Manhole Work Requires a Commitment to Safe Practices

January 17, 2020

Wearing proper gear, such as gas masks and hard hats, is vital to safety but following safety procedures every time you enter a manhole is the best form of incident prevention.

When a workday will be spent in a manhole, the cardinal rule is always: Be safe. A manhole is vertical and confined — two conditions that lead to falls and to being felled by dropped tools — and could be rife with deadly gases. Entering such a workspace casually is asking for trouble.

“I’ve heard stories about pre-OSHA days when people would jump in a manhole to do the work, and if they started feeling lightheaded, they’d jump out,” says Russell Shoats, project manager at TLC Plumbing & Utility in Albuquerque, New Mexico. Like most firms today, TLC embraces OSHA regulations and operates with a safety-first mindset. “The goal is to make sure everyone comes home safely.”

The barrel of a sewer manhole leading to an underground pipeline can vary in inside dimension. In Albuquerque, for example, the narrowest barrel is 4 feet in diameter and the widest is 10 feet. The vertical drop of the barrel depends on how deep a line is buried. The largest sewer mains — 72 inches — often are accessed through a junction box.

Gravity-flow sewer lines commonly space manholes every 500 feet. Additional access points are incorporated when a line turns a street corner or otherwise veers off a straight course, because debris in a line more often backs up at such points. So a mile-long sewer line will have 50 or more manholes that can be accessed by crews.

Major hazard

Among other infrastructure services, TLC contracts with the city to completely replace manhole structures and rehabilitate manholes. The latter normally consists of regrouting the barrel after sulfuric acid has corroded the surface.

The acid is a product of the chemical compound hydrogen sulfide, which is a colorless, flammable gas that is toxic and heavier than air. Not only that, its rotten-egg odor deadens a person's sense of smell. Consequently, someone breathing it can be lulled into not being alarmed until the body collapses.

That gas is the principal hazard in manhole work. "H2S is the big one. It will knock you unconscious," Shoats says. "You want to enter a manhole with no harm or risk, but H2S is the one we try to mitigate."

To detect the level of threat, contractors rely on gas sensors such as ones manufactured by Texas firm Gas Clip Technologies. The Gas Clip units come in several versions, with the most sophisticated model capable of taking readings of hydrogen sulfide, carbon monoxide and oxygen levels, as well as chemical compounds that become flammable in certain concentrations.

A pump version of the device allows a crew to attach and lower a tube to the bottom of the manhole. The pump pulls any gases present in the confined space upward to the sensor, which then gives a crew standing at the manhole entrance a readout of what lurks below. "Some contractors prefer to attach a cord to a sensor, lower the sensor into the manhole, then pull it back up to see what it tells them," says Jeremy Majors, technical representative for Gas Clips. "I prefer the pump."

A nonpump version of the Gas Clip sensor is worn by each crew member who enters a manhole that's declared safe. One reason for wearing a detection device in an already-tested environment is that conditions can change hourly. After lunch, for example, the flow of sewage typically increases, which can alter the concentration of gases.

"And one reading from up top is not a reading for an entire manhole or pipeline," Majors says. "If a crew member goes 20 feet either way from the spot where the air was drop-tested, he can encounter a different atmosphere."

The individually worn sensor doesn't just produce readings. It's an alert system. "It vibrates, it lights up and it has a speaker that produces a minimum of 95 dB of noise when threatening conditions develop," Majors says. "So, even if you are wearing hearing protection and can't hear it, you can feel the vibration and see the flashing light."

Some manufacturers produce sensors that send readings up to crew members outside the manhole, keeping them aware of conditions underground. "But those units are more expensive," Majors says. He notes that an average industry standard for a sensor ranges from $600 to $1,000.

Other risks

Toxic gases are not, however, the only hazard manhole crews encounter in their work. Falling while climbing down or up the manhole ladder is a danger, so a descending crew member typically wears a harness attached to a cable. The cable runs through a pulley mounted on a tripod straddling the manhole opening and connects to a winch. When the opening is too large for a tripod, a cantilevered arm with a pulley is utilized. In either case, the attached cable will arrest the fall of a worker who misses a rung.

