Request from States for Removal of Gasoline Volatility Waiver

Technical Support Document and Cost Analysis

United States
Environmental Protection
Agency

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Assessment and Standards Division
Office of Transportation and Air Quality
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1. Overview

This document provides additional detail supporting EPA's final rule to remove the 1-psi fuel volatility waiver for E10 in Illinois, Iowa, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin (hereinafter the "petitioning states"). Section 2 provides background on how the fuel production and distribution system operates and discusses modifications to this system that are likely to be or are necessary as a result of the action. Section 3 quantifies the impacts on refinery gasoline supply and discusses fuel distribution system impacts on supply. Section 4 discusses the cost of this action and Section 5 provides analysis of potential consumer pricing impacts as a result of program cost and supply reductions. Section 6 discusses the potential benefits of this action and Section 7 discusses how the supply of gasoline may change in 2025. Finally, Section 8 discusses EPA's screening analysis evaluating the potential impacts of this action on small entities. While the Clean Air Act (CAA) does not permit EPA to consider costs and prices in its decision-making on this action, we are nevertheless providing the information as a means of informing stakeholders of the impacts of this action.

The removal of the 1-psi waiver only affects summer conventional gasoline, so the discussion in this document focuses solely on the impacts on summer conventional gasoline, primarily in the petitioning states. While reformulated gasoline (RFG) is also sold within the petitioning states, the 1-psi waiver does not apply to RFG, nor does it apply to winter gasoline. As such, there is comparatively little discussion of impacts on RFG and winter gasoline in this document.

2. Fuel Production and Distribution

A. Overview

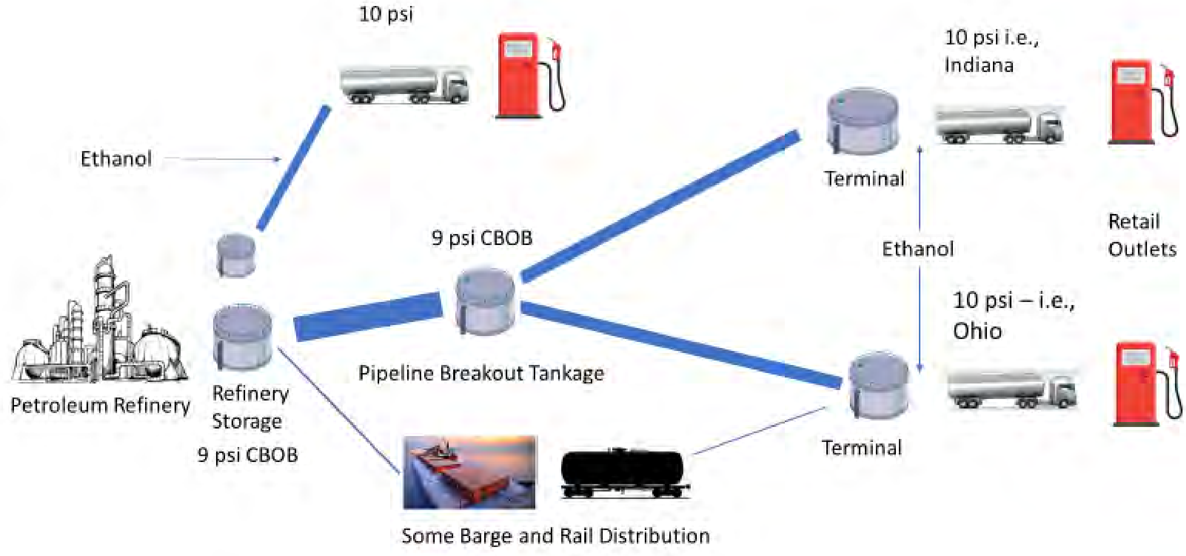
This section presents a high-level overview of how gasoline is produced and distributed in the United States, to provide background for the remainder of this document.

The petitioning states are all located in the Midwest in a refining region called Petroleum Administration for Defense District (PADD) 2. A number of adjacent non-petitioning states are also located in PADD 2, as well as PADDs 1, 3, and 4. The various U.S. refining districts are shown in Figure 2.A-1.

Figure 2.A-1: Refinery Petroleum for Defense Districts (PADDs)

Before assessing the fuel industry’s ability to supply a new lower-volatility gasoline to the petitioning states, it is important to understand how gasoline is supplied, from production to retail outlets. Figure 2.A-2 shows a simplified form of the current fuel distribution system for conventional gasoline in the petitioning states and the volatility of gasoline at various points in the system.

Figure 2.A-2: Interdependent Gasoline Production and Distribution System



The first step of this system is fuel production: petroleum refineries refine crude oil using various processing units to produce blendstocks and then blend the various blendstocks in gasoline blending tanks. Once the gasoline meets required specifications, it is certified and transported to the refinery storage tanks where it awaits scheduling through the fuel distribution system to the retail fuels market. For the most part, refiners produce "suboctane" gasoline blendstocks, which are then blended with ethanol downstream in the fuel distribution system to meet the final gasoline specifications before distribution to retail outlets.[1]

The next step is the fuel distribution system, which transports the gasoline out of the refinery. The last step of refining—storage of gasoline in dedicated tanks—is also the first step of the fuel distribution system, since the gasoline in these tanks is then transported through the fuel distribution system in batches. There are multiple ways for gasoline to be distributed from refineries to retail outlets (e.g., pipelines, barges, and even rail), but gasoline can also be distributed directly to local retail outlets off the refinery's terminal racks.

Most gasoline is transported by pipeline and the pipeline system is capable of transporting multiple fuels, including different gasoline types and grades, diesel fuel, jet fuel, and other various fuel blendstocks. When a pipeline reaches a juncture where a single pipeline branches out to two different pipelines serving different gasoline markets, a set of short-term storage tanks ("breakout tanks") are necessary to offload the fuel from the upstream pipeline to enable scheduling the various fuels through the two downstream pipelines. Pipeline systems often have many branches from the upstream to downstream pipelines to enable transporting the

[1] There are two different types of gasoline blendstocks: conventional gasoline before oxygenate blending (CBOB), which is used in conventional gasoline areas; and reformulated gasoline before oxygenate blending (RBOB), which is used in RFG areas. Additionally, there are two octane grades: regular, which is 87 octane after blending with 10% ethanol; and premium, which is 91–94 octane (generally 93 octane) after blending with 10% ethanol.

fuel to downstream markets. These breakout tanks are particularly important for the supply of different fuel types to different markets.

The next step in the fuel distribution system comprises the downstream terminals that receive the fuel from the fuel distribution system and store the gasoline. The downstream terminals are equipped with truck racks that enable tank trucks to load up with gasoline to transport the fuel to retailers for dispensing to consumers. Storage tanks located at refineries can also act as downstream terminals since gasoline stored in these tanks can be loaded at the refinery's truck racks to distribute the gasoline locally. These terminals also blend ethanol into the CBOB and RBOB to produce finished gasoline.

The final step of the fuel distribution system comprises the retail outlets (gas stations) that receive truck shipments of finished gasoline from downstream and refinery terminals.

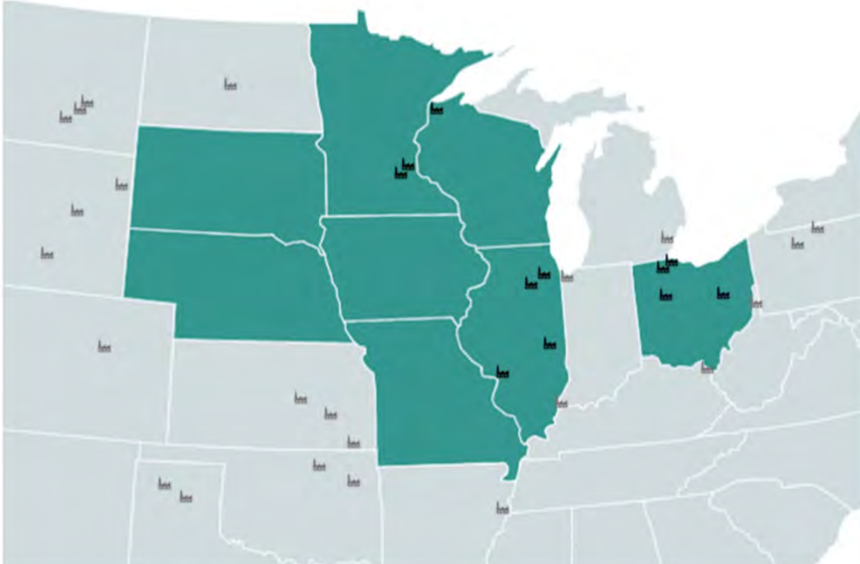
B. Refinery Actions to Control Gasoline Volatility

As a result of this rulemaking, certain refiners will need to reduce the volatility of their CBOB to produce an ~8.0 psi RVP CBOB (i.e., "low-RVP CBOB"), which when blended with ethanol, becomes a 9.0 psi RVP gasoline (i.e., "low-RVP gasoline") for the petitioning states. Today, refiners that distribute gasoline to PADD 2 produce a ~9.0 psi RVP CBOB, which becomes a 10.0 psi RVP finished gasoline once blended with 10% ethanol.[2] Thus, when the 1-psi waiver is removed for the petitioning states, certain refiners will need to produce a CBOB approximately 1.0 psi lower in RVP. Some refineries that distribute gasoline to PADD 2 also produce a 6.4 psi RVP RBOB, which becomes a 7.4 psi RVP finished RFG once blended with 10% ethanol. The RFG gasoline is sold in the Chicago-Milwaukee and St. Louis metropolitan areas in PADD 2 and is unaffected by this rulemaking.

Refineries impacted by the removal of the 1-psi wavier are those located in the petitioning states but may also include many, if not all, refineries located in states adjacent to the petitioning states. Figure 2.B-1 highlights the petitioning states and shows the location of refineries in and around the petitioning states that may be impacted by the removal of the 1-psi waiver. What is not shown in the figure are the refineries located outside this region (e.g., Gulf Coast refineries) that also produce gasoline to supply this region. We note also that 4 petitioning states (Iowa, Missouri, Nebraska, and South Dakota) do not have refineries.

[2] While refiners also produce RBOB for the Chicago-Milwaukee and St. Louis gasoline markets within the petitioning states, the production and distribution of RFG should largely be unaffected by this rulemaking.

Figure 2.B-1: Refineries Located in Petitioning and Adjacent Non-Petitioning States[3]



Refineries typically control the volatility of gasoline at three different points: (1) From the crude oil; (2) At the fluid catalytic cracker (FCC) unit and other refinery units; and (3) Through removal of light hydrocarbons that would otherwise be blended into gasoline. For refineries that utilize light and medium American Petroleum Industry (API) gravity crude oil (i.e., less viscous) that contains butanes and lighter hydrocarbons, a refinery removes such butanes and lighter hydrocarbons either by using a stabilizer unit (a type of distillation column) prior to sending the crude oil to the refinery's atmospheric crude oil distillation tower or by using the atmospheric crude oil distillation tower. A refinery running heavier, low-API gravity crude oil (i.e., more viscous) is less likely to need to remove butane from crude oil because such crude oil contains little or no butane that would need to be removed. We do not anticipate that these refineries refining very heavy crude oil would need to adjust this initial processing step to produce low-RVP CBOB.

Refineries are also able to control RVP by adjusting the product stream of their FCC unit and other refinery units that produce butane. For most refineries, the FCC unit produces a significant portion of the blendstock material needed to produce CBOB. The FCC unit converts heavy hydrocarbons into lighter products such as FCC naphtha—a major gasoline blending component—that usually has an RVP of approximately 9.0 psi. Refineries that produce gasoline blends usually also have a debutanizer that removes at least some of the butane hydrocarbon from the FCC naphtha product prior to blending the FCC naphtha into gasoline. The removed butane is then typically sent to a gas plant where a butane tower separates the various butane compounds from each other.

While the FCC unit likely provides the largest portion of butane to a refinery's gasoline pool, other units also produce butane and other light hydrocarbons that contribute to the volatility of the refinery's gasoline. The reformer—which reforms hydrocarbons into high-octane aromatic compounds—cracks some heavier hydrocarbons into smaller, more volatile hydrocarbons,

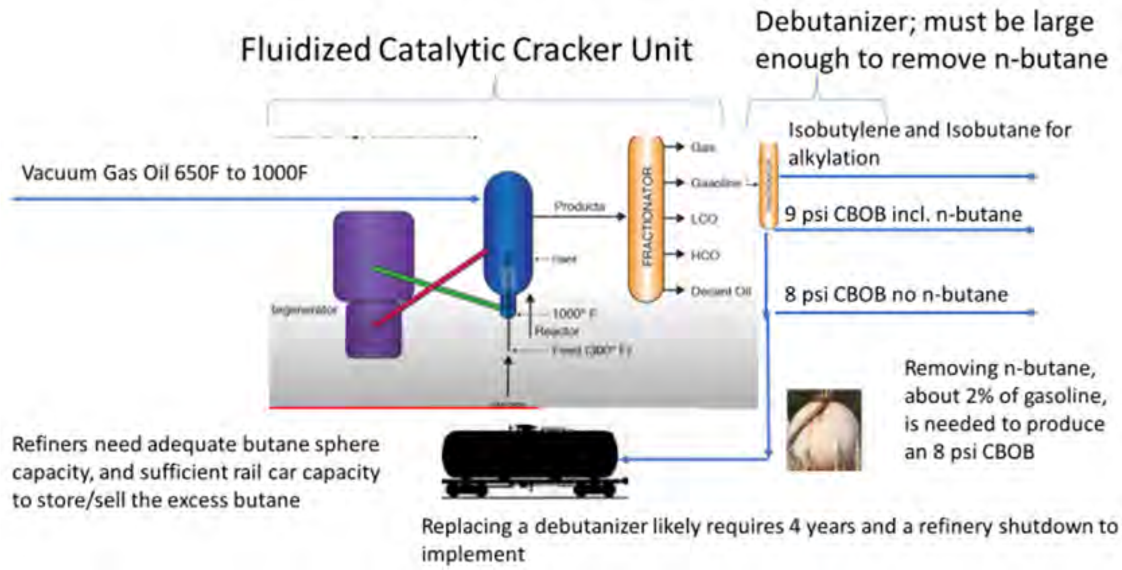
[3] Data source: EIA, Energy Infrastructure and Resources Maps, https://atlas.eia.gov/pages/energy-maps.

including butane. However, due to the widespread blending of ethanol into gasoline, refiners tend to operate their reformers at a lower severity, which contributes a smaller amount of butane and other light hydrocarbons to gasoline. Cokers and hydrocrackers, like the FCC unit, crack heavier refinery streams into lighter petroleum products such as gasoline, and therefore produce some butane and other light hydrocarbons to the gasoline pool. While most refineries do not have cokers and hydrocrackers, those that do could be faced with the need to remove the butane from more than one gasoline blendstock to allow them to produce low-RVP CBOB.

Butane is a highly volatile hydrocarbon that quickly increases the RVP of gasoline. Even if a refinery does not intend to produce low-RVP CBOB, some butane material is typically removed from the FCC naphtha to provide feedstock to an alkylation unit. Alkylation units produce alkylate, a gasoline blendstock that is low in RVP and high in octane, so making use of these units is an economical option for providing octane and producing low-RVP CBOB. Alkylation units react normal butene and iso-butylene—which are olefins or unsaturated analogs of the butane family—with isobutane to produce alkylate, the product stream of the alkylation unit. Once the olefinic and branched chain butane compounds are removed for alkylation, what is left over is normal butane (n-butane; a straight-chain variety of butane). Alkylation units do not use normal butane as feedstock material, although to upgrade it to alkylation feedstock, normal butane could be isomerized to isobutane with the addition of an isomerization unit. However, normal butane is left in the gasoline pool when refineries are producing gasoline for blending with 10% ethanol to meet a 10.0 psi RVP standard.

To meet a 1.0 psi lower RVP standard, typical refineries would need to remove more butane—mainly normal butane—to allow them to produce low-RVP CBOB. However, a refinery's ability to do so depends on the capability of its existing debutanizer column at the FCC unit, or the presence and capacity of debutanizer units at reformers, cokers, and hydrocrackers. If an existing debutanizer column has excess capacity, the refinery may only need to adjust the operation of its existing debutanizer column to enable it to remove the necessary amount of butane. On the other hand, if its debutanizer column is at or near maximum capacity, the refinery may still be able to remove the necessary amount of butane, but to do so would require it to remove some pentanes as well, causing it to remove more gasoline material than desired. If the refinery must modify one or more debutanizer columns to remove the necessary amount additional butane, it could mean replacing the distillation column with a larger, taller column, replacing the heater and associated boiler, and increasing the pumps and associated piping. We anticipate that the need for modifications could be a significant limit on the ability of some refineries to produce low-RVP CBOB since it could take two or more years for a refinery to procure and install the necessary equipment and could require a refinery maintenance shutdown to install and start up the equipment. Any shutdown, although temporary, would impact fuel supply from the refinery. Figure 2.B-2 provides a representation of the FCC unit and associated downstream units, including the debutanizer that removes butane compounds from FCC naphtha; other refinery units that also produce butane would likely have a similar configuration.

Figure 2.B-2: Volatility Control of FCC Naphtha



If refineries solely removed butane to satisfy a 1.0 psi lower RVP standard, the amount of butane needed to be removed amounts to approximately 1.7% of the gasoline. However, we believe that in removing butane, refineries will end up also removing a very small amount of pentane along with the butane. Thus, we estimate that ultimately the removal of light hydrocarbon material to produce low-RVP CBOB will result in a 2% reduction in butane and a small amount of pentane from the gasoline pool.

An additional challenge for refiners associated with removing butane is the needed outlet for the butane. Refineries that do not remove butane from gasoline prior to removal of the 1-psi waiver may not have the means to: (1) Remove butane from gasoline (which requires adequate debutanizer capacity) and separate it from the rest of the butane compounds going to the alkylation unit (which requires adequate gas plant capacity or capability); (2) Pipe the butane from the gas plant; and (3) Either store the butane or load it onto a railcar for shipment out of the refinery. Since refiners typically purchase butane for blending into winter gasoline, they likely have some equipment—including piping and railcar offloading equipment—to be able to blend butane into winter gasoline. However, this does not necessarily mean that they have the equipment needed for creating an outlet for butane from gasoline, including a butane storage tank or outlet to railcars.

Some refineries are already removing all the butane possible for their current product mix (e.g., if its product mix includes a significant amount of RFG). For them to further reduce the RVP of their product mix would require them to also remove pentanes—the next most volatile hydrocarbons—which would have a much larger impact on gasoline production. Pentanes are much lower in RVP than butane, so to achieve a 1-psi reduction in RVP would require roughly 8–10% of the gasoline pool in pentanes. For even other refineries, their feedstock supplies are so light that even removing pentanes may not be sufficient. In such situations, the refinery may have to remove light straight run naphtha (LSR)—the next most volatile hydrocarbons—with an even larger impact on gasoline production.[4] Yet another set of refineries are in a different situation but with a similar outcome wherein they may somehow have to remove large volumes of light hydrocarbons from their gasoline supply. Such refineries are currently blending in natural gas liquids (NGLs) to bring their gasoline up to the RVP limit.[5] For example, refineries processing Canadian tar sands crude oil receive NGLs along with the heavy crude oil and blend the NGLs into their gasoline up to the levels allowed by the RVP standard. Based on information provided in the Baker and O'Brien Study[6] and EPA conversations with individual refiners, these heavy crude oil refineries—some of which are located in the PADD 2—will likely need to remove some NGLs from their gasoline blending. Thus, for some specific refineries within the petitioning states, the impact on supply will likely be significantly larger than just 2%.

In addition to contributing to gasoline's volatility, butane also contributes to its octane; normal butane and isobutane have blending octane values of 92.5 and 99, respectively, higher than regular gasoline's 87 octane. Thus, when removing butane, a refinery must also make other changes to replace the lost octane to keep its product consistent with and in compliance with market gasoline specifications.

A refinery has several choices for making up the lost octane. Producing more alkylate is one possibility that would increase both octane and gasoline volume. However, the alkylation units are typically already optimized for maximum production during the summer season, so unit expansion would likely be needed to produce low-RVP CBOB. Such expansions would be expected to take several years of planning, permitting, and construction. Most refiners have spare capacity to increase the severity of their reformers to offset the octane loss associated with butane removal. Reformers convert low octane naphtha into high-octane aromatic compounds. However, this process tends to also increase the production of benzene—which is also controlled in gasoline under EPA's fuel quality regulations—so the refinery may need to add additional controls for benzene. This could also take considerable time to put in place, but in the meantime the refinery could purchase benzene reduction credits. Reformers also reduce gasoline yield, and thus, further compound the supply shortfall. Furthermore, increasing the severity of reformers would also produce more butane and other light hydrocarbons, which would further hinder the refinery in its production of low-RVP CBOB.

