

Water Quality Management



No. T3 Ver. 1

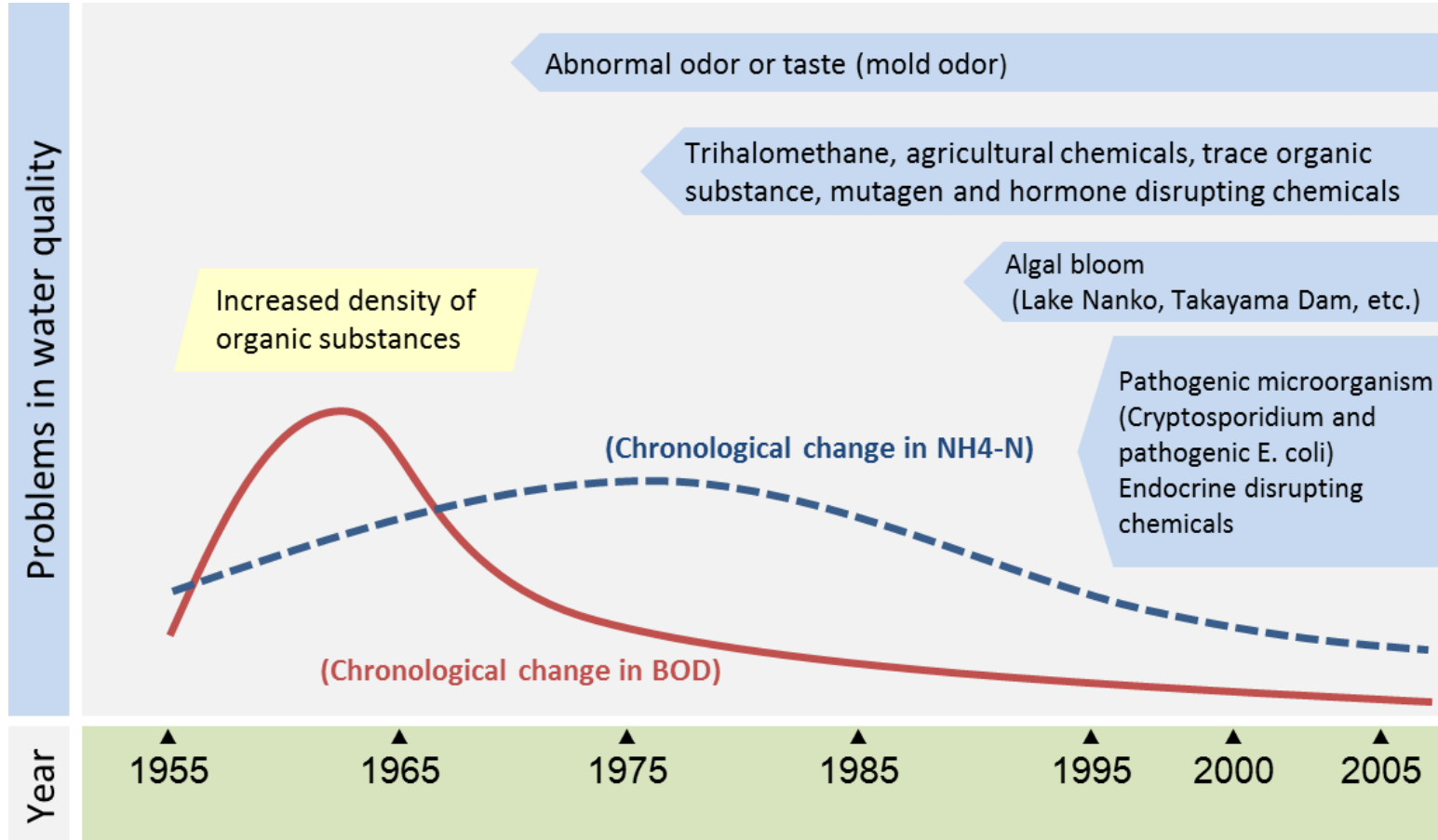
Water quality laboratory at Kitachiba Water Supply Authority (September 21, 2011)

Contents

- 1. Introduction**
- 2. Importance of Water Quality Management**
- 3. Drinking Water Quality Standards and its Compliance**
- 4. Drinking Water Quality Testing**
- 5. Standards for Water Supply Materials and Equipment**
- 6. Preventing Deterioration of Source Water Quality**
- 7. Lessons Learned**

1. Introduction

Historical change in Yodo River water quality; water source for Osaka



Yodogawa river office, Ministry of Land, Infrastructure, Transport and Tourism, "Historical transition of water quality problem," [Online] Available: <https://www.yodogawa.kkr.mlit.go.jp/know/data/problem/02/a.html> [Accessed 8 July 2016]

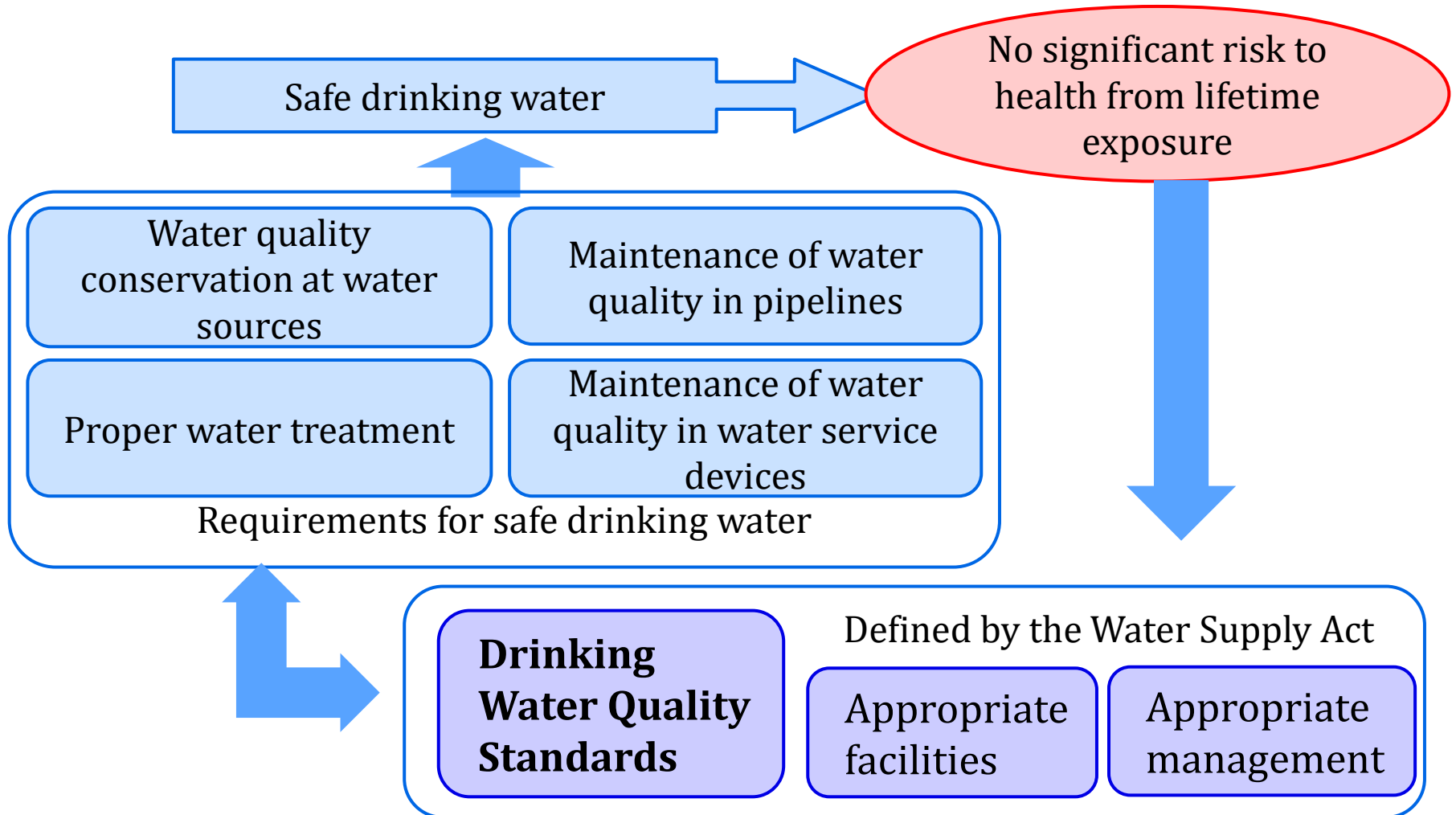
1. Introduction

Frequently asked questions from participants of the water supply training courses

- Q1.** What **measures were implemented to reduce the incidence of waterborne diseases** such as cholera, which affected Japanese society in the past?
- Q2.** Why Japan could implement **long-lasting water quality management**?
- Q3.** What are the requirements for compliance with **water quality standards** for water utilities in Japan?
- Q4.** How has the **good quality equipment** required for water quality management been procured in Japan?
- Q5.** How has Japan dealt with the serious problems caused by **deterioration of source water quality**?

