By Charlie Schwindamann, Wastewater Tech

Problems Meeting Discharge Permit Limits

I have been assisting several cities that operate discharging lagoon treatment systems this past year. Several have had problems meeting permit limits. The Kansas Department of Health and Environment (KDHE) refers some of these systems to KRWA. KRWA's goal is to assist these systems in meeting permit limits and returning to compliance. I hope this article will provide information that will enable other systems to find and correct problems meeting permit limits before KDHE refers them to KRWA – and even more important, before EPA becomes involved and possibly fines the utility for non-compliance of permit limits.

It is important that operators have a familiarity with their discharging permits and effluent limits found in these permits. For most systems, the Biochemical Oxygen Demand (BOD) limit is 30 mg/L, and the Total Suspended Solids (TSS) limit is 80 mg/L. The BOD limit of 30 mg/L is the maximum allowed. This is because your permit also requires an 85 percent reduction of the influent BOD before discharging. This means that if the influent BOD tested is 100 mg/L, the effluent limit will be 15 mg/L.

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Low influent BOD can be due to two common causes. They are: 1) excessive I&I; and, 2) the time of day the sample is collected. The topic of reducing excessive I&I as a major issue in the treatment of waste, as well as possible sewage backups into customers' homes or businesses, has been covered in prior issues of *The Kansas Lifeline*. We'll pass on that topic in this article.

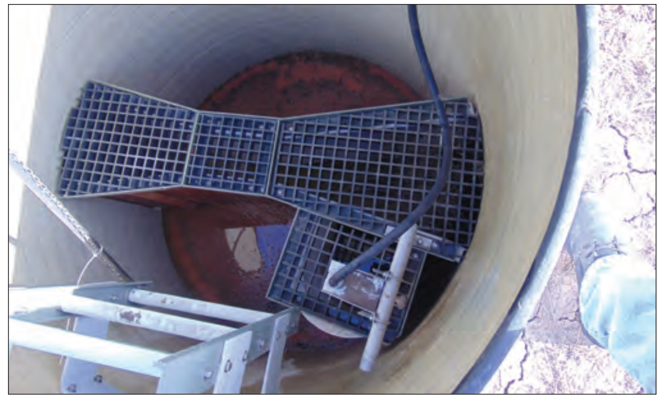
The time of day the sample is taken is a much less discussed issue. I was recently at a system where I reviewed their sample results. The influent sample was 67 mg/L. This means the effluent must be 10 mg/L or less to meet the required 85 percent reduction. This sample was collected at 7:40 A.M. due to the operator needing to drive the sample to their lab to meet holding times. Another sample taken by the same system at 1:15 P.M. resulted in an influent BOD of 160 mg/L. In this case, 85 percent of influent result would decrease the BOD effluent limit to 25 mg/l or less to meet permit limits. These two samples were taken several months apart, but I believe this shows that the time of day the sample is collected makes a difference as the strength of the influent varies over the course of the day depending on customer usage.

Wastewater entering the system in early morning hours will have a lower BOD due to most of this being either bath water or from toilet flushing. Later in the day the strength will be higher due to washing of clothes, dishes and use of garbage disposals from not only residences but also restaurants. The system mentioned here had been occasionally failing permit limits and was referred to KRWA by KDHE. I visited the system and reviewed their discharge monitoring reports (DMR), design capacity of the lagoons and flow data. All seemed to be in order as nothing showed a reason for failure as all data indicated the system was within design capacity other than the failure of discharge permit limits. I admit I did not review their lab data at first for information on when samples were

Pictured here is an influent flow meter to a lagoon. Knowing the daily flow into the treatment is very beneficial to be able to operate and ensure effluent limits are met.

collected. That matter may have also been an issue when calculating the BOD loading rate when the lagoon was originally designed. I discussed the issue with the operator and superintendent. They agreed to collect upstream and downstream samples from several customers that may be discharging high-strength BOD wastewater. The downstream results were striking. The high BOD was more than 400 mg/L which originated from three locations: 1) a nursing home at 460 mg/L; 2) a grocery store that served fried chicken at 420 mg/L; and 3) the high school at 5,000 mg/L!