Alternatively, or in addition, refineries could also change how they operate their hydrocrackers, which can alter the relative refinery production of gasoline versus distillate fuel. As an alternative to replacing lost volume and octane, particularly in the short term, a refinery could choose to not make up for the reduced octane and instead produce less premium gasoline. Premium gasoline is required to meet a higher octane specification, and thus producing less premium gasoline could allow the refinery to make up for some of the loss in octane. Doing so, however, would reduce the supply of premium gasoline.

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[4] LSR has an RVP of 12–17 psi and primarily contains pentanes and hexanes.

[5] NGLs are hydrocarbons separated at natural gas processing plants where the residual liquids carried with the natural gas are separated from the methane/ethane contained in natural gas. NGLs typically purchased and used by refineries have an RVP of 12–17 psi and primarily contain pentanes and hexanes.

[6] Baker and O'Brien, "Midwest States Gasoline RVP – 1 psi Waiver Study, Report for American Fuel and Petrochemical Manufacturers," February 24, 2023. Submitted as part of comments from the American Fuel and Petrochemical Manufacturers (AFPM), Docket Item No. EPA-HQ-OAR-2022-0513-0077.

C. *Pipelines*

Petroleum pipelines allow for transportation of gasoline products throughout the U.S. and are generally a safer, more reliable, and more efficient method of transporting petroleum products from refineries to terminals compared to other modes of product movement. Figure 2.C-1 shows all pipelines transporting gasoline in the U.S., while Figure 2.C-2 shows pipelines transporting gasoline through the western Midwest, where seven of the eight petitioning states are located.

Figure 2.C-1: Map of Petroleum Pipelines in the United States[7]

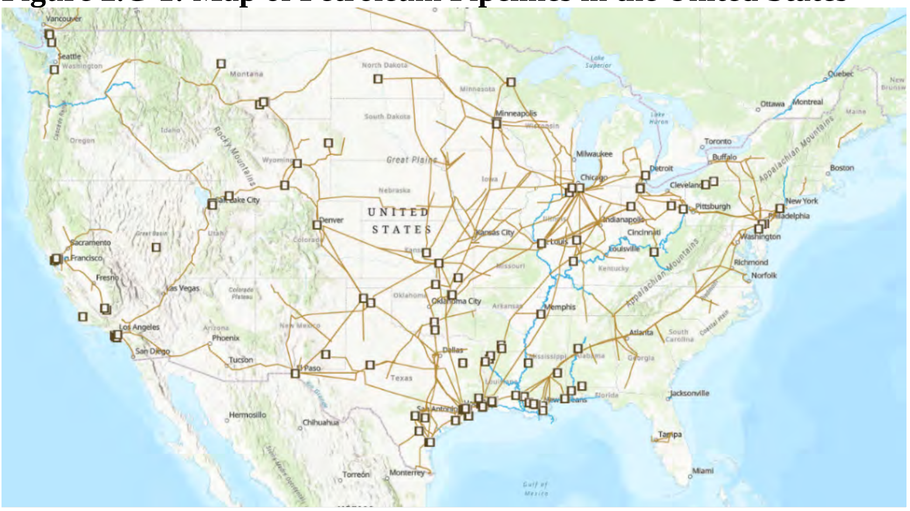
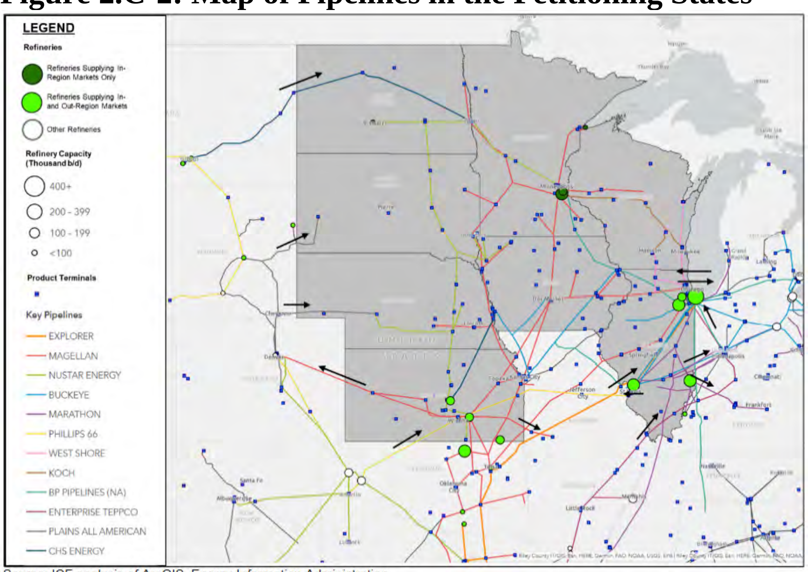


Figure 2.C-2: Map of Pipelines in the Petitioning States[8]



Source: ICF analysis of ArcGIS, Energy Information Administration

[7] Data source: EIA, Energy Infrastructure and Resources Maps, https://atlas.eia.gov/pages/energy-maps.

[8] Figure 3-2 was generated as part of ICF's report to the Renewable Fuels Association (RFA) and was completed prior to the addition of the Ohio and Missouri petitions to remove the 1-psi waiver and prior to Kansas and North

Most pipelines also have breakout tanks that allow for transferring gasoline from the pipeline to another pipeline (or other transportation means), enabling it to serve multiple gasoline markets. As shown in Figure 2.C-2, pipelines transport petroleum products through both petitioning and non-petitioning states. There are an estimated 110 breakout tank terminals located in the petitioning states, and more located outside this area that serve the petitioning states.[9] Some of these breakout tank terminals solely serve the petitioning states and could simply convert their existing gasoline breakout tanks over to low-RVP CBOB; however, other terminals provide gasoline to both petitioning and non-petitioning states. Many of the breakout tank terminals that currently serve both markets will need additional breakout tankage to supply both 9.0 psi and low-RVP CBOB.[10] Lacking this additional tankage, a pipeline will likely need to be dedicated to a single gasoline type.

Additionally, when transporting gasoline, different grades and types intersect as they are shipped through the pipelines to their final or interim destinations. The intermixing of two grades or types at the place they abut is referred to as interface. Pipeline companies attempt to sequence batches of fuel such that the interface can be blended or cut into the batch with the least stringent regulatory specifications. For example, when this interface occurs between premium and regular grade CBOBs, the interface is cut from the premium grade portion of the shipment and blended into the regular grade portion. If this is not possible, then the mixture is referred to as transmix (e.g., an interface between gasoline and diesel fuel), which must be cut out of the pipeline, stored, and then sent to refineries for reprocessing. With the addition of the new low-RVP CBOB, additional smaller batches of gasoline will now have to be shipped. The pipelines will have to reoptimize their shipment schedules to minimize the amount of downgraded product and transmix. They will likely try to schedule batches such that 9.0 psi and low-RVP CBOB abut, allowing the interface to be cut into the 9.0 psi RVP CBOB and minimize the production of transmix. Nevertheless, we expect increased downgrading of gasoline to occur, which will reduce the supply of low-RVP CBOB and increase the supply of 9.0 psi RVP CBOB.

D. Terminals

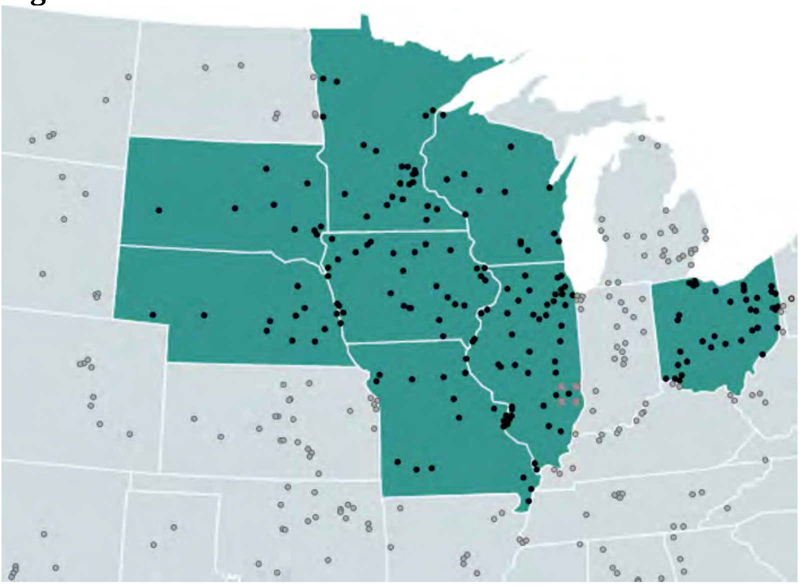
Refined product terminals take receipt of motor vehicle fuels (mostly from pipelines, but also from barges, railcars, ships, etc.), store them, and then dispense them to tank trucks that deliver the fuels to the ultimate consumers, mainly through retail outlets. There are an estimated 250 large gasoline refined product terminals in the petitioning states, each with a storage capacity of at least 50,000 barrels. There are likely another 100 or so smaller fuels storage/transfer facilities—often referred to as bulk plants—that serve more sparsely populated areas. Figure 2.D-1 shows the location of refined product terminals in and around the petitioning states.

Dakota rescinding their petitions. ICF, "Impact of Potential 8-State RVP Waiver Exclusion on Midwest Gasoline Markets," prepared for the Renewable Fuels Association, September 2022 (hereinafter the "2022 ICF Report").

[9] U.S. Department of Transportation, "National Map of pipeline breakout tanks," National Pipeline Mapping System.

[10] See, e.g., Baker and O'Brien Study; Magellan Midstream Partners, "Petition to Delay the Elimination of the 1 psi RVP Waiver for E10 during the Summer Months – Insufficient Supply of Gasoline," September 16, 2022; Magellan Midstream Partners, "Petition to Delay the Elimination of the 1 psi RVP Waiver for E10 Until the Summer of 2025 – Insufficient Supply of Gasoline," August 18, 2023.

Figure 2.D-1: Terminals Located in and Around the Petitioning States[11]



Refined product terminals generally have installed the number of fuel storage tanks needed to serve their local fuels market. If a new fuel must be distributed through the terminal in addition to the existing fuels already being serviced, the terminal will often not have additional tankage available and would likely need to install a new product storage tank(s) to facilitate the distribution of the new fuel. This is likely to be the case for terminals that are located near the border of petitioning and non-petitioning states and serve markets in both types of states, particularly in less-populated areas. In the case where a medium or large city is located near a border between a petitioning and non-petitioning state, and the city is served by multiple terminals, the various terminals may be able to choose between 9.0 psi and low-RVP CBOB in a way that can efficiently distribute both gasoline types.

When a tank needs to be taken out of service for inspection or repair, some refined product terminals have extra tankage or adjustability with regard to how they operate their existing tanks in order to remain in operation. This is likely the case at larger terminals, as smaller outlying terminals likely have less tankage and support a larger area. In these cases, a terminal could decide to use this flexibility in tank usage to provide some supply of low-RVP CBOB as a short-term solution. However, there would likely only be enough tankage to supply a single grade of low-RVP CBOB at the terminal (i.e., regular grade low-RVP CBOB), leaving premium grade low-RVP CBOB still in short supply. Use of this flexibility would also put the terminal at risk of a supply shortage should a tank need to be taken out of service during the summer season. Although most terminals likely do not have sufficient spare tankage to handle both regular and premium grade low-RVP CBOB in addition to their current gasoline slate, some terminals located in or near former 7.8 psi RVP areas may have had additional tankage that could be utilized.[12]

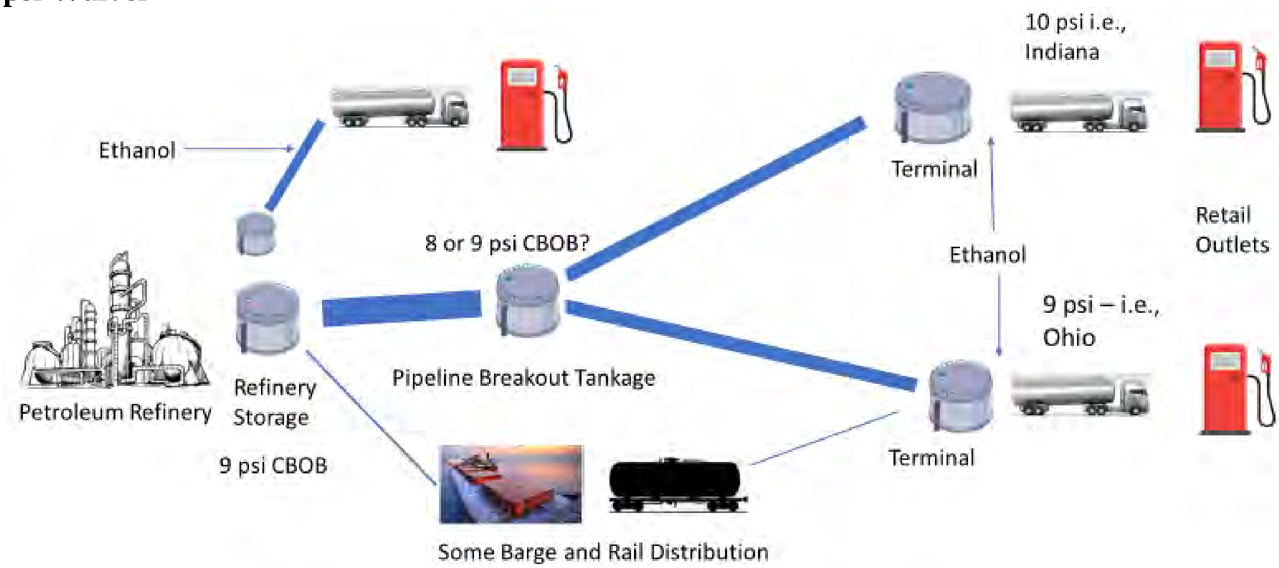
[11] Data source: EIA, Energy Infrastructure and Resources Maps, https://atlas.eia.gov/pages/energy-maps.
[12] See Section 3.A for a list of such former 7.8 psi RVP areas.

3. Evaluating the Supply of Gasoline

A. Assessing the Refining Industry's Ability to Supply Low-RVP Gasoline

To explain how the integrated fuel production and distribution system will need to adjust to the removal of the 1-psi waiver in the petitioning states, it is helpful to lay out a particular example. Figure 3.A-1 shows the conditions required after the removal of the 1-psi waiver and assuming that a pipeline is serving gasoline markets in both Ohio and Indiana. Although we use Ohio and Indiana as an example of petitioning and non-petitioning states, any other adjacent pair of a petitioning and non-petitioning state would suffice. Without the 1-psi waiver, gasoline in Ohio must meet a 9.0 psi RVP standard, while the 1-psi waiver for Indiana remains unchanged, allowing 10.0 psi RVP gasoline to continue to be sold in Indiana.

Figure 3.A-1: Integrated Fuel Production and Distribution System After Removal of the 1-psi Waiver



To continue to serve the gasoline markets in both states, both gasoline types must be accommodated in production and throughout the fuel distribution system. This will require, for example, separate gasoline storage tanks at refineries and pipeline breakout terminals for each fuel type (i.e., 9.0 psi and low-RVP CBOB) and each fuel grade (i.e., regular and premium).

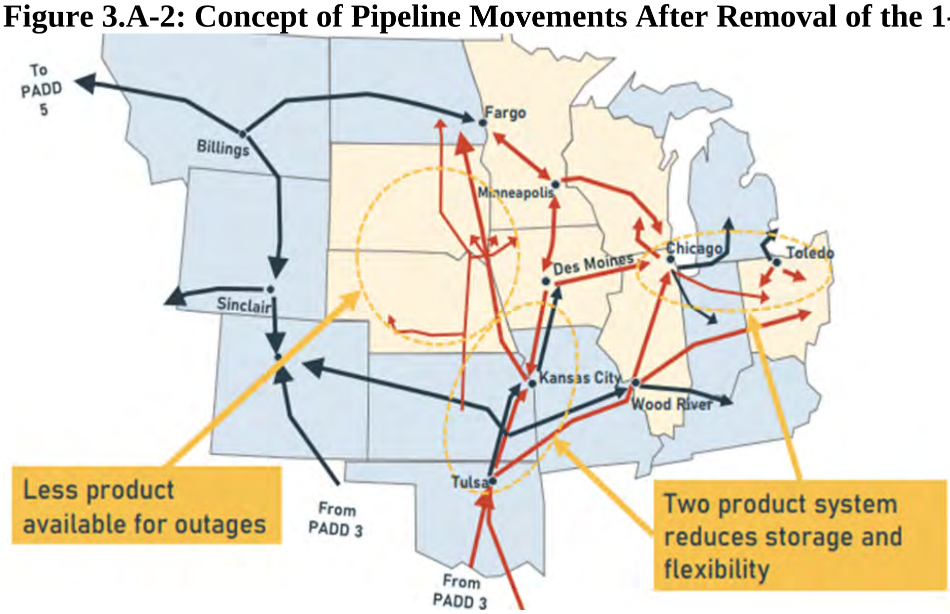
Up to this point, we have shown how the fuel distribution system could provide both 10.0 psi and low-RVP gasoline to PADD 2 markets. However, most of the current fuel production and distribution system in and adjacent to PADD 2 was designed and optimized around a single 9.0 psi RVP CBOB with the 1-psi wavier throughout PADD 2.[13] Therefore, many of the refined product terminals currently serving both petitioning and non-petitioning states depicted in Figure 3.A-1—including pipeline breakout terminals and downstream product terminals—may not be capable of handling the production and distribution of another gasoline type. We received comments on the proposed rule that most of the gasoline storage facilities at pipeline breakout

[13] The system also produces and distributes RFG and some boutique fuels for certain PADD 2 markets.

terminals and refined product terminals are not immediately capable to supply both fuel types.[14] Thus, in Figure 3.A-1, if a pipeline cannot distribute two gasoline types due to the lack of spare tankage at its breakout terminal, it would have to provide low-RVP CBOB to both Indiana and Ohio. Because of that limitation, a refinery would also be limited to only providing low-RVP CBOB to the pipeline, increasing the volume of low-RVP CBOB that needs to be produced and its associated impact on production volume. The refinery, however, may be able to provide 10.0 psi RVP gasoline off its own terminal rack if it has a second set of tanks for its terminal rack. Alternatively, it could also provide 9.0 psi RVP CBOB to the pipeline and low-RVP gasoline off its terminal rack.

The Baker and O'Brien Study proposed a way that the refining and the pipeline systems could function in the near term after removal of the 1-psi waiver in the petitioning states. As capital investments such as tank construction are unavailable for a short-term rollout, many pipelines will likely need to dedicate their assets to distribute either 9.0 psi or low-RVP CBOB. Figure 3.A-2 shows an example of how pipelines could manage distribution of both 9.0 psi and low-RVP CBOB within its constraints. It also highlights the circumstances that arise with such a system, including the parts of the fuel production and distribution system that could experience supply issues should an unexpected outage occur.

Figure 3.A-2: Concept of Pipeline Movements After Removal of the 1-psi Waiver[15]



As shown in Figure 3.A-2, areas in western South Dakota and western Nebraska are not depicted as having access to a major pipeline for providing low-RVP CBOB under this concept. However, as shown in the more detailed pipeline map in Figure 2.C-2, there are short segments of pipelines supplying these areas. These pipelines are shown in Figure 3.A-2 as being supplied out of Colorado and Wyoming and are indicated as being dedicated to distributing 9.0 psi RVP

[14] The Baker and O'Brien Study included a survey of downstream terminals that revealed that terminals in non-petitioning states do not have the spare tankage required to receive, store, and distribute a second gasoline type.
[15] Source: Baker and O'Brien Study. Red lines are movements of low-RVP CBOB and black lines are movements of 9.0 psi RVP CBOB.

