

# On-site Domestic Wastewater Treatment in Japan

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Wastewater treatment facility  
of a sewerage system

Treatment plant of a rural  
sewerage system (installed  
inside of the building)



# Current systems for sanitation

## Sewerage system

(Ministry of land, infrastructure, transport and tourism)

## Rural sewerage system

(Ministry of agriculture, forestry and fisheries)

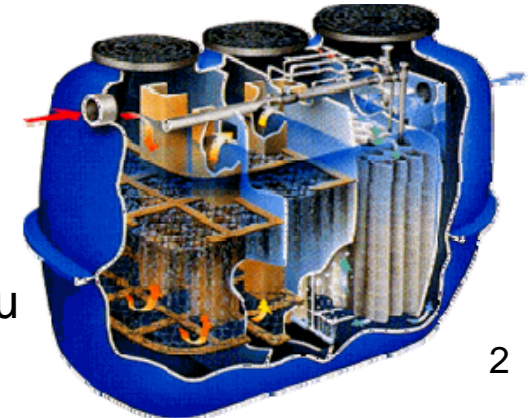
## Johkasou, tandoku-shori johkasou, night soil storage tank (vault and vacuum toilet) and community plant

(Ministry of the environment)



Night treatment plant for collected  
night soil and johkasou sludge  
(installed inside of the building)

Household type johkasou  
(gappei-shori johkasou)

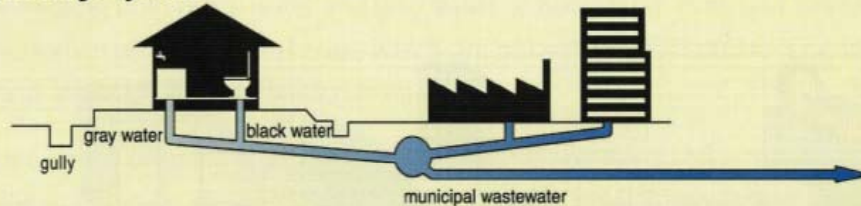




# Major systems for night soil and grey water treatment

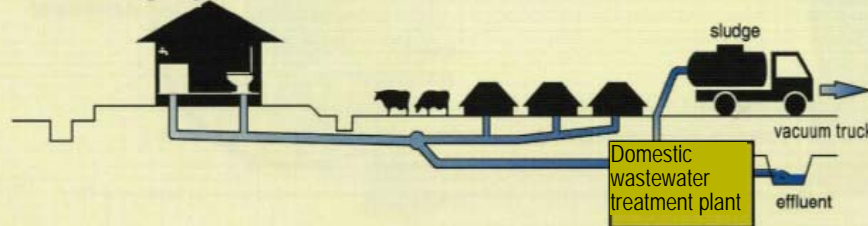
## Night soil + grey water (Domestic wastewater)

Sewerage system

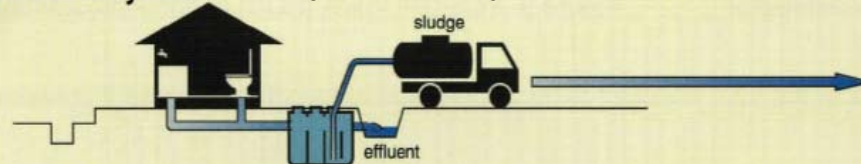


Wastewater treatment facility

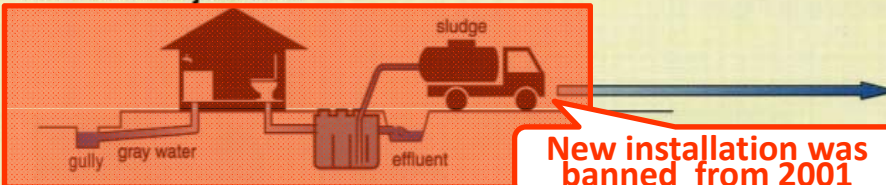
Rural sewerage system



Johkasou system (Formally, Gappei-shori johkasou)



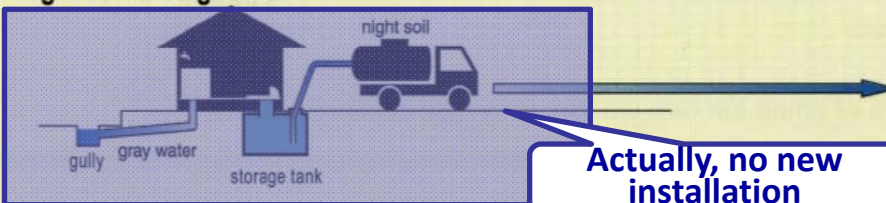
Tandoku-shori johkasou



## Night soil

New installation was banned from 2001

Night soil storage tank (Vault and vacuum toilet)



Actually, no new installation

Night soil treatment facility

Treatment plant for treating collected night soil and johkasou sludge.

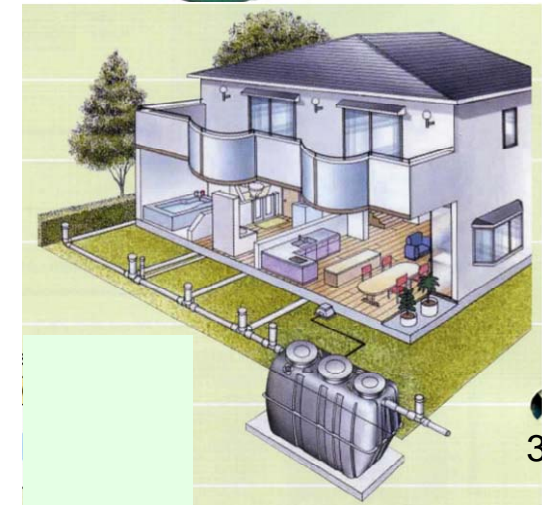
Night soil treatment and organic waste recycling center

Treatment plant for treating and recycling collected night soil, johkasou sludge and other organic wastes

**Community plant:** Similar to Rural sewerage system in technology, but different in administrative management.

**Johkasou:** Formerly, johkasou was called as gappei-shori johkasou.

**Household type johkasou (gappei-shori johkasou)**



johka = purification

sou = tank

➡ johkasou = purification tank

tandoku = sole (only flush toilet wastewater)

gappei = combined (both flush toilet wastewater & grey water = domestic wastewater)

