Attachment 1 - Basis for Determination That Tesoro's Revised Fenceline Air Monitoring Plan and Quality Assurance Project Plan (Submitted February 18, 2023) Do Not Meet District Regulation 12-15-403

1. Appendix B and Appendix E to the quality assurance project plan (QAPP) both contain maintenance and audit procedures for the Unisearch LasIR tunable diode laser absorption spectroscopy ("TDLAS" or "TDL") system. The content is similar but not identical. If a duplicate appendix was provided in error, consolidate the content into a single appendix. Otherwise, make a clearer distinction between the purpose of each one. Also, please consider all comments below, as they may apply to each appendix separately or to both appendices.

2. According to the Air Monitoring Guidelines for Petroleum Refineries (Guidelines) established pursuant to District Regulation 12-15-406 in April 2016, fenceline measurements must be continuously measured with a time resolution of five minutes, and instrumentation must meet a minimum of 75% completeness on an hourly basis, 90% of the time based on annual quarters (p. 5). In other words, because a single clock hour has twelve discrete 5-minute periods, 90% of the clock hours in a calendar quarter must include at least nine valid 5-minute average measurements in order to satisfy the completeness requirement.

   In contrast, the AMP and QAPP contain the following content regarding data completeness:

   a. Page 5 of the air monitoring plan (AMP) states that instruments are operated with the goal of achieving a minimum of 75% completeness by hour and 90% completeness by 3-month annual quarters;

   b. Table 4 of the AMP and Table 10 of the QAPP state the following:

Completeness Requirement	Relevant to
75% per hour	5-min average data
90% per annual quarter	1-hr average data

   c. Pages 27 of the AMP and 22 of the QAPP describe a process for calculating data completeness using various statistics.

   These provisions are inconsistent with the Guidelines. While the Guidelines contain a single requirement for data completeness, mischaracterize it and appear to present it as two separate requirements. Furthermore, although page 27 of the AMP and page 22 of the QAPP provide various statistics that will be used to calculate completeness, the AMP and QAPP still lack adequate detail (e.g., formulas) to establish exactly how completeness will be demonstrated. Additionally, the procedures for determining data completeness in the AMP and QAPP are not consistent with the procedures set forth in our December 22, 2022 letter interpreting Regulation 12-15 and the associated Guidelines (12/22/2022 letter).

   This issue is among several others previously identified in a notice of deficiency sent to Tesoro on July 15, 2022. To aid in resolving this deficiency, Attachment 3 to our 12/22/2022 letter outlined detailed procedures Tesoro must use to demonstrate compliance with the data completeness requirement. The problem nevertheless remains unresolved, as the AMP and QAPP continue to mischaracterize the completeness requirement and contain unacceptable procedures for demonstrating compliance with it.

To correct this deficiency, Tesoro must incorporate the content of Attachment 3 to our 12/22/2022 letter into the AMP and QAPP.

3. With regard to data completeness, page 27 of the AMP and page 22 of the QAPP state that planned maintenance is among exclusionary conditions, which are not counted against the refinery for data completeness calculations. This statement is inconsistent with the Guidelines and must be removed from the AMP and QAPP.

   Recognizing that open-path measurements are affected by low-visibility conditions like dense fog, the Guidelines state that data from such periods will not count against data completeness requirements as long as appropriate meteorological measurements document time periods when those conditions exist (p. 5). However, the Guidelines do not similarly allow for the exclusion of invalid or missing data associated with maintenance or QA/QC activities such as instrument calibrations or bump tests. This issue is addressed in Attachment 3 to our 12/22/2022 letter interpreting the Guidelines. States that the "expected" number of data points is the number of possible 5-minute average concentrations in a given hour, adjusted for periods of low visibility during adverse atmospheric or environmental conditions. Tesoro must address this deficiency by incorporating the contents of Attachment 3 to our 12/22/2022 letter into the AMP and QAPP.

