### Status of Fukushima Daiichi NPS November 2013

### Hideki Masui Safety Research Manager Tokyo Electric Power Company



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  - Inventory Control (Water Management)
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### 1. Status of Fukushima Daiichi NPS



### Fukushima Daiichi (1F) Unit 1~4





### **Roadmap for Recovery and Decommissioning**



### **Monitoring Data of Fukushima Daiichi**

Data as of: Jul. 17, 2012 (Red) Nov.11, 2013 (Blue)





### **Estimated Radioactive Release Rate**



### **RPV Bottom Temperature**



### **PCV Atmosphere Temperature**

#### PCV Atmosphere temperature maintains under 100



## 2. Current Topics

- Inventory Control (Water Management)
- Fuel Removal from unit 4 SFP
- Inner PCV Investigation



# Inventory Control (Contaminated Water Management)



#### **Current Scheme for Contaminated Water Management**

#### **Recirculation Cooling System**



#### **Identification of Radiation Release**



### **Drainage of Water from Underground Trench**

Accumulated contaminated water will be removed from underground trench



### **Chemical Injection, Pump-up, Covering**

#### Reducing groundwater flow through contaminated area



### **Groundwater Bypass**

- 12 wells have been dug to pump up ground water before being contaminated.
- Pumped water are to be released into the sea after radiation check
- Already completed and tested. Waiting clearance.



Groundwater Direction

#### **Comprehensive Measures**

Seaside Impermeable Wall to block water leakage
 Frozen Wall to block water in-leakage into building
 Recovery of Existing Well to reduce ground water level





#### **Seaside Wall / Frozen Wall**

#### 1. Seaside Impermeable Wall

Construction started in May 2012 and is to complete in Sep. 2014

#### 2. Frozen Wall

Frozen wall will be installed to block water in-leakage

Expected to start operation in 2015



### **3-11 Recovery of Existing Well**

#### 3. Recovery of Existing Well

Reactor and turbine buildings are surrounded by wells and pumps (called "sub-drain system) to suppress floating power. Those wells are inoperable due to contamination. Recovery of those existing well can minimize water in-leak into the building. Recovery is expected to be done in 2014



#### Leakage from Storage Tank

- On Aug.19, water puddle was found around storage tank. Tank level was found to be reduced by 3m (equivalent of 300m<sup>3</sup>).
- Since drainage value in the dyke was open, some portion of water was leaked outside dyke.
- •This event was rated to be INES level 3.



Trace of leakage

#### **Investigation of Leak Cause**



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Tank has been disassembled and various tests have been conducted

Bubble test identified leakage point



#### **Investigation of Leak Cause**





# Deformed sealing material caused leakage.



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#### **Emergency Measures**

- 1. Collection of residual water. Recovery of contaminated soil. Inspection of all flange-type tank.
- 2. Enhanced patrol. (twice 4 times a day, 10 60 people)
- 3. Closure of drain valve
- 4. Enhanced monitoring along gutter
- 5. Water level measurement by thermograph

Patrolling with survey meter



Water level measurement by thermograph



#### **Further Measures**

- 1. Installation of level meter for all flange tank
- 2. Introduction centralized monitoring system
- 3. Installation of additional weld tank
- 4. Replacement of flange-tank



### Fuel Removal from Unit 4 SFP



### **Spent Fuel Pool Cooling**

Air cooled SFP cooling system is installed at unit 1-4 Temperature of SFP has been maintained safely.



### **Reinforcement of SPF at unit 4**



Seismic safety analysis, taking account of wall damage, confirmed integrity of R/B at unit 4

To further improve seismic safety, upgrade work was conducted at SFP.

### Water Level Measurement at SFP (unit4)

### Measurement result has confirmed SFP is not tilted



Reactor well	Measurement Date							
	May 18, 2012	Aug 21, 2012	Nov 20, 2012	Feb 2, 2013	May.21 2013	Aug.6 2013		
	492	462	463	465	467	465		
	492	462	464	464	465	465		
	492	461	463	463	464	465		
	492	461	463	463	465	466		

SFP	Measurement Date							
	May 18, 2012	Aug 21, 2012	Nov 20, 2012	Feb 2, 2013	May.21 2013	Aug.6 2013		
	461	453	443	444	439	448		
	461	453	444	443	439	446		
	461	452	442	443	439	446		
	461	452	443	443	438	446		

### **Debris Removal from unit 4**





### **Condition of Spent Fuel Pool (Unit 4)**





Installation of clean-up system made water more clear

Debris have been removed.





### **Fuel Removal Cover (Unit 4)**

The cover for fuel removal has been installed in order to improve work environment and to prevent radioactive materials from scattering and releasing during the work.

Start of fuel removal at Unit 4 started on Nov.18, 2013.





### **Fuel Removal Cover (Unit 4)**











### **Unit 4 Fuel Removal**











### **Unit 4 Fuel Removal**











### Inner PCV Investigation



### **Result of Inner PCV Investigation (Unit2)**



### S/C Investigation by Robot (unit 2, Mar.2013)



### Investigation of unit1 S/C by Remote-controlled Boat



Unit 1 Reactor Building

Investigation was conducted on 13, 14 Nov. 2103



Suppression Chamber (S/C)



Remote-controlled Boat



### **Investigation Result (1)**



Leakage has been identified around one of 8 vent piping.



### **Investigation Result (2)**

Damages were found at sand cushion drain (not PCV boundary)





### 3. Future Activity toward Decommissioning





#### (2)Inspection of lower PCV

Lower PCV will be inspected to identify leak point



#### Spent fuel (3)Stop leakage at lower pool Penetrati **PCV** Stop leakage device RP Water taken from Lower PCV and R/B will be **PCV** Containment repaired. Water will be taken from PCV. us room Stop leakage Spent fuel (4)Water filling of PCV pool Penetratio Penetration Small RP\ Circulation Water will be filled in PCV. Loop Small circulation loop will be PC\ conducted.

Stop leakage

us room

#### (5)Inspection of PCV internals/in-core inspection/sampling

Inspection and sampling will be conducted to grasp characteristics of fuel debris



#### (6)Repair of upper PCV

Upper PCV will repaired to allow further water filling



#### (7)PCV flooding/In-core Inspection/ Sampling

PCV will be flooded and fuel debris in RPV will be sampled



#### (8) Fuel Debris Removal

Fuel debris will be taken and placed into storage container.



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### **Decommissioning and Waste Management**



- Plan to complete the reactor facilities decommissioning in Units 1 to 4 within 30 to 40 years after the completion of Step 2.
- Once fuel debris are removed, existing decommissioning technology may be applicable.
- Still, R&D program is needed to develop post-accident waste treatment method.



### **Concluding Remarks**

We have recently started fuel removal out of unit 4 SFP, which is an essential step toward decommissioning.

- >We are making utmost efforts to control contaminated water accumulated on site.
- Decommissioning of Fukushima Daiichi is challenging and long –term project, involving unprecedented R&D programs
- With the support of government and global partners, we are committed to carry out this challenging task.

