Strategy for Water Leakage Control in Japan

～ In view of the water resources～

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Contents

Necessity of leakage control

- Leakage causes a lot of losses, because leakage uselessly consumes the purified water produced with labour, time and cost.
- Leakage control corresponds to the development of new water resources. Annual water leakage amount in Japan equals about 10 times of dam volume.
- Leakage prevention can contribute to the global warming countermeasure.
- Leakage does not only brings direct losses to the waterworks, but also causes secondary accidents such as road cave-in, traffic accidents and property damage by flooding.
- There is danger of water quality accidents caused by the invasion of contaminated water from the leaking points into pipes.

Analysis of Supplied Water by JWWA

Supplied water (Distribution input)	Effective water	Accounted - for water	Charged water	Water tariff
			wholesale	To other utilities
			Others	Fire fighting, etc.
		Unaccounted -for water	Customer meter inaccuracies	Beyond the measurable limit
			Operational use	Pipe flushing to maintain pipes
			Others	Effectively used but not charged
	Ineffective water		Leakage	Treatment plants to customer meters
			Reduction water by mediation	Due to colored water / leakage, mediated at billing (Uncharged)

Indicators for water leakage management in JAPAN

- Waterworks Vision 2004

  by Ministry of Health, Labour and Welfare
  - Target of "Effective Water Ratio"
  - ・More Than 98% : Large-scale Waterworks
  - ・More Than 95% : small & medium-scale
- Waterworks Guidelines 2005 by JWWA
  - Leakage Ratio & Accounted-for water Ratio

    As a domestic standard an index

Water Balance Table by IWA

: Effective & Unaccounted-for water

: Ineffective water

System input Volume	Authorised Consumption	Billed Authorised Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorised Consumption	Unbilled Metered Consumption	Non-Revenue Water
			Unbilled Unmetered Consumption	
	Water Losses	Commercial (Apparent) Losses	Unauthorised Consumption	
			Customer Meter Inaccuracies and Data Handling Errors	
		Physical (Real) Losses	Leakage on Transmission and Distribution Mains	
			Leakage and Overflows from Storage Tanks	
			Leakage on Service Connections up to the Customer Meter	

Infrastructure Leakage Index : IWA

$$ILI = CAPL/MAAPL$$

CAPL(litres/day) : Current Annual Volume of Physical Losses

MAPL(litres/day) : Minimum Achievable Annual Physical Losses

$$MAAPL\ (litres/day) = (18 \times Lm + 0.8 \times Nc + 25 \times Lp) \times P$$

Lm = mains length (km)

Nc = number of service connections

Lp = total length of private pipe, property boundary to customer meter (km)

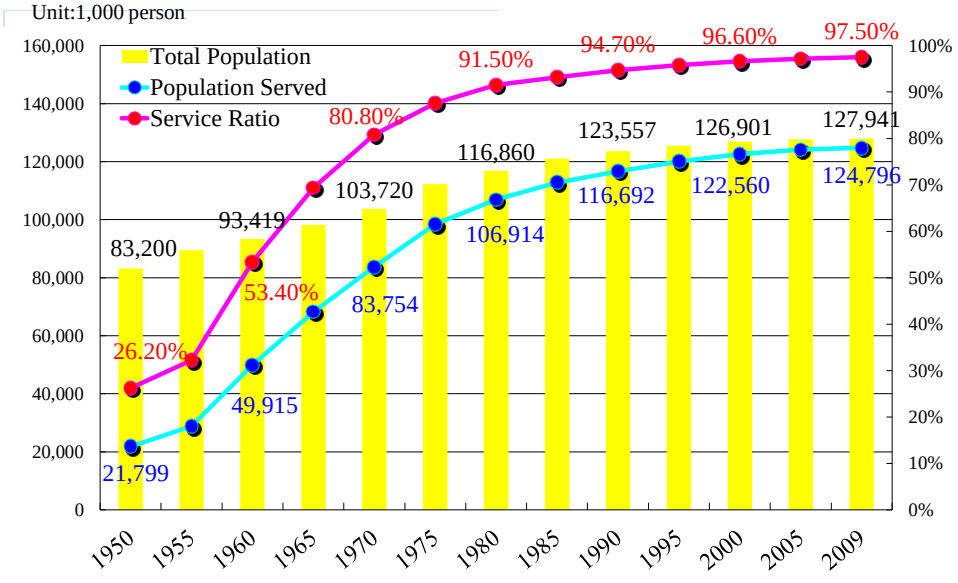
P = average pressure (m)

