

## **TROUBLESHOOTING GUIDE for Extended Aeration Wastewater Treatment Systems.**

Troubleshooting begins by knowing the system. The operator needs to know:

1. What each part of the system is supposed to do.
2. How each process or piece of equipment operates normally.
3. How to recognize abnormal conditions.
4. What alternatives are available when trouble develops.

When problems develop in the activated sludge process, it is important to identify:

1. the problem,
2. the cause of the problem, and
3. the best possible solution.

Remember that the activated sludge process is a biological process and may require from three days to a week or longer to show a response to the proper corrective action. Allow time for the process to stabilize (3 days to a week) after making a change in the treatment process.

The purpose of this section is to present a ready and quick operator's reference to process problems and their solutions. Like the rest of this operator's guide, it provides basic guidance and should be used as a starting point.

The material in this guide has been adapted from several sources:

Package Treatment Plants Operations Manual (1977 – EPA)

Operation of Extended Aeration Package Plants (1985 – WEF MOP OM-7)

Extended Aeration Sewage Treatment Plants (2000 – State of Ohio, U.S.)

Small Wastewater System Operation & Maintenance (2002 – California State University)

### VISUAL CHECK LIST: AERATION COMPARTMENT

Equipment Operation	Appearance of Liquids	Comments	Correction to be Made
Aeration mixing is good and blower is operating	Chocolate brown color, little or no foam	Good: probably adequate air and adequate solids.	Continue same operation.
Aeration mixing is good and blower is operating.	Soapy water; lost of foam	Little or no solids in aeration; young sludge.	Reduce air input by adjusting valves on diffusers. Be sure to maintain uniform roll.
Aeration mixing is good and blower is operating	Black	Septic condition: plant may be receiving large amounts of septic sewage or blower is not running long enough or both.	Aerate heavily until brown color returns and then readjust for adequate aeration. Check and clean diffusers, correct any "dead areas" (areas not receiving airflow required for good mixing). Find source of any septic sewage and eliminate.
Aeration mixing is good and blower is operating	Reddish	Over aeration	If dissolved oxygen (DO) exceeds 3 ppm in aeration compartment, slightly reduce air supply.
Blower operating, but no aeration is occurring.	Black	The system has turned septic. The diffusers may be plugged or blower is not running long enough.	Balance the air supply to all diffusers and check air supply line. Check for plugged diffusers, and V belt slipping on the motor.
Blower operating, but air bubbles are only surfacing in one end of the tank.	Chocolate Color	Will result in "dead" (septic) areas.	Check air line balancing valves, or possibility of diffuser clogging.
Blower not operating and no air bubbles rising in aeration tank.	Black	Mechanical failure.	Check for electrical failure: press motor starter re-set button. Check V belt drive.

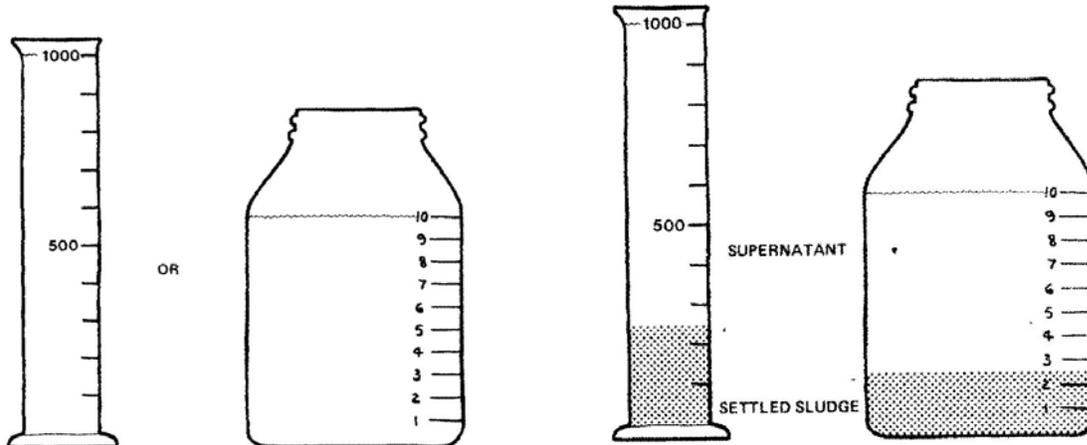
### VISUAL CHECK LIST: CLARIFIER (FINAL SETTLING) COMPARTMENT

