

Partial damage to temperature gauge cables for the  
Reactor Pressure Vessel (RPV) found during the  
Fukushima Daiichi NPS Unit 3 Primary Containment Vessel  
(PCV) internal investigation

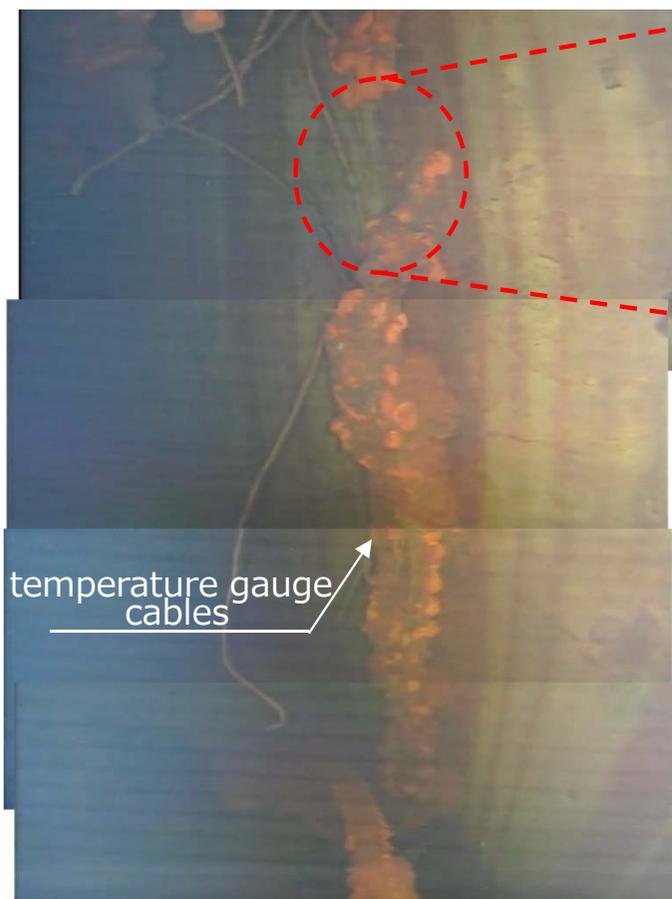
November 30, 2017



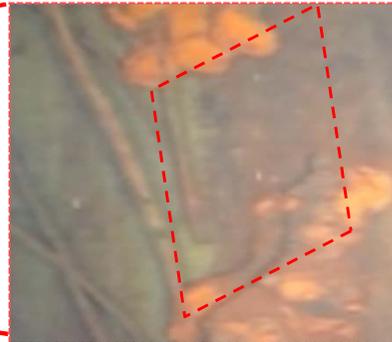
Tokyo Electric Power Company Holdings, Inc.

# Situation of temperature gauges at the bottom of the Unit 3 RPV based on the internal investigation (1/3)

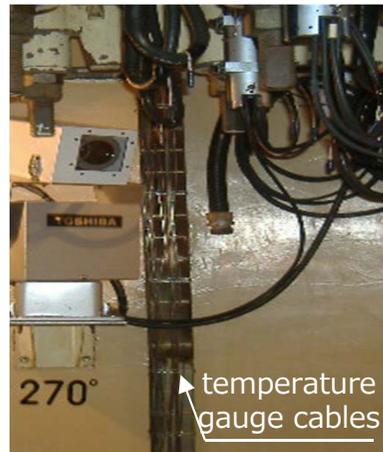
- There are two routes for temperature gauges at the bottom of the RPV, one inside the pedestal (12 temperature gauges\*) and one outside the pedestal (6 temperature gauges\*). \* Three along the inside route and six along the outside route are used to monitor the limiting conditions of operation stipulated in the implementation plan.
- Damage to the inside pedestal route (12 temperature gauges)** was seen in images taken during the internal investigation.
- Damage was found on cables inside the PCV between the relay terminal platform and measuring points