Table 8.2: Physical loss target matrix

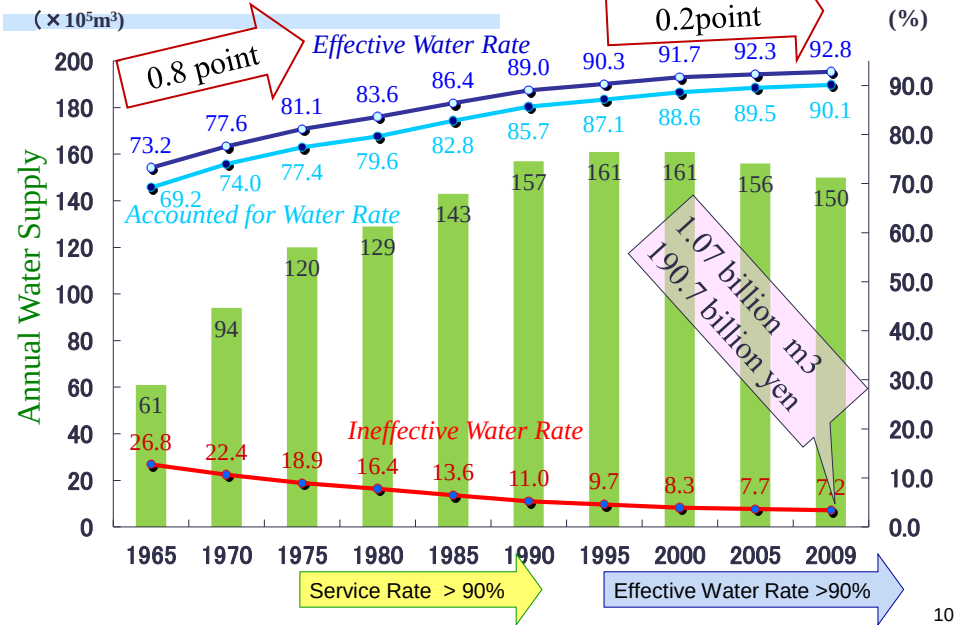
Technical Performance Category		ILI	Physical Losses [litres/connection/day] (when the system is pressured) at an average pressure of:				
			10 m	20 m	30 m	40 m	50 m
Developed Countries	A	1 - 2		< 50	< 75	< 100	< 125
	B	2 - 4		50 - 100	75 - 150	100 - 200	125 - 250
	C	4 - 8		100 - 200	150 - 300	200 - 400	250 - 500
	D	> 8		> 200	> 300	> 400	> 500
Developing Countries	A	1 - 4	< 50	< 100	< 150	< 200	< 250
	B	4 - 8	50 - 100	100 - 200	150 - 300	200 - 400	250 - 500
	C	8 - 16	100 - 200	200 - 400	300 - 600	400 - 800	500 - 1000
	D	> 16	> 200	> 400	> 600	> 800	> 1000

- Category A—Good. Further loss reduction may be uneconomic and careful analysis needed to identify cost-effective improvements.
- Category B—Potential for marked improvements. Consider pressure management, better active leakage control, and better maintenance.
- Category C—Poor. Tolerable only if water is plentiful and cheap, and even then intensify NRW reduction efforts.
- Category D—Bad. The utility is using resources inefficiently and NRW reduction programmes are imperative.

