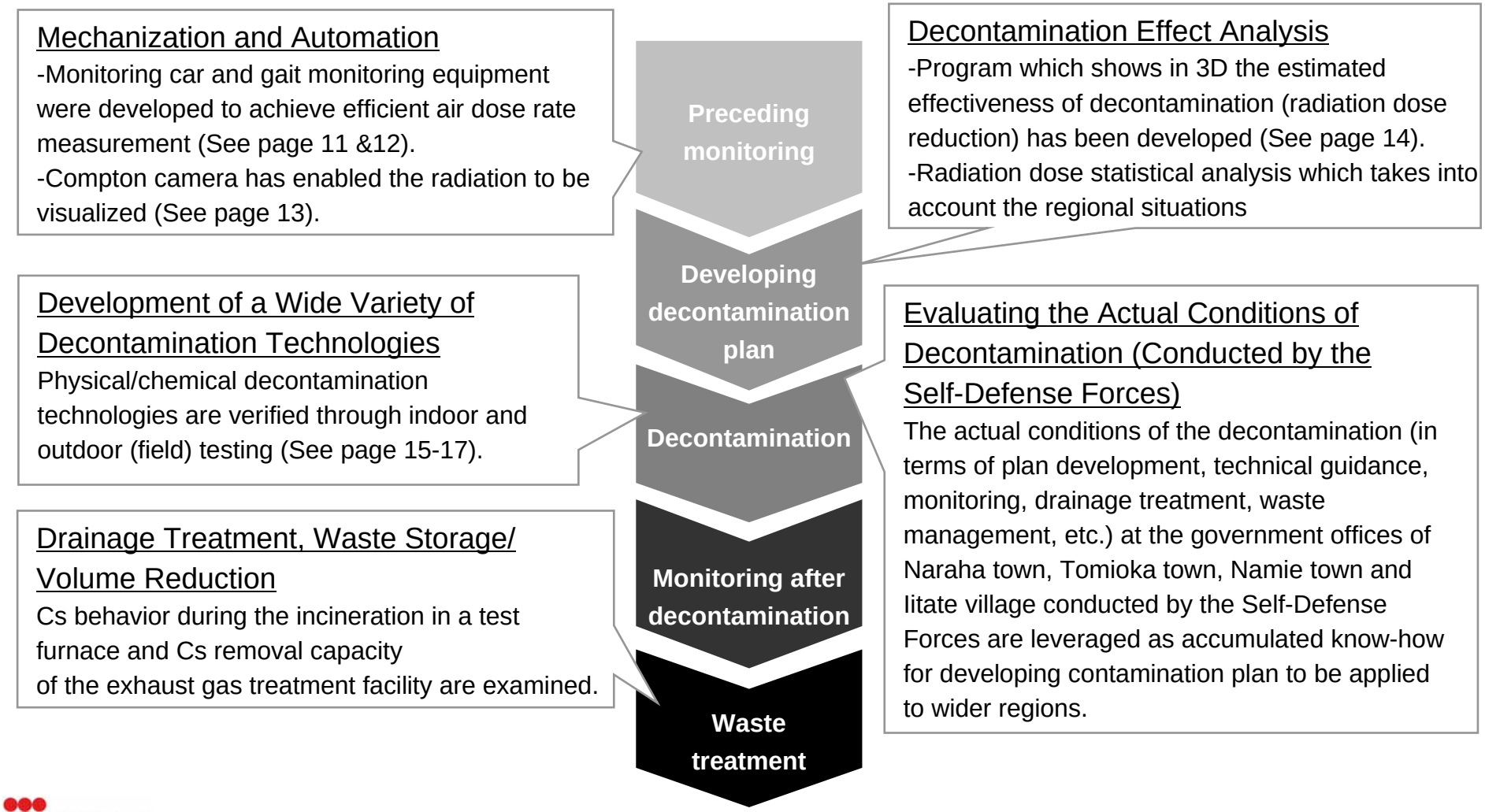
3. Developing Technology on Monitoring Radioactive Materials and Decontamination

