Outline of Water Purification Plants

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Osaka City has three water purification plants: Kunijima, Niwakubo and Toyono. These purification plants are located in balanced formation between the upper and lower reaches of the water source, the Yodo River, so that there is a fixed reaching time sufficient to implement necessary emergency measures between their intake points in the event of a sudden raw water quality accident.

■ Kunijima Purification Plant (1-3-14 Kunijima, Higashiyodogawa-ku, Osaka)

The second Waterworks Expansion Project resulted in the launch, from February 1914, of water transmission by a slow-filtration facility with a water supply capacity of 151,800 m³/day from the Kunijima Water Purification Plant, which is the oldest of the existing water purification plants in Osaka City. Subsequently, the fourth Waterworks Expansion Project established Rapid Sand Filtration Plant No. 1, while the fifth Waterworks Expansion Project produced Rapid Filtration Plant No. 2. In addition, the ninth Waterworks Expansion Project commenced in 1969 and resulted in the abolition of the slow-filtration facility and the installation of Rapid Sand Filtration Plants Nos. 3 and 4, covering a site area of approximately 462,000 m², to provide a water supply capacity of 1,180,000 m³/day today. The upper and lower systems are located at the upper and lower reaches of the Yodo River respectively, and raw water is taken in a natural down-flow from the right bank of the Yodo River in Kunijima, Higashi Yodogawa-ku, and also at the Hitotsuya Intake Station on the right bank of the Yodo River in Hitotsuya, Settsu City, and conveyed by pressure pumping. After purification treatment, water is supplied to the central, northern and northwestern areas of Osaka through 13 trunk lines, including the western trunk line, by pressure pumping.

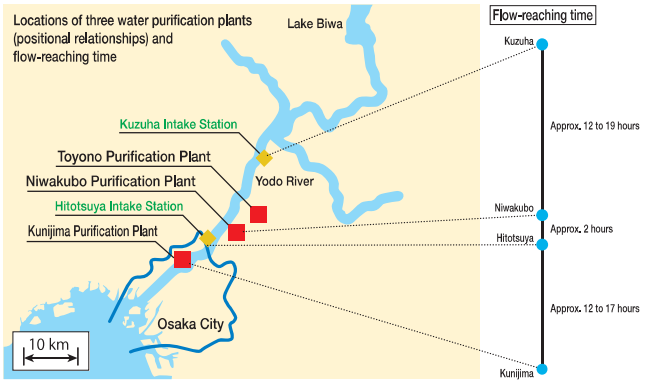
■ Niwakubo Purification Plant (11-31, Yodoe-cho, Moriguchi City)

The sixth Waterworks Expansion Project resulted in the launch, from November 1957, of partial water transmission with a water supply capacity of 120,000 m³/day, and the Niwakubo Water Purification Plant became the second water purification plant in Osaka City, providing full water transmission with a water supply capacity of 240,000 m³/day from July 1958. The plant adopted a rapid filtration system from its inception. Subsequently, the seventh and eighth Waterworks Expansion Projects resulted in a current water supply capacity of 800,000 m³/day and a site area of approximately 220,000 m². Raw water is taken in through natural down-flow from the left bank of the Yodo River down from Dainichi-cho and Oba-cho in Moriguchi City, and after purification processing, water is transmitted to the Oyodo and Tatsumi Water Distribution Plants. Water is then supplied by pressure pumping from the Oyodo Water Distribution Plant through the Naniwa and Taisho trunk lines to central and western areas of Osaka City while water is supplied from the Tatsumi Plant through the Sumiyoshi, south, and new south trunk lines to the southern areas of Osaka City. The Niwakubo Purification Plant was the first in Osaka City to adopt the centralized management system.

■ Toyono Purification Plant (1-1 Uzumasa Takatsuka-cho, Neyagawa City)

The eighth Waterworks Expansion Project provided partial water transmission at the rate of 200,000 m³/day from July 1968, and the Toyono Water Purification Plant, the newest plant in Osaka City, began water transmission at the rate of 400,000 m³/day in September 1969. Subsequently, the ninth Waterworks Expansion Project designed to enhance water supply led to a current water supply capacity of 450,000 m³/day and a site area of approximately 180,000 m². Raw water is taken in by the Kuzuha Intake Station, which is located on the left bank of the Yodo River down from Kuzuha Nakanoshiba in Hirakata City approximately 15 km from the Toyono Water Purification Plant, and transmitted by pressure pumping. After purification treatment, water is transmitted by natural down-flow to the Joto Purification Plant (with an elevation difference of approximately 37 m), and it is transmitted by a combination of natural down-flow and pumping through the Semba, Nagahori and Shin-Imamiya trunk lines to the central and eastern areas of Osaka City. Computer-employed control has been adopted from its inception, and remote computer control has been implemented from the central control room.

