# Interim Recommendations

## Facility Siting

December 2025

## Preface

This document presents two interim recommendations issued by the U.S. Chemical Safety and Hazard Investigation Board (CSB) based on the agency's investigation of the August 11, 2025, explosion at the U.S. Steel Clairton Coke Works facility in Clairton, Pennsylvania.

The incident fatally injured two U.S. Steel employees. Four other U.S. Steel employees and one contractor were seriously injured by the explosion, and six more workers sustained injuries that did not require inpatient hospitalization.

The CSB's investigation of this incident is ongoing. Additional background information can be found in the CSB's September 2025 Investigation Update [1].

At this time, however, the CSB has identified potentially unmitigated hazards relating to facility and building siting at the U.S. Steel Clairton Coke Works facility that need to be addressed promptly even as the CSB's investigation continues. Consequently, the CSB makes the following recommendations relating to the Clairton Coke Works facility:

### 2025-03-I-PA-R1

Conduct a siting evaluation for all occupied and potentially occupied buildings at the Clairton Coke Works facility. Utilize the guidance contained in the Center for Chemical Process Safety's *Guidelines for Evaluating Process Plant Buildings for External Explosions, Fires, and Toxic Releases*, the American Petroleum Institute's Recommended Practices 752, 753, and 756, and other industry good practice guidance documents.

### 2025-03-I-PA-R2

Using the results from the evaluation performed in **2025-03-I-PA-R1**, ensure that all documented facility siting hazards are mitigated in accordance with the guiding principles contained in the American Petroleum Institute's Recommended Practices 752, 753, and 756.

Complete findings, analyses, and additional recommendations, if appropriate, from the CSB's investigation will be detailed in the CSB's final investigation report.

## Background

- The Clairton Coke Works facility converts raw coal into coke, a carbon-rich substance used as fuel in blast furnaces for iron and steel production [2, p. 1]. The coking process occurs in equipment called coke ovens. A coke battery is a series of coke ovens connected by common walls and operated as one unit [3].
- The coking process converts coal into coke by removing tar, light oils, and other volatile compounds from the coal, known collectively as "coke oven gas" [4, pp. 2-3]. Coke oven gas is a hazardous mixture of mainly hydrogen, methane, nitrogen, and carbon monoxide, along with other trace constituents [5].
- U.S. Steel's process gathers coke oven gas generated in the ovens, sends it to a separate unit on site to process the gas, and sends the gas back to the coke oven batteries to be burned as fuel to heat the ovens.
- The August 11, 2025, incident occurred between two coke batteries called Battery 13 and Battery 14. The area between the two batteries is called the "transfer area."
- Within the transfer area, there were at least three rooms that were routinely occupied by people: two control rooms called "reversing rooms," and one room utilized as a break room.
- On the day of the incident, coke oven gas released from process piping in the Battery 13/14 transfer area. At approximately 10:47 a.m., the released coke oven gas contacted an ignition source and exploded. The explosion caused severe damage to all structures within the Battery 13/14 transfer area, including both reversing rooms and the break room (**Figure 1**).


**Figure 1**. Aerial photograph showing the aftermath of the explosion. (Credit: Allegheny County Fire Marshall, annotated by CSB)

- Both fatally injured U.S. Steel employees were in or near a reversing room at the time of the explosion. One was in the Battery 13 reversing room. The other was in the Battery 14 reversing room. One of these two fatally injured workers was propelled by the force of the explosion and was located underneath rubble by emergency responders in the roadway adjacent to the coke batteries. The other fatally injured worker was buried in debris and was found by an urban search and rescue team roughly nine hours after the explosion.

- Two of the five seriously injured workers were in the Battery 13/14 break room at the time of the explosion. Both of these workers were impacted by debris from the break room walls and ceiling. One of them suffered burns, broken ribs, broken vertebrae, and a broken tibia, and the other worker suffered explosion shrapnel to his face, burns, and broken bones in his spine, ankle, lower legs, knees, and hands. One of these two workers freed himself from the rubble, crawled out of the debris, and found help. The other worker was trapped under debris and was unable to free himself. Emergency responders located him, alive, roughly four hours after the explosion.

