6.3. ラオス国浄化槽セミナーにおける発表資料

6.3.1. Current situation of wastewater treatment in Lao PDR (Road map of wastewater management in Lao PDR), ヴァンサヴェン ウッタチャック 氏
ラオス国公共事業運輸省水道局　副局長

Overview of Sanitation Management in Lao PDR

Present by: Department of Water Supply, Ministry of Public Works and Transport
10 December 2025

Content

- Department of Water Supply
- Main On-going Infrastructure Development
- Vision to 2035 and Water Supply Strategic Objective

Macro Responsibilities

Strategic Planning: Develop and implement strategic plans for the Water Supply and Sanitation Sector.

Regulatory Frameworks: Formulate and enforce regulatory frameworks to govern the sector.

Capacity Building: Enhance human resource capacity through targeted training and development programs.

Funding & Investment: Secure funding and investment opportunities to support sectoral growth.

Monitoring & Evaluation: Conduct systematic M&E of sectoral activities to ensure effective implementation.

Challenges in the Sector

Insufficient Legal Framework: Inadequate laws, regulations, and technical standards to meet the sector's needs.

Human Resource Gap: A significant shortage of skilled professionals with expertise in modern technologies.

External Funding Dependence: Heavy reliance on Official Development Assistance (ODA) for financial support.

Water Resource Issues: Resources are often insufficient, contaminated, and face seasonal shortages exacerbated by climate change.

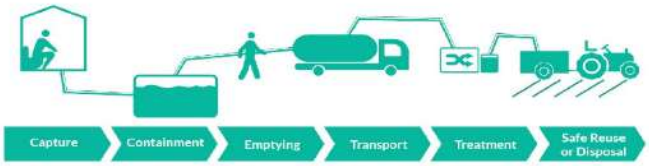
Service Provider Capacity: Both public and private water supply providers require further development.

Public Awareness: Limited public awareness and engagement in water conservation and sanitation practices.

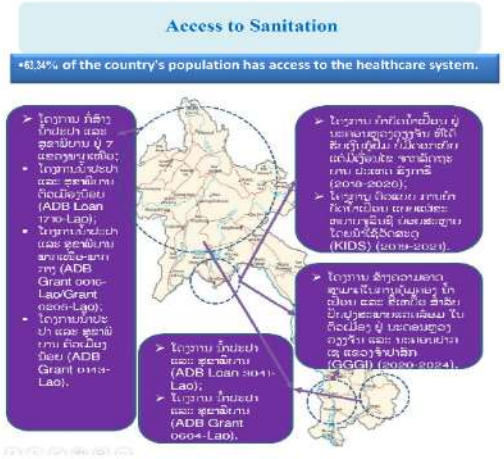
Sanitation Infrastructure

Water that has contaminants above the standard or water that has been used and has undergone quality changes, such as water used in households, markets, communities, agriculture, and other activities.

Removal or destruction of contaminants and water-based pollutants, or reducing contaminant concentrations so they do not exceed national environmental standards before being released into natural water sources, to minimize impacts on aquatic ecosystems.



Overview of Sanitation in Lao PDR



Background and Current Management of Wastewater in Lao PDR

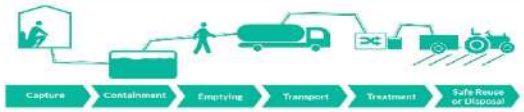
- The development of Singapore's health sector has gradually expanded from urban to rural areas. Households are encouraged to maintain their own vacuum systems and to offer vacuuming services.
- Overall, the government has faced underfunding for the construction and upgrading of sewage treatment and sewer systems, relying largely on support from development partners.

❖ **Urban Sanitation Assessment Framework in Lao PDR**

Contentment

Sanitary systems that ensure minimal germ spread from sewage and household waste

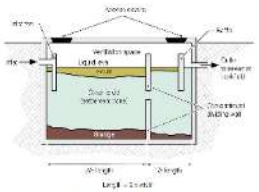
Washing and Transportation	Treatment	Disposal and Reuse
Disposal and transportation of waste using vacuum trucks, etc.	Physical, Chemical, and Biological Treatment Processes for Safe Reuse or Disposal	Treat and non-Treat waste disposal



Wastewater Management in Lao PDR (1/2)

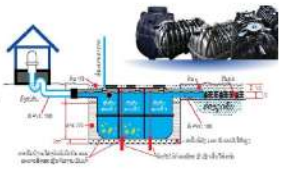
1. Improvement of onsite septic tank and Faecal Sludge Management

Improvements to existing household septic tanks and enhancements in Faecal Sludge management. If septic tanks do not meet standards, they can be replaced with a septic tank system, such as a household-sized balloon system or Johkasou.



Septic Tank

Johkasou Household Type

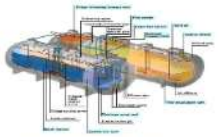


Prefabricated HDPE Tank

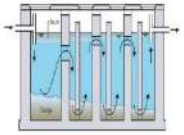
Wastewater Management in Lao PDR (2/2)

2. Small-scale Decentralize wastewater treatment systems.

Such systems include: (i) a simple pipeline system, and (ii) a sewage treatment system, such as an anaerobic baffled reactor (ABR) or a small-scale Johkasou treatment system.



Johkasou Communal Type



Anaerobic Baffled Reactor

Small bore sewer system

3. Decentralize Wastewater Treatment System

Such systems include: (i) integrated or separate sewer systems, including Pumping station, and (ii) large Treatment facilities

Integrated sewage treatment systems are not designed to save money, but they are suitable for urban areas.

Vision for the Development of the Water Supply and Sanitation Sector to 2030

"Safe, satisfying, and accessible water and sanitation for everyone"

Goals and Strategic Expectations by 2030

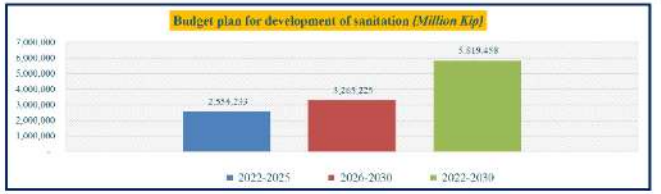
1. Ensure that 90% of the urban have access to safe tap water.
2. Ensure that 100% of the urban population have received proper disposal and sanitation.
3. 50% of provincial and municipal sewage is treated, along with effective and safe sanitation services for the environment and society.

9-Year Development Strategy for the Water and Sanitation Sector (2022-2030) and 4-Year Development Plan (2022-2025)

Development Strategic of Water & Sanitation

1. Strengthen the planning and overall management of water supply and sanitation in municipalities, cities, communities, and rural villages.
2. Develop and expand water supply and sanitation networks for communities and rural village groups that have assigned areas of responsibility in coordination with the Ministry of Public Health and connected to urban development plans.
3. Protect freshwater sources, as well as water supply and sanitation systems, to make them resilient to climate change.
4. Establish and improve the database and information system for water supply and sanitation, which forms the basis for sustainable development management.

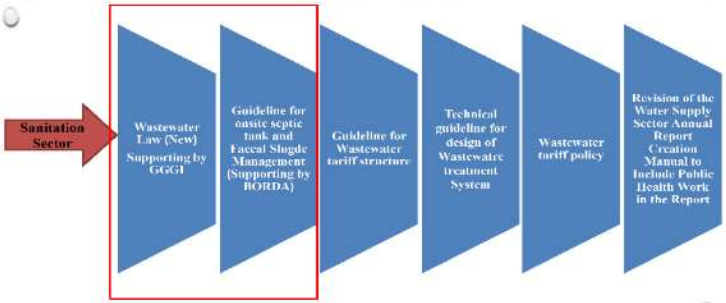
The Budget Plan for the Sanitation Sector



Million Kip

No	Content	Budget Estimates								Notice
		Implementation Period			Source of fund 2022-2025			Source of fund 2026-2030		
		2022-2025	2026-2030	2022-2030	ODA	Government /population	Budget Needs	ODA	Government /population	Budget Needs	
	Sanitation (Wastewater)	2,554,233	5,265,225	5,819,458	927,424	1,187,172	439,637	201,244	2,734,979	329,011	

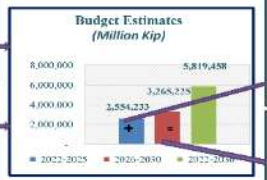
Legislations Plan

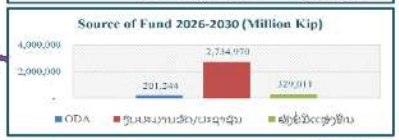


Budget Needs for Sanitation Sector

50% of provincial and municipal sewage is treated, along with effective and safe sanitation services for the environment and society.

100% of the population living in municipalities have access to complete and hygienic sanitation.





Million Kip

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		2022-2025	2026-2030	2022-2030	ODA	Government /population	Budget Needs	ODA	Government /population	Budget Needs	
	Sanitation (Wastewater)	2,554,233	3,265,225	5,819,458	927,424	1,187,172	439,637	201,244	2,734,970	329,011	

Challenges for Sanitation Sector

1. Laws, regulations, and technical standards specific to Sanitation (Wastewater Treatment) are not sufficient.
2. Polluted water resources, Cities Environmental increases, effects to the health of population.
3. Limited of personnel with the knowledge and skills in sanitation compared to the demand.
4. The development of sanitation will continue to rely heavily on external funding sources.
5. Many public and private wastewater business operators still need to spend to improve their performance, both technically and financially.

