Results of the Third Soundness Inspection of Unit 4 Reactor Building at Fukushima Daiichi Nuclear Power Station

November 29, 2012

Tokyo Electric Power Company

TEPCO 東京電力

1. Purpose of Inspection

Unit 4 Reactor Building and Spent Fuel Pool are inspected regularly (four times a year) for soundness. The first inspection was done in May 2012 and the second inspection was done in August 2012. Based on the results, it was confirmed that the spent fuel can be stored safely. The third regular inspection was performed as follows.

[Overview of the regular inspections performed so far]

(1) First regular inspection (May 17-25, 2012)
[Inspection items] 1. Water level measurement, 2. Exterior wall measurement, 3. Visual inspection, 4. Concrete strength evaluation
[Outline of the results] No cracks or building tilt was found and a sufficient level of concrete strength was maintained. The condition allows for safe storage of spent fuel.

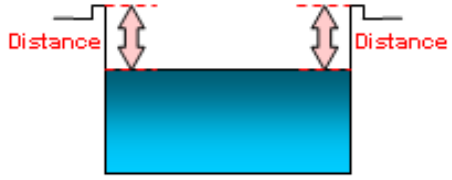
(2) Second regular inspection (August 20-28, 2012)
[Inspection items] 1. Water level measurement, 2. Exterior wall measurement, 3. Visual inspection, 4. Concrete strength evaluation
[Outline of the results] No cracks or building tilt was found and a sufficient level of concrete strength was maintained. The condition allows for safe storage of spent fuel. No significant change was found from the first regular inspection results.

(3) Third regular inspection (November 19-28)
[Inspection items] 1. Water level measurement, 2. Exterior wall measurement, 3. Visual inspection, 4. Concrete strength evaluation

2. Results (1) Building Tilt Measurement (Water Level)

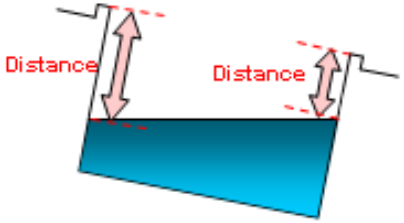
Given that the water surface is always horizontal, the distances between the 5th floor surface and the water levels of the reactor well and spent fuel pool were measured to check if the building is tilted or not. It has already been confirmed that the building is not tilted based on the measurement results obtained on February 7, April 12, May 18 and August 21, 2012.

