

The 2nd International Forum on the Decommissioning of the Fukushima Daiichi Nuclear Power Station

Current Status and Challenges at Fukushima Daiichi Decontamination and Decommissioning

@ Iwaki Washington Hotel

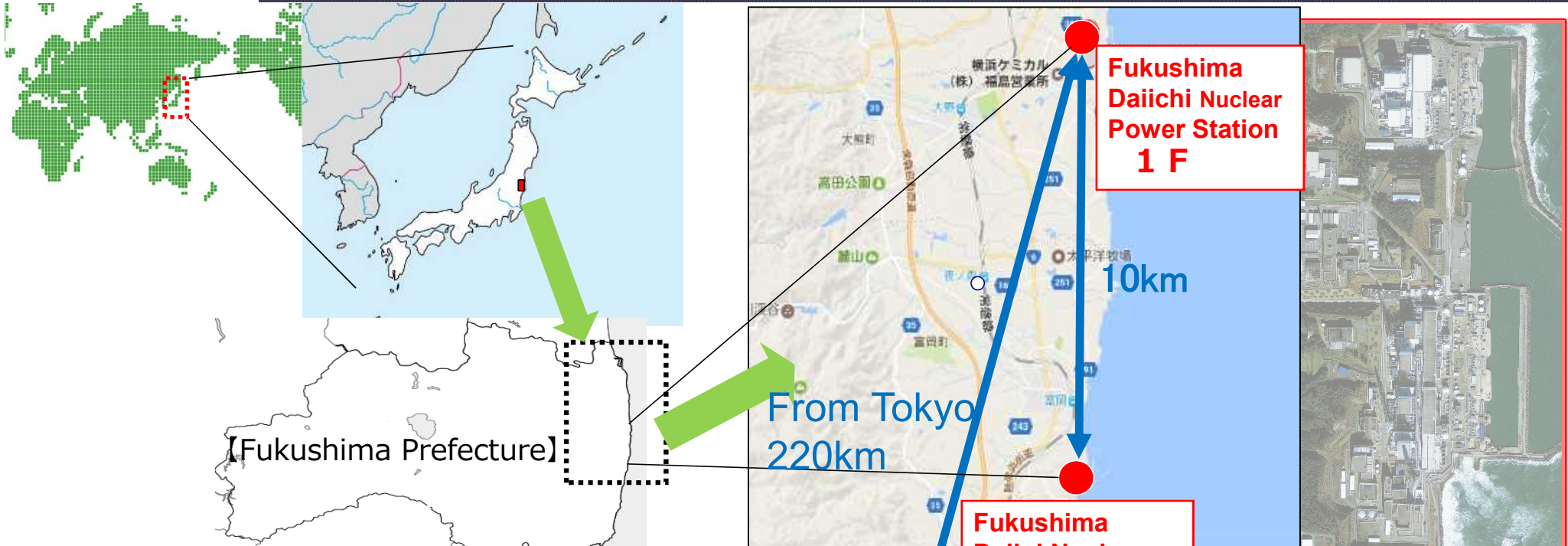
July 3, 2017

Naohiro MASUDA

Chief Decommissioning Officer,

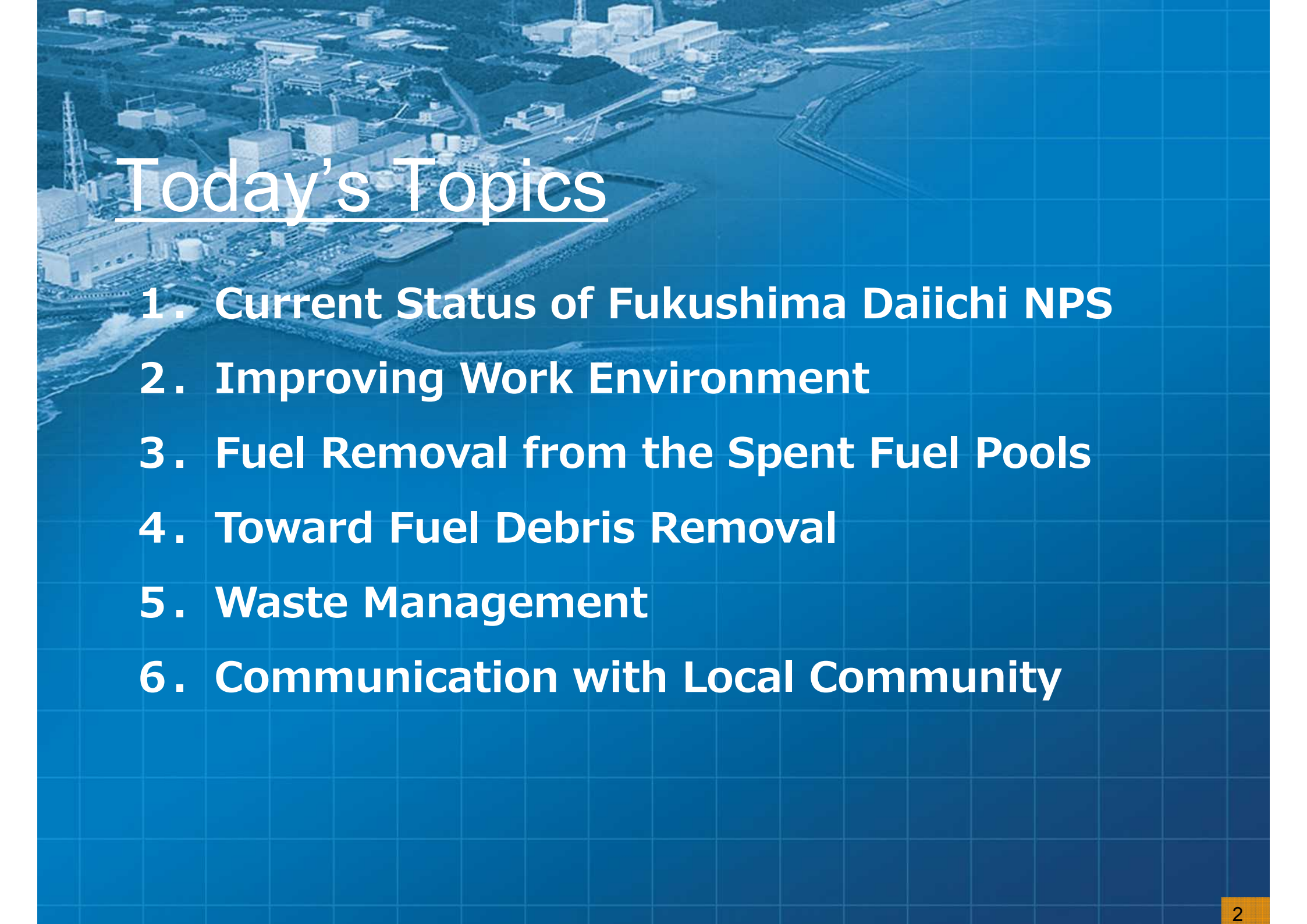
President of Fukushima Daiichi Decontamination and
Decommissioning Engineering Company,
Tokyo Electric Power Company Holdings, Inc.

