Measures for Leakage from the Top Plate of the Upper Part of H6 Area Tank

February 28, 2014

Tokyo Electricity Power Company

TEPCO 東京電力

1. Outlines (1)

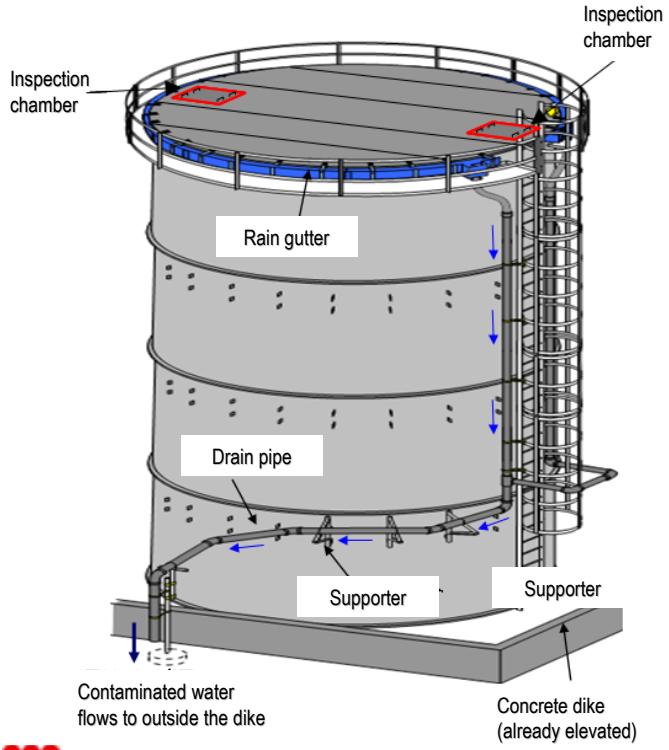
【Leakage from the top plate of the upper part of H6 area tank (leakage status)】

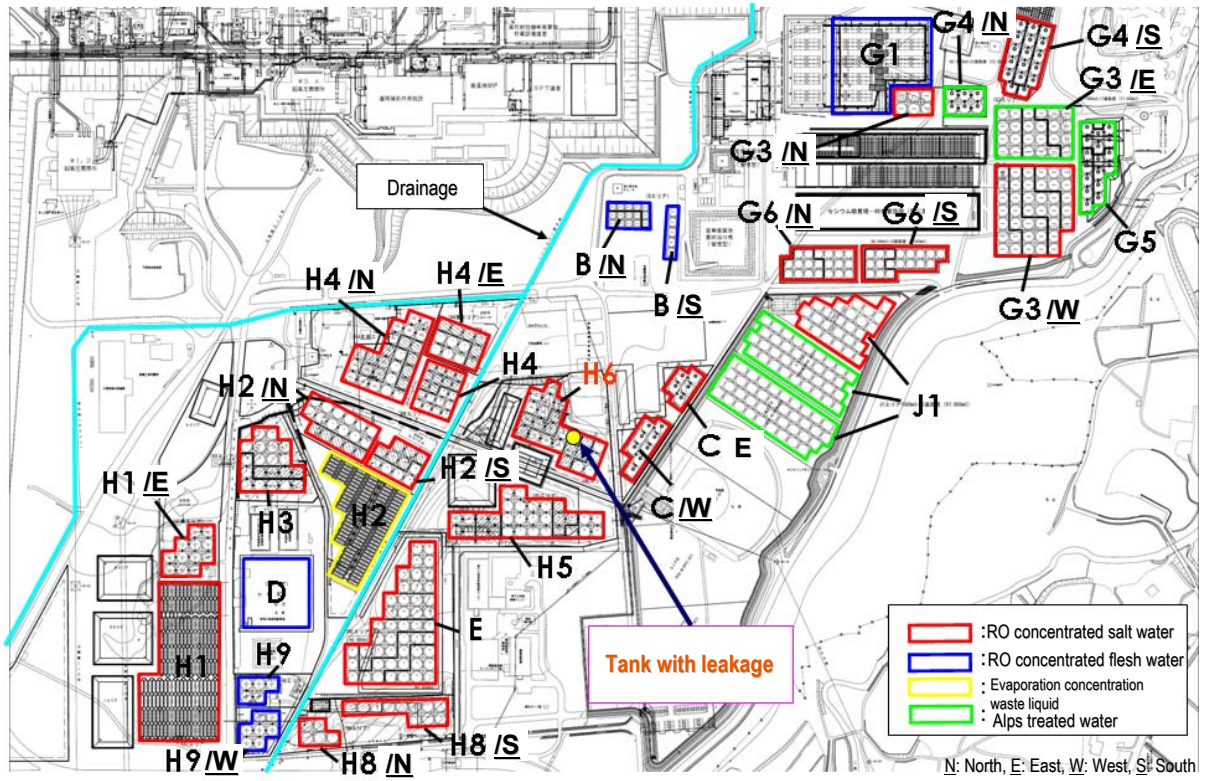
◆ On February 19, at around 23:25, a worker of TEPCO's cooperative company found the leakage on patrol around the tank area.