Thank you very much for your Attention

ກະຊວງກະສິກຳ ແລະ ສິ່ງແວດລ້ອມ
ກົມກວດກາຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ (ກກຊສ)

ກອງປະຊຸມປຶກສາຫາລືກ່ຽວກັບການສົ່ງເສີມການຄຸ້ມຄອງລະບົບການບຳບັດນ້ຳເປື້ອນແບບບໍ່ລວມສູນ (Johkasou) ຂອງຄົວເຮືອນ ໃນ ສປປ ລາວ

Seminar Toward the Promotion of the Decentralized Domestic Wastewater Management in Lao PDR

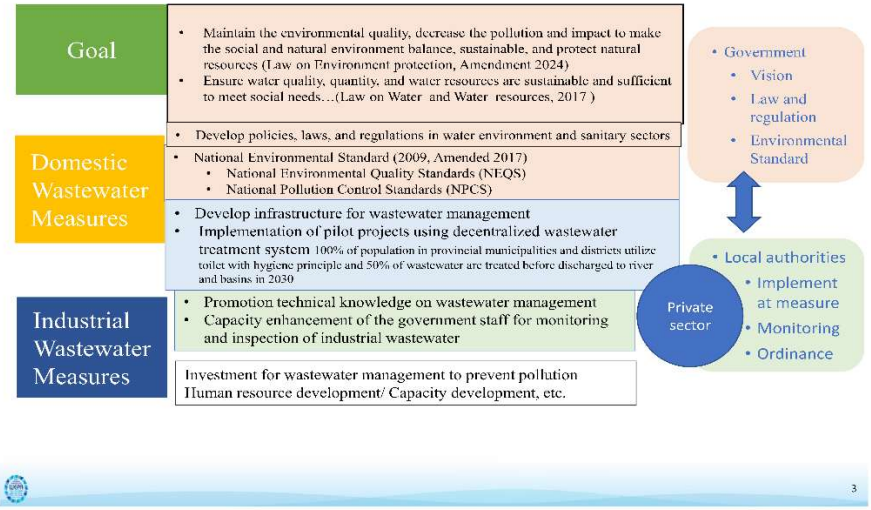
Sengkeo TASAKETH
Deputy Director of division
Ministry of Agriculture and Environment

ທີ່ ໂຮງແຮມຄຣາວພຣາຊາ, ນະຄອນຫຼວງວຽງຈັນ ຄັ້ງວັນທີ 10 ທັນວາ 2025

Contents

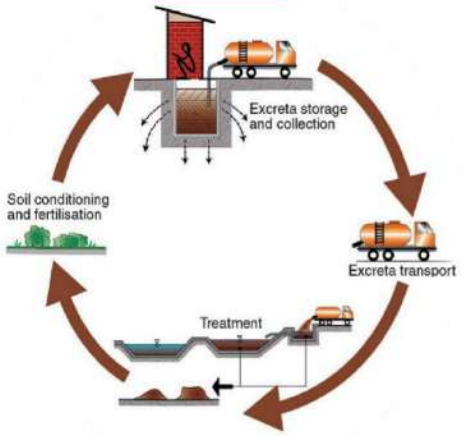
- Regulatory framework for wastewater management
- National Environmental Standard & Basis for the standards
- Lessons learned from The Water Environment Partnership in Asia (WEPA) action program in Lao PDR

1. Regulatory framework for wastewater management



Curent Septage Management Scheme in Lao PDR

Vientiane



Other Cities and Provinces

- Uncontrolled disposal
- Illegal dumping
- No beneficial reuse

2. National Environmental Standard & Basis for the standards

- The standard was developed by studying the standard of ASEAN countries, WHO, FAO, IFC and industry wastewater discharge regulation of Ministry of Industry and Commerce (2005).
- The key parameters were summarized and had consultation meeting with representative of ministries, academic institutions and private sector.
- Base on the industry wastewater discharge regulation, the national environmental standard (National Environmental Quality Standards, National Pollution Control Standards) were established in 2009 and amendment No. 81/GL, dated 21 Feb. 2017

ມາດຕະຖານການປ່ອຍນ້ຳເປື້ອນ (ມາດຕະຖານສິ່ງແວດລ້ອມແຫ່ງຊາດ 2017)

Category of Surface Water Quality

Parameter	Symbol	standard value of each category 1	2	3	4	5	Unit	Methodology
Color, Oder and Taste	None	n	n'	n'	n'	None	Not define	Not define
Temperature	t°C	n	n'	n'	n'	Not define	°C	Thermometer
potential of Hydrogen	pH	6-8	6-8	5-9	5-9	Not define	Not define	Electrometric pH Meter
Dissolved Oxygen	DO	>7	6.0	4.0	2.0	< 2	mg/L	Azide Modification
Electro-conductivity	Ec	< 500	≦1000	≦2000	≦4000	>4000	µS/cm	Ec meter
chemical oxygen demand	COD	<5	5-7	7-10	10-12	>12	mg/L	Potassium Dichromate Digestion; Open Reflux or Closed Reflux
Total coliform bacteria	Not define	n	5,000	20,000	Not define	Not define	MPN/ 100 ml	Multiple Tube Fermentation Technique
Fecal coliform bacteria	Not define	n	1,000	4,000	Not define	Not define	MPN/ 100 ml	Multiple Tube Fermentation Technique
Total Suspended Solid	TSS	<10	≦25	≦40	≦60	>60	mg/L	Glass Fiber Filter Disc
Phosphate	PO_4	< 0.1	0.5	1	2	>2	mg/L	Ascorbic acid
Ammonium ion	NH_4^+	< 0.5	≦1.5	≦3	≦ 4	>4	mg/L	Kjeldahl
Nitrate-Nitrogen	NO_3-N	n	5.0			Not define	mg/L	Cadmium Reduction
Ammonia-Nitrogen	NH_3–N	n	0.5			Not define	mg/L	Distillation Nesslerization
Phenol	C_6H_5OH	n	0.005			Not define	mg/L	Distillation,4-Amino antipyrene
Copper	Cu	n	1.5			Not define	mg/L	AA-Direct
Nickel	Ni	n	0.1			Not define	mg/L	Aspiration
Manganese	Mn	n	1.0			Not define	mg/L	
Zinc	Zn	n	1.0			Not define	mg/L	
Cadmium	Cd	n	0.005			Not define	mg/L	
Chromium Hexavalent	Cr^{+6}	n	0.05			Not define	mg/L	
Lead	Pb	n	0.01			Not define	mg/L	
Mercury	Hg	n	0.001			Not define	mg/L	AA-Cold Vapour Technique
Asenic	As	n	0.01			Not define	mg/L	AA -Direct Aspiration, ICP
Cyanide	CN-	n	0.07			Not define	mg/L	Pyridine Barbituric Acid
Radioactive - alfa - beta	Radioactive -α -β	n	0.1 1.0			Not define	Becquerel/L	GC
Organochlorine pesticide		n	0.05			Not define	mg/L	
Dichlorodiphenyltrichloroethane	DDT	n	1.0			Not define	µg/L	
alpha-Benzene hexachloride	α -BHC ($C_6H_6Cl_6$)	n	0.02			Not define	µg/L	GC
Dieldrin	$C_{12}H_8Cl_6O$	n	0.1			Not define	µg/L	
Aldrin	$C_{12}H_8Cl_6$	n	0.1			Not define	µg/L	
heptachlor and heptachlor epoxide	$C_{10}H_5Cl_7$ And $C_{10}H_5Cl_7O$	n	0.2			Not define	µg/L	
Endrin	$C_{12}H_8Cl_6O$	n	Must be not found			Not define	µg/L	

Note:

Category 1 is a natural source of good quality water, does not go through any production process or chemical additives and is free from wastewater from all kinds of activities.

Category 2 is a source of water that is used and consumed but must be disinfected. This type of water is suitable for the conservation of aquatic animals, fisheries, water sports and so on.

Category 3 It is a source of water for consumption and must be sterilized, this type of water is suitable for agriculture, animal husbandry and so on.

Category 4 A source of water that is used and consumed but must be sterilized, this type of water is suitable for industry, as a place to treat wastewater from the city or community and so on.

Category 5 is a source of water that is used for transportation and be reservoir for treatment of wastewater from cities or communities, and so on.

n: Is a natural water source

n': is a natural water source but does not change ±3°C in temperature

Type and size of buildings that need to be controlled for water pollution

Type of building	Size				
	A	B	C	D	E
Condominium	≧500 rooms	≧100 to <500	<100 rooms	Not define	Not define
Hotel	≧ 200 rooms	≧60 to < 200 rooms	< 60 rooms	Not define	Not define
Dormitory	Not define	≧250 rooms	≧50 to <250 rooms	≧10 to <50	Not define
Massage shop (ฆor similar)	Not define	≧ 5,000 m^2	≧ 1,000 to <5,000 m^2	Not define	Not define
Hospital	≧ 30 bed	≧10 to <30	Not define	Not define	Not define
School, College, institue	≧ 25,000 m^2	5,000 to <25,000 m^2	Not define	Not define	Not define
Office	≧ 55,000 m^2	10,000 to < 55,000 m^2	≧ 5,000 to <10,000 m^2	Not define	Not define
Comercial building	≧25,000 m^2	5,000 to < 25,000 m^2	Not define	Not define	Not define
Fresh market	≧2,500 m^2	1,500 to < 2,500 m^2	1,000 to < 1,500 m^2	500 to < 1,000 m^2	Not define
Resturant, food court	≧2,500 m^2	500 to < 2,500 m^2	250 to < 500 m^2	100 to < 250 m^2	ซ่อยกว่า 100 m^2