## Regulatory Requirements

- The U.S. Occupational Safety and Health Administration's (OSHA) Process Safety Management (PSM) standard, found at 29 C.F.R. 1910.119 [6], contains requirements for preventing or minimizing the consequences of catastrophic releases of toxic, reactive, flammable, or explosive chemicals.
- The PSM standard applies to:
    - any process containing a substance explicitly listed in Appendix A of the standard at an amount in excess of the listed threshold quantity.[a] Neither coke oven gas, nor hydrogen or methane, the two largest components of coke oven gas, are listed in Appendix A of the PSM standard [7]; and
    - any process containing 10,000 or more pounds of flammable gas or liquid.[b] Coke oven gas is a flammable gas. There are two exemptions from this mode of PSM coverage, one of which exempts "hydrocarbon fuels used solely for workplace consumption as a fuel (e.g., propane used for comfort heating, gasoline for vehicle refueling)."[c] OSHA refers to this exemption as the "fuels exemption."
- According to a 2013 OSHA Letter of Interpretation (LOI),[d] processes containing more than 10,000 pounds of coke oven gas are covered by the PSM standard [8].[e]
- The PSM standard requires that companies operating covered processes include facility siting in their Process Hazards Analyses (PHA).[f]
- U.S. Steel has stated to the CSB that it believes the process supplying coke oven gas to the coke batteries at the Clairton Coke Works facility is not covered by the PSM standard. U.S. Steel has not applied the company's process safety management program requirements to the coke oven gas supply piping.

[a] 29 C.F.R. §1910.119(a)(1)(i)

[b] 29 C.F.R. §1910.119(a)(1)(ii)

[c] 29 C.F.R. §1910.119(a)(1)(ii)(A)

[d] OSHA Letters of Interpretation are OSHA's "[explanation] of…requirements and how they apply to particular circumstances" [14]. LOIs "respond to questions posed by an employer or worker, or an issue encountered by a field inspector during a site visit. They explain how standards apply in special or unique situations not explicitly explained in the regulatory text" [15].

[e] In 1992, OSHA issued a LOI called the "King Letter." In the King Letter, OSHA wrote that coke oven gas used as fuel is included within the fuels exemption, as long as the process using coke oven gas did not also use another PSM-covered substance [13]. In 2013, OSHA issued another LOI, called the "Wilkins Letter." In the Wilkins Letter, OSHA explicitly rescinded the 1992 King Letter, stating that coke oven gas does not qualify for the fuels exemption because it does not meet the definition of "hydrocarbon," which OSHA defined as "an organic compound consisting exclusively of carbon and hydrogen" [8].

[f] 29 C.F.R. §1910.119(e)(3)(v)

