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Leading Innovation

Workshop on Radiation Exposure Control
at TEPCO's Fukushima Daiichi Nuclear Power Plant, etc.

Dose Rate Reduction by Decontamination of the Reactor Building at the Fukushima Daiichi Nuclear Power Plant Unit 2

10 November 2015

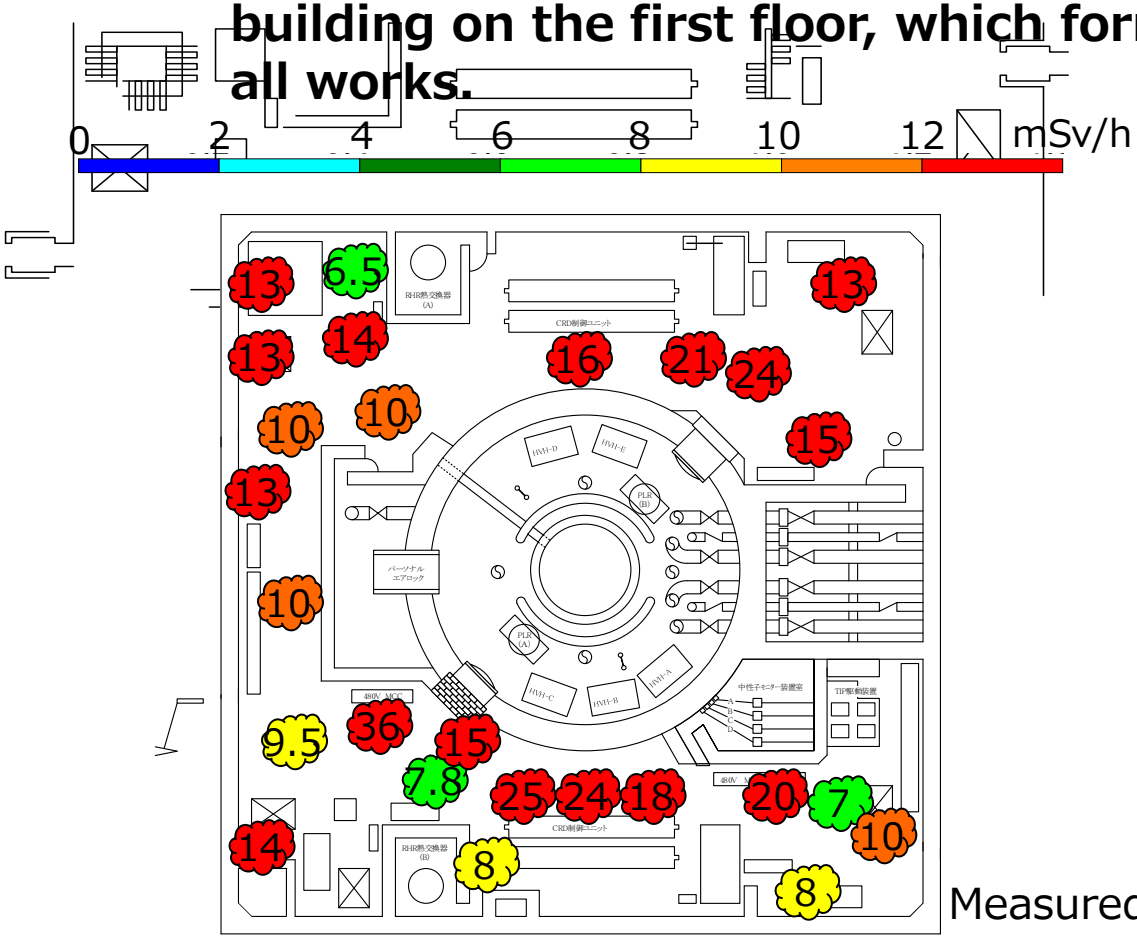
Field Safety and Radiation Protection Control Group
Nuclear Energy Field Engineering Department
Toshiba Corporation

AHGFF-2015-000021 Rev.0
PSNN-2015-0882

I. Introduction

Decommissioning works at 1F

The dose rate reduction is important in the reactor building on the first floor, which forms the basis for all works.



