

KDHE/KRWA Referral Program Helps Wastewater Systems Improve Effluent Quality and Achieve Compliance

This photo shows the primary cell of KDOT lagoon serving Paxico Rest Area west of Topeka. Note that duckweed blanket is so thick, it actually has other vegetation (sprouts of grass and weeds) growing in it. Also note poor color of wastewater in open area. When duckweed becomes well established, it blocks sunlight needed by algae to produce oxygen. That oxygen is then used by aerobic bacteria to breakdown incoming raw sewage. If the bacteria lack needed oxygen, they cannot provide adequate treatment which often results in offensive odors and a poor quality effluent.

In addition to helping water systems throughout the state, the Kansas Rural Water Association (KRWA) has provided technical assistance to wastewater systems for many years as well. However in early 2010, KRWA and KDHE signed an agreement allowing KRWA to begin providing such assistance under a more formal approach. Called the “KDHE/KRWA Wastewater Referral Program”, it allows KDHE to request KRWA assistance for those systems most in need.

Typically systems referred to KRWA under this contract are cities and sewer districts that are experiencing serious compliance problems. Such systems usually have a lengthy history of compliance issues and the next step could result in KDHE initiating formal enforcement action. The decision to participate and receive technical assistance is voluntary on the part of the wastewater system and is provided free of charge. The hope is that by providing a

thorough evaluation of both the collection and treatment systems, operational changes and improvements can be made to help return the system to compliance. This initiative is funded by the Clean Water State Revolving Fund (SRF). Rod Geisler, Chief of the KDHE Municipal Programs

Section, further explains the purpose of the referral initiative:

“The Kansas Department of Health and Environment is very pleased to have the Technical Assistance contract with KRWA. When KDHE identifies a facility with compliance issues, the Agency will assign KRWA to provide assistance and training to the facility staff. The assignments often include small communities with difficult and perplexing non-compliance problems, and the KRWA assistance offers

“hands on” training at the wastewater treatment facility itself to analyze and resolve the causes of non-compliance. Also, assignments include efforts to improve energy efficiency and operational cost savings.”

The decision to participate and receive technical assistance is voluntary on the part of the wastewater system and is provided free of charge.

Helping achieve compliance

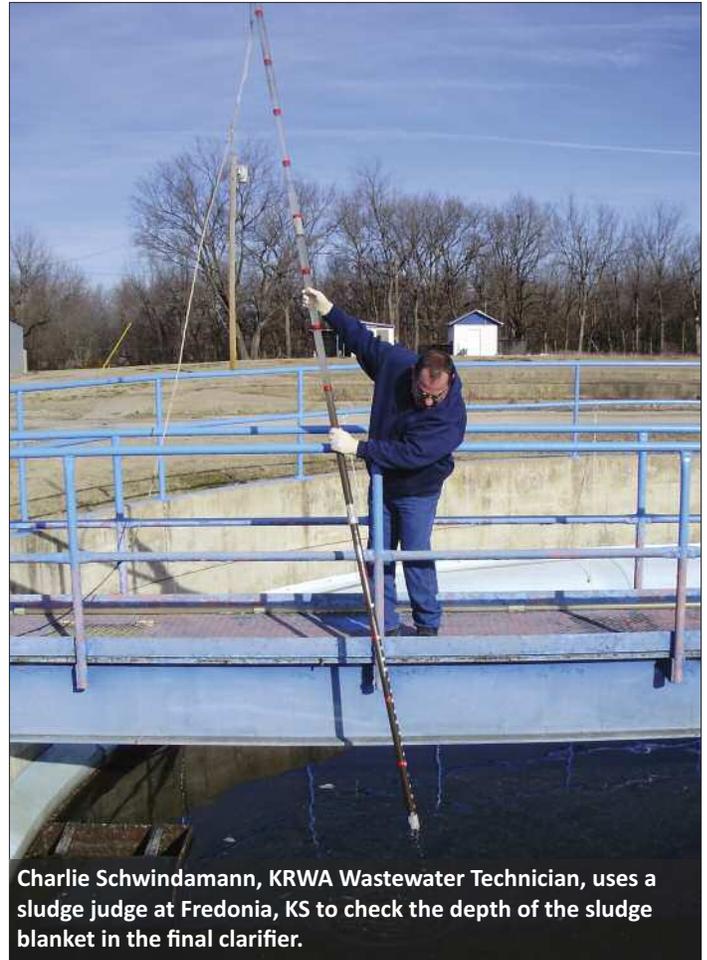
According to the work plan for the referral program, the purpose is to help systems achieve compliance with the laws, regulations, rules and their individual permits while effectively managing their wastewater infrastructure to protect the health and environment of all Kansas citizens. In order for KRWA to provide such assistance, the system must be referred by KDHE. Again, this ensures that limited funding is used efficiently and that those systems most in need receive assistance. KRWA can also advise KDHE of any wastewater systems that in their opinion, would be a good candidate for help. Criteria used to make a determination if a system is eligible for assistance include:

