

OPERATION AND MAINTENANCE OF JOHKASOU SYSTEM IN JAPAN

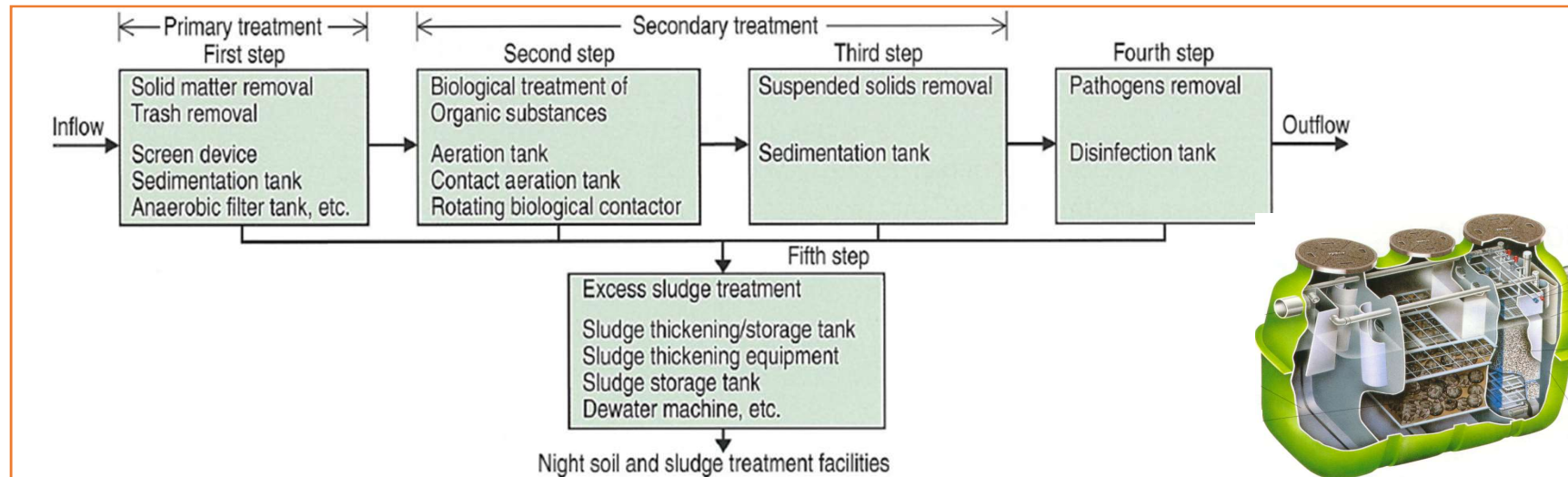
Shinhi Kumokawa Ph.D

**Center for International Cooperation of Johkasou System
Japan Education Center of Environmental Sanitation (JECES)**

TOPICS

1. Legal framework for johkasou O&M
2. Practice of johkasou O&M, etc.
3. Training system for johkasou technicians

WHY O&M OF JOHKASOU ARE NEEDED?



	Device/equipment in johkasou
Primary treatment (1 st step)	Sedimentation tank, Anaerobic filter tank, Slit screen, Aerated screen, Grit chamber, Bar screen, Flow equalization tank,
Secondary treatment 2 nd step	Contact aeration tank, moving bed tank, aeration tank,
3 rd step	Sedimentation tank
4 th step	Disinfection tank
5 th step	Sludge thickening/storage tank, sludge storage tank,
Mechanics	Electromagnetic blower, Control panel, mechanical blower, pump,

TECHNICAL STANDARDS FOR JOHKASOU O&M

- Technical standard for operation and maintenance
(Article 2, Ordinance for Enforcement of Johkasou Act)

This standard stipulates maintenance items and adjustment/repair items that must be carried out during operation and maintenance for every johkasou and the auxiliary device.

- Technical standard for desludging (Article 3, Ordinance for Enforcement of Johkasou Act)

Desludging standards stipulate items to be carried out for each unit and auxiliary device during desludging (e.g. methods for drawing out sludge)

- Guidelines for johkasou operation and maintenance (Official notice)

These guidelines are issued by the Ministry of the Environment as specific policies for operations and maintenance technicians. They are designed to ensure that operation and maintenance as well as desludging are carried out optimally and in line with the specific characteristics of each treatment process.

Guidelines for Johkasou O&M

□ Technical standard for johkasou O&M, (1983, Johkasou Act)

- Guideline for O&M of Tandoku-shori johkasou (2000)
- Guideline for O&M of small-scale johkasou (1993)
- Guideline for O&M of medium/large-scale johkasou (2000)
- Guideline for O&M of N/P removal type johkasou (2000)
- Guideline for O&M of Membrane johkasou (2000)

□ Technical standard for johkasou desludging (1983, Johkasou Act)



1950s

Tandoku-shori johkasou (treat black water only)

1980s

2010s

Johkasou (treat black + grey water)

ORDINANCE FOR ENFORCEMENT OF JOHKASOU ACT

(Rule of Using)

Article 1 Rules of using johkasou under the provisions prescribed in Article 3 paragraph 3 of Johkasou Act (hereinafter referred to as "Act") shall be as follows.

- (i) Water amount for flushing toilet shall be appropriate.
- (ii) Materials like insecticide, detergent, deodorant, fatty, disposable diaper, sanitary goods etc. which interfering with the normal functioning of johkasou, shall not be flowed.
- (iii) abbr.
- (iv) Industrial wastewater, rain water and other special wastewater shall not be flowed into johkasou.
- (v) Johkasou with electric equipment shall not be turned the power supply off.
- (vi) The top or around of johkasou shall has no structural object that may interfere with operation, maintenance and desludging of johkasou.
- (vii) The top of johkasou shall not be loaded which may interfere with its normal functioning.
- (viii) The opening part of aerator shall not be blocked.
- (ix) When the failure or malfunction is found in the johkasou, it should be notified to the johkasou manager immediately.



