

K4 Area Tank Inspection Status

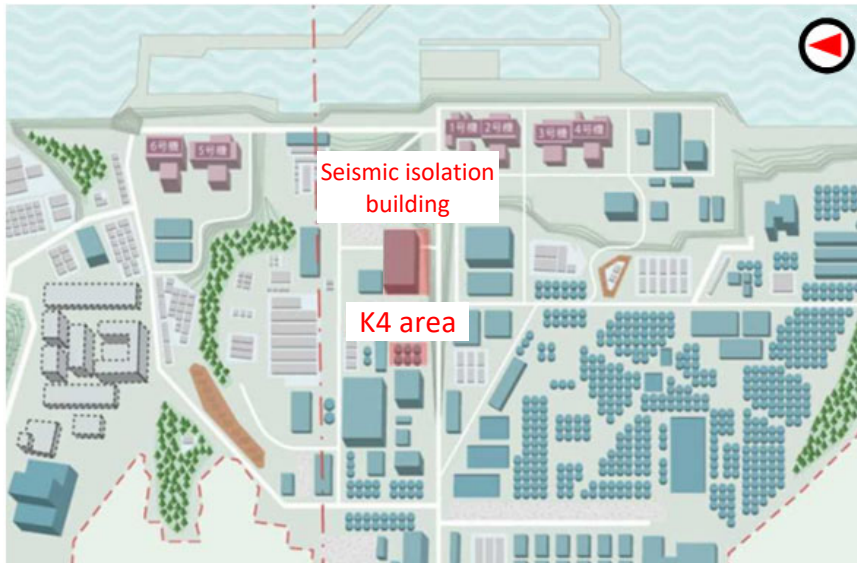
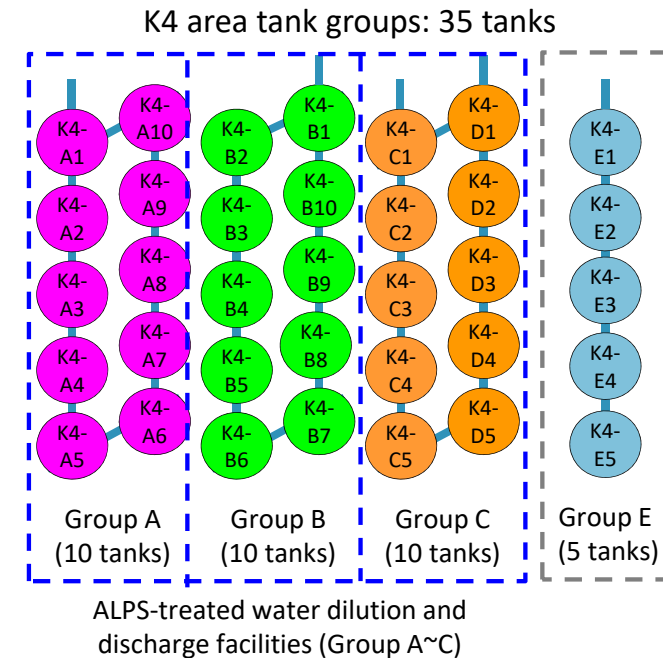
November 28, 2024



Tokyo Electric Power Company Holdings, Inc.

1. K4 area tank overview

- The K4 area tanks that contain ALPS-treated water were manufactured in a factory and installed on-site between July and November 2016. The tanks were put into service in August 2016.
 - Number of tanks: 35
 - Service life: 20 years according to design since they are made thick in consideration of paint specifications and corrosion
- In March 2023, the 30 tanks in groups A, B, and C were put into use as ALPS-treated water dilution and discharge facilities. The five tanks in group E continue to be used for the storage of ALPS-treated water.



