# Results of Internal Inspection of ALPS-Treated Water Storage Tanks

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TEPCO

Tokyo Electric Power Company Holdings, Inc.

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- As reported at the team/secretariat meeting on April 25, 2019, when the internal surface of the tanks were inspected to check for corrosion caused by the chemical reaction to hydrogen sulfide, “scrapes and paint chipping” assumedly caused when the tanks were constructed, were found on the bottom surface of the tanks. Therefore, it was decided that an inspection of the internal surfaces of the Sr-treated water storage tanks and multi-nuclide removal system (hereinafter referred to as, “ALPS”)-treated water storage tanks would be conducted.
- As shown in the chart below, the concentration of radioactive substances in the 36 ALPS-treated water storage tanks (G3 west area (Group D)/J1 area (Groups A,C,G,N)) was higher compared to other ALPS-treated water storage tanks due to water that was left over from when the aforementioned tanks were previously used to store RO concentrated brine and Sr-treated water (data released on TEPCO website).

  An ROV (submersible robot) was used to inspect the bottom of the inside of the tanks due to the possibility of accumulated sludge (one reference tank (G3-D1))

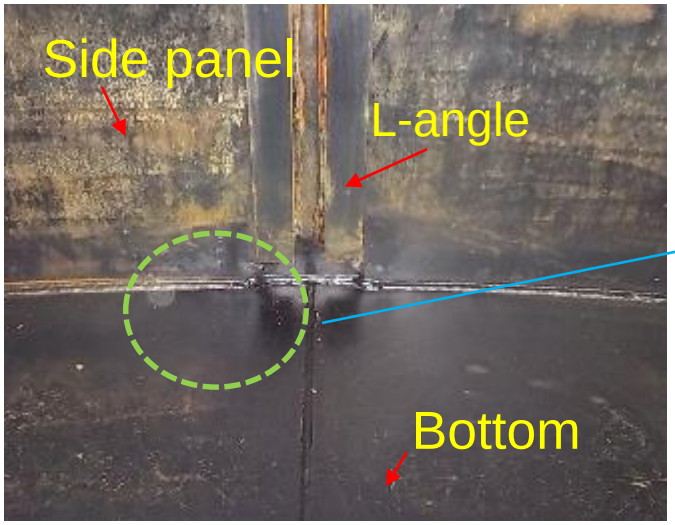
| Tank Group | # of tanks | Storage Amount [$m^3$] | Radioactive substance concentration [Bq/L] | | |
|---|---|---|---|---|---|
| | | | Sr-90 | Cs-134 | Cs-137 |
| G3-D | 7 | Approx. 7,100 | <1.542E+03 | <1.007E+01 | <7.230E+00 |
| J1-A | 8 | Approx. 8,500 | 3.05E+04 | 6.67E+00 | 8.13E+01 |
| J1-C | 9 | Approx. 9,400 | 1.13E+05 | 6.80E+01 | 8.29E+02 |
| J1-G | 9 | Approx. 9,500 | 4.55E+03 | 5.25E+00 | 6.09E+01 |
| J1-N | 3 | Approx. 3,200 | 2.50E-01 | 1.07E-01 | 1.15E+00 |

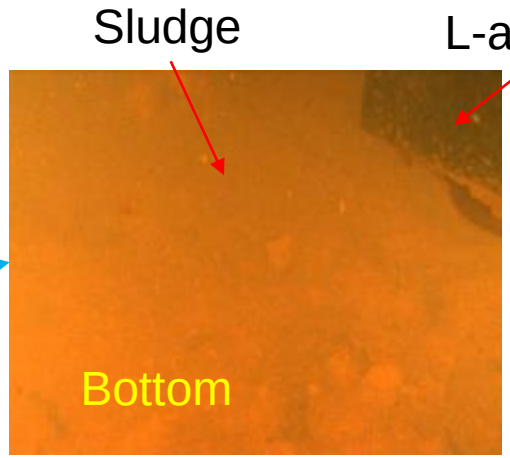
- The internal inspection conducted using an ROV revealed that the bottom of the tanks cannot be observed due to accumulated sludge. The accumulated sludge is, as mentioned above, assumed to be caused by residual Sr-treated water. Therefore, we shall deliberate removing the sludge from the aforementioned 36 tanks to prevent the generation of hydrogen sulfide and also because an internal inspection using an ROV is impossible. (The detailed timeframe for removal of this sludge shall be determined after completion of the treatment of Sr-treated water with ALPS, which is underway at current time.)
- In regards to ALPS-treated water tanks not mentioned above, 24 tanks in the G3 area will be subject to internal inspections using an ROV in October 2020, and inspection plans for other areas shall be created based on the status of these inspections.

