Title: **Teledyne Advanced Pollution Instrumentation Model T101 Ambient H_2S Analyzer – Multipoint Calibration**	Procedure Number: **AM-150A**
	Revision Number: 01
Supersedes: Not Applicable	Issued Date: 08/27/21
Reason for Revision: Refined calibration procedure and clarified the guideline for adjusting the offset.	Effective Date: 08/27/21

Authorization Signatures		
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1.0 PURPOSE, SCOPE, AND APPLICABILITY

This procedure establishes standardized calibration procedures for the Teledyne Advanced Pollution Instrumentation (TAPI) Model T101 Ambient H_2S Analyzer, also referred to as the T101. This procedure will discuss all equipment, forms and spreadsheets needed to calibrate and process data collected.

This SOP is applicable to all TRC air measurements programs using TAPI's T101 H_2S analyzer for the collection and analysis of continuous real time monitoring of SO_2 in ambient air.

2.0 SUMMARY OF RESPONSIBILITIES

Functional Area Managers (e.g., Practice Leader, Group Manager, Project Manager) are responsible for ensuring implementation of the SOP.

Quality Assurance personnel are responsible for:

- Review and approval of SOP
- Auditing, under the direction of a Functional Area Manager, to verify implementation of SOP

The Project Manager is responsible for:

- Calibrations occurring at the proper intervals
- Ensuring calibration documents are reviewed, accurate and complete within an appropriate timeframe

The Field Operations Manager is responsible for:

- Directing the activities of the Field Technician
- Ensuring that all the calibration equipment is available and properly certified

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- Reviewing all documentation related to calibration activities for accuracy and completeness

The Field Technician is responsible for:

- Reading and understanding the appropriate calibration SOPs, calibration forms and project QAPP
- Performing calibrations in accordance with the appropriate calibration SOPs, project QAPP and relevant USEPA quality assurance guidance
- Reviewing documentation for accuracy and completeness
- Contacting the appropriate Field Operations Manager or Project Manager if any checks are outside of acceptable limits.

3.0 REQUIRED SUPPLIES

- TAPI T101 Operation Manual
- Project QAPP
- Laptop with appropriate data logger hardware and software
- Calibration Spreadsheet
- NIST traceable certified items:
  - T700 Dynamic Dilution Calibrator
  - T701 Zero Air Generator
  - Barometer
  - Temperature Sensor
  - Relative humidity sensor
  - H_2S mixed gas cylinder, as close to 10ppm as possible, but no lower
- Current Calibration Certifications for all Standards and equipment current within the last12 months

4.0 CALIBRATION FREQUENCY

The analyzer requires calibration in the following circumstances:

- Upon installation,
- Quarterly,
- Prior to any instrument modification or removal, given that the analyzer is operational.

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- Following any modifications to the instrument.

5.0 AUTOMATED CALIBRATION CHECKS

The data acquisition system (DAS) performs automated calibration checks throughout a testing program. The concentration of calibration checks and their frequency are included in the project specific QAPP.

6.0 CALIBRATION CHECKS AND MULTIPOINT CALIBRATIONS

1. Begin a logbook entry detailing the calibration procedure. Include date and time and names of personnel on-site or remotely performing the multipoint calibration. Be sure to include the following specific information:
   - serial numbers of the T101 and T700,
   - Gaseous Standard concentration, cylinder number, and expiration date,
   - Start and stop time of calibration procedure.
2. Ensure that the zero air and span gas connections are adequately plumbed to the back of the T101 analyzer.
3. On the front panel of the T700, Dynamic Dilution Calibrator, toggle to GEN > AUTO generate a ZERO gas, setting the flow rate to a value that will appropriately flood the

manifold (at least 1.5 times greater than instrument flow rate)

4. Once the T700 is supplying zero air, wait for the response of the T101 to stabilize (typically 5 to 10 minutes). The instrument's response is stable when the displayed stability values is below 1.0. Teledyne recommends waiting until the stability is 0.5 or less before adjusting the instrument offset.
5. Adjust the instrument's zero calibration value (OFFSET), by selecting CAL > ZERO > ENTR. Record the instrument response and updated offset.
6. Generate a span gas concentration to adjust the instrument's slope. On the front panel of the T700 Calibrator, toggle to GEN > AUTO > H_2S to generate a calibration span value documented in the project specific QAPP. Click ENTR to begin generating span gas.
7. Set the flow rate to a value that sufficient to flood the manifold.
8. Once the T700 is supplying calibration gas, wait for the response of the T101 to stabilize (Stability <1.0). Record the instrument response and updated SLOPE.
9. To adjust the instrument span value (SLOPE), wait select CAL > SPAN > ENTR. Note that Teledyne recommends waiting until the stability has fallen below 0.5 before performing this procedure.

Note: Daily and/or weekly checks must be within 10% difference of actual concentrations. Greater than 7% difference indicates a warning that will require investigation. A failed calibration check, greater than 10% difference, will require recalibration. Any time a zero and span calibrations are adjusted, a full multipoint calibration must be performed.

10. To conduct a full multipoint calibration, generate at least three additional concentrations. and document the analyzer response once the stability falls below 1.0.
11. Once the multi-point calibration is complete, generate zero air for 2 minutes to purge calibration gases from the system.
12. Place the T700 in Standby Mode by clicking STBY. This will stop the flow of calibration gas and allow the T101 to sample ambient air. Sample ambient air for a minimum of 2 minutes before return data collection to valid status.

7.0 FORMS RECORDS AND DOCUMENTATIONS

- Forms and spreadsheets are supplied electronically. Printed copies of these forms can be found in the Forms section of the project of the project specific QAPP.
- Documents necessary for completion of this SOP include
  - *T101 Calibration Form*
  - *Station Logbook*
- One copy of the competed *T101 Calibration Form* and the *Station Log* must be signed and remain onsite in the Station Log Book

- An electronic copy of the complete *T101 Calibration Form* and the *Station Log* must be submitted to the project specific database

8.0 REFERENCES

These documents should be available for consultation during setup, operation and routine maintenance procedures. The T101 manual must be available for details not included in this SOP.

TRC SOP AM-005: *Air Measurements Practice Software Control*

Teledyne Advanced Pollution Instrumentation Operation Manual Model T101 UV Florescence H_2S Analyzer

40 CFR 53.23c: *Code of Federal Regulations*, Volume 40, Part 53.23c

40 CFR 58 Appendix A: *Code of Federal Regulations,* Volume 40, Part 58, Appendix A

40 CFR 58 Appendix E: *Code of Federal Regulations,* Volume 40, Part 58, Appendix E

40 CFR 50 Appendix A: *Code of Federal Regulations,* Volume 40, Part 50, Appendix A

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