

Disaster Countermeasures for Johkasou



**Ministry of the Environment
Government of Japan**

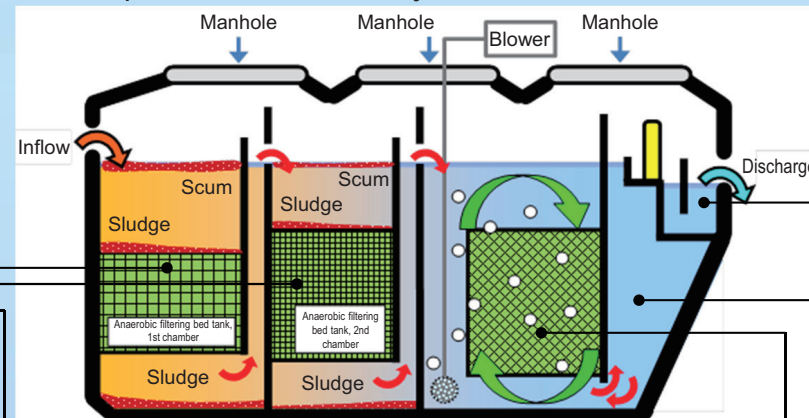
Basic Structure and Characteristics of Johkasou

Johkasou is decentralized wastewater treatment technology unique to Japan for purifying wastewater discharged from general households using the properties of microorganisms to degrade organic contaminants.

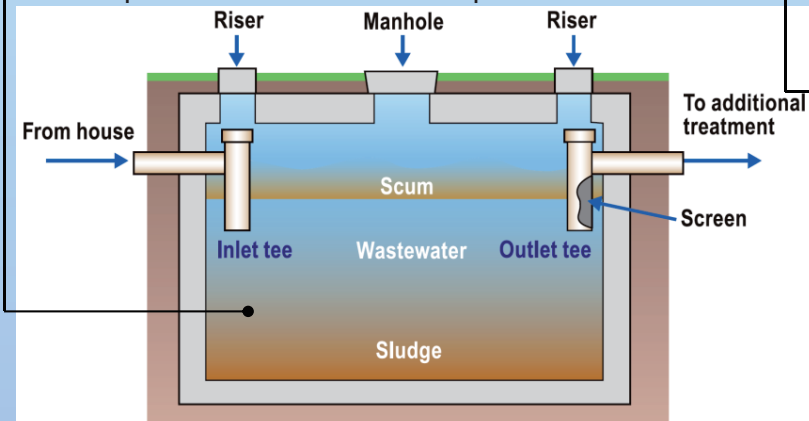
The structure of johkasou is designed to fully demonstrate the purification functions of microorganisms.

In terms of decentralized wastewater treatment technology overseas, septic tanks are widely used in developing countries, but these tanks have structural, maintenance and control problems that make it difficult to ensure hygienic treatment of wastewater. On the other hand, johkasou demonstrates excellent sewage treatment performance by combining anaerobic and aerobic treatments, and its structure is convenient in terms of maintenance and management.

Example of the structure of johkasou



Example of the structure of a septic tank



- Solid waste in wastewater is separated and sludge is stored.
- Organic contaminants are degraded by anaerobic microorganisms.

Treatment processes of johkasou is different from decentralized household wastewater treatment facilities overseas. The red frames to the right show the treatment processes not possessed by septic tanks.

Disinfection tank

Treated water is disinfected by chlorine before discharge.

Sedimentation tank

Suspended solids in treated water settle and the clean layer is fed to the disinfection tank.

Biological contact aeration equipment

- Aerobic microorganisms degrade organic contaminants.
- Ammonia is oxidized.

| Johkasou | Septic tank |
|---|---|
| Anaerobic treatment + Aerobic treatment | Anaerobic treatment |
| Treated wastewater is discharged directly into the environment. | Retreatment (land treatment) of treated water is essential. |

Major characteristics of johkasou

Excellent treatment performance

The purification functions of microorganisms are utilized, and wastewater treatment with high water quality similar to that of a sewage treatment plant is possible (20 mg/L and lower, and BOD removal ratio 90% and higher). Advanced treatment such as the removal of nitrogen and phosphorous is also applied.

