

Emergency Activity during a Disaster by the Public–Private Cooperation in Nagoya City

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ABSTRACT

A water supplier is required to supply safe water after a large earthquake. Nagoya City is predicted to suffer extensive damage in the upcoming Nankai Trough Earthquake. Therefore, we are promoting ways to develop seismic resistance of water facilities.

However, facing a severe financial situation due to decreasing water supply revenues, it will take a long time to make all water facilities earthquake resistant. Furthermore, in case of serious damages due to a large earthquake, there remains concern regarding whether the personnel necessary for disaster response can be secured quickly. Therefore, to construct a rapid post-disaster response system, we have been promoting the expansion of a cooperative system with Meisuikyo, an organization consist of Nagoya City designated company for water supply equipment work, during a disaster.

We report on this public and private partnership system, which we have been promoting between the city authorities and Meisuikyo, that operates during a disaster.

We concluded an agreement on emergency water supply in 2000 with Meisuikyo. In 2012, considering the situation during the Great East Japan Earthquake that occurred in March 2011, we revised the agreement and included emergency water supply, emergency restoration, and emergency waterproofing in it. Thus, we have prepared the foundation for a cooperation system that can be implemented during a disaster. Moreover, in 2016, we entrusted temporary water faucets, which are equipment for opening emergency water supply facilities, to Meisuikyo, who is working closely with local communities on a daily basis, and requested them to open 105 of 207 emergency water supply facilities after the earthquake occurred. We have thus established a system that can rapidly develop emergency water supply activities. Furthermore, we incorporate cooperative drills with Meisuikyo in our disaster reduction drills, which we conduct annually, and are trying to maintain and strengthen the collaboration structure between them.

From now on, we will continue to build the earthquake resistance of water facilities with limited personnel and financial resources. Furthermore, to implement emergency activities more effectively, we will strengthen our cooperation with various collaborators such as Meisuikyo and develop a town that can respond strongly during a disaster.

INTORODUCTION

In recent years, large earthquakes have occurred around the world. Japan has also frequently witnessed large earthquakes, such as the Great East Japan Earthquake in 2011 and the 2016 Kumamoto Earthquake, which have caused extensive damage to various places.

As shown in Figure 1, Nagoya City is located near the center of Japan. The outline of the city's water supply works is as indicated in TABLE I. In recent years, there are concerns over the occurrence of a Nankai Trough megathrust earthquake with an epicenter at the Nankai Trough located in coastal waters, which is also expected to cause severe damage to Nagoya City [1].

Nagoya City Waterworks & Sewerage Bureau, aiming to continue the stable supply of safe and secure drinking water even after the occurrence of a large earthquake, such as a Nankai Trough megathrust earthquake, has made daily efforts to ensure the earthquake resistance of water supply facilities. As of the end of March 2017, the percentage of earthquake-resistant pipes out of all of the approximately 8,400 km of distributing pipes owned by the Bureau is approximately 28%.

In recent years, however, Nagoya City's revenue from water supply has decreased year by year. In such severe financial conditions, it would still take a long time to make all the water supply facilities earthquake-resistant with only a few annual construction works to improve the resistance to earthquakes of water supply facilities, which requires a large amount of funding. In the case of severe damage due to a large earthquake, with an expectation that many of our staff members will sustain damage, there remain concerns over whether we can quickly secure the personnel required to respond to such a disaster.

As such, our Bureau has improved and strengthened its emergency activity system in cooperation with private companies. Among such efforts, aiming to establish a quick response system at the time of disaster, we have improved and expanded our cooperative framework for the time of disaster with Nagoya City Designated Water Service Installers' Association (hereinafter "Meisuikyo"), one of the union organizations of the city's designated water supply device installers. Since the member water service installers of Meisuikyo have skilled techniques and daily interactions with local residents as the water service installer for the town, they can serve as reliable and encouraging entities for local residents at the time of disaster.



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Figure 1. Location of Nagoya

TABLE I. Outline of Nagoya City's water service

Start of water supply	1914
Population served	Approx. 2.4 million people (2016)
Water supply ratio	100.0 % (2016)
Daily average water supply volume	Approx. 760,000 m ³ /day (2016)
No. of staff members	Approx. 2,300 people (2016)
Managed by	Local governments