CBOB. If in fact these pipelines cannot also distribute low-RVP CBOB, the supply of low-RVP CBOB into western South Dakota and western Nebraska would either have to be trucked in, or the pipeline (or a portion thereof) would have to converted to low-RVP CBOB, causing at least parts of Colorado and Wyoming to have to use low-RVP CBOB, increasing the volume of low-RVP CBOB that would need to be produced and its associated impact on production volume. Additionally, the conversion of the Denver area from a 7.8 psi RVP gasoline area to RFG starting in 2024 will create a greater challenge to providing gasoline to western South Dakota and western Nebraska.[16]

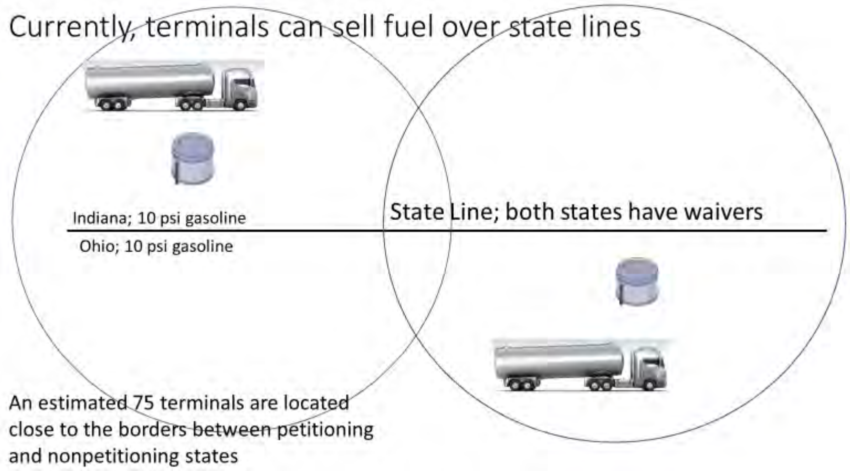
Similarly, while northern Minnesota retail outlets currently lack direct pipeline access for gasoline, they are supplied with some gasoline from Fargo, which receives gasoline via pipeline from the west (i.e., Montana). Figure 3.A-2 shows that Fargo would be serviced with a dedicated 9.0 psi RVP CBOB pipeline. With this loss of supply to the region, gasoline would need to be supplied from another source, such as the two refineries in the Minneapolis region, although that would take gasoline away from the areas to the south that they currently supply. The gasoline supply to Minnesota is further complicated by the closure of a products pipeline that brings gasoline in from the southwest.[17]

If a refinery that supplies low-RVP CBOB has an unexpected shutdown during the summer season, both petitioning and non-petitioning states that are supplied by the refinery would be more likely see the impacts of the lost supply, as it is more difficult to resupply than if the gasoline in the region is fungible.

In certain situations, downstream terminals may also be impacted by the removal of the 1-psi waiver, which will affect gasoline supply. While a terminal that solely distributes gasoline to either petitioning or non-petitioning states will likely continue its current practice of simply selling the gasoline it receives, a terminal located near the border of a petitioning and non-petitioning state may end up in a more challenging situation. Such terminals likely serve gasoline markets in both states because it is the most efficient way to distribute gasoline to the markets in both states—it minimizes the travel distance from the terminal to retail outlet and requires fewer tank trucks and tank truck drivers. As an example, we consider terminals located near the border of Indiana and Ohio. Figure 3.A-3 shows how these terminals can provide the same gasoline type to both states prior to the removal of the 1-psi waiver.

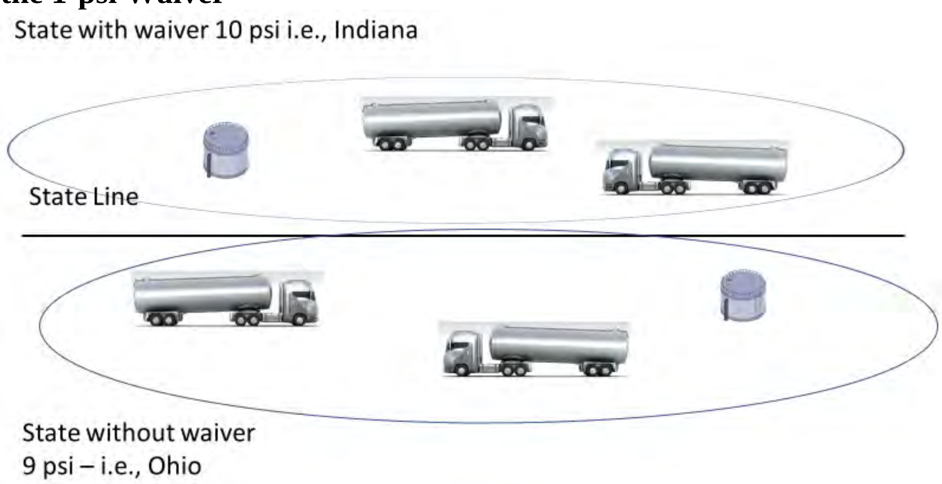
[16] 87 FR 60926 (October 7, 2022).
[17] Pipeline County Star, "Pipeline running through Pipestone County to be decommissioned," May 5, 2022, https://www.pipestonestar.com/articles/pipeline-running-through-pipestone-county-to-be-decommissioned.

Figure 3.A-3: Gasoline Distribution From Terminals Near State Borders Prior to Removal of the 1-psi Waiver



If a terminal near the border of a petitioning and non-petitioning state does not have extra tanks to accommodate the addition of low-RVP gasoline, it will likely have to adjust its distribution area to serve either one state or the other, but this is still challenging. Again, we consider the example of terminals located near the border of Indiana and Ohio. Figure 3.A-4 shows how such terminals that do not have spare tankage to distribute both 10.0 psi and low-RVP gasoline would need to choose to sell only one type of gasoline after the removal of the 1-psi waiver in Ohio.

Figure 3.A-4: Gasoline Distribution From Terminals Near State Borders After Removal of the 1-psi Waiver



In this case, if the terminal located in Indiana primarily served the Indiana gasoline market prior to the removal of the 1-psi waiver, we expect it would continue to sell only 10.0 psi RVP gasoline even after the removal of the 1-psi waiver in Ohio, such that the terminal would be limited to distributing its gasoline only to retailers in Indiana. In this case, another terminal would need to pick up distributing low-RVP gasoline to the retailers in Ohio. However, compared to Figure 3.A-3, the distribution of gasoline in Figure 3.A-4 would be less efficient and thus more costly (in both states) because the gasoline would need to be distributed over longer distances. We expect that either more tank trucks would be needed, or the existing tank trucks would need to be used more often (i.e., more and longer trips per day) to cover the further distances that gasoline would need to be distributed. Either way, more drivers and probably more trucks would be needed to transport the gasoline longer distances, which would require some time to put into place. Note that while the terminal in Indiana could not distribute its gasoline into Ohio, the terminal in Ohio could distribute its gasoline into Indiana since the low-RVP gasoline would meet the 10.0 psi RVP standard in Indiana, which could mitigate some of the gasoline distribution challenges near these terminals.

We also believe that at least some downstream terminals may have spare tankage that would allow those terminals to store another gasoline type. There have been previous lower RVP and RFG programs in PADD 2 that required refiners and fuel distributors to provide gasoline types other than 10.0 psi RVP gasoline (i.e., 9.0 psi RVP CBOB). In recent years, a number of these programs have been eliminated, as listed below. However, the capabilities that allowed these additional fuel types to be produced and distributed may still be available in some locations to provide some flexibility to produce and distribute both 9.0 psi and low-RVP CBOB.

In petitioning states:

- *Missouri*
  - On March 12, 2021, EPA published a final rule (86 FR 14007) that removed Missouri's 7.0 psi RVP standard that applied to 3 counties in the Missouri portion of the Kansas City, KS-MO area from the approved SIP. The final rule was effective on April 12, 2021.
- *Ohio*
  - On April 7, 2017, EPA published a final rule (82 FR 16932) that removed Ohio's 7.8 psi RVP standard that applied to 8 counties in the Cincinnati and Dayton areas from the approved SIP. The final rule was effective on April 7, 2017.

In adjacent non-petitioning states:

- *Kansas*
  - On March 12, 2021, EPA published a final rule (86 FR 14000) that removed Kansas' 7.0 psi RVP standard that applied to 2 counties in the Kansas portion of the Kansas City, KS-MO area from the approved SIP. The final rule was effective on April 12, 2021.
- *Kentucky*
  - On May 15, 2018, EPA approved an opt-out petition (83 FR 22593) that removed the RFG requirement for 3 counties in the Kentucky portion of the Cincinnati-Hamilton, Ohio-Kentucky-Indiana maintenance area for the 2008 ozone NAAQS (Northern Kentucky Area). The opt-out was effective on July 1, 2018.
- *Tennessee*
  - On June 7, 2017, EPA published a final rule (82 FR 26354) that removed the 7.8 psi federal RVP standard in 5 counties in the Middle Tennessee area (Nashville). The final rule was effective on June 7, 2017.

- On December 22, 2017, EPA published a final rule (82 FR 60675) that removed the 7.8 psi federal RVP standard for 1 county in the Memphis area. The final rule was effective on January 22, 2018.

To minimize the cost and other impacts to enable production and distribution of low-RVP CBOB, refiners and fuel distributors will need time to make capital investments to optimize the refinery and fuel distribution system to enable replacing the gasoline solely in the petitioning states with low-RVP gasoline. We expect that fuel distributors will need approximately two years to finance, design, permit, and construct additional tankage and put it into service to efficiently distribute low-RVP gasoline solely to the petitioning states. Neither the implementation schedule requested by the petitioning states (summer of 2023) nor the summer of 2024 provide that amount of lead time.

Several refiners stated in their comments that the removal of the 1-psi waiver in the petitioning states should be delayed until at least the summer of 2025 to allow for sufficient lead time. Smaller projects (e.g., adjusting piping and pumps) could potentially be completed in less than a year with minimal operations interruptions, which could help reduce supply losses on the margin (e.g., moving more butane to storage that was previously inaccessible, allowing for shipment and storage offsite if needed). However, many refineries will require more significant capital projects to offset or at least minimize the supply losses. Refiners estimate that a major capital construction project (e.g., new tankage) requires at least 2 years to complete.[18] With this timeline in mind, implementing these types of major projects cannot be completed ahead of the summer of 2024, but could be finished in time for the summer of 2025 if the investment process has already begun. However, with the uncertainty in the final implementation date of the removal of the 1-psi waiver, most refineries have expressed difficulty in obtaining financing for these types of investments. These refineries are looking at a much tighter construction window and may not have their projects completed before the summer of 2025, particularly if the projects are of sufficient scale to require a refinery shutdown for the work to occur (e.g., re-traying or converting the debutanizer to packing). Some refineries may not be able to make such large, more complex modifications until their next regularly scheduled full refinery maintenance shutdown, although, depending on their size and scope, some projects (e.g., debutanizer debottlenecking) may only require a partial refinery shutdown.

The total amount of time needed to invest in, put in place, and make operational new capital investments is not the only factor affecting refiners' and fuel distributors' ability or desire to put in place new capital investments in time. The lack of a firm effective date for the removal of the 1-psi waiver is another factor. The CAA prescribes the effective date of the removal of the 1-psi waiver for E10 and allows EPA to extend that date by a year upon a determination of insufficient gasoline supply. That extension can then be renewed in additional one-year increments. This allowance creates uncertainty in the ultimate effective date of the removal of the 1-psi waiver, thereby limiting refiners' and fuel distributors' ability to plan for investments that take more than a year to implement.

In their comments, refiners expressed concern that if they invest in upgrades to enable production of low-RVP CBOB, two different actions could occur that could strand their capital

[18] Petition from HF Sinclair (November 15, 2023).

investments. The first action would be Congress promulgating legislation to extend the 1-psi waiver to E15, which they assert would allow E15 to be produced using the same CBOB currently produced for E10.[19] The second action would be where a Governor requests that the 1-psi waiver for E10 be reinstated after the rule is finalized.[20] The commenters further suggested that price spikes or spot shortages could be reasons for such a request to reinstate the 1-psi waiver. If refiners and fuel distributors are concerned that any capital investments could be stranded, they are less likely to invest in them even if they have sufficient time to plan for such investments.

Due to the lack of detailed information on every component of the fuel production and distribution system in PADD 2—and the resulting significant uncertainty—it is not possible to conduct a detailed assessment of the extent that non-petitioning states would use low-RVP gasoline instead of 10.0 psi RVP gasoline. Various uncertainties include:

- **Refineries**
    - Which refineries have sufficient butane removal equipment and the ability to store the butane or move it out of the refinery. These are likely the refineries that can produce low-RVP CBOB at a lower cost and with only a 2% loss of gasoline production.
    - Which refineries would need to remove less-volatile hydrocarbons at a much higher cost and a greater loss of gasoline volume, and if the refinery can remove at least some butane in addition to less-volatile hydrocarbons, what proportion of that is butane.
    - Which refineries have extra gasoline blending/storage tanks or other tankage that could be switched into gasoline service, which would allow them to produce both 9.0 psi and low-RVP CBOB.
    - What gasoline distribution options each refinery has access to—for example, what portion of its gasoline can it sell off its terminal rack versus other downstream distribution means (e.g., pipeline, barge, railcar).

- **Gasoline Distribution (Including Pipelines, Barges, Railcar and Tank Truck)**
    - Which breakout terminals have extra gasoline blending/storage tanks or other tankage that could be switched into gasoline service, which would allow the pipelines to transport both 9.0 psi and low-RVP CBOB.
    - For pipelines that are unable to transport both 9.0 psi and low-RVP CBOB, are there any other options, or would the entire downstream market need to convert to low-RVP gasoline.
    - Which pipelines (or segments thereof) would not be able to transport both 9.0 psi and low-RVP CBOB, and how much would it affect the sale of low-RVP gasoline in non-petitioning states.
    - What capacity exists to rely on barges, railcars and tank trucks—in lieu of pipelines—to move gasoline into either the petitioning or non-petitioning states,

[19] See, e.g., Senate Bill 2707, Nationwide Consumer and Fuel Retailer Choice Act of 2023.
[20] Indeed, we have provided such a regulatory provision in this action at 40 CFR 1090.297. Additionally, we have had several governors rescind their petitions for removal of the 1-psi waiver prior to this final action.

and the ability for those alternative transportation means to respond once a gasoline supply issue becomes apparent.

- **Terminals**
  - How many terminals serve both petitioning and non-petitioning states and what portion of the gasoline they distribute is currently distributed to either state.
  - Which terminals have extra gasoline blending/storage tanks or other tankage that could be switched into gasoline service, which would allow them to distribute both 10.0 psi and low-RVP gasoline.
  - How many terminals located near the border of petitioning and non-petitioning states have the storage capacity to receive and distribute both 10.0 psi and low-RVP gasoline.
  - How many terminals have access to alternative gasoline distribution means (e.g., railcar, barge) if the pipeline they currently rely on is limited in the type of gasoline it can distribute.
  - Whether there would be sufficient availability of additional tank trucks and drivers in the case of terminals without spare tankage need to distribute gasoline further distances.

It is clear from the above examples that the fuel production and distribution system will need to sort out which refineries will supply low-RVP gasoline and how it will be moved to various markets in the petitioning states while still supplying 10.0 psi RVP gasoline to non-petitioning states. Ideally this sorting out would occur as contracts are established for supplying different gasoline markets in advance of the summer season. It is unlikely, however, that the supply of low-RVP gasoline to every single gasoline market in the petitioning states can be sorted out in advance. If the supply of low-RVP gasoline is insufficient to any gasoline market and causes the drawing down of its gasoline inventories, the price of gasoline will increase in that market and the fuel distribution system will respond to the higher gasoline prices by moving more gasoline into that market. In cases of refinery outages today, it is this pricing mechanism that causes the fuel distribution system to move gasoline from different markets to fill the void left by the refinery outage.

After considering the capacity constraints of the fuel production and distribution system, it is clear that some amount of low-RVP gasoline—potentially a significant amount—will need to be supplied to at least part of the area of the non-petitioning states immediately adjacent to the petitioning states. Although selling low-RVP gasoline in non-petitioning states will significantly increase the volume of low-RVP gasoline needed to be produced and distributed to satisfy demand, it will dramatically ease the burdens on the fuel distribution system and reduce the chance for supply issues. Over time, the fuel production and distribution system will invest in the necessary capital to optimize fuel production and distribution to more efficiently target low-RVP gasoline solely to the petitioning states. In the next section we estimate the volumetric supply impact of producing and distributing low-RVP gasoline and provide an estimate of the amount of gasoline in non-petitioning states that could be impacted.

B. Impact of the Action on Supply-Demand Balance

Estimating the reduction in gasoline supply after the removal of the 1-psi waiver is challenging. There are two principal components: (1) The amount of the reduction in gasoline supply by the refiners producing low-RVP CBOB; and (2) The amount of gasoline—including gasoline used in non-petitioning states—that will be low-RVP gasoline. Although our evaluation of insufficient supply described in the preamble is solely concerned with the supply of gasoline in the petitioning states, we are still interested in the other impacts of the removal of the 1-psi waiver, including gasoline supply impacts in non-petitioning states. This concern is because as more light hydrocarbons are removed from the PADD 2 gasoline pool, it further decreases the quantity of gasoline available in PADD 2, including the petitioning states.

As discussed in Section 2.B, we identified two different means for refiners to produce low-RVP CBOB. The first is by solely removing butane, which is the most desirable way because it results in only a 2% loss in gasoline production. The second, less-desirable way to produce low-RVP CBOB is to remove somewhat less-volatile hydrocarbons (e.g., pentanes, LSR or NGLs). However, because of the lower volatility of these hydrocarbons relative to butane, as much as 10% of these hydrocarbons would have to be removed to achieve the same 1-psi reduction in RVP. The refineries that fall into this second category are those that may not have the ability to remove or store all the butane in their gasoline, as well as refineries that refine heavy crude oil and therefore rely on these less-volatile hydrocarbons to blend their gasoline up to the RVP limit.

To estimate the impact on gasoline supply, it is necessary to estimate what portion of refinery gasoline production would achieve the 1-psi reduction in RVP by removal of butane versus by removal of the less-volatile hydrocarbons. We began by reviewing the information provided in the Baker and O'Brien Study and in conversations with individual refiners. The Baker and O'Brien Study included a survey indicating that 30% of refineries would have difficulty producing low-RVP CBOB, to the point that these refineries may need to reduce their crude oil throughput volume in order to produce low-RVP CBOB. This would reduce not only gasoline supply, but also the supply of diesel fuel, jet fuel, and other refined products. However, in our discussions with some refiners, they stated that the challenges they would face in producing low-RVP CBOB would result in a much larger decrease in gasoline production than if they only needed to reduce butane content in their gasoline, but none said that they would need to reduce crude oil throughput volume at their refineries.

Because of the higher supply impact and associated higher cost compared to refineries that can produce low-RVP CBOB by solely removing butane, some of these refineries may want to continue producing 9.0 psi RVP CBOB to sell in non-petitioning states. If a refinery has separate tankage to allow this, it could sell one gasoline type to a pipeline (e.g., low-RVP CBOB) and the other gasoline type off its terminal racks (e.g., 10.0 psi RVP gasoline). However, some of these refineries are located in petitioning states and may not be able to easily sell their gasoline in non-petitioning states, so they may need to find a way to produce low-RVP CBOB despite its much larger impact on gasoline production and higher cost.

The Baker and O'Brien Study listed several ways that a refinery could reduce the RVP of its gasoline to help reduce the loss of gasoline supply, to which we added additional ideas. These include:

- If the refinery is isomerizing its LSR to increase the RVP and octane of the LSR, it could stop isomerizing the LSR. To make up for the resulting loss in octane, the refinery could run its reformers at a higher severity, which would produce more aromatics that are lower in RVP, but also produce more light hydrocarbons from the cracking reactions.
- Although refineries already tend to send their heavy gasoline swing cuts to gasoline during the summer, if the refinery is still sending either the heavy straight run naphtha or heavy FCC naphtha to distillate, it could move these streams back to gasoline. This would increase the volume of low-RVP gasoline blendstocks, thereby lowering the overall RVP of the refinery's gasoline pool and making up for any loss of gasoline volume by removing any high-RVP gasoline blendstocks.
- The refinery could refine a somewhat heavier crude oil slate, which would help to reduce the low-RVP material the refinery produces. However, this option is often limited by the refinery configuration and doing so could cause a reduction in refinery's gasoline and diesel fuel production.
- The refinery could purchase some heavy gasoline blendstock material (e.g., heavy FCC naphtha, heavy reformate, or alkylate) to blend into its gasoline, which would lower the RVP of the refinery's gasoline pool.

While the reduction in gasoline volume based solely on butane removal is easily calculatable, the impact for these other refineries facing a larger gasoline loss is more difficult to estimate. Each of these refineries is configured differently and the necessary data to calculate their gasoline loss is not publicly available. Aside from not knowing which refineries can take advantage of the options from the above list, there are two critical pieces information that would allow us to better quantify the impacts:

(1) Does the refinery have the butane removal and storage/export capacity to allow it to produce low-RVP CBOB by solely removing butane, and for those refineries that cannot, what RVP level is achievable by solely removing butane?

(2) Does the refinery have the blending/storage tank capacity to produce a different gasoline type to sell off its terminal rack (e.g., 10.0 psi RVP gasoline) compared to the gasoline it sends to a pipeline (e.g., low-RVP CBOB)? As shown in Figure 2.B-1, many of the refineries that produce gasoline for the petitioning states are located in or near non-petitioning states, so an outlet of both 10.0 psi and low-RVP gasoline is possible.

The first component needed to estimate the impact on gasoline supply as a result of the removal of the 1-psi waiver is an estimate of the volume of gasoline that will be low-RVP gasoline. Table 3.B-1 summarizes the month-by-month conventional gasoline volume in the petitioning states in the summer of 2021 and shows that the average gasoline demand in the petitioning states was 41.9 million gallons per day. This estimate from the prime supplier sales volume—which provides volumes on a state-by-state basis—is lower than the product supplied volume, which according to EIA is the most accurate estimate of gasoline consumption but unfortunately is not provided on a state-by-state basis. When comparing the product supplied volume to the prime supplier volume, the product supplied volume exceeds the prime supplier sales volume for the U.S. by 5%. Based on discussions with EIA, the product supplied volume is more accurate, so we adjusted the state-by-state volumes prime supplier sales volume higher by 5%. The prime supplier sales volume also includes the volume of ethanol in the gasoline, which should not be included for purposes of our analysis since the reduction in refinery output applies only to the volume of CBOB produced at refineries. We assumed that the gasoline volumes contained an average of 10% ethanol. Adjusting the total average gasoline volume by the 5% increase and 10% decrease results in a final average gasoline volume of 39.6 million gallons per day for the petitioning states.

