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September 19, 2022

DC Water
Transmitted Via Email

Mr. David Gadis
CEO and General Manager

Mr. Tommy Wells
Chair and Principal Board Member

Ms. Kishia Powell
Chief Operating Officer

Mr. William Elledge
Senior Manager, Design

Re: Soapstone Valley Sewer Rehabilitation Project

Dear Mr. Gadis, Mr. Wells, Ms. Powell and Mr. Elledge,

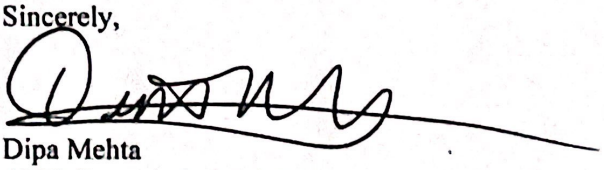
In advance of ANC 3F's meeting tomorrow (September 19th), I am writing in reference to the Air Monitoring Plan for the Soapstone Valley Park Sewer Rehabilitation Project. A summary Powerpoint of the Plan was presented to members of the community (including me) on July 15, 2022 by a representative of AECOM on behalf of DCW. On July 17th, I followed up with five open questions for DCW and DOEE coming out of the July 15th meeting. Four remain outstanding (the fifth was addressed last week when Mr. Ours shared the boiler truck permit). On August 30th, I received a copy of the detailed Plan upon which the summary was based.

Questions about the composition of the resin liner, our request to adjust the location of the PIDs, and information about the firewall that will be established for individuals who have roles at both DCW and The Water Research Foundation remain outstanding. In the meantime, I received the attached report outlining deficiencies in DCW's Plan to monitor the quality of the air at the project site and in the lateral sewer lines that connect directly to residential and commercial buildings adjacent to Soapstone Valley Park.

In light of the questions that remain unanswered and the concerns documented and substantiated in the report by Professor Andrew Whelton, an environmental engineer and nationally-recognized expert in CIPP technology and its associated public health, environmental and occupational health hazards, there remain significant concerns about the efficacy of the testing and monitoring Plan put forward by DCW. It is my hope that DCW will take these health and safety concerns seriously, not just for the sake of my constituents, but for the sake of all who live, work and play around such future CIPP projects throughout the District.

Given all of the above, I will propose a resolution with respect to the testing and monitoring plan and ask that DCW provide responses/reactions to the attached report by October 1st to inform the content of that resolution. As always, I remain available to discuss any aspects of this Project and hope that we can work together to ensure it is carried out in a timely and safe manner both in Soapstone Valley Park and elsewhere in our city. Thank you.

Sincerely,



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Deficiencies and Recommendations for the Cured-in-Place Pipe (CIPP)
Air Monitoring Plan for Soapstone Valley Park Sewer Rehabilitation Project

Prepared by Marjorie L. Share in consultation
with Andrew Whelton, Ph.D.[1] at Purdue University

The items raised in this document are based on the review of DC Water's "Air Quality Site Monitoring and Emissions Testing Plan" (the "Plan"), which was prepared by AECOM, and submitted to DOEE on July 13, 2022. The Plan, which was subsequently shared with ANC 3F on August 30, 2022, pertains to actions proposed by DC Water in connection with the Soapstone Valley Park Sewer Rehabilitation Project (the "Project") where hot water cured-in-place pipe (CIPP) technology was selected by DC Water. The Project involves the handling and conversion of resin to manufacture more than one mile (1.174 miles) of CIPPs, which are plastic polymer composites. This manufacturing process emits air pollutants into the air.

The 17 deficiencies and recommendations outlined in this document concern pollution transport into laterals sewer lines that are directly connected to buildings (including homes); use of air testing devices; proper chemical identification and quantification methods; collection of representative air samples; sampling frequency, duration and location; action thresholds; disclosures to the public; actions that would prompt site shutdown, and other items. It is undisputed that rehabilitation of the pipes in Soapstone Valley Park project is necessary due to the age of the sewer infrastructure.

Separately, at a July 15, 2022 meeting to discuss monitoring, DC Water told participants "that the plan is designed to address community safety, not *Clean Air Act* compliance or occupational safety." Yet, the detailed Plan submitted to DOEE two days earlier claimed to have been designed to pertain to *all* of these concerns.

The *Clean Air Act*, which pertains to protecting the public health and welfare from major and minor air pollution sources, invokes specific hazardous air pollutants (HAPs) that are used for CIPP manufacturing activities. Prior studies (referenced below) have shown that not all HAPs brought onsite in CIPP resins or emitted during CIPP manufacturing process into air are disclosed on material Safety Data Sheets (SDSs). The Plan does not define how the information gathered would be compared against requirements of the *Clean Air Act* or local regulations. Moreover, while the Plan refers to "occupational" safety, occupational exposures do not address the safety of exposures to others who are located in close proximity to Soapstone, such as

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[1] *Andrew Whelton is an environmental engineer and national expert on CIPP technology. He has often been called for help by health departments in and outside the U.S., as well as environmental and worker safety agencies before and after CIPP chemical exposure incidents. His team has documented over 100 incidents across the U.S through National Science Foundation, National Institutes of Environmental Health Sciences, National Institute for Occupational Safety and Health, and Federal Highway Administration backed studies. They have provided training to CIPP contractors, regulators, and health departments to help communities better understand and minimize public health and occupational risks.*

directly-adjacent residents in homes and apartment buildings, children in the nearby preschool, or those working in offices or patronizing local businesses.

To design an evidence-based air testing plan for public health and environmental protection decisions, chemicals in the resin, byproducts created during manufacture, and emitted into the air must be understood.

Deficiency #1

DC Water's Plan (p.9), Presentation (p.7), associated meetings, and email correspondence document total reliance on material Safety Data Sheets (SDSs) for chemical air testing decisions. CIPP resin SDSs have proven repeatedly not to list all chemicals present or emitted into the air during manufacture including carcinogens, endocrine disrupting compounds, hazardous air pollutants (HAPs), and other ingredients. Many can be harmful if they exceed threshold concentrations, and some have regulated limits under the *Clean Air Act.*

Evidence: The following U.S. National Institute for Occupational Safety and Health (NIOSH) study explains why chemicals emitted into air, which can be harmful, are not listed on SDSs:

- NIOSH / CDC explains what is and is not required to be in a SDS, and finds a chemical emitted into the air that was not listed on the SDS. (2019 article, "Potential Hazards not Communicated in Safety Data Sheets…," from the *Annals of Work Exposures and Health*, Vol. 63, No. 1, 124-130, LeBouf, Hawley and Cummings)

  If, for example, the manufacturer believes an ingredient is part of a trade secret, they do not have to list it. And, if the ingredient is less than 1% of the resin, they do not have to list it. As NIOSH shows in their article (for non-CIPP resin), the ingredients that are not listed can have health risks.

The following studies highlight what chemicals have and have not been listed on CIPP resin SDSs that have been tested and compared to their SDSs as of today. By solely relying on SDSs to determine what chemicals to test for and may be emitted into the air, DC Water places the health of bystanders and the environment at risk with this testing plan.

- 2022 peer-reviewed study: Environmental and human health risks of plastic composites can be reduced by optimizing manufacturing conditions. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2022.131803

- 2020 peer-reviewed study: An emerging mobile air pollution source: outdoor plastic liner manufacturing sites discharge VOCs into urban and rural areas. *Environmental Science: Processes and Impacts.* https://doi.org/10.1039/D0EM00190B

- 2019 peer-reviewed study: Considerations for emission monitoring and liner analysis of thermally manufactured sewer cured-in-place-pipes (CIPP). *Journal of Hazardous Materials.* https://doi.org/10.1016/j.jhazmat.2019.02.097

- 2019 peer-reviewed study: Outdoor manufacture of UV-Cured plastic linings for storm water culvert repair: Chemical emissions and residual. *Environmental Pollution*. https://doi.org/10.1016/j.envpol.2018.10.080

- 2019 peer-reviewed study: Considerations for emission monitoring and liner analysis of thermally manufactured sewer cured-in-place-pipes (CIPP). *Journal of Hazardous Materials.* https://doi.org/10.1016/j.jhazmat.2019.02.097

- 2017 peer-reviewed study: Worksite Chemical Air Emissions and Worker Exposure during Sanitary Sewer and Stormwater Pipe Rehabilitation Using Cured-in-Place-Pipe (CIPP). *Environmental Science and Technology Letters.* https://doi.org/10.1021/acs.estlett.7b00237

- A CIPP industry funded study conducted by Louisiana Tech University (Feb 2020) also found chemicals not listed on SDSs in the air at CIPP worksites.

Recommendation: To properly design an evidence-based air testing study, sole reliance on SDSs for identifying chemicals to test for must be abandoned. Seek experts competent in CIPP resin chemistry, composition, and CIPP manufacturing.

Prior to any CIPP work, thoroughly sample and chemically characterize the uncured resin. Resin should be extracted with organic solvents to identify which VOCs and semi-VOCs are present. Previous investigators have accomplished this by immersing resins in methylene chloride and in *n*-hexane solvents, and then analyzing the extract using gas chromatography-mass spectrometry. In another approach, NIOSH took uncured resin, placed it in a closed glass container, and tested the chemicals in the air after some time period.

Without this information, any decisions about safety or environmental impact made using the current air testing plan cannot be supported by evidence.

Deficiency #2

The CIPP manufacturing process itself creates new chemical combinations that are not listed on SDSs. These byproducts are created during plastic manufacturing (not present in the resins) and can be emitted into the air during manufacturing or left inside the new CIPP plastic where they can subsequently volatilize into sewer air. This information was not incorporated into the air testing Plan.

Evidence:

- 2022 peer-reviewed study: Environmental and human health risks of plastic composites can be reduced by optimizing manufacturing conditions. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2022.131803
- 2019 peer-reviewed study: Evaluation of the physical, chemical, mechanical, and thermal properties of steam-cured PET/polyester cured-in-place pipe. *Journal of Composite Materials.* https://doi.org/10.1177/0021998319839132
- 2019 peer-reviewed study: Considerations for emission monitoring and liner analysis of thermally manufactured sewer cured-in-place-pipes (CIPP). *Journal of Hazardous Materials.* https://doi.org/10.1016/j.jhazmat.2019.02.097
- 2019 peer-reviewed study: Outdoor manufacture of UV-Cured plastic linings for storm water culvert repair: Chemical emissions and residual. *Environmental Pollution.* https://doi.org/10.1016/j.envpol.2018.10.080
- 2017 peer-reviewed study: Worksite Chemical Air Emissions and Worker Exposure during Sanitary Sewer and Stormwater Pipe Rehabilitation Using Cured-in-Place-Pipe (CIPP). *Environmental Science and Technology Letters.* https://doi.org/10.1021/acs.estlett.7b00237

Recommendation: Thoroughly identify and confirm the byproducts that will be created from the plastic manufacturing process. Seek experts competent in CIPP resin chemistry, composition, and CIPP manufacturing expertise. Without this information, any decisions about safe exposures or environmental impact cannot be supported by evidence.

Deficiency #3

The scale of air pollution due to the Soapstone Valley Sewer Rehabilitation Project from CIPP manufacture may be significant, and the Plan does not estimate the magnitude of air pollution nor put forward an air testing approach that would quantify the actual magnitudes emitted for manufacturing CIPPs more than 1 mile in length.

Evidence: The amount of resin brought on site should be proportional to the air pollution emitted including resin components, initiator compounds, degradation products, and byproducts of manufacture. The Soapstone Valley project involves manufacturing a total length of CIPP of more than one mile. This will likely include thousands of pounds of resin, possibly greater than 10,000 pounds of resin. Studies have shown that CIPP manufacture can release as much as 9.3% of the total starting mass of the resin into the air (for UV CIPP), and lesser amounts for thermal styrene- and non-styrene CIPPs.

- 2020 peer-reviewed study: An emerging mobile air pollution source: outdoor plastic liner manufacturing sites discharge VOCs into urban and rural areas. *Environmental Science: Processes and Impacts.* https://doi.org/10.1039/D0EM00190B

- 2019 peer-reviewed study: Considerations for emission monitoring and liner analysis of thermally manufactured sewer cured-in-place-pipes (CIPP). *Journal of Hazardous Materials.* https://doi.org/10.1016/j.jhazmat.2019.02.097

Second, it is CIPP Industry standard practice to include excess resin at a range of 3 to 15 percent by volume for CIPPs that are created; the industry openly expects the resin to leave the uncured resin tube. Per *American Standards for Testing and Materials (ASTM) method F1743–08, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP).*

> *"The volume should be adjusted by adding 3 to 15 % excess resin to allow for the change in resin volume due to polymerization, the change in resin volume due to thermal expansion or contraction, and* ***resin migration through the perforations of the fabric tube and out onto the host pipe****."*

Furthermore, on Plan, p. 7 it was declared that the initiator compounds will react and their degradation products will be emitted into the air during CIPP manufacture.

Recommendation: Require that the contractor submit the weight of the resin to be used for each CIPP to be manufactured before the project begins. This should declare the total amount of resin to be used for each CIPP that will be created to line the entire Soapstone project.

Disclosure of the total amount of resin will help estimate ranges for the total amount of initiator degradation products emitted into the air. This action should also be conducted in parallel with chemical analysis of the resin to identify the chemicals that will be emitted, not listed on the SDS. Only then, with the chemical extraction data from Deficiency #1 and Deficiency #2, can the mass of HAPs emitted into the air begin to be estimated.

Deficiency #4

CIPP non-styrene resin brought on-site could contain styrene (even if not listed on the SDS). Contractors themselves can inadvertently contaminate non-styrene resin with styrene due to their equipment handling practices. The Plan makes clear that DC Water assumes and will not verify that the resin to be used on site will not contain styrene or be contaminated with styrene when onsite.

Evidence: Purdue University researchers recently discovered this issue with a CIPP resin company. The company provided the researchers a non-styrene CIPP resin and styrene CIPP resin. It turned out before the company shipped their non-styrene resin to the team, they contaminated it with a low amount of styrene (that was detected in the air during the air testing). The company had used the same equipment for processing styrene and non-styrene CIPP resins, which they explained is common in the industry.

- 2022 peer-reviewed study: Environmental and human health risks of plastic composites can be reduced by optimizing manufacturing conditions. *Journal of Cleaner Production.* https://doi.org/10.1016/j.jclepro.2022.131803

In 2017 at worksites in California, Purdue University researchers and California Department of Transportation (CALTRANS)-backed researchers found that contractors inadvertently chemically contaminated their own non-styrene storm sewer CIPPs with styrene. They found styrene emission into the air and styrene leaching into the water from the non-styrene CIPP.

- 2019 peer-reviewed study: Considerations for emission monitoring and liner analysis of thermally manufactured sewer cured-in-place-pipes (CIPP). *Journal of Hazardous Materials.* https://doi.org/10.1016/j.jhazmat.2019.02.097

- 2017 peer-reviewed study: Worksite Chemical Air Emissions and Worker Exposure during Sanitary Sewer and Stormwater Pipe Rehabilitation Using Cured-in-Place-Pipe (CIPP). *Environmental Science and Technology Letters.* https://doi.org/10.1021/acs.estlett.7b00237

- 2017 Final Report for CALTRANS: Water Quality Of Flow Through Cured-In-Place Pipe (CIPP). https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/final-reports/ca17-2530-finalreport-a11y.pdf

It is hard to imagine that after 40 years of CIPP use in the U.S. that Purdue University and CALTRANS-backed researchers were able to find the only two instances of chemical contamination of resins and CIPPs. There is no chemical verification by industry or utilities that the resin brought on site is what was claimed and is not contaminated with something else. Even when the resins become cross-contaminated with another resin, there is no testing or verification for this. This means utilities and other parties involved would not know what the material is or what could be emitted into air. No prior studies were found for non-styrene CIPPs, that the resins

used for CIPP were actually what they were reported to be and not contaminated with styrene-resins or done so in the field.