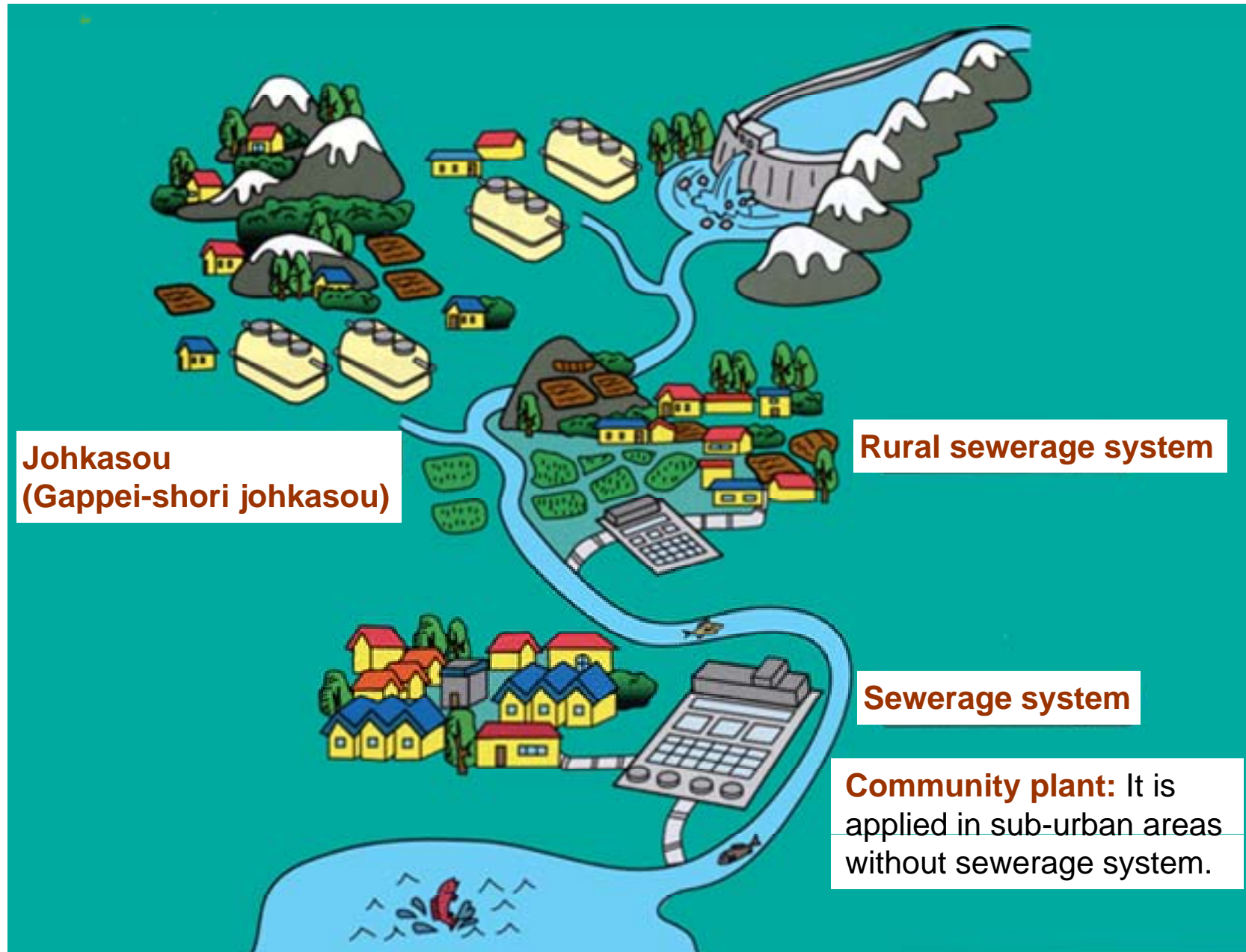
shori = treatment

➡ tandoku-shori johkasou = purification tank for treatment of only  
flush toilet wastewater

gappei-shori johkasou = purification tank for treatment of  
domestic wastewater

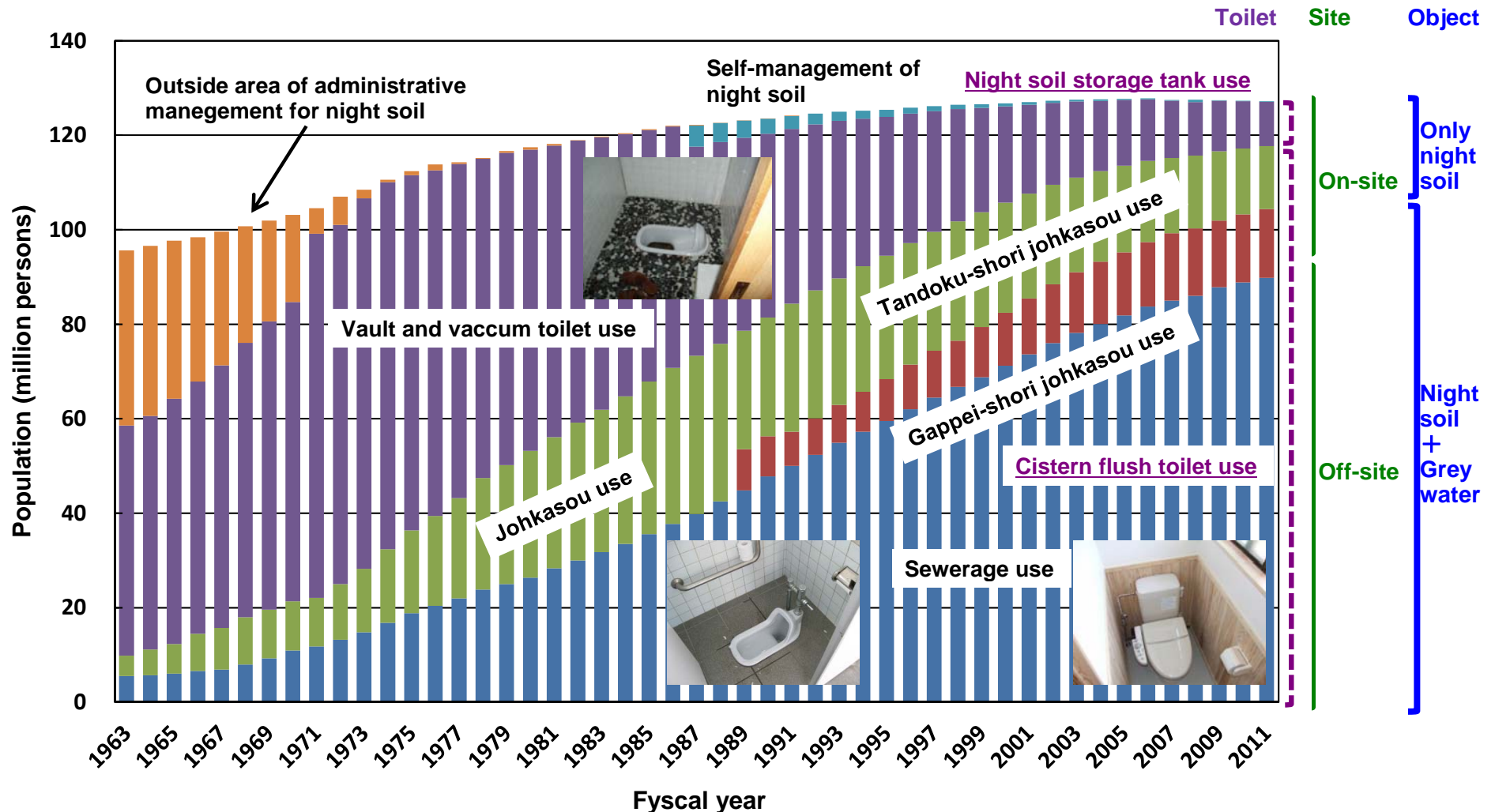
Tandoku-shori johkasous have been banned to install from 2001, and  
johkasou means gappei-shori johkasou.