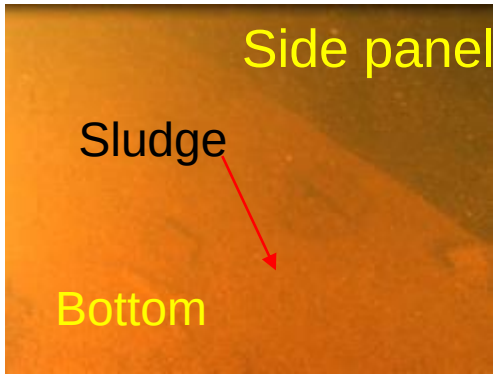
# Results of internal surface inspections of G3 area D1 tank

- An internal surface inspection of the G3-D1 tank conducted using an ROV found the following.
  - Sludge has accumulated over the entire bottom surface of the tank
  - The bottom surface of the tank could not be seen even when the ROV was lowered to the bottom and slid sideways to push some of the sludge out of the way.
- Furthermore, it is assumed that the primary reason why sludge has formed in mixed-water tanks is because, “ferric chloride injected into the RO treatment equipment to protect the RO membrane has coagulated and settled to form crud that has adhered to the multimedia filter (hereinafter referred to as, “MMF”), and some of the crud was transferred to the Sr-treated water tanks via the RO condensed water side during backwashing to eliminate MMF clogs.”

【Reference】Conditions on the bottom of the other tanks (taken after the tanks had been drained)



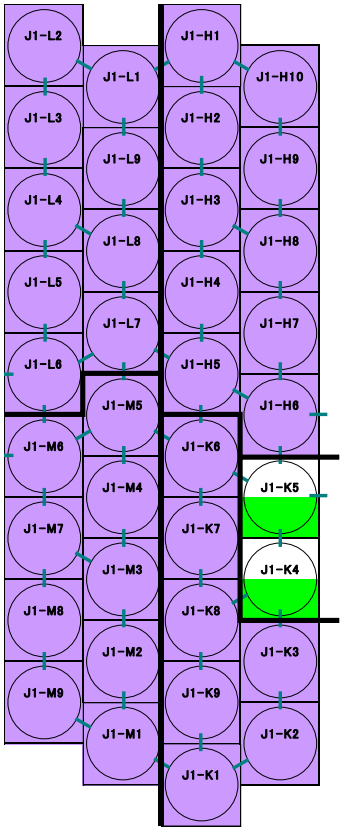

Conditions at the bottom of tanks (photographed during internal surface inspections conducted using an ROV)

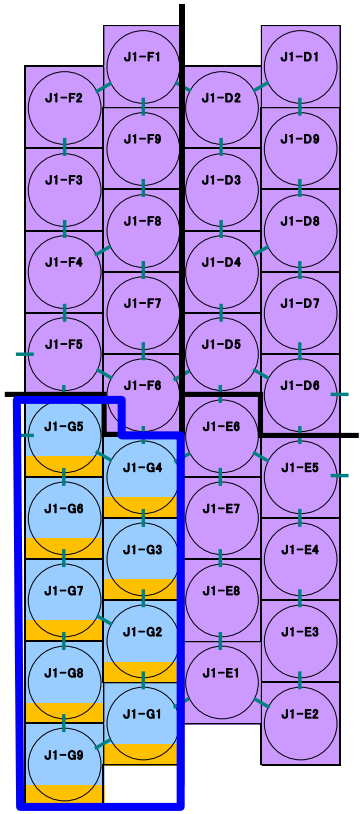
# 【Reference】ALPS-treated water tanks in which sludge has accumulated