Recommendation: Chemically extract and confirm the resins to be used are what DC Water requested. Require contractors to legally certify that their equipment is cleaned with liquids (have them declare their process and materials) that can remove residual contamination from other CIPP jobs before being used for the Soapstone project. Require contractors to certify both that the resins brought on site are not contaminated with other materials, and that their installation equipment is not contaminated with other materials. Require that the air testing plan address chemical air testing, assuming contamination does take place and spans both non-styrene and styrene-resin CIPP manufacturing activities.

If the resins are found to be contaminated with something other than the intended resin, DC Water can likely terminate the contract with the CIPP Company (the CIPP Company would be in breach) for failure to comply with the terms of the contract. Should DC Water proceed with the use of a contaminated resin, any consequences of the CIPP project on human health and the environment would have been preventable and foreseeable. Another consequence of using contaminated materials could be premature mechanical failures of the newly installed CIPPs (delamination, pinholes, etc.).

Deficiency #5

The testing plan omitted characterizing VOCs that are known to be emitted from the specific materials proposed for use at Soapstone Valley. The air testing methods selected will not detect or quantify those compounds. For this reason, the study will be unable to estimate environmental or public health impact of the CIPP practice.

Evidence: A review of the Plan provided from the DOEE to the ANC indicates DC Water plans to use AKPEROX C80 as an initiator compound. This is mentioned in Appendix A, Plan p. 24. In the SDS provided, AKPEROX C80 does not just contain cumene hydroperoxide (80-85 wt%), cumene (1-2.5 wt%), or acetophenone (1-3 wt%) as was presented July 15, 2022 at the Zoom meeting. The SDS submitted to DOEE states that two other compounds that are not being tested for will be present too at similar or greater magnitudes. For example, 2-phenylproan-2-ol (1-5 wt%) will be present as well as methyl acetoacetate (10-20 wt%). Both are VOCs and likely to evaporate into the air based on their chemical structures.

The TO-15 method, as indicated in DC Water's Air Quality Monitoring and Testing Plan presentation of July 15th (p. 11) will not screen for 2-phenylisopropan-2-ol or methyl acetoacetate. Here is a description of the TO-15 method reviewed: EPA TO15 Normal.pdf (easlab.com). By not testing for chemicals expected to be emitted into the air, data users will be unable to make public safety and health assessments using air testing data.

Further, DC Water told the participants during the July Zoom meeting that an "activator" compound (slide 7) was going to be used, but this was not disclosed in the Plan submitted to DOEE. During the presentation, DC Water indicated that the majority of the "activator" (maybe DC Water meant to say initiator?) would be reacted and not remain after CIPP manufacture. DC Water should disclose what activator compound they are using. Initiators and activators are different materials.

Regardless, large amounts of resin (and large volumes of initiator) will be brought on site. So, the magnitude of initiator degradation products may be quite large. This information was not disclosed to Zoom meeting participants or to DOEE in the monitoring Plan.

Recommendation: DC water should disclose the material SDS for the "activator" compound they plan to use. DC Water should test for the declared AKPEROX C80 degradation products in the air. DC Water should disclose the total mass of resin to be used for the CIPP project. The mass of initiator used for the CIPP project should also be disclosed. DC Water should make clear what methods will be used to capture and detect, and quantify all degradation products from the initiator compounds, which the Initiator Manufacturer has disclosed.

Any air sampling information collected must be interpretable and the devices must be used properly used.

Deficiency #6

Photoionization Detectors (PIDs) are prone to error and have not been proven to determine the exact chemical composition, magnitude, and health risks of CIPP chemical exposures for CIPP activities. PIDs have under- and overestimated styrene levels at actual CIPP worksites. NIOSH has found that environmental conditions, especially humidity and temperature, can depress the ability of the device to detect VOCs. Sewers are high humidity environments.

A March 2021 editorial document issued by the CIPP industry claimed PIDs should be used to detect styrene levels at CIPP worksites. No data or peer-reviewed studies were presented that validated this claim. While styrene resin is not planned to be used at the Soapstone Project, relying upon PIDs at the Soapstone Project CIPP worksites (in the way DC Water plans to do so) places the safety and well-being of those workers and persons nearby at risk.

Evidence: PIDs are subject to environmental conditions, especially humidity and temperature, which NIOSH has proven in their own PID studies. In addition to humidity and temperature, these devices are prone to error due to multiple chemicals in the air. Humidity should influence the signals in response to organic vapor. A humidity filter could be used to limit this impact.

- 2012 peer-reviewed study: Effect of calibration and environmental condition on the performance of direct-reading organic vapor monitors. *Journal of Occupational and Environmental Hygiene.* 9 (2012), pp. 670-680. https://www.doi.org/10.1080/15459624.725015

- 2013 peer-reviewed study: Effect of calibration environment on the performance of direct-reading organic vapor monitors. *Journal of Air Waste Management Association*, 63 (5) (2013). https://www.doi.org/10.1080/10962247.2013.772926

- 2015 peer-reviewed study: Effect of interferents on the performance of direct-reading organic vapor monitors. *Journal of Air Waste Management Association* , 65 (3) (2015), pp. 261-269. https://www.doi.org/10.1080/10962247.2014.986308

Evidence has not been found showing that PIDs can provide actionable information at CIPP worksites for safety or environmental pollution assessments. The 2017 Purdue University study at actual CIPP worksites shows that PIDs underestimated styrene concentration numerous times at significant magnitudes, 10x to 1000x.

- 2019 peer-reviewed study: Considerations for emission monitoring and liner analysis of thermally manufactured sewer cured-in-place-pipes (CIPP). *Journal of Hazardous Materials.* https://doi.org/10.1016/j.jhazmat.2019.02.097

Recommendations: Evidence shows that PIDs alone should never be used to determine whether an environmental or safety issue exists before, during, or after CIPP manufacture. Because humidity in sewers may adversely affect PID signals and provide erroneous readings, the reliability of PIDs in sewers must first be evaluated. DC Water and DOEE separately should request NIOSH to conduct such a study. NIOSH has no financial interest in the outcome of such a study and as a service to the U.S. Department of Human Health Services has conducted prior studies at no cost to the organizations they serve. Information can be found here: https://www.cdc.gov/niosh/hhe/request.html

If PIDs are used, all stakeholders should recognize that the PID signal may have nothing to do with safety or VOC air concentration. PIDs can sometimes indicate "changes" in an atmosphere, not necessarily changes in VOC concentrations. PIDs should be located inside lateral lines, main sewer-side and building-side of installed temporary sewer plugs; between plugs and connected homes, etc.; in the main sewer lines above temporary plugs; at all vent points on main sewer and lateral lines, as close to the emission source as possible (not feet away).

Deficiency #7

Taking a PID measurement every 30 minutes (the Plan, p. 11) ignores all the PID signal information collected between 0 and 30 minutes, which makes no sense. PIDs have continuous data collection capability and this information is automatically recorded. Some PIDs can record data on 30 second by 30 second intervals or 1 minute by 1 minute resolution. Ignoring results within 30 minute intervals would miss potentially-significant changes in signal magnitude. Secondly, the measurements should not be "averaged" over 30 minutes, otherwise the peaks would be averaged out. The signals should be collected at the shortest-test interval possible, and data should be reported in full.

Recommendations: Before CIPP installation begins, first establish representative background-level PID monitoring data in the sewer system at manholes and sewer laterals (when CIPP is not being installed) to be able to determine what PID response could indicate chemicals left the work site. This would need to be conducted multiple times over long periods to characterize the types of signals that could be expected due to routine sewer system atmosphere changes. Without this step, stakeholders should assume that any detection in PID signal during or after the CIPP installation process indicates chemicals have left the liner or worksite and pose acute health risks.

Deficiency #8

The location of the PIDs was proposed at the cleanouts (p. 13 in the laterals) between the clean-out and building. Locating the PID inside the lateral at the bottom of the clean out is necessary to limit the dilution of chemical air concentrations before air sampling.

Evidence: Dilution of contaminated air is a known fact of physics. Sampling air far away from the concentration air would bias chemical analysis results.

Recommendation: PIDs should be located inside the sewer system before air reaches the clean-outs in all sewer laterals rather than at the clean outs.

Deficiency #9

The Plan (p. 12) states that samples will be collected 4 inches above the manhole. Once the emissions travel up from the source, which is feet away down in the manhole, the chemical air concentrations will be diluted. Thus, the samples will not represent what the maximum chemical level is generated inside the manhole, which may travel to nearby buildings and closed spaces.

Evidence: Dilution of contaminated air is a known fact of physics. Sampling air far away from the concentrated air would bias chemical analysis results.

Recommendation: Sample inside the manhole at <1 foot from the actual emission surface. To understand the types and magnitude of pollution generated it is necessary to sample directly AT the source (not feet from the source), as this will have the greatest diversity of chemicals and concentrations.

Deficiency #10

The Plan describes long duration sample collection but will be unable to identify short-duration high chemical concentrations generated by the CIPP practice.

Evidence: The number and duration of canister grabs will have profound impact on the usefulness and interpretability of the results. The shorter the duration samples the better. These 2017-2021 peer-reviewed studies show magnitude variability in VOC emission during a single CIPP installation, which can vary by minute.

- NIOSH 2021 CIPP Report: Evaluation of Exposures to Styrene during Cured-in-place Pipe Liner Preparation and during Pipe Repairs using Hot Water and Steam. https://www.cdc.gov/niosh/hhe/reports/pdfs/2019-0080-3379.pdf

- NIOSH 2019 CIPP Report: https://www.cdc.gov/niosh/hhe/reports/pdfs/2018-0009-3334_revised032019.pdf

- 2019 peer-reviewed study: Considerations for emission monitoring and liner analysis of thermally manufactured sewer cured-in-place-pipes (CIPP). *Journal of Hazardous Materials.* https://doi.org/10.1016/j.jhazmat.2019.02.097

- 2017 peer-reviewed study: Worksite Chemical Air Emissions and Worker Exposure during Sanitary Sewer and Stormwater Pipe Rehabilitation Using Cured-in-Place-Pipe (CIPP). *Environmental Science and Technology Letters.* https://doi.org/10.1021/acs.estlett.7b00237

Recommendation: Sample inside the manhole at <1 foot from the emission surface (i.e., CIPP liner itself). To understand the types and magnitude of pollution generated it is necessary to sample directly at the source (not feet from the source), as this will have the greatest diversity of chemicals and concentrations.

Deficiency #11

The Plan does not mention the number of canister grab samples to be collected. A one-hour canister sampling time is mentioned (Plan, p. 12) and this will potentially dilute contaminants away from the sample—and underestimate the maximum chemical air concentrations generated.

The number and duration of canister grabs will have profound impact on the usefulness and interpretability of the results.

Evidence: The shorter the duration and more frequent the sampling the better. These 2017-2021 peer-reviewed studies show magnitude variability in VOC emission during a single CIPP installation, which can vary by minute.

- NIOSH 2021 CIPP Report: Evaluation of Exposures to Styrene during Cured-in-place Pipe Liner Preparation and during Pipe Repairs using Hot Water and Steam. https://www.cdc.gov/niosh/hhe/reports/pdfs/2019-0080-3379.pdf

- NIOSH 2019 CIPP Report: https://www.cdc.gov/niosh/hhe/reports/pdfs/2018-0009-3334_revised032019.pdf

- 2019 peer-reviewed study: Considerations for emission monitoring and liner analysis of thermally manufactured sewer cured-in-place-pipes (CIPP). *Journal of Hazardous Materials.* https://doi.org/10.1016/j.jhazmat.2019.02.097

- 2017 peer-reviewed study: Worksite Chemical Air Emissions and Worker Exposure during Sanitary Sewer and Stormwater Pipe Rehabilitation Using Cured-in-Place-Pipe (CIPP). *Environmental Science and Technology Letters.* https://doi.org/10.1021/acs.estlett.7b00237

Recommendation: Sample in great frequency and maximize short duration grab air samples. For a proposed 2-hour curing process, at both the entry and terminal manhole for the CIPP being installed, the sampling should be as follows or more frequent:

- 4 grab samples before liner insertion at the entry and terminal manhole
- 4 grabs during tube insertion at the entry and terminal manhole
- 8 grabs during active 2-hour curing at the entry and terminal manhole
- 4 grabs during cooldown at the entry and terminal manhole
- 4 grabs at site cleanup at the entry and terminal manhole
- 4 grabs during physical cutting of the new CIPPs at the entry and terminal manhole

During cutting of the new CIPP liner, emissions are released into the air. Waste is emitted into air and some debris is created and left onsite, which should be sampled. Samples in spatial proximity of the worksite (and at waste discharge/exit points) should also be collected (upwind, downwind, etc.) if the extent of contamination above-ground is of interest.

Failure to collect numerous short-duration samples for chemical identification and quantification

at the source may result in analytical results being of little value or uninterpretable. One (1) hour canister samples will result in DC Water and other agencies involved not knowing the maximum chemical exposure concentration that took place, which is relevant to understanding bystander safety where emissions reach bystanders through aboveground and belowground pathways.

Deficiency #12

The materials emitted into the air during hot water curing have not been proven to be water vapor or organic vapor only. On the contrary, CIPP had been used for 4 decades in the U.S. with claims that emissions were safe, not a health risk, styrene was the only chemical emitted, when studies over the last 6 years from NIOSH, Purdue University, industry, and others revealed many of those blanket statements were not true. The hot water CIPP emissions may, like steam CIPP waste, be a complex mixture of particulates, partially cured plastic, organic vapors, and water vapor. Canister grab samples and PID samples will not be able to accurately collect a sample of the discharged waste for physical and chemical analysis.

Evidence:

- 2017 peer-reviewed study: Worksite Chemical Air Emissions and Worker Exposure during Sanitary Sewer and Stormwater Pipe Rehabilitation Using Cured-in-Place-Pipe (CIPP). *Environmental Science and Technology Letters.* https://doi.org/10.1021/acs.estlett.7b00237

Recommendation: Collect the waste in a vacuum exhaust pipe setting and have it chemically and physically analyzed. This has been done previously. Care must be taken so as not to dilute the waste sample over time as the emitted materials and chemicals from the CIPP process (i.e., over a 1 hour interval) may decrease during curing.

Hire a third-party contractor who has not been recruited by or has any affiliation with DC Water, NASSCO, or CIPP companies. Companies that are hired should be required to disclose the chemical incidents that have occurred on the CIPP projects they have managed, recommended, or conducted so that all stakeholders can understand expertise, standard of care, and experience involved. Expertise about CIPP resin chemistry and CIPP manufacturing was not incorporated into the existing DC Water / AECOM Air Quality Site Monitoring and Emissions Testing Plan.

Deficiency #13

The Plan, as stated in the Introduction, p.7, focuses only on chemicals emitted during the curing process, not during resin tube insertion, cooldown, or site cleanup. It has been proven that chemicals are emitted before, during, and after active curing has stopped. It has also been shown that emissions can increase after heating has stopped.

Evidence:

- 2022 peer-reviewed study: Environmental and human health risks of plastic composites can be reduced by optimizing manufacturing conditions. https://doi.org/10.1016/j.jclepro.2022.131803

Recommendation: Prior recommendation and concerns in this document about sampling frequency and duration should be implemented.

PID levels cited for taking action are arbitrary and have no public health or safety protection basis.