Equipment Operation	Appearance of Liquids	Comments	Correction to be Made
All equipment functioning	Surface clean and effluent clear	Good: ideal condition.	Continue same operation.
All equipment functioning	Large chunks of scum	Likely due to inadequate return of sludge (RAS) or inadequate scraping (squeegee) of clarifier walls and sloped bottom.	Scrape (squeegee) clarifier walls and sloped bottom more frequently. Check air lift: increase RAS rate.
All equipment functioning	Visible sludge blanket less than 1 foot below water's surface	Likely due to young sludge, and/or too much skimming or excessive sewage flows.	If settleability test indicates young sludge: don't waste sludge (WAS) until % solids in aeration basin increase. Slightly increase return sludge (RAS) rate. Decrease skimmer by reducing air or limiting operation by limiting operation of skimmer to weekly visits when squeegee-ing clarifier and guiding scum with squeegee blade toward skimmer.
All equipment functioning	Heavy black sludge on bottom of tank.	Inadequate return or waste of sludge (RAS or WAS).	Increase RAS rate and/or waste sludge (WAS) if settleability results so indicate.
Skimmer not working	Large amounts of scum on surface.	May be due to clog in air line or insufficient submergence of skimmer lip.	If clogged, rod out line or blow out by shutting off discharge end and opening needle valve.
All equipment functioning	Large amounts of slimy brown sludge on surface of tank. Seems to float immediately upon entering clarifier	Plant under loaded: not enough solids in plant.	Raise inlet baffle in final tank to trap scum and skim by hand. Reduce air input by adjusting diffuser valves or by decreasing aeration cycle (NOTE: under no circumstances shall OFF period exceed 60 minutes).
All equipment functioning	Excessive solids in effluent.	Likely due to too much skimming and excessive sludge return.	Decrease skimming and sludge return to increase clarifier retention period.
Sludge air lift not working			Rod out air lift and/or air lift airline.

## **Procedure 1: SETTLEABILITY TEST**

The settleability test indicates how well the biological floc will settle; it is considered the major process control test for small package plants.

### **Equipment:**



1,000 mL graduated cylinder or a 1-litre wide-mouth jar calibrated as shown.

Illustration of reading of 25% settled solids; i.e., 25% settleability

Images from EPA-430/9-77-005

### **Procedure:**

1. Collect a sample of the contents of the aeration chamber<sub>1</sub>. Samples should be taken at the same location – away from influent or sludge return line – and approximately at the same time of day each time for comparison of test results over time. If aeration is on a timer, ensure that the system has been aerating for at least 10 minutes prior to collecting the sample.
2. Fill the graduated cylinder or jar to the top mark on the scale. Place the sample in the shade, on a level surface, and away from any vibration caused by the blowers.
3. Observe the test for the first 5 minutes; how the sludge settles is just as important as the final percent that settles. Note whether compaction is slow or fast and whether particles remain in the water<sub>2</sub> above the settling sludge. After settling for 5 minutes, record the settleability (percent of solids).
4. After settling for 30 minutes, record the settleability (percent of solids) and note the quality of the water above the sludge; e.g., clear, cloudy, etc.
5. After settling for 60 minutes, record the settleability (percent of solids). The condition of the settled sludge after 60 minutes is significant. Note if the sludge has begun to rise.

**Refer to Trouble Shooting Table 3 for interpretation of results.**

<sub>1</sub>Mixed liquor : the mixture of activated sludge (bacteria and organic matter) and wastewater in an aeration compartment.

<sub>2</sub>Supernatant: clear water above a sludge layer and below a scum layer.

### INTERPRETATION OF SETTLEABILITY TEST

Status of Plant	Observation	Settleability	Indication	Adjustment
<b>Well Operating</b> 	Medium brown sludge compacts slowly, forming a screening blanket, with clear supernatant above it.	50-70% at 5 minutes  25- 50 % at 30 minutes	Good	None necessary
	Sludge is dense and remains settled for at least 60 minutes	25 to 40%	Good	None necessary
<b>Poorly Operating</b>				
	Light colored sludge with cloudy water above it.	Less than 25 % at 30 minutes	Poor quality sludge – a “young sludge” inadequate to treat the incoming loads.	No wasting of sludge (WAS) until % solids in aeration basin increase. Slightly increase return sludge (RAS) rate.
	Dark brown to black sludge compacts rapidly leaving a cloudy supernatant above it.	More than 50 % at 30 minutes	Poor quality sludge – an “old sludge” with a large amount of inorganic solids.	Waste sludge per Procedure 3.
	Sludge begins to lift before 60 minutes settling. NOTE: A properly oxidized sludge will not start rising to the surface until two hours after the test was started.		Several Possibilities: 1. Too much air, or 2. Too many solids, or 3. Too few solids	1. If dissolved oxygen (DO) exceeds 3 ppm in aeration compartment, slightly reduce air supply. 2. If settleability > 50%, waste sludge (WAS) per Procedure 3. 3. If settleability < 20%: <ul style="list-style-type: none"> <li>• slightly increase return sludge (RAS),</li> <li>• do not waste sludge, and</li> <li>• If dissolved oxygen (DO) exceeds 3 ppm in aeration compartment, slightly reduce air supply.</li> </ul>