Standard Operating Procedure: Data Acquisition Using the US EPA Geospatial Measurement of Air Pollution-Remote Emission Quantification by Direct Assessment (GMAP-REQ-DA) Method

Scope: The following protocol describes procedures for acquisition of data using the US EPA Geospatial Measurement of Air Pollution-Remote Emission Quantification–Direct Assessment (GMAP-REQ-DA) technique. This protocol describes guidance on positioning the measurement vehicle for data acquisition and the specific data elements that must be collected.

Purpose: To provide specific guidance on how to acquire data using the GMAP-REQ-DA technique.

1.0 Overview

The US EPA Geospatial Measurement of Air Pollution-Remote Emission Quantification by Direct Assessment (GMAP-REQ-DA) advanced mobile measurement system has been developed as a tool to assess emissions of air pollutants from distributed point sources. The system consists of a fast-response Greenhouse Gas Analyzer instrument, global positioning system (GPS), and wind monitors, installed in a measurement vehicle. The integrated system uses customized software to control operation of instrumentation, and acquisition of data. The system has been deployed during numerous measurement campaigns to assess emissions at upstream oil and gas production sites. During the measurement campaigns, the system is deployed to assess emissions from multiple sites, on a site-by-site basis.

The current document describes procedures for acquiring data in the field using two different measurement modes; ***Mobile Monitoring and Mapping*** and ***Stationary Monitoring***. Both measurement modes area employed during a GMAP-REQ-DA measurement campaign, and are necessary for assessing emissions from individual sites. This SOP includes guidance on positioning the measurement vehicle for data acquisition and specific data elements that should be collected.

Prior to initiation of data acquisition using either the Mobile Monitoring and Mapping or Stationary Monitoring methods, the user should review all safety procedures presented in Appendix H, *Health & Safety Protocol: Application of the U.S. EPA Geospatial Monitoring of Air Pollution-Remote Emissions Quantification-Direct Assessment (GMAP-REQ-DA) Method.*

Additional details on operating the customized data acquisition and control software can be found in *Appendix G, Standard Operating Procedure: U.S. EPA Geospatial Monitoring of Air Pollution-Remote Emissions Quantification-Direct Assessment (GMAP-REQ-DA) Method: Data Acquisition and Control Software Manual.*

2.0 Mobile Monitoring and Mapping

Mobile Monitoring and Mapping is performed by driving the vehicle at a constant speed of approximately 20 miles per hour downwind of suspected emitting sites. While the vehicle is in motion, one member of the team continuously monitors the real-time methane concentration levels. The goal of mobile monitoring is to identify sites having methane concentration values higher than the background values observed in the area (indicating the presence of fugitive emissions). Although electronic data are not logged during Mobile Monitoring, the locations of sites having elevated emissions are manually noted in the project notebook.

After sites with fugitive emissions have been identified, Mobile Mapping is performed. Mobile Mapping is conducted by driving the vehicle downwind of the emitting sites, and collecting methane concentration data with the Greenhouse Gas Analyzer, and GPS data on vehicle location. Although meteorological data are not collected continuously when the vehicle is in motion, the vehicle is parked periodically during Mobile Mapping to collect meteorological data. The data collected are used to create a map of methane concentrations observed over the survey area, using the mapping function in the instrument control and user interface software. The methane concentration maps generated may be used to identify sites where Stationary Monitoring may be conducted.

The Mobile Monitoring and Mapping method is best for sites located within 100 meters of the roadway. Emissions from sites located farther upwind are often difficult to apportion due to atmospheric dispersion, especially if multiple sites are located upwind of the monitoring location. Prior to initiating Mobile Monitoring and Mapping, the user should have prior knowledge of the prevailing wind direction at the time of measurements, and select only sites located upwind of the roadway as candidates for monitoring. The following steps detail procedures for performing Mobile Monitoring and Mapping, and logging methane concentration and GPS data for use in creating concentration maps using the software mapping function:

1. Upon entering the study field, deploy hazard lights on vehicle, and reduce vehicle speed to approximately 20 miles per hour.
2. Identify the potential source or sources for monitoring by assessing the current prevailing wind direction, and select sites within approximately 15 to 100 meters upwind of the roadway.
3. After sites with fugitive emissions have been identified, start a mobile mapping data acquisition file using the following naming convention “mmddyyxx”, where: mm = month, dd = day, yy = last two digits of year, and xx is a unique numerical increment (01, 02…xx).