TEPCO



提供：日本スペースイメージング㈱, (C)DigitalGlobe

Plant	Unit	Start of Operation	Reactor Type	Containment Type	Power Output (MWe)	Main Contractor	Pre-earthquake Status
1F	1	1971. 3	BWR-3	Mark-I	460	GE	Operating
	2	1974. 7	BWR-4	Mark-I	784	GE/Toshiba	Operating
	3	1976. 3	BWR-4	Mark-I	784	Toshiba	Operating
	4	1978.10	BWR-4	Mark-I	784	Hitachi	Outage Full core offloaded to spent fuel pool
	5	1978. 4	BWR-4	Mark-I	784	Toshiba	Outage
	6	1979.10	BWR-5	Mark-II	1,100	GE/Toshiba	Outage
2F	1	1982. 4	BWR-5	Mark-II	1,100	Toshiba	Operating
	2	1984. 2	BWR-5	Mark-II modified	1,100	Hitachi	Operating
	3	1985. 6	BWR-5	Mark-II modified	1,100	Toshiba	Operating
	4	1987. 8	BWR-5	Mark-II modified	1,100	Hitachi	Operating



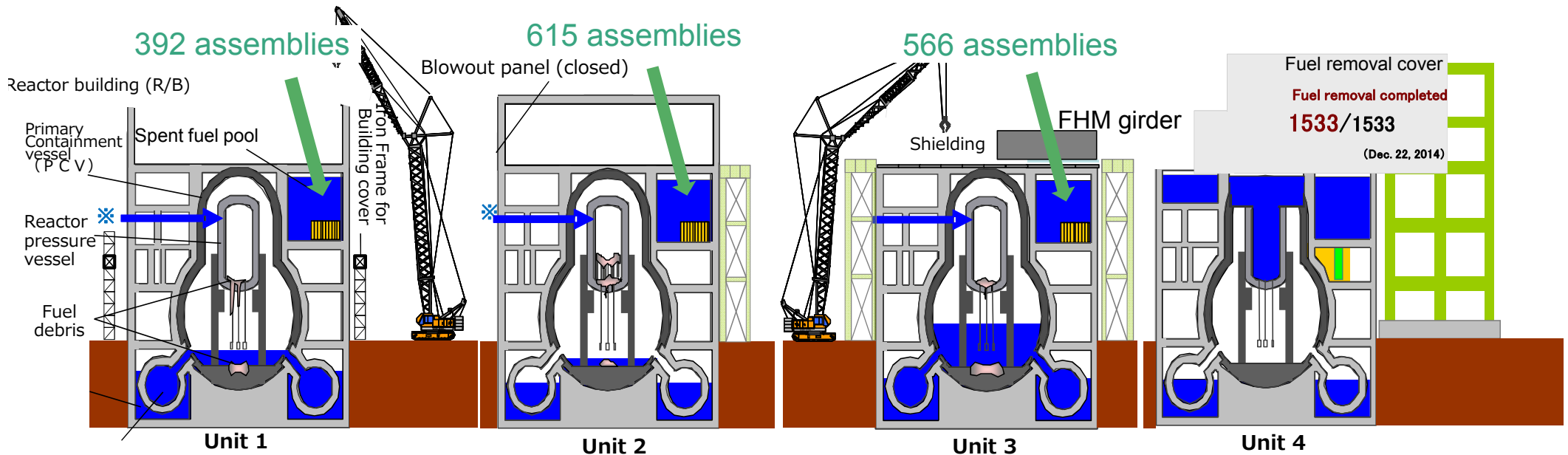
Today's Topics

- 1. Current Status of Fukushima Daiichi NPS**
- 2. Improving Work Environment**
- 3. Fuel Removal from the Spent Fuel Pools**
- 4. Toward Fuel Debris Removal**
- 5. Waste Management**
- 6. Communication with Local Community**



1. Current Status of Fukushima Daiichi NPS

- All reactors are in cold shutdown condition.
- Plant parameters including RPV and PCV temperatures are monitored continuously 24 hours/day.



Values as of 11:00 am on June 9, 2017

* Cooling water injection

	Temperature at the bottom of the pressure vessel	Temperature inside the containment vessel	Fuel pool temperature	Reactor coolant volume
Unit 1	21 °C	21 °C	25 °C	3.0 m ³ /hour
Unit 2	27 °C	28 °C	26 °C	3.0 m ³ /hour
Unit 3	24 °C	24 °C	26 °C	3.0 m ³ /hour
Unit 4	—	—	23 °C	—

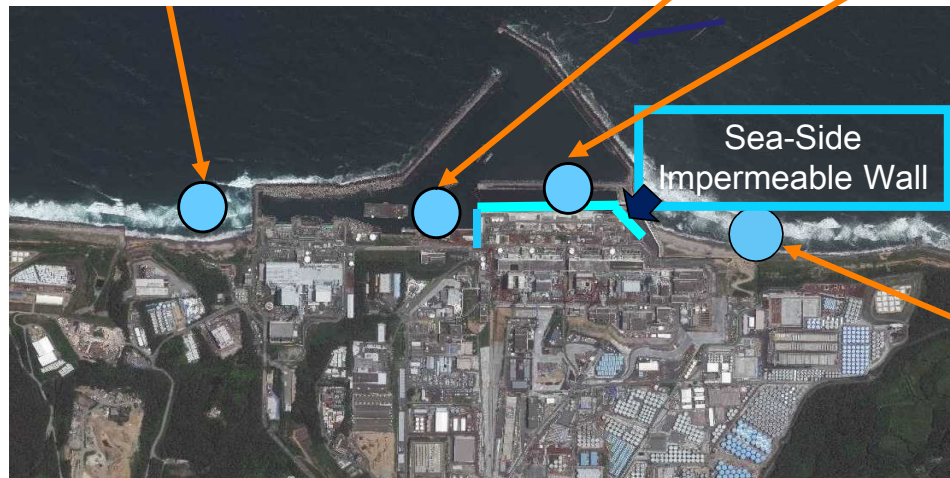
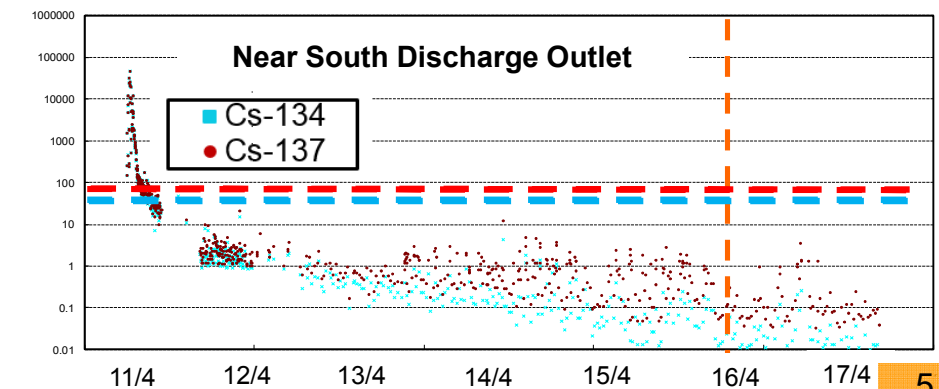
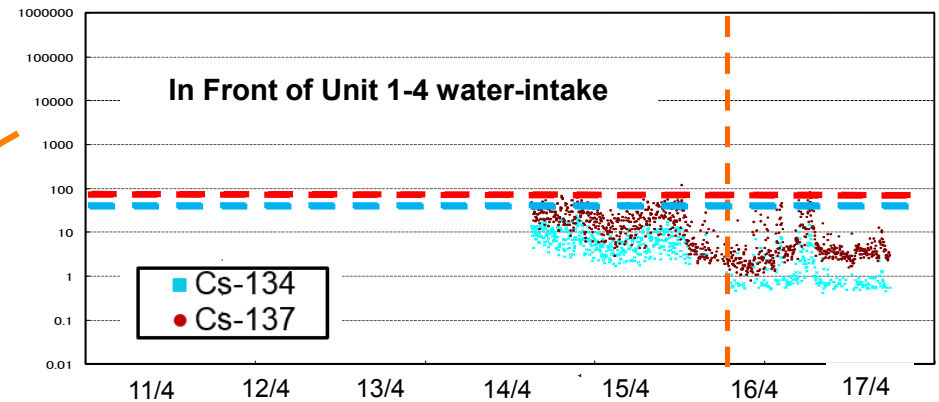
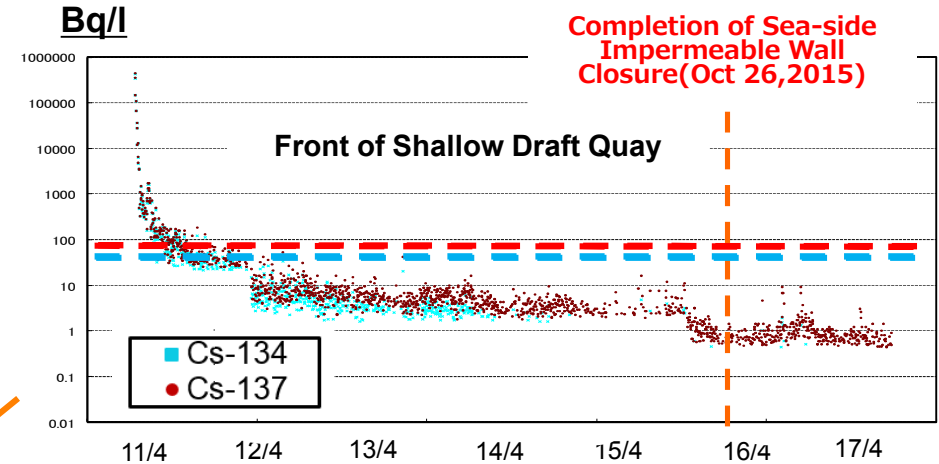
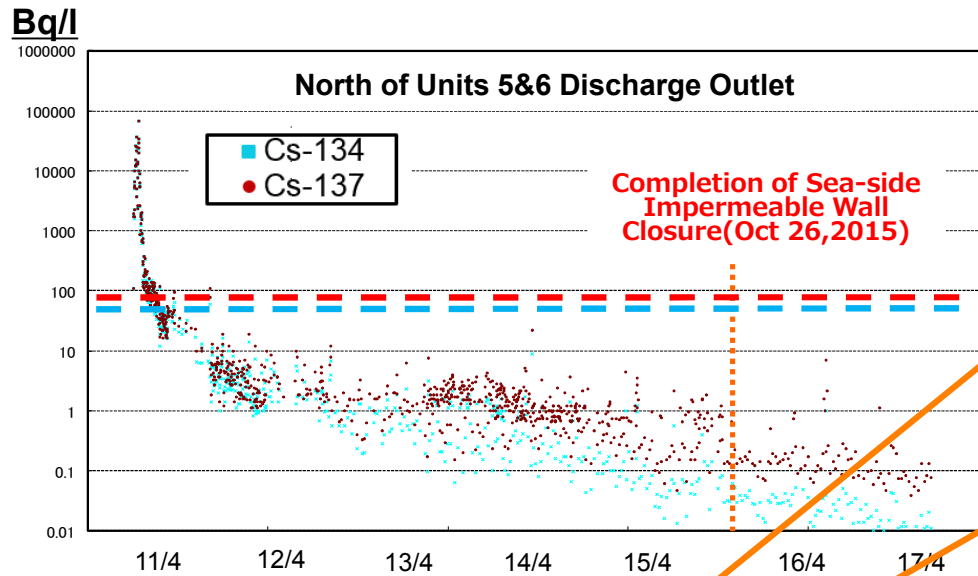


