O&M Case Study in Japan and in Asian Countries



Photo: Ministry of the Environment, Japan

Yurie Shirakawa, Ph.D.
Manager, International Affairs Division
Japan Education Center of Environmental Sanitation (JECES)

2026 Onsite Wastewater Mega-Conference · Track 6 · October 27, 2026

Disclaimer

The materials being presented represent the presenter's own opinions,
and do NOT reflect the opinions of NOWRA.

Japan Education Center of Environmental Sanitation

Organization	Non-profit foundation working on onsite wastewater and sanitation
Core work	Training, qualification and technical materials for the O&M workforce
International	Cooperation and training programs in Asian countries

Contents

1 Legal position of the three functions

2 Qualification system, from installation to inspection

3 What O&M actually checks

4 The O&M market in Japan

5 The picture across Asian countries

1

Legal position of the three functions

O&M · Desludging · Legal inspection



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Three separate duties on one johkasou

Operation & maintenance

Check and adjust the unit while it is running

Desludging

Withdraw sludge and scum, and wash the tank

Legal inspection

Independent check that the unit works

O&M

- Check the operating condition of each treatment unit
- Check equipment: blower, pumps, disinfection device
- Check water quality on site



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Frequency (Enforcement Ordinance, Art. 6): at least once every 4 months for a combined unit of 20 PE or less, every 3 months for 21–50 PE, and weekly for activated-sludge units. Old Type Johkasou: every 3 to 6 months, by process.

O&M (cont.)

- Adjust air volume, sludge return and disinfectant
- Carried out by a licensed Johkasou Operator



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Frequency (Enforcement Ordinance, Art. 6): at least once every 4 months for a combined unit of 20 PE or less, every 3 months for 21–50 PE, and weekly for activated-sludge units. Old Type Johkasou: every 3 to 6 months, by process.

Desludging

- Withdraw accumulated sludge and scum from each chamber
- Wash the tank interior, media and appurtenances
- Refill with water and restart the unit



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Frequency (Enforcement Ordinance, Art. 7): at least once a year, and approximately every six months for full-aeration units.

Desludging (cont.)

- At least once every year
- Carried out by a permitted desludging contractor



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Frequency (Enforcement Ordinance, Art. 7): at least once a year, and approximately every six months for full-aeration units.

Legal inspection

- Carried out by a third party, not by the service contractor
- Checks appearance, water quality and the service records
- First inspection in the five months after the third month of use — months 4 to 8 (Act Art. 7)
- Then once every year (Act Art. 11)
- Body designated by the prefectural governor

Timing of the first inspection is set by the Enforcement Ordinance, Art. 4.

The three cannot substitute for one another

O&M

Adjusts the process.
It does not remove the accumulated sludge.

Desludging

Removes the sludge.
It does not verify treatment performance.

Legal inspection

Verifies performance.
It does not adjust or repair anything.

Each answers a different question, so all three are required by law.

Technical standards are set by ministerial ordinance

- Frequency of O&M and desludging, by process type and size
- Items to be checked and the methods to be used
- Standards for the legal inspection are set separately
- Standards are revised as treatment technology changes

Ordinance for Enforcement of the Johkasou Act (Ministry of the Environment): O&M frequency Art. 6, desludging Art. 7, records Art. 5. A separate MOE notification sets the O&M frequency for units with remote monitoring.

The owner holds the duty

- The johkasou manager is the owner or occupier of the unit
- Must contract O&M and desludging
- Must receive the legal inspection



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

The owner holds the duty (cont.)

