



Enforcement Alert: Benzene Fenceline Monitoring at Petroleum Refineries

Note: *This alert was developed in response to and required by the EPA's Office of Inspector General report titled "The EPA should Enhance Oversight to Ensure that Refineries Comply with the Benzene Fenceline Monitoring Regulations*

<https://epa.gov/www.epaoig.gov/sites/default/files/reports/2023-09/_epaoig_20230906-23-p-0030_errata.pdf>" (Sept. 6, 2023).

September 2025

Key Compliance Requirements: Root Cause Analysis and Corrective Action

EPA has identified compliance concerns under the Clean Air Act's benzene fenceline monitoring regulations at petroleum refineries. The regulations require root cause analysis reports and corrective actions anytime the annual average benzene concentrations recorded by a refinery's fenceline monitors are greater than the regulatory action level.

The fenceline monitoring regulations help verify that refineries are complying with applicable emissions limits of hazardous air pollutants, like benzene. Benzene, which serves as a surrogate for hazardous air pollutants emitted from refineries, has short-



US EPA Method 325 approved passive air sampling tubes within a shelter are placed along refinery fencelines to provide a complete coverage of fugitive benzene emission.

and long-term health consequences. Benzene is a known carcinogen. Short-term exposure can irritate the eyes, skin and respiratory system. Chronic, or long-term inhalation exposure has caused various blood disorders and reproductive effects.

To ensure protection of human health and the environment and reduce toxic air emissions, EPA continues to investigate noncompliance with these requirements. When a refinery is found to be in noncompliance with the regulation, EPA may initiate enforcement actions that could result in the assessment of penalties and appropriate injunctive relief, including the installation of emission control equipment.

Fenceline Monitoring Requirements

The CAA's National Emission Standards for Hazardous Air Pollutants from Petroleum Refineries (40 C.F.R. part 63, Subpart CC) establish the fenceline monitoring regulations for petroleum refineries. Subpart CC applies to petroleum refining process units and to related emission points located at a plant site that is a major source under CAA section 112(a) and that emit or have equipment containing or contacting one or more of the hazardous air pollutants listed in Table 1 of Subpart CC.

Subpart CC requires refinery owners or operators to conduct passive air sampling along the facility property boundary, also known as “fenceline monitoring” and analyze the samples for benzene. Passive air monitors must be located around the facility property boundary in accordance with

- Fenceline monitoring requirements of Subpart CC (40 C.F.R. § 63.658(c)).
- EPA Method 325A – “Volatile Organic Compounds from Fugitive and Area Sources: Sampler Deployment and VOC Sample Collection.” [✉ <https://www.ecfr.gov/current/title-40/chapter-i/subchapter-c/part-63/appendix-appendix%20a%20to%20part%2063>](https://www.ecfr.gov/current/title-40/chapter-i/subchapter-c/part-63/appendix-appendix%20a%20to%20part%2063)

A sample from each monitor must be collected every 14 days (“sampling period”).

Within 45 days of the completion of each sampling period, the owner or operator must determine whether the new sampling results bring the average measured concentration for the past year above the benzene action level.

To make the determination regarding the benzene action level, Clean Air Act regulations require the owner or operator to perform the following:

1. Determine the facility impact on the benzene calculation or “ Δc ” in accordance with the fenceline monitoring requirements (40 C.F.R. § 63.658(f)(1)).
2. Calculate the annual average Δc based on the average of the 26 most recent 14-day sampling periods.
3. Compare the annual average Δc to the action level for benzene.

The regulations establish the benzene action level at 9 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) on an annual average basis. If the annual average Δc for benzene is less than or equal to $9 \mu\text{g}/\text{m}^3$, rounded to a single significant figure, the concentration is below the action level. If the annual average Δc for benzene is greater than $9 \mu\text{g}/\text{m}^3$, rounded to a single significant figure, the concentration is above the action level.