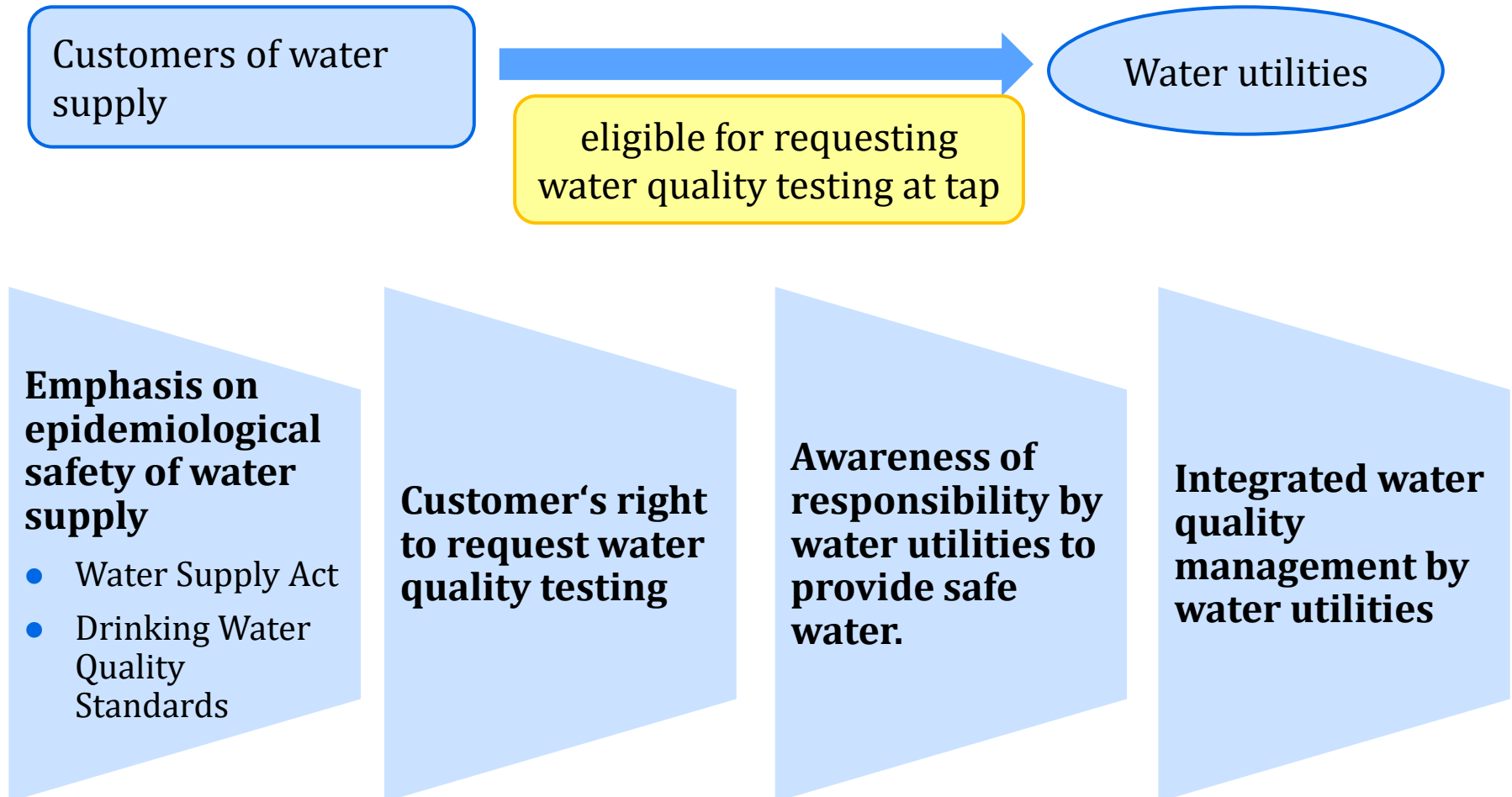
2. Importance of Water Quality Management

(1) History and Background of Water Quality Management



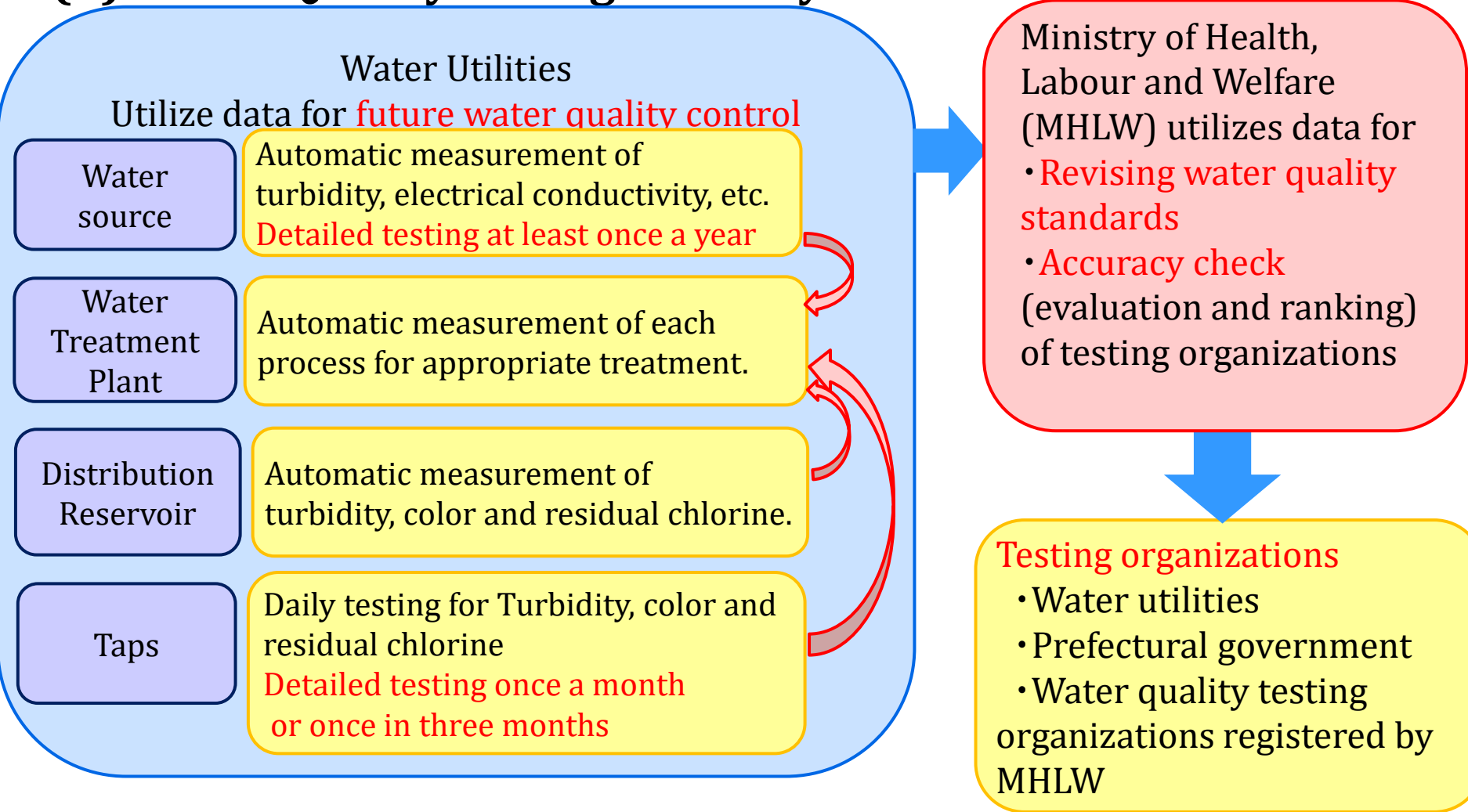
2. Importance of Water Quality Management