Space-saving installation/early achievement of investment effect

Compact space equivalent to only one parking spot is required for johkasou installation at each household, and johkasou is buried out of sight underground. In addition, installation construction work takes only about one week and the investment effect is quickly realized.

Less impact to the water environment

The form of water discharge from each household is unchanged after installation of johkasou; there is no change other than the improved quality of the water discharged. Johkasou also contributes to maintaining the stable water flow of rivers.

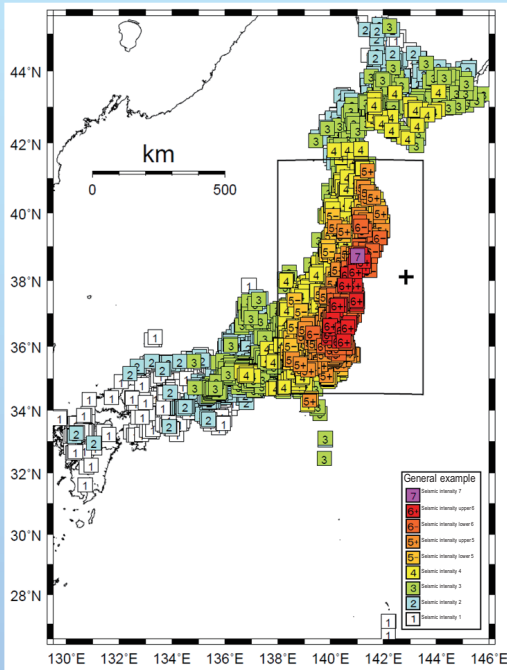
Resilient to disasters such as earthquakes

Johkasou is installed individually without any long pipes, which makes it more resilient to disasters such as earthquakes.

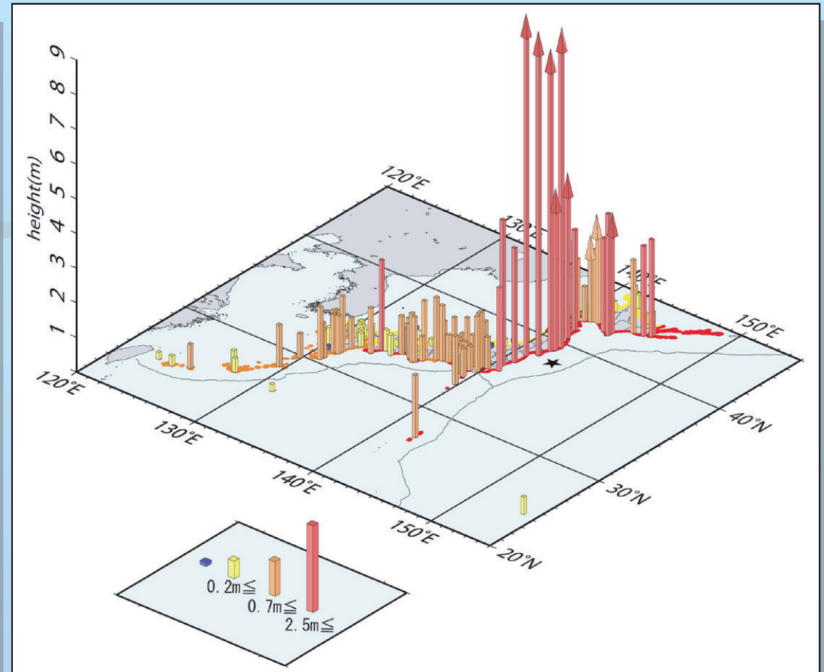
Status of Damage Caused by the Great East Japan Earthquake

The Great East Japan Earthquake with a magnitude 9 (seismic intensity 7), the highest ever recorded in Japan, occurred in March 2011. This powerful tremor extended across a wide range from Tohoku to Kanto and a tsunami exceeding 10m was also observed.