Fukushima Daiichi Nuclear Power Station Site Diagram



K4 area tanks

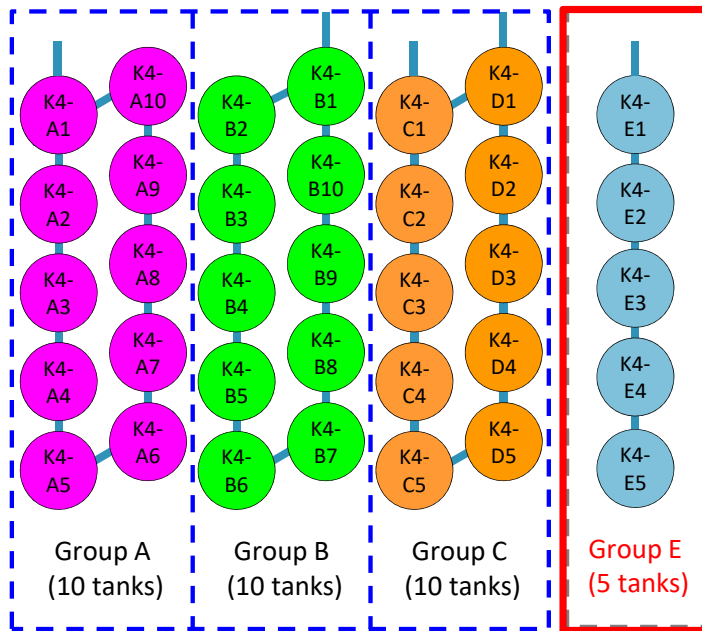
- Usage: Storage of ALPS-treated water
- Capacity: Approximately 1,000m³
- Inner circumference: Approximately 10m
- Height: Approximately 14.5 m
- Wall thickness: Approximately 15mm
- Material: SS400
- Year put into service: 2016

K4 area tank group overview

2. K4-Group E tank inspection results

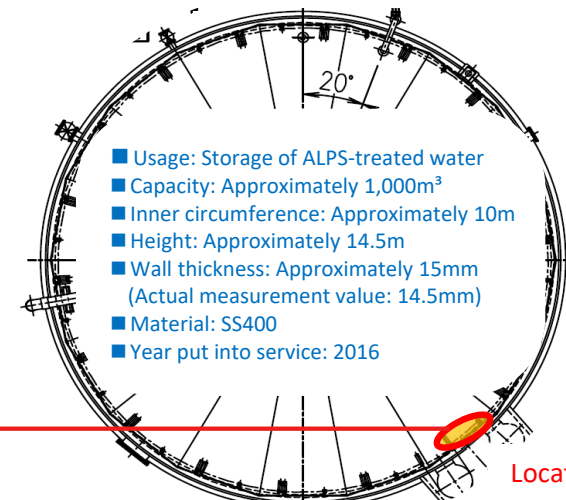
- The transfer of ALPS-treated water being stored in the Group E tanks (E1~E5) to the measurement/confirmation facility was completed on November 21, 2023, and an internal inspection of the tanks was implemented between March and July 2024.
- Localized paint peeling and wall thinning due to corrosion was found in tanks E1, E2, and E5.
- A simulation was used to perform a stress assessment of the tanks (Reference 1) to ascertain the impact of the thinning, and it was confirmed that there has been no impact on the structural strength of the tanks.
- The locations of thinning in the group E tanks were repaired using overlay welding that was then repainted (Reference 2).

K4 area tank groups: 35 tanks

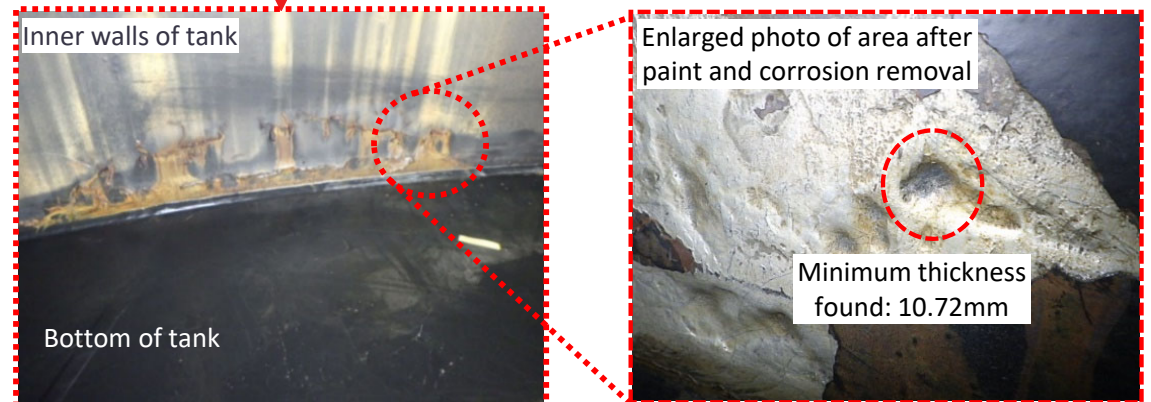


ALPS-treated water dilution and discharge facilities (Group A~C)