4. Page 6 of the AMP and page 33 of the QAPP state that Tesoro will provide hourly and 5-minuate average concentration data to the Air District in a comma separated value (CSV) file along with the site code, local standard time, measurement duration, signal strength, concentration unit, and QC and OP codes. These provisions are inconsistent with the procedures set forth in our 12/22/2022 letter interpreting the Guidelines. In particular, attachments 2 and 3 to the letter:

   - stated that all fenceline monitoring concentration data should be provided as 5-minute averages (hourly data are not needed);
   - identified several required data elements;
   - specified formats for the required data elements;
   - specified procedures for reporting missing data;
   - specified reporting procedures for bump tests and calibration checks;
   - specified reporting procedures for quarterly data completeness; and
   - required the use of templates provided by the Air District.

   These provisions are either missing or inadequately specified in the AMP and QAPP. The contents of attachments 2 and 3 to our 12/22/2022 letter must be included in the AMP and QAPP.

5. With regard to quality assurance and quality control, the Guidelines require the AMP to include a QAPP that follows EPA guidelines and specifies methodologies for ensuring appropriate levels of QA/QC, data acceptance criteria, levels of data quality, data management issues and procedures, and data review and validation procedures (p. 10).

   Tables 6 and 11 of the AMP, tables 4 and 12 of the QAPP, and Table B-1 of Appendix B identify a variety of corrective action, maintenance, and QA/QC activities for the H_2S monitoring system. As a general matter, the AMP, QAPP, and appendix contain an insufficient level of detail regarding the methods, procedures, equations, and calculations that will be used to perform these actions. For example, tables 6, 4, and B-1 state that an "evolving checklist" of system performance indicators will be checked on a

quarterly basis. It is unclear what indicators will be checked, how they will be checked, and what acceptance criteria will be used.

As another example, the same three tables state that system settings should be verified on an annual basis. However, neither the AMP, QAPP, nor Appendix B explain what that involves or include procedures for performing the verification. Details that should be provided in the QAPP or in standard operating procedures (SOPs) attached to the QAPP include: an explanation of the settings and how they affect instrument performance, the range of options available for each setting, typical or expected values for each setting, considerations to make when adjusting the settings, and procedures for documenting adjustments that are made.

While these examples are not exhaustive, they illustrate a fundamental lack of detail in the AMP and QAPP. To resolve this issue, Tesoro must do the following:

a. attach to the QAPP detailed SOPs for all performance indicator checks, corrective actions, maintenance activities, QA/QC activities, data management activities, and reporting activities; and

b. for each performance indicator check, corrective action, maintenance activity, QA/QC activity, data management activity, or reporting activity identified in the AMP or QAPP, provide references to the relevant SOPs.

Note that this is among the issues previously discussed in our July 15, 2022 and 12/22/2022 letters that Tesoro has failed to resolve. Also note that the SOPs will become part of the publicly available AMP and QAPP. As a result, if an SOP contains confidential information, two copies must be submitted – one that has the confidential information redacted and that can be made available to the public, and another unredacted copy for internal Air District reference. Finally note that by submitting a confidential redacted version, Tesoro represents to the District that it includes information recognized as trade secret under California law.

6. Section 3.3 of the QAPP outlines procedures for subjecting measurements to precision and accuracy tests. Accuracy and precision are defined on page 23 of the QAPP as follows:

$$\%Accuracy = \frac{\bar{x} - x_{std}}{x_{std}} \times 100\%$$

$$Precision \equiv \%CV = \frac{\sigma}{\bar{x}} \times 100\%$$

The term "accuracy" is generally understood in the scientific community to refer to the closeness of agreement between a measured quantity and its true value, such that a higher accuracy represents greater agreement. However, as it is defined above, higher values of "accuracy" actually reflect less agreement between the measured quantity and its true value because the formula represents error in the measurements rather than accuracy. This convention may be confusing or misleading to casual readers of the AMP and QAPP, and, because they are public documents, it is important that they be clear and understandable, and use plain language, to the extent possible. To improve clarity, Tesoro must modify the formulas as shown below and revise the AMP, QAPP, and any attachments as necessary to accommodate the revised definitions (e.g., if the QAPP currently states that corrective action will be taken if % Accuracy exceeds ±20%, it should be revised to state that corrective action will be taken if the % Error exceeds 20%).

$$\% \text{ Error} = \left| \frac{\bar{x} - x_{std}}{x_{std}} \right| \times 100\%$$

$$\% \text{ CV} = \frac{\sigma}{\bar{x}} \times 100\%$$

7. With regard to bump tests:
    - Table 6 of the AMP, Table 4 of the QAPP, and Table B-1 of Appendix B state that a bump test will be performed monthly and corrective action will be taken if the percent accuracy exceeds ±25%;
    - Table 11 of the AMP and Table 12 of the QAPP state that the acceptance criterion for accuracy during the monthly bump tests is ±25%, and a footnote to the table says corrective action will be taken when accuracy nears this level; and
    - Appendices B and E further outline procedures for performing bump tests.