Measured date
22 March 2013

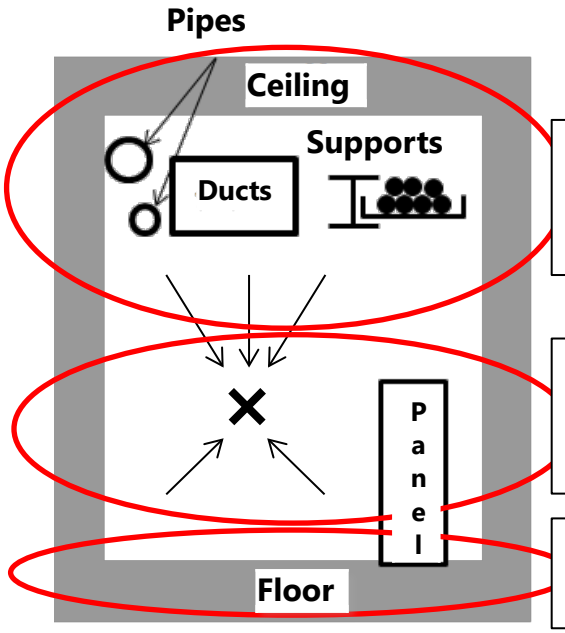
Geometric average dose rate
13.3 mSv/h

Planned daily exposure dose of workers
2.5 mSv/d

About 10 min to reach the planned exposure dose.
No complex works could be done.

Measured height: 1.2 m from the floor

2. Decontamination targets and the decontamination plan



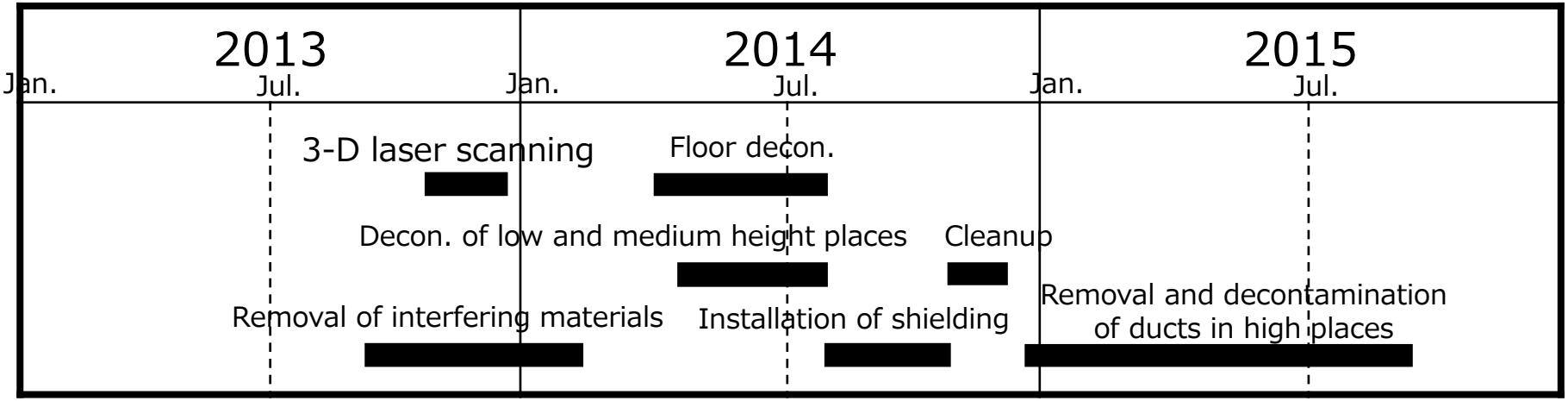
High places (including ducts)