- Compliance status, especially with NPDES effluent limitations;
- Reduction of wet weather flows;
- Reduction in the volume of wastewater discharged;
- Watershed priority;
- Total Maximum Daily Loads (TMDL) for the watershed;
- Improvements to reduce effluent ammonia, bacteria and nutrients (nitrogen and phosphorous) in anticipation of stricter limits in the future.

Results of lagoon evaluations

To date, KDHE has referred 28 wastewater systems to KRWA for assistance. That total is divided fairly evenly between lagoons (15) and mechanical plants (13). Two of the lagoon systems (Bronson and Lebo) were referred to KRWA because of proposals for an industry or commercial establishment to relocate to town. In both cases, the new businesses would have discharged high-strength process wastewater to the city's collection systems. KRWA's role was primarily to help educate both city councils on potential outcomes should the businesses relocate and begin discharging high-strength wastewater. In both cases, there was the very real possibility of overloading their respective lagoon systems. In the case of Lebo, the city council retained a consulting engineer that confirmed the city's lagoon did not have sufficient capacity to treat such wastes and both odor and treatment problems would result.

Most of the remaining lagoon systems were referred to KRWA due to problems meeting effluent limitations. While some of the violations involved exceeding BOD and TSS limits, many were due to exceeding ammonia and/or E. coli limits. Based on KRWA



Charlie Schwindamann, KRWA Wastewater Technician, uses a sludge judge at Fredonia, KS to check the depth of the sludge blanket in the final clarifier.



JAYHAWK
SOFTWARE

UTILITY BILLING, FUND ACCOUNTING
AND MUNICIPAL COURT SOFTWARE

SOFTWARE SOLUTIONS

- Utility Billing
- Municipal Court
- Fund Accounting
- Customer Read Billing
- Website Hosting

CUSTOMER SERVICE

- On-Site Training
- Toll-Free Support
- Certified Technicians
- Online Demo Available

TIME-SAVING MODULES

- Website Payment Processing
- AMR Handheld Devices
- Cash Drawer & Receipt Printing
- Bar Code Payment Scanning