Column: Article 18 of the Water Supply Act



2. Importance of Water Quality Management

(2) Water Quality Management System



2. Importance of Water Quality Management

(3) Cost of Water Quality Management



2. Importance of Water Quality Management

Small Scale Public Water Supply Using Good Quality Water Sources

Small Scale Public Water Supply

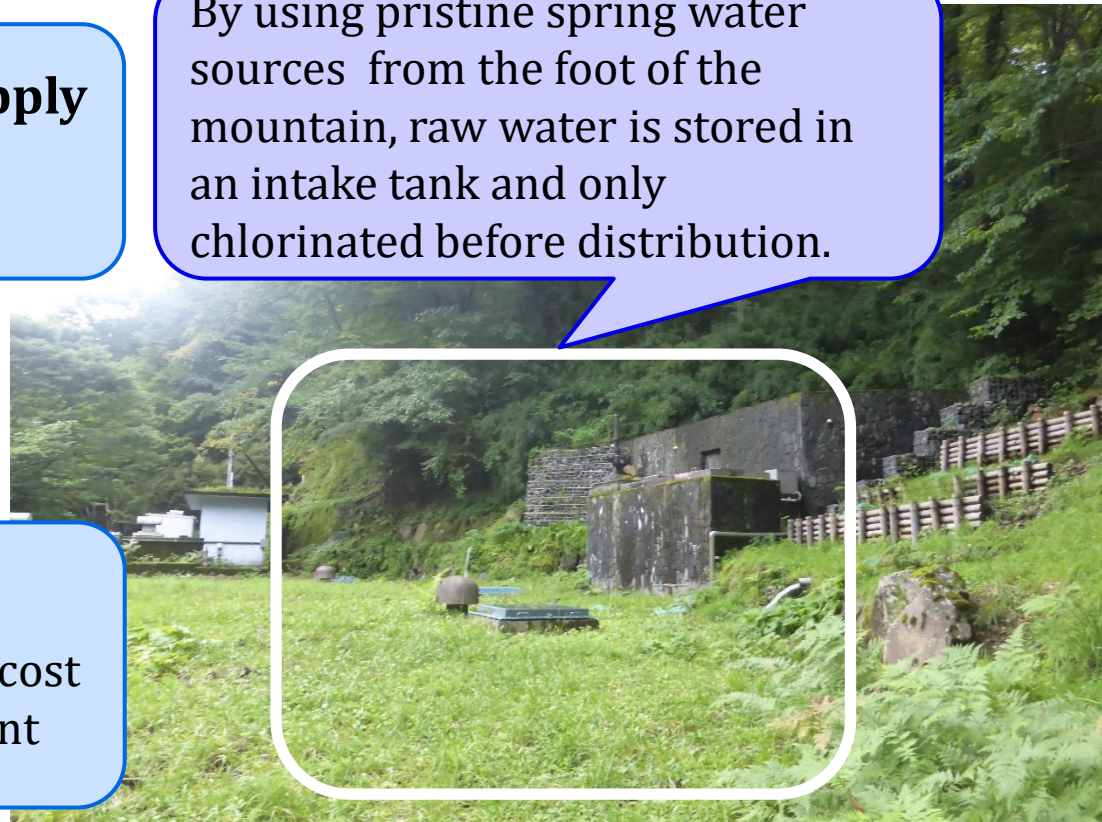
- Limited financial capacity
- Understaffing



Pristine water source

- Reduction of water treatment cost
- Easy water quality management

By using pristine spring water sources from the foot of the mountain, raw water is stored in an intake tank and only chlorinated before distribution.



2. Importance of Water Quality Management

(4) Clear Responsibility for Water Quality Management

Appoint responsible person for water quality management

Water Supply Services Technical Administrator (Article 19)

Responsibilities

- Inspection of water supply facilities to meet technical standards
- Water quality examination
- Sanitary measures such as disinfection
- Water supply suspension

Establish administrative checking system

On-site inspection, guidance and supervision by a supervising authority (Article 36, Article 39 of the Water Supply Act)

On-site inspection, instruction for improvement and water supply suspension order by the national government or prefectural government

Assist small and medium scale water utilities whose capacity is limited

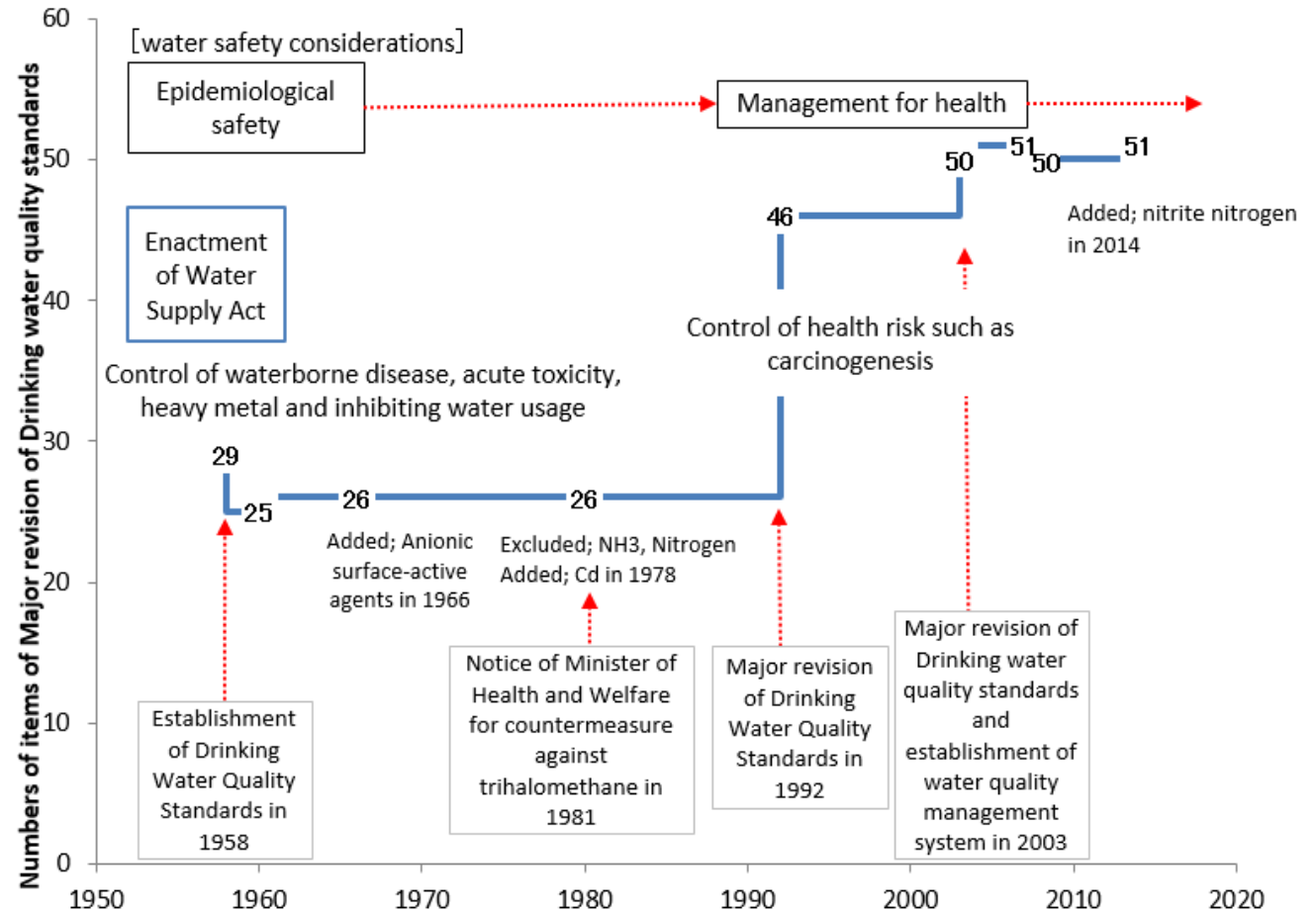
Support by health center

- Assessment of result of water quality examination
- Providing technical information

3. Drinking Water Quality Standards

(1) Formulation of Drinking Water Quality Standards

Drinking Water Quality Standards in Japan have been developed and modified based on the new knowledge on toxic substances and the technical level of water quality testing.



