

Attachment 1 - Basis for Determination That Chevron’s Revised Fenceline Air Monitoring Plan and Quality Assurance Project Plan (Submitted February 17, 2023) Do Not Meet District Regulation 12-15-403

1. 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 air monitoring plan (AMP) and quality assurance project plan (QAPP) contain the following content regarding data completeness:

- a. Pages 6 and 20 of the AMP state that instrumentation must meet a minimum of 90% completeness based on hourly data and that the tunable diode laser (TDL) will meet 75% completeness for the first year and increase to 90% after the first year.
- b. Table 2-1 of the QAPP includes the following:

Completeness Requirement	Relevant to
75% per hour	5-min binned average data, all instruments
90% per quarter	1-hr binned average data, all instruments except TDL
75% per quarter for the first year; 90% per quarter after it is shown to be achievable during the first year.	TDL

- c. Page 17 of the QAPP describes 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, the AMP and QAPP mischaracterize it and Table 2-1 of the QAPP appears to indicate it is two separate requirements. Furthermore, there are no provisions in the Guidelines allowing a lesser degree of data completeness for newly installed equipment, and language in the AMP and QAPP stating the TDL will meet 75% completeness in the first year is unacceptable.

Lastly, although page 17 of the QAPP provides various statistics that will be used to calculate completeness, the QAPP still lacks adequate detail (e.g., formulas) to establish exactly how completeness will be demonstrated, and the information in the QAPP is not consistent with the procedures for determining data completeness outlined in the Air District’s December 22, 2022, letter interpreting Regulation 12-15 and the associated Guidelines (12/22/2022 letter).

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

compliance with them. Chevron must incorporate the content of Attachment 3 to our 12/22/2022 letter into its AMP and QAPP to correct this deficiency.¹

2. With regard to data completeness, page 17 of the QAPP states 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 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 activities 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, which 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. Chevron must address this deficiency by incorporating the contents of Attachment 3 to our 12/22/2022 letter into the AMP and QAPP.

3. Page 21 of the AMP and page 28 of the QAPP state that Chevron will provide 5-minute average and binned hourly concentration data to the Air District in a comma separated value (CSV) file along with the site code, local standard time, measurement duration, concentration unit, QC and OP code, signal power, and real-time minimum detection limits (MDLs). These provisions are inconsistent with the procedures specified in our 12/22/2022 letter. 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.

4. As stated in Attachment 3 to our 12/22/2022 letter, Chevron's quarterly report must include meteorological data and a narrative explanation sufficient to justify invalidation of data for every hour of the calendar quarter where data has been excluded due to adverse atmospheric or environmental conditions. While page 29 of the QAPP states that meteorological data will be provided to the Air District with each quarterly report, it does not also state that the accompanying narrative explanation will be provided. The AMP and QAPP are deficient in this regard. The content of Attachment 2 to our 12/22/2022 letter must be included in the AMP and QAPP in its entirety.

¹ While provisions in the AMP and QAPP related to hydrogen sulfide monitoring are the focus of our review, note that page 8 of the AMP states the FTIRs are designed to operate at least 75% of the time based on annual quarters. This is inconsistent with the Guidelines and must also be corrected.

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).

Table 3.6 of the AMP, tables 1-2, 1-4, 1-6, and 4-5 of the QAPP, and Table D-1 of Appendix D identify a variety of corrective action, maintenance, and QA/QC activities for the H₂S 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 as required by the Guidelines. For example, Table 1-6 states that 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. The QAPP must identify the specific system performance indicators referred to in this table.

As another example, Table 1-6 of the QAPP states that system settings should be verified on an annual basis. While Appendix D has procedures for verifying the system settings (see Section 4.7), it merely directs personnel to view the settings, compare them with historical settings, and explain any changes. Details that should be provided in the QAPP, or in the 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, Chevron 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 discussed in our July 15, 2022 and 12/22/2022 letters that Chevron has failed to resolve. Also note that the SOPs will become part of the publicly available 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, Chevron represents to the District that it includes information recognized as trade secret under California law.

6. Section 3.1 of the QAPP outlines procedures for subjecting measurements to precision and accuracy tests. Accuracy and precision are defined on page 19 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, Chevron 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 percent accuracy exceeds 15%, it should be revised to state that corrective action will be taken if the percent error exceeds 15%).

