



Best Practice: Water Leakage Prevention Controls

REPORT UPDATED: MARCH 23, 2010

CITY: TOKYO

POLICY AREAS: ENVIRONMENT; ENERGY

BEST PRACTICE

The City of Tokyo's Bureau of Waterworks leads the world in the field of **detection and control of water leakage** technology. Compared with other large cities, Tokyo maintains an extremely low rate of water leakage from its vast network of underground pipes. Tokyo's water supply serves approximately 12 million residents and water is supplied by four rivers -- Tone, Ara, Tama and Sagami. Untreated water from these rivers is purified through three processes at local plants - coagulation, sedimentation and filtration. It is then pressurized and supplied to customers as tap water through underground pipelines.

The total length of distribution pipes is about 25,262 kilometers. Leakages are repaired on the same day that they are reported. Efforts are made to carry out early detection for leaks and the Bureau regularly replaces pipes and improves pipe materials (i.e. from cast iron to ductile cast iron for distribution pipes). In 1985 there were about 58,000 cases of leakage repair - this dropped to about 15,000 in FY 2008.

ISSUE

Tokyo Metropolitan Government stores and distributes 6.3 million square meters of water per day. A major challenge facing the Bureau of Waterworks is the insufficient intake of water due to river-bed degradation. The Tone river system, which accounts for 80% of the overall water resource of Tokyo, is not as protected against drought as compared to other river systems since dam construction is incomplete and recent changes in precipitation patterns.

As of FY 2008, there were 26,000 kilometers of distribution pipes under the Tokyo metropolitan area. Water pipes laid underground are constantly exposed to the danger of leakage, and the leakage can cause secondary disasters such as poor water flow, road collapse, and flooding of the buildings and inundation.

- In FY 1956 the leakage rate was 20%
- In FY 2008 the leakage rate was 3.1%

Most leakage is caused by:

- 97% cracked or corroded pipes service pipes
- 3% aging distribution pipes

In addition to routine checks and repairs, renewal of aged pipes and replacement of lead feeder pipes with stainless steel pipes are a major priority. This has succeeded in reducing vast amounts of water leakage over the past 50 years.

Amid prospects that climate change will affect water resources, it has become increasingly important to prevent water leakage to ensure maximum utilization of limited water resources. The value of leakage prevention is equivalent to new water resource development.

GOALS AND OBJECTIVES

The overall goals are to make the best use of limited water resources, to adapt to climate change, and to prevent collateral disasters caused by the water leakage such as shortages in water supply, depressions and cracks on surface streets due to groundwater drainage, accidental flooding into buildings and so forth.

Best Practice: Water Leakage Prevention Controls

IMPLEMENTATION

In addition to routine checks and repairs, renewal of aged pipes and replacement of lead feeder pipes with stainless steel pipes is a major priority.

Specific measures include:

- **Underground leakage:** Leaks are detected by using electronic leak detectors. The potential leakage quantity is estimated by using night flow measurement tools.
- **Replacement of pipes and improvement of pipe materials:** From cast iron to ductile cast iron for distribution pipes as these have higher strength and better earthquake resistance; from lead to stainless steel for service pipes laid under public roads.
- **The K-Zero project** (K stands for Keinen-kan in Japanese which means "aged pipes") has been in place since 2002. The project was launched to completely replace existing aged large-diameter pipes (400 mm or over) with new pipes. As of FY 2008, 99% of the old pipes have been replaced.
- **Monitoring of service pipes:** these account for 97% of the total number of leakage repairs so early prevention of leakages is essential.
- **Training and Technical Development Centre:** This newly established centre is charged with preventing leakage through research and development.
- **Computerized system:** This calculates and gathers information on leakages. Data collected includes the causes, details of each repair case, and the cost for repairs.

Energy Saving System

The City's Water Supply Operation Centre manages all data relating to water supply through a computerized system which monitors and controls activities 24 hours a day, 7 days a week. This ensures that water supply is stable from the purification plants and water supply stations. The system contributes to the efficient management of both water supply and pump operation.

Water-saving equipment

The City also requests that manufacturers develop and supply water saving equipment including, taps, tap plugs, toilets, and washing machines. These are being fitted wherever possible throughout the system. Water-saving plugs were also developed and distributed to customers for free.

COST

In FY 2008, Tokyo's Bureau of Waterworks spent 6.0 billion YEN (54.5 million USD) on its water leakage control activities.

RESULTS AND EVALUATION

- The amount of water wasted by the City in the past ten years has been cut almost in half, from 150 million square meters of water to 68 million square meters of water, due to the City's effective method of detecting and repairing leaks
- Tokyo's focus on same-day repair work has helped to drastically reduce the leakage rate, from 20% in 1956 to 3.6% in 2006

Best Practice: Water Leakage Prevention Controls

- The amount of CO2 emissions reduced by diminution of leakage rate is about 65,000 t CO2 (equal to the amount of carbon dioxide emitted by about 28,000 cars)
- The amount of electricity converted from the volume of water prevented from being wasted (with respect to the amount of the wasted in 1956) was about 168MkWh in FY 2008
- The electricity charges saved by diminution of leakage rate (with respect to the amount of the wasted in 1956) is about 2.6 billion yen (23.6 million USD) in FY 2008
- Prevented expense by leakage control was estimated at 11.7 billion yen (106.4 million USD) in FY 2008

TIMELINE

1945	Leakage rate 80%
1955	Leakage rate 20%
1960	Adoption of a ductile iron pipe to a distribution pipe
1980	Adoption of a stainless steel pipe to a service pipe
1992	Leakage rate 10.2%
2007	Leakage rate 3.3%
2008	Leakage rate 3.1%

LEGISLATION

Tokyo Metropolitan Government launched Waterworks programs without legal enforcement.

LESSONS LEARNED

In recent years, leakage prevention efforts have grown increasingly more difficult to maintain at the Bureau of Waterworks due to a decreased number of experienced staff and increased volume of road traffic. With limited staff, the focus is on technology fostered to date.

The Training and Technical Development Center, established in 2005, is one of the largest facilities for waterworks training, research and development in Japan. Staff training is based on real case studies and continues to be critical to the success of the Bureau. The Center is also currently developing new leak detection equipment to improve efficiency.

TRANSFERABILITY

Tokyo's water leakage control activities have been highly successful in both reducing CO2 emissions and in energy and cost savings.

CONTACTS

Tokyo Metropolitan Government Bureau of Waterworks

Sunao Takehi

Director

Investigation section, General Affairs Division

Tel +81-3-5320-6336 Fax +81-3-5388-1678

international_affairs@waterworks.metro.tokyo.jp

Facts and figures in this report were provided by the highlighted city agency to New York City Global Partners.