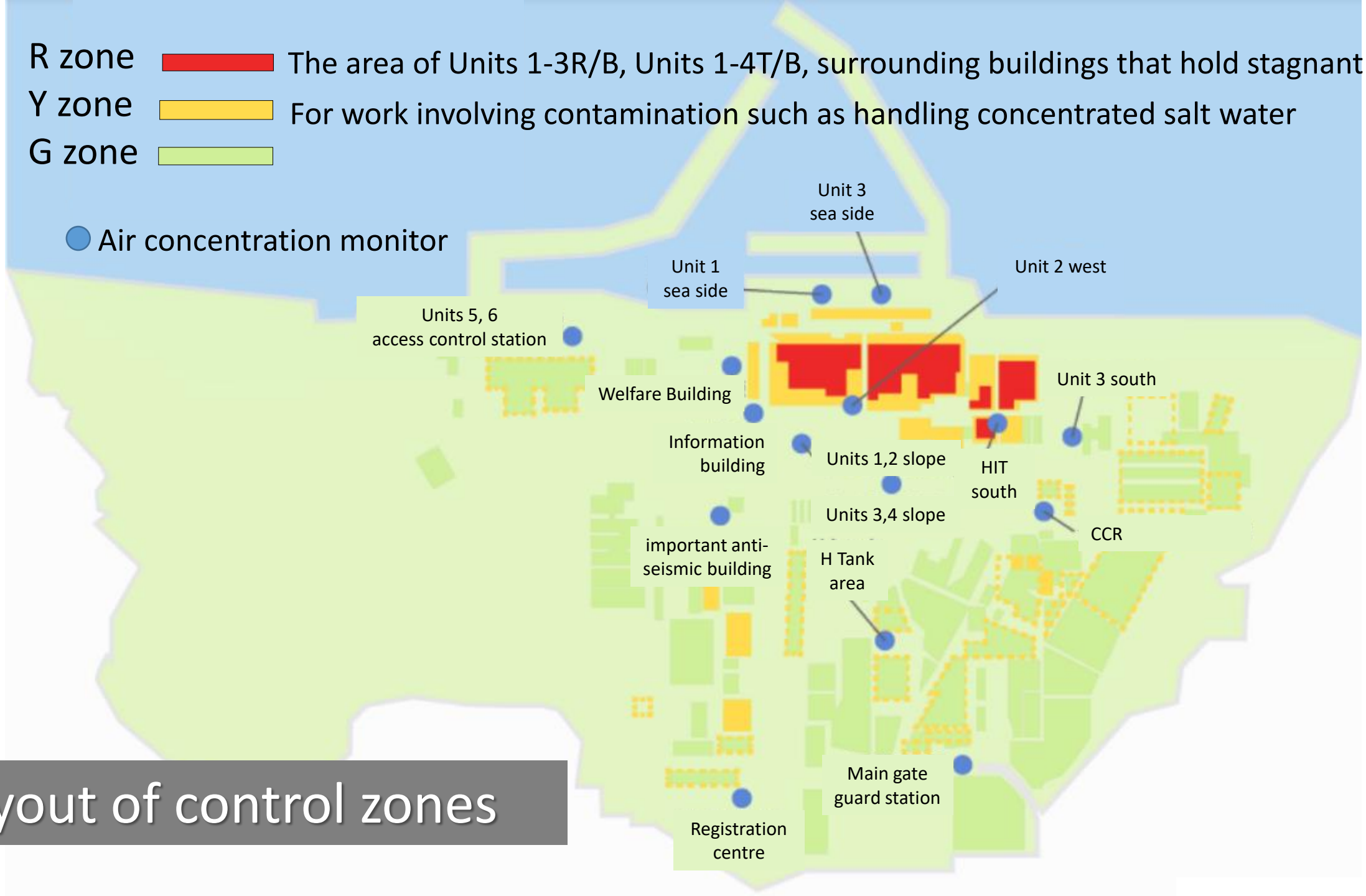
Decrease in air dose rates



Environmental improvements (facings, decontamination, removal of contaminated materials) have reduced air dose rates throughout the premises.

By FY2020, 96% of the premises will no longer require full face mask.

Layout of control zones



Equipment for each zone

R zone	Y zone	G zone
Full face mask 	Full or half face mask 	Disposable dust mask 
Anorak over coverall 	Coverall 	General Operating Wear 