# Application of major domestic wastewater treatment systems





# Population trend for night soil treatment and domestic wastewater treatment



- Gappei-shori johkasou use includes Rural sewerage system use and Community plant use.
- Off-site include Sewerage system and Rural sewerage system.
- Tandoku-shori johkasou: 4.67 million units, Gappei-shori johkasou: 3.14 million units (as of the end of FY 2011)

# Chronological development of on-site systems

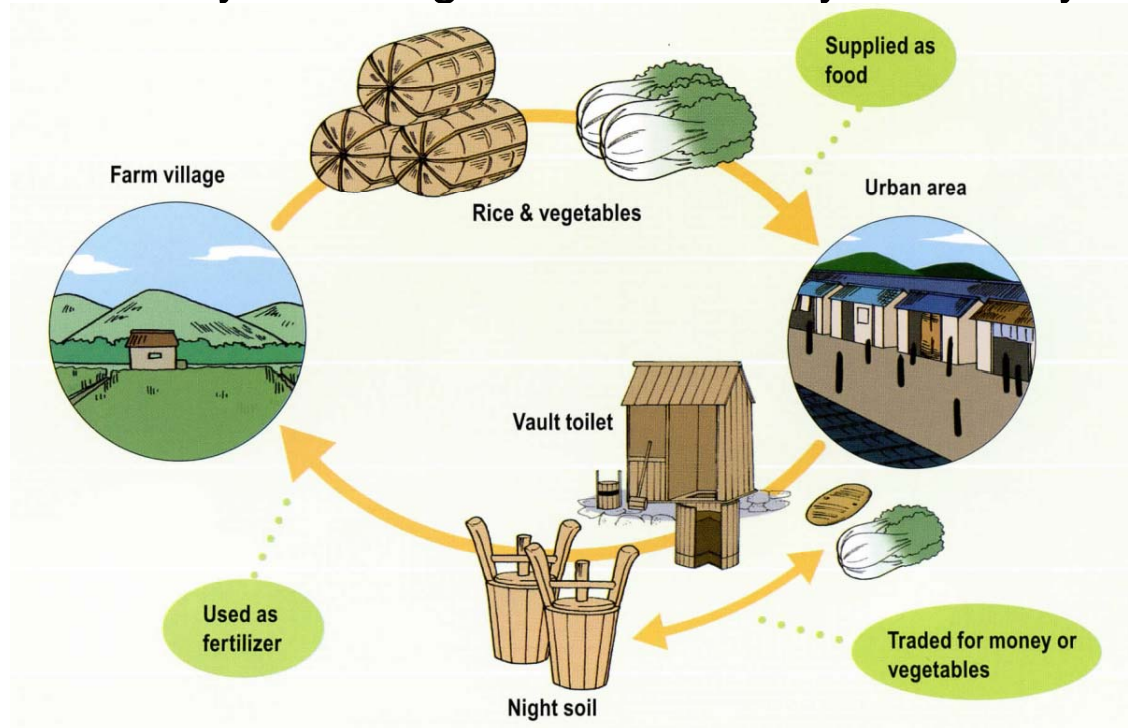
## ~The World War II (1945)

### Social circumstances

- Night soil was used as a valuable fertilizer.

### Technologies and systems

- Night soil was stored in a vault and traded for money or vegetables.
- Grey water was directly discharged to the nearby waterways.





However

- Recommendation of no-use by the Occupation Force to prevent parasitic diseases
- Spread use of cheap chemical fertilizers etc.

**1945~1955**

### Social circumstances

- Drastic decrease of night soil use in agriculture



Illegal and/or unsanitary disposal of night soil

### Technologies and systems

- Beginning of night soil treatment facility construction  
(Anaerobic digestion + supernatant treatment)

Hole for dropping  
of excreta





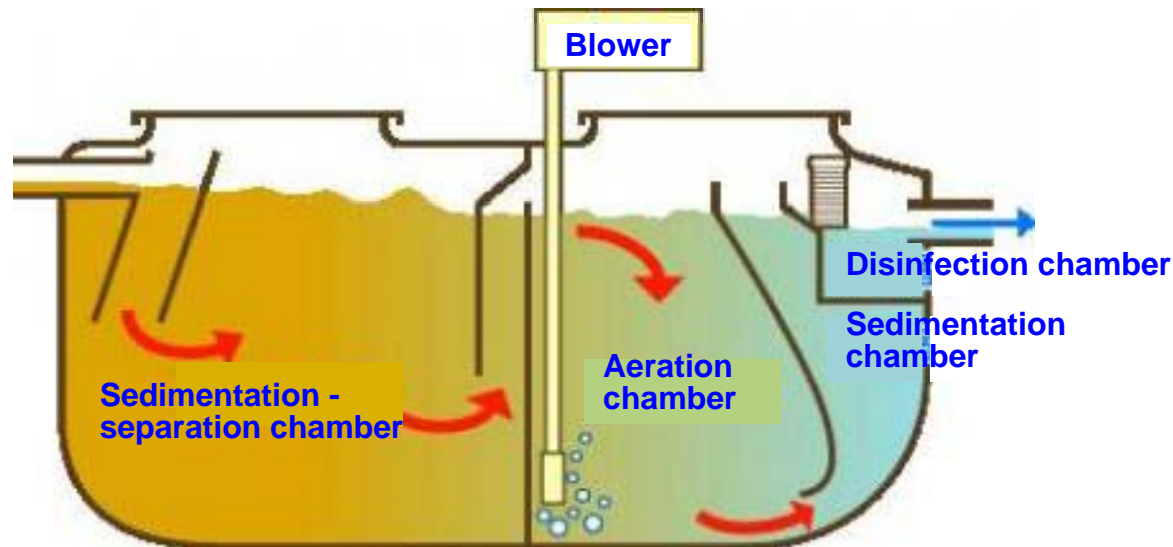
## Social circumstances

- Requirement of cistern flush toilet use

## Technologies and systems

- Beginning of household type tandoku-shori johkasou use
- Grey water was still directly discharged to the nearby waterways.