Standards for water pollution control from resettlement villages

Parameter	Symbol	maximum value for each type		Unit	Analysis method
		(A) 100 to 500	(B) ≧500		
potential of Hydrogen	pH	5.5-8.5	5.5-8.5	Not define	pH Meter
Biological Oxygen Demand 5 Days	BOD_5	30	20	mg/L	Azide Modification at 20 °C , 5 days
Total Suspended Solid	TSS	40	30	mg/L	Glass Fiber Filter Disc
Sediment Solid	SS	0.5	0.5	mg/L	Imhoff Cone 1,000 cm3 1hour
Total Dissolved Solid	TDS	500	500	mg/L	Dry Evaporation 103-105 °C, 1 hour
Sulfide	S^{2-}	1.0	1.0	mg/L	Titration
Nitrogen	TKN	35	35	mg/L	Kjeldahl
Fat, Oil and Grease	FOG	20	20	mg/L	Sovent Extraction by Weight

Standards for control of water pollution from buildings

Parameter	Symbol	maximum value for each type					unit	Analysis method
		A	B	C	D	E		
potential of Hydrogen	pH	5.5-8.5	5.5-8.5	5.5-8.5	5.5-8.5	5.5-8.5	Not define	pH Meter
Biological Oxygen Demand 5 Days	BOD_5	20	30	40	50	60	mg/L	Azide Modification at 20 °C, 5 days
Total Suspended Solid	TSS	30	40	50	50	60	mg/L	Glass Fiber Filter Disc
Sediment Solid	SS	0.5	0.5	0.5	0.5	Not define	mg/L	Imhoff Cone 1,000 cm^3 1hour
Total Dissolved Solid	TDS	500	500	500	500	Not define	mg/L	Dry Evaporation 103-105 °C 1hour
Sulfide	S^{2-}	1.0	1.0	3.0	4.0	Not define	mg/L	Titration
Nitrogen	TKN	35	35	40	40	Not define	mg/L	Kjeldahor colormetric
Fat, Oil and Grease	FOG	20	20	20	20	100	mg/L	Solvent Extraction by Weight

Standards for controlling water pollution from toilets

Parameter	symbol	standard value	Unit	Analysis method
potential of Hydrogen	pH	6-9	Not define	pH Meter
Biological Oxygen Demand 5 Days	BOD_5	30	mg/L	Azide Modification at 20 °C , 5 days
Chemical Oxygen Demand	COD	125	mg/L	Potassium Dichromate Digestion ; Open Reflux or Closed Reflux
Total Suspended Solid	TSS	50	mg/L	Glass Fiber Filter Disc
Total Nitrogen	TKN	10	mg/L	Kjeldahl
Phenol	C_6H_5OH	2	mg/L	Distillation and Aminoantipyrine Method 4
Fat, Oil and Grease	FOG	5.0	mg/L	Solvent Extraction by Weight
Total Dissolved Solid	TDS	400	MPN/ml	Dry Evaporation 103-105 °C, 1 hour

Parameter	symbol	standard value	Unit	Analysis method
Fat, Oil and Grease	FOG	5.0	mg/L	Solvent Extraction by Weight
Total Dissolved Solid	TDS	400	MPN/ml	Dry Evaporation 103-105 °C, 1 hour

Standards for controlling water pollution into public canals

Parameter	symbol	standard value	Unit	Analysis method
potential of Hydrogen	pH	5.5-8.5	Not define	pH Meter
Electro-Conductivity	Ec	2,000	µS/cm	
Total Dissolved Solid	TDS	1,300	mg/L	Dry Evaporation 103-105 °C, 1 hour
Biological Oxygen Demand 5 Days	BOD_5	30	mg/L	Azide Modification at 20°C 5 days
Total Suspended Solid	TSS	30	mg/L	Glass Fiber Filter Disc
Per-manganese	MnO_4^-	6.0	mg/L	Titration
Hydrogen Sulfide	H_2S	1.0	mg/L	Titration
Cyanide	CN^-	0.2	mg/L	Distillation and Pyridine Barbituric Acid
Fat, Oil and Grease	FOG	5.0	mg/L	Solvent Extraction by Weight
Formaldehyde	CH_2O	1.0	mg/L	Spectrophotometry
Phenol and Cresol	C_6H_5OH	1.0	mg/L	Distillation and Aminoantipyrine Method 4
Resident Chlorine	Cl	1.0	mg/L	Lodometric Method
Radioactive	Not define	must not have	mg/L	General
Color and Odor	Not define	not observed	mg/L	General
Tar	Not define	must not have	mg/L	General
Heavy metal				
Zinc	Zn	5.0	mg/L	Atomic Absorption (AA)
Chromium Hexavalent	Cr^{+6}	0.3		
Arsenic	As	0.25		
Copper	Cu	1.0	mg/L	Atomic Absorption (AA)
Mercury	Hg	0.005		
Cadmium	Cd	0.03		
Barium	Ba	1.0		
Selenium	Se	0.02		
Lead	Pb	0.1		
Nickel	Ni	0.2		
Manganese	Mn	0.5		

3. Lessons learned from The Water Environment Partnership in Asia (WEPA) action program in Lao PDR

- Survey conducted for period 2022 – 2023
- **Survey team**
- Officers from Department of Natural Resources and Environment Inspection, MONRE
- Lecturers and students from Department of Chemistry, Faculty of Natural Sciences, NUOL

Field survey in dry season and rainy season

1. Field survey in dry season

Location	Public Canal	BORDA DEWATS	Johkasou	Septic Tank	Sampling Date
Vientiane Capital	1 (2)	3 (7)	1(2)		24-25 Nov 2022
Luang Prabang	1 (3)	1 (2)		1(2)	30 Dec 2022
Khammouan		1 (4)			17 Jan 2023

2. Field survey in rainy season

Location	Public Canal	BORDA DEWATS	Johkasou	Septic Tank	Sampling Date
Vientiane Capital	1 (2)	3 (7)	1(2)	1 (1)	7 July 2023
Luang Prabang	1 (3)	1 (2)		1 (2)	8-9 August 2023
Khammouan		1 (4)			28 July 2023

Note:

- *Number in parenthesis ( ) is number of samples taken*
- *Samples taken mostly at inlet and outlet of facilities*

Survey of wastewater quality and sampling plan

Location	Type of facility	Sampling point	
Vientiane capital	Kualuang temple DEWATS	Inlet	Outlet
	Thongkhankham DEWATS	Inlet	Outlet
	Johkaso at Airport terminal	Inlet	Outlet
	Septic tank	Inside	
	Canal	Upstream	Downstream
Luang phrabang	Septic tank	Inlet	Outlet
	Night market DEWATS	Inlet	Outlet
	Johkasou	Inlet	Outlet
	Canal	Upstream, Middle stream	Downstream
Theun Hin Boun Power Company Camp, Khounkhamdistrict, Khammouan Province	DEWATS Anaerobic + Constructed Wetland+ aeration and UV	Inlet	Outlet

Survey in Vientiane capital - Dry season

(24-25 Nov 2022)

Survey in Vientiane Capital Rainy season

(7 July 2023)

Survey in Luang Prabang - Dry season

(30 Dec 2022)

Survey in Luang Prabang Rainy season

8-9 August 2023

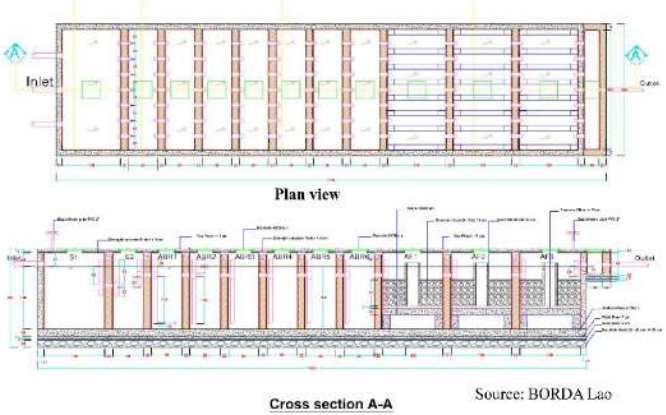
Survey in Facility of Theun Hin Boun Power Company (Khammouan) Dry season

(17 Jan 2023)

Survey in Facility of Theun Hin Boun Power Company (Khammouan) Rainy season

28 July 2023

Example of layout of decentralized wastewater treatment system



Source: BORDA Lao

Case of community decentralized wastewater treatment system

Parameter	Inflow/ outflow	Unit	Designed condition (2010)*	Sampling in 2011**	Chanthavilay et al (2017)	This time (Nov,2022)	(July 2023)
Number of users			146				
COD-cr	Inflow	mg/L	970		485	280	276
	Outflow	mg/L	80		359	116	148
BOD5	Inflow	mg/L	540	82	226	>60	149
	Outflow	mg/L	28	36	162	35	57

- Effluent BOD5 is almost the same with the value in 2011. It show that the treatment facility still operates well, maybe because desludging was conducted in August 2022.
- However, the value is slightly over effluent BOD5's national environmental standard for community village (BOD5 30 mg/L)