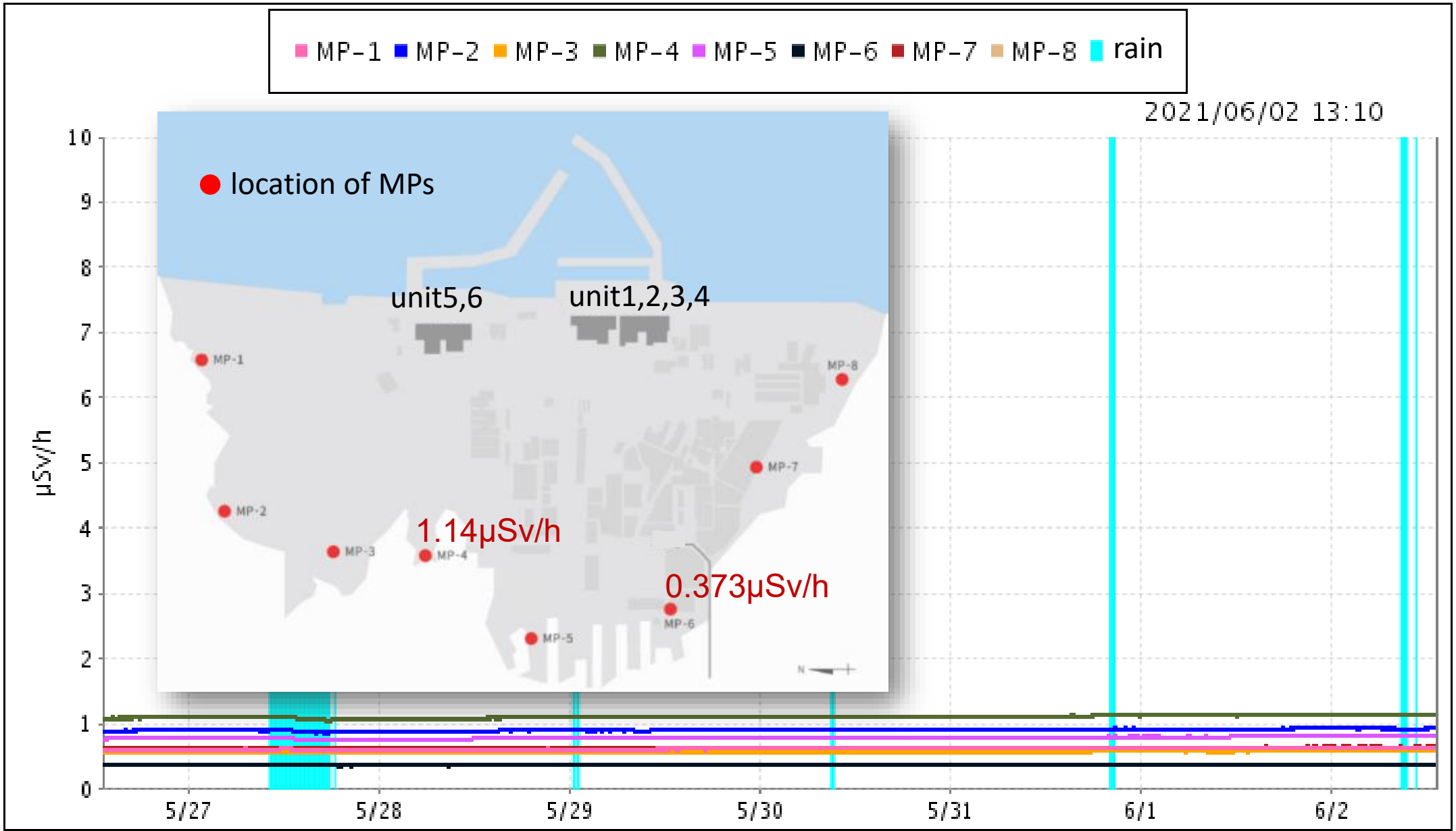
the concentration of radioactive materials in the air did not exceed the standard for wearing masks (2×10^{-4}[Bq/cm^3])

Wearing both active & passive dosimeter

RPL Dosimeter
"Glass Badge" as legal dosimeter
(γ & β)

Electric Personal Dosimeter
(γ & β)

