

発表論文等

1.Overview of Drinking Water Quality Management

Presenter

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Overview of Drinking Water Quality Management in Japan

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1. Introduction

It has been over 100 years since modern piped water supply system was introduced into Japan. It covers 96.6% of whole population up to now, and has greatly contributed to the promotion of public health. On the other hand, there still remain issues to be dealt with in terms of drinking water quality management as well as management of water supply system itself.

This paper briefly introduces the drinking water quality management system in Japan and progress made during intersessional period.

2. Characteristics of water supply in Japan

2.1 Development of modern water supply system

The modern water supply system was originally introduced into Yokohama city in 1887 with the aim of preventing infectious disease through drinking water such as cholera and typhoid fever prevailing in the mid 1800s. The modern system was developed in harbor cities at the first step and has gradually spread all over Japan. Especially, remarkable development was achieved after the World War II. The percentage of population served increased from 53.4 percent in 1960 to 96.6 percent in 2000.

In addition, infectious disease decreased dramatically, following the development of modern water supply from piped water.

2.2 Water demand

Water demand increased with improvement of living standards, development of sewage system, concentration of population to urban areas. But lately it has reached its peak because of economical stagnation, and prevailing water reuse and so on.

2.3 Water resource

Drinking water mainly comes from surface water, especially of river waters. (Surface water: 71%, ground water: 26%). Many reservoirs as water resources have been constructed. As a result, dependence on reservoirs has been increasing year by year and it covers about 40% of whole water resources. On the other hand, dependence on ground water including shallow well, deep well and river-bed water remains unchanged in ten years.

In respect of water quality in public water bodies, about 80% of those are compliant with the environmental standards of organic pollution (BOD in rivers, and COD_{Mn} in lakes and coastal water).

2.4 Water purification

A lot of water suppliers adopt rapid sand filtration system in Japan, because surface water is major source of drinking water. Recently, some water suppliers, especially the ones of large-scale water suppliers, have introduced advanced water treatment processes such as activated carbon treatment and ozonization in addition to a conventional rapid sand filtration system.

As for ground water treatment, most treatment plants have no treatment facility with the exception of chlorination system, because the quality of ground water seems to be fairly well.

2.5 Trend of water quality issues

One of the main purposes of introducing water supply systems was prevention of waterborne infectious diseases caused by pathogenic microorganisms like cholera. This is still very important, even if most people care nothing about it.

After World War II, many kinds of chemicals got to be used and a matter of concern was also changed from pathogenic microorganisms to chemicals such as

industrial effluents and pesticides. The latest issues to be dealt with are chlorine-resistant microorganisms like *Cryptosporidium*, disinfection by-products, and trace chemicals such as dioxins and endocrine disruptors.

3. Legislation and institution

3.1 Legislations

Various laws concerning water supply facilities and services have been promulgated to cover the different aspects.

a. Water Works Law

The basic law concerning water supply is the Water Works Law which was enacted in 1957, and on the basis of this, National Government (Ministry of Health, Labour and Welfare) or prefectures authorize the business license to water suppliers.

b. Basic Environment Law

In point of conserving the quality of water resources, based on the Basic Environment Law, Environmental Quality Standards for water quality in public water bodies and ground water are set as target levels of water quality to be achieved and maintained.

c. Water Pollution Control Law

The Water Pollution Control Law lays down uniform national effluent standards for specified facilities discharging effluents into public water bodies. It also regulates hazardous waste should not be discharged on the ground.

d. Law on Promotion for Water Quality Protection at Source

The Law on Promotion for Water Quality Protection at Source was promulgated in order to conserve water resources. When water suppliers fail to meet Drinking Water Quality Standards (DWQSs) through their own effort like upgrading their treatment method, they may ask prefectures or river administrator to formulate a promoting plan for constructing public sewerage system, individual sewage treatment

installations, river facilities for improving surface water quality, and controlling THMs precursors.

