APPENDIX E

Troubleshooting

APPENDIX E

TROUBLESHOOTING

Table 9-5. Common Problems in Wastewater Treatment Pond Operation (Richard and Bowman 1991)

Problem	Possible Causes	Possible Solutions
Odors	Organic overload	Increase aeration capacity.
	Poor aeration or mixing	After aerator run time, change or supplement type of aeration.
	Previous ice-covered ponds	Increase aerator run time, change type of aerator to eliminate ice over.
	Duckweed growth	Increase aerator run time, chemical treatment (Diquat), physical removal (harvest), add ducks or geese.
	Excess weed growth on pond banks harboring flies, and mosquitoes, trapping grease and organics.	Physical removal by pulling, mowing, burning or chemical treatment (Diquat). In winter, lower pond level and allow ice to freeze around weed stem. Increase water level.
Poor BOD Removal	Organic overloading	Increase aeration capacity.
	Short Circuiting	Improve inlet-outlet conditions, add baffles, add recirculation to improve mixing, add or improve aeration of ponds.
	Ice-covered ponds	Change or add aerator.
	Recent reduction in pond temperature	Increase hydraulic detention time.
	Algal bloom	Increase mechanical mixing; add physical shade (Aquashade, Photoblue), floating cover such as swimming pool cover, Styrofoam sheets or balls, duckweed cover. Addition of algal predator such as daphnia. Add chemicals (copper sulfate). Addition of constructed wetlands to polish effluent.
High Effluent TSS	Algal bloom	See algal bloom solution above.
	Excess pond mixing or short circuiting	See short circuiting solution above.
	Spring or Fall turnover	Add different types of aeration to eliminate stratification or add supplemental aeration, add recirculation.
	Excessive solids buildup in bottoms of ponds	Physically remove solids by pump or sludge barge; proper sludge disposal in conformance with State and Federal regulations.
Poor Fecal Coliform Removal	Chlorine residual too low or poor chlorine contact chamber design	Increase chorine feed rate, provide 40:1 1:w ratio, provide a minimum 30 minute detention time at peak flow.
	Increase in chlorine demanding substance in effluent (H_2 S, NO_2)	Remove solids from chlorine contact chamber, increase chlorine feed rate.
	Water fowl contamination	Increase chlorine feed rate.
High pH	Algal stripping of carbon dioxide and bicarbonate alkalinity	See algal bloom solution above.
Low pH	Accumulation of organic sludge stuck in the “acid phase”	Physically remove sludge by pumping or sludge dredge.
	Extensive nitrification	Increase aerator run time, add recirculation.
	Organic overloading	Increase aeration capacity, add recirculation.
	Excessive daphnia growth	Increase aeration capacity or run time.

Table 9-6. Troubleshooting Test and Probable Causes (Richard and Bowman, 1991)

Probable Cause		Test
BOD_5 - high C BOD_5 – high TSS – moderate Filtered BOD_5 - high	Low DO	DO/DO Profile Microscopic Exam TSS/BOD_5 Ratio
BOD_5 - high C BOD_5 – low TSS – high pH - high	Low DO at night (Algae overgrowth or nitrification)	Filtered BOD DO Profile (early morning) Effluent Ammonia Test TSS/BOD_5 Ratio Microscopic Exam
BOD_5 – high C BOD_5 – high TSS – moderate Filtered BOD - high	Low DO Short circuiting Sludge Buildup (Soluble organics released from sludges)	DO/DO Profile Microscopic Exam TSS/BOD_5 Ratio

Table 9-7. Troubleshooting Tables (USEPA, 1977)
How to Control Water Weeds (USEPA, 1977)

Indicators/Observations	Probable Cause	Solutions
Weeds provide for burrowing animals cause short circuiting problems, stop wave action so that scum can collect and make a nice home for mosquitoes, and odors develop in the still area. Duckweed stops sunlight penetration and prevents wind action thus reducing the oxygen in the pond. Root penetration causes leaks in pond seal.	Poor circulation, maintenance insufficient water depth.	• Pull weeds by hand if new growth. • Mow weeds with a sickle bar mower. • Lower water level to expose weeds, then burn with gas burner. (Check with local fire department prior to burning.) • Allow the surface to freeze at a low water level, raise the water level and the floating ice will pull the weeds as it rises. (Large clumps of roots will leave holes in pond bottom; best results are obtained when weeds are young.) • Increase water depth to above tops of weeds. Use riprap. Caution: If weeds get started in the riprap they will be difficult to remove but can be sprayed with EPA approved herbicides. • To control duckweed, use rakes or push a board with a boat, then physically remove duckweed from pond.

