

## Paradise via Nebraska

*by Jim Heyen, Wastewater Technician*

ALOHA! With all the rain, I feel we should be living on a tropical island. I find myself almost longing for the traditional Nebraska dry summers of yester year. At least with all the rain, I do not have to help Deb water the numerous flower beds in our yard!

The rain is great for the farmers of our state but can cause havoc on older sewer systems. A few years back, I read an article published in one of the State Rural Water Association magazines and thought I would share it with my readers once again.

### The Benefits of Smoke Testing a Collection System

Smoke testing is one of the most efficient and most cost-effective ways to locate and identify the source of an inflow or infiltration problem. It is important to find and identify these sources because they may seriously affect the efficiency of the wastewater treatment facility and increase operating expenses. Some examples of the impact that inflow and infiltration may cause are:

- Pump station handling large volumes of unnecessary water
- Hydraulic overloads that greatly reduce system efficiency
- Increased operating expenses due to the processing of ground water and storm water that do not require treatment
- Unnecessary equipment wear
- Increases collection system maintenance and cleaning

There are a few factors to consider when deciding if implementing a smoke testing program will be beneficial to your facility. For example, what ages and types of materials are used in the collection system? Many sanitary systems are 50 to 100 years old and are constructed of out-dated materials. Over time, decay and roots cause breaks in the lines that will permit excessive infiltration during wet periods.

The presence of undesired connections such as basement and yard drains, catch basins, cross connections from storm sewers, foundation drains, and roof downspouts will cause elevated flows every time it rains. The easiest way to tell if this exists in your collection system is to have a look at the plant's influent flow meter.

Smoke testing is a very quick and easy way to determine if buildings are properly connected to your system. Smoke should exit the vent stakes of the surrounding properties within the testing area. If traces of the smoke or its odor enter the building, it is an indication that gases from the sewer system may also be entering. Smoke that enters a building can cause panic and stress to an unsuspecting individual. This will require some good public relations skills and allow for an opportunity to stress the importance of correcting the problem. Remind citizens that the smoke entering their building is their friend. If smoke is entering their home or business, DANGEROUS

gases could be entering as well. The smoke that is manufactured specifically for testing is not dangerous or toxic, leaves no residuals or stains, and has no effects on plants or animals. It has a distinctive, but not unpleasant, odor. The visible smoke and odor will last for only a few minutes if there is adequate ventilation. **SEWER GASES ARE DANGEROUS!** A few of these gases have no odor and present the most serious problem because they can enter a building undetected. These gases can cause anything from minor illness to death. Identifying and correcting the source of any smoke entering a building is urgently advised.

In the end, if the situation is handled properly, the property owner is usually grateful for the assistance and information that you provide.

Smoke testing can also be very useful in locating “lost” manholes. Although collection systems can cost millions of dollars, they are often the first thing to be neglected when there is a decrease in funding and staffing levels because they are out of sight and out of mind until a problem occurs.

#### **POSSIBLE CAUSES FOR SMOKE ENTERING A BUILDING:**

- The vents connected to the building’s sewer lateral are inadequate, defective, or improperly installed.
- The traps under sinks, tubs, basins, showers, floor drains, etc. are dry, defective, improperly installed, or missing.
- The pipes, connections, and the seals of the building’s sewer system are damaged, defective, have plugs missing, or are improperly installed.

In my opinion, the biggest benefit of conducting a smoke testing program is the high visibility and learning opportunities for the staff as they go into the collection system for a few days.

The public, in general, has a preconceived notion that wastewater plant operators don’t do much. Make sure to seize the opportunities that arise while conducting this testing to explain what you are doing. You will be surprised at how grateful they are! Staff will also be provided a great chance to familiarize themselves with the design, function, location, and the condition of the collection system, which they seldom get the chance to see.

#### **HOW DOES SMOKE TESTING WORK?**

Smoke testing is conducted by placing a blower over a centrally-located manhole and forcing non-toxic, smoke-filled air through a sewer line. Depending on the equipment being used, the smoke will be generated by lighting a smoke bomb or utilizing liquid smoke. Using liquid will generally cut your labor costs. The smoke under pressure will fill the main line and any connections. It then follows the path of the leak to the ground surface, quickly revealing the source of inflow and infiltration. Only enough force to overcome atmospheric pressure is required.

After placing the blower and filling the lines with smoke, staff must perform a visual inspection of the area being tested. When using liquid smoke, you control the time you want it to run. Typically, you will let the smoke run until the crew has had ample time to do a thorough inspection. The field crew should include a minimum of two people.

Check all connected lines, including abandoned and supposedly disconnected service lines. Do not rush, because minor leaks can easily be overlooked. It is important to carefully check around houses, with close attention given to cleanouts and roof leaders. It is not uncommon to see smoke coming out of the grass, wooded area, or cracks in the pavement. If smoke is found during the inspection, it must be carefully recorded so that it can be corrected after testing. Cameras make the job easier. A picture will help you relocate the problem after testing so that you can take corrective measures. It is also proof that the leak was found.

Blocking off a sewer line should not be necessary except when isolation is important. As long as openings exist for the smoke to follow, smoke tests are effective, regardless the surface type, soil type and the depth of the lines.

The best results are obtained when the water tables are low and the days are dry because water is an excellent vapor barrier. Smoke testing should also be avoided on windy days because even a very light breeze can disperse a wisp of smoke before it is visible at the source of a leak.