1) Building not tilted

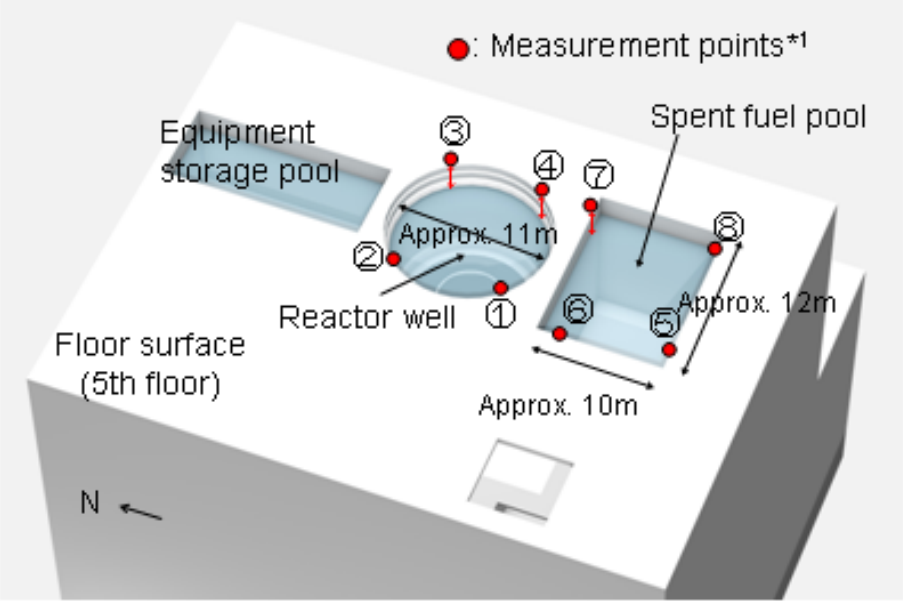


The distances are the same

2) Building tilted



Difference in the distances

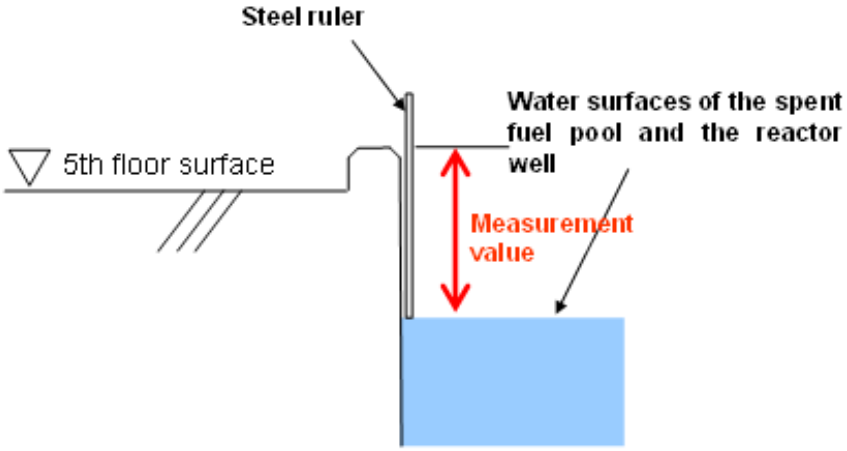


Measurement points (Floor surface of the 5th floor)

*1 The measurement points are set according to the progress status of cover installation for fuel removal.

2. Results (1) Building Tilt Measurement (Water Level)

Considering that the water level measurement values on the four corners were about the same, it has been concluded that the 5th floor surface and the water levels of the spent fuel pool and the reactor well are parallel similarly to the past results.



Measurement method*1

*1 Error must be taken into account as the measurement is done visually by a person

*2 Water levels are subject to change daily depending on the operation status of cooling equipments.

*3 On February 7, 2012, measurement was done only on the reactor well.

Water level*2 Measurement Results

Unit [mm]

Reactor well	Measurement date				
	Feb. 7, 2012	Apr. 12, 2012	May 18, 2012	Aug. 21, 2012	Nov. 20, 2012 (This time)
①	462	476	492	462	463
②	463	475	492	462	464
③	462	475	492	461	463
④	464	475	492	461	463

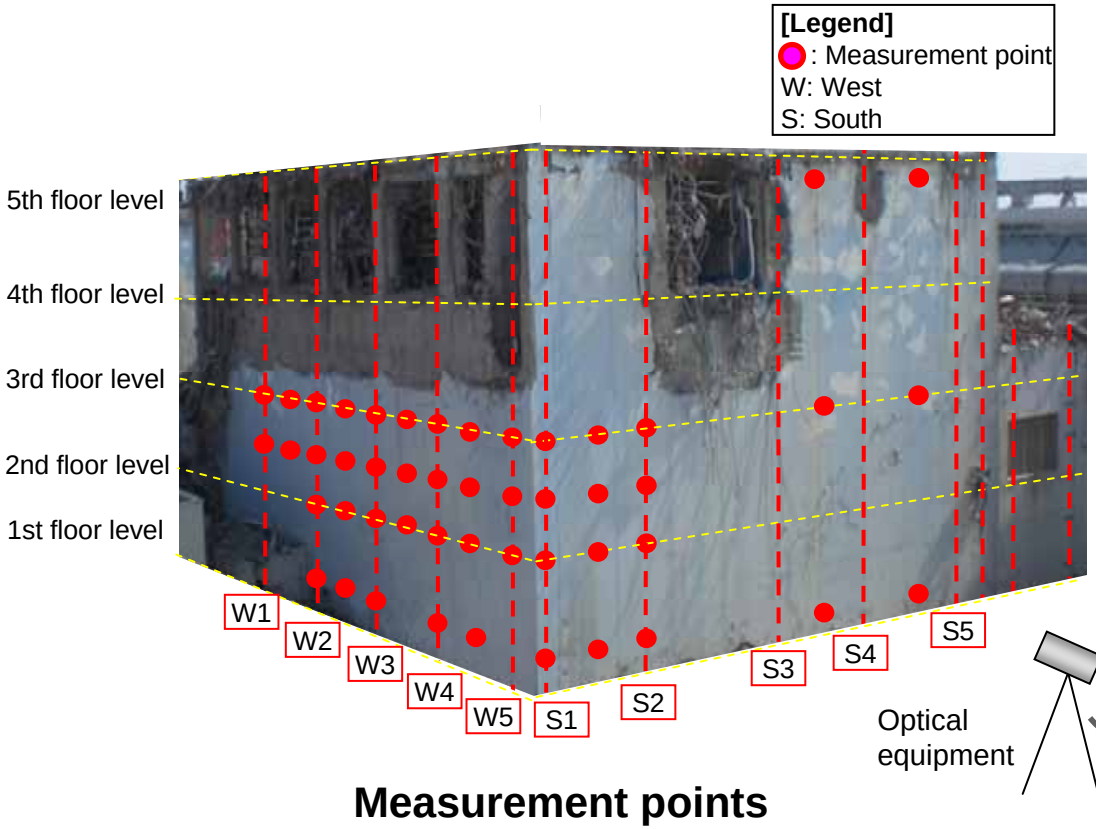
Spent fuel pool	Measurement date				
	Feb. 7, 2012	Apr. 12, 2012	May 18, 2012	Aug. 21, 2012	Nov. 20, 2012 (This time)
⑤	— (*3)	468	461	453	443
⑥		468	461	453	444
⑦		468	461	452	442
⑧		468	461	452	443

