SANIMAS

Effluent Discharge Standards and Variances

Technology Performance and Operations and Maintenance (O&M)

About this Knowledge Brochure

This brochure includes some key learnings from the SANIMAS evaluation process that are interesting and relevant for SANIMAS stakeholders. They also support important recommendations in the final report, which were selected to be extracted from the report for wider distribution.

The brochure contains international examples and case studies on:

1. Effluent Discharge Standards and the Role of Variances
2. Technology Performance – The Importance of Operations and Maintenance (O&M)

Target audience

The main target audience for this brochure are national-level Indonesian government stakeholders who work on urban sanitation development and policymaking.

However, the information may also be useful for sub-national government stakeholders, and other interest groups, such as international organisations, NGOs, associations, and the private sector, in Indonesia and globally.

Kementerian PPN/ Bappenas
IsDB البنك الإسلامي للتنمية Islamic Development Bank
BILL & MELINDA GATES foundation
DALCO POINT
CITY-WIDE INCLUSIVE SANITATION TECHNICAL ASSISTANCE HUB IN SOUTH ASIA

What is SANIMAS?

Since the early 2000s, the Indonesian government has implemented important policy interventions and made significant investments to increase sanitation access across the nation, especially in the area of community-based decentralised small-scale sanitation systems (SSS).

The SANIMAS, or 'Community-Based Sanitation' (Sanitasi Berbasis Masyarakat) approach offered the Indonesian government a sanitation service option that had not been used anywhere else at scale before. The approach provides technical and institutional assistance to poor urban communities to develop sanitation infrastructure, which targets 50 to 200 households in urban areas; and includes decentralised SSS, for the collection and treatment of domestic wastewater, or a combination of SSS and a toilet block (MCK).

By the end of 2019, almost US $1 billion has been invested through six key SANIMAS programs with various funding sources including the Indonesian government, the World Bank, the Asian Development Bank (ADB), and the Islamic Development Bank (IsDB). Through these programs, 21,832 SANIMAS decentralised SSS were built, serving an estimated 6 million people, and MoPWH was responsible for implementing 97% of them.

The SANIMAS Independent Evaluation

The Indonesian government, IsDB, Bill & Melinda Gates Foundation (BMGF), and other stakeholders recognised that the sanitation sector had been rapidly evolving over the last 20 years. Due to this fact, it was agreed to conduct a decentralised waste-water management and sanitation sector assessment; and to seek comprehensive recommendations for Indonesia's approach, with a special focus on SANIMAS as one approach for decentralised SSS.

In June 2020, Dalco Point was engaged by the Technical Assistance Hub in South Asia to carry out the 'Independent Evaluation of SANIMAS model as an approach for providing decentralised sanitation'. This evaluation aimed to assess the success and limitations of the SANIMAS approach; to assess the lessons learned from the IsDB and the other SANIMAS investment programs; and assess the feasibility of introducing an updated SANIMAS or a next phase of the program as a sustainable approach for providing decentralised sanitation in future sanitation access investments.

The main output of the evaluation was the final evaluation report which includes a review of the successes, challenges, and opportunities for expanding SANIMAS approaches; and integration of SANIMAS into a more City-Wide Inclusive Sanitation (CWIS) approach. It also provides 15 specific recommendations for an improved scope, financing, and coverage for upscaling more sustainable SANIMAS investments in the future.

Download Final Report

Effluent Discharge Standards and Variances

Evaluation Recommendation

Vary the 2016 Discharge Standards

Request MoEF to provide a variance for SANIMAS SSS to be required to meet the pre-2016 domestic wastewater discharge standards. Many countries allow for variances based on viable economics, small size of system/ number of users, quality of the receiving water and other social or environmental reasons.

The cost for the SANIMAS program to meet the 2016 discharge standards, whether upgrading existing SSS, or installing new ones will cost between 200%-400% more in CAPEX and OPEX than the current SSS. A variance of the domestic discharge standards offers a way to balance high costs, serving more people and protecting public health and the environment.