Air dose rates measured at the site boundary monitoring posts



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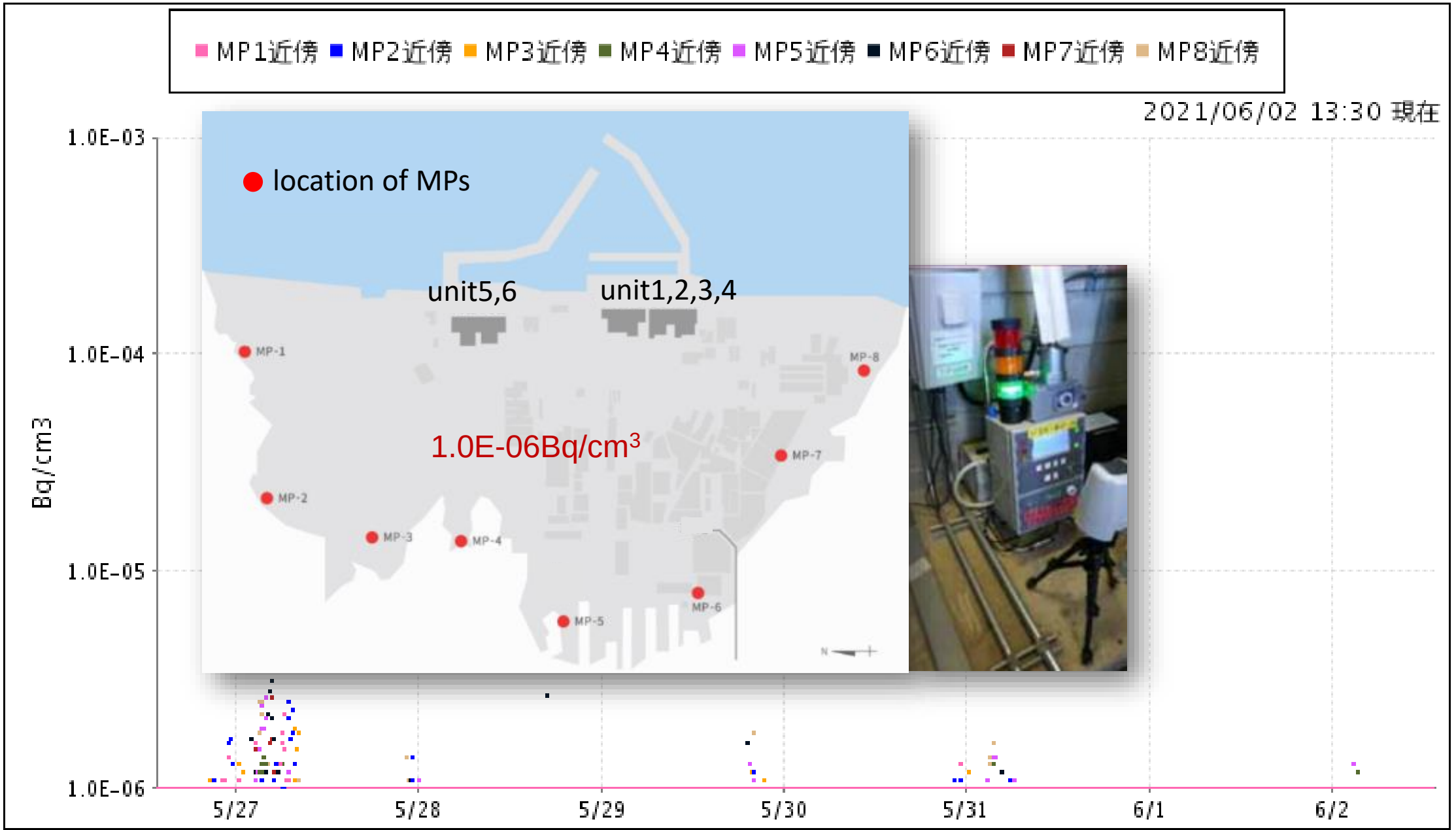
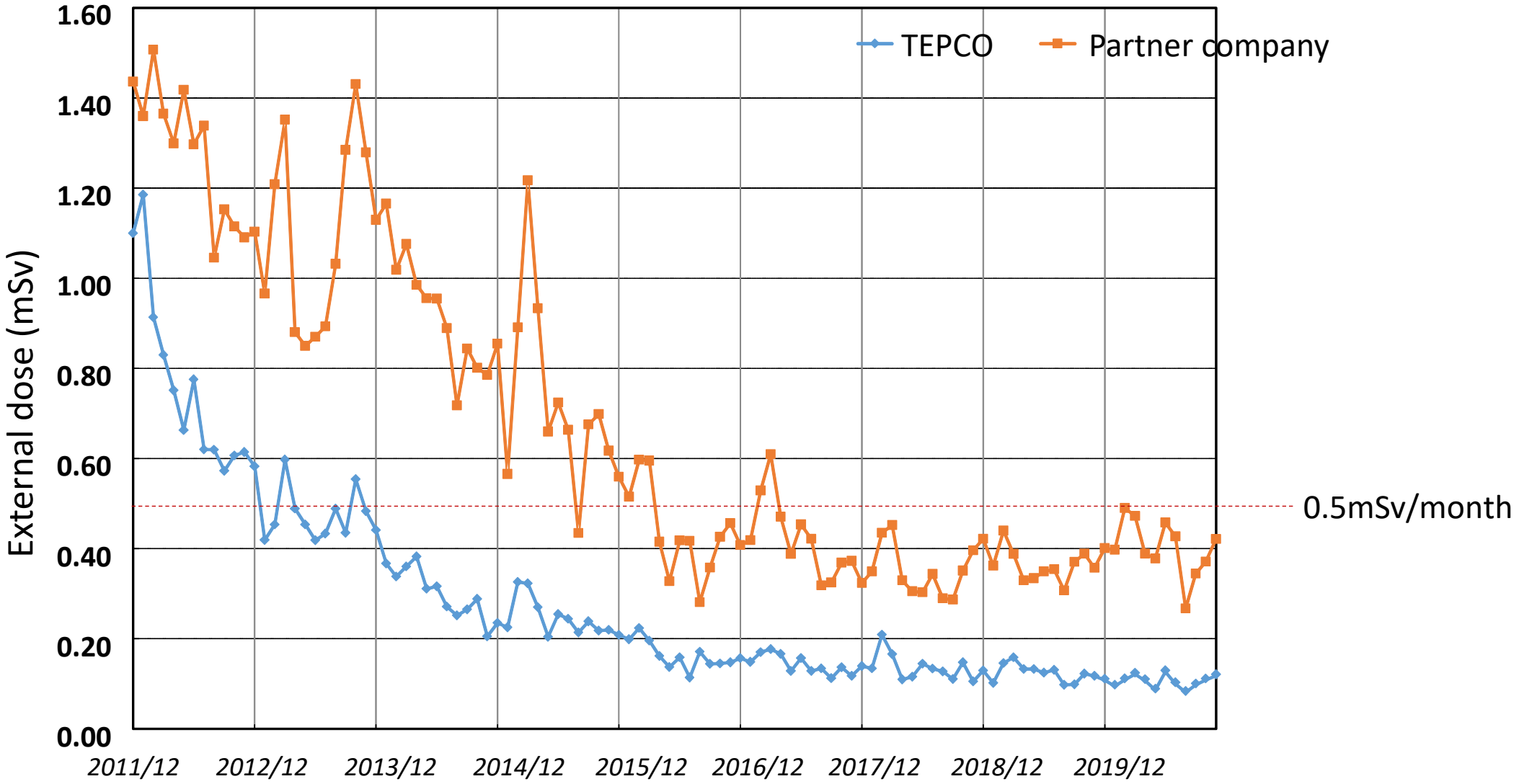


