12 System malfunction – symptoms, problems, solutions

DEWATS are designed to be particularly robust. Nonetheless, problems may be caused by improper use or operation, insufficient maintenance or structural flaws. A malfunctioning system is a risk to public health and the environment. Reoccurring problems create further complications, if they are not quickly attended to.

As a result, each DEWATS facility requires responsible personnel to:
- recognise the symptoms of a malfunctioning system at an early stage
- identify the cause of the problem
- repair the system, appropriate measures, as soon as possible

There are two main types of system malfunction:
- insufficient treatment of wastewater and
- reduced flow at the outlet of the facility

In case of malfunction, the following sections can be consulted for guidance. They present common symptoms and list possible problems and specific maintenance solutions.

To facilitate troubleshooting, it is beneficial to have a plan of the system and a record of past maintenance activities. Records of pumping, inspection, and other maintenance work should be kept (see operation & maintenance manual referred to in picture 6_25, page 128).
It should be clear who is responsible and who can be contacted if the problem reoccurs. A list of specialists (including name, address and phone numbers) should be available – and all staff and users know where it is kept.

12.1 Insufficient treatment of wastewater

Treatment of the wastewater is considered insufficient if it does not correspond to the desired discharge standards in one or several of the following categories:
- BOD
- COD
- suspended solids
- smell
- faecal contamination

Symptoms • extensive plant growth (eutrophication) in the discharge water body • fish dying • turbid effluent • frothy discharge • biological and nutrient contamination in nearby wells or surface waters • smell • high pH-value	
Problem	**Solution**
Accumulated sludge within Imhoff tank, septic tank, anaerobic baffled reactor, biogas digester or pond system. This leads to a reduction of the hydraulic retention time for treatment.	**determining sludge depth**: 1. wrap one metre of white fabric around the end of a long stick 2. place the stick into the sludge, behind the outlet baffle – leaving it there for one minute 3. remove the stick and note the sludge line 4. If the sludge line is within 30cm of the outlet baffle or 45cm within the outlet fitting, the system requires cleaning. For details on correct sludge removal, handling, treatment and reuse – see section 11.3. If many non-biodegradable materials such as plastics, disposable nappies or sanitary towels are found in the sludge – awareness raising for proper use of the system is necessary.

Table 42: Insufficient treatment of wastewater

cont. Table 42: insufficient treatment of wastewater

Problem	Solution
Accumulated scum (soap suds and fat) floating on the wastewater surface within Imhoff tank, septic tank or baffled reactor Scum reaches the tank outlet and flows into subsequent treatment units, which are not designed to handle it. Extremely fast scum growth may be an indicator of excessive hydraulic loading.	**Measuring scum depth:** 1. attach a 15cm square board to the bottom of a stick. 2. extend the stick through the scum to locate the bottom of the baffle or effluent pipe in the tank – mark the stick to indicate that point. 3. raise the stick to locate (by feeling or seeing) the bottom of the scum layer – mark the stick again. 4. If the marks are less than 8cm apart, or if the scum surface is less than 3cm from the top of the outlet baffle, the tank requires cleaning. Treatment facilities treating very greasy wastewater (for example from restaurants) should have a grease trap (see section 9.2, page 176) – remove grease from the water surface with a shovel and deposit it in grease pit (at least 10m from well) twice weekly.

cont. Table 42: insufficient treatment of wastewater

Problem	Solution
Excessive inflow quantity caused by • increased number of users • changed user habits • structural deficiencies This leads to a reduction of the hydraulic retention time; insufficient time for treatment can lead to low pH levels, caused by volatile fatty acids. It can also lead to backlogging water within the system, or extrusion of water at unforeseen places, if the filter velocity though wetland or filters is insufficient.	Uncontrolled inflow of ground- or stormwater through leaking or damaged pipes or structures must be prevented by locating infiltration points and carrying out repairs. (This can include leaking roofs of community sanitation centre shower or toilet rooms). Uncontrolled stormwater inflow through maintenance openings must be prevented. Attaching wastewater flow from more users than the system was designed for must be discouraged. If the wastewater amount has grown beyond system capacity, a system upgrade is necessary or a parallel treatment system must be installed. Alternatively, awareness-raising activities to promote water-saving habits or fixtures can be applied.
Daily peaks higher than expected	Consider an equalisation tank.

cont. Table 42: insufficient treatment of wastewater

Problem	Solution
Excessive inflow contamination caused by: • Inflow of wastewater sources unforeseen in the planning of the facility (e.g. industrial wastewater connected to a domestic wastewater treatment unit). • Excessive BOD and ammonia loadings. Can lead to increased accumulation of settleable solids, low pH-value due to volatile fatty acids or temperature shifts in anaerobic reactors (esp. in the case of illegal industrial connection) Methanogenesis is sensitive to both high and low pHs and occurs between pH 6.5 and pH 8. Low pH-levels are inhibiting methanogenic organisms and causing smells.	Inflow of inappropriate wastewaters must be prevented. An appropriate facility or an upgrade of the existing treatment plant is required. **Anaerobic ponds:** adding lime (12g/m³ of the pond) may help to raise the pH value. **Facultative ponds:** create multiple inlets to the pond. Periodically add sodium nitrogen as a supplement source of combined oxygen Where possible, public-awareness campaigns can help to minimise pollution through habit change, for example in cooking practices or handling of kitchen waste.
System short circuit caused by • defective separation walls and baffles in tanks or reactors • excessive aquatic vegetation in facultative ponds, reducing the area of flow across the system This leads to less retained settleable solids and reduction of the hydraulic retention time (also see "incorrect retention time" below).	In most cases, draining the facility is necessary to carry out the required repairs or maintenance.