Details on using the data collected during mobile mapping for creating a concentration map using the data acquisition and control software can be found in *Appendix F, Standard Operating Procedure: U.S. EPA Geospatial Monitoring of Air Pollution-Remote Emissions Quantification-Direct Assessment (GMAP-REQ-DA) Method: User Interface Software Manual*

3.0 Stationary Monitoring

Stationary Monitoring is conducted at sites where methane emissions were detected during Mobile Monitoring and Mapping. The Stationary

Monitoring method is used to quantify emission rates from point sources (well and/or production sites) in close proximity to the mobile sampling vehicle. The following procedures describe how to acquire Stationary Monitoring data from a non-mobile vehicle using a fixed, elevated probe height.

1. Identify the potential source location, assess wind direction, and plan safe and legal stationary deployment of the measurement vehicle on the side of the roadway, as described in Appendix H, *Health & Safety Protocol: Application of the U.S. EPA Geospatial Monitoring of Air Pollution-Remote Emissions Quantification-Direct Assessment (GMAP-REQ-DA) Method.*

2. Determine if the source is assessable by checking if it is (1) safely observable, (2) wind direction (WD) and public road access allows a stationary observation, (3) wind speed (WS) is sufficient > 1.0 m/s, (4) source is within 15 m to 100 m from observation position. (5) Emissions from the site were detected during Mobile Monitoring and Mapping, and (6) no additional interfering sources are apparent in the vicinity of the source being monitored.

3. If the source is assessable, start an entry in the project notebook for the source by recording the date, time, and file name with the remaining fields to be filled in using the steps below.

4. Position the vehicle in the plume by observing the methane concentration readings and plots from the emission source locator tool in the user interface software. The presence of a plume is confirmed when consistently elevated concentration values are observed. The compass orientation of the source, with respect to the measurement vehicle, is indicated by the wind bin (or bins) containing the highest average analyte concentration. Approach the observation point with the front of the measurement vehicle pointing in the direction of the emission (plume approaching from the front not the back of the measurement vehicle). Ideally, the exhaust side of the measurement vehicle is oriented downwind of the sampling

point to minimize measurement vehicle interference in the positioning sequence. The plume should not approach the measurement vehicle from the rear.

5. Position the measurement mast so that the quad-sample inlets are oriented into the wind, towards the emissions source, as indicated by the emission source locator tool plot. Observe the plot from the locator tool for five minutes, and adjust the orientation of the sample inlets until the maximum methane concentration values appear close to the 180° wind direction bin of the emission source locator tool plot. This ensures that the measurement mast is optimally aligned to capture the emissions plume.
6. Turn off the measurement vehicle and confirm good position by looking for plume hits. If none are observed within five minutes, reassess wind direction and reposition.
7. Deploy traffic cones and ensure the observation point is safe and that no power lines are present. Turn on the measurement vehicle’s hazard lights.
8. Attach the 3D sonic anemometer to the measurement mast and confirm proper orientation by measuring magnetic north with the compass attached to the measurement mast, and aligning the arrow located on the base of the 3D sonic anemometer with the position of magnetic north (this step will be done once daily at the time the 3D sonic anemometer is initially attached to the measurement mast).
9. Connect canister to mast and record can ID in field notebook and canister chain of custody sample form.
10. Start a Stationary data acquisition file using the following naming convention “mmddyyxx”, where: mm = month, dd = day, yy = last two digits of year, and xx is a unique numerical increment (01, 02…xx). The acquisition time is 20 minutes. (Note that the acquisition can begin at background concentration but the Greenhouse Gas Analyzer data must be monitored to make sure that the plume has sufficient overlap within the target 20 minute data sampling period.)

11. Remove the compass from the measurement mast, and walk directly behind the measurement mast, with the compass aligned towards the source, in line with the mast. Measure the azimuth angle (heading) of the mast (which should be aligned towards the source). The azimuth angle measurement must be measured at some distance away from the mast and measurement vehicle to ensure that the magnetic field from the vehicle does not affect the instrument. Enter the azimuth angle value to the data acquisition software user interface screen, when prompted. This value is then logged to the processed data log file of the data acquisition software. This value should also be recorded in the field notebook.
12. Using the laser rangefinder mounted to the mast, measure the distance from the mast to the source. Enter this value to the data acquisition software user interface screen, when prompted. This value is then logged to the processed data log file of the data acquisition software. This value should also be recorded in the field notebook.
13. Using the Abney Level that is attached to the mast, measure the elevation angle of the site (measured from the mast). Enter this value to the data acquisition software user interface screen, when prompted. This value is then logged to the processed data log file of the data acquisition software. This value should also be recorded in the field notebook.
14. Measure the GPS coordinates of the measurement point (base of the sampling mast) using the handheld GPS, and record in the field notebook.
15. Obtain multiple photos of the measurement site using a digital camera, including a photo of the source, as viewed from the measurement mast. Enter the file names of all digital media to the data acquisition software user interface screen, when prompted. The file names are then logged to the processed data log file of the

data acquisition software. The file names of all digital photos should also be recorded in the field notebook.