Deficiency #14

The "TVOC threshold" cited for "taking action" at the Soapstone CIPP site or in buildings or sewers has no scientific basis, and therefore no public health protective value. DC Water has put forward no evidence that the PIDs they will use can reliably respond to concentrations of VOCs in air under the conditions of the Project.

Evidence: The July 15, 2022 presentation (p. 10, TVOC Action Level) and the Plan (p. 13) cite a decision threshold of 10 parts per million (10 ppm) which appears to have no basis in fact. Actions must have a factual basis; otherwise, any action will have no public health protective basis for the PIDs and the results are not interpretable. No evidence has been provided to justify why 0.1 ppm, 1 ppm, or any other number should not be the decision threshold.

Recommendation: DC Water should publicly disclose to stakeholders that the PID value they have selected for action has no evidentiary basis, that they do not know if the PIDs will accurately predict VOC levels in the air, and therefore cannot help inform public health and safety decisions for these CIPP projects. Reliance on an arbitrary PID threshold for safe/unsafe determinations (and 'taking action' vs. not taking action) will jeopardize public safety.

The presence of an odor does not mean a compound present on a material safety data sheet (SDS) is the cause.

Deficiency #15

DC Water claimed that any odor detected (the Plan, p. 14) will be solely associated with cumene or acetophenone despite the fact that other VOCs are present in the initiator and are likely created and emitted from the resin during manufacture. Assuming that only chemicals DC Water knows about would be responsible for causing an odor jeopardizes the safety of the public (and workers). As previously mentioned, DC Water wrongly assumed that a SDS solely informed them about the chemicals in the air. Evidence from prior CIPP resin characterization studies clearly shows that SDSs do not provide utilities or CIPP companies with full-understanding of chemicals brought onsite or emitted into the air.

If an odor is detected, DC Water cannot associate that odor with any specific chemical exposure. Sometimes the presence of multiple chemicals in the air can cause a single odor characteristic.

Evidence: Multiple chemicals have been present in non-styrene resins (not listed on SDSs) that can cause odors. Past CIPP manufacturing studies have shown emission of a complex mixture of chemicals into air, not just two chemicals as DC Water has assumed. Past CIPP manufacturing studies have shown a complex mixture of chemicals that remained in non-styrene CIPPs (some could be in the air). Sole reliance on SDSs indicates a still-unmet need for persons with knowledge of and expertise in CIPP resin, manufacturing or exposures.

Recommendation: Any odor detected should prompt an immediate shutdown of the CIPP project indicating a failure to contain plastic manufacturing waste which may pose an immediate health and safety risk to bystanders.

Deficiency #16

Actions for informing and communicating with the Community and halting operations are inadequate. Complaints about illness should not be investigated by DC Water, its consultants, CIPP contractors, or its agents (the Plan, p. 20).

Evidence: Examples from prior CIPP chemical exposures elsewhere, at schools, office and apartment buildings, homes, and public areas have sometimes been investigated by utility and CIPP Contractors. In some cases, exposures resulted in hospitalization, but utilities and CIPP contractors sometimes claimed symptoms were not related to CIPP only to find out later they were associated with a nearby CIPP project. Sometimes CIPP companies have received complaints (in person, by telephone), entered private properties, and did not inform the utility, fire or health departments about the incidents. The DC Fire Department may call in other agencies to help find the source of the problem but are not trained in CIPP manufacturing. Emergency responders are also sometimes given SDSs when they arrive onsite, but the SDSs do not describe all the chemicals that are present onsite, emitted into the air, or the concentrations possible. Emergency responders also sometimes think PIDs will help them understand CIPP created chemical atmospheres, even though available peer-reviewed evidence indicates they will not. Emergency responders and the DC Department of Health need to have a complete list of chemicals used at the job site. PID devices do not determine whether an immediate safety risk exists at CIPP sites.

Recommendations: Persons complaining about odor or illness near the CIPP manufacturing sites should be directed to seek medical attention or call 911. Neither DC Water nor its agents should enter private premises where contamination may have occurred. All parties have conflicts of interest with the potential discovery of illness associated with the CIPP activity. Under DC Water's plan to discharge CIPP manufacturing waste into the environment, suspected or confirmed illness cases should prompt immediate project shutdown (CIPP curing should be immediately halted). The DC Department of Health should be called in to investigate. The team can seek training (at no cost) from Purdue University who has trained other health departments about CIPP chemical exposure and incident investigations.

Deficiency 17

The Plan fails to explain how air testing data from one CIPP installation will be considered for the next CIPP installation as 14 day turnaround times are needed by laboratories to analyze and report chemical air testing results.

Evidence: There is no explanation of how changes to improve public safety and environmental protection would be made by DC Water once it receives air testing results.

Recommendation: The Plan should explain how long pauses between CIPP installations will occur so that air sample data can be obtained, reviewed, and shared with all agencies and the public involved, and changes can be made for air testing and public notices.

AECOM

Soapstone Valley Park Sewer Rehabilitation Project

Air Quality Site Monitoring and Emissions Testing Plan during the CIPP Installation

District of Columbia Water and Sewer Authority (DC Water)

Project number: 60632324

May 16, 2022
Updated July 13, 2022

Delivering a better world

Quality information

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Tables

Acronyms

ACGIH – American Conference of Governmental Industrial Hygienists

AECOM – AECOM Technical Services, Inc.

AEGL – Acute Exposure Guidance Level

AMC – Air Monitoring Contractor

AQD – Air Quality Division

AQMP – Air Quality Site Monitoring and Emissions Plan

CAL – California

CAS – Chemical Abstract Service

CIPP – Cured-in-Place Pipe

DC Water – District of Columbia Water and Sewer Authority

DFR – Daily Field Report

DOEE – Department of Energy and Environment

HAP – Hazardous Air Pollutant

LPM – Liter per Minute

NIOSH – National Institute for Occupational Safety and Health

OSHA – Occupational Safety and Health Administration

PEL – Permissible Exposure Limit

PID – Photoionization Detector

ppm – Parts per million

QA/QC – Quality Assurance / Quality Control

REL – Recommended Exposure Limit

RPD – Relative Percent Difference

SDS – Safety Data Sheet

Soapstone Project – Soapstone Valley Creek Sewer Rehabilitation Project

TLV – Threshold Limit Value

TVOC – Total Volatile Organic Compounds

TWA – Time Weighted Average

USEPA – United States Environmental Protection Agency

VOC – Volatile Organic Compound

1. Introduction

AECOM Technical Services, Inc. (AECOM) of Chelmsford, Massachusetts was retained by The District of Columbia Water and Sewer Authority (DC Water) to prepare this Air Quality Site Monitoring and Emissions Testing Plan (AQMP) for evaluating emissions and odors during the Cured-in-Place-Pipe (CIPP) activities during the Soapstone Valley Park Creek Bed Sewer Repair and Rehabilitation Project (Soapstone Project). This AQMP responds directly to the requirements in the Letter from the Department of Energy and Environment (DOEE) Air Quality Division (AQD) dated April 12, 2022.

DC Water will conduct air quality monitoring and emissions testing during the CIPP activities during the Soapstone Project to address the following concerns: worker safety; community safety; and potential for air emissions. Worker safety is addressed in individual Contractors' Health and Safety Plans and will be conducted in parallel with the requirements of this AQMP. This AQMP includes a Site Monitoring Plan and Emissions Testing Plan.

1.1 Background

DC Water is performing the Soapstone Project as part of its Capital Improvement Program. The project will address aging and defective sewer pipes extending from Albemarle Street NW to Broad Branch Road NW. The Soapstone Project includes the following activities:

- Rehabilitation of defective sanitary sewer pipes;
- Rehabilitation of defective sewer manholes;
- Protection of other sewer infrastructure assets; and
- Repair of Municipal Separate Storm Sewer System outfall.

This AQMP responds specifically to the potential for emissions related to the CIPP activities during the rehabilitation of the defective sanitary sewer pipes. Air quality monitoring is planned for these activities to assess the emissions and community impact. An overview of the project area is shown in **Figure 1**.

CIPP is a type of trenchless technology that involves the insertion of a tube lining coated with resin and an activator into the existing or host pipe. Following placement into the host pipe, the tube is cured in place with heat using steam, hot water, or ultra-violet light. Hot water curing has been selected for the Soapstone Project. Hot water cured CIPP installations use thermal energy to accelerate the curing of resins. In the hot water cure process, the liner is inserted into the host pipe and pressurized water expands the uncured liner into the host pipe. The water is then heated and held at an elevated temperature for the time recommended by the manufacturer as the resin cures. The heated water, under light pressure, maintains the pipe shape as it cures in place. After the resin cures, the water is cooled, the downstream end of the liner is cut, and the water is released at a controlled rate to the downstream sewer where it mixes with wastewater and conveys to a treatment plant for processing.

DC Water has selected a non-VOC/non-styrene based resin and hot water curing method for the Soapstone Project. A comparison of the Resin and Curing Agent's Safety Data Sheets (SDS), included in **Appendix A**, against the United States Environmental Protection Agency's (USEPA) list of Hazardous Air Pollutants (HAPs)[1] regulated under the Clean Air Act indicates that the Curing Agent contains cumene as the only ingredient listed as a HAP with acute or chronic inhalation health risk. The SDS for the Curing Agent contains up to 2.5% cumene by weight; however, during the curing process approximately 90-95% of the curing agent, including the cumene, reacts with the resin hardening into a cured material and is not released from the matrix during the CIPP process. Additionally, the Curing Agent contains a second HAP, acetophenone, up to 3% by weight. As the curing agent combines with the resin there is a potential for it to interact with other molecules and generate additional volatile organic compounds (VOCs) at relatively

[1] Clean Air Action identifies 188 HAPs that the USEPA is required to control to protect public health. www.epa.gov/clean-air-act/overview accessed May 5, 2022.

smaller proportions. Therefore, total volatile organic compounds (TVOCs) will be measured in real-time using a Photoionization Detector (PID) as a screening device and the TVOCs results will be used to modify work activities as needed. Individual VOCs will be categorized using USEPA Method TO-15[2].

The water-cured CIPP operations also require the use of a refrigeration truck. This truck along with the terminal discharge manhole represent the most likely locations to experience concentrations of cumene in ambient air caused by the CIPP activities. In addition, gases from the CIPP installation have the potential to migrate up the lateral connections towards residential properties and care should be taken to determine the impacts at these sensitive locations as well. Therefore, air monitoring and testing during the Soapstone Project will focus on these three work areas.

Figure 1: Site Overview

1.2 Air Quality Monitoring and Emissions Testing Summary

During the CIPP activities, air quality monitoring will be conducted at the perimeter of the work zones to provide real-time notification to the project team of air emissions. This will be paired with emissions testing at the terminal discharge manhole to quantify emissions released to the atmosphere during the curing process.

The results of the real-time site monitoring and emissions testing will be used to determine best practices and inform future monitoring and testing requirements.

[2] USEPA, Center for Environmental Research Information Office of Research and Development. Compendium Method TO-15 Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters And Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS). January 1999. EPA/625/R-96/010b

2. Air Quality Standards

DC Water has reviewed the chemicals used in the CIPP process and the available air quality standards and developed a project-specific real-time Action Level to assess air quality conditions in real-time. The Action Level will be used as a trigger point at which operational controls must be implemented to minimize the impacts of the CIPP activities on the neighboring communities. Compliance with available community exposure levels will also be completed on a chemical-by-chemical basis using the results of integrated samples collected at the perimeter of the work zone.

2.1 Chemicals of Interest

Based on a review of the SDS for the resin and activator (curing agent), the primary ingredient of the activator is cumene hydroperoxide with the balance being other VOCs including cumene up to 2.5 weight percent and acetophenone up to 3 weight percent. Cumene and acetophenone are the only VOCs present in the curing agent that are categorized as HAPs under the Clean Air Act. However, only cumene has acute or chronic inhalation health risk defined by USEPA. Both cumene and acetophenone have additional long-term occupational (worker exposure) exposure levels recognized by the United States Department of Labor, including Occupational Safety and Health Administration (OSHA), National Institute for Occupational Safety and Health (NIOSH), and American Conference of Governmental Industrial Hygienists (ACGIH) and will be evaluated as part of this measurement program. Additional information on these chemicals is provided in the following sections.

2.1.1 Cumene

Cumene (CAS Number 98-82-8) is an alkylated benzene that has an isopropyl group and is also referred to as isopropylbenzene. Cumene is a colorless liquid with a sharp, penetrating, aromatic gasoline-like odor. Cumene is a ubiquitous pollutant since it is naturally present in petroleum and tobacco smoke.

The USEPA Acute Exposure Guidance Levels (AEGLs)[3] are science-based standards that apply to the general public and should not be exceeded in areas that are accessible to the general public – the AEGLs for cumene are included in **Table 1**. AEGLs are appropriate for use for once-in-a-lifetime, or rare, exposure to airborne chemicals. Since CIPP activities will only occur once on any section of sewer pipe and each residence would only be closest to the work for a single installation, these values are appropriate for use.

Other occupational exposure levels associated with occupational safety (worker exposure) are listed in **Table 2**. The occupational exposure levels for cumene are the same as the USEPA AEGL-1 equal to 50 ppm for an 8- to 10-hour time-weighted average.

Cumene is an odorous chemical, with an odor threshold of 0.008 – 0.132 ppm. This means that cumene can be detected by the human nose at concentrations well below those determined to be irritating by the USEPA AEGLs (50 ppm). Odors are expected to be present periodically during the CIPP process and most notably during the initial opening of the refrigeration truck. Detected odors do not correlate with health risk; however, they can be useful to help companies reduce measured concentrations of the cumene with good site practices related to odor control. Site requirements for odor/emissions mitigation will be documented in the Contractor's Work Plan.

[3] AEGLs describe the human health effects from once-in-a-lifetime, or rare, exposure to airborne chemicals. Values are available at https://www.epa.gov/aegl, accessed April 19, 2022.

Table 1: Cumene USEPA Acute Exposure Guideline Levels

Guideline or Standard		Exposure Duration					Endpoint
		10 min	30 min	1 hour	4 hour	8 hour	
AEGL 1	Non-Disabling	50 ppm 250 µg/m^3	50 ppm 250 µg/m^3	50 ppm 250 µg/m^3	50 ppm 250 µg/m^3	50 ppm 250 µg/m^3	Mild eye and respiratory irritation in humans
AEGL 2	Disabling	550 ppm 2,700 µg/m^3	380 ppm 1,900 µg/m^3	300 ppm 1,300 µg/m^3	190 ppm 930 µg/m^3	130 ppm 640 µg/m^3	Mild reversible neurological changes and NOEL for ataxia in rats, and impaired ability to escape
AEGL 3	Lethal	1,300 ppm 6,400 µg/m^3	920 ppm 4,500 µg/m^3	730 ppm 3,600 µg/m^3	460 ppm 2,300 µg/m^3	300 ppm 1,500 µg/m^3	Lethality threshold from CNS depression in rats

Table 2: Cumene Occupational Exposure Levels

Exposure Level	Level	Averaging Period
OSHA PEL	50 ppm	8-hour TWA
NIOSH REL	50 ppm	Up to 10-hour TWA
ACGIH TLV	50 ppm	8-hour TWA
CAL/OSHA PEL	50 ppm	8-hour TWA

Definitions:
ACGIH – American Conference of Governmental Industrial Hygienists
CAL - California
NIOSH – National Institute for Occupational Safety and Health
OSHA – Occupational Safety and Health Association
PEL – Permissible Exposure Level
ppm – Parts per million
REL – Recommended Exposure Limits
TLV – Threshold Limit Value
TWA – Time Weighted Average

2.1.2 Acetophenone

Acetophenone (CAS Number 98-86-2) is an organic compound containing a carbonyl group and is known as a ketone. Acetophenone is a colorless viscous liquid with a sweet pungent odor resembling oranges. Acetophenone is formed as a byproduct of the cumene process and is a precursor in resins and fragrances. Because acetophenone is a byproduct of the cumene process it is anticipated that there will be a strong correlation between cumene concentrations/odors and the presence of acetophenone. For this reason, acetophenone sampling will be limited to the emissions testing.

