

Water Quality Tests

History of Water Quality Testing Laboratory

Established on April 5, 1949 as the first self-testing entity for tap water quality in Japan, the Osaka Municipal Waterworks Bureau's Water Quality Testing Laboratory boasts a history that spans more than half a century. To date, the Laboratory has accomplished countless achievements in the field of tap water quality management. Its achievements include the introduction of water quality inspection for the Lake Biwa and Yodo River basins, the source of raw water for Osaka City, and breakpoint pre-chlorination technology, the development of methods of analysis of trihalomethane and malodorous substances, studies into micro-organic substance treatment technology, and the introduction of advanced water purification technology.

Branch offices to carry out water quality management of water purification and other processes were established at the Niwakubo Water Purification Plant on August 1, 1957 and at the Toyono Water Purification Plant on June 17, 1968.

Acquisition of waterworks GLP certification

The Laboratory was Japan's first institution that acquired Good Laboratory Practice certification for waterworks (Waterworks GLP) and has been working to ensure precision in water quality inspections and tests, thereby communicating the highly reliable results of water quality inspections to customers. (Certification acquired on December 26, 2005)



Water quality inspections at faucets

(Daily inspections) Inspection of water quality at faucets is carried out using remote water quality inspection devices installed at a total of 37 locations in each water distribution system, monitoring and measuring the color, cloudiness, toxicity and residual effects of disinfection continuously around the clock. (Fig. 3)

Details of daily inspection at faucets

| Inspection name | Number of measuring locations | Number of measuring items | Remarks |
|--|---|---------------------------|--|
| Water quality inspection plan (daily inspection) | 37 locations determined in Osaka City (marked with ●) | 3 items | Inspection conducted at least once a day on color, cloudiness, toxicity and residual effects of disinfection (Item 1 (a), Paragraph 1, Article 15 of Waterworks Law Enforcement Regulations) |
| | | 3 items | Water temperature, pH value, electrical conductivity |

Fig. 3 Water intake points for daily inspections (Remote water quality monitoring devices at 37 locations)



Water quality management at purification plants

The purpose of water quality management is to ensure that water transmitted to Osaka City from water purification plants conforms to water quality standards and that water purification is properly implemented. In addition, extraordinary water quality inspections are conducted when raw water has become highly cloudy due to heavy rain, when there is an abnormal water shortage, when a raw water contamination accident has occurred, or when irregularities are discovered in water purification processes, and the results are promptly reflected in water purification treatment.

Details of water quality inspections at water purification plants

| Inspection name | Number of measuring items | Number of measuring items | Measuring frequency |
|--|---|---|---------------------------|
| Purification plant water quality management plan | Water purification processes at each water purification plant (raw water to purified water) | Water quality standard items, water quality management target items, etc. (over 200 items, including 91 items and agricultural chemicals) | Once a day to once a year |

Osaka City Waterworks and Water Quality Management Plan

To ensure the safety of tap water, it is necessary to conduct appropriate water quality measurement in all processes, from raw water to each faucet, on a process-by-process basis. In this respect, the Water Quality Testing Laboratory studies the characteristics of water quality fluctuations in each process for each water quality item, and it formulated a plan on water quality management that designates the items of comprehensive water quality measurement spanning all processes, water intake locations, and measurement frequency. As shown below, the water quality management plan comprises four plans, including the Water Quality Inspection Plan, which each waterworks entity is required to formulate under Paragraph 6, Article 15 of the Waterworks Law Enforcement Regulations.

Fig. 1 Structure of Water Quality Management Plan

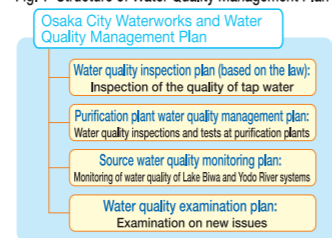
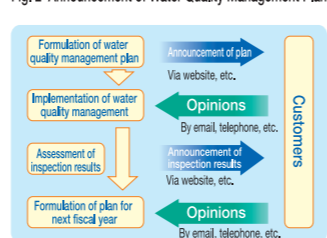


Fig. 2 Announcement of Water Quality Management Plan



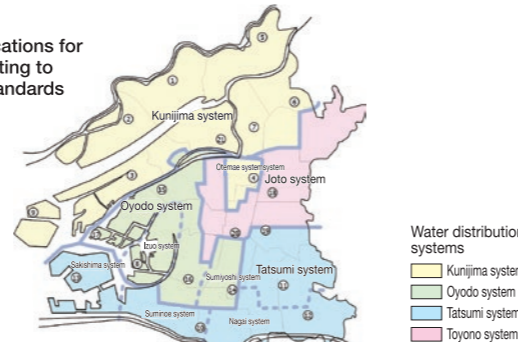
Water quality inspections relating to water quality standards

<Water quality inspections relating to water quality standards> Apart from daily inspections, to check representative water quality for each distribution system, Osaka City has designated a total of 21 water taps and conducts inspections at each such location. Together with the inspections it conducts at exits of purification plants, the City conducts inspections on all the water quality standard items. (Fig. 4) In addition, of the water quality management target items, inspection is also conducted on items associated with the possibility of fluctuations in density in water distribution and supply systems, along with the water quality standard items.

