50th JAIF Annual Conference

Current Status and Challenges at Fukushima Daiichi Decontamination and Decommissioning

@Tokyo International Forum

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Fukushima Daiichi (1F) and Daini (2F) Nuclear Power Station



Today's Topics

- L. Current Status of Fukushima Daiichi NPS
- 2. Improving Work Environment
- 3. Three Policies for Measures to Counter Contaminated Water
- 4. Fuel Removal from the Spent Fuel Pools
- 5. Toward Fuel Debris Removal
- 6. Information Sharing and Communication
- 7. Fukushima Revitalization Activities involving TEPCO Group employees and related parties

1. Current Status of Fukushima Daiichi NPS

TEPCO (1) State of Units 1~4

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 March 23, 2017

	Temperature at the bottom of the pressure vessel	Temperature inside the containment vessel	Fuel pool temperature	Reactor coolant volume	
Unit 1	1 5°C	1 5°C	2 5°C	3.0 ㎡/hour	
Unit 2	1 9°C	20°C	2 8 °C	3.0 ㎡/hour	
Unit 3	18°C	1 8°C	2 7°C	3. 0 m [*] /hour	
Unit 4	_	_	1 4°C	-	



TEPCO (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.



TEPCO (3) Airborne Radiation Level

Estimated exposure dose at site boundary attributable to radioactive materials released from Units 1 to 4 has decreased to approx. 0.00034mS v /y as of Feb. 2017 which is about one-5,000th compared to the estimated value in Jul. 2011 (approx. 1.7mSv/y).

Amount of radioactive materials (cesium) released from Units 1 to 4 is estimated based on airborne radioactive material concentrations at top of reactor buildings

Estimated value of total release amount (As of Feb. 2017) : approx. 77,000 Bq/hr

Accordingly, estimated the exposure dose at site boundary at maximum 0.00034 mSv/y (Excluding effect of already released radioactive materials)



2. Improving Work Environment

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



(2) Decreasing Site Radiation Dose

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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.



TEPCO (3) Worker Security and New facilities

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

Changes in number of workers

- Number of workers (TEPCO employees and contractors) per weekday engaged in work is 6,110 as of Feb. 2017.
- Percentage of workers from local area is approx. 55% as of Feb. 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 (from May 2015)
- Convenience store and shower rooms began operating
- Fukushima Revitalization Meal Service Center was established in Ohkuma Town(from 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.



Contractors' logos

3. Three Policies for Measures to Counter Contaminated Water





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(1) Three Principles for Measures to Counter Contaminated Water 2

The status of each measure is shown below.

Measure		Status		
① Removing	Purification with multi nuclide removal equipment (ALPS)	Completed RO concentrated water treatment in May, 2015	Continue operation	
source Of conta- mination	Removal of contaminated water from trenches	Completed in December, 2015	Completed	
② Isolating fresh water from Contamin- ated Areas	Pump up of groundwater through groundwater bypass wells	The accumulated amount of drainage to the sea : 264,000t (As of mid-March, 2017)		
	Pump up of groundwater through subdrain	The accumulated amount of drainage to the sea : 290,000t (As of mid-March, 2017) ※Including pumped up water through groundwater drain (for pumping up ground- water dammed up by seaside impermeable wall)	Continue operation	
	Ice Wall (Frozen soil wall)	All but one place on the landside is in freezing mode	Wall formation	
	Paving to prevent rain water seepage into soil	Completed planned area in Mar. 2016	Completed (100%)	
③ Preventing leakage of contam- inated water	Ground improvement with liquid glass	Completed in March, 2014	Completed	
	Installation of sea side impermeable wall	Completed closure in October, 2015	Completed	
	Augmentation of tanks	 Replacement of flanged tanks with more reliable welded tanks and additional construction of welded tanks [As of Mar. 23] Total capacity of tanks for Unit 1 to 4: Approx. 1,010 thousands m³ Replacement: Approx. 130 thousands m³ 	Continue construction	

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(2) Ice Wall (Frozen Soil Wall)

- Freezing pipes have been installed 1m apart (30 m deep).
- As of April 2017, all but one place is in freezing mode.
- Combined with subdrain system, Ice Wall blocks the flow of groundwater into the buildings by controlling the level of groundwater. It also helps remove the contaminated water in the buildings.
- In order to prevent contaminated water in R/B and T/B from escaping, TEPCO constantly monitors the water level to ensure that groundwater always keeps higher than water level inside the buildings.



Sea

side

4. Fuel Removal from the Spent Fuel Pools

TEPCO (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





of fuel removal facility (The volume of steel used is equivalent to those of Tokyo Tower.)

(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.

Fuel removal will take place in the middle of FY2018.



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

- Building cover was installed in Oct. 2011 to prevent dispersion of radioactive materials.
- Dismantling of the cover was completed in Nov. 2016 toward removal of spent fuel.
- Fuel removal will start in FY 2020.



5. Toward Fuel Debris Removal

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(1) Investigation inside the Primary Containment Vessel (Unit 2)

- Investigation inside the PCV and at the bottom of the RPV was conducted.
- X-6 opening was used as a path for devices to go inside.

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Undamaged part of the RPV and distortion of the grating could be seen.



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- Investigation inside the PCV was conducted to gain the information on the location of fuel debris
- A robot inserted through X-100B opening dropped a camera from the grating on the first floor using a cable and investigated the situation around the bottom of PCV.
- Currently obtained data is being analyzed.