There are no USEPA AEGLs for acetophenone. Acetophenone is classified by the USEPA as a Group D chemical, which has no known chronic (long-term) reproductive, developmental, or carcinogenic effects in humans. However, there are other occupational exposure levels associated with occupational safety (worker exposure) as listed in **Table 3**.

Acetophenone is an odorous chemical, with an odor threshold of 0.36 – 0.6 ppm. Like cumene, acetophenone can be detected by the human nose at concentrations well below the occupational exposure levels. Since cumene has a lower odor threshold than acetophenone, it is anticipated that cumene will be observed before acetophenone. Like cumene, odors are expected to be present periodically during the CIPP process and most notably during the curing process. Detected odors do not correlate with health risk; however, they can be useful to help manage measured concentrations of the

acetophenone with good site practices related to odor control. Site requirements for odor/emissions mitigation will be documented in the Contractor's Work Plan.

Table 3: Acetophenone Occupational Exposure Levels

Exposure Level	Level	Averaging Period
OSHA PEL	None	8-hour TWA
NIOSH REL	None	Up to 10-hour TWA
ACGIH TLV	10 ppm	8-hour TWA
CAL/OSHA PEL	10 ppm	8-hour TWA

Definitions:
ACGIH – American Conference of Governmental Industrial Hygienists
CAL - California
NIOSH – National Institute for Occupational Safety and Health
OSHA – Occupational Safety and Health Association
PEL – Permissible Exposure Level
ppm – Parts per million
REL – Recommended Exposure Limits
TLV – Threshold Limit Value
TWA – Time Weighted Average

2.2 Real-Time Action Level

DC Water has reviewed the regulatory compliance levels set forth above and has developed an Action Level that is far more conservative to use in real-time to manage site activities. To add another layer of conservatism DC Water has identified the TVOC Action Level as less than 50% of the AEGL-1 for cumene and equal to the long-term occupational (not acute) exposure levels for acetophenone (10 ppm or more). Although the TVOC Action Level is equal to the occupational exposure levels for acetophenone, TVOC will be measured on a much shorter time interval (15-minute or instantaneous) which offers a final layer of conservatism, since response actions would be implemented in real-time, preventing sustained concentrations greater than the Action Level. Additionally, an odor intensity action level was developed based on categorization of moderate odors that may be objectionable/irritating.

The Action Levels will be used as a real-time screening tool to manage remedial activities and minimize the potential for off-site emissions that could be irritating to the public. A comparison of the real-time TVOC and odor monitoring results to the Action Levels will provide a preliminary evaluation of air quality conditions. The Real-Time Action Levels are included in **Table 4**.

Table 4: Site-Specific Action Levels

Target Parameter	Action Level
TVOC (15-minute average or instantaneous concentration)	10 ppm or greater
Odor Intensity* (Instantaneous observation related to Site activities)	Observed odor > 3 on odor intensity scale; or Off-Site odor complaint verified by Air Monitoring Contractor

*See **Table 6** for odor intensity scale.

2.3 Community Exposure Levels

The AEGLs for cumene will be utilized to evaluate the results of the chemical-specific sampling performed upwind and downwind of the refrigeration transport truck. Although additional AEGLs are not presented

within this document, if it is determined that concentrations of other USEPA HAPs are caused by the CIPP activities, these concentrations will be evaluated against the AEGLs for each specific HAP as necessary.

3. Community Air Monitoring and Sampling

Air monitoring and sampling will be performed during active CIPP processes for the Soapstone Project including the installation of the liner and the hot water curing process. The locations and frequency of monitoring and sampling are included in **Table 5**. The following sections present the required monitoring and sampling.

Table 5: Locations and Frequency of Real-Time Air Monitoring

No.	Location	Frequency
1	At the upwind and downwind perimeter of the exclusion zone of the refrigeration transport truck with special consideration for the orientation of the truck doors and proximity of the residential receptors.	• Continuous 15-minute TVOC average concentrations and instantaneous odor observations every 15-minutes during work hours • Samples (TO-15) collected during 8- to 12-hour workday
2	Downwind of the insertion manhole exclusion zone	• Hand-held instantaneous TVOC measurements and odor observations every 30-minutes during the curing process
3	Downwind of any pass-through manholes	• Hand-held instantaneous TVOC measurements and odor observations every 30-minutes during the curing process
4	Downwind of the terminal discharge manhole	• Hand-held TVOC measurements and odor observations every 30-minutes during the curing process
5	Downwind of the downstream manhole	• Hand-held TVOC measurements and odor observations, as needed during the curing process based on results of TVOC measurement at the terminal discharge manhole (<Action Levels)
6	Lateral connection downwind of the cleanout manhole*	• Hand-held TVOC measurements and odor observations every 30-minutes during the curing process

Notes:
* Additional TVOC measurements in the cleanout manhole may be performed for informational purposes to facilitate site management decisions.

3.1 Real-Time Air Monitoring

Real-time air monitoring for TVOCs and odor intensity will be conducted during work activities of the CIPP process. For the Soapstone Project, measurements will be performed at the locations and frequency during CIPP activities as included in **Table 5**. The locations of monitoring will vary based on the type of connection between the CIPP activities and the connected residences. There are four main types of sewer system connections, these scenarios are included in **Appendix B**.

3.1.1 TVOC Monitoring

Real-time air monitoring for TVOCs will be performed using a Photoionization Detector (PID) that is capable of measuring TVOCs down to 1 ppm with an 11.6 eV lamp. TVOC will be measured as isobutylene and reported as cumene. Real-time TVOC monitoring is categorized in the following two ways:

1. Emissions from the refrigeration transport truck are anticipated to be more significant than those downwind of the various manholes; therefore, continuous monitoring is planned for this location to better understand any emissions that leave this work area. PIDs will be set up in the upwind and downwind directions and programmed to measure 15-minute average TVOC concentrations continuously during the active CIPP process. Instruments will be configured to provide an auditory/visual alarm on the PID when the Action Level is reached or exceeded.
2. Emissions downwind from the manholes are only anticipated during the hot water curing process. Therefore, hand-held instantaneous measurements of TVOCs will be obtained every 30-minutes during the curing process during this part of the CIPP process.

3.1.2 Odor Monitoring

Characteristic odors associated with cumene and acetophenone during CIPP process are anticipated especially when the doors to the refrigerated transport truck are initially opened. Such odors have been often described as sharp, penetrating, aromatic, gasoline-like, or citrus-like odors.

Since there is a potential for other sewer type (organic or sulfur-based) odors possible while the sewer covers are opened, observations will not be limited to just cumene and acetophenone. General odor intensity will be taken during the CIPP process based on a qualitative and subjective assessment of odor intensity and/or complaints received from the public or adjacent property owners. If the odor intensity is documented at a 2 or greater, documentation of an odor description shall be recorded to assist in analysis and project understanding. A table of the odor intensity scale that will be used is presented in **Table 6**.

Table 6: Odor Intensity Scale

Odor Intensity	Odor Intensity Description
0 – Not detectable	Odor not detectable by the sense of smell.
1 – Very Light	An odor present in air which activates the sense of smell, but the characteristics may not be distinguishable.
2 – Light	An odor present in air, which activates the sense of smell and is distinguishable and definite. This may not necessarily be objectionable in short durations but may be objectionable in longer durations.
3 – Moderate	An odor present in air which easily activates the sense of smell, is very distinct and clearly distinguishable, and may tend to be objectionable and/or irritating.
4 – Strong	An odor present in air, which would be objectionable and cause a person to attempt to avoid it completely and may cause physiological effects during prolonged exposure.
5 – Very Strong	An odor present in the outdoor air, which is so strong, it is overpowering and intolerable for any length of time and causes physiological effects.

3.2 Chemical-Specific Sampling

Chemical-specific sampling and analysis will be conducted for VOCs to document the appropriateness of the Action Levels and to determine compliance with the AEGL for cumene and other chemicals as necessary. Each day at the start of CIPP activities, integrated samples will be collected for 8-hour to 12-hour periods at specified locations. Samples will be collected upwind and downwind of the refrigeration transport truck work zone as included in **Table 5**.

Each integrated sample will be collected at or near the breathing zone[4]. Locations of the chemical-specific sampling may change based on accessibility, safety of workers, or the results of the real-time measurements. Sample collection will start in the field with the start of CIPP activities and will run continuously throughout the workday.

Ambient concentrations of VOCs will be characterized using USEPA Method TO-15 (USEPA, 1999) for the expanded list of VOCs. The samples will be collected in 6-liter (L) Summa Canisters using flow controllers calibrated to collect a 6-L sample volume over a 12-hour period. Prior to shipping pre-cleaned evacuated canisters to the project for use, the laboratory will evacuate the canisters to the prescribed negative pressure, not less than -28 inches of mercury (in. Hg). The pressure will be checked upon arrival at the Site, and if the negative pressure is less than -28 in. Hg, the canister will not be used and will be returned to the laboratory for replacement.

Samples collected in the field will be labeled and kept in a secure location until ready for shipment back to the laboratory. Prior to shipping air samples, a chain of custody form will be completed for each batch of samples. The chain of custody form will include information such as project name, project number, sampler's name, sampling date, reporting address, sample contact, laboratory and contact information, sample identifications, sample matrix, analysis required, and special instructions or comments. The

[4] Area above the ground at the approximate height of where average humans breathe (i.e., height of human mouth or nose).

completed chain of custody will be signed and timed/dated before the samples are shipped. A copy of the chain of custody will be retained for the project file. The samples will be shipped to the laboratory within 1 business day following collection via overnight or second-day shipping and analyzed on an expedited turnaround time estimated to be no more than 3 business days.

Laboratory personnel will sign and date the chain of custody form in acknowledgment of receipt and comment, as necessary to document the sample conditions upon receiving each batch of samples. The laboratory will also assign a case number or unique sample identification number to each sample and will retain one (1) copy of the completed chain of custody for its records.

Results will be delivered electronically to the Air Monitoring Contractor (AMC).

Based on the results of the sampling the VOC list of chemicals analyzed may be reduced to the standard TO-15 analysis list for the selected analytical laboratory. Likewise, the turnaround time for the analysis may be increased to the standard turnaround time estimated to be 10-15 business days. Acetophenone sampling may be discontinued with concurrence from DOEE based on the results early in the Soapstone Project.

3.3 Community Baseline Air Monitoring and Sampling

Baseline sampling will be conducted early in the Soapstone Project and the need for baseline emissions testing will be evaluated as the project progresses. Baseline emissions testing will be conducted the morning of or the day before the installation of the CIPP with the collection of two 1-hour summa canister samples at the locations and frequencies included in **Table 7**. The samples will be collected in 6-liter (L) Summa Canisters using flow controllers calibrated to collect a 6-L sample volume over a 1-hour period. These results would be used to establish conditions in the neighborhood prior to the start of CIPP for comparison purposes. These samples are subject to the same laboratory analysis and turnaround time as those described in **Section 3.2**.

Additionally, odor observations shall be documented by the sampling team prior to the start of CIPP activities to establish baseline odor levels.

Depending on the results of the baseline and CIPP emissions testing, the continued need for baseline sampling will be evaluated and may be eliminated at the discretion of DC Water.

Table 7: Locations and Frequency of Baseline Chemical-Specific Sampling

No.	Location	Frequency
1	In the area where the refrigerated transport truck will be located	Sample (TO-15) collected during 1-hour either the day before or the morning of the CIPP activities

4. Emissions Testing

Emissions testing of the air coming out of the termination manhole will be performed during active CIPP processes for the Soapstone Project including the installation of the liner and the hot water curing process. The locations and frequency of the emissions testing are included in **Table 8**. The following sections present the required emission testing.

Emissions testing includes chemical-specific sampling for cumene and acetophenone combined with flow measurements at the terminal discharge manhole to determine emissions.

Table 8: Locations and Frequency of Chemical-Specific Sampling

No.	Location	Frequency
1	Terminal discharge manhole (approximately 4 inches above the center of the manhole) for VOCs, including cumene.	Sample (TO-15) collected during 8- to 12-hour workday.
2	Terminal discharge manhole (approximately 4 inches above the center of the manhole) for acetophenone.	Sample (Method 18) collected two or three 1-hr samples during 8- to 12-hour workday.

4.1 Chemical-Specific Sampling

Chemical-specific sampling and analysis will be conducted for VOCs (including cumene and acetophenone) at the termination manhole (as shown in **Table 8**) to determine the emission rates of specific VOCs being released to the environment. The results of these samples will not be compared to the AEGLs because they represent source concentrations and do not reflect concentrations leaving the work zone.

4.1.1 Cumene

VOC samples will be collected at the termination manhole (approximately 4 inches above the center of the manhole) using 6-Liter Summa canisters over the 8- to 10-hour workday. These samples will be subject to the same procedures, analysis requirements and turnaround times as those described in **Section 3.2**.

4.1.2 Acetophenone

Sampling for acetophenone will need to be conducted with an alternate VOC collection method designed for ketone organic compounds. Acetophenone will be collected and analyzed using USEPA Method 18, Determination of Gaseous Organic Compounds by Direct Interface Gas Chromatography-Mass Spectrometry (USEPA 1997).

Acetophenone sampling will be conducted using adsorption tubes with XAD media in accordance with USEPA Method 18. Two midget impingers will be set up prior to the XAD sorbent tubes and samples for 1-hour at a rate of 1.0 liters per minute (LPM). A leakless Teflon-coated diaphragm-type pump or equivalent to deliver at least 1 LPM is required for sampling. The impinger tube contents will be analyzed for acetophenone along with the XAD media. During the analysis, acetophenone is the specific compound that will be identified. Laboratory analysis involves using a high-resolution gas chromatograph coupled to an appropriate detector for acetophenone. Two or three 1-hour samples will be collected to capture peak potential emissions with at least one sample collected one hour after the start of the CIPP process and one hour prior to the end of the CIPP process. Acetophenone samples will be subject to the same chain of custody documentation and turnaround times as those described in **Section 3.2**.

4.2 Manhole Flow Measurements

Flow measurements from the terminal discharge manhole will be conducted hourly during the CIPP process. A measurement device similar to a Vane Anemometer or a Thermal Anemometer will be used to

measure air velocity measurements at the terminal discharge manhole (approximately 4 inches above the center of the manhole). The anemometer measures facial velocity across the cross-section of the manholes. Multiple measurements will be taken across the manhole as a grid pattern to capture average facial velocity of the manhole. The average flow rate will be calculated using the measured velocity, area of the manhole cross-section, and measured ambient temperature.

A vane anemometer is a device that measures the speed of airflow by measuring the pressure against a surface such as a propeller. The propeller produces an output that drives the electric generator which is proportional to the air velocity. This measured velocity is calculated to volumetric flow at the specific location.

A thermal anemometer works on the principle that an electrically heated wire when placed in a gas stream cools the wire and heat is transferred from the wire to the gas. This temperature gradient is measured as the difference in electrical output and translated to air velocity. This measured velocity is calculated to volumetric flow at the specific location.