3.2 Institutions on water supply

On the basis of Water Works Law, National Government (Ministry of Health, Labour and Welfare) or prefecture authorize the business license to water suppliers and supervise depending on the scale of suppliers. To be more precise, MHLW supervise water suppliers that supply to more than 50,000 people and bulk water suppliers that have more than 25,000m³/day water supply, and prefectures supervise smaller water suppliers and bulk water suppliers. Prefectures also control private water supply system and small-scale water supply system.

3.3 Water quality management system in Japan

The main purpose of water supply is to provide safe drinking water. So all drinking water provided by water supply systems should comply with the DWQSSs stipulated by the Article 4 of the Water Works Law. The DWQSSs have 29 parameters on human health and 17 parameters on acceptability of drinking water. And parameters for desirable taste and parameters for monitoring are set. Also this law establishes several provisions to secure proper facilities and management measure.

In respect of proper facilities, it establishes the following.

- Technological facility standards
(possession of treatment system to get adequate water compliant with drinking water quality, etc.) [Article 5]
- Supervision of the construction of facilities by engineers [Article 12]
- Test of water supply facilities and water quality prior to the start of water supply service [Article 13]
- Standards on plumbing [Article 16 etc.]

In respect of management measure, it establishes the following.

- Appointment of water supply engineering supervisor [Article 19]
- Regular and ad hoc water quality analysis [Article 20]
- Health check of employees [Article 21]

- Sanitary measures (disinfection) [Article 22]
- Emergency suspension of water supply when supplied water is suspected to be harmful to human health [Article 23]

4. Problems on water supply systems

4.1 Quantity Aspect

The balance of water demand and supply has been improved by the effort of construction of dams. But now, construction of a new dam and a reservoir becomes difficult in most areas due to shortage of suitable sites and opposition by inhabitants, and it is vital to utilize existing water resources as effectively as possible to achieve sustainable supply of drinking water.

4.2 Quality Aspect

It becomes more important to strengthen the water quality management system, because the quality of water resources is deteriorated, resulting from the pollution of river and ground water by effluent of domestic wastewater and chemical substances.

In addition, not only the water quality management system but also conserving water resources is the key issue. Although some counter-measures have been promoted in some area based on the Law on Promotion for Water Quality Protection at Source, improvement is not necessarily sufficient all over Japan. Therefore it is crucial to promote counter-measures cooperating with environment, river and sewage water administration.

4.3 Technical and financial capacity

Especially small water suppliers face various problems in keeping their proper management of facilities, water quality and crisis, because of their weak technical and financial capacity.

Although it is very important to renew facilities according to plan and strengthen anti-seismic measure, there are many water suppliers unable to invest enough funds. Strengthening technical and financial capacity of water suppliers is important so that they supply safe water sustainably.

5. New measures

5.1 Amendment of the Water Works Law

As noted above, most of water suppliers are small municipalities, and their financial and technical capabilities remain low. There were some outbreaks of infectious disease resulting from supplied water.

The Water Works Law was amended last year. One of major points is to systematize the entrustment of management practices to the third parties in order to strengthen the management system of water suppliers. Another is to simplify licensing procedures for merging water suppliers. This amendment also aims to take measures for a stronger management system covering unregulated water supply system with many users and water supplied from receiving water tanks from the viewpoint of securing drinking water.

5.2 Comprehensive review of water quality standards

Current DWQs were set for 46 items in 1992. In March 2002, it was announced officially that the standard value for lead would be strengthened from 0.05 mg/L to 0.01 mg/L as of April 2003.

Parameters for Monitoring were set for 26 items in 1992, and 6 items were added afterward. Besides, in the wake of Special Measures Law on Dioxins, the provisional value of Dioxins (1 pg-TEQ/L) was added in 1999 from the viewpoint of securing drinking water. And the value of Chlorine dioxide (0.6mg/L) and that of Chlorite (0.6mg/L) were added in 2000 to secure water with using Chlorine dioxide as a disinfectant.

DWQs in Japan are now being reviewed comprehensively taking into account of the revision of WHO's Guidelines of Drinking Water Quality in 2003.

6. Conclusions

Since the previous conference in Colorado Springs, a number of measures to conserve water quality have been taken. However, there are several issues yet to be tackled. Therefore we expect that the conference will contribute better mutual understandings and closer cooperation for both countries through information exchange and discussion with wider point of view.

