By Jeff Lamfers, KRWA Consultant

Dealing With Seasonal Turnovers in Lagoons

This photo shows an example of a primary lagoon cell experiencing a spring turnover. Notice the brownish-green color of the wastewater and the numerous clumps of floating sludge on the surface. These solids coming to the surface bring with them offensive gases such as hydrogen sulfide, methane, etc.

It's that time of year again when lagoon treatment systems can present some unique operational challenges. And sometimes, these challenges can "rattle" new operators. This spring I received calls from two operators operating their lagoon systems for slightly more than six months. Both reported that they had checked their lagoons earlier in the week and everything looked normal. Wastewater in all cells was a good, sparkling green color, no odors and no floating sludge masses. However, after checking their lagoons several days later, they found an entirely different situation. In both cases, the wastewater was a milky gray color with many clumps of black sludge coming to the surface. And there was now a septic odor which can present problems in the form of complaints from nearby homeowners. Both of these systems were experiencing a seasonal turnover which is not uncommon. It in no way reflects the job both operators were doing. It's simply a natural phenomenon. In most cases, no action is required. However, if complaints are a problem, there are actions that operators can take to resolve the problem.

As KRWA staff discuss during lagoon workshops conducted by KRWA, most lagoons have layers defined by the type of bacteria present. On the surface, aerobic bacteria primarily obtain and use oxygen produced by algae and transferred by prevailing winds. In the middle depth, there typically is a slightly clearer zone with facultative bacteria present. And on the bottom, there is an anaerobic layer where the decomposition of sludge/solids occurs in the absence of oxygen. It should be noted that this bottom layer can also produce some heat due to the anaerobic process. Typically, turnovers occur in the spring and sometimes fall when there are wide swings in temperature. For example, in the spring, daily temperatures can sometimes vary as much as 40 degrees, from a daily high in the afternoon of 75 to 80 degrees and a low at night of 40 degrees or lower. This wide swing in air temperature will warm and cool the upper layer of a lagoon. A turnover occurs when this upper layer cools sufficiently, so the sludge layer on the bottom is warmer than the surface layer. This results in the sludge layer on the bottom rising to the surface and bringing septic material that contains gases such as hydrogen sulfide, methane, etc. When this occurs, problems can result temporarily with treatment and also cause odor complaints. When turnovers occur, they are usually more intense and can last longer when a deeper sludge layer is on the bottom of the cells. And when turnovers occur, they typically affect the primary cell the most. In fact, during some turnovers, the later cells are little affected.

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So, the question is what should operators do when their lagoons flip and turn over? In most cases, no action is required. And the main reason no action is required is that in most cases turnovers rarely last for an extended period. Typically, seasonal turnovers in lagoons rarely last more than a couple of weeks until the floating solids settle again to the bottom and the aerobic and anaerobic layers are re-established. In short, the problem is corrected naturally over time. However, if the lagoon is located with homes or businesses downwind and offensive odor complaints result, several actions can be taken.

Solution No. 1: Switch to Parallel Operation

This first solution is usually very easily done, assuming all control structures are in good working order. In the case of a lagoon operating in series, change the stop plates/valves in the influent structure so that part of the influent is directed to the second cell. This takes part of the organic loading off of the primary cell, allowing it time to recover. A good rule of thumb is to transfer about 50 percent of raw flow to the second cell. If the turnover is severe and lasts longer than usual, operators might consider directing all raw flow to the second cell. However, if this is done, KDHE should be contacted and an Incident Report Form submitted since the entire primary cell is no longer in service and is being bypassed. Operators may want to also note this in their daily log as effluent quality could be adversely affected several months later. The turnover may need to be reported as a cause for exceeding permit limits in the next Discharge Monitoring Report.

Solution No. 2: Provide Supplemental Aeration

This solution can help, but typically it isn't easy to provide enough aeration to make much of a difference. However, if the system owns several pumps, those pumps can be set up and used to pump off the lagoon's surface and then spray that water back over the surface. A tractor power-take-off can be used to power the pumps. Such agitation will provide more oxygen which should help hasten recovery. EPA Manuals suggest installing floating surface aerators, but those are not usually available unless purchased. Electrical power is also necessary and most lagoons do not have power on site.

Solution No. 3: Recirculate Lagoon Effluent

Another solution to consider is recirculating lagoon effluent back to the influent box to hasten recovery. This solution should only be considered if the final cell is not also experiencing a turnover. But if the final cell still has a good, green color, the effluent should be high in dissolved oxygen and desirable green algae. Transferring that effluent back to the primary cell will help considerably if the system has a large enough pump. Keep the pump running 24 hours/day until noticeable visual improvement is observed.

Solution No. 4: Apply Sodium Nitrate

I recommend using sodium nitrate as a last resort when all other options fail and odor problems persist. Local farm supply businesses sometimes have sodium nitrate on hand. Please make sure to purchase sodium nitrate and not some other chemical as that could worsen the problems. EPA Manuals recommend initially adding 100 pounds/acre of lagoon area and then 50 pounds/acre as a second application if needed. I suggest waiting at least 5-7 days between applications to see if a second application is needed. If wastewater in the affected cell shows signs of green algae starting to appear and there are fewer odors, a second application is probably unnecessary. The best way to add

Generally, once a turnover has started, wind will blow the clumps of floating sludge to the corners of the lagoon. Wave action will eventually break up these solids and they will settle back to the bottom of the lagoon.

sodium nitrate is in the wake of a small motorboat. It helps with mixing and allows the operator to distribute the chemical throughout the lagoon cell. Using a small boat with a trolling motor should work fine. Avoid using a boat with a large outboard motor as that will only worsen matters by stirring up sludge on the bottom of the cell. Dragging a burlap bag containing the sodium nitrate behind the boat is an effective way of distributing the chemical. I suggest going north/south with half the recommended dosage and then, east/west with the rest. Sodium nitrate works effectively by providing a chemical molecule that contains oxygen that aerobic bacteria can use to grow and reproduce. It is one of the few chemicals I would ever recommend adding to a lagoon and in the cases where it has been used, it's generally effective.

Again, be sure to assess the situation should a seasonal turnover occur. In most cases, no action will be required. But should an operator be concerned about ongoing treatment or odor complaints, consider the four options offered. Also, if symptoms of a turnover are observed during times of the year other than spring or fall, the lagoon may be suffering from other, more serious problems. For example, if the lagoon turns anaerobic in the middle of summer, then such conditions are most likely caused by something other than a turnover. Please contact us if I or any other KRWA staff can assist in dealing with seasonal turnovers or other lagoon issues. We would be more than glad to provide our recommendations. I can be reached at either (913) 850-8822 or jeff@krwa.net.

Jeff Lamfers began work for KRWA in November 2008. Jeff has more than thirty years of regulatory experience in the oversight and operation of water and wastewater systems with the Kansas Department of Health and Environment. He is a graduate of the University of Kansas with a degree in Environmental Studies with an emphasis in aquatic biology.