Leak Detection and Repair

A Best Practices Pamphlet

UNITED STATES • ENVIRONMENTAL PROTECTION AGENCY •

Introduction

In general, EPA has found significant widespread noncompliance with Leak Detection and Repair (LDAR) regulations and more specifically, noncompliance with Method 21 requirements. In 1999, EPA estimated that, as a result of this noncompliance, an additional 40,000 tons of VOCs are emitted annually from valves at petroleum refineries alone.

The EPA document "Leak Detection and Repair—A Best Practices Guide" (http://www.epa.gov/Compliance/resources/publications/assistance/ldarguide.pdf) provides a detailed discussion of the sources and causes of equipment leaks, elements and benefits of an LDAR program, compliance problems with current LDAR programs, and the major elements of successful LDAR programs.

This brochure is focused on the major elements of successful LDAR programs. Experience has shown that facilities with an effective record of preventing leaks integrate an awareness of the benefits of leak detection and repair into their operating and maintenance program. LDAR programs that incorporate most or all of the elements described in the following sections have achieved more consistent results in their LDAR programs, leading to increased compliance and lower emissions.

Some of the elements of a model LDAR program, as described in this brochure, are required by current Federal regulations. Other model LDAR program elements help ensure continuous compliance although they may not be mandated from a regulatory standpoint. Furthermore, State or local requirements may be more stringent than some elements of the model LDAR program, such as with leak definitions. Prior to developing a written LDAR program plan, all applicable regulations should be reviewed to determine and ensure compliance with the most stringent requirements.

The model LDAR program includes the following elements:

1. Written LDAR Program

A written LDAR program specifies: the regulatory requirements and facility-specific procedures for recordkeeping certifications, monitoring, and repairs; the roles of each person on the LDAR team; documents all the required procedures to be completed and data to be gathered; and all process units subject to federal, state, and local LDAR regulations.

Key elements of the written LDAR program include:

- An overall, facility-wide leak rate goal that will be a target on a process-unit-by-process-unit basis.
- A list of all equipment in light liquid and/or in gas/vapor service that has the potential to leak VOCs and VHAPs, within process units that are owned and maintained by each facility.
- Procedures for identifying leaking equipment within process units;
- Procedures for repairing and keeping track of leaking equipment;
- A process for evaluating new and replacement equipment to promote the consideration of installing equipment that will minimize leaks or eliminate chronic leakers.
- A list of "LDAR Personnel" and a description of their roles and responsibilities, including the person or position for each facility that has the authority to implement improvements to the LDAR program.
- Procedures (e.g., a Management of Change program) to ensure that components added to each facility during maintenance and construction are evaluated to determine if they are subject to LDAR requirements, and that affected components are integrated into the LDAR program.

Within thirty (30) days after developing the written facility-wide LDAR program, submit a copy of the Program to EPA and to the appropriate state agency. The plan should be updated as necessary to ensure accuracy and continuing compliance.

2. Training

A training program provides LDAR personnel with: technical understanding necessary to make the written LDAR program work and education of the LDAR team members on their individual responsibilities. These training programs can vary according to the level of involvement and degree of responsibility of LDAR personnel.

The training program should:

- Provide and require initial training and annual LDAR refresher training for all facility employees (e.g., monitoring technicians, database users, QA/QC personnel, the LDAR Coordinator) who are assigned LDAR compliance responsibilities.
- For other operations and maintenance personnel with responsibilities related to LDAR, provide and require an initial training program that includes instruction on aspects of LDAR that are relevant to their duties (e.g., operators and mechanics performing valve packing and unit supervisors that approve delay of repair work). Provide and require "refresher" training in LDAR for these personnel at least every three years.
- Collect training information and records of contractors, if used.

3. LDAR Audits

Internal and third-party audits of a facility LDAR program are a critical component of effective LDAR programs to ensure that the LDAR program is being conducted correctly and problems are identified and corrected. The audits verify that the correct equipment is being monitored, Method 21 procedures are being followed, leaks are being fixed, and the required records are being kept.

An audit program should include requirements to:

- Review records on a regular cycle to ensure that all required LDAR-related records, logs, and databases are being maintained and are up to date.
- Ensure and document that the correct equipment is included in the LDAR program and that equipment identified as leaking is physically tagged with the equipment ID number.
- Observe the calibration and monitoring techniques used by LDAR technicians, in particular to ensure the entire interface is checked and the probe is held at the interface, not away from the interface.
- Retain a contractor to perform a third-party audit of the facility LDAR program at least once every four (4) years.
- Perform facility-led audits every four (4) years.
    - » Use personnel familiar with the LDAR program and its requirements from one or more of the company's other facilities or locations (if available).
    - » Perform the first round of facility-led LDAR audits no later than two (2) years after completion of the third-party audits outlined above, and every four (4) years thereafter.

- This rotation ensures that the facility is being audited once every two (2) years.