- Must keep the resulting records
- Performance can be delegated; responsibility cannot



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Who performs each function

Owner	Holds the legal duty, signs the contracts, keeps the records
O&M contractor	Employs licensed Johkasou Operators; services and reports
Desludging contractor	Withdraws sludge and delivers it for treatment
Inspection body	Independent of the two above; performs the legal inspection
Prefecture / municipality	Registers, permits, designates, and issues guidance

Registration and permit system

O&M business	Registration with the prefecture
Desludging business	Permit from the municipality
Inspection body	Designation by the prefectural governor
Requirements	Qualified staff, equipment, and record keeping
Supervision	Reporting, on-site inspection, and revocation

Records are what make supervision possible

- O&M and desludging results are recorded and given to the owner
- Records are retained for a set period
- The inspection body reviews those records during the annual legal inspection



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

The owner and the contractor each keep the records for three years (Enforcement Ordinance, Art. 5). With the owner's consent, records may be delivered and kept electronically.

Records are what make supervision possible (cont.)

- Results are reported to the prefecture or municipality
- Non-compliance can lead to guidance and, ultimately, an order



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

The owner and the contractor each keep the records for three years (Enforcement Ordinance, Art. 5). With the owner's consent, records may be delivered and kept electronically.

2

Qualification system

From installation through to inspection



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

One chain, four qualifications

Installation	O&M	Desludging	Verification
Johkasou Installation Worker	**Johkasou Operator**	**Desludging technician**	**Inspector**

Each stage of the life of a unit is covered by a national qualification or registered training.

Johkasou Installation Worker — installation

- National qualification held by the supervisor of installation work
- The installer must place the work under a qualified supervisor
- Obtained by examination, or by an accredited course
- Installation defects appear years later as an O&M problem

Routes to the qualification: the MLIT examination, or a designated course for holders of the national technical qualification for plumbing works management (Construction Business Act, Art. 27).

Johkasou Operator — O&M

- National qualification required to perform O&M
- Obtained by national examination, or by an accredited course



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

The examination and the accredited course are run under MOE designation. Refresher training became compulsory under the 2019 amendment, in force April 2020.

Johkasou Operator — O&M (cont.)

- Covers all process types and sizes
- Refresher training keeps holders current with revised standards



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

The examination and the accredited course are run under MOE designation. Refresher training became compulsory under the 2019 amendment, in force April 2020.

Desludging technician

- Qualification for the staff who carry out desludging work
- Covers withdrawal sequence, washing, refilling and restart



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Formally the Johkasou Desludging Technician (johkasou seisou gijutsusha) — a course-based qualification rather than a national licence. JECES runs the course.

Desludging technician (cont.)

- Safety is a major component: confined space and hydrogen sulfide
- Poor desludging can damage the unit and set treatment back for months



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Formally the Johkasou Desludging Technician (johkasou seisou gijutsusha) — a course-based qualification rather than a national licence. JECES runs the course.

Inspector

- Employed by a designated inspection body
- Trained and registered specifically for the legal inspection
- Must be independent of O&M and desludging contracts
- Judges the unit against a defined set of criteria

The report records one of three judgments: "appropriate", "broadly appropriate" or "not appropriate" (MOE, Judgment Guideline for Johkasou Legal Inspection).

How the examinations are designed

- The question set is built from the tasks actually performed on site
- Balanced across law, structure, equipment, water quality and safety
- Questions test judgment, not only recall
- Results are analyzed after each examination and fed back

JECES designs and runs the examination and the teaching materials under Ministry of the Environment designation.

How the teaching materials are designed

- Aligned with the ordinance and with the examination scope
- Standard textbooks, supported by figures and site photographs



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

How the teaching materials are designed (cont.)