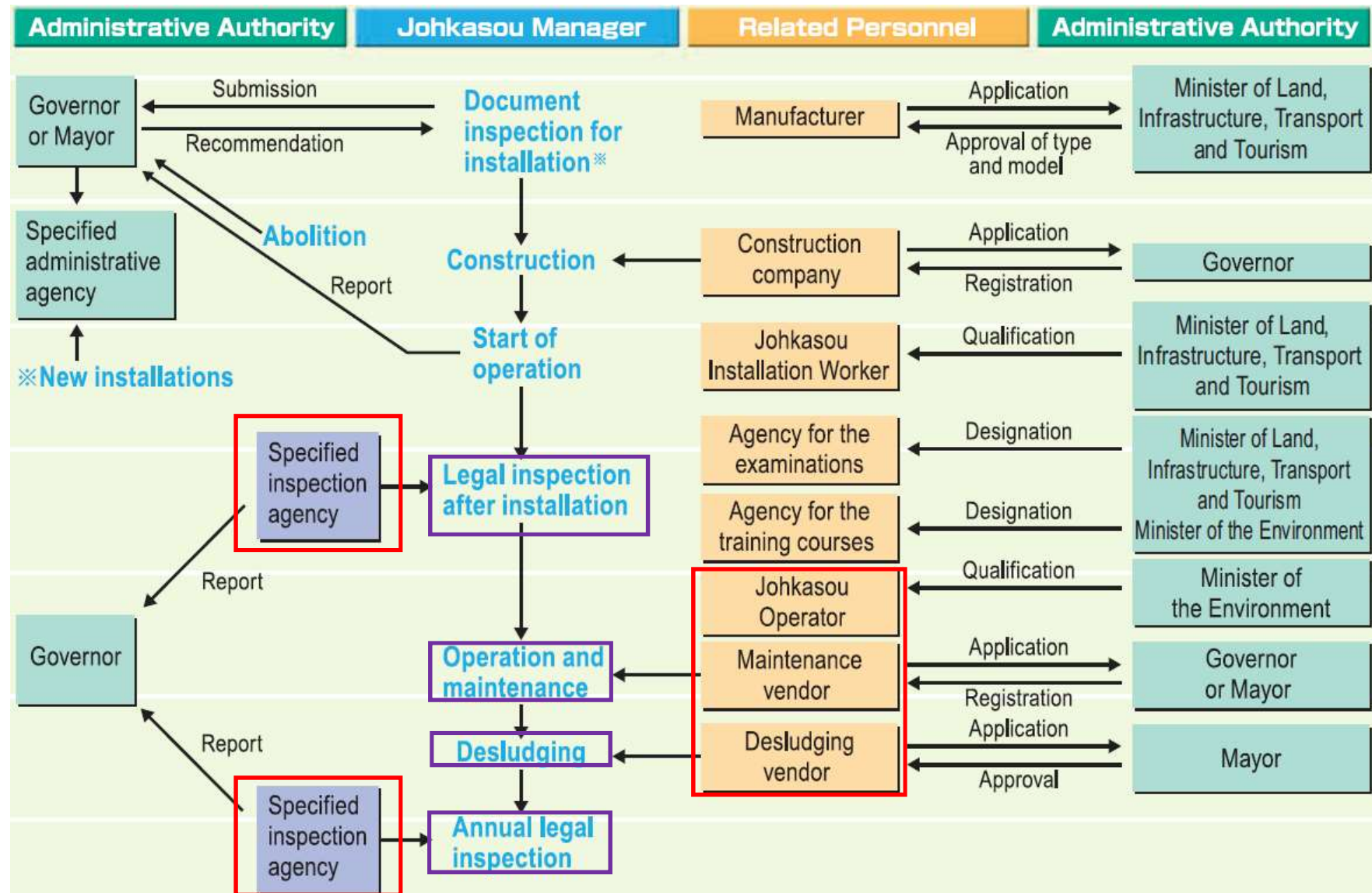
O&M FREQUENCY OF JOHKASOU

(Article 6-2, Ordinance for Enforcement of Johkasou Act)

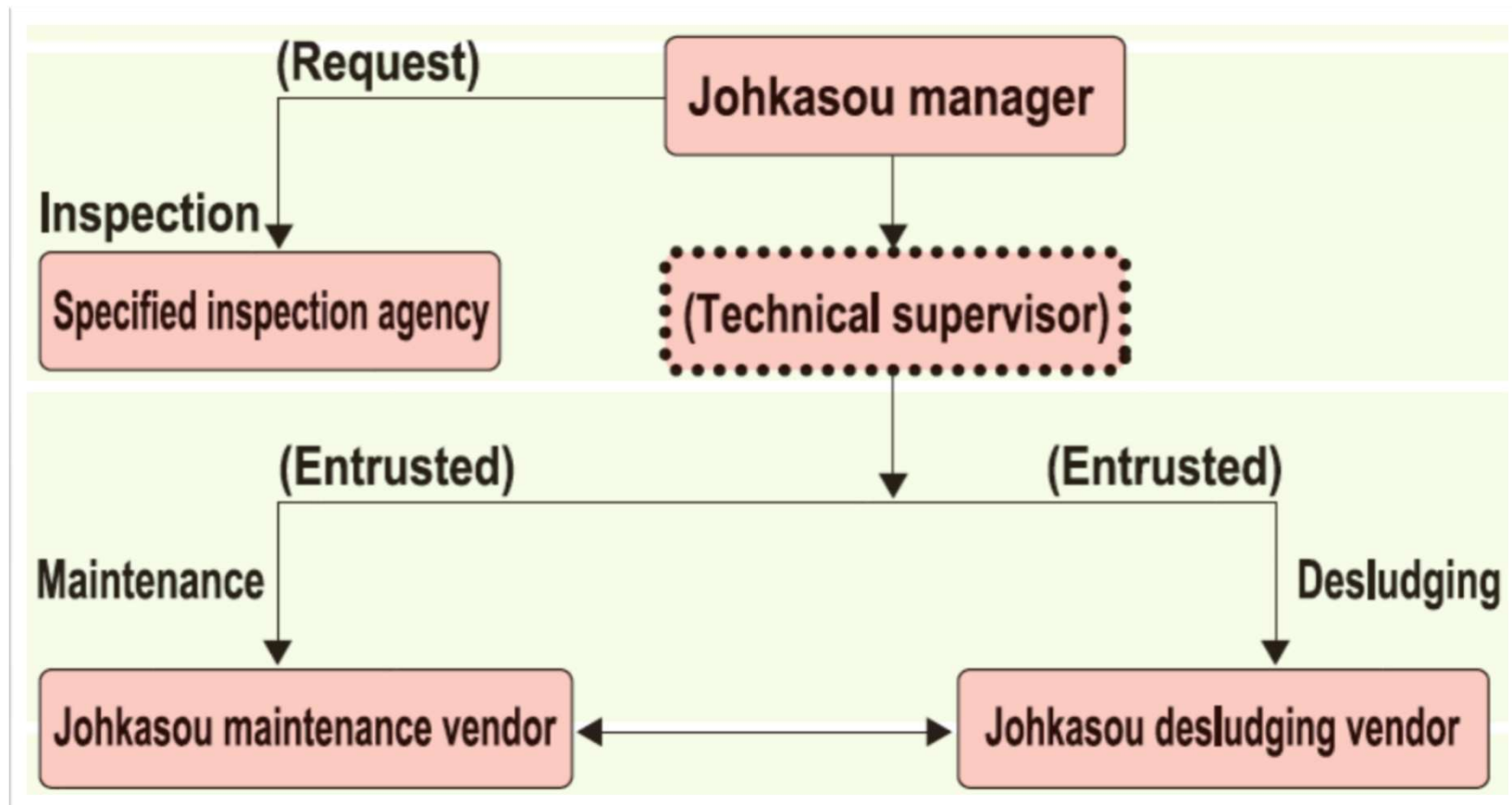
Treatment process	Type/size of johkasou	Frequency
● Separation-contact aeration process ● Anaerobic filter-contact aeration process ● Denitrification type anaerobic filter-contact aeration process	1. Johkasou with a size less than 20 PE	4 month
	2 . Johkasou with a size more than 21 PE and less than 50 PE	3 month
● Activated sludge process	(> 100PE, M/L)	1 week
● Rotating biological contactor process ● Contact aeration process ● Trickling filter process	1. Johkasou with sand filter device, activated carbon adsorption device or flocculation tank (> 50PE, M/L)	1 week
	2. Johkasou with screen and flow equalization chamber or flow equalization tank (> 50PE, M/L)	2 week
	3. Other Johkasou (> 50PE, M/L) (without screen equipment, etc.)	3 month

LEGAL FRAMEWORK OF JOHKASOU MANAGEMENT

- REGULATIONS BASED ON JOHKASOU ACT



LEGAL FRAMEWORK OF O&M, DESLUDGING AND LEGAL INSPECTION OF JOHKASOU



JOHKASOU TECHNICIANS AND VENDORS

Qualifications /vendor	Registrant/ number of vendor	Business content	Legal basis
Johkasou Operator	80,042	Operation and maintenance	Johkasou Act
Johkasou Installation Worker	86,595	Installation/construction	
Johkasou Technical Supervisor	29,794	Management of johkasou over 500 PE	Enforcement regulations of Johkasou Act
Johkasou Desludging Technician	16,021	Desludging	
Registered Johkasou Inspector	1,280	Legal inspection	
Specified Inspection Agency	65	Legal inspection	Johkasou Act
Johkasou manufacturer	18	Research, development and manufacture	
Johkasou maintenance vendor	12,435	Operation and maintenance	
Johkasou desludging vendor	5,291	Desludging	
Johkasou Installation vendor	28,356	Installation/construction	

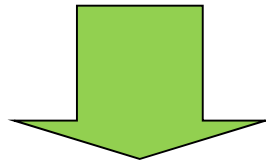
Source: Ministry of Environment, Japan, etc. (as of March 31, 2016)

TOPICS

1. Legal framework for johkasou O&M
2. Practice of johkasou O&M, etc.
3. Training system for johkasou technicians

Definition of johkasou O&M

Operations concerning to inspecting, maintaining and repairing johkasou (Johkasou Act, Article 2-3)



- Prevent loss of unit function and device breakdown
- Maintain normal treatment performance
- Promote proper regular desludging



