Advanced Public Sanitation in 17-19th Century Japan

By Susan B. Hanley

Astonishingly enough, a million inhabitants of Edo (today's Tokyo) enjoyed better public hygiene than their counterparts in major cities in the West in terms of quality of water supply and waste disposal from the mid-17th century through the mid-19th century. All wooden pipes for the water supply were laid underground in order to prevent contamination that would otherwise have been likely to occur. Pipes can only be seen above the ground in the ravine. In 1655, the townsfolk were ordered to dispose of their garbage and rubbish on an island, with the result that waste disposal became a very profitable business.

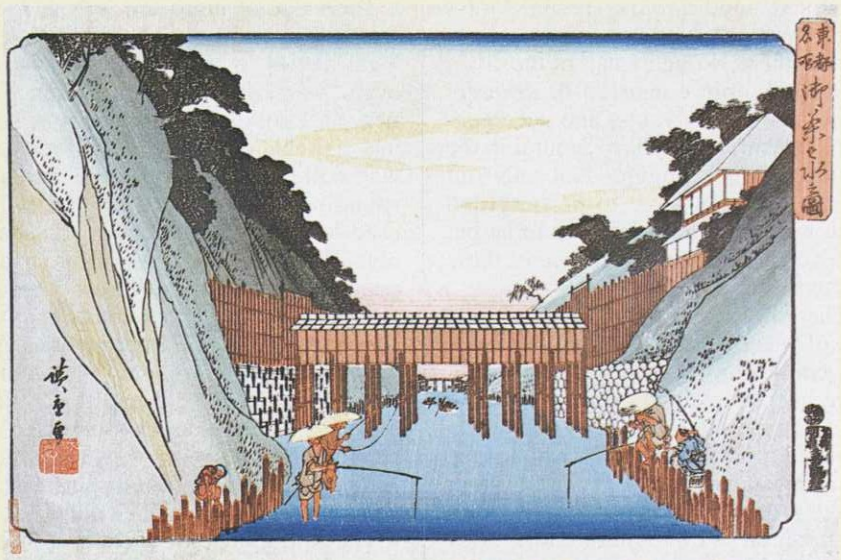


Photo : Tokyo Metropolitan Central Library, Tokyo Shiryo Bunko

The Edo period is better characterized as one in which government weighed heavily on the people under a conservative, authoritarian regime rather than one in which rulers actively promoted public health. However, public health was a beneficial side effect of the regulations set down to maintain law and order in the Shogunal capital of Edo (today's Tokyo). Strong control enabled the city to grow into a metropolis of a million inhabitants by the early 18th century, nearly double the size of London, Europe's largest city. Equally important, it gave them a level of health and life expectancy by the 19th century that was comparable to Europe's.

A strong case can be made that sanitation in Japan through the mid-19th century was as good as or better than in the West. In England, Queen Victoria's consort, Prince Albert, died in 1861 of typhoid fever thought to have been contracted because of faulty sewage drains. Cholera, typhoid, and other bacterial diseases spread by filthy conditions were endemic in American, English, French, and other Western cities. Only in 1921 was London's water supply considered safe to drink.

In contrast, the water supply and waste disposal methods in Edo and other Japanese cities were generally efficient and relatively hygienic. In 1877, an Englishman, R.W. Atkinson, read a paper before the Asiatic Society of Japan in which he concluded that Tokyo in the decade just after the Meiji Restoration had a water supply purer than London's. Atkinson had tested Tokyo's water for organic matter, which would indicate contamination from sewage. As might be expected, he found it purer the closer it was to its source. But his overall conclusion surprised even him, considering that Tokyo was still using Edo's wooden pipes while London's system had metal pipes and the latest technology. Thus, Edo's quality of water was dependent not upon industrial technology, but upon earlier methods rigorously applied and controlled.

Most important for public health was providing an adequate and high quality water supply. When Tokugawa Ieyasu selected the site for his capital in 1590, he ordered a former retainer, Okubo Togoro Tadayuki, to construct a water supply system. The first water system constructed, the Kanda system, drew its water from the Inokashira spring to the east of Edo. Water was carried in exposed aqueducts to the city, and within the city, in wooden pipes.

The Kanda system was over 41 miles in length and water from the Inokashira spring was limited. By the mid-17th century this system proved inadequate for the city's needs. In 1652, a second system was begun using water from the Tama River. The Tama River system carried water nearly 27 miles to the Yotsuya gate of Edo castle, where siphons were used to draw water up into the castle. This system first supplied the Shogun with water and then the nearby areas of Kojimachi, Yotsuya, Kyobashi, and Akasaka.