- Revised whenever the technical standards change
- Adapted versions are used for training in other countries



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

3

What O&M checks

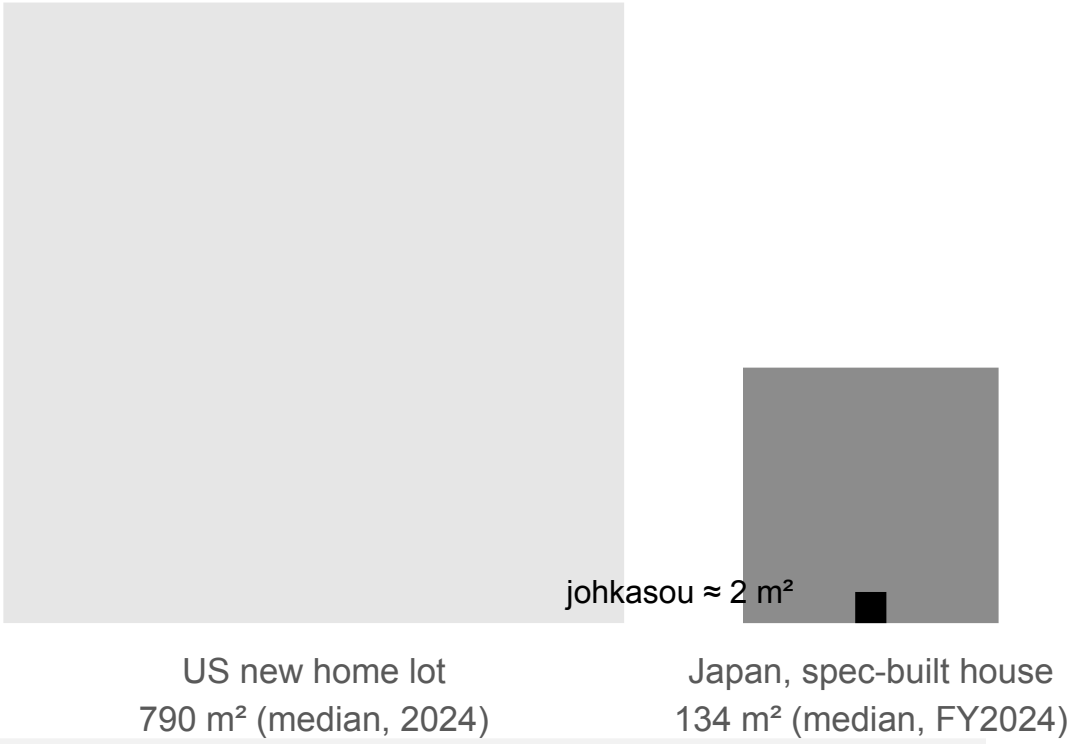
Small units, larger units, and the technician's judgment



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Small lots, small units

- Japan, spec-built house: 134 m² (median site area, FY2024)
- Tokyo metropolitan area: 115 m²
- US, new single-family home: 790 m² (8,506 sq ft, 2024)
- A Japanese lot is about one sixth of a US lot — house, parking and johkasou share it

