

Smoke Testing - The First Step to Correcting I & I Problems



The city of Nortonville, KS provided addresses to their lift stations. Having an address can be important in cases of emergencies to provide responders a physical address such as “the lift station at 810 Main” rather than to say “a lift station in north end of town.”

Since I began working for the Kansas Rural Water in the fall of 1999, KRWA has conducted smoke testing of 137 wastewater systems. On those projects, we have identified 6,265 Inflow and Infiltration (I&I) problems. The problems found since late 1999 include: 590 manholes, 649 main lines, 378 where smoke entered a structure, 1,692 clean outs, 2,294 service lines and 662 other problems that include commercial building roof drains, storm sewers and down spouts connected to the sanitary sewer.

I think it’s a bit ironic that 3,986 or 63 percent of these problems are caused by private owners. Corrections of problems on private property can be the most difficult for a wastewater utility to address. Several systems have used incentives such as paying a portion of the cost for correcting the problems. For example, some systems pay up to 50 percent of the corrections, to a “not to exceed amount”; some wastewater utilities even pay the full bill up to a certain dollar amount.

Infiltration and Inflow costs

Infiltration and inflow (I & I) problems have several effects that can cause problems for a wastewater system. The most recognizable is the sanitary sewer overflows (SSO’s) from manholes, lift stations, broken pipes and into homes, mostly in basements. The other is that too much I&I, which exceeds designed daily flow, can cause a

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wastewater treatment facility to “washout” sending under-treated wastewater to the receiving stream which can result in exceeding permit limits and polluting streams where fishing and swimming occur. If these washouts occur frequently, they can lead to the system receiving an Administrative Order from KDHE to correct the problems in order to return to compliance with discharge limits. These orders usually include a timetable for correcting all problems.

To reduce the chance of your system receiving an Administrative Order, I highly recommend if you have wash outs or excess I&I you do what all should do, find the problem and spend the money to correct it.

When a system requests smoke testing, I always hope they will be progressive and use the information to correct the problems that are identified. Correcting the problems requires a commitment of the entire city organization – from staff to the governing body. Smoke testing has no benefit if the council will not finance the repairs. Many of the problems identified in a smoke testing can be corrected with local staff. Certainly not all problems need to be corrected immediately. Therefore, the best approach is to prioritize the repairs so they can be budgeted for over several years and to also achieve the “biggest bang for the buck”. To correct the most significant sources of I & I first, a plan of action should be written so in case a new council member is elected, then that person will understand why the

corrections are being made in a certain order. I can assist with creating such a plan for systems if needed. For example, the plan may include manhole rehabilitation of 10 percent of the manholes every year until completed. It should include repairing or replacing mains that are defective. Such work should involve televising of lines, including routine cleaning of one-third of the system per year. For a small system, budgeting several thousand dollars a year is much less troublesome than receiving an administrative order from the regulatory agency to correct all the problems within a short time. When a system receives an administrative order, engineers are required to evaluate the project and to design improvements. Many systems have personnel who have been employed for several years and have a great working knowledge of the trouble areas; those individuals should be requested to offer suggestions for the corrections. It would be best to develop a corrective action plan using employees' knowledge before receiving an administrative order. While it may sound to utility staff like I am preaching to the choir, I hope this article will open some eyes of the board and council members to become proactive in sanitary sewer collection system repair and maintenance.

KRWA has a form for private property sewer inspections that includes looking for storm sewer sump pumps, area way and floor drains, and downspouts from roof gutters, to name a few. As I have mentioned many times at training sessions, a 1/3 HP sump pump can pump 2,200 gallons per hour of run time. Although this small amount doesn't sound like a lot, if multiplied by 10 or 20, it's a very significant amount of storm water entering the sanitary sewer collection system.

The example ordinance from Hiawatha authorizes the inspection of all structures for sale in the city. If a fault is found, no occupancy is allowed until the fault is corrected. This is a proactive ordinance that has already provided positive results; I suggest that other systems consider adopting a similar ordinance. According to Dave Grimm, Hiawatha Wastewater Superintendent, in the short time the ordinance has been in effect, the city has found that approximately 25 percent of those homes and buildings inspected have a storm sewer sump pump connected to the sanitary sewer. With 1,500 customers, this means that the city has nearly 375 homes with sump pumps. Even conservatively figuring 10 percent, or 150 homes, at 2,200 gallons per hour would add 330,000 gallons of extra

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storm water to the system in the one hour of run time for these sump pumps. The 330,000 gallons is about the city's average dry weather daily flow. It is easy to realize that the sump pumps can double the daily flow into the system with just one hour of run time. Again, that amount does not include other infiltration due to other system problems.