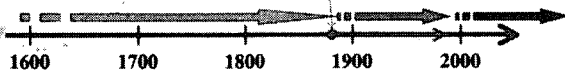
Overview of Drinking Water Quality Management

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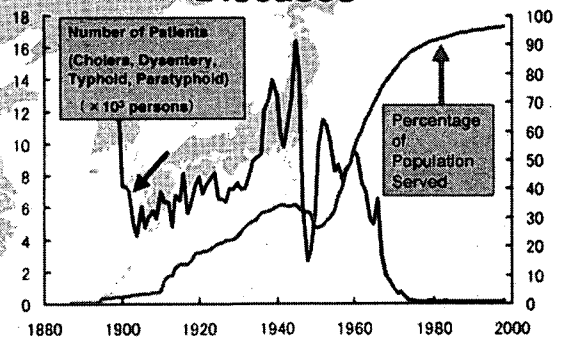
1. Characteristics of Water Supply In Japan

History of Modern Waterworks

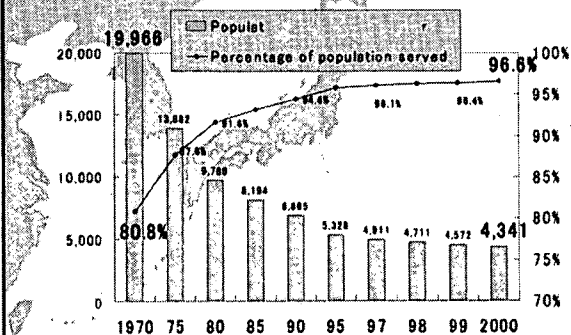
- 1887: The first modern waterworks in Yokohama City. (iron pipes, pumps, sand filters)
- 1889: Hakodate City
- 1891: Nagasaki City
- 1895: Osaka City
- 1898: Tokyo (Ports and big cities)