2. Results (2) Exterior Wall Measurement (Measurement Points)

The horizontal differences*1 of the exterior walls were measured by an optical equipment (with fixed points set on the upper and lower sides of the walls) and the deformation characteristics of the exterior walls were evaluated.

Though partial bulge was found on the exterior walls, it has been confirmed that the building itself is not tilted based on the results of the first regular inspection (May 2012), the detailed inspection of exterior walls (June 2012) and the second regular inspection (August 2012).

*1 Horizontal distance between the fixed point on the first floor and the fixed point on the upper floor



Measurement points

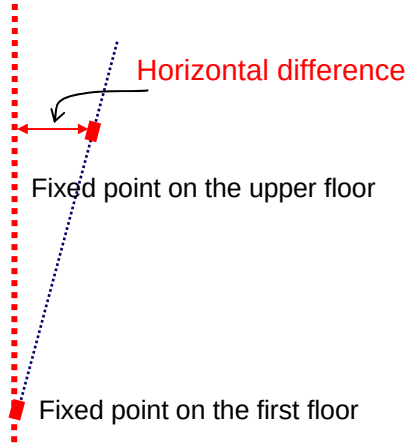
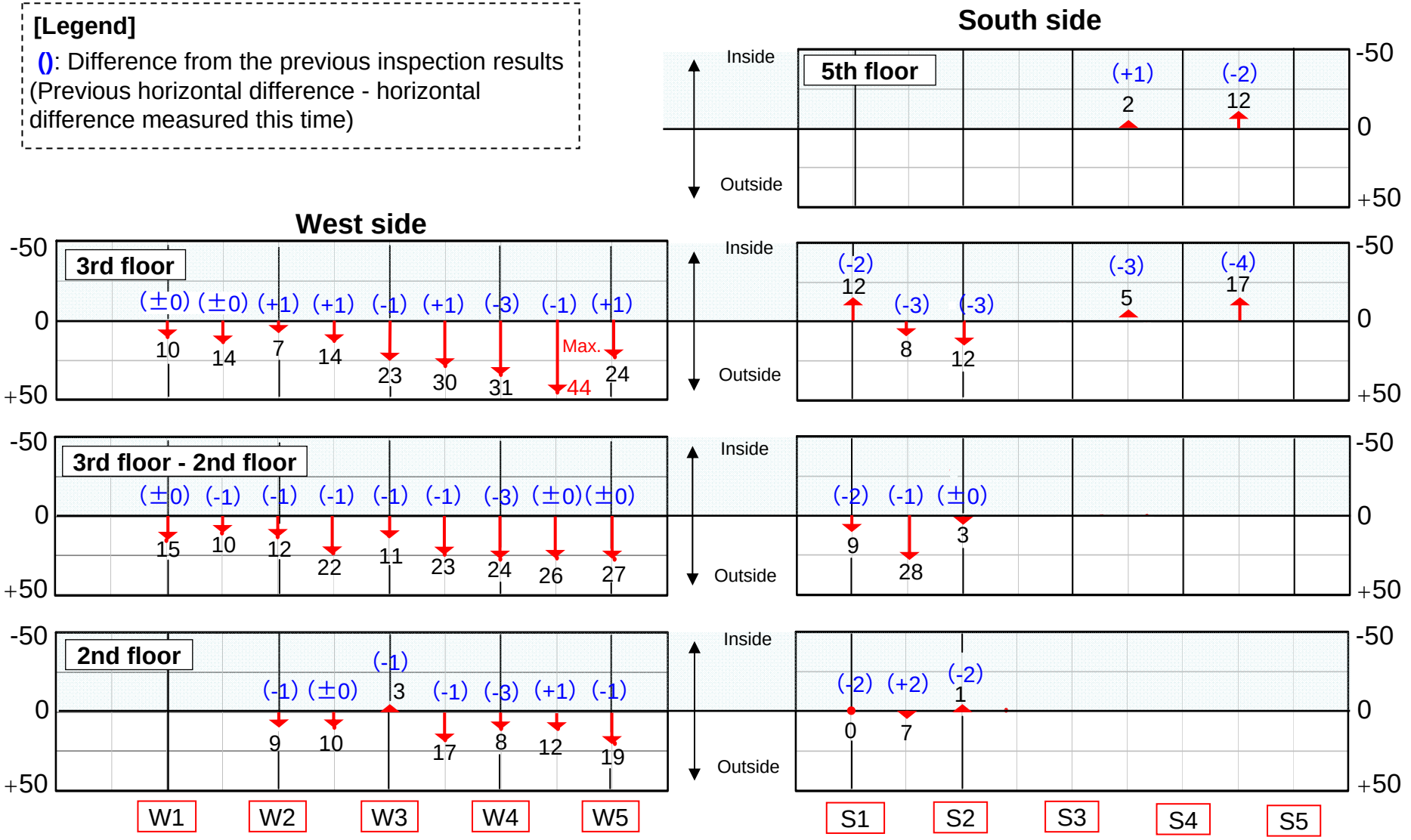