TEPCO 東京電力

10. Development of Technologies of Monitoring and Decontamination

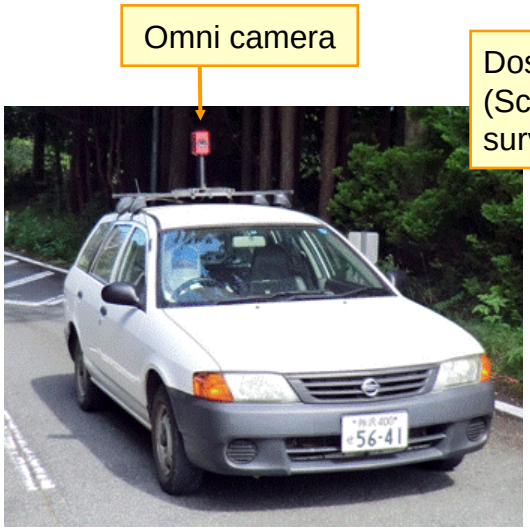
We are currently in the process of developing technologies to be utilized in each stage of decontamination in order to ensure safety, accuracy and efficiency in implementing decontamination.

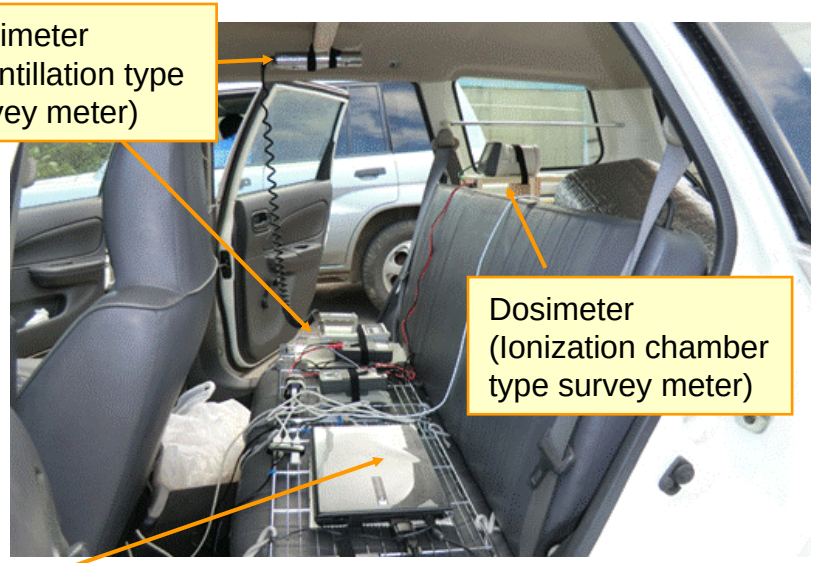


11. Driving Survey Using a Monitoring Car

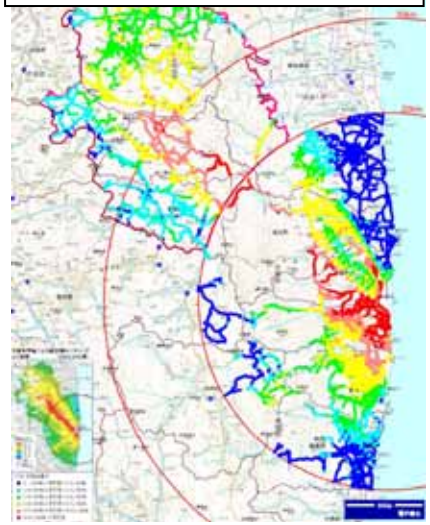
-We have developed a monitoring car which allows for a driving survey of air dose rate (1m from the ground). The omni camera installed on the vehicle allows photos of the surroundings to be taken at the same time. The dose rate measurement equipment was developed under the supervision of Kyoto University.

-The driving survey is ongoing in the Evacuation Zone and the Planned Evacuation Zone (Currently in the 8th round). One round takes about 40 days (The measurement is done not only on the main roads such as Joban expressway and national roads, but also on smaller roads. The total running distance per round is approx. 6,000km and there are approx. 150,000 measurement points set every 10m).