■ Distribution of seismic intensity (+ shows the epicenter)



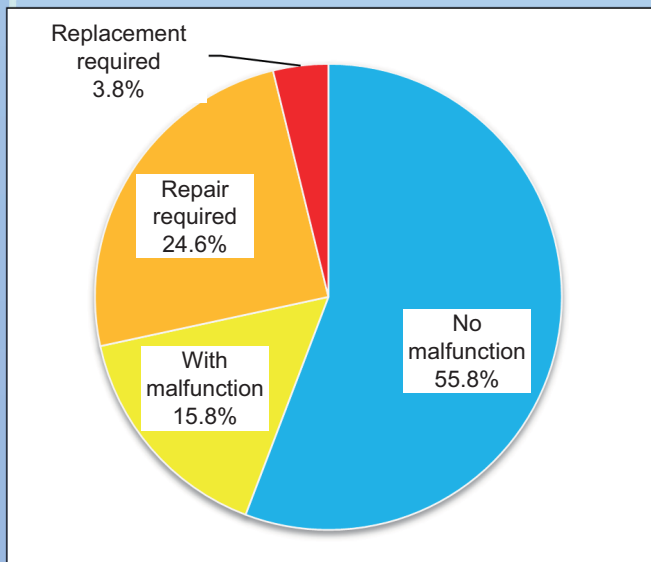
■ Height of tsunamis observed at tsunami observation centers



○ Source: Left figure) Meteorological Agency: Earthquake/Volcano Monthly Report, March 2011 (Disaster Prevention Edition) (2011)
Right figure) Meteorological Agency: Tohoku Region Pacific Coast Earthquake Survey Report, 2011 (2012)

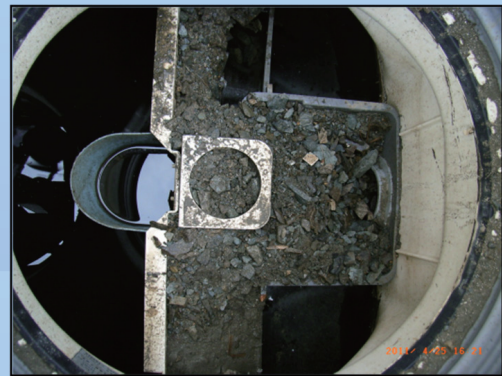
The Ministry of the Environment, Government of Japan surveyed damage to roughly 1,000 units of johkasou caused by the Great East Japan Earthquake. The earthquake was responsible for the largest scale of human and material destruction in Japan's postwar period, and many units of johkasou throughout the region were damaged. However, rate of Johkasou which required replacement is only 3.8%.

■ Status of johkasou damage caused by the Great East Japan Earthquake



○ Source: Ministry of the Environment, Government of Japan : Research report on damage situation of johkasou in the Great East Japan Earthquake, 2011

■ Inflow of sand and mud caused by a tsunami



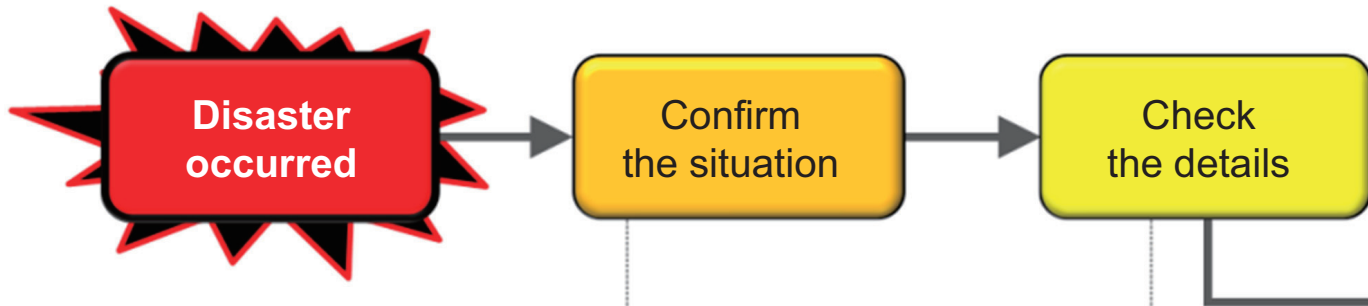
■ Tank pushed up to the surface by liquefaction