Image processing was partially applied from the perspective of physical protection.

2. Results (2) Exterior Wall Measurement (Measurement Results)

[Legend]

(): Difference from the previous inspection results (Previous horizontal difference - horizontal difference measured this time)



Horizontal difference*1 calculation results (Unit: mm)

*1 Horizontal distance between the fixed point on the first floor and the fixed point on the upper floor

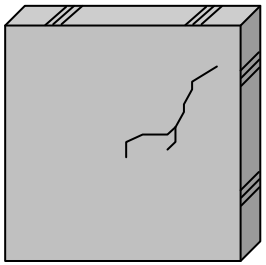
2. Results (2) Exterior Wall Measurement (Consideration)

- The horizontal differences measured this time were about the same as those in the first inspection (May 2012) the detailed inspection of exterior walls (June 2012) and the second inspection (August 2012), and the deformation characteristics on the measurement points were also similar.
- The small difference from the previous measurement results may be due to factors such as error of the optical equipment (Measurement error of ±2mm may cause approx. 4mm (Max.) error in horizontal difference) and thermal expansion of concrete (thermal expansion coefficient: Approx. 7-13×10^{-6}/℃) which may cause approx. 5-9mm error because of the difference of average monthly temperatures of August and November.

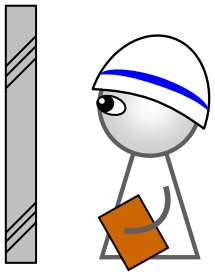
2. Results (3) Visual Inspection

Visual inspection*1 was done on the concrete floor and walls. In the case that a crack of a width of 1mm or more is found, repair must be done as appropriate. No crack of a width of 1mm or more was found in the first inspection (May 2012), the detailed inspection of exterior walls (June 2012) and the second regular inspection (August 2012).

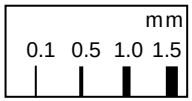
*1 The visual inspection was done while avoiding interference with the cover installation work for fuel removal.