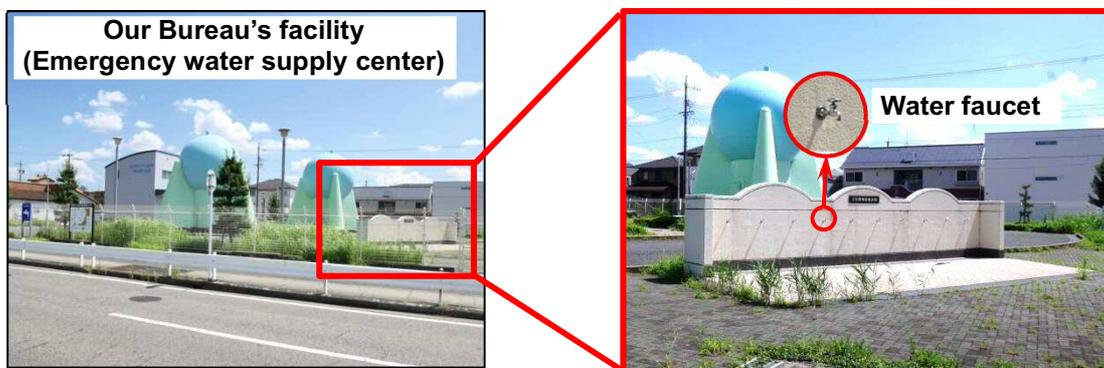
We will herein summarize and report on the public-private sector cooperative framework regarding emergency activities at the time of disaster, which has been advanced between our Bureau and Meisuikyo.

EMERGENCY WATER SUPPLY ACTIVITY SYSTEM

Our Bureau formulated Nagoya City Waterworks & Sewerage Bureau's Business Continuity Plan (earthquake countermeasure version) aiming for the quick recovery of water supply and sewerage functions and a quick response to disaster, and has made the emergency activity system and details of our emergency activities widely known to our staff by setting them in a manual.

Also, emergency water supply facilities are set in the water supply areas at approximately 2 km intervals, so that local residents can easily secure water at the time of disaster. There are some 207 such facilities. Emergency water supply facilities are roughly classified by their shapes into permanent types and temporary types. Permanent facilities are established inside our Bureau's facilities, such as water purifying plants, water distribution stations and emergency water supply center. Equipped with faucets even in normal times, our Bureau's permanent water supply facilities are open to the public as an emergency water supply (see Figure 2 (a)). Meanwhile, temporary facilities are installed in facilities such as safety evacuation area and designated evacuation shelters, in which the Bureau's staff members temporarily set water faucets as an emergency water supply after carrying in and assembling temporary water faucets, which consist of exclusive equipment for the time of disaster (see Figure 2 (b)).

According to the Bureau's arrangement, with the occurrence of an earthquake intensity of



(a) Permanent type



(b) Temporary type

Figure 2. Our Bureau's emergency water supply facilities

lower 6 or stronger on the Japanese scale of seven in Nagoya, we should establish an emergency water supply system by quickly opening all of our emergency water supply facilities.

After a disaster occurs, using these emergency water supply facilities and water supply vehicles, we will supply safe and secure drinking water to all local residents and evacuees.

COOPERATIVE FRAMEWORK BETWEEN THE BUREAU AND MEISUIKYO **Conclusion of the Disaster Mutual Aid Agreement**

In April 2000, our Bureau and Meisuikyo concluded an agreement regarding emergency restoration works for water supply equipment with the aim of restoring water supply equipment quickly if these equipment are damaged due to the occurrence of an earthquake or other natural phenomenon. However, the Great East Japan Earthquake, which occurred on March 11, 2011, made us recognize that cooperation with private companies is absolutely essential in emergency water supply activities at the time of disaster, not to mention emergency restoration activities.

Thereafter in December 2012, we reviewed the content of the conventional agreement, and concluded a new Disaster Mutual Aid Agreement. The new agreement clearly stipulates that in an effort to improve conventional agreement details, we shall carry out not only “emergency restoration works” but also “emergency water supply activities” and “emergency water stopping operations” in cooperation with Meisuikyo.

Thanks to the conclusion of this new agreement, in addition to emergency restoration works, we have also become able to make a dispatch request to Meisuikyo for necessary personnel and vehicles in terms of emergency water supply activities and emergency water stopping operations. This has allowed Meisuikyo to expand the scope of its emergency activities, which in turn has led to improving the cooperative framework between our Bureau and Meisuikyo at the time of a disaster.

Cooperative implementation of disaster reduction drills

Our Bureau holds a disaster reduction drill in September every year. The emergency water supply activity training is also one of the implementation items. Since 2012, when we concluded the new Disaster Mutual Aid Agreement, with the purpose of strengthening our cooperation with Meisuikyo at the time of a disaster, we have held cooperative emergency water supply activity training with Meisuikyo. In this emergency water supply activity training, our Bureau and Meisuikyo jointly conduct training on loading a vehicle with a 1 m³ water supply tank, training on



(a) Training on loading a vehicle with a water supply tank (1 m³)



(b) Training on installing temporary water faucets

Figure 3. Our Bureau's disaster reduction drills attended by Meisuikyo

installing temporary water faucets, information transmission training, and so on (see Figure 3).

Implementation of large-scale disaster reduction drills

Although we have improved the cooperative framework between our Bureau and Meisuikyo through such efforts as the conclusion of the agreement, there are concerns that many designated member water service installers of Meisuikyo have little experience of disaster response at the time of a large earthquake, and little accumulation of technologies and skills related to emergency activities. That is why we were expected to hold disaster reduction drills specializing in practical operations at the time of a disaster. As such, a large-scale disaster reduction drill, hosted by Meisuikyo and co-hosted by our Bureau, was held in 2013 at the Bureau's training facility. In this disaster reduction drill, which was attended by at least 300 people from member water service installers of Meisuikyo, some practical training was held, such as training on installing temporary water faucets, training on loading and transporting a vehicle with a water supply tank (1 m³), training on operating gate valves and water stop valves, emergency training on operating gate valves and water stop valves, and emergency training on stopping water (see Figure 4).