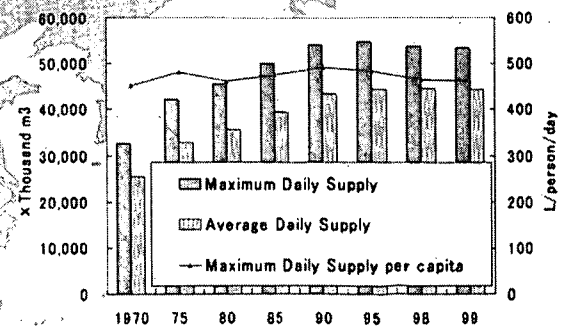
Water Supply and Infectious Diseases



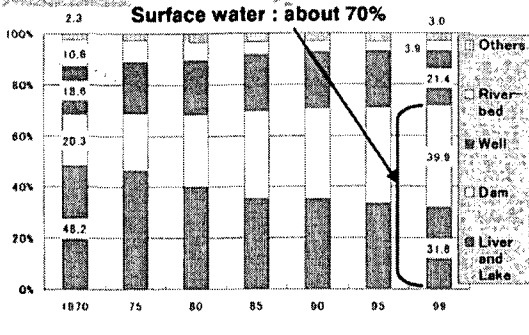
Increase of Population Served



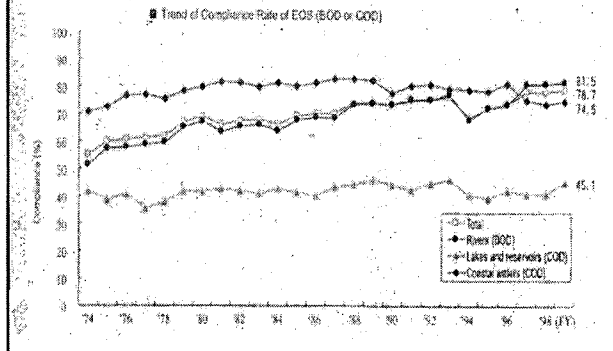
Water Demand



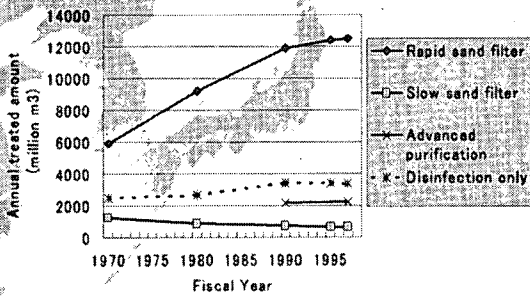
Classification of Water Sources



Water Quality in Public Water Bodies



Water Purification



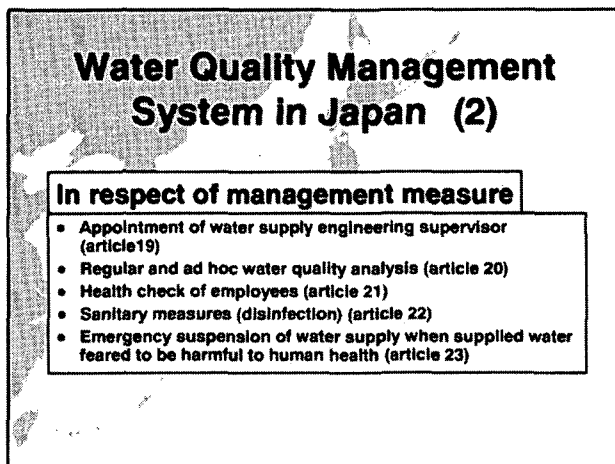
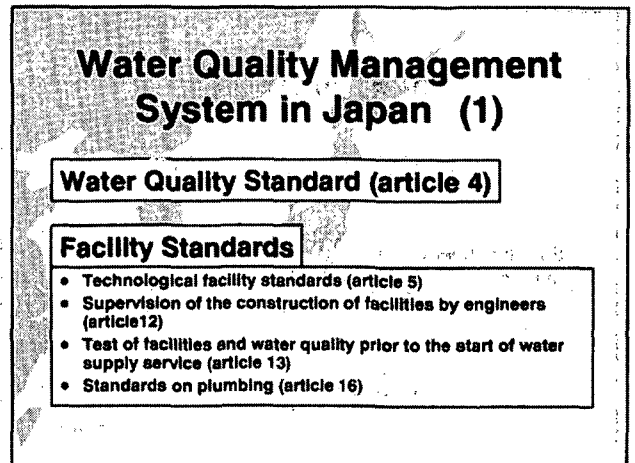
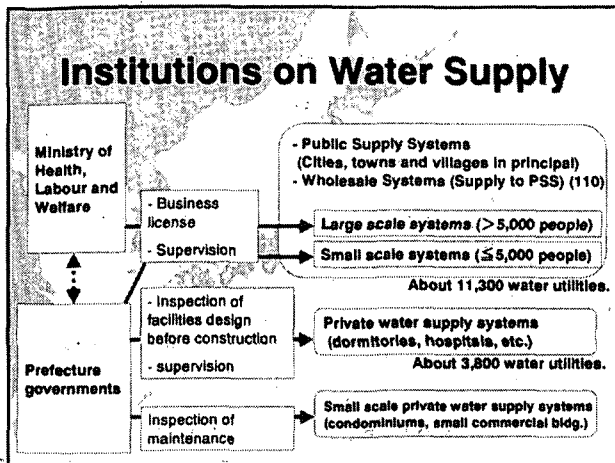
Trend of Water Quality Issues

- Late 19th century -
Cholera and other microorganisms
- 20th century
Microorganisms → chemicals
- Late 20th century -
Disinfectant by-products
Cryptosporidium
Trace chemical substances

