Air Toxics and Odor Measurement Within Camden, NJ and a Demonstration of Emission Rate Determination Using OP-FTIR and Path-Averaged Summa® Canisters at the Camden WWTF

Prepared By:
Rutgers University, Dept. of Environmental Sciences
Christopher Uchrin, Ph.D.

Robert Kricks, Ph.D.
RJK Consulting
Cranford, NJ

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NJDEP has been interested in sources of emissions of air toxic compounds, especially area sources such as, wastewater treatment facilities. NJDEP was also interested in further defining the air quality for the southern industrialized areas in the city of Camden. This pilot project study was conducted as part of NJDEP efforts to obtain information concerning the sources of air toxic compounds in the Camden general area, to supplement neighborhood "bucket brigade" sampling recently instituted in the area, and to demonstrate the use of Open-Path Fourier Transform Infrared technology (OP-FTIR) in obtaining air toxic emission rates from local sources. A major potential contributor to ambient air levels of certain chemicals in the project area is the Camden County Municipal Utilities Authority (CCMUA) wastewater treatment facility (WWTF), which includes many area sources that require specialized sampling to determine emission potential. Use of OP-FTIR for air emissions assessment was suggested from results of a former study conducted at the Joint Meeting WWTF. Further evaluation of the technique for air toxics measurement and emission rate assessment was incorporated for the present study. NJDEP and local community issues related to odor control and odorous compound sampling prompted alteration of the initially designed program to include some refined additional air sampling methods for these types of components.

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PROJECT DESCRIPTION

The focus of the study was to utilize new tools to better characterize air toxic compounds from a complex fugitive emission source. To further field test this emerging technology, the area of Camden Waterfront South was considered as concerns of fugitive air emissions were noted in early meetings for the air toxics risk reduction pilot project being conducted there. This methods development research project was conducted as a preliminary effort to obtain improved information for potential sources of air toxic compounds in Camden South Waterfront area, and to supplement neighborhood "bucket brigade" sampling recently instituted there. A major potential source in the project area, the Camden County Municipal Utilities Authority (CCMUA), which includes many area sources, such as open tanks and waste material handling operations, requiring specialized sampling to determine emission potential was selected for the study. The CCMUA is a regional wastewater treatment facility that treats approximately 60 million gallons of wastewater from approximately 37 municipalities, representing a mix of residential, commercial and industrial input.

This study provides an approach to compiling data on potential area sources of a number of chemicals, including Volatile Organic Compounds (VOCs) [hydrocarbon, oxygenated compounds, aromatics, and chlorinated compounds] and ammonia, demonstrating use of Open Path-Fourier Transform Infrared (OP-FTIR) instrumentation, in conjunction with standard air sampling methods. The OP-FTIR has real-time analysis capabilities and can measure pollutants across an open space, such as the top of a tank. A beam of infrared light is sent across the open tank, or along a path upwind or downwind of a potential emission source, to a reflector. This light-beam is then reflected back to the instrument; molecules of chemicals intercepted in the beam path uniquely absorb energy allowing analysis of the resulting absorption spectrum to identify and quantify the molecules present.

The main scope of the project was a demonstration program using OP-FTIR technology in conjunction with path-averaged SUMMA® (stainless steel evacuated canister) sampling methods data, with one unit or operation source at CCMUA to be selected as the highest emission source to generate air toxic emission rate data for the source. SUMMA® canisters were employed for collection of air toxic components and selected VOCs as listed in the EPA TO-14 method. Modifications to the original scope of work added a limited odor-producing chemical characterization effort. Specially-coated SUMMA® canisters allowed for desorption of sulfur compounds and analysis by Gas Chromatography/Mass Spectrometry (GC/MS) for selected reduced sulfur compounds [methyl mercaptan, carbonyl sulfide, dimethyl sulfide, dimethyl disulfide, and carbon disulfide] and hydrogen sulfide. The canisters were also be analyzed for selected aldehydes using GC/MS.

Limited neighborhood samples were collected at several downwind locations in coordination with simultaneous NJDEP Bucket Brigade sampling. The project results provided additional information to improve future targeted sampling and analysis efforts, increase our knowledge of chemicals observed in the area, and will assist wastewater treatment facilities in refining odor-related chemical measurements and possibly in better targeting operational and/or control modifications for consideration.

PROJECT OBJECTIVES

1. Determine WWTF area sources compound identification and relative concentrations by applying path averaged coated SUMMA® Summa canister data collection for identified area sources at the facility as well as for upwind backgrounds for this facility in a preliminary sampling.

2. Provide a database identifying and quantifying air toxic compounds for the highest emitting WWTF sources consisting of OP-FTIR data and path averaged SUMMA® canister data.

3. Demonstrate the emission rate determination process for the suspected highest emitting source using OP-FTIR and supplementary SUMMA® canister data.

4. Assess the feasibility of extending emission rate determination to other WWTF area sources and other area sources that NJDEP may have an interest in.

The study was composed of two phases. The first phase included SUMMA® canister sampling in order to obtain preliminary information of background levels and on-site sources with respect to air toxics and certain odorous compounds.

Preliminary Sampling Locations
Background: Western Edge of Facility
Background: On the Delaware River
Inside the Pre-treatment Building
Primary Settling Tanks: Influent Weir
Primary Settling Tanks: Scum Transport Channel
Primary Settling Tanks: Effluent Weir
Aeration Tank Splitter Chamber
Hypochlorite Contact Zone
Inside the Sludge Storage Building
Sludge Truck Weighing Area
Septic & Grease Delivery Area

During the preliminary phase, only acetone and toluene were observed at somewhat elevated levels outdoors. Indoor area sampling observed higher levels of these compounds and methyl ethyl ketone. Measurable levels of sulfur compounds were rarely observed, even inside process and storage buildings.

The second, or follow-up sampling phase, further employed the use of the Open Path-Fourier Transform Infrared (OP-FTIR) instrumentation. During this second sampling phase, more intense sampling was performed at targeted on-site locations (selected from the results of the phase one effort).

Follow-up (Main) Sampling Locations
Background: Western Edge of Facility
Primary Settling Tanks: Influent Weir
Primary Settling Tanks: Effluent Weir
Hypochlorite Contact Zone
Scum Process
Sludge Processing Area
South Fenceline: Near MAFCO (a neighboring industrial facility)
East Fenceline: Community Locations During a Staged Bucket-Brigade Sampling

In this second phase of the study, some ammonia was observed in ambient air. In addition, there were also very small quantities of potentially odorous compounds, such as methylthioformamide. Concentrations of toxic organic compounds continued to be quite low.

Overall, it should be noted that although OP-FTIR is unique in allowing for detection of a wide range of chemicals and allows for use over a large surface area source, the limits of detection for specific compounds may be somewhat high. Additional refinement of the methods used with this equipment will be necessary prior to routine use in monitoring air around complex facilities. However, the method does demonstrate promise when combined with SUMMA® canister sampling. The canister sampling does enhance the detection capabilities of such projects, but again, in the case of reduced-sulfur compounds, the detection limits of the method are important to be aware of.

The course of this project, the project team was able to provide suggestions for improved operations and to point out to CCMUA some areas where odor control strategies might be most effective. Additional funding is currently being sought for projects to address enhanced reduced-

sulfur air monitoring at lower detection limits and more chemical specific methods for licorice-root processing facilities, such as the neighboring MAFCO facility.

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