

**Koji NAKAMURA**  
**Masaaki OZAKI**

*Japan Institute of Wastewater Engineering Technology*

## **WASTEWATER UTILITY BUSINESS CONTINUITY PLAN FOR LARGE-SCALE EARTHQUAKE**

### **KOMUNALNY PLAN UTRZYMANIA CIĄGŁOŚCI DZIAŁANIA SYSTEMU WOD-KAN W PRZYPADKU WIELKICH TRZĘSIEŃ ZIEMI**

*Skutkiem doświadczeń wpływających z dużych trzęsień ziemi, które nastąpiły w przeszłości dokonano przeglądu środków zapobiegawczych dla systemu wod-kan w Japonii, zarówno pod kątem strukturalnym, jak i niestrukturalnym. Opracowano plan ciągłości działań (BCP) dla jednego ze środków niestrukturalnych. Japońska inicjatywa stworzenia BCP dla systemu ściekowego rozpoczęła się wraz z wydaniem „Manual od Sewerage BCP Development” przez Rząd w 2008 roku. Po Wielkim Trzęsieniu we Wschodniej Japonii przeprowadzono ankietę w oczyszczalniach ścieków dotkniętych przez trzęsienie ziemi, w konsekwencji okazało się, że jedynie 17% oczyszczalni stworzyło BCP. Przeprowadzono dochodzenie w celu zbadania wpływu stworzenia BCP dla tych oczyszczalni i innych obiektów, jak również wyzwania wynikających z pierwszej odpowiedzi przemysłu wodno-kanalizacyjnego.*

## **1. Introduction**

In the aftermath of the Great East Japan Earthquake, the facilities supporting sewerage service suffered unheard of massive damage where most of the sewerage service provided by local governments was ceased. It was pointed out that a standstill of the service following the disaster disabled the use of sewerage at some of the evacuation centers which, along with the delayed deployment of emergency toilets, exacerbated the sanitation conditions at the evacuation centers<sup>1)</sup>. Figures 1 and 2 show sanitary conditions at evacuation centers in Ishinomaki City, Miyagi Prefecture, where immersed houses totaled 53,742, accounting for approximately 70% of the total, and 22,357 houses (about 40% of immersed ones) were completely destroyed. In these figures, "Evacuation centers having poor sanitary conditions" mean those having unsanitary toilets which will probably cause infectious diseases, judged by doctors. In area (1) where no wastewater facilities were damaged, evacuation centers having poor sanitary conditions were resolved within about a month. In area (2) where wastewater facilities were tremendously

damaged, on the other hand, evacuation centers having poor sanitary conditions took about 2 months to solve sanitary problems. Though poor sanitary conditions were not only caused by sewage use, it was confirmed that continued sewage services were important to reduce occurrence of infectious diseases due to worsened sanitary conditions. There are no substitute measures for sewage functions at the time of disaster, since they secure public health by eliminating and disposing wastewater, protect immersion by removing rainwater, and preserve water quality at public water bodies by reducing pollution load. To secure citizens' lives, therefore, it is necessary to promptly recover sewage functions at the time of disaster, and to maintain sewage services.

To that end, we report in this paper the necessity of the BCP for sewerage (hereinafter referred to as BCP) in terms of the beneficial effects of the BCP development and issues related to the first response, which are extracted based on the findings from the questionnaire surveys conducted on local governments and their related authorities in the areas stricken by the Great East Japan Earthquake, and private corporations engaging in the sewerage service.

