

Introduction of Examples for Reducing Exposure Dose during the Decontamination at the Reactor Building (Fukushima Daiichi Nuclear Power Plant Unit 3)

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Activities toward decommissioning have been promoted at the Fukushima Daiichi Nuclear Power Plant. However, the dose rate inside buildings, especially in the reactor building, is still high, and decontamination works by human workers are not realistic.

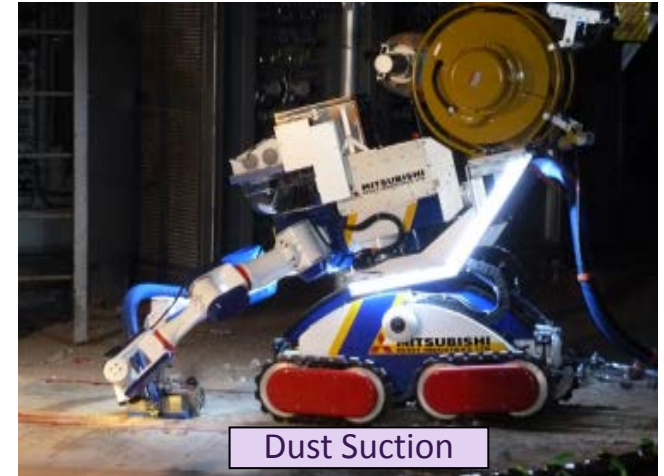
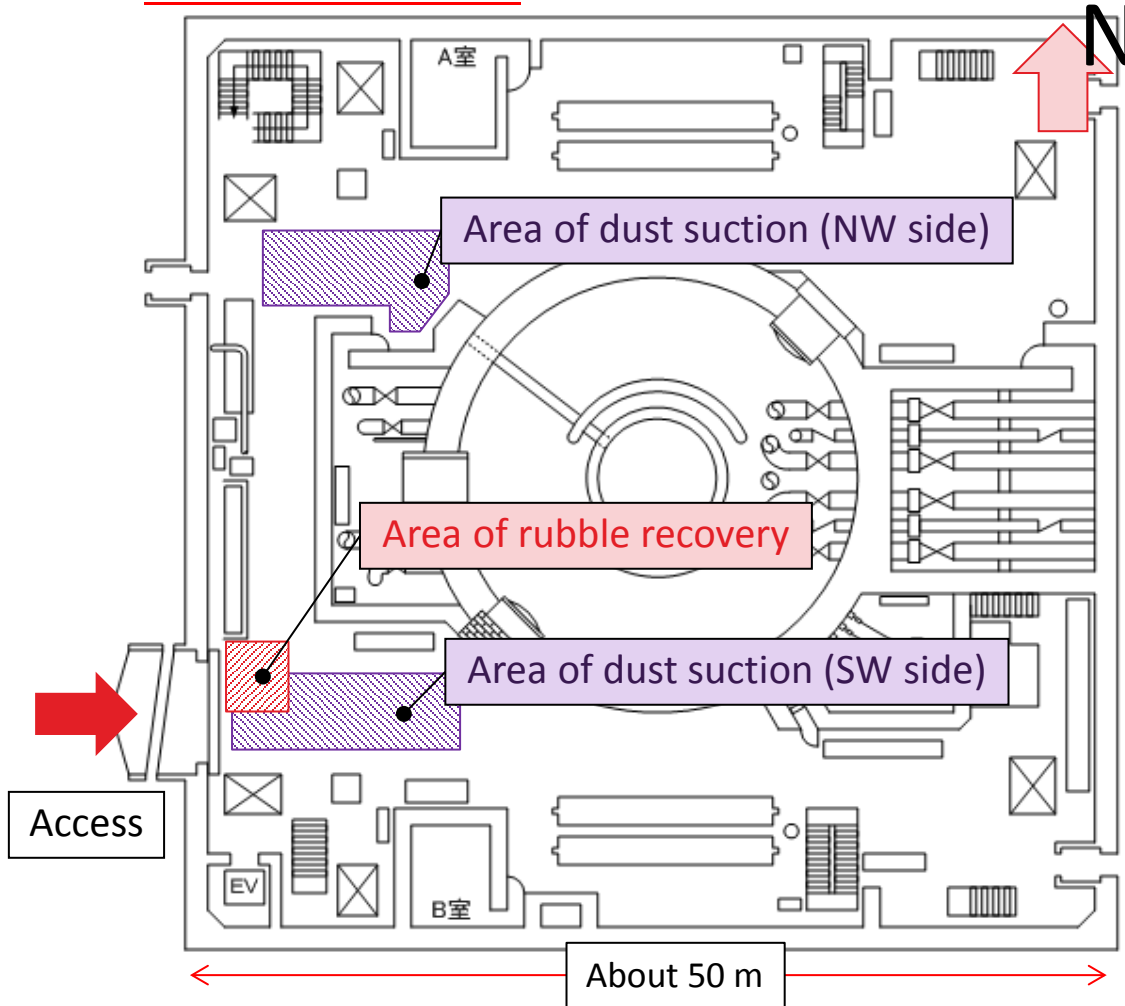


