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November 7, 2024

The Honorable Michael Regan
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

RE: Request to Delay the Effective Date to Implement a Request from States for Removal of Gasoline Volatility Waiver

Dear Administrator Regan:

On February 29, 2024, the Environmental Protection Agency ("EPA") finalized regulations to remove the 1-pound per square inch ("psi") Reid Vapor Pressure ("RVP") waiver for summer gasoline containing 10 percent ethanol by volume ("E10") in 8 states, effective April 28, 2025.[1] Pursuant to Clean Air Act Section 211(h)(5)©(ii), the American Fuel & Petrochemical Manufacturers ("AFPM") petitions EPA to exercise its statutory authority to delay implementation of the effective date by an additional year, to April 28, 2026.[2] Absent a timely implementation delay, the Midwest could suffer supply disruptions, increased fuel prices, and increased vulnerability in the event of unplanned outages. Gasoline producers and distributors are already planning for summer gasoline supplies in 2025. It is therefore critical for midwestern consumers that EPA timely grant this petition before the end of 2024, but certainly well in advance of its 180-day statutory deadline.

In 2022, eight midwestern states petitioned EPA to remove the one-pound RVP waiver for E10, requiring a lower RVP gasoline blendstock for oxygenated blending to meet the states' demand for gasoline. AFPM and other commenters raised significant concerns with the likely impact this action would have on refiners, pipelines, and terminals, potentially resulting in an insufficient supply of gasoline, higher risk for more frequent and longer supply disruptions, and potential negative economic impacts on the Midwest region and its consumers. In its comments to the

[1] 89 Fed. Reg. 14,760 (Feb. 29, 2024) ("Final Rule"). The petitioning states are Illinois, Iowa, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin. AFPM notes that Ohio and Missouri submitted separate petitions from the other states, and Missouri has an extra year of eligibility for extension under 42 U.S.C. § 7545(h)(5)(C)(ii)(I)(bb).
[2] 42 U.S.C. § 7545(h)(5)(C)(ii)(I).

March 2023 proposed rule, AFPM included a study conducted by Baker & O'Brien on the likely supply and cost impacts of removing the RVP waiver in the petitioning states. In its February 2024 Final Rule, EPA reviewed the Baker & O'Brien report and rightfully agreed and found that implementation of the new standard for 2024 summer gasoline would cause an insufficient supply of gasoline in the Region[3] and delayed implementation for one year, as permitted by statute.

In its Final Rule, EPA interpreted "insufficient supply of gasoline" to "require a demonstration that gasoline supply disruptions would result from the removal of the 1-psi waiver, such that the necessary quantities of gasoline may not be available in the States at the time they are required."[4] In its analysis, EPA identified several factors supporting its conclusion, including (1) continued low gasoline inventories in PADD 2, (2) limited time for the supply chain to make necessary physical changes, (3) reduction in supply resulting from implementation of the waivers. EPA also considered (1) lack of sufficient time to make capital investments and physical changes to refineries and the fuel distribution system, and (2) less flexibility of the fuel distribution system to mitigate impacts.[5] Each factor remains in place as of the date of this petition.

In support of this request, AFPM commissioned Baker & O'Brien to update its analysis, adding the impacts from the addition of Missouri to the petitioning states and conducting a second round of confidential interviews with refiners and pipeline operators to assess market readiness for a lower RVP gasoline blendstock. The updated report from Baker & O'Brien confirms that the market dynamics supporting EPA's rationale for the finding of insufficient supply remain materially unchanged and EPA should extend the effective date by an additional year. The updated Baker & O'Brien analysis and a letter to AFPM summarizing its findings and response to EPA's comments are included as an attachment to this petition.

In summary, the updated Baker & O'Brien analysis concludes that production of gasoline and diesel in the Region would potentially decline by a greater estimated volume than initially determined, up to 131,000 barrels per day (B/D) and up to 39,000 B/D respectively, requiring replacement supply from outside the Region. Baker O'Brien's conclusion that there have been no material changes to market readiness is unsurprising, and is indeed supported by EPA's own conclusions in the Final Rule that it takes two or more years to plan, permit, and construct storage infrastructure and debottleneck refineries.[6] These capital investment decisions are significant, and had to be made against the backdrop of legislative efforts to negate the pending petitions, along with uncertainties regarding timing of a Final Rule and the rule's effective date.

AFPM notes that in the Final Rule and the accompanying Response to Comments and Technical Support Document, EPA critiqued several aspects of the 2023 Baker & O'Brien analysis. AFPM asked Baker & O'Brien to evaluate and respond to EPA's comments. Those responses are included in their letter to AFPM.