Table 9-7 (Cont.)

How to Control Burrowing Animals (USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
Burrowing animals must be controlled because of the damage they do to dikes. Rodents such as muskrats and nutria dig partially submerged tunnels into dikes. If the water level is raised, they will burrow further and may go on out the top thus weakening the dike.	Bank conditions that attract animals. High population in area adjacent to ponds.	• Remove food supply such as cattails and burr reed from ponds and adjacent areas. • Muskrats prefer a partially submerged tunnel, if the water level is raised it will extend the tunnel upward and if lowered sufficiently, it may abandon the tunnel completely. They may be discouraged by raising and lowering the level 6-8 inches over several weeks. • If problem persists, check with local game commission officer for approved methods of removal, such as live trapping, etc.

How to Control Dike Vegetation (Modified USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
High weed growth, brush, trees and other vegetation provide nesting places for animals. This can cause weakening of the dike and presents an unsightly appearance. Also may reduce wind action on the pond.	Poor maintenance.	• Periodic mowing is the best method. Sow dikes with a mixture of fescue and blue grasses on the shore and short native grasses elsewhere. It is desirable to select a grass that will form a good sod and drive out tall weeds by binding the soil and "out compete" undesirable growth. • Spray with approved weed control chemicals. Note: Be sure to check with authorities. Some states do not allow chemical usage. All others require that chemicals be bio-degradable. • Some small animals, such as sheep, have been used. May increase fecal coliform, especially to the discharge cell. Not recommended with pond systems utilizing synthetic pond liner. Practice "rotation grazing" to prevent destroying individual species of grasses. An example schedule for rotation grazing in a 3-pond system would be: Graze each pond area for 2 months over a 6-month grazing season.

How to Control Scum (USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
It is necessary to control sum formations to prevent odor problems and to eliminate breeding spots for mosquitoes. Also, sizeable floating rafts will reduce sunlight.	Pond bottom is turning over with sludge floating to the surface. Poor circulation and wind action. High amounts of grease and oil in influent will also cause scum.	• Use rakes, a portable pump to get a water jet or motor boats to break up scum formations. Broken scum usually sinks. Any remaining scum should be skimmed and disposed of by burial or hauled to landfill with approval of regulatory agency.

Table 9-7 (Cont.)

How to Control Odors (Modified USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
Low pH (less than 6.5) and dissolved oxygen (less than 1 mg/L). Foul odors develop when algae die off.	Blue-green algae is an indicator of incomplete treatment, overloading and/or poor nutrient balance.	• Refer to Common causes of pond effluent noncompliance. • Apply chemical such as sodium nitrate. Application rate: 5-15 percent of sodium nitrate per pound of BOD on a pound for pound basis. Or apply 200 pounds sodium nitrate per million gallons. See literature for commercial products. Repeat at a reduced rate on succeeding days. Or use 100 pounds sodium nitrate per acre (112kg/ha) for first day, then 50 pounds per acre (56 kg/ha) per day thereafter if odors persist. Apply in the wake of a motor boat. • Install supplementary aeration such as floating aerators, caged aerators, or diffused aeration to provide mixing and oxygen. Daily trips over the pond area in a motor boat also helps. Note: Stirring the pond may cause odors to be worse for short periods but will reduce total length of odorous period. • Recirculate pond effluent to the pond influent to provide additional oxygen and to distribute the solids concentration. Recirculate on a 1 to 6 ratio. • Eliminate septic or high-strength industrial wastes.

How to Control Insects (Modified USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
Insects present in area and larvae or insects present in pond water.	Poor circulation and maintenance.	• Keep pond clear of weeds and allow wave action on bank to prevent mosquitoes from hatching out. • Keep pond free from scum. • As for stocking fish, note that Gambusia do not eat mosquito larvae any faster than other small fish species. • Spray with EPA approved larvacide as a last resort. Check with state regulatory officials for approved chemicals.

