

# SMOKE TESTING A COLLECTION SYSTEM

By David Branham

It is important to find and identify Infiltration and Inflow (I&I) in your system and address these problem areas of your collection system, as they may be seriously affecting the efficiency of your wastewater facility and increase operating expenses. Smoke testing is one of the most efficient and cost effective ways to locate and identify the source of an I&I problem.

Some examples of the impact that I&I may cause are as follows:

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

If you are considering implementing a smoke testing program, there are a few factors to consider if the testing is to be beneficial to your facility. What is the age and type of materials used in the collection system, remember that many sanitary systems are 50 to 100 years old; and thus, these systems will be constructed of outdated material. Over time, decay and roots cause breaks in the lines that will permit excessive infiltration during wet periods and these are exactly the areas you are looking for.

Another point to look for is the presence of undesired connections such as basement and yard drains, catch basins and roof drains; remember that it was a common practice to hook these drains into the sanitary sewer during the previous mid-century. Also, another important source to look for is cross connections from storm sewers and foundation drains. 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 stacks of the surrounding properties within the testing area. If traces of smoke or its odor enter the building, it is an indication that gases from the sewer system may also be entering. In order to offset any panic and stress that may happen if smoke enters the premises will require some good public relations skills. Remember that this is an excellent time for the opportunity to stress the importance of correcting the problem. It is also an opportune time to remind them that sewer gas is very **dangerous and has been known to cause anything from minor illness to death.** If the resulting smoke is making its way into the building then sewer gases may also be present. Identifying and correction of the source of any smoke entering a building is urgently advised. Remember to inform the customers that the smoke is manufactured specifically for testing, is not dangerous or toxic, leaves no residuals or stains, and has no effects on plants or animals. The smoke has a distinctive, but not unpleasant odor and only lasts for a few minutes where there is adequate ventilation.

Some possible causes for this smoke entering a building are:

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

When all is said and done, if the situation is handled properly, the property owner is usually grateful for the assistance and information that you provide.

Other areas that smoke testing has been proven to be invaluable is in the identification of underground breaks and fractures in the sewer line, as well as helping locate and identify possible storm sewer connections, and last but not least the testing may help you locate and find "lost" manholes. Of

course I understand that never happens in your system, right?

### **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. Smoke will be generated by lighting a smoke bomb or utilizing liquid smoke. The smoke under pressure will fill the main line plus any connections; then follows the path of the leak to the ground surface quickly revealing the source of I&I. Only enough force to overcome atmospheric pressure is required.

After placing the blower and filling the lines with smoke, staff will have to perform a visual inspection of the area being tested. A field crew should consist of no fewer than two people and I recommend four or more people. You should check all connected lines, including abandoned and supposedly disconnected service lines, remember don't rush because minor leaks can be easily overlooked. It is important to carefully check around houses with close attention given to cleanouts and roof leaders and down-spouts. It is not uncommon to see smoke coming out of the grass, wooded areas, or cracks in the pavement. If smoke is found in these areas during the inspection it must be carefully recorded so that it can be corrected. Be sure to take pictures as it can help relocate the problem so you can take corrective measures. It will also be proof of the leak found.

Blocking off the 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 of surface type, soil type, and depth of lines.

Best results are obtained when the water tables are low and on dry days 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 the leak.

### **Preparing to Smoke Test**

Smoke testing may involve many hours of labor, has the potential to affect the occupants of all the buildings connected to the collection system, disrupt traffic, and cause people to summon

emergency personnel. Advance preparation is essential to a successful smoke testing program. It is very important that you determine what areas of the collection system you would like to test and choose a reasonable period of time that you can devote enough staff to perform the job correctly.

You should obtain a comprehensive map with street names, addresses and the overall picture of the area to be tested. This map should show you where the manholes are as well as direction of the line flow. Ideally it will show any force mains, storm drains, and any other items of importance. This map will be an excellent reference to put your notes on, and remember, good notes will prevent delays on the job. Manholes to be used for the blower placement should be predetermined and accessed prior to commencing the test. 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**

Get a list of all the property owners that are in the surrounding area of the vicinity that you have chosen to test. You must send the homeowner or the occupant of said building a notification letter approximately two weeks in advance of the starting test date that includes all pertinent information to the homeowner.

**This letter should be similar to the following sample:**

Dear Resident:

*The Public Works Crew will be conducting a four day leak test of the sanitary sewer system, beginning, **Date**. 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 the trap.*

*If smoke should enter your home or building, correction of defects on private property is 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 help you identify the source of the smoke.*

*Some sewer mains and manholes may cross property lines 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 of fieldwork. If you have any questions or observe smoke in your home please call PHONE NUMBER.*

*Advanced 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.*

## **Commencing the Smoke Testing**

Before commencing work each day and every day of the smoke testing, be sure to call dispatch and/or the Fire Department to inform them and they also need to be informed when you are done for the day. Even with all 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 sort out a panic call from a real emergency.

## **Concluding a Smoke Test**

All of the notes, pictures and findings that are 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 and include the rule or sewer use ordinance that they are in violation of. Give them all the information they need to do the repairs such as permits required, repair methods and phone numbers that they may use to obtain any further information. Be sure to set a time limit and always do a follow up in section.

*This article has been compiled by David Branham with information obtained from various*