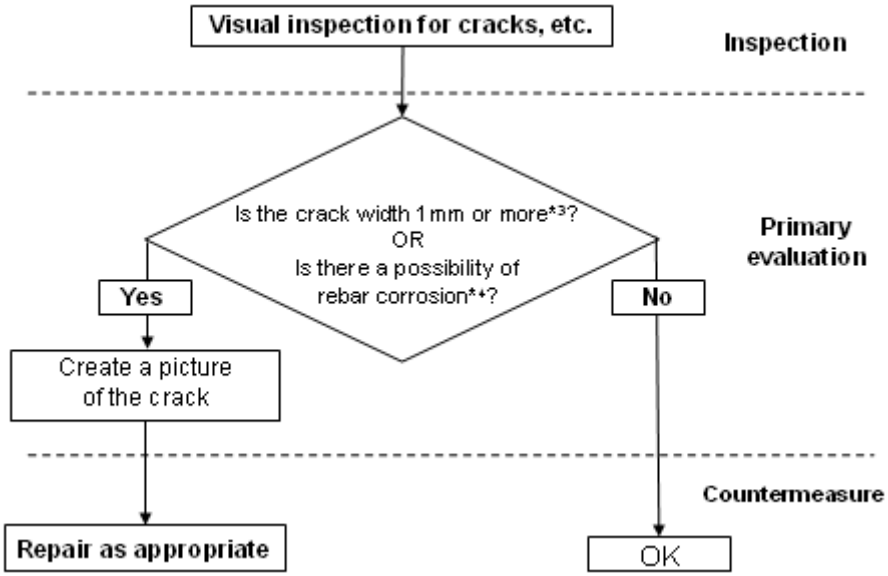
Check for cracks on the walls and the floor



Visual inspection



Crack scale*2



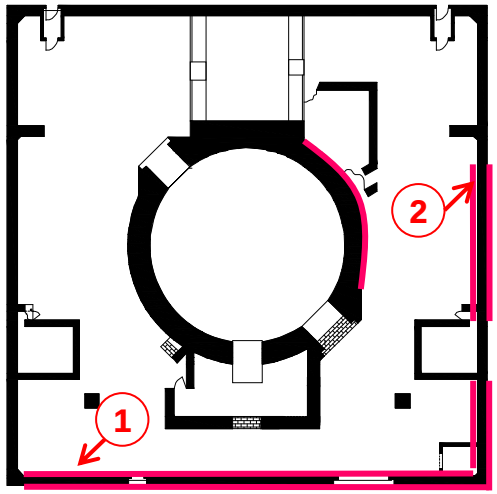
Flow of Visual Inspection

*2 Crack scale: Used to measure the width of a crack. (The scale is placed on a crack to measure its width.)
*3 In the case that the crack width is 1mm or more, the durability of the building must be reviewed in accordance with the "Maintenance and Management of Structures in Nuclear Facilities" specified by the Architectural Institute of Japan.
*4 In the case that rebar corrosion which may affect the building durability is found on the inspected area.

2. Results (3) Visual Inspection

As a result of visual inspection, no crack of a width of 1mm or more or with possible rebar corrosion was found (similarly to the past results).