## Industry Guidance

- Both the Center for Chemical Process Safety (CCPS) and the American Petroleum Institute (API) provide guidance on how to conduct facility siting evaluations.
- In its book titled *Guidelines for Evaluating Process Plant Buildings for External Explosions, Fires, and Toxic Releases,* the CCPS defines a "building siting evaluation" as "the procedures used to evaluate the hazards and establish the design criteria for new buildings and the suitability of existing buildings at their specific locations" [9, p. xviii].
- According to the CCPS, the purpose of a building siting evaluation is to "address the explosion, fire and toxic impacts to process plant buildings and occupants occurring as a result of hazards associated with operations external to the building" [9, p. 5].
- API has issued three recommended practice (RP) documents pertaining to facility siting: RP 752, RP 753, and RP 756. API RP 753 deals with portable buildings, API RP 756 deals with tents, and API RP 752 deals with new and existing process plant buildings and structures.
- API RP 752 defines a "siting evaluation" similarly to the CCPS, as "the procedures…used to site buildings/tents given their performance characteristics and the hazards at the specific location" [10, p. 4].
- Broadly, both CCPS's and API's guidance materials follow the same process:
    - Determine which buildings are in the scope of the siting evaluation by identifying buildings that are either intended for occupancy, or which experience intermittent occupancy.
    - Determine whether those buildings could be impacted by fire, explosion, or toxic hazards.
    - Perform a consequence assessment on those buildings.
    - For existing buildings, mitigate the potential consequences, and for new buildings, incorporate the consequence analysis into the building's design [9, p. 5] [10, p. 10].
- API RP 752 provides numerous examples of buildings intended for occupancy and divides such buildings into two main categories: 1) buildings with personnel assigned, and 2) buildings used for a recurring group function. API requires that such buildings *shall* be included in a siting evaluation.
- API's examples of buildings with assigned personnel include:
    - buildings that may become occupied during an emergency;
    - control rooms;
    - operator buildings, which API defines as "buildings where operators are routinely located;"
    - guard houses;
    - laboratories;
    - maintenance shops;
    - shop buildings for fabrication, welding, or equipment assembly;
    - offices; and
    - warehouses [10, p. 7].

- Examples of buildings used for recurring group functions include:
    - rooms used for breaks or meals;
    - lunchrooms;
    - change houses;
    - orientation rooms;
    - training rooms;
    - conference and meeting rooms; and
    - weather shelters [10, p. 7].

- Whether a building is intended for occupancy is one of the major considerations of API's and CCPS's facility siting guidance. Although API 752 allows companies to exclude certain buildings from the facility siting evaluation [10, pp. 8-9], it cautions companies that "the basis for a building's exclusion should consider the number and frequency of visiting personnel and the cumulative level of occupancy among all occupants" [10, p. 9]. Thus, even though a building may not be *intended* for occupancy, if it *is* occupied, even occasionally, it should be considered for inclusion in a siting evaluation.

- API advises users to mitigate facility siting hazards in accordance with the following guiding principles, which API orders from most effective to least effective:
    - Eliminate either the occupancy or the hazards by locating personnel away from process areas;
    - Reduce either the occupancy or the severity of the hazards by minimizing the use of buildings in close proximity to process areas;
    - Increase the distance between building occupants and the hazards;
    - Increase the resistance of the building to the hazards by considering and accounting for fire, explosion, and toxic hazards in a building's design; and
    - Administratively manage the occupancy [10, p. 1].

## Basis for the Recommendations

- It is widely known and well understood in the chemical process industry that explosions can damage or destroy occupied buildings, causing or failing to prevent harm to building occupants. Two of the deadliest incidents in the history of the United States chemical process industry involve explosions damaging or destroying buildings that were not designed to protect their occupants from explosions:
    - On October 23, 1989, a vapor cloud was released from process equipment at the Phillips 66 facility in Pasadena, Texas. The vapor cloud contained approximately 85,000 pounds of a mixture of ethylene, isobutane, hexene, and hydrogen. The cloud found an ignition source, exploded, and set off a chain of subsequent explosions that ultimately killed 23 people, some of which were located within buildings at the time of the explosion. In its 1990 report on the incident, OSHA concluded that "buildings containing personnel […] were not separated from process units in accordance with accepted engineering principles or designed with sufficient resistance to fire and explosion" [11].
    - On March 23, 2005, flammable hydrocarbons released from process equipment at the British Petroleum (BP) Texas City Refinery, in Texas City, Texas. The liquid hydrocarbons vaporized, contacted an ignition source, and exploded. Fifteen people were killed and 180 were injured. Among other consequences, the explosion destroyed several nearby temporary office trailers. All of the fatalities occurred in or near the temporary trailers, which were located as close as 121 feet from the release point [12].
- U.S. Steel conducted PHAs on its coke oven gas system. U.S. Steel conducted its first PHA of the system in 1998 and conducted revalidation PHAs in 2003, 2008, 2013, and 2018. However, U.S. Steel has not conducted a PHA of the coke oven gas system since 2018.
- Despite conducting PHAs on its coke oven gas systems, U.S. Steel has not evaluated facility siting. Documents from the company's 1998, 2003, and 2008 PHAs explicitly state that the teams did not consider the topic.
- The 2003 PHA team issued a recommendation to site management to conduct a facility siting study of the coke batteries. Clairton management rejected the recommendation, writing:
    - "The [coke oven gas] system is not explicitly covered by OSHA's [PSM] regulation. Accordingly, elements of PSM are selectively applied to this system as deemed necessary and appropriate by Clairton Works management. Elements applied are considered adequate to ensure employee safety and operational integrity. Therefore, management does not consider it necessary to conduct the activities as recommended[.]"
- The most recent PHA, from 2018, purports to have considered facility siting, stating that the subject was addressed "qualitatively" and that "specific discussion relative to facility siting is documented throughout the [PHA] worksheets." Other than that brief statement, however, the topic is not discussed anywhere else in the PHA documentation, and U.S. Steel has not provided any other documentation to support the PHA team's statement that the topic was addressed.