Under the initiative of the Ministry of Economy, Trade and Industry (METI), the MHI has implemented the national project “Development of Remote Decontamination Technology in the Reactor Building”, and has developed a remote decontamination robot.



The MHI employed the developed decontamination robot at the Unit 3 reactor building. This presentation introduces examples for reducing exposure dose during the decontamination.

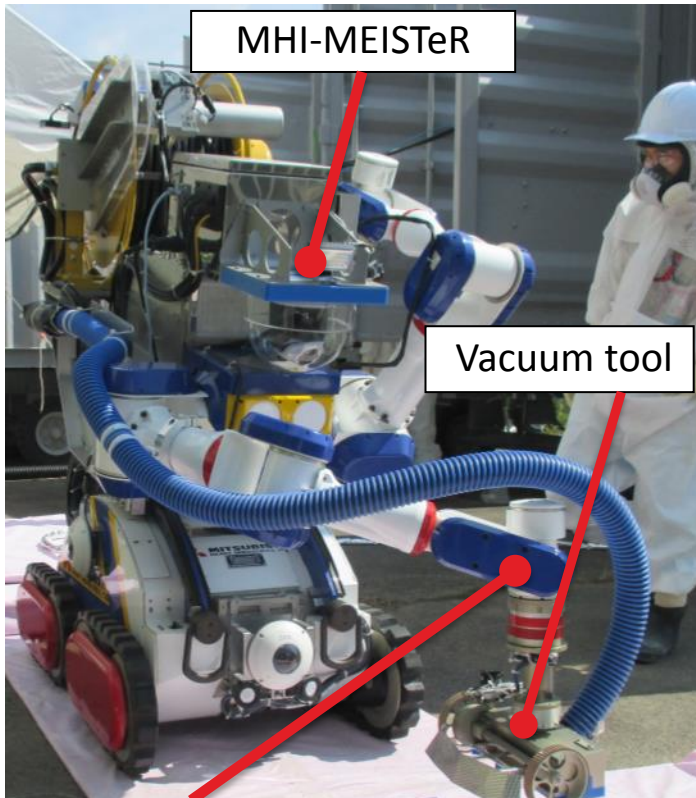
In order to reduce the dose rate in the Unit 3 reactor building, dust suction and rubble removal were both conducted on the floor.