Table 3.B-1: Conventional Gasoline Volume in the Petitioning States in 2021 (kgpd)[21]

State	**March**	**April**	**May**	**June**	**July**	**August**	**Average**
Illinois	3,987	4,182	4,275	4,300	4,373	4,354	4,245
Iowa	3,326	3,699	3,786	3,871	3,850	3,815	3,724
Minnesota	5,344	5,814	6,423	6,781	6,730	6,640	6,289
Missouri	5,405	5,711	5,793	6,009	6,071	5,880	5,811
Nebraska	2,158	2,345	2,404	2,570	2,497	2,485	2,410
Ohio	12,623	13,146	13,584	13,634	13,718	13,880	13,431
South Dakota	1,114	1,188	1,253	1,425	1,481	1,394	1,309
Wisconsin	3,908	4,334	4,733	5,047	5,136	4,973	4,689
Total	37,900	40,400	42,300	43,600	43,900	43,400	41,900
Adjusted Total	**35,800**	**38,200**	**39,900**	**41,200**	**41,400**	**41,000**	**39,600**

[a] Total volume adjusted by the 5% increase and 10% decrease discussed earlier in this section to account for: (1) The underestimate of the prime supplier sales volume data compared to the product supplied volume data; and (2) The volume of ethanol in the reported gasoline volume.

However, as discussed above, the limitations in the fuel distribution system—especially in the first year after the removal of the 1-psi waiver—are expected to result in some of the gasoline outside the petitioning states to also be low-RVP gasoline to avoid supply shortfalls in the petitioning states and adjacent non-petitioning states. Table 3.B-2 summarizes the conventional gasoline demand in adjacent non-petitioning states in the summer of 2021.

[21] Data source: EIA, Petroleum & Other Liquids, Prime Supplier Sales Volumes (2021), https://www.eia.gov/dnav/pet/pet_cons_prim_dcu_nus_m.htm.

Table 3.B-2: Conventional Gasoline Volumes in Adjacent Non-Petitioning States in 2021 (kgpd)[22]

	March	April	May	June	July	August	Average
Arkansas	3,903	4,144	4,147	4,160	4,237	4,074	4,111
Colorado	5,703	5,896	6,099	6,456	6,675	6,571	6,233
Indiana	6,786	7,296	7,260	7,467	7,542	7,499	7,308
Kansas	4,330	4,494	4,596	4,812	4,743	4,617	4,599
Kentucky	4,649	4,924	4,973	5,007	5,100	4,970	4,937
Michigan	11,207	11,281	12,084	12,415	12,626	12,776	12,065
Montana	1,814	2,036	2,191	2,611	2,715	2,504	2,312
North Dakota	914	972	1,013	1,142	1,101	1,044	1,031
Oklahoma	5,556	5,664	5,710	5,825	5,842	5,673	5,712
Pennsylvania	6,698	6,952	7,215	7,508	7,549	7,512	7,239
Tennessee	9,255	9,816	9,828	9,828	9,947	9,898	9,762
West Virginia	1,799	1,809	1,829	1,823	1,874	1,834	1,828
Wyoming	824	901	1,006	1,235	1,268	1,175	1,068

In light of the significant uncertainty in evaluating the extent to which the removal of the 1-psi waiver might lead to an insufficient supply of gasoline, we evaluated a low-, medium-, and high-impact scenario for how the market might respond. The scenarios reflect different volumes of low-RVP gasoline that would end up being supplied to non-petitioning states to reflect our uncertainty for what that impact could be. Table 3.B-3 provides very rough estimates of the percentage of gasoline impacted in each adjacent non-petitioning state, which vary based on the type of border the state shares with petitioning states.

Table 3.B-3: Percentage of Gasoline Impacted in Adjacent Non-Petitioning States

Impact Scenario	**Two Borders** Indiana, Kansas, Michigan, North Dakota	**Single Border** Arkansas, Kentucky, Pennsylvania, West Virginia, Wyoming	**State Corner** Colorado, Montana, Oklahoma, Tennessee,
Low	25%	10%	0%
Medium	50%	25%	10%
High	75%	50%	25%

There is likely a temporal component to what the low-, medium-, and high-impact scenarios could represent, as well as a feasibility component. The temporal component is that early on there is less ability for the fuel distribution system to supply low-RVP gasoline to the petitioning states without also supplying low-RVP gasoline to non-petitioning states. We expect that early on—especially if we had removed the 1-psi wavier for 2023 or 2024—the volume of low-RVP gasoline supplied to non-petitioning states would have been towards the high end of the impact scenario. Although we still expect an impact on gasoline supply in 2025, we anticipate that it will be less severe than what would have been observed with a 2023 or 2024 implementation date. A 2025 implementation date provides refineries with more time for at least

[22] Data source: EIA, Petroleum & Other Liquids, Prime Supplier Sales Volumes (2021), https://www.eia.gov/dnav/pet/pet_cons_prim_dcu_nus_m.htm.

minor projects to be completed (e.g., piping or debottlenecking). Over time, as fuel distributors add the capital equipment needed to optimize their operations and better target distributing low-RVP gasoline solely to the petitioning states, we expect the impacted volumes to move towards the low-impact scenario.

The feasibility of producing and distributing gasoline is also an important consideration for how much low-RVP gasoline will be sold in non-petitioning states. If fuel distributors find it infeasible to distribute low-RVP gasoline solely to the petitioning states without also distributing low-RVP gasoline to non-petitioning states, and refiners can produce more low-RVP gasoline even if doing so is at a higher cost, we expect the impacted volumes will be towards the high-impact scenario. If, however, fuel distributors find it feasible to distribute low-RVP gasoline mostly to the petitioning states, but the cost for refiners to produce additional low-RVP gasoline is significant, then we expect the impacted volumes will be towards the low-impact scenario.

Considering the uncertainties in producing and distributing low-RVP gasoline—which varies by individual facility and by groups of facilities in parts of PADD 2, both initially and over time—it is very challenging to estimate how much low-RVP gasoline will be sold in non-petitioning states. Also, while we use consistent low, medium, and high percentages in Table 3.B-4 to estimate the amount of low-RVP gasoline sold in non-petitioning states, it is possible that there might be more low-RVP gasoline sold in non-petitioning states in one part of PADD 2, while there might be less low-RVP gasoline sold in non-petitioning states in another part of PADD 2.

We then applied the percentages in Table 3.B-3 to the volumes in Table 3.B-2 to estimate the volume of low-RVP gasoline in non-petitioning states, as summarized in Table 3.B-4.

Table 3.B-4: Estimated Low-RVP Gasoline Volumes in Adjacent Non-Petitioning States (kgpd)

State	Average Conventional Gasoline Demand	Impact Scenario		
		Low	Medium	High
Arkansas	4,111	411	1,028	2,055
Colorado[a]	3,117	0	312	779
Indiana[b]	7,308	1,827	3,654	5,481
Kansas	4,599	1,150	2,299	3,449
Kentucky	4,937	494	1,234	2,468
Michigan[c]	6,032	1,508	3,016	4,524
Montana	2,312	0	231	578
North Dakota	1,031	258	516	773
Oklahoma	5,712	0	571	1,428
Pennsylvania	7,239	724	1,810	3,619
Tennessee	9,762	0	976	2,440
West Virginia	1,828	183	457	914
Wyoming	1,068	107	267	534
Total		6,661	16,371	29,045
Adjusted Total[d]		**6,300**	**15,500**	**27,400**

[a] Gasoline demand volume in Colorado was reduced by 50% to exclude existing 7.8 psi RVP (and future RFG) program in the Denver area based on Denver's population relative to the population of the entire state.
[b] Gasoline demand volume in Indiana was not reduced to exclude the 7.8 psi RVP program in the Indiana portion of the Louisville area, as this area makes up only 3% of the gasoline consumption in Indiana.
[c] Gasoline demand volume in Michigan reduced by 50% to exclude existing 7.0 psi RVP program in the Detroit area based on Detroit's population relative to the population of the entire state.
[d] Total volume adjusted by the 5% increase and 10% decrease discussed earlier in this section to account for: (1) The underestimate of the prime supplier sales volume data compared to the product supplied volume data; and (2) The volume of ethanol in the reported gasoline volume.

The estimated total daily volume of low-RVP gasoline in both the petitioning and non-petitioning states for the three scenarios is summarized in Table 3.B-5.

Table 3.B-5: Estimated Total Daily Volume of Low-RVP Gasoline in Petitioning and Non-Petitioning States

	Impact Scenario		
	Low	Medium	High
Thousand Gallons per Day (kgpd)	45,900	55,100	67,100
Thousand Barrels per Day (kbpd)	1,090	1,300	1,600

The next component needed to estimate the impact on gasoline supply as a result of the removal of the 1-psi waiver is the portion of gasoline production that would experience this higher gasoline production loss due solely to butane removal versus those that would need to remove less-volatile hydrocarbons (e.g., pentanes, NGLs, and LSR). These impacts are likely to be greater at the start of the summer gasoline production season, as pipelines require that gasoline meet a more-stringent interim RVP specification starting March 1st each year (the "transition period") to ensure that the measured RVP of the gasoline in all downstream terminal tanks will comply with the applicable RVP standard by the May 1st start of the summer season.

This extra-low RVP gasoline mixes with the high-RVP winter gasoline leftover in the various distribution storage tanks to more quickly and efficiently "turn-over" the gasoline from winter to summer specifications. While the duration of the transition period is likely to be different for different pipelines, regions, and refineries, at least one pipeline company plans to keep this interim RVP specification in place during March and April for most of its pipeline system. We therefore separate our analysis below into two sets of calculations: One for May to September and one for the transition period (March and April).

We begin with our analysis of impacts during May to September. In our conversations with refiners, the refineries that might need to remove less-volatile hydrocarbons in addition to butane as a result of producing low-RVP CBOB accounted for much less than 50% of the gasoline pool. The survey of refiners included in the Baker and O'Brien Study indicated that 30% of refineries were categorized as potentially needing to reduce their crude oil throughput volume. While we do not think that refineries will need to reduce their crude oil throughput, we do anticipate that these are the refineries that will need to remove less-volatile hydrocarbons and experience a greater gasoline production loss.[23] For the purposes of our analysis, we assumed that 30% of gasoline production would experience a 5–10% loss commensurate with needing to remove less-volatile hydrocarbons,[24] while 70% of gasoline production would experience only a 2% loss commensurate with only butane removal.

Table 3.B-6: Estimated Gasoline Production Loss From Producing Low-RVP CBOB (May to September)

	Butane Removal Only	Less-Volatile Hydrocarbon Removal	Overall Loss
Gasoline Production	70%	30%	
Gasoline Production Loss - Low	2%	5%	2.9%
Gasoline Production Loss - High	2%	10%	4.4%

The high gasoline production loss scenario is more representative of the supply impact if the implementation date of the removal of the 1-psi waiver had been 2023 or 2024. The low gasoline production loss scenario is more representative of the supply impact for later years (e.g., a 2025 or later implementation date), where more time has been allowed for capital projects to be completed. Over time, as refineries add and complete these capital equipment projects, allowing them to remove butane instead of less-volatile hydrocarbons, we expect the gasoline production loss to decrease towards the low gasoline production loss scenario.

[23] This analysis estimates that during the initial year or two after the removal of the 1-psi waiver, there will be a larger effect on gasoline supply by refiners needing to remove more, less-volatile hydrocarbons (e.g., pentane, NGLs, and LSR) instead of butane. As refiners make capital investments and optimize their refining operations to enable removing butane, the supply impacts of producing low-RVP gasoline will decrease.

[24] In discussions with refiners who reported challenges with producing low-RVP CBOB, their estimated impact on gasoline production at these refineries ranged from 4–9%. To capture this range in reduced gasoline production at these refineries for our supply analysis, we rounded the range to a low- and high-impact scenario of 5% and 10%, respectively.

We then combined the range of gasoline production loss estimates in Table 3.B-6 with the range of low-RVP gasoline volumes in Table 3.B-5 to estimate gasoline supply impacts during May to September, as shown in Table 3.B-7.

Table 3.B-7: Estimated Gasoline Supply Impacts During May to September

Gasoline Production Loss Scenario	Impact Scenario					
	Low		Medium		High	
	kgpd	kbpd	kgpd	kbpd	kgpd	kbpd
Low	1,330	32	1,600	38	1,940	46
High	2,020	48	2,420	58	2,950	70

Next, we move to our analysis of impacts during the transition period. One pipeline company stated that while low-RVP CBOB would normally be required to meet a 7.8 psi RVP specification, the interim RVP specification would be 7.3 psi.[25] Pipelines currently require 9.0 psi RVP CBOB to meet an interim 8.5 psi RVP specification instead of the normal 8.8 psi RVP specification, so the net effect for refineries is now a 1.2-psi reduction in RVP, going from 8.5 psi to 7.3 psi (instead of from 8.8 psi to 7.8 psi).[26]

While we previously estimated the impacts of a 1-psi reduction in RVP in Table 3.B-7, going from 8.5 psi to 7.3 psi RVP requires a change in the mix of hydrocarbons that are removed. The more-stringent RVP standard is expected to increase the amount of less-volatile hydrocarbons that need to be removed in comparison to during the May to September timeframe, increasing the impact on gasoline supply. To estimate the supply impact of the interim 7.3 psi RVP specification, we need to estimate: (1) The percentage of gasoline that must be removed; and (2) The portion of gasoline impacted.

We first estimate the mix of light hydrocarbons that would be removed to meet the interim 7.3 psi RVP specification. In Table 3.B-6, we estimated that refiners would need to remove 2.9–4.4% of butane and other less-volatile hydrocarbons from their gasoline to achieve a 1-psi reduction in RVP to produce low-RVP CBOB. This estimate assumed that 70% of gasoline production could be achieved by solely removing butane, while the other 30% would need to remove less-volatile hydrocarbons. However, for a 1.2-psi reduction in RVP during the transition period, we extrapolated this 70/30 ratio to estimate that 55% of gasoline production could be achieved by solely removing butane, while the other 45% would need to remove less-volatile hydrocarbons. We again estimate that, per 1-psi RVP reduction, solely removing butane would reduce the gasoline pool by 2%, while removing less-volatile hydrocarbons would reduce the gasoline pool by 5–10%, or an average loss of 7.5%. As shown in Table 3.B-8, we estimate that refiners that produce 7.3 psi RVP CBOB would experience an average loss of 5.4% during the transition period.

[25] Magellan Midstream Partners, "Petition to Delay the Elimination of the 1 psi RVP Waiver for E10 during the Summer Months – Insufficient Supply of Gasoline," September 16, 2022.
[26] Magellan Midstream Partners, "Schedule of Origin Volatility Requirements," Revision Date July 1, 2017.

Table 3.B-8: Estimated Gasoline Production Loss During the Transition Period

	Butane Removal Only	Less-Volatile Hydrocarbon Removal	Overall Loss per 1-psi RVP Reduction	RVP Reduction	Overall Loss
Gasoline Production Loss	2%	7.5%			
Gasoline Production (7.8 psi RVP)	70%	30%	3.7%	1 psi	3.7%
Gasoline Production (7.3 psi RVP)	55%	45%	4.5%	1.2 psi	5.4%

To estimate the impact on gasoline supply during the transition period, we estimated that between 30–70% of the low-RVP gasoline in petitioning and non-petitioning states would need to meet the interim 7.3 psi RVP specification. The balance of low-RVP gasoline in these states would come from sources that are not forced to meet this more-stringent RVP specification (e.g., refineries that sell gasoline off their terminal racks). At the low end of the range (30%), we assumed that more gasoline is sold from refinery racks and blended and stored in separate refinery tanks. Additionally, we assumed that some pipeline segments would not require the more-stringent RVP specification, either due to these segments being shorter or having fewer branches with fewer breakout terminals that need to be turned over. Conversely, at the high end of the range (70%), we assumed that less gasoline is sold from refinery racks and that all gasoline distributed by pipeline is required to meet the more-stringent RVP specification. We then combined this range with the range of gasoline production losses in Table 3.B-8 to estimate the average gasoline production loss across the entire gasoline pool during the transition period, as shown in Table 3.B-9.

Table 3.B-9: Estimated Average Gasoline Loss During the Transition Period

Gasoline Production Loss Scenario	7.8 psi RVP CBOB		7.3 psi RVP CBOB		Average Gasoline Loss
	Portion	Gasoline Loss	Portion	Gasoline Loss	
Low	70%	3.7%	30%	5.4%	4.2%
High	30%	3.7%	70%	5.4%	4.9%

We then combined this range with the range of low-RVP gasoline volumes in Table 3.B-5 to estimate additional gasoline supply impacts during the transition period, as shown in Table 3.B-10.

Table 3.B-10: Estimated Gasoline Supply Impacts During the Transition Period

Gasoline Production Loss Scenario	Impact Scenario					
	Low		Medium		High	
	kgpd	kbpd	kgpd	kbpd	kgpd	kbpd
Low	1,928	46	2,314	55	2,818	67
High	2,249	53	2,700	64	3,288	78

There are also other future market changes that could further stress gasoline supply in the petitioning states. For example, the Denver area will convert from a 7.8 psi RVP area to an RFG area in 2024.[27] This will require gasoline sold in the area to meet a more-stringent 7.4 psi RVP standard (without the 1-psi waiver for E10) rather than the current 7.8 psi RVP standard (with the 1-psi waiver for E10).[28] To produce RFG, refineries must remove 5% of light gasoline blending components relative to the 8.8 psi RVP gasoline currently produced for the Denver area. Based on the estimated volume of gasoline sold in the Denver area, RFG production for this area is estimated to cause the removal of 5 kbpd or more of gasoline blendstock. The fuel distribution system in the Mid-Continent area will also be significantly impacted as it will need to be modified to accommodate another type of gasoline (both regular and premium grades) to be distributed to this area. While Denver is located in PADD 4, there are connections both to and from the petitioning states for gasoline supply; thus, there will be some ripple effects in PADD 2.

We have considered the potential impact of increased E15 sales volumes as a result of the removal of the 1-psi waiver in the petitioning states. Although CAA section 211(h)(5) requires removal of the 1-psi RVP waiver for E10, the governors, in their petitions, cite a desire to support year-round sales of E15, and this action will allow E10 and E15 to be produced using the same blendstock, thus removing one of the hurdles to E15 sales in the summer.[29] However, other hurdles remain, including vehicle compatibility, fuel offerings, liability concerns, and especially compatibility with existing retail outlet infrastructure. This action does not authorize the use of E15. While removal of the 1-psi waiver may have some impact on E15 sales volumes, any impact is difficult to project and quantify as data on E15 consumption is limited.

Nevertheless, in prior actions, we have assessed future volumes of E15. In the Renewable Fuel Standard (RFS) Set Rule, EPA used data from USDA's Biofuels Infrastructure Partnership (BIP) to complete its analysis on potential future volumes of E15.[30] This analysis demonstrated an overall increase in E15 volumes over the studied years (with the exception of 2020 due to the effects of the COVID-19 pandemic), as seen in Figure 3.B-1. When future years were extrapolated from the data, a continued upward trend in E15 volumes was projected, primarily as a result of increased E15 retail outlet growth.

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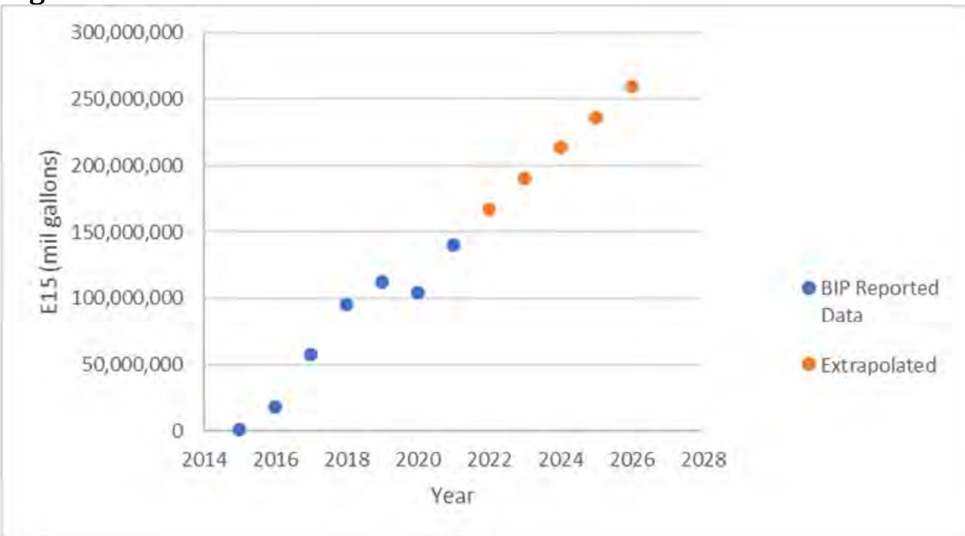
[27] 87 FR 60926 (October 7, 2022).