cont. Table 42: insufficient treatment of wastewater

Problem	Solution
Incorrect retention time within the unit can create **smell or effluent-quality problems** In grit chambers, a rotten-egg smell indicates sedimentation of organic matter, due to slow flow velocity/too-long retention time. The removed sand is grey and contains grease. In anaerobic ponds, HRT longer than one day leads to fermentation – not only of the bottom sludge but also the liquid phase. A too-short HRT creates effluent with low pH and emits H_2S odour. In facultative ponds, growth of filamentous algae and moss indicates underloading. Poor flow distribution can be responsible for insufficient retention time and treatment.	Adjustments of flow must be made: • Increasing flow velocity by using fewer parallel units, if available. • Lowering retention time by bypassing overloaded units if the following ones can handle the higher load. Ideally, upgrading of the facility. • Increasing retention time by redu-cing flow quantity or capping peakflow (equalisation tank) Check inlets and distribution of flow to treatment units like ponds or wetlands: • **Anaerobic ponds:** distribution by perforated pipes on the bottom of the pond. • **Facultative ponds:** create several inlets with uniform distribution to each. • **Wetlands:** ensure influent distribution across the full width.
Incorrect water level in horizontal gravel filters, resulting in surface algae growth or insufficient treatment.	The water level should be just below the filter surface; the flow-regulation pipe should be adjusted accordingly, during weekly maintenance tasks.

cont. Table 42: insufficient treatment of wastewater

Problem	Solution
Scum layers or floating material on ponds can hinder some treatment processes.	**Anaerobic ponds:** no measure needs to be taken. The scum layer helps to maintain the absence of oxygen, controls the temperature and prevents the release of bad odours. **Facultative ponds:** remove scum layers, place scum into plastic bags and practise proper garbage disposal. Light and wind penetration of the pond surface should be ensured.
Growth of aquatic or terrestrial vegetation or algae in or on ponds can hinder the treatment process and create smell.	**Anaerobic ponds:** Vegetation on internal or external slopes, as well as in shallow water should be removed completely and regularly. **Facultative ponds:** remove excessive algae growth on the surface, which is prohibiting passage of light, with sieves. Remove excessive aquatic plants restricting the area flow and creating oxygen demand upon plant mortality. **Indicator ponds (polishing ponds):** Algae should be removed from the walls by a brush every 14 days.
High concentrations of algae (SS) in the effluent of pond systems	Install baffles to retain and remove algae. Use multiple cells in series with shorter retention time in each.

Problem	Solution
Cloudy weather and low temperature over long stretches of time reducing treatment efficiency in facultative ponds and causing bad odours.	Reduce the depth of the facultative pond temporarily. If possible, put ponds in parallel operation.
Metal or concrete erosion in anaerobic reactors caused by **insufficient ventilation.**	Check and remove obstructions to the ventilation system, including chamber connections.
Insufficient water seal in the biogas settler causing inefficient treatment and making the system unsafe.	Insert a stick through the hole in the manhole cover to measure the distance until it gets wet. If necessary, refill water seal.

cont. Table 42: insufficient treatment of wastewater

If a system malfunction was caused by improper use of the system, awareness raising campaigns should teach users how to prevent such problems in the future.

If a system malfunction was caused by insufficient operation and maintenance the existing maintenance schedule should be reviewed and adhered to in the future. A maintenance time schedule and log book is recommended (see operation & maintenance manual, picture 6_25, page 128).

12.2 Reduced flow at the outlet of the facility

The effluent volume of a system does not always equal the influent volume – it depends on the amount of evaporation of constructed wetlands or pond systems. However, when the amount of effluent is far less than expected, the system is either clogged at one or more locations and/or is discharging wastewater at unforeseen locations. All control openings should be checked to identify the location causing the irregularity in flow.

Symptoms

- poorly draining toilets, showers, sinks or drains – nuisance to the users, easily identifiable
- extrusion of wastewater at unforeseen places – environmental & health hazard, likely to go unnoticed or to be disregarded. Noticeable as:
  - pools of water in unexpected places
  - lush, green vegetation, even during dry weather, in places where there should be none
  - pathogen or nitrate contamination of nearby wells
  - dying plants in a horizontal gravel filter, due to lack of water
- reduced flow at the outlet or significant fluctuations – parameter should be monitored by maintenance personnel

Problem	Solution
Pump malfunction, hindering wastewater flow	If a pump is used, check for obstructions and remove them. Check whether the pump-level control is functioning and that the pump is adequately lubricated. Each pump differs slightly, so consult the maintenance manual for the pump for more information about pump maintenance.