Result of water quality analysis

- Influent: COD-Cr 36-332, mg/L, BOD5 11-150 mg/L
- Effluent BOD5 of 4 Anaerobic DEWATS
  - Dry season : (3) DEWATS 12-35 mg/L, (1) DEWATS 120 mg/L
  - Rainy season: 8-57 mg/L
- Effluent BOD5 of DEWATS with Anaerobic-Plant gravel- Aeration and disinfection with UV: 4-6 mg/L (Influent 11- 48 mg/L)
- Effluent BOD5 of Septic tank: 45-58 mg/L
- Effluent BOD5 of Joukasou: 21- 23 mg/L
- BOD5 in national environmental standard for community village and toilet effluent is 20-30 mg/L. **BOD5 of 2 DEWATS (35 -120 mg/L), and a Septic tank (45-58 mg/L) did not pass the effluent standard.**

https://wepa-db.net/program/lao-pdr

6.3.3. History and Current Situation of Wastewater and Legal Framework of Johkasou in Japan, ホワン ティー マイ 氏　環境省 環境再生・資源循環局 廃棄物適正処理推進課 浄化槽推進室　環境専門調査員

History and Current Situation of Wastewater and Legal Framework of Johkasou in Japan

10th December 2025

Ms. Mai HOANG THI
Senior Environment Expert, Office for Promotion of Johkasou

Office for Promotion of Johkasou
Waste Management Division
Environmental Regeneration and Material Cycles Bureau
Ministry of the Environment
Government of JAPAN

https://www.env.go.jp/recycle/jokaso/en/

Table of Content

Water pollution in Japan during rapid economic growth

Sumida River (Tokyo)
in the 1970s

Dohkai Bay (Kitakyushu)
in the 1960s

Chofu Weir, Tama River(Tokyo)
in the 1970s

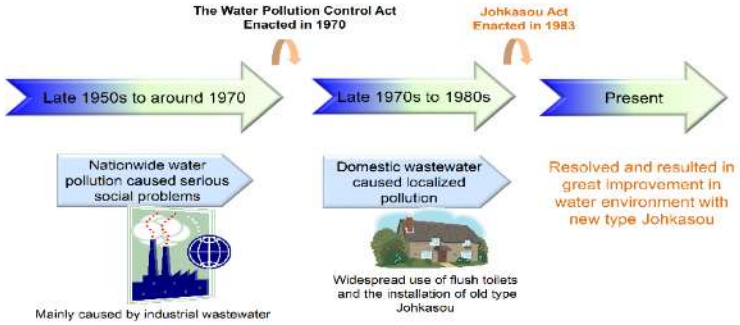
History of wastewater treatment and infectious diseases

- Up to the 1950s, night soil was used as agricultural fertilizer and regarded as a valuable resource.
- From the late the 1950s, due to the spread of chemical fertilizer and rapid urbanization, night soil shifted from being seen as "fertilizer" to being treated as "waste". The lack of night soil treatment facilities and hygienic treatment led to serious social problems.
- The spread of infectious diseases continued until the Japan's period of rapid economic growth in the 1970s.

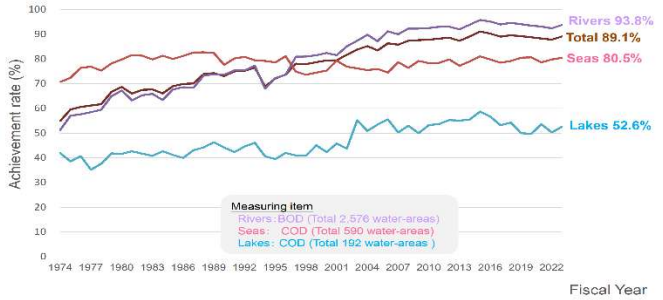
Trends of waterborne disease rates in Japan

Reference: Yuzo Inoue, History and technology of night soil treatment in Japan, J. of Monthly Johkasou

Domestic wastewater treatment issues in Japan



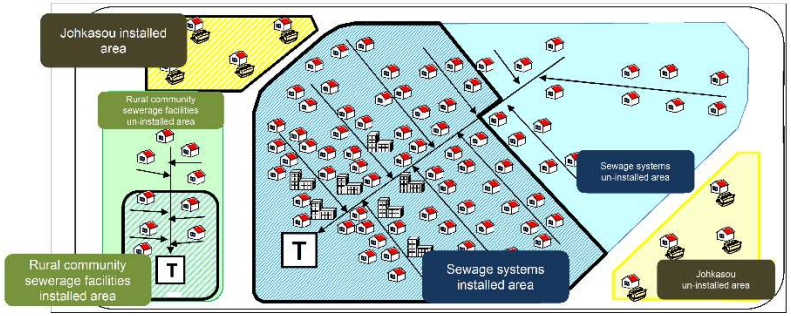
Achievement of water quality related to Effluent Standards



Public waters water quality measurement results (2023)

Ministry of the Environment, Government of Japan

Domestic Wastewater Treatment Systems in Japan



- **Sewage Systems** : managed by the Ministry of Land, Infrastructure, Transport and Tourism
- **Rural community sewerage facilities**: managed by the Ministry of Agriculture, Forestry and Fisheries
- **Johkasou**: managed by the Ministry of the Environment

Current situation of population served for treating domestic wastewater

Type of treatment facility	Population served (× 1,000 people)	
	End of FY2024	End of FY2023
Sewage systems	**101,397 (81.8%)**	101,279 (81.4%)
Rural community sewerage facilities including Facilities for fishing villages, Facilities for forestry villages, Simple wastewater facilities	**2,835 (2.3%)**	2,938 (2.4%)
Johkasou	**11,746 (9.5%)**	11,772 (9.5%)
Municipal Johkasou Installation Program	**817**	824
Johkasou Installation and Maintenance Program	**6,220**	6,229
Other Johkasous	**4,708**	4,719
Community plants, etc.	**148 (0.1%)**	154 (0.1%)
Total population served	**116,126**	116,144
Percentage of population served	**93.7%**	93.3%
Total population	**123,964**	124,483
Total population not served	**7,838**	8,339
Population without domestic wastewater treatment	**6.3%**	6.7%

General Information of Johkasou

- "Johkasou" is categorized as a decentralized wastewater treatment system for domestic wastewater discharged by household, building and similar sources.
- Johkasou have a combined purification structure capable of treating both night soil (black water) and miscellaneous wastewater (gray water).
- Johkasou achieve high and stable performance comparable that of sewage treatment plants, and more than 4 million units have been installed across Japan.

Typical layout of small scale Johkasou for household

Box shape　　Cylindrical shape

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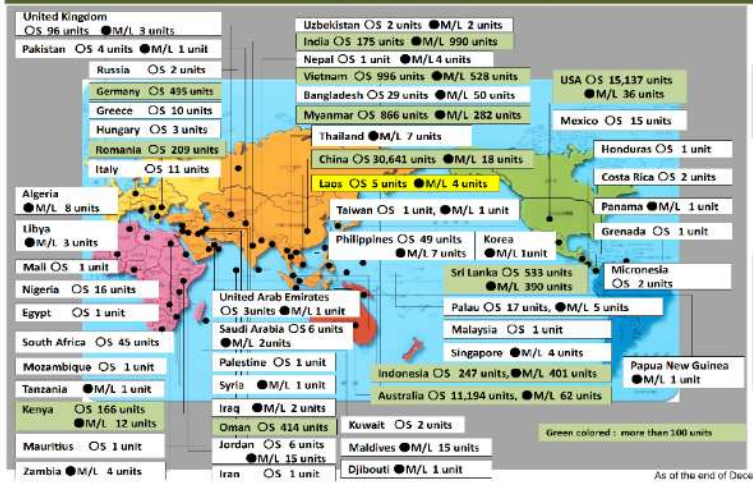
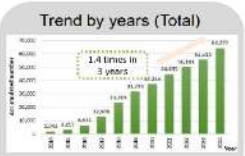
Installation Records of Japanese Johkasou Overseas (as of Dec.2024)



○Small	61,409 units
●Medium/Large	2,863 units
TOTAL	64,272 units
	56 countries

○S : Small-scale (5 PE ~ 50 PE)
● M/L : Medium/Large-scale (51 PE ~)



As of the end of December 2024 by Johkasou System Association

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Overall concept of water environment improvement and related legal framework

Basic Environment Law
Basic National Environmental Policies

Industrial Wastewater Measures
■ Water Pollution Control Act
- Wastewater Standards for wastewater from factories or establishments
- Regulations on business operators
- Notification, measuring and recording of wastewater, on-site inspection
- Penalties, improvement orders and other administrative guidance

Domestic Wastewater Measures
■ Sewerage Law
Sewerage System Establishment
■ Johkasou Act
Installation of Johkasou etc.

National Government
- Vision
- Law & Regulations
- Technical Standards
- National Subsidies

Sharing responsibility

Local Government
- Master Plan and its implementation
- Ordinance
- Construction, operation and management of sewerage facilities
- Advice and guidance on Johkasou operation and maintenance

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Johkasou Act

■ Purpose
- Strengthen regulations of manufacturing, installation, operation, maintenance and desludging of Johkasou.
- Provides qualifications for Johkasou installation workers and operators
- Provides registration systems for Johkasou installation vendors and maintenance vendors
- Provide licensing systems for desludging vendors

Promotion of domestic wastewater treatment by Johkasou for conservation of water quality in public water area, preservation of the living environment and improvement of public health

■ Definition
- Johkasou is the decentralized wastewater treatment facility that can treat both black water and gray water from household, building and so on and discharge effluent comply with effluent standards.
- Johkasou should be installed when installing a flush toilet under the Building Standard Law, unless the wastewater is discharged to sewerage systems.

■ Related Laws

Johkasou Act → **Enforcement Ordinance** → **Enforcement Regulations**

Enacted in 1983
Define the scale of Johkasou which need Johkasou Operators etc.
Define the period of inspection, desludging or the technical standard of desludging etc.