O&M OF SMALL-SCALE JOHKASOU

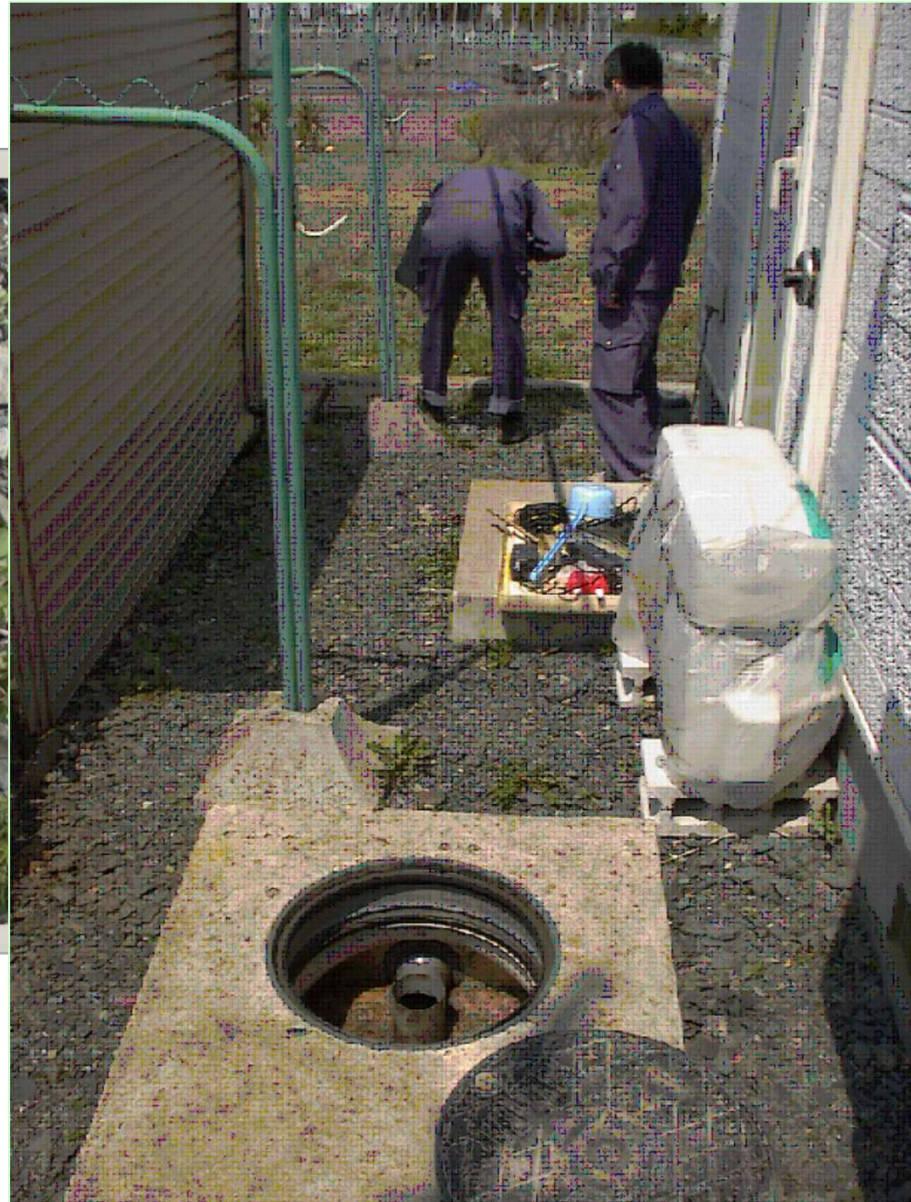
- Surrounding conditions
- Water flow condition
- Treatment performance
- Sludge accumulation
- Electrical and mechanical devices

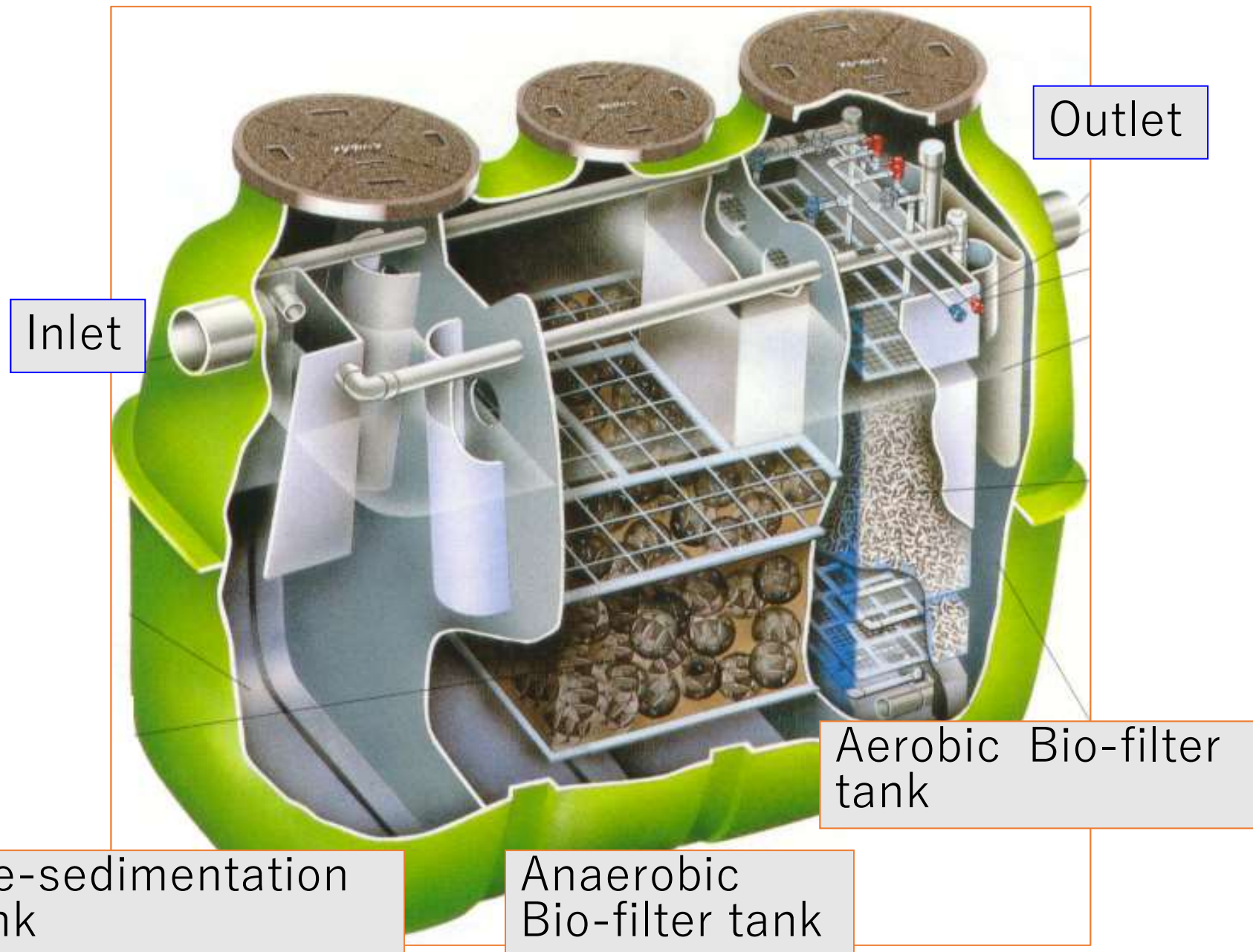
Surrounding conditions

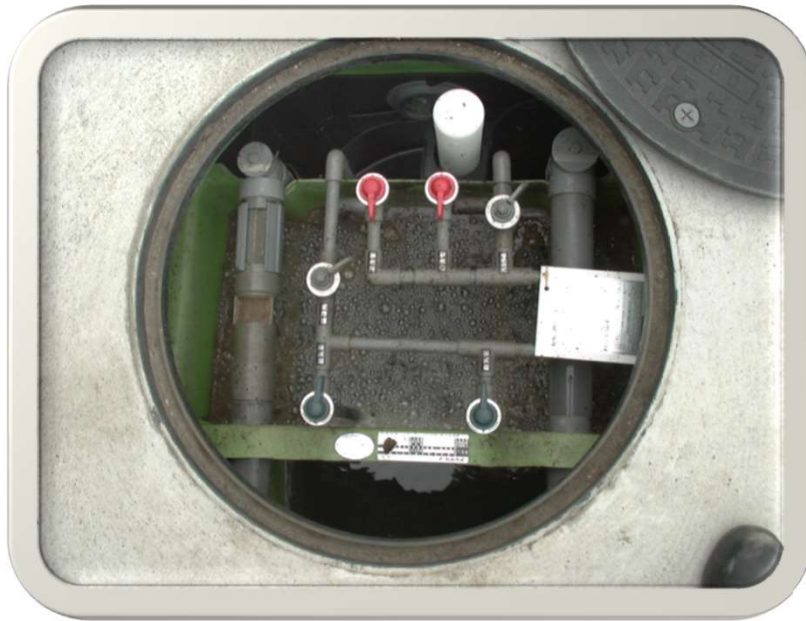
- abnormal noise/sound
- strong odor/smell



