

The EPA Should Enhance Oversight to Ensure that All Refineries Comply with the Benzene Fenceline Monitoring Regulations

September 6, 2023 | Report No. 23-P-0030



Report Contributors

Kathryn Burns
Tina Eastman (formerly Lovingood)
Erica Hauck
Xiang (Sharon) Liu
Andrea Martinez
Pedro Perez

Abbreviations

C.F.R.	Code of Federal Regulations
EPA	U.S. Environmental Protection Agency
µg/m ³	micrograms per cubic meter
OECA	Office of Enforcement and Compliance Assurance
OIG	Office of Inspector General
SSMP	Site-Specific Monitoring Plan

Key Definitions

Action level	The ambient concentration above which a refinery is required to take corrective action under the benzene fence-line monitoring requirements. The action level is 9 micrograms per cubic meter on a rolling annual average basis.
Delta c	The difference between the value of a refinery's highest individual monitor and the value of a refinery's lowest individual monitor for a given two-week sampling period. The delta c for 26 consecutive two-week sampling periods is used to calculate the refinery's annual average delta c, which in turn is used to determine whether a refinery has exceeded the action level.

Cover Image

A petroleum refinery neighboring a community park. (EPA OIG image)

Are you aware of fraud, waste, or abuse in an EPA program?

EPA Inspector General Hotline

1200 Pennsylvania Avenue, NW (2431T)
Washington, D.C. 20460
(888) 546-8740
(202) 566-2599 (fax)
OIG_Hotline@epa.gov

Learn more about our [OIG Hotline](#).

EPA Office of Inspector General

1200 Pennsylvania Avenue, NW (2410T)
Washington, D.C. 20460
(202) 566-2391
www.epaoig.gov

Subscribe to our [Email Updates](#).
Follow us on X (formerly Twitter) [@EPAoig](#).
Send us your [Project Suggestions](#).



At a Glance

The EPA Should Enhance Oversight to Ensure that All Refineries Comply with the Benzene Fenceline Monitoring Regulations

Why We Did This Audit

To accomplish this objective:

The U.S. Environmental Protection Agency Office of Inspector General conducted this audit to determine to what extent oversight of the benzene fenceline monitoring requirements by the EPA and delegated authorities ensures that refineries take corrective action and lower benzene concentrations when they exceed the action level.

Benzene is a known human carcinogen emitted by petroleum refineries. In 2015, the EPA issued regulations requiring petroleum refineries to monitor benzene concentrations around their perimeters, or *fencelines*. If their annual average concentrations exceed the action level, which the EPA set at 9 micrograms per cubic meter, refineries must conduct a root cause analysis and take corrective actions. The EPA oversees the fenceline monitoring requirements. Delegated authorities are state and local agencies that the EPA has approved to oversee the requirements within their borders.

To support these EPA mission-related efforts:

- *Improving air quality.*
- *Partnering with states and other stakeholders.*

To address this top EPA management challenge:

- *Integrating and leading environmental justice, including communicating risks.*

Address inquiries to our public affairs office at (202) 566-2391 or OIG.PublicAffairs@epa.gov.

[List of OIG reports.](#)

What We Found

Oversight by the EPA and delegated authorities has not ensured that all refineries that exceed the action level reduce their benzene concentrations at their fencelines. For example, from January 2018 to September 2021, 13 of the 118 refineries we reviewed had benzene concentrations above the action level in 20 or more weeks after the initial exceedance. Many of these refineries are located near communities with potential environmental justice concerns. Furthermore, three of these 13 refineries had not reduced their annual average concentration to the action level or below. These refineries may not have accurately identified the root cause of their exceedances or taken appropriate corrective actions. Despite the existence of potential issues, the EPA and delegated authorities took limited formal enforcement-related actions at refineries under the benzene fenceline monitoring regulations.

We identified barriers that could prevent the EPA and delegated authorities from determining whether refineries exceed the action level. For example, some refineries have EPA-approved monitoring plans that rely solely on modeling—instead of on additional monitoring, as required by EPA regulations—to estimate contributions to benzene concentrations from emissions sources not covered by the monitoring regulations. Modeling could overestimate benzene contributions from these other sources and mask whether a refinery has exceeded the action level. Also, some refineries did not submit all the required data to the EPA and thus may not have reported high concentrations that could have pushed them over the action level. Specifically, based on our analysis of the data from January 2018 to September 2021, five refineries failed to report monitoring data for at least two weeks. If the EPA and delegated authorities cannot identify exceedances of the action level, then they cannot ensure that refineries take corrective action as required. This could result in communities being exposed to higher benzene concentrations and associated health risks than if appropriate corrective actions were taken.

If refineries do not reduce benzene concentrations that exceed the action level, nearby communities could face increased risk of adverse health effects, and communities with environmental justice concerns could be disproportionately affected.

Recommendations and Planned Agency Corrective Actions

We recommend that the EPA provide guidance to delegated authorities on what constitutes a violation of the regulations and how to identify gaps in refinery-submitted data, develop a strategy to address refineries that fail to reduce their benzene concentrations after an exceedance of the action level, and ensure that monitoring plans that rely solely on modeling are appropriately amended to incorporate additional monitoring. The Agency agreed with our recommendations and provided acceptable planned corrective actions with estimated milestone dates. We consider the recommendations to be resolved with corrective actions pending.



OFFICE OF INSPECTOR GENERAL
U.S. ENVIRONMENTAL PROTECTION AGENCY

September 6, 2023

MEMORANDUM

SUBJECT: The EPA Should Enhance Oversight to Ensure that All Refineries Comply with the Benzene Fenceline Monitoring Regulations
Report No. 23-P-0030

FROM: Sean W. O'Donnell, Inspector General

A handwritten signature in blue ink that reads "Sean W O'Donnell".

TO: David Uhlmann, Assistant Administrator
Office of Enforcement and Compliance Assurance

Joseph Goffman, Principal Deputy Assistant Administrator
Office of Air and Radiation

This is our report on the subject audit conducted by the U.S. Environmental Protection Agency Office of Inspector General. The project number for this audit was [OA-FY22-0070](#). This report contains findings that describe the problems the OIG has identified and corrective actions the OIG recommends. Final determinations on matters in this report will be made by EPA managers in accordance with established audit resolution procedures.

The Office of Enforcement and Compliance Assurance and the Office of Air and Radiation are primarily responsible for the issues discussed in this report.

In accordance with EPA Manual 2750, your office provided acceptable planned corrective actions and estimated milestone dates for Recommendations 1 through 6. These recommendations are resolved. A final response pertaining to these recommendations is not required; however, if you submit a response, it will be posted on the OIG's website, along with our memorandum commenting on your response. Your response should be provided as an Adobe PDF file that complies with the accessibility requirements of section 508 of the Rehabilitation Act of 1973, as amended. The final response should not contain data that you do not want to be released to the public; if your response contains such data, you should identify the data for redaction or removal along with corresponding justification.

We will post this report to our website at www.epaoig.gov.

Table of Contents

Chapters

1	Introduction	1
	Purpose	1
	Background	1
	Responsible Offices	5
	Scope and Methodology	6
2	Oversight Has Not Ensured that All Refineries that Exceeded the Action Level Appropriately Reduced Their Benzene Concentrations	8
	Regulations Require Refineries that Exceed the Action Level to Take Corrective Action	8
	Not All Refineries that Exceeded the Action Level Have Reduced Their Benzene Concentrations to 9 µg/m ³ or Below	9
	Communities Could Face Increased Health Risks If Refineries Do Not Reduce Their Benzene Concentrations	15
	Conclusions	17
	Recommendations	17
	Agency Response and OIG Assessment	17
3	Barriers Hinder the Ability of the EPA and Delegated Authorities to Identify When Refineries Need to Take Action	19
	The EPA Approved SSMPs that Rely Solely on Modeling Rather Than Additional Monitoring	19
	Not All Refineries Reported Monitoring Data for All Two-Week Sampling Periods	20
	The Office of Air Quality Planning and Standards and OECA Have Reached Agreement on the Significant Figures of the Action Level	21
	If the EPA and Delegated Authorities Cannot Identify Exceedances of the Action Level, They Cannot Ensure that Refineries Take Appropriate Corrective Action	22
	Recommendations	22
	Agency Response and OIG Assessment	22
4	Status of Recommendations	24

Appendixes

A	Detailed Scope and Methodology	25
B	Refineries that Exceeded the Action Level	30
C	Refineries that Exceeded the Minimal Risk Level	31
D	Refineries with Missing Data	32
E	OECA's Response to Draft Report	33
F	The Office of Air and Radiation's Response to Draft Report	40
G	Distribution	42

Chapter 1

Introduction

Purpose

The U.S. Environmental Protection Agency Office of Inspector General [initiated](#) this audit to determine to what extent oversight of the benzene fenceline monitoring requirements by the EPA and delegated authorities ensures that refineries take corrective action and lower benzene concentrations, as required, when they exceed the action level. The term ***delegated authorities*** refers to state, local, and tribal air agencies that the EPA has approved to implement the benzene fenceline monitoring requirements for refineries under their purview.

Top Management Challenge Addressed

This audit addresses the following top management challenge for the Agency, as identified in the OIG's *U.S. Environmental Protection Agency Fiscal Year 2023 Top Management Challenges report*, issued October 28, 2022:

- Integrating and leading environmental justice, including communicating risks.

Background

Benzene is a known human carcinogen and a regulated hazardous air pollutant under section 112 of the Clean Air Act. According to the EPA's most recent National Air Toxics Assessment, which is based on data from 2014, benzene is a "national cancer risk contributor." This means that 25 million or more people in the United States are exposed to a cancer risk level from benzene that exceeds one in one million. In addition to potentially causing cancer with long-term, or chronic, exposure, inhalation of benzene in high enough concentrations can lead to short-term, or acute, health effects, including dizziness, headaches, and unconsciousness.

Petroleum refineries emit hazardous air pollutants, including benzene. Benzene is emitted through various sources at refineries, such as tanks, equipment leaks, and wastewater treatment. The EPA estimates that 85 percent of benzene emissions from refineries are fugitive emissions, meaning they come from open sources and are not emitted through a stack or vent, thus making them difficult to measure. The highest concentration of fugitive benzene emissions outside the refinery's property boundary, referred to as the ***fenceline***, is likely to occur near ground level. High concentrations of benzene resulting from refinery emissions can pose risks for nearby communities.

EPA Regulations Establish Benzene Fenceline Monitoring Requirements

In 2015, the EPA issued [regulations](#) requiring petroleum refineries to measure benzene concentrations in the ambient air through a network of monitors installed around their fencelines. The regulations also mandate that refineries take corrective actions if the benzene concentrations exceed a certain level,

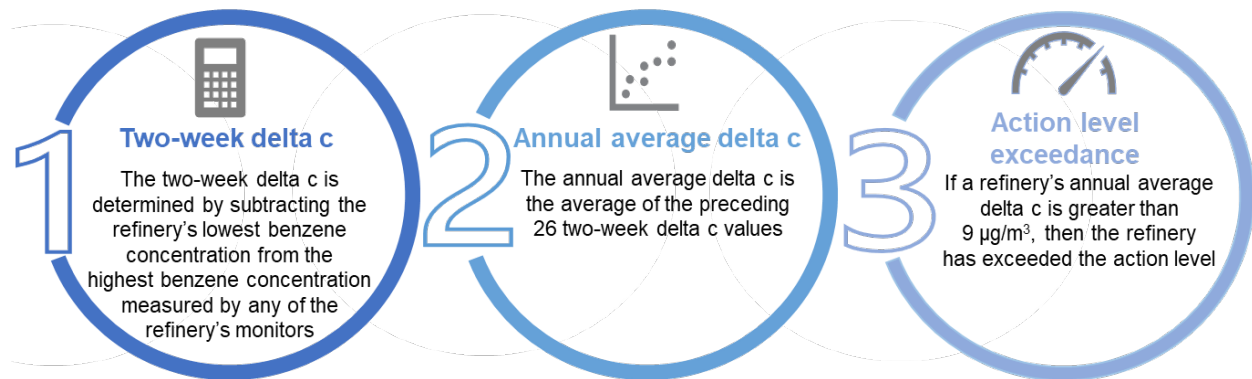
referred to as the **action level**. The EPA set the action level at 9 micrograms per cubic meter, or $\mu\text{g}/\text{m}^3$, on a rolling annual average basis.

The EPA defines **ambient air** as the portion of the atmosphere, external to buildings, to which the general public has access.

A **rolling annual average** is the average calculated over the most recent 26 two-week periods, or 52 weeks.

A refinery must continuously measure concentrations at each of its monitors over two-week periods and report those concentrations to the EPA at the end of each quarter. These two-week periods are referred to as **sampling periods**. After each sampling period, a refinery must determine whether its annual average concentration for the most recent 26 two-week sampling periods is over $9 \mu\text{g}/\text{m}^3$. As shown in Figure 1, the concentration that a refinery uses to determine whether it is over the action level is referred to as the **delta concentration, or delta c**. The delta c accounts for benzene in the ambient air that may not be directly attributable to the refinery. The delta c is determined by subtracting the lowest benzene concentration measured by any of a refinery's monitors from the highest benzene concentration measured by any of a refinery's monitors for each two-week sampling period. If the refinery's average delta c for the preceding 26 two-week sampling periods is above $9 \mu\text{g}/\text{m}^3$, the refinery has exceeded the action level.