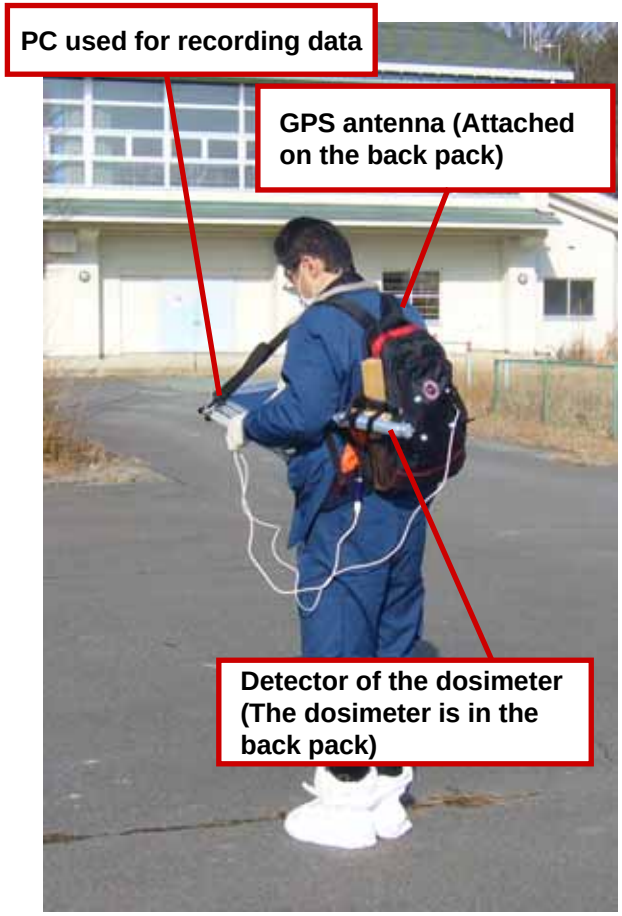
Measurement Result Acquired by the Monitoring Car