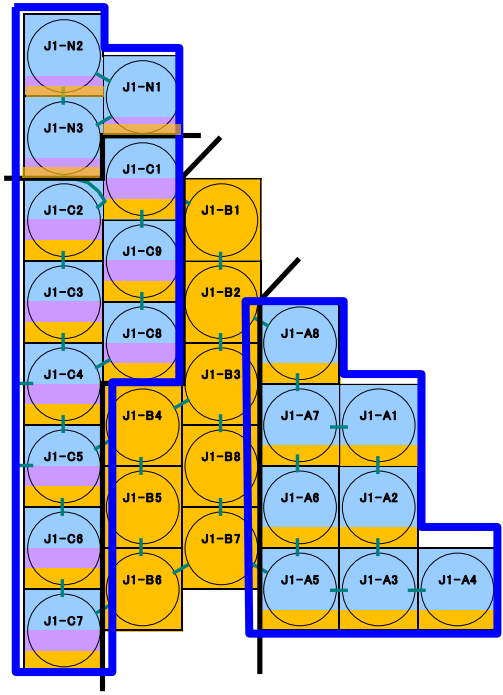
: Inspected tanks

: ALPS-treated water tanks in which it is assumed that sludge has accumulated


G3 Area




J1 Area

Existing ALPS water tanks

Sr-treated water tanks

High-performance ALPS water tanks

Rain water tanks

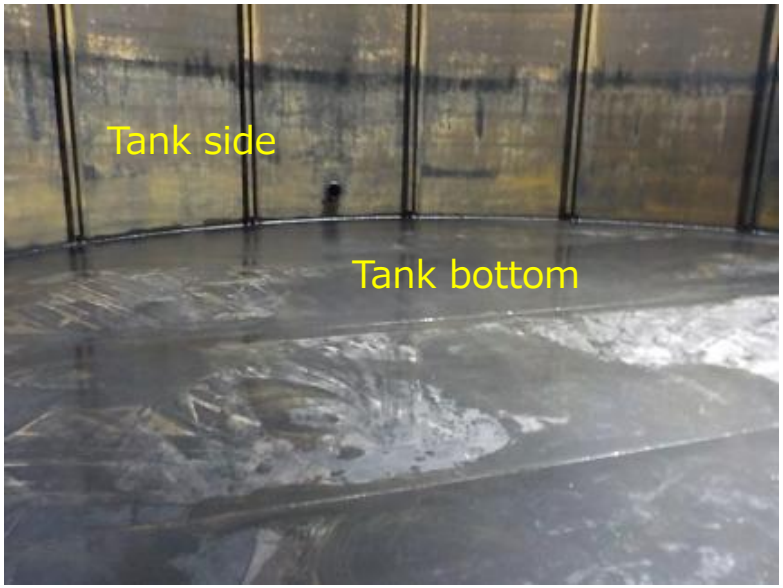
Additionally installed ALPS water tanks

# 【Reference】Results of internal surface inspection of reference tank performed in conjunction with tank internal condition survey

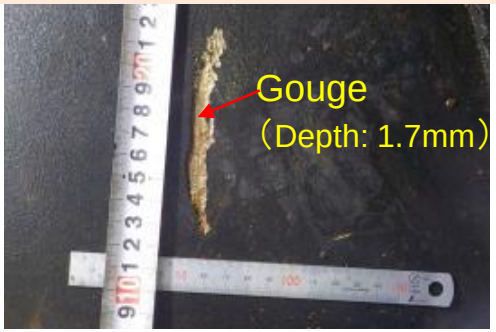
(reprinted from materials distributed during team/secretariat meeting on April 25, 2019)

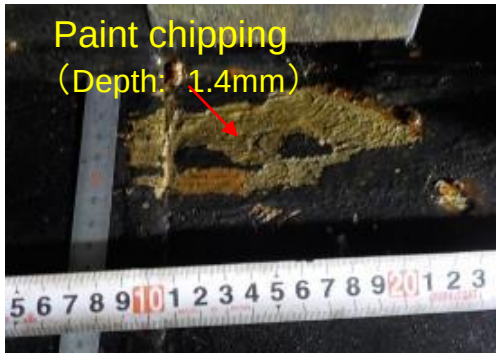
- G3-E5 tank selected as reference tank for internal inspection due to high concentrations of suspended solids and relatively large amounts of sulfate-reducing bacteria found to exist from water analysis tests done on G3 area tanks.
- Sludge recovered from the bottom of the G3-E5 tank and a visual inspection of the inner surface conducted
  - Scratches/gouges (maximum depth: 1.7 mm) and paint chipping assumedly caused during construction found on the bottom. No paint chipping, etc., was found on the side surfaces.
  - No large discrepancies with inspection results from neighboring tanks (G3-F4) in which hydrogen sulfide was not found.
  - Inspection of areas where paint is chipping (locations of corrosion) found that there was no black iron sulfide film, so it was determined that the paint chipping was not caused by sulfate-reducing bacteria. Furthermore, the rate of corrosion of locations of paint chipping assumedly caused during construction is 0.26 mm/year, which is approximately the same as the normal speed of corrosion of carbon steel (less than 0.3 mm/year).

In light of the above inspection results we will continue to use other welded tanks in which Sr-treated water is being stored after draining them to perform internal surface inspections and repair/paint scratches.




Internal surface conditions



Scratches, etc., found at the bottom of the tank

# 【Reference】Impact on welded tanks in other areas by reference tank internal inspection results (scratch countermeasures)

(reprinted from materials distributed during team/secretariat meeting on April 25, 2019)

- Scratches with a depth of 1.7mm on the bottom that were found during internal surface inspections of the G3-E5 tank are not problematic because the plate thickness allowance is 9mm (nominal plate thickness: 12mm-required plate thickness: 3mm), but they will be repaired and painted just to be safe.
- The plate thickness allowance of the bottom plate of other welded tanks (stored water: Sr-treated water, ALPS-treated water) is:
  - 9 mm → G3, G1 south, H1~H6, H8, B, J1~J9, K1 area
  - 19mm → G1 south, H4 south area
  - 22mm → D, G7, H4 south, K2~K4 area

The smallest plate thickness allowance is 9 mm, which is the same as the G3-E5 tank, so there is no problem if there are similar scratches

・At current time there are no leaks from scratches
・Welded tanks in which Sr-treated water is being stored will be drained and the internal surface inspected in conjunction with future ALPS treatment plans
・Welded tanks in which ALPS-treated water is being stored will be subject to internal surface inspections after being drained, or will be inspected using submersible cameras, as part of future long-term inspection plans