    The Air District has the following comments regarding these provisions:

    a. The Air District's 12/22/2022 letter stated that the hydrogen sulfide (H_2S) tunable diode laser (TDL) must have a measurement accuracy within 15% of the reference standard and a coefficient of variation (CV) not greater than 15%; the letter further stated that the accuracy and precision specifications must be met for each monthly bump test. None of the tables referenced above reflect the precision requirement, and they incorrectly state the accuracy requirement as 25%. The AMP, QAPP, and any SOPs must clearly state that both accuracy (as % Error) and precision (as % CV) will be assessed during each bump test, with acceptance criteria of less than or equal to 15% for both performance indicators.

    b. The Air District's 12/22/2022 letter stated that the H_2S TDL must meet the accuracy and precision specifications for each bump test at a concentration of 50 to 100 ppb. While the procedures for single-point bump tests in section 6.1 of Appendix E provide an example calculation based on a 250 ppm-m sealed cell, the Appendix does not explicitly state what cell concentration will be used. That information must be clearly stated in the standard procedures while ensuring the resulting path average concentration is between 50 and 100 ppb for each path.

    c. As noted above, our 12/22/2022 letter stated that the H_2S TDL must meet the accuracy and precision specifications for each bump test at a concentration of 50 to 100 ppb. The procedures for performing bump tests outlined in Section 5 of Appendix E using flow-through cells call for use of a 750 ppm blend of H_2S. Such a cell concentration will result in a path average concentration outside of the required range for all paths but one.

        As explained in Appendix E, the 750 ppm blend of H_2S will be delivered to the optical path through a 0.167 m flow-through cell. This will result in a 125.25 ppm-m path integrated concentration along all paths:

        Path integrated concentration (ppm-m) = [H_2S concentration in cell] x [flow cell length]

        Path integrated concentration = 750 ppm x 0.167 m = 125.25 ppm-m

The path average concentration then equals the path integrated concentration divided by the total optical path length. The path lengths from Table 1 of the AMP and resulting path average concentrations are shown below:

$$\text{Path average concentration} = \left(\frac{125 \text{ ppm-m}}{2 * 654 \text{ m}}\right)\left(\frac{1000 \text{ ppb}}{1 \text{ ppm}}\right) = 96 \text{ ppb}$$

Path	One-way Path Length (m)	Path Average Concentration (ppb)
1	654	96
2	484	129
3	598	105
4	571	109

Tesoro must revise the procedures in Appendix E so they utilize cell concentrations that result in average path concentrations within the required 50 to 100 ppb range for all paths.

d. Page 23 of the QAPP states that bump tests will be performed using sealed cells containing H_2S and that NIST-certified cells will be used where commercially available. A similar statement about the use of NIST-certified sealed cells is also on page 31 of the AMP. In the event NIST-certified sealed cells are not available, non-certified sealed cells should not be used. Rather Tesoro should use flow-through cells with NIST traceable gases. Also note that the requirement to use NIST traceable standards applies to 3-point calibration checks just as it does to bump tests. The AMP and QAPP must be revised accordingly.

8. With regard to 3-point calibration checks:
   - Table 6 of the AMP and Table 4 of the QAPP state that a 3-point calibration check will be performed on a quarterly basis and corrective action will be taken if the % accuracy is greater than ±25% for H_2S concentrations less than or equal to 2,000 ppm-m or ±10% for concentrations greater than 2,000 ppm-m;
   - Table 11 of the AMP and Table 12 of the QAPP state that 3-point calibration checks will be performed on a quarterly basis, with acceptance criteria of ±25% for H_2S concentrations less than or equal to 2,000 ppm-m and ±10% for concentrations greater than 2,000 ppm-m for an unspecified performance measure.