- In Battery 13/14, the coke oven gas supply piping was located underneath the 13/14 transfer area, in a congested area called the "basement." The construction of the two batteries and the transfer area was such that the rooms within the transfer area were located roughly just 10-20 feet directly above the coke oven gas supply piping, and the release point for this incident (**Figure 2**).

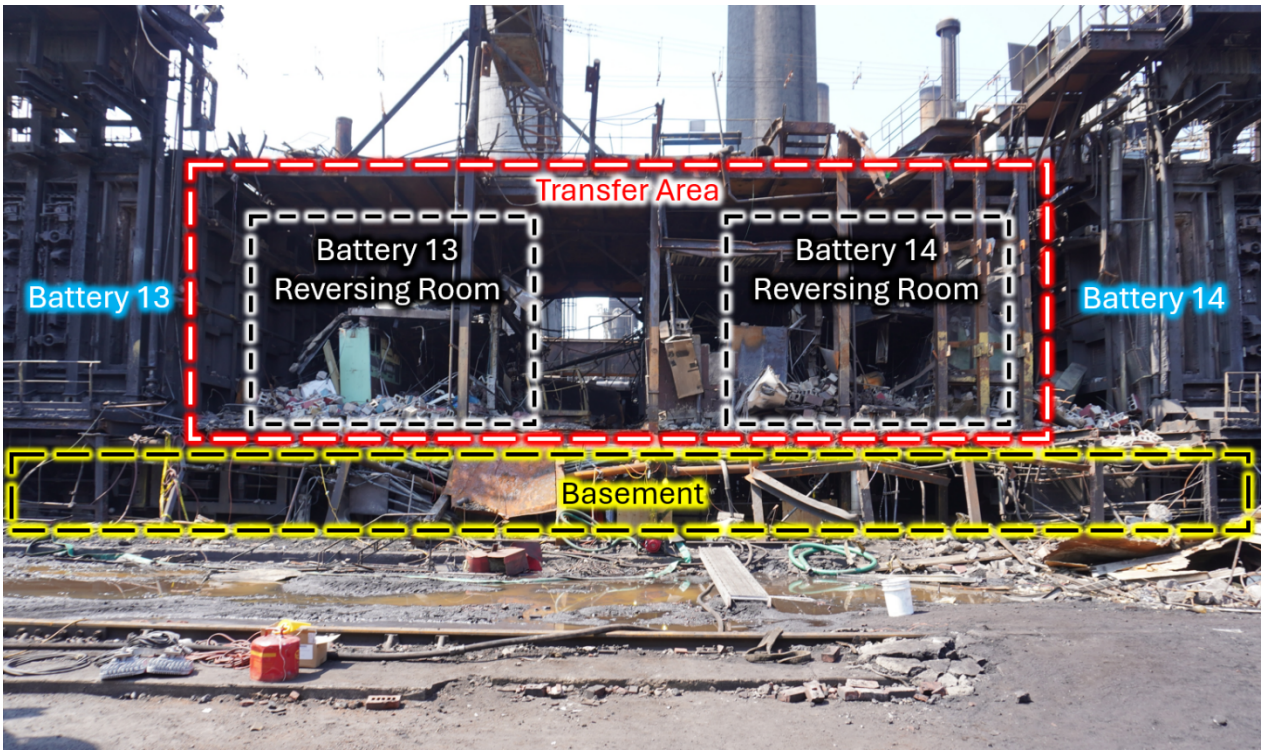


**Figure 2**. Post-incident photo showing the damage to the Battery 13/14 transfer area. Locations of the reversing rooms are approximate. (Credit: CSB)

- It is evident from the incident and its consequences that the buildings in the 13/14 transfer area could not withstand or protect their occupants from the explosion. Both fatally injured workers and two of the five seriously injured workers were located inside or near buildings in the transfer area at the time of the explosion.

- Conducting a facility siting evaluation and mitigating the hazards appropriately prior to the explosion could have reduced the severity of this incident by preventing the two fatalities and two of the five serious injuries.

- U.S. Steel currently is undertaking efforts to rebuild the facilities and equipment that were destroyed or damaged in the explosion. The company has already rebuilt the damaged Battery 13 and 14 coke oven gas supply piping in almost the same location and layout as it was prior to the explosion, with a few minor changes.

- U.S. Steel also informed the CSB that it is relocating the Battery 13/14 control rooms and the relevant personnel to a building located approximately 100 feet away from the transfer area, which the company selected because the building was not physically affected by the August 11, 2025, explosion. Additionally, the company informed the CSB that it is not rebuilding the 13/14 transfer area break room and that the company will administratively require employees to take breaks in other locations away from the 13/14 transfer area.

- U.S. Steel informed the CSB in writing that it has not conducted a building or facility siting evaluation as part of its efforts to reconstruct and/or relocate its personnel facilities.