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History of Johkasou Act

1960 to around 1980	Widespread use of flush toilets and the installation of old type Johkasou (treating black water only)
1983	Johkasou Act enacted (enforced in 1985)
2000	New installation of old type (Tandoku-shori) Johkasou was prohibited
2005	Stricter water quality management systems introduced
2019	• Strengthening the authority of prefectural governors for conversion from old type to the current type (Gappei) Johkasou • Clarification for proceeding Johkasou installation as a public works • Others

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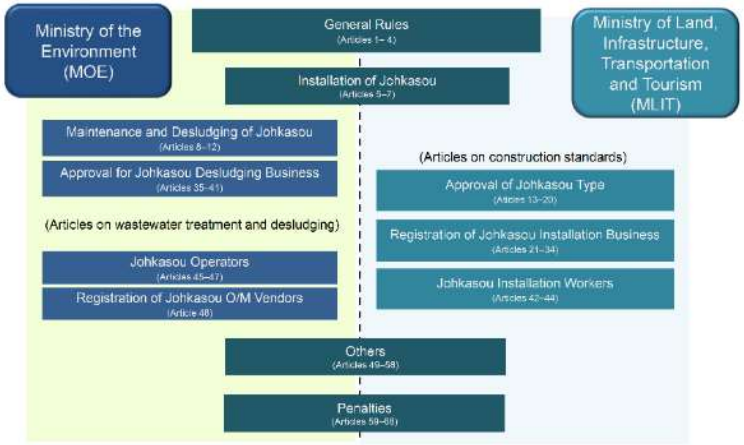
Outline of Articles and its jurisdiction in Johkasou Act



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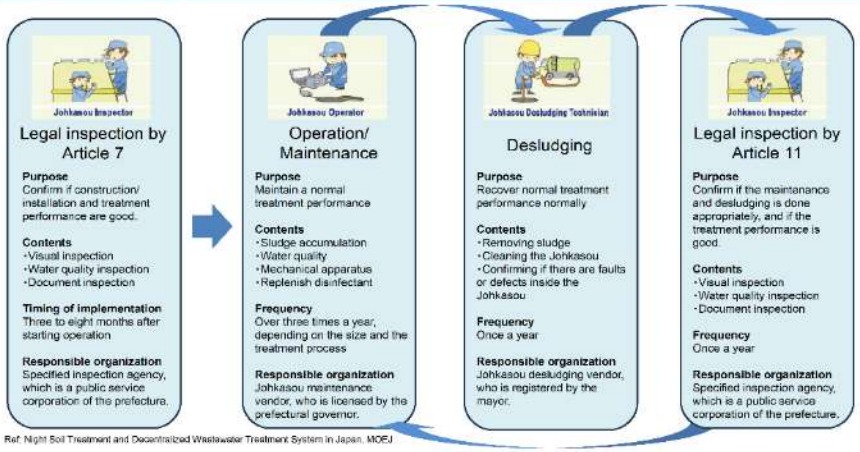
Inspection and Maintenance of Johkasou



Ref: Night Soil Treatment and Decentralized Wastewater Treatment System in Japan, MOEJ

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Registration process and qualifications system

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Training courses for Johkasou Technicians

- Johkasou Technicians should possess extensive knowledge not only in wastewater treatment and Johkasou, but also in water environment conservation and public health.
- The training curricula for Johkasou Operator and Johkasou Installation Worker are outlined as below.

Johkasou Operator by Article 45		Johkasou Installation Worker by Article 42	
Basic of Johkasou	8 hrs	Basic of Johkasou	6 hrs
Laws and regulations related with Johkasou	4 hrs	Laws and regulations related with Johkasou	3 hrs
Structure and function of Johkasou	22 hrs	Structure and function of Johkasou	15 hrs
Introduction of installation of Johkasou	4 hrs	Management of Johkasou installation	8 hrs
Operation and maintenance of Johkasou	30 hrs	Introduction of O&M and desludging of Johkasou	3 hrs
Water quality management of Johkasou	10 hrs		
Introduction of desludging of Johkasou	2 hrs		

Total 80 hours (13 days)
Test 2 hours

Total 37 hours (5 days)
Test 2 hours

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Thank you for your kind attention

Check Japan's Johkasou System on Youtube

https://www.youtube.com/watch?v=r4xOKGbYWes

6.3.4. Japanese Johkasou manufacturers' activities in Lao PDR – NIKKO COMPANY, 長谷 勲 氏　ニッコー株式会社　取締役

NIKKO COMPANY

About Us -Company Overview-

NIKKO COMPANY

Headquarters	383 Ainoki-machi, Hakusan City, Ishikawa Prefecture
Tokyo Headquarters	2-36-1 Kanda-Jinbocho, Chiyoda-ku Tokyo Prefecture
Founded	May 11, 1908
Employees	607 (consolidated)
Consolidated net sales	14.719 billion yen
Domestic affiliated companies	MITANI SANGYO Co., Ltd.

Akiko Mitani
Chief Executive Officer

Our areas of business

Table Top Division

Housing and Facility Environmental Equipment Division

Functional Ceramic Products Division

NIKKO is a conglomerate with four business units

Waste Water Treatment

Creating a cycle of clean water through micro-infrastructure

Johkasou Wastewater Treatment Over 1,000,000 units supplied

Bath Life

Creating an haute couture bath together with the customer

Over 10 thousand baths installed over 20 years

Functional Ceramics

To make the world an easier place to live in with ceramic technologies

and be an organization that enriches people's lives

Ceramics and Lifestyle

Continually creating a richer living space

For over 110 years, NIKKO has continued to create tableware, since its establishment in 1908

About Us -As Johkasou Manufacturer-

All small-scale Johkasou are manufactured at our own factory in Saitama Prefecture and shipped domestically and internationally.

About Us -Full Support Thought the Installation-

We provide you high-quality products and services as a water treatment device manufacturer

About Us -Our Main Product-

LINE UP

Products	MIZU	NSA	NK-USR II
			
Water quality	BOD : 200 → 20 mg/L T-N : 45 → 20 mg/L SS : 160 → 20 mg/L	BOD : 200 → 20 mg/L T-N : 45 → 20 mg/L SS : 160 → 15 mg/L COD : 100 → 30 mg/L	BOD : 100~450 → 20 mg/L COD : 100→ 30 mg/L SS : 160 → 30 mg/L
Average daily wastewater inflow	Not exceed 2.0m³/day	Not exceed 10.0 m³/day	Capable of handling up to 200.0m³/day
Construction Purpose	Small-sized establishment detached house, store	Medium-sized establishment store, satellite office, clinic, school	Large-sized establishment store, satellite office, clinic, factory

About Us -Our Main Product-

MIZU

Water Quality	BOD : 200 → 20 mg/L T-N : 45 → 20 mg/L SS : 160 → 20 mg/L

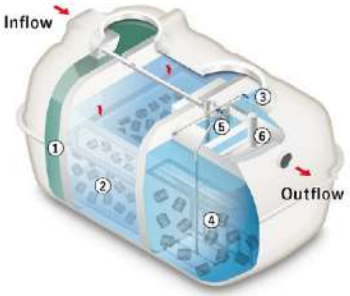
Support 5 to 10 people

Inflow water volume: Up to 2m3/day

- The air volume from the blower is kept to a minimum, achieving top-class energy-saving performance compared to other Japanese-made products.
- The simple structure makes maintenance easy.

About Us -Our Main Product-

NSA



Water Quality	BOD : 200 → 10 mg/L T-N : 45 → 20 mg/L SS : 160 → 15 mg/L COD : 100 → 30 mg/L

Support 14 to 50 people

Inflow water volume: Up to 10m3/day

- Its shallowest design, the highest in the industry, offers superior construction ease, is cost-effective, and provides treated water with consistent quality.

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About Us -Our Main Product-

NIKKO SINCE 1908

NK-USR II

Water Quality	BOD : 100～450 → 20 mg/L COD : 100 → 30 mg/L SS : 160 → 15 mg/L

Support 51 to 2,000people

Inflow water volume: Up to 200m3/day

- Flow regulation type biofiltration circulation process
- It can handle a daily inflow of up to 200m3/day,making it suitable for a wide range of construction purposes.

About Us -Overseas Projects-

NIKKO SINCE 1908

Our involvement in projects

Through partnerships with overseas companies in Vietnam, the UAE, and other countries, we are expanding our business globally. Our products serve as high-performance wastewater treatment facilities, providing safe and clean Johkasou.

Installation at a Campsite in Abu Dhabi, UAE / Installation at a Wind Power Plant, Quang Binh Province, Vietnam / Installation at a Private Villa, Hanoi, Vietnam / Installation at the Institute for Agricultural Environment, Hanoi, Vietnam / Wastewater Recycling for Desert Experience Tourist Villas / Wastewater Recycling Private Villa Sharjah / Wastewater Recycling Station Project, Abu Dhabi

About Us -Overseas Projects-

NIKKO SINCE 1908

Exhibiting at exhibitions

To promote the attractiveness of Nikko Johkasou in various countries,
we participated in exhibitions on the water environment in Vietnam, Myanmar and the UAE.

2017, VIETNAM / 2019, Myanmar / 2024, UAE

About Us -Overseas Projects-

NIKKO SINCE 1908

To convey the importance of water

We are paying courtesy visits to the Mayor of Luang Phabang and working to distribute the picture book created in Lao "THE WATER KING," produced by Nikko, to local children.
This picture book helps raise awareness about the importance of water and the need for proper wastewater treatment.

2024, LUANG PHABANG, LAOS / THE WATER KING / LAO VERSION

About Us -Overseas Projects-

Nikko Johkasou supplied overseas

Nikko Johkasou are being delivered to Asian countries, including Vietnam, and to the Middle East.

