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Groundwater pollution and the prospects of the Fukushima Daiichi NPS

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Contaminated groundwater problems at Fukushima Daiichi Nuclear Power Station and countermeasures for them have been reported in various ways since its accident on March 11, 2011. However, it seems that few reports accurately describe the local natural environment, and the purpose and conditions of countermeasures for contaminated groundwater (Marui, 2014). Consequently, many misunderstandings have occurred and many proposals and criticisms have been made in the media. In this report, based on the latest knowledge on the local geological and groundwater conditions, current problems and countermeasures taken are described considering the long-term plan of the national government and Tokyo Electric Power Company for reactor decommissioning, and future challenges are discussed based on them.

The current position and volume of contaminated water; The trench means a kind of tunnel from the building to the sea, through which pipes and wires run. It became widely known because contaminated water leaked out immediately after the accident and contaminated the surrounding soil and sea. Although the surrounding soil was improved using water glass (chemical feeding), 11,000 tons of contaminated water still remains in it as of October 2014. The contaminated water flew out directly from the turbine building, and high concentration contaminated water exist in the trench. Currently, the trench is isolated from the buildings with the frozen soil method, and countermeasures to remove the internal contaminated water are being taken with a method of filling in the trench.

There are melt-down fuels in the reactor, which are being cooled every day. Consequently, a large amount of contaminated water that leaked out from the reactor exists in the reactor buildings and the turbine buildings next to them. In addition, because measures to prevent the leakage of contaminated water from the buildings are taken by letting surrounding groundwater leak into the buildings, contaminated water is increasing by about 400m3 per day (groundwater in middle-grained sandstone beds flows into the buildings). To treat it and transfer it to the tanks, the process building and the HTI building are also temporarily used for storage of contaminated water. It is estimated that about 89,300m3 of contaminated water exists in these buildings currently, and prompt treatment is desired.

The place where the largest amount of contaminated water is stored is the land-based tanks. It is said that they hold about 200,000 tons of contaminated water treated using radioactive material removal equipment (described later) and about 360,000 tons of high concentration contaminated water that waits for treatment or that has been treated. Because 400 tons per day of surrounding groundwater flows into the buildings, contaminated water is anticipated to increase by about 130,000 tons per year. This would be an appropriate estimate because in addition to a large amount of contaminated water generated for cooling at the early stage of the accident, more than three and half years have passed since the accident.

For decommissioning, debris which melted down has to be retrieved finally. Countermeasures for contaminated groundwater are discussed below considering what should be done and the steps to be adopted for retrieval. The overall decommissioning plan is as follows:

1) Drying-up:
2) Circulative cooling:
3) Retrieval of debris:

Based on the current conditions, it is scheduled that dry-up is finished within 10 years after the accident, circulative cooling is performed for about 15 years after then, and debris is retrieved during the next 15 years or more. Because there are many technologies to be developed and many challenges found at present (contaminated groundwater problems, etc.), it is inevitable that completion of decommissioning will become in the latter half of this century.

I will discuss about the condition of groundwater, countermeasures and prospectives at the NPS.

Keywords: Fukushima Daiichi NPS, East Japan Great Earthquake, Groundwater, Pollution, Radioactive contamination, Countermeasures