TECH TIPS FROM NASSCO

Tech Tips by NASSCO is a bi-monthly article on trends, best practices and industry advice from NASSCO's trenchless technology membership professionals.

HYDROGEN SULFIDE IN A COLLECTION SYSTEM:

WHAT WE SHOULD KNOW AND DO TO PREVENT HUMAN INJURY AND SEWER ASSET DETERIORATION.

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IMAGINE THIS:

- A sewer worker enters a manhole for one more look late in the day, just to check one final thing. He does this without an entry permit, a harness and tri-pod or a safety person on the surface. His co-workers, not knowing what he is doing, miss him. They look in the manhole and he is not there. He is found an hour or so later, dead at the sewage treatment plant.
- A sewer inspection crew begins their day by placing their smoke machine on a manhole and pulls the cord without first taking gas readings in the manhole. The resulting explosion breaks most of the bones in the face of the inspector.
- The public works director of a moderate size southern city receives bad news upon arriving at his office. The trunk sewer carrying one third of the city's wastewater has collapsed and is overflowing into sensitive wetlands.
- An odor is wafting over an outdoor amphitheater located next to a sewage pump station disturbing concert goers.

EACH OF THESE IS A TRUE STORY, OF INCIDENTS THAT OCCURRED FROM A SINGLE CULPRIT – HYDROGEN SULFIDE GAS IN OUR SANITARY SEWER WASTEWATER.

Why is this happening? It begins with sulfates. Wastewater is a perfect environment for sulfate formation. Sulfates are the natural result of the decomposition of sulfur in fecal material and nitrogen in urine. Under anaerobic conditions sulfates convert to sulfides. When sanitary sewer systems are stagnant, surcharged, full pipe or excessively laminar, the wastewater does not readily aerate with oxygen and sulfides rapidly build up. As this anaerobic, sulfide-laden flow encounters turbulence, perhaps at the intersection with a force main or a steeper slope gravity line, air is mixed with the flow, resulting in hydrogen sulfide gas production. This is the gas that smells like rotten eggs, causing troublesome complaints, but which also is explosive and can asphyxiate and kill those who are directly exposed. This hydrogen sulfide is also the gas that, when it condenses on the surface of iron and concrete sewer pipes, manholes and mortar between bricks, is converted by bacteria into sulfuric acid which is highly corrosive to many sewer collection system materials.

Low concentrations of hydrogen sulfide warn us by smell, but that warning is short-lived since it quickly kills our sense of smell. Thereafter, even a few breaths of higher concentrations can cause asphyxiation and death. It is crucial that sewer workers are aware of the potential presence of this gas and are prepared to detect if this gas is present before entering a manhole. We must be especially alert if, for example, we are opening a manhole immediately downstream of a force main discharging into the main sewer or where we think the waste water flow may be slow and laminar. Properly equipped sewer inspection equipment must contain detection and safety equipment including gas detector, fresh air blower, tripod, harness, personnel removal gear, communication devices, goggles, self-contained breathing apparatus and easily accessible information regarding local emergency procedures. All of this equipment must not merely be available on the job site but must be used in accordance with confined space entry procedures. We must also warn future inspectors that propose entry to the sewer system by clearly noting on all inspection reports if hydrogen sulfide is a potential or has been detected.

In addition to safety issues, we have yet to consider the damage and costs resulting from corrosion. What can be done? First of all sewers and manholes in harm's way can be built of non-corrosive materials. Some utility agencies, for example, build manholes that specifically include epoxy lining and install PVC pipe where the presence of hydrogen sulfide is suspected or confirmed.

But what of our existing sewers? It is very important that we know the precise condition of the pipe and have a way of tracking the rate of deterioration. Remember, we don't want to define a condition after a pipe collapse – we want to identify the extent of ongoing pipe damage caused by hydrogen sulfide and prevent the collapse from ever happening. This is one of the many ways where the NASSCO PACP/MACP program analysis is particularly useful. It allows us to observe the pipe deterioration and progressively code and rate it as time passes. Common codes will indicate pipes being in good condition or in the process of deteriorating by using various levels of codes beginning with surface roughness increased (SRI) all the way to surface missing wall (SMW). This coding allows future inspectors to observe changes in the pipe condition and record the change that has occurred. Asset management analysts can then project the rate of deterioration and alert utilities as to the need for rehabilitation or replacement. In many cases the deterioration of pipelines and manholes, the erosion of bedding materials and the resulting pipe collapse can be readily monitored and maintenance procedures implemented to prevent the high costs associated with pipeline collapse.

While hydrogen sulfide gas may cause some to hold their noses, it may cause others to take action. It is much more important that we understand the potential for sickness, injury, death and collection system deterioration. Awareness of the potential hazards, detection, and careful and consistent observation can prevent each of these situations, reduce the consequences to human life and proactively prevent the deterioration of one of our most valued commodities: the sewer.

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