Future Plan

Nikko is committed to expanding its contribution to sustainable water treatment solutions alongside its valued partners.

In addition, Nikko is engaged in various sustainable initiatives.

Thank you for your attention.

NIKKO COMPANY

Please visit our website at:
https://www.nikko-company.co.jp/en/watercreation-environment/

6.3.5. Johkasou Demonstration Project in Luang Prabang City, 雲川 新泌 氏　公益財団法人　日本環境整備教育センター　浄化槽システム国際協力センター

Johkasou Demonstration Project in Luang Prabang City

Kumokawa Shinhi PhD.

Japan Education Center of Environmental Sanitation

1. Overview: Water Environment Improvement Project by Introduction of Advanced Johkasou System in the World Heritage City in Lao

Ministry of the Environment, Government of Japan

Implementation systems

Japan side

- Nasu Create Co., Ltd.
- JAPAN TECHNO CO., LTD.
- Japan Education Center of Environmental Sanitation (JECES)

Lao side

- UMSO, Luang Prabang City
- DPWT, Luang Prabang Province
- DONRE, Luang Prabang Province

Background

- Lao PDR is aiming to move away from dependence on resource exploitation in its main industries, such as mining and hydropower, and transform its economy to one based on agriculture, services, tourism and manufacturing. The tourism industry accounts for about 40% of the country's GDP, and the number of tourists is growing rapidly with the construction of new airport and hotels.
- Urban area in Luang Prabang City is designated to world heritage-listed area. However, traditional latrines remain, in which human waste is not properly treated, and miscellaneous wastewater is discharged untreated. Such existing system deteriorates water environment, and may seriously affect tourism due to rapid tourist destination development and urbanization.
- Stringent standards on wastewater discharge amended in 2017, for example, BOD 20 mg/L, are applied to specified buildings. Wastewater treatment technology and strategy appropriate to the World Heritage City need to be developed.

Project outline

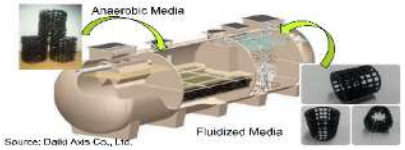
- This project is conducted in order to verify the effects of Advanced Johkasou System which is appropriately modified to Lao requirement, and then Johkasou business plan is provided.

Location

Luang Prabang City, Luang Prabang Province, Lao People's Democratic Republic

Outline of technology

- Johkasou, of which technology Japanese manufacturer developed, complies with ammonia regulations in ASEAN countries. The products are delivered by container shipping. The Company has sold about 1,500 units in 20 countries.
- Performance of the product is achieved with less space as well as less energy consumption compared to the conventional technology.
- The product is long-lasting, and easy to maintain and manage, suitable to developing countries.



Source: Daiki Axis Co., Ltd.

Expected results and business prospects

- Improved environmental sanitation and water environment will contribute for sustaining tourism resources in the World Heritage City through high-quality wastewater treatment using Japanese Advanced Johkasou System.
- Johkasou business model that integrates "EPC + OM" will be introduced to Lao through working together utilizing the know-how and network of Johkasou business in Vietnam.

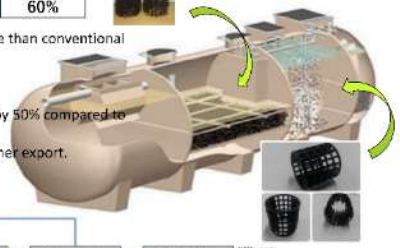
2. Overview and features of Johkasou technology

Advanced-type Johkasou

- Treatment Process : Anaerobic-separation Moving-bed Process
- Treatment Performance :

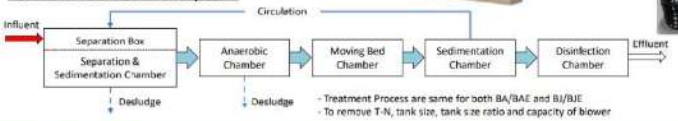
	Influent.	Effluent	Removing Rate
BOD	300mg/L	10mg/L	97%
NH_4−N	−	10mg/L	−
T−N	50mg/L	20mg/L	60%

Media



- Features
  - ✓ Space-saving design requires 60% less installation space than conventional models.
  - ✓ Long-life design for excellent durability.
  - ✓ Easy to maintain.
  - ✓ Energy-saving design reduces electricity consumption by 50% compared to conventional models.
  - ✓ Outer diameter Φ2170mm (compact) allows for container export.

Flow for the treatment system



- Treatment Process are same for both BA/BAE and BJ/BJE
- To remove T-N, tank size, tank size ratio and capacity of blower

3. Johkasou Installation Work

Installation Work (2021)

(Video of the installation work : https://youtu.be/fapfvdIwU3w)

Base slab

Main body installation

Backfilling

Piping work

Blower and control panel

Installation status

Drainage ditch (for rainwater prevention)

4. Results of the survey of the treatment performance (1)

Results of water quality（2022）

Rate of removing pollutant loads

Item	influent	Effluent	Rate
BOD, mg/L	192	24	87.5%
SS, mg/L	499	17	96.6%
NH4-N, mg/L	27	7	75.6%
T-N, mg/L	33	19	42.6%

Water quality of treated water

Item	Min.	Max.	Avg.	Compliance rate with wastewater standard (A)	Standard (A)
BOD, mg/L	15.0	44.2	24.0	64%	20
SS, mg/L	3.8	50.6	16.9	73%	30
NH4-N, mg/L	0.6	17.6	6.5	(82%)	(10)
T-N, mg/L	5.0	66.2	18.9	(82%)	(20)
TKN, mg/L	2.0	55.0	12.3	91%	35

Results of water quality（2023）

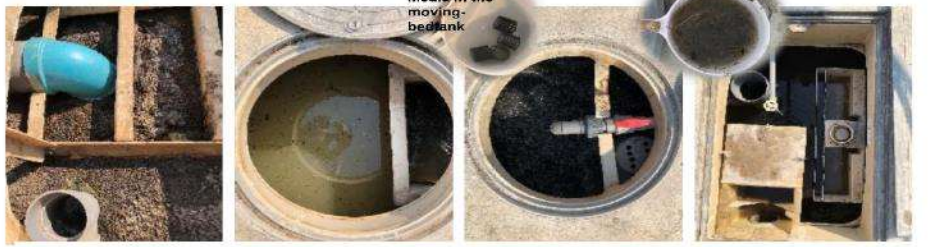
Result of water quality analysis

	Influent		Treated water	
Item	Range	Avg.	Range	Avg.
BOD, mg/L	4.5～225	54	5.2～12.3	8.9
SS, mg/L	8.0～545	135	5.1～29.2	13.5
NH4-N, mg/L	2.53～18.4	9.4	0～0.45	0.5
T-N, mg/L	6.0～44.0	17	5.0～13.0	8.5
TKN, mg/L	-	-	0.66～4.79	2.3
Coliform CFU/100ml	-	-	4330～92,000	-

4. Results of the survey of the treatment performance (2)

Maintenance inspections were conducted during the on-site sur (February 2023).

- Sludge transfer from the settling tank
- Scum transfer from the disinfection tank
- Treatment performance was good, but desludging was required.

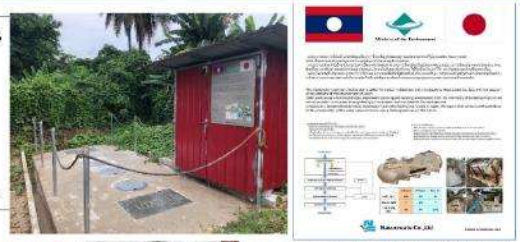


Separation tank　Anaerobic tank　Moving-bed tank　Sedimentation tank Disinfection tank

4. Results of the survey of the treatment performance (3)

Maintenance inspections were conducted in July,2023

- Desludging
- Transfer the sludge in the sedimentation tank
- Disinfectant replenishment



Separation tank　Anaerobic tank　Moving-bed tank　Sedimentation tank Disinfection tank

5. Building partnerships with relevant local governments（1）

1) Results of the 1st mission (2-7 May, 2022)

Destination	Meeting content
Office of Urban Management and Services, LPB City（UMSO）	• Installation regulations for new and renovated buildings • ADB Urban Environment Improvement Investment Project • Introduction of johkasou in LPBs using Japanese ODA • Draft decentralized wastewater management ordinance • Training in Japan
Dep. of Natural Resources and Environment, LPB Pro.（DONRE）	• Installation restrictions for new and renovated buildings • Proposal for a decentralized wastewater management ordinance
Dep. of Public Works and Transport, LPB Pro.（DPWT）	• Installation Restrictions for Newly Constructed and Renovated Buildings • ADB Urban Environment Improvement Investment Project • Installation of johkasou in LPB Using Japanese ODA • Draft Decentralized Wastewater Management Ordinance
Dep. of Information, Culture and Tourism, LPB Pro.（DoICT）	• World Heritage Office Reorganization • LPB Johkasou Demonstration Project • Proposal for Decentralized Wastewater Management Ordinance
Ministry of Public Works and Transport（MPWT）	• Promoting the Use of Johkasou in Laos • Installation Restrictions for Newly Constructed and Renovated Buildings • ADB Urban Environment Improvement Investment Project • Installation of Johkasou at LPBs Using Japanese ODA
Embassy of Japan in the Lao PDR	• Sharing information on the LPB johkasou demonstration project • Application for the Ministry of Foreign Affairs' Grassroots Grant Aid Program
JICA Laos office	• Sharing information on the LPB johkasou demonstration project • JICA country-specific training