Check up the way of inflow water

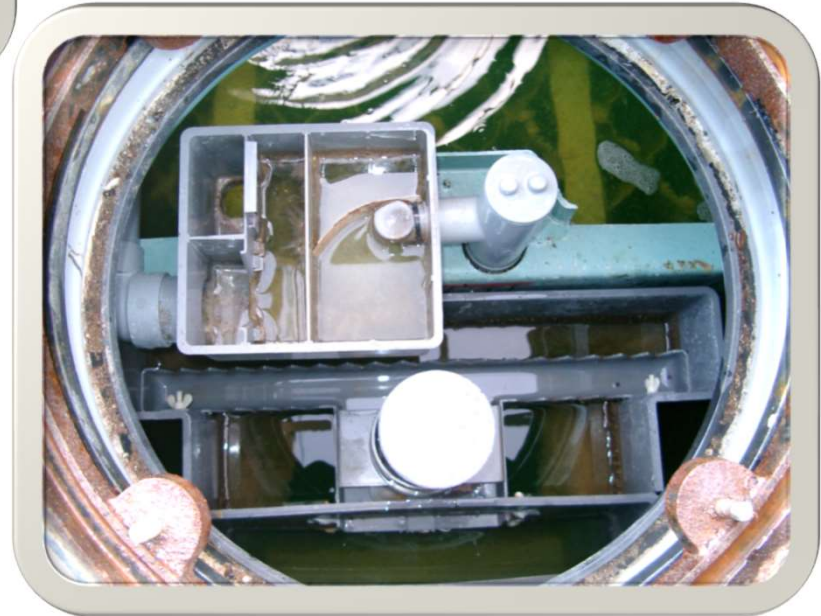


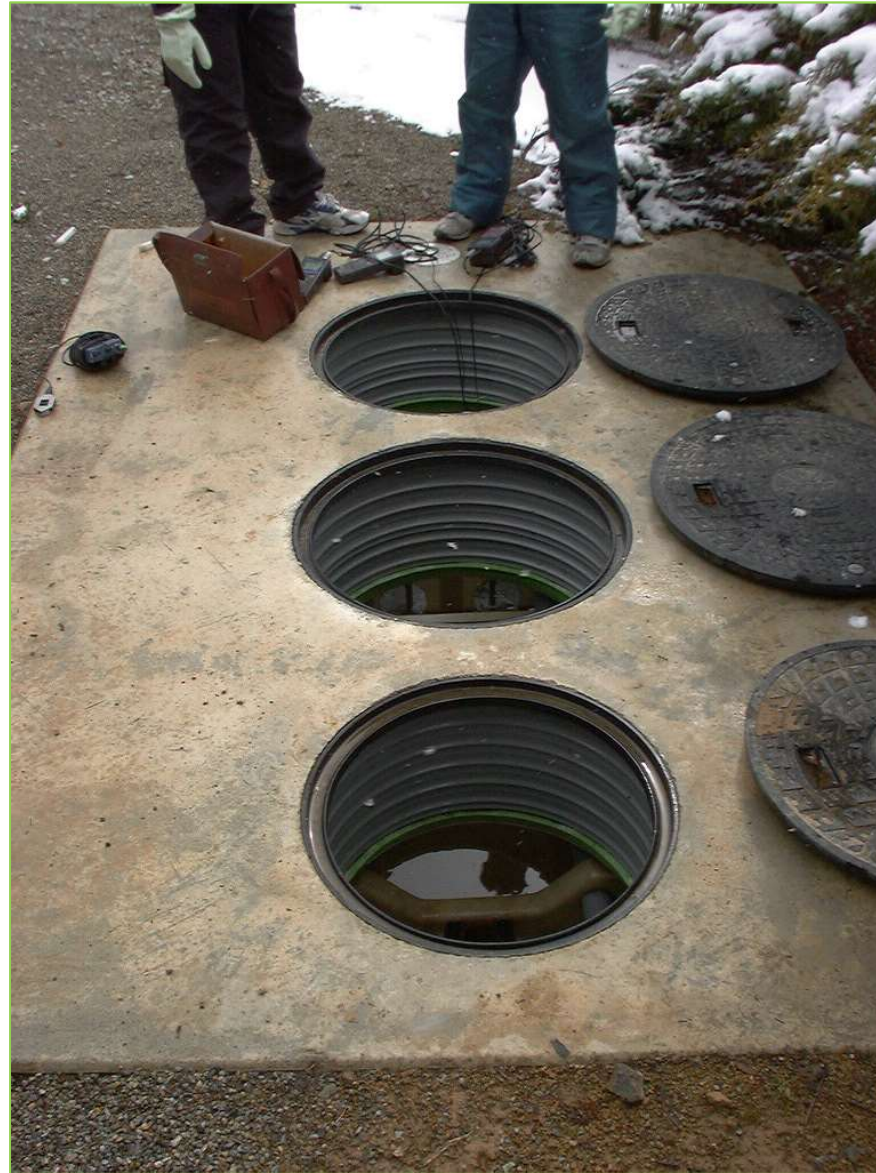




Check the aeration device and the aeration condition, adjust the air flow when necessary

Check the distribution device, the amount of return water and the condition of disinfection device





Check the water quality (DO, pH, ORP, NO₂-)