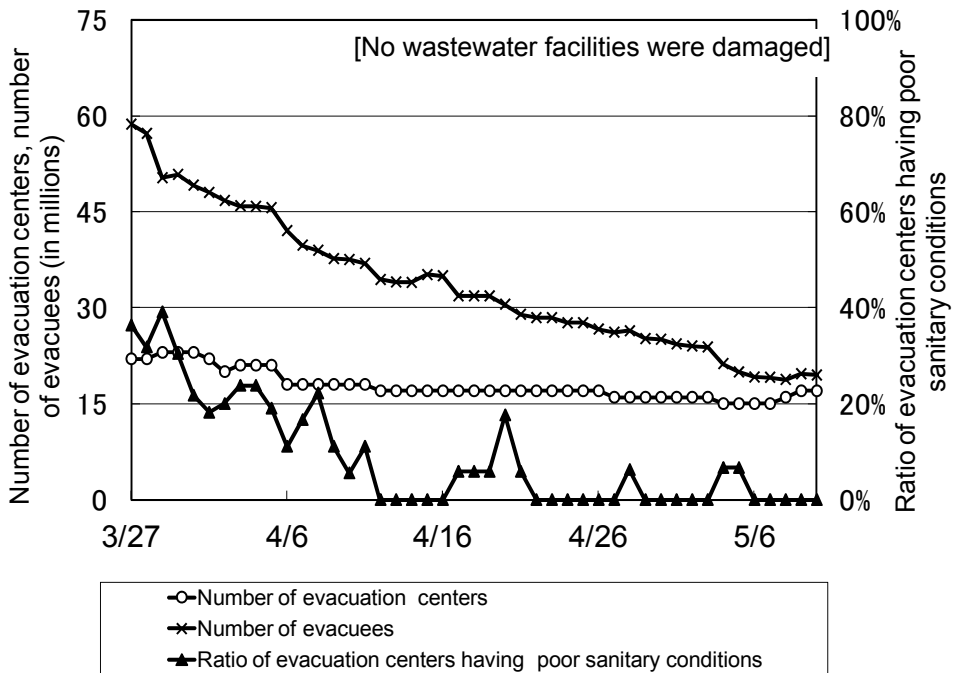


Fig.1. Sanitary conditions in evacuation centers in Ishinomaki City (Area (1)), Source from Red Cross Ishinomaki Hospital

Rys. 1. Warunki sanitarne w centrach ewakuacyjnych w Ishinomaki (strefa 1) Źródło: Szpital Czerwonego Krzyża w Ishinomaki

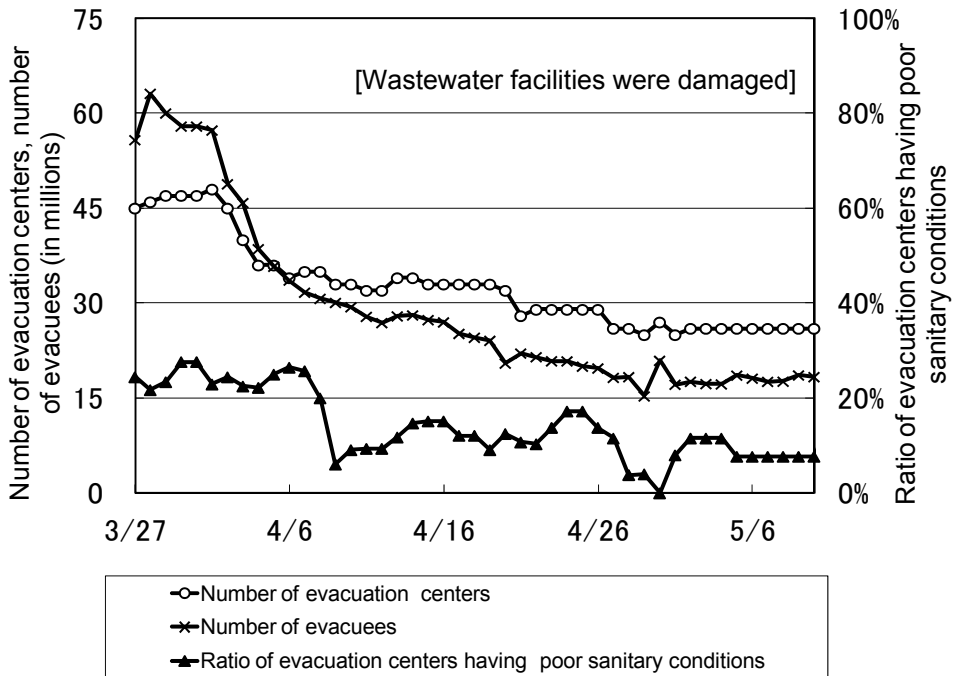


Fig. 2. Sanitary conditions in evacuation centers in Ishinomaki City (Area (2)), Source from Red Cross Ishinomaki Hospital

Rys. 2. Warunki sanitarne w centrach ewakuacyjnych w Ishinomaki (strefa 2)  
Źródło: Szpital Czerwonego Krzyża w Ishinomaki

## 2. Overview of questionnaire

### 2.1. Details

Treatment plants: Measures taken before and after the disaster (whether a BCP existed, the time elapsed before restoration work commenced, etc.)

