

# Prescription for Healthy Sewers

A plan for pro-actively optimizing sewer performance.

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In 2006, the U.S. experienced more than 20,000 beach closures due to sanitary sewer overflows. This single statistic underscores the critical role sewers play in maintaining both public health and the health of our environment. Colloquially, the term “healthy” refers to a biological system performing optimally—that system can be human or some other organism, or it can be the broader ecosystem that supports all life. By the same definition, a sewer can be regarded in terms of its health; a sewer is a biological system whose optimum performance determines not only its own capacity and lifespan, but the health of the people and the ecosystem it’s designed to serve.

“Healthy sewers promote healthy communities and a healthy environment.”

At Helix, we believe healthy sewers promote healthy communities and a healthy environment. Our research focuses on maintaining optimal sewer function through the combined application of beneficial microbes and a non-hazardous molecular neutralizer. We’re committed to making these technologies accessible to municipalities in a way that is turn-key, data-driven and ROI-positive. Taken together, our high-performance technologies and service-based implementation model constitute our Prescription for Healthy Sewers.

Here, we look closer at two of the most significant factors impacting sewer health: the accumulation of fats, oils and grease (FOG), and the production of hydrogen sulfide (H<sub>2</sub>S). We examine the risks they pose, and how they can be mitigated successfully, cost-effectively and simultaneously.

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## Clearing Obstructions

The flow capacity of a sewer system is engineered to the specific needs of the community it serves. This capacity can be diminished by physical obstructions, and by the inflow of groundwater. Obstructions can include sediment, debris, roots and collapses, but the build-up of fats, oils and grease—or FOG—causes 47% of all sanitary sewer overflows (SSOs) and up to 62% of residential backups. FOG adheres to the wall of pipe, diminishing its carrying capacity, and also clogs pumps and lift stations.

FOG accumulates because the bacteria naturally present in sewage do a poor job of breaking it down. At Helix, we cultivate application-specific microbes that excel at digesting grease. These microbes displace wild bacteria, creating a persistent slime layer capable of digesting FOG in a sustainable, eco-friendly manner—a strategy known as bioaugmentation. Typically with bioaugmentation, problem areas are shocked with a high dose of microbes to clear existing FOG, and then precise maintenance doses are administered by dispensers installed upstream. After initial implementation, FOG is monitored regularly and doses recalibrated to maximize the cost-effectiveness of the solution.

With FOG under control, municipalities typically see a dramatic drop in SSOs and residential backups, along with the attendant regulatory fines, liability and bad publicity. But they also realize other benefits. For example, pro-actively managing FOG means fewer emergency call-outs for cleaning crews, which reduces their exposure to traffic safety hazards and sewer toxins. It also means fewer traffic disruptions for the community. In addition, bioaugmentation stabilizes collection system performance, making it easier for managers to budget and plan sewer maintenance, as well as extending the service life of costly pumping equipment.

The problem of FOG has been around as long as sewers, although contemporary dietary trends have exacerbated the problem. Likewise, traditional techniques for managing FOG are still available, but

### FOG Solutions

|                  | bioaugmentation | jetting/pigging | chemicals | manual |
|------------------|-----------------|-----------------|-----------|--------|
| non-invasive     | ●               | ○               | ●         | ○      |
| stand-alone      | ●               | ●               | ●         | ●      |
| worker-safe      | ●               | ○               | ○         | ○      |
| non-hazardous    | ●               | ●               | ○         | ○      |
| self-sustaining  | ●               | ○               | ○         | ○      |
| water-conserving | ●               | ○               | ●         | ●      |

bioaugmentation delivers a new level of effectiveness. Compared to persistent jetting, bioaugmentation is a far less invasive and labor-intensive way to manage recurring FOG. Jetting also consumes large amounts water, a major concern in drought-stricken regions. Many chemical-based solutions pose worker safety risks and introduce hazardous effluent that can harm downstream treatment processes. Manual grease removal is labor and cost intensive, and also endangers worker safety. For these reasons, bioaugmentation is rapidly gaining preference among collection system operators, and microbe providers compete on value-added service and potency.

### **Restoring Equilibrium**

Sewers keep communities and the environment healthy by containing harmful solid and liquid effluent. When that effluent becomes gaseous, however, it's less easy to contain. In any sewer, hydrogen sulfide is the most noxious and corrosive gas produced. It's the primary source of odor complaints, it's toxic, and it's a precursor to sulfuric acid, which aggressively corrodes pipe. The smell of hydrogen sulfide is not just unpleasant, research shows it irreversibly poisons the brain, and chronic exposure can cause dizziness, fatigue, insomnia and slowed reaction times. Breathing more acute concentrations, such as found in some pumps and lift stations, causes rapid unconsciousness and death. But beyond that, certain sewer conditions convert concentrations of just 20 ppm to sulfuric acid, which can erode pipe walls a full inch over the span of five years—enough to cause pipe collapses, significant groundwater inflow and sinkholes.

