National Project ‘Development of a Remote Controllable Decontamination Technique inside the Reactor Buildings’

Decontamination Device for Lower Level and Machine Verification (Suction and Blast Device)

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Tokyo Electric Power Company

TEPCO 東京電力

1. Background and purpose

Background

Development of decontamination device of reactor buildings for lower levels of reactor buildings* (FY2012)

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Verification test for the remote controllability (in Fukushima Daini NPS) (FY2012)

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Extracting points to be improved (FY2012)

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Improvement of decontamination device (FY2013)

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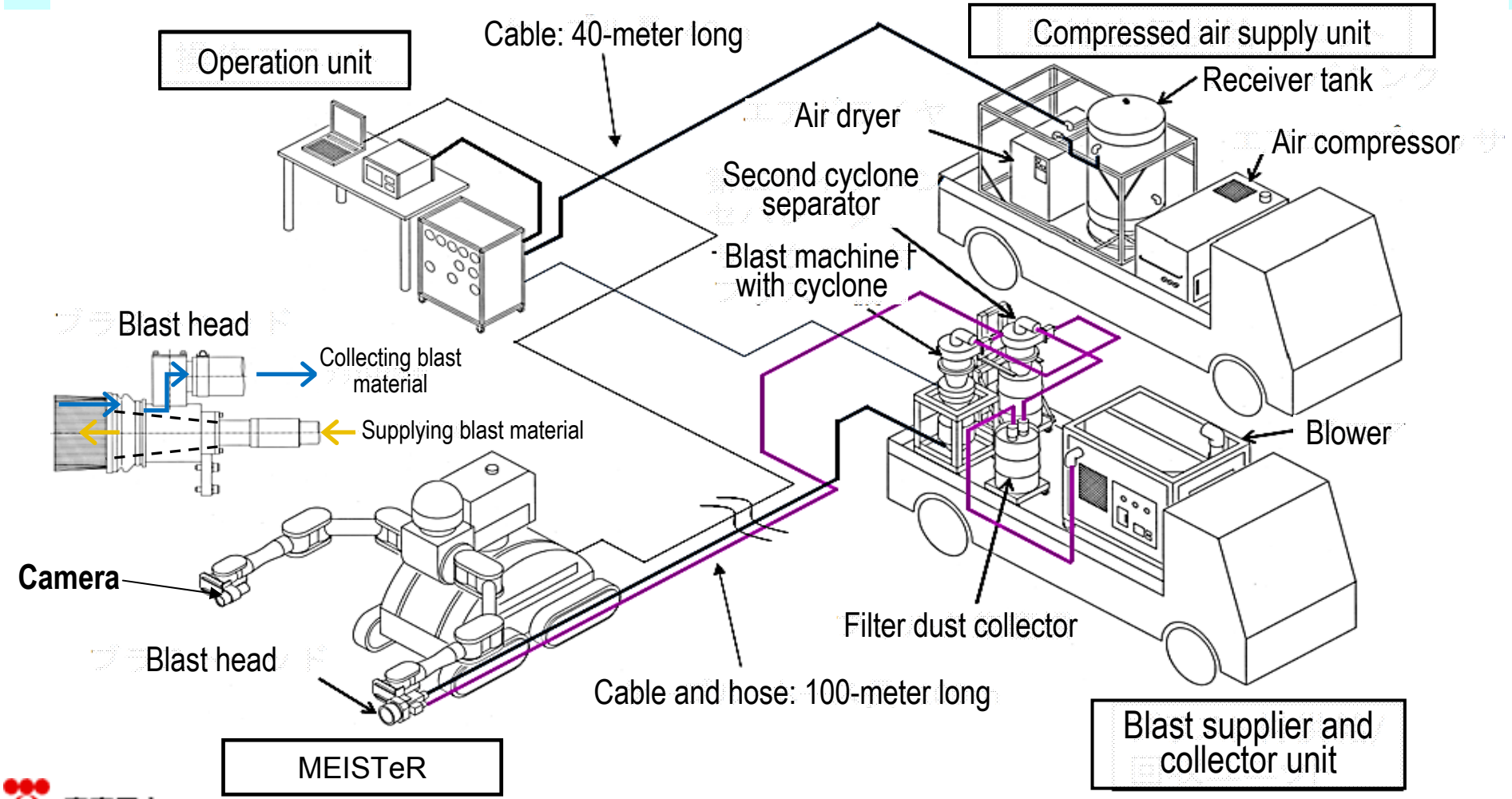
- **Suction and blast decontamination device**
- **Dry ice blast decontamination device**
- **High pressure water decontamination device**