Culvert: Measures taken before and after the disaster (whether a BCP existed, the time elapsed before restoration work commenced, etc.), measures taken to ensure public sanitation

Related private corporations: Measures taken before and after the disaster (whether a BCP existed, restoration support service conducted by local governments and issues regarding assistance toward the support service, etc.)

## 2.2. Survey Method

Distribution and collection of a questionnaire via email

## 2.3. Survey Subjects

Treatment plants: All treatment plants that suffered damage to the facilities from the Great East Japan Earthquake (120 treatment plants, of which 26 plants were affected by the tsunami)

Culvert: Local governments and organizations that suffered damage from the Great East Japan Earthquake (135 local governments and organizations, of which 37 governments were affected by the tsunami)

Related private corporations: 136 corporations such as general contractors, manufacturers and consulting companies involved in the domestic sewerage industry

## 2.4. Duration of survey and response rate

Treatment plants: Duration of survey (from September 5, 2011 to December 16, 2011), collection rate (71 percent)

Culvert: Duration of survey (from September 5, 2011 to December 16, 2011), collection rate (86 percent)

Related private corporations: Duration of survey (from November 29, 2011 to December 16, 2011), collection rate (55 percent)

## 3. Results and review

### 3.1. Existence of BCP

As of November 2010, BCP development was conducted by approximately 2 percent of sewerage works administrators nationwide <sup>3)</sup>, which is an extremely low value. The results of the survey showed a BCP development ratio of 17 percent for treatment plants and 21 percent for culverts which still indicate a low trend. On the other hand, 57 percent of private sewerage related corporations appeared to develop BCP, which indicates a slower acceptance of BCP development by public authorities compared to private corporations. Furthermore, even though BCP development was completed, none of the treatment plants has prepared any plan for tsunami evacuation and other measures.

### 3.2. Development status of BCP and average time elapsed before the start of restoration procedures

Figure 3 shows the development status of BCP and average time elapsed before the start of restoration procedures. Many of the water treatment plants that were not affected by the tsunami only suffered minor damage, and since the restoration work was conducted swiftly following the disaster, there was no significant difference among respondents whether or not developing BCP. On the other hand, in the water treatment plants that were damaged by the tsunami, those with BCP were able to reduce time to conduct an emergency inspection by about 70 percent, to conduct an emergency investigation by about 60 percent, and to take preventive measures against secondary disasters by about 90%.

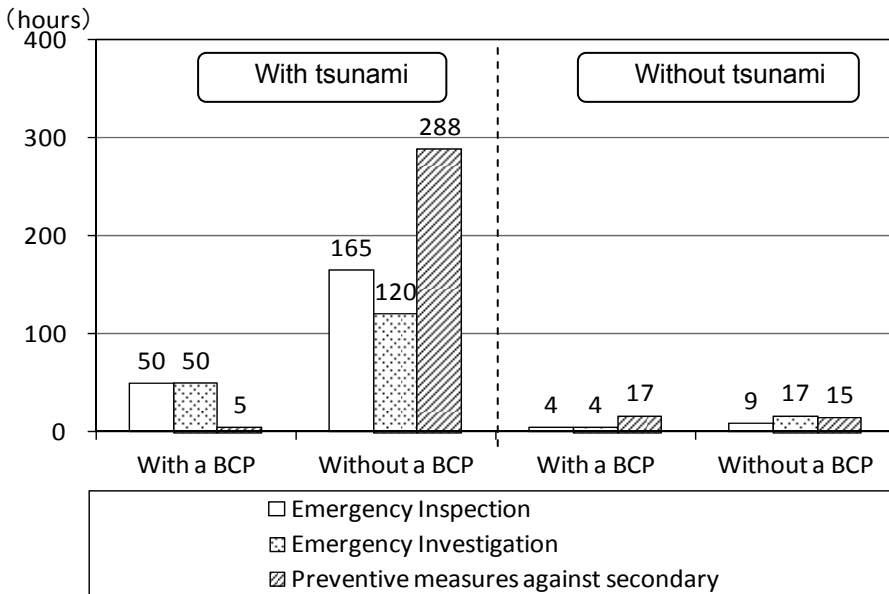


Fig.3. Development status of BCPs and average elapsed times before starting restoration procedures