[Legend] : Inspected areas



First floor

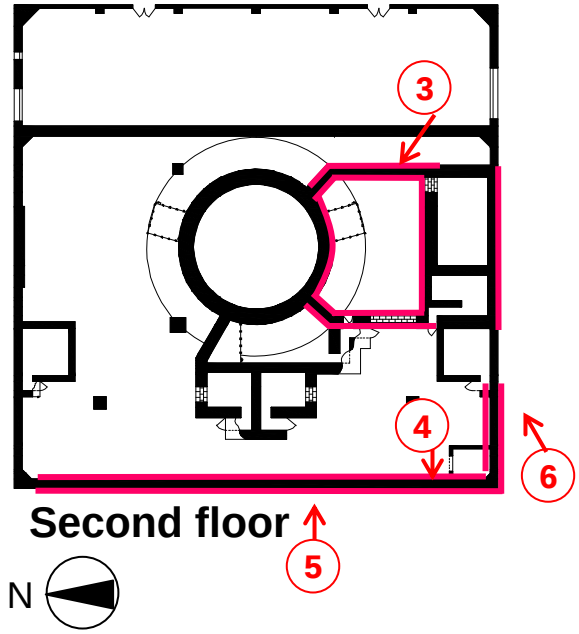
N

① West wall

② South wall

2. Results (3) Visual Inspection

[Legend] : Inspected areas



③ Wall on the SFP side

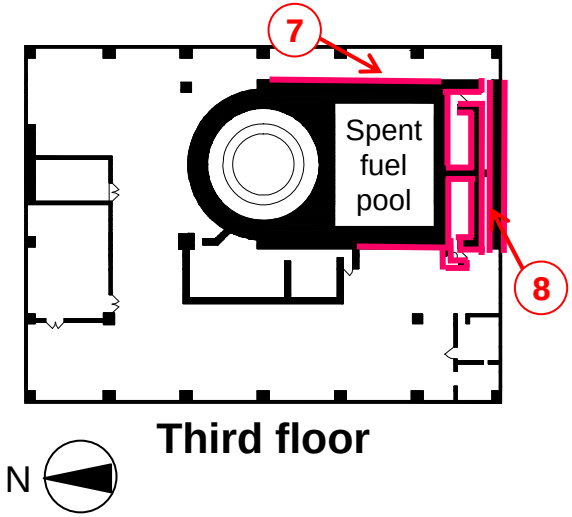
④ West wall (Interior wall)

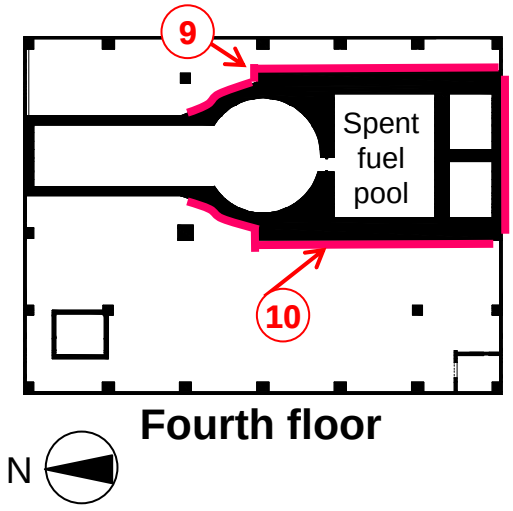
⑤ West wall (Exterior wall)

⑥ South wall (Exterior wall)

2. Results (3) Visual Inspection

[Legend] : Inspected areas





⑦ Wall on the SFP side (East)

⑧ Wall on the SFP side (South)

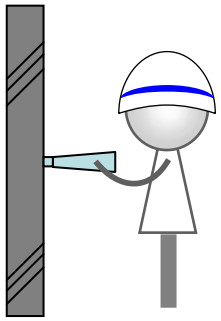
⑨ Wall on the SFP side (East)

⑩ Wall on the SFP side (West)

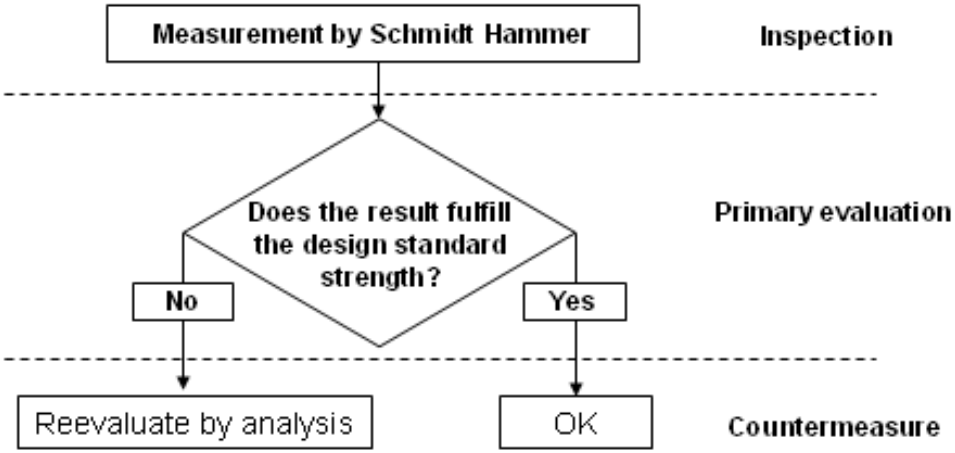
2. Results (4) Concrete Strength Evaluation

The concrete strength of the spent fuel pool frame was evaluated*1 by non-destructive inspection techniques (Schmidt Hammer*2, etc.) to confirm that the strength fulfills the design standard. The concrete strength fulfilled the design standard in the first inspection (May 2012), the detailed inspection of the exterior walls (June 2012) and the second regular inspection (August 2012).