Purpose

We will conduct verification test of improved decontamination devices (suction and blast devices) for its remote controlled decontamination on the first floor at Unit 1 in Fukushima Daiichi NPS (Subsidized project in FY2013).

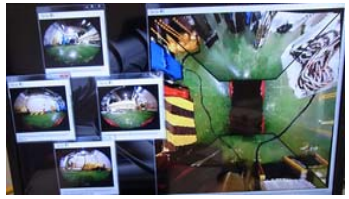
2. Overview of devices

- The device grinds the surface by jetting abrasive (polygonal particle made of special steel) on it. The polygonal participle will be reused after collected and separated from contamination.
- The device can suction tiny debris (e.g. the size of approx.1cm length)

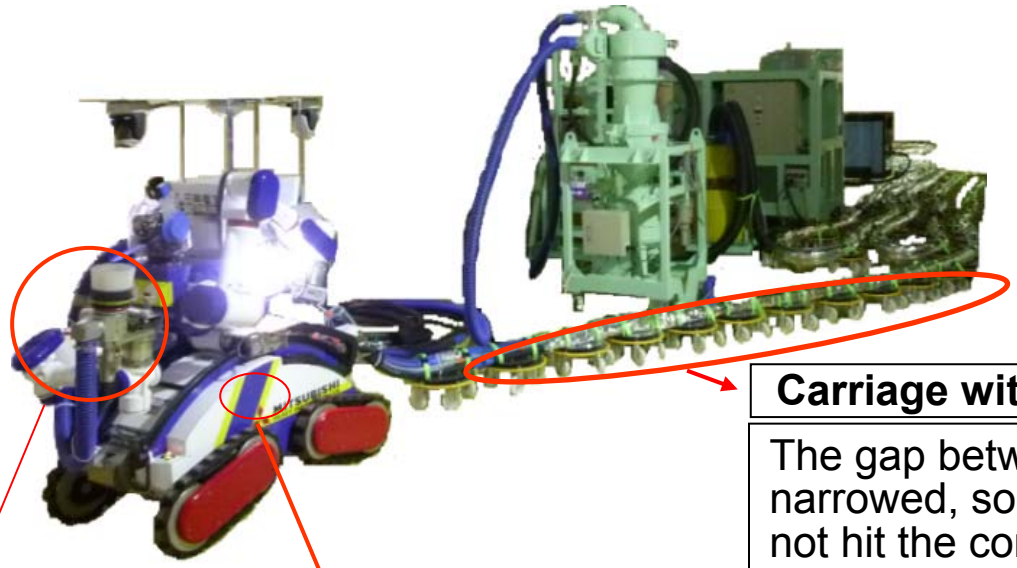


3. Improved points

Operation display and operational programming



・Improving a display: Adoption of 360-degree view
・Increasing the size of the monitor display



Carriage with hose and cable caster

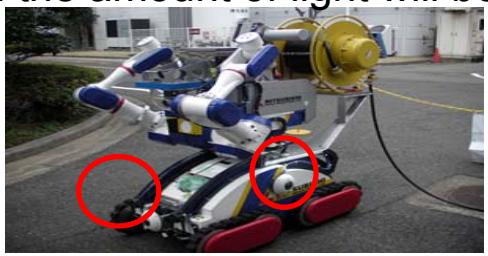
The gap between carriages will be narrowed, so that the hose cable do not hit the corner such as a pillar etc..

Suction decontamination head

A rotary brush will be installed, and a wide decontamination head exclusively for suction decontamination will be produced.

Location of camera and light

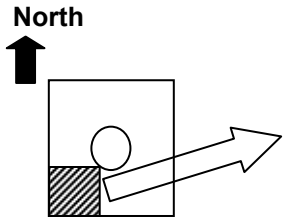
The location of the camera and lights, the amount of light, and the amount of light will be reconsidered.

