



Familiarity with the collection system helps projects go smooth. City staff Tom Osterhaus, Charlie Schwindamann of KRWA and Tim Heinen made good time on a recent project at Seneca.

Smoke Testing Is a Starting Point to Correcting Collection System Issues

The most efficient way to locate places where extraneous water can enter a sanitary sewer system is through a process known as smoke testing. Smoke testing is a relatively simple process that consists of blowing smoke mixed with large volumes of air into the sanitary sewer line. The smoke is usually introduced into the system at a manhole. The smoke will find the path of least resistance. It will emit at locations that likely are allowing surface water to enter the system.

Smoke will identify broken manholes, illegal connections including roof drains, yard drains, uncapped lines and even will show cracked mains and laterals, providing there is a passageway for the smoke to travel to the surface. But smoke testing will not find all inflow and infiltration (I&I) issues, but will generally find a high percentage of them. This article provides some information about the smoke testing process.

KRWA responds to requests for smoke testing. The utility provides a copy of the collection system map. Meetings are held with the operator or others from the community to discuss the collection system and problems they are aware of. Next, manholes are selected for the locations to cover the entire system or area desired to be tested. The utility will need to notify customers that the project will be conducted at least a week prior to the testing. Sample notices are provided by KRWA. Door hangars that advise citizens of the smoke testing are also available. The door hangars are usually placed on properties a day or two before the smoke test. The most frequent complaint is that the customers were not notified. If notices are placed in the local paper, posted in other public locations or on radio and TV, there's not much more than can be done. One system even used the local emergency preparedness system



The smoke blower needs to set as flush as possible on the manhole to ensure no smoke escapes. Smoke is created by special oil dripping onto the engine muffler.

KRWA uses liquid smoke that drips onto the muffler of the engine and then the blower forces the smoke into manhole.

such as reverse 911 where the local emergency preparedness director sends out text messages emails or phone calls.

Smoke testing is usually done by placing a blower on a manhole to induce smoke. KRWA uses liquid smoke that drips onto the muffler of the engine and then the blower forces the smoke into the manhole. The smoke will usually travel at least two blocks in each direction, and even further if there are not many connections. The smoke will not go far if there are sags or blockages that restrict the smoke from moving through the collection system. It is important to have a good seal between the blower and manhole to push smoke into the system. A gallon of oil will cover approximately 200 connections depending on the number of problems found. The time required is usually about two hours per 200 connections. KRWA charges \$90 per gallon for the oil and use of the blower. KRWA does not charge for labor as the labor is funded by USDA Rural Development through the Wastewater Tech Assistance contract.

Where's the smoke coming from?

Smoke can enter homes that have dry traps or faulty plumbing. The smoke KRWA uses is non-toxic, but still might affect people with breathing disorders. Notices of the project state that those with breathing disorders should leave the premises if smoke enters the building. We have even smoke tested to find places with sewer smells in buildings and found plumbing open in the walls, dry traps and in one case, broken pipes in the ductwork of a church

It requires four people to efficiently smoke test; that is one KRWA staff member and three others. Smaller communities can be completed with just two people; one KRWA staff member and one from the system. It is sometimes desirable to have one more person to stand by the smoker to keep the equipment operating. As sections are completed a map is highlighted to indicate completion of an area to not miss others. The smoker is placed on the manhole and we divide into two groups and walk the collection system looking for the smoke. If the collection system is in the alley that is where we walk as the service will connect to the mains without going from the front to the back to connect in most cases. The



Brian Rusche, City Superintendent at Seneca and KRWA Wastewater Tech Charlie Schwindamann, review the map of sections completed and mark others to ensure desired areas are tested.

smoke then escapes from broken or cracked pipes, broken or damaged connections, roof vents and manholes. Smoke has been found coming from places you would not think smoke should come from such as barriers around gas meters and on playgrounds. We walk only a couple blocks each direction in most cases depending on connections. Then the smoker is moved to the next manhole location.



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WW tech Charlie Schwindammann records a service line problem so the property owner can be notified of the issue.

A fiber optic phone casing intersected this sewer line. Smoke did not appear due to the heavy clay soil; the phone company paid for all the repairs and were on site during the repairs.



KRWA records the project with a camcorder to document the problems. The audio also provides locations and gives an idea of the distance involved. An example might be “John Smith’s house on Oak Street, appears to be service line leak; 25 feet from Oak Street and 15 feet north of alley”. A written report is also provided that identifies the problem and street address. The issue we have at times is that we get too close to the problem and don’t get a good scan of the area around the problem. We like to stay in the street or alley and record the problem then zoom in a closer then zoom back out to provide the best idea of where the problem is.

If the soil is clay-type around the pipe, smoke testing will only find issues near surface such as service laterals. Also excessive rain such as many locations in Kansas experienced in 2016 makes the ground too wet to allow smoke to escape. So with this in mind it usually needs to be dry and the subsoil needs to be dry as well to smoke test. We can smoke test when it is wet if the problem is large such as inflow issues from a storm sewer catch basin drain or downspouts. Smoke testing will not find storm sewer sump pumps in homes as they usually have a check valve. The only way to find storm sewer sump pumps that are connected to the sanitary sewer system is to perform a property inspection of customers.

Making it efficient

A lot of time can be saved if the system can narrow the problem to a specific area. This requires checking lift stations and only those collection system areas with significant increases at lift stations during rain events. Or an area where several homes had backups during rain event. Again, a map is needed to

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During dry weather, problems in ditches such as under this box culvert are easier to locate.

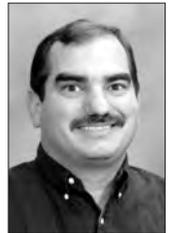
have been identified. I have always been a believer that before a utility asks its customers to fix their problems, the system should repair its problems first. Systems should at least have a plan to repair the system's issues such as pipe lining or manhole rehabilitation before requesting or requiring customers to make repairs.

If you would like to purchase/rent/borrow smoke testing equipment, I can train personnel to perform the smoke test. That way it can be conducted when the system's crews have time. The smoke testing equipment can be purchased by most supply companies including USA BlueBook. The camcorders are basic units that can be purchased at retail electronic suppliers. In the meantime, if your system has I&I issues or have other questions about wastewater collection systems, send an email to me at charlie@krwa.net or call me at 785.799.6105.

decide where to set up. These are usually larger systems that have multiple lift stations, but also a few smaller systems have at least two lift stations. Regular recording of the hours or flow from each lift station will provide valuable information about where the issues may be.

When the smoke testing is completed, KRWA provides two DVDs and a written report that detail the problems found. Then it is up to the utility to correct the problems that

Charlie Schwindamann has been Wastewater Tech at KRWA since September 1999. Charlie holds Class II Water and Class I Wastewater Operator certification.



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