4.3 Emission Rates Calculation

Results of the chemical-specific sampling will be used in combination with the measured average flow rate to determine emission rates (lb/hr) for cumene and acetophenone. Emissions for other VOCs shall be determined based on an evaluation of whether they are related to CIPP activities or naturally occurring in the sewer. Laboratory analysis results will be reviewed and a determination will be made based on whether an elevated concentration is detected and then if the chemical is suspected to be involved with CIPP activity. Baseline emissions as described in **Section 4.4** will be used to determine if a chemical is suspected to be involved with CIPP activity. If additional chemicals are determined to be related to the CIPP activities, the emission rates (lb/hr) will be calculated using the laboratory results and average flow rates using the same approach used for cumene and acetophenone. Chemicals may be excluded from the analysis with concurrence from DOEE.

4.4 Emissions Testing Baseline

Baseline sampling will be conducted early in the Soapstone Project and the need for baseline emissions testing will be evaluated as the project progresses. Baseline emissions testing will be conducted the morning of or the day before the installation of the CIPP with the collection of samples at the locations and frequencies included in **Table 8** and include:

- TO-15 samples will be collected in 6-liter (L) Summa Canisters using flow controllers calibrated to collect a 6-L sample volume over a 1-hour period.
- USEPA Method 18 samples will be collected using 1.0 LPM collected over a 1-hour period.

Baseline sampling should be completed at the termination manhole once the bypass pump is in operation based on its proximity to the exclusion zone. These results would be used to establish conditions in the sewer prior to the start of CIPP for comparison purposes. These samples are subject to the same laboratory analysis and turnaround times as those described in **Section 3.2**.

Depending on the results of the baseline and CIPP emissions testing the continued need for baseline sampling will be evaluated and may be eliminated at the discretion of DC Water.

5. Quality Assurance Quality Control

The AQMP includes several activities related to Quality Assurance Quality Control (QA/QC) designed to ensure that the monitoring and testing program is being and has been properly conducted and that the analytical results have been reviewed for accuracy and overall quality. The primary goal of the QA/QC aspect of the program is to assure that the field activities; laboratory results; the associated responses to exceedances; and the data reporting are appropriate and protective of the environment and public health.

5.1 Field Documentation

A field logbook and measurement device calibration field forms, along with monthly data listings, will be maintained by the AMC throughout the air monitoring program. Information to be recorded by the AMC will include:

- Description of daily activities;
- Daily Site maps showing the locations of the hand-held and observational monitoring and sampling locations for the day;
- Any corrective actions conducted due to elevated real-time air monitoring concentrations;
- Chemical-specific VOC sample media receipt dates, conditions, and numbers;
- Copies of the chain of custody forms;
- General field weather conditions on sampling days; and
- Any unusual situations which may affect samples or sampling.

General QA/QC procedures related to the collection and analysis of representative field monitoring data and samples are discussed in the following sections.

5.2 Instrument Calibration

Instrument calibrations will be performed according to the manufacturer's recommendations. Hard copies of the manufacturer's instrument manuals will be kept onsite for reference.

PIDs will be determined "fit for use" by checking the instrument against known standards on a daily basis in accordance with the manufacturer's instructions using either commercially available standards, or internal calibration points. Specific calibration checks may be conducted at the start of daily activities. In certain circumstances, similar calibration checks will be conducted at the conclusion of the measurement day. For example: A calibration check will be conducted if a device, such as a PID, is suspected to not be functioning properly or a calibration check may be conducted during the operational day if a device is suspected of malfunction. There may also be circumstances where a calibration check is conducted in conjunction with a period of elevated concentrations to verify or validate the instrument (device) readings. This check could be conducted just after the period of elevated readings or in certain circumstances during the period of elevated concentrations.

Each PID will be calibrated (to zero and an upscale concentration) once daily using a certified standard isobutylene gas for TVOC mode. Each anemometer will be calibration checked prior to project mobilization by a certified standard device and repeated at the frequency recommended by the manufacturer.

5.3 Chemical-Specific Sampling

The TO-15 samples will be collected in a 6-L Summa Canister equipped with a flow control regulator during remediation activities. Spare flow control regulators will be supplied by the laboratory for use on the integrated/composite VOC sample. The flow controllers will be calibrated by the laboratory to collect a

sample at a flow rate that will allow the canister to fill over a 1-hour or 10-hour period. The flow controllers will be returned to the laboratory for cleaning when routine checks indicate a change in flow rate.

The USEPA Method 18 samples will be collected with a sampling pump capable of collecting a sample through the impinger and XAD at 1 LPM. The sample pump will be calibrated in accordance with the instrument's manufacture specifications. If a flowmeter is used in the field to confirm the flowrate, this shall also be calibrated in accordance with the manufacturer's specifications.

5.3.1 Field Quality Control Samples

Field duplicate samples for both TO-15 and Method 18 will be collected and used to facilitate the evaluation of the precision and accuracy of the results from the laboratory samples. Duplicate samples will be collected at a rate of one (1) routine duplicate sample collected at one of the sample locations for every 20 routine samples. The results will be evaluated, and it will be determined if the results are reasonable.

Relative Percent Differences (RPDs) between the collocated or duplicate samples should be less than or equal to 50% when both results are greater than five times the reporting limit or less than or equal to 100% when either result is less than five times the reporting limit.

6. Action Level Response Plan

The AQMP includes a conservative approach for evaluating site conditions according to Action Levels presented in **Section 2.0**. This approach shall be consistent with the Contractor's Work Plan. The following sections define the site conditions and the air monitoring Action Level Response Plan.

6.1 Site Conditions

Air monitoring data measured on-site will be used to evaluate the site conditions on a real-time basis to allow the Construction Manager to adequately, and in a timely manner, respond to periods of elevated concentrations. **Table 9** presents each target parameter and the associated site conditions.

Table 9: Site Conditions

Target Parameter	Operational Condition	Action Site Condition	Stop Work Condition
TVOC	TVOC ≤ Action Level	TVOC > Action Level	TVOC > AEGL
Odor Intensity	Odor ≤ Action Level	Odor > Action Level or Public Complaint	--

* Action Levels are defined in **Section 2.0**.

6.2 Alert and Action Level Response Plan

The PIDs operating continuously will alarm audibly and visibly in the work zone in the event of a TVOC or concentration greater than the Action Level. Hand-held TVOC measurements will be manually assessed by the technician making the measurements. The AMC will respond to changes in site conditions as described below:

1. AMC will verify actual site conditions and determine whether those conditions are related to CIPP activities;
2. AMC will notify the Construction Manager of periods of elevated concentrations related to CIPP activities;
3. AMC will move further downwind and document any lateral dispersion between the manhole and nearby residences;
4. AMC will work with the Construction Manager and CIPP Contractor to agree on the appropriate response action;
5. CIPP Contractor will implement control and mitigation measures in accordance with the Contractor's Work Plan;
6. Construction Manager will evaluate the performance of the control and mitigation measures;
7. AMC will continue to track air monitoring results and will notify Construction Manager of changes in the site conditions; and
8. The Construction Manager will notify the CIPP Contractor of any modifications to the control response based on real-time air monitoring results.
9. DC Water will notify DOEE of any TVOC exceedances greater than the Action Level that are determined to be caused by CIPP activities.

6.2.1 Documentation

Each period of elevated concentrations greater than the Action Levels will be documented by the AMC in the field log notebook. Information recorded during periods of elevated concentrations will include but not be limited to the following:

- Time of exceedance;
- Location of exceedance;
- Cause for exceedance and supporting documentation for the cause (related or unrelated to CIPP activities);
- Relevant meteorological conditions;
- Background concentrations;
- CIPP activities; and
- Documented response actions.

The AMC will provide an initial verbal notification for each period of elevated concentrations.

7. Reporting

The air monitoring and emissions sampling results from the program will be documented and reported in several ways: verbal exceedance notifications; daily field reports; and a Final Report at the conclusion of the project.

7.1 Verbal Exceedance Notifications

Notifications of real-time exceedances of the Action Level will be provided verbally to the on-site Construction Manager as they occur or sampling results greater than the AEGL as they are received from the laboratory. These will be documented by the AMC in the field notebook.

7.2 Daily Field Report

Daily field reports (DFRs) will be provided and will detail any exceedances of the real-time Action Levels and comment on the associated responses to exceedance notifications. The reports will also include a preliminary summary of the real-time data and field weather conditions. The DFR will be provided electronically to the Construction Manager the following business day after receiving an initial reasonability review. Laboratory results from subsequent periods will be attached to the DFRs and labeled accordingly. The preliminary data presented in the DFRs will be subject to change based on data validation conducted during the preparation of the project area reports.

DFRs will be shared with DOEE for any CIPP activities that had a documented exceedance of TVOC Action Levels and/or cumene sample results greater than the AEGLs. The source of the exceedance will be documented, and any supporting documentation will be included/summarized in the DFR for DOEE review.

7.3 Project Area Reports

A separate Community Air Monitoring Area Report and Emissions Testing Area Report will be compiled for each Project Area (noted on **Figure 1**). The Community Air Monitoring Area Report will be developed for community distribution and Emissions Testing Report Area Reports will be developed for DOEE review/comment. The separate Project Area Reports will compile the real-time monitoring and chemical-specific sampling results for each Project Area. The expected content of the Project Area Reports is summarized in **Table 10**. Reports should be tailored to the specific audience such that they are suitable for distribution.

Table 10: Project Area Report Requirements

Community Air Monitoring Area Reports	Emissions Testing Area Reports
• Brief summary of the air monitoring and sampling performed.	• Detailed summary of the air monitoring and sampling performed and QA/QC procedures.
• Summary of the real-time TVOC and odor monitoring results compared to the Action Level and AEGL. Summary shall include daily average and maximum concentrations by location and notation of any exceedances.	• Summary of the real-time TVOC and odor monitoring results compared to the Action Level and AEGL. Summary shall include daily average and maximum concentrations by location and notation of any exceedances.
• Table of exceedance conditions with a summary of the cause and the site response actions taken to reduce emissions.	• Table of exceedance conditions with a summary of the cause and the site response actions taken to reduce emissions.
• Summary of the chemical-specific results from the perimeter of the refrigeration transport truck comparing daily cumene concentration to the AEGL.	• Summary of the chemical-specific results from the perimeter of the refrigeration transport truck comparing daily cumene concentration to the AEGL. Review of additional chemical-specific results compared to each published AEGL to determine if any additional VOCs were present or resulting from the CIPP activities.
• Site map showing the locations of the CIPP installation (inclusive of the refrigerated transport truck and applicable manholes and cleanouts).	• Calculated cumene/acetophenone emission rates from the terminal discharge manhole (by combining the average daily facial flow from the manhole and the cumene/acetophenone sample results). Emission rates for other VOCs determined to be related to the CIPP activities will also be quantified.
• Summary of daily weather conditions from local meteorological system (DC Water or local airport).	• Site map showing the locations of the CIPP installation (inclusive of the refrigerated transport truck and applicable manholes and cleanouts).
--	• Summary of daily weather conditions from local meteorological system (DC Water or local airport).
--	• Recommendations or proposed changes to the monitoring or sampling protocols for future project areas.
--	• Real-time data listings.
--	• Laboratory reports.
--	• QA/QC records.

7.4 Final Air Monitoring and Emissions Testing Report

At the conclusion of the program, a comprehensive Final Air Monitoring and Emissions Testing Report of the real-time and chemical-specific air monitoring results will be prepared for DOEE submittal. The report should include a high-level summary of the overall project, any changes or modifications, and air quality conditions relative to the cumene AEGL. The report should include final Emissions Testing Area Reports and any noticed trends between work areas.

Up to two (2) hard copies and one (1) electronic copy of the final report documenting the air monitoring results will be prepared. The Final Air Monitoring and Emissions Testing Report will be submitted to DC Water for review within 60 days of the project completion.

Appendix A Safety Data Sheets

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SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product name AKPEROX C80

Chemical name Cumyl Hydroperoxide

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses Industrial use.

Uses advised against No specific uses advised against are identified.

1.3. Details of the supplier of the safety data sheet

Supplier

AKPA KİMYA AMBALAJ SANAYİ VE TİCARET ANONİM ŞİRKETİ
Yenibosna Merkez Mah. Ladin Sok.
No:36/70 Kat:12 34197 Townofis Bahçelievler, İstanbul, TÜRKİYE
Web: www.akpakimya.com
TEL: +90 212 580 55 59
FAX: +90 212 580 55 21
E-mail: info@akpakimya.com

Contact person Export Department - export@akpakimya.com

1.4. Emergency telephone number

Emergency telephone AKPA Kimya : +90 212 580 55 59

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification (EC 1272/2008)

Physical hazards Org. Perox. F - H242

Health hazards Acute Tox. 4 - H302; Acute Tox. 3 - H331; Acute Tok. 4 - H312; Skin Corr. 1B - H314; STOT SE 3 - H335; STOT RE 2 – H373

Environmental hazards Aquatic Chronic 2 - H411

2.2. Label elements

Pictogram

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Signal Word	Danger	
Hazard statements	H242	Heating may cause a fire.
	H302 + H312	Harmful if swallowed or in contact with skin.
	H314	Causes severe skin burns and eye damage.
	H331	Toxic if inhaled.
	H335	May cause respiratory irritation.
	H373	May cause damage to organs through prolonged or repeated exposure.
	H411	Toxic to aquatic life with long lasting effects.
Precautionary statements	P210	Keep away from heat, hot surfaceass, sparks, open flames and other ignition sources.- No smoking.
	P220	Keep away from acids, alkalis, heavy metal compounds, oxidising material, combustible materials.
	P273	Avoid release to the environment.
	P260	Do not breathe dust/ fume/ gas/ mist/ vapours/spray.
	P280	Wear protective gloves/protective clothing/eye protection/face protection.
	P301+P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor.
	P303+P361+P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
	P304+P340	IF INHALED : Remove person to fresh air and keep comfortable for breathing.
	P312	Call a POISON CENTER/doktor if you feel unwell.
	P305+351+338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
	P411+P235	Store at temperature not exceeding -30 +40˚C. Keep cool.
	P501	Dispose of contents/container in accordance with national regulations.

Commission Regulation (EU) No 2015/830 of 28 May 2015.
Contains α,α-dimethylbenzyl hydroperoxide; cumene hydroperoxide

2.3. Other hazards

This substance is not classified as PBT or vPvB according to current EU criteria.

SECTION 3: Composition/information on ingredients

3.2. Mixtures

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α,α-dimethylbenzyl hydroperoxide; cumene hydroperoxide			**%80-85**
CAS Number	**80-15-9**	**EC Number**	**201-254-7**
Classification		**Specific concentration limits**	
Org. Perox. E	H242	Skin Corr. 1B; H314: C ≥ 10 %	
Acute Tox. 3	H331	Eye Irrit. 2; H319: 1 % ≤ C < 3 %	
Acute Tox. 4	H302	Skin Irrit. 2; H315: 3 % ≤ C < 10 %	
Acute Tox. 4	H312	STOT SE 3; H335: C < 10 %	
Skin Corr. 1B	H314	Eye Dam. 1; H318: 3 % ≤ C < 10 %	
STOT RE 2	H373		
Aquatic Chronic 2	H411		

2-phenylpropan-2-ol			**%1-5**
CAS Number	**617-94-7**	**EC Number**	**210-539-5**
Classification			
Acute Tox. 4	H302		
Skin Irrit. 2	H315		
Eye Irrıt. 2	H319		

cumene			**%1-2,5**
CAS Number	**98-82-8**	**EC Number**	**202-704-5**
Classification			
Flam. Liq. 3	H226		
Asp. Tox. 1	H304		
STOT SE 3	H335		
Aquatic Chronic 2	H411		

acetophenone			**%1-3**
CAS Number	**98-86-2**	**EC Number**	**202-707-8**
Classification			
Acute Tox. 4	H302		
Eye Irrit. 2	H319		

methyl acetoacetate			**%10-20**
CAS Number	**105-45-3**	**EC Number**	**203-299-8**
Classification			
Eye Irrit. 2	H319		

The Full Text for all R-Phrases and Hazard Statements are Displayed in Section 16.