Site-specific monitoring plans must include additional monitoring stations to measure background and near field concentrations.

Site Specific Monitoring Plans

Site-specific monitoring plans are an option for an owner or operator to pursue. The fenceline monitoring regulations allow an owner or operator to request approval from EPA for a site-specific monitoring plan to account for offsite upwind sources or onsite sources specified in 40 C.F.R. § 63.640(g). 40 C.F.R. § 63.658(i). These site-specific monitoring plans require, at a minimum, additional monitoring stations to determine background concentrations and near field concentrations. The regulations do not authorize the use of data models that predict rather than directly measure benzene concentrations to account for any potential offsite or background emissions.

Under the regulations, an owner or operator must initiate a root cause analysis **within five days of each determination that the action level has been exceeded and no longer than 50 days after the completion of the sampling period**, even if the facility has conducted a root cause analysis of monitoring data from a prior sampling period.

The root cause analysis for exceedances of the benzene action level must:

1. Determine the cause(s) of the exceedance of the action level.

2. Include an initial “corrective action analysis” that determines the appropriate corrective action(s) necessary to reduce the annual average Δc of benzene at or below $9 \mu\text{g}/\text{m}^3$.

A root cause analysis should **assess**, through a process of investigation, **the primary and underlying cause(s)**, and **all other contributing causes** to an exceedance of an action level. The owner or operator must complete the root cause analysis and take any initial corrective actions no later than 45 days after determining there is an exceedance (40 C.F.R. § 63.658(g)).

EPA has observed during inspections that benzene action level exceedances are frequently caused by the following refinery emission sources:

- **Tanks storing high benzene content material** such as pure benzene product, reformate, light naphtha, and pyrolysis gasoline from co-located ethylene plants.
- **Marine vessel loading operations** involving the high benzene content material listed above and the poor operation of loading arms; improper disposal of slop waste that drips from loading arms; barges that are not fully vapor tight; and/or barge pressure relief valves lifting during loading or while the barge is docked.
- **Wastewater operations** including uncontrolled dissolved air floatation systems and aerated biological treatment units, and uncontrolled junction boxes.

Best practices for finding root causes of action level exceedances include using:

- **Monitors**, such as gas chromatographs that can provide near real-time measurement, can be better correlated with wind direction than the two-week diffusion tube samples required by Method 325, and can specifically measure benzene at the parts per billion level;
- **Forward looking infrared** or “FLIR” **cameras** to quickly screen large areas for emissions and leaks; and,
- **Benzene-specific handheld photoionization detectors** that can measure parts per billion benzene at emissions interfaces to pinpoint benzene emissions.

Corrective Action Plan

Under Subpart CC, an owner or operator must develop a corrective action plan if one of the following occurs:

1. Upon completion of the corrective action analysis and corrective actions, the Δc for the next 14-day sampling period that begins after the completion of the corrective actions is greater than $9 \mu\text{g}/\text{m}^3$.
2. All corrective action measures identified in the initial corrective action analysis require more than 45 days to implement.

The regulations require a corrective action plan to describe:

1. The corrective action(s) completed to date;
2. Additional measures that the owner or operator proposes to employ to reduce fenceline concentrations below the $9 \mu\text{g}/\text{m}^3$ action level; and,
3. A schedule for completion of these measures.

An owner or operator must submit the corrective action plan to EPA and the delegated state within 60 days of either:

- Receiving the analytical results indicating that the Δc value for the 14-day sampling period following the completion of the initial corrective action is greater than $9 \mu\text{g}/\text{m}^3$.
- Determining, pursuant to the initial corrective action analysis, that all corrective measures identified will require more than 45 days to complete.

Failure to include any of the three elements of a corrective action plan or failing to submit a proposed plan by the 60-day timeframe is a violation of the fenceline monitoring regulations (40 C.F.R. § 63.658(h)).