pH

pH meter

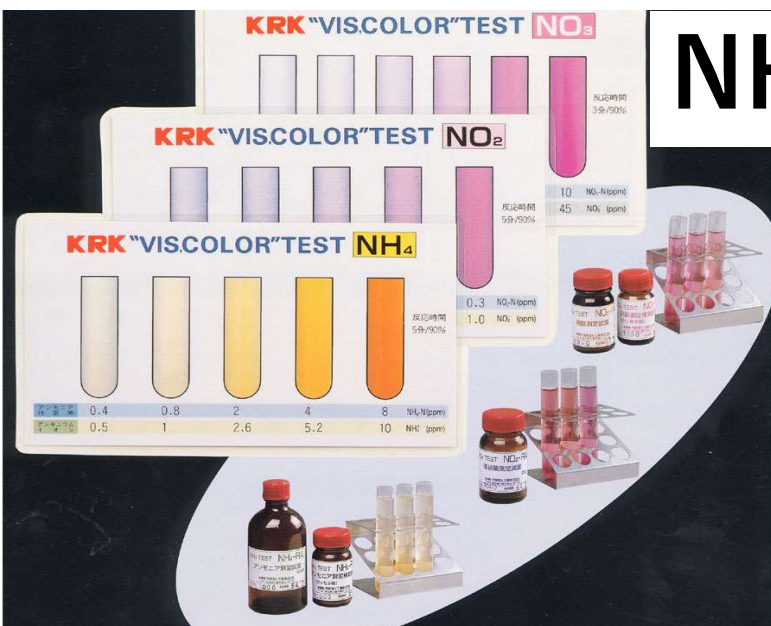


DO

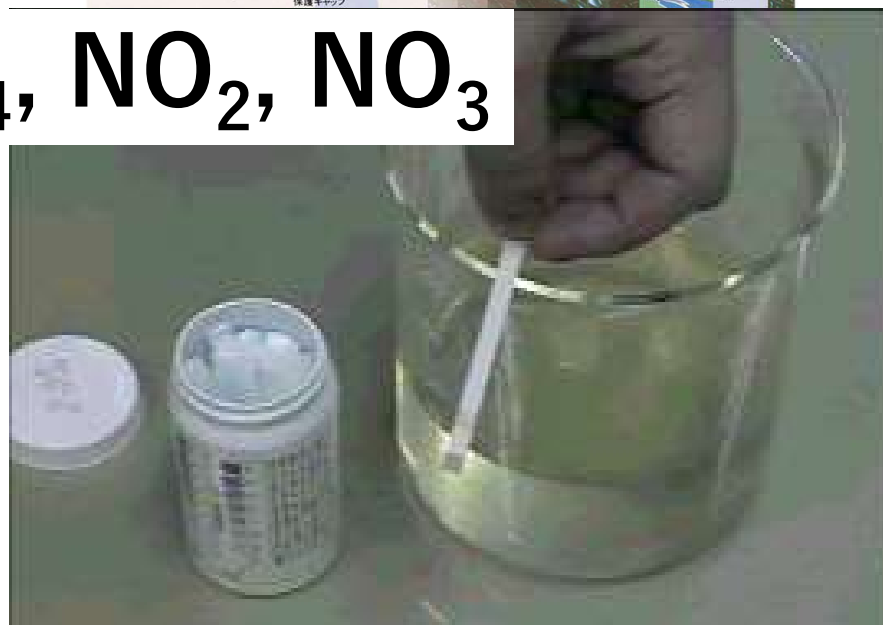
DO meter



NH₄, NO₂, NO₃



NH₄, NO₂, NO₃ portable testing unit



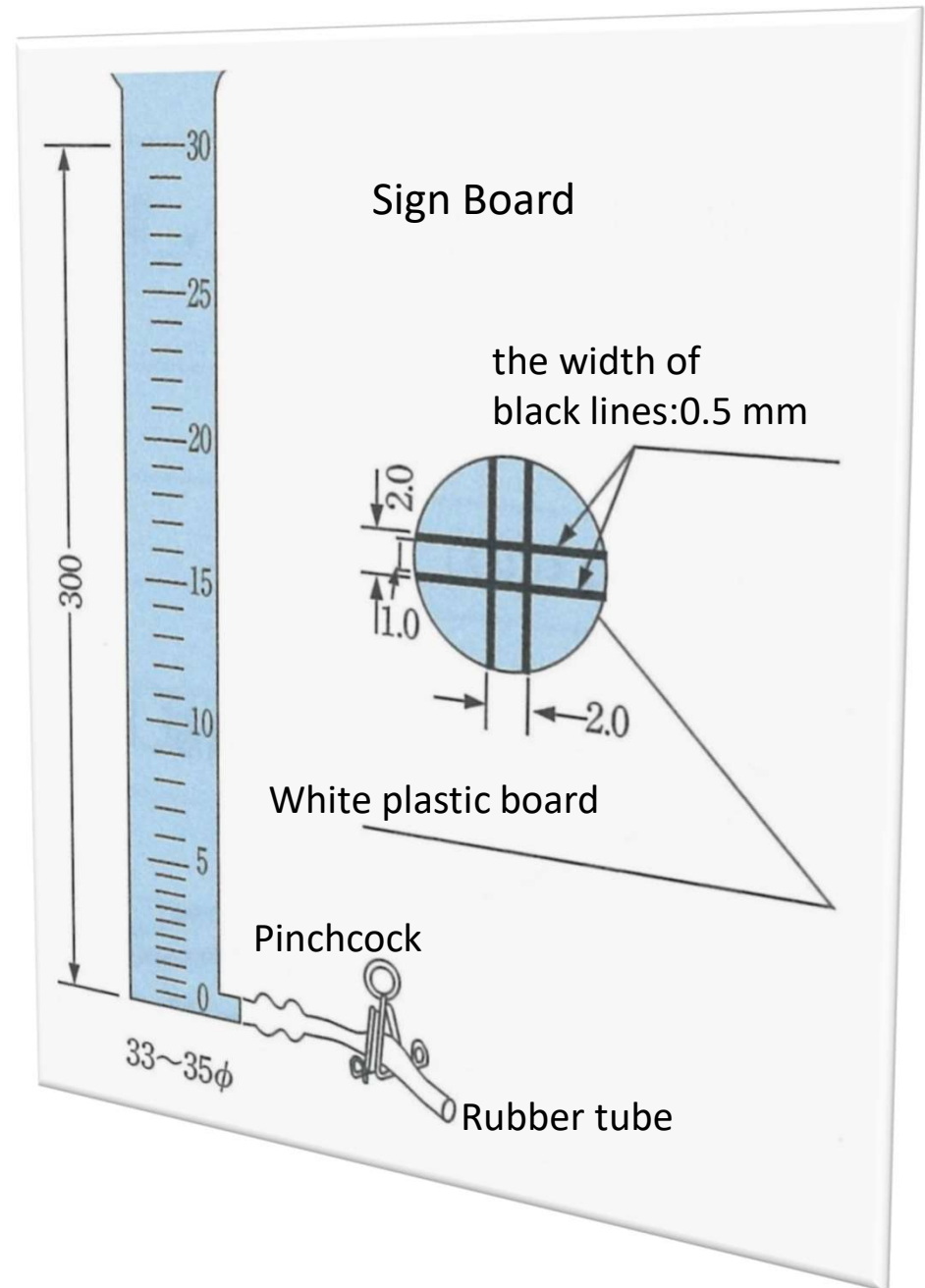
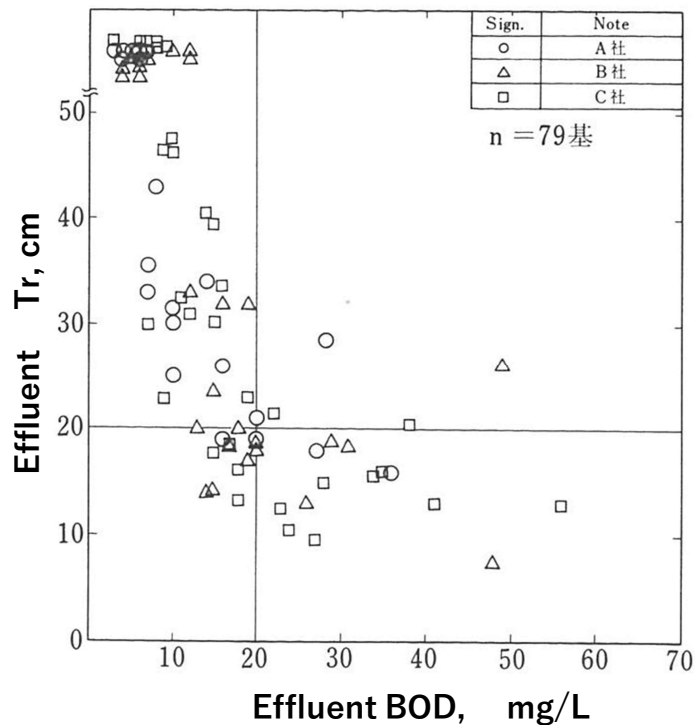
NH₄, NO₂, NO₃ test paper

Check the water quality (Transparency)



Transparency meter

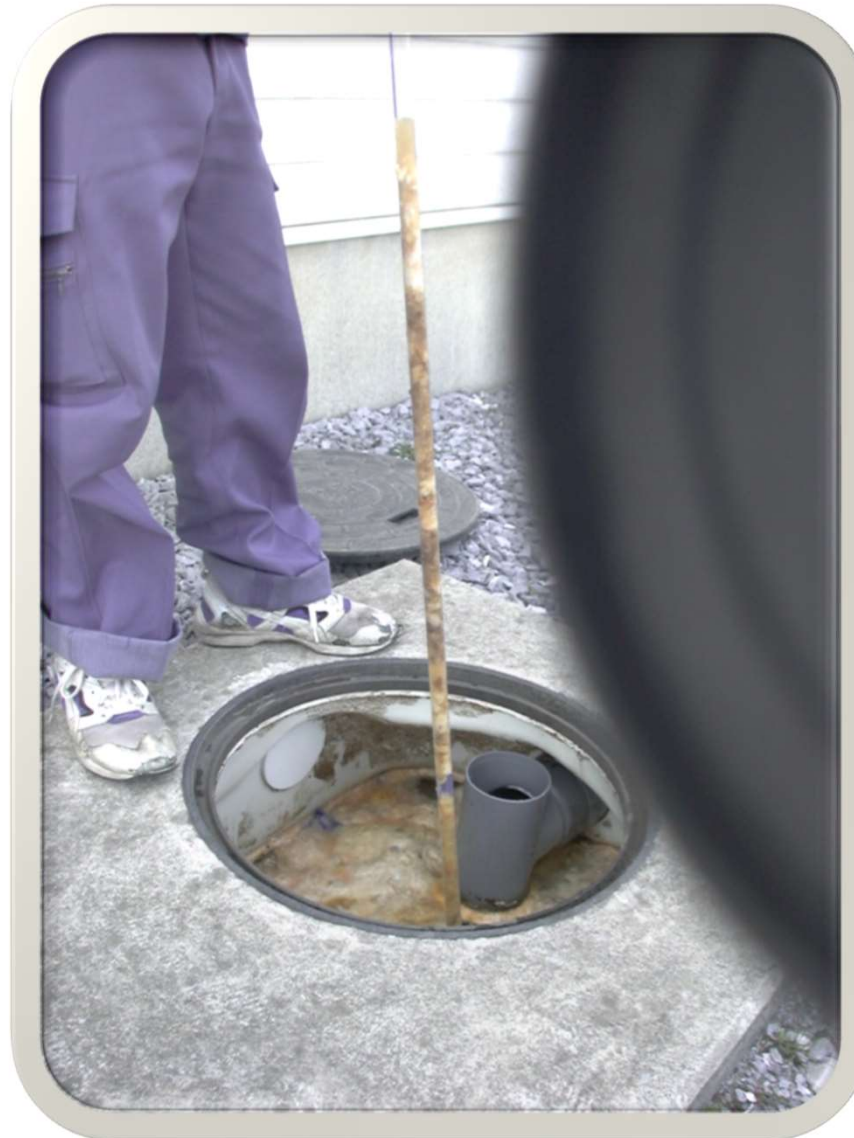
- A simple but very useful item
- Indicates SS and/or BOD indirectly