“*[Hydrogen sulfide] irreversibly poisons the brain, and chronic exposure can cause dizziness, fatigue, insomnia and slowed reaction times.*”

Hydrogen sulfide is produced by the slime layer in a collection system under anaerobic conditions. At Helix, we administer a polymeric amine molecular neutralizer that breaks down hydrogen sulfide and mercaptans, creating water and bonding the sulfur to harmless, non-volatile polysulfides. The molecular neutralizer liquid is applied in a manner similar to bioaugmentation: concentrations are measured using a gas monitor, and then a shock dose is administered followed by steady application of a maintenance dose. After initial implementation, gas is monitored periodically and doses recalibrated.

**Sulfide Solutions**

|                       | molecular neutralizer | mechanical oxidizers | chemical oxidizers | nitrites | pH neutralizers | iron salts |
|-----------------------|-----------------------|----------------------|--------------------|----------|-----------------|------------|
| compact footprint     | ●                     | ○                    | ○                  | ○        | ○               | ○          |
| capital non-intensive | ●                     | ○                    | ○                  | ○        | ○               | ○          |
| biology-preserving    | ●                     | ●                    | ○                  | ●        | ○               | ○          |
| sludge-free           | ●                     | ●                    | ●                  | ●        | ○               | ○          |
| non-hazardous         | ●                     | ●                    | ○                  | ●        | ◐               | ○          |
| non-regulated         | ●                     | ●                    | ○                  | ○        | ◐               | ●          |
| mercaptan-fighting    | ●                     | ○                    | ○                  | ○        | ○               | ○          |

Not only does aggressive hydrogen sulfide management resolve odor complaints, it reduces the potential for debilitating or even deadly exposure among sewer workers. Moreover, eliminating the potential for sulfuric acid dramatically extends the service life of sewer infrastructure, forestalling the cost of replacement; preventing capacity-robbing groundwater inflow; and avoiding the backups, SSOs and soil destabilization caused when pipes fail.

Helix’s molecular neutralizer is dispensed into lift stations using simple, compact metering equipment. It provides a cost-effective alternative to competing technologies, which tend to be large and capital-intensive. The molecular neutralizer does not adulterate the slime layer with sulfur reducing bacteria, nor does it introduce regulated compounds into the effluent stream. And compared to oxidation technologies, certain caustics, and iron salts, it poses no hazards, nor does it produce sludge. Because the molecular neutralizer targets only sulfides, it is not wasted in any ancillary reactions, which makes it both extremely effective and affordable.

In addition to hydrogen sulfide, the presence of mercaptans (a separate class of common sulfur-based compounds) also degrades sewer health by producing foul odors. Helix solutions are uniquely able to neutralize mercaptans and prevent related complaints.

**Leveraging Expertise**

Bioaugmentation and molecular neutralizer uniquely treat two of a sewer’s biggest health risks: FOG and H<sub>2</sub>S. When administered together, they comprehensively optimize sewer function in a way that makes communities and the environment healthier. And yet, the effectiveness of any treatment plan goes beyond simple “medication”; it encompasses expert diagnosis, comprehensive care, and routine follow-up.

At Helix, this is our Prescription for Healthy Sewers. Under this comprehensive service program, Helix experts perform a system-wide sewer assessment to diagnose problems, and then implement specific

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treatments followed by ongoing monitoring and replenishment. The program relieves collection system operators from the guesswork and field work of commodity solutions, and ensures maximum performance and ROI through targeted, calibrated treatment. And because Helix solutions deploy compactly and affordably in any manhole or lift station, prospective customers are encouraged to participate in a subsidized pilot project to demonstrate Helix's value in a local setting.

In the U.S. alone, \$25 billion is spent each year to keep sewer lines open. This number speaks both to the prevalence of FOG congestion, and to the accelerated failure of pipe due to agents like H<sub>2</sub>S. But behind this dollar amount lies the true cost of unhealthy sewer function: public complaints, budget overruns, employee safety risks, liability, non-compliance, fines and premature infrastructure failure. The good news is sewer operators can mitigate these costs by pro-actively maintaining their infrastructure—advanced technologies delivered with affordable, turn-key implementation make it easier than ever to do so. Ultimately, optimal sewer function supports healthy communities and a healthy environment. At Helix Laboratories, this understanding is the foundation of our Prescription for Healthy Sewers.