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SECTION 4: First aid measures

4.1. Description of first aid measures

General information

Move out of dangerous ares. Show this Safety data sheet to the doktor in attendance. Do not leave the victim unattended. Symptoms of poisoning may appear several hours later. Call a physician immediately.

Inhalation

Remove affected person from source of contamination. Move affected person to fresh air and keep warm and at rest in a position comfortable for breathing. Maintain an open airway. Loosen tight clothing such as collar, tie or belt. When breathing is difficult, properly trained personnel may assist affected person by administering oxygen. Place unconscious person on their side in the recovery position and ensure breathing can take place. Get medical attention if any discomfort continues.

Ingestion

Rinse mouth thoroughly with water. Stop if the affected person feels sick as vomiting may be dangerous. Do not induce vomiting unless under the direction of medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Never give anything by mouth to an unconscious person. Move affected person to fresh air and keep warm and at rest in a position comfortable for breathing. Place unconscious person on their side in the recovery position and ensure breathing can take place. Maintain an open airway. Loosen tight clothing such as collar, tie or belt. Get medical attention if any discomfort continues.

Skin contact

It is important to remove the substance from the skin immediately. Take off immediately all contaminated clothing. Rinse immediately with plenty of water. Continue to rinse for at least 15 minutes and get medical attention. Chemical burns must be treated by a physician. Get medical attention if symptoms are severe or persist after washing.

Eye contact

Rinse immediately with plenty of water. Remove any contact lenses and open eyelids wide apart. Continue to rinse for at least 10 minutes. Get medical attention if symptoms are severe or persist after washing.

Protection of first aiders

First aid personnel should wear appropriate protective equipment during any rescue. Wash contaminated clothing thoroughly with water before removing it from the affected person, or wear gloves. It may be dangerous for first aid personnel to carry out mouth-to-mouth resuscitation.

4.2. Most important symptoms and effects, both acute and delayed

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General information See Section 11 for additional information on health hazards. The severity of the symptoms described will vary dependent on the concentration and the length of exposure.

Inhalation A single exposure may cause the following adverse effects: Difficulty in breathing. Unconsciousness. Vapors may irritate the respiratory system. Frequent inhalation of vapors over a long period of time increases the risk of developing lung diseases.

Ingestion May cause sensitization or allergic reactions in sensitive individuals. May cause discomfort if swallowed. May cause stomach pain or vomiting.

Skin contact May cause skin sensitisation or allergic reactions in sensitive individuals. Causes severe burns. Symptoms following overexposure may include the following: Pain or irritation. Redness. Blistering may occur.

Eye contact Causes serious eye damage. Symptoms following overexposure may include the following: Pain. Profuse watering of the eyes. Redness.

4.3. Indication of any immediate medical attention and special treatment needed

Notes for the doctor Treat symptomatically. May cause sensitization or allergic reactions in sensitive individuals.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media Extinguish with alcohol-resistant foam, carbon dioxide, dry powder or water fog. Use fire extinguishing media suitable for the surrounding fire.

Unsuitable extinguishing Media Do not use water jet as an extinguisher, as this will spread the fire.

5.2. Special hazards arising from the substance or mixture

Specific hazards May cause or intensify fire; oxidizer. May cause or intensify fire; oxidiser. Containers can burst violently or explode when heated, due to excessive pressure build-up. Fire-water run-off in sewers may create fire hazard. This product is toxic. Severe corrosive hazard. Water used for fire extinguishing, which has been in contact with the product, may be corrosive.

Hazardous decomposition products

Hazardous decomposition products are not known.

5.3. Advice for firefighters

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Protective actions during firefighting

Avoid breathing fire gases or vapours. Evacuate area. Keep upwind to avoid inhalation of gases, vapours, fumes and smoke. Ventilate closed spaces before entering them. May cause or intensify fire; oxidiser. Cool containers exposed to heat with water spray and remove them from the fire area if it can be done without risk. Cool containers exposed to flames with water until well after the fire is out. Avoid discharge to the aquatic environment. Control run-off water by containing and keeping it out of sewers and watercourses. If risk of water pollution occurs, notify appropriate authorities.

Special protective equipment for firefighters

Wear positive-pressure self-contained breathing apparatus (SCBA) and appropriate protective clothing. Firefighter's clothing conforming to European standard EN469 (including helmets, protective boots and gloves) will provide a basic level of protection for chemical incidents.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions

No action shall be taken without appropriate training or involving any personal risk. Keep unnecessary and unprotected personnel away from the spillage. Wear protective clothing as described in Section 8 of this safety data sheet. Follow precautions for safe handling described in this safety data sheet. Wash thoroughly after dealing with a spillage. Ensure procedures and training for emergency decontamination and disposal are in place. Do not touch or walk into spilled material. Avoid contact with skin and eyes.

6.2. Environmental precautions

Environmental precautions

Do not discharge into drains, water courses or onto the ground. Spillages or uncontrolled discharges into watercourses must be IMMEDIATELY alerted to the Environmental Agency or other appropriate regulatory body.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up

Keep combustibles away from spilled material. Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Ventilate. Dike far ahead of larger spills for later disposal. Absorb in vermiculite, dry sand or earth and place into containers. Wash thoroughly after dealing with a spillage.

6.4. Reference to other sections

Reference to the other Sections

For personal protection, see Section 8. See Section 11 for additional information on health hazards. See Section 12 for additional information on ecological hazards. For waste disposal, see Section 13.

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SECTION 7: Handling and storage

7.1. Precautions for safe handling

Usage precautions

Read and follow manufacturer's recommendations. Wear protective clothing as described in Section 8 of this safety data sheet. Keep away from food, drink and animal feeding stuffs. Keep container tightly sealed when not in use. Avoid handling which leads to dust formation. Avoid discharge to the aquatic environment. Do not handle until all safety precautions have been read and understood. Do not handle broken packages without protective equipment. Do not reuse empty containers.

Advice on general occupational hygiene

Wash promptly if skin becomes contaminated. Take off contaminated clothing. Wash contaminated clothing before reuse. Do not eat, drink or smoke when using this product. Wash at the end of each work shift and before eating, smoking and using the toilet. Change work clothing daily before leaving workplace.

7.2. Conditions for safe storage, including any incompatibilities

Storage precautions

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Store away from other materials. Keep only in the original container. Keep container tightly closed, in a cool, well ventilated place. Keep containers upright. Protect containers from damage. Protect from sunlight. Bund storage facilities to prevent soil and water pollution in the event of spillage. The storage area floor should be leak-tight, jointless and not absorbent. Store at temperatures between -30°C and 40°C.

7.3. Specific end use(s)

Specific end use(s)

The identified uses for this product are detailed in Section 1.2.

SECTION 8: Exposure Controls/personal protection

8.1. Control parameters

Occupational exposure limits

Ingredients	CAS No.	Value	Control Parameters	Basis
α,α-dimethylbenzyl hydroperoxide	80-15-9	TWA	1 ppm	US WEEL
Cumene	98-82-8	TWA	50 ppm	ACGIH
			50 ppm 245 mg/m^3	NIOSH REL
				OSHA Z-1
				OSHA P0

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Derived No Effect Level (DNEL) according to Regulation (EC) No. 1907/2006:

Substance name	End Use	Exposure routes	Potential health effects	Value
α,α-dimethylbenzyl hydroperoxide	Workers	Inhalation	Long-term exposure	6 mg/m^3

Predicted No Effect Concentration (PNEC) according to Regulation (EC) No. 1907/2006:

Substance name	Environmental Compartment	Value
α,α-dimethylbenzyl hydroperoxide	Fresh water	0.0031 mg/l
	Marine water	0.00031 mg/l
	Fresh water sediment	0.023 mg/kg
	Marine sediment	0.0023 mg/kg
	Soil	0.0029 mg/kg
	Sewage treatment plant	0.35 mg/l
	Intermittent use/release	0.031 mg/l

8.2. Exposure controls

Protective equipment

Appropriate engineering controls

Provide adequate ventilation Personal, workplace environment or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment. Use process enclosures, local exhaust ventilation or other engineering controls as the primary means to minimize worker exposure. Personal protective equipment should only be used if worker exposure cannot be controlled adequately by the engineering control measures. Ensure control measures are regularly inspected and maintained. Ensure operatives are trained to minimize exposure.

Eye/face protection

Eyewear complying with an approved standard should be worn if a risk assessment indicates eye contact is possible. Personal protective equipment for eye and face protection should comply with European Standard EN166. Wear tight-fitting, chemical splash goggles or face shield. If inhalation hazards exist, a full-face respirator may be required instead.

Hand protection

Chemical-resistant, impervious gloves complying with an approved standard should be worn if a risk assessment indicates skin contact is possible. The most suitable

glove should be chosen in consultation with the glove supplier/manufacturer, who can provide information about the breakthrough time of the glove material. To protect hands from chemicals, gloves should comply with European Standard EN374. Considering the data specified by the glove manufacturer, check during use that the gloves are retaining their protective properties and change them as soon as any deterioration is detected. Frequent changes are recommended.

Other skin and body protection

Appropriate footwear and additional protective clothing complying with an approved standard should be worn if a risk assessment indicates skin contamination is possible.

Hygiene measures

Provide eyewash station and safety shower. Contaminated work clothing should not be allowed out of the workplace. Wash contaminated clothing before reuse. Clean equipment and the work area every day. Good personal hygiene procedures should be implemented. Wash at the end of each work shift and before eating, smoking and using the toilet. When using do not eat, drink or smoke. Preventive industrial medical examinations should be carried out. Warn cleaning personnel of any hazardous properties of the product.

Respiratory protection

Respiratory protection complying with an approved standard should be worn if a risk assessment indicates inhalation of contaminants is possible. Wear suitable mask. Ensure all respiratory protective equipment is suitable for its intended use and is 'CE'- marked. Check that the respirator fits tightly and the filter is changed regularly. Gas and combination filter cartridges should comply with European Standard EN14 387 and EN143. Full face mask respirators with replaceable filter cartridges should comply with European Standard EN136. Half mask and quarter mask respirators with replaceable filter cartridges should comply with European Standard EN140.

Environmental exposure controls

Keep container tightly sealed when not in use. Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

SECTION 9: Physical and Chemical Properties

9.1. Information on basic physical and chemical properties

Appearance	Clear Liquid
Colour	Max. 180 Pt-Co/APHA
Odour	Pungent
Melting point	No data available.
Flash point	No data available.

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Flammability (solid, gas)	Not applicable
Density	1,05 - 1,07 gr/cm^3 20˚C
Viscosity	10,4 mPa.s 20˚C

9.2. Other information

Active Oxygen Content	8,40-8,94%

SECTION 10: Stability and reactivity

10.1. Reactivity

Reactivity Stable at normal ambient temperatures and when used as recommended.

10.2. Chemical stability

Stability Stable under recommended storage conditions.

10.3. Possibility of hazardous reactions

Possibility of hazardous reactions No potentially hazardous reactions.

10.4. Conditions to avoid

Conditions to avoid Avoid heat, flames and other sources of ignition. Static electricity and formation of sparks must be prevented. Avoid exposure to high temperatures or direct sunlight.

10.5. Incompatible materials

Materials to avoid Reducing agents. Flammable/combustible materials. Hydrocarbons. Organic cyanides (nitriles). Esters. Some metals. Keep away from amine and cobalt accelerators, acids, alkalis and heavy metal compounds, combustible materials.

10.6. Hazardous decomposition products

Hazardous decomposition Products Methane
Acetophenone
2-Phenylisopropanol

SECTION 11: Toxicological information

11.1. Information on toxicological effects

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Toxicological information
Harmful if swallowed.
Product:

Acute oral toxicity:	Acute toxicity estimate: 595,23 mg/kg Method: Calculation Method
Acute inhalation toxicity:	Acute toxicity estimate: 3,57mg/l Method: Calculation Method
Acute dermal toxicity:	Acute toxicity estimate: 1309,5 mg/kg Method: Calculation Method
Serious eye damage/irritation:	Corrosivity to eyes is assumed.
Skin corrosion/irritation:	Causes severe burns.
Respiratory or skin sensitisation:	
Respiratory sensitisation	May cause respiratory irritation.
Germ cell mutagenicity:	
Genotoxicity - In Vitro - In Vivo	Based on available data the classification criteria are not met.
Carcinogenicity:	Based on available data the classification criteria are not met.
Reproductive Toxicity:	May damage the unborn child. Suspected of damaging fertility
Reproductive Toxicity – Development	Not available.
Specific target organ toxicity - single exposure:	
STOT - Single exposure	May cause respiratory irritation.
Specific target organ toxicity - repeated exposure:	
STOT - Repeated exposure	May cause damage to organs through prolonged or repeated exposure.
Aspiration Hazard	Harmful if swallowed or in contact with skin.
Inhalation	A single exposure may cause the following adverse effects: Difficulty in breathing. Unconsciousness.
Ingestion	May cause sensitisation or allergic reactions in sensitive individuals. May cause chemicalburns in mouth, oesophagus and stomach. Symptoms following overexposure may include the following: Severe stomach pain. Nausea, vomiting.
Skin contact	May cause skin sensitisation or allergic reactions in sensitive individuals. Causes severe burns. Symptoms following overexposure may include the following: Pain or irritation. Redness. Blistering may occur.

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Eye contact	Causes serious eye damage. Symptoms following overexposure may include the following: Pain. Profuse watering of the eyes. Redness.
Route of entry	Ingestion Inhalation Skin and/or eye contact
Target organs	Respiratory system, lungs
Medical considerations	Skin disorders and allergies.

Toxicological information on ingredients

α,α-dimethylbenzyl hydroperoxide

Acute oral toxicity	LD50 Oral (Rat): 382 mg/kg	
Acute inhalation toxicity	Acute toxicity estimate: 2.01 mg/l	Exposure time: 4h
Acute dermal toxicity	Acute toxicity estimate: 1,100 mg/kg	

Cumene

Acute oral toxicity	LD50 (Rat): 2,700 mg/kg
Acute dermal toxicity	LD50 (Rabbit): > 3,160 mg/kg

2-phenylpropan-2-ol

Acute oral toxicity	LD50 (Rat): 1,300 mg/kg
Acute dermal toxicity	LD50 (Rabbit): 4,300 mg/kg

SECTION 12: Ecological Information

12.1. Toxicity

Toxicity No data available.

Ecological information on ingredients.

α,α-dimethylbenzyl hydroperoxide

Toxicity to fish	LC50, 96h (Oncorhynchus mykiss (rainbow trout)): 3.9 mg/l
Toxicity to daphnia and other aquatic invertebrates	EC50, 48h (Daphnia magna (Water flea)): 18 mg/l
Toxicity to algae	EC50, 72h (Desmodesmus subspicatus (green algae)): 1.6 mg/l

Cumene

Toxicity to fish	LC50, 96h (Oncorhynchus mykiss (rainbow trout)): 4.8 mg/l
Toxicity to daphnia and other aquatic invertebrates	EC50, 48h (Daphnia magna (Water flea)): 2.14 mg/l
Toxicity to algae	EC50, 72h (Desmodesmus subspicatus (green algae)): 2.01 mg/l
Toxicity to microorganisms	EC50, 3h : > 2,000 mg/l
Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	NOEC, 21d: 0.35 mg/l

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12.2. Persistence and degradability

Persistence and degradability No data available.