① Leaked from the top plate of the upper part of the tank and flowed along the rain gutter to outside the dike. Estimated amount of leakage: approx. 100m3

② Radioactivity density of leaked water was Gross β 2.4 x 10^8 Bq/L at max. (Leakage outside the dike). It is estimated that no leaked water was flowed into the ocean as there were no water discharge channels in the area and preventive measures for spreading leakage have been taken.

③ The leaked water remained on the ground in the amount of 43m3 and the neighboring soil in the amount of approx. 130m3 have been collected.



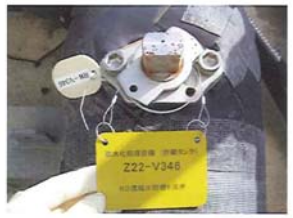


1. Outlines (2)

【Leakage from the top plate of the upper part of H6 area tank (Cause)】

◆ **Contaminated water was originally designed to be transferred to the tank in E area. But at the time the leakage occurred, the system was switched to the design the water to be transferred to the first tank of H6 area, that is, the valve for E area (V346) was "closed" while the valves for H6 (V347) were "opened".**

To note, at the time the leakage was confirmed, the system had been back to the original the water to be transferred to E area.

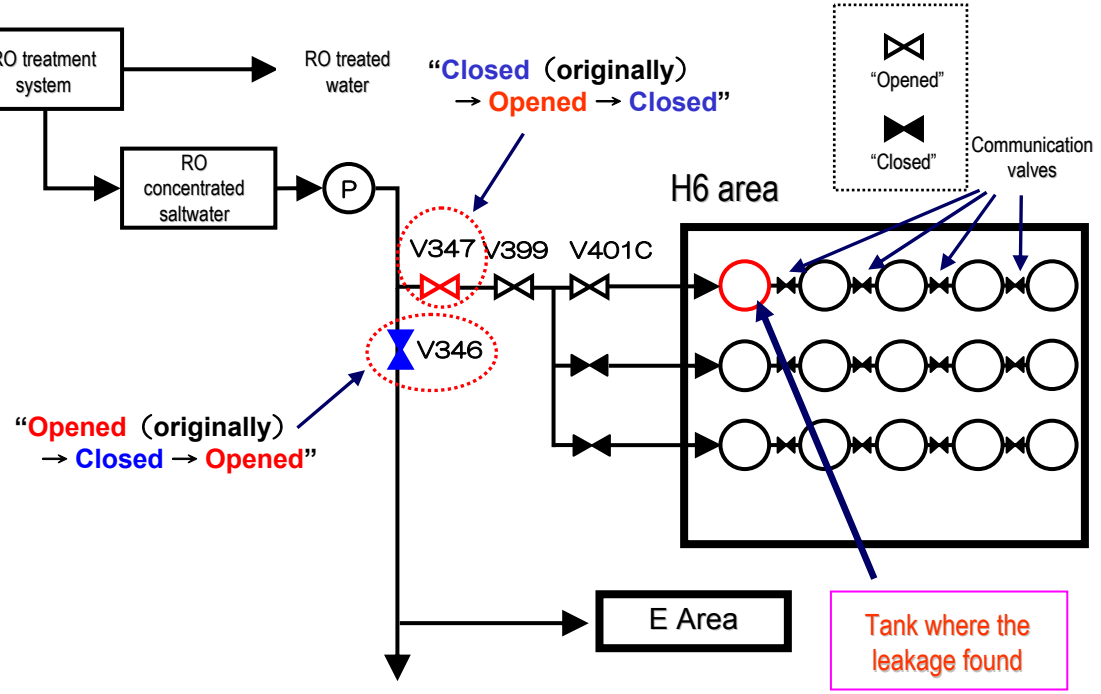


Confirmed V346 "Open"
(Around 11:00AM Feb 19)