Low and medium height places

Floor level

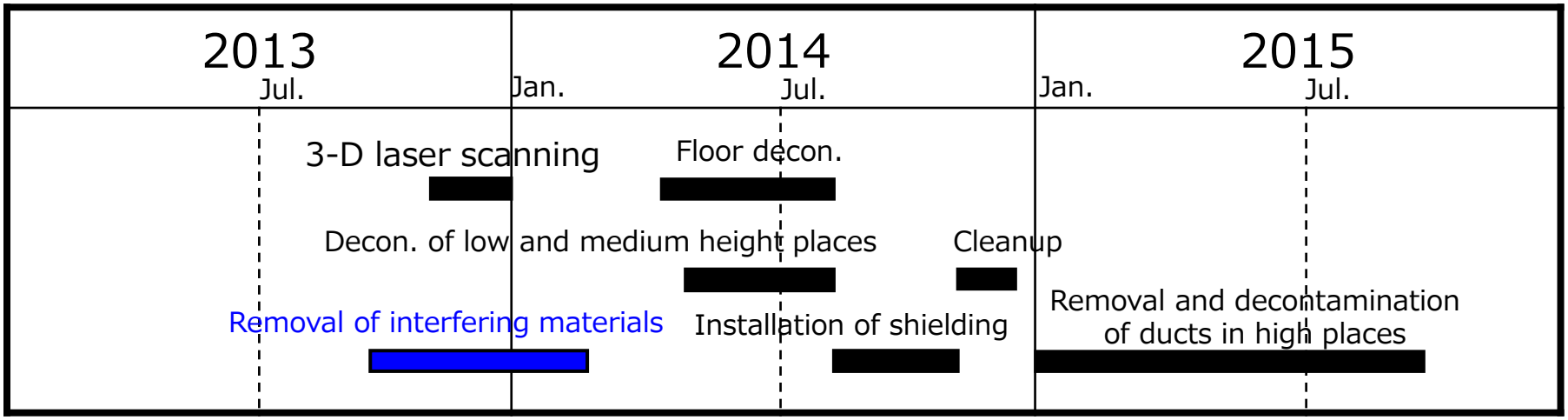
● Contribution to the air dose rate*1
Floor: about 20%
Wall/ceiling, hot spots: about 10%
Others: about 70%
(assumed to be ducts, cable trays, pipes and supports, etc.)

Decontamination is necessary not only for the surface of the floor but also for the three-dimensional space.



*1: Developed with financial support from the subsidiary for the Decommissioning/Contaminated Water Measures Project (METI)

3. Decontamination results（removal of interfering materials）

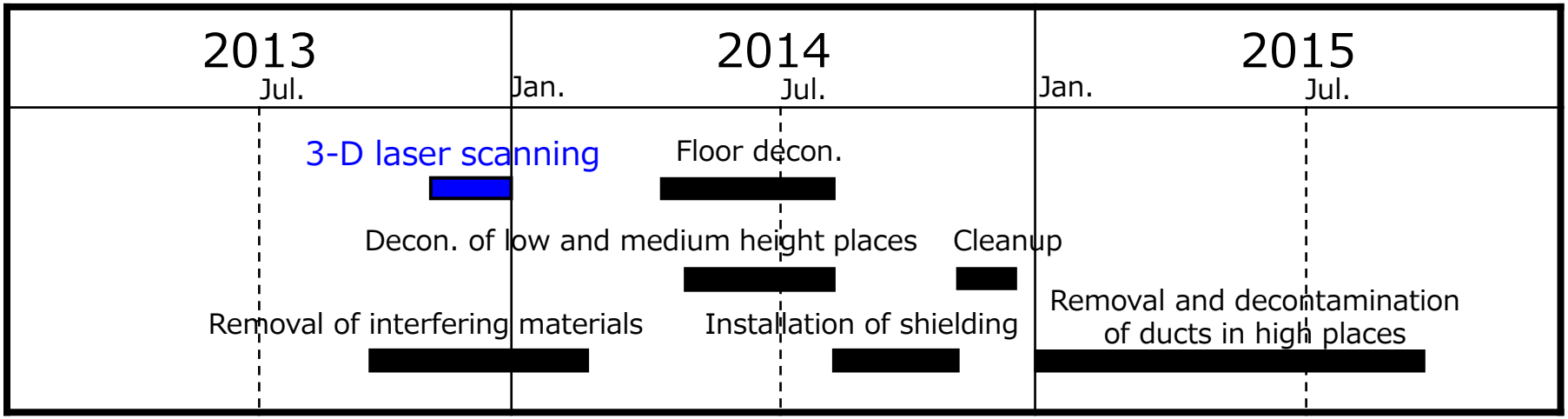


Removed unnecessary or interfering materials for decontamination.