Population Served in Japan

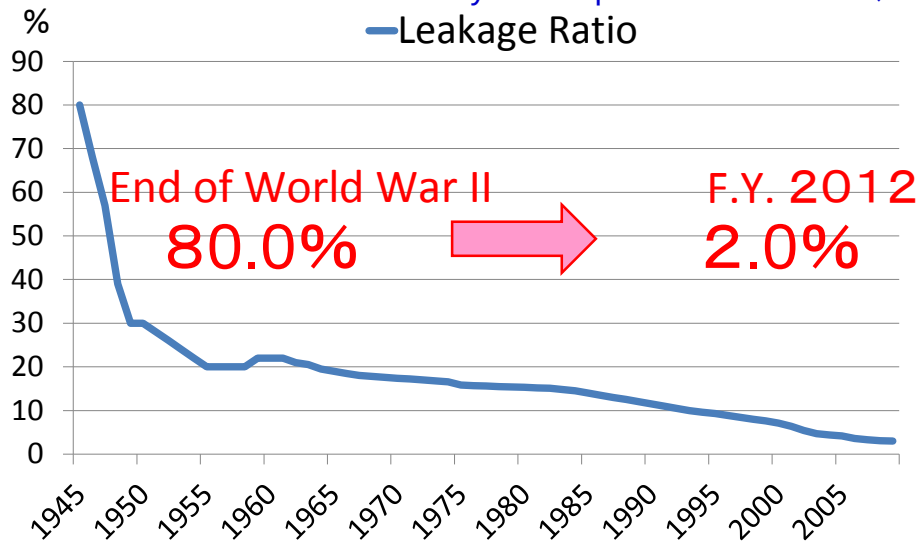


Effective Water Rate and Supply Amount



Trends in Leakage Ratio

（Bureau of Waterworks, Tokyo Metropolitan Government）



Six Stages of Leakage Control Measures

Stage	Approx. Leakage Rate	Purpose of Leak Reduction Work	Means
1st	More than 35%	To decrease surface leakage and apparent losses	Human wave tactics, door to door check, distribution pressure control, public education
2nd	35 – 25%	To decrease underground leakage and water theft	Zoning, exact piping maps, training & good equipment
3rd	30 – 25 % (overlapping 2nd)	To stop recurrence of leakage	Big increase in leakage control work & starting replacement of aged pipes
4th	25 – 15 %	To carry out thorough leakage control work	Revision of working method & acceleration of pipe replacement
5th	15 – 5 %	To wrap up the proactive leakage control work	Completion of pipe replacement & Collection and analysis of leakage data
6th	Less than 5%	To keep the minimum rate	Leakage management using continuous monitoring data

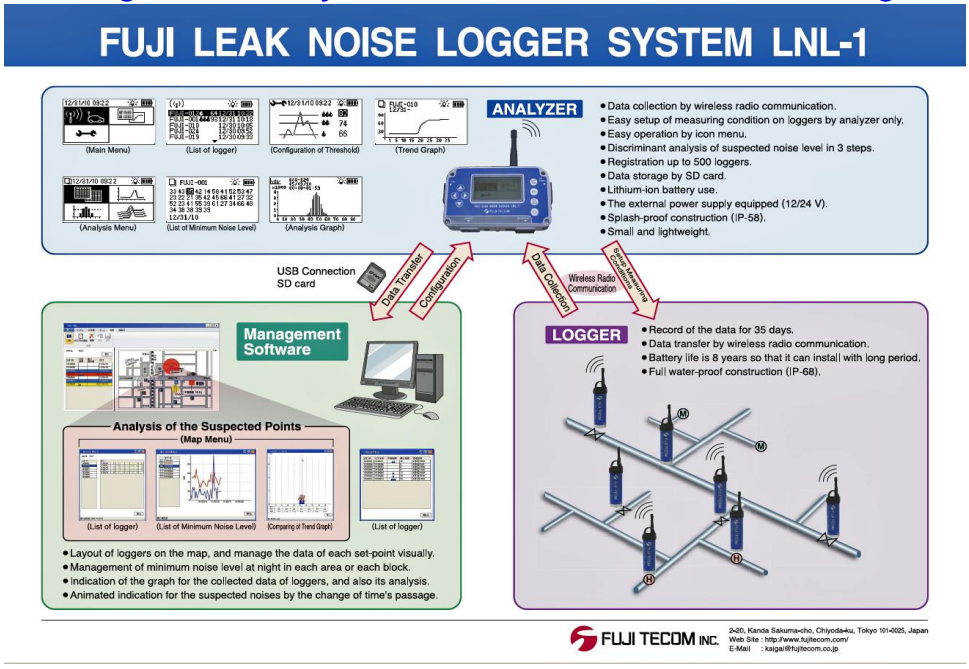
Reference : Shozo Yamazaki , Non-Revenue Water Management , 2011

Systematization of Water Leakage Prevention

Counter-measure	Items	Specific Schemes
Basic measures	Preparation	Establishment of the construction system
	Basic research	Grasp of the flow amount & pressure
	Technical development	Improvement of materials & leak detection method
Symptomatic treatment measures	Quick response work	Quick repair of surface leakage
	Planned circulation Work	Detection of potential leakage
Preventive measures	Pipeline improvement	Aged pipeline renewal
	Pressure adjustment	Network maintenance, pressure measurement
	Monitoring of pipeline condition	Evaluation by the collection and analysis of pipeline data

"Water maintenance guidelines" by JWWA, 2006

Leakage Control by the Continuous DATA Monitoring



FUJI TECOM supports your NRW reduction project, through the agency of 37 countries in the world.

Thank you for your attention ! FUJI TECOM INC.