The Tama River system too proved inadequate, not so much because of insufficient water, but because of the difficulties of raising the water to higher ground as the city expanded, even though increasingly sophisticated engineering techniques were used. Another major reason construction of water systems continued was the problem of frequent and devastating fires in Edo where the buildings were primarily of wood. After the great Meireki fire of 1657, when approximately two-thirds

of the city was destroyed, policies were implemented to decrease the density of population at the city's center. And four new water systems were added, all relying on the Tama River for their supply.

The motivation for these policies and massive public construction was to create a city suited to serve as the administrative capital for the Shogunate and the headquarters in Edo for the two hundred sixty-odd *daimyo* (feudal lords) who were required to maintain residences there. Roughly half of the city's million people consisted of *daimyo*, their families, servants, and accompanying samurai as well as samurai in the service of the Shogun. Not only did this population have to be provided with water, but measures had to be put in place to ensure maintenance of these systems.

The government tightly regulated the use of water. Only samurai of high status could draw water by directly tapping into the main system. The public was supplied with water from wells built into the aqueducts. This ensured an adequate flow of water twenty-four hours a day. In contrast, by the mid-18th century, Londoners could draw water only seven hours a day, three days per week. The Tama River system brought so much water into Edo that a waterfall in the Shinjuku Imperial Gardens was created from the surplus and no emergency back-up system was considered necessary. The water quality remained so high that the Ebisu Beer Company founded in the early Meiji period used water from this same system. In fact, Edo's system was so well designed that when it was modernized at the end of the 19th century, the only major change was to replace the wooden pipes with impervious metal ones.

Limiting access to water helped maintain its purity, but because the underground pipes were not built of impervious materials, control of waste matter was crucial in maintaining its quality. The most important difference between the disposal of human wastes in Japan and the West was how it was regarded. In Japan, human excreta was not an economic "bad"—something that one paid to have removed – but an economic good with a monetary value. Human waste from Japanese cities had long been used as fertilizer in a country with too little land to let fields lie fallow. By the Edo period, the limited amount of arable land combined with population growth and the relative scarcity of other kinds of fertilizer gave human excreta a value far higher than it had in the West.

The value of night soil is best documented in Osaka where there were legal battles to rights to collect it and even "wars" between contending parties. In Edo, disputes were not as serious a problem, but night soil here too was collected by farmers in the surrounding areas to fertilize the fields used to supply Edo with its food supply. When waste has a positive value, people aren't going to throw it away, and so excreta was not dumped into the streets, as it was in European cities, nor was it allowed to seep into the ground. Archaeologists have found fewer sites of toilets in Edo than they expected to, probably because the waste was collected and sold to farmers instead of being stored in pits or cesspools.

The importance of night soil to the farm villages can be seen from the economic losses suffered by a village head in Tama who lost his supply of fertilizer in 1725 when the main residence of the *daimyo* of Owari Tokugawa burned. As a result, this farmer suffered major crop losses. Usually each *daimyo* contracted out the rights to collect night soil from his residence, with the price determined on the basis of market demand. For example, in 1742, the Hitotsubashi *daimyo* sold the rights to waste from his residence to a farmer named Hanbei in a Tama village. The price was 1,500 large *daikon* (white radishes), 2,000 middle-sized *daikon* or two *ryo* in cash, whichever Hanbei preferred, to be paid at the end of the year. Each year this *daimyo* house let farmers bid on its waste.

As the price of night soil rose over time, entrepreneurs sought rights to place containers to collect urine on busy street corners in Edo, but these petitions were denied. Because Edo was the seat of government, officials were concerned with appearance, but they also worried that the containers would block narrow streets and smell. To circumvent these objections, an innovative petition was put forth in 1789 requesting permission to use soy sauce and sake barrels instead of urinals because these would be less unsightly. Thus the value of human waste combined with a concern of the officials for the appearance of the administrative capital resulted in a city in which relatively few human contaminants reached the city water supply.

Edo officials also had to be concerned with wastes other than night soil. They classified it into four types: 1) household waste, probably kitchen garbage for the most part; 2) trash discarded along the roads and in the waste water drains; 3) junk floating in various waterways – moats, rivers, canals, and harbor; and 4) waste from fires. Waste water from a million inhabitants also posed major disposal problems.

Regulations regarding waste in Edo began to appear as early as the mid-17th century. The problem was keeping the streets, open areas, and drainage ditches free from rubbish. At the same time, problems relating to the disposal of human excreta came to the attention of the authorities. In 1648, city regulations mandated that small huts and toilets situated along the banks of rivers be torn down. The repeated issue of this and similar regulations over the next half-century indicates that Edo residents must have been slow to comply with the new, more sanitary arrangements for waste disposal. And most likely the demand for night soil was not so high during the 17th century as it was in the following centuries.