Removal of remaining materials that had been stored since before the earthquake.

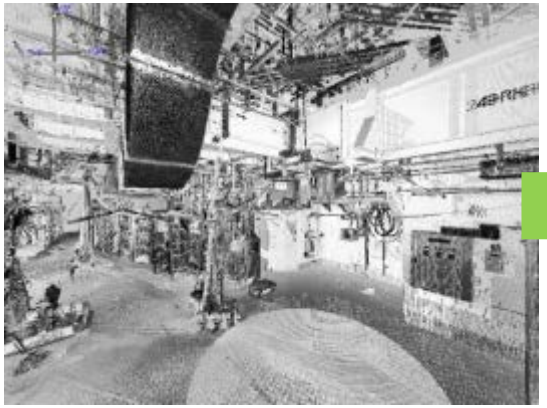
Removal of materials and equipment used in the preceding works after the earthquake.

3. Decontamination results (3-D laser scanning)

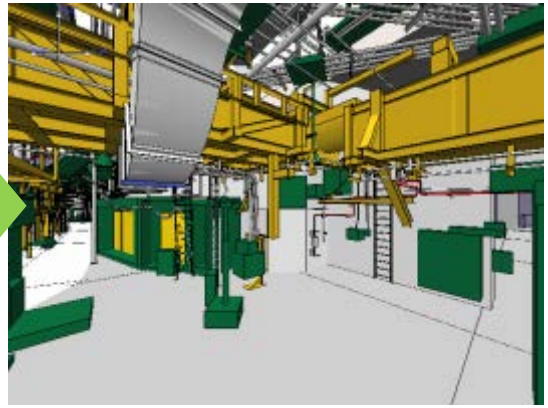


Planning of decontamination procedures by digitization of locational information of equipment, leading to significant reduction of exposure dose rate during the investigation.

3-D laser scanned data(whole view)

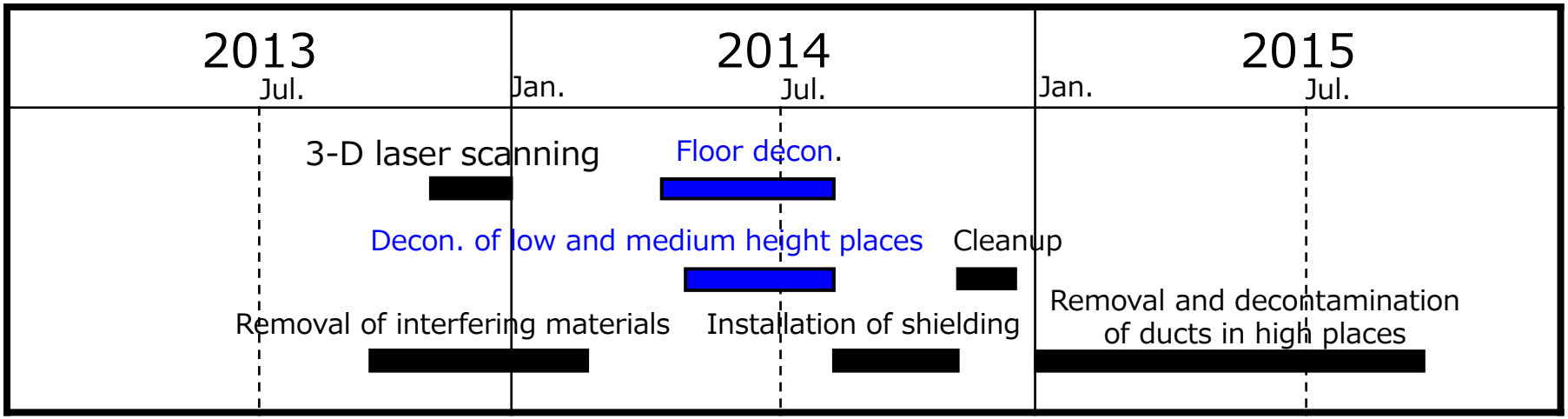


3-D laser scanned data



3-D CAD data

3. Decontamination results (decontamination of the floor and low and medium height places)



Floor decontamination with a remote handled decontamination machine, decontamination by mechanical wiping and suction for medium height places. Decontamination by wiping by workers for narrow areas, walls, and other structural components.