*1 The evaluation was done while avoiding interference with the cover installation work for fuel removal.



Non-destructive inspection
(Schmidt Hammer*2)

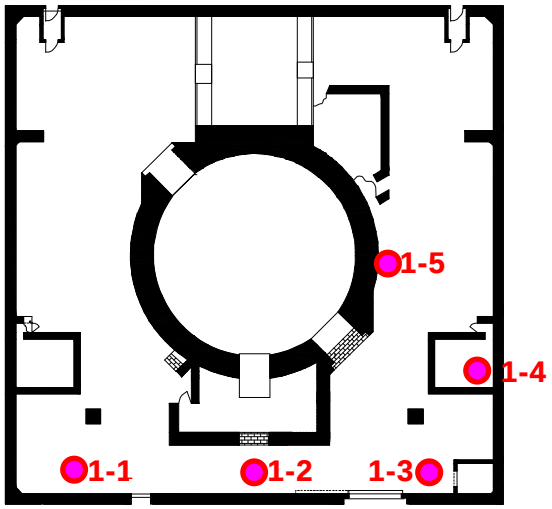


Flow of Non-destructive Inspection

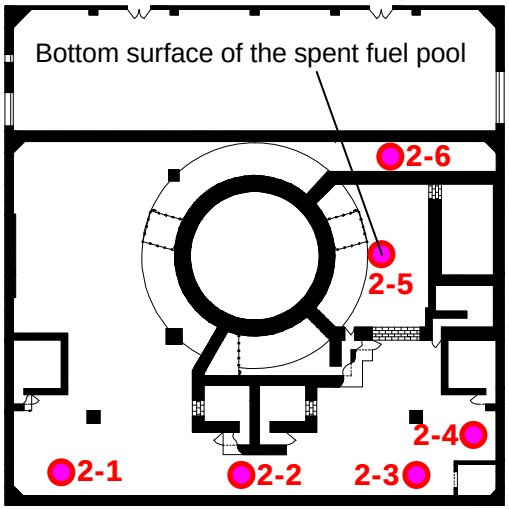
*2 Schmidt Hammer Technique: A non-destructive inspection technique to estimate concrete strength by hammering the concrete and measuring the impact returned.

2. Results (4) Concrete Strength Evaluation

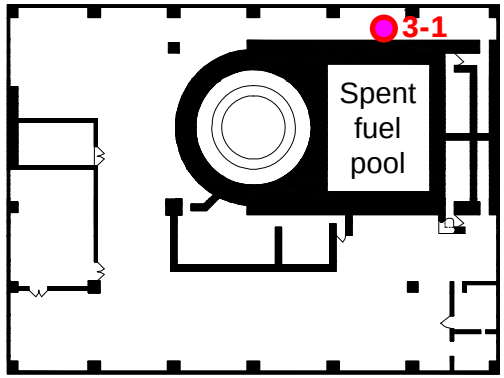
The concrete strength measurement points*1 are indicated below.



