Q&A

31Q5: NRW ratio is 50% around in our water supply. I want to know a method of NRW reduction. (S.K., Bangladesh)

A1: Countermeasures to reduce non revenue water

1) At first, top management of water supply utility should recognize that their utility has high non revenue water and the fact that such high non revenue water (NRW) may cause lack of water resources, lack of energy and worth management. A department director of the counterpart organization, which I had been dispatched before, said “Our utility has no water leakage upon the ground nor leakage under the ground”. Another department director did not accept the fact even though the JICA expert team showed leakage points on a map with photographs of the sites. We showed how much water was leaked with movies. Finally, they understood that they wasted water resources, money and energy and how important reducing non revenue water is.

2) After the utility started reducing non revenue water, grasping contents of non revenue The utility should find which part is wasting more water.
water is necessary. According to “Standard IWA/AWWA methodology of balancing consumption and water losses” shown in Fig 1.

<table>
<tr><td rowspan="8">System Input Volume</td><td rowspan="3">Authorized Consumption</td><td rowspan="2">Billed Authorized Consumption</td><td>Billed Metered Consumption (readings of the consumer water meters)</td><td rowspan="2">Revenue Water</td></tr>
<tr><td>Billed Un-metered Consumption (Estimates of Consumption)</td></tr>
<tr><td rowspan="2">Unbilled Authorized Consumption</td><td>Unbilled Metered Consumption</td><td rowspan="6">Non Revenue Water(NRW)</td></tr>
<tr><td>Unbilled Un-metered Consumption</td></tr>
<tr><td rowspan="5">Water Losses</td><td rowspan="2">Apparent Losses</td><td>Unauthorized consumption</td></tr>
<tr><td>Customer Metered Inaccuracies and Data Handling Errors</td></tr>
<tr><td rowspan="3">Real Losses</td><td>Leakage in Transmission and Distribution Mains</td></tr>
<tr><td>Storage Leaks and Overflows from Water Storage Tanks</td></tr>
<tr><td>Service Connections Leaks up to the Water meter</td></tr>
</table>

Figure-1. Standard IWA/AWWA methodology of balancing consumption and water losses

The utility should find which part is wasting more water. Baseline condition should be surveyed in a districted metered area (DMA) which is planned before the surveillance.

Minimum night flow is measured from 2am to 4am when water is slightly used. The measured flow is a part of water losses. With the measured amount, water supply utility makes a plan how to reduce water losses and proceeds it. Amount of water which is used in distribution network or treatment plant (unbilled un-metered consumption), insensitive water to meter, illegal connected water (stolen water or unauthorized water), leakage upon the ground and leakage under the ground, etc. should be also surveyed.
For accuracy of water meter, acceptable error is decided as ±2% by the law in Japan. Such criteria should be set because there is no such law or regulation in many developing countries.
For illegal connection, staff should have enough communication with illegal users to explain the meaning of surveillance while meter reading or surveillance of water losses. In my experience, a staff member of water supply was arrested by the police while he explained to the user about illegal connection that he found. I heard that high-ranking officials and rich families make illegal connection more than ordinary people in that country.
In Japan, service pipe between distribution pipe and water is managed by water supply utility. On the other hand, a customer repairs the leakage from service pipe in some developing country. In such country, ownership of piping is not decided or staff of water supply does not know the regulation even there is the regulation on ownership.

3) Human resources development will be more important. Training on maintenance of distribution network is necessary. Training for meter readers is also necessary to obtain accurate data and inhibit illegal actions. Display of water meter has also a problem. There are some kinds of meters as showing till 1m3, 100L, 10L etc. I have ever seen three kinds of meters were set in one DMA. Same type of meter should be set in a supplying area. However, it is decided under each country's condition and not easy to improve.

4) Leakage should be surveyed in time when water is supplied. There are few countries where leakage is surveyed according to the surveillance plan. For example, a water supply utility surveys leakage from 10am. And no leakage is found because the utility supply water from 5am to 7am, for just 2hours. Then, road is already dried at 10am. The utility can say that there is no leakage upon the ground.
There are many utilities which have no leakage detector or which have no staff to handle the detector properly even they have it. I found some cases that leakage detector was not used: the machine was covered with dust because it had been not used; the machine did not work because cables were broken; staff member could not exchange batteries or

battery was not sold in that area.

5) Appropriate equipment and maintenance for it is important. Polyvinylchloride (PVC) pipe and asbestos cement pipe are popularly used in developing countries. There are many leaking points from joint with these kinds of pipes. Leakage will happen in several years after it is repaired because of less skill of repairing. Many leakage detectors have been provided from Japan to Indonesia. Staff of Indonesian waterworks authority often ask Japanese expert why they cannot find a leakage with the equipment. Provided detectors are matched to finding leakage from iron pipe and staff cannot find the leaking sound from PVC pipe. They need an equipment designed for leakage from PVC pipe. Recently, such equipment, which can show analog and digital result, is developed. With proper equipment and effective plan, leakage should be surveyed.

6) There many utilities which have no pipeline map. Mapping of network is important to reduce water losses. Location, diameter, material and laid year of distribution pipe are very important information to make plan of reducing water losses.

7) Effective countermeasures against water loss are replacing old pipe and appropriate choice of its diameter and material. Using old distribution pipe and service pipe does not contribute to reduce non revenue water. Repairing such pipe is no solution because other leakage may happen soon. Though replacing pipe costs more than repairing, using long life material for new pipe decreases possibility of leakage and reduces total cost. And material with less joint and protecting corrosiveness contribute reducing water losses too. Reducing water losses realize stable supply of safe water. It provides customers enough satisfaction and attracts new customers.

8) Life Cycle Cost (LCC) for 100 years should be considered. LCC for long years is calculated with various kind of material, equipment for network and service pipe. With the result, the best material is chosen for distribution and service pipe. Then LCC can be lower even if the initial cost is higher than usual.

9) Summary: necessary countermeasure against non revenue water.

- Understanding the present condition of NRW and establishing NRW reduction section
- Managing distribution network map
- Surveillance in each DMA

- Managing and exchanging water meter
- Human resources development for staff and construction workers
- Usual management of equipment
- Replacing old pipe
- Considering LCC

(Answerer: Mr. NAKANOSONO Kenji, Mr. SEGAWA Shinta, Yokohama Water Co.,Ltd, 2014)