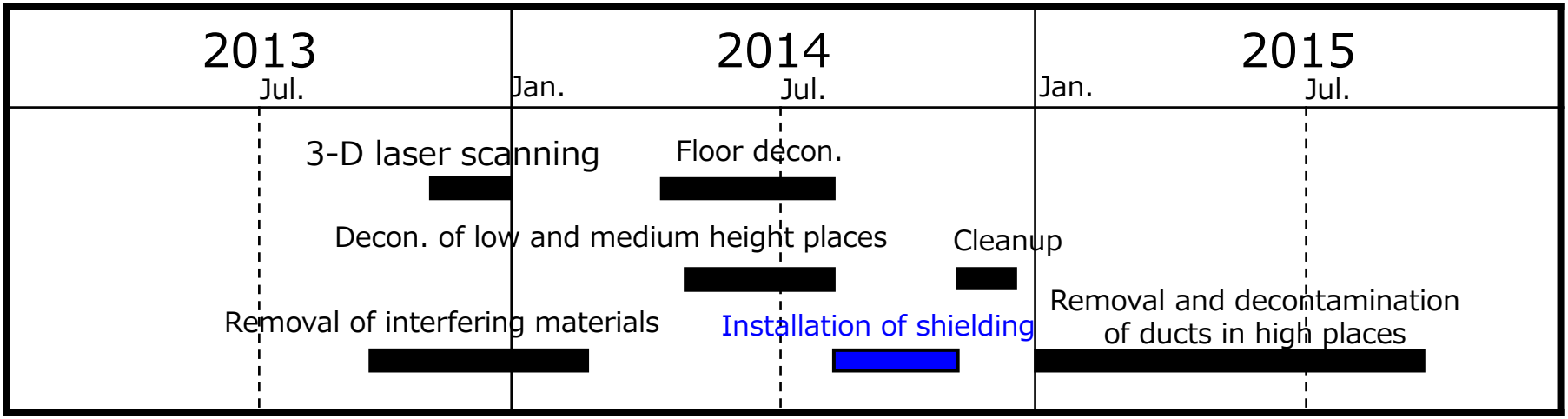
Developed by ATOX, Ltd.

Developed by ATOX, Ltd.

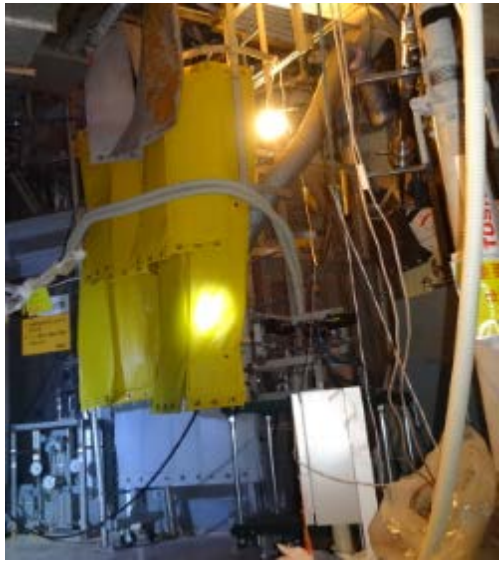
Remote handled decontamination machines (for floors, and low and medium height places).