Figure 1: Using the delta c value to determine whether a refinery has exceeded the action level



Source: OIG analysis of benzene fenceline monitoring regulations. (EPA OIG image)

Exceeding the action level is not in and of itself a violation of the regulations; rather, it triggers a legal obligation for a refinery to take action to lower its benzene concentrations. Specifically, when a refinery exceeds the action level, it must conduct a root cause analysis to identify why the benzene concentration is elevated and then take initial corrective action, such as leak detection and repair, to correct the identified problem. If the delta c for the sampling period that starts after the completion of the initial corrective action is above $9 \mu\text{g}/\text{m}^3$, or if the initial corrective actions will take longer than 45 days to implement, then the refinery must submit to the EPA or delegated authority a corrective action plan. This plan is required to include (1) a description of corrective actions taken by the refinery to date, (2) additional measures the refinery will take to reduce its benzene concentrations below the action level, and (3) a schedule of completion for the additional measures. The regulations require refineries that exceed the action level to reduce their annual average benzene concentrations to

9 $\mu\text{g}/\text{m}^3$ or below. The regulations, however, do not include a specific number of sampling periods by which a refinery must reduce its annual average benzene concentration to below that level.

Benzene Action Level Is Based on Modeling

The action level of 9 $\mu\text{g}/\text{m}^3$ is not based on risk to nearby communities or any health-based standard. Rather, it was determined based on EPA-conducted modeling of refinery-reported benzene emissions. This modeling assumed that refineries are complying with all pollution control requirements for benzene emissions. Specifically, based on its modeling, the EPA determined that refineries would not have benzene concentrations at their fencelines above 9 $\mu\text{g}/\text{m}^3$ if they are complying with all benzene pollution control requirements. As such, an exceedance of the action level is an indicator that there could be a problem at the refinery that needs to be addressed.

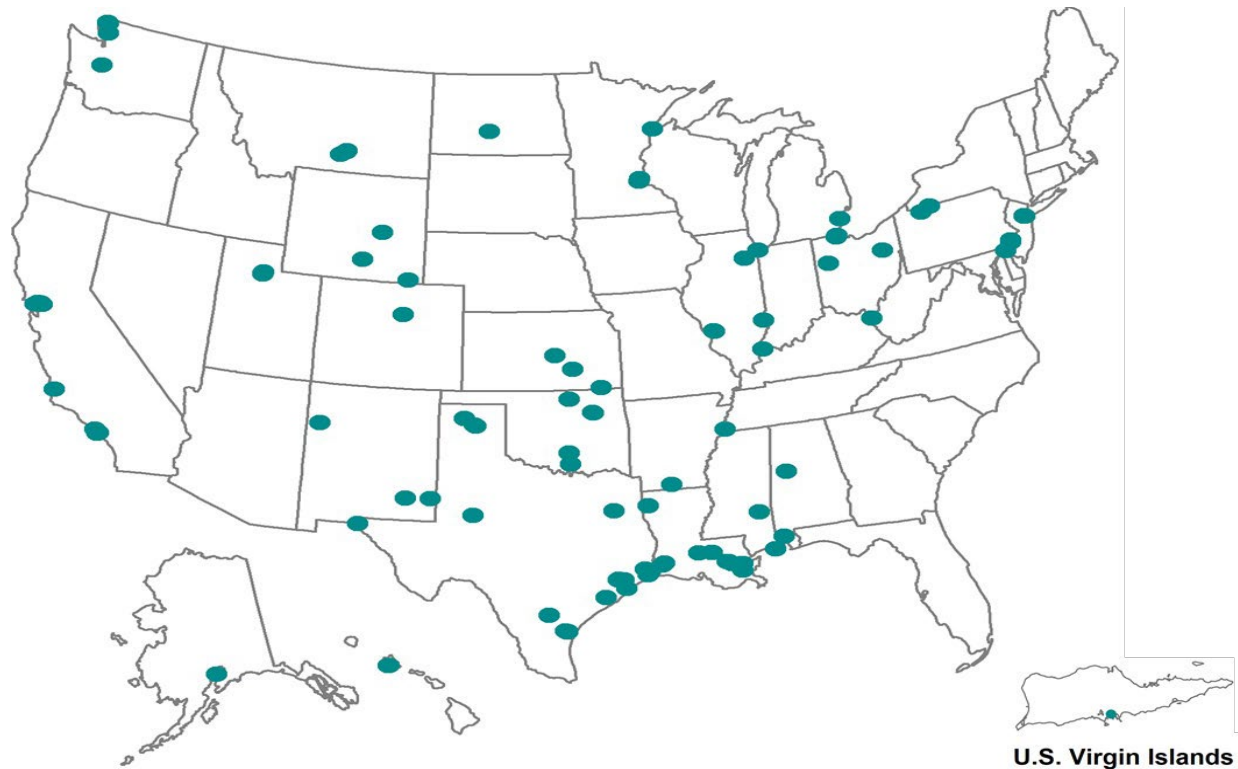
A refinery's fenceline monitors are intended to measure benzene levels attributable to the refinery; they are not intended to provide a measure of benzene levels in nearby communities. According to EPA staff, this is because benzene concentrations decrease the farther they are from their source, as the pollutant becomes diluted in the ambient air. Nearby communities may also be close to several sources of benzene emissions, such as other refineries or industrial facilities, so that concentrations within a community could be higher than what is measured at one refinery's fenceline.

While the benzene fenceline action level is not based on risk, the Agency for Toxic Substances and Disease Registry, in accordance with EPA guidelines, has established an acute inhalation ***minimal risk level*** for benzene. That minimal risk level is 29 $\mu\text{g}/\text{m}^3$ and represents an estimate of the amount of benzene a person can breathe each day for up to two weeks without an appreciable risk of adverse noncancer health effects. Exceedance of the minimal risk level does not necessarily mean that exposed individuals will experience health problems. Rather, an exceedance of the minimal risk level can be used to screen for potential health problems.

Refineries Must Report Benzene Fenceline Monitoring Data

Refineries are required to submit their benzene fenceline monitoring data, including their delta c values and individual monitor results, to the EPA on a quarterly basis through an EPA reporting system called the Compliance and Emissions Data Reporting Interface. The EPA has developed a template that refineries are required to use to report their data. According to the EPA, after a 30-day processing period, the EPA makes the data publicly available through WebFIRE, an online system that provides public access to various reports that regulated industrial sources are required to submit to the EPA. In total, 118 refineries have submitted benzene fenceline monitoring data to the EPA since the monitoring requirements took effect in January 2018 through September 2021. Figure 2 shows the locations of these refineries.

Figure 2: Map of the 118 refineries that have reported data to the EPA under the benzene fenceline monitoring regulations from January 2018 through September 2021



Note: The images of Alaska, Hawaii, and the U.S. Virgin Islands on this map are not to scale. Some locations have multiple refineries, so refinery locations overlap in some areas of the map.

Source: OIG analysis of reported benzene fenceline monitoring data from January 2018 through September 2021. (EPA OIG image)

Site-Specific Monitoring Plans Address Other Benzene Sources

The benzene fenceline monitoring requirements cover only emissions from refining processes at individual refineries. However, some refinery locations have emissions sources that are not considered refinery processes, and some refinery locations are located downwind of other industrial sources that emit benzene. For example, some refinery locations also include nonpetroleum chemical manufacturing, which emits benzene but is not covered by the benzene fenceline monitoring requirements. For this reason, the EPA regulations allow refineries to develop site-specific monitoring plans, or SSMPs, to account for such exempt sources, which are referred to as *near-field sources*, in their delta c values. Per the regulations, SSMPs must include additional monitoring to determine contributions from near-field sources.

The EPA Can Delegate Implementation and Enforcement of the Benzene Fenceline Monitoring Requirements to State, Local, and Tribal Agencies

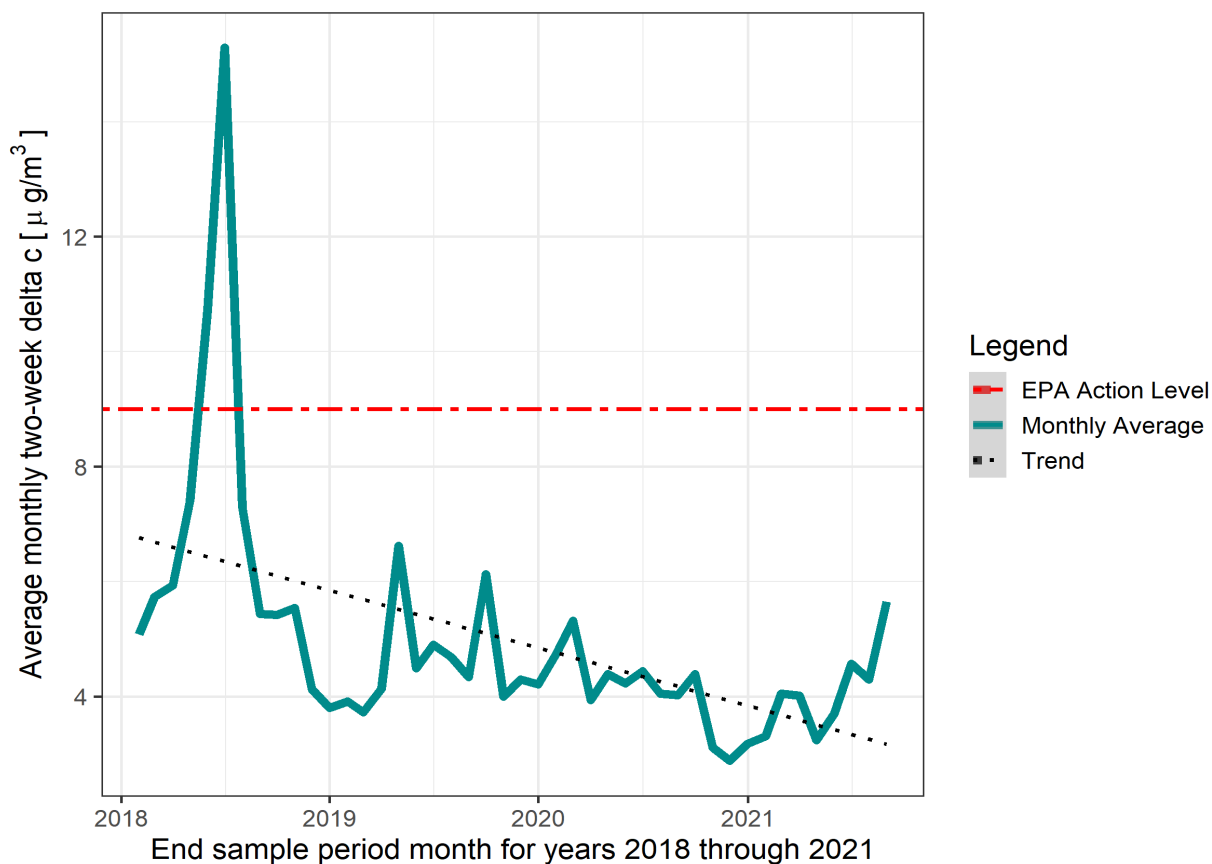
Per the regulations, the EPA can delegate implementation and enforcement of the benzene fenceline monitoring requirements to state, local, and tribal agencies. Upon delegation, the delegated state, local or tribal agency becomes the primary authority to implement and enforce the requirements. Oversight

activities taken by delegated authorities may include, among other things, review of the reported monitoring data, on-site inspections, and informal calls with refineries. The EPA also provides oversight of delegated authorities through things like regular conference calls and technical assistance, and the Agency also retains authority to take its own enforcement action for violations if the delegated authority does not do so. The authority to approve SSMPs is retained by the EPA and is not delegated to delegated authorities.

Monitoring Data Show a Downward Trend in Average Delta C Values

Overall, refineries’ delta c values decreased from February 2018 through September 2021, the most recent month for which we had data at the time we began our audit. As shown in Figure 3, there was an overall downward trend in the average benzene concentration for all reported two-week sampling period delta c values, by month, from February 2018 through September 2021.

Figure 3: Average two-week sampling period delta c for all refineries, February 2018–September 2021



Source: OIG analysis of reported benzene fenceline monitoring data. (EPA OIG image)

Responsible Offices

The EPA shares responsibility for implementing and enforcing the benzene fenceline monitoring requirements with delegated authorities. The Office of Air Quality Planning and Standards, within the

EPA's Office of Air and Radiation, maintains the refinery-reported data and is responsible for approving SSMPs. Delegated authorities are authorized to evaluate compliance with the regulations and pursue enforcement action as appropriate. The EPA's Office of Enforcement and Compliance Assurance, or OECA, and the EPA regions retain concurrent compliance and enforcement authority, while also providing oversight of the delegated authorities.

Scope and Methodology

We conducted this performance audit from February 2022 to March 2023 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective.

We assessed the internal controls necessary to satisfy our audit objective.¹ In particular, we assessed the internal control components—as outlined in the U.S. Government Accountability Office's *Standards for Internal Control in the Federal Government*—significant to our audit objective. Any internal control deficiencies we found are discussed in this report. Because our audit was limited to the internal control components deemed significant to our audit objective, it may not have disclosed all internal control deficiencies that may have existed at the time of the audit.

To identify refineries that had exceeded the action level, we obtained all refinery-reported monitoring data in WebFIRE for January 2018, which was when the monitoring requirements took effect, to September 2021, which was the most recent month for which we had complete data at the time we began our audit. We compiled this monitoring data into one spreadsheet to conduct our analyses. Using the compiled data, we independently calculated two-week and annual average delta c values. We then performed analyses on these independently calculated values to identify the refineries that had exceeded the annual average action level and the number of subsequent two-week sampling periods those refineries had concentrations above the action level. We also identified refineries that exceeded the minimal risk level of 29 $\mu\text{g}/\text{m}^3$. To identify refineries that exceeded these thresholds, we rounded all calculated two-week sampling period and annual average delta c values to one decimal place. If a refinery's calculated two-week sampling period or annual average delta c was rounded to 9.5 $\mu\text{g}/\text{m}^3$ or higher, we considered that to be an exceedance, in accordance with the Agency's rounding conventions described in the preamble to the EPA's 2015 benzene fenceline monitoring rule.