- Without a facility siting evaluation, it is not clear that U.S. Steel has chosen a safe location to relocate its workers. That the selected building was unaffected by the August 11, 2025, explosion does not preclude the building or its occupants from being affected by a potential future explosion, fire, or toxic release.
- In addition to Batteries 13 and 14, U.S. Steel operates four other coke batteries at the Clairton facility, all of which have personnel-occupied buildings that are not blast resistant located within varying proximity to the batteries and their coke oven gas systems. Therefore, plausible and potentially unmitigated facility siting hazards may also exist within U.S. Steel's other coke battery units.
- Conducting a facility siting evaluation and mitigating the possible consequences appropriately could reduce the severity of potential future fire, explosion, or toxic release incidents at the U.S. Steel Clairton Coke Works facility.

# Recommendations

Pursuant to its enabling legislation, 42 U.S.C. §7412(r)(6), the CSB is charged with "recommending measures to reduce the likelihood or the consequences of incidental releases and proposing corrective steps to make chemical production, processing, handling and storage as safe and free from risk of injury as possible."

Board procedures authorize the development and issuance of interim safety recommendations before a final investigation report is completed.

Accordingly, the Board makes the following interim safety recommendations to the U.S. Steel Clairton Coke Works facility in Clairton, Pennsylvania:

### 2025-03-I-PA-R1

Conduct a siting evaluation for all occupied and potentially occupied buildings at the Clairton Coke Works facility. Utilize the guidance contained in the Center for Chemical Process Safety's *Guidelines for Evaluating Process Plant Buildings for External Explosions, Fires, and Toxic Releases*, the American Petroleum Institute's Recommended Practices 752, 753, and 756, and other industry good practice guidance documents.