Wiping by workers

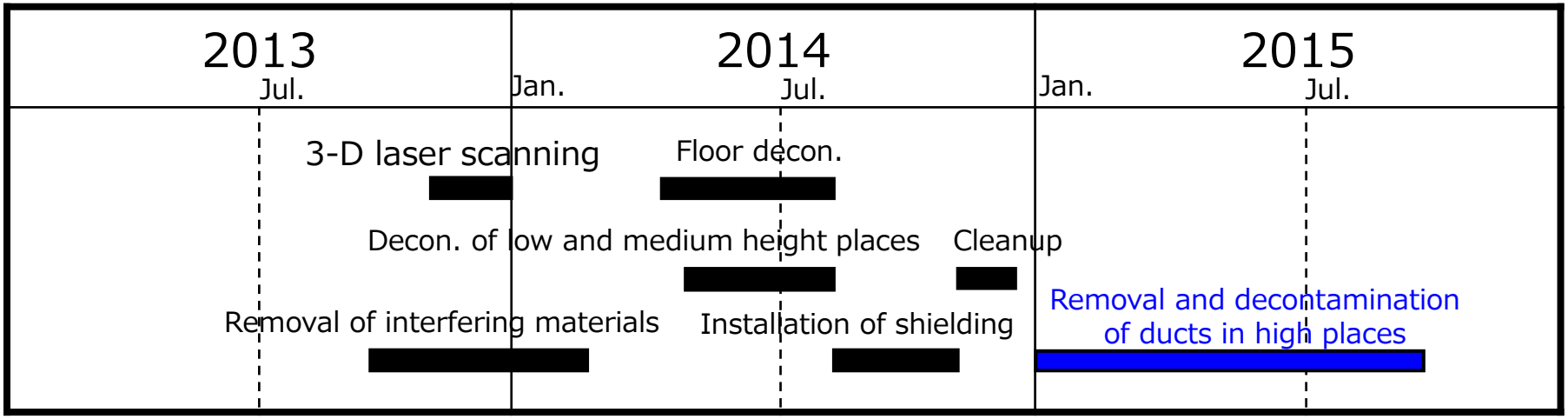
3. Decontamination results（installation of shielding)



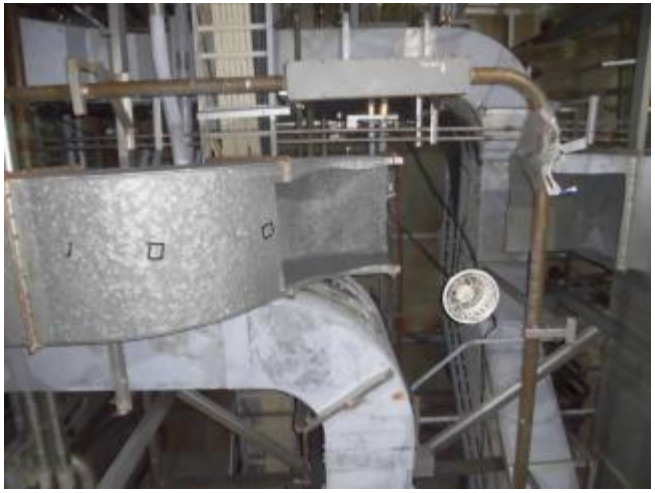
Installation of lead shielding at places of high dose rate where it is difficult to carry out decontamination.



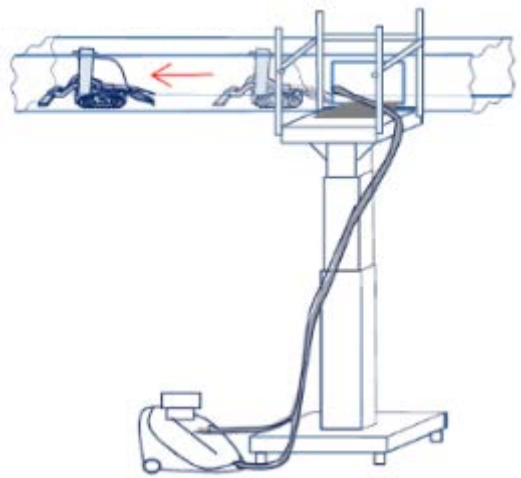
3. Decontamination results (removal and decontamination of ducts in high places)

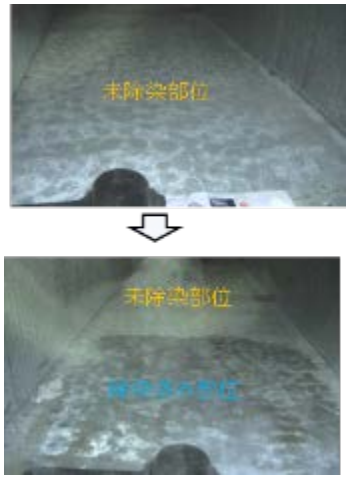


Removal of ducts in high places (broad areas). Decontamination of places where it is difficult to remove the ducts (narrow areas).