6. Information Sharing and Communication

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- Based on agreements with 13 municipalities, TEPCO reports to local governments about the progress of decommissioning tasks. TEPCO also informs them of accidents and troubles at Fukushima site.
- TEPCO reviewed how to report the results of data analysis so that the latest data of radioactive dose at each observatory can be easily accessible.
- More visualized information and video footage are available to enhance the understanding of decommissioning work. Articles based on interviews with workers on-site are also available on magazines so that local residents can feel familiar with TEPCO.

Example of website

<Information on radiation >



<Archived videos >

2017.4.3 Unit 1 Primary Containment Vessel internal investigation (State of the field work)

Information Magazine



"Hairo Michi" (first published in Apr. 2017)

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(2) Two-Way Communications with Local Residents

Explanation at public meeting

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



Left : Ishizaki, Representative of the Fukushima Revitalization Headquarters

Right : Masuda, Chief Decommissioning Officer, President of Fukushima Daiichi Decontamination and Decommissioning Engineering Company

Invitation to Site Visits

- Inviting prefectural govern-ment and organizations
- Percentage of visitors from within the prefecture has increased to 31% (from 28% in FY2015)
- 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"



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

7. Fukushima Revitalization Activities involving TEPCO Group employees and related parties

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 (1) Nurturing the next generation who will help decommission Fukushima Daiichi in partnership with educational community ①
 ~ Human resource development program ~

- A new program "Program for the enhancement of Decommissioning Research and Human Resource Development "was added to the existing Initiative called "The Center of World Intelligence Project for Nuclear S&T and Human Resource Development" sponsored by MEXT. The aim is to acquire and nurture human resources that will help decommission Fukushima Daiichi in the future.
- Decommissioning R&D Partnership Council was established at NDA to enhance the partnership between the decommissioning site, universities and research institutes etc.
- TEPCO promotes the partnership through practical realization, supply of actual data and dispatch of emissaries who have hands-on experiences.



Above are research representatives which supervise adopted themes. They cooperates with co-researchers such as universities, colleges and other organizations. ©Tokyo Electric Power Company Holdings, Inc. All Rights Reserved 26

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- (1) Nurturing the young generation who will help decommission Fukushima Daiichi in partnership with educational community 2 ~Discussion with high school students~
- In order to promote understanding among young generation with regard to the current situation of Fukushima Daiichi and surrounding area, TEPCO had a discussion with high school students who are interested in Fukushima Revitalization.
- Students under 18 (from Fukushima High School) visited Fukushima Daiichi for the first time.

Discussion with students from Fukushima High School and their visit to Fukushima Daiichi

- 13 students, 5 teachers, Professor Hayano from Tokyo University, Mr. Itoi and others participated in the tour (21 people)
- <Remarks from participants>
- The visit has enabled me to think about what I can do to address the current situation.
- I would like to continue Fukushima revitalization activity.



Site visit

Discussion with students from Nada High School and High School at Komaba, University of Tsukuba

- TEPCO cooperated with a trial tour for educational purpose organized by Fukushima Prefecture
- 15 students from High School at Komaba, University of Tsukuba and 15 students from Nada High School
- Discussion on Fukushima Daiichi and Fukushima Revitalization Activities



Question and answer session with students from Fukushima High School after the site visit

TEPCO (2) Partnership with Industry Segments

In order to dispel harmful rumors about or local farm produce or tourism in Fukushima, the organization comprised of companies including TEPCO was established in Nov. 2014. The number of member companies has increased to 35 as of Mar. 2017 from 11 at the time of the establishment.

TEPCO contributed to the matching event held by Fukushima Consortium of Robotics Research for Decommissioning and Decontamination (Secretariat : Fukushima Technology Centre) for two years in a row.

O-EN Network

- Activities
 Promotion of Fukushima Produce
 -Using the ingredients in
 cafeterias and in-house sales
 event of fresh farm produce
 - Promotion of tourism and convention facilities in Fukushima
 - Organizing visits to local farms with regard to the safety of produce from Fukushima
 - Introduction and sharing of events held by Fukushima Prefecture and activities conducted by member companies

Members 35 companies

(about 56,000 employees)

TEPCO's Contribution to Fukushima Consortium of Robotics Research for Decommissioning and Decontamination

- TEPCO and its contractors joined the event in which robots for decommissioning and decontamination, and related technologies were introduced to companies which are performing decommissioning and decontamination work.
- The events have been held as exhibitions as well as matching events. The last fiscal year's event also included demonstration.
- Visitors to the venue (Naraha Remote Technology Development Center) totaled 539 people last fiscal year.
 - (1) Contractors performing decommissioning and decontamination :218
 - (2) Companies and organizations : 56
 - (3) Research Institutes, universities and public offices

: 73

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(3) Fukushima Revitalization Activities involving TEPCO Group employees

Bearing in mind that it is our mission and existential reason to carry through our responsibilities TEPCO owes to Fukushima, TEPCO Group employees are performing revitalization activities.

As the return of local residents makes progress, Fukushima Revitalization Headquarters (Tomioka Town) are continuing their activities in response to their needs. The cumulative number of TEPCO Group employees engaged in the activities reached approx. 330,000 at the end of Feb. 2017.

Outdoor Cleaning & Clearing



[Employees' activities]Weed removal



■ Snow removal



Before and After: Making a Difference (Weed and Mud removal for Restoration of Agriculture Business)





In Conclusion

 Fukushima Daiichi (Decommissioning Site)

The center of world intelligence

Technologies of all kinds

Invaluable field

Let's come together for decommissioning Fukushima Daiichi !









福島復興への責任。 心をひとつに、 庭后事業を貫徹しま



福島第一廃炉推進カンパニー



Thank you for your kind attention!!

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TEPCO Fukushima Daiichi NPS Map