[28] 40 CFR 1090.215(a)(3).

[29] We note that in the Energy Policy Act of 2005, Congress instituted a renewable fuel program requiring increasing volumes of renewable fuel be used in gasoline through 2022. And in recognition of the expected increase in ethanol use resulting from these provisions, Congress added the state relief provision in CAA section 211(h)(5) to allow states to obtain an exclusion from the less-stringent RVP limit under CAA section 211(h)(4) for air quality reasons. Additionally, CAA section 211(a) authorizes EPA to designate fuels and fuel additives and requires manufacturers of such fuels and fuel additives to register them with EPA prior to introduction into commerce. EPA allowed for the introduction of E15 into commerce in 2010 and 2011. 75 FR 68094 (November 4, 2010), 76 FR 4662 (January 26, 2011).

[30] Chapter 6.5, "RFS Program: Standards for 2023–2025 and Other Changes: Regulatory Impact Analysis," EPA-420-R-23-015, June 2023 ("RFS Set Rule RIA").

Figure 3.B-1: Total Nationwide Annual Sales of E15



There are several different programs at the federal and state levels that have been supporting the buildout of E15 retail outlets, which is influencing the majority of E15 sales volume growth. Minnesota and Iowa both have regulations and incentives to promote the use of E15 and provide annual E15 sales data, which allows for further analysis. Figures 3.B-2 and 3 show the data reported by these two states and, similar to the BIP data, we extrapolated future E15 use in these states based on the data provided. When future years were extrapolated from the data, a continued upward trend in E15 volumes was projected, primarily as a result of increased E15 retail outlet growth.

Figure 3.B-2: Iowa Annual Reported E15 Sales and EPA Extrapolations

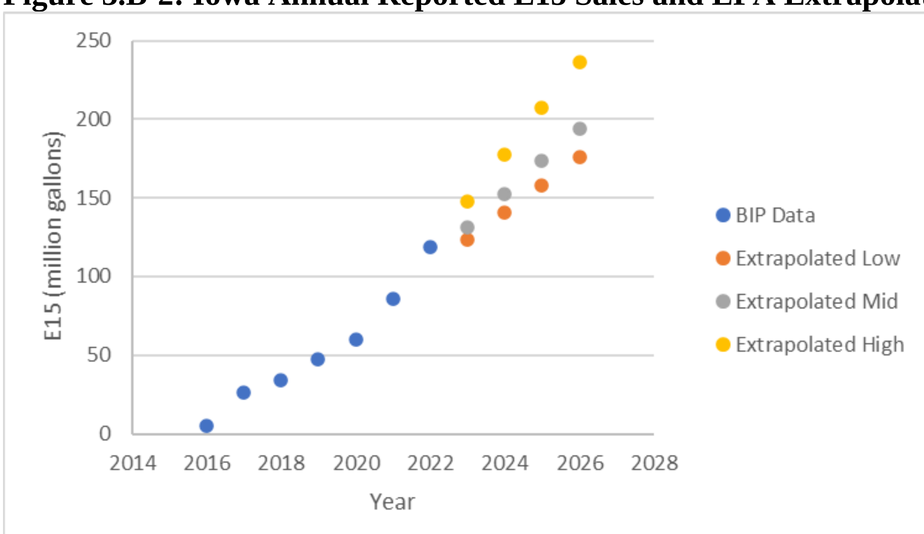
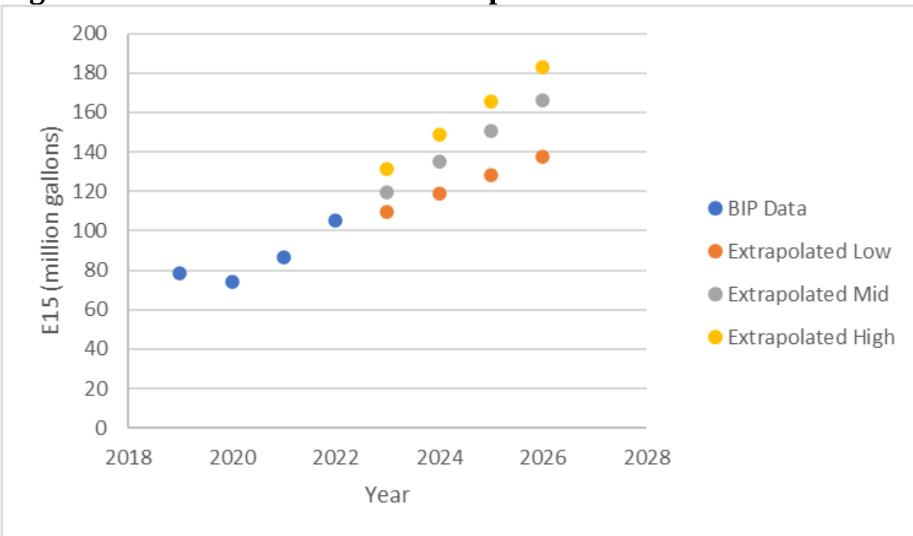


Figure 3.B-3: Minnesota Annual Reported E15 Sales and EPA Extrapolations



A series of EPA actions from 2019–2023 has allowed parties blending E15 to utilize the same blendstock used to blend E10 during the summer; thus, any impact of removing the 1-psi waiver in the petitioning states should already be reflected in the baseline E15 sales volume data.[31] Given existing barriers, and our understanding of the factors that contribute to increased growth, we believe that removal of the 1-psi waiver will have relatively little impact on the growth of E15 sales volumes in the future.

Finally, even if an increase in E15 sales volumes were to occur, the overall impact on gasoline supply would be muted due to the fact that each gallon of E15 displaces a gallon of E10—with just a 5% impact on gasoline volume—and that E15 sales are only a very small fraction of overall gasoline sales. We estimated that the impact of the 1-psi waiver on E15 sales is approximately 16% of annual per-station sales of E15.[32] At current E15 sales penetration, the resulting change in ethanol sales volume associated with a 16% change in E15 sales would equate to a change of less than 0.1% of summertime gasoline sales, and only 1-2% of the gasoline supply reduction projected earlier in this section.

C. Accommodating a Reduced Gasoline Supply in 2025

As estimated in the previous section and summarized in Tables 3.B-7 and 10, 30–80 kbpd of light gasoline material will be removed from the gasoline pool as the fuel production and distribution system adjusts to comply with removal of the 1-psi waiver in the petitioning states. This light gasoline material is less energy dense than gasoline; therefore, the gasoline-equivalent volume of the removed light gasoline material will be less than its actual volume by ~15%.

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[31] If the 1-psi waiver is not extended to E15 during the summer of 2024, E15 sales in the petitioning states could decrease slightly for 2024 and then be restored for 2025. Our estimate of the impact of the 1-psi waiver on E15 sales is approximately 16% of annual per-station sales of E15. Chapter 1.7.2, "RFS Program: RFS Annual Rules: Regulatory Impact Analysis," EPA-420-R-22-008, June 2022 ("2020–2022 RFS Rule RIA").

[32] Chapter 1.7, 2020–2022 RFS Rule RIA.

There are several ways that, in combination, this reduced gasoline supply can be accommodated in 2025.

First, downstream terminals that distribute low-RVP gasoline to non-petitioning states due to the inflexibilities in the fuel distribution system could blend butane into low-RVP gasoline to bring the RVP up to 10.0 psi. This option is only available to downstream terminals that have the capability to receive and blend butane.

Second, refiners could choose to delay a full or partial maintenance shutdowns of refineries that supply gasoline to PADD 2 and instead continue to supply PADD 2 gasoline markets in anticipation of a supply shortfall due to the removal of the 1-psi waiver. This choice would depend on the severity of the maintenance planned for the shutdown.

Third, any spare gasoline supply in the PADDs 1, 3, and 4 could be distributed to PADD 2 to make up for its gasoline supply shortfall. In particular, additional volumes could be moved up from Gulf Coast refineries via pipelines, barge, and rail. In the past, a considerable volume of gasoline flowed from PADD 3 into PADD 2. However, with the higher arbitrage received for export to PADD 1 or overseas following the war in Ukraine, excess gasoline production from PADD 3 has flowed there instead. Higher gasoline prices resulting from implementation of the removal of the 1-psi waiver could cause considerable volumes of gasoline from PADD 3 to flow once again to PADD 2. Furthermore, pipelines can adjust the products shipped in other ways. Based on conversations with pipeline operators, however, we are aware that due to increasing Canadian tar sands crude oil production—which require NGLs as diluent to permit shipping the tar sands—the pipeline capacity out of the Gulf Coast into PADD 2 has been increasingly taken up by these northward shipments of NGLs, reducing the capacity to move gasoline into PADD 2. Refiners that remove NGLs and LSR to produce low-RVP CBOB could send these removed materials to Canada as diluent, which would free up pipeline space to allow more gasoline to be shipped from the Gulf Coast to PADD 2.

Fourth, some or potentially all of the gasoline supply shortfall could also be covered by the gasoline stored in inventory at the many gasoline storage tanks in the fuel distribution system. We review the impact of the 2022 gasoline supply shortfalls in PADD 2 in the next section, and it appears that they were primarily covered by PADD 2 gasoline inventories.

Finally, we also note that some of the gasoline supply shortfall could be made up through a reduction in gasoline demand. EIA forecasts that gasoline demand will increase by 60 kbpd from 2023 to 2024, and then subsequently decrease by 140 kbpd from 2024 to 2025.[33] Furthermore, while gasoline demand is fairly inelastic with respect to gasoline prices, higher gasoline prices resulting from implementing the removal of the 1-psi waiver would be expected to result in a small decrease in gasoline demand in PADD 2.

D. Recent and Current Supply and Demand Balance of Gasoline Inventories

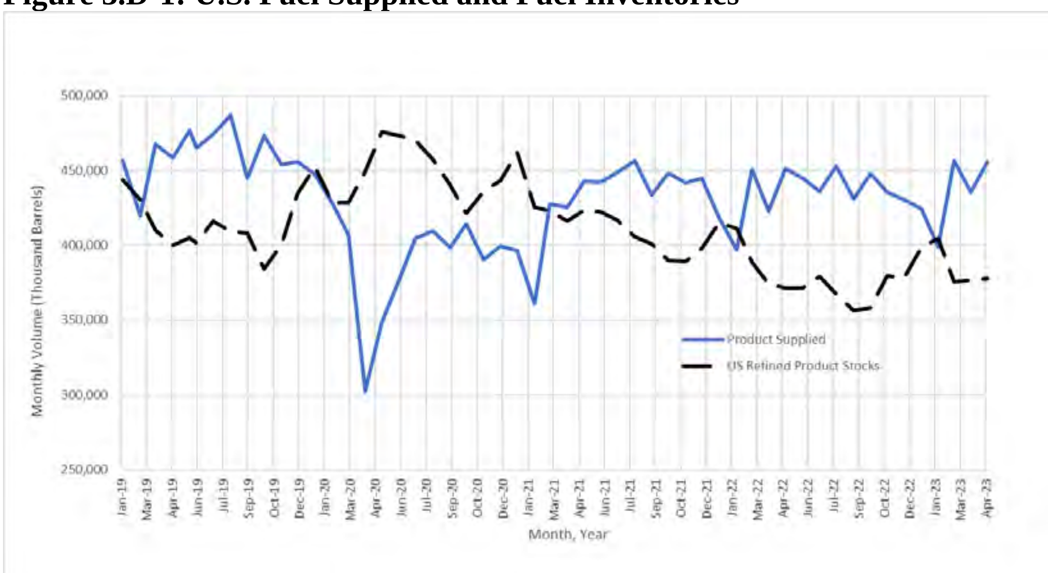
The impact of removing the 1-psi waiver on gasoline supply and the extent to which it might result in insufficient supply needs to be understood in the context of the existing supply

[33] EIA, Annual Energy Outlook (AEO) 2023, Table 11, https://www.eia.gov/outlooks/aeo.

and demand balance of gasoline in the U.S. and more specifically PADD 2 where the petitioning states are located. While the supply of gasoline is primarily from the refineries that produce the gasoline, inventory of gasoline contained in the fuel distribution system can also be a source of supply. The fuel distribution system usually contains more gasoline inventories than the minimum volume required for the system to be functional, and this excess volume can be utilized as a supplemental source of gasoline supply. Changes in refinery gasoline supply and the drawing down of gasoline inventories in the fuel distribution system can both have price impacts. This review of gasoline refinery supply and inventory is particularly warranted due to: (1) The supply issues that occurred and affected many industries across the U.S. economy coming out of the COVID-19 pandemic and subsequent war in Ukraine; (2) The recent closure of two large Gulf Coast refineries and conversion of several other U.S. refineries to produce renewable diesel; and (3) Refinery outages in 2022 that impacted PADD 2 gasoline inventories.

To assess the supply and demand balance, we reviewed the total supply volume of the primary refined products of refineries, including gasoline and gasoline blendstocks, distillate, and jet fuel. While each of these refined products are distinctly different from each other, refineries can move some refinery blendstocks between different product pools and change refinery unit operations. For example, heavy naphtha material can be blended into either gasoline or distillate, and hydrocrackers can be adjusted to produce different amounts of refinery gasoline or distillate blendstocks. During much of 2022, there was a shortfall in distillate supply that led to low inventories and elevated distillate prices. Therefore, most refiners were operating their refineries to produce a maximum amount of distillate during this time. The supply of all refined products is estimated by adding together monthly "product supplied" volumes of gasoline blendstock, finished gasoline, distillate, and jet fuel, as depicted in Figure 3.D-1.

Figure 3.D-1: U.S. Fuel Supplied and Fuel Inventories[34]



[34] Data source: EIA, Petroleum & Other Liquids, Product Supplied, https://www.eia.gov/dnav/pet/pet_cons_psup_dc_nus_mbbl_m.htm; EIA, Petroleum & Other Liquids, Stocks by Type, https://www.eia.gov/dnav/pet/pet_stoc_typ_d_nus_SAE_mbbl_m.htm.

Refined product supplied averaged 461 million barrels (15.4 million bpd) in 2019, the year prior to the COVID-19 pandemic. From March to December of 2020, when the COVID-19 pandemic emerged, refined product supply decreased to an average of 383 million barrels (12.8 million bpd), a 17% reduction compared to 2019. Refined product supply increased to 445 million barrels (14.6 million bpd) over the second half of 2021 through the beginning of 2023. While refined product supply has increased substantially since the COVID-19 pandemic, as of April 2023 it is still 5% lower than the average supply in 2019.

It is important to understand the change in refinery disposition as this is the source of reduced refined product supply to the U.S. There were a number of refinery closures and conversions, most due to impacts from the COVID-19 pandemic. Shell closed its Convent, Louisiana refinery at the end of 2020, which had a crude oil refining capacity of 211 kbpd. Increased product demand, along with the closure of the Shell refinery, caused refined product stocks to decrease by an average of 240 kbpd in 2021. At the end of 2021, Phillips 66 decided to shut down its Belle Chasse, Louisiana refinery, which had a crude oil refining capacity of 255 kbpd. Additionally, several refiners have opted to fully or partially convert their petroleum refineries to produce renewable diesel in recent years, including full conversions of the Marathon refinery in Dickinson, North Dakota, and the Holly Frontier refineries in Artesia, New Mexico and Cheyenne, Wyoming, and a partial conversion of the CVR refinery in Wynnewood, Oklahoma. Although only the Dickinson and Wynnewood refineries are in PADD 2, the other refineries can indirectly affect the volume of gasoline available to PADD 2. These refineries had a combined crude oil refining capacity of approximately 200 kbpd. While still in operation and producing a distillate blendstock, they no longer contribute to gasoline production.

From Figure 3.D-1, it is clear that the reduced demand for refined products during the COVID-19 pandemic caused an increase in refined product inventories. Refined product inventories for the entire U.S. averaged 400 million barrels for most of 2019, but then increased to 450 million barrels in 2020 after the pandemic hit and caused a reduction in fuel demand. After the pandemic and refinery closures and conversions, total fuel inventories in 2022 were 50 million barrels lower compared to 2019. In 2019, wintertime fuels inventories were 450 million barrels, and the following summer showed fuels inventories of 400 million barrels. In contrast, wintertime fuels inventories in 2022 were 420 million barrels, and the subsequent summer were 370 million barrels. Fuels inventories decreased further to 400 million barrels in the winter of 2023. It appears that despite the lower fuel demand in 2021 and 2022 relative to 2019, national fuel inventories seem to be declining, perhaps due to the aforementioned refinery closures and conversions.

Since removal of the 1-psi waiver will directly impact the gasoline supply, it is important to understand the inventory of gasoline. Figure 3.D-2 compares U.S. national gasoline inventories for 2022 and 2023 to the five-year historical range of gasoline inventories.

Figure 3.D-2: U.S. National Gasoline Inventories

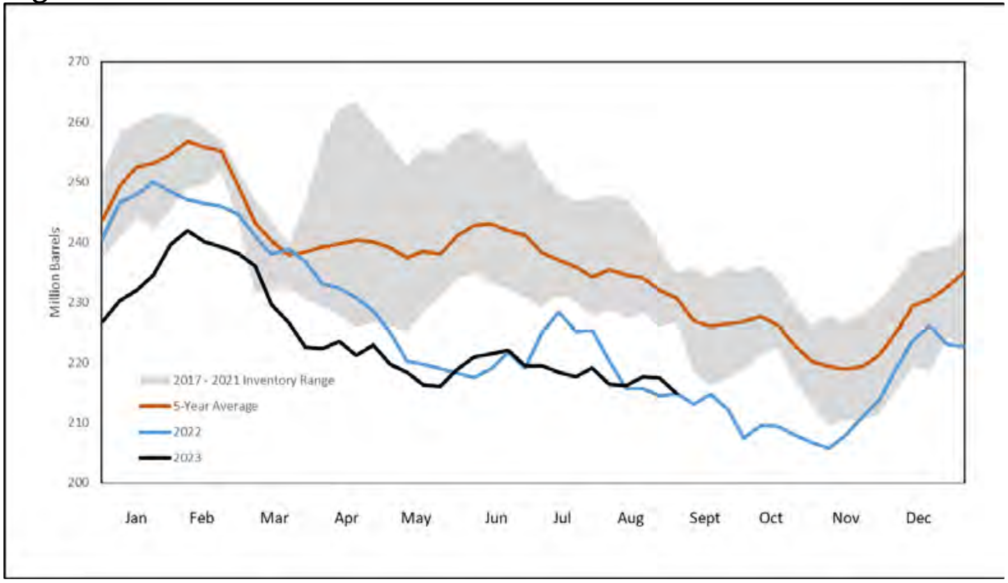


Figure 3.D-2 shows that U.S. national gasoline inventories have been below their typical historical range since early 2022, when the war in Ukraine began. With less gasoline in inventory, there would be less gasoline available in the fuel distribution system to cover reduced supply. However, it is most important to understand the inventory of gasoline in the region where the petitioning states are located (i.e., PADD 2).

The inventory of gasoline specifically in PADD 2 is depicted in Figure 3.D-3. This data shows that the impacts of the pandemic on PADD 2 were more muted, as gasoline inventories in 2020 and 2021 were relatively stable, with no large increase in 2020 and no significant decrease in 2021. However, PADD 2 gasoline inventories suffered a dramatic decline in 2022, decreasing at a relative high rate of 100 kbpd during the early part of the year. Since May 2022, PADD 2 gasoline inventories have been below their historical minimums and did not recover over the winter of 2022/2023. As a result, PADD 2 gasoline inventories at the start of 2023 were 10 million barrels lower than typical levels for that time of year and remained below the five-year historical range of gasoline inventories throughout the summer of 2023.