Confirmed V346 " Closed"
(0:30AM Feb 20)

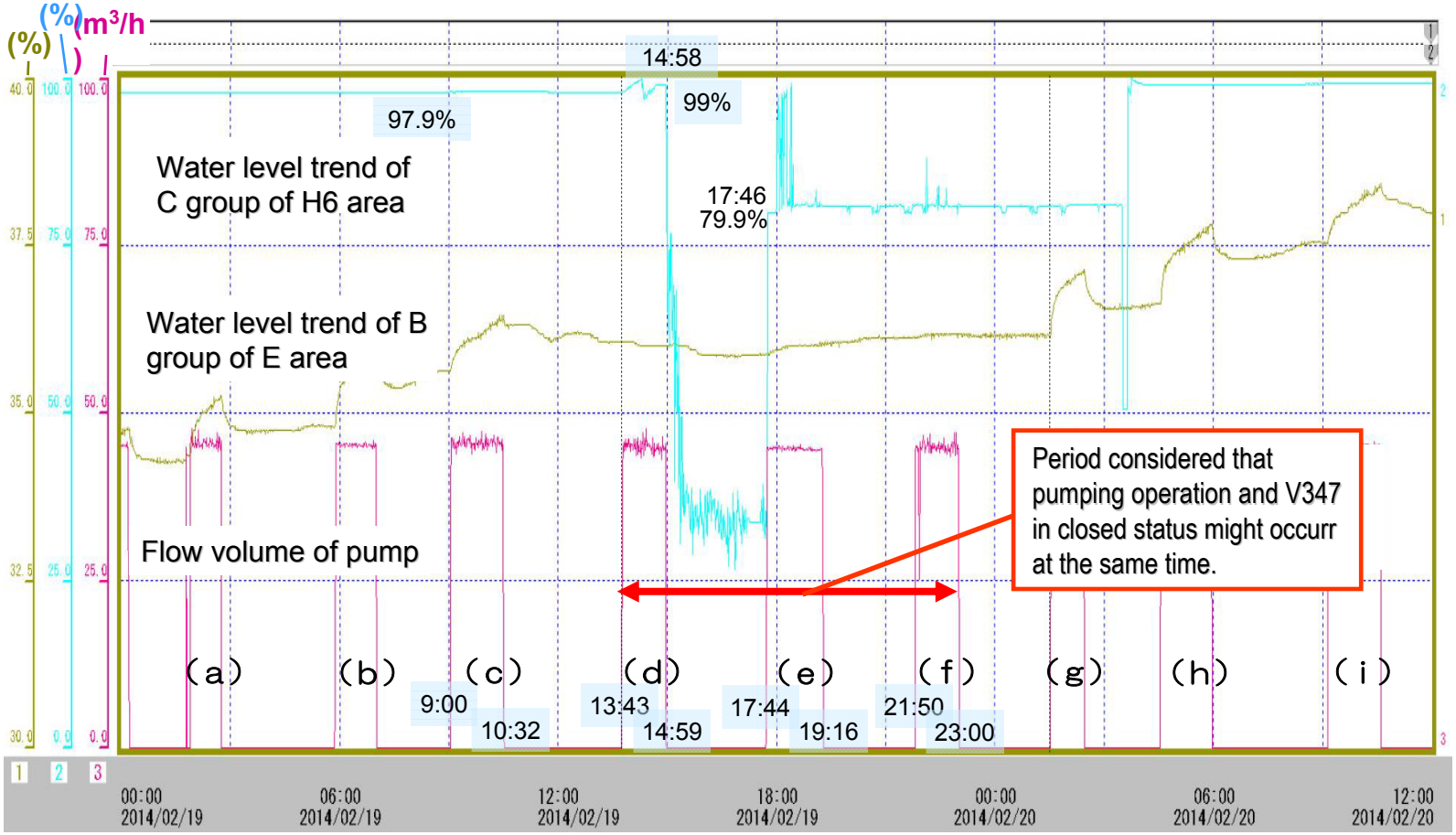
Confirmed V347 " Opened"
(Around 11:00AM Feb 19)