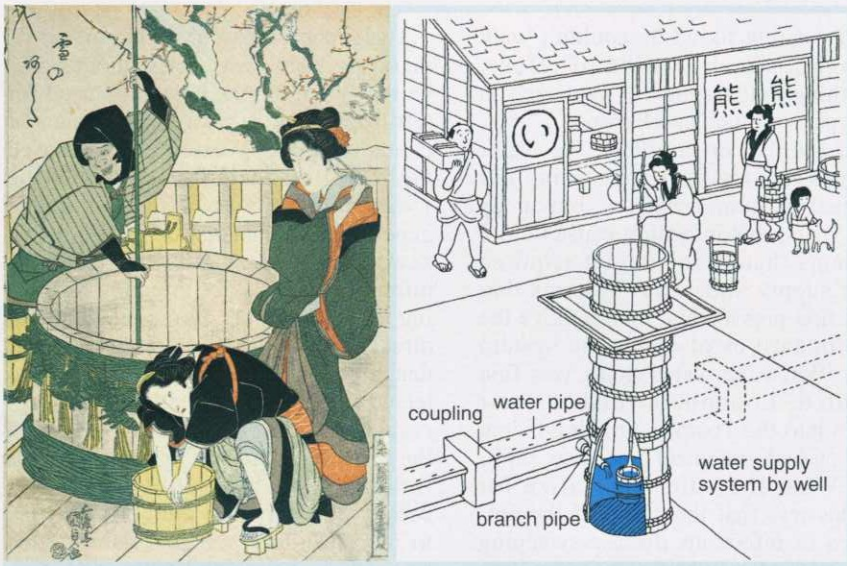
In 1655, the people in Edo were ordered to dispose of their garbage and rubbish on the island of Eitai in Edo Bay, rather than just dump it in the rivers. During the next decade disposal policies were gradually put into place: collection points for refuse were established in each ward, transport was contracted to specific jobbers, and wards were ordered to bear the costs. From the collection points in each ward, the

rubbish was loaded onto boats and transported to Eitai island. Although the original purpose of these measures was to keep the river channels open for commerce and traffic, they resulted in the establishment of a dump outside the city limits and most certainly reduced public health hazards over the next two centuries.

The designation of Eitai Island as a dump eventually resulted in the creation of new land from the swampy ground in eastern Edo. Several other landfills also resulted in the creation of fields, so that disposing of Edo's wastes became a very profitable business. By the 1820s, at least eighty contractors were involved in collecting the rubbish from Edo. Now townspeople had only to deposit their refuse at a collection site within each ward and pay for its collection and transportation for final disposal by a contractor.

Finally, there was the problem of the disposal of waste water from hundreds of thousands of households. From the number of regulations issued, the major problem seems to have been keeping waterways free from rubbish, rather than providing for drainage itself. Detailed instructions were issued: people were ordered to construct drainage channels along the fronts of their houses, under the eaves. These ditches collected runoff from the streets and roofs, as well as people's waste water used in the kitchen, laundry, and bathing. Water flowed through these ditches, partially covered by stones to prevent people from falling in. Archaeological excavations in Tokyo reveal the fine network of drainage ditches even within the compounds of what would be considered crowded working-class housing at best and slums at worst. Similar ditches can still be seen in Tokyo suburbs and other Japanese cities today.

Authorities had tight control over the enormous population of Edo. The city was divided into *machi*, which were village-sized units responsible for government at the local level. The premodern equivalents of the police box were set up at large intersections, not only to keep an eye out for criminal activities, but also to ensure that no water pipes were leaking and that the streets were kept clear. City authorities made use of outcasts who lived within the city to keep the streets free from dead animals, handle corpses, and perform tasks the ordinary residents would not touch. Not long after the Meiji Restoration, the American scientist, Edward Morse, wrote that the poorest areas of Tokyo "are immaculate in comparison with the unutterable filth and misery of similar quarters in nearly all the great cities of Christendom."



Photos : The Seikado Bunko Library (left) Hamura Museum (right)

Water pipes were laid underground in order to prevent contamination that would otherwise have been likely to occur. The Japanese public was supplied with hygienic water twenty-four hours a day from wells.

Urban sanitation from the mid-seventeenth through the mid-19th century was almost certainly better in Japan than in the West in terms of waste disposal and the quality and quantity of the water supply. The Japanese had fewer domestic animals, and since most goods were transported by boats and human labor rather than horses, cities did not have to contend with large amounts of dung in the streets. Finally, government played a major role in setting and maintaining standard of sanitation in the cities.