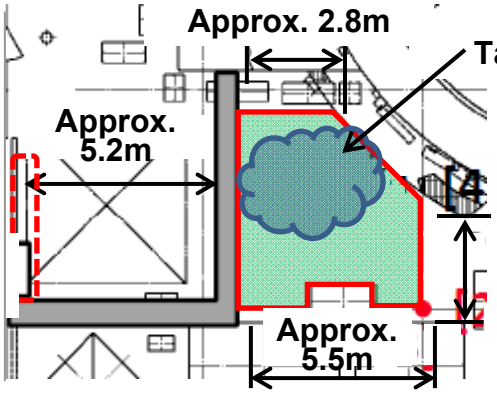


4. Verification test area and decontamination range

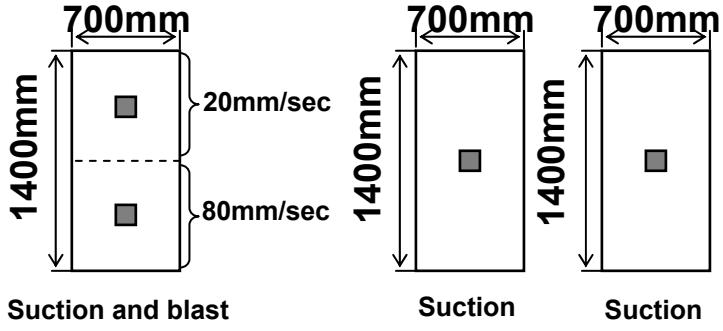
- Suction decontamination will be conducted in an area of approx. 3m^2, and blast decontamination approx. 1m^2
- In a blast decontamination, we will adopt two kinds of velocity (of a head movement), (20mm/sec. and 80mm/sec.). After examining the effectiveness of the decontamination, we will extract the best processing condition.

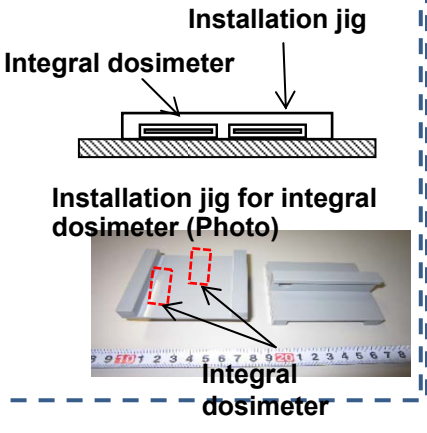
Verification test area



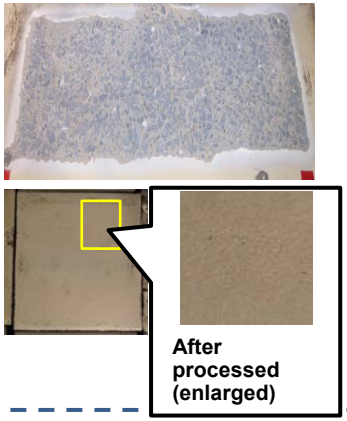


Decontamination range and installation of integral dosimeter





Blast decontamination processing (mock-up)