Table 43: Reduced flow at the outlet of the facility

cont. table 43: reduced flow at the outlet of the facility

Problem	Solution
Clogged pipes – anywhere between the household and location of effluent discharge, including wastewater-treatment plant possible causes include: • improper system use as garbage-disposal for non-biodegradable materials such as plastics, disposable nappies, sanitary napkins, etc. • plant roots growing into the system	Obstructions at manholes should be removed with a shovel and bucket until normal flow is achieved. Pipes should be opened at all maintenance openings to check for backlogged water. The section of clogged pipe lies between the last control opening with backlogged water and its downstream opening. The intermittent section of piping is cleared using boiling water, a drain snake or long pole. Caustic drain openers should not be applied. The reason for pipe obstruction should be identified to prevent identical problems in the future: • roots or saturated soils in the system indicate a damaged pipe.The section of pipe should be replaced. Reasons for pipe damage should be identified. Responsible trees should be removed and/or heavy loading of the pipe with machinery or vehicles should be prevented. • future system misuse should be discouraged through awareness-raising campaigns for users.

cont. table 43: reduced flow at the outlet of the facility

Problem	Solution
Damaged pipes – anywhere between the household and location of effluent discharge, including wastewater-treatment plant Leaking pipes cause reduced flow in the system and pollute the environment. At times of high groundwater, or during strong rainfall, inflow to the damaged pipe can lead to large fluctuations of flow. Possible causes include: • plant roots growing into the system • unforeseen heavy loading (vehicles or machinery) on laid pipes • leaking joints	Monitoring flow at various control openings helps to locate leaks. Damaged pipes must be replaced. The reasons for pipe damage should be identified to prevent identical problems in the future: • trees responsible should be removed • excessive loading of the pipe with machinery or vehicles should be prevented • ensure compacted clean sand bed under the pipes and backfilling with clean granular sand, compacted in layers • during regular maintenance, check for leaking system components
Clogged anaerobic filter Inefficient treatment – as discussed in the previous chapter – results in too many suspended solids reaching the filter.	Filter material must be washed with high hydraulic pressure. In most cases the filter material must be removed, cleaned and replaced. Personnel must wear mouth and skin protection. A clogged filter is an indicator that prior treatment is insufficient and too many suspended solids reach the unit. To prevent identical problems in the future, the cause of insufficient treatment can be identified and corrected with the help of the previous section/ table.

cont. table 43: reduced flow at the outlet of the facility

Problem	Solution
Clogged horizontal gravel filter Plant growth on only certain parts of the filter can indicate irregular flow – leading to a reduction of retention time until the filter is totally clogged. Possible causes include: • any of the reasons listed in the section "inefficient treatment" – too many suspended solids reach the filter • improper use of the system (great amounts of grease or cooking oils can solidify within the filter and cause clogging) Dead plant matter or extensive weed growth on the filter surface can as well be responsible for filter clogging.	Inlet and outlet pipes and channels should periodically be checked for obstructions and cleaned, so that a uniform flow (vital for efficient treatment) can be guaranteed. The plants growing on the filter should be trimmed regularly to not less than 1m. Dead-leaf litter in and around the planted gravel filter should be manually removed every week. The area around the filter should be weeded regularly. If plants grow too densely, they should be thinned out. Look for evidence that heavy equipment has been on the wetland, filter or drainage field, to locate areas of possible compaction and damage. Identification of the cause for clogging may require digging up a small portion of the wetland or drainage field. Maintenance might require draining of the unit, material removal and cleaning. A clogged filter is an indicator that prior treatment is insufficient and too many suspended solids are reaching the unit. To prevent identical problems in the future, the cause of insufficient treatment can be identified and corrected with the help of the previous section.

cont. table 43: reduced flow at the outlet of the facility

Problem	Solution
Structural deficiencies – cracks and leaks • cracked or improperly sealed walls or floors of treatment units • leaking pipes or pipe joints • loss of water due to flaws in the liner of a horizontal gravel filter – indicated by dying plants	Testing for leaks or cracks: • Filling the unit with closed outflow; waiting for 24 hours to see if it loses water • Empty the unit with closed inflow; waiting for 24 hours to see if water infiltrates from the outside If so, locate the leaks and repair them.

12.3 Other problems and nuisances

Symptoms • Excessive mosquito breeding	
Problem	**Solution**
Stagnant water turns into a breeding ground for mosquitoes, which cause discomfort for those near the pond, and increase the likelihood of insect-borne diseases such as malaria.	Increase flow, so that water does not become stagnant. Alternatively, introduce lung-breathing fish into the pond (i.e. *Gambusia spp.*).
Clogged biogas lines caused by an accumulation of condensed water.	The valve to release water vapours should be opened daily, after biogas has been switched off for one minute. Biogas burners and pipes should be cleaned every second day to avoid clogging with water vapour and ensure the flow of gas. Ensure that the valve is switched off during maintenance and clean gas holes with a small cloth. Detach the flexible pipe from the biogas pipe and clean the connection.

Table 44: Other problems and nuisances