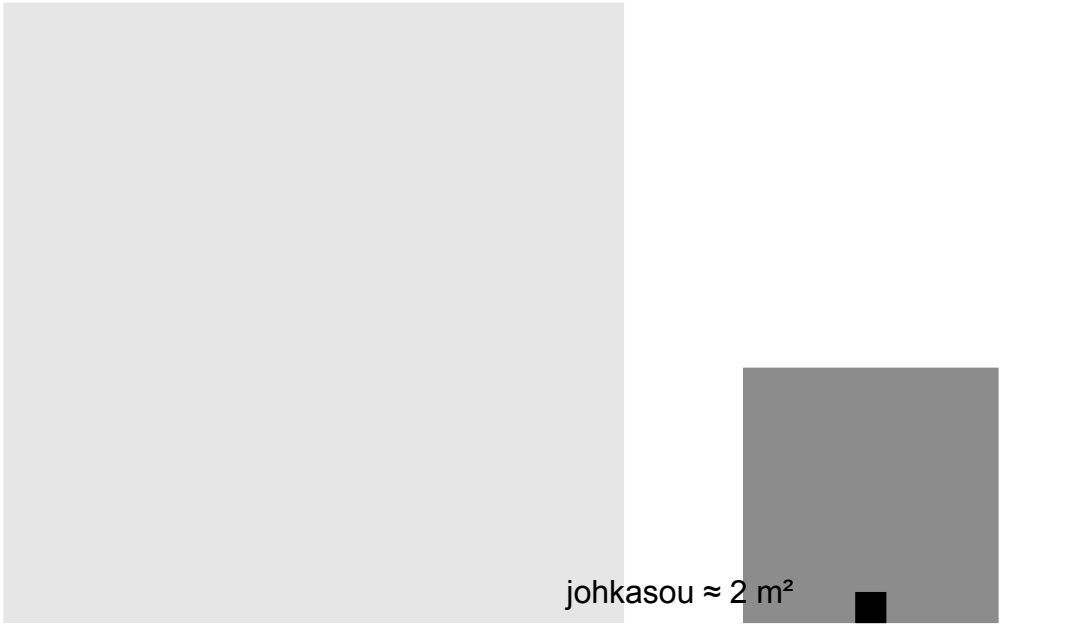


Compact units are not a design preference. They are what the site allows — and the same tight site sets the working space for every O&M visit.

Sources: Japan Housing Finance Agency, Flat 35 User Survey FY2024 (median site area); US Census Bureau, Survey of Construction 2024, as reported by NAHB (median lot size, new single-family detached homes sold).

Small lots, small units (cont.)

- Median lot of a new single-family home sold in the US: 790 m² (8,506 sq ft)
- A Japanese lot is roughly one sixth of a US lot, and the house, the parking space and the johkasou share it



Compact units are not a design preference. They are what the site allows — and the same tight site sets the working space for every O&M visit.

Sources: Japan Housing Finance Agency, Flat 35 User Survey FY2024 (median site area); US Census Bureau, Survey of Construction 2024, as reported by NAHB (median lot size, new single-family detached homes sold).

A small johkasou — what is measured (cont.)

- Sludge and scum accumulation in each chamber
- Residual chlorine and disinfectant stock
- Condition of blower, pumps and filters



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Measured chamber by chamber

Separation / anaerobic	Sludge depth, scum thickness, filter clogging
Contact aeration	Dissolved oxygen, air volume, condition of the biofilm
Sedimentation	Transparency, sludge return, carry-over of solids
Disinfection	Residual chlorine, remaining tablets

Target ranges are set for each process in the technical standards and in the JECES textbooks; the technician reads each value against the range for that process.

Larger and advanced units

- Larger units are checked more often and by additional qualified staff
- Nitrogen removal: recirculation rate, sludge concentration, alkalinity



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Units of 501 PE or more must also have a Technical Manager (Act Art. 10(2)); activated-sludge units are checked weekly (Enforcement Ordinance, Art. 6).

Larger and advanced units (cont.)

- Membrane units: pressure, flux and the cleaning cycle
- Phosphorus removal: dosing rate and chemical stock



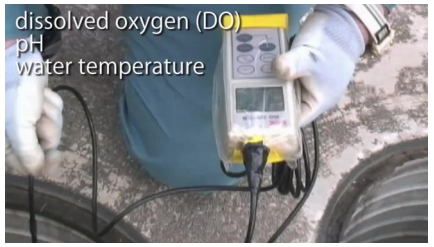
Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Units of 501 PE or more must also have a Technical Manager (Act Art. 10(2)); activated-sludge units are checked weekly (Enforcement Ordinance, Art. 6).

From finding an anomaly to adjusting the unit

Observe → **Measure** → **Identify the cause** → **Adjust or report** → **Record**











Most faults are invisible from outside the unit, so the visit has to be scheduled.

Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Judgment, and the record that follows it

- Judgment combines measured values with what is seen and heard on site
- The technician decides what to adjust now and what to report as a repair



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

Judgment, and the record that follows it (cont.)