Rys. Status postępu BCP i średni czas do rozpoczęcia procedur naprawczych

### 3.3. Use of disinfectant during emergency discharge from manholes

Figure 4 shows whether or not using a disinfectant during the emergency discharge from manholes. When the emergency discharge is conducted from manholes, from the viewpoint of ensuring public sanitation, it is required to discharge after disinfecting with solid chlorine. However, only 30 percent of manholes were disinfected during the emergency discharge in the Great East Japan Earthquake, which indicates that the preparation and training for emergency are essential. All local governments and organizations that had completed BCP development used a disinfectant for emergency discharge from manholes.

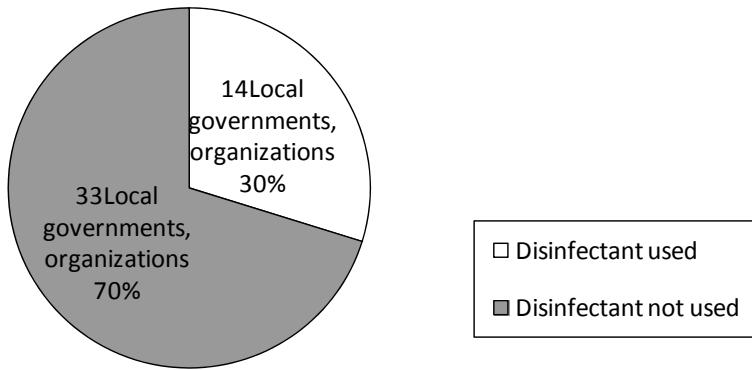


Fig. 4. Usage of disinfectant \* No-responses excluded)

Rys. 4. Użycie dezynfektantu \* z wyłączeniem braku odpowiedzi

### 3.4. Existence of procurement and deployment plans for emergency toilets and transition of their installation

Roughly 40 percent of local governments and organizations had developed plans for the procurement and deployment of emergency toilets in the disaster areas. Figure 5 shows the transition of the number of emergency toilets installed by local governments (number of evacuees / number of installed emergency toilets). Complaints were radically diminished when emergency toilets were installed with the ratio of 100 persons per toilet, and virtually no complaints when toilets were installed with the ratio of 75 persons per toilet<sup>4)</sup>. Up to the third day following the disaster, the ratio of installation of emergency toilets was far exceeding 100 persons per toilet, and decreased down to 50 persons or less per toilet onward. Among all the functions of the sewerage, the toilet function has the greatest effect on the civilian, and hence a substitute function must be provided without delay at the time of stoppage of the sewerage function. Improvements are required for the prompt procurement and deployment of emergency toilets through sufficient coordination with the department concerned.

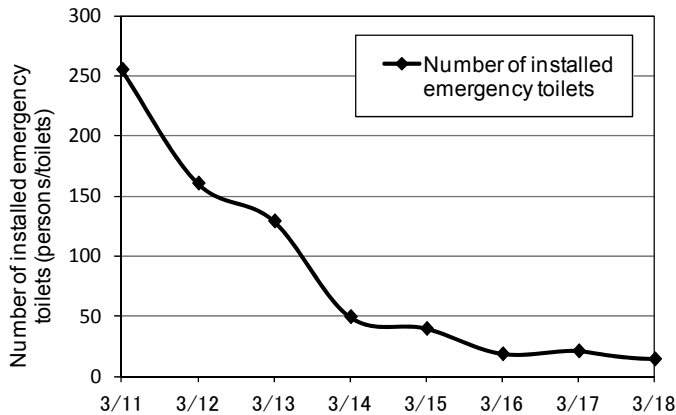


Fig. 5. Transition of installed emergency toilets

Rys. 5. Wykresu postępu instalacji zapasowych toalet

### 3.5. Issues in local governments when receiving assistance from private corporations

Figure 6 shows issues in local governments when receiving assistance from private corporations.