Using an OIG-developed scoring method, we scored the refineries on the following factors:

- Total number of two-week sampling periods with a delta c that exceeded the action level.
- Total number of two-week sampling periods with a delta c that exceeded the minimal risk level.
- Ten percent of the refinery's highest reported two-week sampling period delta c value.

¹ An entity designs, implements, and operates internal controls to achieve its objectives related to operations, reporting, and compliance. The U.S. Government Accountability Office sets internal control standards for federal entities in GAO-14-704G, *Standards for Internal Control in the Federal Government*, issued September 10, 2014.

Using this method, the higher scores indicated the refineries that had higher benzene concentrations and more exceedances of the action level and minimal risk level. As such, we selected the nine refineries with the highest scores to review in-depth. These nine refineries, which we list in Table A-1 of Appendix A, are located in multiple states and EPA regions. For these nine refineries, we conducted interviews with the applicable regions and delegated authorities, and we reviewed documentation related to actions taken at these refineries. We also interviewed staff and managers from OECA and the Office of Air Quality Planning and Standards on several occasions.

We also identified refineries that needed to submit a corrective action plan and assessed whether the two-week sampling period benzene concentrations were reduced after the date the plan was submitted or the corrective actions were planned to be implemented. To identify refineries that needed a corrective action plan, we used the maximum time allowed in the regulations for refineries to obtain sampling results, determine whether an exceedance has occurred, and take initial corrective actions as part of the root cause analysis process. This approach was conservative in that it likely did not identify all instances when corrective action plans were required, as some refineries may have received their sampling results and been able to identify an annual average exceedance more quickly than the maximum time frames allowed in the regulations.

We also reviewed a judgmental sample of EPA-approved SSMPs to determine whether they included all elements related to additional monitoring, as required by the regulations. The sample was based on refineries with approved SSMPs that made the greatest adjustments to their reported two-week sampling period delta c values. Initially, we reviewed the SSMPs for the three refineries that made the largest adjustments to their two-week reported delta c values. When we determined that these three SSMPs relied on modeling as opposed to additional monitoring—and that the refineries were all owned by the same company—we decided to review all EPA-approved SSMPs for refineries owned by that company. As this company had five refineries with approved SSMPs, we ultimately reviewed a total of five SSMPs.

We also identified refineries that had missing benzene monitoring data for at least one two-week sampling period. We excluded 2018 from this analysis because some refineries were granted an extension to begin monitoring in 2019 instead of 2018.

Scope Limitations

We did not verify whether all refineries that are required to submit data per the benzene fence-line monitoring requirements had in fact done so. To conduct our analyses, we relied on the data that refineries had submitted to the EPA during the period of our audit.

For more details on our scope and methodology, see Appendix A.

Chapter 2

Oversight Has Not Ensured that All Refineries that Exceeded the Action Level Appropriately Reduced Their Benzene Concentrations

Based on our analysis of the data from January 2018 to September 2021, 25 of 118 refineries exceeded the action level at least once. Thirteen of the 25 refineries that exceeded the action level had two-week delta c values above $9 \mu\text{g}/\text{m}^3$ in ten or more subsequent sampling periods after the initial exceedance. Of these 13, three never reduced their annual average to $9 \mu\text{g}/\text{m}^3$ or below in subsequent sampling periods, and six had additional exceedances of the action level after successfully reducing their annual average delta c in at least one sampling period. This may be due to refineries failing to identify the root cause of the benzene exceedance or to initiate appropriate actions to correct the root cause of the exceedance, as required by the regulations. It may also be due to limited enforcement action taken by the EPA and delegated authorities to ensure that refineries comply with the regulations. If refineries do not reduce benzene concentrations after exceeding the action level, nearby communities could be exposed to an increased risk of adverse health effects if the concentrations are high enough. Excess concentrations of benzene could also disproportionately impact communities with potential environmental justice concerns.

The EPA defines *environmental justice* as “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies.”

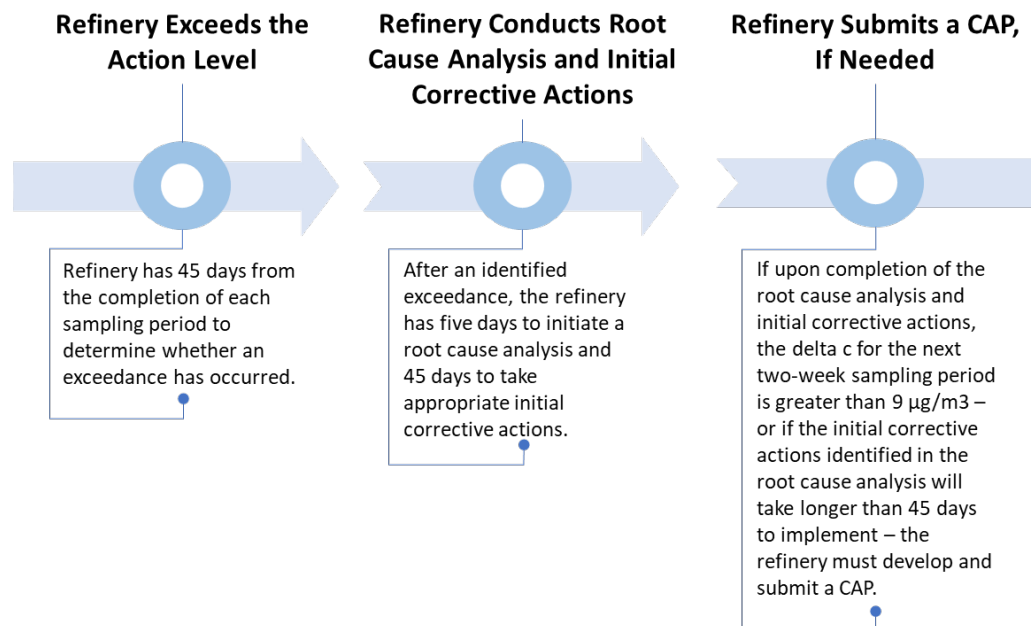
According to the EPA, *fair treatment* “means no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental, and commercial operations or policies.”

Regulations Require Refineries that Exceed the Action Level to Take Corrective Action

The benzene fenceline monitoring regulations, codified in 40 C.F.R. § 63.658, require refineries that exceed the benzene action level of $9 \mu\text{g}/\text{m}^3$ on a rolling annual average basis to conduct a root cause analysis and take appropriate corrective actions to reduce their annual average delta c to $9 \mu\text{g}/\text{m}^3$ or below. Specifically, within 45 days of the completion of each two-week sampling period, a refinery must determine whether it has exceeded the action level based on the average delta c of the 26 most recent two-week sampling periods. If a refinery determines that it has exceeded the action level, it must initiate a root cause analysis within five days to identify why the exceedance has occurred and what corrective actions will address the exceedance. The refinery is required to complete the root cause analysis and initial corrective actions within 45 days of determining that there is an exceedance. If, upon completion of the root cause analysis and corrective actions, the delta c for the next two-week sampling period is greater than $9 \mu\text{g}/\text{m}^3$, or if the initial corrective actions identified in the root cause analysis will take

longer than 45 days to implement, the refinery must develop and submit to the EPA or the delegated authority a corrective action plan to reduce the refinery's annual average delta c to or below the action level. This process is shown in Figure 4.

Figure 4: Actions required by refineries after an exceedance of the benzene action level



Note: CAP = Corrective Action Plan.

Source: Benzene fenceline monitoring regulations in 40 C.F.R. § 63.658. (EPA OIG image)

The corrective action plan must include:

- A description of the corrective actions the refinery has taken to date.
- Additional measures the refinery proposes to take to reduce concentrations to 9 µg/m³ or below.
- A schedule for completion of the proposed additional measures.

The regulations do not include a specific number of sampling periods by which a refinery must reduce its delta c before a violation occurs. However, a refinery that does not identify the true root cause of an exceedance or does not take appropriate corrective actions to address the root cause would be in violation of the regulations. Refineries that either fail to reduce their benzene concentrations to 9 µg/m³ or below after an initial exceedance or reduce their concentrations to or below the action level but then exceed 9 µg/m³ again in subsequent sampling periods may have failed to identify the root cause or taken inappropriate corrective actions.

Not All Refineries that Exceeded the Action Level Have Reduced Their Benzene Concentrations to 9 µg/m³ or Below

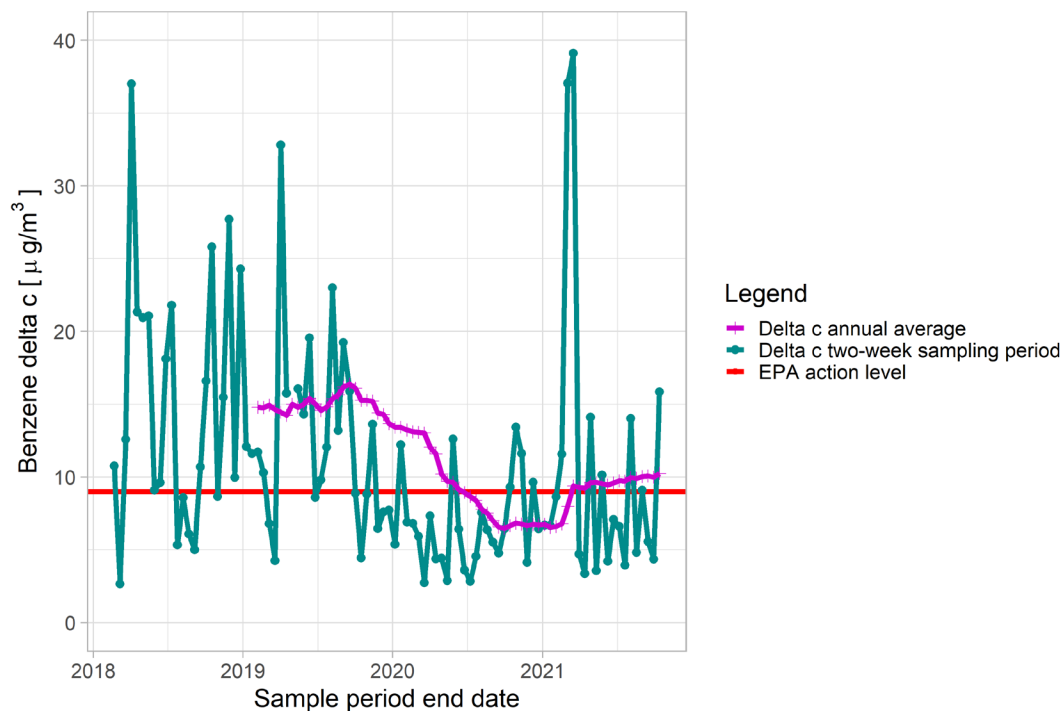
Not all refineries that exceeded the action level reduced their delta c to 9 µg/m³ or below in subsequent two-week sampling periods. Twenty-five of 118 refineries exceeded the action level at least once, based on our analysis of the data, from January 2018 through September 2021. Of these 25 refineries, 23 reported

two-week delta c values above 9 $\mu\text{g}/\text{m}^3$ in at least one subsequent sampling period, and 13 reported two-week delta c values above 9 $\mu\text{g}/\text{m}^3$ in ten or more subsequent sampling periods. Specifically:

- Six refineries had from ten to 19 subsequent sampling periods with two-week delta c values above 9 $\mu\text{g}/\text{m}^3$.
- Five refineries had from 20 to 39 subsequent sampling periods with two-week delta c values above 9 $\mu\text{g}/\text{m}^3$.
- Two refineries had more than 40 subsequent sampling periods with two-week delta c values above 9 $\mu\text{g}/\text{m}^3$.

Of the 13 refineries identified in the bullets above, three had not reduced their annual average delta c value to 9 $\mu\text{g}/\text{m}^3$ or below in any subsequent sampling period. Ten of these 13 refineries did eventually reduce their annual average delta c to 9 $\mu\text{g}/\text{m}^3$ or below in at least one subsequent sampling period by the end of September 2021. However, six of these ten again exceeded the action level in subsequent sampling periods. Figure 5 shows how one of these refineries continued to exceed 9 $\mu\text{g}/\text{m}^3$ in multiple subsequent sampling periods after successfully reducing its annual average delta c. See Appendix B for a list of all 25 refineries that exceeded the action level and the number of subsequent sampling periods with two-week concentrations above 9 $\mu\text{g}/\text{m}^3$ for each refinery.

Figure 5: Example of a refinery that had multiple exceedances of the action level after successfully reducing its annual average delta c



Notes: The annual average does not start until 2019 because the refinery needed 26 two-week delta c values to calculate the annual average. The refinery reduced its annual average delta c in 2020 but exceeded the action level again in 2021.

Source: OIG analysis of reported benzene fence-line monitoring data. (EPA OIG image)

Oversight Did Not Always Ensure that Refineries Reduced Benzene Concentrations to 9 µg/m³ or Below

While some refineries have succeeded in reducing their annual average delta c to or below the action level after an initial action level exceedance, not all refineries have done so. This may be due to the refineries' failure to identify the true root cause of the benzene exceedance or to take appropriate corrective action. In addition, oversight of the refineries by the EPA and delegated authorities has not always been sufficient to ensure that refineries that did not correct their exceedances both performed a root cause analysis that correctly identified the cause and implemented appropriate corrective actions to reduce their benzene concentrations to 9 µg/m³ or below. And although the EPA and delegated authorities have the authority to take enforcement action at refineries that do not identify and implement appropriate corrective action to address the root cause of exceedances as required by the regulations, enforcement-related actions by the EPA and delegated authorities were limited.