Check the accumulated sludge



**Check the
accumulated
sludge**



Inspecting wastewater flow



Measuring transparency



Checking remaining disinfectant



Measuring
deposited
sludge



An Example of johkasou O&M

Explaining inspection results



Creating maintenance
inspection report



Blower inspection

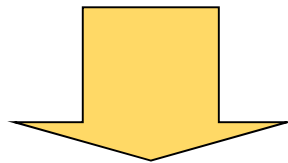


Measuring circulating water volume

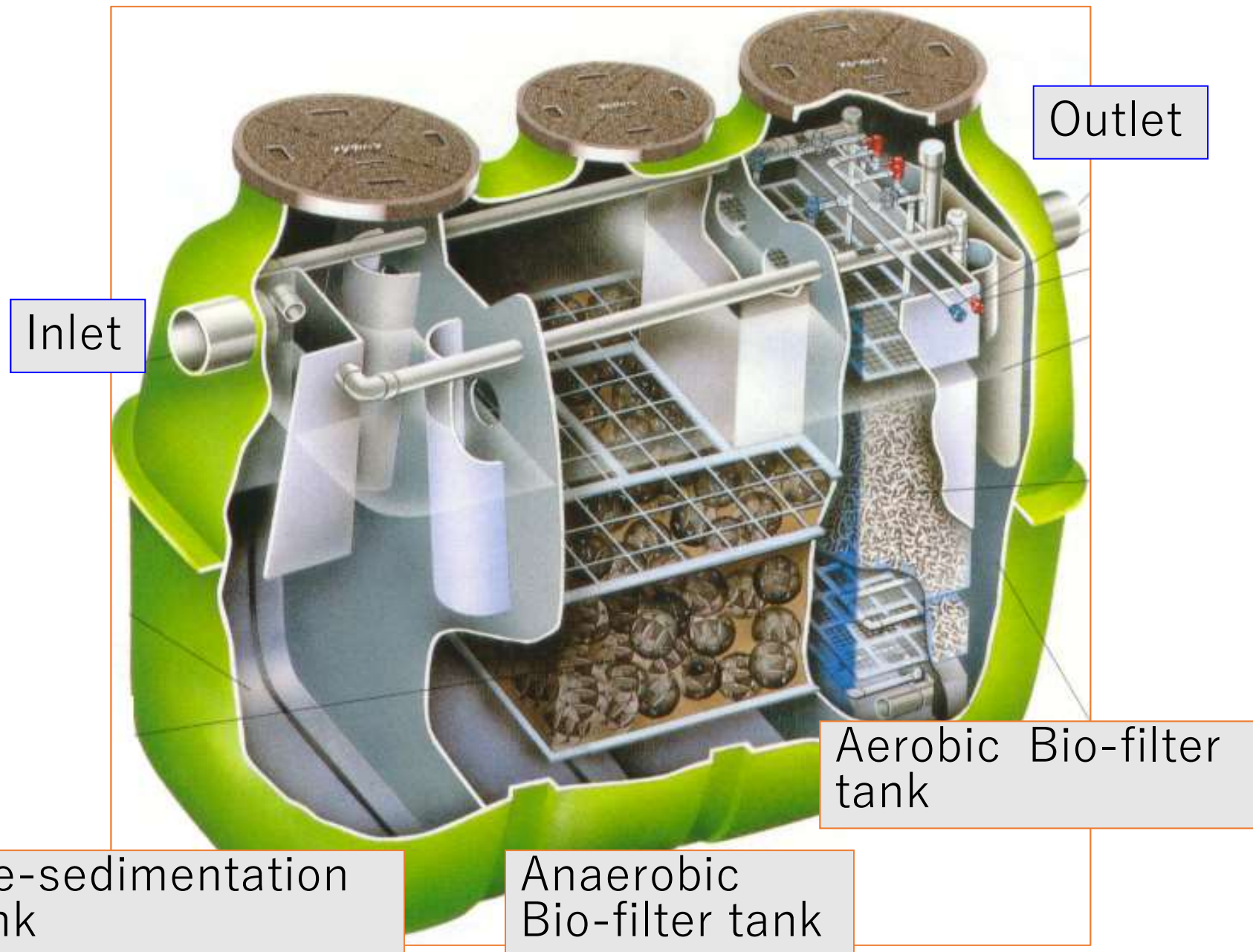
Definition of johkasou desludging

Desludging involves extracting the generated sludge and scum from johkasou and conditioning sludge in the tank, as well as cleaning tanks and auxiliary equipment.

(Johkasou Act, Article 2-4)



Recover/reset treatment performance of johkasou
by removing sludge regularly



Vacuum Truck for Desludging





Preparation work



Drawing sludge out of the 1st-room of anaerobic filter tank



Drawing sludge out of the 2nd-room of anaerobic filter tank



An examples of johkasou desludging

Reporting the results of desludging to the owner



Filling the tanks with water



Cleaning the tank



LEGAL INSPECTION

- Article 7 inspection (inspection after installation)

This inspection focuses on installation status and looks to see whether the johkasou has the intended treatment functions. It is carried out when most of the functions are up and running, between three and five months from the time usage begins.

- Article 11 inspection (periodic inspection)