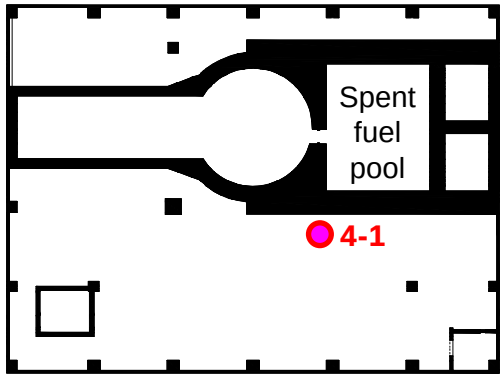
First floor



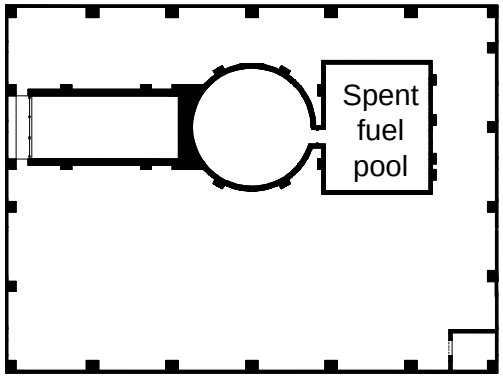
Second floor



Third floor



Fourth floor



Fifth floor

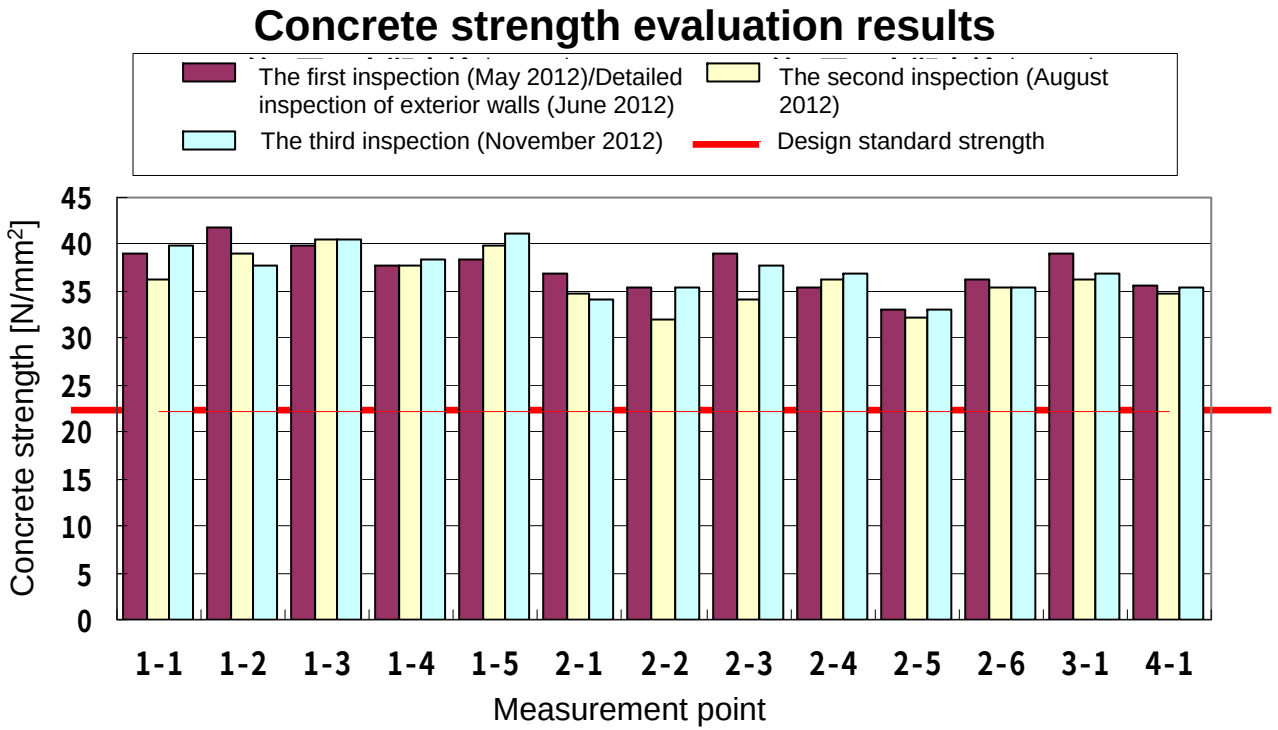
[Legend] ●: Measurement points

*1 The measurement points were set at slightly different locations from the previous measurement points.

2. Results (4) Concrete Strength Evaluation

As a result of measurement, the concrete strengths on all the measurement points were above the design standard (22.1N/mm^2) similarly to the past results. The results obtained this time are considered to be about the same as the previous results taking into consideration the error of Schmidt Hammer*1 and that the measurement points were set at slightly different locations from the previous ones.

*1 Error of approx. 3N/mm^2 is assumed for the experimental value and the strength criterion formula according to the "Guidelines for evaluation of concrete compressive strength by Schmidt Hammer" (August 1958, Material Testing Research Association of Japan).



Summary

- As a result of the third inspection, it has been concluded that the building is not tilted and a sufficient concrete strength is maintained with no cracks that would affect the structural strength of the building.
- The condition of Unit 4 Reactor Building has not changed much since the first and the second inspections and is capable of safely storing the spent fuel pool.
- The inspection will be conducted on a regular basis in order to check for changes over time.