

Region 4
U.S. Environmental Protection Agency
Laboratory Services & Applied Science Division
Athens, Georgia

Operating Procedure

Title: Leak Detection and Repair

ID: LSASDGUID-102-R4

Issuing Authority: Field Services Branch Supervisor

Effective Date: April 22, 2023

Review Due Date: October 30, 2026

Method Reference: N/A

SOP Author: Paula Whiting

Purpose

This guidance describes how Laboratory Services and Applied Science Division (LSASD) conducts direct monitoring for Leak Detection and Repair (LDAR) investigations. The purpose of these investigations is to monitor regulated tanks and equipment in volatile organic compounds (VOCs) service for potential leaks.

Scope/Application

This guidance covers how to evaluate the Thermo Toxic Vapor Analyzer (TVA) 2020 or 1000B instruments performance, how TVAs are used by LSASD personnel to detect VOC leaks from individual sources and how to document LDAR monitoring investigations. This protocol contains directions developed solely to provide internal guidance to LSASD employees. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Note: LSASD is currently migrating to a paperless organization. As a result, this SOP will allow for the use of electronic logbooks, checklists, signatures, SOPs, and forms as they are developed, which will also be housed in the LIMS and traceable to each project. LSASD is committed to maintaining its quality system by continued traceability of original observations in the final report as migration to an electronic system occurs.

TABLE OF CONTENTS

Table of Contents

Purpose	1
Scope/Application	1
1. Documentation/Verification	3
2. General Precautions.....	3
3. Instrument Performance Evaluation	4
4. Methodology	4
References	7
Figure 1 - Instrument Performance Log	8
TVA Precision Test & Response Time by: Notes by:	8
Figure 2 - Air Monitoring Investigation Log	9
Revision History.....	10

General Information

1. Documentation/Verification

- 1.1. This document was prepared by persons deemed technically competent by LSASD management, based on their knowledge, skills and abilities and has been tested in practice and reviewed in print by a subject matter expert. The official copy of this guidance resides on the Division's local area network (LAN). The Quality Assurance Manager is responsible for ensuring the most recent version of the procedure is placed on the LAN and for maintaining records of review conducted prior to its issuance.

2. General Precautions

2.1. Safety

- 2.1.1. Proper safety precautions must be observed when conducting LDAR inspections. Refer to the LSASD Safety, Health and Environmental Management Program Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASPs) for guidelines on safety precautions as determined by the job hazard assessments of the anticipated LDAR activities. These guidelines, however, should only be used to complement the judgment of an experienced professional. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate.

- 2.1.2. The instrument used to monitor leaks of organic vapors should be intrinsically safe, as defined by International Electrotechnical Commission (IEC) for operation in any explosive atmospheres that may be encountered.

2.2. Procedural Precautions

- 2.2.1. The following is a list of some items that should be considered when taking field measurements:

- Allow ample time for instrument warm-up before calibration.
- If instrument is not working properly, red tag it and remove it from use.
- Observe shelf life of calibration standards.
- Read operational manuals.
- Response time is the time interval from a step change in VOC concentration at the input of the sampling system to the time at which 90 percent of the corresponding final value is reached as displayed on the instrument readout meter.
- Response factor is the ratio of the known concentration of a VOC compound to the observed meter reading when measured using an instrument calibrated with the reference compound specified in the applicable regulation.
- Ensure written documentation is maintained for monitoring data.
- During direct monitoring of equipment, caution must be exercised to prevent liquids, grease, dirt, etc., from being pumped into the instrument's probe.

3. Instrument Performance Evaluation

3.1. First, the warmed-up TVA(s) should be calibrated using the appropriate Thermo TVA Operation Manual and the calibration gas(es) with concentrations near the defined leaks specified in the regulations. This calibration needs to be recorded.

3.1.1. Then, according to EPA Method 21:

- A calibration precision test must be completed prior to placing the instrument into service and at subsequent 3-month intervals.
- The calibration precision must be equal to or less than 10% of the calibration gas value.

3.1.2. If the 10% precision requirement is not met, the instrument must be recalibrated. If, after recalibration, these values still cannot be met, the instrument will be red-tagged and taken out of service.

3.1.3. A calibration precision test is conducted by making three alternating measurements of the zero gas and the specified calibration gas using the TVA and recorded. The average difference between three different meter readings and the calibration gas value is then calculated. [Note: Only positive numbers can be used, therefore it is necessary to use the absolute difference between the calibration gas and the meter reading] This average difference is divided by the known calibration value and multiplied by 100 to obtain the calibration precision. See Figure 1 for an example of an Instrument Performance Log.