I learned from an operator at another system that the high school in their community had been scraping all food waste to the garbage disposal as opposed to disposing with other solid wastes in trashcans. Consequently, all the waste food was going to the city's collection system. This is why I suggested samples be collected downstream from the school. The city also has a grade school and the BOD downstream from it was 110 mg/L. The city discussed the issue with their customers and all but one was responsive and changed how they dispose of their food waste. Samples have since been taken and are all within more reasonable limits. The biggest reduction came from the high school where results of "Non-detect" and 73 mg/L were found after in-house training of cafeteria staff on the proper disposal of the food waste and fats, oils and grease (FOG). In two subsequent quarters, the July influent BOD was 160 mg/L and TSS of 107 mg/L. The effluent for July was ND (non-detect) for BOD and TSS was 20 mg/L taken at 1:15 p.m. The October sample showed the influent BOD of 67 mg/L and TSS 100 mg/L; the effluent was BOD of 21 mg/L and TSS of 57 mg/L. Again I visited with the city and discussed the time samples were taken may have been part of the low influent BOD found in October. In the future, they plan to collect samples later in the day to get a more representative influent BOD.



This effluent flow meter was recently installed on a lagoon discharge to monitor the discharge rate of the lagoon. This installation is unique; it is also solar/ battery operated.

Short-circuiting

Another issue that causes failure of effluent limits is short-circuiting. Short-circuiting is a term used to indicate reduced detention time. This causes incomplete treatment of the wastewater. Excessive I&I is the most common cause and can be determined by use of flow meters or hour meters on lift stations. This usually requires the collection system to be evaluated by smoke testing and televising to find I&I sources and eliminate them. Sometimes on-site inspections of individual customers are also conducted to find illegal connections such as down spouts or storm sewer sump pumps connected to the sanitary sewer system.

I have also found several short-circuiting issues in lagoon treatment systems. Some were not obvious at first, but after review of blue prints and discussions with the operators we found what I consider poor original design. Changes require an engineer and KDHE's approval. Not to be critical of licensed engineers, but some of the problems are obvious to experienced operators. The problem facilities are generally older lagoons built in the late 1960's to early 1970's. We have even found some designed and built in the later 1990's with design flaws as well. These include influent pipes terminating at the center of the lagoon cell or influent pipes situated too close to the discharge pipe to the next cell.

The majority of short-circuiting I have found is due to operators not fully understanding the flow pattern of the lagoon design. Sometimes it may be the lack of performing regular inspections and maintenance of the lagoon control structures to determine if there is blockage of a pipe. Just driving up to the gate or driving around the cells is not adequate. Yes, color, wave action and depth of the cells are important, but operators also need to check the flow to make sure it is to the correct cells. There are a few lagoon systems that unfortunately do not have structures that allow the operator to make visual inspections and ensure proper flow.

The effluent is extremely clear. This is common when a lagoon is operating efficiently.

These systems have valves instead of open structures and the only way operators can determine if there is a blockage is when the water levels rises in one cell and not the others. All slide gates and valves should be operated quarterly to ensure that they will open and close when needed. Valves and slides in some systems have not been exercised since the lagoons were constructed; now the gates and vales are rusted in place and not operable. These should be repaired or replaced, as they are a necessary component needed to properly operate the treatment system.

I recently visited a system that had good structures and appeared to have good design. We reviewed the design plan. Our inspection of the lagoons determined there was short-circuiting of the flow. It was a four-cell system with all influent flow entering the first cell, then flowing to the second cell. From the second cell it flowed to the third cell, but in the third cell there was a pipe and structure that allowed flow to almost immediately flow to the discharging cell (Cell 4). All of the three cells were at the proper operating depth of five feet. Wastewater flowed to the final cell which caused short-circuiting and possible failure of permit limits. More than forty percent of the flow was bypassing the third cell. The only corrective action the operator could take was to lower the third cell three to four inches and thereby prevent bypass to the final cell. This change was made in late November and quarterly results have not yet been received by the system. It will take several months to determine if this will be successful because of the need to wait for the detention time of the cells to effect treatment. I am very optimistic that the correction the operator made will now allow the system to meet effluent permit limits in the future.

Hopefully these problems and their solutions will assist other systems in evaluating and troubleshooting their wastewater lagoon treatment systems and meeting discharge permit requirements.

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