The first floor of the reactor building in 1F

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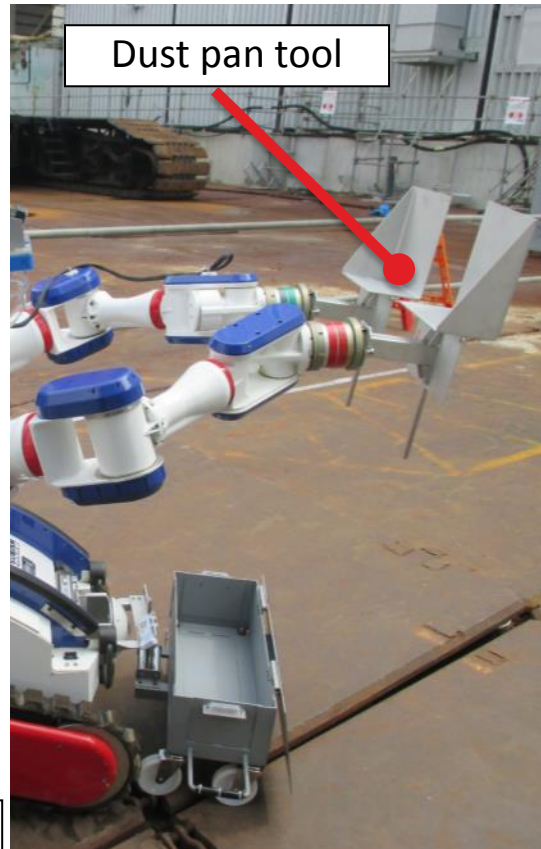
Developed as a work robot with double arms, utilized in both the contamination survey and decontamination in 1F (at the reactor building).



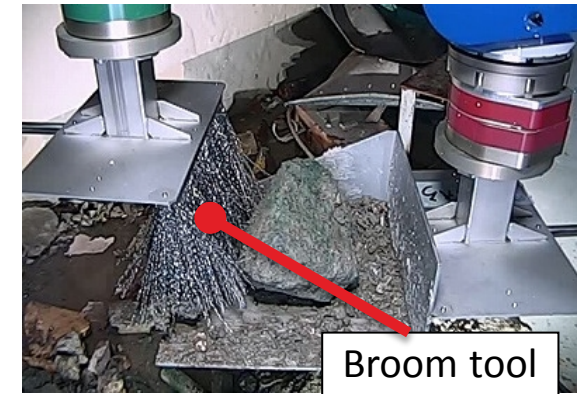
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Vacuum tool

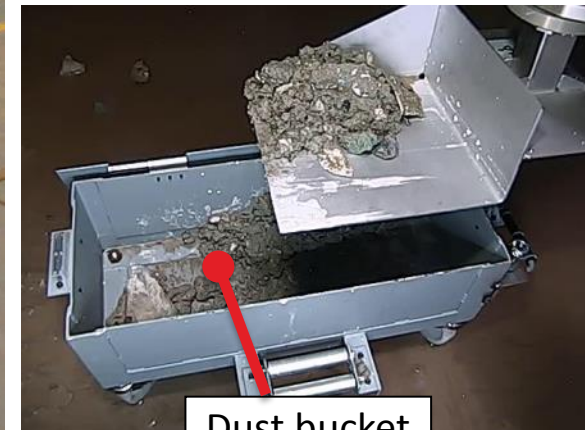
A 7-axis manipulator (with double arms)



Dust pan tool



Broom tool



Dust bucket

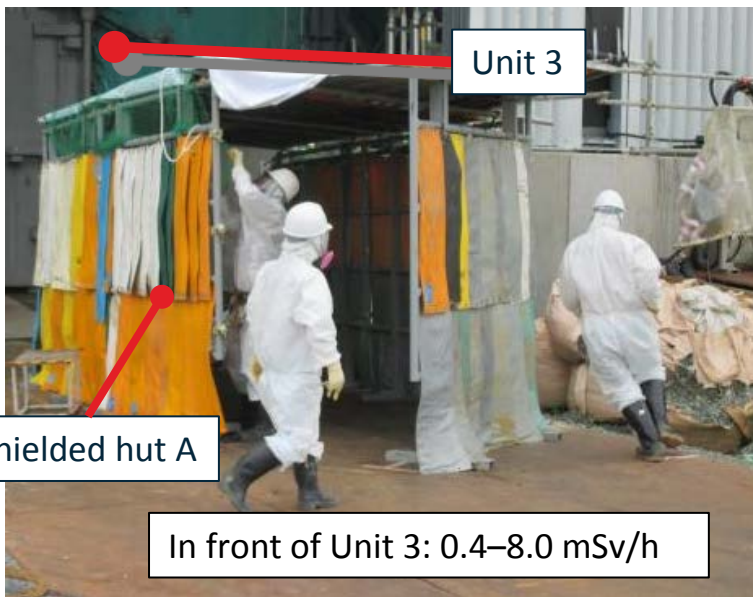
Overview of the work [Procedures]