   The Air District's 12/22/2022 letter stated that the H_2S TDL must have a measurement accuracy within 15% of the reference standard, and a coefficient of variation not greater than 15%. These specifications must be met at each calibration point. The AMP and QAPP do not satisfy these requirements, and are deficient in this regard. The AMP, QAPP, and any SOPs must clearly state that both accuracy (as % Error) and precision (as % CV) will be assessed during each 3-point calibration check, with acceptance criteria of ≤15% for both performance indicators at each calibration point.

9. With regard to the required 3-point calibration checks and bump tests, the Air District's 12/22/2022 letter stated that a failure to meet the stated accuracy and precision specifications must trigger repair,

maintenance, and root cause analysis, followed by repeat calibration checks or bump tests, until a passing check or test is completed. The letter also stated that all steps in this process, including results of each passing and failed calibration check and bump test, and monitor response or calibration adjustments, must be fully documented in the quarterly report submitted to the Air District. While page 23 of the QAPP states that repair, maintenance, and root-cause analysis will be performed if monthly bump test accuracy and precision specifications are not met, the QAPP does not contain similar provisions for failed 3-point calibration checks. In addition, neither the QAPP nor the AMP state that the results of each passing and failed calibration check and bump test, and monitor response or calibration adjustments, will be documented in the quarterly report submitted to the Air District. The AMP and QAPP are therefore deficient and must be revised to include these requirements.

10. With regard to the established precision and accuracy specifications, the Air District's 12/22/2022 letter stated that a failure to meet the specifications during two or more bump tests in any quarter, or four bump tests in any 12-month period, will result in a violation of the accuracy or precision specifications (as applicable) and QAPP requirements. The letter further stated that such occurrences will invalidate all data prior to the failed bump test, going back to the last passing bump test, and that invalidated data will count against data completeness requirements. These requirements and procedures cannot be found in the QAPP and must be added.

11. With regard to the detection capabilities of the H_2S monitoring equipment, our 12/22/2022 letter stated that a TDL system used to monitor H_2S must have a limit of quantitation (LOQ), which ranges from 3 to 25 ppb depending on environmental and operational conditions. In comparison to this requirement:

    a. page 23 of the AMP and page 7 of the QAPP state that, under acceptable operating conditions, the expected *minimum detection limit* (MDL) is between 3 and 25 ppb;

    b. Table 3 of the AMP and Table 1 of the QAPP state that the MDL for all paths is 25 ppb;

    c. Table 10 of the AMP and Table 11 of the QAPP state that 25 ppb is the screening level for MDL screening checks;

    d. Table 11 of the AMP and Table 12 of the QAPP state that a value of less than or equal to 25 ppb is the acceptance criterion for the 5-minute MDL;

    e. pages 23 of the AMP and 7 of the QAPP define the real-time MDL as three times the standard deviation of the last seven 5-minute average concentration values containing no measurable analyte; and

    f. we found no definition for the LOQ of the system in the AMP or QAPP.

    The AMP and QAPP are deficient with respect to this requirement, as they are inconsistent with the specifications in our 12/22/2022 letter. Tesoro must revise the AMP and QAPP to explain how the LOQ is determined, and reflect the requirement that the LOQ (not MDL) of the H_2S system be between 3 and 25 ppb.

12. Page 23 of the AMP and page 7 of the QAPP state that, under acceptable operating conditions, the expected MDL for the TDL is between 3 and 25 ppb below 3% to 5% transmission. At the same time, the AMP and QAPP use a signal power of 0.4 as a quality control parameter (see AMP, pp. 32 & 40; QAPP, pp. 13 & 31; Appendix B, pp. B-8 & B-13; Appendix E, p. E-20), which the Air District understands corresponds to a transmission greater than 3% to 5%. These provisions fail to satisfy the requirement in our October 6, 2021, and 12/22/2022 letters that interpreted the Guidelines to require that the system

have specified detection capabilities at a light transmission of 1% or less. Tesoro must revise the AMP and QAPP to reflect this performance specification.