5. Building partnerships with relevant local governments (2)

2) Results of the 2nd mission (29 Jan.-3 Feb., 2024)

Destination	Meeting content
Office of Urban Management and Services, LPB City (UMSO) Dep. of Public Works and Transport, LPB Pro. (DPWT) Dep. of Housing and Urban Planning, Ministry of Public Works and Transport (MPWT-DHUP) Dep. of Water Supply, Ministry of Public Works and Transport, (MPWT－DWS)	• Report on the Results of the Asia Water Environment Improvement Model Project • Request for Support for the Future Spread of Johkasou (1) Environmental Education: Introducing "King of Water" (2) Discussion on Grassroots and ADB Projects (3) Strengthening Regulations for New Construction and Renovation (4) System Design for the Spread of Advanced Johkasou
Embassy of Japan in the Lao PDR	• Sharing information on the LPB Johkasou demonstration project • Application for the Ministry of Foreign Affairs' Grassroots Grant Aid Program
JICA Laos office	• Sharing information on the LPB Johkasou demonstration project • Inquiries regarding JICA country-specific training

Courtesy call on the Mayor of Luang Prabang

Presented the picture book "King of Water" by Nikko Co., Ltd., a johkasou manufacturer

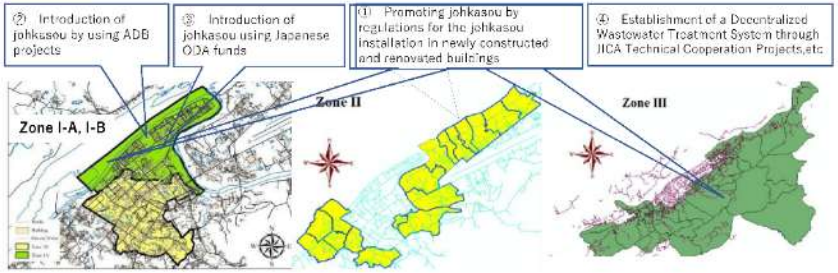
5. Building partnerships with relevant local governments (3)

Issue	Survey Results
Expectations for the johkasou Spread	The results of the johkasou demonstration project were highly evaluated, and it was confirmed that each government agency is proactive in introducing johkasou.
Challenges and countermeasures for johkasou implementation	➢ Johkasou are expensive. ⇒ Request johkasou manufacturers to provide products at reasonable prices and consider the conditions and possibilities for assembling johkasou locally; ➢ Electricity usage and maintenance costs are high. ⇒ Introduction of energy-saving equipment and solar panels, and consideration of operation methods appropriate to the inflow load. ➢ Securing land for johkasou installation is difficult. ⇒ 1) For buildings where it is difficult to secure space for johkasou installation, collect wastewater from several buildings through pipes; ⇒2) Install medium- to large-sized johkasou in locations where land is easy to secure (public facilities, temples, parking lots, etc.) to treat wastewater.。 ➢ Lack of information about johkasou. ⇒ 1) Provide Laos with materials such as johkasou pamphlets and English translations of the johkasou Law created by the Ministry of the Environment, as well as visual aids on johkasou; ⇒2) Hold johkasou information sessions utilizing existing johkasou; ⇒3) Hold johkasou seminars.

6. Proposal for Improving the Water Environment in LPB

Proposal for Improvements to LPB Wastewater Treatment

Zone	Definition and Scope of Each Zone	Proposal Content
Zone I-A	Old City Areas (approximately 70 hectares) in World Heritage Conservation Areas without Natural Wetlands	① Proposal for a regulation requiring the installation of high-performance wastewater treatment facilities in newly constructed and renovated buildings ② Introduction of johkasou by using ADB projects ③ Introduction of johkasou using Japanese ODA funds (using Grassroots scheme of the Ministry of Foreign Affairs) ④ Establishment of a Decentralized Wastewater Treatment System through JICA Technical Cooperation Projects, etc.
Zone I-B	Areas in World Heritage Conservation Areas with Natural Wetlands	
ZONE II	Densely Populated Areas Outside World Heritage Conservation Areas (Population Density of 2,000 people/km² or more)	
Zone III	Low-Density Areas	



7. Installation of high-performance wastewater treatment facilities in newly constructed and renovated buildings (Draft)

Objective	Improve public health, improve living conditions, and preserve the quality of public waters in Luang Prabang City
Target aera	● Zone I-A, Zone I-B, Zone II, Zone III, LSEZ(S1-S3)
Target Building	● Newly constructed or renovated buildings ➢Hotels, guesthouses, restaurants ➢Public facilities, residential buildings
Content	● Requirements for the installation of high-performance wastewater treatment facilities in newly constructed or renovated buildings ● High-performance wastewater treatment facility requirements ● Domestic wastewater treatment facilities must meet or exceed the Class A water quality standards set by Lao PDR Environmental Standard No. 0832/2017/MONRE. ● Building Regulation Requirements (Draft) ✓Hotels and guesthouses with 5 or more rooms ✓Restaurants and coffee shops with a total floor area of 300 square meters or more ✓Residential buildings with 3 or more bedrooms or a total floor area of 400 square meters or more ✓Public facilities (schools, hospitals, temples, government buildings, civil servant housing, etc.)
Challenges	● Coordination with local relevant agencies (DPWT, DONRE, UMSO) ● Regulation Procedures (Notification from the Provincial Governor or Mayor)

Thank You

ຂອບໃຈ Khob Chai

6.3.6. Citywide Sanitation Improvement The Urban Environment Improvement Project in Luang Prabang City, チッタヴォン ケオマニヴォン 氏　ラオス国公共事業運輸省住宅都市計画部技術者

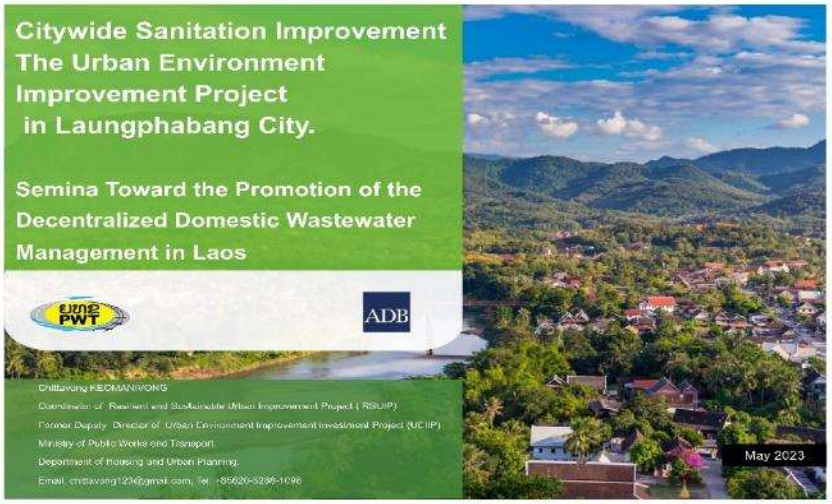


Table of Contents

1. Project Impact, Outcome and Outputs

IMPACT

Quality of life and sustainability of Luang Prabang improved
(2030 Vision and 10-Year Socio-Economic Development Strategy 2016-2025)

OUTCOME(ໝາກຜົນ)

Urban development in Luang Prabang is sustainable, resilient and inclusive
ການພັດທະນາຕົວເມືອງຢູ່ຫຼວງພະບາງມີຄວາມຍືນຍົງ, ທົນທານ ແລະ ມີສ່ວນຮ່ວມຈາກທຸກພາກສ່ວນ.

OUTPUTS (ຜົນຮັບ)

1. **Urban infrastructure Improved**
ໂຄງລ່າງພື້ນຖານຕົວເມືອງໄດ້ຮັບການປັບປຸງ

2. **Enabling environment for inclusive resilient urban and tourism services strengthened**
ສະພາບແວດລ້ອມທີ່ເອື້ອອຳນວຍ ໃຫ້ເກົາຕົວເມືອງໃຫ້ມີຄວາມຄົງທົນ ແລະ ລວມທັ້ງ ການບໍລິການ ການທ່ອງທ່ຽວ ມີຄວາມຂົ້ມແຂງ

3. **Women's leadership and employment enhanced**
ພະນັກງານການນຳ ເພດຍິງ ແລະ ການຈ້າງງານຂອງເພດຍິງໃຫ້ເພີ່ມຂຶ້ນ

Urban Environment Improvement Investment Project

2. Output 1: Urban infrastructure Improved

Solid Waste Management (SWM)	Citywide Sanitation Improvement	Urban road, Drains and Footpath Rehabilitation	Urban Greenspace and Bury Power Lines
• Improve exiting landfill to semi aerobic landfill 17.4 ha at KM 8 • Change waste at landfill to be money ; • **Expand MSW collection** areas. • New collection vehicle and heavy machines for landfill • Dustbin 13,000 units	• **Construct/upgrading 1,000 septic tanks** • **600 grease traps** (ອ່າງດັກໄຂມັນ 600 ອັນ) • **20 decentralize treatment facilities** (ສ້າງອ່າງບຳບັດນຳເບື້ອນແບບ ບໍ່ລວມສູນ 20 ແຫ່ງ (ABR)/KIDS/ Johkasou; • **Improve/expand existing fecal sludge treatment capacity** (ປັບປຸງ ແລະ ຂະຫຍາຍ ຄວາມອາດສາມາດ ຂອງການຈັດການຂີ້ກະເຜດ).	• Urban Roads 9 km and Village access roads 7 km; • Streetlights 8 km; • Footpaths 7 km.	• Cleaning, landscaping, and footpaths on public land surrounding Pond 70; • Meakong river side Public Park ; • Underground 3 km of 22.0 kV and 0.4 kV overhead power and other utility cables

2. Output 1 - Citywide Sanitation Improvements

On-site containment improvement by installing/upgrading septic tanks (approx. **1,000**)

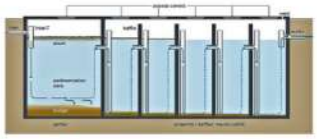
Decentralized treatment for public facilities and community/private facilities(**20 sites**) ,

anaerobic baffled reactor (ABR)/ KIDS /Johkasou

Improve/expand existing fecal sludge treatment capacity (for approx. 40m³/day);
Six Vacuum Tankers: 5m³=3 units,Electrict Vacuum truck 5m³=1 unit, 7m³=2 units.