(2) Monitoring Level in the Sea

- Compared to the situation just after the accident, the current level of radioactivity has been lowered to parts per hundred thousand, to per million.
- The concentrations outside the port are substantially below regulation limits.
- Concentration levels decreased further after closure of the sea-side impermeable wall.

Regulation Limit

- Cesium 137: 90Bq/L
- Cesium 134: 60Bq/L



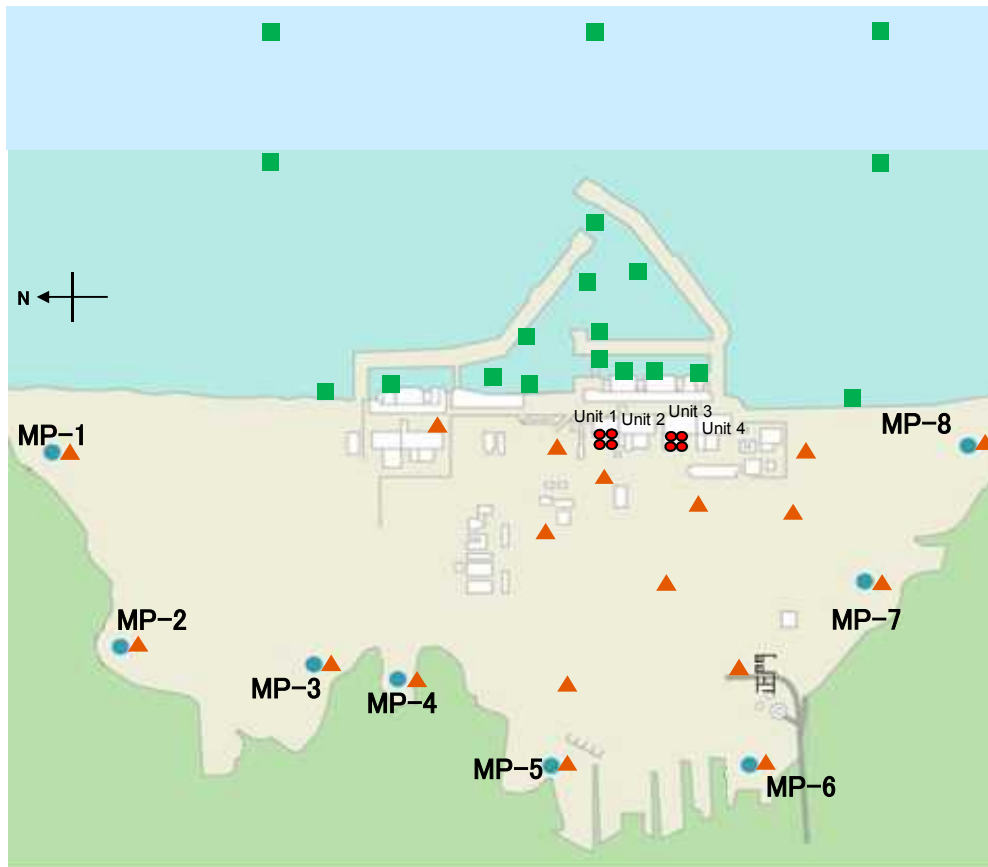
A blue-tinted photograph of an industrial construction site. Several workers wearing hard hats and safety harnesses are visible, working on a large structure with a grid-like floor. The scene is dimly lit, with the overall color palette dominated by shades of blue and grey. The workers are engaged in various tasks, some holding long cables or hoses. The background shows the complex steel framework of the building under construction.

2. Improving Work Environment

In order to make workers feel secure, display monitors showing real-time dose-rate have been placed at the seismic isolation building etc.

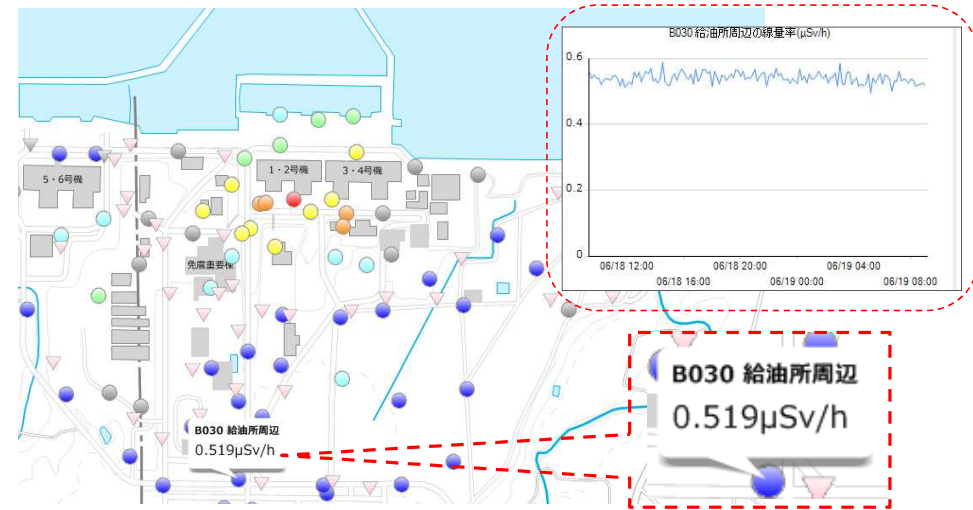
Location of sampling points, dust monitors and monitoring posts

- Dust monitors on the refueling floor
- Monitoring Post
- ▲ Dust Monitors
- Sampling points in the sea area



Installation of dose-rate monitors

- System visualizing real time dose rate in place.
- Dose rate display monitors (about 90 points) and dust monitors are placed where workers can easily access.



(2) Decreasing Site Radiation Dose

- As a result of radiation reduction measure, workers don't have to wear full-face respirator or half-face respirator anymore in most parts of the site.