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- ① Preparation / preliminary maintenance
- ② Placement of equipment in front of Unit 3 [high dose rate]
- ③ Dust suction [high dose rate]
- ④ Changing the tool
(Suction ⇒ Recovery of rubble)
- ⑤ Recovery of rubble [high dose rate]
- ⑥ Post-maintenance/ clearance



Maintenance area: up to 0.02 mSv/h



Unit 3

Shielded hut A

In front of Unit 3: 0.4–8.0 mSv/h



A suction hose (100 m) and a worker supporting the hose

Shielded hut B

Shielded hut: 0.60 mSv/h
(when the door of Unit 3 is open)

[Major causes of radiation exposure]

- ① It was necessary for the workers to support the cables and hoses, due to difficulty in full remote operation, whenever the equipment was moved inside the building.

[Measure]

Transport of decontamination equipment into and from the reactor building, limited to Mondays and Fridays, respectively, rather than every day.

⇒ Reduction in the work load of the workers for the cables and hoses.

Coordination ①: Impossible to close the door after the work because of the cables and hoses of the equipment passing the door of the reactor building. Adjustment made to enable the work with the door slightly open all through the day.

Coordination ②: Decision made for the equipment to be stored inside the reactor building, taking into account the estimated failure risks from the knowledge obtained from past test results and literature, etc. with the understanding of increase in failure risks due to accumulation of radiation.