Group E



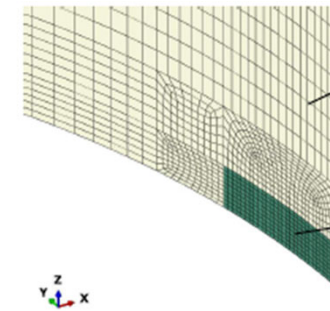
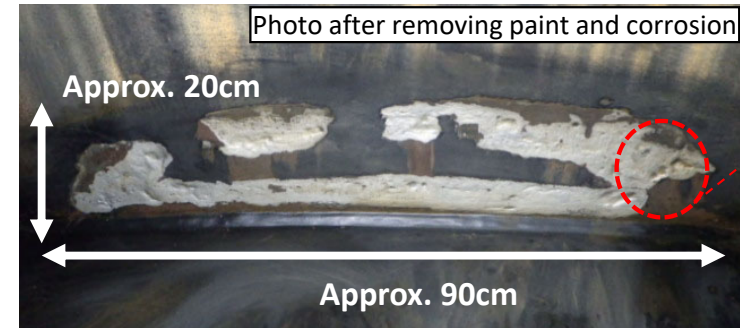
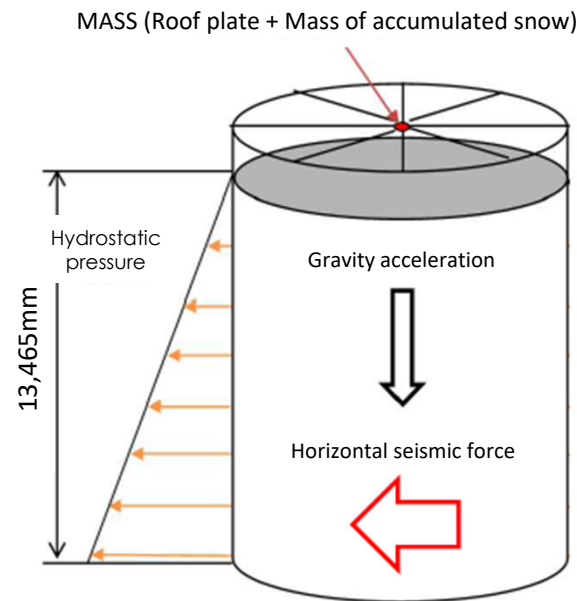
K4 area: Tank E1 plan view



[Reference 1] Structural integrity assessment (stress assessment)

- A stress analysis was performed using FEM analysis that considers thinning since there was concern over a decrease in integrity due to the thinning. (Amount of thinning: 14.5mm (General thickness measurement) – 10.72mm (Minimum thickness found) ≐ 3.8mm)
- To be conservative, a 20cm X 90cm concave section of wall with a uniform thickness of 10.7mm was modeled and a stress assessment was performed. Results found that the maximum stress to the concave section was 93MPa, thereby indicating a seismic resistance margin of approximately 2.5 considering the threshold of 236MPa.

- Analysis code: ABAQUS
- Analysis model: 3-dimensional model
- Elements
 - Material: SS400
 - Thickness: 14.5[mm] (Actual measurement)
 - Inner diameter: 10,000[mm]
- Constraint conditions: Bottom of the tank is totally secured
- Load conditions
 - Deadweight: 86,000kg (Specific gravity of liquid: 1.1)
 - Hydrostatic pressure: 13,465mm
 - Horizontal seismic force: 0.36G (Seismic resistance class B)