3. Drinking Water Quality Standards

(2) Notifications about Drinking Water Quality

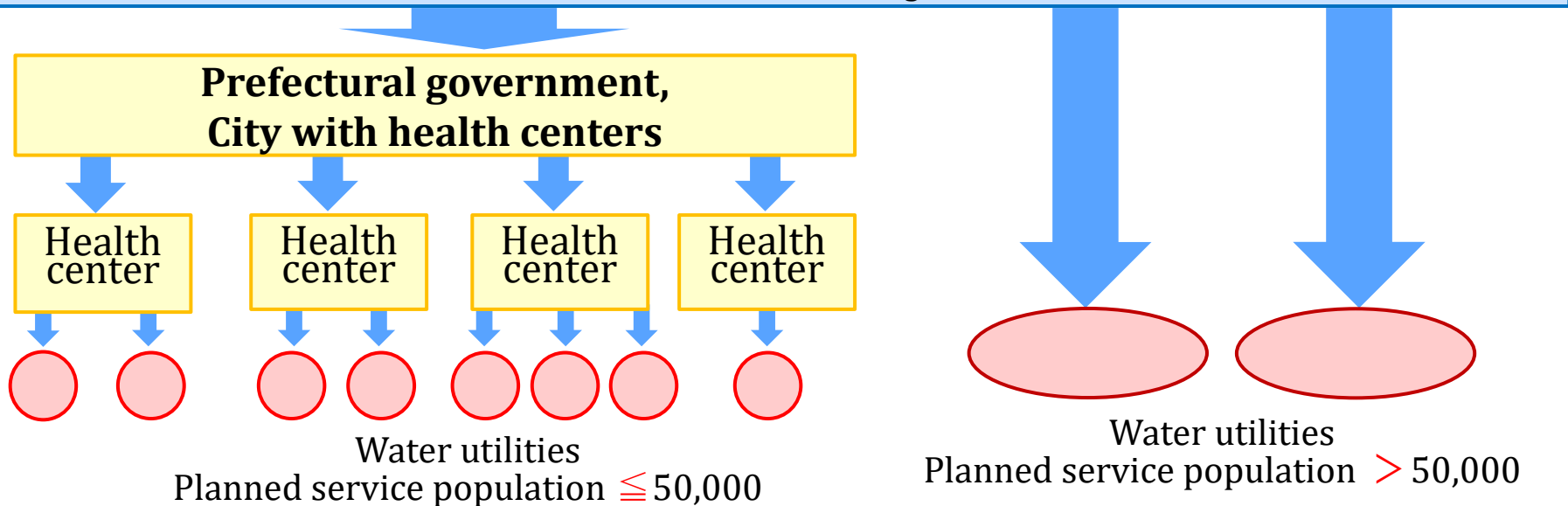
National Government

(Water Supply Division of the Ministry of Health, Labour and Welfare)

Article 39 of the Water Supply Act; Collection of reports and on-site inspection

Article 36 of the Water Supply Act; Instruction for improvement, etc.

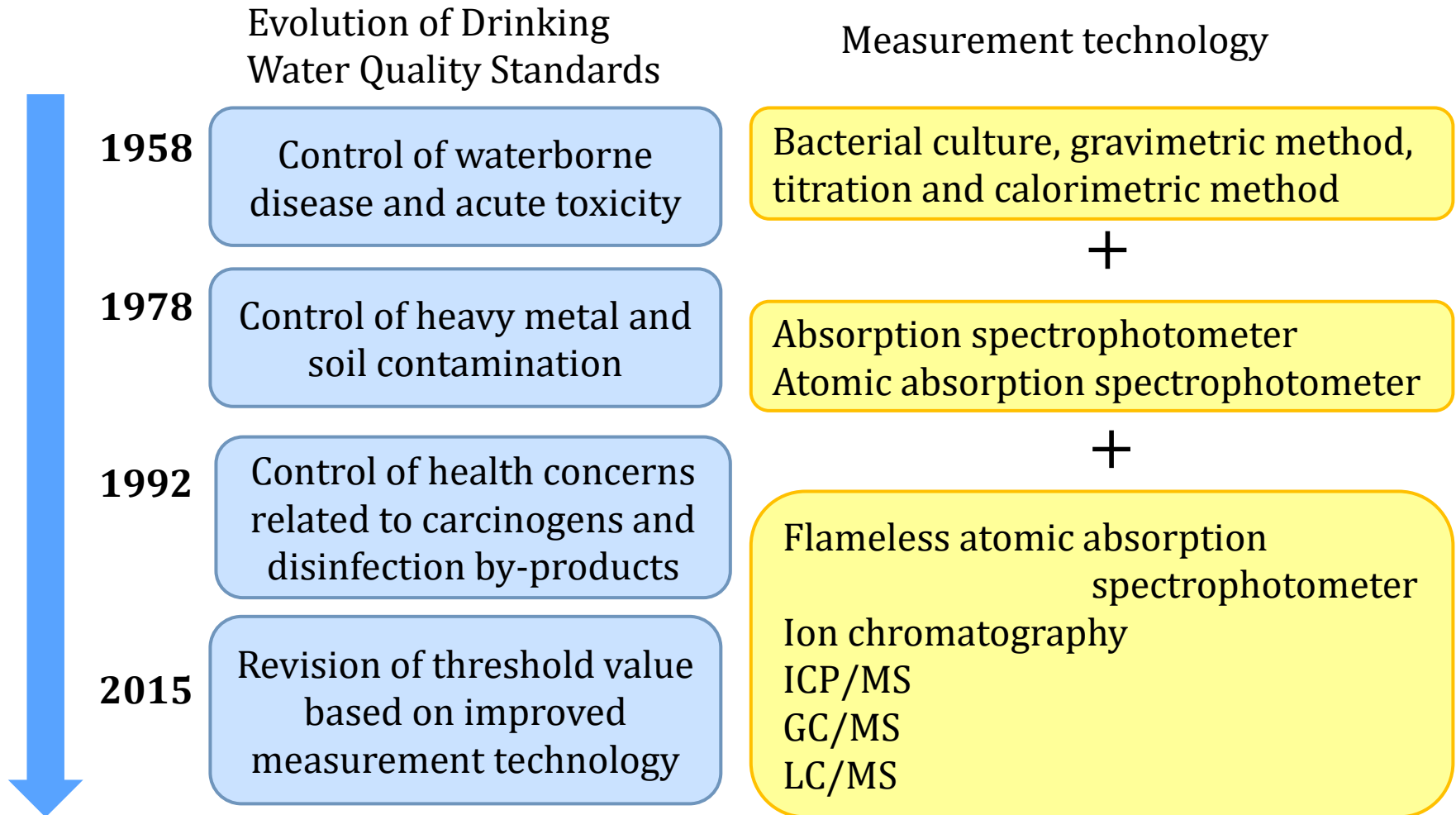
Article 14 of the Order for Enforcement of Water Supply Act; Delegation of authority to the prefectural governors



Health center; Organization established based upon Community Health Act
Ensures comprehensive promotion of regional public health measures

4. Drinking Water Quality Testing

(1) Water Quality Parameters and Testing Methods



4. Drinking Water Quality Testing

(2) Responsibility for Water Quality Testing

How can
**Small-Scale
Utilities**
manage
water quality
testing?

Water utilities must make their own arrangements for water quality testing

1. Establish a shared testing facility
2. Utilize external service such as health centers, etc.

Water quality testing by health centers became difficult as parameters stipulated in Drinking Water Quality Standards increased.

Increasing outsourcing to private testing facility registered by the Minister of Health, Labour and Welfare

Water utilities prepare a water quality monitoring plan, conduct daily tests (residual chlorine, color and turbidity) by themselves, judge the safety of water and guarantee water quality.