Internationally, regulators often apply mitigating factors when determining discharge standards for specific wastewater treatment plants based on:

1. The volume of wastewater
2. The quality of the receiving water
3. Sensitive environments
4. Economic impacts
5. Financial considerations
6. Geographical challenges

Many countries have codes for design and installation of individual septic tanks, which generally discharge to ground via a drain field or a soak pit.
The following are examples of how different countries balance discharge standards with the size of the population served, age of the system, and the cost/benefit of the standards.

United Kingdom: User Equivalents or 'Population Equivalents' (PE) *

The UK uses discharge levels that are based on 'population equivalents' of the treatment plant and vary according to the size of the population served. Relevant points include:
You must use 'appropriate treatment' for discharges from communities of:

- less than 2,000 PE to freshwater or estuaries
- less than 10,000 PE to coastal waters

Appropriate treatment is the treatment of urban wastewater by any process or disposal system which, after discharge, allows the receiving waters to meet the relevant quality objectives, provisions, and other relevant regulations. Thus, for less than 2,000 PE, the discharge is 'appropriate'.

Secondary treatment is required for wastewater systems serving settlements of:

- more than 2,000 PE to freshwaters (including groundwater) or estuaries.
- more than 10,000 PE to coastal water

More advanced tertiary treatment is required for wastewater systems serving settlements of more than 10,000 PE.

* UK Environment Agency (2019). Guidance - Waste water treatment works: treatment monitoring and compliance limits: https://www.gov.uk/government/publications/waste-water-treatment-works-treatment-monitoring-and-compliance-limits/waste-water-treatment-works-treatment-monitoring-and-compliance-limits#ut-for-bod-and-cod

Malaysia: Age and Type of System *

In Malaysia, Indah Water Korporation (IWK), which controls more than 8,000 SSS & centralised wastewater systems, negotiated with the Malaysia Department of Environment to create a new set of standards based on the operational age of systems.

Taking a pragmatic approach to improving sanitation system systems, Malaysia created a new set of discharge standards which were based on the location and age of the systems, the type of treatment system, and provided with a timeframe to upgrade to the new standards.

The older facilities would be gradually upgraded to meet the new standards. The table below shows the discharge standards based on the systems' age.

* Indah Water Konsortium: Environmental Quality (Sewage) Regulations 2009

MALAYSIAN EFFLUENT DISCHARGE STANDARDS, 2009 (SOURCE: IWK)

	T [°C]	pH [-]	BOD [mg/L]	COD [mg/L]	SS [mg/L]	NH_3-N [mg/L]	NO_3-N [mg/L]	P [mg/L]	O&G [mg/L]
CATEGORY 1: NEW STPS (AFTER 2009), RIVERS									
STANDARD A*	40	6-9	20	120	50	10	20	-	5
STANDARD B**	40	5.5-9	50	200	100	20	50	-	10
CATEGORY 2: STPS DESIGNED FROM 1999 TO 2009									
STANDARD A	-	-	20	120	50	-	-	-	20
STANDARD B	-	-	50	200	100	-	-	-	20
CATEGORY 3: STPS DESIGNED PRIOR TO 1999									
COMMUNAL SEPTIC TANK	-	-	200	-	180	-	-	-	-
IMHOFF TANK	-	-	175	-	150	-	-	-	-
OXIDATION POND	-	-	120	360	150	-	-	-	-
AERATED LAGOON	-	-	100	300	120	-	-	-	-
MECHANISED STP (STD A)	-	-	60	180	100	-	-	-	20
MECHANISED STP (STD B)	-	-	80	240	120	-	-	-	20

* Upstream of drinking water intake ** Downstream of drinking water intake

*Variance Based on Cost and Social Impact **

In the United States, overall discharge standards and permitting are set by the United States Environmental Protection Agency (USEPA). However, variances are negotiated regionally with state governments. Generally, the variance requires the operator to: justify that alternative treatment/control options have been considered and are not feasible to meet water quality standards; and justify that all cost-effective and reasonable best management practices have been implemented.