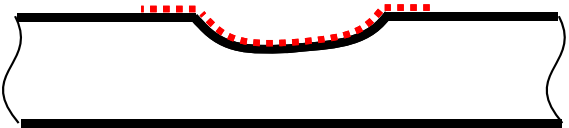
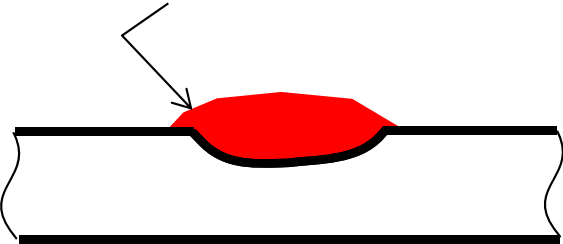
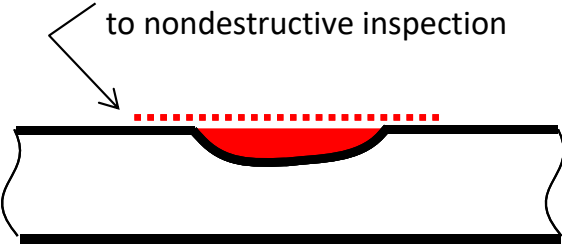
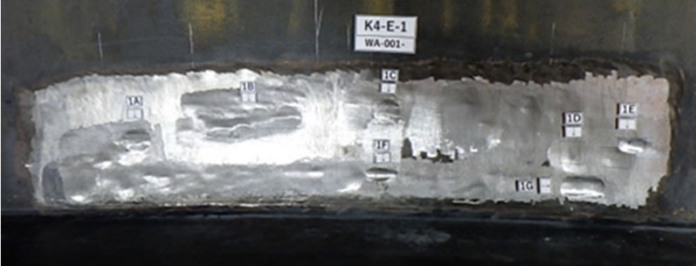
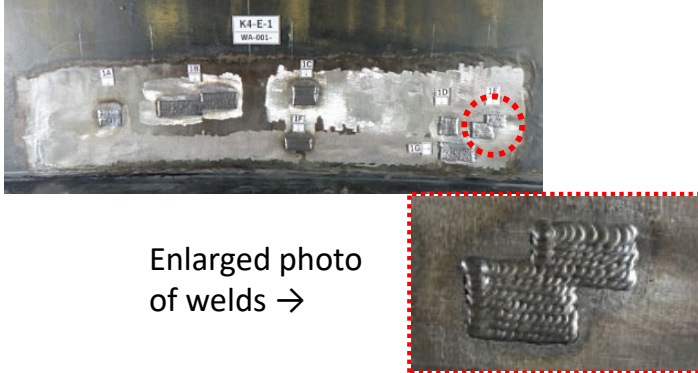

Maximum stress assessment results

Assessed component	Generated stress [MPa]	Threshold [MPa]	Seismic resistance margin	Result
Body plates※	93	236	2.54	○

※ To be conservative, a 20cm X 90cm concave section of wall with a uniform thickness of 10.7mm was modeled for assessment

[Reference 2] Repair method/Repair records

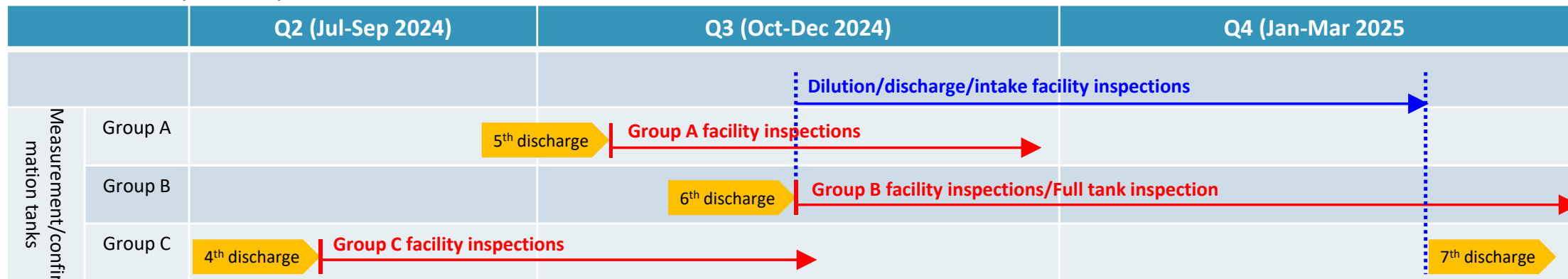
➤ A grinder was used to smooth out the entire area where thinning occurred and welding was overlaid after which the area was smoothed. (Photo: K4 area E1 tank)