2. Legislations and Institutions

Legislations

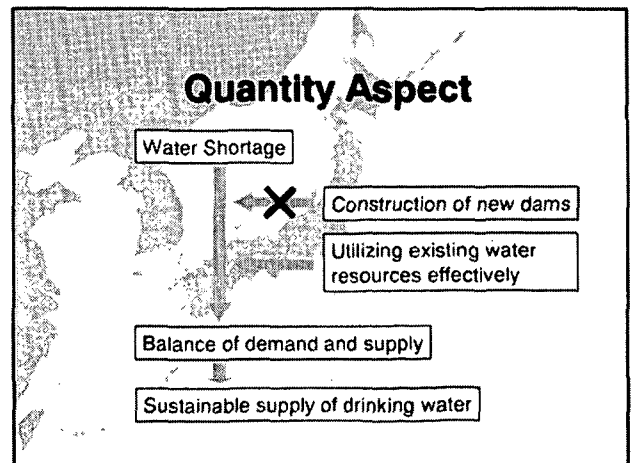
- **Basic law : Water Works Law**
 - Enacted in 1957, latest amendment in 2001
- **Related laws**
 - **Quality Control on Water Resource**
 - The Basic Environment Law
 - Water Pollution Control Law
 - Lake Law
 - Law on Promotion For Water Quality Protection at Source
 - Law on Special Measures for Preventing Water Source Pollution
 - **Others**
 - Laws on water resources development, management / land and urban planning, loan and Labour relation ...

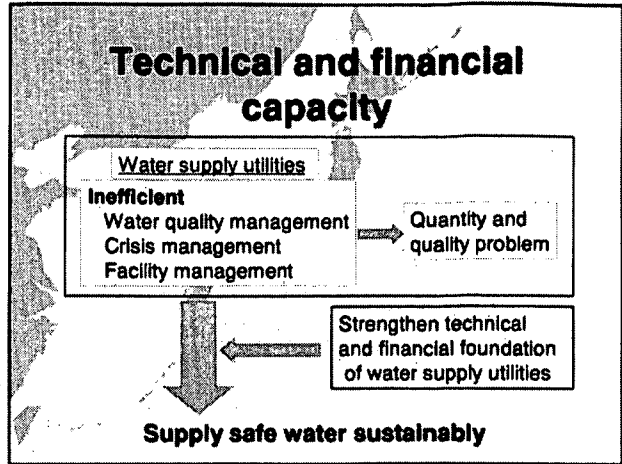
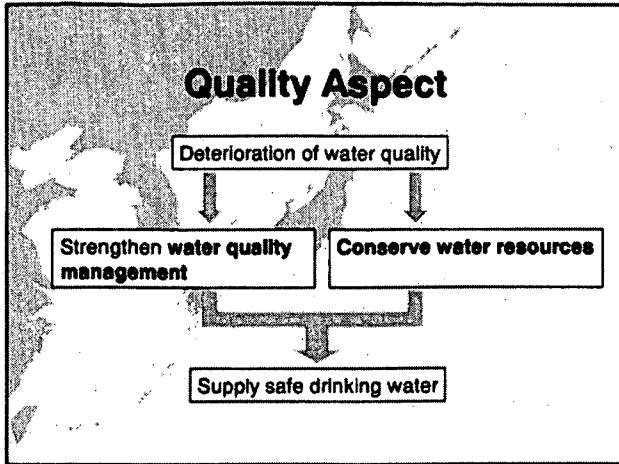


Water Quality Standards

Standards designated by Waterworks Law	<ul style="list-style-type: none"> • 29 parameters on human health • 17 parameters on acceptability of drinking water 	<ul style="list-style-type: none"> • Standard plate count • Coliform count • Cd • Hg • Se • Odor <p>etc.</p>
Parameters for Desirable Taste	13 parameters	<ul style="list-style-type: none"> • Mn • Al • Residual chlorine • Free carbon dioxide • Organic substances • Total residue <p>etc.</p>
Parameters for Monitoring	35 parameters	<ul style="list-style-type: none"> • Trans-1,2-dichloroethylene • Toluene • Xylenes • Boron <p>etc.</p>

3. Problems on Water Supply Systems and New Measures





- ### New Measures
- **Amendment of Water Works Law**
 - Enacted in 2002 April
 - Major points:
 - Systematize the entrustment of management practices to the third parties
 - Simplifying licensing procedures for merging water utilities
 - **Comprehensive review of Water Quality Standards**
 - WHO guidelines for drinking-water quality is to be revised in 2003
 - Water quality standards will be revised taking into account of the revision of the WHO guidelines