PRODUCTS

- Bill Cards, Server & PC Sales

866-800-5156 • jayhawksoftware.com • sales@jayhawksoftware.com



SERVING SMALL TO LARGE CITIES
& RWD'S SINCE 1980

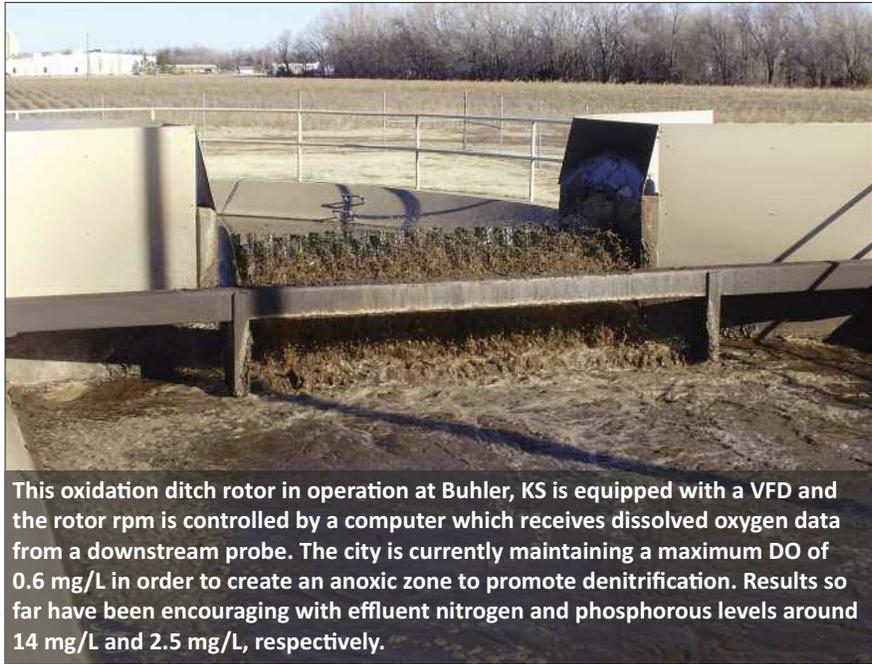
evaluations, the following issues were found to be likely causes for most of the violations:

- Excess quantities of sludge accumulating over many years and reducing original treatment capacity;
- Excessive infiltration and inflow (I&I) reducing lagoon detention time. In short, it seems that all systems have an I&I problem of some kind. The difference is in the degree of inflow. In the case of one system, most of the collection system is in a shallow, perched water table that continuously contributes excess water, especially during times of the year when they receive heavy rainfall. Flow was so high in some of the sewer mains that smoke testing was impossible;
- Short-circuiting within individual lagoon cells due to inlet and outlet structures located in close proximity;
- Allowing heavy blankets of duckweed and other aquatic plants to develop on the water surface, thereby blocking sunlight and reducing the amount of oxygen needed to provide adequate treatment.

Some operators assume control structures or valves between cells are in their proper positions to operate the lagoon in series, only to discover that was not the case. This can also happen if transfer lines between cells become totally or even partially blocked with debris. In one such system, very little flow was entering their primary cell. Consequently, detention time was greatly reduced as only two of three cells were actually in use.

Poorly designed effluent structures that do not allow drawing effluent from different depths of the final cell. If the effluent structure only allows discharging from a set depth and that point is near the water surface, the effluent will often have high TSS concentrations (and violations) due to excessive algae levels. This is typically a problem during the summer only.

Poor effluent sample collection procedures, especially if the lagoon does not discharge at a high flow rate. This can be a problem with some lagoon systems, especially during summer months. If care is not taken when collecting samples, biological growth can be scrapped off the metal weir plate and adversely affect sample results. In such cases, KRWA has recommended that a 90° V-notch be cut in the top of the plate so that effluent flows out, away from the plate. This should allow collecting samples that are more representative of normal effluent quality and do not capture any biological growth or solids off the plate.



This oxidation ditch rotor in operation at Buhler, KS is equipped with a VFD and the rotor rpm is controlled by a computer which receives dissolved oxygen data from a downstream probe. The city is currently maintaining a maximum DO of 0.6 mg/L in order to create an anoxic zone to promote denitrification. Results so far have been encouraging with effluent nitrogen and phosphorous levels around 14 mg/L and 2.5 mg/L, respectively.

Finally, the operator at Natoma discovered that the valve on a drain line drawing wastewater (and sludge) from the bottom of the final cell had failed and was wide open. This line discharged into the final cell effluent structure and allowed poor quality wastewater from the bottom of the cell to mix with and adversely affect effluent flowing over the top of the final weir. Due to the ingenuity of the operator, this drain line was plugged and effluent quality improved dramatically.