Step 1	Step 2	Step 3
	 <p style="text-align: center;">Overlay welding</p>	 <p style="text-align: center;">Smoothest with grinder, subjected to nondestructive inspection</p>
<ul style="list-style-type: none"> ● Grinder used to remove rust and dirt from the location where weld is to be overlaid. ● After cleaning the area with a grinder, MT was used to confirm the integrity of the base material prior to overlay welding 	<ul style="list-style-type: none"> ● Welding overlaid 	<ul style="list-style-type: none"> ● After the weld was overlaid a grinder was used to flatten the weld so that it is flush with the base material. ● MT and UT were used to confirm the integrity of the weld after it was cleaned. Plate thickness measurements were also taken to confirm that minimum thickness had been achieved.
	 <p style="text-align: center;">Enlarged photo of welds →</p>	

3. K4-Groups A~C tank inspection plan

- After completion of the 4th discharge of ALPS-treated water into the sea in FY2024, we began successively inspecting measurement/confirmation tanks in accordance with its long-term inspection plan. (Full inspections are underway for group B)
 - Since localized corrosion was found near the bottom of the group E tanks during the inspection, an internal inspection[※] was added to the annual inspections of group A and group C.
 - The long-term integrity of the measurement/confirmation tanks, etc., shall be maintained through regular inspections.
- ※ Visual inspection of areas near the bottom (including paint repairs)

< FY2024 inspection plan >



※ During full inspections (once every 10 years) the tanks are drained and subjected to an internal inspection (thickness measurements, complete repainting, etc.)
 ⇒ Group B targeted during FY2024

➤ Tank inspections to be performed in FY2025 and after are as follows:

	Group A (10 tanks)	Group B (10 tanks)	Group C (10 tanks)
FY2024	Annual inspection (internal inspection added)	Full inspection	Annual inspection (internal inspection added)
FY2025	Annual inspection	Annual inspection	Full inspection
FY2026	Full inspection	Annual inspection	Annual inspection

- **Annual inspection:** Once a year Visual inspection, etc. (In light of the inspection results from this fiscal year, the addition of an internal inspection is being deliberated)

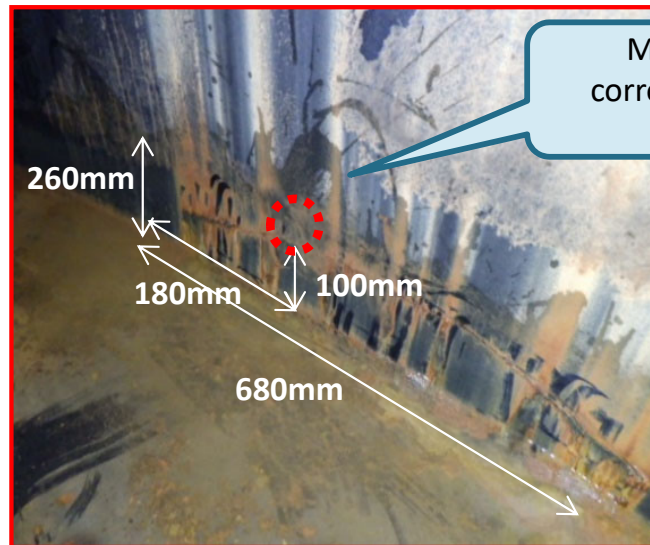
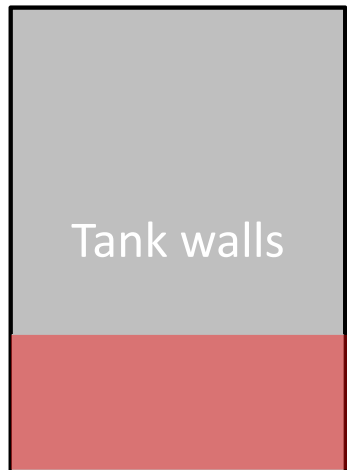
- **Full inspection:** Once every 10 years Visual inspection + Internal inspection (thickness measurements, bottom plate thickness measurements, paint repairs, etc.)

