**VOCs**

**EPA Priority:**

Leak Detection and Repair (LDAR)

A brief overview of the established U.S. Leak Detection and Repair (LDAR) program.
A LDAR program is a facility’s system of procedures to minimize fugitive volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions from leaking components (e.g., valves, pumps, connectors, compressors, and agitators). It is a structured program to detect and repair equipment that is identified as leaking. A portable device is used to identify equipment that is emitting sufficient amounts of material above a specified threshold (e.g., 10,000 parts per million by volume [ppmvl]) to warrant reduction of the emissions through repair techniques. Additionally, sight, sound, and/or smell inspections are performed for certain types of equipment. LDAR is applied to equipment types that can be repaired while in operation, resulting in immediate emissions reduction.

The U.S. Environmental Protection Agency (EPA) has identified the reduction of fugitive VOC and HAP emissions as a key enforcement priority and has been conducting audits and pursuing enforcement actions of LDAR programs in the petroleum refining and chemical manufacturing since the late 1990s. Both large and small facilities have been reviewed under this coordinated EPA program. EPA is also conducting LDAR inspections at natural gas processing plants.

**EXAMPLE FINDINGS in Recent Notices of Violations**

1. Having open-ended lines. Inspectors can easily identify this issue by visual inspection during audit walkthroughs. Inspectors commonly find open-ended lines at sampling connection systems.
2. Not conducting monitoring of each regulated component every monitoring period, or not having sufficient documentation that monitoring was conducted.
3. Not repairing leaks within the timeframes required (e.g., completing repair, including Method 21 monitoring within 15 days of discovery).
4. Not conducting follow-up monitoring after leak repair (i.e., monitoring conducted within three months of repair or monitoring for two consecutive months with no leaks discovered, depending on the rule).
5. Not maintaining leaker tags.
6. Improperly applying “delay of repair”.
7. Classifying insulated valves as exempt from monitoring.
8. Not maintaining required lists (e.g., difficult-to-monitor [DTM], unsafe-to-monitor [UTM], instrumentation systems, and pressure relief valves equipped with rupture disks).
10. Not maintaining complete leak repair records.

EPA’s Inspection Program

Initially, EPA focused on petroleum refineries for its LDAR-related enforcement activities. Since 2005, however, the agency has also concentrated enforcement efforts within the chemical industry (e.g., facilities subject to Hazardous Organic NESHAP [HON], Pharmaceutical MACT, Miscellaneous Organic NESHAP [MON], and NSPS VV/VVa). Furthermore, EPA has conducted inspections for natural gas processing plants, including those potentially...
subject to NSPS rules. As shown in recent notices and/or findings of violations, the compliance issues discovered by EPA at chemical manufacturing facilities encompass all facets of the LDAR standards.

In a typical LDAR program, portable analyzers are utilized to periodically monitor each regulated component at a frequency varying from monthly to every eight years, depending on the applicable regulation and component being monitored. If the component is found to be leaking, it is tagged and must be repaired within a specified time.

Please note that these are leak detection programs; therefore, leaks are expected to be discovered. Finding a leak is not always a violation; however, failure to conduct appropriate monitoring, record-keeping, and repairs would be violations. Therefore, a review of recordkeeping (e.g., repair timing records and leak rate calculations), reporting (delay of repair), and monitoring frequencies are key components to any EPA inspection (see sidebar “Example Findings in Recent Notices of Violations” on previous page).

Example Finding: Not Conducting Method 21 Properly

For both petroleum refineries and chemical manufacturing facilities, EPA has cited inappropriate application of 40 CFR 60, Appendix A, Method 21 (Method 21). Method 21 requires a portable monitoring device for identifying components emitting VOC/HAP above the applicable leak definitions (e.g., 10,000 ppmv or 500 ppmv). One of the primary methods by which EPA assesses adherence to the Method 21 is “comparative monitoring.” Often when conducting comparative monitoring, EPA inspectors will observe the facility LDAR technician while conducting parallel monitoring per Method 21, which includes observing the following:

- zero and leak definition calibration checks;
- calibration precision testing;
- instrument response time checks;
- time spent monitoring per component; and
- leak interface monitoring techniques for each component.
Upon completion of the monitoring, EPA will compare its leak rates (e.g., percentage of leaking components to number of components monitored) with the facility technician’s leak rates. In a study covering 17 petroleum refineries, the leak rate based on EPA monitoring was approximately 5%, while the leak rate based on industry monitoring was approximately 1%. Discrepancies between the leak rates can be due to any one of the above-listed factors and increases the level of scrutiny for facility leak rates previously reported. For example, according to EPA, being one centimeter away from the interface can cause the technician to miss a defined leak.