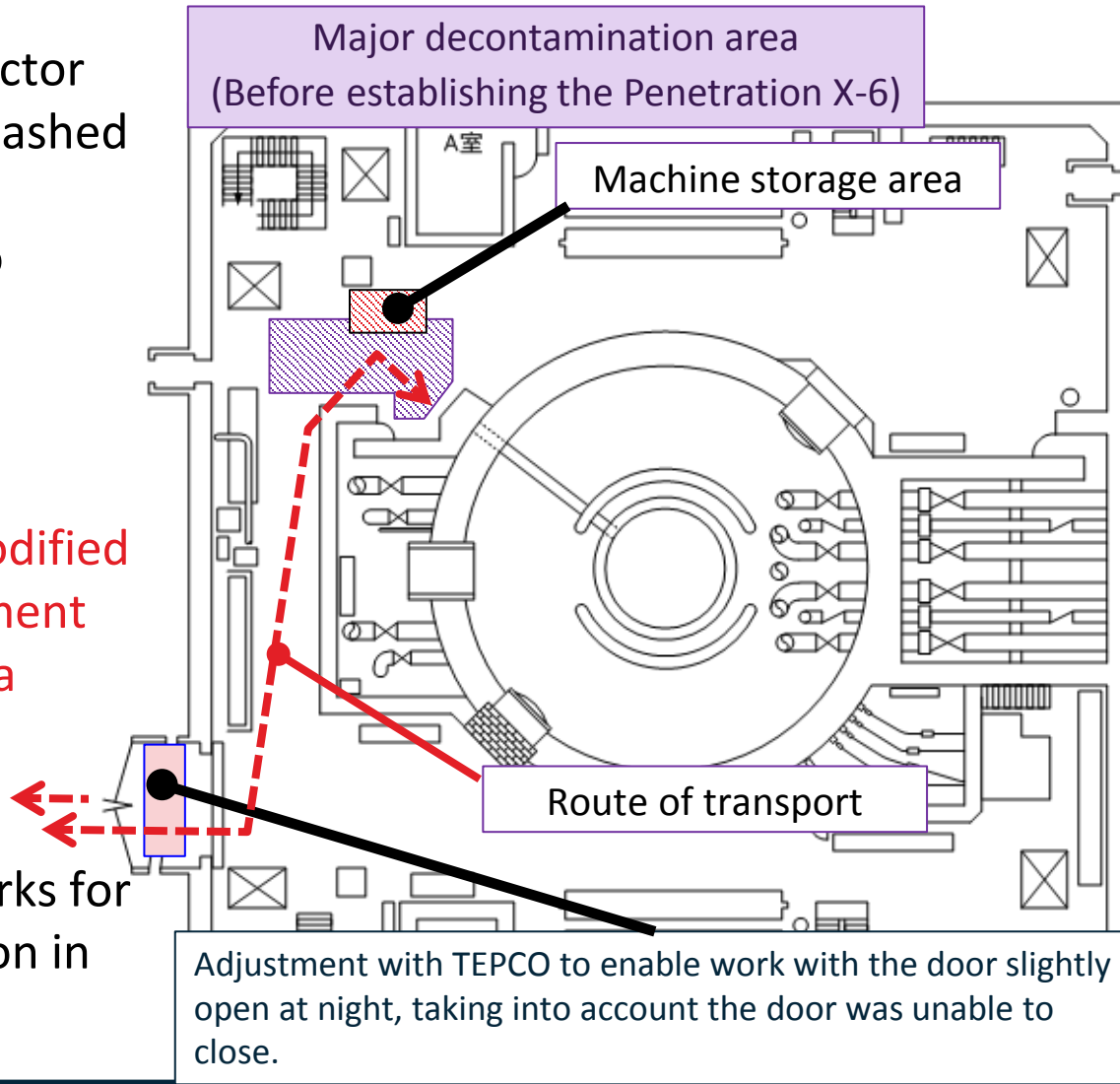
■ Before the measure

Transport of decontamination equipment into and from the reactor building every day (as shown in dashed red line) ⇒ Increase in radiation exposure due to works related to supporting the cables, etc.

■ After the measure

The method of operation was modified to store decontamination equipment around the decontamination area inside the reactor building.

⇒ Resulting in no supporting works for the cables, leading to reduction in daily radiation exposure.



Supporting hoses

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A suction hose and the wheeled platform



Supporting hoses required during the work is a cause of radiation exposure.



Development and utilization of wheeled platforms to relieve the work load for workers supporting the hoses, etc.

[Major causes of radiation exposure]

- ② A shielded hut (only vertical sides shielded) constructed for temporary use aimed at radiation dose reduction for workers at the site, less effective due to gamma rays from all directions (from beneath the floor, vertical sides, and above the building).