Decreasing radiation dose

FY2013

40 %

FY2014


77 %

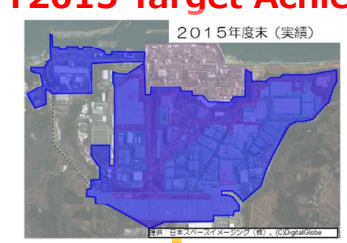
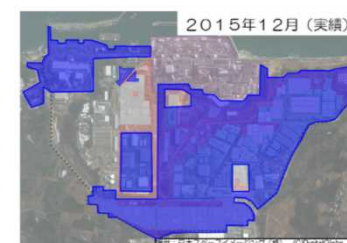
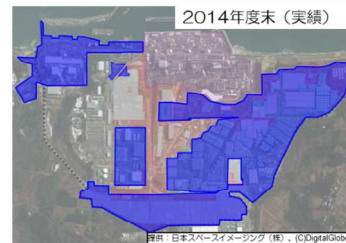
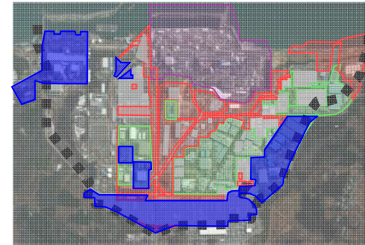
As of Dec. 2015

89 %

As of Mar. 2016

100 %


 : Area confirmed below 5μSv/h




FY2015 Target Achieved

Personal equipment in each zone as of Mar. 2017



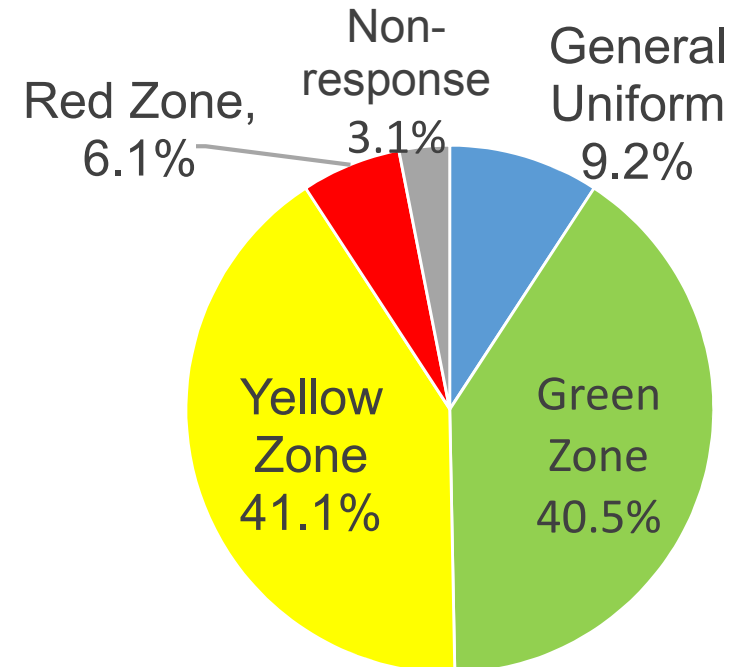
 Area where people can work in general uniforms (dust mask) **【95% of the site】**



 Area where people should work in protective gears (full-face respirator or half-face respirator)



Percentage of workers in each zone



(results from questionnaire in FY2016)

- Currently less than 6,000 persons/day are working on weekdays, which is twice as many as several years ago.
- Facilities such as Contractors' Office Building and Large Rest House have created the environment where TEPCO and contractors can address the decommissioning work closely in the vicinity of the site.

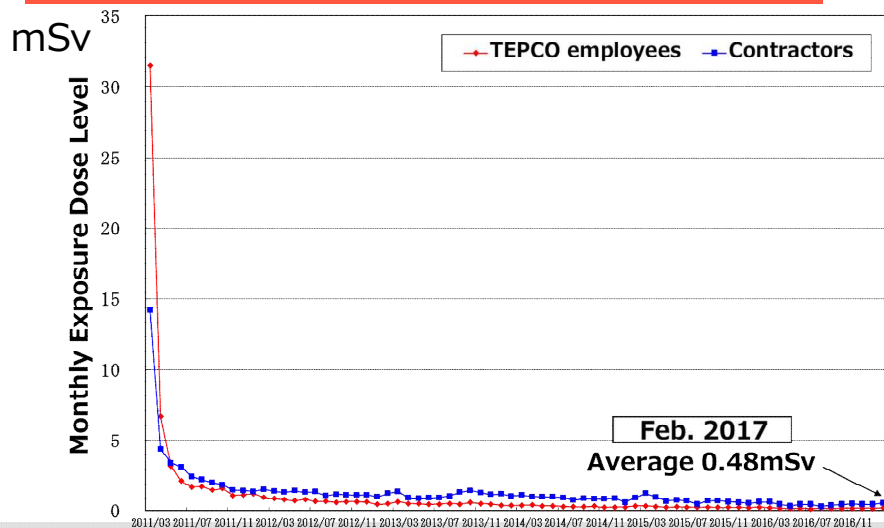
Changes in number of workers

- Number of workers (TEPCO employees and contractors) per weekday engaged in work is 5,470 as of Apr. 2017.
- Percentage of workers from local area is approx. 55% as of Apr. 2017.



Change in the average number of workers (actual value) per weekday in the months following 2013.

Trend of monthly exposure dose rate



New Facilities

- Large rest house with a capacity of approx. 1,200 workers (since May 2015)
- Convenience store and shower rooms began operating (Mar. 2016)
- Fukushima Revitalization Meal Service Center was established in Ohkuma Town (March 2015)
 - Providing warm meals to Fukushima Daiichi
 - Creation of employment opportunities in Ohkuma Town



Large Rest House

Ensuring stable long-term employment

- It is important to create an environment where workers from contractors can work over the long term in order to steadily proceed with decommissioning work for 40 years.
- Currently, approximately 90% of orders are fulfilled by negotiated contracts, which enables contractors to secure workers in a long term.
- By securing long term workers, more deliberate personnel assignment and human resource development is possible.

Decommissioning through close ties with contractors

- Contractors' Office Building began operating, which has enabled TEPCO and contractors work closely in the vicinity of the decommissioning site.
- On January 19, TEPCO and contractors jointly held a congress to pledge for no human-caused accident to happen.



Congress held by TEPCO and contractors



Contractors' office building



Contractors' logos

TEPCO's Office building



Held on January 19, 2017 after the "Safety Congress" by TEPCO and contractors

Held at New Office Building from May 23 to 25, 2017. 18 contractors (27 teams) and TEPCO employees (6 teams) participated in the play.



3. Fuel Removal from the Spent Fuel Pools

(1) Fuel Removal from the Spent Fuel Pool (Unit 4)

- Fuel removal started on November 18, 2013.
- Removal of 1535 fuel bundles completed on December 22, 2014 as scheduled
- No risk from fuel remains at unit 4. This gives confidence to proceed to fuel removal at units 1, 2 and 3



September 22, 2011



July 5, 2012



November 12, 2013: Completion of fuel removal facility
(The volume of steel used is equivalent to those of Tokyo Tower)



Process of removing fuel rods at SFP Unit 4



Fuel removal was completed on Dec. 22, 2014. : Major risk reduction at Fukushima Daiichi

(2) Fuel Removal from the Spent Fuel Pool (Unit 3)

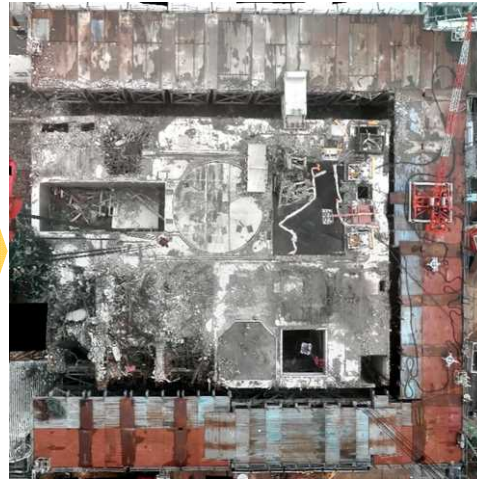
- Removal of large pieces of rubble on the refueling floor and spent fuel pool was completed in 2015.
- Decontamination work was completed in June 2016 and shielding was completed in December 2016.
- In January 2017, the work for installing fuel removal cover started. Installation of a basis for Fuel Removal Cover started in March and was completed in June. The removal will take place in the middle of FY2018.