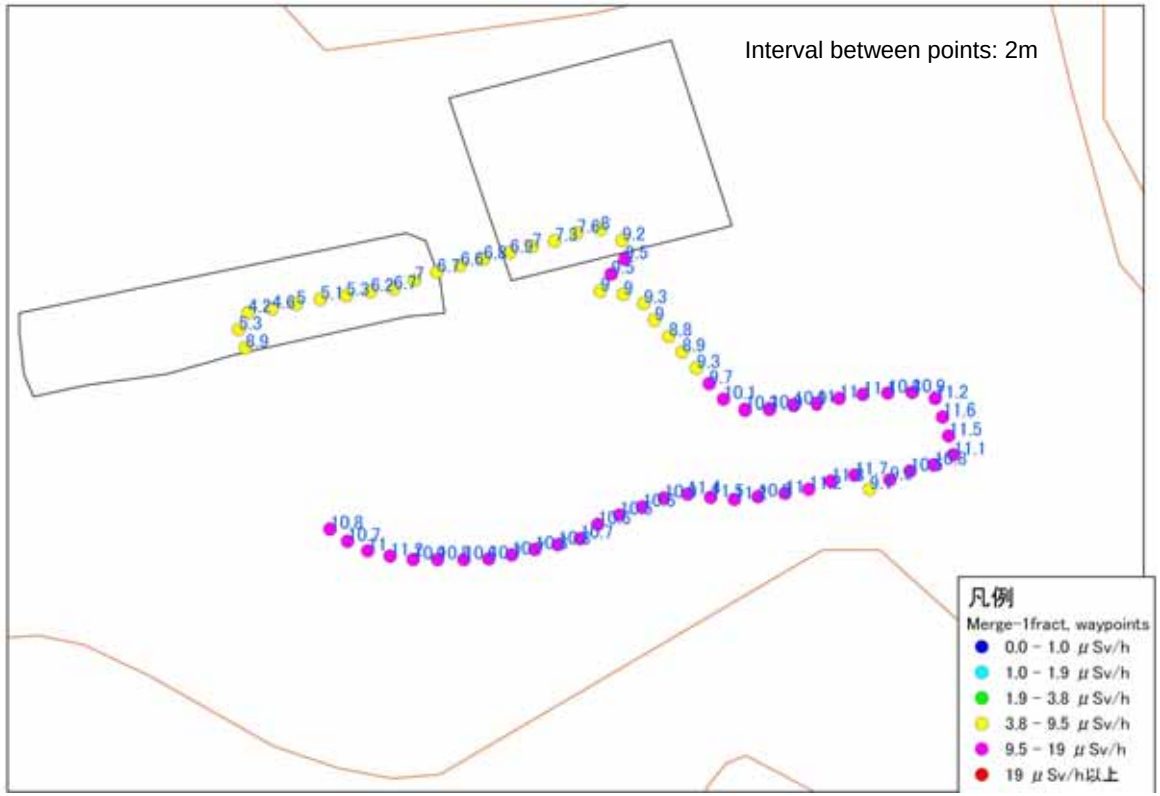


Source: Documents provided by the Team in Charge of Assisting the Lives of Disaster Victims (Cabinet Office) and the Ministry of Education, Culture, Sports, Science and Technology (Apr. 27, 2012)

12. Development and Utilization of Gait Monitoring Equipment

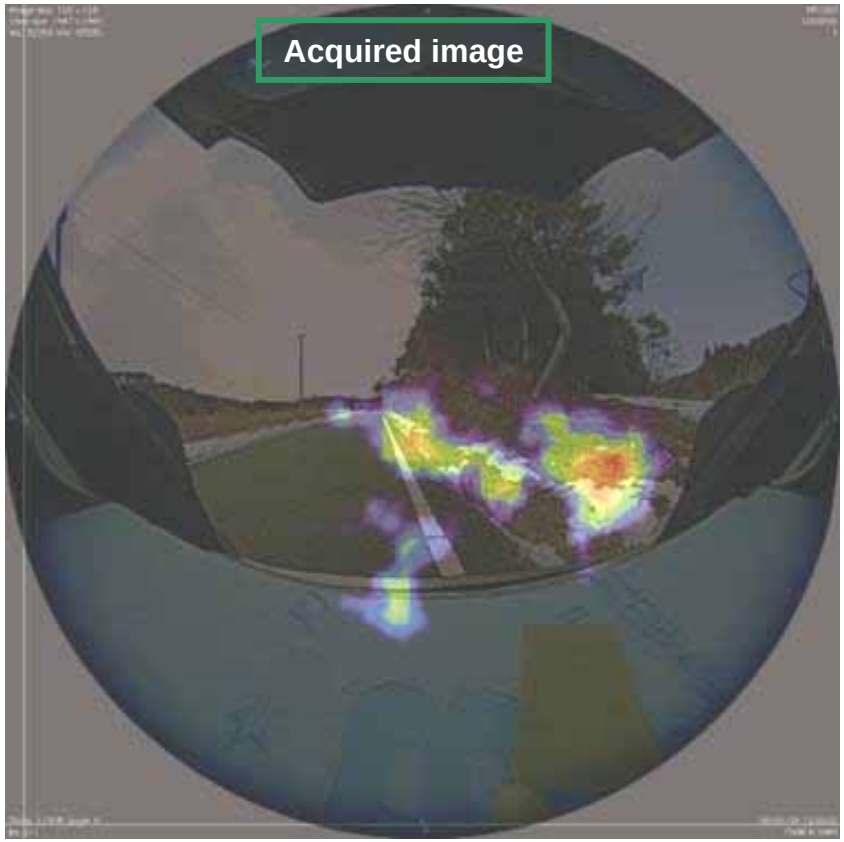
The gait monitoring equipment was developed based on the technologies used for developing the monitoring car. The gait monitoring equipment allows for automatic recording of the location information and dose rate on the PC, and is utilized for measurements in areas where the monitoring car cannot enter (for example, off-road residential area).





13. Radiation Visualization Utilizing a “Super-wide Angle Compton Camera”

The utilization of the Compton camera experimentally produced by JAXA for decontamination is currently under consideration (JAEA and TEPCO). A “super-wide angle Compton camera” allows to visualize radioactive materials such as cesium-134 and cesium-137 by identifying the nuclide, direction and intensity of radioactive materials excluding the air dose rate of the environment (See below).



14. Development of a Program which Predicts and Evaluates the Effectiveness of Decontamination

We have developed an analysis program “DeConEP” which predicts and evaluates the effectiveness of decontamination (reduction of air dose after decontamination).