Japanese style  
cistern flush toilet



An example of household type tandoku-shori johkasous

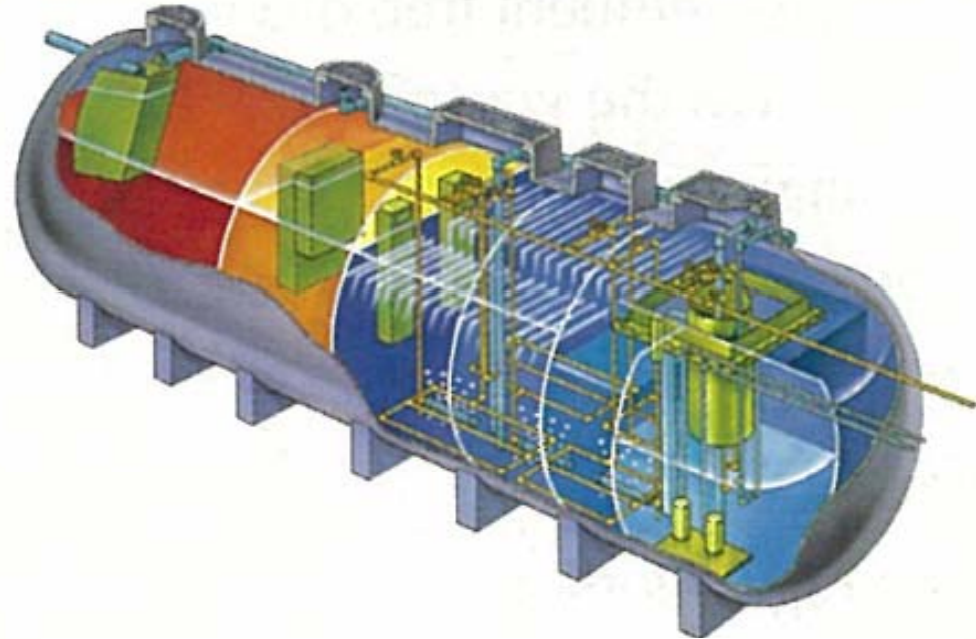
## 1955~1965

### Social circumstances

- Start of economic development
- Urbanization and industrialization
- Spread of public nuisance

