

Evaluation of Air Emissions from Polyester Resin CIPP with Steam Cure Webinar: TTC Response to Comments

The following comments were collected from the chat function of the live webinar presented by TTC on December 17, 2019. Similar technical comments have been grouped together and answered as one to minimize responses. More information related to these comments are addressed in more detail in the full report. Non-technical comments have all been addressed previously.

1. **Comment:** Explain the peer-review process (C.Mata)

Response: This project had multiple layers of peer-review that included two panels within NASSCO as well as an outside technical advisory group, who are acknowledged in the report. Additionally, some individual sections of the study were reviewed by industry experts during and at the completion of the project. The research team is also submitting two articles for peer-reviewed journal publication in the near future.

2. **Comment:** Explain the data tied to workers (L.Gray, L.Cerda, J.Hunt)

Response: The workers with measured data wore sorbent tubes on their clothes throughout the day so the data is aggregated for all of their locations and not just for one location during the day or just next to the emission stack.

3. **Comment:** Explain what the cargo truck is referring to (C.Murray, W.Lake)

Response: The cargo truck is the refrigerated (“reefer”) truck used to transport the liner to the jobsite. Readings were taken from inside the reefer truck as discussed in the webinar and report.

4. **Comment:** Explain the resins used for the project (M.Slack, K.Bainbridge, L.Cerda)

Response: There were differences in the resins used, but all were polyester resins containing styrene. This information was collected, but we did not see the need to publicize it since there was not a significant variation in the emissions results at each site.

5. **Comment:** Explain the measurement of rogue emissions (M.Heyman, R.Hanson)

Response: The study did include measurement of the rogue emissions (i.e. not stack emissions, but emissions from the manhole opening and end of the liner), but that was not the primary objective of the study so we were not able to collect samples at all rogue locations. We did however take several measurements directly at rogue locations and several of the sampling methods used did also account for rogue emissions including sorbent tubes on workers and at locations around the sites.

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6. **Comment:** Explain the meaning of the 'E' estimated data values more (C.Block, C.Jackson)

Response: The "E" values represent numbers that are above the calibration range, and so the error from the 'true' value is based on how far above that range and how linear the calibration range is out to that estimated value. In other words, if the measured concentration is say 10% above the high calibration standard, then the error in that estimated value is likely to be quite small, say 10% or less. If the estimated value is orders of magnitude above the high calibration standard, the estimated value could be +/-50%.

7. **Comment:** Explain the different stack configurations (E.Cheeseman, R.Hanson)

Response: For most sites, one stack was used. The horizontal or vertical setup was contractor dependent although vertical stacks are recommended already by the industry. Stack 1 was the only stack that was emitting for the entire cure at Site 6. Stack 2 was active part of the time and Stack 3 for less time. Emission data collected around Site 6 does still take into account all emissions from all three stacks.

8. **Comment:** Explain why the stacks look like car mufflers (B.Carmody)

Response: Contractors use different designs, but the muffler is used to minimize the sounds of the emissions.

9. **Comment:** Explain the concentrations for when the Hapsite was saturated (M.Heyman)

Response: The sensitivity of the Hapsite equipment does not allow for the equipment to capture higher concentrations accurately when the detector becomes saturated. This is why multiple methods of emission collection were used to ensure accurate readings at the sites.

10. **Comment:** Were the labs used NeLAc certified or equivalent (J.Reyes)

Response: Yes, the labs are accredited labs (see report Appendices).

11. **Comment:** Explain how your results compare with the literature (M.Najafi, J.Awalt)

Response: In general, the results compared closely to many of the previously published studies except for the few studies that reported much higher concentrations from the stack locations. This study was much broader than any of the other previously published studies.

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12. **Comment:** Explain the wet-out process used for these projects (T.Schultz)

Response: Field wet-outs were not used on any projects as these were all relatively small diameters, which is most common for steam-cured liners sites. Field wet-outs are typically used for much larger diameters and hot water curing is primarily used in those cases.

13. **Comment:** Explain the justification for omitting the validity of the 1,820 ppm measurement (C.Block)

Response: The 1,820 ppm concentration far exceeds all of the concentrations measured at the truck opening for all sites. Also, the 316 ppm duplicate canister which was run at a different lab does not line up with the 1,820 ppm canister. Since the value is estimated in the lab, it is possible it may contain some significant error. For this reason, only the 316 ppm concentration, which is consistent for all other sites was considered when developing the recommendations in Chapter 6. Despite that, the recommendations for safety around the transport truck would still be applicable if readings were 1,800 ppm.