Consent Decree—Enhanced LDAR

As a result of recent LDAR audits and associated enforcement actions, EPA has initiated enhanced LDAR programs as part of the most recent consent decrees. The enhanced LDAR programs for chemical facilities are more stringent than the enhanced LDAR required for the refining industry. Starting in 2000, petroleum refineries were required by consent decree to implement enhanced LDAR programs. The petroleum refinery enhanced LDAR includes four main elements:

1. Leak definitions were lowered from NSPS VV levels (e.g., 10,000 ppmv) to HON levels (e.g., 500 ppmv);
2. Limited delay of repair usage until “drill and tap” is utilized;
3. Initial attempts at repair were required at concentrations as low as 200 ppmv (not a “leak” but a lowered action level); and
4. Periodic internal/third-party audits were required, including comparative monitoring of valves.

Recent chemical industry consent decrees have included enhanced LDAR programs incorporating many of the petroleum refinery enhanced LDAR requirements, while adding several new aspects:

1. Lowering the leak definitions: pumps—lowered from HON (e.g., 1,000 ppmv) and Pharma MACT (e.g., 2,000 ppmv) levels to 500 ppmv; agitators—lowered from HON/Pharma MACT...
levels (e.g., 10,000 ppmv) to 2,000 ppmv or 500 ppmv; and all other components—lowered from 500 ppmv to 250 ppmv or sometimes even lower (i.e., lower than the petroleum refinery enhanced LDAR leak definitions).

2. Requiring certified “low-leak” technology and packing materials for repair of leaking or installation of new valves and connectors.

3. Periodic monitoring of closure devices associated with open-ended lines via Method 21 at a defined leak definition (e.g., 200 ppmv).

4. Requiring more stringent delay of repair provisions.

5. Comparative monitoring within third-party LDAR audits for valves, closure devices on open-ended lines, pumps, connectors, and agitators.


**LDAR Penalty Policy**

In addition to enhanced LDAR, consent decrees have a penalty fee and stipulated penalties associated with them. EPA has an LDAR penalty policy that is organized by the following categories:

- Recordkeeping violations ($250—$37,500).
- Reporting violations ($250—$37,500 for missing information and $250 per day for late reports with a cap as high as $37,500).
- Failure to identify equipment, including misidentifying equipment ($250—$5,000 per component depending on the component type, with a cap of $2.5MM).
- Inspection and Method 21 monitoring violations ($100—$2,000 per component for missed inspections, $250 per calibration non-compliance, and $2,500—$18,500 per monitoring requirement per process unit for failure to monitor correctly).
- Failure to tag leaking equipment for repair ($100—$2,000 per component).
- Failure to repair leaks on time or at all ($100—$3,000 per component per day with caps of $1,000—$375,000 per component).
- Equipment standard violations (e.g., OELs, compressor seals; $750—$2,000 per component, or higher for long-term violations).
- Pressure testing violations ($100—$2,000 per component).

A multiplier is applied to the fee listed in the policy if emissions are associated with HAPs, HAPs with risk to communities, and/or VOC non-attainment areas.

In addition to the above penalties for past non-compliance, stipulated penalties are outlined to address any future specific non-compliance, such as not developing a timely, written LDAR plan; not conducting Method 21 accordingly; and not conducting third-party LDAR audits, as required.

**Summary**

EPA will continue to conduct LDAR audits and seek enhanced LDAR requirements for facilities undergoing enforcement action. Facilities subject to LDAR requirements that have not been affected thus far should consider the lessons learned from the refining and chemical sectors that have already been affected.

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**Notes and References**

1. It should be noted that 40 CFR 98 also requires leak detection for greenhouse gases (GHGs).
2. Other pollutants are regulated, such as GHGs under 40 CFR 98, but this article focusses primarily on LDAR for HAP and VOC emissions.
3. Per 40 CFR 63.161, as well as other definition sections of LDAR regulations, Open-ended valve or line means any valve, except pressure relief valves, having one side of the valve seat in contact with process fluid and one side open to atmosphere, either directly or through open piping.
4. Connectors, depending on the regulation, may also be subject to follow-up monitoring. Please refer to your applicable LDAR regulations for other examples.
5. While there is an exemption from monitoring for insulated connectors for regulations where periodic monitoring is required, no such exemption exists for insulated valves.
7. Please note not all chemical facilities that received LDAR-related consent decrees have been required to initiate an enhanced LDAR program.
8. While current field decree consent for natural gas processing plants are not on the same order as refining and chemical industries consent decrees, it does not mean that future consent decrees for oil and gas industry would not be similar to chemical and refining industries consent decrees.
9. The frequency of third-party audits was dependent on each individual consent decree. It could be annual, biennial, every five years, etc.
10. Please note that this is not a rigorous list and not all consent decrees will include all these elements.