Differential Air Pressure Study at Drop Structures
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Introduction

This paper is intended to provide a brief summary and constructive critique of the City of Los Angeles' Differential Air Pressure Study at Drop Structures (Drop Structure Study), which was conducted as part of the City's ongoing Air Treatment Facility Evaluation Study. The purpose of the Drop Structure Study was to better understand how wastewater flowing through drop structures influences the pressure of the free air space in the sewer. The Drop Structure Study also examined the affect turning on and off various air treatment facilities (ATF) had on the sewer air pressure.

A drop structure is necessary when the elevation of a sewer must change abruptly. This can be required at the confluence of two sewers when one is higher than the other. Air above the flowing wastewater is dragged in the approach sewer and with the flow falling into the drop structure. This action can cause high pressures to develop if the moving air is obstructed from traveling downstream from the drop structure. To help alleviate this problem an air return line connecting the bottom and top of the drop structure is often included in the design. The City had observed that drop structures with these air return lines often had high pressures in their approach sewers and that at least one drop structure without a return line operated with an approach sewer having air pressure lower than atmospheric. Those sewers with high pressures could cause odors to escape and impact the local community while the low air pressure sewer would be unlikely to be offensive.

Due to the observed air pressures in and around the drop structures, the City performed a series of tests to measure the effects of (1) blocking the air return lines, (2), modifying wastewater flows, and (3) cycling the ATFs off and on to measure the effects on air pressures upstream and downstream of five drop structures.[1]

The technical memo's additional stated objective was to identify potential changes to the planned odor control strategies and methods to control odorous air releases in the proximity of the drop structures.

Investigation Procedures

The City's team conducted a series of experiments in the field that first involved measuring the air pressure in the sewers as they are currently built and operated to obtain baseline data. Data was gathered in the North Outfall Sewer (NOS) and Eagle Rock Interceptor Sewer (ERIS) approaches to the drop structures, in the drop structures, and in the North Outfall Relief Sewer

[1] The four drop structures tested were located at Division, Humbolt, Mission & Jesse, and 23rd San Pedro, and the University of Southern California (USC).

(NORS), East Central Interceptor Sewers (ECIS) and North East Interceptor Sewer (NEIS) on the downstream side of the drop structures.

The air return lines were then blocked with inflatable plugs to prevent airflow from the bottom of the drop structures from flowing back to the top of the drop structures. As this was done additional air pressure data was collected. Then, wastewater flows through the drop structures were manipulated by removing barriers known as stop logs within diversion structures in the sewers. These diversion structures, as the name implies, are used to divert flow from one sewer to another. Finally, while the air return lines were blocked and the flows manipulated in the drop structures, the ATFs at the Humboldt and Mission and Jesse locations were cycled on and off. Air pressure data was collected to determine if the air they extracted from the sewer would influence the air pressures in the drop structures as well as the upstream and downstream sewers.

Overview of Collected Data and Observations

For a detailed summary of the data collected at each drop structure site, please request a copy of Independent Odor Expert's more extended comments from the Community Liaison.

General Remarks and Conclusions

The City of Los Angeles has gone to considerable effort to understand how sewer air pressure is influenced by drop structure design, wastewater flow, and operation of ATFs. While there is good information that can be derived from the data collected, there is no one obvious conclusion from the information obtained that will allow a clear decision to be made regarding the solution to the problem of air emissions from the sewers and the odor impacts that result. This is not to say that the information is not valuable and that reasonable engineering decisions based on better informed judgment cannot now be made. What can be gleaned from the data is that a number of changes that each contribute a little to the solution could be made to lower the probability of odor emissions.

The most significant conclusion that I have come to after examining the Drop Structure Study is that it will likely be necessary to use more appropriately sized and located ATFs to remove air from the sewers and thus reduce the high pressures that result in uncontrolled odor emissions. As long as such high pressures exist in the sewers, uncontrolled emissions are virtually certain. Because none of the methods investigated in the Drop Structure Study (including blocking air return lines and manipulating wastewater flows), could dependably achieve a substantial and consistent reduction in air pressure, the only real alternative is to build more ATFs.

The information obtained in the Drop Structure Study can be used to help size and locate more ATFs through a formal design process.