Figure 3.D-3: PADD 2 Gasoline Inventories[35]

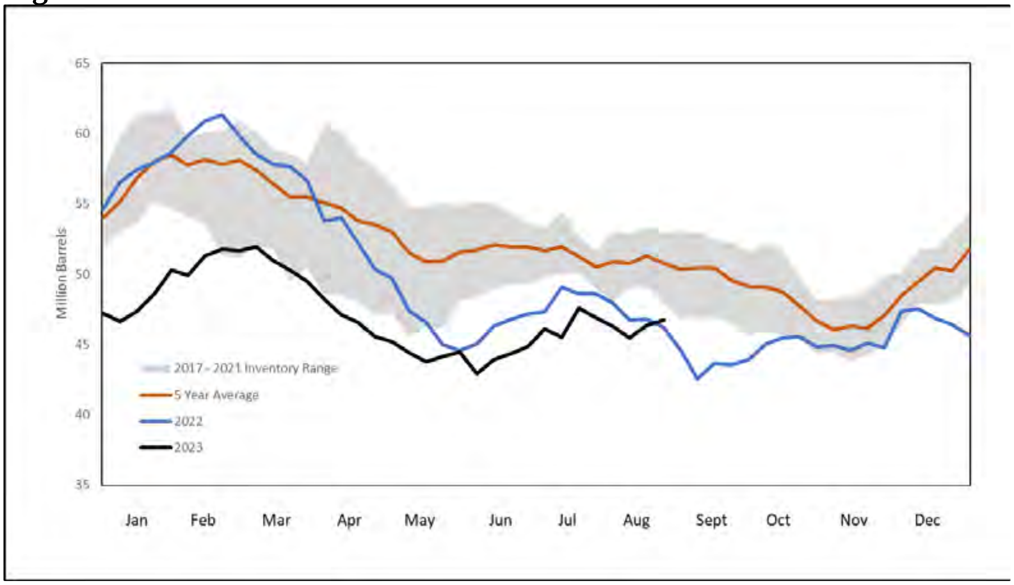
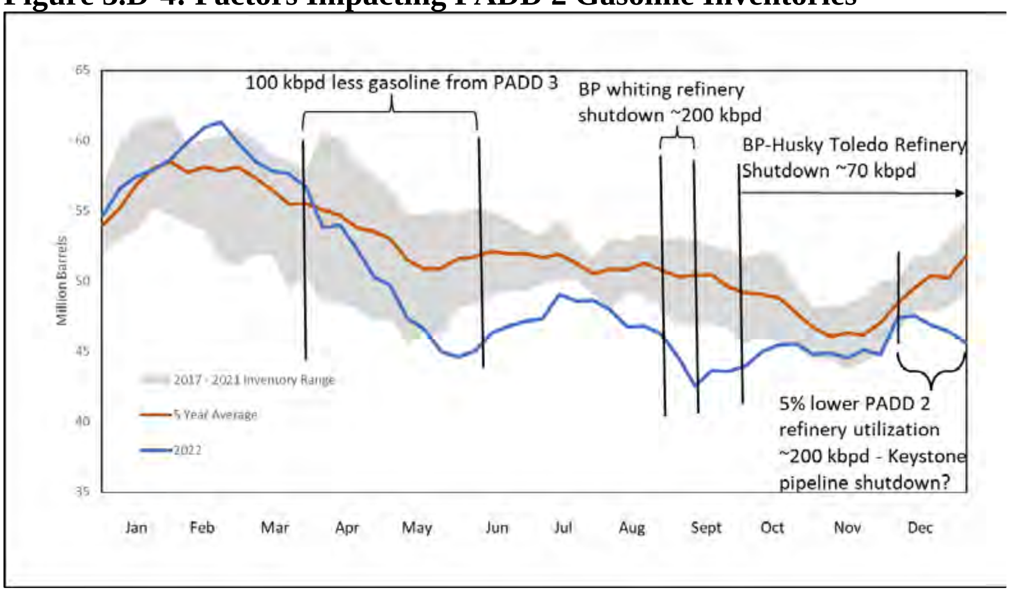


Figure 3.D-4 depicts the factors that impacted gasoline supply to PADD 2 in explain why PADD 2 gasoline inventories began falling dramatically in April 2022 and generally remained below the five-year historical range of gasoline inventories for most of 2022 and the first half of 2023.

Figure 3.D-4: Factors Impacting PADD 2 Gasoline Inventories



In response to the war in Ukraine that began in March 2022, gasoline supply to the East Coast was impacted as fewer imports from Europe were being received. As a result, PADD 3 (Gulf Coast) refineries routed gasoline normally destined for PADD 2 to the East Coast to make

[35] Data source: EIA, Petroleum & Other Liquids, Weekly Stocks, https://www.eia.gov/dnav/pet/pet_stoc_wstk_dcu_r20_w.htm.

up for the gasoline loss there. Over the three-month period (April to June 2022), an average of 100 kbpd of gasoline supply from the Gulf Coast was not available to PADD 2. In July 2022, the gasoline movements from the Gulf Coast returned to their normal historical levels and gasoline inventories recovered somewhat relative to historical levels. On August 24, 2022, the BP refinery in Whiting, Indiana, which is the largest refinery in PADD 2, experienced an electrical fire that shut down a significant portion of the refinery. The refinery was reportedly starting up several weeks later, and an additional report stated that some of the refinery units were still not operational at the end of September.[36] The BP Whiting refinery's maximum crude oil throughput capacity is 440 kbpd.[37] Assuming that the refinery's gasoline production is about half of its crude oil throughput volume, its gasoline production likely ranges between 180–220 kbpd when it is operating at full capacity.[38] Thus, this short-term shutdown of the BP Whiting refinery caused PADD 2 gasoline inventories to decrease once again.

PADD 2 gasoline inventories began to recover at the end of September 2022, likely due to the restart of the BP Whiting refinery, along with the end of the summer RVP season which allows the blending of butane. However, on September 20, 2022, the BP-Husky refinery (now owned by Cenovus) in Toledo, Ohio experienced an explosion that forced a shutdown of the refinery. The refinery restarted in June 2023, significantly after the date when refiners begin producing summer gasoline in 2023. The Cenovus Toledo refinery's maximum crude oil throughput capacity is 160 kbpd and its gasoline production likely ranges between 60–80 kbpd when it is operating at full capacity. Cenovus also owns a refinery in Superior, Wisconsin that has been shut down since an explosion in 2018. Cenovus has been rebuilding the refinery for several years and is still in the process of starting it back up.[39] Although small, this refinery's gasoline production likely ranges between 17–25 kbpd when it is operating at full capacity, providing gasoline to the difficult-to-supply region of northern Wisconsin.

Despite the Cenovus Toledo refinery shutdown, gasoline inventories rose to a point above the 5-year minimum at the end of October 2022 and appeared to be on a path to recover over the winter. However, in early December 2022, PADD 2 refinery utilization decreased by 5%. The reason for the decline is not clear, although it may have been due to a shutdown of the Keystone pipeline, which brings Canadian tar sands crude oil to the lower Midwest and Gulf Coast refineries. Whatever the cause, a 5% reduction in PADD 2 refinery utilization is estimated to have reduced gasoline supply by around 200 kbpd. This decreased PADD 2 gasoline inventories during the winter when gasoline inventories were expected to increase by 10 million barrels.

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[36] Reuters, "BP bringing Whiting, Indiana, refinery back to normal operation -company," September 2, 2022, https://www.reuters.com/business/energy/bp-bringing-whiting-indiana-refinery-back-normal-operation-company-2022-09-02.

[37] EIA, Refinery Capacity Report, Table 3, https://www.eia.gov/petroleum/refinerycapacity/table3.pdf.

[38] Gasoline production at U.S. refineries averaged 47% of the volume of all the crude oil they refined. EIA, Petroleum & Other Liquids, Refinery Yield, https://www.eia.gov/dnav/pet/pet_pnp_pct_dc_nus_pct_a.htm.

[39] Wisconsin Public Radio, "Superior refinery still hasn't resumed full operations," July 31, 2023, https://www.wpr.org/superior-refinery-cenovus-energy-husky-gas-full-operations.

E. Oil Industry Estimated Impact on Supply

The Baker and O'Brien Study included a summary of their analysis of the impact of the removal of the 1-psi waiver on gasoline supply.[40] As part of the study, Baker and O'Brien modeled each individual refinery that would likely be impacted by the removal of the 1-psi waiver. However, it appears that the study's findings on gasoline supply impacts were mostly informed by a survey that Baker and O'Brien conducted of refiners and fuel distributors on their perceived impact of the removal of the 1-psi waiver on gasoline and distillate production and distribution. The Baker and O'Brien Study listed the following major findings of their survey:

- Many of the refineries currently operate near a physical or economic limit for removing light ends from the summertime gasoline pool.
- Some refiners may need to:
    - Reduce crude runs (i.e., reducing production of gasoline and all other products) in order to control the amount of high RVP gasoline components blended in the gasoline pool—estimated to be 30% of refineries.
    - Augment a mode of butane or LSR sales (e.g., truck, rail, or pipeline deliveries).
    - Reduce high octane gasoline production or purchase high octane blendstocks.
    - Invest in fractionation, piping, and storage to enable more efficient production of low-RVP CBOB—estimated to be \$50–\$75 million per refinery.
- Capital projects take 18–24 months to implement after a final go-ahead decision, but such decisions will likely be delayed until there is clarity regarding a possible nationwide extension of the 1-psi waiver to E15.
- Due to logistical constraints, some 10.0 psi RVP gasoline areas will only be supplied with low-RVP gasoline, especially in the first two years.
- Terminals that serve 10.0 psi RVP gasoline markets will not be available for low-RVP gasoline storage.

The Baker and O'Brien Study divided refineries into 4 different groups and estimated the gasoline and distillate supply impact in the petitioning states for each group, as shown in Table 3.E-1:

- Group A – Refineries within the petitioning states
- Group B – Refineries within adjacent non-petitioning states
- Group C – Refineries in Oklahoma
- Group D – Refineries in the Gulf Coast

[40] The Baker and O'Brien Study was conducted based on the removal of the 1-psi waiver in seven states—before Missouri submitted their petition.

Table 3.E-1: Baker and O'Brien Study Estimated Gasoline and Distillate Supply Impacts

Group	Impact on Gasoline (%)	Reduced Gasoline Volume (kbpd)	Reduced Distillate Volume (kbpd)
A	6.2	63–72	12–20
B	4.7	21–41	6–10
C	5.0	4–12	2–3
Total		88–125	20–33

The Baker and O'Brien Study assumed that the supply shortfalls in Table 3.E-1 would be made up by additional gasoline and distillate supplied from refineries in Group D (i.e., Gulf Coast refineries), while at the same time highlighting some of the associated challenges and changes to the distribution system to allow that to happen. Additional information from the study shows that approximately two-thirds of the estimated supply impact is from refineries producing less gasoline, presumably by removing light hydrocarbons. The other one-third of estimated supply impacts is due to reduced crude oil throughput, impacting both gasoline and distillate production.

While the Baker and O'Brien Study provided a summary of their survey and made other statements relevant to their supply analysis, there was insufficient information provided to explain how the supply impacts in Table 3.E-1 were estimated. For example, the study does not explain how the percent impact on gasoline values in Table 3.E-1 were calculated. Also, while some refiners apparently reported that they *may* need to reduce crude oil throughput volumes, the Baker and O'Brien Study conservatively assumed that these refineries *would* in fact reduce their crude oil throughput. This conservative assumption adopted by the Baker and O'Brien Study may explain why it estimated a higher supply impact compared to EPA's estimate.

F. 2022 ICF Report Analyzing Supply

In a 2022 report conducted for the Renewable Fuels Association (RFA), ICF analyzed the fuel supply in the petitioning states in 2023.[41] In general, the ICF Report assessed similar issues as EPA, including the supply and demand balance, gasoline production, butane logistics, refinery changes, refinery and pipeline logistics, and ability to respond to disruptions. The report analyzed the supply impacts for the original eight states that petitioned to remove the 1-psi waiver. Thus, it includes Kansas and North Dakota, which have subsequently rescinded their petitions to remove the 1-psi waiver, and it excludes Ohio and Missouri, which petitioned to remove the 1-psi waiver in June and December 2022, respectively. Consequently, some reassessment is warranted. Additionally, while the report assessed refinery production and market demand, it did not assess gasoline inventories in the region. This factor contributes to the region's ability to withstand fluctuations in the supply of gasoline.

The report acknowledged some potential changes that may have been unable to be implemented prior to the summer of 2023, including refinery processing changes to reduce RVP, addition of infrastructure, and changes at pipelines, terminals, and refineries for additional

[41] ICF, "Impact of Potential 8-State RVP Waiver Exclusion on Midwest Gasoline Markets," prepared for the RFA, September 2022 ("ICF Report").

segregation tankage. The report did not assess whether such changes would be necessary prior to an implementation date in 2023.[42]

The report further acknowledged that maintaining supply of gasoline to the region should be "manageable," but also noted a potential difficulty responding to unexpected outages of gasoline supply to the region, as only low-RVP gasoline can be used to in the petitioning states.[43] It also acknowledged that "states facing gasoline shortages could request a temporary waiver to allow temporary reinstatement of the 1-psi RVP waiver for E10 or a general RVP waiver" without addressing the timing or implications of such actions.[44]

[42] The ICF Report was conducted prior to the proposed rule with a focus on implementation in 2023 and therefore did not speak specifically to 2024 or 2025. Nevertheless, the information in the report is also relevant for assessing implementation in 2024 or 2025.
[43] ICF Report at 22.
[44] *Id.* at 24.

4. Cost of Removing the 1-psi Waiver in the Petitioning States

Potentially every part of the fuel distribution system could incur some cost when providing low-RVP gasoline to the petitioning states. The cost incurred by refineries to produce low-RVP gasoline is the largest and most predictable portion of the total cost. The cost to refineries is driven by the opportunity cost of selling the light hydrocarbons removed from gasoline (a high value product) and selling them in much lower-priced hydrocarbon markets. Because the fuel distribution system is complicated, it is much more difficult to estimate the ultimate cost of compliance for the fuel distribution system, although we provide some cost information that provides some context for estimating the ultimate fuel distribution system cost.

We reference several different cost studies in this section. First, two separate refinery modeling studies conducted by MathPro examined the long-term refining cost for removing the 1-psi waiver nationwide—one conducted for RFA[45] and another conducted for the International Council on Clean Transportation (ICCT)[46] (collectively the "MathPro Studies"). We also reference the Baker and O'Brien Study in this section, which included cost estimates specifically for removal of the 1-psi waiver in the petitioning states. Notably, the Baker and O'Brien Study compared two different approaches for estimating the cost of removing the 1-psi waiver in the petitioning states: (1) Baker and O'Brien's proprietary "PRISM" refinery analysis software, which is a "typical RVP cost model" that uses and assumes "'ideal' operation and 'average' properties" for a refinery;[47] and (2) An "extended cost model" that provides a "range of costs based on each refinery's specific capabilities plus any infrastructure and logistics costs associated with bringing Low RVP CBOB from each refinery to the affected states."[48] These models are discussed in more detail below.

A. Cost Studies

There are several factors that contribute to the cost of producing low-RVP gasoline. The largest portion of the cost is the lost revenue associated with having to sell the removed butane at market prices for butane that are much lower than the high-value gasoline it would otherwise be blended into.[49] There are also additional capital and operating costs that will need to be recouped over time.

We first discuss the two MathPro refinery modeling studies. The portion of the studies summarized here was performed for the entirety of PADD 2, not just the eight petitioning states. Nevertheless, they provide a reasonable estimate of the long-term per-gallon cost associated with the removal of the 1-psi waiver in the petitioning states. Table 4.A-1 summarizes the key cost information from the two studies.

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[45] MathPro, "Assessment of a 1-psi reduction in the RVP of Conventional Gasoline Blendstock (CBOB) in the Summer Gasoline Season," prepared for RFA, December 1, 2021.
[46] MathPro, "Refining Economics of a National Low Sulfur, Low RVP Gasoline Standard," prepared for the International Council for Clean Transportation (ICCT), October 25, 2011.
[47] Baker and O'Brien Study at 9.
[48] *Id*. at 8.
[49] Butane is typically priced at less than half of the wholesale price of gasoline.

Table 4.A-1: MathPro Estimates of Long-Term Refining Cost for Removal of the 1-psi Waiver in PADD 2

	RFA Study (2021)	ICCT Study (2011)
Crude Oil Price ($/bbl)	57–94	90
Capital Cost ($MM)	214–261	250
Refining Cost (¢/gal)	2.2–2.6	2.4
Fuel Economy Savings (¢/gal)	(0.7)–(1.0)	(0.2)
Net Consumer Cost (¢/gal)	1.5–1.6	2.2
Total Annual Cost ($MM)	258–309	261

Based on the MathPro Studies, the estimated refining cost for reducing the RVP of gasoline by 1.0 psi ranged from 2.2–2.6¢ per gallon, with the cost of RVP control increasing at higher crude oil prices. However, the net cost to consumers is slightly lower due to an expected increase in the energy density of low-RVP gasoline, which allows vehicles to travel further on each gallon of gasoline. The magnitude of the fuel economy effect varies by the study case—ranging from 0.2–1.0¢ per gallon—and reduces the net cost of low-RVP gasoline to 1.5–2.2¢ per gallon.

Table 4.A-1 also summarizes the MathPro Studies' estimates of the capital costs investments that would be required to replace the volume and octane content of the removed butane for all of PADD 2. Since this action affects only a portion of PADD 2, the capital costs for refineries as a result of the removal of the 1-psi waiver in the petitioning states is expected to be half of the MathPro estimates. The MathPro models, however, tend to underestimate a portion of the capital costs because they do not consider the capital costs for revamping or adding debutanizers, gas plants, or butane handling and storage. If the available excess volumetric and octane production capacity among all PADD 2 refineries, as well as the PADD 3 refineries that supply PADD 2, is sufficient to make up for this removed butane, then the refining sector may not need to invest any capital dollars to cover the octane loss due to the removal of butane and may allow for a more rapid transition to low-RVP gasoline in the petitioning states. However, it may also mean that some refineries currently providing gasoline to the petitioning states would cease to do so or reduce their supply, while others with fewer hurdles would enter or expand into these markets. Of course, these changes would complicate the supply of gasoline to the petitioning states.

In addition to assessing the gasoline supply impact, the Baker and O'Brien Study also estimated potential cost impacts. Baker and O'Brien surveyed refiners and pipeline operators in and around the petitioning states and were able to estimate the cost to produce low-RVP gasoline in both the near- and long-term using these survey results. Similar to the MathPro Studies, the Baker and O'Brien Study examined the cost of removing butane from gasoline, but also analyzed the cost of removing pentanes and additional effects of low-RVP gasoline production. The PRISM model from the Baker and O'Brien Study (i.e., the "typical RVP cost model") estimated that refiners' production cost would be about 3¢ per gallon based on solely butane removal from gasoline production.[50] This is slightly higher but still close to the estimated refining cost from the

[50] Baker and O'Brien Study at 9.

MathPro Studies. The higher cost estimate from Baker and O'Brien compared to MathPro is likely due to Baker and O'Brien including some additional costs (e.g., additional production, blendstock purchases, and distribution capabilities).

Table 4.A-2 shows the estimated refining costs with each model from the Baker and O'Brien Study. These estimates depend upon the implementation date of the removal of the 1-psi waiver and location of fuel supply. Implementation in 2024 would likely lead to price impacts on the higher end of their cost ranges, whereas implementation in 2025 or later could allow for lower price impacts. The cost also varied based on proximity to the petitioning states. The Baker and O'Brien Study estimated the projected cost not only to the petitioning states, but also to adjacent non-petitioning states due to the production and distribution limitations described in Section 3. The Baker and O'Brien Study estimated that adjacent non-petitioning states are likely to see similar price increases as the petitioning states. For example, the Baker and O'Brien Study's extended cost model estimates that if removal of the 1-psi waiver was implemented in 2024, petitioning and adjacent non-petitioning states could have seen a cost increase of 3–12¢ per gallon. States beyond the petitioning and adjacent non-petitioning states were also analyzed and projected to have a much lower, if any, price impact from the low-RVP gasoline production.

Table 4.A-2: Baker and O'Brien Study Estimates of Refining Cost

Model	Timeframe	Region	Refining Cost (¢/gal)	
			Low	High
Typical RVP Cost Model	2022	Petitioning	2	10
		Adjacent	2	3
Extended Cost Model	2023-2024	Petitioning	3	12
		Adjacent	3	12
	2025+	Petitioning	3	11
		Adjacent	3	8

As described in the Baker and O'Brien Study, the timeframe for implementation of removal of the 1-psi waiver effects potential price increases. In the near term (e.g., 2023 and 2024), any investment requiring a permit would require more lead time and cause a need for other solutions to produce low-RVP gasoline. This includes storage tank alternatives (e.g., railcars), adjusting crude slate purchases for RVP control, or using tank trucks to ship products further to markets in need, as discussed in Section 3. A longer-term implementation in 2025 or later would allow for more changes and preparation for refineries and pipelines. Although projects such as storage tank construction would likely take longer than a 2025 implementation date, other projects could likely be completed (e.g., piping changes, pump installation, or operational unit debottlenecking). This timeframe would also allow for more railcars to be constructed and made available for use, which would aid in the sale and storage of excess butane.

Baker and O'Brien also studied the historical wholesale price difference between RBOB and CBOB in Chicago as an additional evaluation of the cost of RVP control.[51] While price data can capture market effects that can bias the costs, wholesale price data are essentially refinery

[51] *Id*. at 46.

gate prices and generally are assumed to reflect marginal production costs, not other market effects. Baker and O'Brien found that the wholesale price difference between RBOB and CBOB can be estimated based on a cost estimate of 87% butane removal and 13% NGLs removal. Since RFG must meet a 7.4 psi RVP specification and does not receive the 1-psi waiver, RBOB is estimated to be 2.6 psi lower in RVP than CBOB; thus, the RBOB/CBOB price difference is divided by 2.6 to estimate the refining cost per 1-psi reduction in RVP. Table 4.A-3 summarizes the Baker and O'Brien Study's estimated cost of RVP control based on this RBOB and CBOB wholesale price data.