Thorough investigations utilizing advanced monitoring technologies to identify the root causes of fenceline benzene action level exceedances, taking expeditious action to address the causes, and maintaining robust records of this work will not only help petroleum refinery owners and operators demonstrate compliance with the Subpart CC fenceline monitoring requirements, but also assist the owners and operators with maintaining fenceline benzene concentrations below the action level.

Case Example

EPA concluded its first case resolving violations of Subpart CC in the Spring 2025. Leading up to EPA's enforcement action, the fenceline concentration at the subject facility was over 900 $\mu\text{g}/\text{m}^3$ for multiple fourteen-day sampling periods and had an annual average concentration as high as 290 $\mu\text{g}/\text{m}^3$, more than 30 times above the action level. EPA took enforcement because the facility failed to determine and implement appropriate corrective action to reduce fenceline benzene concentrations below 9 $\mu\text{g}/\text{m}^3$ as required by the fenceline monitoring regulations (40 C.F.R. § 63.658(g) and (h)).

More specifically, EPA found that the company returned an external floating roof tank containing benzene material to service despite determining the tank was the primary source of benzene emissions causing the refinery's Subpart CC action level exceedance. The company initially removed the tank from service and fenceline benzene concentrations began to fall below the action level. However, the company reversed this corrective action, causing fenceline benzene concentrations to rise back above the corrective action threshold. Putting the tank back into service constituted a violation of Subpart CC. To resolve the violation, the company agreed to take measures addressing existing benzene emissions sources contributing to fenceline benzene concentrations, to install real-time benzene fenceline monitors, and to identify and address benzene emission sources identified through the real-time benzene monitoring results.

Resources

The references listed below are intended to provide refinery owners and operators with information to ensure compliance with the Benzene fenceline monitoring requirements.

- EPA Benzene Fenceline Monitoring Dashboard
- Env'tl. Prot. Agency, Final Rule, Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards, 80 Fed. Reg. 75,178 (Dec. 1, 2015)
 <<https://www.govinfo.gov/content/pkg/fr-2015-12-01/pdf/2015-26486.pdf>>

- National Emission Standards for Hazardous Air Pollutants from Petroleum Refineries, Fenceline Monitoring Provisions (40 C.F.R. § 63.658) [🔗](https://www.ecfr.gov/current/title-40/chapter-i/subchapter-c/part-63/subpart-cc/section-63.658)
<<https://www.ecfr.gov/current/title-40/chapter-i/subchapter-c/part-63/subpart-cc/section-63.658>>
- 40 C.F.R. Part 63, Appendix A, Method 325A, “Volatile Organic Compounds from Fugitive and Area Sources: Sampler Deployment and VOC Sample Collection” [🔗](https://www.ecfr.gov/current/title-40/chapter-i/subchapter-c/part-63/appendix-appendix%20a%20to%20part%2063)
<<https://www.ecfr.gov/current/title-40/chapter-i/subchapter-c/part-63/appendix-appendix%20a%20to%20part%2063>>
- 40 C.F.R. Part. 63, Appendix A, Method 325B, “Volatile Organic Compounds from Fugitive and Areas Sources: Sampler Preparation and Analysis” [🔗](https://www.ecfr.gov/current/title-40/chapter-i/subchapter-c/part-63/appendix-appendix%20a%20to%20part%2063)
<<https://www.ecfr.gov/current/title-40/chapter-i/subchapter-c/part-63/appendix-appendix%20a%20to%20part%2063>>
- EPA Office of Inspector General, “The EPA Should Enhance Oversight to Ensure that Refineries Comply with the Benzene Fenceline Monitoring Regulations” (Sept. 6, 2023) <https://www.epaoig.gov/sites/default/files/reports/2023-09/_epaoig_20230906-23-p-0030_errata.pdf>

Disclaimer: Nothing in this Enforcement Alert is meant to replace or revise any EPA regulatory provision or any other part of the Code of Federal Regulations, the Federal Register or Clean Air Act.

Last updated on October 30, 2025