### Technologies and systems

- Beginning of medium- and large-scale gappei-shori johkasou use



An example of medium-scale gappei-shori johkasou

## 1985~1995

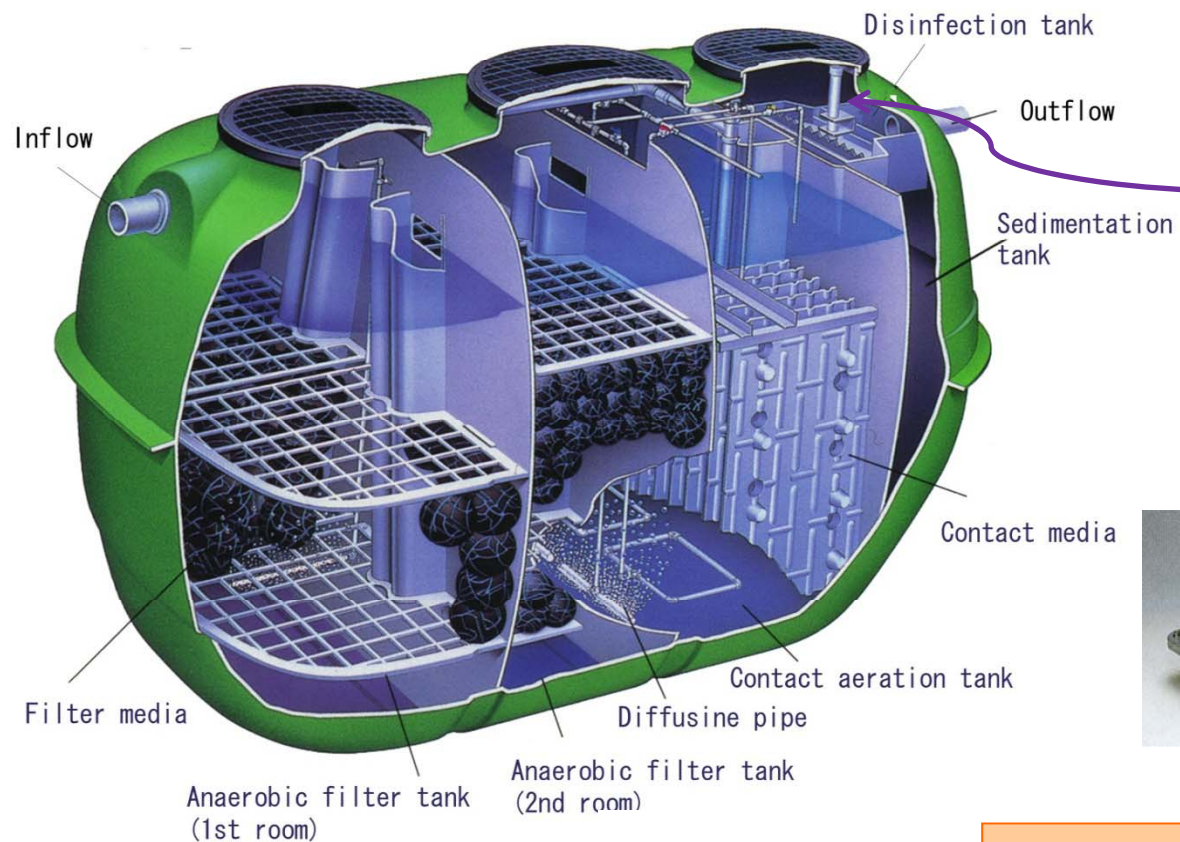
### Social circumstances

- People's requirement of access to water environment

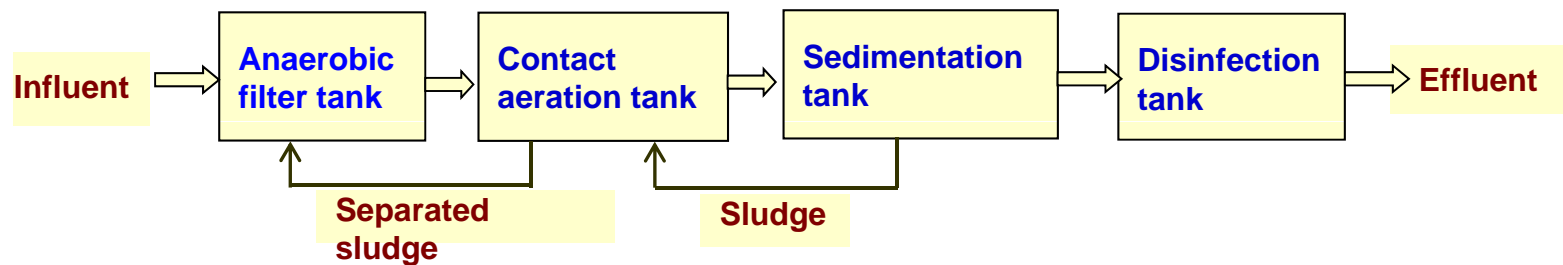
### Technologies and systems

- Development of household type gappei-shori johkasou with the effluent BOD concentration  $\leq 20$  mg/L

## An example of household type gappei-shori johkasou



Effluent water quality  
 $\text{BOD} \leq 20 \text{ mg/L}$





## **1995~2005**

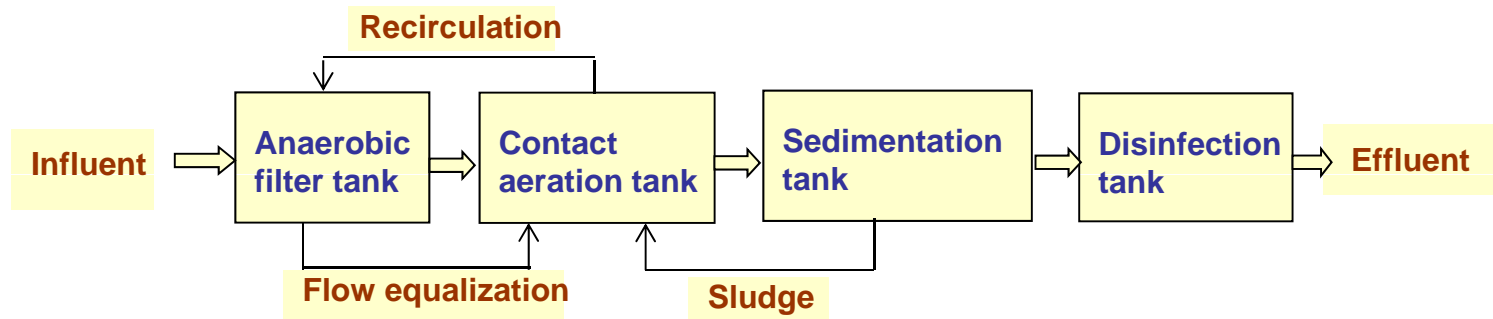
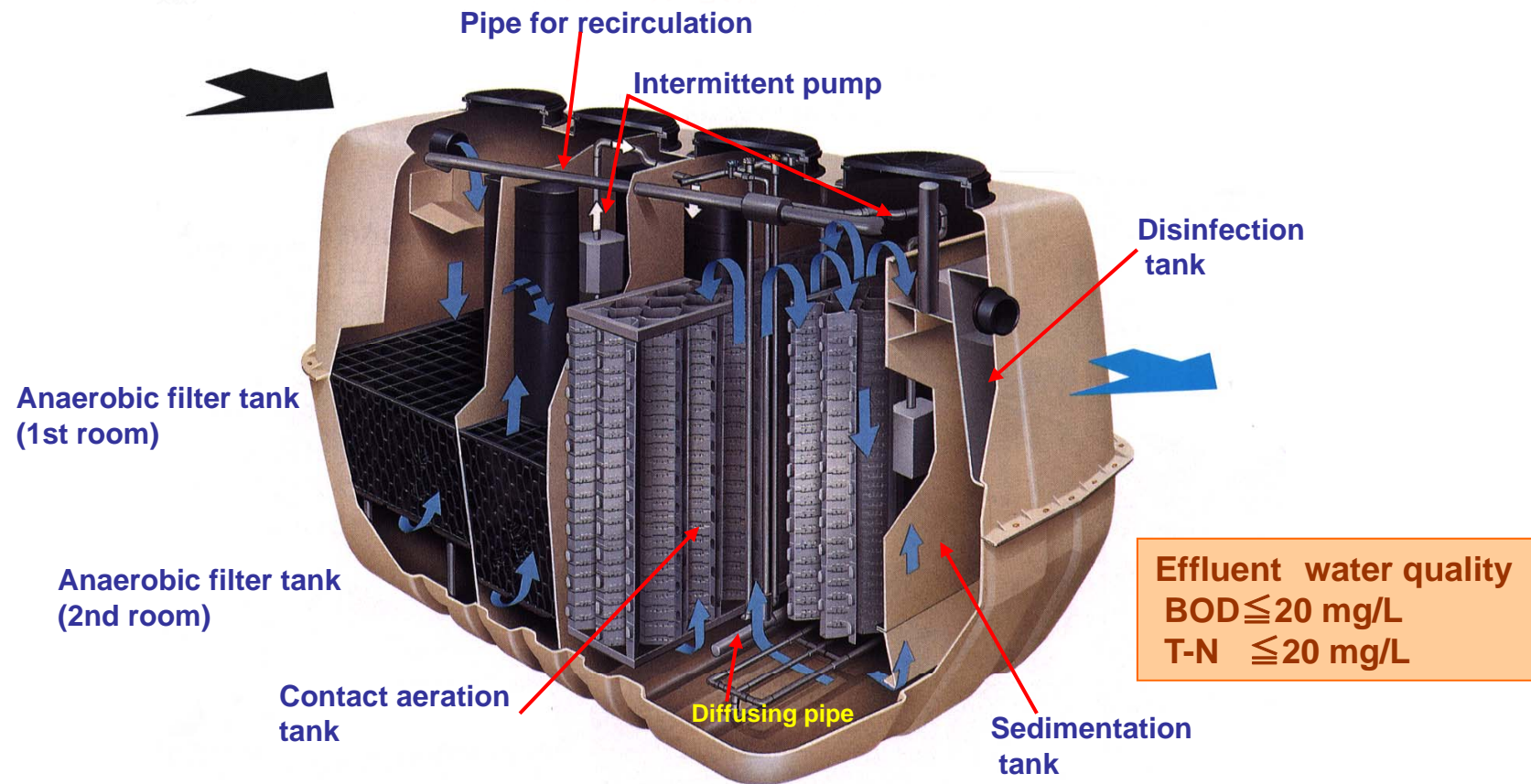
### Social circumstances