Table 4.A-3: Baker and O'Brien Study Estimated Cost of RVP Control

	RVP Cost (¢/gal per 1 psi decrease)	
Month	**2019**	**2022**
April	6.9	5.5
May	10	10.5
June	10.6	10
July	8.4	11.4
August	4.5	10.9
Average	**8.1**	**9.7**

The Baker and O'Brien Study found that this cost estimate based on historical RBOB and CBOB wholesale price data is in line with their near-term costs for low-RVP gasoline. However, estimating the cost of a 1-psi reduction in RVP based on the cost of complying with the RFG program risks overestimating the cost because as the RVP standard increases in stringency, the cost of compliance increases. In other words, it costs more per 1-psi reduction in RVP to produce RFG than it does to produce low-RVP gasoline. Another important observation is that crude oil prices were higher in 2022 due to the political uncertainty that occurred that year as a result of the war in Ukraine; thus, the higher average cost in 2022 likely represents RVP costs at higher crude oil prices, while the lower average cost in 2019 likely represents RVP costs at more moderate crude oil prices.

B. Distribution Cost

The Baker and O'Brien Study estimated distribution costs associated with the removal of the 1-psi waiver, although these costs were not listed separately from other costs. The study estimated the installation cost for a gasoline storage tank to be $7–10 million.[52] Assuming that the storage tank has a 50,000-barrel capacity and amortizing the capital cost over the gasoline stored in the tank assuming a 3-day storage time, installing this storage tank would add 0.3¢ per gallon to the cost of distributing gasoline. If more than one storage tank needs to be installed in the gasoline distribution chain from refinery to downstream terminal, the total distribution cost would be higher.

Many terminals that currently provide gasoline to both petitioning and non-petitioning states will likely not be able to continue to do so due to the lack of available tankage. This will

[52] *Id*. at 31.

likely change how gasoline is distributed to these gasoline markets, increasing distribution costs. Distributing gasoline from product terminals to retail outlets is estimated to typically cost 6¢ per gallon, although this typical cost is an average over a large range due to varying transportation distances.[53] Presumably, the gasoline shipped to some of these markets would need to be shipped from further away, which would increase the gasoline distribution cost for these markets and demand more from the fleet of tank trucks and drivers, exacerbating the existing truck driver shortage.[54]

There would likely be other costs associated with distributing an additional type of gasoline. Since conventional gasoline consumed in PADD 2 would largely be divided between 10.0 psi and low-RVP gasoline, gasoline batch sizes would be smaller in many cases, increasing the cost of distributing both gasoline types. Furthermore, if a refinery serving PADD 2 only produces one of the two gasoline types, it could mean that another refinery would have to produce a portion of the gasoline previously served by the first refinery, and the gasoline sold by both of these refineries would likely need to be moved further distances than before, increasing the distribution cost for both refineries' gasoline. Similarly, if a downstream terminal decided to carry only one of the two gasoline types, it would have to sell solely into either petitioning or non-petitioning states. This in turn would likely mean that the trucks that distribute gasoline from that terminal would have to travel further distance than they currently do.

C. Discussion of Costs

MathPro and Baker and O'Brien both estimated the cost of removing the 1-psi waiver using linear program refinery models. The Baker and O'Brien Study's refinery modeling costs, using an approach similar to that used by MathPro, were only somewhat higher than those presented in the MathPro Studies. However, after including a more detailed refinery-by-refinery analysis using their extended cost model and incorporating a wholesale price analysis of Chicago RFG, the Baker and O'Brien Study concluded that removing the 1-psi waiver would cost considerably more than the cost estimate from their typical RVP cost model.

After reviewing the refinery modeling analyses in the MathPro Studies, we identified several reasons why their cost studies likely underestimate the cost of complying with the removal of the 1-psi waiver in the petitioning states:

(1) By using an aggregated model, the MathPro Studies did not identify or account for the higher costs incurred by some refineries, such as those refining heavier crude oils, which would have to produce low-RVP gasoline by removing less-volatile hydrocarbons (e.g., NGLs).

(2) The MathPro Studies did not account for additional costs due to the implementation of the removal of the 1-psi waiver prior to the installation of capital projects needed

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[53] National Association of Convenience Stores, "Who Makes Money Selling Gas?" November 12, 2021, https://www.convenience.org/Media/conveniencecorner/Who-Makes-Money-Selling-Gas.

[54] CNBC, "Why driving big rig trucks is a job fewer Americans dream about doing," July 5, 2022, https://www.cnbc.com/2022/07/05/why-driving-big-rig-trucks-isnt-a-job-americans-want-to-do-anymore.html.

to optimize production and distribution of low-RVP gasoline by refiners and fuel distributors.

(3) In assuming that that the entire conventional gasoline pool would be converted to low-RVP gasoline, the Mathpro Studies did not assess or quantify the additional costs incurred by limitations in the fuel distribution system to distribute low-RVP gasoline when it was not designed for widespread distribution of an additional gasoline type.

This review is not to criticize MathPro's refinery model, nor their ability to model low-RVP programs; they simply modeled costs under the optimal circumstances of a nationwide removal of the 1-psi waiver, rather than in just the petitioning states.

The Baker and O'Brien Study, on the other hand, specifically modeled costs of the removal of the 1-psi waiver in the petitioning states for both short- and long-term compliance cases based at least partially on a survey conducted of refiners and fuel distributors. Furthermore, the Baker and O'Brien Study analyzed the compliance costs of refineries on an individual basis. For these reasons, the Baker and O'Brien Study overcame the limitations inherent in the MathPro Studies and better estimates the costs of the removal of the 1-psi waiver. However, we are concerned that the Baker and O'Brien Study may have overestimated these costs for several reasons:

(1) After learning that some refineries were concerned that they may need to reduce their crude oil throughput to produce low-RVP gasoline, Baker and O'Brien conservatively assumed that these refineries would in fact reduce their crude oil throughput. However, when the survey was conducted, many refineries likely had not completed their detailed review of how they could or would produce low-RVP gasoline.

(2) If the Baker and O'Brien Study did model low-RVP gasoline being sold in non-petitioning states—which they indicated would need to occur due to limitations in the fuel distribution system—it did not mention, nor did it likely model, butane blending at downstream terminals in non-petitioning states to bring the RVP of the gasoline up to 10.0 psi RVP, which would reduce the cost of compliance.

(3) The Baker and O'Brien Study appeared to at least partially rely on a review of Chicago RFG price data to represent the cost of removing the 1-psi waiver. Although the Baker and O'Brien Study compared this price data to cost data to help ensure that the prices reasonably represented costs, we are still concerned that the price data included market factors that would overestimate the cost of removing the 1-psi waiver.

After reviewing the MathPro and Baker and O'Brien Studies, we conclude that the cost of removing the 1-psi waiver is likely above that estimated by MathPro, but also that the Baker and O'Brien cost estimates are likely too conservative. We conclude that the cost of removing the 1-psi waiver is most likely somewhere in-between the estimates of these cost studies.

Using the MathPro and Baker and O'Brien Studies as the potential range of per-gallon costs and the low-, medium-, and high-impact scenarios discussed in Table 3.B-5, we were able to bound the potential range of the total annual cost of the removal of the 1-psi waiver in the petitioning states, as shown in Table 4.C-1. For the low-impact scenario, we used a cost of 2¢/gal, which is the average cost estimated by the two MathPro Studies. For the high-impact scenario, we used a cost of 12¢/gal, which is the highest cost estimated by the Baker and O'Brien Study. For the medium-impact scenario, we used a cost of 7¢/gal, which is the midpoint between the low- and high-impact scenarios. For estimating total gasoline volume, we assumed that refiners would produce low-RVP gasoline for 180 days on average.[55]

Table 4.C-1: Estimated Total Annual Cost of Removing the 1-psi Waiver in the Petitioning States

Impact Scenario	Daily Volume (kgpd)	Total Volume (million gallons)[a]	Per-Gallon Cost (¢/gal)	Total Annual Cost (million $)
Low	45,900	8,260	2	170
Medium	55,100	9,910	7	690
High	67,100	12,070	12	1,450

[a] Total Volume = Daily Volume * 180 days ÷ 1,000

Given that we expect the actual per-gallon cost to be somewhere in-between the MathPro and Baker and O'Brien Studies, we believe that the medium-impact scenario is most likely to represent costs in the first year or two after the removal of the 1-psi waiver. After this time, we expect that refiners will have completed the capital changes needed to optimize the production of low-RVP gasoline by concentrating on removing butane instead of more-expensive less-volatile hydrocarbons. We also expect that after the first several years, the fuel distribution system will have made the necessary capital changes and optimized their operations to more cost effectively distribute low-RVP gasoline to the petitioning states. As a result of these investments and operational improvements, we expect compliance costs to decrease to a value closer to the low-impact scenario.

[55] While refiners distributing low-RVP CBOB through regional pipelines—with multiple onloading and offloading points—are expected to produce low-RVP CBOB for about 200 days each year (March 1 to September 15), other refiners will not need to produce low-RVP CBOB as long. For example, a refiner that owns its own pipeline connecting its refinery to its retail market likely has a much shorter summer gasoline production period. A refiner that sells low-RVP gasoline off its own terminal racks may be able to reduce its summer gasoline production period to as little as 145 days, starting their production just prior to the start of the May 1 summer season.

5. Potential Price Impacts When Implementing the Removal of the 1-psi Waiver

There is a temporal element to how fuel prices reflect the changing costs associated with producing that fuel. For example, while gasoline prices generally reflect production costs in the competitive gasoline market, this may not be the case when removal of the 1-psi waver is first implemented, as gasoline supply is reduced and not yet recovered. Given the challenges in estimating market price impacts, we have not attempted to do so, as it would be difficult to estimate which refiner will set the gasoline price and what that price might be. However, we have analyzed the various factors that contribute to fuel prices and discuss them in this section and provide some information on historical price impacts for comparison. While fuel prices are primarily a function of crude oil prices and the fuel production and distribution costs, they are also often a function of the relative balance of fuel supply and demand.

If refineries increase the volume of their crude oil runs to produce more low-RVP gasoline to make up for the reduction in gasoline output, there could be an increase in crude oil prices. If refineries increase their crude oil runs by 30–80 kbpd, which is the same volume of gasoline material estimated to be removed from the gasoline pool due to the removal of the 1-psi waiver, it would only impact 0.03–0.08% of the roughly 100 million bpd of world crude oil demand. The short-term oil price elasticity of demand is estimated to be 0.1,[56] and therefore for a midpoint 0.05% impact on supply, the price impact is 0.5%. Assuming crude oil is priced at $80 per barrel, the price impact would be $0.40 per barrel, or a 1¢/gal increase in the price of crude oil, which would affect all products refined from crude oil. Since there are many factors that affect crude oil prices—including refinery startups or closures or changes in crude oil production—the impact of the removal of the 1-psi waiver on crude oil prices is just one factor among many impacting crude oil prices.

As discussed in Section 4, the removal of light hydrocarbons to produce low-RVP gasoline will incur a cost of 2–12¢ per gallon. Refiners will seek to pass that cost onto consumers, so the price of gasoline in the petitioning states will likely increase by at least that amount.

When fuel supply falls short of demand and inventories drop, fuel prices typically rise. As previously described, removal of the 1-psi waiver may cause a reduction in supply that could increase fuel prices beyond the cost impacts discussed in Section 4.[57] As summarized in Section 3, we estimate the gasoline supply impact of the removal of the 1-psi waiver to range from 30–80 kbpd. To understand the potential impact of this reduced gasoline supply on gasoline prices, we conducted an analysis to estimate the price impacts associated with the PADD 2 supply shortfalls in 2022, which we described in Figure 3.D-4.

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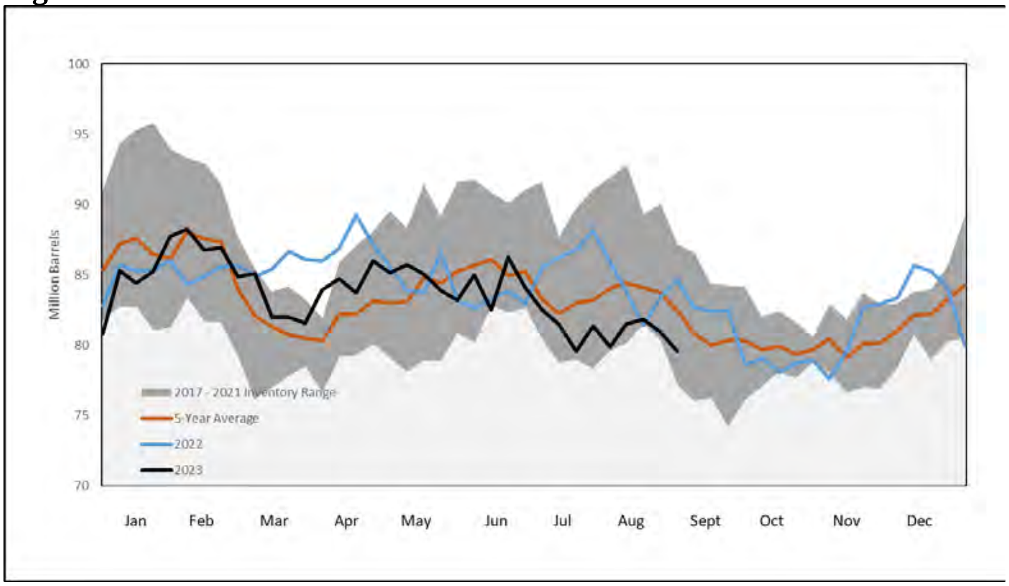
[56] Caldara, Dario, Michele Cavallo, and Matteo Iacoviello (2016). Oil Price Elasticities and Oil Price Fluctuations. International Finance Discussion Papers 1173. http://dx.doi.org/10.17016/IFDP.2016.1173. A percent crude oil price change multiplied by -0.1 estimates the percent change in supply. In the case for the percent change in supply, divide the percent change in supply by -0.1 to estimate the percent change in the price of crude oil.

[57] The cost estimates of the removal of the 1-psi waiver reflect a cost to society. The price impacts discussed here are what consumers pay at the pump. To the extent that fuel prices exceed the average costs, it would result in a wealth transfer from consumers to the refining industry.

In the discussion that follows, we discuss historical price impacts in PADD 2. This assessment requires an initial comparison of the price changes in PADD 2 vs. PADD 3 in order to account for any broad market factors (e.g., crude oil prices) that are independent of supply-induced price impacts.[58] This then allowed the broad market factors to be backed out from the overall PADD 2 price changes to better isolate just the supply-induced price impacts in PADD 2. To validate this price comparison between PADD 2 and PADD 3, we need to verify that PADD 3 was not also experiencing a gasoline supply shortfall in 2022 that would complicate an estimate of the price impacts caused by the supply issues in PADD 2. Figure 5-1 summarizes PADD 3 gasoline inventories.

Figure 5-1: PADD 3 Gasoline Inventories[59]

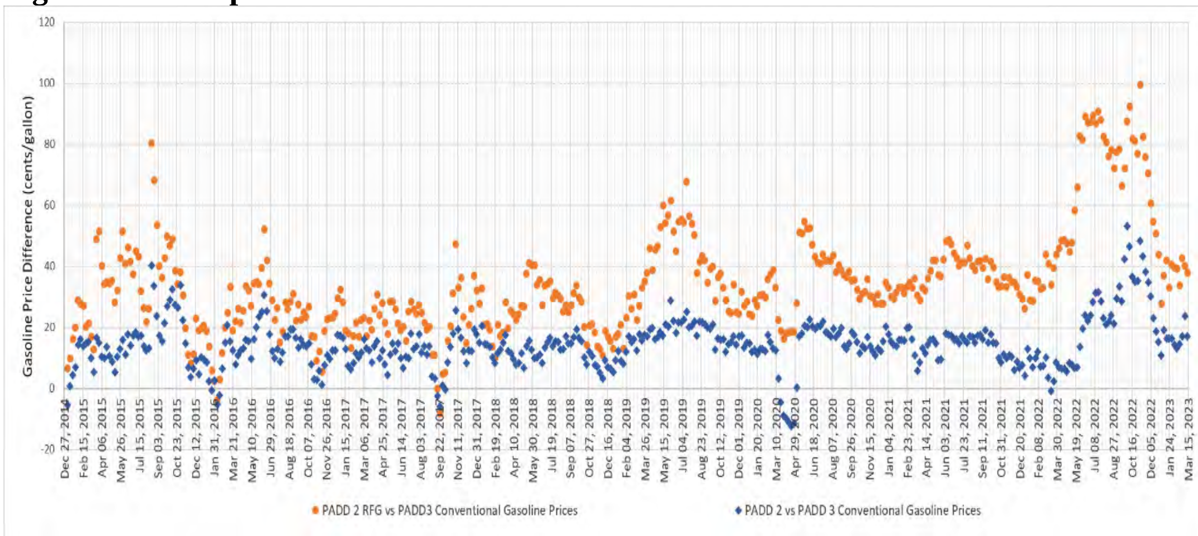


As shown in Figure 5-1, PADD 3 gasoline inventories during 2022 were consistent with that of previous years, which should make the gasoline prices in PADD 3 a valid baseline for comparison with those of PADD 2.

Comparing the prices in PADD 2 and PADD 3 eliminates price impacts due to broad market factors (e.g., the war in Ukraine) that affect gasoline prices in both PADDs, so we expect this effect to be largely, if not completely, zeroed out. Figure 5-2 compares PADD 2 RFG and conventional gasoline prices to PADD 3 conventional gasoline prices.

[58] PADD 3 consists of Alabama, Arkansas, Louisiana, Mississippi, New Mexico, and Texas.
[59] Data source: EIA, Petroleum & Other Liquids, Weekly Stocks, https://www.eia.gov/dnav/pet/pet_stoc_wstk_dcu_r20_w.htm.

Figure 5-2: Comparison of PADD 2 and PADD 3 Gasoline Prices[60]



The first thing that stands out in Figure 5-2 is the very large RFG and conventional gasoline price spike in 2022, which likely reflects the price effect due to the gasoline supply shortfall. However, there is a fairly consistent price difference in previous years that is unrelated to the supply shortfall in 2022. There are several differences between PADD 2 and PADD 3 that can account for this difference, which include: (1) Differences in crude oil prices that vary by PADD; (2) Differences in gasoline production and distribution costs; and (3) Different state tax rates. Not accounting for this normal price difference between the two PADDs would bias the supply shortfall price analysis. Therefore, we evaluated the price difference between PADD 2 and PADD 3 prior to 2022 to determine how to estimate this price difference. The price difference between the two PADDs for 2021 was lower than that for 2019 and 2020, but higher than that before 2019. Since the price differences in 2021 were more typical of those in previous years, we chose 2021 as the comparison year.

The gasoline price increase in PADD 2 due to the gasoline supply shortfall in 2022 was estimated in two steps. First, the price difference between PADD 2 and PADD 3 was estimated for 2022. Then the price difference was also estimated for 2021 and subsequently subtracted from the 2022 price difference. The price differences were estimated using weekly price data for both PADD 2 RFG and conventional gasoline in comparison to conventional gasoline in PADD 3.[61]

The results of the estimated price impacts attributed to the supply shortfall in PADD 2 are summarized in Figure 5-3. The price impacts are shown by the red and blue lines referenced to

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[60] Data source: EIA, Petroleum & Other Liquids, Weekly Retail Gasoline and Diesel Prices, https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_w.htm.

[61] *Id*. For example, the average PADD 2 RFG price the first week of May 2022 was $4.30/gal, while the average PADD 3 conventional gasoline price for the same week was $3.85/gal, for a difference of $0.45/gallon. During the first week of May 2021, the average PADD 2 RFG price was $2.79/gal, while the average PADD 3 conventional gasoline price was $2.43/gal, for a difference of $0.36/gal. Subtracting the $0.36/gal price difference in 2021 from the $0.45/gal price difference in 2022 yields a price increase of $0.09/gal attributed to the supply shortfall in 2022.

the lefthand vertical axis. The figure also shows the impact of the gasoline supply shortfall, which is the grey line referenced to the righthand vertical axis.

Figure 5-3: PADD 2 Supply Factors in 2022 and Their Price Effects

Figure 5-3 shows the supply shortfall in PADD 2 for April, May, and June to be 50, 160, and 110 kbpd, respectively, estimated by comparing the gasoline supply from PADD 3 to PADD 2 in 2022 to that in 2021.[62] The 50 kbpd shortfall in April 2022 seemed to cause a modest price increase, particularly for RFG.