Details of water quality inspections relating to water quality standards at water supply taps

| Inspection name | Number of measuring locations | Number of measuring items | Measuring frequency | Remarks |
|---|--|--|-------------------------------------|--|
| Water quality inspection plan (water quality inspections relating to water quality standards) | 21 locations designated in Osaka City (1~21) | 56 items, including water quality standard items and water quality management target items | Once a month to once every 3 months | Water quality inspections to check for compliance with water quality standards under Article 4 of the Waterworks Law |

Fig. 4 Water intake locations for inspections relating to water quality standards (21 locations)



Source water quality monitoring

The Lake Biwa and Yodo River basins, the sources of raw water for Osaka City, are monitored to grasp the condition of water quality while surveys are conducted in order to contribute to the prediction of future water sources and raw water quality. The Water Examination Laboratory works in collaboration with other waterworks entities that also use Lake Biwa and the Yodo River as water sources to monitor, investigate and research* water quality. In addition, Osaka City conducts independent surveys on industrial waste water released into the Uji and Yodo River basins. In the event of a raw water accident occurring at the source, the established liaison structure is used to promptly acquire accurate information and to put measures in place at water purification plants.

Details of periodic inspections concerning water source quality monitoring

| Inspection name | Number of measuring locations | Number of measuring items | Measuring frequency |
|-------------------------------|-------------------------------|--|--|
| Lake Biwa survey* | 5 | 27 items | Once a month to once every 2 months |
| Yodo River mainstream survey* | 8 | 58 items and 114 types of agricultural chemicals | Once a month to once every 2 months |
| Yodo River tributary survey* | 5 | 48 items and 114 types of agricultural chemicals | Once every 2 months to once every 3 months |
| Industrial waste water survey | 9 | 56 items | Once every 3 months to once every 6 months |

Fig. 5 Source water rivers and industrial waste water intake locations



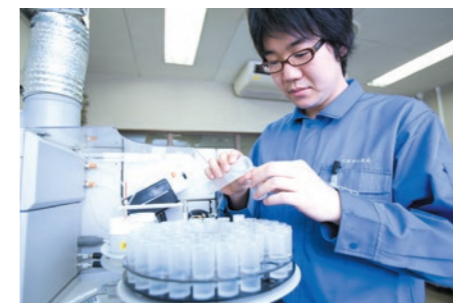
Water quality testing of industrial water

Water quality is tested to check that industrial water supplied for use to industries in Osaka City is of appropriate quality. Regular testing is carried out at the Higashi Yodo River Water Purification Plant (daily and monthly).

Other tests

Various other tests and inspections are conducted, including tests on water purification maintenance and management and on chemicals, materials and equipment related to safety of tap water.

- Quality testing of waterworks chemicals (aluminum sulfate, caustic soda, sodium hypochlorite, concentrated sulfuric acid, etc.)
- Quality testing of materials and equipment (granular activated carbon, filtration sand, gravel, etc.)
- Testing of waste water from specific water purification plants (waste water testing pursuant to Clean Water Act and Sewage Act, etc.)
- Water flow testing at waterworks facilities, such as distribution reservoirs
- Testing for leakage (judging whether the water is tap water)
- Contracted testing (commissioned testing based on the Osaka City Waterworks Bureau Contracted Water Quality Testing Handling Regulations)
- Water quality testing in response to customer inquiries



Research on tap water quality

To ensure the safety of tap water both at present and in the future, concerning substances contained in raw water for tap water with a minute concentration and substances that may be generated as byproducts in the processes of purification treatment or water distribution/supply, Osaka City gathers and examines information on their impact on the health and convenience of people. For items that require additional research, the City works to establish measuring methods and formulate measures to grasp the status of their presence and reduce them.

| Major research target items | Research method |
|--|--|
| Microorganism indicators | • Gathering information |
| Infectious microorganisms | • Development and application of measurement methods |
| Endocrine disruptors (environmental hormones) | • Understanding the status of presence of target items (identifying the presence and concentration in raw water, etc.) |
| Agricultural chemicals | • Understanding behavior in advanced water purification processes, etc. |
| Residual organic pollutants | • Establishment of reduction measures |
| Organic synthetic compounds | • Verification of tap water safety |
| Disinfection byproducts | |
| Items requiring examination of water quality standards | |

List of major precision analysis devices owned by the Water Quality Testing Laboratory

| Analysis device name | Target substance | Number of units owned |
|--|---|-----------------------|
| Inductively coupled plasma mass spectrometer | Metals, including lead | 3 |
| Gas chromatograph mass spectrometer | Agricultural chemicals and organic substances including disinfection byproducts | 4 |
| Purge trap gas chromatograph mass spectrometer | Chloroform and other volatile organic substances | 1 |
| Head space gas chromatograph mass spectrometer | Chloroform and other volatile organic substances | 5 |
| Liquid chromatograph mass spectrometer | Agricultural chemicals and organic substances including environmental hormones | 5 |
| Atom light absorption photometer | Metals including iron | 3 |
| Mercury meter | Mercury | 3 |
| Gas chromatograph | Organic chlorine substances such as PCB | 1 |
| High-speed liquid chromatograph | Anionic surfactant and non-ionic surfactant | 2 |
| Post column high-speed liquid chromatograph | Organic substances including agricultural chemicals | 1 |
| Post column ion chromatograph | Negative ion types including bromates and chlorides | 3 |
| Post column ion chromatograph | Cyan, etc. | 2 |
| Full organic carbon meter | Organic substances quantities | 3 |
| Full organic halogen analyzer | Organic halogen quantities | 2 |
| Scanning-type electron microscope | Solids | 1 |
| Epi-illumination fluorescent microscope | Microorganisms such as cryptosporidium | 3 |
| ATP meter | Total bacteria content | 1 |
| Infrared spectrometer | Plastics | 1 |
| PCR device | Microorganism | 2 |
| Full-automatic solid phase extraction device | Organic substances such as agricultural chemicals | 8 |
| Total nitrometer | Total nitrogen | 1 |
| Micro-plate reader | Bioassay such as environmental hormones | 1 |