12.3. Bio accumulative potential

Bio accumulative potential No data available on bioaccumulation.

12.4. Mobility in soil

Mobility No data available.

12.5. Results of PBT and vPvB assessment

Results of PBT and vPvB assessment This product does not contain any substances classified as PBT or vPvB.

12.6. Other adverse effects

Other adverse effects None known.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

General information The generation of waste should be minimised or avoided wherever possible. Reuse or recycle products wherever possible. This material and its container must be disposed of in a safe way. Disposal of this product, process solutions, residues and by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any local authority requirements. When handling waste, the safety precautions applying to handling of the product should be considered. Care should be taken when handling emptied containers that have not been thoroughly cleaned or rinsed out. Empty containers or liners may retain some product residues and hence be potentially hazardous.

Disposal methods Dispose of surplus products and those that cannot be recycled via a licensed waste disposal contractor. Waste, residues, empty containers, discarded work clothes and contaminated cleaning materials should be collected in designated containers, labelled with their contents. Containers should be thoroughly emptied before disposal because of the risk of a fire. Do not cut or weld used containers unless they have been thoroughly cleaned internally.

SECTION 14: Transport information

General information For limited quantity packaging/limited load information, consult the relevant modal documentation using the data shown in this section.

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14.1. UN number

UN No. (ADR/RID)	3109
UN No. (IMDG)	3109
UN No. (ICAO)	3109
UN No. (ADN)	3109
UN No. (IATA)	3109

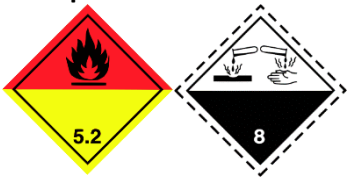
14.2. UN proper shipping name

Proper Shipping name (ADR/RID)	ORGANIC PEROXIDE TYPE F, LIQUID (CUMENE HYDROPEROXIDE)
Proper Shipping name (IMDG)	ORGANIC PEROXIDE TYPE F, LIQUID (CUMENE HYDROPEROXIDE)
Proper Shipping name (ICAO)	ORGANIC PEROXIDE TYPE F, LIQUID (CUMENE HYDROPEROXIDE)
Proper Shipping name (ADN)	ORGANIC PEROXIDE TYPE F, LIQUID (CUMENE HYDROPEROXIDE)
Proper Shipping name (IATA)	ORGANIC PEROXIDE TYPE F, LIQUID (CUMENE HYDROPEROXIDE)

14.3. Transport hazard class(es)

ADR/RID class	5.2
Subsidiary hazard class	8
ADR/RID label	5.2
IMDG class	5.2
ICAO class/division	5.2

Transport labels



14.4. Packing group

Not applicable.

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14.5. Environmental hazards
Environmentally hazardous substance/marine pollutant

14.6. Special precautions for user
Always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what todo in the event of an accident or spillage.

EmS	F-J, S-R
ADR transport category	2
Emergency Action Code	2W
Hazard Identification Number (ADR/RID)	539
Tunnel restriction code	(D)

14.7. Transport in bulk according to Annex II of MARPOL and the IBC Code

Transport in bulk according to Annex II of MARPOL	Not Applicable.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

National regulations	Health and Safety at Work etc. Act 1974 (as amended). The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (SI 2009 No. 716). The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (SI 2009 No. 1348) (as amended) ["CDG 2009"]. EH40/2005 Workplace exposure limits.
EU legislation	Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (as amended). Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures (as amended).

15.2. Chemical safety assessment

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No chemical safety assessment has been carried out.

SECTION 16: Other information

Key literature references and sources for data	This SDS is prepared based on the information received from the product owner.
Classification procedures according to Regulation (EC) 1272/2008	Acute Tox. 4 - H302; Acute Tox. 3 - H331; Acute Tok. 4 - H312; Skin Corr. 1B - H314; STOT SE 3 - H335; STOT RE 2 – H373; Aquatic Chronic 2 - H411: Calculation Method. Org. Perox. F - H242: Expert Judgement.
Training advice	Read and follow manufacturer's recommendations. Only trained personnel should use this material.
Revision comments	The SDS is generated in accordance with the 1907/2006 REACH and 1272/2008 CLP regulations.
Issued By	Simge ARIK lab@akpakimya.com +90 282 361 80 99
Issued Date	01.02.2018
Revision date	31.05.2019
Revision	1.0
Hazard statements in full	H226 Flammable liquid and vapour. H242 Heating may cause a fire. H302 Harmful if swallowed. H304 May be fatal if swallowed and enters airways H312 Harmful in contact with skin H314 Causes severe skin burns and eye damage. H315 Causes skin irritation H319 Causes serious eye irritation. H331 Toxic if inhaled H335 May cause respiratory irritation. H373 May cause damage to organs through prolonged or repeated exposure. H411 Toxic to aquatic life with long lasting effects.

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Other abbreviations

ACGIH	USA, ACGIH Thershold Limit Values (TLV)
NIOSH REL	USA NIOSH Recommended Exposure Limits
OSHA P0	USA OSHA – TABLE Z-1 Limits for ait contaminants – 1910.1000
OSHA Z-1	USA Occupational Exposure Limits (OSHA) – Table Z-1 Limits for air contaminants

(SDS for Resin)

SAFETY DATA SHEET

Date Prepared: 08/06/2021 Date Modified: 01/18/2022 Date Printed: 2/10/2022

1. CHEMICAL PRODUCT & COMPANY IDENTIFICATION

MATERIAL IDENTITY:
NOVOC 4900 series 4985-36H
Vinyl Ester Resin

INFORMATION TELEPHONE:
920-803-1700

COMPANY:
Andara LLC
3687 Enterprise Drive
Sheboygan WI 53083

EMERGENCY TELEPHONE:
CHEMTREC: 800-424-9300

2. HAZARDS IDENTIFICATION

GENERAL HAZARD STATEMENT

Exposure to this material may induce an allergic or sensitization reaction and aggravate systemic disease. Chronic effects of exposures may cause liver and kidney damage.

EMERGENCY OVERVIEW

OSHA HAZARDOUS

Target Organ Effect: Skin Sensitizer, Irritant

Target Organs: Kidney, Liver, Heart

GHS LABEL ELEMENTS, INCLUDING PRECAUTIONARY STATEMENTS

Health		Environmental		Physical
Acute Toxicity, Dermal Skin Irritation Eye Irritation Skin Sensitization	Category 5 Category 2 Category 2A Category 1	Not Classified		Not Classified

Pictogram:

Signal Word Warning

Hazard Statements	Precautionary Statements
H303 + H313 May be harmful if swallowed or in contact with skin H315 Causes Skin Irritation H317 May cause allergic skin reaction H319 Causes serious eye irritation	P261 Avoid breathing dust/fume/gas/mist/vapours/spray. P264 Wash skin thoroughly after handling. P280 Wear protective gloves/protective clothing/eye protection/face protection. P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P302+P352 IF ON SKIN: Wash with plenty of soap and water. P501 Dispose of contents/container to an approved waste disposal plant.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Characterization:

Ingredient(s)	CAS Number	% (by weight)
Vinyl Ester polymer	Proprietary	25 – 65 %
Unsaturated Polyester polymer	Proprietary	10-35%
Talc	1407-96-6	5-15%
Hydroxyethyl Methacrylate	868-77-9	15 – 35 %
Dipropylene glycol diacrylate	57472-68-1	1-10%

4. FIRST AID MEASURES

Eyes Contact: Can cause severe eye irritation. Symptoms include severe irritation, redness, tearing, blurred vision and corneal damage. Immediately flush eyes gently with large amounts of water for at least 15 minutes. Retract eyelids often. Get prompt medical attention.

Skin Contact: May be absorbed through the skin in harmful amounts. May cause skin sensitization, and allergic reaction which become evident upon re-exposure. Remove contaminated clothing. Wash the exposed area with mild soap and water. Flush w/lukewarm water for 15 minutes. Launder contaminated clothing before re-use. Seek medical attention if ill effect or irritation develops.

Ingestion: Can cause gastrointestinal irritation with nausea, vomiting and diarrhea. Do not induce vomiting. Never give anything by mouth to an unconscious person. Keep person warm, quiet and get medical attention.

Inhalation: If overcome by exposure, remove victim to fresh air immediately. Give oxygen or artificial respiration as needed. Obtain emergency medical attention immediately.

Advice to physicians: Treat symptomatically and supportively.

5. FIRE FIGHTING MEASURES

Conditions of Flammability

Not flammable or combustible.

Fire or excessive heat may result in rupture of container due to bulk polymerization. Heating may cause explosion.

Suitable extinguishing media

Dry Chemical, CO2, alcohol resistant foam, water spray/water fog for cooling. USE WATER WITH CAUTION. Water may be ineffective in fighting the fire.

Hazardous Decomposition Products

Acrid smoke-fumes, carbon monoxide, carbon dioxide and perhaps other toxic vapors may be released during a fire involving this product.

Fire Fighting Instructions

Wear self contained breathing apparatus (pressure-demand MSHA/NIOSH) approved or equivalent and protective clothing. See Section 10 for decomposition products. Fight fire from safe distance/protected location. Water may be ineffective in firefighting due to low solubility. Use water spray/fog for cooling. Pressure relief system may plug with solids, increasing risk of overpressure. Notify authorities if liquid enters sewer/public waters.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions

Spilled or released material may polymerize and release heat/gases. Eliminate all ignition sources and ventilate area. Wear protective equipment during clean up (see Section 8).

Environmental Precautions

Prevent runoff from entering drains, sewers, or streams. Dispose/report per regulatory requirements.

Methods and Materials for Containment and Cleaning Up
Spilled or released material may polymerize and release heat/gases. Eliminate all ignition sources and ventilate area. Do Not let product enter sewers. Dike and recover large spills. Soak up small spills with inert solids (such as vermiculite, clay) and sweep/shovel into vented disposal container. Wash spill area with a strong detergent and water solution; rinse with water but minimize water use during clean up. Dispose/report per regulatory requirements.

7. HANDLING AND STORAGE

Precautions for Safe Handling
Unless inhibited, product can polymerize, raising temperature and pressure, possibly rupturing container. Check inhibitor content often, adding to bulk liquid if needed. Do not blanket or mix with oxygen-free gas as it renders inhibitor ineffective. Do not store at below 32F - inhibitor can separate as a solid. If frozen, warm and remix material gently (<90F).

Conditions for Safe Storage
Do not store at below 32F - inhibitor can separate as a solid. If frozen, warm and remix material gently (<90F). Prevent moisture contact. Store in tightly closed, properly vented containers away from: heat, sparks, open flame, strong oxidizers, radiation and other initiators. Prevent contamination by foreign materials. Use only non-sparking tools and limit storage time.

Decontamination Procedures
Follow standard plant procedures or supervisor's instructions for decontamination operations.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMITS

HAZARDOUS COMPONENT	PEL	STEL	TLV	Other
Polyester Polymer	NE	NE	NE	NE
Monomer(s)	NE	NE	NE	NE

Engineering Controls
Local exhaust ventilation may be required in addition to general room ventilation.

Respiratory Protections
Where exposure through inhalation may occur from use, NIOSH/MSHA approved respiratory protection equipment is recommended. If cured material is cut or sanded a NIOSH/MSHA particulate respirator is recommended.

Eye Protection
Eye protection such as chemical splash goggles and/or face shield must be worn when possibility exists for eye contact due to splashing or spraying liquid, airborne particles or vapor. Contact lenses should not be worn.

Skin and Body Protection
When skin contact is possible, protective clothing including apron, sleeves, boots head and face protection should be worn. Wear chemical resistant gloves such as neoprene, rubber, latex, etc.

Other hygienic practices
Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Other work practices
Use good personal hygiene practices. Wash hands before eating, drinking, smoking or using toilet facilities. Promptly remove soiled clothing and wash thoroughly before reuse. Shower after work using plenty of soap and water.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	
Form	viscous liquid
Color	Straw to light yellow
pH	N/DA
Melting/Freezing Temperature	< - 60 C (,-76 F)
Boiling Point	67 C/ 153 F
Flash Point	96 C/ 205 F closed cup
Ignition Temperature	N/DA
Autoignition Temperature	N/DA
Lower explosive limit N/AP	Upper explosive limit N/AP
Vapor Pressure	0.1 mm Hg
Vapor Density (air=1)	>1
Specific Gravity (water=1 @39.2F)	1.12 at 25 C/77 F
Solubility	N/DA
Viscosity, Kinematic	AP varies with product mix cps at 25 C/77F
Percent Volatiles	Negligible
Evaporation Rate (Bac=1)	N/DA
Odor	Mild to sweet acrylic odor
Odor threshold	N/DA

10. STABILITY AND REACTIVITY

Chemical Stability

Stable under recommended storage conditions

Possibility of Hazardous Reactions

No data available.

Conditions to Avoid

High temperatures, localized heat sources (i.e., drum or band heaters), oxidizing conditions, freezing conditions, direct sunlight, ultraviolet radiation, inert gas blanketing

Materials to Avoid

Strong oxidizers, strong reducers, free radical initiators, inert gases, oxygen scavengers, peroxides.

Hazardous Decomposition Products

Acrid smoke-fumes, carbon monoxide, carbon dioxide and perhaps other toxic vapors may be released during a fire involving this product.

11. TOXICOLOGY INFORMATION

Acute Toxicity Based on HEMA

Oral LD50	Rat	>5,000 mg/kg.
Dermal LD50	Rabbit	>3,000 mg/kg

Skin Corrosion/Irritation

Skin	Rabbit	Irritating to skin 24 h

Serious Eye Damage/Eye Irritation

Eyes	Rabbit	Irritating to eyes

Respiratory or Skin Sensitization

Guinea pig, various test systems Sensitizing

Cases of sensitization also observed in humans

Mutagenicity

Positive as well as negative results in in-vitro mutagenicity/genotoxicity tests.
No experimental indication of genotoxicity in vivo available.

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

12. ECOLOGICAL INFORMATION

Aquatic Ecotoxicity

LC50	Oryzias latipes,	OECD 203,	semi-static 96 h	> 100 mgl
LC50	Oryzias latipes,	OECD 204,	semi-static 96 h	> 100 mgl
EC50	Daphnia magna,	OECD 202,	Flow through 21 d	24.1 mgl
EC50	Selenastrum capriconnutum	OECD 210	7a h	380 mg/l

Bacteria Toxicity

EC50 >3,000 mg/l	Psuedomonas fluorescens	16 hours

Biodegradability

No data

Mobility in soil

Do not allow to enter soil, waterways or wastewater.

13. DISPOSAL CONSIDERATIONS

Waste Disposal

When a decision is made to discard this material as supplied, it does not meet RCRA's characteristics definition of ignitability, corrosiveness, or reactivity and is not listed in 40CFR261.33. The toxicity characteristic (TC), has not been evaluated by the Toxicity Characteristic Leaching Procedure (TCLP).

14. TRANSPORTATION INFORMATION

DOT (US)

Non-Regulated

IMDG

Non-Regulated

IATA

Non-Regulated

15. REGULATORY INFORMATION

TSCA INVENTORY STATUS

All components of this product are listed, or excluded from listing, on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory.

OSHA HAZARDS

Target Organ Effect, Skin Sensitizer, Skin Irritant, Eye Irritant

HMIS Classification		NFPA Rating
Health Hazard;	2	2
Flammability	1	1
Physical Hazards	0	0

SARA TITLE III: Section 311/312 Hazard Class

Acute Health Hazard, Chronic Health Hazard

SARA TITLE III: Section 313 (40CFR370)

This product does not contain a chemical which is listed in Section 313 at or above the de minimus concentrations.