However, the large 160 kbpd supply shortfall in May 2022—and corresponding decrease in gasoline inventories depicted in Figure 3.D-4—is associated with an overall price increase of over 40¢/gal in PADD 2. Despite the additional 110 kbpd supply shortfall in June 2022, the RFG price was relatively flat while conventional gasoline prices declined by 7¢/gal. The RFG price increased further to over 50¢/gal in July 2022, before both RFG and conventional gasoline prices started to decrease with the return to balanced supply and increasing gasoline inventories.

As discussed in Section 3.D, the BP Whiting refinery suffered an emergency shutdown at the end of August 2022 and was still at least partially shutdown for several weeks. RFG prices spiked again, this time above 60¢/gal, and eventually above 70¢/gal, at a time when PADD 2 gasoline inventories declined to their lowest point of the year. Notably, however, conventional gasoline prices did not increase, perhaps because the BP Whiting refinery is located adjacent to Chicago, the primary RFG area in PADD 2.

Also as discussed in Section 3.D, the Cenovus (formerly BP-Husky) Toledo refinery experienced an emergency shutdown at the end of September 2022 and remained shut down for about 6 months. The Cenovus Toledo refinery shutdown did not result in a decrease in PADD 2

[62] In 2021, the volume of gasoline supplied from PADD 3 to PADD 2 was more typical of the volume supplied in most years. Thus, when we compared the volume of gasoline supplied from PADD 3 to PADD 2 in 2022 to that in 2021, we were able to estimate the gasoline supply reduction from PADD 3 to PADD 2 during April to June 2022.

gasoline inventories, likely because the summer gasoline season was over and the gasoline pool expanded due to increased blending of butane. However, conventional gasoline prices increased by about 15¢/gal after the Cenovus Toledo refinery shutdown. It is likely, however, that the 6-month shutdown of the Cenovus Toledo refinery played an important role in preventing PADD 2 gasoline inventories from recovering over the wintertime.

The estimated range of 30–80 kbpd of reduced gasoline supply caused by the removal of the 1-psi waiver is smaller than the average 100 kbpd supply shortfall experienced by PADD 2 from April to June 2022. This lower impact on gasoline supply suggests a smaller price increase is likely as a result of the removal of the 1-psi waiver. However, the supply shortfall has at least some potential to last longer—perhaps over the entire summer.

A separate, but related factor are PADD 2 gasoline inventories when the removal of the 1-psi waiver takes effect. At the beginning of the 2022 summer gasoline production season—which was prior to the 100 kbpd supply shortfall in PADD 2—PADD 2 gasoline inventories were 3 million barrels higher than the 5-year average for that time of year. The price impacts from the removal of the 1-psi waiver will likely be larger if PADD 2 gasoline inventories are still low at the beginning of 2024 like it was in 2023, in addition to the previously discussed supply shortfall.[63] The opposite will likely be true if PADD 2 gasoline inventories recover and match and even exceed those of early 2022.

An additional factor affecting gasoline price impacts is uncertainty regarding whether and how gasoline markets will be supplied when the removal of the 1-psi waiver is implemented. If refiners that currently supply a certain gasoline market decide not to participate in that market due to the increased cost of producing low-RVP gasoline or limits in their ability to supply low-RVP gasoline to that market, it could create uncertainty about whether that gasoline market will be supplied. This uncertainty could have a price effect of its own and would potentially be additive to other price effects.[64] In Figure 5-3, we analyzed the price effects of the reduced supply of gasoline and decreasing PADD 2 gasoline inventories for 2022, but this price effect was solely due to reduced supply and shrinking gasoline inventories. In the case of the removal of the 1-psi waiver, there are a combination of factors that could increase prices: (1) The reduced supply of gasoline caused by removing light gasoline material to produce low-RVP gasoline; and (2) Changes in how gasoline is produced and distributed throughout PADD 2, creating uncertainty about how gasoline markets will be satisfied. These two price effects may be additive, causing an even greater increase in gasoline prices than either factor alone. In addition, the latter factor would tend to lead to different price impacts in different markets, depending on the localized distribution issues faced.

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[63] EIA, "Gasoline explained: Gasoline price fluctuations," https://www.eia.gov/energyexplained/gasoline/price-fluctuations.php.

[64] *Id*. General Accountability Office (GAO), "Special Gasoline Blends Reduce Emissions and Improve Air Quality, but Complicate Supply and Contribute to Higher Prices," GAO-05-421, June 2005, https://www.gao.gov/assets/gao-05-421.pdf.

6. Benefits of Removing the 1-psi Waiver

As discussed in the preamble, under the relevant CAA provisions, upon receiving a petition from a state governor that is accompanied by a successful demonstration of emissions increases as a result of the 1-psi waiver, EPA is required to remove the 1-psi waiver in the areas requested by the governor. In deciding whether to grant the petition, the statute does not provide EPA with the authority to consider the benefits of the removal of the 1-psi waiver. Therefore, we have not considered benefits in this action; we merely present here some assessment of the potential benefits for awareness.

Modeling performed by the petitioning states in support of their petitions indicated reductions in emissions of VOC, NOx, and CO. Specifically, those results show reductions between 0.66–2.9% for VOC, 0.19–0.53% for NOx, and 0.05–0.14% for CO.[65] The modeling results also demonstrated increases between 0.08–0.30% for $PM_{2.5}$ and 0.08–0.32% for PM_{10}. However, quantifying and monetizing air pollution-related health benefits related to these reductions was not possible, and even if we had carried out such an analysis, we believe that the results would not indicate meaningful benefits.

To put these changes in context, we can refer to recent work published by EPA assessing the emissions and air quality impacts (i.e., ambient ozone, PM, and NO_2 levels) of fuel formulation changes resulting from the RFS Program, including increases in ethanol blend level and volatility.[66] This "anti-backsliding study" (ABS), required under CAA section 211(v)(1), examined the impacts on air quality that might result from changes in vehicle and engine emissions associated with renewable fuel volumes of ethanol under the RFS program relative to approximately 2005 levels. Hoekman, *et al*., (2018) also reviewed available literature on potential air quality impacts for E10 versus E0 across the entire lifecycle.[67] Both studies found potential increases and decreases in ambient concentration levels of pollutants, but none of them were large despite having much larger emission inventory impacts than those associated with removing the 1-psi waiver. Thus, we similarly expect any air quality impacts from the removal of the 1-psi waiver to also be small.

Additionally, any benefits (or cost impacts) as a result of increased E15 sales volumes are negligible or nonexistent. As discussed in Section 3.B, we do not anticipate significant increases in E15 in the marketplace as a result of the removal of the 1-psi waiver. This action removes one hurdle to E15, but others remain, including vehicle compatibility, fuel offerings, liability concerns, and especially compatibility with existing retail outlet infrastructure. Even if E15 sales volumes were to increase, as discussed in the recent RFS Set Rule,[68] E15, while often priced lower than E10 at retail, currently costs more to produce and distribute than E10, and thus we do not expect any cost savings from increased E15 sales volumes.

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[65] We believe that the reductions of CO and NOx would, in addition to VOC emissions impacts, satisfy the requirements of the statute and justify granting the petitions.
[66] "Clean Air Act Section 211(v)(1) Anti-backsliding Study," EPA-420-R-20-008, May 2020; "Final Determination for Renewable Fuels and Air Quality Pursuant to Clean Air Act Section 211(v)," EPA-420-R-21-002, January 2021.
[67] Hoekman, S. K., Broch, A., & Liu, X. (2018). Environmental implications of higher ethanol production and use in the U.S. Renewable and Sustainable Energy Reviews, 81, 3140-3158.
[68] Chapter 7.4, RFS Set Rule RIA.

7. Gasoline Supply Situation Changes for 2025

As discussed in the preamble and supported throughout this document, there are a number of considerations supporting our determination of insufficient supply for 2024. These include:

(1) Continued low gasoline inventories in PADD 2.
(2) The limited time available after the promulgation of this action for coordination between various parties to make the necessary physical changes to the gasoline production and distribution infrastructure.
(3) Greater reduction in supply as a result of the removal of the 1-psi waiver than estimated at the time of the proposal.
(4) The lack of sufficient time to make the capital investments and physical changes to refineries and the fuel distribution system.
(5) Less flexibility within the fuel distribution system than had been anticipated to adequately mitigate the supply reduction until such time as the capital and physical changes can be made.

Delaying the removal of the 1-psi waiver to 2025 will allow more time for the necessary coordination between the various parties. Allowing more time for the gasoline supply and demand balance to improve and for refiners and fuel distributors to make necessary changes to supply increased volumes of low-RVP gasoline will also alleviate supply constraints in 2025.

As described in Section 3, PADD 2 gasoline inventories were low in 2023. Due to an expected large increase in the number of refinery maintenance projects in the fall of 2023 and first quarter of 2024, gasoline inventories were expected to remain low going into 2024.[69] Furthermore, EIA estimates that U.S. gasoline demand will increase by 60 kbpd in 2024 compared to 2023, which will further strain PADD 2 gasoline inventories.[70] Further, as described in Section 3.B, the start of the RFG program for the Denver area in 2024 will place an additional strain on the gasoline supply and demand balance in 2024. As described in Section 3.D, PADD 2 gasoline inventories are an important source of gasoline supply during times of disruption and shortfall in new production and import supply. The confluence of all these impacts on the supply and demand balance support our determination of insufficient supply for 2024; however, additional time to allow gasoline inventories to recover, refinery maintenance-related outages to be completed, gasoline demand to fall, and the market to adjust to supplying RFG to Denver should provide a much-improved gasoline supply and demand balance in PADD 2 in 2025.

The amount of time required for some refineries to produce low-RVP gasoline—or to produce low-RVP gasoline without a large impact on their gasoline supply—and the difficulties associated with distributing low-RVP gasoline to the petitioning states also informs our determination of insufficient supply of gasoline in 2024. The various limitations to produce and distribute low-RVP gasoline to the petitioning states—which can be overcome by making capital

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[69] Bloomberg News, "Nearly 2.5 Million Barrels a Day of US Refining Capacity to Shut for Fall Maintenance," October 2, 2023, https://www.bnnbloomberg.ca/nearly-2-5-million-barrels-a-day-of-us-refining-capacity-to-shut-for-fall-maintenance-1.1979186.
[70] EIA, AEO 2023, Table 11, https://www.eia.gov/outlooks/aeo.

investments—are outlined in Section 3.A. However, such investments take time to plan, engineer, permit, and construct. Some easy-to-implement capital projects can be completed by 2024. However, other more-involved projects requiring more extensive design, permitting, and construction (e.g., debottlenecking debutanizers, installing new gasoline storage tanks) will take more time to implement. These projects often require at least 2 years to complete.

Consequently, EPA typically provides significant lead time and/or phase-in of its fuel standards. In theory, refiners and fuel distributors could have begun making these investments after the first petition was submitted in April 2022. Alternatively, they could have started their planning after EPA proposed to remove the 1-psi waiver in March 2023. Regardless of whether refiners and fuel distributors earnestly started their planning and engineering design mid-2022 or in early 2023, there would not have been sufficient time to design, permit, and complete the construction of these more-involved capital projects before the start of the 2024 summer gasoline production season (e.g., most refiners will start producing summer gasoline in March 2024).

Many of these same supply and demand balance concerns may still exist for 2025, in large part depending on the progress that the fuel production and distribution system is able to make in putting in place their capital investments. However, the magnitude of these concerns is expected to diminish not only due to the additional time available, but also due to changing circumstances in 2025. First, the gasoline supply and demand balance is expected to improve in 2025. As discussed in Section 3.C, EIA forecasts that nationwide gasoline demand in 2025 will decrease by 140 kbpd relative to 2024, which is 80 kbpd less than 2023.[71] Thus, due to reduced gasoline demand, the supply and demand balance is expected to improve significantly in 2025 relative to 2024, and even improve relative to 2023. The forecasted reduction in gasoline demand in 2025 would help to offset much of the estimated loss of gasoline production caused by producing low-RVP gasoline. Refiners are also expected to catch up with their refinery maintenance in 2023 and 2024; thus, they will be able to maintain higher gasoline production at the end of 2024 heading into 2025, allowing PADD 2 gasoline inventories to recover closer to normal prior to the summer of 2025. Refiners supplying RFG to Denver will also have optimized their gasoline supply to Denver in 2024; thus, these refiners will be better positioned to continue to supply RFG to Denver in 2025 while also supplying low-RVP gasoline to nearby petitioning states.

Second, the types of capital investments that can be made by refiners and fuel distributors by 2025 will improve their ability to produce and distribute low-RVP gasoline. Refiners will be able to produce low-RVP gasoline at a lower overall loss of gasoline production. We have heard from several refiners and fuel distributors that some planned investments are able to be completed by the summer of 2025. Both refiners and fuel distributors will be able to further improve their ability to distribute low-RVP gasoline, particularly those refineries and pipeline segments that serve both petitioning and non-petitioning states.

[71] EIA, AEO 2023, Table 11, https://www.eia.gov/outlooks/aeo. In making its estimate, EIA considers economic growth, oil price, oil and gas supply, and zero-carbon technology cost (i.e., electric vehicles). EIA, "Annual Energy Outlook 2023 Release at Resources for the Future," March 16, 2023, https://www.eia.gov/outlooks/aeo/pdf/AEO2023_Release_Presentation.pdf.

8. Screening Analysis for Potential Impacts on Small Entities

This section discusses EPA's screening analysis evaluating the potential impacts of the removal of the 1-psi waiver on small entities. The Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute, unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities (referred to as a "No SISNOSE finding"). Pursuant to this requirement, EPA has prepared a screening analysis for this rule.

Section 8.A provides background on the RFA and this rule, including the regulated small entities. Section 8.B describes EPA's calculations of the costs of the rule and the resulting cost-to-sales ratios. Section 8.C concludes.

A. Background

i. Overview of the Regulatory Flexibility Act (RFA)

The RFA was amended by SBREFA to ensure that concerns regarding small entities are adequately considered during the development of new regulations that affect those entities. The RFA requires us to carefully consider the economic impacts that our rules may have on small entities. The elements of the initial regulatory flexibility analysis accompanying a proposed rule are set forth in 5 U.S.C. § 603, while those of the final regulatory flexibility analysis accompanying a final rule are set forth in section 604. However, section 605(b) of the statute provides that EPA need not conduct the section 603 or 604 analyses if we certify that the rule will not have a significant economic impact on a substantial number of small entities.

ii. Need for the Rulemaking and Rulemaking Objectives

A discussion on the need for and objectives of this action is in Preamble Section I. CAA section 211(h)(5) requires EPA to remove the 1-psi waiver for E10 via regulation upon a demonstration by a governor that the 1-psi waiver increases emissions in their state.

iii. Definition and Description of Small Entities

Small entities include small businesses, small organizations, and small governmental jurisdictions. For the purposes of assessing the impacts of the rule on small entities, a small entity is defined as: (1) A small business according to the Small Business Administration's (SBA) size standards; (2) A small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; or (3) A small organization that is any not-for-profit enterprise that is independently owned and operated and is not dominant in its field.

Small businesses (as well as large businesses) would be regulated by this rulemaking, but not small governmental jurisdictions or small organizations as described above. As set by SBA, the categories of small entities that would potentially be directly affected by this rulemaking are described in the table below.

Small Business Definitions		
Industry	***Defined as small entity by SBA if less than or equal to:***	***NAICS[a] code***
Gasoline and diesel fuel refiners	1,500 employees[b]	324110

[a] North American Industrial Classification System.
[b] EPA has included in past fuels rulemakings a provision that, in order to qualify for small refiner flexibilities, a refiner must also produce no greater than 155,000 barrels per calendar day (bpcd) crude capacity. See, e.g., 40 CFR 80.225(a)(1) (2019), 40 CFR 80.550(a) and (b) (2019), 40 CFR 80.1142(a)(1) (2019), 40 CFR 80.1338(a) (2019), 40 CFR 80.1442(a)(1), 40 CFR 80.1620(a) (2019).

EPA used the criteria for small entities developed by the Small Business Administration under the North American Industry Classification System (NAICS) as a guide. Information about the characteristics of refiners comes from sources including the Energy Information Administration (EIA) within the U.S. Department of Energy, oil industry literature, and previous rulemakings that have affected the refining industry. In addition, EPA used publicly available employment information to determine which companies meet the SBA definition of "small entity." These refiners fall under the Petroleum Refineries category, 324110, as defined by NAICS.

Small entities that are subject to this rulemaking include domestic refiners that produce and distribute gasoline to the petitioning states. While in the proposed rulemaking EPA did not identify any affected small refiners that would be affected by this action, two commenters identified three potential small refiners that would be affected by this action. After evaluating the information submitted by the commenters, EPA now believes that there is currently one refiner (CountryMark) located in a non-petitioning state that produces and distributes gasoline to the petitioning states that meets the small entity definition of having 1,500 employees or fewer. However, while EPA disagrees that the other two refiners (Ergon-West Virginia and Wyoming Refining Company) are eligible to qualify as small entities,[72] for purposes of this screening analysis we have nonetheless evaluated the impact of this rulemaking on these companies as well.

iv. Reporting, Recordkeeping, and Other Compliance Requirements

Registration, reporting, and recordkeeping are necessary to track compliance with EPA's fuel quality regulations. However, these requirements are already in place under the existing fuel quality regulations. Therefore, we do not anticipate that there will be any significant cost on directly regulated small entities.

B. Screening Analysis Approach and Results

This section concerns EPA's screening analyses performed for the removal of the 1-psi waiver. In general, we expect that refiners, including small refiners, will be able to recover the

[72] See RTC Section 7.1.

cost associated with the removal of the 1-psi waiver through higher gasoline prices in the petitioning and surrounding states. Nevertheless, we estimated the cost-to-sales ratios for each of the three purported small refiners that distribute gasoline to the petitioning states using refinery-specific data under the assumption that they could not recover their increased production costs.

Using recent RFS compliance data, we first estimated the annual gasoline production volume for each refinery assuming the total gasoline production for each of these refineries remains unchanged. Using information from recent small refinery exemption (SRE) petitions and other publicly available information, we then estimated the amount of each refinery's gasoline production that would be distributed to the petitioning states, assuming each of these refineries continues to distribute gasoline to the petitioning states and that only that portion would be required to be low-RVP CBOB. We then multiplied that volume of gasoline by 12¢ per gallon, which is the upper end of the range of projected fuel costs in Table 4.A-2 and represents the worst-case scenario for refinery production costs as reported in the Baker and O'Brien Study. The actual calculations for each refiner are provided in Section 8.D; a non-CBI example of these calculations is shown below in Table 6.B-1.

Table 6.B-1: Example Refiner Costs Calculation

Company	Total Gasoline Production (gal)	Gasoline Distribution to Petitioning States	Low-RVP CBOB Production (gal)	Cost ($/gal)	Total Cost
Example	150,000,000	50%	75,000,000	$0.12	$9,000,000

Using information from recent SRE petitions and other publicly available information, the final step in our analysis is to divide the total estimated costs for each refiner by its total estimated annual sales. The resulting range of cost-to-sales ratios for these refiners are shown in Table 6.B-2, along with a non-CBI example of these calculations using the data in Table 6.B-1.

Table 6.B-2: Estimated Cost-to-Sales Ratios

Company	Total Cost (Million Dollars)	Total Sales (Million Dollars)	Cost-to-Sales Ratio
Refiners (Actual)[a]	--	--	0.13 – 0.15%
Example	$9.0	$2,500	0.36%

[a] The actual calculations for each refiner are provided in Section 8.D.

C. Conclusions

We conducted a screening analysis by looking at the potential impacts on the three specific purported small refiners that distribute gasoline to the petitioning states. While we believe that refiners will recover the cost associated with the removal of the 1-psi waiver through higher gasoline prices in the petitioning and surrounding states, we have nonetheless evaluated the impacts of this rule assuming a worst-case scenario wherein the cost of producing low-RVP CBOB was 12¢/gal and refiners could not recover their costs. Under these extreme assumptions we were able to estimate costs of this rule using the methodology described in the previous section and then use a cost-to-sales ratio test (a ratio of the estimated annualized compliance costs to the value of sales per company) to assess whether the costs were significant.[73]

Even if refiners are not able to recover the cost associated with the removal of the 1-psi waiver through higher gasoline prices, based on our cost-to-sales analysis, the refiners would be affected at less than 1% of their sales as a result of this action (i.e., the estimated costs of this rule would be less than 1% of their sales); the actual cost-to-sales percentages ranged from 0.13% to 0.15%. Therefore, based on our outreach, fact-finding, and analysis of the potential impacts of this rule on small businesses, EPA finds that the removal of the 1-psi waiver in the petitioning states will not have a significant economic impact on a substantial number of small entities.

D. Refiner CBI Data

[Information Redacted – Claimed as CBI]

[73] A cost-to-sales ratio of 1% represents a typical agency threshold for determining the significance of the economic impact on small entities. See "Final Guidance for EPA Rulewriters: Regulatory Flexibility Act as amended by the Small Business Regulatory Enforcement Fairness Act," November 2006.