Confirmed V347 "Closed"
(0:30AM Feb 20)



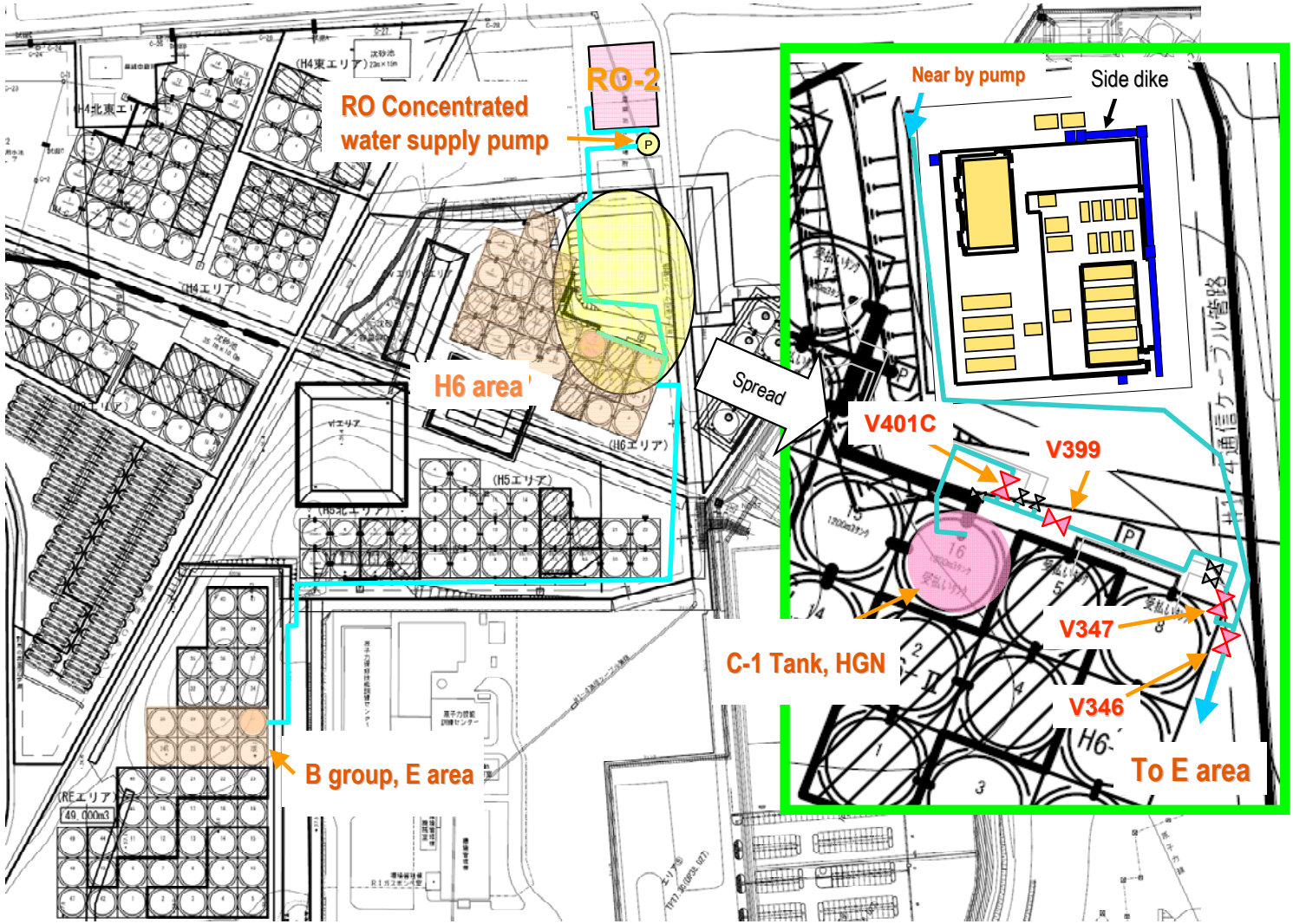
At the time of WG dated Feb 24, it was understood that an instruction to TEPCO dated Apr 17, 2013 was given for V399 and V401 to keep them "Opened" because re-acceptance of water may occur. But, with further investigation, it was then found that the instruction meant the communicating valves of a group of tanks. As for the opening-closing status of V399 and V401, investigation is ongoing.