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

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

7. With regard to bump tests:

- Table 1-6 of the QAPP states that a bump test will be performed monthly and corrective action will be taken if the percent accuracy exceeds 20%;
- Table 4-5 of the QAPP states that the acceptance criteria for accuracy and repeatability (as %CV) during the monthly bump tests are $\pm 25\%$ and a footnote to the table says corrective action will be taken at $\pm 20\%$; and
- Appendix D further outlines 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 H₂S TDL must have a measurement accuracy within 15% of the reference standard and a coefficient of variation not greater than 15%; the letter further stated that the accuracy and precision specifications must be met for each monthly bump test. The AMP and QAPP are inconsistent with these requirements. 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 $\leq 15\%$ for both performance indicators.
- b. The Air District’s 12/22/2022 letter stated that the H₂S 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 D 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, the Air District’s 12/22/2022 letter stated that the H₂S 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 D using flow-through cells call for use of a 750 ppm blend of H₂S. 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 D, the 750 ppm blend of H₂S 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:

$$\text{Path integrated concentration (ppm-m)} = [\text{H}_2\text{S concentration in cell}] \times [\text{flow cell length}]$$

$$\text{Path integrated concentration} = 750 \text{ ppm} \times 0.167 \text{ m} = 125.25 \text{ ppm-m}$$

The path average concentration then equals the path integrated concentration divided by the total optical path length. The path lengths from Table 3.3 of the AMP and resulting path average concentrations are shown below:

$$\text{Path average concentration} = \left(\frac{125 \text{ ppm-m}}{2 * 692 \text{ m}} \right) \left(\frac{1000 \text{ ppb}}{1 \text{ ppm}} \right) = 90 \text{ ppb}$$

Path	One-way Path Length (m)	Path Average Concentration (ppb)
D	692	90
E1	415	151
E2	376	166
F1	497	126
F2	400	156

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

- d. While page 18 of the QAPP states that bump tests will be performed with sealed cells, Appendix D to the QAPP includes procedures for using both sealed and flow-through cells. If NIST-certified sealed cells are not available, flow-through cells with NIST traceable gases may be used in the alternative. However, the AMP, QAPP, and any SOPs must be clear and consistent about which procedures will be used and when.²

8. With regard to 3-point calibration checks:

- Table 1-6 of the QAPP states that a 3-point calibration check will be performed on a quarterly basis and corrective action will be taken if the percent accuracy is greater than ±20% for H₂S concentrations less than or equal to 2,000 ppm-m, or ±10% for concentrations greater than 2,000 ppm-m;
- Table 4-5 of the QAPP states that 3-point calibration checks will be performed on a quarterly basis, with acceptance criteria of ±25% for H₂S concentrations less than or equal to 2,000 ppm-m and ±10% for concentrations greater than 2,000 ppm-m for both accuracy and repeatability.

The Air District's 12/22/2022 letter stated that the H₂S 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.

² Page 18 of the QAPP states that during the first year of TDL operation, a flow-through cell will be tested in addition to the 3-point calibration with the sealed cell. However, the use of flow-through cells for bump tests is not addressed.

9. Page 18 of the QAPP states that whenever equipment is replaced or added, a factory acceptance test (FAT) and site acceptance test (SAT) will be performed to determine the precision and percent error of the system. The QAPP goes on to say that the expected precision is greater than 90% and the expected percent error is less than 25%. As discussed previously, the TDL must have a measurement accuracy within 15% of the reference standard and a coefficient of variation not greater than 15%. Chevron must revise the language regarding the FATs, SATs, and acceptable level of field performance so it is consistent with the established performance specifications.

10. Table 4.1 of the AMP and Table 4-6 of the QAPP state that the measurement error of the TDL is $\pm 25\%$ for H₂S concentrations less than or equal to 2,000 ppm-m and $\pm 10\%$ for concentrations greater than 2,000 ppm-m. As previously discussed, the measurement error must not be more than 15% at any concentration; Table 4-6 must be revised accordingly.

11. 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 16 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.

12. 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.

13. As stated in our 12/22/2022 letter, the accuracy and precision specifications of 15% must be met during each bump test and at each calibration point used in the 3-point calibration checks.

In contrast, page 19 of the QAPP states that Chevron will determine the coefficient of variation by selecting 5-minute data during periods with low variability and when concentrations are well above the MDL. The QAPP goes on to state that the CV will be calculated using bump test data if there are no periods of low variability with concentrations above the MDL.

The QAPP must be consistent with the specified procedures, and language allowing the use of other data for demonstrating compliance with the accuracy and precision specifications must be removed.