The program is useful in acquiring information as follows.

-How much reduction in radiation dose can be expected after decontamination?

-To what extent should decontamination be done in order to reduce air dose to the target level?

-What is the appropriate decontamination rate to reduce air dose to the target level?

-The radiation source of which has the most significant influence on the air dose of a particular part?

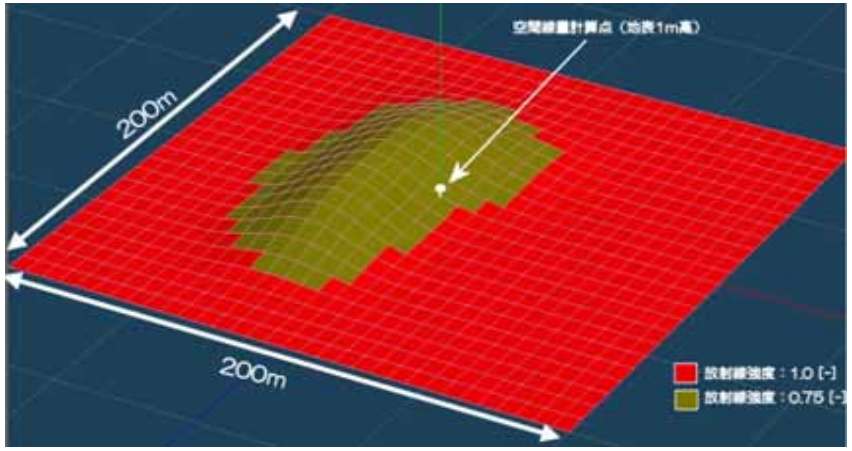
The program overview and evaluation examples were announced at the “Scientific meeting on environmental radioactivity decontamination”*.

* Watanabe et al., “Development of a Decontamination Effectiveness Prediction and Evaluation Program DeConEP”, 1st presentation of the studies on environmental radioactivity decontamination, S4-5, Scientific meeting on environmental radioactivity decontamination, May 19-21, 2012

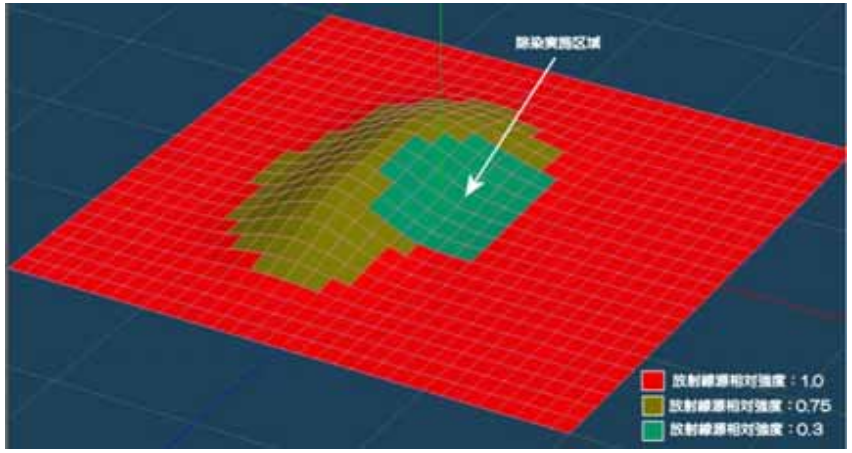
Decontamination Effectiveness Evaluation Using DeConEP

(Input information)

Settings of shape and radiation source (Before decontamination)



Settings of shape and radiation source (After decontamination)