Before removal of large pieces of rubble



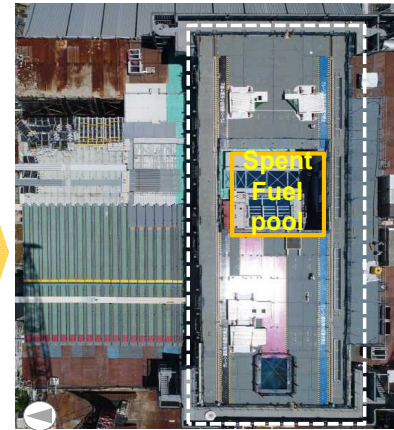
Mar. 2013

After removal of large pieces of rubble



Feb. 2016

Installation of a basis for Fuel Removal Cover



Jun. 2017

【Major Tasks in the Future】



✂ Installing cover started in January 2017



Fuel removal cover
(Drill for installment at Onahama)

(3) Fuel Removal from the Spent Fuel Pool (Unit 1)

- Building cover was installed in Oct. 2011 to prevent dispersion of radioactive materials.
- Removal of panels was completed in Nov. 2016 toward removal of spent fuel. Removal of posts and beams was completed in May. 2017.
- Fuel removal will start in FY 2020.

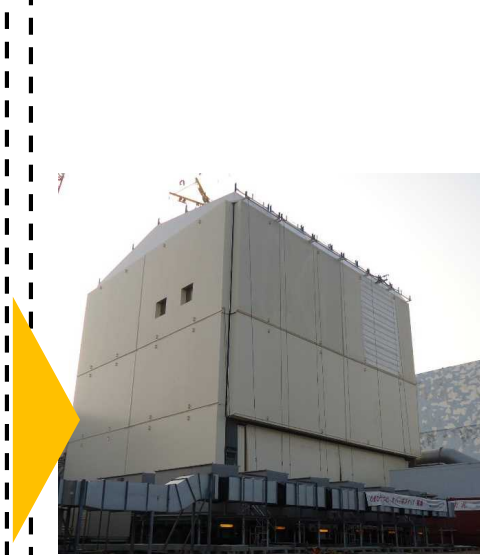
The status in 2011



Northwest side
(Jun. 2011)



Southeast Side
(Jun. 2011)



Complete installation
of building cover
(Oct. 2011)

The current status

Removal of roof panels
(Jul. 2015)



Removal of wall panels
(Sep. 2016)



Removal of posts
and beams
completed (May. 2017)

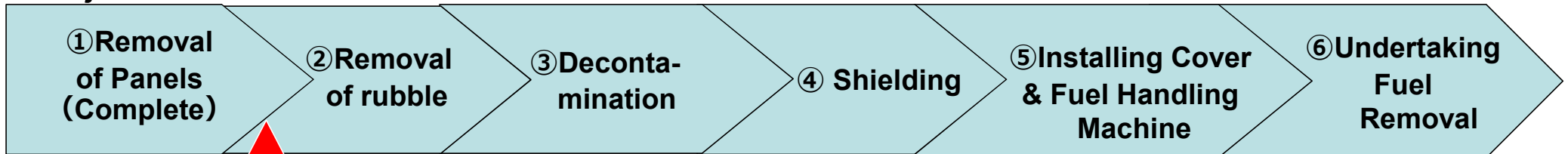


Panels removal
completed (Nov. 2016)



The removed posts and beams to be revamped for installing windbreak sheets.

【Major Tasks in the Future】



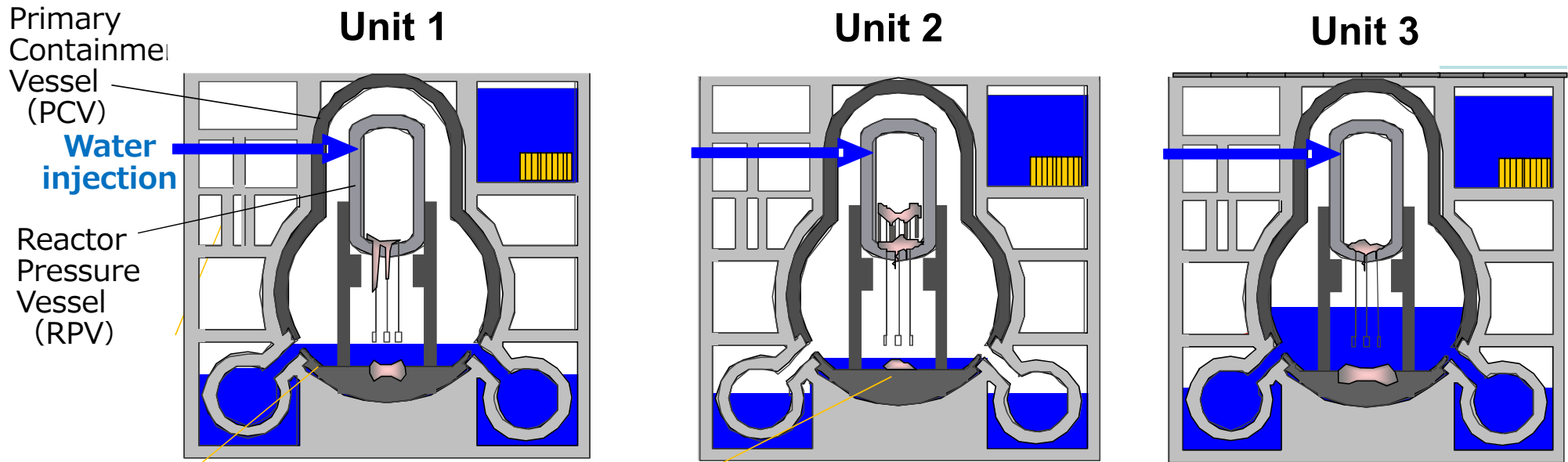
✂ Currently investigation of rubble status on the refueling floor is underway



4. Toward Fuel Debris Removal

(1) Assumed Distribution of Fuel Debris

- It is assumed that at Unit 1, almost all fuel debris has dropped to the pedestal.
- It is assumed that at Unit 2 and 3 that some of fuel debris has dropped to the bottom of RPV and the bottom of PCV, while others are likely to have remained in the reactor cores.
- At Unit 3, underwater investigation is planned due to the high water level inside PCV.
- Distribution of fuel debris is assumed comprehensively based on the analysis of accident development and the results of the investigation inside each PCV etc.



At the time of investigation, deposits have been found on the floor .



Probe robot in Mar. 2017

At the time of investigation, a rise of steam has been found



Probe robot in Feb. 2017



Remotely operated vehicle in Jul. 2017

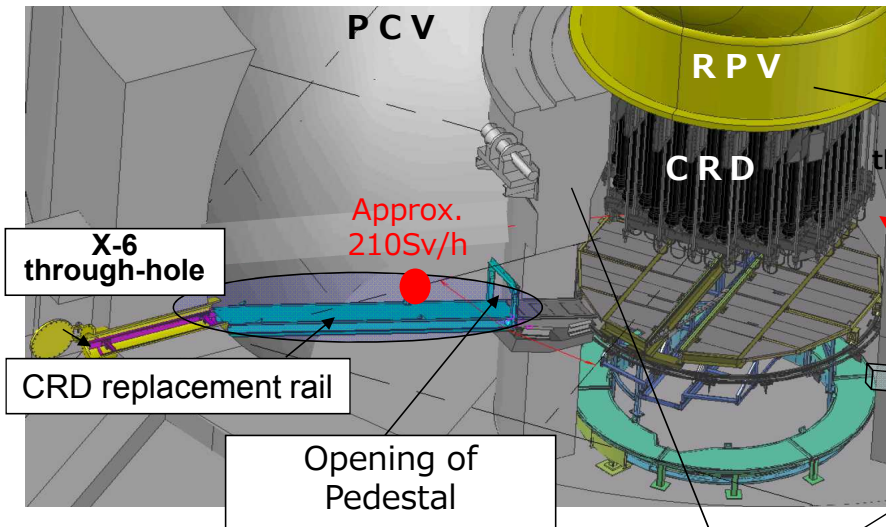
- Investigation inside the PCV and at the bottom of the RPV was conducted.(from Jan. to Feb. 2017)
- X-6 through-hole was used as a path for devices to go inside.
- Equipment at the lower part of the RPV and the grating were observed.