Measures after the Great East Japan Earthquake

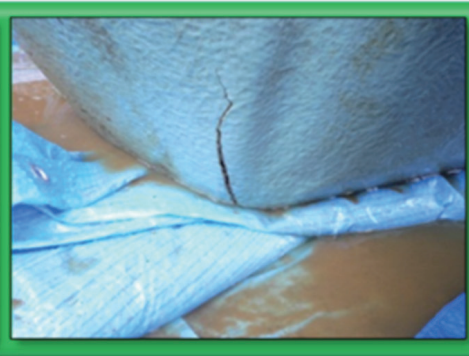
Several hours to several days after the disaster

Several days to several weeks after the disaster



- Johkasou users (residents, etc.) check the extent of damage.
- Whether damaged johkasou may cause fire whether the minimum level of public hygiene can be secured checked.

- A johkasou engineer (maintenance operator, etc.) confirms the details of damage to johkasou and its attachment.
- Whenever necessary, temporary measures are implemented to prevent danger and to regain treatment functions.



Example of other temporary measures

A hose is connected to the damaged air pipe.



A temporary manhole lid is installed to replace the lid that was swept away.

Roughly 3 months or shorter after the disaster



- If the johkasou itself is not severely damaged, temporary use is possible after a detailed check or other temporary measures.
- After temporary measures, bathrooms can be used, which substantially improve the evacuees' quality of life.

- If the original performance cannot be regained through temporary measures, will be conducted restoration work.
- Restoration work is executed to enable safe use of johkasou in the same way as before.



Photos provided by: Sendai City

A temporary pipe is installed in place of the damaged pipe.



These measures were swiftly implemented after the Great East Japan Earthquake, and restoration was completed for some facilities only one and a half months after the disaster struck.

Source: Iwate Prefecture Johkasou Inspection Center, Iwate Prefecture Johkasou Association
FY2011 Great East Japan Earthquake Johkasou Damage Emergency Survey Report (Iwate Prefecture) (FY2011)

Quick installation of Johkasou after the Great East Japan Earthquake

The Great East Japan Earthquake and tsunami caused severe damage to residents, with roughly 470,000 people evacuated at the peak. Many evacuees later moved out of the evacuation centers (public facilities such as public schools and community halls) to temporary housing. At that time, sewage treatment plants and pipes were severely damaged, causing substantial problems for household wastewater treatment in disaster hit areas. Johkasou were quickly installed at many temporary housing facilities.