- Improvement in environmental standards achievement
- Request of cost down in installation of household type gappei-shori johkasou

### Technologies and systems

- Standardization of advanced processes was introduced in gappei-shori johkasou including household type

An example of household type gappei-shori johkasou for BOD & N removal

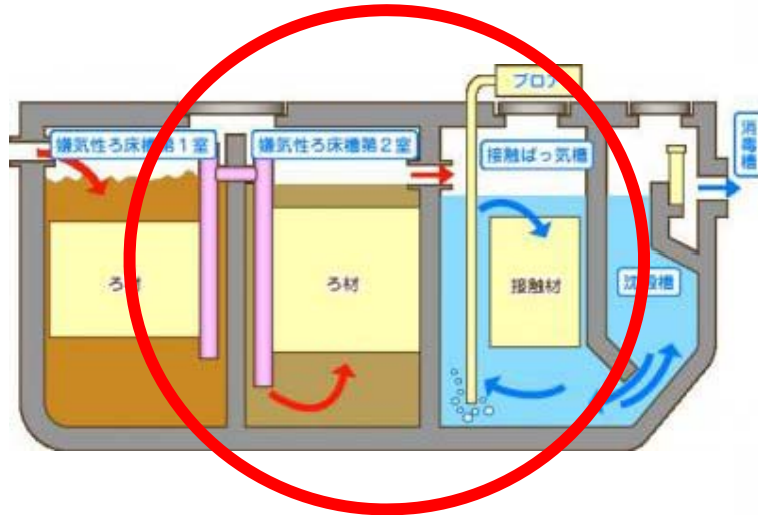


▪ Abolition of new installation of tandoku-shori johkasou

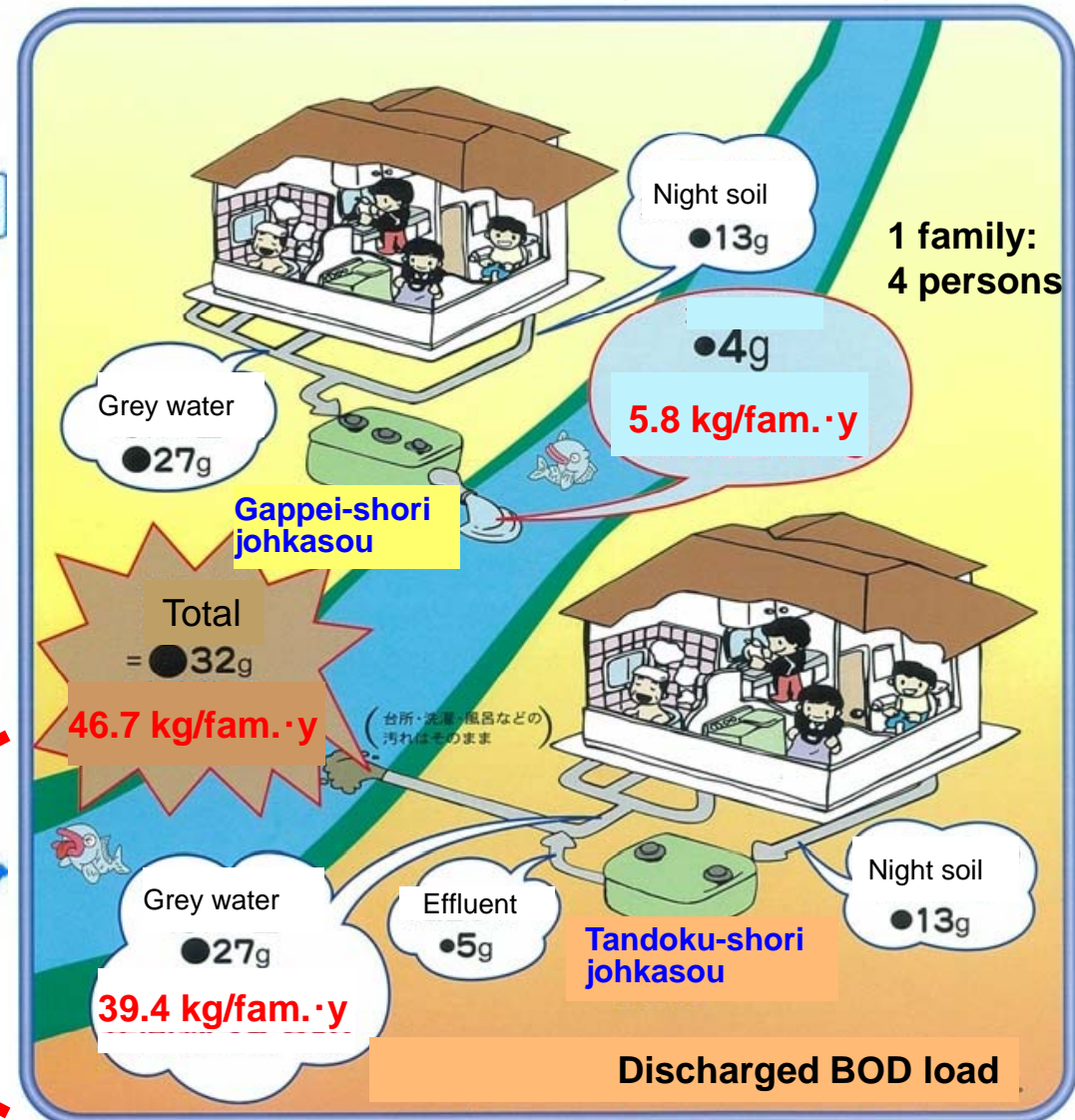
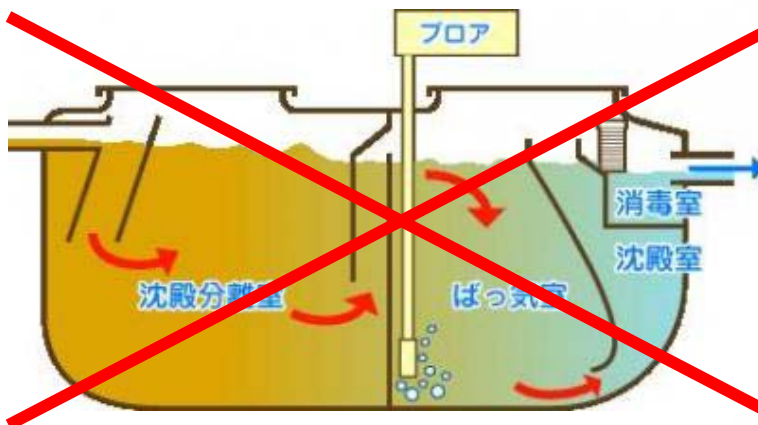
BOD load of night soil] : 13 g/cap.·d