4. Drinking Water Quality Testing

(3) Administrative Framework for Water Quality Testing

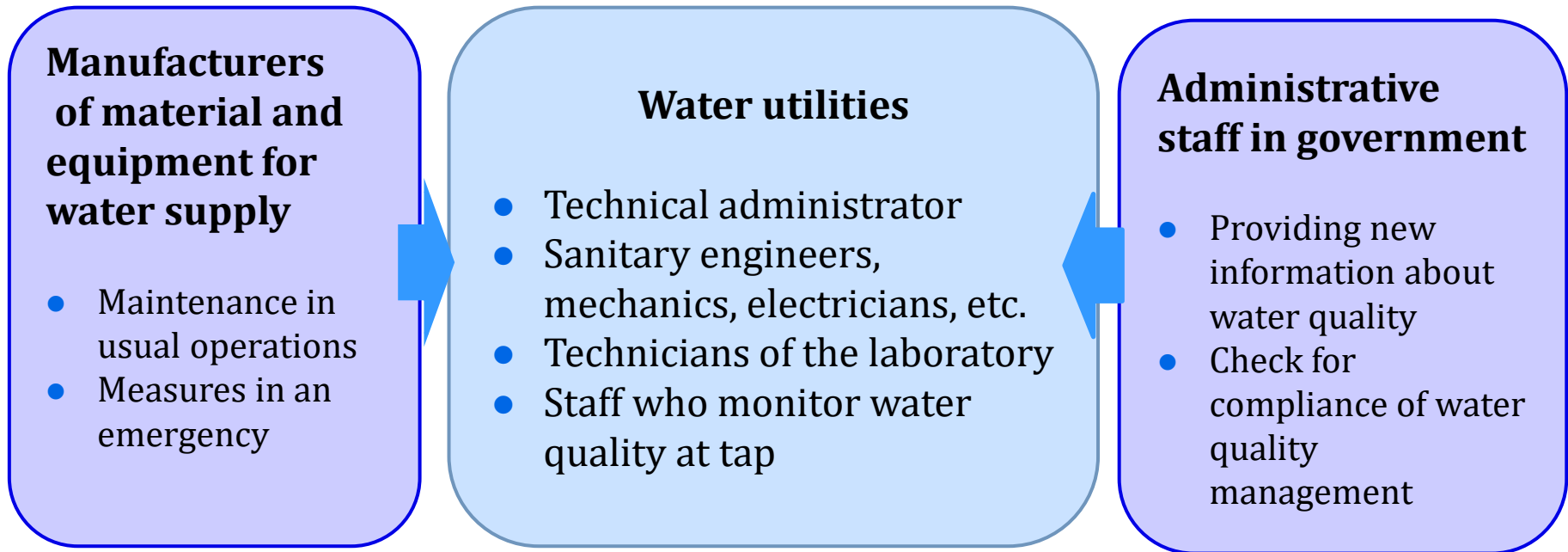
Contents of water quality monitoring plan

1. Specific water quality issues that require attention in the water quality monitoring plan
2. Items, sampling points and frequency for regular water quality testing
3. Items omitted from regular testing and the reasons
4. Items for extraordinary water quality testing and the reasons
5. Tests that will be outsourced, when water utilities send samples to health centers or private laboratories
6. Other issues to be considered, such as evaluation of the results, revision of the water quality monitoring plan, quality control, and reliability assessment

The national government or the prefectural government checks the water quality monitoring plan and recommends improvements where necessary.

4. Drinking Water Quality Testing

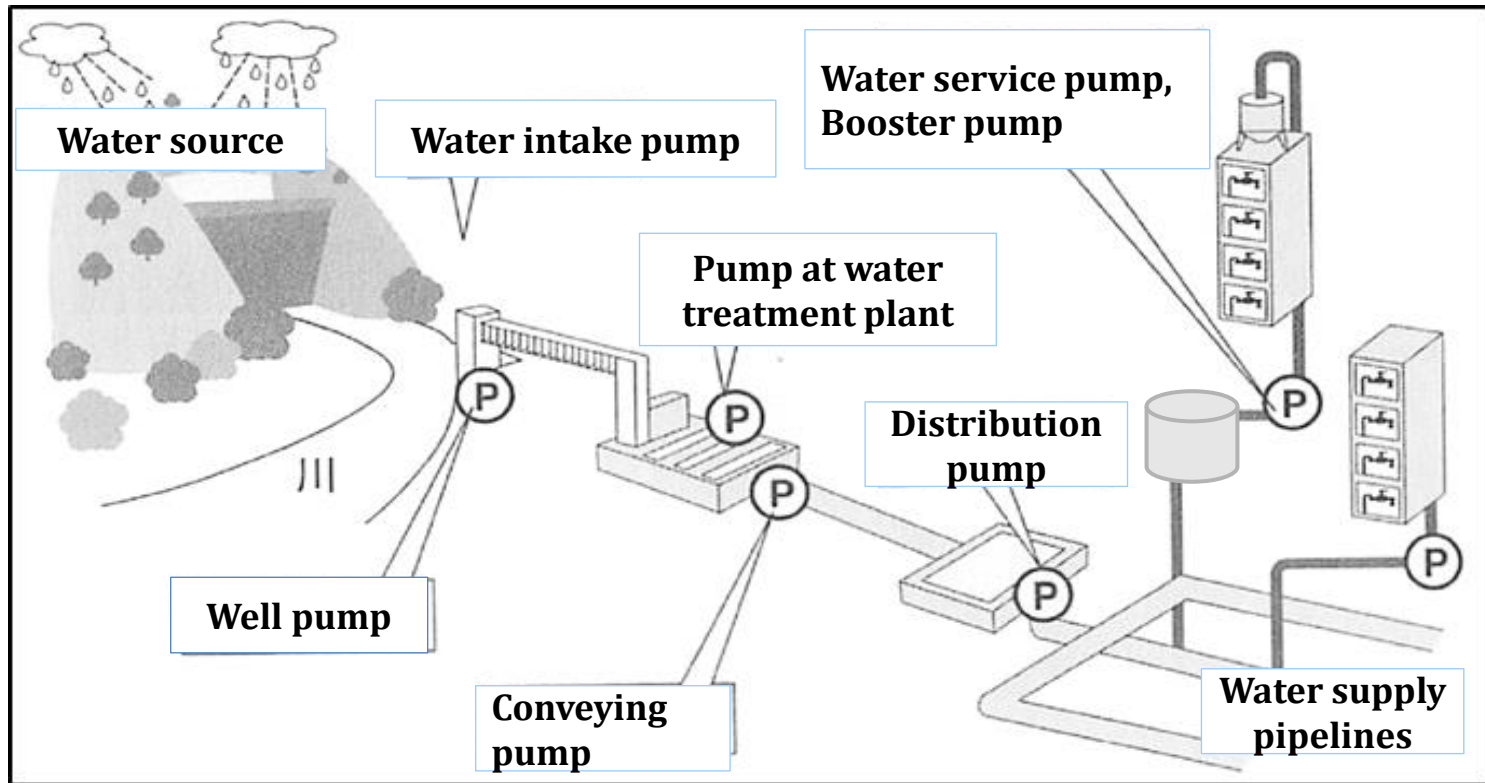
People engaged in Water Quality Management



5. Standards for Materials and Equipment for Water Supply

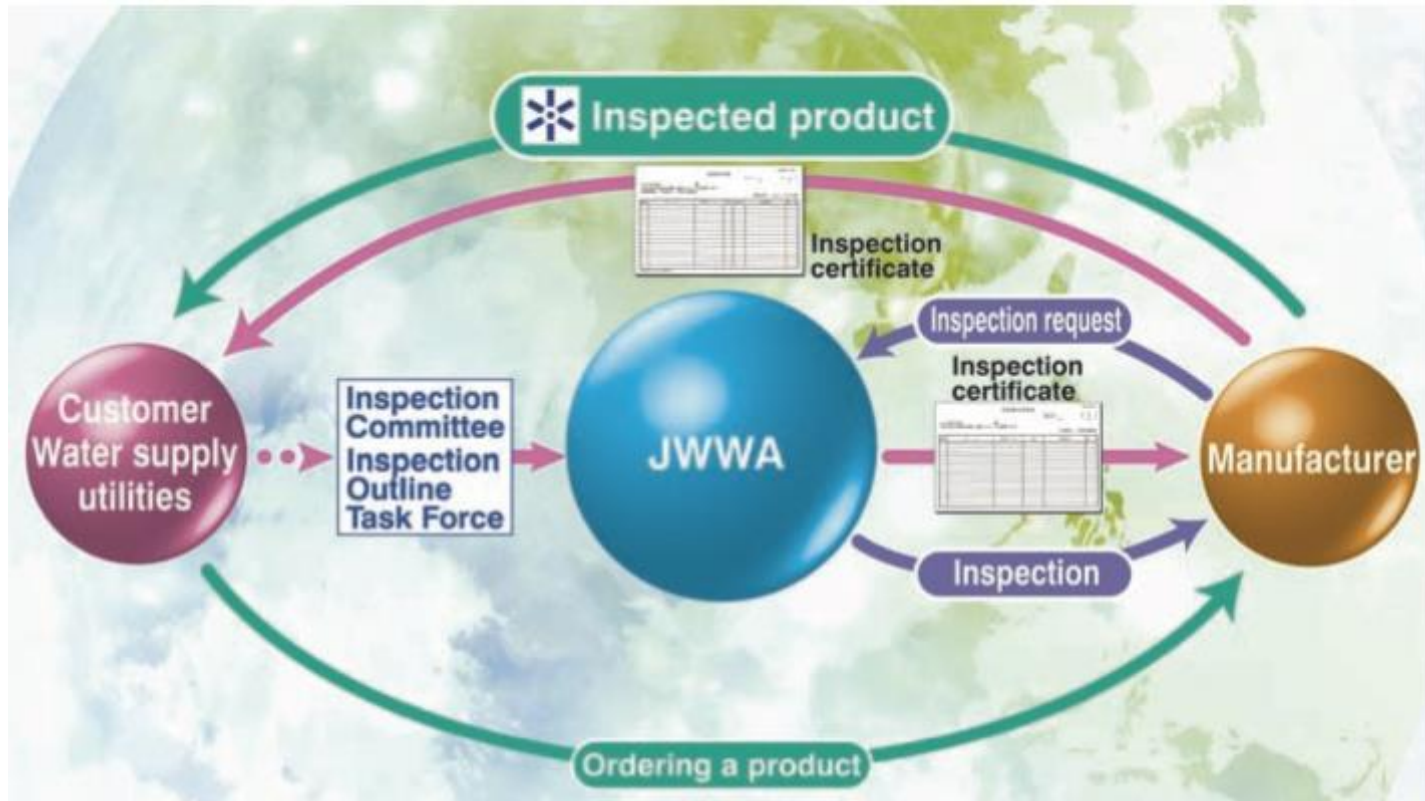
Water quality management
from water source to each tap

