The Problem with Septic Systems

Shallow trenches and lightweight PVC pipe make AIRVAC installations faster and safer.

Many Cities Turn to Vacuum Technology as a Cost-effective Solution

By Steve Gibbs

Everyone wants clean water. You don't have to be a committed environmentalist to realize that we must protect our waterways. However, every day millions of Americans contribute to the contamination of our water, and they may not realize it.

According to the Environmental Protection Agency (EPA), about one in five housing units in this country – approximately 26 million homes and apartments – are served by soil-based septic systems. While septic tanks are fine for the treatment of sewage on a limited basis, they are problematic when there is a large concentration of them in heavily populated areas, especially if those areas have sensitive environmental issues or high groundwater tables.

There's a reason why so many communities rely on septic tanks for sewage treatment; modern collection and treatment systems are very expensive and disruptive to install. Public works officials are faced with the difficult task of finding an efficient, cost-effective way to eliminate this potentially damaging source of pollution, an effort often mandated by state or local government.

In recent years many municipalities and public works districts have turned to AIRVAC vacuum sewer technology to solve this problem. In the right application, vacuum sewers have proven to be easier to install and less expensive that other collection system alternatives. They don't leak so they protect the environment, and they are easy to maintain and last for decades. When you examine the benefits of vacuum sewer technology you will quickly discover why they are becoming so popular with engineers and public works officials who need to replace septic systems.

Geography & Economy

Almost half (47 percent) of the homes currently on septic systems are located in growing suburban areas, and the number of housing units on septic systems has increased by almost two million since 1985, so the situation is gradually getting worse, not better.

An example is Hooper, Utah, which is located near Ogden and Salt Lake City. Once a small community with a few scattered farmhouses, the town grew rapidly during the 1990s, reaching a population of more than 4,000 by the time it incorporated in 2000. Upon incorporation it became the largest unsewered city in Utah. A Board of Health study in 2001 indicated that sewage from Hooper's septic systems was finding its way into local waterways, creating health and environmental concerns.

Hooper's geographic and economic situation is like that of many towns, especially those located in coastal areas. Flat terrain and a high groundwater table created significant design problems for the civil engineers working to create a collection system. Gravity sewer lines would have to be buried 20-25 feet deep to attain the necessary grade. Contractors would need to shore up and dewater the trenches. Traffic would be disrupted for weeks due to the trench work and heavy equipment, and they would have to build multiple lift stations along the way. The cost of the project was staggering.

The price tag for a gravity sewer system led Hooper's engineers to seek collection alternatives. Their research led them to AIRVAC. They discovered that vacuum sewer lines are buried in shallower trenches, that a single vacuum station can serve as many as two thousand homes, and that the system is environ-

mentally friendly, odor-free and easy to maintain. Best of all, a vacuum sewer would cost 25 percent less than a comparable gravity or low-pressure sewer system.

Hooper and many other municipalities have turned to AIRVAC as an efficient, cost-effective alternative to gravity and low-pressure sewers. Fripp Island, South Carolina, is a coastal community with geographic issues similar to Hooper – flat terrain and high groundwater. Fripp Island saved more than $1.6 million by installing vacuum sewers. York County, Virginia, solved a significant problem with septic systems by choosing AIRVAC. Albuquerque, New Mexico, met an important government mandate by installing a vacuum sewer in 1993 and has expanded their system several times since.

What these towns are discovering is that in many situations, AIRVAC technology is easier to install, requires less maintenance and protects the environment.

How It Works

Public works directors and civil engineers who are unfamiliar with vacuum technology may think that AIRVAC systems are complex and fragile. In fact, the opposite is true. Vacuum systems operate on simple principals of physics and have proven over many years to be extremely reliable.

Homeowners usually don't notice the difference between vacuum sewers and other systems because gravity is used to transport wastewater from the home or business to the first collection point, the vacuum valve pit, which is usually buried near the street. The valve pit consists of a small collection sump and a pneumatic vacuum valve mechanism located in a chamber above the sump. One or two homes are typically connected to a single valve pit.

When the wastewater in the valve pit sump reaches a predetermined level, usually around 10 gallons, it triggers the pneumatic valve that releases the waste water into the vacuum main where negative pressure propels it at speeds up to 18 feet per second toward the vacuum station. The speed of the wastewater helps scour the line and break up solids. The PVC collection line is laid in a sawtooth profile to ensure adequate vacuum levels at every point along the line. Burial depths typically range from 4-6 feet.

Vacuum stations are often designed to look like other structures in neighborhood. Each station contains two or more vacuum pumps, two sewage discharge pumps and a collection tank. A single vacuum pumping station can collect wastewater from houses located as far as two miles away. Because vacuum sewers are closed systems there is no odor.

Disaster Relief

Natural disasters can wreck havoc on a city's infrastructure and create significant health and safety issues for citizens. This is especially true for municipal sewer systems. Loss of electrical power can occur as a result of hurricanes, tornadoes, ice storms and floods. When power is lost, so is sewer service. Any town with multiple lift stations faces the real possibility of sewage backups during power outages if every station is not equipped with a backup generator. This isn't always practical or affordable. If sewage backups do occur, the situation is made worse when flooding also occurs, as raw sewage becomes a potential source of biological contamination to everyone.

Vacuum systems are much more resilient to natural disasters for three important reasons. Number one: a single vacuum station typically replaces five or more gravity lift stations so there are fewer locations where problems can occur. Number two: the vacuum stations are equipped with a backup generator so the loss of electrical power is not a concern. Number three: vacuum technology is a closed system. The PVC collection lines don't leak. Furthermore, stormwater can't infiltrate the system and overburden the treatment plant. If a vacuum collection line is ever damaged, the repair can be done rather quickly due the shallow burial depth of the line.

Public works crews who maintain AIRVAC systems quickly learn to appreciate the advantages of vacuum technology. Vacuum valve pits are virtually maintenance free. If a malfunction does occur, the pit can easily be accessed and the problem repaired in minutes. Vacuum stations are relatively clean environments; workmen almost never come in contact with raw sewage. As for long-term reliability, the first vacuum sewers installed in the United States are now approaching 40 years old and are still providing reliable sewer service.

A prefabricated sewage collection tank is lowered by crane into an AIRVAC vacuum sewer station in Key Largo, Fla.

There is little disagreement that reducing the number of septic systems in the United States will ultimately produce cleaner water, but transporting and treating wastewater is expensive. AIRVAC technology is a cost-effective alternative for many municipalities. Vacuum sewers not only solve many of the problems created by septic systems, they provide numerous other benefits, as well.

Steve Gibbs is a freelance writer in Memphis, Tenn., with 25 years of experience covering wastewater collection technologies.