Results of mechanical plant evaluations

Other than a few minor exceptions, most mechanical plants that have been referred to KRWA have also had ammonia and E. coli violations. Most of the ammonia violations have been attributed to not hauling sufficient quantities of sludge in order to keep the mixed-liquor solids concentration within an acceptable range. Several of these mechanical plants have had 30-minute settleability test results greater than 90 percent solids. These plants also likely have solids washout and effluent violations during high flows. When sludge is routinely wasted from the process and disposed of properly, effluent violations ceased. Unfortunately, many of these plants still haul sludge as a liquid and have limited storage. Consequently there are times of the year when land application sites are not available as they are either too wet or frozen. In such cases, purchasing equipment such as a belt press to dewater sludge allows wasting during any time of the year.

The E. coli violations have almost always been due to poor UV system maintenance. This can include not cleaning UV bulbs/sleeves on a routine basis, not replacing burned out bulbs and continuing to use UV bulbs that have lost

intensity due to surpassing the maximum hours in service recommended by the bulb manufacturer. Average lamp life ranges from 9,000-14,000 hours. Some of the systems exceeding their E. coli limit were still using bulbs with over 20,000 hours of operation.

Finally, KRWA has also been requested by KDHE to assist several cities that have oxidation ditches with reducing total nitrogen and phosphorous in their effluent. While none of these systems presently have effluent limits for nitrogen or phosphorous, they likely will at some point in the future. KRWA's goal is to see if these plants can be operated at lower dissolved oxygen concentrations in order to create an anoxic zone that allows for better nutrient removal. Presently, KRWA is assisting Edgerton, Buhler, Clay Center and Fredonia in this area. Equipment needed to effectively lower nutrient concentrations include DO probes and VFD's on the rotors. Computerized controls use information from the DO probes to adjust the rotor rpm so that the desired DO concentration can be consistently maintained in the oxidation ditch. Surprisingly, best results occur when the DO level is maintained at a maximum of 0.5-1.0 mg/L. That is usually sufficient to provide for adequate nitrification (conversion of ammonia to nitrate) but not too high to inhibit denitrification (conversion of nitrate to gaseous nitrogen oxide). These systems must monitor ammonia several times each week to ensure that DO levels do not drop too low, resulting in higher effluent ammonia levels. One benefit of an oxidation ditch operated in this manner is that usually only one rotor is used and it also usually operates at a much lower rpm than in the past. Consequently, there is a saving in electrical costs in addition to improving effluent quality.

The real purpose of this article is to assist all wastewater systems that may have potential compliance problems. Systems currently experiencing effluent violations are encouraged to review the causes previously identified in this article to see if any may apply to their situation. I encourage such systems to conduct their own evaluation to hopefully determine the cause of poor effluent quality. KRWA is also available to smoke test collection systems or measure sludge depths in lagoons. Since funding for the

The real purpose of this article is to assist all wastewater systems that may have potential compliance problems. Systems currently experiencing effluent violations are encouraged to review the causes previously identified in this article to see if any may apply to their situation.

KDHE/KRWA Referral Program is limited, some systems needing assistance may not be placed on the referral list. But by reviewing the causes and solutions used by other systems with similar problems, systems may be able to solve problems without additional assistance. Anyone wanting to discuss specific problems in more detail is encouraged to contact me. I can be reached by email at jeff@krwa.net or by phone at (913) 850-8822. If you believe your system is a serious candidate for assistance under this program, I suggest calling either Rod Geisler or

Shelly Shores-Miller with KDHE, Topeka or your KDHE District Office.

I also encourage everyone to check out the numerous sessions at the upcoming KRWA conference. There are several sessions that address wastewater issues.

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.



CENTRAL TANK COATINGS, INC.

"General Water Tower Maintenance"

Kelly Koehn, Owner
19736 Cable Ave.
Elgin, Iowa 52141-8134

877.530.6226 Toll Free
563.426.5967 Office
563.380.2647 Cell
563.426.5641 Fax

- Crews available for winter emergencies
- Sandblasting
- Painting
- Roofs, pipes, jackets
- Video inspections
- Annual maintenance contracts available
- Over 30 years experience