Survey by a robot

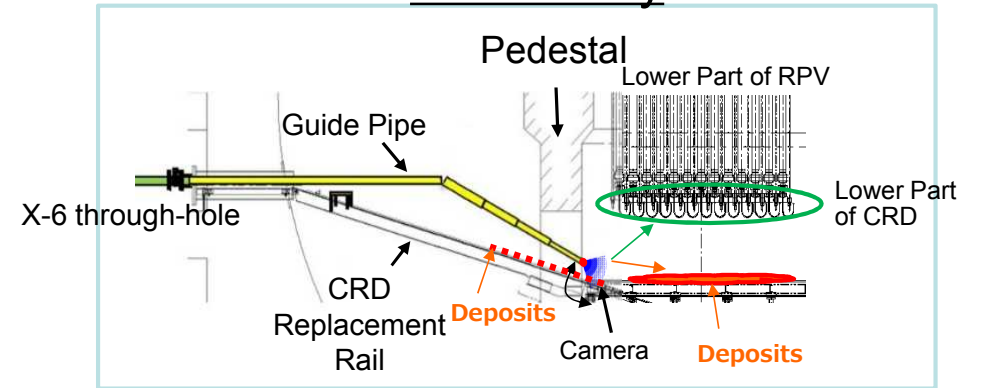


IRID

<Obtained information on radiation level through robot exploration>



Pre-survey



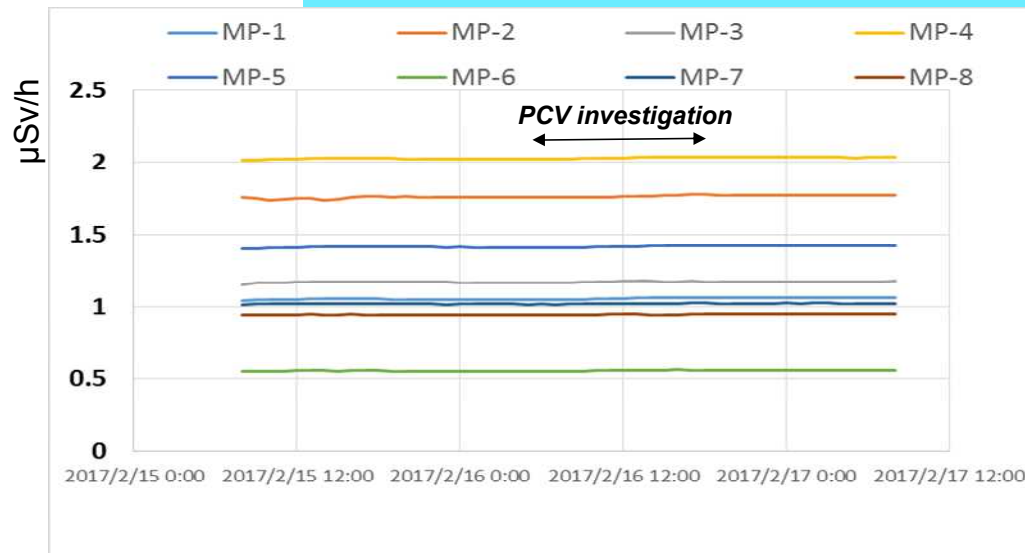
<Photos taken inside the pedestal >



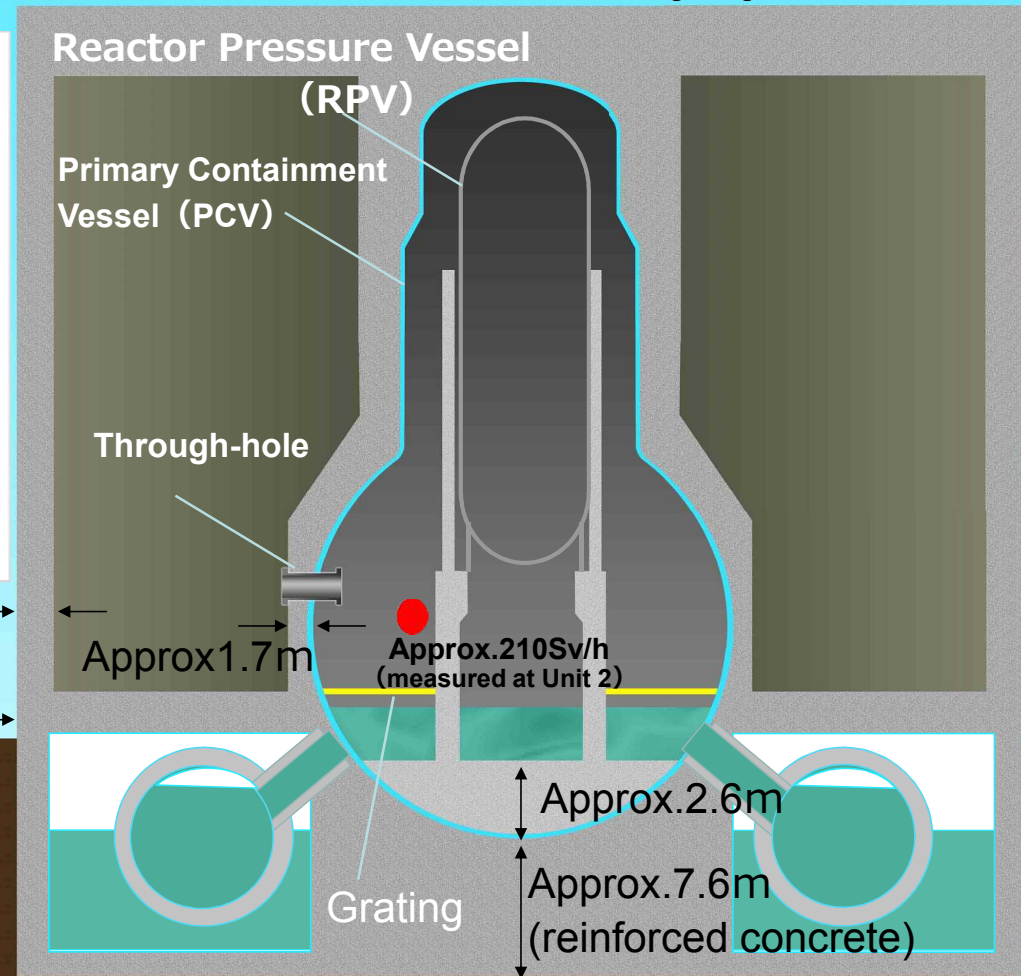
※ Places where fuel debris is presumed to exist

- Radiation in the reactors is blocked by iron and reactor buildings.
- The measurement of 210Sv/h at the time of Unit 2 PCV investigation on Feb. 16 doesn't mean that radiation had an impact on the environment.

No change in dose rate has been found after the work.



※The data regarding thickness is from Unit1.