⇒ Refer to slide 8 for details on inspection contents

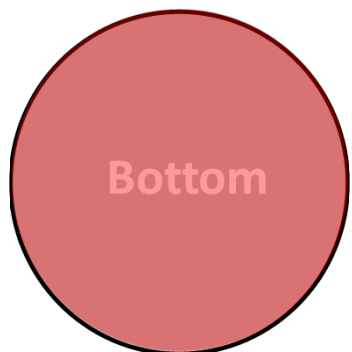
4. K4-Group C tank (measurement/confirmation facility) inspection results

- Between September~October 2024, the tanks were drained and an internal inspection was performed
- Some paint peeling, rust, and slight corrosion was found at the bottom of the walls of the tanks, but there was no thinning as seen in K4-Group E, and ultrasonic thickness measurements of the tank walls confirmed that thickness exceeds requirements. ※
- Group C has been repainted and repaired. (Reference 3)

※ Required thickness (implementation plan): Tank bottom plate: 3 mm, Tank walls: 10.2 mm



Minimum thickness at the place where the most corrosion/thinning was found in K4 (group C) tank C5:
12.89mm (required thickness: 10.2mm)



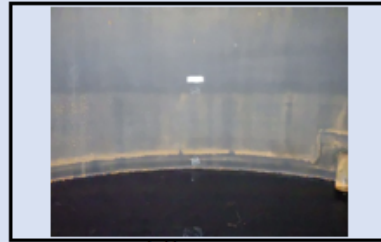
[Reference 3] K4-Group C tanks (Excerpt from C5 tank results) **TEPCO**

➤ Paint cracks and base material rust was removed and the areas were repainted. (Target paint thickness: 500μm)

Prior to repainting



Tank walls 0°



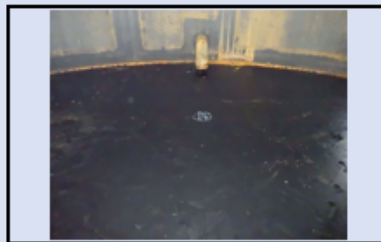
Tank walls 90°



Tank walls 180°



Tank walls 270°



Tank bottom 0°



Tank bottom 90°

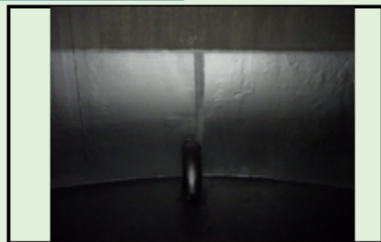


Tank bottom 180°

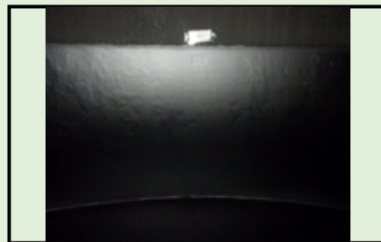


Tank bottom 270°

After repainting



Tank walls 0°



Tank walls 90°



Tank walls 180°



Tank walls 270°



Tank bottom 0°



Tank bottom 90°



Tank bottom 180°



Tank bottom 270°

5. Inspections of welded tanks used to store ALPS-treated water **TEPCO**

➤ The service life of welded tanks is 20 years according to design since they are made thick in consideration of paint specifications and corrosion, however by performing regular visual and internal inspections (refer to the chart below) before the service life is met, we are striving to detect abnormalities early and make appropriate repairs so as to maintain long-term integrity.

※The service life of some tank areas (areas G3, H8, and J1 that were put into use early in 2013) is five years, but we have confirmed through regular inspections and repainting that there are no problems with continued usage.

Inspection Type		Liquid in tanks	Target		Frequency	Inspection details
Annual inspection	① Visual inspection	Implemented regardless of whether or not there is liquid in the tanks	All tanks		Once a year	Outer surface: Checked for deformation, cracks, paint peeling, corrosion, and leaks <u>Target areas</u> Sidewalls, nozzles, bolts/nuts, caulking to prevent rain from seeping into the bottom plate, ancillary facilities (vertical ladders, etc.)
	② Sidewall thickness measurements taken from the outside (ultrasonic flaw detection)		<ul style="list-style-type: none"> • Membrane thickness: Less than 100μm • Thickness allowance: Less than 1mm • Service life: More than 10 years 	Once a year	Sidewalls: Checked to confirm that there is no abnormal thinning	
Full inspection	③ Internal inspection (after draining water) (ultrasonic flaw detection)	No	All tanks	Tanks that have been emptied through the discharge of ALPS-treated water, etc.	Once every 10 years	Sidewalls: Paint blistering, peeling, base material thinning Bottom plate: Same as above (Internal paint membrane thickness measurements, wall thickness measurements)
	④ Underwater internal inspection (submersible ROV)	Yes		Tanks that cannot be drained		Sidewalls: Paint blistering, peeling, base material corrosion Bottom plate: Same as above