Refineries May Not Be Identifying the True Root Cause of Benzene Exceedances or Taking Appropriate Corrective Action

According to OECA staff, refineries may not be finding the true root cause of action level exceedances. They also may not be developing and implementing appropriate corrective actions to address the true root cause. Based on a conservative analysis of the time frames in the regulations, we identified four refineries that needed to submit corrective action plans after exceeding the action level. We requested that the delegated authorities for these four refineries provide us with all the corrective action plans that had been submitted. We reviewed a total of eight corrective action plans submitted by these four refineries to determine whether they appropriately reduced their benzene concentrations. We reviewed the five subsequent sampling periods after the date the refinery had submitted the corrective action plan or had planned to complete the additional corrective actions, and we found that only one of the refineries had two-week delta c values below 9 µg/m³ in all five subsequent sampling periods. The remaining three refineries continued to report two-week delta c values that exceeded 9 µg/m³ in at least one of the five subsequent sampling periods—and, in two instances, all five subsequent sampling periods exceeded 9 µg/m³.

For the three refineries whose two-week delta c values continued to exceed 9 µg/m³, we also looked at the concentrations that were measured at individual monitors that were identified in the corrective action plans as being the cause of the refineries' exceedances. In about 52 percent of instances where an individual monitor was identified in a corrective action plan, the plan did not reduce the two-week delta c values at that monitor to 9 µg/m³ or below in the five subsequent sampling periods. This could be because the refineries did not identify the true root cause of the exceedances or because the corrective actions they took were not appropriate.

In addition, not all corrective action plans we reviewed contained completion dates for the proposed additional measures, as required by the regulations. Specifically, five of the eight corrective action plans we reviewed did not contain completion dates for all additional measures identified in the plans.

The regulations do not require the EPA or delegated authorities to approve corrective action plans that are submitted by refineries. Thus, there is no formal mechanism for the EPA or delegated authority to provide feedback if it believes the corrective actions laid out in the corrective action plan are not appropriate.

When EPA and Delegated Authority Oversight Did Not Ensure that Refineries Reduced Their Emissions, Enforcement Was Limited

While the EPA and delegated authorities employed a variety of oversight activities for the benzene fenceline monitoring requirements, these activities have not always resulted in the reduction of benzene concentrations to or below the action level. As an example of oversight activities conducted, OECA reviews reported monitoring data on a quarterly basis to identify facilities with potential noncompliance. Additionally, Region 6 staff said that they also review the monitoring data quarterly. As another example, the Texas Commission on Environmental Quality, which is a delegated authority, also has a process in place to review data submitted by refineries and has required refineries to take action when they failed to meet regulatory time frames for data reporting, root cause analysis, and corrective actions. Other oversight activities taken by the EPA and delegated authorities we reviewed include conference calls with refineries that exceed the action level, on-site inspections to assess compliance with the regulations, and real-time pollutant monitoring to identify high benzene concentrations. However, despite these oversight activities, some refineries that exceeded the action level never reduced their annual average benzene concentrations to $9 \mu\text{g}/\text{m}^3$ or below during the period covered by our analysis, as detailed earlier in this chapter.

Enforcement-related action at refineries with persistent two-week or annual average delta c values over the action level was limited. From January 2018 through September 2021, for the nine refineries that scored the highest in our ranking of refineries based on their benzene concentrations, the delegated authorities did not take any enforcement action, and the EPA took enforcement action at only one of these refineries: HollyFrontier Artesia.

When we ranked refineries based on their benzene concentrations, the HollyFrontier Artesia refinery had the highest score, primarily because it had a maximum sample period delta c value of $998 \mu\text{g}/\text{m}^3$. The refinery also had 55 two-week delta c values over the action level and 26 two-week delta c values that exceeded the minimal risk level of $29 \mu\text{g}/\text{m}^3$.

Specifically, EPA Region 6, in coordination with OECA, sent a notice of violation in May 2020 to the HollyFrontier Artesia refinery in New Mexico for multiple violations including returning a problematic tank to service, even though that tank was identified as a root cause of benzene exceedances and the refinery's corrective action plan included removal of this tank as a corrective action. OECA and Region 6 did send information requests pursuant to section 114 of the Clean Air Act to three of the highest-ranking refineries in order to gather information about their root cause analyses and corrective actions. However, these information requests were not sent until late 2021 or early 2022, which was after the last sampling period we reviewed in our analysis. Information received in response to these requests will be used to ascertain whether any violations have occurred.

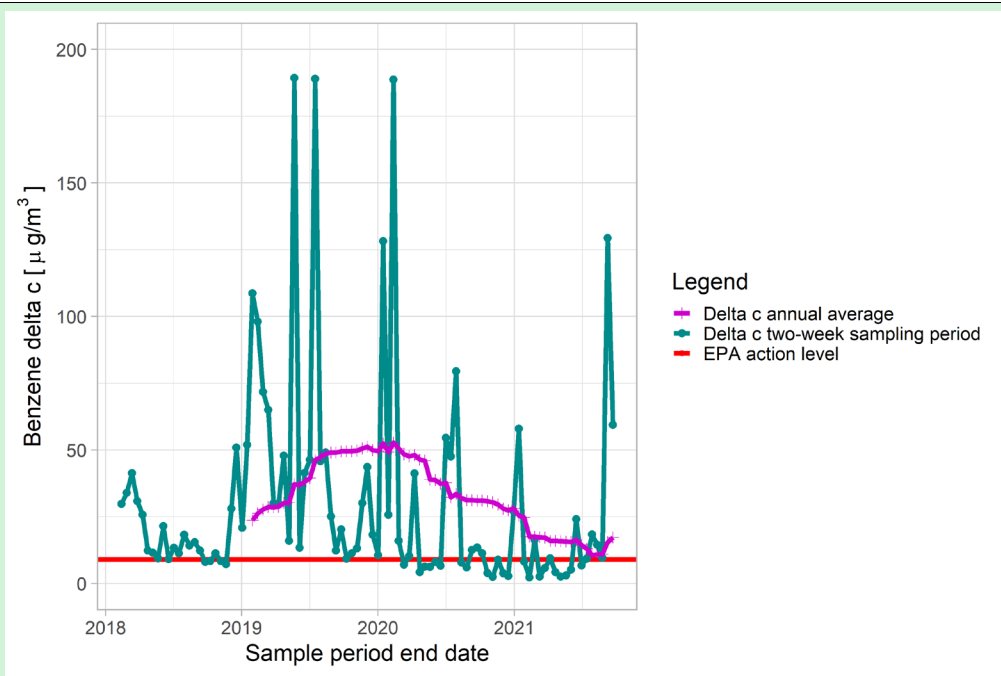
We identified several reasons for the limited enforcement action taken by the EPA and the delegated authorities, including:

- **Delegated authorities' views that enforcement of the regulations is challenging.** For example, one state told us that enforcement of the regulations is challenging because an exceedance of the action level is not in and of itself a violation. An EPA region told us that its states' perspective was that the program was challenging to enforce because $9 \mu\text{g}/\text{m}^3$ is not an enforceable threshold. In addition, one state told us that enforcement is challenging because the regulations do not contain a time frame or number of sampling periods by which a refinery must correct an exceedance. Thus, delegated authorities may be unsure when enforcement action may be warranted or should be taken.
- **Difficulty in determining from the monitoring data alone whether a violation has occurred.** For example, the EPA or delegated authorities may need to do an in-depth assessment of a refinery's root cause analyses and corrective actions if it continues to exceed $9 \mu\text{g}/\text{m}^3$ after an initial exceedance or if it reduces its benzene concentrations and then subsequently exceeds the action level once again. In addition, some requirements in the regulations, such as submission of a corrective action plan, are based in part on when a refinery obtains its sampling results and determines that an exceedance has occurred. However, the EPA template that refineries use to report their data does not include an entry for the date a refinery obtained its sampling results. Thus, the EPA and delegated authority cannot tell based on the reported data alone when a corrective action plan needs to be submitted.
- **Allocation of enforcement resources.** According to OECA, available enforcement resources were allocated to prioritize enforcement attention at the most problematic refineries based on the submitted monitoring data.
- **Lack of staff and resources at one delegated authority that we interviewed.** According to a manager, the delegated authority was unable to take enforcement action due to limited staff expertise and a high staff vacancy.

Case Study:

Philadelphia Energy Solutions refinery experienced an explosion and continued to exceed the action level without enforcement action

While the EPA has taken enforcement action against HollyFrontier Artesia, the refinery with the highest score based on the OIG's ranking of refinery benzene concentrations, it has not taken enforcement action at the second highest-scoring refinery, Philadelphia Energy Solutions. After initially exceeding the action level in January 2019, Philadelphia Energy Solutions exceeded the action level in 44 subsequent sampling periods. The refinery also exceeded the minimal risk level in 23 sampling periods after its initial exceedance of the action level. In June 2019, shortly after submitting a corrective action plan for its benzene exceedances, the refinery experienced an explosion and, according to EPA Region 3, ceased refining processes in July 2019. Philadelphia Energy Solutions' two-week delta c still exceeded $9 \mu\text{g}/\text{m}^3$ in 57 percent of the sampling periods between July 2019 and September 2021. The figure below shows both the annual average and two-week delta c values for Philadelphia Energy Solutions from January 2018 through September 2021.



Note: The annual average does not start until 2019 because the refinery needed 26 two-week delta c values to calculate the annual average.

Source: OIG analysis of reported benzene fenceline monitoring data. (EPA OIG image)

Post explosion, Region 3 said that the EPA’s most critical concern was the presence of hydrogen fluoride at the refinery that posed an immediate risk to the surrounding community. The region conducted a series of three on-site inspections from July through September 2019; these inspections focused on hydrogen fluoride, not benzene emissions.

Region 3 staff told us that exceedances of the action level after the explosion were the result of dismantling processes and movement of benzene products on-site, and they said that the refinery conducted additional monitoring near dismantling processes to assess where the high benzene concentrations were coming from. Both the Office of Air Quality Planning and Standards and OECA told us there were tanks at the refinery location that could be responsible for the elevated benzene concentrations measured at the fenceline, since the tanks contained pure or high levels of benzene. OECA staff expressed concerns to Region 3 via email beginning in January 2020 about continued elevated benzene levels at the refinery. Based on the documentation we obtained, Region 3 did not conduct an on-site inspection at that time but had email communication with the refinery in March and June 2020 about remaining tanks at the site. In October 2020, the EPA conducted a mobile monitoring study at the refinery, which did not identify any high concentrations of benzene. However, this study measured benzene concentrations on one day only and was thus not a long-term study of concentrations at the refinery.

Region 3 stated that it conducted an on-site tour of the facility in May 2022 and observed that the majority of the site had been dismantled and that almost all storage tanks were empty or removed from the site. We confirmed in WebFIRE that for the last sampling period for which Philadelphia Energy Solutions submitted data, the period ending on March 23, 2022, the refinery reported a two-week delta c of 3.2 µg/m3. While the data show that the benzene concentration was below the action level in March 2022, the refinery exceeded the action level in the majority of two-week periods for more than two years after ceasing operations, and no enforcement action was taken.

Philadelphia Energy Solutions is in a community with environmental justice concerns. In 2020, the EPA awarded a grant to the delegated authority, Philadelphia Air Management Services, to conduct ambient monitoring in the nearby community to assess impacts from multiple sources of air toxics emissions, including benzene. As of January 2023, this study was ongoing.

Communities Could Face Increased Health Risks If Refineries Do Not Reduce Their Benzene Concentrations

If refineries do not reduce their benzene concentrations after exceeding the action level, nearby communities could be exposed to benzene concentrations that increase the risk of adverse health effects. Of the 25 refineries that exceeded the action level, 18 also exceeded the minimal risk level of $29 \mu\text{g}/\text{m}^3$ in subsequent two-week sampling periods. Figure 6 shows the city and state in which these 18 refineries are located. Some of these 18 refineries had multiple exceedances of the minimal risk level in subsequent two-week sampling periods. For example, after Philadelphia Energy Solutions initially exceeded the action level, the refinery also reported benzene concentrations above the minimal risk level in 23 subsequent two-week sampling periods. As another example, after initially exceeding the action level, the Total refinery, located in Port Arthur, Texas, reported benzene concentrations above the minimal risk level in 11 subsequent two-week sampling periods. If such levels are not reduced, nearby communities could face an increased risk of adverse health effects.