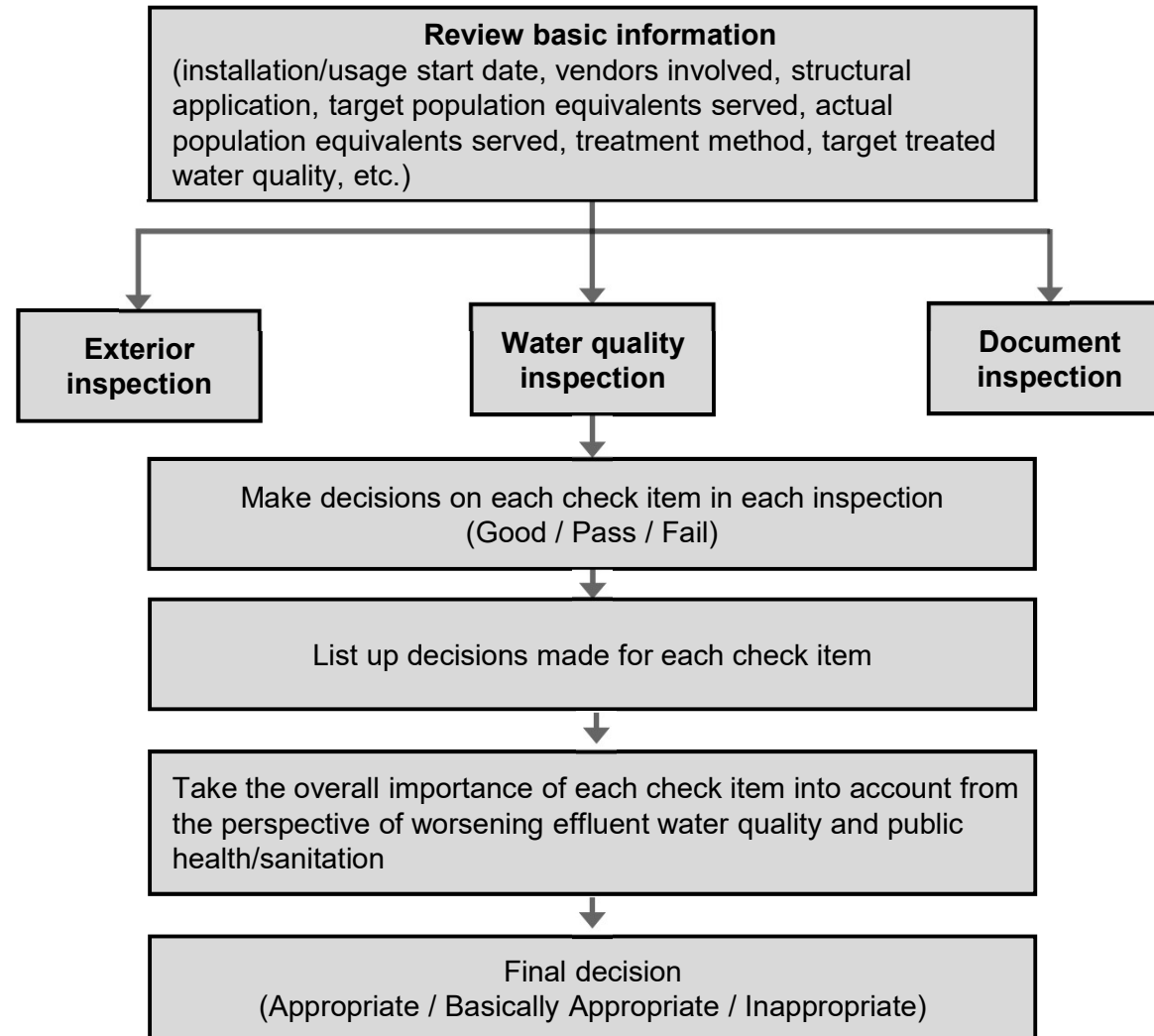
This inspection focuses on maintenance inspection and desludging status and looks to see whether the intended treatment functions are being maintained through proper operations and maintenance. It is carried out once a year.

- Agencies authorized to carry out legal inspection

There are 66 Specified Inspection Agency designated by prefectural governors to carry out legal inspection. To be designated, an agency must assign experts who have knowledge of johkasou inspection as Johkasou Inspector with the requisite skills and have inspection experience at least two years.



LEGAL INSPECTION PROCESS



User interview



Checking inside the johkasou



Water quality measurements



An example of johkasou legal inspection

BOD measurement



Reporting the inspection results to the owner



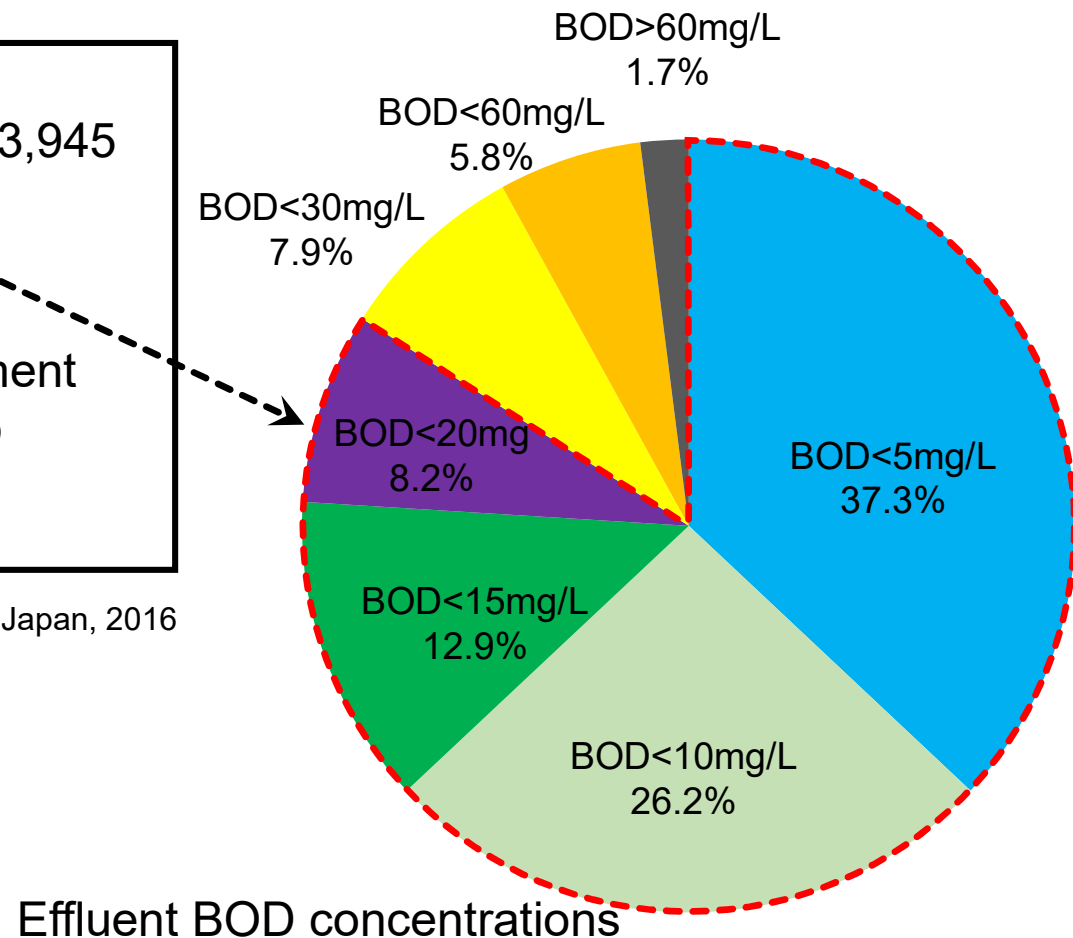
Measuring residual chlorine concentration



TREATMENT PERFORMANCE OF JOHKASOU

- **85.0%** johkasou out of 1,273,945 units shows effluent BOD<20mg/L
- Johkasou shows high treatment performance comparable to sewage treatment plants

Source: Ministry of the Environment, Japan, 2016



TOPICS

1. Legal framework for johkasou O&M
2. Practice of johkasou O&M
3. Training system for Johkasou technicians

TRAINING AND CERTIFICATION SYSTEM FOR JOHKASOU TECHNICIANS

1. Position of the qualifications in the Act

Johkasou Installation Worker

Article 42(1)(ii), Johkasou Act

Johkasou Operator

Article 45(1)(ii), Johkasou Act

Johkasou Technical Supervisor

Article 10(2), Johkasou Act

Johkasou Desludging Technician

Article 11(iv), Ordinance of Johkasou Act

Johkasou Inspector

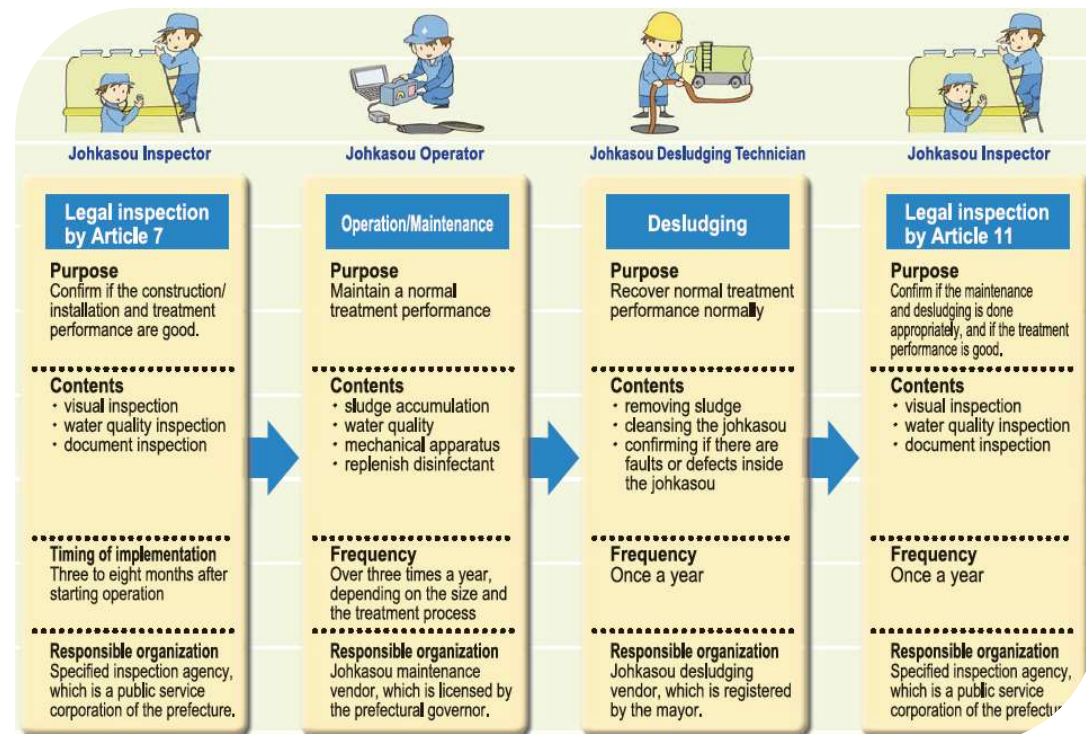
Article 5(1)(iv), Ordinance of Johkasou Act

Examination/training Agency

Article 43, 46, Johkasou Act

2. Business content of the qualifications

As shown in the right figure.