■ Effects of johkasou installed at temporary housing

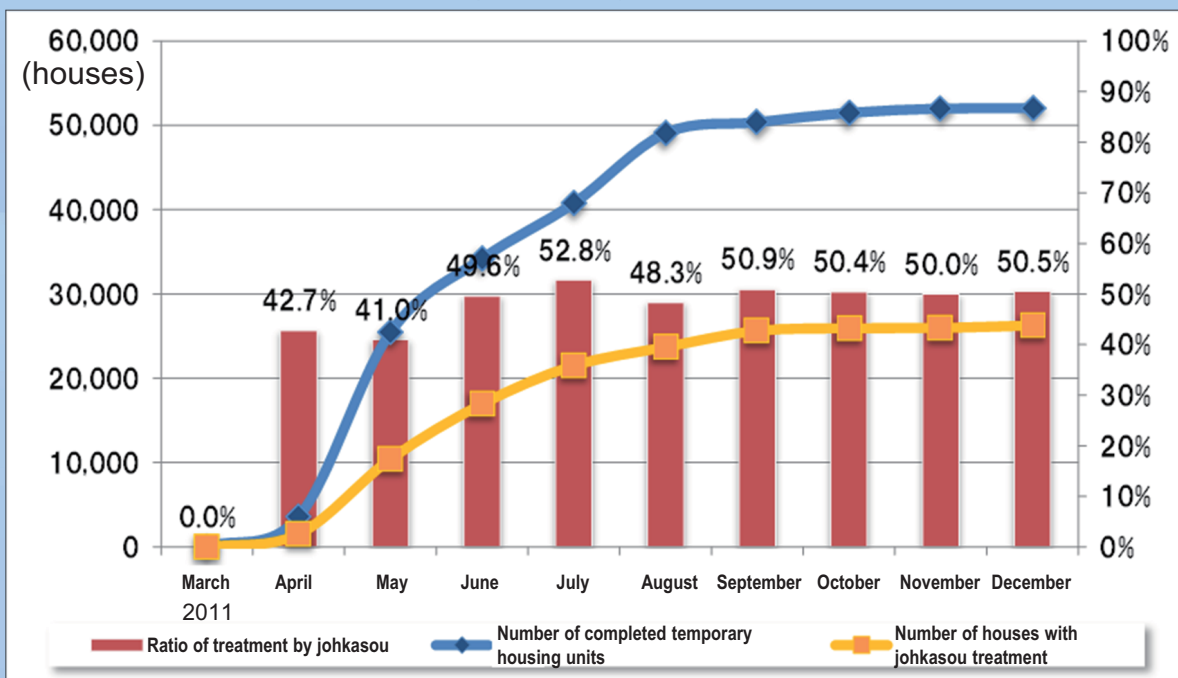
- Quality of life of the evacuees was quickly restored.
- Hygiene safety in disaster hit areas was regained.
- Easy to remove after use.

■ Johkasou installed at temporary housing after the Great East Japan Earthquake

- Ratio of johkasou installed 50.5% (= 26,278 houses / 52,028 houses)
- Number of johkasou installed 1,748 units (Johkasou for 21~50 people was the mainstay)



■ Number of constructed temporary housing units/number of supplied johkasou after the Great East Japan Earthquake (cumulative)



○ Source: Ministry of the Environment, Government of Japan:: Manual of anti-disaster for Johkasou, 2nd Edition, Collection of Examples (2012)

Issues and Lessons Learned from the Great East Japan Earthquake

■ Issues arising from the Great East Japan Earthquake

- Accurate information on damage and restoration of johkasou was not shared.
- Standards to determine whether or not to temporarily install johkasou were not established.

■ Lessons learned from Great East Japan Earthquake

1. Clarification of disaster prevention measures for johkasou

- Conclusion of agreements of support during disasters among johkasou-related parties (Realize smooth measures during disasters)
- Establishment of a communication system during disaster among johkasou-related parties (Share accurate information)
- Updating of the johkasou management register (Update reliable basic information)
- Updating of stockpiles (Realize temporary use at an early stage)
- Establishment of construction methods to improve strength of johkasou (Realize disaster prevention and disaster mitigation)

2. Revision of the Manual to Handle Damage, Etc. to Johkasou during a Disaster

Based on the issues revealed during the Great East Japan Earthquake, the “**Manual of anti-disaster for Johkasou**” was revised in March 2012.

<Major revisions>

- Clarification of role sharing for disaster measures
- Establishment of standards to determine temporary use
- Upgrading of the collection of examples

3. “Notes Related to Installation, Maintenance, Management and Effective Reuse of Johkasou Installed at Temporary Housing”

“**Notes Related to Installation, Maintenance, Management and Effective Reuse of Johkasou Installed at Temporary Housing**” was summarized in booklet form in February 2014 to allow appropriate construction, maintenance, management and reuse of johkasou installed at temporary housing.

<Major contents>

- Heat insulation work when installed above the ground
- Securing of power source, hydrant socket, vacuum car routes, safety facilities, etc.
- Conclusion of contracts for reliable maintenance and management

Ministry of the Environment, Government of Japan

Japan Education Center of Environmental Sanitation

Issued in March, 2015