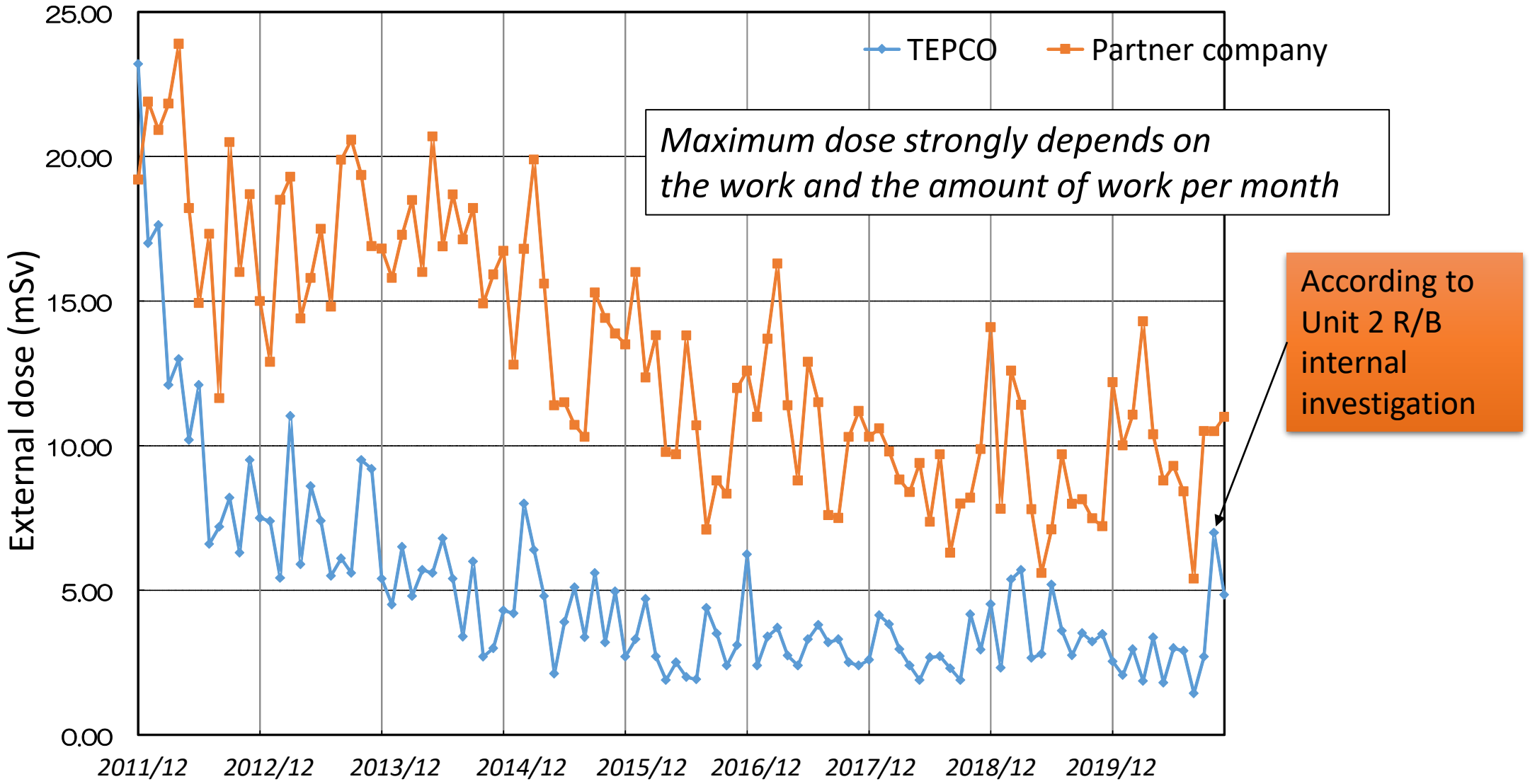
Changes in external radiation dose

since December 2011 -*monthly average dose*-

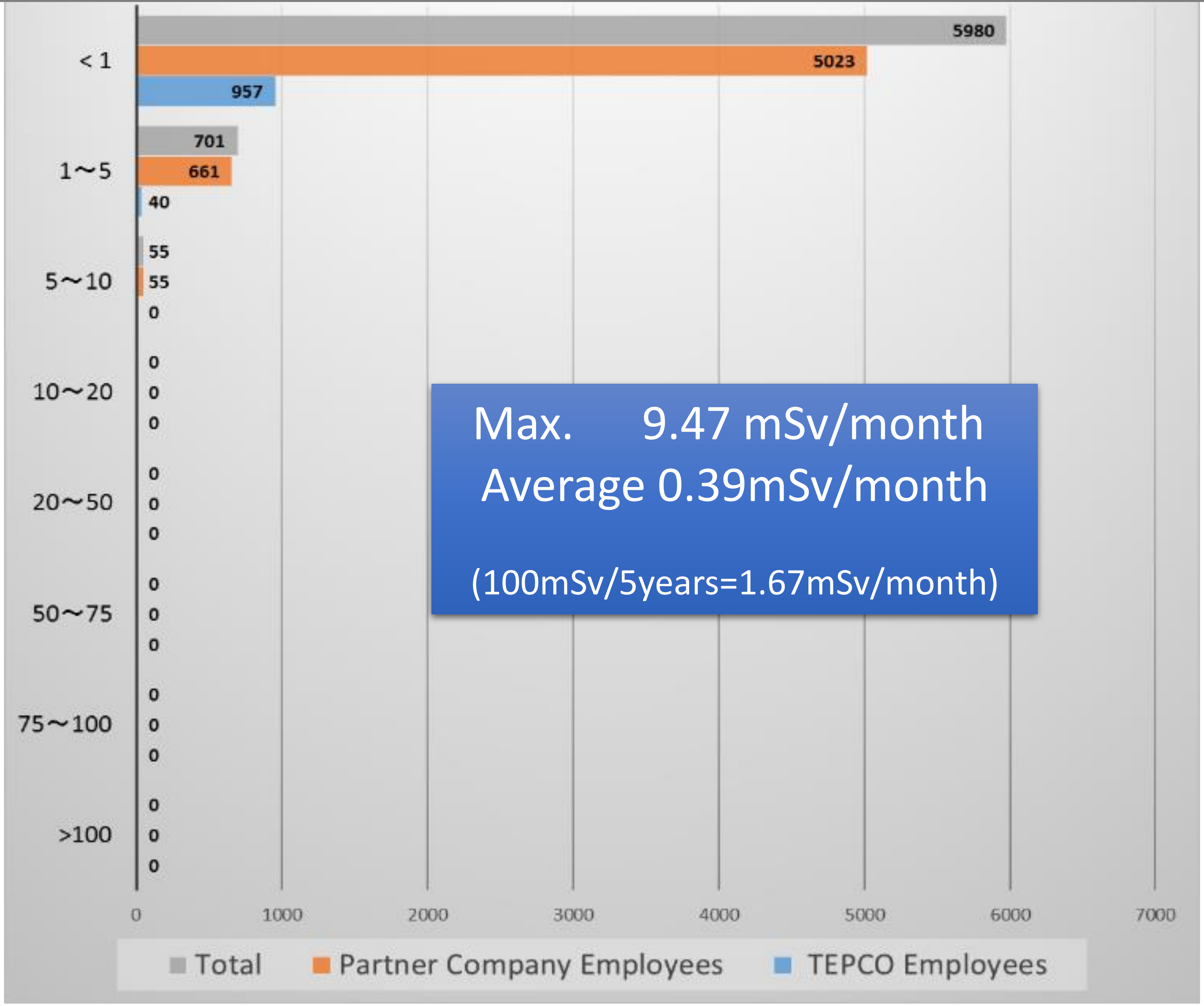


Changes in external radiation dose

since December 2011 -*monthly maximum dose*-



External radiation dose distribution for workers



Max. 9.47 mSv/month
Average 0.39mSv/month

(100mSv/5years=1.67mSv/month)

March 2021
total 6736 workers

Internal radiation dose

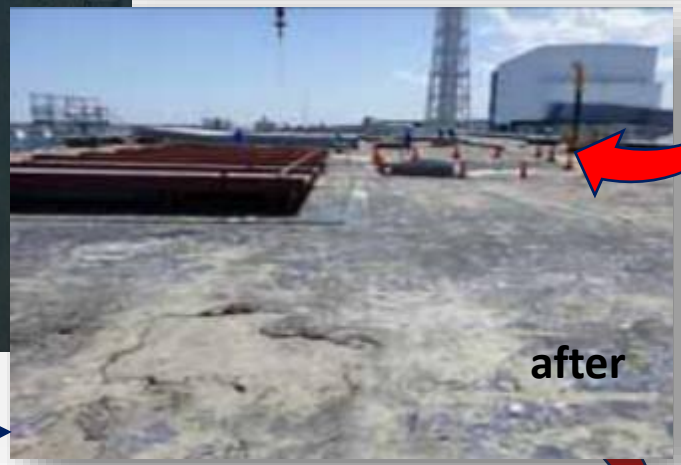
No significant internal exposure (above 2mSv) has been observed since October 2011

Top 10 operations in terms of exposure dose

from April to December 2020

No.	Subject of work	Situation	Exposed dose
1	Units 1-4: Installation of drainage system for residual water in the building	in progress	1.59 manSv
2	Unit 1: PCV access route construction site demonstration	in progress	0.79 manSv
3	Units 1-4: Installation of drainage system for residual water in the building	in progress	0.55 manSv
4	Unit 2: Removal of interference from the south yard	in progress	0.45 manSv
5	Unit 2: Debris removal from the Rw/B and others	in progress	0.43 manSv