1. Outlines (3)



Water level of tank in E and H areas and the start-up status of RO concentrated water supply pump

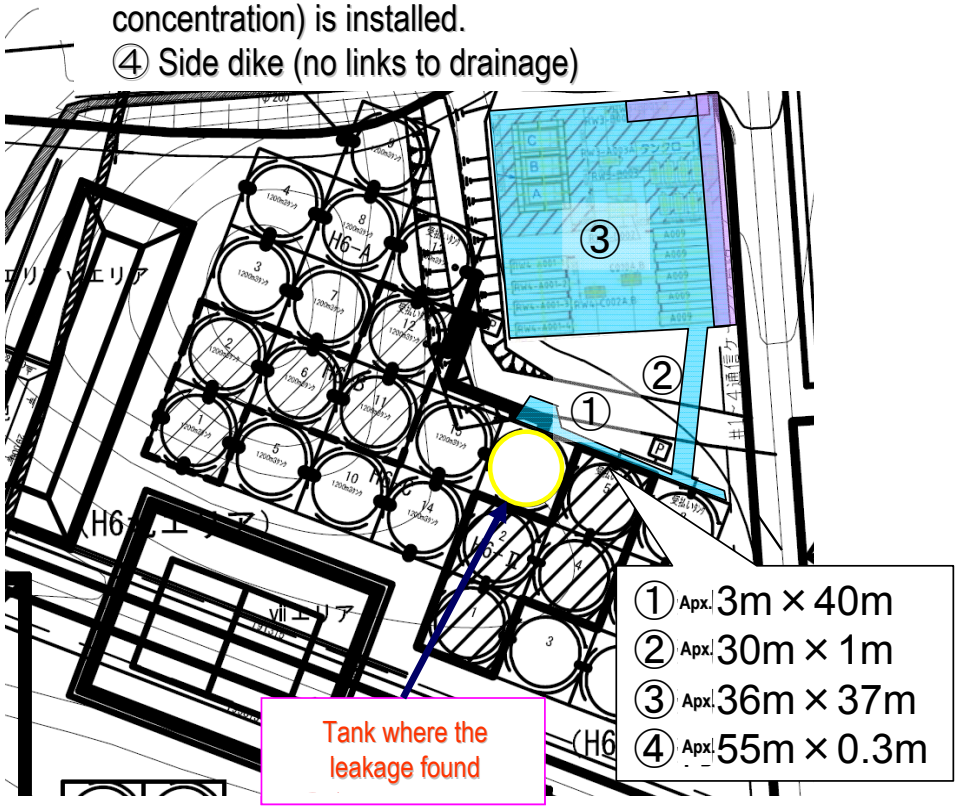
1. Outlines (4)



Pipe Route Layout (RO concentrated water supply pump – H6 Area Tank)

1. Outlines (5)

- Water overflowed outside the dike (Approx. 100m^3)
  ① Around the H6 tank area dike.
  ② U-shaped gutter where electric cables are stored.
  ③ Area where the desalination system (evaporative concentration) is installed.
  ④ Side dike (no links to drainage)



Leakage status (① area)

Leakage status (③area)

Contaminated Water Leakage area

2. Actions to prevent spreading contaminated water leakage

To prevent spreading contamination by leaked water, removal of contamination sources and monitoring measures were taken as follows:

①Collection of water remained

- By February 21, of approx. 100m^3 of the contaminated water leaked to outside the dike, approx. 42m^3 have been collected.
- In future, since seeping out of neighboring soil, etc. attributed to the contaminated water may cause accumulation of water in the side dike of the leakage area, routine check will be conducted to collect the water as necessary.