Figure 6: Location of refineries that exceeded the minimal risk level in at least one two-week sampling period after an initial exceedance of the action level



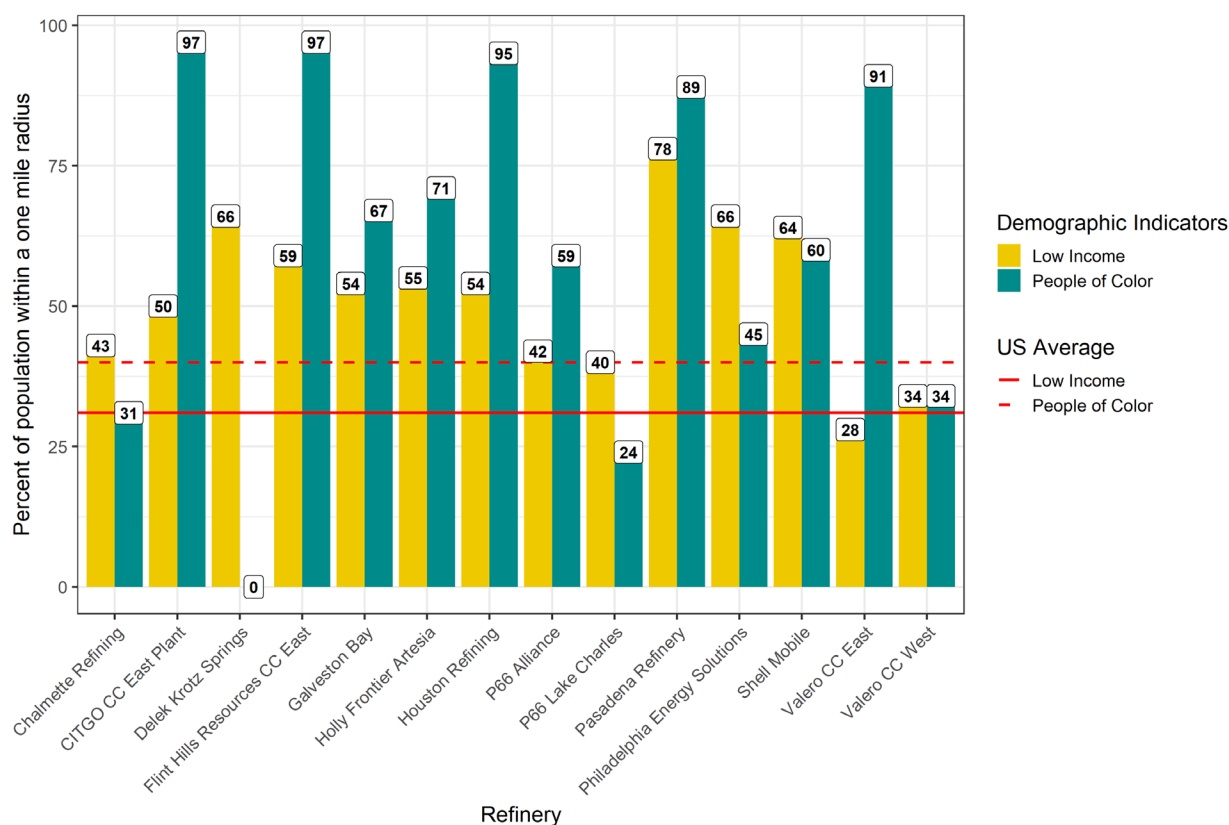
Note: Corpus Christi, Texas, has four refineries that exceeded the minimal risk level of $29 \mu\text{g}/\text{m}^3$ after an initial exceedance of the action level.

Source: OIG analysis of reported benzene fence-line monitoring data. (EPA OIG image)

Communities with Environmental Justice Concerns Could Be Disproportionately Impacted If Refineries Do Not Reduce Their Benzene Concentrations

Relatively high benzene concentrations could disproportionately impact communities with environmental justice concerns. Of the 18 refineries that exceeded the minimal risk level of $29 \mu\text{g}/\text{m}^3$ in subsequent sampling periods after an initial action level exceedance, nearly 80 percent are in communities with environmental justice concerns. Specifically, 14 of the 18 refineries are in communities with higher-than-average percentages of people of low income and/or people of color, which are demographic indicators of communities with environmental justice concerns. For each of these 14 refineries, Figure 7 shows the proportion of low-income individuals and people of color who live within a one-mile radius of the monitor reporting the highest benzene concentration. Figure 7 also compares those proportions to the national averages.

Figure 7: Demographic indicators for refineries with environmental justice concerns that had exceedances of the minimal risk level after an initial exceedance of the action level



Note: CC stands for Corpus Christi, Texas.

Source: OIG analysis of refinery-submitted monitoring data and demographic information in the EPA's EJScreen. (EPA OIG image)

Appendix C contains a list of all refineries that exceeded the minimal risk level after an initial exceedance of the action level, along with the city and state each refinery is located in and demographic information for communities within a one-mile radius of each refinery.

Conclusions

The EPA should enhance oversight of the benzene fence-line monitoring requirements to ensure that all refineries that exceed the action level take appropriate corrective actions to address exceedances and reduce their benzene concentrations to the action level or below. This is particularly important for refineries that exceed the minimal risk level of 29 $\mu\text{g}/\text{m}^3$ so that nearby communities do not experience continued benzene concentrations that may increase the risk for adverse health effects. If the EPA and delegated authorities fail to ensure that these refineries take appropriate corrective actions, communities could be exposed to higher benzene concentrations than if appropriate corrective actions were taken. Further, communities with environmental justice concerns could face disproportionate impacts from potentially harmful benzene concentrations.

Recommendations

We recommend that the assistant administrator for Enforcement and Compliance Assurance:

1. Provide guidance to delegated authorities on what constitutes a violation of the benzene fence-line monitoring regulations to assist the delegated authorities in taking action when a violation may have occurred.
2. Develop an internal strategy to address refineries that fail to reduce their benzene concentrations to 9 micrograms per cubic meter or below after initially exceeding the action level. The strategy should include best practices for:
 - a. Monitoring benzene concentrations to determine whether a refinery has exceeded the action level and continues to exceed 9 micrograms per cubic meter in subsequent two-week sampling periods.
 - b. Verifying that the refinery submits an appropriate corrective action plan that addresses the root cause and actions.
 - c. Taking action at refineries that fail to undertake root cause analyses or implement appropriate corrective actions—such as Clean Air Act section 114 information requests, inspections, and enforcement actions—to reduce benzene concentrations to 9 micrograms per cubic meter.
 - d. Coordinating between the Office of Enforcement and Compliance Assurance, the EPA regions, and the delegated authorities.

Agency Response and OIG Assessment

Appendix E includes OECA's response to our draft report. In its response, OECA agreed with Recommendation 1 with a proposed revision: removing the portion of the draft recommendation that would require the guidance to include EPA-developed metrics to assist the delegated authorities in

identifying instances when a violation may have occurred. OECA expressed concern that such uniform metrics may “end up being under and/or over inclusive of potential problems,” and as a result, “serious problems may not be identified for long periods of time as benzene fence-line monitoring data fluctuates.” In addition, OECA stated that it planned to address Recommendation 1 by developing an enforcement alert that provides guidance to both delegated authorities and regulated industry; as such, OECA is concerned that including specific metrics would release enforcement-sensitive strategies. While the draft Recommendation 1 did not specifically say that the guidance should be targeted toward regulated industry, we agree with OECA’s intention to do so if it believes more guidance is needed by industry. For these reasons, we have revised our recommendation to remove the provision for EPA-developed metrics, and we believe the Agency has provided a sufficient planned corrective action plan and estimated completion date for this recommendation. As a result, we consider Recommendation 1 to be resolved with corrective actions pending.

OECA agreed with Recommendation 2 but proposed revisions so that the internal strategy includes “a variety of options and approaches, using various enforcement tools ... to achieve compliance with the [regulations] on a case-by-case basis whether action is taken by EPA or a delegated authority.” Furthermore, OECA believes that an internal document setting forth best practices would assist both OECA and EPA regional staff in addressing refineries that exceed the action level and fail to reduce benzene concentrations below that level. We agree with OECA and believe its proposed revisions and corrective actions satisfy the intent of Recommendation 2. As a result, we have revised our recommendation to reflect OECA’s proposed changes. We consider Recommendation 2 to be resolved with corrective actions pending.

Chapter 3

Barriers Hinder the Ability of the EPA and Delegated Authorities to Identify When Refineries Need to Take Action

We identified barriers that could hinder the EPA's and delegated authorities' ability to determine whether a refinery has exceeded the action level and thus needs to take action to reduce its benzene concentrations. Specifically:

- The EPA has approved SSMPs that rely solely on modeling, which could overestimate contributions from exempt sources and mask whether a refinery has in fact exceeded the action level.
- Not all refineries reported monitoring data for all two-week sampling periods, which means they may not be reporting high concentrations that could push them over the action level.

If the EPA and delegated authorities cannot identify when exceedances have occurred, they cannot ensure that refineries take corrective action as required. This could result in communities being exposed to higher benzene concentrations than would be the case if appropriate corrective actions were taken. The EPA should enhance oversight to ensure that all exceedances of the action level can be properly identified.

The EPA Approved SSMPs that Rely Solely on Modeling Rather Than Additional Monitoring

The Office of Air Quality Planning and Standards has approved SSMPs that rely solely on modeling—as opposed to additional monitoring—to estimate contributions from near-field sources. These SSMPs do not adhere to the regulations. The benzene fence-line monitoring regulations allow refineries to develop SSMPs to account for contributions from near-field sources in their reported two-week sampling period delta c values. An approved SSMP provides the methodology that the refinery uses to adjust its two-week sampling period measured delta c value. The refinery can adjust its reported two-week sampling period delta c value by reducing the value in an amount equal to the contribution from near-field sources. Pursuant to 40 C.F.R. § 63.658(i)(1)(ii), SSMPs must include the “[l]ocation of the additional monitoring stations that shall be used to determine the uniform background concentration and the near-field source concentration contribution.” SSMPs must be submitted to and approved by the Office of Air Quality Planning and Standards.

Out of a total of 13 EPA-approved SSMPs, we initially reviewed the EPA-approved SSMPs for the three refineries that made the biggest adjustments to their reported two-week sampling period delta c values based on contributions from near-field sources. All three relied solely on modeling as opposed to additional monitoring. When we identified that all three SSMPs were from refineries owned by the same company, Valero, we decided to review all the SSMPs for refineries owned by that company. We thus

reviewed a total of five SSMPs, and we found that all five relied solely on modeling to estimate contributions from near-field sources.

A manager from the Office of Air Quality Planning and Standards told us that the regulations intend for SSMPs to incorporate additional monitoring to account for near-field sources. The manager told us that the office initially approved some SSMPs that relied on modeling because it thought using modeling could be a reasonable approach in some situations, especially given the complexities of isolating the contributions of near-field sources through monitoring. However, the manager stated that relying on modeling can be problematic because modeling inherently involves uncertainty. This means that modeling could underestimate or overestimate emissions and resulting contributions from near-field sources. Additionally, OECA staff told us that modeling is often conservative in favor of the environment. This means that emissions and resulting contributions from near-field sources are more likely to be overestimated, resulting in a greater downward adjustment to a refinery's delta c value, which could mask an exceedance of the action level.

In some cases, SSMPs result in a very large difference between the refinery's uncorrected or unadjusted two-week sampling period delta c and the two-week sampling period delta c that is reported by the refinery. For example, the Valero Corpus Christi East refinery has an SSMP that relies solely on modeling. For one sampling period, the refinery's measured or unadjusted two-week sampling period delta c was 385 $\mu\text{g}/\text{m}^3$, but when adjusted to account for the modeled contributions from near-field sources, its reported two-week sampling period delta c was 3 $\mu\text{g}/\text{m}^3$. As this example shows, refineries with SSMPs may be able to greatly adjust their reported two-week sampling period delta c downward, going from a two-week sampling period delta c many times greater than the action level to a two-week sampling period delta c well under the action level. When refineries are basing the contributions from near-field sources on modeling, they could be overestimating emissions and resulting contributions from near-field sources. As a result, they could be overadjusting their reported two-week sampling period and annual average delta c, and a true exceedance of the action level could be masked. In such situations, the EPA and delegated authorities would not be able to determine whether a true exceedance occurred and whether the refinery needed to take corrective action.

Not All Refineries Reported Monitoring Data for All Two-Week Sampling Periods

The benzene fenceline monitoring regulations require refineries to report all monitoring data for each two-week sampling period to the EPA on a quarterly basis. Based on our analysis of the data from January 2019 through September 2021, we identified five refineries, which are all located in EPA Regions 5 and 8, that had not submitted any monitoring data for at least one two-week sampling period. A failure to submit the required data could impact the EPA's and delegated authorities' ability to determine whether the action level was exceeded. Specifically:

- One refinery had missing data for one sampling period.
- One refinery had missing data for five sampling periods.

- Two refineries had missing data for six sampling periods.
- One refinery had missing data for 13 sampling periods.

These refineries, along with the dates of their missing data, are listed in Appendix D.

A refinery with missing data may have failed to report an elevated benzene concentration. If that concentration was high enough, that data could have caused the refinery to exceed the annual average action level of $9 \mu\text{g}/\text{m}^3$ without being detected. The gap in data could mask such an elevated concentration, and that data would not be reflected in the refinery's rolling annual average. This would negatively impact the EPA's and delegated authorities' ability to determine whether a benzene exceedance has occurred. However, the EPA has not provided written guidance on how EPA regions and delegated authorities should review data that are submitted by refineries to identify data quality problems, including missing data.

The Office of Air Quality Planning and Standards and OECA Have Reached Agreement on the Significant Figures of the Action Level

When we began our audit, the Office of Air Quality Planning and Standards and OECA held inconsistent understandings of the number of significant figures in the action level of $9 \mu\text{g}/\text{m}^3$. The term ***significant figures*** refers to the number of digits in a value that are used to express the value's degree of accuracy. The significant figures of the action level affect the thresholds for whether an action-level exceedance has occurred and whether a refinery needs to conduct a root cause analysis and take corrective actions.

According to the Office of Air Quality Planning and Standards, there is only one significant figure in the action level, which means that any value up to $9.5 \mu\text{g}/\text{m}^3$ could be rounded down to $9 \mu\text{g}/\text{m}^3$ and would not be an exceedance. However, based on longstanding enforcement policy, OECA understood the action level as having two significant figures, meaning that $9 \mu\text{g}/\text{m}^3$ should have a zero after the decimal point, thus making $9 \mu\text{g}/\text{m}^3$ actually $9.0 \mu\text{g}/\text{m}^3$. Thus, only values up to $9.05 \mu\text{g}/\text{m}^3$ could be rounded down to $9.0 \mu\text{g}/\text{m}^3$. For refineries with annual average delta c values from $9.05 \mu\text{g}/\text{m}^3$ to $9.5 \mu\text{g}/\text{m}^3$, the difference in significant figures would result in different determinations as to whether the refinery exceeded the action level and needed to take action.