A four-person crew is standard for TLC manhole work — two entering the hole, one on the winch and a fourth person periodically reading a gas monitor and fetching tools and material as needed. “You don’t want the man on the winch leaving it to get a hammer,” Shoats says.

Lighting is a safety issue as well. Ambient light isn’t always enough. “Some people hook a light fixture to a cantilever or tripod, but I don’t recommend it,” Shoats says. “It’s hard to direct the light, and the fixture is another object that can fall and hit someone. What I like to do is buy the guys some headlamps for their hard hats. That’s the best way to provide light in the least-invasive way.”

There is another option. Shane Jacobson, a sewer contractor in Iowa, has invented and patented a manhole lighting device he calls a Light Ring. “A buddy and I were out on a job and he asked, ‘Is there something you can buy to light up a manhole?’ I looked around to see if there was a product out there.” There wasn’t, so Jacobson created one.

The Light Ring is a bright, safety-orange device that attaches snugly to the surrounding edge of a manhole. A downrigger can be affixed to it for the safety harness cable. When a switch is thrown to activate an 18-volt lithium-ion battery, LED lighting floods the hole, greatly enhancing visibility for inspection, rehab or more extensive repair work — and creating a safer working environment.

“Right at noon, the light difference is minimal because there’s so much light down there already,” Jacobson says. “But during the morning or afternoon sun, the Light Ring really lights up the hole. That’s especially true at night, of course. Plus, mounting the downrigger on the ring keeps the cable out of the middle of the opening so you don’t lose open space. It makes work a lot more productive.”

The Light Ring is a reputably tested product: Jacobson’s sewer services firm — CIT Sewer Solutions — was awarded the American Public Works Association 2019 contractor of the year award in Iowa. Utility departments in such far-flung cities as Sacramento, California, Omaha, Nebraska, and Fargo, North Dakota, are illuminating their manhole projects with the Light Ring, but full-scale production of the device has not yet begun.

Culture of safety

In the end, safety equipment is not as important as attitude in preventing injuries and fatalities. Hard hats, waders, gloves, gas detectors, adequate light, gas masks, fans to create fresh airflow when gases have pooled dangerously — all of these are vital to safety, but the faithful following of safety procedures by crew members is the single most effective incident prevention tool.

“It has to be part of your culture,” says Dave Balogh, vice president of business development and strategy in the Taplin Group, which provides a variety of underground infrastructure services in Michigan. “We use that word — culture — quite a bit, but if you are not living and breathing safety every day, you’re not exercising it.”

The company developed a sweeping safety system it calls ELKS, an acronym for elimination of loss through knowledge and stewardship. ELKS is a behavior-based safety program. That is, it inculcates a safety mindset in employees and ultimately changes their behavior. Hence, Balogh’s admonition about living and breathing it.

The key to the program’s success is the authority given to every crew member to stop work on a project because of a safety concern. “Everyone has the same authority, whether he’s been with the company for one minute or 10 years,” Balogh says. Work stoppage isn’t recorded every day, obviously, but occurs as often as someone speaks up.

If an objection is raised, the crew revisits the morning job planning meeting and determines if safety indeed is being compromised. The company also reports on near-loss incidents to see what can be learned from the narrow escapes. If a procedure needs changing, it is done so and then codified, according to Balogh.

“If we see that a JSA (job safety analysis) report for a project is written one way and isn’t appropriate for what’s before us, we modify it to make it safer. Then we send the change back to our safety director to add it to future JSA planning. We’re constantly seeing what works best.”

TLC’s approach to safety is nearly as methodical as Taplin’s. Shoats says every project has a stated safety goal tailored to a job. A checklist of safety equipment is run through. A job hazard analysis checklist is worked up and scrutinized by the entire project team. “All of this stuff is handled before we ever enter a manhole, making sure that everyone is on the same page.”

Furthermore, everyone entering a manhole has completed confined-space safety training. “Everyone at TLC goes through the class, an initial one after they are hired and periodic classes throughout the year. An employee cannot enter a confined space without the class being taken.”