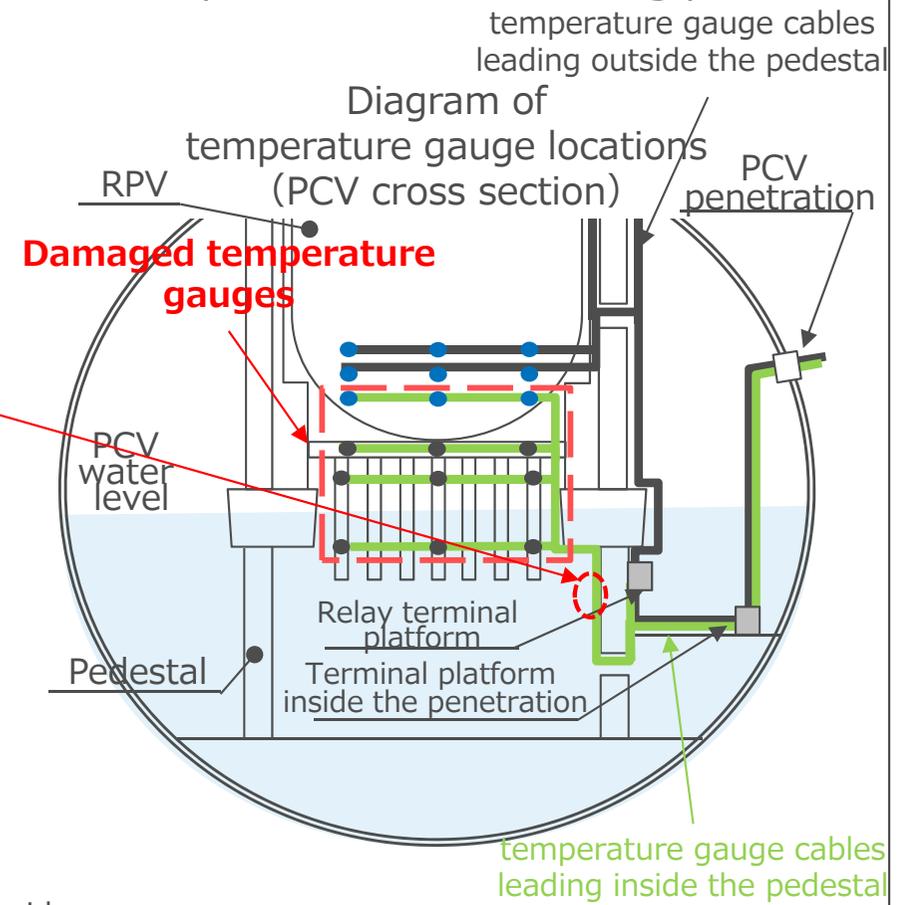
Damage was found along the route inside the pedestal



Location of damage (enlarged)



Temperature gauge cable condition inside the pedestal before the accident



**Damaged temperature gauges**

● : Temperature measuring point  
● : Temperature measuring point (implementation plan)

# Situation of temperature gauges at the bottom of the Unit 3 RPV based on the internal investigation (2/3)

## <Assumed causes of the damage>

- temperature gauge cables found damaged are made of a metallic sheath and wires that have a melting point of more than 1,000°C.
- It is assumed that the cables experienced thermal cutting by **high-temperature molten objects** that fell onto the cables from the RPV bottom.
- **The 12 temperature gauges along the route leading inside the pedestal are considered to be “broken”** because thermal cutting of the cables has rendered them unable to measure the temperatures at the bottom of the RPV.

## <Status of reactor cooling>

- There are many uncertainties surrounding the location of fuel debris, however it is assumed that during the accident, molten fuel debris fell to the bottom of the RPV or PCV and landed on structures located between the bottoms of the RPV and PCV during the fall.
- **This fuel debris is being kept cool in a stable manner** by continuously injecting enough cooling water to sufficiently offset the amount of thermal heat being generated by the fuel debris.
- **It has been confirmed** from not only temperature readings taken at the RPV and PCV, but also temperature gauges installed in the PCV after the accident, PCV gas management equipment dust monitors and the measured concentrations of hydrogen and xenon 135 **that the overall state of cooling is being maintained and that the fuel debris is cool.**