16. Collect a canister sample with a target 30 second collection time. This can be done anytime during the 20- minute stationary acquisition but should probably be done early in the sequence as steps below can be done even after the acquisition is complete. The target sampling time should be as fast as possible to achieve < 5 psi. Start the canister sample collection only when the plume hits are robust. Record canister start and stop times in the lab notebook using control computer clock as accurately as possible. Record the canister start and stop times and pressures on the chain of custody form.

17. If an infrared camera is available for the measurement campaign, assess the source from a safe location (may be closer than the measurement vehicle position) to identify emission origination and check for the presence of multiple emission points. Acquire and save a date coded video files using the manufacturer file naming convention. Record the filenames in the lab notebook and make emitting component, potential interference, and measurement vehicle location notes in the lab notebook.

18. In order to confirm the measurement of distance from the measurement mast to the source (as described in Step 12), the measurement vehicle is moved to a second location downwind of the source, and the measurements described in Steps 11, 12, 13, and 14 above are repeated. By collecting the mast heading, distance from the mast to the source, elevation angle of the source, and GPS location of the measurement point from a second location downwind of the source, it is possible to create a virtual triangle, where two sides of the triangle are defined by the paths from the source to the location where the two sets of distance and angle measurements were collected, and the third side is defined as the distance between the two locations where distance and angle measurements were collected. Using simple geometry, the distance from the point where the

vertical stationary measurements were collected to the source (measured with the laser rangefinder, as described in Step 12) can be confirmed. Figure 1 shows the location of measurements collected during stationary vertical monitoring.

19. Move to next assessable target.

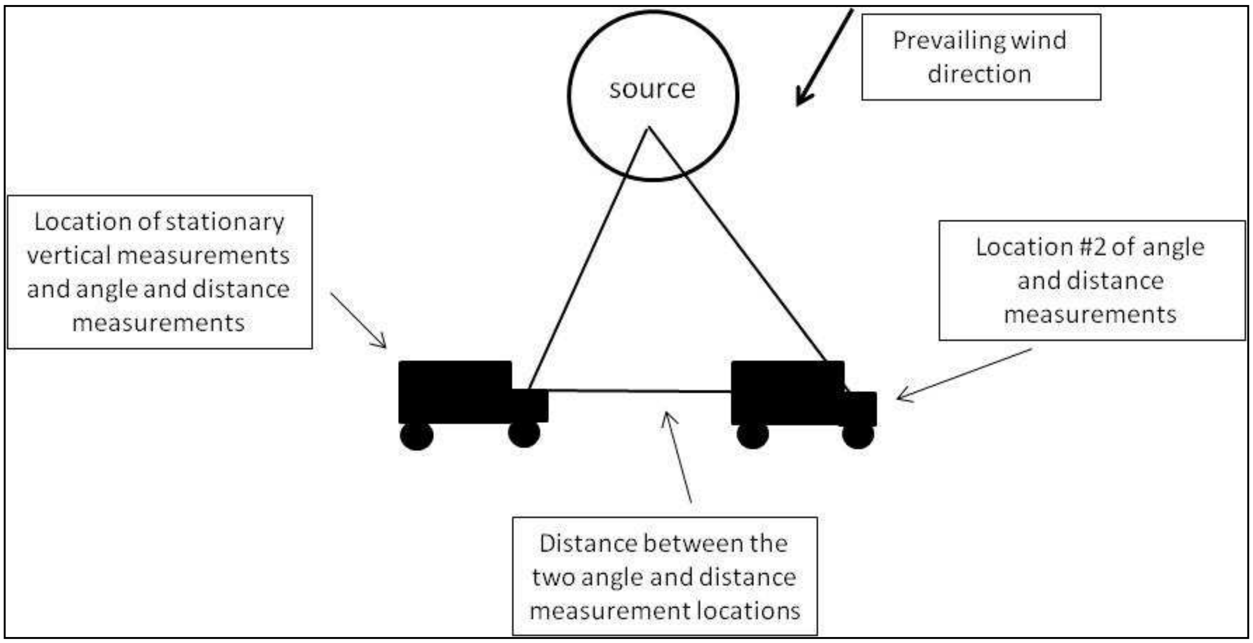

Figure1. Location of measurements collected during stationary monitoring