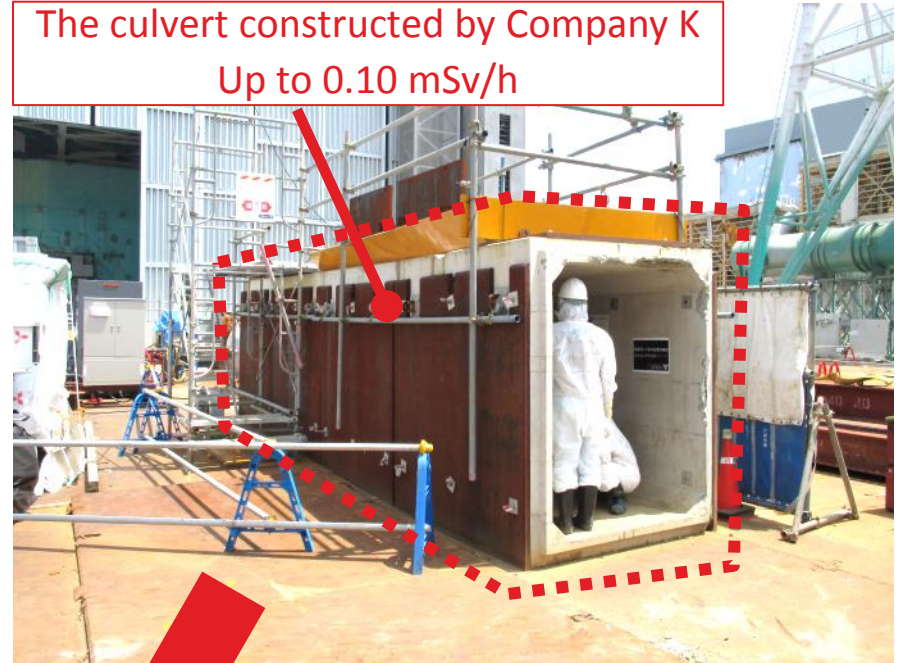
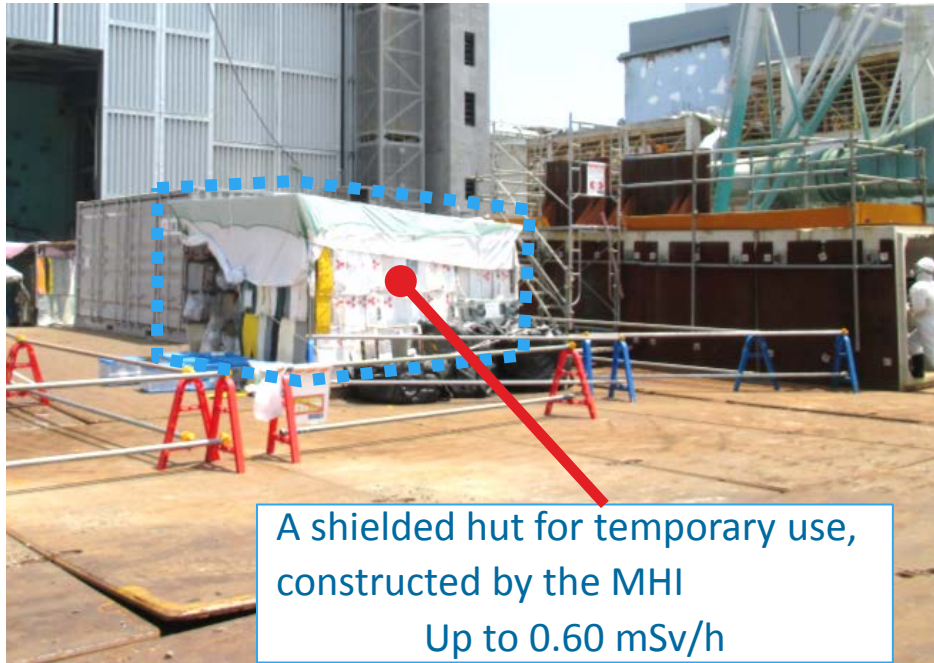
[Measure]

- ⇒ A box culvert placed near the work area (constructed by Company K), borrowed from K, used as the common rest facility for workers.

Coordination ①: The rest facility constructed by K to be in common use for staff of TEPCO as well as related parties.