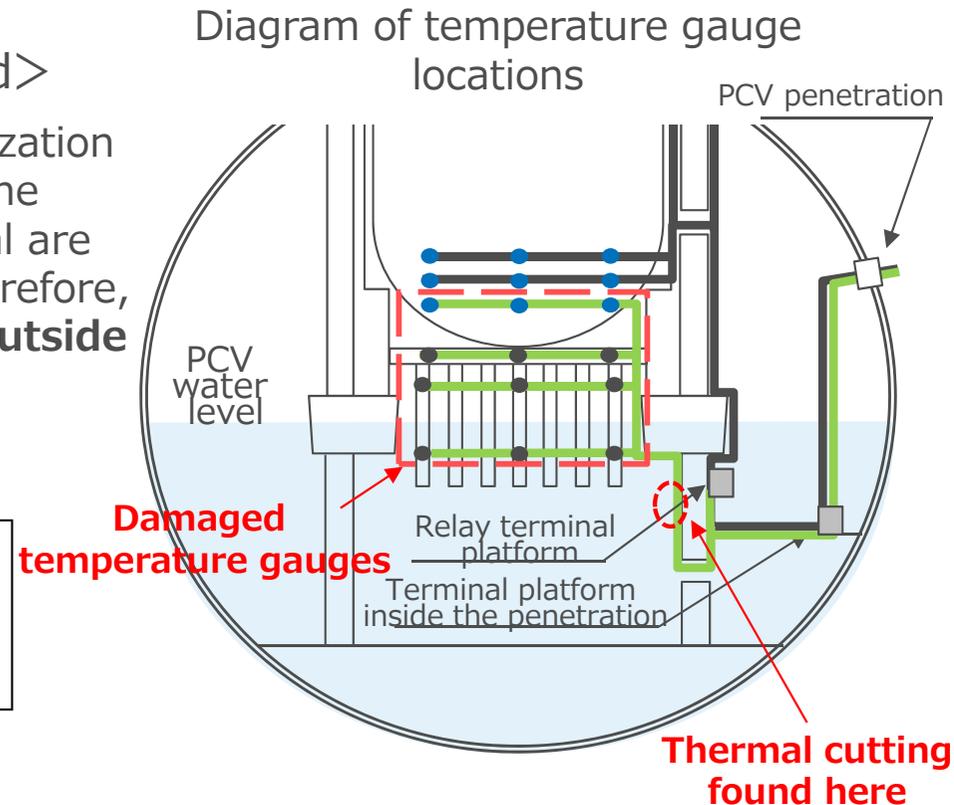
# Situation of temperature gauges at the bottom of the Unit 3 RPV based on the internal investigation (3/3)

## <Temperature gauges other than those found damaged>

- It is assumed that the RPV was damaged after the depressurization of Unit 3, and thought unlikely that melted fuel spattered to the height that the temperature gauge cables outside the pedestal are located and reached temperatures of more than 1,000°C. Therefore, **it is assumed that temperature gauges along the route outside the pedestal were not damaged by thermal cutting.**



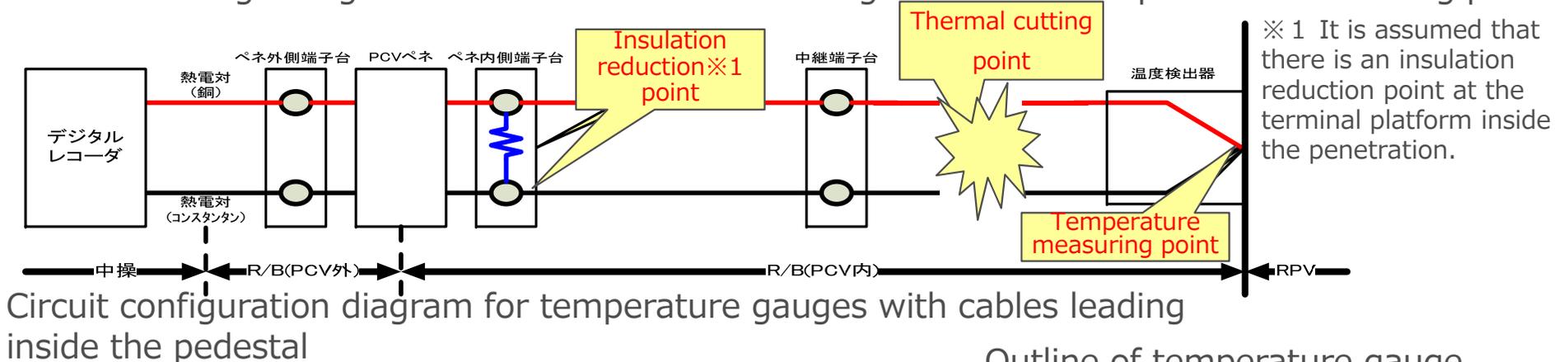
Due to the location of installation it is thought that the state of cooling is confirmed, but a further investigation will be performed.