22 percent of the total responded that assistance was given without problem. On the other hand, views such as "Requests for assistance were late", "Instructions from local governments were unclear", and "Instructions from local governments were late" made up 46 percent indicating the necessity for local government personnel of regular training and other provision for emergency, as well as manpower assistance from other local governments. Furthermore, 21 percent of the total responded that "Accounting methods for costs incurred were unclear" indicating the necessity to make sure that point in advance agreements, etc.

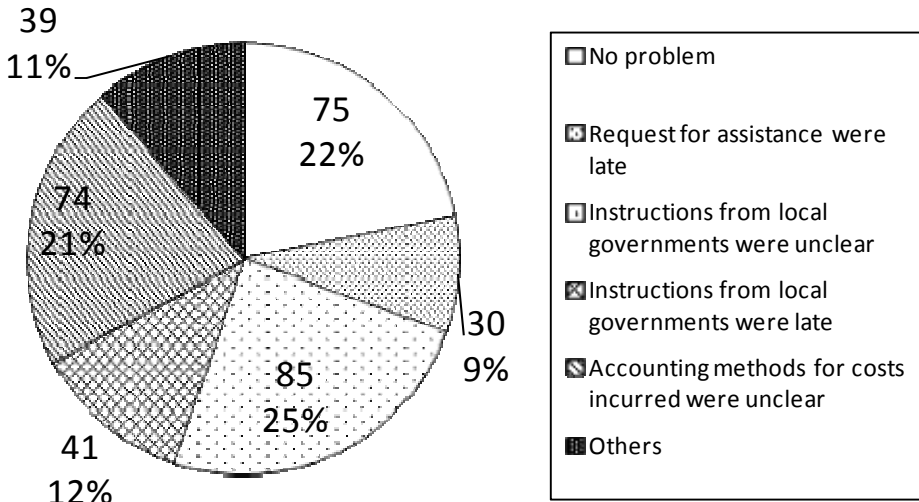


Fig. 6. Issues in local governments when receiving assistance from private corporations (multiple answers possible)

Rys. 6. Problemy władz lokalnych podczas przyjmowania pomocy z prywatnych korporacji (możliwe zaznaczenie wielu odpowiedzi)

## 4. Conclusion

### 4.1. Beneficial effects of BCP development

- At the water treatment plants affected by the tsunami, those that already developed BCP were able to reduce the average time before commencement of work by as much as 50 percent, and thus to commence restoration procedures quickly.
- Local governments and organizations that already developed BCP used a disinfectant for emergency manhole discharge, thereby ensuring public sanitation.



## 4.2. Issues in the sewerage industry toward the first response

- Only a low rate of 17 to 21 percent of local governments in the disaster area had developed BCP as the first response indicating the need to further promote BCP. (Even though BCP development had been completed, none of the treatment plants has prepared any plan for tsunami evacuation and other measures.)
- Only 30 percent of local governments and organizations used a disinfectant for emergency manhole discharge indicating the necessity of preparation and training to make sure to use a disinfectant for emergency discharge from the viewpoint of ensuring public sanitation.
- Roughly 40 percent of local governments and organizations had planned in advance to procure and deploy emergency toilets, but up to the third day following the disaster there was a shortage of toilets at the evacuation centers. To ensure speedy procurement and deployment, it is necessary to establish a cooperative system in advance with the relevant authorities.
- In providing assistance, views such as "Requests for assistance were late", "Instructions from local governments were unclear", and "Instructions from local governments were late" given from private corporations against local governments made up 46 percent indicating the necessity for local government personnel of regular training and other provision for emergency.

From the above results, the beneficial effects of BCP development have been confirmed. However, a review of BCP is required in light of issues that remain in response and measures taken at the time of arrival of the tsunami, even for local governments that have already developed BCP.

With concerns of a major earthquake and tsunami occurring in the very near future, BCP development that can address new challenges based on the lessons learned from the recent disaster is necessary for people involved in sewerage works.

## References

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