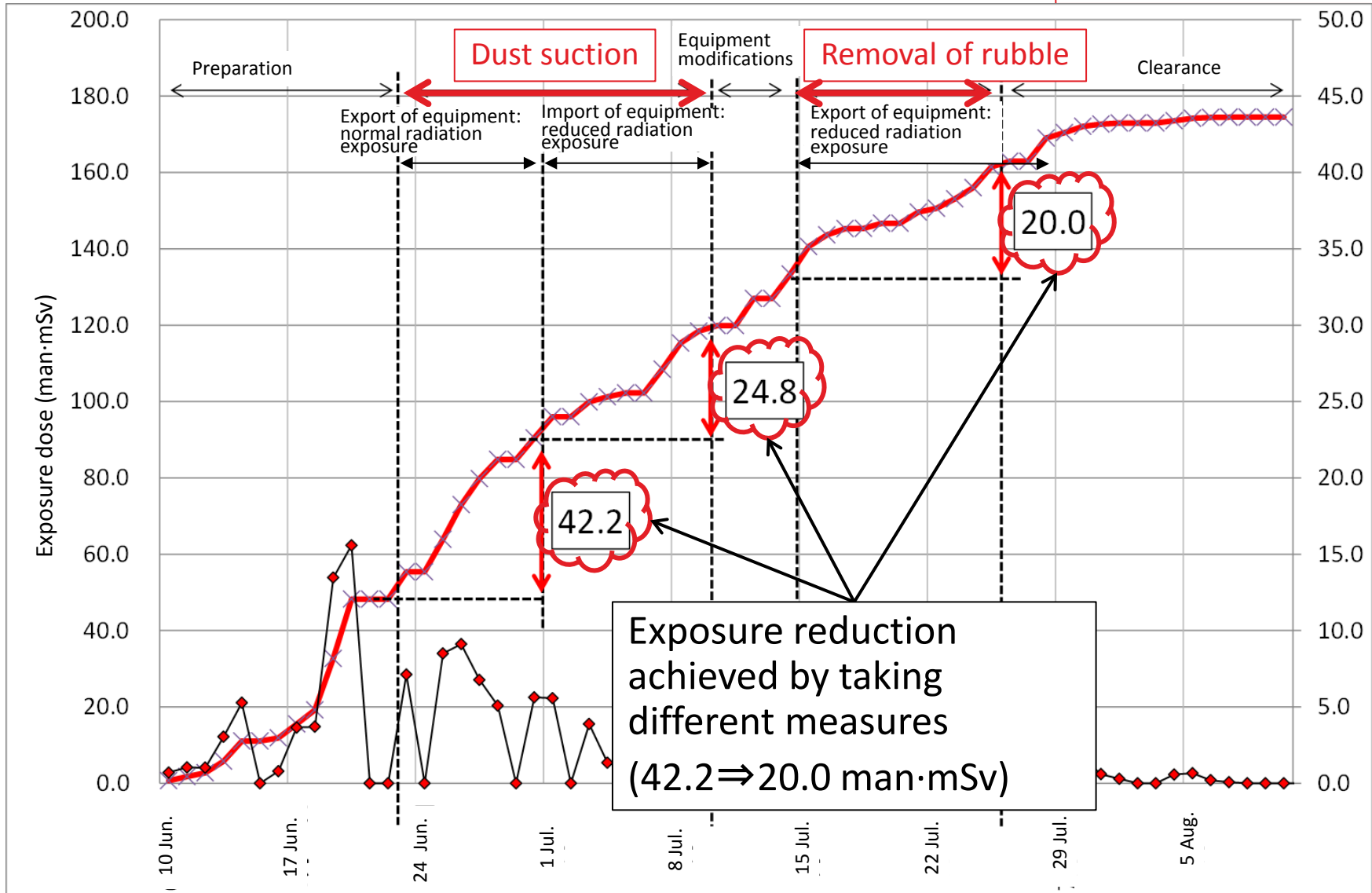
Coordination ②: Daily work plans, adjusted between the MHI and Company K to avoid time schedule conflicts for the efficient use of the culvert.

Use of the box culvert



The box culvert in use in the neighboring work area, to be in common use as the rest facility for workers.

Exposure reduction effect



- Measures have been implemented for reducing exposure dose during the decontamination works on the first floor of the Unit 3 reactor building in the Fukushima Daiichi Nuclear Power Plant.
- Decontamination equipment has been stored inside the reactor building during the work with an assessment of failure risks. Exposure has been reduced to radiation that would be received during transport of equipment into and from the reactor building.
- Improvement of efficiency in radiation exposure reduction by using a common rest facility with other companies working at the site.
- It is important, when conducting works in areas of high radiation outside the reactor building, to establish a coordination framework under the guidance of TEPCO where information on the rest facilities and areas of low radiation is mutually shared while such facilities and areas are used as common areas.



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