CERCLA Information (40CFR302.4)

This material contains no hazardous or extremely hazardous substances as defined by CERCLA or SARA Title III, and release is therefore not reportable.

This material contains an inhibitor (HQ, MEHQ, etc.). The type and amount meet product specifications. Contact a company representative for exact concentrations and details on inhibitor level maintenance.

California Proposition 65 Information:

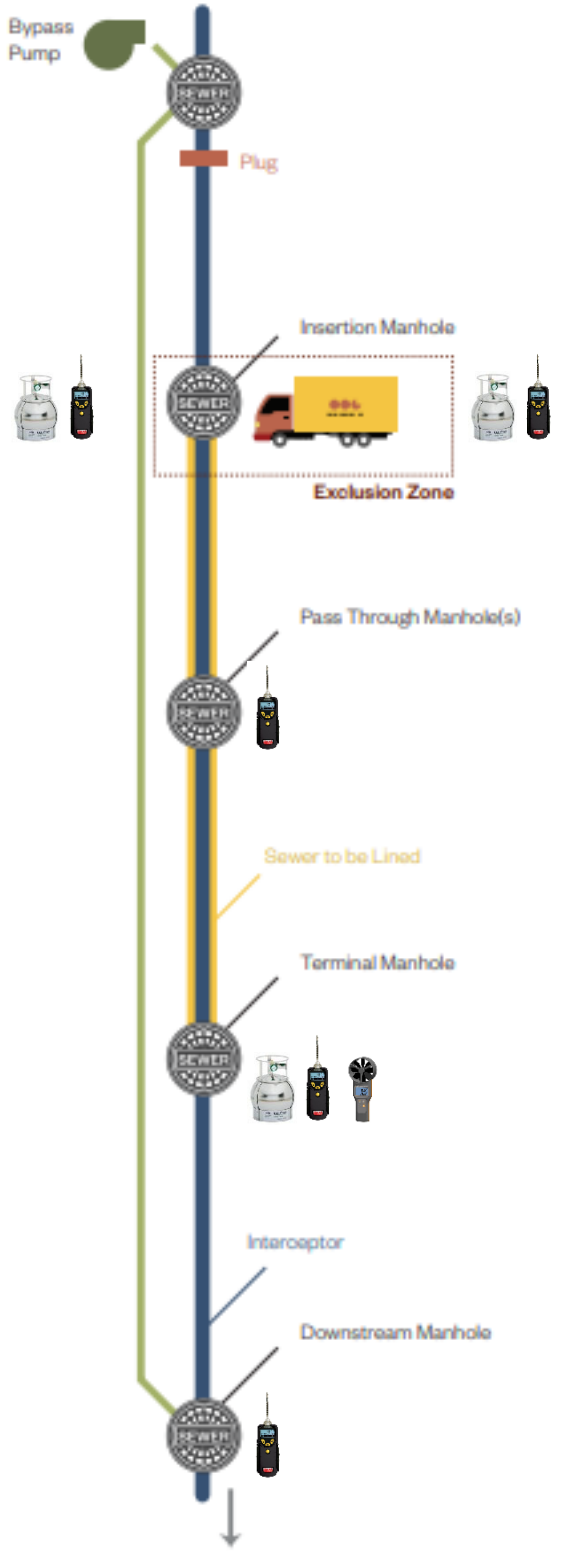
This product does not contain substance(s) known to the state of California to cause cancer and/or reproductive toxicity.

16. OTHER INFORMATION

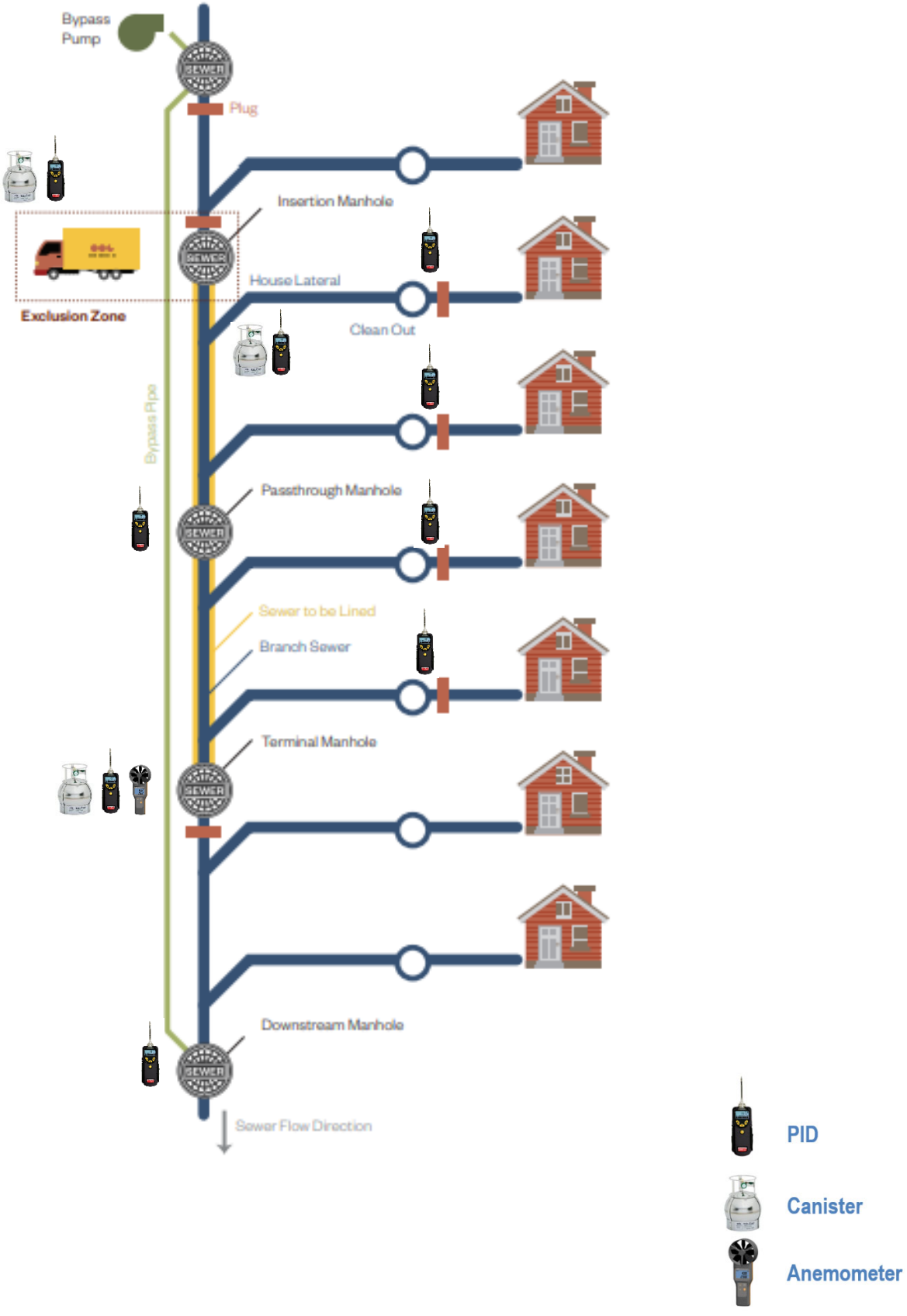
Some of the information presented and conclusions drawn herein are from sources other than direct test data on the product itself. The information in this SDS was obtained from sources, which we believe are reliable. However, the information is provided without any warranty, express or implied, regarding its correctness. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, we do not assume responsibility and expressly disclaim liability for loss, damage or expense arising out of or in any way connected with the handling, storage, use or disposal of the product. This SDS was prepared and is to be used only for this product. If the product is used as a component in another product, this SDS information may not be applicable. This SDS has been prepared in accordance with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Appendix B Work Area Scenario Examples

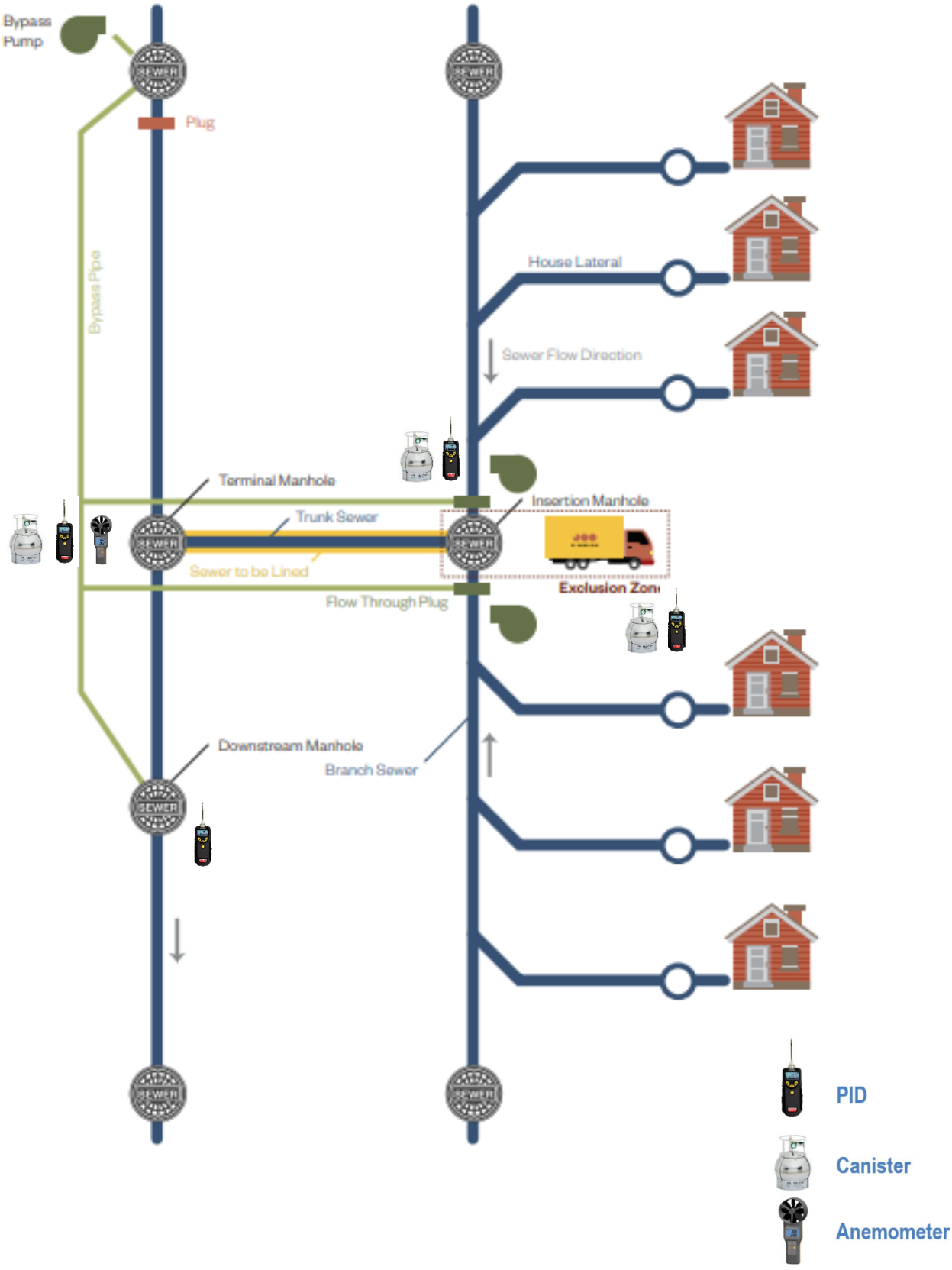
CIPP Sewer with No Connection



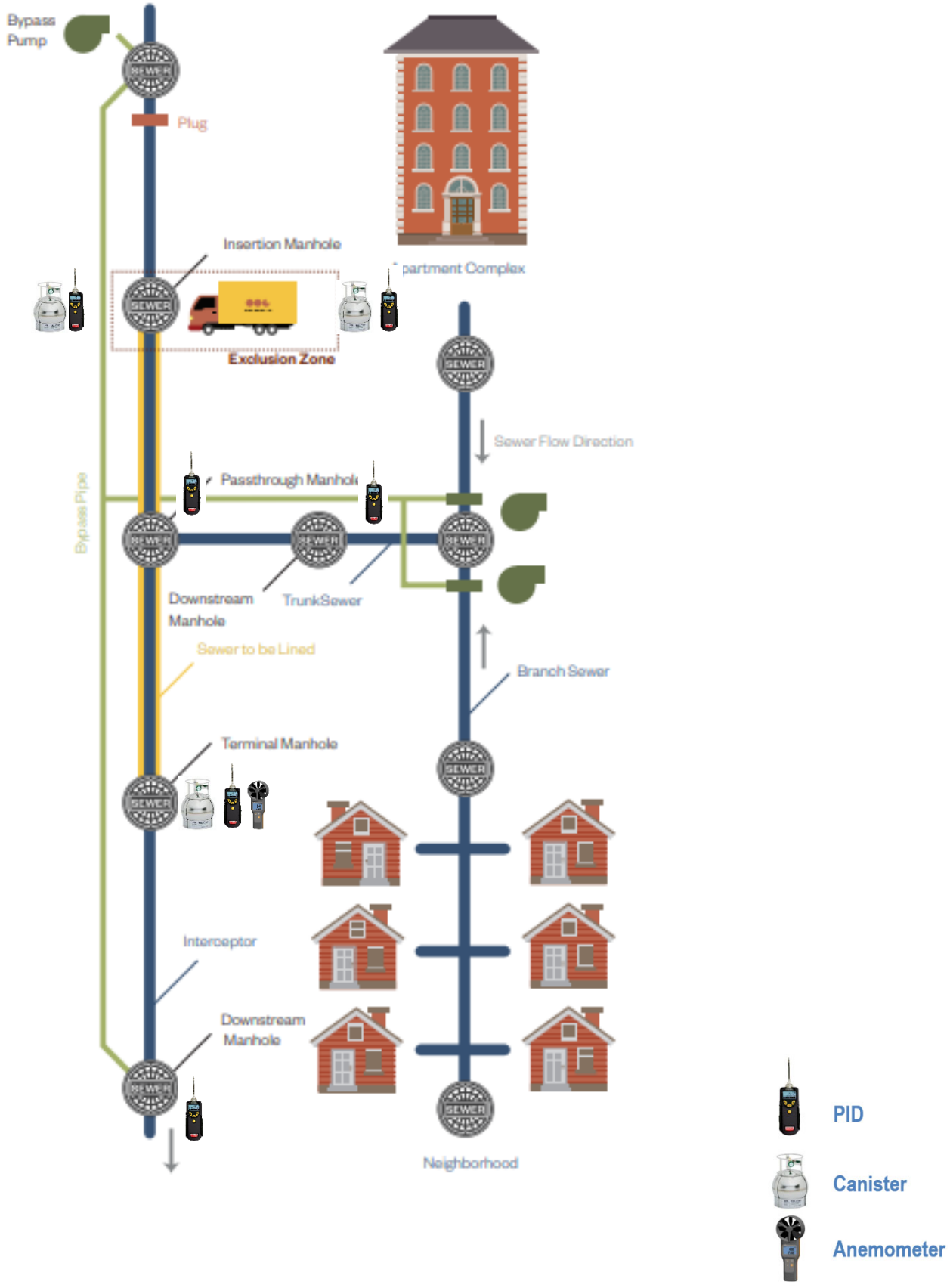
CIPP Branch Sewer with Direct House Lateral Connections



CIPP Branch Sewer with No Direct House Lateral Connections



CIPP Branch Sewer with Trunk Sewer Connection



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