Need to ensure **quality of material and equipment** for water supply



5. Standards for Materials and Equipment for Water Supply

Japan Water Works Association (JWWA) conducts inspection of material and equipment for water supply facilities



Japan Water Works Association, "Profile Public Interest Incorporated Association Japan Water Works Association," [Online] Available: http://www.jwwa.or.jp/jigyoku/kaigai_file/jwwaProfile2015.pdf [Accessed 11 July 2016]

6. Preventing Deterioration of Source Water Quality

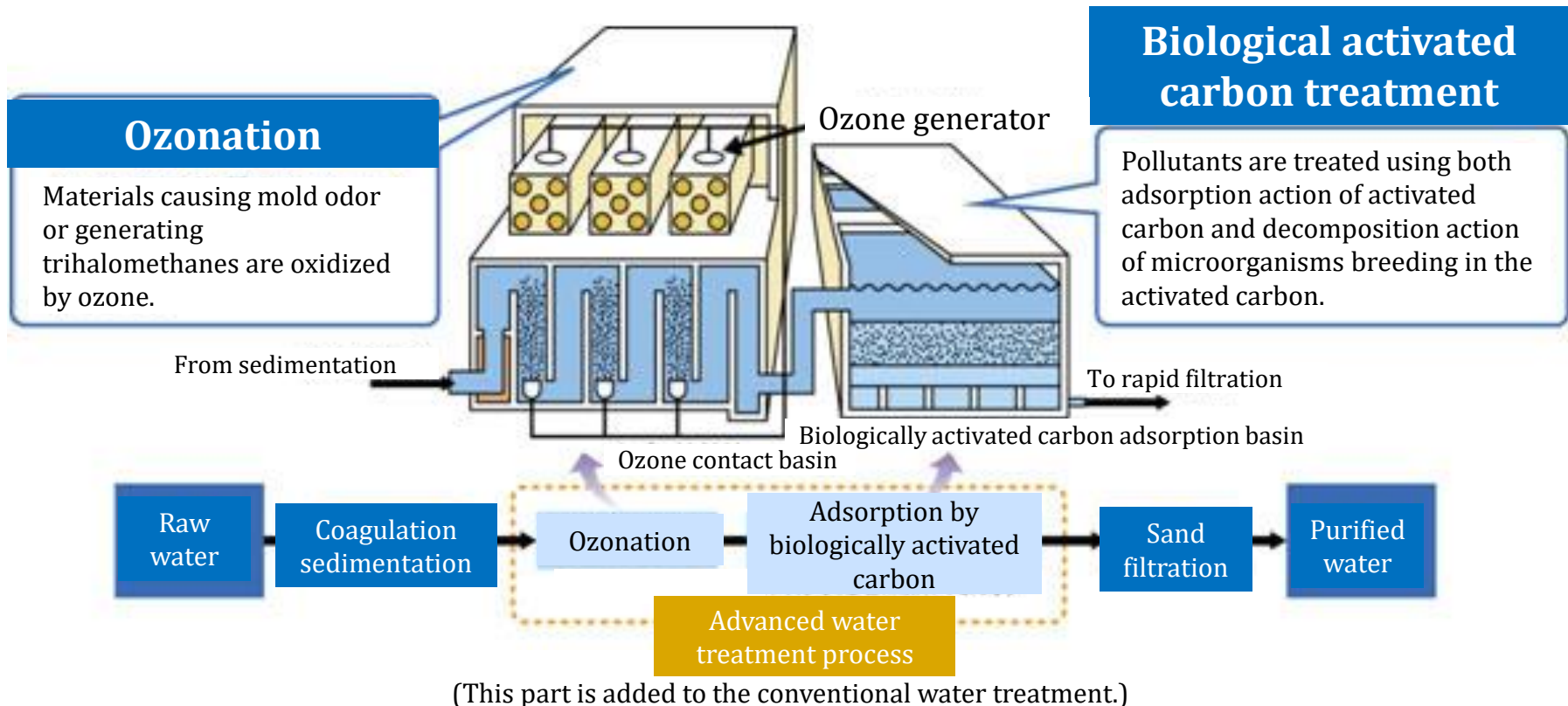
(1) Action taken in response to Changes in Source Water Quality

Year	Laws and systems	Issues of water quality management	Water supply coverage*
1954		Period of High Economic Growth	33%
1964	The River Act was enacted.	↓ Water pollution by industrial wastewater,	69%
1967			72%
1970	The Water Pollution Control Act was enacted.		81%
1973		↓ Contamination by household wastewater with the rise of water supply coverage	84%
1979		Trihalomethane problem Toxicity of water-bloom, odor of purified water	91%
1988	National subsidy for advanced water treatment started.		94%
1994	The Law concerning the Promotion of Projects	Countermeasure against disinfection by-products is required.	95%
2001	The Johkasou(decentralized treatment system) Law was amended.	Dissemination of combined Johkasou(decentralized treatment system)	97%
2014	The Basic Act on the Water Cycle was enacted.		98%

*Water supply coverage is according to estimation until 1955 and "Water Supply Statistics" since 1956.

6. Preventing Deterioration of Source Water Quality

Introduction of Advanced Water Treatment Processes for Deteriorated Raw Waters



6. Preventing Deterioration of Source Water Quality

(2) Conservation of Water Catchment Forests

Under the Forest Act water utilities have made efforts to conserve the forests in the catchment area, to improve source water quality and quantity.

In order to protect water sources proactively, water utilities

- Procure forests in the upstream area
- Call for volunteers to take care of trees

Example of Catchment Forest Conservation by Some Utilities

Water utility	Location	Area
Tokyo Metropolis	Upstream of Tama River (Okutama machi and part of Yamanashi Prefecture), started in 1910 as the first attempt	23,000ha
Yokohama City (Kanagawa pref.)	Upstream of Doshi River (Yamanashi Prefecture), located outside Kanagawa pref.	2,873ha
Kagawa Prefecture	Upstream of Yoshino River (Kochi Prefecture) Subsidy for improvement cutting and tree thinning for water source forest.	—

6. Preventing Deterioration of Source Water Quality

Example: Watershed Forest in Doshi

The Doshi River is an important water source for Yokohama City, and its upstream areas belonged to neighboring Yamanashi Prefecture. Yokohama City procured publicly-owned forest lands from Yamanashi Pref. in 1916 and started conservation activities of those lands.



Proactive support of conservation activities by the citizens;

- Organize a volunteer group
- Establish the Doshi Forest Fund and collect contributions
- Use the sales of bottled water “Hamakko Doshi”, this name means “we are citizens of Yokohama city together.”



The forest is very wide, and account for 36% of the area of Doshi Village.