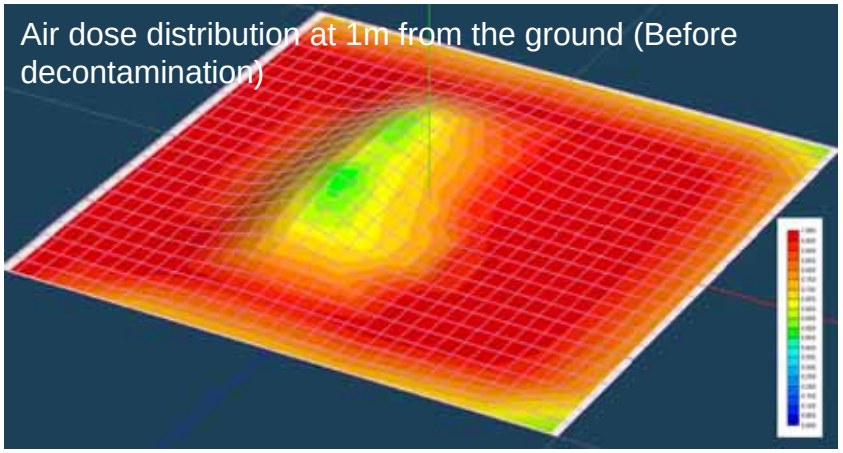
(Output: Calculation result)

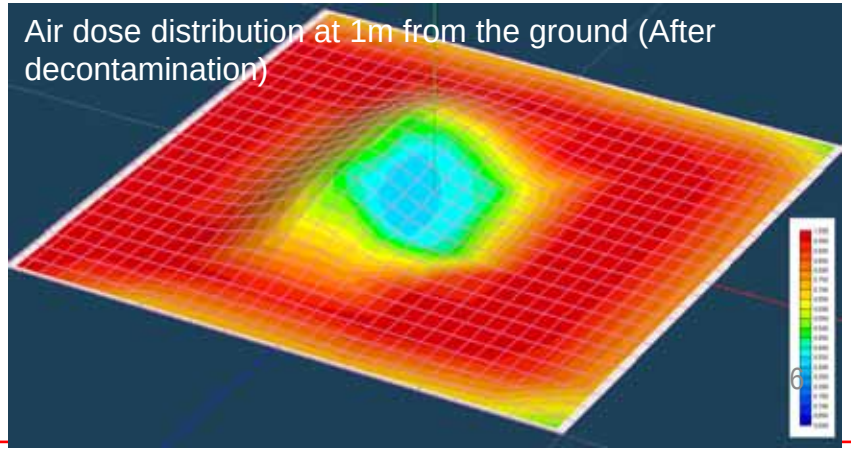
DECONEP Ver 1.45
** SUMMARY **
Demo200m
.....
(Omitted)
.....
-- Decay Ratio--
Dose before decontamination: 1.40333721824403
Dose after decontamination: 0.661739000692256
Decay Ratio: 0.471546676087077

Air dose (Relative value)

Air dose decay ratio

(Output: Visualization of calculation result)





15. Laboratory Testing to Verify the Decontamination Agent Capability

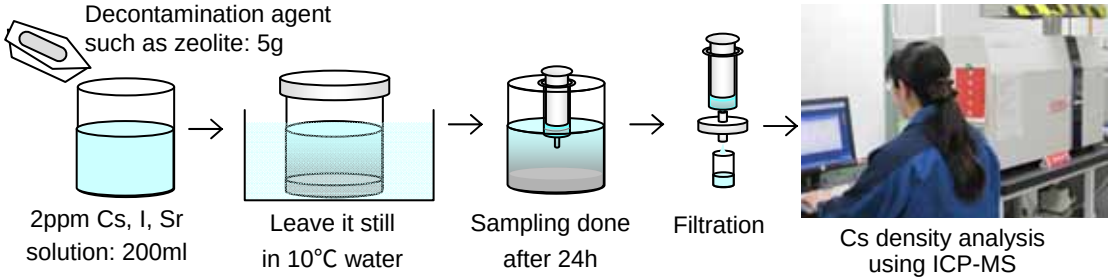
As the contamination condition varies for water, soil and artifacts, the decontamination agent capability is verified in a laboratory testing which allows testing under the same condition.

-Non-radioactive cesium is used as the test material as its behavior is the same as that of radioactive cesium.