Table 9-7 (Cont.)

How to Control Blue-Green Algae (Modified USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
Low pH (less than 6.5) and dissolved oxygen (less than 1mg/L). Foul odors develop when algae die off.	Blue-green algae is an indicator of incomplete treatment, overloading and/or poor nutrient balance.	• Refer to common causes of pond effluent noncompliance. WARNING!: Prior to using copper sulfate, see explanation below. • Apply 3 applications of a solution of copper sulfate. ➢ If the total alkalinity is above 50 mg/L apply 1200 kg/m^3 (10 lbs/MG) of copper sulfate per million gallons in cell. ➢ If alkalinity is below 50 mg/L reduce the amount of copper sulfate to 600 kg/m^3 (5 lbs/MG. **Note:** Some states do not approve the use of copper sulfate since in concentrations greater than 1 mg/L it is toxic to certain organisms and fish. • Break up algal blooms by motor boat or a portable pump and hose. Motor boat motors should be air cooled as algae may plug up water cooled motors. **Important:** In the past copper sulfate has been used to control algae. It is recommended that the operator check with the regulatory agency to determine if a copper parameter must be added to the discharge permit. It should also be noted that prolonged use of copper sulfate may cause a buildup of copper in the benthic sludges making it difficult to dispose of the sludges when pond cleaning becomes necessary.

How to Obtain Best Algae Removal In The Effluent (Modified USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
Most of the suspended solids present in a pond effluent are due to algae. Because many single-celled algae are motile and are also very small they are difficult to remove.	Weather or temperature conditions that favor particular population of algae.	• Draw off effluent from below the surface by use of a good baffling arrangement or variable depth draw off. • Use multiple ponds in series. • Check other chapters in the manual for latest algae control methods. • In some cases, alum dosages of 20mg/L have been used in final cells used for intermittent discharge to improve effluent quality. Dosages at or below this level are not toxic.

Table 9-7 (Cont.)

How to Correct Lightly Loaded Ponds (USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
Lightly loaded ponds may produce filamentous algae and moss which limits sunlight penetration. These forms also tend to clog pond outlets.	Overdesign, low seasonal flow.	• Correct by increasing the loading by reducing the number of cells in use. • Use series operation.

How to Correct Overloading (Modified USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
Overloading which results in incomplete treatment of the waste. Overloading problems can be detected by offensive odors, a yellow green or gray color. Lab tests showing low pH, DO, and excessive BOD loading per unit should also be considered.	Short circuiting, industrial wastes, poor design, infiltration, new construction (service area expansion), inadequate treatment and weather conditions.	• Bypass the cell and let it rest. • Use parallel operation. • Apply recirculation of pond effluent. • Look at possible short-circuiting. • Install supplementary aeration equipment.

How to Correct A Decreasing Trend In pH (USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
pH controls the environment of algae types, as an example, the green chlorella needs a pH from 9.0 to 8.4 pH should be on the alkaline side, preferable about 8.0 to 8.4 Both pH and DO will vary throughout the day with lowest reading at sunrise and highest reading in the afternoon. Measure pH same time each day and plot on a graph.	A decreasing pH is followed by a drop in DO as the green algae die off. This is most often caused by overloading, long periods of adverse weather or higher animals, such as Daphnia, feeding on the algae.	• Bypass the cell and let it rest. • Use parallel operation. • Apply recirculation of pond effluent. • Check for possible short circuiting. • Install supplementary aeration equipment if problem is persistent and due to overloading. • Look for possible toxic or external causes of algae die-off and correct at source.

Table 9-7 (Cont.)

How to Correct A Low Dissolved Oxygen (DO) (Modified USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
A low, continued downward trend in DO is indicative of possible impending anaerobic conditions and the cause of unpleasant odors. Treatment becomes less efficient.	Poor light penetration, low detention time, high BOD loading or toxic industrial wastes. (Daytime DO should drop below 1.0 mg/L during warm months.)	• Increase aerator running time. • Remove weeds such as duckweed if covering greater than 40 percent of the pond. • Reduce organic loading to primary cell(s) by going to parallel operation. • Add supplemental aeration (surface aerators, diffusers and/or daily operation of a motor boat). • Add recirculation by using a portable pump to return final effluent to the head works. • Apply sodium nitrate (see How to Control Odors for rate). Determine if overload is due to industrial source and remove it.