14. With regard to the detection capabilities of the H₂S monitoring equipment, our 12/22/2022 letter stated that a TDL system used to monitor H₂S 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:
- Page 18 of the AMP states that the Unisearch TDL's detection limit is below 25 ppb;
 - Page 8 of the QAPP states that under acceptable operating conditions, the expected minimum detection limit is between 3 and 25 ppb;
 - Table 4-4 of the QAPP states that the MDL for all paths is 25 ppb;
 - Table 4-5 of the QAPP states that a value of less than or equal to 25 ppb is the acceptance criterion for the 5-minute MDL;
 - Page 21 of the QAPP defines the MDL as three times the standard deviation of the last seven 5-minute average concentration values containing no measurable analyte; and
 - There is no definition for the limit of quantitation (LOQ) 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. Chevron must revise the AMP and QAPP to explain how the LOQ is determined, and to reflect the requirement that the LOQ (not MDL) of the H₂S system be between 3 and 25 ppb.

15. Page 8 of the QAPP states 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, p. 22; QAPP, pp. 9 & 26; Appendix D, p. D-17), 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 the system have specified detection capabilities at a light transmission of 1% or less. Chevron must revise the AMP and QAPP to reflect the required performance specification.

16. The caption to Table 4-2 of the QAPP states that if visibility is less than 2.5 miles and data are invalid, the data are flagged as invalid due to environmental conditions. When such conditions preclude valid measurements, the Guidelines (p. 5) require Chevron 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 outlined in Attachment 3 to our 12/22/2022 letter and must be incorporated into the AMP and QAPP. Furthermore, Chevron has provided no information to demonstrate the relationship between visibility and open-path measurements. If Chevron is going to use a specific visibility threshold for invalidating data, a reasonable justification must be provided.

17. Page 16 of the QAPP states, "Final data sets will be compiled quarterly—60 days after each quarter—and provided to the BAAQMD by the Refinery PM." The AMP and QAPP must be revised to state that final data sets will be provided to the BAAQMD no later than 60 days after the end of each calendar quarter.

18. The AMP and QAPP are unclear and ambiguous about how data are validated and about what data are displayed to the public. For example, a statement on page 20 of the QAPP says automated screening checks are used to "screen out" invalid data for public display, and a similar statement is included on page 21 of the AMP. Presumably this means that if a measurement is flagged by an automated screening check, it may be invalidated and never make it to the public website. This is particularly troubling given that

descriptions of the automated checks are either vague or altogether missing. For example, page 21 of the AMP states that an automated system conducts the QA checks listed in Table 3.6 of the AMP before data are reported to the website. However, rather than listing QA checks, Table 3.6 identifies responses to potential monitor problems, and we are unable to find an alternate table in the AMP with the relevant information. Moreover, even where information is provided about the automated checks, it is unsatisfactory. For example, page 20 of the QAPP states that the automated checks include one for the rate of change, which flags values that change rapidly without reasonable cause. It is unclear how "rapidly" is defined in this instance, and how the data management system determines what the cause was and whether or not it was reasonable.

Finally, page 22 of the QAPP states that data flags identified through auto-review will be reviewed during data validation (i.e., not in real time), and that if an analyst determines the data were incorrectly flagged, the analyst will manually change the flag. According to the QAPP, this secondary data review may occur daily or less frequently. As a result, it appears that legitimate measurements may be concealed or mislabeled for days at a time, which runs counter to the purpose of making real-time (or near real-time) data available.

To resolve these issues, Chevron 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.

19. The caption to Table 4-1 of the QAPP states that the table provides an overview of *automated* data QC and operational (OP) codes. It is unclear whether all of these codes are based on automated checks since the list of OP codes does not fully correspond to the list of automated data checks on page 20 of the QAPP. Please explain. Also, provide a comprehensive list of all OP codes associated with both automated checks and manual data reviews, and define all OP codes in the list.

20. Page 21 of the AMP states that all data will be retained for a period of five years, consistent with Regulation 12-15-302. Please change the citation to the correct citation to the rule, which is 12-15-502.

21. Page 26 of the AMP states that Table 4-4 in Appendix B summarizes the expected detection ranges for the open path monitors. This table reference appears to be incorrect and should be revised.

22. Page 16 of the QAPP states that the AMP, QAPP, or SOPs may be updated periodically and distributed to the Air District; this must be revised to state that the revised documents will be submitted to the Air District for review and approval.