3.1.4. The average response time should be determined by introducing zero gas into the instrument sample probe. When the meter reading has stabilized, switch quickly to the specified calibration gas. After switching, measure the time required to attain 90 percent of the final stable reading. Perform this test sequence three times and record the results and calculating the average response time.

3.1.5. Finally, the response factors can be obtained from published documents for the compounds of interest for the instrument or detector type, or **facilities** may determine the response factors for each compound of interest through testing as part of their LDAR program.

4. Methodology

4.1. Summary of Method

4.1.1 A portable calibrated instrument or TVA is used to detect VOC leaks from process equipment. Leak sources include, but are not limited to, valves, flanges and other connections, pumps, compressors, pressure relief devices, process drains, open-ended lines, pump and compressor seal system degassing vents, accumulator vessel vents, agitator seals, and access door seals. A leak definition concentration (based on a reference compound) is specified in each applicable regulation. This method is intended to locate and classify leaks only and is not to be used as a direct measure of mass emission rate from individual sources.

4.2. Apparatus, Materials, Chemicals

- TVA 2020 or TVA 1000B
- Calibration gases [parts per million by volume (ppmv)]:
 - Zero gas (air, less than 10 ppmv VOC)
 - Methane (100, 500, 1,000, and/or 10,000 ppmv) or others if applicable. Note: for each organic species that is to be measured during individual source surveys, obtain, or prepare a known standard in air at a concentration approximately equal to the applicable leak definition specified in the regulation.

4.3. Personnel Responsibilities/Training

4.3.1. Personnel will be trained on the use of instruments capable of detecting VOCs and Method 21 (40 CFR Part 60, Appendix A) prior to taking field measurements. The training includes reading Method 21 and the instrument manufacturer's operation manual. Personnel should demonstrate competency/proficiency by properly calibrating the instrument and by using it to measure known samples.

4.4. Maintenance and Calibration

4.4.1. All instruments will be maintained and operated in accordance with the manufacturer's instructions and the LSASD Operating Procedure for Equipment Inventory and Management (LSASDPROC-1009). All instruments placed in service will be calibrated to ensure that they are operational before they are taken to the field. If the instrument is not functioning properly, it will be red tagged and taken out of service. An instrument that has been red tagged will be repaired by personnel qualified to do instrument repair or by authorized company representatives, then calibrated, and returned to service. The instrument will be calibrated daily in the field before use by the procedure prescribed in the instrument's manufacturer's operational manual and Method 21.

4.5. Procedure

4.5.1. The Clean Air Act, Resource Conservation and Recovery Act (RCRA), and/or state statutes require facilities with regulated equipment in VOC service to develop and implement a Leak Detection and Repair (LDAR) program to control fugitive VOC emissions. Federal equipment leak regulations that affect the chemical industry are found in the following Code of Federal Regulations (CFR):

- 40 CFR, Part 60, Subpart VV
- 40 CFR, Part 61, Subparts J & V
- 40 CFR, Part 63, Subparts H & I
- 40 CFR, Parts 264 & 265, Subparts AA, BB & CC

4.5.2. Component monitoring must be conducted periodically, as outlined in the applicable statute. LDAR on-site inspections performed by LSASD involve monitoring regulated VOC-service components, performing data evaluation/preparation, and reporting inspection findings.

4.5.3. The monitoring method used is EPA Method 21. The TVA is used to detect VOC leaks from tanks or components by **slowly** placing the probe inlet near the surface of the components interfaces where leaks can occur. **NOTE: Be careful not to pump liquid or debris into the probe.** Move the probe along the interface periphery while observing the instrument readout. If an increased meter reading is observed, slowly sample the interface where leakage is indicated until the maximum meter reading is obtained. Leave the probe inlet at this maximum reading location for approximately two times the instrument response time. If the maximum observed meter reading is greater than the leak definition in the applicable regulation, record and report the results as specified in the regulation reporting requirements. Components that should be monitored may include pressure relief devices, manways or hatches, pumps or compressor seals, valves, flanges, process drains, and open-ended lines. A no detectable emission means a local VOC concentration at the surface of a leak source, adjusted for local VOC ambient concentration, that is less than 2.5 percent of the specified leak definition concentration.

4.6. Data Review and Documentation

4.6.1. Monitoring results will be recorded in project logbooks. All records should be entered according to the procedures outlined in the LSASD Operating Procedure for Logbooks (LSASDPROC-1002). See Figure 1 for an example of an Instrument Performance Log, and Figure 2 for an example of an Air Monitoring Investigation Log. Detectable organic emissions viewed with an infrared camera, FLIR GF-320, may be used to record a video of the leak.