How to Correct Short Circuiting (Modified USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
Odor problems low DO in part of the pond, anaerobic conditions and low pH found by checking values from various parts of the pond and noting on a plan of the pond. Difference of 100 percent to 200 percent may indicate short circuiting. After recording the reading for each location, the areas that are not receiving good circulation become evident. These areas are characterized by a low DO and pH.	Poor wind action due to trees or poor arrangement of inlet and outlet locations. May also be due to shape of pond, weed growth or irregular bottom.	• Cut trees and growth at least 150 m (500 ft) away from pond if in direction of prevailing wind. • Install baffling around inlet location to improve distribution. • Add recirculation to improve mixing. • Provide new inlet-outlet locations including multiple inlets and manifolds. • Clean out weeds. • Fill in irregular bottoms. • Add directional surface mixers or aerators to mix and retard flow.

Table 9-7 (Cont.)

How to Correct Anaerobic Conditions (USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
Facultative pond that turned anaerobic resulting in high BOD, suspended solids and scum in the effluent in continuous discharge ponds. Unpleasant odors, the present of filamentous bacteria and yellowish-green or gray color and placid surface indicate anaerobic conditions.	Overloading, short circuiting, poor operation or toxic discharge.	• Change from a series to parallel operation to divide load. Helpful if conditions exist at a certain time each year and are not persistent. • Add supplemental aeration if pond is continuously overloaded. • Change inlets and outlets to eliminate short circuiting. See How to Correct Short Circuiting. • Add recirculation (temporary use portable pumps) to provide oxygen and mixing. • In some cases temporary help can be obtained by adding sodium nitrate at rates described elsewhere in this manual. • Eliminate sources of toxic discharges.

How to Correct Problems In Aerated Ponds (USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
Fluctuating DO, fin pin floc in final cell effluent, frothing and foaming, ice interfering with operation.	Shock loading, over-aeration, industrial wastes, floating ice.	• Control aeration system by using time clock to allow operation during high load periods, monitor DO to set up schedule for even operation, holding approximately 1 mg/L or more. • Vary operation of aeration system to obtain solids that flocculate or “clump” together in the secondary cell but are not torn apart by excessive aeration. • Locate industrial wastes that may cause foaming or frothing and eliminate or pretreat wastes. Examples are slaughter house, milk or some vegetable wastes. • Operate units continuously during cold weather to prevent freezing damage or remove completely if not a type that will prevent freeze-up.

Table 9-7 (Cont.)

How to Correct A High BOD In The Effluent (Modified USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
High BOD concentrations that are in violation of NPDES or other regulatory agency permit requirements Visible dead algae.	Short detention times, poor inlet and outlet placement, high organic or hydraulic loads and possible toxic compounds.	• Refer to Common Causes of Lagoon Effluent Noncompliance. • Check for collection system infiltration and eliminate at source. • Use portable pumps to recirculate the water. • Add new inlet and outlet locations. • Reduce loads due to industrial sources if above design level. • Prevent toxic discharges.

How to Correct Problems In Anaerobic Ponds (USEPA 1977)

Indicators/Observations	Probable Cause	Solutions
Odors Hydrogen sulfide, (rotten egg) odors or other disagreeable conditions due to sludge in septic condition. **Low pH** pH below 6.5 accompanied by odors are the result of acid bacteria working in the anaerobic condition.	Lack of cover over water surface and insufficient load to have complete activity which eventually forms scum blanket. Acid formers working faster than methane formers in an acid condition.	• Use straw cast over the surface or polystyrene plans as a temporary cover until a good surface sludge blanket has formed. • The pH can be raised by adding a lime slurry of 580 kg dehydrated lime/200L water (100 lbs/ 50 gal) at a dosage rate of 12 g/10,000 L (1 lb/ 10,000 gal) in the pond. The slurry should be mixed while being added. The best place to put the lime is in at the entrance to the lagoon so that it is well mixed as it enters the pond.