②Collection of soil

- Collection of approx. 130m^3 of contaminated soil was done.
- Collection of contaminated soil is underway with heavy machinery.
- For the spot hard to handle with heavy machinery due to obstacles lying such as piping, etc., the soil collection will be conducted after such obstacles were removed. Currently, rearrangement/removal of piping is underway.
- Separately, the collection range is being studied in light of the contamination status.

③Installation of monitoring holes and well points

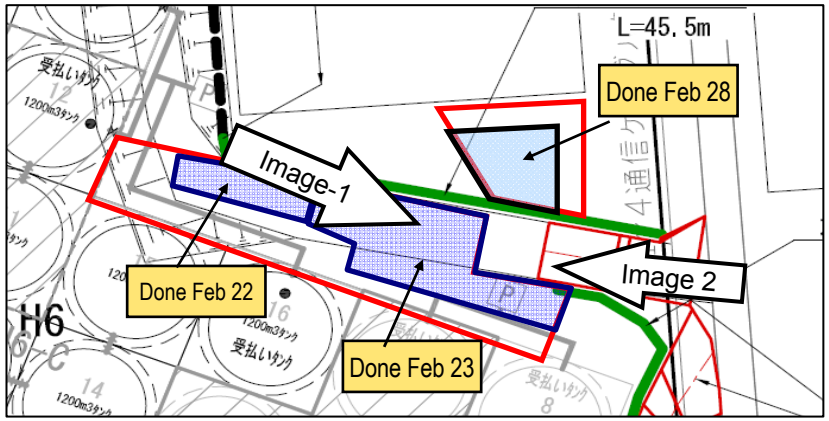
・Installation of groundwater observation holes

- Installation of groundwater observation holes to monitor contamination status of groundwater has been started.
- Observation holes are to be installed in the area where the leakage occurred and at the down stream of groundwater (three locations in total).

・Installation of well points

- Planning of the installation of well points beforehand is underway to prepare for the case where contamination of groundwater is confirmed.
- Relevant equipment has been arranged. Installation work will be started in line with the progress status of soil collection and installation work of observation holes.

(Reference) Removal of contaminated soil



3. Causes and measures

Immediate causes of the leakage of this time are as follows:

- The following two symptoms indicating abnormalities of the facilities were overlooked to take appropriate actions to handle them, which resulted in failing to prevent the leakage of contaminated water.
  - Despite the fact that contaminated water was delivered to E area tank, the water level of the tank in question didn't rise.
  - Warning alarm for "Water level high-high" was on due to contaminated water delivering to H6 tank area.
- The open-close of valves was not controlled.

The following measures will be taken to prevent recurrence of contaminated water leakage in future.

- Handling of abnormal symptoms
- Handling of the open-close operation of valves

In addition, sincerely accepting the leakage of this time, not only sticking to the measures mentioned above, further comprehensive measures to prevent contaminated water leakage will be continuously studied to implement.

4. Inadequate response to abnormal symptoms (1)

With regard to contaminated water leakage of this time, although two abnormal symptoms were shown in terms of the facilities condition, both were overlooked. As a result, the leakage of contaminated water was not able to be avoided.

- **Despite the fact that contaminated water was delivered to E area tank, the water level of the tank in question didn't rise.**
  - In usual circumstances, when no tendency of rising water level was observed while grasping the water delivering status, on-site check should be made. But, in this case, since the tank level was not monitored with a trend within an appropriate range, a symptom showing abnormality in the move of a particular tendency was overlooked to take necessary actions such as on-site check, etc.
- **Warning alarm informing "Water level high-high" for the tank was on due to contaminated water being delivered to H6 tank area.**
  - In usual circumstances, firstly stop the supply pump, and then the actual water level should be checked from the top plate. But, since the water level indicator showed a phenomenon of extreme down or decrease in water level after the alarm of "Water level high-high" was given, and the fact that there was no abnormalities, such as leakage, discovered through checking around the tank in question, it was misjudged as a trouble with instrumentation system.

Keeping in mind these problems, the following measures will be taken to address any abnormal symptoms appropriately without fail in order to prevent reoccurrence of contaminated water leakage again.