Randy Johnson of Bluff's Edge Environmental Services provided the instruction for two activated sludge and nutrient removal training sessions sponsored by KRWA in November 2009 in Lawrence and Manhattan. The classes were well attended with more than 50 operators participating.



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Until December 2006, Hiawatha operated two wastewater treatment plants. One was for the north side of town and the other for the south side. The treatment was consolidated to the south plant and the old north plant is now a pump station with a bar screen. KRWA smoke tested part of the system several years ago for the south plant area and will smoke test some other areas of the north plant lift station system when weather permits.

The City of Hiawatha has adopted an ordinance that states in part:

(c) INSPECTIONS. All residential housing and/or commercial building, which is connected to the sanitary sewer of the City of Hiawatha, Kansas can be inspected by the City of Hiawatha Sanitary Officer or his duly authorized representative. Each residential housing or commercial building shall be inspected for ground or surface water before the property or properties are sold to another individual, private party, company, person, persons, or transfer property from one owner to another owner. Such property shall not be grandfathered to disallow an inspection. In the event any sanitary sewer line in any residential or commercial property is found to be in violation of Section 15-323, the sewer line must be repaired in compliance with the recommendation of the City of Hiawatha Sanitary Officer or his authorized agent to allow no groundwater or surface water to enter into the sanitary sewer system, which repair will be paid by the owner of said property. The property shall not be occupied by a new owner until the sanitary sewer line violation has been corrected to the specifications of the City of Hiawatha Sanitary Officer or his authorized agent.



This brick manhole shows signs of deterioration which allows infiltration of surface water.

Surveying prior projects

KRWA recently sent a survey to 24 wastewater systems, or 17 percent of those 137 smoke-tested since August 1999. The purpose was to determine how those communities have progressed in correcting the problems that were identified. The letter was sent to systems that were smoke tested in 2002, 2004 and 2006. Seven systems replied. I know that repairs were made in two other systems.

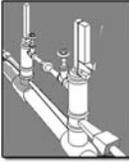
Four of these 24 systems are very progressive; they have or are in the process of making major sewer line improvements. These include main line repairs and replacements and manhole rehabilitations to the tune of millions of dollars by each system. One of the four has a large combined sewer system; that city will be working to separate the storm sewer from the sanitary sewer system in the next couple of years. The other three cities have taken major strides in correcting many of their I & I problems.

The remaining systems also have corrected many problems. As I suggested earlier in this article, they each have developed a program to correct several problems annually within a budgeted amount. For smaller towns that expenditure is generally in the range of \$5,000 annually; in the larger towns, the amount is \$35,000 or more per year.

Congratulations to each of these systems for their efforts to protect the health and environment of their cities and the state by working to stop sanitary sewer overflows.

KRWA has 25 systems on its smoke-testing list. Several of these are carried over from 2008 because above-normal precipitation in 2009 was not conducive to conducting smoke testing. KRWA plans to be aggressive on these projects once the ground dries this spring and summer. With luck, we can get these systems completed and more

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Fred Weins (plaid Jacket) and Tony Wedel of city of Moundridge set up a demonstration camera from Key Equipment to try to find cause of odor entering a residence. The city now owns a similar camera with 400 feet of cable and is equipped with a locator beacon to locate the head of cable; it can be used with the city's existing locator. In this case, the problem was failed glue joints on a vent pipe from an upstairs bathroom.

repairs can be made. If it's dry this coming year, I expect to be catching up on these as some are for engineering analysis for failure of compliance to meet permit limits.

2010 conference

I also encourage readers to attend the 2010 KRWA conference that offers numerous sessions addressing wastewater utilities. These include the full-day pre-conference session, "Wastewater Collection Systems and Managing Infiltration and Inflow" on Tuesday, 3/30. Concurrent sessions on Wednesday and Thursday, 3/31 and 4/1 include:

- ◆ Waste Stabilization Ponds: Theory Of Operation
- ◆ Wastewater System Regulatory Update By KDHE
- ◆ Water, Wastewater Sample Collection Procedures
- ◆ Activated Sludge – Apply The M & M Principle
- ◆ Solutions To Biosolids Dewatering
- ◆ Troubleshooting Pumps And Maintenance Issues
- ◆ Vacuum Prime Pump Stations
- ◆ Water And Wastewater Management

Charlie Schwindamann has been Wastewater Tech at KRWA since September 1999. Charlie holds Class II Water and Class I Wastewater Operator certification. He is a member of the Marysville, KS City Council.



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