As a result of our audit, the Office of Air Quality Planning and Standards and OECA came to agreement in October 2022 that, based on their review of the regulatory record, the action level was promulgated with one significant figure. Thus, the EPA reached internal agreement on the significant figures of the action level and the rounding of monitoring results for the benzene fenceline monitoring regulations. As such, this barrier to identifying facilities that exceeded the action level was resolved, and we make no recommendations regarding this finding.

If the EPA and Delegated Authorities Cannot Identify Exceedances of the Action Level, They Cannot Ensure that Refineries Take Appropriate Corrective Action

The EPA's approval of SSMPs that rely on modeling and refineries with missing data are barriers to the EPA's and delegated authorities' ability to determine whether an exceedance of the action level has occurred. If the EPA and delegated authorities cannot identify when exceedances have occurred, they cannot ensure that refineries take corrective action as required. This could result in communities being exposed to higher benzene concentrations than if appropriate corrective actions were taken.

Recommendations

We recommend that the assistant administrator for Air and Radiation:

3. Review all approved site-specific monitoring plans to identify which ones rely solely on modeling, as opposed to additional monitoring, to account for near-field sources. Take appropriate steps to ensure that the site-specific monitoring plans identified are amended to incorporate additional monitoring to account for contributions to benzene concentrations from near-field sources, as required by EPA regulations.

We recommend that the assistant administrator for Enforcement and Compliance Assurance:

4. Provide guidance to the EPA regions to periodically review all reported benzene monitoring data to identify any gaps in data for refineries.
5. In consultation with applicable EPA regions and delegated authorities, investigate OIG-identified benzene monitoring data gaps and ensure submission of missing data if the data are available.
6. Provide guidance in the form of best practices to the EPA regions for investigating missing benzene monitoring data, securing the submission of the data if the data are available, and evaluating enforcement options.

Agency Response and OIG Assessment

The Office of Air and Radiation agreed with Recommendation 3 and stated that it will review all approved SSMPs, identify all SSMPs that rely solely on modeling, and take appropriate steps to ensure that identified SSMPs are amended to incorporate additional monitoring to account for contributions to benzene concentrations from near-field sources. Thus, we consider Recommendation 3 to be resolved with corrective actions pending. The Office of Air and Radiation's response to our draft report is in Appendix F.

OECA's response to our draft report is in Appendix E. For Recommendation 4, OECA agreed to provide guidance to the EPA regions to identify gaps in refinery-submitted data as part of its internal strategy

developed in response to Recommendation 2. Thus, we consider Recommendation 4 to be resolved with corrective actions pending.

For Recommendation 5, OECA agreed to investigate OIG-identified benzene monitoring data gaps and ensure the submission of missing data if the data are available. OECA noted that refineries may not have the data in some cases, such as in the wake of a natural disaster, and thus proposed revising the draft recommendation to clarify that it would ensure the data are reported when available. We agree with this proposed revision and believe OECA's planned corrective action meets the intent of the recommendation. In addition, in its response to the draft report, OECA committed to providing best practices to the EPA regions for investigating missing benzene monitoring data, securing the submission of available data, and evaluating enforcement options. OECA stated that it would include these best practices as part of the internal strategy developed in response to Recommendation 2. As such, we added a new recommendation, Recommendation 6, to the report, to reflect this commitment. Based on OECA's proposed corrective actions for these two recommendations, we consider Recommendations 5 and 6 to be resolved with corrective actions pending.

Status of Recommendations

Rec. No.	Page No.	Recommendation	Status*	Action Official	Planned Completion Date
1	17	Provide guidance to delegated authorities on what constitutes a violation of the benzene fenceline monitoring regulations to assist the delegated authorities in taking action when a violation may have occurred.	R	Assistant Administrator for Enforcement and Compliance Assurance	4/1/24
2	17	Develop an internal strategy to address refineries that fail to reduce their benzene concentrations to 9 micrograms per cubic meter or below after initially exceeding the action level. The strategy should include best practices for: <ul style="list-style-type: none"> a. Monitoring benzene concentrations to determine whether a refinery has exceeded the action level and continues to exceed 9 micrograms per cubic meter in subsequent two-week sampling periods. b. Verifying that the refinery submits an appropriate corrective action plan that addresses the root cause and actions. c. Taking action at refineries that fail to undertake root cause analyses or implement appropriate corrective actions—such as Clean Air Act section 114 information requests, inspections, and enforcement actions—to reduce benzene concentrations to 9 micrograms per cubic meter. d. Coordinating between the Office of Enforcement and Compliance Assurance, the EPA regions, and the delegated authorities. 	R	Assistant Administrator for Enforcement and Compliance Assurance	4/1/24
3	22	Review all approved site-specific monitoring plans to identify which ones rely solely on modeling, as opposed to additional monitoring, to account for near-field sources. Take appropriate steps to ensure that the site-specific monitoring plans identified are amended to incorporate additional monitoring to account for contributions to benzene concentrations from near-field sources, as required by EPA regulations.	R	Assistant Administrator for Air and Radiation	3/31/24
4	22	Provide guidance to the EPA regions to periodically review all reported benzene monitoring data to identify any gaps in data for refineries.	R	Assistant Administrator for Enforcement and Compliance Assurance	4/1/24
5	22	In consultation with applicable EPA regions and delegated authorities, investigate OIG-identified benzene monitoring data gaps and ensure submission of missing data if the data are available.	R	Assistant Administrator for Enforcement and Compliance Assurance	4/1/24
6	22	Provide guidance in the form of best practices to the EPA regions for investigating missing benzene monitoring data, securing the submission of the data if the data are available, and evaluating enforcement options.	R	Assistant Administrator for Enforcement and Compliance Assurance	4/1/24

* C = Corrective action completed.
 R = Recommendation resolved with corrective action pending.
 U = Recommendation unresolved with resolution efforts in progress.

Detailed Scope and Methodology

To answer our objective, we analyzed all refinery-reported monitoring data from January 2018 through September 2021, which represented the most complete data at the time we began our audit. We were unable to download all refinery-submitted reports from WebFIRE. As a result, the EPA directly provided us with all reports from WebFIRE. We then compiled all the data from the individual refinery reports into one spreadsheet, on which we performed multiple cleaning and verification steps, including:

- Verifying that each refinery used the same name during the period we were auditing. For refineries that may have data submitted under different names, we revised the spreadsheet to include only one version of the name to maintain consistency.
- Identifying and removing duplicated data.
- Correcting obviously incorrect data, such as sampling period end and start dates that were not logical.
- Reformatting data to ensure consistency between the data fields.
- Removing special characters, such as the “Δ” symbol.
- Identifying monitor benzene concentrations that were corrected due to an SSMP.
- Relabeling monitor types to ensure proper identification of co-located monitors.
- Selecting 40 random report identification numbers from our compiled spreadsheet and verifying their values with the submitted report in WebFIRE. This step enabled us to ensure that we had correctly compiled the data from all the reports that were provided by the Agency.

Calculating Two-Week and Annual Average Delta C Values

Using our cleaned and verified spreadsheet, we independently calculated two-week sampling period delta c and annual average delta c values from refinery-reported concentrations from individual monitors. We removed all monitor results that were flagged as outliers or that were not one of the following types of monitors: regular monitor, extra monitor, or duplicate monitor.

When a refinery submits quarterly data, it must identify the type of monitor it is reporting. Examples of monitor types include regular, extra, duplicate, field blank, and inactive. For this audit, we only considered regular monitors, extra monitors, and duplicates.

To calculate the two-week sampling period delta c value, we identified the minimum and maximum monitor values for each two-week sampling period. If a minimum or maximum monitor value was co-located with another monitor, we averaged these two monitors’ measured benzene concentrations. We

then calculated the difference between the maximum and minimum measured benzene concentration for each sampling period, which resulted in the OIG's independently calculated two-week sampling period delta c value. To calculate the annual average delta c value for each refinery, we started at the 26th submitted sampling period for each refinery and performed a rolling average using the 26 most recent sampling period delta c values. We conducted the analysis the same way regardless of whether or not the refinery had gaps in reported data. All two-week sampling period and annual average delta c values were rounded to one decimal place.

Identifying Refineries that Exceeded the Action Level and the Minimal Risk Level

Using the OIG's independently calculated two-week sampling period and annual average delta c values, we identified all refineries that had at least one annual average delta c value that exceeded $9 \mu\text{g}/\text{m}^3$. We considered a refinery to have exceeded the action level of $9 \mu\text{g}/\text{m}^3$ if its annual average delta c value was $9.5 \mu\text{g}/\text{m}^3$ or greater. Any number that rounded to $9.5 \mu\text{g}/\text{m}^3$ or higher was considered to be greater than $9 \mu\text{g}/\text{m}^3$. If a refinery had at least one annual average exceedance of the action level, we identified the following metrics for that refinery:

- Initial date that the refinery's annual average delta c was greater than $9 \mu\text{g}/\text{m}^3$.
- Number of times that the refinery's annual average delta c was greater than $9 \mu\text{g}/\text{m}^3$.
- Number of times that the refinery's two-week sampling period delta c value was greater than $9 \mu\text{g}/\text{m}^3$.
- Number of times that the refinery's two-week sampling period delta c value was greater than $29 \mu\text{g}/\text{m}^3$.
- Number of times that the refinery's two-week sampling period delta c value was greater than $9 \mu\text{g}/\text{m}^3$ after the initial exceedance of the action level.
- Number of times that the refinery's two-week sampling period delta c value was greater than $29 \mu\text{g}/\text{m}^3$ after the initial exceedance of the action level.
- The refinery's highest two-week sampling period delta c value.

Identifying Refineries for In-Depth Review

To identify refineries to review in-depth, we created an OIG scoring method based on the refineries' monitoring data. The scoring method summed up the following factors for each refinery that had at least one exceedance of the action level:

- Total number of sampling periods with a two-week delta c that exceeded the action level.
- Total number of sampling periods with a two-week delta c that exceeded the minimal risk level.
- Ten percent of the refinery's highest two-week delta c value.

We then selected the nine refineries with the highest score based on these metrics. We selected nine refineries since that number provided us with the greatest diversity of EPA regions and delegated authorities. The nine refineries we selected, along with their applicable EPA region, state, and delegated authority, are listed in Table A-1. For these nine refineries, we conducted interviews with the applicable regions and delegated authorities, and we reviewed documentation related to actions taken to try to ensure that the refinery reduced its benzene concentration to at or below the action level.

Table A-1: Refineries selected to review in-depth

Refinery	EPA region	State	Delegated authority
HollyFrontier Artesia	6	New Mexico	New Mexico Environment Department
Philadelphia Energy Solutions	3	Pennsylvania	Philadelphia Air Management Services
Total Refinery	6	Texas	Texas Commission on Environmental Quality
Pasadena Refinery	6	Texas	Texas Commission on Environmental Quality
Delek Krotz Springs	6	Louisiana	Louisiana Department of Environmental Quality
Galveston Bay Refinery	6	Texas	Texas Commission on Environmental Quality
Flint Hills Resources Corpus Christi LLC, East Refinery	6	Texas	Texas Commission on Environmental Quality
Chalmette Refining LLC	6	Louisiana	Louisiana Department of Environmental Quality
Chevron Pascagoula	4	Mississippi	Mississippi Department of Environmental Quality

Source: OIG analysis of refinery-reported monitoring data. (EPA OIG table)

Identifying Refineries that Needed to Submit a Corrective Action Plan

Using a conservative approach based on maximum allowable time frames in the regulations, we identified refineries that needed to submit a corrective action plan and assessed whether benzene concentrations were reduced either after the date the corrective action plan was submitted or after the corrective actions were scheduled to be completed. We identified refineries that needed to submit a corrective action plan based on whether they had eight or more subsequent two-week sampling period delta c values that exceeded 9 µg/m³ after an annual average exceedance of 9 µg/m³. This approach was based on the assumption that each refinery took the maximum amount of time allowed under the benzene fenceline regulations to obtain its sampling results and conduct initial corrective actions before a corrective action plan is required. The regulations state the owner or operator has no longer than 50 days after completion of the sampling period to initiate a root cause analysis for an exceedance; that the root cause analysis and initial corrective actions shall be completed and take no later than 45 days after determining there is an exceedance; and that if the concentration in following sampling period—in other words, 14 days—is still greater than 9 µg/m³, then the owner or operator shall develop a corrective action plan. We then used the below formula to determine the maximum number of sampling periods that a refinery could exceed 9 µg/m³ before the need for a corrective action plan would be triggered under any scenario. We divided by 14, since that is the number of days in a single sampling period.

$$\frac{50 + 45 + 14}{14} = 7.8 \text{ sampling periods} = \sim 8 \text{ sampling periods}$$

This approach is conservative in that it likely did not identify all instances when corrective action plans would be required, because that is based in part on when a refinery obtains its sampling results and how long it takes to complete initial corrective actions.

This conservative approach identified four refineries that needed to submit corrective action plans. In total, we reviewed eight corrective action plans submitted by these four refineries. For each corrective action plan, we used the refinery's monitoring data to determine whether the refinery had a two-week delta c value above $9 \mu\text{g}/\text{m}^3$ in the five sampling periods after the corrective action plan stated that the planned corrective actions were to be completed. If the corrective action plan did not include completion dates for the planned corrective actions, we looked at the two-week delta c values in the five subsequent sampling periods after the corrective action plan was submitted. In addition, for corrective action plans that identified specific individual monitors as problematic, we reviewed the concentrations for those specific monitors to determine whether their concentrations were reduced to $9 \mu\text{g}/\text{m}^3$ or below in the five sampling periods after corrective actions were planned to be completed.