Yokohama Waterworks Bureau
<http://www.city.yokohama.lg.jp/suidou/kyoku/torikumi/suigen-hozen/doshivolunteer.html>

6. Preventing Deterioration of Source Water Quality

(3) Legislative Framework for Protection of Water Source Quality

Promoting water quality management over the whole river basin was rather difficult in Japan, due to fragmentation of the competent authorities and laws. However, improvement of basin-wide water quality management is expected by better coordination among water utilities and local governments, as well as the enforcement of the newly-enacted the Basic Act on Water Cycle.

Wastewater treatment in Kyoto City and many other upstream cities to protect water sources for downstream cities

Necessity of water quality management for the whole watershed

Osaka Bay

Osaka city

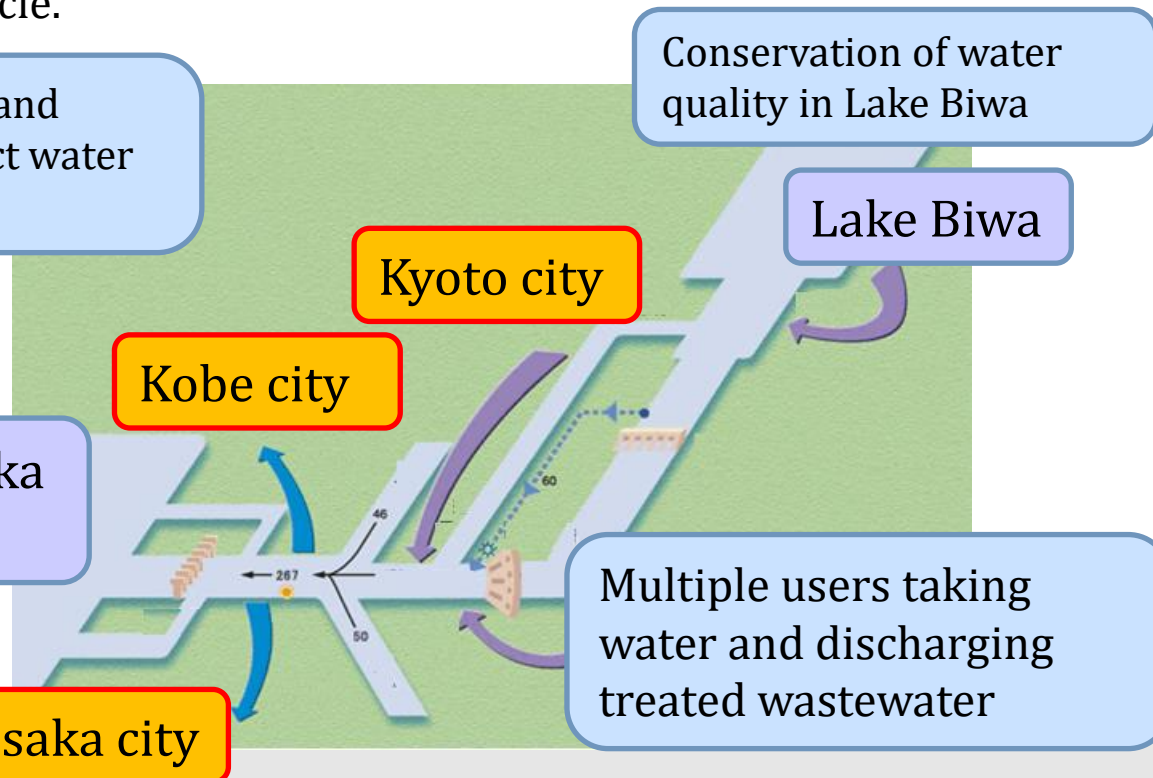
Kobe city

Kyoto city

Conservation of water quality in Lake Biwa

Lake Biwa

Multiple users taking water and discharging treated wastewater



6. Source Water Quality

Formaldehyde Contamination at Tone River

In 2012 a factory located upstream accidentally discharged hexamethylenetetramine. The chemical reacted with chlorine at several downstream water treatment plants to produce formaldehyde. Consequently, the concentration of formaldehyde in treated water increased significantly, almost reaching the limit set by the water quality standard. The following actions were taken to manage the incident;

To find the cause

- Increase the frequency of water quality testing of purified water
- Strengthen the water quality monitoring system
- Communicate closely with other water utilities

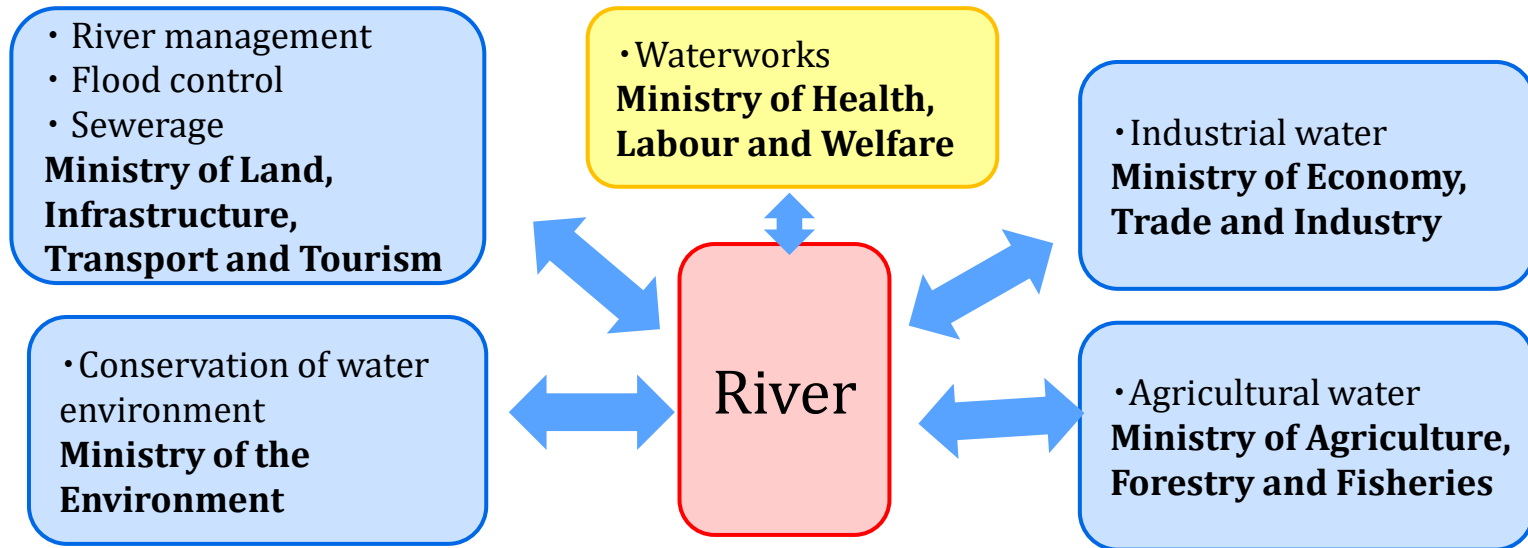
To avoid distribution of contaminated water

- limit or suspend the intake of contaminated water
- Use other water sources including groundwater
- Supply from stock and not-affected treatment plants
- Urgently release water from the upstream reservoirs to dilute and flush the contaminated water

In such a large basin, a single incident can affect many downstream water utilities. Therefore, the networking system among utilities and local governments has been built to share the information and provide rapid emergency response.

6. Source Water Quality

(4) Practical countermeasures against water source pollution



Two Laws concerning drinking water resources (enacted in 1994)