4.6.2. Data will be reviewed to ensure that the data is complete and meets the enforcement/ technical requirements of the particular investigation objectives. The data will be reviewed by the project leader, team members, other technical experts, and LSASD quality control staff, as appropriate. This review will be conducted in accordance with LSASD Operating Procedure for Report Preparation and Distribution, SESDPROC-003.

References

LSASD Operating Procedure for Equipment Inventory and Management, LSASDPROC-1009, Most Recent Version

LSASD Operating Procedure for Logbooks, LSASDPROC-1002, Most Recent Version

Thermo TVA 1000B Operation Manual

Thermo TVA 2020 Operation Manual

US EPA, Method 21, Determination of Volatile Organic Compound Leaks (40 Code of Federal Regulations, Part 60, Appendix A)

USEPA, Enforcement and Compliance Assurance, Inspection Manual: Federal Equipment Leak Regulations for the Chemical Manufacturing Industry Volume I:, EPA/305/B-98/011, December, 1998.

USEPA. Safety, Health and Environmental Management Program Procedures and Policy Manual. Region 4 LSASD, Athens, GA, Most Recent Version

Figure 1 - Instrument Performance Log

Instrument 1 ID: TVA2020 – _____ Date/time _____
Calibrated by: _____ Accepted Y / N Notes by: _____

Instrument 2 ID: TVA2020 – _____ Date/time _____
Calibrated by: _____ Accepted Y / N Notes by: _____

Instrument 3 ID: TVA2020 – _____ Date/time _____
Calibrated by: _____ Accepted Y / N Notes by: _____

Instrument 4 ID: QRae3 – _____ Date/time _____
Calibrated by: _____ Accepted Y / N Notes by: _____

Weather: _____

Calibration gases:

Span Gas	Concentration	Manufacture	Lot	Expiration	
	Zero				
1	Methane - 500 ppm				
2	Methane - 1000 ppm				
3	Methane - 10000ppm				
4	Toluene – 100 ppm				
5	4-Gas (CO, H2S, O2,LEL)				

TVA Precision Test & Response Time by:

Notes by:

Instrument Number	Span Gas	Concentration Check	Response / Time (s)	Response / Time (s)	Response / Time (s)	Average Response (s)	Precision Test %
	1	500 ppm					
	2	1000 ppm					
	3	10000 ppm					
Instrument Number	Span Gas	Monitoring Check			Post Monitoring Check	Time	
	1	500 ppm					
	2	1000 ppm					
	3	10000 ppm					

Precision Test % = (Avg. reading / Known Concentration) X 100

Figure 2 - Air Monitoring Investigation Log

Process Area(s):

	Component	ID	Background (ppm)	TVA Reading (ppm)	Time	Comments
01						
02						
03						
04						
05						
06						
07						
08						
09						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Revision History

History	Effective Date
Replaced Chief with Supervisor; General formatting revisions.	April 22, 2023
<p>LSASDGUID-102-R3, <i>Leak Detection and Repair</i>, replaces SESDGUID-102-R2.</p> <p>The guidance document was put in the new SOP format. SESD was replaced with LSASD as appropriate. Made minor revisions and corrections. Updated "Quality Control" to "Instrument Performance Evaluations". Updated Section for Methodology. Added Figure 1 Instrument Performance Log example & Figure 2 Air Monitoring Investigation Log example.</p>	<p>July 2021</p> <p>Note: This guidance document was originally reviewed, modified and approved for posting in August 2020. Due to an internal error, the document was never posted. As a result, the document was posted in July 2021.</p>
<p>SESDGUID-102-R2, <i>Leak Detection and Repair</i>, replaces SESDGUID-102-R1.</p> <p>Cover Page: SESD's reorganization was reflected in the authorization section by making John Deatrick the Supervisor of the Field Services Branch. The FQM was changed from Liza Montalvo to Hunter Johnson.</p> <p>Revision History: Changes were made to reflect the current practice of only including the most recent changes in the revision history.</p> <p>General: Throughout the document added reference to TVA 2020, where appropriate.</p> <p>Section 3.3: Third sentence, changed "must" to "should."</p> <p>Section 3.5: First sentence, added "Resource Conservation and Recovery Act (RCRA)." Fourth Bullet, replaced "Subpart BB" with "Subparts AA, BB & CC."</p>	October 15, 2015
SESDGUID-102-R1, <i>Leak Detection and Repair</i> , replaces SESDGUID-102-R0.	April 20, 2011
SESDGUID-102-R0, <i>Leak Detection and Repair</i> , Original Issue	June 13, 2008