- The result is written up and handed to the owner
- That record is read again at the annual legal inspection



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

4

The O&M market in Japan

Who provides the service, and what it costs



Photo: Ministry of the Environment, Japan — video "Operation and Maintenance, and Desludging of Johkasou" (production: JECES)

The demand base

Johkasou in service	7.43 million units — 4.14 million combined, 3.29 million Old Type
Services required each year	At least 3 O&M visits, 1 desludging and 1 legal inspection per unit
Actually carried out, FY2024	O&M 74.5% | desludging 65.9% | Art. 11 legal inspection 50.9%

Source: Ministry of the Environment, installation status of johkasou, FY2024 (as of 31 March 2025).

Qualified people

Johkasou Operator	41,816 licence holders
Technical Manager (501 PE and above)	8,084 licence holders
Johkasou Inspector	1,495 registered
Desludging technician	Course-based qualification, run by JECES

Source: MOE, FY2024 Survey Results on Guidance and Promotion of Johkasou.

What the owner pays

Legal inspection, Art. 11	JPY 5,500 a year for a 5–10 PE unit (Tokyo) — a published fee
Legal inspection, Art. 7	JPY 13,500 once, for the same size
O&M and desludging	Contracted at market prices — there is no national tariff
Municipality-managed units	A monthly fee, like a sewer bill

Inspection fees: Tokyo Metropolitan Government, designated body Tokyo Environmental Public Service Corporation, as of 1 April 2024. O&M and desludging prices vary with region, unit type and contract.

Why the price differs so much

- Process type and size of the unit
- Region, travel distance and route density
- Bundled contract or three separate contracts
- Owner-managed or managed by the municipality
- Repairs and replacement parts are charged separately

Which way the market is moving

Total units	Combined	Old Type	New units
7.43 M (−22,000)	4.14 M (+45,081)	3.29 M (−66,872)	84,377 (68,612 advanced)

The work is shifting from Old Type units to combined and advanced-treatment units.

Source: Ministry of the Environment, installation status of johkasou, FY2024 (as of 31 March 2025).

5

The picture across Asian countries

Where the same hardware is used without the same framework

Five countries, one recurring pattern

China	Rural facilities built at scale; provinces now writing O&M rules and training operators
India	Strict standards and a product standard in place; operator certification still to come
Vietnam	Johkasou installed, but no O&M and no legal duty on the owner
Indonesia	Private plants in tourist areas fail unless O&M is contracted
Malaysia	National framework and operator in place, but desludging is on request and compliance is low

China

- Rural wastewater treatment began around 2005, led by Shanghai and Zhejiang, and expanded rapidly
- National ministries now require an O&M mechanism: quarterly inspections and water quality monitoring every six months (2024)
- Jiangsu and Zhejiang have provincial O&M regulations and training courses for operators
- Changshu Model: planning, construction and O&M under one body raised performance within a short period
- Remaining gaps: facilities have no clear legal status, and O&M funding is not yet secured



O&M training course



Rural treatment facility

Source and photos: Prof. Min Yang (RCEES, Chinese Academy of Sciences), presentation material, 13th International Workshop on Decentralized Domestic Wastewater Treatment in Asia (MOEJ, Tokyo, Nov 2025)

India

- Strict standards for decentralized plants (BOD 10, TSS 20, TN 10 mg/L), following a National Green Tribunal case
- Johkasou introduced in 2018; government plants of 10–500 m³/day, e.g. under the Namami Gange Programme
- National product standard IS 18797:2024 for packaged sewage treatment plants
- No operator certification yet; skills built through a university pilot course and on-site skill checks
- Proposed next steps: government certification of operators, and a testing facility under the India–Japan MoC



Maintenance skill check



Johkasou at a government site

Source and photos: Prof. A. A. Kazmi (IIT Roorkee), presentation material, 13th International Workshop on Decentralized Domestic Wastewater Treatment in Asia (MOEJ, Tokyo, Nov 2025)