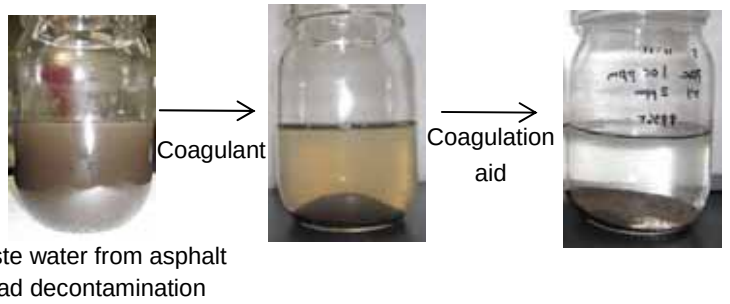
-Water decontamination using zeolite, ferrocyanide and coagulant is currently being tested (116 kinds of decontamination agents were tested as of the end of 2011).

-Soil/artifacts decontamination using detergent/cleaning substance and medical agent is also being tested.

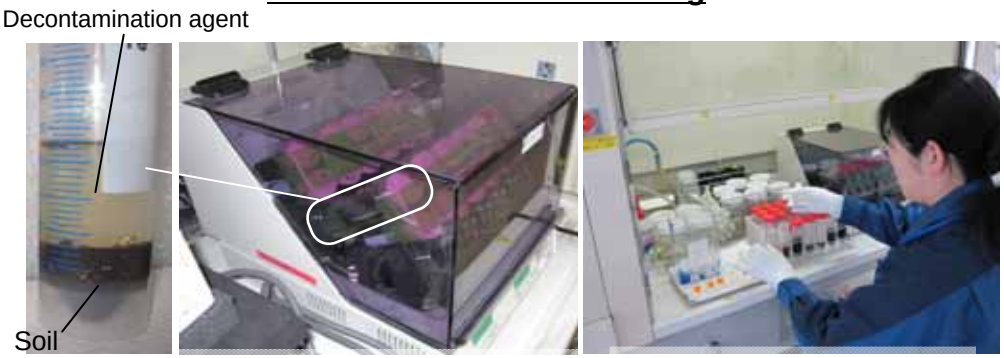
Water decontamination testing in a beaker



Waste water treatment testing (coagulation-sedimentation)



Soil decontamination testing



Artifacts decontamination testing

16. On-site Decontamination Effectiveness Testing

We have conducted on-site decontamination testing (in the Evacuation Zone) in order to verify the effectiveness of a variety of decontamination methods. The results (such as decontamination rate and workability) are leveraged for decontamination to be done in wider areas (including decontamination conducted by the Self-Defense Forces). Decontamination testing using a variety of methods is being conducted from September 2011.

Decontamination testing (Example)

-Road surface (asphalt, concrete): High-pressure water cleaning (50-150atm), sandblast (iron powder, coarse sand, very fine sand), grinder, metal brush

-Turf and plants: Strip the surface soil with a mower (hammer knife style, shoulder mower), remove fallen leaves with a blower, high-pressure water cleaning of trees

-Inside buildings: Wiping, vacuuming

Locations

TEPCO facilities in the Evacuation Zone, government offices, etc.

High-pressure water cleaning

Stripping the turf surface with a mower

Road decontamination testing

Removing fallen leaves with a blower

High-pressure water cleaning of trees

17. Decontamination Testing of Surface Soil

Decontamination testing of surface soil using a variety of machines/equipments was done in order to achieve effective soil decontamination and reduce the amount of soil to be removed. The depth of soil removed, cesium density reduction rate, work speed etc. were measured. As a result, it was confirmed that the thin surface of soil could be removed with the machines/ equipments used in the testing and by doing so, sufficient reduction in the radioactive density of soil was observed. Some of the methods below were used in JAEA decontamination model verification project.

Test period: August 8, 2011 – March 30, 2012
Methods tested: 1. Vacuuming suction, 2. Sweeper, 3. Mower, 4. Turf stripper, 5. Asphalt surface cutting machine, 6. Collecting fallen leaves with a blower (See below photos)
Location: TEPCO General Training Center (Hino city, Tokyo), etc.
Hazama Corporation and TEPCO jointly reported the deliverables of this testing at the 1st presentation of the studies on environmental radioactivity decontamination (Scientific meeting on environmental radioactivity decontamination, May 19-21, 2012).

1. Vacuuming suction

2. Sweeper

3. Hammer knife style mower

4. Turf stripper

5. Asphalt surface cutting machine

6. Blower