* USEPA (2020). Water Quality Standards Variance Building Tool; Implementing Water Quality Standards Variances for NPDES Permit Holders Version 1.0, Oregon DEQ, 2012

One of the six of the following criteria need to be met before a discharge variance can be approved:

- Controls to reduce pollutant would cause substantial and widespread economic (cost) and social impact
- Naturally occurring pollutant prevent attainment of water quality standards
- Human-caused pollutants cannot be remedied or would cause more environmental damage to correct
- Natural physical features of a stream prevent attainment of water quality standards
- Hydrologic modifications prevent attainment of water quality standards
- Physical conditions related to the natural features of the waterbody, unrelated to water quality, prevent attainment of water quality standards

Technology Performance – The Importance of Operations and Maintenance (O&M)

All sanitation systems have O&M requirements, which need to be carried out by competent, trained service providers. The service requires an operating budget to pay the service provider and for materials, spare parts, repairs, and services. Simple sewerage and anaerobic treatment systems require intermittent O&M such as checking for leaks, clearing blockages, cleaning sumps and grease traps, and desludging the tanks. More complex systems require electricity, mechanical equipment replacements, chemicals, and more testing.

Recommendation

Establish a model for CAPEX and OPEX Financing

Establish a financing model, and contracts, that considers both CAPEX and OPEX; and finance according to maximising the BOD reduction and lowers CO2 emissions.

Key recommendations include:

- Pay for full time, trained O&M staff
- Calculate the 10-year OPEX cost in decision making
- LG should pay for major repairs and scheduled desludging
- Pilot private sector DBO, performance-based contracts
- Maximise BOD reduction by adding more connections and repairing existing assets
- Lower the carbon footprint by avoiding aeration

India - Lessons Learned Show O&M Crucial for Sustainability *

An evaluation of 9,500 small scale sanitation (SSS) technology performance in India found 14 factors that influence technology sustainability. The 14 factors covered five areas: (i) planning; (ii) design and implementation; (iii) O&M; management and monitoring; (iv) socio-cultural aspects; and (v) finance. Of these, O&M was the most prevalent cause of unsustainability. Nearly all of the SSS designs were anaerobic baffled reactors (ABRs) and many also included anaerobic filters (AFs). The following are specific O&M areas affecting long-term SSS sustainability.

* Eawag (2020). Policy Brief Small-Scale Sanitation in India: Research Results and Recommendations: https://www.eawag.ch/fileadmin/Domain1/Abteilungen/sandec/schwerpunkte/sesp/4S/policy_brief.pdf

O&M Issues that led to technology failure:

System start-up: The formal handover and O&M responsibility from construction to long-term management are essential. This evaluation showed that a lack of technology-specific O&M knowledge by the operator caused operational issues. Operators, managers, and owners lacking knowledge, or having the necessary training, for good performance requirements led to trouble-shooting deficiencies and system failure.

Paying for O&M: In many cases the full cost of O&M was not in the budget. Costs for paying the operator, desludging the units, or making repairs were unfinanced and led to system failure.

Limited O&M supervision and monitoring: Communities lack sources of assistance and lack of scheduled monitoring failed to detect technology failure.

Weak documentation of O&M activities: The absence of systematic documentation and archiving of data leads to the loss of knowledge and a lack of understanding of the systems' performance and history. Such data is crucial for decision-making.

Poor scheduled maintenance, repairs and replacement: Often, lack of scheduled O&M led to technology breakdown that went unrepaired or not replaced. This led to the entire system failing. Reasons include lack of planning, but most often is a lack of budget.

Evaluation recommendations to promote technology sustainability:

Standardised guidance and training:
Standardise the manuals, operator training/ certification, technology certification, knowledge transfer, design details and make operational manuals user-friendly.

Life-cycle costing:
Technology selection should include design, construction, and context-specific O&M costs. O&M should also include personnel training, performance monitoring, and system optimisation (see Figure 1).

Supervision and monitoring services:
The absence of systematic documentation and archiving of data leads to the loss of knowledge and a lack of understanding of the systems' performance and history. Such data is crucial for decision-making.