Vietnam

- JICA project in Hung Yen (2018–2023): O&M trial on johkasou in an upscale Hanoi residential area with about 100 small units
- Before O&M: sludge never removed, blower filters and media clogged, no disinfection, high coliform counts
- Units buried under soil and tiles; houses turned into restaurants overload the design capacity
- Users ask why a johkasou needs O&M, because septic tanks usually receive none
- Presenters' conclusion: a legal duty on the owner, and trained installers, operators and desludging workers



Sludge accumulated before O&M



On-the-job training

Source and photos: Y. Tahara (Showa Eisei Center) and Nguyen Duc Son (Hoshi Densetsu Viet Nam), presentation material, 13th International Workshop on Decentralized Domestic Wastewater Treatment in Asia (MOEJ, Tokyo, Nov 2025)

Indonesia

- Bali: only about 45% of wastewater is treated; tourism generates over 40% of it
- Denpasar sewerage suffers from garbage, grease, manholes opened in heavy rain, and aging pipes
- Hotels, malls and hospitals run their own plants; many fail without O&M — overheated blowers, sludge carry-over
- Under an O&M contract, a hospital johkasou (80 m^3/day) recovered from 10 cm to over 30 cm transparency
- Barriers: low awareness of regular maintenance, a fragmented market, and uneven enforcement



Before O&M contract



After O&M contract

Source and photos: A. Rivai (PT Earth Creative Indonesia), presentation material, 13th International Workshop on Decentralized Domestic Wastewater Treatment in Asia (MOEJ, Tokyo, Nov 2025)

Malaysia

- Sewerage and on-site sanitation are regulated nationally under the Water Services Industry Act 2006 (regulator: SPAN; national operator: Indah Water Konsortium)
- The owner of the premises is responsible for maintaining the septic tank
- Scheduled desludging ended on 1 January 2008; it is now arranged by the owner, on request

Sources: Indah Water Konsortium, Desludging Service; SPAN, reported by Bernama, 20 May 2026. Peninsular Malaysia and Labuan have over 1.38 million individual septic tanks.

Malaysia (cont.)

- Required interval: every two years inside local authority areas, every three years outside
- Compliance is very low — in Perlis, 302 of 8,520 notified households, about 3.5%

Sources: Indah Water Konsortium, Desludging Service; SPAN, reported by Bernama, 20 May 2026. Peninsular Malaysia and Labuan have over 1.38 million individual septic tanks.

Service is triggered by failure, not by schedule

Reactive response

Nothing is done until the unit backs up or overflows

Emptying on request

The household decides when, and pays a large one-off fee

No routine check

Nobody looks at the unit between failures

> **South Asia: 40% of operators had no formal training, and O&M recovers less than 60% of its cost on average.**

Source: R. R. Shrestha (Gates Foundation), presentation material, 13th International Workshop on Decentralized Domestic Wastewater Treatment in Asia (MOEJ, Tokyo, Nov 2025), citing the Eawag 4S project

What is missing behind that pattern

Responsible party	No named party carries a duty once construction ends
Supervision	No authority registers providers or checks the work
Asset register	Units are not listed, so service cannot be scheduled
Workforce	No qualification, so competence cannot be verified
Money and sludge	No recurring fee, and nowhere lawful to take the sludge

What the Japanese experience suggests

- Performance comes from the management system, not from the tank alone
- The three functions work because they are separate and all compulsory

What the Japanese experience suggests (cont.)

- Qualification is what makes the work verifiable
- Japan has all of this, and still loses ground where owners act alone

Relevance for practice in the United States

- Advanced units fail silently between visits, in any country
- Verification carries more weight when it is separate from the service

Relevance for practice in the United States (cont.)

- Where a managing entity holds the contract, compliance stops being optional
- Septage has to have somewhere to go, or emptying simply stops

Thank you

Yurie Shirakawa, Ph.D.
Manager, International Affairs Division
Japan Education Center of Environmental Sanitation (JECES)
2-23-3 Kikugawa, Sumida-ku, Tokyo 130-0024, Japan