Identifying Gaps in the Data

To identify refineries with data gaps, we analyzed our data for instances when a refinery's sampling period start date did not align with the previous sampling period end date. In other words, we looked for instances when the sampling period start date was not exactly the previous sampling period's end date. If a refinery did not have aligning dates, we calculated the number of days elapsed from the last day of the previous sampling period and the first day of the sampling period in question. We then focused on refineries that had a lapse greater than or equal to 14 days, suggesting that the refinery did not submit data for an entire two-week sampling period.

Identifying Percentages of People of Color and Low-Income Residents in Fenceline Communities

Using the list of refineries that had at least one annual average exceedance of the action level, we determined the percentage of the population who identified as people of color or low-income and who lived within a one-mile radius of the refinery. To do this, we identified the monitor at each refinery that had the highest frequency of maximum benzene concentration events. Using the EPA's EJScreen, we created a one-mile radius around each refinery's identified monitor's coordinates and then documented the population and the percentage of people of color and low-income residents living within that radius. The demographic data in EJScreen are from the U.S. Census Bureau.

EJScreen defines people of color as individuals who identify as a race other than White alone and/or who identify their ethnicity as Hispanic or Latino. Thus, the term includes all people other than non-Hispanic White-alone individuals. The word "alone" in this case indicates that the person is of a single race, not multiracial. EJScreen defines low-income individuals as those whose household incomes are less than twice the federal poverty level.

Analyzing Refineries with SSMPs and Selecting SSMPs to Review In-Depth

We identified all refineries that had an EPA-approved SSMP and calculated their two-week sampling period delta c and annual average delta c values for both their measured benzene concentrations and their corrected benzene concentrations. We compared each refinery's measured and corrected benzene two-week sampling delta c values to determine which refineries made the biggest adjustments to their delta c values. The three refineries that made the biggest adjustments to their values were all owned by the same company. We reviewed all three refineries' SSMPs. After reviewing these SSMPs, we found that all three refineries relied on modeling instead of additional monitoring. Since the company that owned all three of these refineries had approved SSMPs for two additional refineries, we also reviewed those two SSMPs. Thus, we reviewed a judgmental sample of five EPA-approved SSMPs to determine whether they complied with the regulations.

Analyzing Benzene Concentrations Over Time

For background purposes, we conducted an analysis of the average benzene concentrations for all reported two-week sampling period delta c values over time. To conduct this analysis, we grouped all two-week sampling period delta c values into months based on their sampling period end dates. We considered only sampling period end dates from February 2018 through September 2021. We then averaged the monthly two-week sampling period delta c values. We plotted the monthly average delta c value against time and developed a trend line based on a linear model comparing the monthly average delta c value to time.

Refineries that Exceeded the Action Level

Table B-1 lists the 25 refineries that exceeded the annual average action level of 9 $\mu\text{g}/\text{m}^3$ at least once based on our analysis of the data from January 2018 through September 2021. The table also includes the location of each refinery, the date of the refinery's initial exceedance of the action level, and the number of sampling periods in which a refinery had a two-week delta c value over 9 $\mu\text{g}/\text{m}^3$ after the initial exceedance.

Table B-1: Refineries that exceeded the action level

Refinery	City	State	Date of initial action level exceedance	Number of sampling periods that exceeded 9 $\mu\text{g}/\text{m}^3$ after initial exceedance
Chalmette Refining LLC	Chalmette	Louisiana	1/29/19	24
Chevron Pascagoula	Pascagoula	Mississippi	1/24/19	13
CITGO Corpus Christi Refinery East Plant	Corpus Christi	Texas	11/21/19	23
Countrymark Refining and Logistics LLC	Mt. Vernon	Indiana	7/13/21	2
Delek El Dorado	El Dorado	Arkansas	1/29/20	1
Delek Krotz Springs	Krotz Springs	Louisiana	1/27/20	16
Flint Hills Resources Corpus Christi LLC, East Refinery	Corpus Christi	Texas	2/6/19	26
Flint Hills Resources Corpus Christi LLC, West Refinery	Corpus Christi	Texas	2/2/21	4
Galveston Bay Refinery	Texas City	Texas	1/24/19	37
HF Artesia	Artesia	New Mexico	1/29/19	33
HF Lovington	Lovington	New Mexico	3/26/20	4
Houston Refining LP	Houston	Texas	1/24/19	14
LIMETREE BAY	Christiansted	Virgin Islands	9/3/21	1
Marathon Catlettsburg Refining LLC	Catlettsburg	Kentucky	10/21/20	0
P66 Alliance	Belle Chasse	Louisiana	8/19/20	5
P66 Lake Charles	Westlake	Louisiana	9/29/20	8
P66 Wood River Docks	Roxana	Illinois	10/2/19	9
Pasadena Refinery	Pasadena	Texas	1/22/19	16
Philadelphia Energy Solutions	Philadelphia	Pennsylvania	1/30/19	44
Shell Mobile	Saraland	Alabama	4/22/20	13
Shell Norco Manufacturing Complex	Norco	Louisiana	3/13/19	19
Total Refinery	Port Arthur	Texas	1/7/19	50
Valero Corpus Christi East	Corpus Christi	Texas	1/23/19	6
Valero Corpus Christi West	Corpus Christi	Texas	1/23/19	7
Valero St. Charles	Norco	Louisiana	9/7/21	0

Source: OIG analysis of refinery-reported monitoring data. (EPA OIG table)

Refineries that Exceeded the Minimal Risk Level

Table C-1 shows the 18 refineries that exceeded the minimal risk level of 29 $\mu\text{g}/\text{m}^3$ based on our analysis of the data from January 2018 through September 2021 after an initial exceedance of the action level. It also includes the location of each refinery, the number of two-week delta c values over 29 $\mu\text{g}/\text{m}^3$ after an initial exceedance of the action level, and the percentage of the population within a one-mile radius of the refinery that is people of color or low income.

Table C-1: Refineries with a two-week delta c value over the minimal risk level after an initial exceedance of the action level

Refinery	City	State	Number of sampling periods that exceeded 29 $\mu\text{g}/\text{m}^3$ after initial exceedance	Percent of people of color within a one-mile radius (%)	Percent of low-income residents within a one-mile radius (%)
Chalmette Refining LLC	Chalmette	Louisiana	2	31	43
Chevron Pascagoula	Pascagoula	Mississippi	3	11	27
CITGO Corpus Christi Refinery East Plant	Corpus Christi	Texas	1	97	50
Delek Krotz Springs	Krotz Springs	Louisiana	10	0	66
Flint Hills Resources Corpus Christi LLC, East Refinery	Corpus Christi	Texas	4	97	59
Galveston Bay Refinery	Texas City	Texas	5	67	54
HF Artesia	Artesia	New Mexico	5	71	55
HF Lovington	Lovington	New Mexico	1	n/a	n/a
Houston Refining LP	Houston	Texas	2	95	54
P66 Alliance	Belle Chase	Louisiana	2	59	42
P66 Lake Charles	Westlake	Louisiana	2	24	40
Pasadena Refinery	Pasadena	Texas	3	89	78
Philadelphia Energy Solutions	Philadelphia	Pennsylvania	23	45	66
Shell Mobile	Saraland	Alabama	7	60	64
Shell Norco Manufacturing Complex	Norco	Louisiana	4	7	24
Total Refinery	Port Arthur	Texas	11	32	18
Valero Corpus Christi East	Corpus Christi	Texas	1	91	28
Valero Corpus Christi West	Corpus Christi	Texas	2	34	34

Source: OIG analysis of refinery-reported monitoring data and demographic information from the EPA's EJScreen. (EPA OIG table)

Refineries with Missing Data

Table D-1 lists the five refineries we identified that had not submitted monitor data for at least one two-week sampling period based on our analysis of the data from January 2019 through September 2021. The table also shows the location of each refinery, the dates of the missing data, and how many two-week sampling periods the refinery was missing data for.

Table D-1: Refineries that had missing monitor data for at least one sampling period, January 2019–September 2021

Refinery	City	State	EPA region	Dates of gap	Number of sampling periods missing
Calumet Montana Refining LLC	Great Falls	Montana	8	9/29/20–10/13/20	1
ExxonMobil Billings Refinery	Billings	Montana	8	9/30/20–12/23/20	6
Lima Refining Company	Lima	Ohio	5	6/29/20–12/28/20	13
P66 Wood River Docks	Roxana	Illinois	5	5/1/19–7/09/19	5
Toledo Refining Company LLC	Oregon	Ohio	5	3/31/20–6/23/20	6

Source: OIG analysis of refinery-reported monitoring data. (EPA OIG table)

OECA's Response to Draft Report



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

June 20, 2023

MEMORANDUM

SUBJECT: Response to the Office of Inspector General Draft Report, *The EPA Should Enhance Oversight to Ensure that All Refineries Effectively Address Exceedances of the Benzene Action Level*, Project No. OA-FY22-0070, May 11, 2023

FROM: Lawrence E. Starfield, Acting Assistant Administrator

TO: Erica Hauck, Acting Director
Pollution Control and Cleanup Directorate
Office of Audit
Office of Inspector General

LAWRENCE STARFIELD
Digitally signed by
LAWRENCE STARFIELD
Date: 2023.06.20
08:47:17 -04'00'

Thank you for the opportunity to respond to the recommendations in the subject draft report. The following is our response to each of the report recommendations directed to the Office of Enforcement and Compliance Assurance (OECA), which include Recommendations 1, 2, 4, and 5. Recommendation 3 is directed to the Office of Air and Radiation (OAR). OECA, in coordination with EPA Regions 3, 5, 6, and 8, agrees in principle with Recommendations 1, 2, 4, and 5, but proposes changes to the recommendations to facilitate successful implementation. Additionally, we have attached technical comments on the draft report, which we have marked as enforcement confidential.

The first issue OECA wishes to highlight is the title. The Office of Inspector General's (OIG's) overarching recommendation is that EPA should enhance oversight to ensure refineries "effectively address exceedances." The OIG's methodology, however, does not (nor as we understand it was ever intended to) identify actual violations at any refineries named in the report or the appendices. For example, even at a refinery that has repeated two-week sampling periods with benzene concentrations over 9 ug/m³, depending on the nature and number of underlying causes and whether the monitored concentrations were the result of the same or multiple causes, the refinery's response could be compliant with the underlying regulatory requirements. As such, the OIG's emphasis on two-week sampling periods as indicative of compliance status is misleading. The title of the report suggests that exceedances are violations, when they may not be. We would like to suggest revising

the title to “*The EPA Should Enhance Oversight to Ensure that All Refineries Achieve Compliance with the Clean Air Act Benzene Fenceline Monitoring Requirements.*”

OECA also wishes to highlight and acknowledge the OIG’s efforts and coordination to minimize the amount of enforcement sensitive information in the draft report. Such efforts are appreciated. Our technical comments identify certain residual statements that raise enforcement sensitivity issues, including the OECA and Regional strategies for investigating and enforcing the benzene fenceline program, and the resources directed to enforcing the applicable regulations. Releasing this information could reduce the effectiveness of our enforcement work. The enforcement sensitive information is flagged in greater detail in the confidential attachment which we request not be released to the public.

Lastly, OECA appreciates the productive conference held on June 8 regarding this matter. The responses below reflect the topics discussed during that conference. OECA believes continued discussion would be helpful for discussing OECA’s proposed changes to the OIG’s recommendations and identifying any further refinements to the recommendations to ensure successful implementation. We welcome the opportunity to further confer with the OIG after its receipt of this response.

OIG Recommendation 1:

Provide guidance to delegated authorities on what constitutes a violation of the benzene fenceline monitoring regulations to assist the delegated authorities in taking action when a violation may have occurred. This guidance should contain EPA-developed metrics to assist the delegated authorities in identifying instances when a violation may have occurred.

OECA Response – Agree in Principle; Changes Proposed

OECA agrees in principle with this recommendation. Specifically, we agree that providing additional information about common types of violations of the benzene fenceline monitoring regulations could be helpful to delegated authorities and the regulated industry. While the legal obligations are set forth clearly in the regulatory text, we also agree that addressing the questions raised to date by regulated entities could improve compliance and assist delegated authorities with identifying and enforcing violations and facilitate more efficient compliance discussions between those parties and EPA. Therefore, we accept Recommendation 1’s overarching directive to provide additional information to delegated authorities but see value in also sharing this information with regulated entities. We believe that a good way to accomplish this is through an enforcement alert.

OECA does not agree, however, with providing delegated authorities specific metrics to assist in identifying instances when a violation may have occurred. As an initial matter, such a document that provides targeting metrics beyond reviewing the reported data would reveal sensitive enforcement strategies about how EPA evaluates and interprets that data and makes enforcement decisions. That type of information, if publicly disclosed, would inhibit effective enforcement. Additionally, metrics, such as the type, size, and location of a facility, or magnitude or frequency of action level exceedances, can end up being under and/or over inclusive of potential problems. As a result, serious problems may not be identified for long periods of time as benzene fenceline monitoring data fluctuates.

Therefore, OECA proposes changes to the recommendation to reflect the comments above:

Provide guidance in the form of an enforcement alert that will assist delegated authorities and the regulated industry in identifying violations of the benzene fenceline monitoring regulations and consolidate answers to questions raised by delegated authorities and the regulated industry.