Grease traps 600

Anaerobic Baffled Reactor



Description and Design

3. Output 2 - Resilient Urban and Tourism Services

Prepare **climate-informed Luang Prabang City urban master plan** (urban report, land use plan, guidelines and regulation; GIS; 3D scale model and digital rendering)

Climate and gender-responsive urban services institutional strengthening plan (ISWMS, CWIS program, USOs corporate plan, new landfill FS, O&M)

Prepare and implement a **creative city strategy and action plan** (enables city to join UNESCO creative cities network) and establish a **women-led creative industries design innovation network**, with business development services and child-care for women entrepreneurs

CWIS: Citywide Inclusive Sanitation; ISWMS: Integrated Solid Waste Management Strategy; FS: Feasibility Study; O&M: Operation and Maintenance; USO: Urban Service Office

4. Output 3- Women's Leadership and Employment Enhanced

Higher education scholarship program for 150 female officials employed in the water supply, sanitation, public works, urban and tourism subsectors

Urban Services and Tourism **Vocational Training Program** for 1,900 women in water supply, sanitation, public works and tourism

5. Project Cost Estimates

Item		Cost	USD(M)
A		INVESTMENT COSTS	
	1	Civil Works	23.34
	a	*Semi aerobic Landfill*	*8.42*
	b	*Citywide Sanitation*	*3.04*
	c	*Urban Roads, Drainage, Green Space*	*9.34*
	d	*Underground Utility Cables*	*2.54*
	2	Mechanical and Equipment	2.36
	3	Environmental and Social Mitigation	0.52
	4	Women's Scholarship Program	3.85
	5	Project Management	3.63
	6	Capacity Development	1.1
B		RECURRENT COSTS (PCU & PIU))	2.58
C		CONTINGENCIES	6.41
D		FINANCIAL CHARGES DURING IMPLEMENTATION	1.08
		TOTAL	45.00

Citywide Sanitation Improvements UEIIP:

1) installing/upgrading septic tanks **(approx. 1,000)**
2) Decentralized treatment for public facilities and community/private facilities**(20 sites)** , anaerobic baffled reactor (ABR)/ KIDS /Johkasou;
3) Improve existing fecal sludge treatment capacity (for approx. 40m^3/day); Six Vacuum Tankers: 5m^3=3 units, EV Vacuum truck 5m^3=1 unit, 7m^3=2 ;
4) **Grease traps 600;**
5) **Scholarships** for 150 female officials employed in the water supply, sanitation, public works, urban and tourism subsectors;
6) **Training Program** for 1,900 women in water supply, sanitation, public works and tourism.

Urban Environment Improvement Investment Project

Case studies in LPB city: Grease traps =20 and NBS by GRET

Case studies in LPB city: Grease traps=20 (Continue) by GRET

Case studies in LPB city: Grease traps=20 (Continue)

Case studies in LPB city: Nature-Based Solutions (NBS) by GRET

Case studies in LPB city: Nature-Based Solutions (NBS) by GRET

Case studies in LPB city: Nature-Based Solutions (NBS) by GRET

6. Wastewater Treatment System in Laos (1): Johkasou

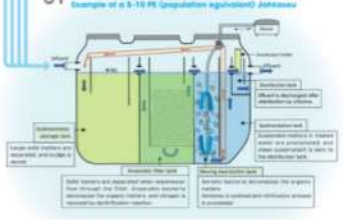
Johkasou can be said as a "prefabricated small scale sewage treatment plant" in wastewater management.

Johkasou can be classified into three types depending on its treatment performance.

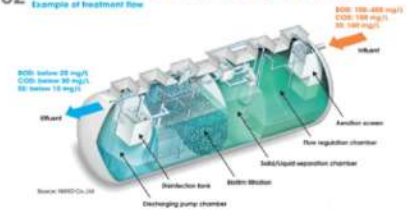
- BOD removal types (Effluent BOD below than 20mg/l)
- Nitrogen or/and phosphorous removal types (Effluent BOD 20mg/l, T-N 20mg/l, T-P 1mg/l)
- Membrane Johkasou (Effluent BOD below than 5mg/l)

BOD Below than 20mg/l

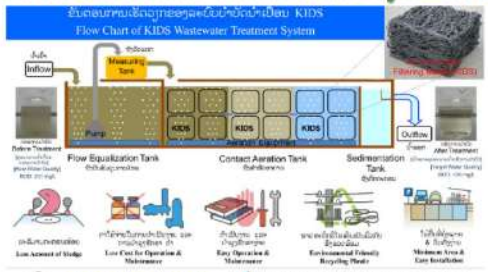
01 Example of small-scale Johkasou structure



02 Example of medium - and large - scale Johkasou structure

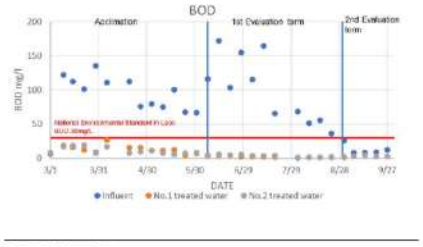


6. Wastewater Treatment System in Laos (2): KIDS

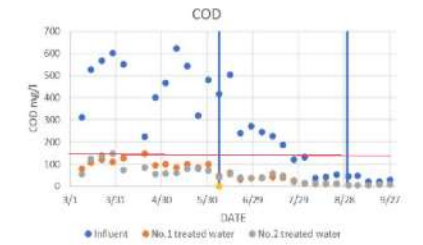


ACCRETE CO.,LTD Nihon Suido Consultants Co., Ltd.

KIDS in DONGDOK: 30 m3/d



Treatment Performance (COD)



6. Comparations of WWM

6. Wastewater Treatment System in Laos(3): BORDA- DEWATS, 30 m3/d

DEWATS CACULATION: waste water 30 m^3

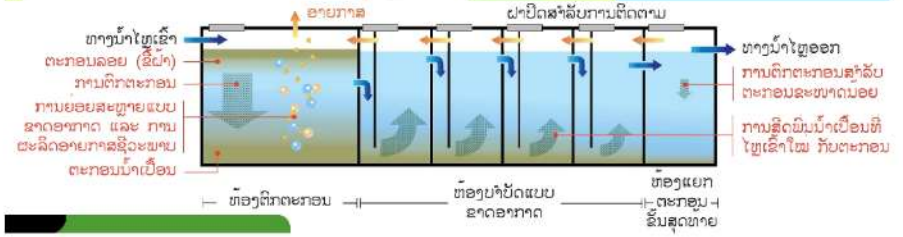
Settler		ABR 4 Chamber	AF 3 Chamber	HGF
S1	S2			
W= 4 m	W= 4 m	W= 3 m	W= 3 m	W= 15 m
L= 2.7 m	L= 1.4 m	L= 0.8 m	L= 1.5 m	L= 7.2 m
D= 2 m	D= 2 m	D= 2 m	D= 2 m	D= 0.5 m
		W_{ABR}= 6 m	W_{AF}= 6 m	
		L_{ABR}= 4.8 m	L_{AF}= 4.5 m	
		D= 2 m	D= 2 m	

W_s= 4 m/2 L_s= 4.1 m

$W_{ABR,AF}$= 6 m $L_{ABR,AF}$= 12.4 m

W_{HGF}= 15 m L_{HGF}= 8.2 m

S= 213.8 m2 (Minimum area)

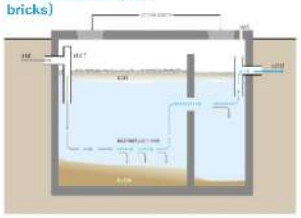


6. Wastewater Treatment System in Laos(4): Septic Tank, Manufactured ST

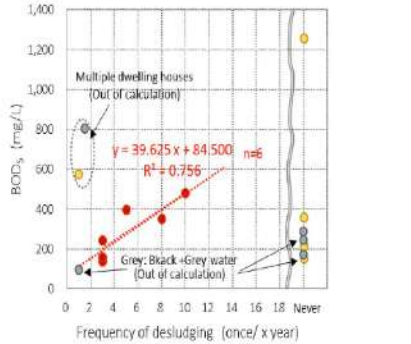
Typical decentralized wastewater treatment facility in developing countries - Septic Tank (ST)

- As no aerobic treatment is used, effluent of ST is very smell.
- The BOD of effluent from ST is high, even it has been desludged once a year, BOD will over 100 mg/L.

Constructed ST (RC / bricks)



Manufactured ST



relation between desludging frequency and effluent BOD
Source: JICA report, (Vietnam)ベトナム国SDGs指標6.3.1モニタリング手法構築に係る情報収集・確認調査ファイナルレポート, JICA, 2019年3月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