BOD load of grey water: 27 g/cap.·d

Gappe-shori johkasou



Tandoku-shori johkasou





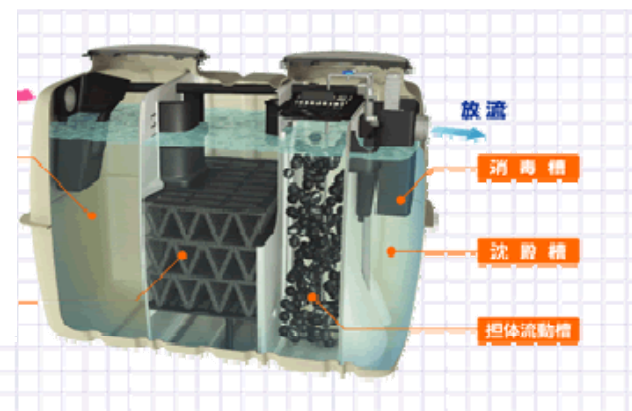
▪ Development of compact household type gappei-shori johkasou



Appearance of a standard household type gappei-shori johkasou  
(Volume required for treatment is about 3.0 m<sup>3</sup>)



Compact household type  
gappei-shori johkasou  
(Volume required for treatment is reduced to about 70% of the standard type.)



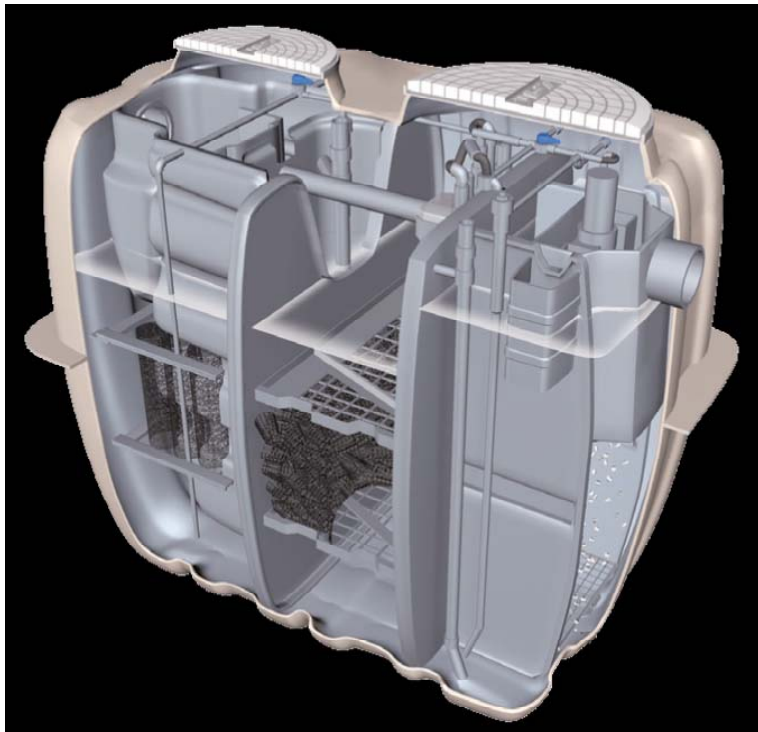
**2005~**

## Social circumstances

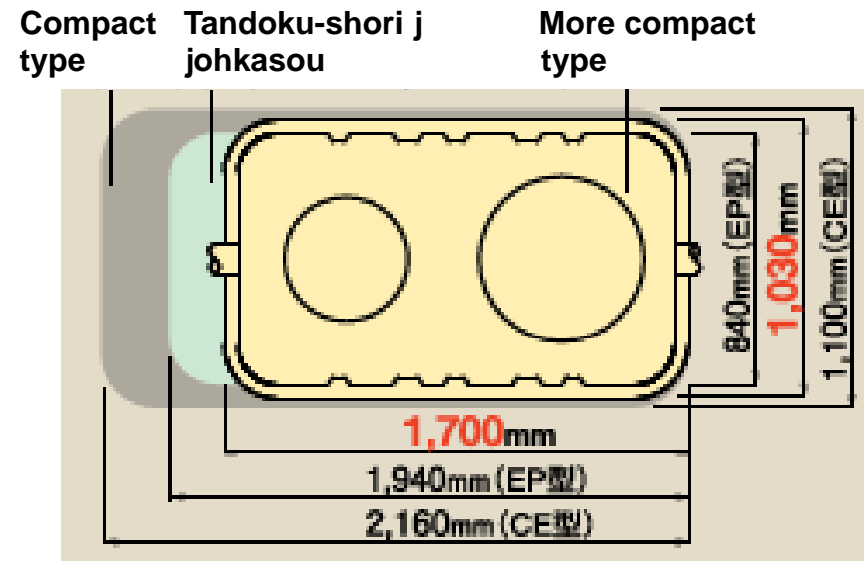
- Request of cost down in installation of household type gappei-shori johkasou
- Request of replace of tandoku-shori johkasou by gappei-shori johkasou

## Technologies and systems

- Development of more compact household type gappei-shori johkasou  
(Volume required for treatment is reduced to about 50% of the standard type)























An example of more compact household type gappei-shori johkasou for BOD & N removal