- If areas of noncompliance are discovered, initiate a plan to resolve and document those issues.
  - Implement, as soon as practicable, steps necessary to correct causes of noncompliance, and prevent, to the extent practicable, a recurrence of the cause of the noncompliance.
  - Retain the audit reports and maintain a written record of the corrective actions taken in response to any deficiencies identified.

4. Contractor Accountability

Facilities should have in place sufficient oversight procedures to increase the accountability of contractors performing monitoring.

LDAR program managers should:

- Write contracts that emphasize the quality of work instead of the quantity of work only.
- Require contractors to submit documentation that their LDAR personnel have been trained on Method 21 and facility-specific LDAR procedures.
- Ensure that the contractor has a procedure in place to review and certify the monitoring data before submitting the data to the facility.
- Review daily results of contractor work to ensure that a realistic number of components are being monitored.
- Perform spot audits in the field to ensure that Method 21 procedures are being followed. This can include spot-checking monitored components with another hydrocarbon analyzer or following LDAR personnel as they perform monitoring.
- Have periodic reviews of contractor performance (e.g., quarterly or semi-annually) to resolve issues and correct problems.

5. Internal Leak Definition for Valves and Pumps

The varying leak definitions that can apply to different process units and components can be confusing and lead to errors in properly identifying leaks. To counter this potential problem, operate your LDAR program using an internal leak definition for valves and pumps in light liquid or gas vapor service. The internal leak definition would be equivalent to or lower than the applicable definitions in your permit and the applicable federal, state, and local regulations. Monitoring against a uniform definition that is lower than the applicable regulatory definition will reduce errors and provide a margin of safety for identifying leaking components.

Elements:

- Adopt a 500-ppm or lower internal leak definition for VOCs for all valves in light liquid and/or gas vapor service, excluding pressure relief devices.
- Adopt a 2,000-ppm or lower internal leak definition for pumps in light liquid and/or gas/vapor service.
- Record, track, repair, and monitor leaks in excess of the internal leak definition. Repair and monitor leaks that are greater than the internal leak definitions but less than the applicable regulatory leak definitions within thirty (30) days of detection.

Consent Decrees between EPA and many chemical facilities subject to the HON require using a 250-ppm leak definition for valves and connectors and a 500-ppm leak definition for pumps.

Note: If a state or local agency has lower leak definitions, then the internal leak definition should be set to the lowest definition or even lower to include/allow for margin of error.

6. More Frequent Monitoring

Some equipment leak regulations allow an alternative work practice (i.e., skip periods) where less frequent monitoring is required when good performance (as defined in the applicable regulation) is demonstrated. Skip periods usually apply only to valves and connectors. For example, after a specified number of leak detection periods (e.g., monthly) during which the percentage of leaking components is below a certain value (e.g., 2% for NSPS facilities), a facility can monitor less frequently (e.g., quarterly) as long as the percentage of leaking components remains low. The facility must keep a record of the percentage of the component type found leaking during each leak detection period.

To ensure that leaks are still being identified in a timely manner and that previously unidentified leaks are not worsening over time, the LDAR program should include a plan for more frequent monitoring for components that contribute most to equipment leak emissions.

This plan should require monitoring of:

- Pumps in light liquid and/or gas vapor service on a monthly basis.
- Valves in light liquid and/or gas vapor service—other than difficult-to-monitor or unsafe-to-monitor valves—with no skip periods.

7. Repairing Leaking Components

To stop detected leaks while they are still small, most rules require a first attempt at repair within 5 days of the leak detection and a final repair within 15 days. However, any component that cannot be repaired within those time frames must be placed on a "Delay of Repair" list to be repaired during the next shutdown cycle.

First attempts at repair include, but are not limited to, the following best practices where practicable and appropriate:

- Tightening bonnet bolts.
- Replacing bonnet bolts.
- Tightening packing gland nuts.
- Injecting lubricant into lubricated packing.

For those components that monitoring personnel are not authorized to repair, the schedule for the "first attempt at repair" should be consistent with the existing regulatory requirements.

The component for which a "first attempt at repair" was performed should be monitored no later than the next regular business day to ensure the leak has not worsened.

If the first attempt at repair has not succeeded then other methods, such as "drill and tap" should be employed where feasible. Drill and tap procedures are no longer considered extraordinary practices.

8. Delay of Repair Compliance Assurance

Any component that cannot be repaired during the specified repair interval must be placed on a "Delay of Repair" list to be repaired during the next shutdown cycle. Delay of repair compliance assurance procedures ensure that the appropriate equipment is justifiably on the "Delay of Repair" list and that facilities have a plan to fix these components.