14. **Comment:** Explain the contents of the transport truck at each site (M.Slack, J.Hunt)

Response: In most cases, additional liners were on the transport trucks for future projects. This data was not collected as it was outside of the project scope and a study of the transport truck is recommended for future study.

15. **Comment:** Explain the QA/QC process for CIPP manufacturers (B.Carmody)

Response: There is not a CIPP-specific governing body for CIPP manufacturers, but they are regulated like any other similar organization. NASSCO published such guidelines on its website. See "Guideline for The Safe Use and Handling of Styrene Based Resins in Cured-In-Place Pipe (CIPP)."

16. **Comment:** Explain the administrative and engineering controls at the sites (J.Reyes)

Response: A safety review and documentation of the installations is included for each site in the report.

17. **Comment:** Explain how many contractors/crews were used for this study (K.Rahaim, K.Bainbridge, J.Schiro)

Response: There were two primary contractors used in this study and several different crews in total. Beyond the orientation of the stacks, there were no other noticeable differences in the methods of steam curing noted.

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18. **Comment:** Explain if measurements were taken from inside any structures (T.Fisher, S.Mongeau, F.Harvey, N.O'Connor, D.DiCesare, K.Bainbridge, C.Mata, J.Hunt, J.Thompson)

Response: There were measurement taken from inside several structures to determine if emissions were propagating up the laterals. More information is available in the report, but in general there was no risk identified at the sites for this study. There is currently another study underway focused completely on emissions and lateral connections.

19. **Comment:** Explain the differences between steam cure and UV CIPP (B.Carmody, M.Fremder)

Response: This is outside of the scope of this study.

20. **Comment:** Explain the availability of handheld devices for measuring styrene (W.Elledge)

Response: PIDs are available for detecting all VOCs, which includes styrene. For each site in this study, styrene was the only significant VOC detected so a PID would be a good general device for detecting concentration levels at steam-cured CIPP sites.

21. **Comment:** Explain the applicability of NSF 61 (B.Carmody)

Response: There are NSF 61 certified materials for CIPP in water mains, but that is outside of the scope of this study. There are various labs certified to test for NSF 61.

22. **Comment:** Explain the applicability of the recommendations to dense urban areas (C.Dzidek)

Response: The recommendations should still be appropriate for dense urban areas, but dense urban sites were not used for collecting data in this study.

23. **Comment:** Explain the condensate sample results (R.Hershman)

Response: The condensate data is presented in the report, but in general, since there was not a significant variation across the sites in emission concentrations, the condensate results were not believed to have a significant impact on the emission results.

24. **Comment:** Explain the 15-ft perimeter (D.Steffen, S.Freeman)

Response: This is a radius measurement from the emission source. This would be applicable to both workers and the general public.

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25. **Comment:** Explain why two labs were used for Site 6 (M.Najafi)

Response: Its common practice to use multiple labs or duplicate samples to ensure quality of the results.

26. **Comment:** Explain the potential impacts to downstream water sources (N.Bonfadini, T.Peacock)

Response: There have been other studies focused on this aspect of CIPP, but that is outside of the scope of this study.

27. **Comment:** Explain whether or not door hangers are used to alert residents of upcoming work (J.Jones)

Response: Yes, this is a common practice for public works in residential and commercial areas.

28. **Comment:** Explain the impact the recommendations have on current procedures (J.Awalt)

Response: The recommendations will help to make CIPP sites more safe, which is a positive for the industry. These recommendations are currently being incorporated into NASSCO safety practices.

29. **Comment:** Explain the availability of technologies for cleaning emissions from the stack (K.Hjelm, R.Hanson)

Response: We are not aware, and this is outside of the scope of this study.

30. **Comment:** Explain how the readings were taken around the exhaust stack and truck (W.Lake, J.Hunt)

Response: This is discussed in detail in the report. Any issues are noted if applicable. The location was dependent on the method of measurement and multiple methods of measurement were used at each site.

31. **Comment:** Explain what temperature and humidity was present at the work sites (M.Slack)

Response: This is discussed in detail in the report.

32. **Comment:** Explain the health impacts for concentrations over EPA limits (J.Chapin)

Response: This is discussed in detail in the report.

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33. **Comment:** Explain which exposure limit you recommend (C.Mata)

Response: Exposure limits are set by regulating authorities and is outside of the scope of this study.

34. **Comment:** Explain how this work impacts the health of residents (M.Fremder)

Response: This is outside of the scope of this study, but there have been numerous studies on the health impacts from styrene, which is what the regulatory thresholds are based on. All measurements in this study taken in public areas (outside restricted work areas) were well below regulatory thresholds.