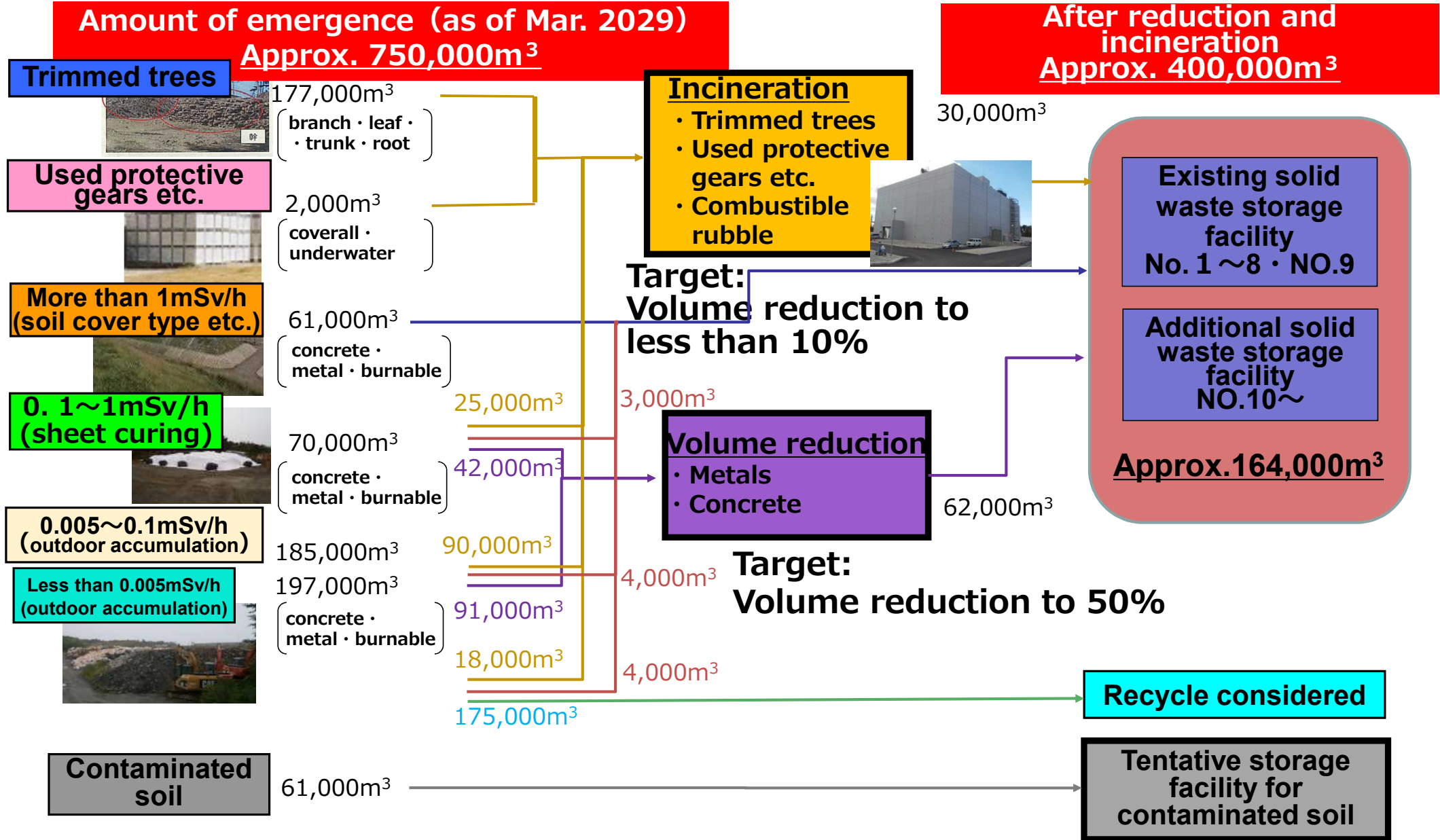
<Reference>

Work area in the vicinity of the through-hole at Unit 2 : Approx.0.003~0.007Sv/h (3~7mSv/h)
 Max value of monitoring posts : Approx.0.000002Sv/h (2µSv/h)

5. Waste Management

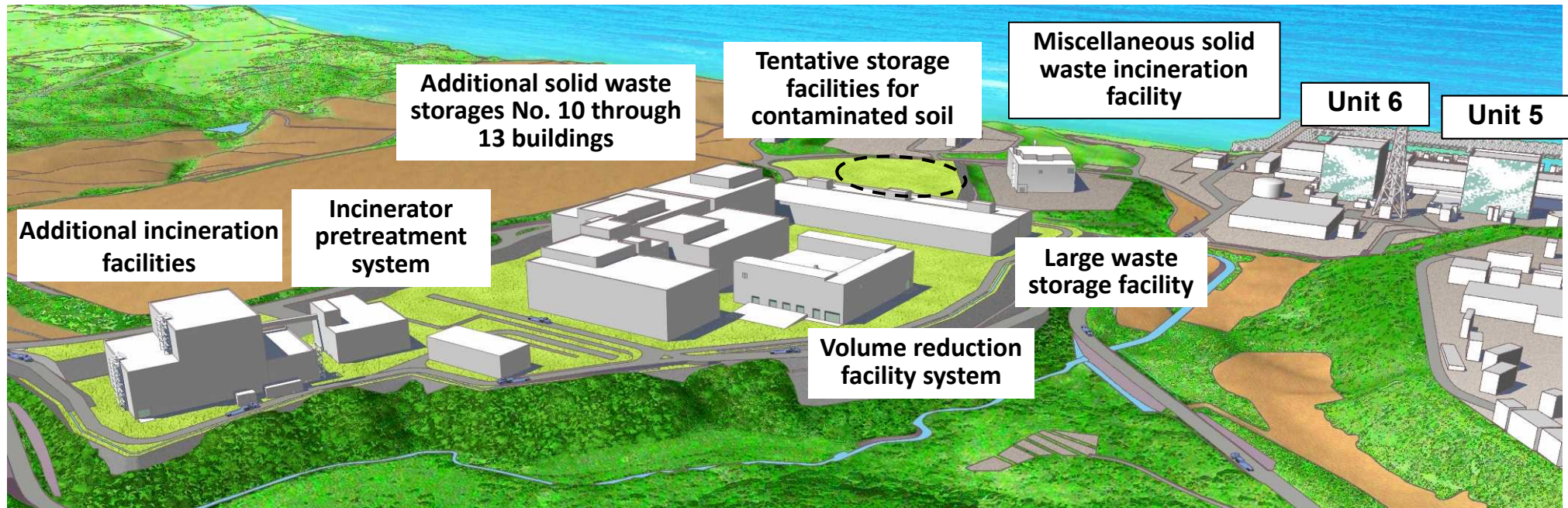
(1) Secure Storage of Waste

After incineration and volume reduction, waste will be stored appropriately based on the storage management plan released on Mar. 31, 2016



(2) Blueprint in the Future

Image of the establishment of systems and facilities





6 . Communication with Local Community

- Practitioners and Experts in communication discussed how to improve communication with local community.
- TEPCO received suggestions such as importance of two-way communication.

【Issues discussed in the 1st Forum】

①	Communicating in a honest and transparent manner by transmitting all information
②	Participating and cooperating in decision making by local people
③	Two-way communication
④	Translating technical jargon into easy-to-understand words
⑤	Providing places for learning and experiencing
⑥	Transmitting information based on what people want to know

【TEPCO's efforts for the last 1year】

①②	<p>【Participation in meetings held by local municipalities】</p> <p>(Examples of topics)</p> <ul style="list-style-type: none"> ・Works toward spent fuel removal at Unit 3 ・Formation of frozen soil wall, Removal of residual water in the buildings
③	<p>【Site visits for Fukushima people】</p> <ul style="list-style-type: none"> ・Officials of local municipalities ・Members of private organizations ・Fukushima High School students
⑤	<p>【Communication with students at R&D facilities】</p> <ul style="list-style-type: none"> ・Robot contest (Dec. 2016) ・Dialogue with high school student from outside Fukushima (Dec. 2016) ・A new organization to be established to communicate with local Univ. students. (2017)
④⑥	<p>【Improvement of information sharing through new contents】</p> <ul style="list-style-type: none"> ・Provision of real time data on the Web ・New videos featuring people's interest ・New leaflet "Hairomichi"

Explanation at public meeting

- Status Updates with regards to decommissioning are given to the public at the regular public meetings called “Kenmin Kaigi” hosted by Fukushima Prefecture
- Opinions to TEPCO have been reflected to decommissioning measures

- Attendance at other regular public meetings called “Anzen Kanshi Kyogikai” set up by Fukushima Governor.
- Confirmation of safety at Fukushima Daiichi and information sharing with related organizations have been implemented.



Left : Ishizaki, Former Representative of the Fukushima Revitalization Headquarters
 Right : Masuda, Chief Decommissioning Officer, President of Fukushima Daiichi Decontamination and Decommissioning Engineering Company



55th “Anzen Kanshi Kyogikai”
 (June. 2017)

Source: Fukushima Pref.

