EPA Tools & Resources Training Webinar | Q&A
Sensor Pods (SPods) for Volatile Organic Compound (VOC) Fenceline Monitoring and Data Analysis

1. Will other EPA Regions provide a loan program for sensor pods in the future? We don't know at this time.

2. Would raw data be available to the public? This would depend on the specifics of the project and the groups that are implementing the effort. SPod fenceline sensor data can easily be made available to the public in raw and/or processed form.

3. Is EPA providing sensors to community organizations, or only state and local governments? The EPA Southeast Regional Office (EPA Region) 4 SPod fenceline sensor loan pilot program plans to make the technology available only to state and local governments at this point.

4. Will samples be required to be analyzed at an EPA lab that is good laboratory practice (GLP) qualified and certified? SPod-triggered canister grab samples may be analyzed by any suitably qualified and equipped laboratory (commercial, academic, or government).

5. Does EPA anticipate using these SPods to help improve monitoring associated with the Interstate Air Pollution rule? Additionally, could they use the data to better assign responsibility to a direct source of pollution from up-wind sources? No. This is not envisioned since SPod fenceline sensors should be located close to the potential source(s) of emissions. The wind direction resolved SPod VOC concentration data can help improve understanding of specific upwind sources near the sensor location.

6. Do the commercially available SPods have the automatically triggered mini canisters incorporated into them, or is that just in the experimental phase? Yes. The commercial SPod fenceline sensors the Agency's Office of Research and Development (ORD) is currently using have the capability to trigger canister acquisitions. The evacuated air canisters are not part of the SPod and must be separately supplied.

7. What are the steps taken after high levels of Volatile Organic Compounds (VOC's) are determined? Are the industry polluters notified and what types of corrections, if any, are they required to do to reduce high amounts of pollutants being emitted? In some locations there are specific regulations and procedures that are based on use of technologies like the SPod and other fenceline instruments. Over time, we anticipate this type of monitoring will increase and inform responsive actions if needed. EPA also anticipates the additional information will spark voluntary cooperative action between states, communities, and private industry to improve local air quality.

8. Can you elaborate on how the baseline adjustment was done in Slide 11? How does the user decide if it's best to adjust based on meteorological data (Temp, RH, etc.) vs. just a simple timeseries adjustment? For the ORD prototype software, only a timeseries baseline fit is used. Since the photoionization detector (PID) sensor baseline drift typically changes slowly over time compared to the rapidly changing advected emission plume signal observed by the sensor, it is relatively easily to separate the baseline drift and source emission signal using a simple spline fit. This type of baseline subtraction also removes slowly varying airshed background VOC signal (SPod fenceline sensors focus on the emission source). Other types of background correction

(e.g., based on temperature and relative humidity) are possible but these approaches have yet to be pursued by ORD. Further information on EPA background subtraction approach can be found in (https://www.mdpi.com/1424-8220/22/9/3480).

9. Do the tools have the potential to inform short-term, emergency situations—such as the need for environmental remediation where VOCs might be released into the environment? Yes. Sensors like the SPod are already being used by EPA On-Scene Coordinators for a variety of applications. Depending on the specific project and emission profile, SPods may be useful to inform certain remediation activities.

10. What quality assurance (QA) procedures does EPA recommend for the commercial SPod? There are several QA procedures in place. They include:

    a. Quarterly (or more frequent) in-field "bump checks" using a 0.5 to 1.0 part per million (ppm) concentration isobutylene reference gas standard to verify 10.6eV photoionization detector (PID) sensor response.
    b. Full calibration of the PID using a VOC free zero air gas and 1 ppm isobutylene span gas performed at least annually or if the bump check is out of tolerance (+/- 20% from actual).
    c. Continuous monitoring of SPod parameters to identify anomalus behavior.
    d. Collocating SPods for unit-to-unit comparisons.

11. If there are numerous spikes, would the canister be collected and then another canister immediately deployed? Is there any way to identify spikes of different chemicals? The commercial SPod EPA is currently using can be configured to sequentially acquire up to four canister grab samples. The parameters of the elevated VOC signal and the duration needed to trigger a canister is set by the user. The SPod produces a non-speciated VOC measurement so you need the canister analysis to understand what chemicals are present in the source emission plume.

12. Is some sort of alert fired when a canister is collected? How quickly do canisters need to be retrieved and analyzed? The commercial SPod EPA is currently using documents the exact start and stop time for the canister acquisition in the data record. It is possible for the user to be alerted to the acquisition event, but this is not currently an automated process. Ideally, the canisters should be retrieved from the field and analyzed by the laboratory within about two weeks of sample acquisition.

13. Are you aware of any efforts to develop NGEM approaches for fenceline groundwater monitoring? This site may be helpful (https://www.epa.gov/water-research/water-sensors-toolbox)

14. Are the source direction indicator plots also called bivariate polar plots? Yes.

15. Can this system detect volatile organic fluorine and if so, how? No, this sensor is not used for fluorine applications.

16. Are there requirements or guidelines for placing both fenceline and community sensors to obtain maximum sensing and sampling quality? Are there considerations for height and proximity to structures, trees, etc.? We do not know of any comprehensive guidance in this regard. Because of real-world siting restrictions, it may be difficult to achieve obstruction-free siting for many fenceline applications. The most important aspect of fenceline siting is that you have good observation (open field of view) from the SPod sensor location to the potential source under observation.

