The Chuetsu Offshore Earthquake and water cutoff countermeasures created for small-scale water supply systems

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1. Introduction

The Chuetsu Offshore Earthquake struck the Chuetsu area of Niigata Prefecture on the 16th of July 2007. Coincidentally, it was 'Ocean Day', a national holiday in Japan.

The damage to the area was gravely serious, because it was the season in which water consumption was at its peak, therefore securing a stable water supply, as a stopgap measure, became important.

This area had already suffered during the Chuetsu Earthquake in 2004, which had showed the necessity for water in the times of disaster.

Following is a report on the role of tank-based water supply systems in an emergency situation.

2. Survey area and durations

Surveys were conducted from July 16 th to October 30 th, 2007, in Kashiwazaki City and Kariya Village. There are 471 water tanks located in the area, including 142 small-scale private water supply systems. The surveys focused on 62 facilities (62 water tanks and 25 elevated water tanks).

3. Survey details

	Survey Subject	Methods	Details of the survey
1	Damage to facilities	On-site inspection	1) Installation of the earthquake-resistant pipes at tanks 2) Damage to the water tank systems (figure 1)
2	Facility use		3) Changes in number of residents at the shelter and of water supply 4) Volume of water consumption, volume of water supplied by water trucks and volume of water stored in water tanks
3	Initial response/action of facility management	Interviews	5) Initial responses, restrictions on water consumption, management of feed valves, the damaged sections, the presence or absence of earthquake-resistant pipes, the condition of infrastructure lifelines (electricity and water supply)

4. Results of the facility-damage surveys and the initial responses/actions after the earthquake

4.1 The damage to the facilities

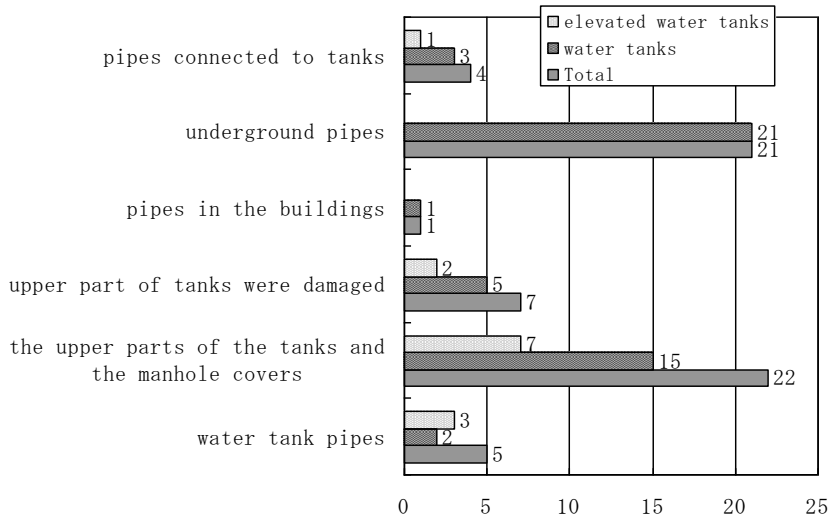
1) 47 (54%) of the 62 water tanks and 25 elevated water tanks had 3-point earthquake-resistant measures (at the outlets, drains and connecting pipes). And 36 (41%) of those tanks were fixed types which had no earthquake-resistant measures in place, or only partial earthquake-resistant measures in place (excluding underground types).

5 tanks had damage at the pipes. 2 of which were the fixed types. Another 2 tanks were partially earthquake-resistant. Although the remaining tank was designed to be fully earthquake-resistant, this tank was outdated-made in 1970. Effectiveness of earthquake-resistant pipes can be verified from the results of this survey.

2) Figure 1 shows the location and amount of damage to the private water supply systems. The most damaged areas were around the upper regions of the tanks and the manholes. Those totaled 22. As for the underground pipes, the most damaged parts were the water supply pipes near the buildings-pipes from the public waterworks to the water tank and facets-which totaled 21.

Many tanks had damage to parts above the tank's water level at the time of the earthquake. Also there was damage found at hot water yanks, cooling towers, and within the plumbing of water sprinkler systems.

Figure 1 Number of damaged parts from the connection at public waterworks to private water supply systems



4.2 Facility use

3) The number of residents that used the emergency shelters peaked on July 16th and 17th, decreasing from the 18th (the 3rd day after the earthquake). However, the amount of water supplied by the water tanker trucks peaked from July 20 to 23. After those peaks, the water supply started to recover.

4) According to the results of the survey, the amount of water supplied by public waterworks, water supplied by water tanker trucks, and water in tanks, totaled 60% of the total water consumed in the same month the previous year. The amount of water in supply on the first week just after the earthquake totaled less than 20% of the same period the previous year, highlighting the importance of water reserves of the water tanks.

4.3 The initial responses/action of the facility management (appropriate measures)

Case 1 There was a leak in the underground pipes, but the tank was left intact. The staff shut off the affected pipe valve and prevented an outflow.

Case 2 The upper part of a water tank was damaged. Staff covered the damaged upper section with a waterproof canvas sheet to avoid contamination from a nearby air conditioning unit.

Case 3 Staff organized a team, and installed a water intake valve in a water tank as an emergency measure.

5. Discussion and the countermeasures hereafter

The survey reconfirmed the effectiveness of the properly installed earthquake-resistant pipes in water tanks. It also highlighted the many cases in which reservoir water was wasted due to inappropriate action and thusly recommends the following action be taken.

Initial responses

1. Turn off the power supply to pumps and inspect for leakage of water before recovery of power or start of the independent power generation.
2. Shut off the valves from water tanks and elevated water tanks and inspect for leaks before re-opening.
3. Inspect the water pipes from the tanks, including the underground as fast as possible to prevent leakage of water.
4. Shut off the primary valves of water tank and inspect the water tank to prevent inflow of muddy water.
5. Inspect the upper part of the tank to prevent contamination.

Improvement of the water tank system

1. Replace the drain, water supply pipes and connecting pipes with flexible pipes.
2. Take countermeasures against the leakage of water at the upper part of the water tank.

And make the penetration holes for the pipes large enough to prevent damage.

3. Locate the underground pipes and take countermeasures against leakage of water.

(Countermeasures such as the earthquake-resistant joints, the uncovered pipes on the ground or in the buildings and the valves to shut off to stop a leakage of water are recommended.)

6. Conclusion

While many municipalities are installing new large underground water tanks as a countermeasure for disasters, the importance of existing water reservoirs in the water tanks was verified in this report.

Of equal importance was the necessity for earthquake-resistant pipes and an appropriate initial response in times of disaster.

In conclusion, a combined effort by waterworks bureaus and water management staff is necessary for drilling the efficient use of water tanks and water reservoirs at shelters in times of disaster.