6	Unit 3: Construction work for rainwater control in the northeast part of the R/B	completion	0.43 manSv
7	Unit 1: Removal of debris from the skimmer and surge tank room	completion	0.42 manSv
8	Unit 3: Installation of pump for transfer of stagnant water in the R/B	in progress	0.40 manSv
9	Unit 3: Removal of debris from the rooftop of the T/B	completion	0.39 manSv
10	Units 2-4: Installation of safety corridor and improvement of working environment	in progress	0.36 manSv

Removal of debris from the top of the Unit 3 T/B building



unmanned backhoe

remote suction equipment

Unmanned and remote operation to reduce exposure

The 600t crane, suction equipment and unmanned backhoe were remotely operated in low dose areas to reduce exposure.

Air dose rate

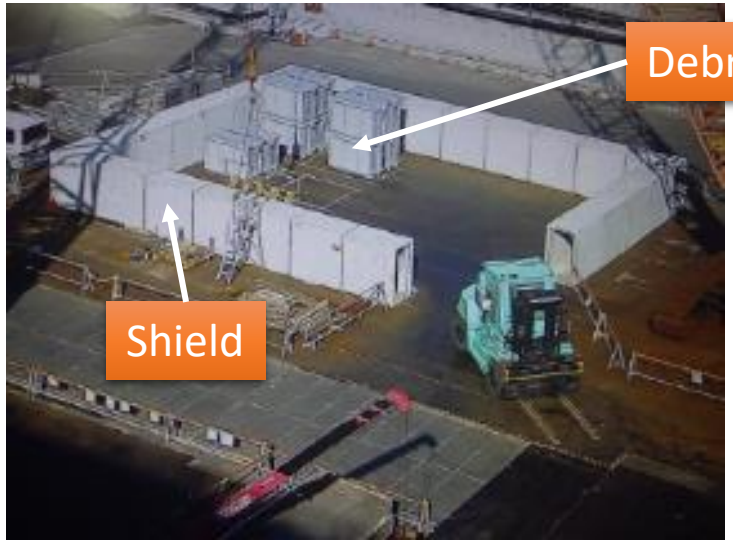
approx. 3.8mSv/h (T/B rooftop)

approx. 6.0μSv/h (in the remote control room)

Reduction effect

approx. 7.6 man･Sv

Reduction of exposure by installation of shielding



The high-dose container containing the debris from the rooftop of the Unit 3 T/B was placed in the temporary storage area

Shielding was installed to reduce the impact on the surrounding area.