Plane figures of some johkasou 16

# Outlines of structural standards of johkasou

## (Treatment process, number of users for design and designed treatment performance)

Class	Type of treatment	Treatment process	Number of users for design							BOD removal rate	Treatment performance			
											Effluent quality (mg/ℓ)			
			5	50	100	200	500	2000	5000		BOD	COD	T-N	T-P
1	Combined domestic wastewater treatment	Separation-contact aeration process								90% or more	20 or less	—	—	—
		Anaerobic filter-contact aeration process											—	—
		Denitrification type anaerobic filter-contact aeration process											20 or less	—
4	Flush toilet wastewater treatment	Septic tank process								55% or more	120 or less	—	—	—
5		Land infiltration process								SS: 55% or more	SS: 250 or less	—	—	—
6	Combined domestic wastewater treatment	Rotating biological contactor process								90% or more	20 or less	30 or less	—	—
		Contact aeration process												
		Trickling filter process												
		Extended aeration process												
		Conventional activated sludge process												
7		Contact aeration and trickling filter process								—	10 or less	15 or less	—	—
		Coagulation separation process								—	10 or less	10 or less	—	—
8		Contact aeration and activated carbon absorption process								—	10 or less	10 or less	—	—
		Coagulation separation and activated carbon absorption process								—	10 or less	15 or less	20 or less	1 or less
9		Nitrified water recirculation type activated sludge process								—	10 or less	15 or less	20 or less	1 or less
		Tertiary treatment type denitrification dephosphorization process												
10		Nitrified water recirculation type activated sludge process								—	10 or less	15 or less	15 or less	1 or less
		Tertiary treatment type denitrification dephosphorization process												
11		Nitrified water recirculation type activated sludge process								—	10 or less	15 or less	10 or less	
		Tertiary treatment type denitrification dephosphorization process												
12	Emission standard under the Water Pollution Control Law	Class: 6 - 11	COD (mg/ℓ): 60	SS (mg/ℓ): 70	n-Hex (mg/ℓ): 20	pH: 5.8~8.6	Total coliforms (N/mℓ): 3,000 or less							
		6 - 11	45	60	20	5.8~8.6	3,000 or less							
		6 - 11	30	50	20	5.8~8.6	3,000 or less							
		7 - 11	15	15	20	5.8~8.6	3,000 or less							
		8	10	15	20	5.8~8.6	3,000 or less							

note: Class 2 and Class 3 were deleted in 2006.



# Necessary jobs for proper use of johkasou



**Installation**



**Operation & Maintenance**  
(once every 4 months)



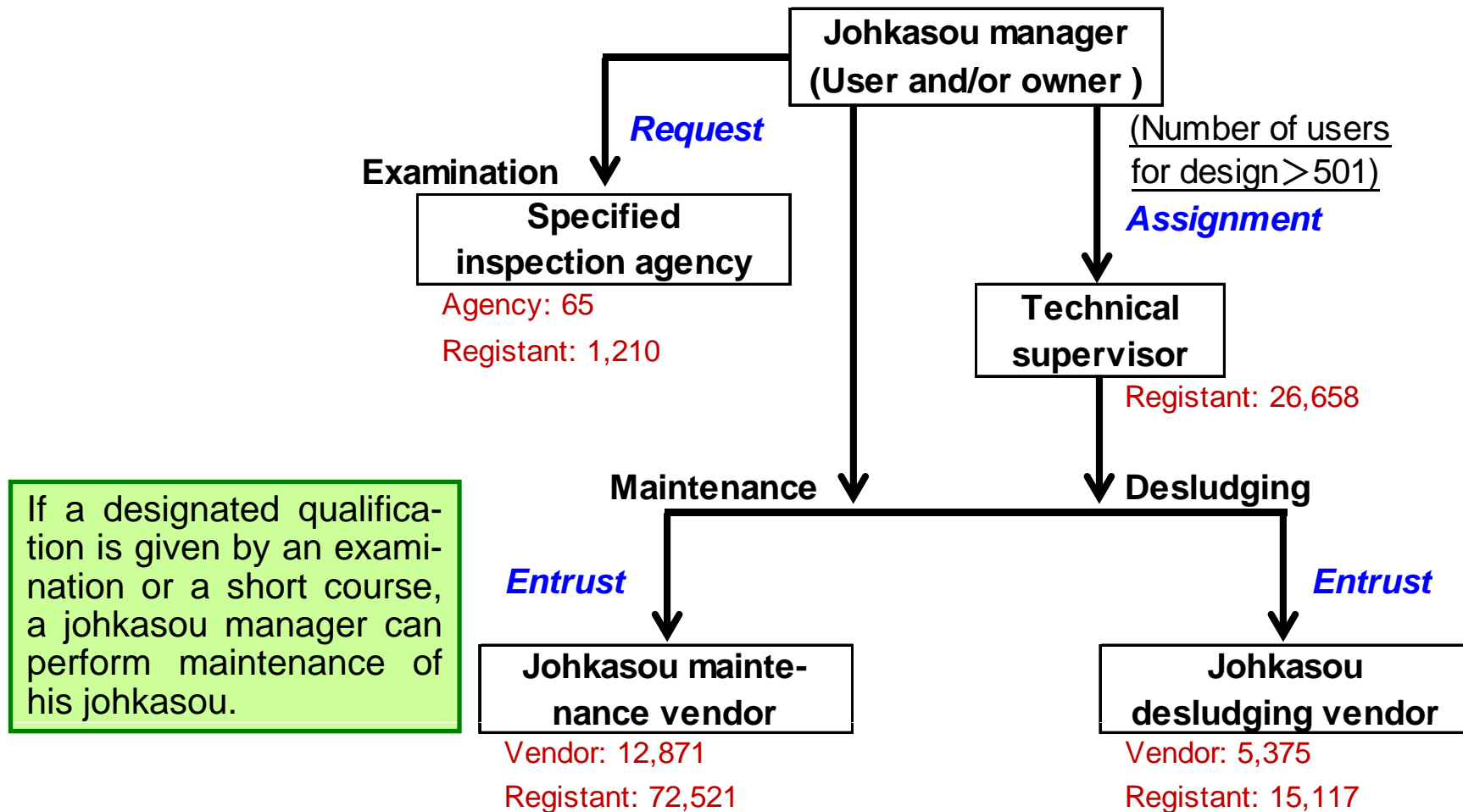
**Desludging**  
(once a year)



**Inspection**  
(after installation  
and once a year)

Technologically, frequency of desludging can be changed according to how to use each johkasou (actual number of users, applied effluent standard, etc.).

# Framework of johkasou management under the Johkasou Law



Johkasou manufacturer: 27

Johkasou installation vendor: 33,593, Johkasou installation worker: 83,205