### 2025-03-I-PA-R2

Using the results from the evaluation performed in **2025-03-I-PA-R1**, ensure that all documented facility siting hazards are mitigated in accordance with the guiding principles contained in the American Petroleum Institute's Recommended Practices 752, 753, and 756.

# References


[1] U.S. Chemical Safety and Hazard Investigation Board (CSB), *Investigation Update - Fatal Explosion at U.S. Steel Clairton Coke Works,* September 2025.

[2] H. Valia, "Coke Production for Blast Furnace Ironmaking," American Coke and Coal Chemicals Institute (ACCCI), 11 July 2021. [Online]. Available: https://accci.org/wp-content/uploads/2021/07/coke-production-for-blast-furnace-ironmaking-07-22-2021.pdf. [Accessed 21 August 2025].

[3] United States Environmental Protection Agency (EPA), "Coke Oven: Pushing, Quenching and Battery Stacks: National Emission Standards for Hazardous Air Pollutants," May 2024. [Online]. Available: https://www.epa.gov/stationary-sources-air-pollution/coke-ovens-pushing-quenching-and-battery-stacks-national-emission. [Accessed 24 August 2025].

[4] M. Platts, "The Coke Oven By-Products Plant," American Coke and Coal Chemicals Institute (ACCCI), 22 July 2021. [Online]. Available: https://accci.org/wp-content/uploads/2021/07/the-coke-oven-by-product-plant-07-22-2021.pdf. [Accessed 21 August 2025].

[5] U.S. Steel, "Cryogenically Processed COG SDS," [Online]. Available: https://www.ussteel.com/documents/40705/43680/Cryogenicaly+Processed+COG+SDS.pdf/e23d9031-07b0-b221-b2e7-624dec6cdd08?t=1603230630489. [Accessed 18 Nov 2025].

[6] U.S. National Archives and Records Administration, "eCFR :: 29 CFR 1910.119 -- Process safety management of highly hazardous chemicals," [Online]. Available: https://www.ecfr.gov/current/title-29/subtitle-B/chapter-XVII/part-1910/subpart-H/section-1910.119. [Accessed 18 Nov 2025].

[7] U.S. Occupational Safety and Health Administration (OSHA), "1910.119 Appendix A," [Online]. Available: https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.119AppA. [Accessed 18 Nov 2025].

[8] U.S. Occupational Safety and Health Administration (OSHA), "Clarification of the term "hydrocarbon" as using in the PSM standard," 4 Feb 2013. [Online]. Available: https://www.osha.gov/laws-regs/standardinterpretations/2013-02-04-0. [Accessed 18 Nov 2025].

[9] The Center for Chemical Process Safety of the American Institute of Chemical Engineers (CCPS), Guidelines for Evaluating Process Plant Buildings for External Explosions, Fires, and Toxic Releases, 2nd ed., New York, NY: Center for Chemcial Process Safety, 2012.

[10] American Petroleum Institute (API), *Recommended Practice 752 Management of Hazards Associated with Location of Process Plant Permanent Buildings,* 4th ed., 2024.

[11] U.S. Occupational Safety and Health Administration (OSHA), *A Report to the President - The Phillips 66 Company Houston Chemical Complex Explosion and Fire,* 1990.

[12] U.S. Chemical Safety and Hazard Investigation Board (CSB), *Report No. 2005-04-I-TX; Refinery Explosion and Fire,* 2007.

[13] U.S. Occupational Safety and Health Administration (OSHA), "Process Safety Management Standard," 19 Jun 1992. [Online]. Available: https://www.osha.gov/laws-regs/standardinterpretations/1992-06-19. [Accessed 18 Nov 2025].

[14] U.S. Occupational Safety and Health Administration (OSHA), "Letters of Interpretation," [Online]. Available: https://www.osha.gov/laws-regs/interpretations. [Accessed 18 Nov 2025].

[15] U.S. Occupational Safety and Health Administration (OSHA), "Laws and Regulations," [Online]. Available: https://www.osha.gov/laws-regs. [Accessed 18 Nov 2025].