OIG Recommendation 2

Develop an internal strategy to help ensure that refineries that fail to reduce their benzene concentrations to 9 µg/m³ or below after initially exceeding the action level reduce their benzene concentrations. The strategy should address:

- a. How, for each refinery that exceeds the action level, the Office of Enforcement and Compliance Assurance and the EPA Regions will:
 - Monitor benzene concentrations to determine whether the refinery continues to exceed 9 µg/m³ in subsequent sampling periods.
 - Verify that the refinery submits an effective corrective action plan that addresses the root cause, as needed.
- b. How the Office of Enforcement and Compliance Assurance and the EPA Regions will coordinate with delegated authorities to take action, such as sending a Clean Air Act section 114 information request, at refineries that fail to reduce benzene concentrations to 9 µg/m³ or below.
- c. What actions the Office of Enforcement and Compliance Assurance and the EPA Regions will take if the delegated authority does not take action when a violation may have occurred.

OECA RESPONSE -- Agree in Principle; Changes Proposed

OECA agrees in principle with this recommendation and agrees that OECA and the EPA Regions should have an internal strategy to address refineries that fail to reduce their fenceline benzene concentrations to 9 µg/m³ or below after initially exceeding the action level. However, we do not agree that the internal strategy should require or commit either EPA or delegated authorities to take specific actions. Rather, we believe the internal strategy should include a variety of options and approaches, using various enforcement tools as described below, to achieve compliance with the rule on a case-by-case basis whether action is taken by EPA or a delegated authority. This is because different circumstances will understandably warrant different degrees of response. A “one size fits all” approach could limit response options for both EPA and delegated authorities and take away needed flexibility to address violations. Finally, coordination with delegated authorities may need to take into account their available expertise, resources, and existing enforcement commitments including compliance monitoring commitments under the Clean Air Act Stationary Source Compliance Monitoring Strategy (CMS), which could be hindered by requiring prescriptive, specific actions.

We believe that an internal document setting forth best practices would assist both OECA and EPA Regional staff in addressing refineries that exceed the fenceline benzene concentration action level and fail to reduce benzene concentrations below that level. The internal document can provide recommendations on monitoring fenceline benzene concentration levels, verifying the receipt of corrective action plans, coordinating with delegated authorities (including during annual compliance

strategy meetings), compliance evaluations, and effectively using enforcement tools like Clean Air Act section 114 information requests. Therefore, OECA proposes changes to the recommendation, as set forth below. The proposed changes include language revisions to align the recommendation with the operative language of the regulations:

Develop an internal strategy to address refineries that fail to reduce their benzene concentrations to 9 µg/m³ or below after initially exceeding the action level. The strategy should include best practices for:

- a. Monitoring benzene concentrations to determine whether a refinery has exceeded the action level and continues to exceed 9 µg/m³ in subsequent two-week sampling periods;
- b. Verifying that the refinery submits an appropriate corrective action plan that addresses the root cause and actions.
- c. Clean Air Act section 114 information requests, inspections, and enforcement actions that can be taken at refineries that fail to undertake root cause analyses or appropriate corrective action to reduce benzene concentrations to 9 µg/m³; and,
- d. Coordination between the Office of Enforcement and Compliance Assurance, the EPA Regions, and delegated authorities.

OIG Recommendation 4

Provide guidance to the EPA Regions to periodically review all reported benzene monitoring data to identify any gaps in data for refineries.

OECA RESPONSE – Agree in Principle; Changes Proposed

OECA agrees in principle with the recommendation that EPA Regions should have a framework for identifying gaps in refinery benzene data. We wish to note that several EPA Regions and delegated authorities already routinely review reported benzene monitoring data, and several EPA offices, including OAR, participate in the review of the benzene monitoring data.

It is also important to note that any guidance to EPA Regions on how to review benzene monitoring data to identify data gaps, which are potential violations, will be enforcement sensitive and should remain in an internal document. Therefore, OECA proposes changes to this recommendation to clarify that the guidance will be an internal document:

Provide as part of the internal strategy developed in response to Recommendation 2 guidance to the EPA Regions to periodically review all reported benzene monitoring data to identify any gaps in data for refineries.

OIG Recommendation 5

In consultation with applicable EPA Regions and delegated authorities, ensure that refineries with gaps in their benzene monitoring data submit all missing data, including all OIG-identified data gaps.

OECA RESPONSE – Agree in Principle; Changes Proposed

OECA agrees in principle that EPA Regions should have a strategy and framework for securing the submission of missing benzene monitoring data. As a practical matter, however, OECA cannot

commit enforcement resources to “ensure” that refineries with gaps in their benzene monitoring data submit *all* missing data. In some instances, the data may not be available. For example, EPA Regions have determined that missing data might not be available due to extreme weather events, laboratory errors, or other circumstances that rendered the sample or sampling data unusable. This includes EPA Region 5’s investigation of missing data at the Phillips 66 Wood River Docks, which is identified in Table D-1 of the draft report. That data is unavailable because the sampling locations were flooded during the monitoring period.

Also, when data is available, EPA and delegated authorities must be able to retain the flexibility to determine in each case whether and, if so, how much time and resources should be spent on ensuring submission of all missing data. For instance, enforcement resources may be better spent, depending on the site-specific circumstances, evaluating whether corrective actions were appropriate rather than searching for data gaps where the pattern of exceedances is already understood. OECA can commit, however, to investigating the OIG-identified data gaps and can provide EPA Regions with information on best practices for investigating missing data with the aim of reducing data gaps to the extent possible in the future. We therefore recommend the following changes to the recommendation:

- In consultation with applicable Regions and delegated authorities, investigate OIG-identified benzene monitoring data gaps and ensure submission of missing data if data is available.
- Include as part of the internal strategy developed in response to Recommendation 2 a discussion of best practices for investigating missing benzene monitoring data, securing the submission of the data if it is available, and evaluating enforcement options.

PROPOSED CORRECTIVE ACTIONS

OECA agrees in principle with Recommendations 1, 2, 4, and 5. Provided the OIG agrees to OECA’s proposed changes, OECA is willing to implement, within the stated completion dates, the corrective actions proposed in the table below.

	<i>Recommendation, with OECA Proposed Changes</i>	<i>High-Level Intended Corrective Action(s)</i>	<i>Estimated Completion Dates</i>
1	Provide guidance in the form of an enforcement alert that will assist delegated authorities and the regulated industry in identifying violations of the benzene fenceline monitoring regulations and consolidate answers to questions raised by delegated authorities and the regulated industry.	OECA will develop an enforcement alert directed at both delegated authorities and the regulated industry. The alert will highlight common violations of the benzene fenceline monitoring regulations and address questions raised by delegated authorities and the regulated industry to date.	April 1, 2024

2	<p>Develop an internal strategy to address refineries that fail to reduce their benzene concentrations to 9 µg/m³ or below after initially exceeding the action level. The strategy should include best practices for:</p> <ul style="list-style-type: none"> a. Monitoring benzene concentrations to determine whether a refinery has exceeded the action level and continues to exceed 9 µg/m³ in subsequent two-week sampling periods; b. Verifying that the refinery submits an appropriate corrective action plan that addresses the root cause and actions. c. Clean Air Act section 114 information requests, inspections, and enforcement actions that can be taken at refineries that fail to undertake root cause analyses or appropriate corrective action to reduce benzene concentrations to 9 µg/m³; and, d. Coordination between the Office of Enforcement and Compliance Assurance, the EPA Regions, and delegated authorities. 	<p>OECA will develop an internal strategy identifying best practices for enforcing the benzene fenceline monitoring regulations that specifically addresses the items a-d of the recommendation.</p>	April 1, 2024
4	<p>Provide, as part of the internal strategy developed in response to Recommendation 2, internal guidance to the EPA Regions to periodically review all reported benzene monitoring data to identify any gaps in data for refineries.</p>	<p>OECA will include, as part of the internal strategy developed in response to Recommendation 2, guidance to the EPA Regions identifying best practices for enforcing resources, strategies, and best practices for periodically reviewing all reported benzene monitoring data to identify any gaps in data for refineries.</p>	April 1, 2024
5	<ul style="list-style-type: none"> • In consultation with applicable Regions and delegated authorities, investigate OIG-identified benzene monitoring data gaps and ensure submission of missing data if data is available. • Include as part of the internal strategy developed in response to Recommendation 2 a discussion of best practices for investigating missing 	<ul style="list-style-type: none"> • OECA will consult with the Regions and relevant delegated authorities, investigate or support the investigation of OIG-identified benzene monitoring data gaps, and take steps or provide support to Regions or delegated authorities taking steps to 	April 1, 2024

benzene monitoring data, securing the submission of the data if it is available, and evaluating enforcement options.

secure the submission of any data that is available but has not been submitted.

- OECA will include, as part of the internal strategy developed in response to Recommendation 2, guidance concerning the investigation of missing benzene monitoring data and securing the submission of any available data, including best practices and enforcement strategies.

The Office of Air and Radiation's Response to Draft Report



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

June 8, 2023

OFFICE OF
AIR AND RADIATION

MEMORANDUM

SUBJECT: EPA Response to Draft Report: "The EPA Should Enhance Oversight to Ensure that All Refineries Effectively Address Exceedances of the Benzene Action Level" – Project No. OA-FY22-0070, May 11, 2023

FROM: Joseph Goffinan
Principal Deputy Assistant Administrator
Office of Air and Radiation

TO: Erica Hauck, Acting Director
Pollution Control and Cleanup Directorate
Office of Audit
Office of the Inspector General

The Office of Air and Radiation (OAR) welcomes the opportunity to provide a written response to the findings and recommendations of the draft report, titled "The EPA Should Enhance Oversight to Ensure that All Refineries Effectively Address Exceedances of the Benzene Action Level." Specifically, we address one recommendation presented in the draft report.

Recommendation 3: *Review all approved site-specific monitoring plans to identify which ones rely solely on modeling, as opposed to additional monitoring, to account for near-field sources. Take appropriate steps to ensure that the site-specific monitoring plans identified are amended to incorporate additional monitoring to account for contributions to benzene concentrations from near-field sources, as required by EPA regulations.*

Response: OAR concurs with the Office of the Inspector General's (OIG) recommendation. The Office of Air Quality Planning and Standards, Sector Policies and Programs Division (OAQPS, SPPD) will review all approved site-specific monitoring plans (SSMPs) and identify all plans that rely solely on modeling, as opposed to additional monitoring, to account for offsite or onsite non-refinery source contributions to benzene concentrations. OAQPS/SPPD will take appropriate steps to

ensure that the site-specific monitoring plans identified are amended to incorporate additional monitoring to account for contributions to benzene concentrations from near-field sources. We believe three months is an appropriate period of time to allow for development of revised plans, and an additional three months following is an appropriate timeframe for EPA's review and approval of the plans.

Planned Completion Date: Six months following issuance of final OIG report.

Thank you for providing OAR the opportunity to review and provide comments on this draft OIG report. If you have any questions regarding this response, please contact Tiffany Purifoy, OAQPS/OAR Audit Liaison, at (919) 541-0878.

cc: Betsy Shaw
Grant Peacock
Peter Tsirigotis
Penny Lassiter
David Cozzie
Peter South
Juan Santiago
Tiffany Purifoy
Brenda Shine
Patrick Lessard
Gerri Garwood

Distribution

The Administrator
Deputy Administrator
Chief of Staff, Office of the Administrator
Deputy Chief of Staff for Management, Office of the Administrator
Agency Follow-Up Official (the CFO)
Assistant Administrator for Enforcement and Compliance Assurance
Assistant Administrator for Air and Radiation
Principal Deputy Assistant Administrator for Enforcement and Compliance Assurance
Principal Deputy Assistant Administrator for Air and Radiation
Deputy Assistant Administrator for Air and Radiation
Deputy Assistant Administrator for Stationary Sources, Office of Air and Radiation
Deputy Assistant Administrator for Mobile Sources, Office of Air and Radiation
Regional Administrators, Regions 1-10
Deputy Regional Administrators, Regions 1-10
Agency Follow-Up Coordinator
General Counsel
Principal Deputy General Counsel
Associate Administrator for Congressional and Intergovernmental Relations
Associate Administrator for Public Affairs
Director, Office of Continuous Improvement, Office of the Chief Financial Officer
Director, Office of Air Quality Planning and Standards, Office of Air and Radiation
Director, Office of Civil Enforcement, Office of Enforcement and Compliance Assurance
Audit Follow-Up Coordinator, Office of the Administrator
Audit Follow-Up Coordinator, Office of Air and Radiation
Audit Follow-Up Coordinator, Office of Enforcement and Compliance Assurance
Audit Liaison, Office of Air Quality Planning and Standards, Office of Air and Radiation

Errata Sheet

In the “What We Found” section of the “At a Glance” page, the second sentence was changed on September 11, 2023, to correct a typographical error that resulted in the number 18 being used instead of the number 118. The original sentence read, “For example, from January 2018 to September 2021, 13 of the 18 refineries we reviewed had benzene concentrations above the action level in 20 or more weeks after the initial exceedance” (emphasis added). The corrected sentence reads, “For example, from January 2018 to September 2021, 13 of the 118 refineries we reviewed had benzene concentrations above the action level in 20 or more weeks after the initial exceedance” (emphasis added).



Whistleblower Protection

U.S. Environmental Protection Agency

The whistleblower protection coordinator's role is to educate Agency employees about prohibitions on retaliation and employees' rights and remedies in cases of reprisal. For more information, please visit the whistleblower protection coordinator's [webpage](#).

Contact us:



Congressional Inquiries: OIG.CongressionalAffairs@epa.gov



Media Inquiries: OIG.PublicAffairs@epa.gov



EPA OIG Hotline: OIG_Hotline@epa.gov



Web: epaoig.gov

Follow us:



X (formerly Twitter): [@epaoig](https://twitter.com/epaoig)



LinkedIn: linkedin.com/company/epa-oig



YouTube: youtube.com/epaoig



Instagram: [@epa.ig.on.ig](https://www.instagram.com/epa.ig.on.ig)



www.epaoig.gov