- These regulations make the qualifications to be indispensable for persons who want to join johkasou businesses, and give incentives to them.
- The qualifications could be obtained by receiving training courses or passing national examinations.
- This training and qualification system has played an essential role to enhance the technical level of johkasou technicians, and contributed to the appropriate spread of johkasou.

FEATURES OF THE TRAINING SYSTEM (1)

○ Public Cleansing Act era (~ 1970)

- Training for operators already regularly involved in johkasou desludging to make them specialist technicians in operations and maintenance

○ Waste Disposal and Public Cleansing Act era (1970–1985)

- Operations and maintenance separated into maintenance inspection and cleaning, training for different johkasou managing engineers for each
- Training for technicians who carry out johkasou construction
- Training for technicians who carry out johkasou legal inspections

○ Johkasou Act era (1985~)

- National qualifications established for Certified Johkasou Installation Worker and Certified Johkasou Operator with testing and training sessions implemented for each
- Training sessions implemented for Certified Johkasou Engineering Managers, Certified Johkasou Cleaning Technicians, and Certified Johkasou Inspectors

FEATURES OF THE TRAINING SYSTEM (2)

Working-level contents of curricula for johkasou businesses

- Johkasou technicians should be equipped with extensive knowledge on not only wastewater treatment/johkasou, but also water environment conservation and public health.
- Curriculums for johkasou operator and johkasou installation worker are as shown below

Training course for Johkasou Operator		Training course for Johkasou Installation Worker	
➤ Fundamental of johkasou	8 H	❑ Fundamental of johkasou	8 H
➤ Laws and regulations related johkasou	4 H	❑ Laws and regulations related johkasou	3 H
➤ Structure and function of johkasou	22 H	❑ Structure and function of johkasou	15 H
➤ Introduction to installation of johkasou	4 H	❑ Management of johkasou installation	8 H
➤ Operation and maintenance of johkasou	30 H	❑ Introduction to O&M and desludging of johkasou	3 H
➤ Water quality management of johkasou	10 H		
➤ Introduction to desludging of johkasou	2 H		
Total	80 Hours	Total	37 Hours



FEATURES OF THE TRAINING SYSTEM (3)

Follow-up for johkasou technicians and continuing professional development (CPD)

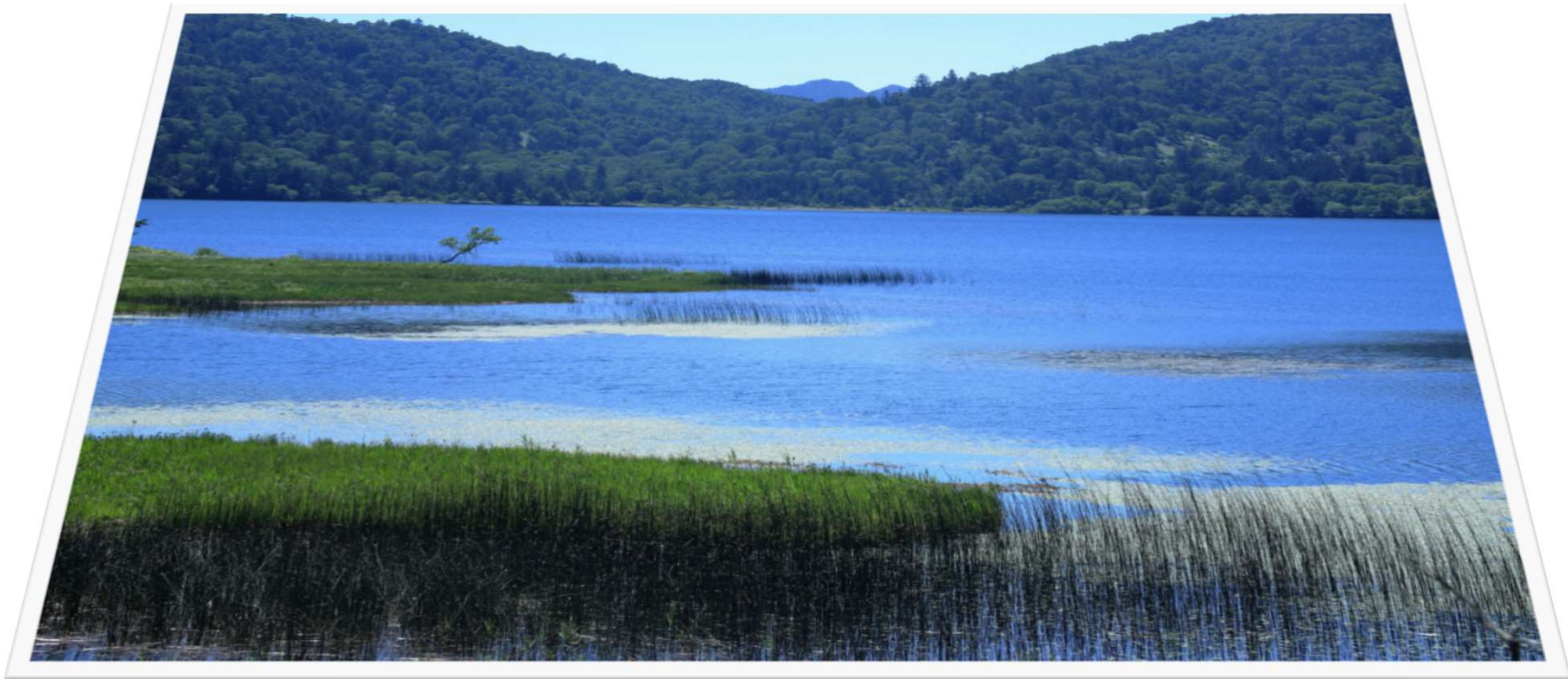
- ◆ Support the johkasou technicians by providing updated technical information on johkasou, and give them appropriate information/advice on johkasou O&M, desludging and legal inspection.
Publication of monthly journal JOHKASO and books related johkasou technology/administration
Holding a national conference on johkasou technology, johkasou technicians and other stake-holders coming together for exchanging information and discussing issues on johkasou businesses.
- ◆ Seminar courses for CPD of johkasou technicians
 - Special seminar for johkasou desludging workers
 - Special seminar on installation management of johkasou
 - Special seminar on O&M of compact type johkasou
 - Special seminar on desludging practice of compact type johkasou



SUMMARY

- As johkasou are required to treat and discharge wastewater free from hygienic risk and complying with the water quality stipulated by the technical standard, the O&M, desludging and legal inspection are very important to ensure the johkasou function as designed.
- Technical standards for O&M and desludging as well as the guidelines are prepared for johkasou of different sizes and treatment processes. These documents make it possible for technicians to conduct O&M and desludging of johkasou appropriately.
- A training system for certification of johkasou technicians has been established. More than two hundred thousand of various johkasou technicians have been raised so far. With the support of the technicians, johkasou industry has developed significantly in Japan.
- The experiences of Japan shows that appropriate O&M, desludging and monitoring as well as a training system are essential to implementation of decentralized domestic wastewater treatment, and a legal institution should be necessary to integrative

THANK YOU FOR YOUR ATTENTION !



WWW.JECES.OR.JP