The procedures should specify that:

- The unit supervisor approve in advance and certify all components that are technically infeasible to repair without a process unit shutdown.
- Equipment placed on the "Delay of Repair" list should continue to be monitored as part of the facility's regular LDAR monitoring program. For leaks above the internal leak definition rate and below the regulatory rate, put the equipment on the "Delay of Repair" list within 30 days.
- Within 15 days of implementing the written LDAR program, the following repair policies and procedures should also be implemented:
  - » For valves, other than control valves or pressure relief valves, that are leaking at a rate of 10,000 ppm or greater and cannot be feasibly repaired without a process unit shutdown, use "drill and tap" repair methods to fix the leaking valve, unless you can determine and document that there is a safety, mechanical, or major environmental concern posed by repairing the leak in this manner.
  - » Perform up to two "drill and tap" repair attempts to repair a leaking valve, if necessary, within 30 days of identifying the leak.

9. Electronic Monitoring and Storage of LDAR Data

Electronic monitoring and storage of LDAR data will:

- Help evaluate the performance of monitoring personnel (via time/date stamps),
- Improve accuracy,
- Provide an effective means for QA/QC, and
- Retrieve records in a timely manner for review purposes.

The data handling procedures of the LDAR program should include these Elements:

- Incorporate and maintain an electronic database for storing and reporting LDAR data.
- Use data loggers or other data collection devices during all LDAR monitoring.
- Use best efforts to transfer, on a daily basis, electronic data from electronic data logging devices to the database.
- For all monitoring events in which an electronic data collection device is used, include a time and date stamp, operator identification, and instrument identification.
- Paper logs can be used where necessary or more feasible (e.g., small rounds, re-monitoring fixed leaks, or when data loggers are not available or broken), and should record, at a minimum, the monitoring technician, date, and monitoring equipment used.
- Transfer any manually recorded monitoring data to the database within 7 days of monitoring.
- Review records to identify "problem" components for preventative maintenance (repair prior to anticipated failure) or for replacement with "leakless" technology.

10. QA/QC of LDAR Data

QA/QC audits ensure that Method 21 procedures are being followed and LDAR personnel are monitoring the correct components in the proper manner. The LDAR program should include procedures to ensure QA/QC review of all data generated by LDAR monitoring technicians on a daily basis or at the conclusion of each monitoring episode.

Examples of QA/QC procedures include:

- Daily review/sign-off by monitoring technicians of the data they collected to ensure accuracy and validity.
- Periodic review of the daily monitoring reports generated in conjunction with recordkeeping and reporting requirements.
- Quarterly QA/QC of the facility's and contractor's monitoring data including:
  - » Number of components monitored per technician;
  - » Time between monitoring events; and
  - » Abnormal data patterns.

11. Calibration/Calibration Drift Assessment

Always calibrate LDAR monitoring equipment using an appropriate calibration gas, in accordance with 40 CFR Part 60, EPA Reference Test Method 21.

- At a minimum, the calibration drift assessments of LDAR monitoring equipment should be conducted at the end of each monitoring shift using approximately 500 ppm of calibration gas.

If any calibration drift assessment after the initial calibration shows a negative drift of more than 10% from the previous calibration, re-monitor all valves that were monitored since the last calibration with a reading of greater than 100 ppm. Re-monitor all pumps that were monitored since the last calibration with a reading of greater than 500 ppm.

12. Records Maintenance

The equipment leak regulations specify recordkeeping and reporting requirements. Organized and readily available records are an indication of an effective LDAR program and also indicate that the LDAR program is integrated into the facility's routine operation and management.

Incorporating the elements below will help ensure your facility LDAR records are thorough and complete.

Maintain certification records that the facility:

- Implemented the "first attempt at repair" program.
- Implemented QA/QC procedures for review of data generated by LDAR technicians.
- Maintains an identification of the person/position at each facility responsible for LDAR program performance as defined in the written program.
- Developed and implemented a tracking program for new valves and pumps added during maintenance and construction defined in the written program.
- Properly completed calibration drift assessments.
- Implemented the "delay of repair" procedures.

Record the following information on LDAR monitoring:

(1) The number of valves and pumps present in each process unit during the quarter.

(2) The number of valves and pumps monitored in each process unit;

(3) An explanation for missed monitoring if the number of valves and pumps present exceeds the number of valves and pumps monitored during the quarter.

(4) The number of valves and pumps found leaking.

(5) The number of "difficult to monitor" pieces of equipment monitored.

(6) A list of all equipment currently on the "Delay of Repair" list and the date each component was placed on the list.

(7) The number of repair attempts not completed promptly or completed within 5 days.

(8) The number of repairs not completed within 30 days and the number of components not placed on the "Delay of Repair" list.

(9) The number of chronic leakers that do not get repaired.

The facility should also maintain records of audits and corrective actions. Prior to the first third-party audit at each facility, include in your records a copy of each audit report from audits conducted in the previous calendar year and a summary of the actions planned or taken to correct all deficiencies identified in the audits.

For the audits performed in prior years, retain identification of the auditors and documentation that a written plan exists identifying corrective action for any deficiencies identified and that this plan is being implemented.

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