Briefings

- Briefings are held on the issue of great concern to residents
- Explanation on :
 - The current state of dismantling the Unit 1 building cover
 - Overview of the training yard facility in Hirono Town

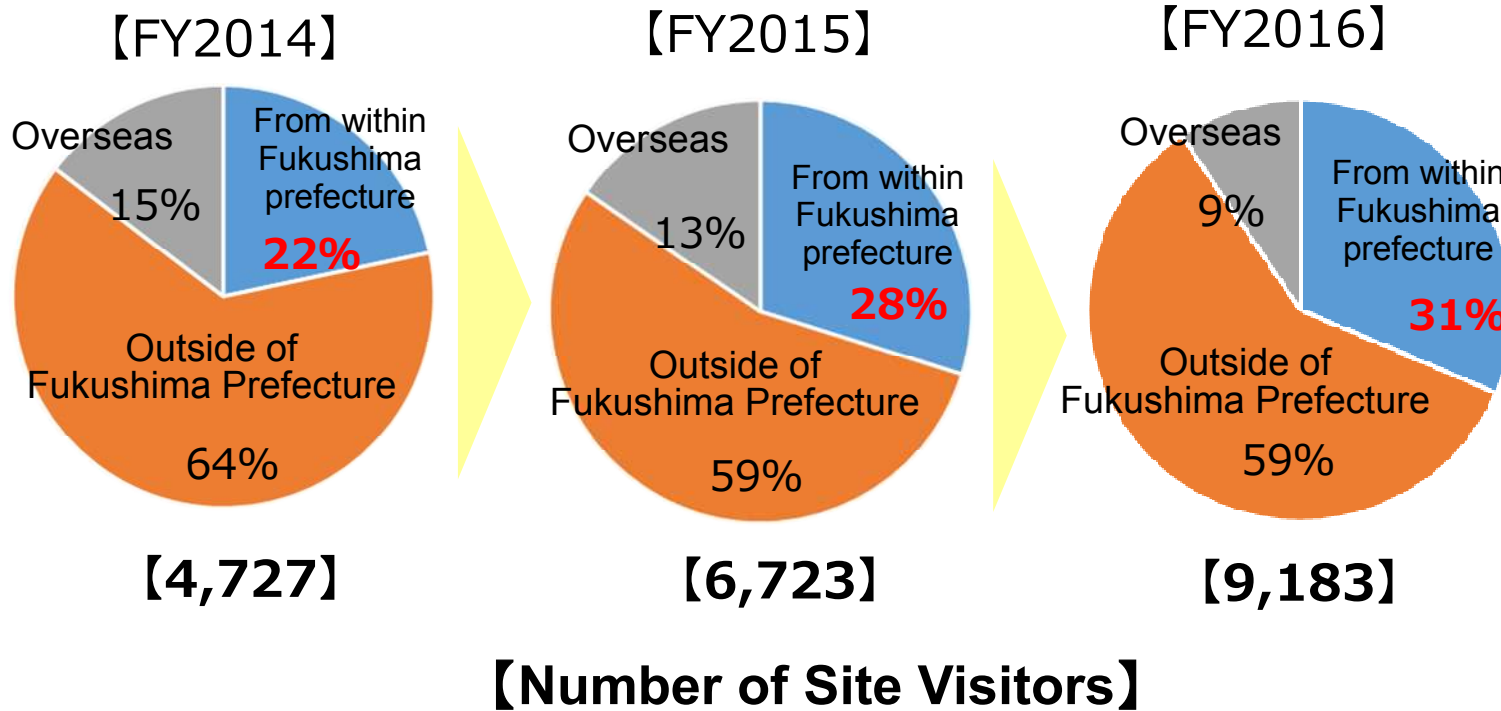
【Briefing held in Hirono Town】
 (December 2015)



Participants: 29

(3) Two-way Communications with Local Residents ~Invitation to Site Visits~

- Invitation of the prefectural government officials etc. have led to the increase of percentage of visitors from within the prefecture.
- In November 2016, students under 18 (from Fukushima High School) visited Fukushima Daiichi for the first time
- As a first step toward upgrade of site visits, TEPCO has moved its activity base from J Village in Naraha Town to a PR hall in Tomioka Town.
- TEPCO aims to increase the number of site visitors to 20,000/y by Tokyo Olympics.



【Examples of comments received】
 “Decommissioning is a big undertaking done with the cutting edge technology”
 “Seeing is believing”
 “Every time I visited Fukushima Daiichi, I was able to find some progress”

More than 28,000 visitors since the accident (as of the end of FY 2016)

- TEPCO cooperates in the operation of R&D facilities the national government is investing in. It reflects so called “Innovation Coast Initiative” which aims to revitalize Fukushima in terms of industry.
- In addition to supporting “Hairo Sozo Robocon” (robot contest) , TEPCO is trying to establish a contact point with local university students.

New Facilities for R & D (JAEA)

Radioactive Substance Analysis, Research Facility (Ohkuma)

- Analysis of fuel debris and other materials



Decommissioning International Collaborative Investigation Center (Tomioka)

- Integration of R&D and HR development
- Center of world excellence
- TEPCO staff to work there to communicate with the local students



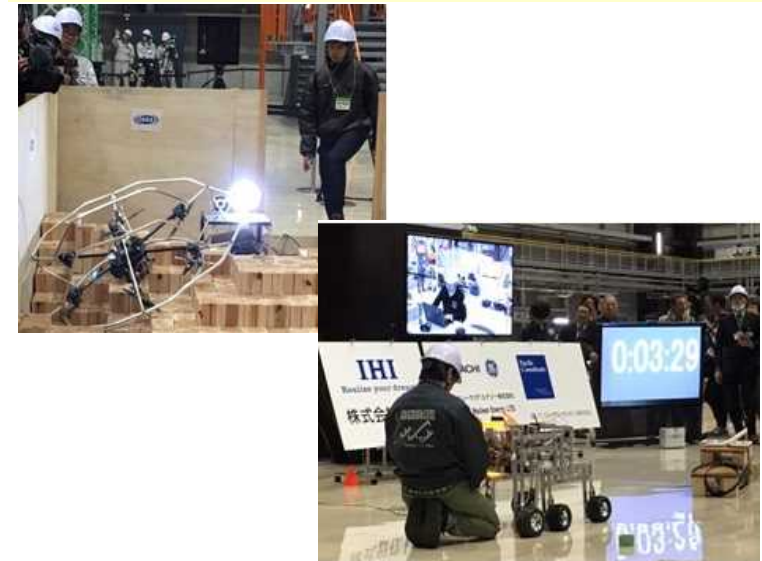
Remote Technology Development Center (Naraha)

- For development and deployment of remote control devices



Robot Contest

- The contest was held at Remote Technology Development Center in Dec, 2016.
- 15 teams from 13 technical colleges around the country joined the contest
- TEPCO supported the contest by sending off a judge etc.
- The 2nd contest will be held in Dec. 2017.



Dialogue with high School students from outside Fukushima

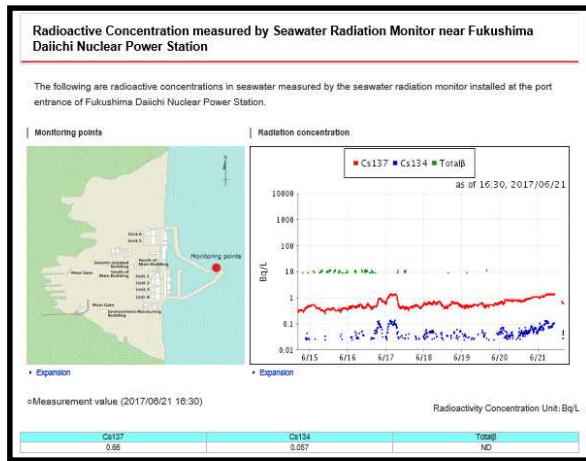
- TEPCO cooperated in a trial tour for educational purpose organized by Fukushima Prefecture and discussed decommissioning and revitalization.

- TEPCO reviewed its website so that the real time data of radioactive dose at each observatory can be easily accessible.
- TEPCO released new videos where “Risk Communicators” respond to the interests of people.
- In a new magazine, TEPCO focuses on understandability and familiarity by featuring persons in local or educational communities who are engaged in the decommissioning work.

Information sharing through website

Information Magazine

<Real time data on radioactivity >



<An explanatory video by “Risk Communicators” >



“1F”

“Hairo Michi”
(first published in Apr. 2017)



In Conclusion

◆ For Fukushima Revitalization

- Proceed with decommissioning work steadily in a stable manner
- Dialogue with local people with integrity and humility while resolving their concerns in a respectful manner



福島復興への責任。

安全最優先で、心をひとつに、廃炉事業を貫徹します



TEPCO

福島第一廃炉推進カンパニー



Thank you for your kind attention.

TEPCO