17. What method did you use to determine the calibration interval? The calibration of the SPod sensor for fenceline applications is stable over time (months) so there is no need calibrate frequently. In general, the calibration interval will depend on the specific application. VOC sensors (or various kinds) that are intended to operate kilometers away from emission sources and attempt to determine accurate absolute air shed VOC concentrations may require more frequent calibration checks to understand bias associated with sensor baseline drift. This is less of an issue for fenceline applications which focus on advected emission plumes and use application-specific background correction procedures.

18. Do you need more than one sensor around a site, e.g., one in the north, east, west, south? Or is just one enough? Once a sensor is sited downwind of the potential source, it can provide very valuable information. More than one sensor provides improved source location capability. Putting sensors at the north, south, east, and west of the potential source can add valuable upwind data and higher temporal data coverage since you can observe the source under a variety of wind directions.

19. Can you comment on the exact PID sensors that are being deployed in the SPOD such as the manufacturer, concentration range, etc.? As a federal agency, the EPA does not endorse a specific PID sensor vendor, but we currently use PID sensors from Ion Science, model MiniPID2-HS, with a concentration range of 0 to 3 ppm isobutylene.

20. What other sensors can be installed besides ones that measure VOCs, such as for SO2, NOx, and/or CO? The current SPod is limited to VOCs, but there are many commercial examples of other types of sensors entering the marketplace.

21. Can metal oxide sensors be used in SPods? It is possible but not in its current form. There are many SPod-type sensors entering the market so we would expect this combination will be available at some point.

22. When you're looking at cost do you factor in all the labor involved in collecting the Pods and doing testing? Although the SPod fenceline sensor is generally much lower in cost than higher performance air quality instruments that require installed site infrastructure (such as air conditioned enclosures), it does take time to site the sensor, change canisters, and process data. In general, we think that the total costs for an SPod deployment will depend in large part on the number of canisters acquired for commercial laboratory analysis.

23. Can you share which vendor's PID sensor is in use in the unit? As a federal agency, the EPA does not endorse a specific PID sensor vendor, but we currently use PID sensors from Ion Science. Agency researchers have compared collocated SPods with sensor from different manufacturers (see, for example www.mdpi.com/1424-8220/22/9/3480).

24. Did the SPod data correlate with the imagery gathered with the FLIR camera, where they were used? SPod type devices using the same PID sensor but located inside of facilities have successfully made this comparison (see for example https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=CEMM&dirEntryId=350905).

25. Have you calibrated sensor measurements with another high frequency measurement method like PTR-MS? We have not done that specific comparison, but we have compared to automated gas chromographs (see for example www.mdpi.com/1660-4601/16/11/2041).

26. How are samples preserved and will there be a time limit on quality of sample for analysis based on EPA guidelines? There are no special preservation requirements for canister grab samples but ideally they should be analyzed within a couple of weeks of sample acquisition. The sample holding times may depend on the compounds that are the subject of the analysis.

27. Can you talk about the LOD for SPod? What happens past 500 m of the source you're trying to measure (is it still valid data, but just not considered "fenceline" monitoring)? At larger distances away from the source, the emission plume becomes more dispersed and begins to blend in with airshed VOC signal from other sources. The signal also mixes with variations in absolute VOC levels caused by sensor baseline drift. PID-based sensors like the SPod have a limit of detection around 10 to 20 parts per billion of isobutylene (reference gas). However, the baseline drift (artifact signal) can be several times this depending on system design and deployment conditions. For fenceline applications near the source, this baseline drift can be separated from the emission plume signal using a time-base background correction procedure.

    For additional information please see the EPA Science Inventory, including an abstract and link to a video, for “Fenceline Monitoring with Low-Cost Sensors,” presented by EPA researchers at at a the 2021 Air Sensors International Conference (ASIC) Virtual Meeting Series

28. Do you envision incorporation of other non-PID instruments that could be integrated into the SPod approach that could be used to monitor non-VOC odors? Yes. We anticipate this topic area will continue to advance and odor sensors (sometimes called “electronic noses”) are of growing interest to numerous groups.

29. If a community with multiple site sources were to buy one SPOD and then move it to another fenceline source — how long would you suggest the placement be at each site + wind directions — to get a representative sample of emissions? . A good rule of thumb is at least a month of observation time is needed, but it will depend on the specifics of the potential source(s) under study and the wind conditions in the area. If the potential emission source is temporally variable, it will take longer to successfully observe it. If the sensor cannot be sited directly downwind of the potential source, it will take more observation time for the wind to come from the direction of the source to the sensor location

30. Can the SPod replace Proton Transfer Reaction Mass Spectrometry technique? No, these are very different types of techniques. The Proton Transfer Reaction Mass Spectrometry technique is a very sensitive and resource-intensive approach that can provide speciated data. The SPod fenceline sensor is a lower cost non-speciating VOC sensor.

31. Could the PID detectors be deployed for mobile (vehicle-mounted) monitoring? Yes, this is possible and is being done by several groups. However, it can be more difficult to interpret the data. Significant sources of VOC emissions can be easily detected with mobile SPod-type systems so the approach can be valuable in a screening context for some applications.