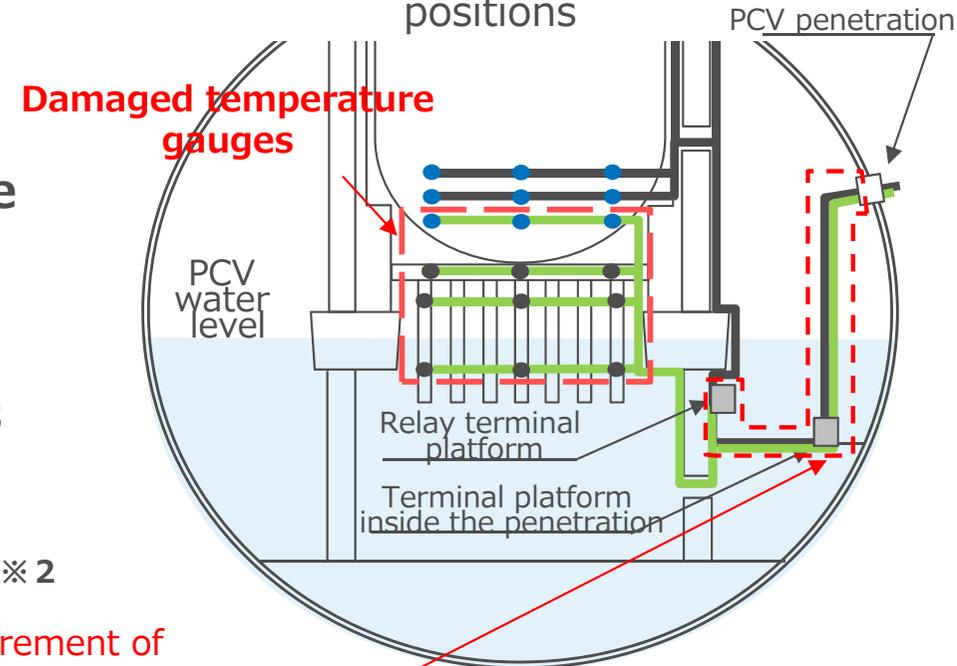
- We will further confirm the state of cooling by measuring the resistance of temperature gauge circuits and looking at past temperature data for RPV and PCV temperature gauges.
- We will also deliberate how to check the state of cooling going forward based on the results of the PCV internal investigation etc.

# Reference: Temperature measurements along the route inside the pedestal

- Temperature readings that have been obtained from the 12 temperature gauges along the route inside the pedestal infer the following in regards to the current circuit configuration and temperature measuring points.



Outline of temperature gauge positions



- Thermocouple temperature gauges can measure temperatures only when the copper and constantan wires form a closed circuit. **The temperatures in the RPV (measuring points) cannot be measured** because the cables were severed by thermal cutting.
- Insulation reductions inside the PCV caused by the accident have been confirmed. Temperature readings can be taken at locations of insulation reductions because the insulation reductions form thermocouple circuits. **This means that temperatures in the PCV<sup>※2</sup> are being measured.**

※2 Scope of measurement of temperature gauges with cables severed by thermal cutting

# Reference: Trends for current temperatures at the bottom of the Unit 3 RPV