In contrast, Westerners traditionally relied on pits in the grounds, such as cesspools, for the disposal of human wastes, and the danger of polluting the water supply was ever present. In some cities maids emptied chamber pots out windows, and streets in London had open sewers running down the middle of them as late as the early-18th century. Even in the 1880s, Cambridge, England, was described as "an undrained, river-polluted cesspool city."

Streets in American cities were no better and possibly worse. In 1857 streets in New York were described as "one mass of reeking, disgusting filth, which in some places is piled to such a height as to render them almost impassable by vehicles." Laws put responsibility for cleaning streets on the owners of the abutting buildings, but these were ignored. One solution was to let hogs feed on the refuse instead of collecting the garbage. Visitors from Western Europe were disgusted, not only by the streets of New York but Louisville, Cincinnati, and other cities.

In contrast, Western visitors to Edo, from the beginning of the Edo period to its end, found its streets preferable to those in Europe. A Spaniard in Edo in 1609 found the main streets wide and long and superior to those in Spain, finding them so clean that "one hardly thinks people even use them." In the 19th century, the first British minister to Japan, Rutherford Alcock, remarked

that one rarely found he couldn't walk through a street because of refuse, something that frequently happened in many parts of Asia and Europe.

The English invention of the water closet is famous for transforming our disposal of human wastes, but in its early years, this invention caused more problems than it solved. It required water supply and sewer systems that could first provide and then remove the large quantities of water the system used. When the water closet was first invented, Londoners flushed their wastes into the Thames, thinking that at last they had gotten rid of a nasty problem. What they did not realize for decades was that the cause of the epidemics of infectious disease sweeping London was the flushing of sewage into the upper Thames and taking drinking water from downstream. Paris, Europe's second largest city, suffered the same problem. As late as 1850, a large part of its water supply was drawn from the main collector sewer, the Seine River.

Photo : Tokyo Metropolitan Central Library, Tokyo Shiryo Bunko

Efforts were made to shield the water supply from the drainage system. Sewage would flow into the ditches constructed under the eaves of houses, which prevented waste matter from percolating through the soil and kept the underground water pipes clean.

The Japanese use of night soil on its market gardens was not without problems. When human excreta is used for fertilizer, there is always the danger of contamination. Westerners once used night soil on their farms, but by the 19th century, both officials and the general public had a strong bias against sewage farming. However, Asians minimized the risk of infection by storing night soil prior to use, knowing that direct application of raw night soil was dangerous. And Japanese further protected themselves by eating most vegetables cooked, by drinking water in the form of tea, removing their footgear indoors, and by following Shinto beliefs of purity and pollution that led to more sanitary personal habits, such as washing hands and using salt, fire, and water as purifiers.

Although customs relating to hygiene within the household depended on individual conformity to have effect, public sanitation also depended on government. A major reason that clean streets and an adequate water supply of high quality could be maintained was the high degree of control that existed over the populace during the Edo period. Government control was enhanced by two factors. First, the raison d'etre of the samurai class was to govern Japan. Explicit in the neo-Confucian philosophy the samurai adopted was the concept of rulers as benevolent, as responsible to the ruled, and as moral examples. Second, by the 18th century, there were more samurai than were needed to govern, and overstaffing resulted in numerous detailed regulations and sufficient officials to see that these regulations were enforced.

The result of all this government was a level of public health in Edo, and other large cities as well, that enabled the maintenance of urban populations larger than European capitals in the seventeenth and eighteenth centuries. These were surprisingly free from the devastating effects of epidemics. Cholera reached Japan only in the 19th century and then was quickly contained by rigorous enforcement of public regulations. In the late 19th century, Edward Morse was astonished to learn that the death rate of Tokyo was lower than that of Boston. Life expectancy in Europe was around 40 years in the mid-19th century, the same as most of the samples we have for Japan at the same time.

What has obscured the realization that the level of public health was high in premodern Japanese cities is the fact that the sanitation systems in the 20th century were backward by modern standards. In 1985, only 34 percent of Japanese communities had modern sewer systems, and ironically, the residents of a town named Tamagawa Josui (Tama River Water Supply) were still without a sewer hookup. But it was the very success of the premodern methods for dealing with night soil that made the Japanese slow to modernize their toilet and sewage systems. Because the basic methods used in the Edo period functioned so well, there was no imminent need to spend the vast sums necessary to install flush toilets and construct water-carriage sewage systems to remove waste water. Public funds could be expended instead to enhance economic growth.

Despite the shortcomings in public sanitation facilities, the Japanese today have the longest life expectancy of any major nation in the world and the world's second largest economy. I think premodern public health played a large contributing role in both accomplishments. JJTI

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