State of Oregon

Department of Environmental Quality Guidelines

Guidelines for Hydrogen Sulfide Tests

BACKGROUND

Sewage collection design should seek to prevent odor, corrosion, and safety hazards associated with H_2S (hydrogen sulfide). In the Pacific Northwest, relatively cool temperatures usually make it possible to design for zero H_2S. At a maximum, the H_2S concentration of pumped sewage discharged into gravity sewers should not exceed 0.1 mg/l unless concrete sewer and manhole components are armored (see below).

Note that a level of 0.1 mg/l dissolved (aqueous) H_2S is still significant and may be objectionable. The vapor-phase equilibrium concentration at this level is roughly 25 ppm, which is extremely foul and may eventually corrode steel and concrete. However, the vapor-phase equilibrium for 0.1 mg/l is well under the reported lethal level of 300 ppm.

In the Pacific Northwest, H_2S levels over 0.1 mg/l are generally associated with stagnant pump station wetwells and filled, anaerobic sewage pipes. For example, force mains, STEP system mains, and inverted siphons.

Often the development of H_2S can be predicted, and not all filled pipes will generate H_2S^*. During the summer, for 0.1 mg/l H_2S to develop usually requires "fresh" domestic sewage to be contained in a full pipeline or a stale wetwell where it is deprived of oxygen for about 25 minutes.

As a rule of thumb, sulfide controls need to be provided unless the sewage flowrate is adequate to purge the entire force main every 25 minutes. This is often not possible in new subdivisions, and it may not be attainable until substantial buildout has been completed. Sulfide controls are warranted in all such situations, at least until buildout develops adequate flows.

TEST REQUIREMENT

In some designs, the potential for H_2S may be uncertain. In others, experimental systems may be proposed, or calibration and dose adjustment may be necessary. Mandatory H_2S testing will then be required as a condition of plans approved per Oregon Administrative Rules 340-52-020.

A field test procedure has been developed. The object of the test is to estimate the concentration of aqueous H_2S in the liquid phase. Note that this test method is approximate: it is not a certifiable laboratory test. However, so far as accuracy and reproducibility of results, a simple commercial field test is preferable to precise laboratory titration of a degraded sample. There are several such kits on the market such as Hach HS-7 or equal (Hach Chemical Co., 800-227-4224). The kit costs about $20.00 for 100 tests. We will accept equivalent tests, but they must be field tests.

TEST PROCEDURE

A. An H_2S evaluation, unless otherwise noted, should include at least 6 tests. Samples shall be dipped at the first manhole where it enters the gravity sewer system during a normal period of active discharge. Each sample should be dipped approximately one minute after the pump starts its normal pumping cycle. A coffee can taped to a length of PVC pipe is an adequate sampler. To avoid a false test, samples must be poured gently into the test bottle with a minimum of agitation or turbulence.

B. Each sample shall be tested immediately at the site, using Hach Chemical Co. sulfide test kit HS-7 with a fresh Alka-Seltzer tablet, or equivalent. Avoid shaking or aerating the sample to prevent low readings. A duplicate should be dipped and tested for confirmation.

C. As a minimum, unless otherwise required, samples shall be dipped and tested no less than 1/week during June - August.

D. Test results shall be reported to DEQ no later than September 15.

E. If the average hydrogen sulfide concentration of the samples exceeds 0.1 mg/l, then the report shall include a proposal for effective control of H_2S below 0.1 mg/l and an implementation schedule.

CONTROL METHODS

Sulfide controls that have been used in Oregon, ranked from least expensive to most expensive:

- Complete backdrainage of the force main into the wetwell between pump cycles. This requires an ascending main. Drainage is controlled through a pneumatic pinch or electric plug valve. Solenoid valves do not last in this type of service. Since one or two evacuations per day is enough to prevent the growth of sulfide bacteria, a time-delay relay on the valve actuator has been used to minimize repumping the wetwell contents.

- Compressed air injection. Air injected into a force main should be designed for 2 SCFM per inch diameter at static head (pumps off). The design should include control instrumentation and an airflow meter. Air can also be injected into wetwells to freshen the sewage and extend the aerobic zone of the force main. To avoid pumping problems, airlines into wetwells should be fitted with a solenoid to stop aeration while pumps are running.

- Chemical injection into force mains (hypochlorite, calcium nitrate, hydrogen peroxide).

- Weekly sterilization of force main with sodium hydroxide solution to pH 12 or with hypochlorite to 500 mg/l chlorine.

Ferrous chloride is being used in one force main which discharges directly to an open plant headworks. At this location, a sulfide concentration of 2 mg/l is tolerable and a strict limit of 0.1 mg/l is not necessary.

Various alternatives may be successful in other states and will be considered. All sulfide controls should be accompanied by design calculations to facilitate review and approval.

ALTERNATIVE TO MANDATORY TESTING

In lieu of sulfide controls or testing, there are areas where odor is not a concern and the downstream gravity sewer and manholes can be armored with acid-proof liners or coatings a sufficient distance to preserve their structural integrity. The length of sewer which is to be armored, and the acceptability of foul air in the discharge area, should be determined by the sewer system owner. Significant corrosion of unarmored sewers in the Pacific Northwest has been TV'd over 2000' below strong sulfide discharges. However, armoring for about 1000' may be adequate in low-impact situations.

Liners for armoring of concrete sewers against sulfide attack shall be polyethylene, PVC, or equal. Coatings for concrete manholes shall be Preco Fos-Roc or Belzona Metalife Immersion Grade (Belzona Oregon, 503/672-1904 in Roseburg). Remove all metal manhole steps.

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