① Accumulation of contaminated water

【Current situation】

There exist highly radioactive materials, mainly molten fuel, inside the Fukushima Daiichi Nuclear Power Plants as contaminants and approx. 400 tons of water is continuously poured into the buildings every day to cool them. The water is contaminated by the molten fuel. Added to that, approx. 400 tons of groundwater flowing into the basements of the buildings also becomes contaminated due to cracks in the containment vessels. Therefore, approx. 800 tons of contaminated water is pumped up every day and treated by cesium removal and desalination equipment. After that, approx. 400 tons of water goes to tanks for storage and the rest of the treated water is reused for cooling.

There are several types of tanks used for storage of the treated water and leaks have occurred from bolted storage tanks. To mitigate the risk of leaks from the same type of tanks, installation of a welded type of tanks will be accelerated as much as possible. At this moment, it is expected to take about 6 months to install the welded storage tanks after they are ordered. The volume of the tanks will be approx. 1000 tons each; the diameter is approx. 12 meters; the height is approx. 10 meters. See the photo below. The bolted type of tanks will be replaced by the welded ones in the future. Moreover, patrol measures will be strengthened since risks of leaks from tanks or pipes cannot be reduced to zero even after the replacement. Also, water gauges and leak detectors will be installed in case leaks occur from tanks or pipes so as to take measures at the early stage of leaks and to prevent the contamination of the nearby soil.

Welded type of tanks

【Technologies needed】

（1）Requirements for the welded type of tanks

- To accelerate the replacement of tanks, the term for delivery of parts and construction of each tank needs to be shortened compared to the current situation. (Goal: less than 5 months from the order to install)
- Contaminated water （Cs137：10^4Bq/l, Sr90:10^8Bq/l） can be safely stored in the tanks.
- Proof against leakage can be assured for more than 10 years without any need to inspect the inside and/or repair the tanks.
- The tanks need to be effectively stored inside the limited site area. (Standard: cylindrical steel tanks with a volume of 1000 tons)
- The tanks need to be able to withstand considerable earthquakes (more than 0.36 G) and be able to contain with water without leakage.
- If possible, the tanks should be able to shield Bremsstrahlung X-rays which are produced inside the tanks.

（2）Other requirements for tanks

- Other methods than stated in （1） to store large amounts of contaminated water safely for a long period of time, including methods using other than tanks, can be proposed, e.g. increasing the size of the tanks; the use of deep underground areas; the use of offshore tankers, etc.

(Note that there is currently no area for offshore tankers to be installed inside the harbor so that conditions need to be checked for their installation outside the harbor.)

- If any, methods which can deal with land subsidence are desirable.

(3) Technologies for detection of minor leaks

Improvement in the detection ability of beta rays on patrol

- Surface contamination density of beta rays (Bq/cm^2) can be measured by removing the effect of radiation by gamma rays (approx. 50 μSv/h of 1 cm dose equivalent).
- The detectors need to be light and portable for workers. (A dramatic weight reduction from the current weight of 10 kg is expected.)

Improvement in visibility of leaks from tanks

- By coloring contaminated water, it will be possible to differentiate between contaminated and rainwater puddles around tanks.
- Radioactive materials need to be removed from contaminated water without any difficulty caused by colorants.
- Colorants need to be removed and cause no serious harm to the environment.

(4) Facilitating removal of the bolted type of tanks

- After removal of water from tanks, radioactive materials on the wall surface and the bottom surface need to be swiftly removed.
- By shortening working time or using remote control, radiation exposure of workers needs to be mitigated.
- Radioactive filters that were used for removing radioactive materials, etc. need to be stored and managed for a long period of time.