Air dose rate

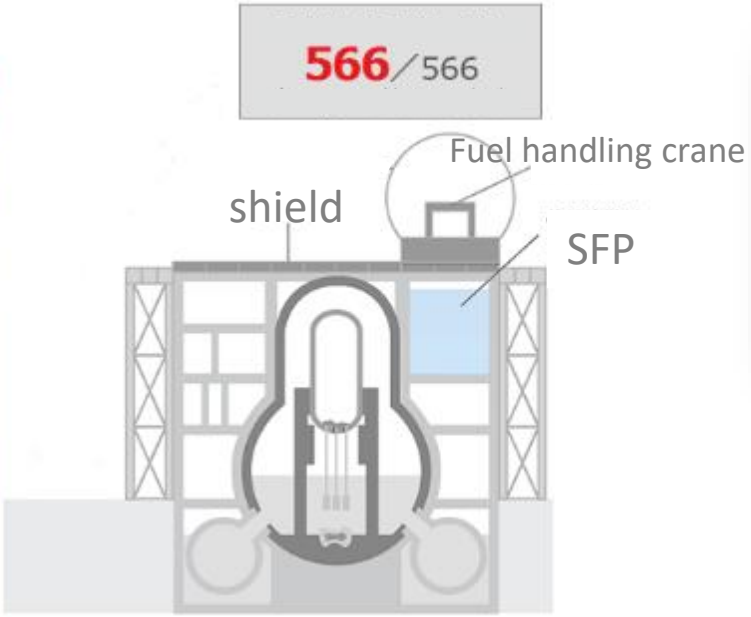
approx. 1.2mSv/h (T/B rooftop)

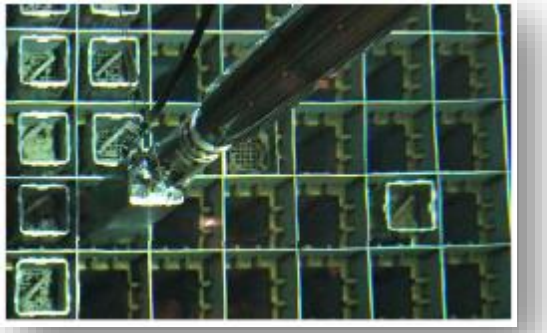
approx. 50μSv/h (in the remote control room)