## **PREPARING TO SMOKE TEST**

Smoke testing may involve many hours of labor. It has the potential to affect the occupants of all buildings connected to the collection system, disrupt traffic, and cause people to summon Emergency Personnel; therefore, advance preparation is essential to a successful smoke testing program.

You should obtain a comprehensive map with street names, addresses, and the overall picture of the area to be tested. This map will show where the manholes are and which direction the lines flow. It will also show where there are force mains, storm drains, and any other items of importance. This is an excellent map on which to include your notes. Good notes will prevent delays on the job. Manholes to be used for blower placement should be predetermined and accessed prior to commencing the test. This will save a tremendous amount of time. When choosing the manholes to use, always try to avoid busy intersections because creating a detour or closing an intersection will upset some drivers, causing dangerous situations.

## **NOTIFICATION PROCEDURES**

Obtain a list of all property owners in the surrounding area of the vicinity that you have chosen to test. The people who do the billing are usually very helpful. Approximately two weeks before starting the test date, you must send the property owners a notification

letter that includes all information that is pertinent to the homeowner. This letter should be similar to the following:

*Dear Resident:*

*The Water Pollution Control Facility (WPCF) anticipates conducting four days of leak tests in the sanitary sewer system beginning DATE. A non-toxic smoke will be blown into the system to reveal leaks that allow stormwater and other surface waters to enter. Locating and correcting these leaks will conserve expensive capacity at the treatment facility. A video record of leaks will be made.*

*The smoke manufactured specifically for this purpose, leaves no residuals or stains, and has no effects on plants or animals. It has a distinctive, but not unpleasant odor. The visible smoke and odor last only a few minutes if there is adequate ventilation.*

*The smoke should not enter your home; if this does occur, any of the following could be the cause:*

- The vents connected to your buildings sewer lateral are inadequate, defective, or improperly installed.*
- The traps under sinks, tubs, basins, showers, floor drains, etc. are dry, defective, improperly installed or missing.*
- The pipes, connections, and seals of the building's system are damaged, defective, have plugs missing, or are improperly installed.*

*During the week prior to DATE, pour water down ALL drains in your home or building to ensure that traps are full.*

*If traces of the smoke or its odor enter your house or building, it is an indication that odor from the sewer system may also be entering. This can be unpleasant, dangerous, and a potential health hazard. The location, identification, and correction of the source of any smoke entering your house are urgently advised.*

*The WPCF can provide assistance in locating the source of smoke entering your house; however, correction of any defects in the pipes and sewer on private property is the responsibility of the owner. If smoke is observed in your home and the source is not readily identified, or if you have any questions, please call PHONE NUMBER.*

*Sincerely,  
Superintendent*

A news release and smoke testing CAUTION LETTER should be sent out to the media and other officials to let them know your plans. This is usually done one week in advance. The news release should include the days and exact locations, why you are doing the test, and where they can expect to see smoke. List your phone number for

questions. Remember that this is just a reminder. Your notification letter should have covered all of the necessary details. The reminder should be similar to the following example:

**“SMOKE TESTING OF THE SANITARY SEWER SYSTEM”**

*The Water Pollution Control Facility inspection crew will be conducting a survey of the sanitary sewer system. The survey will involve opening manholes in the streets and easements. A non-toxic smoke will be blown into the sewer mains to locate breaks and defects in the sewer system. The smoke that may be seen coming from vent stacks on buildings or holes in the ground is **non-toxic, harmless, and creates no fire hazard**. The smoke should not enter your home, unless the plumbing is defective or drain traps have dried up. If you have any seldom-used drains, pour water into the drain to fill trap.*

*If smoke should enter your home or building, corrections of the defects on private property are the responsibility of the owner. A licensed plumber should be consulted to ensure the corrections are properly made. If smoke is observed, you may contact a member of the survey crew working in your area. They will be pleased to assist you in identifying the source of the smoke.*

*Some sewer mains and manholes may cross property line easements or other rights of way. Whenever these lines require investigation, the crew will need access to the sewer mains and manholes. Clearing of some easements to facilitate access may be performed prior to the survey.*

*Video records or photographs are to be made of leaks that are found. The survey should begin on DATE and require four days for fieldwork. If you have questions or observe smoke in your home, please call PHONE NUMBER.*

Advance notification allows anybody with special requirements, such as health concerns, enough time to inform you of their situation so that necessary arrangements can be made. Don't forget to include any concerns with your notes.

**COMMENCING THE SMOKE TESTING**

Before beginning each day of the smoke testing, be sure to call Dispatch and/or Fire Department to inform them. They also need to be informed when you are finished for the day. Even with all of your preparation, you will undoubtedly get a panic call sooner or later. The emergency personnel in your area need to be aware of this so they can tell a panic call from a real emergency.

A truck that has been stocked with all the necessary equipment and materials prior to the morning of the project will once again save valuable time in the field.

## **CONCLUDING A SMOKE TEST**

All of the notes, pictures, and findings accumulated in the field should be put into a comprehensive report summarizing the smoke testing work.

Send a letter to all property owners who need to do repair work. Be sure to cite the rule or sewer use ordinance that is being violated. Give them all the information they need to do the repairs, such as permits required, repair methods, and a phone number that they may use to obtain any further information. Be sure to set a time limit and always do a follow-up inspection.

*This article has been compiled with information obtained from Hurco Technologies, Inc., Town of Simsbury WPCF, and various short articles written by State Rural Water Association Wastewater Technicians.*

If your village or city is experiencing any of the problems discussed in the above article and are interested in scheduling a smoke test, please contact our office or myself to arrange an appointment at (402) 480-8524.