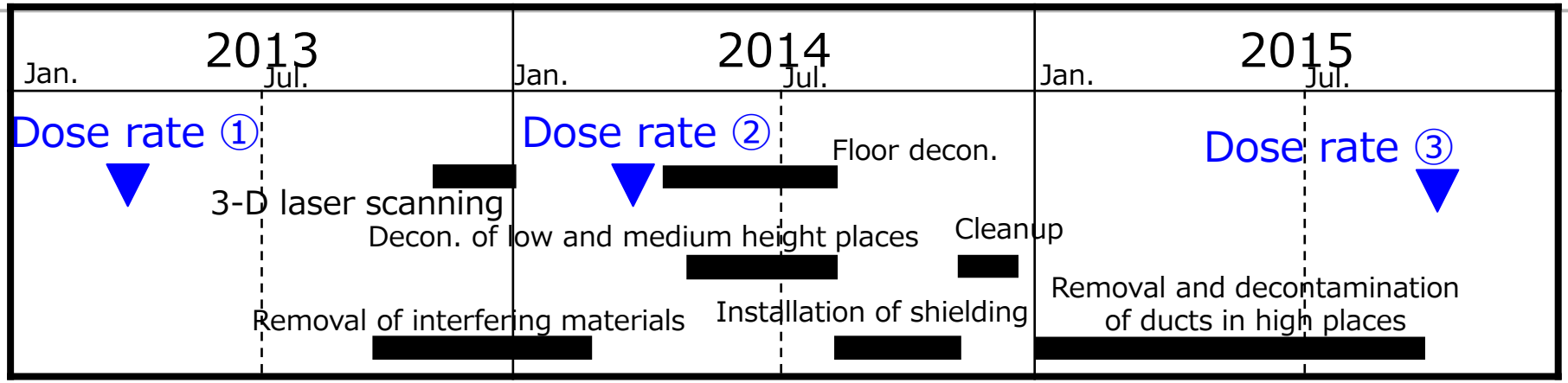
Removal of ducts (broad area)





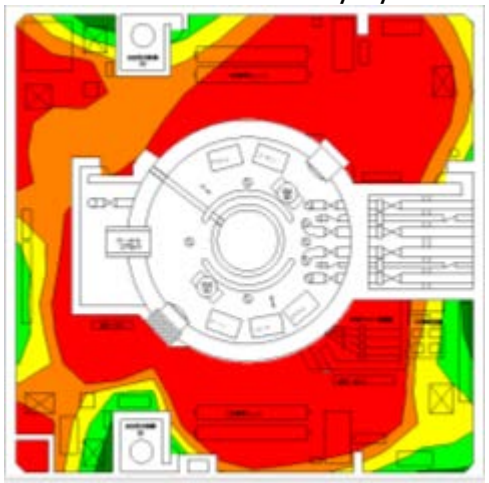
Decontamination of ducts (narrow area)

4. Confirmation of the decontamination results



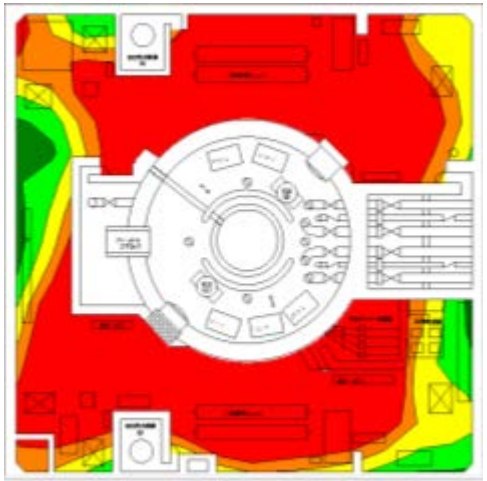
The dose rate at the floor has been reduced by 40% or more even when considering the radioactive decay of the radiation source.