Reduction effect

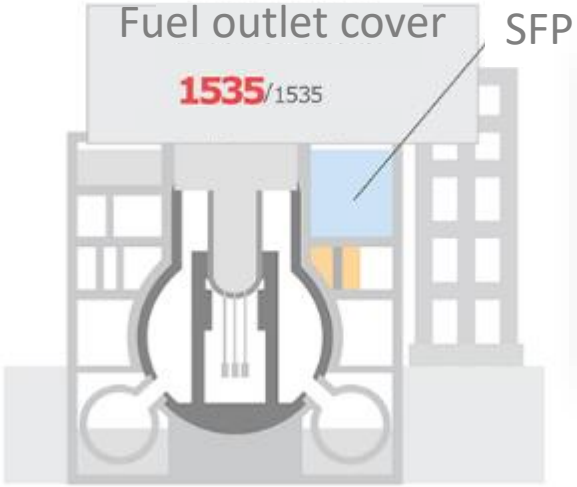
approx. 0.2man･Sv

Status of fuel removal from the spent fuel pool



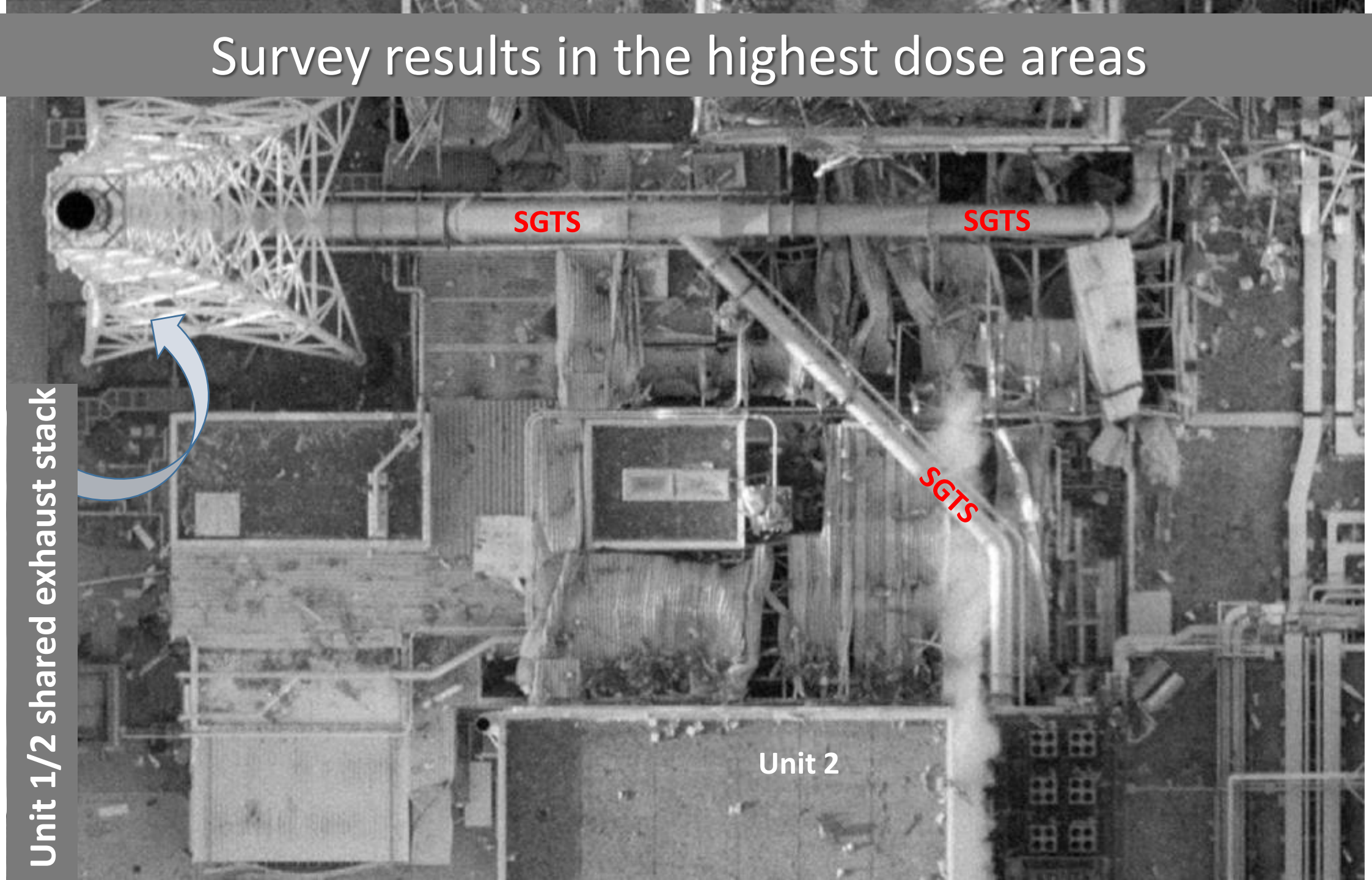


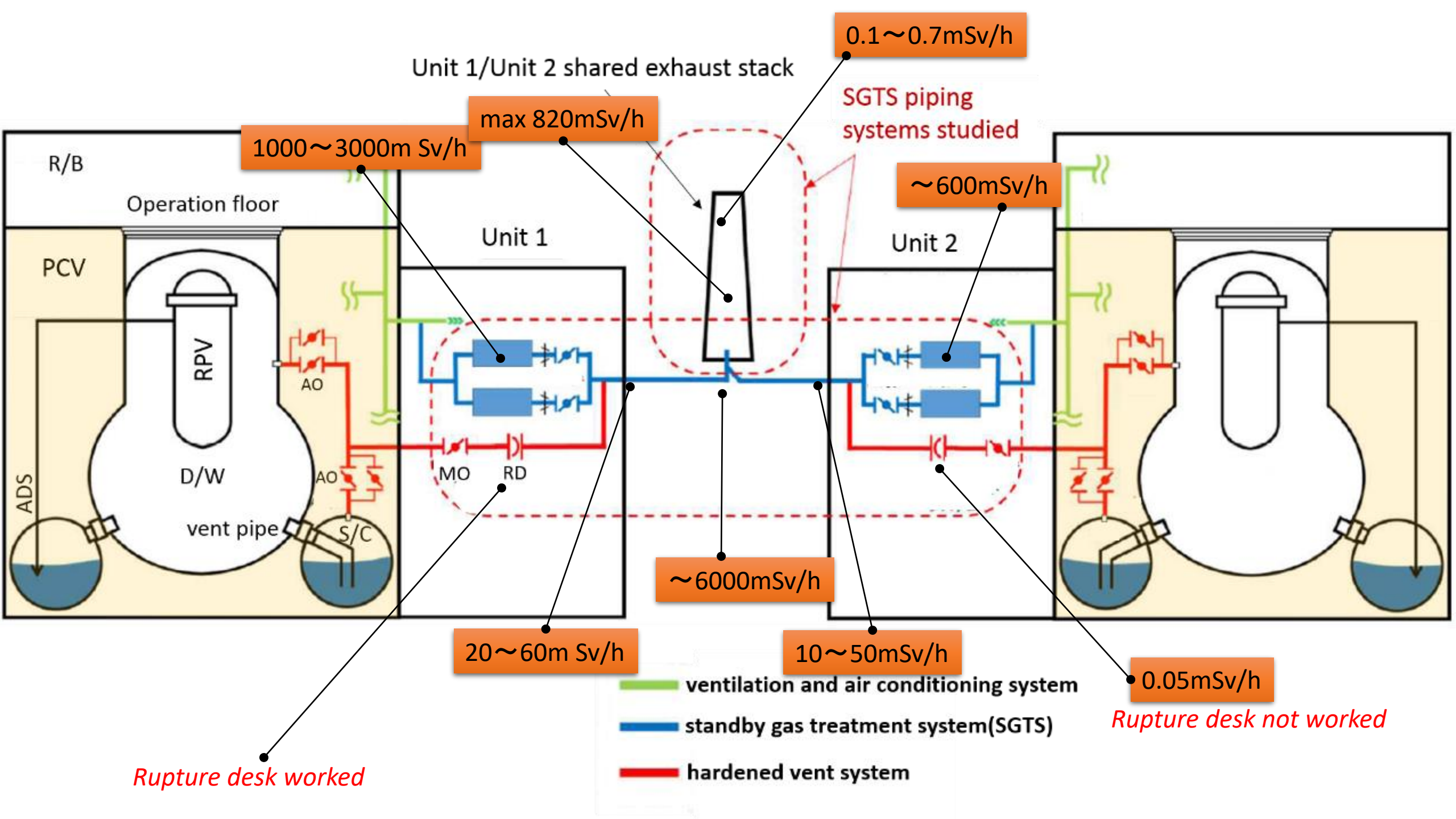
On Feb.28/2021, the last six spent fuel were removed from the transport container into the common spent fuel pool