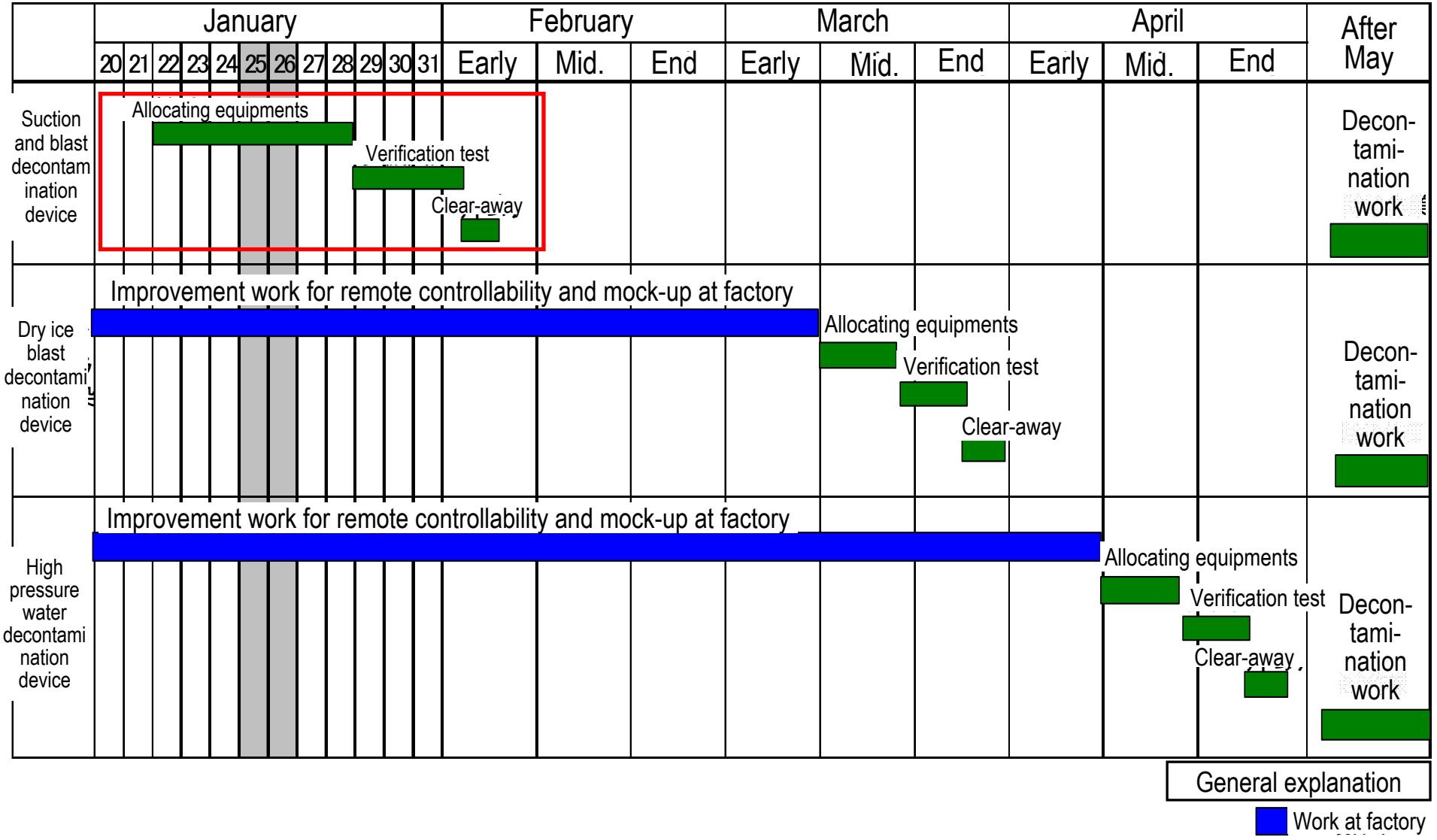
20㎜/sec.:
Epoxy and the surface part of concrete are removed.

80㎜/sec.:
Only epoxy is removed.

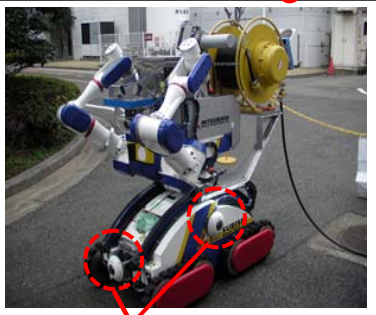
5. Verification

Item	Verification tool	Verification method
Effectiveness of suction decontamination	Image of camera	・We will check if dust etc. are removed from the decontamination range (visual check).
	Integral dosimeter (γ ray and $\beta + \gamma$ rays)	・We will assess the verification the effectiveness based on the differences of integral radiation dose (β ray and γ ray)
Effectiveness of blast decontamination (verification conducted after suction decontamination)	Image of camera	・Roughness and removal status on the concrete-painted surface (visual check).
	Integral dosimeter (γ ray and $\beta + \gamma$ rays)	・We will assess the verification the effectiveness based on the differences of integral radiation dose (β ray and γ ray)