4. Inadequate response to abnormal symptoms (2)

① Improvement of sensitivity

・Strengthening of monitoring system

- Monitor the interfacing between the operation of contaminated water supply pump and the water level in the tank to which the water is delivered on a regular basis (every one hour), If any abnormality found, inform the function in charge.
- In the case where the interfacing shows obvious abnormality, stop the supply pump and check the system composition (the status of opening-closing of valves and transfer line) on site.
- In the case where an alarm indicating “water level high-high” is given, stop the supply pump and check the system composition (the status of opening-closing of valves and transfer line) and the water levels in tank from the top plate on site.

  *The above three actions have been reflected on the manual and revised on Feb. 23
- Monitor the water level in tank by not only the person on duty of Water treatment control room but also the person on duty of Main Anti-Earthquake Building, to work it double check function.

・Training (commenced from early in March)

- Understanding that the delivering of contaminated water is extremely crucial in terms of safety, retraining of the cooperative companies’ workers as well as TEPCO employees who are engaged in the operation will be continuously conducted based on the examples of the contaminated water leakage ever occurred.
- To enhance the awareness to the above measures, reading together of relevant procedures will be made among workers repeatedly to be able to follow the operational procedures without fail at actual work.

4. Inadequate response to abnormal symptoms (3)

② Improvement of control systems

- **Improvement of the control systems for leakage alarming for all water level indicators.**
  - At present, every tank except for the first tank is designed to give an alarm depending on the water level drop rate in terms of water leakage detection, whereas the first tank is for high water level in terms of water overflow prevention.
  - To make an improvement, the system will be redesigned to be able to give an alarm for both case of the high water level and the water level drop rate in terms of water over flow prevention and leakage detection, which will be applied to all of the tanks.
- **Improvement of the control systems to prevent contaminated water overflow from tank.**
  - The existing interlocks to stop the supply pump respond only to a signal indicating high water level of the first tank of a tank group to which the water is delivered.
  - In addition to the above, an interlock to forcibly stop the supply pump with a signal for high water level will be installed to every first tank of tank groups to which water is not designated to be delivered. (planned to be addressed in late March)

5. Measures to control the opening/closing operation of valves

As a background factor of having brought this accident, it can be taken up that the circumstances had allowed an easy operation of opening and closing the valves. To prevent recurrence of a similar type of the leakage in future, the following measures will be taken to stop easy access to the valves for opening and closing.

① Prevention of operational error

- **Implementation of locking control of the valves (planning to be implemented early in March)**
  - Lock the valves not to be able to be opened easily.
  - Handling of the corresponding key is limited to the person in charge of the operation.

Before locking

After locking

5. Measures to control the opening/closing operation of valves

② Strengthening of monitoring activities

・To all the tank areas, on-site patrol will be strengthened in addition to a routine patrol in tank area as follows: (Commenced from February 21, which will be continued for a while)

- Patrol by the person on duty (TEPCO's employees) (frequency: twice/day)
- Patrol by the recovery team (TEPCO's employees) (frequency: twice/day)
- Patrol by the protection control (TEPCO's employees and entrusted employees) (patrol frequency will be increased)

・Addition of recording function to the surveillance camera for the area of the water treatment facilities.

- Recording function was added to the surveillance cameras installed in the existing tank areas (done on February 26)
- Any surveillance camera to be newly installed will be equipped with recording function. (every time a new area starts to be operated)
- More surveillance cameras will be installed to the tank areas (planning to be done by May)
- Under consideration of having blighter illumination for monitoring at night.

・Control of closing of all isolation valves

- Isolation valves of the area (group of tanks) where water delivery has been completed will be controlled in a closed position. (relevant manual was revised on February 25, and on-site check has been done)
- The status of the isolation valves will be checked on a daily patrol.

(Reference) Investigation structure

Investigation structure

・Investigation structure will be established under the responsible of the Internal audit & Management of Quality & Safety Dept. of the Head Office who is in charge of TEPCO's operational quality control.

・Investigation team consists of eight staffs of the Internal audit & Management of Quality & Safety Dept. and two staffs of the Engineering, Quality and Safety Management Dept., with consultation to experts.