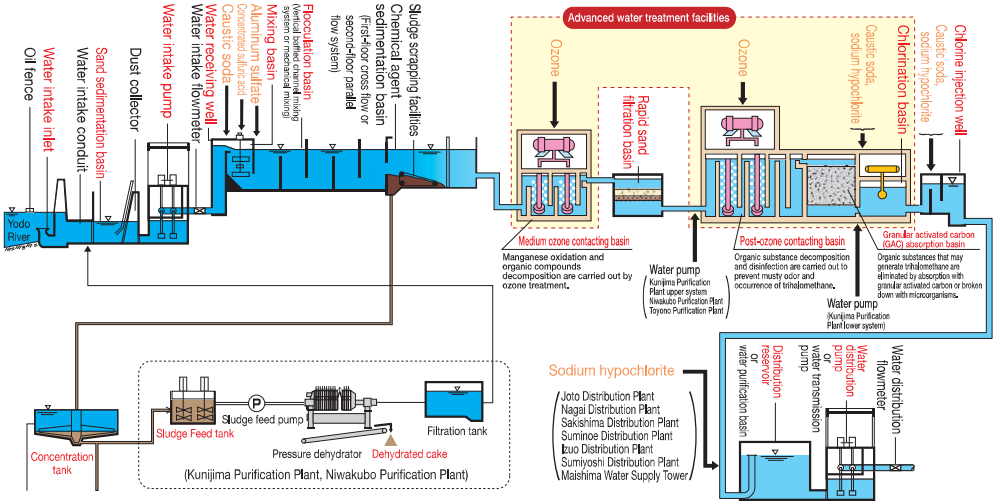
■ Map of waterworks facilities



Water purification treatment system

With the aim of improving general tap water quality in Osaka City by measures such as the removal of mold-like and other unpleasant odors and the reduction of trihalomethane, the Osaka Municipal Waterworks Bureau has introduced an advanced water treatment system, which is based on conventional purification processing that adopts sedimentation basins and rapid sand filtration with the addition of ozone and granular activated carbon treatment.

■ Treatment systems at purification plants



Advanced water treatment

Advanced water treatment is the product of the Advanced Water Purification Facility Improvement Project undertaken from 1992 to 1999 with the aim of realizing the supply of safer, higher-quality water. As a result, advanced water purification facilities for ozone processing and granular activated carbon processing were installed at all purification plants. Then water transmission started to the downstream system of the Kunijima Purification Plant in March 1998, the Niwakubo Purification Plant in March 1999, and the upstream system of the Kunijima Purification Plant and the Toyono Purification Plant in March 2000. The total project cost was 75.3 billion yen.

○ Reasons that advanced water treatment was necessary

Raw water from Lake Biwa, the water source for Osaka City, produced a mold-like odor more or less every year beginning in 1981, and this caused unpleasant odors in tap water taken from Lake Biwa and the Yodo River system. When the unpleasant odor became strong, the approaches taken included the injection of powdered activated carbon and interim chlorination, which failed to adequately remove the unpleasant odors.
In addition, some of the chlorine used in the purification processes and some organic substances present in raw tap water reacted to produce trihalomethane. Although total trihalomethane density at city water faucets was within water quality standards, it became necessary to reduce these levels in order to ensure a safer water supply.
Meanwhile, it was difficult to remove chemicals and small quantities of various organic substances present in rivers by using conventional sedimentation reservoirs and rapid filtration methods mainly applied to the removal of constituents causing cloudiness.
Against this background, with the aim of improving tap water quality, including the removal of unpleasant odors and reduction of trihalomethane, the City introduced advanced water treatment using ozone and granular activated carbon.

○ Outline of advanced water treatment

• Ozone treatment

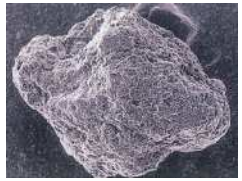
Artificially produced ozone is formed into minute bubbles and diffused to react with target substances in the water to achieve purification. Ozone, which has the second most powerful oxidizing and sterilizing properties after fluorine, is generated from air and electricity alone and there is no need for the transportation and storage of raw materials.
In addition, ozone ensures ease of inverter-controlled adjustments for the amount produced to match the state of raw water. Moreover, ozone returns to oxygen after the reaction, leaving no residual impurities.

* Ozone (O_3), a highly oxidized substance that combines three oxygen atoms, is effective in breaking down organic and other substances that cause mold-like odors, thereby eliminating unpleasant odors. Ozone also serves to oxidize manganese present in water and to disinfect water.


Ozone contact reservoir

• Granular activated carbon treatment

Granular activated carbon, which is a multi-porous substance with a total internal particle space surface area of approximately 2,000 m²/g, removes material such as organic substances dissolved in the water that cause a mold-like odor and trihalomethane-generating substances by adherence to its pores and by breakdown of substances that adhere to its surface into microorganisms.


Granular activated carbon viewed through an electron microscope