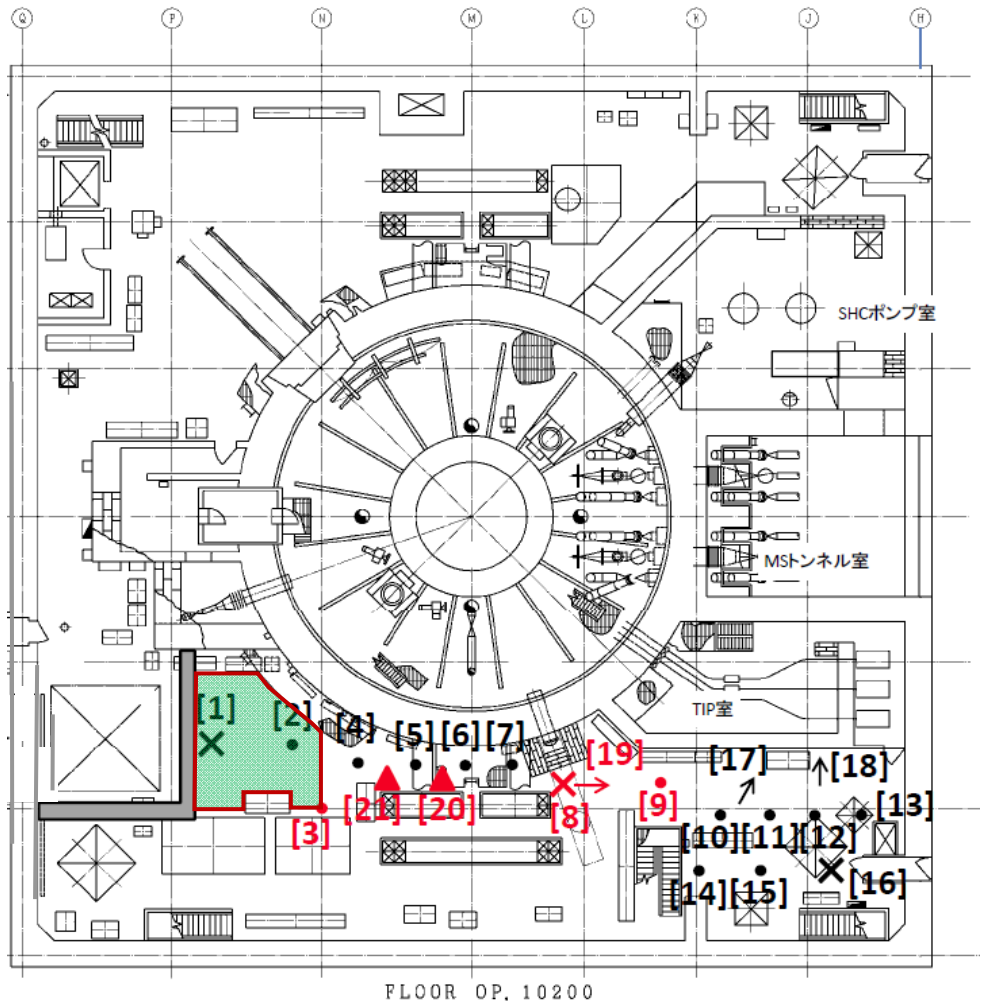
6. Schedule (Proposed)



[Reference] Points found to be improved in the verification test in Fukushima Daini NPS in FY2012 (Suction and blast decontamination devices)

Purpose	Task	Task (detailed)	Measures for improvement
Enhancing work efficiency	Decontamination device (Decontamination head)	Blast head suffers from lower work/decontamination efficacy in a suction decontamination	A rotary brush will be installed, and a wide decontamination head (exclusively for suction decontamination) will be produced. 
	MEISTeR (Control)	Initial settings of decontamination work consumes time.	The software will be improved, so that it can memorize a instructed data when the carriage changes its location (instruction memorization and then apply the data).
	Hose and cable	The caster carriages hit the corners when travelling..	The gap between caster carriages will be narrowed, so that the hose cable does not hit the corner. 
Enhancing visibility	MEISTeR (Monitor display)	Operation display of MEISTeR is small.	The visibility will be improved by forwarding the image of the camera and operation display to a larger television display. 
	MEISTeR (Camera)	Camera of MEISTeR has a blind angle, and hence cannot avoid hitting something.	A camera with 'around-view function' will be installed so that it has a wider view for its vehicle width and the travelling way. 
	MEISTeR (Light)	The light is weak, and provides with poor visibility.	The location of lights, the amount of light, and the number of lights will be reconsidered.

