Concern about odor and corrosion in wastewater collection systems has been escalating as prevention and control costs increase, collection systems age, and revenues decline. While there is some understanding of the causes of odorous gases and their deleterious impact in collection systems; the underlying science and mechanisms of odor generation, prevention, and control is lacking. This research study was the second in a three-phase project to address these issues.

Phase I was an extensive review of over 4,000 published technical abstracts and literature supplied by utilities, manufacturers, and vendors. It resulted in a single, less technical guide to address odor and corrosion in collection systems which explained how odor- and corrosion-causing compounds form and how to control them; provided information on odor-sampling methods; and identified highest priority research needs. This second phase of the project investigated the effectiveness of sewer ventilation as a method to control odors. Phase III, drew from the prior two phases to develop a web-based tool which provides guidance to utility managers and operators on strategies for how to control odors.

**Sewer Ventilation Research**

The purpose of this second phase study was:
- To measure air ventilation within full-scale gravity collection system components.
- To simultaneously measure parameters related to ventilation.
- To use the field experimental results to evaluate current ventilation models.
- To develop a concept for an improved ventilation model.

Field experiments were conducted at four different locations within the Los Angeles, California and King County, Washington wastewater collection systems. Sewer components included concrete gravity pipes ranging in diameter from 33-96”. The locations represent a set of full-scale gravity collection system components of varied length, slope, and diameter. The experiment used carbon monoxide tracer measurements. At each location, pure carbon monoxide gas was injected at the upstream end of the gravity sewer, and the concentration was measured at the downstream end. The time difference between each pulse tracer release and corresponding downstream concentration peaks was used to determine the average headspace air velocity during the travel time.

A stand pipe and hotwire anemometer arrangement was used to measure air entering or exiting the sewer components. Ambient wind speed, temperature, and relative humidity; headspace temperature and relative humidity; and wastewater flow and temperature were measured with information recorded continuously using data loggers. The field experiments resulted in a large database of measured ventilation and related parameters characterizing ventilation in full-scale gravity sewers. The field data were used as input to three current ventilation models to evaluate their accuracy compared to the measured field data. Strengths and weaknesses of each model are summarized in Table 1. Observations from the study were then used to develop a concept for an improved ventilation model based on conservation of momentum equations in connected collection system components.

**BENEFITS**

- Provides a database that can be used to understand collection system ventilation.
- Demonstrates field measurement techniques that can be used to characterize ventilation in a range of different collection system components.
- Shows how various forces influence collection system ventilation.
- Provides an understanding of the strengths and weaknesses of current ventilation models.
- Provides scientific basis to develop future modeling tools to predict sewer ventilation.
- Proposes new ventilation model that can be superior to current models.

**RELATED PRODUCTS**

Minimization of Odors and Corrosion in Collection Systems: Phase I (04CTS1)
Collection System Odor and Corrosion Study Tools and Database: Phase III (04CTS1AT)

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VENTILATION WITHIN A SINGLE GRAVITY COLLECTION SYSTEM COMPONENT MAY BE INFLUENCED AS MUCH BY FORCES UPSTREAM OR DOWNSTREAM OF THE COMPONENT AS BY FORCES WITHIN THE COMPONENT. ALTHOUGH AIR MOVED CONSISTENTLY DOWNSTREAM AT ALL FOUR LOCATIONS, MEASURED UPSTREAM–DOWNSTREAM PRESSURE GRADIENTS WERE SOMETIMES REVERSED. THIS IMPLIES SERIOUS VARIABILITY OF VENTILATION IN REAL COLLECTION SYSTEMS MAY BE MUCH GREATER THAN MODEL-PREDICTED VARIABILITY.

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