In 2017, the second large-scale disaster reduction drill was similarly held. We will maintain and strengthen Meisuikyo's designated member water service installers' capacity to respond to disasters by periodically holding practical disaster reduction drills like this one again in the future.

Joint participation in disaster reduction drills which are held in the local community

Previously, our Bureau had participated alone in disaster reduction drills held in the local community, such as voluntary disaster reduction drills held by neighborhood association in



(a) Training venue



(b) Training on emergency stopping water



(c) Training on operating a gate valve



(d) Training on installing temporary water faucets

Figure 4. A large-scale disaster reduction drill

response to requests from the organizers of the drills. Currently, however, our Bureau and Meisuikyo are jointly participating in these drills. In disaster reduction drills held in local communities, we explain about our emergency activity system and emergency water supply facilities, and hold emergency water supply activity training with the participation of local residents. As such, our Bureau is strengthening the cooperation between the Bureau and Meisuikyo, and is making efforts to realize quicker and more effective emergency activities at the time of disaster by strengthening our ties with Meisuikyo and with local residents.

Entrustment of temporary water faucets

In 2016, for the quicker securement of an emergency water supply system after the occurrence of a large earthquake, our Bureau and Meisuikyo concluded an agreement concerning the installation of temporary water faucets (see Figure 5) and related matters at the time of disaster. The main points of this agreement will be shown in TABLE II.

The conclusion of this agreement has allowed our Bureau to entrust the temporary water faucets to be installed in emergency water supply facilities to Meisuikyo, and, at the time of disaster, to have a system in which designated member water service installers of Meisuikyo, on behalf of our Bureau, can install temporary water faucets after going into action at emergency water supply facilities.



Figure 5. Temporary water faucet

TABLE II. Main points of agreement concerning the installation of temporary water faucets and related matters at the time of disaster

[Main point 1] Entrustment of temporary water taps to Meisuikyo.
Our Bureau entrusts our temporary water taps to Meisuikyo free of charge.
[Main point 2] Designation of emergency water supply facilities for which Meisuikyo will install temporary water faucets, and of responsible water service installers
Specify beforehand emergency water supply facilities in which the entrusted temporary water taps will be installed, and Meisuikyo's designated member water service installers who are responsible for the operation of opening the facilities.
[Main point 3] Specification of actions based on observed seismic intensity
Specify actions to be taken by Meisuikyo's designated member water service installers depending on the maximum seismic intensity observed in Nagoya.
In the case of an earthquake measuring upper 5 or less on the seismic intensity scale Install temporary water taps in previously specified emergency water supply facilities in response to a request from the Bureau.
In the case of an earthquake measuring lower 6 or more on the seismic intensity scale Install temporary water taps in previously specified emergency water supply facilities, assuming that the Bureau has requested them.

Since designated member water service installers of Meisuikyo always engage in community-based activities, and many of them live in their shops, after the occurrence of a large earthquake, we can expect a more rapid emergency water supply system in which these installers can go into action at the emergency water supply facilities more quickly than the Bureau's staff members to install temporary water faucets. In the case of an emergency on holidays or at nighttime, in particular, since our Bureau's staff members need to come from far away to assemble at the Bureau's office and are then dispatched to the emergency water supply facilities, the installers would be able to open emergency water supply facilities more quickly.

Currently, based on this agreement, we have selected 105 out of all our Bureau's 207 emergency water supply facilities for Meisuikyo to take charge of the operation of opening the facilities, with 112 temporary water faucets entrusted by our Bureau to Meisuikyo stored by each designated water service installer in charge of the operation of opening emergency water supply facilities. The agreement stipulates that the number of responsible service installers for these emergency water supply facilities and the number of entrusted temporary water faucets can be increased or decreased through discussion between the two parties as required.

Furthermore, with training on installing temporary water faucets in cooperation between our Bureau and Meisuikyo added to disaster reduction drills as a training item, we are striving to secure Meisuikyo's technical skills and to maintain and strengthen the cooperative framework between the two parties.

IN CONCLUSION

Through the efforts explained above, our Bureau has established a system for quicker and more ensured emergency activities at the time of disaster. To make our emergency activities more effective, even after the highly likely occurrence of large earthquake in the near future, we must aim to establish a system with which we can make our facilities earthquake-resistant within our limited financial and human resources, and continuously supply safe and secure drinking water even after the occurrence of a large earthquake in an effort to create a disaster resilient city by strengthening and maintaining our public-private cooperative framework with private companies including Meisuikyo.

[1] "*Estimation of Damage by a Nankai Trough Megathrust Earthquake*" published by Nagoya City in 2014