13. Page 26 of the QAPP states there is an expectation that no measurements would be collected when visibility is less than 2.5 miles. This is a false expectation, and must be stricken from the QAPP. Tesoro must operate its fenceline monitoring systems at all times, including periods with low visibility. When such conditions preclude valid measurements, the Guidelines require Tesoro to provide the Air District with appropriate meteorological measurements to justify exclusion of the data when assessing data completeness. The procedures for providing this information are in Attachment 3 to our D12/22/2022 letter, which must be incorporated into the AMP and QAPP; the language described above must also be stricken from the QAPP.

    In addition, the AMP and QAPP both state that if open-path data are missing or invalid due to low light and low visibility, the data are automatically flagged as invalid. The AMP states that the 2.5 mile threshold is based on path length, manufacturer specifications, and review of observed instrument performance metrics. However, Tesoro states on page 26 of the QAPP that there is no exact relationship between visibility and open-path measurements, and Tesoro has provided no actual information to demonstrate that relationship, or to support the use of a specific threshold for flagging data. If Tesoro is going to use an automated process to flag data based on visibility data, a more thorough justification must be provided.

14. With regard to quarterly reporting:

    - Page 6 of the AMP states, "Once QA/QC of the final data is completed (within 60 days after the end of each calendar quarter), hourly and 5-min concentrations of species are provided to BAAQMD…"
    - Page 41 of the AMP states, "Final data sets are compiled quarterly, 60 days after each quarter's end and are provided to the BAAQMD."

    The AMP must be revised to clearly state that the quarterly reports will be provided to the BAAQMD no later than 60 days after the end of each calendar quarter.

15. The AMP and QAPP are unclear and ambiguous about the data management and validation process. For example, the AMP (p. 34) states that in near real time, data are transferred from infield instruments through a data acquisition system (DAS) to the data management system (DMS). The AMP goes on to say that the DAS averages data to 5-minute values, requiring that raw data completeness meets prescribed thresholds for each analyzer. However, those thresholds are not specified anywhere in the AMP or the QAPP and it is unclear what constitutes a valid 5-minute measurement. The AMP further states that values meeting the completeness criteria are transferred to the DMS, raising questions about whether any of the raw measurements are being saved in the DMS. While Tesoro must report 5-minute averages (Guidelines, p. 5), the underlying raw data that is used to produce those averages must be saved. Otherwise, there is no way to verify Tesoro is reporting accurate measurements.

    Aspects of the data validation process are also unclear. In particular, page 35 of the AMP states that the DAS and DMS automatically apply flags to all collected data points, including an "invalid" flag for data that, "do not meet the quality control criteria." While page 38 of the AMP identifies a number of DMS auto screening checks, the AMP identifies them as "additional," and it is unclear what they are in addition to. Furthermore, while Table 10 of the AMP and Table 11 of the QAPP indicate that certain screening checks result in a suspect/questionable flag, page 30 of the QAPP states more generally that data are invalidated

"in the event of an automated screening check failure," calling into question what checks may be used to invalidate data.

To resolve these issues, Tesoro must:

a. include in the QAPP a detailed process flow diagram depicting the end-to-end data handling, review, and management process, from the moment of data acquisition to the quarterly submittal of final quality-controlled data to the Air District;

b. revise the narrative descriptions of the data handling, review, and management process in the AMP and QAPP to clearly and fully describe the step-by-step process depicted in the flow diagram;

c. articulate all decision rules used to automatically or manually screen data;

d. illustrate the application of all auto-screening rules using real data and screen shots depicting how the auto-screened data are depicted on the public website; and

e. improve transparency about the data that has been invalidated by revising the website to allow members of the public to see two alternative views of the data – one view with invalid data removed, and another view showing all data (valid and invalid). Invalid data displayed on the website must be flagged as such, and the reason for invalidation must be indicated on the website alongside the corresponding invalid data.

16. Page 23 of the QAPP states that standards will not be used past their expiration date, and that if an expired standard is used, it will be recertified by the manufacturer. This language must be stricken from the QAPP because the use of expired standards is unacceptable. As such, any system audits using expired standards will be considered invalid.