Dose rate ① 22/3/2013



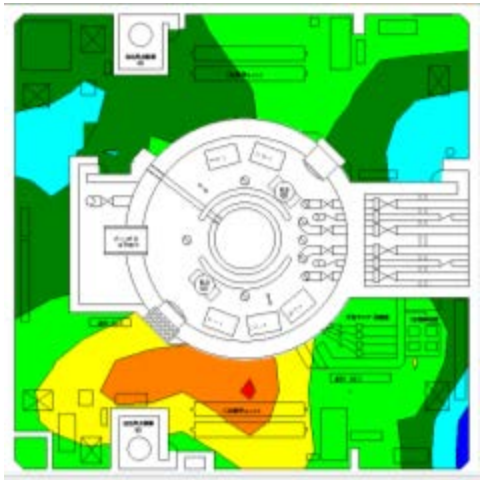
Geometric average:13.3 mSv/h

Dose rate ② 27/3/2014



Geometric average:13.0 mSv/h

Dose rate ③ 15/9/2015



Geometric average: 5.0 mSv/h

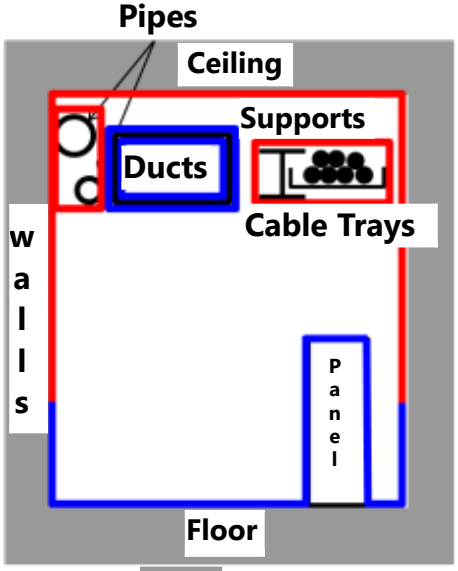
Planned value 2.5 mSv/d

Allowed to stay about 30 min

Measured height: 1.2m from the floor

5. Future decontamination plans

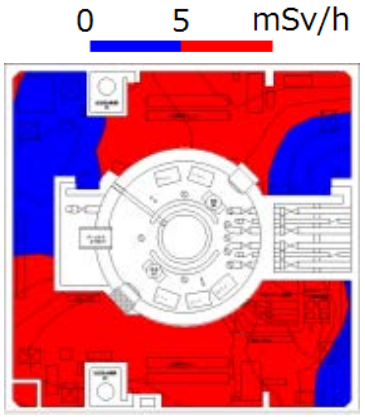
Decontamination of ceilings, upper part of walls, etc. and investigation of radiation sources in high places with a gamma camera



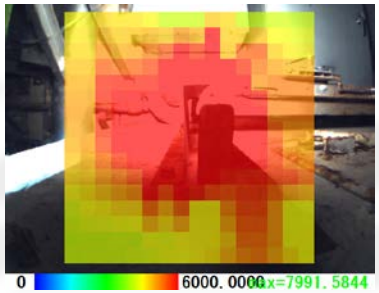
Decontaminated

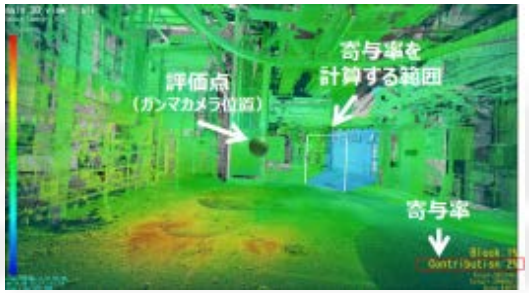
To be decontaminated

Target: <5 mSv/h



Dry ice-blast decontamination system for the high places*2





Decontamination based on data from radiation source surveys in high places with the gamma camera and 3-D scanning.

Patent pending
(Patent 2013-51302, Patent 2014-212583)

*2: Developed with financial support from the Subsidies for the Decommissioning/Contaminated Water Measures Project (Development of Remote Decontamination Technology in the Reactor Building)(FY 2013)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