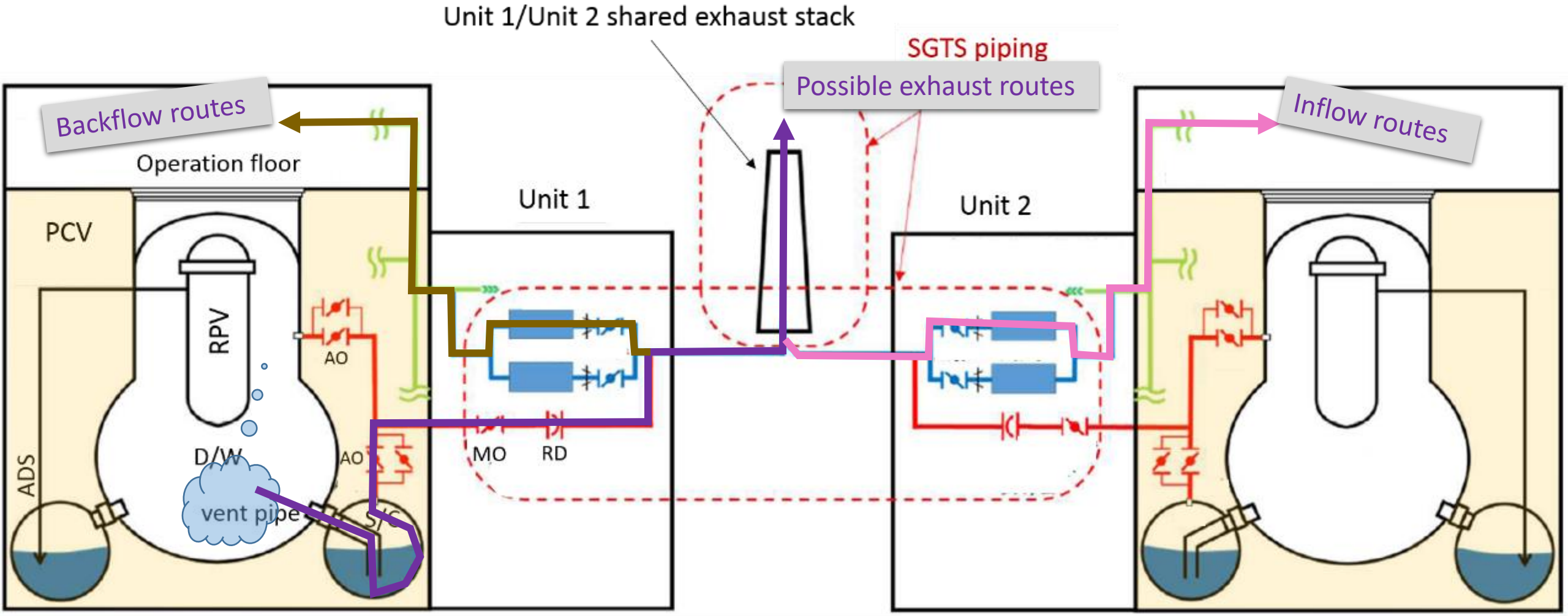


On Dec.22/2014, spent fuel was removed from the SFP of Unit 4, which had suffered a hydrogen explosion as a result of hydrogen backflow from a shared stack with Unit 3, despite the reactor being shut down

Survey results in the highest dose areas




0.1～0.7mSv/h
Unit 1/Unit 2 shared exhaust stack
SGTS piping systems studied
max 820mSv/h
1000～3000m Sv/h
～600mSv/h
R/B
Operation floor
Unit 1
Unit 2
PCV
RPV
AO
D/W
AO
MO
RD
ADS
vent pipe
S/C
～6000mSv/h
20～60m Sv/h
10～50mSv/h
0.05mSv/h
Rupture desk not worked
Rupture desk worked
ventilation and air conditioning system
standby gas treatment system(SGTS)
hardened vent system



The contamination of the SGTS piping systems of Units 1 and 2 was confirmed by the results of the site investigation and the results of the JAEA analysis.

It is considered that the vent gas from Unit 1 flowed back into the SGTS filter train of Unit 1 (*backflow to Unit 1*) and into the SGTS piping system of Unit 2 (*inflow to Unit 2*).

Fuel debris removal will start from Unit 2...

・Unit 2 is more airtight and more capable of trapping radioactive material than Units 1 and 3, which suffered hydrogen explosions that destroyed parts of their buildings.
Preventing the spread of radioactive dust is the top priority

・The work environment on the ground floor of the R/B of Unit 2 has been improved and the dose rate level is lower at 5 mSv/h compared to Unit 1 (approx. 600mSv/h) and Unit 3 (10mSv/h)

・In Unit 2, the internal investigation of the PCV is in progress and we have the most information on the access routes to the fuel debris and the status of the fuel debris

Summary

Efforts to reduce exposure doses at TEPCO's Fukushima Dai-ichi NPS

1. Reduction of air dose by installing shields at high-dose areas and by decontaminating workplaces in advance
2. The establishment of travel routes and work procedures to minimize exposure doses when working in areas with high radiation doses, such as inside R/Bs
3. Introduction of remote working equipment, such as robots and special jigs in high dose areas to reduce exposure doses
4. After the improvement of the site environment, the dose contribution from Cesium direct radiation immediately after the accident has been replaced by the scattered radiation. Therefore, wearing a shielding waistcoat with a lead thickness of a few millimetres has been able to reduce the exposure dose by 30-40%
5. Reduction of skyshine by removing highly contaminated debris from the rooftop of the R/Bs


Thank you for your attention!