[Reference] Dose distribution on the first floor at Unit 1 Reactor Building



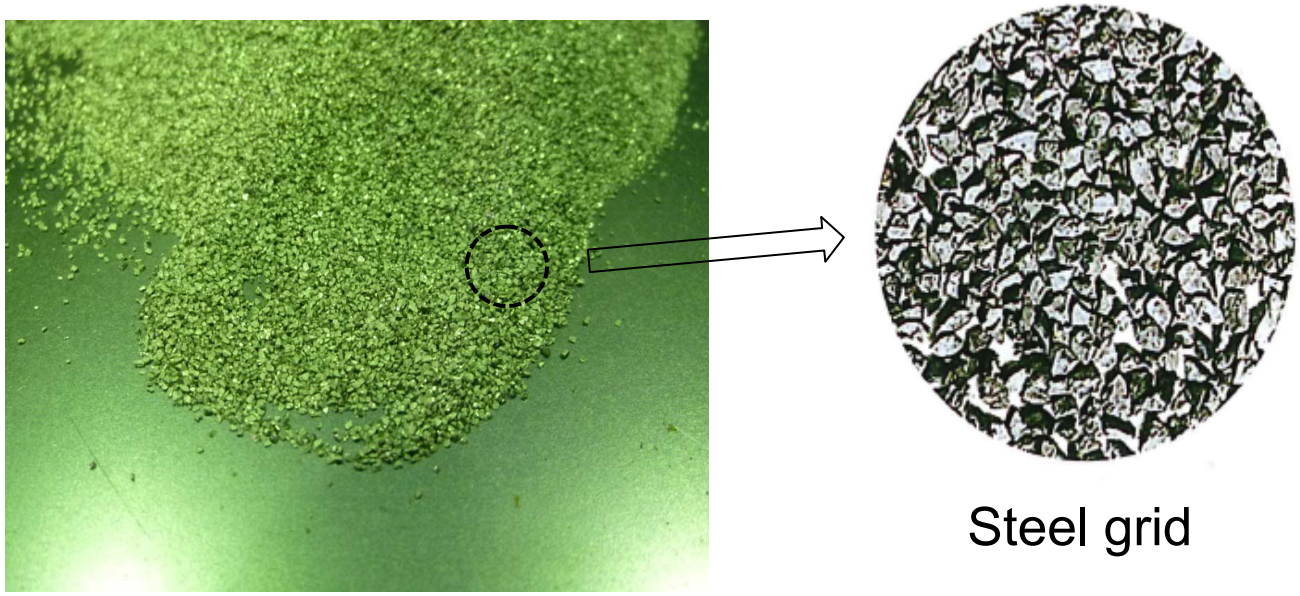
■ : **Demonstration test conducted here**

Measu-ring point	Dose rate (mSv/h)	
	1500mm high	50mm high
[1]	12.97	15.87
[2]	30.84	20.19
[3]	105.50	–
[4]	61.95	40.83
[5]	65.17	42.99
[6]	25.52	31.85
[7]	41.65	17.55
[8]	52.32	30.64
[9]	–	–
[10]	1661.79	185.92
[11]	1096.64	330.98
[12]	510.51	274.30
[13]	313.57	244.23
[14]	139.11	38.17
[15]	91.31	35.44
[16]	166.98	133.37
[17]	659.38	157.75
[18]	202.94	144.04

Measurement dates
（From Dec. 22 to 24 in FY 2013)

[Reference] Steel grid material

- Blast material specification
  - Steel grid (Diameter: Approx. 0.3mm)



Steel grid