**Ministry of Health,
Labour and Welfare**

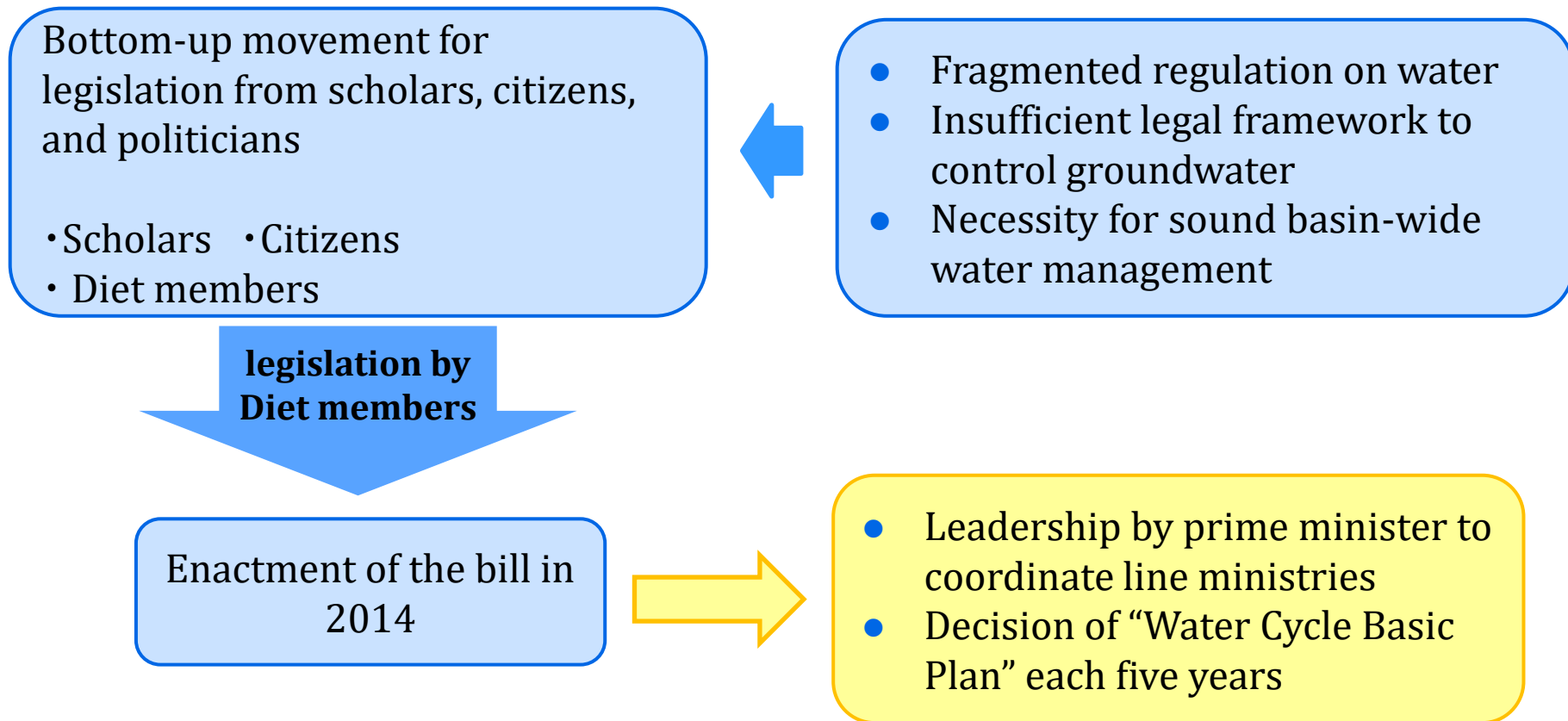
Act on Advancement of Project for Quality Management of Raw Water

**Ministry of the
Environment**

Act on Special Measures concerning Water Quality Conservation at Water Resources Area in Order to Prevent the Specified Difficulties in Water Utilization

6. Source Water Quality

Background of the Basic Act on Water Cycle



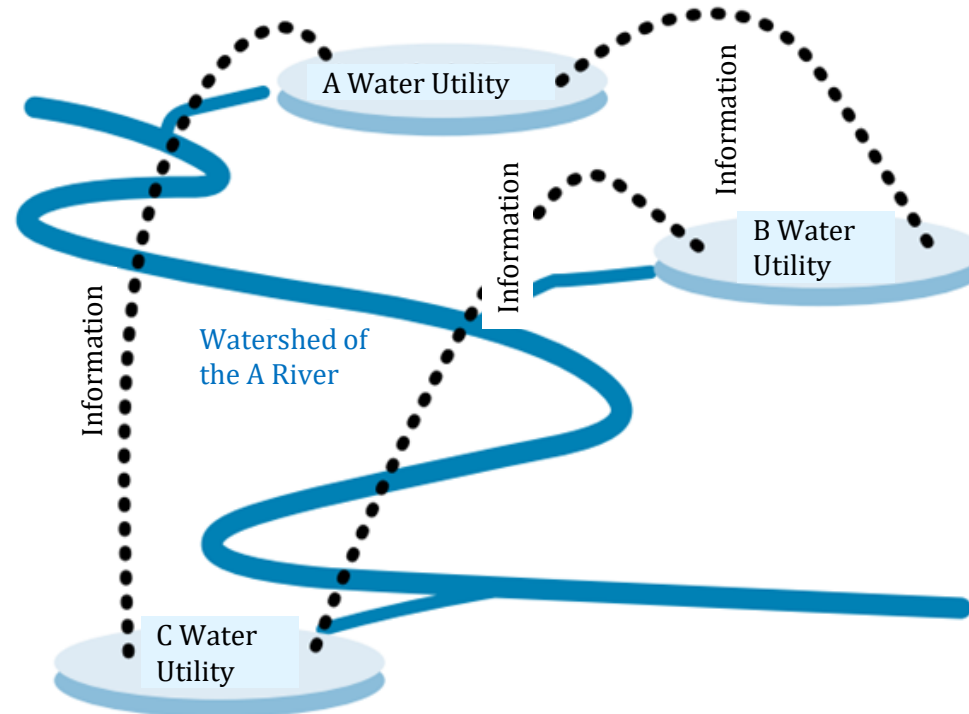
6. Source Water Quality

Necessity of cooperation between upstream and downstream users

Councils of stakeholders for information sharing and dialogue, assembled in each watershed

Cooperation between environmental administration and water supply administration in Prefecture

Water Safety Plan based on information of watershed



7. Lessons Learned (1)

- **(From Source to Taps)** Water quality management is considered as **a whole of management procedures** to meet the water quality standards of **tap water throughout from the water source**. The national government and water utilities have been actively involved in periodical review of water quality standards, improvement of water quality testing methods, monitoring by administrative organizations, quality control of materials and equipment, and human resource development.
- **(Public Health)** Japan has been focusing on epidemiological safety of modern water supply because it experienced outbreak on waterborne diseases. Water quality management is critical to the utilities' ability to supply safe drinking water; it is very important to **public health**.
- **(Monitoring)** Water quality is monitored at the water source, treatment plant, distribution reservoir up to the customers' tap. Automated systems has been introduced in place of manual tests for daily testing of residual chlorine, color and turbidity. It is important to **utilize the data accumulated** for water resource conservation, water treatment and emergency response to accidental contamination of source water quality.

7. Lessons Learned (2)

- **(Cost of Water Quality Management)** Utilities have made **sustained efforts in water quality management** by securing necessary **budget** in their business plan. This is based on the recognition that water quality management requires certain costs for chemicals, electricity and many other expenses.
- **(Starting with a Good Quality Water Source)** **Small-scale utilities** with limited technical capacity and funding have utilized a **good quality water source** and have installed facilities to simplify and economize the treatment process.
- **(Designing Water Quality Management)** In designing **water quality management system**, it should **comply with the legal requirements** prescribed by the relevant Acts and regulations. These include:
(1) designating **a responsible officer** for water quality management;
(2) having national nor government oversight; and (3) **supporting** small and medium scale utilities with limited capacity.

7. Lessons Learned (3)

- **(Setting of Water Quality Standards)** The aim of setting **drinking water quality standards** is the protection of public health from toxic substances and bacteria, and the parameters of our health concern. Water quality standards for contaminants suspected to cause long term health risk (such as cancer), are **revised** as a result of new knowledge, public concerns, and availability of measurement instruments. It was important to establish the standards considering **qualities of water resources** and **drinking water**, the **technical levels** of water quality testing and **measurement instruments** in the country.
- **(Standards for Materials and Equipment)** It is important that utilities use **certified materials and equipment**. The **inspection and certification services** of Japan Water Works Association for materials and equipment play an important role in maintaining the high quality of such products. It is essential that water supply system utilize standardized materials and equipment.

7. Lessons Learned (4)

- **(Protecting Water Source)** Utilities use **advanced water treatment** processes to deal with odor caused by quality deterioration of water sources, but those are expensive. Therefore, **water resource conservation** such as construction of sewage facilities, regulation of industrial wastewater, enhancement of information sharing among surface water users, awareness-raising activities and conservation of water catchment forests. As the water demand saturated and stabled, it became important to **conduct water resource conservation with stakeholders around watershed** while seeking for cleaner water source, for example **moving intake facilities to upstream**.
- **(Cooperation in Watershed)** Utilities in the same watershed cooperate, share information and take prompt action together in case of incidents of pollution. The formal mechanisms for cooperation and coordination greatly facilitate **information sharing** and **water quality management**. In this regard, the development of **water safety plan** is promoted by the national government in Japan.