Mandatory O&M documentation:
Systems operation, upkeep, and online logbooks are part of the documentation.

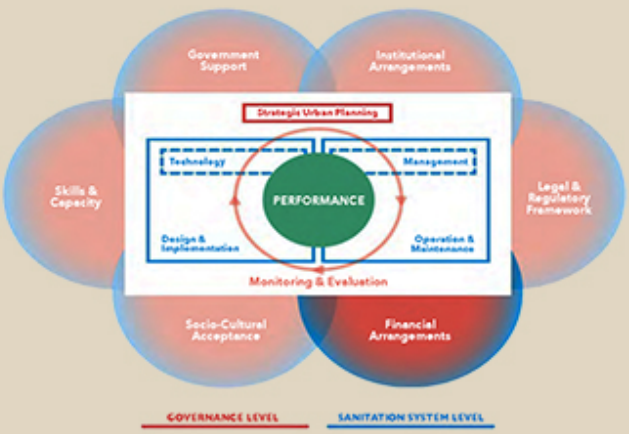

Figure 1.
Life Cycle Cost Considerations *

* Eawag (forthcoming). Chandragiri, R., Reymond, P., Ulrich, L. & Lüthi, C. Governance of Small-Scale Sanitation in India – Institutional Analysis and Policy Recommendations. 4S Project Report Vol. II.

Malaysia – Regulated Utility Model with Tariff Leads to O&M Success

In Malaysia, SSS are managed using a utility model. The operator is IWK, engaged through a negotiated contract. The water regulator, SPAN *, sets sewerage charges for all water customers receiving sewerage or SSS services. The monthly tariff is a planned, phased tariff starting at US$2 per household and then phased to full cost recovery of US$4 household over a decade. On-site, SSS technologies are installed by registered, private sector suppliers and transferred to IWK for O&M.

Lessons learned:

Phased tariff.

In most developing countries, sewerage customers typically pay a sewerage tariff but are not initially charged the full cost of sewerage O&M (WaterAid,2013). In the interest of public health and the environment the government provides subsidies until incomes rise sufficiently.

Utility model to address technology and O&M.

Malaysia experienced challenges with SSS O&M, similar to Indonesia and India. The utility model with IWK as the operator, was in part to address technology and O&M deficiencies.

Utility model implementation:

Utility managed central database.

Since the main issue was poor technology performance mainly due to O&M, the Malaysian government implemented a centralised, transparent database.

Utility benefits.

The utility model for managing O&M offered economies of scale for equipment, human resources, training, and customer service; bringing costs down while providing better service.

Training, certifications, registration standardises services.

Standardised services and technology lower the risk of failure. The utility established a training centre for operators.

The need for monitoring.

O&M for SSS is periodic and to lower cost, regular visitation schedule provided regular O&M. Technology fitted with sensors provide another layer of O&M management.

* National Water Services Commission

Japan – Technology and O&M Standardisation Limits Technology Failure

Japan takes the approach that standardising technology and the O&M requirements limits technology failure. The individual and SSS technology mandated nationwide is the Johkasou, a modular unit that uses media, fine bubble aeration, and disinfection to meet Japan's strict discharge standards without a drain field.

Bi-annual inspections are carried out by trained operators which guarantees performance. The 1983 Johkasou Law defines design, manufacturing, installation, maintenance and desludging; as well as registration of Johkasou installers, maintenance operators, and licensing of Johkasou desludging vendors.

Johkasou system

The approach has **valuable lessons learned for Indonesia** that include:

Lessons learned from technology standardisation:

- The regulatory and enforcement system address all aspects of design, manufacture, installation, sludge disposal - and is tied to enforced building codes
- Guarantees effluent quality from a unit without a drain field
- Technology and O&M are more expensive than traditional ABRs; requires a continuous power supply

Lessons learned from O&M standardisation:

- O&M is standardised and required for all systems which reduces performance risk
- Private sector O&M contractors to maintain the systems are paid by the owner
- A simple institutional structure supported by trained human resources, regulations and an enforcement regime works