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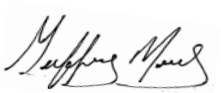
[3] Region refers to the 8 petitioning states as well as contiguous states that supply product into the area. *See* Baker & O'Brien's Midwest States Gasoline RVP – 1 PSI Waiver Study, p 12.
[4] 89 Fed. Reg. at 14,769.
[5] *Id.* at 14,770.
[6] *Id.* at 14,771.

Finally, as of the date of this petition, gasoline stocks in PADD 2 are near the bottom of the 5-year range on both an absolute and days of supply basis due to planned and unplanned refinery outages this year.[7] Ongoing planned refinery maintenance is currently impacting ~450 thousand barrels per day of refining capacity in the Region.[8] At the same time, total US gasoline demand[9] has been stronger than in 2021 when it averaged 8.8 million barrels per day. EIA projects gasoline demand to average 8.9 million barrels per day in 2024 and 2025.[10] Gasoline demand in PADD 2 has also remained strong, averaging 2.6 million barrels per day[11] in 2021, 2022, 2023, as well as January through July 2024.

Delaying the effective date of the proposed gasoline vapor pressure reduction would mitigate the risk of supply inadequacy to the Midwest and provide policymakers with the opportunity to consider alternatives to achieve their policy goals.

AFPM urges you to move swiftly to protect midwestern consumers by granting this petition. We stand ready to assist however we can.

Sincerely,



Geoff Moody

Senior Vice President, Government Relations & Policy

cc:

Joseph Goffman, Principal Deputy Assistant Administrator Performing Delegated Duties of Assistant Administrator

Alejandra Nunez, Deputy Assistant Administrator for Mobile Sources, Office of Air and Radiation

Sarah Dunham, Director, Office of Transportation and Air Quality

Ben Hengst, Deputy Director, Office of Transportation and Air Quality

Paul Machiele, Director, Fuels Program Center, Office of Transportation and Air Quality

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[7] EIA Weekly Petroleum Status Report, October 11, 2024, p.7, https://www.eia.gov/petroleum/supply/weekly/pdf/wpsrall.pdf; https://www.eia.gov/dnav/pet/pet_stoc_typ_d_r20_SAE_mbbl_m.htm; and https://www.eia.gov/dnav/pet/pet_cons_psup_dc_r20_mbblpd_m.htm

[8] BP's Whiting, Indiana refinery to start planned turnaround as early as next week, IIR says | BOE Report; Marathon, Teamsters negotiations remain at standstill as strike enters third week; and HF Sinclair Predicts Margin Recovery, Moves Up Kansas Refinery Turnaround -- OPIS

[9] EIA Product Supplied

[10] October 2024 Energy Information Administration Short-Term Energy Outlook, https://www.eia.gov/outlooks/steo/data/browser/#/?v=9

[11] https://www.eia.gov/dnav/pet/pet_cons_psup_dc_r20_mbblpd_a.htm

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DATE: 11/06/2024

FROM: Stephen Clark
Gary Devenish
Ed Scardaville

SUBJECT: MIDWEST STATES GASOLINE RVP – 1 PSI WAIVER STUDY UPDATE

BACKGROUND

The U.S. EPA currently allows finished summer gasoline at 10.0-psi RVP to meet the 9.0-psi RVP specification through a 1-psi waiver. The waiver allows blending up to 10 volume % ethanol into conventional gasoline blendstock for oxygenate blending (CBOB), which increases gasoline RVP by approximately 1 psi. Governors in an eight-state region[1] (the "Region") joined a notice to remove the existing 1-psi waiver for 10 volume % ethanol gasoline (E10) beginning with the 2023 summer ozone seasons, effectively requiring refiners to produce a lower RVP CBOB. The Region's governors aim to create a new CBOB grade suitable for

[1] As of December 21, 2022, the eight-state region comprised Illinois, Iowa, Minnesota, Missouri, Nebraska, Ohio, South Dakota, and Wisconsin.

blending to E10 or E15 during the summer months ("Low RVP CBOB"[2]).

The EPA published a final rule on February 29, 2024, removing the 1-psi waiver in the Region effective April 28, 2025.[3] American Fuel & Petrochemical Manufacturers (AFPM) engaged Baker & O'Brien, Inc. (Baker & O'Brien) to update our February 2023 study (the "2023 Study") that evaluated the overall impacts on fuel supply and the estimated cost of producing and distributing Low RVP CBOB. Specifically, AFPM requested we update the 2023 Study to incorporate Missouri's supply and demand impacts and evaluate the lead time required by refiners, pipeline operators, and other petroleum supply chain participants to ensure the availability of low RVP fuel starting April 28, 2025. Refiners and terminals must transition RVP production and product stored before this deadline. The transition to clear out higher RVP winter gasolines from the distribution system must typically begin in February.

SUMMARY OF UPDATED FINDINGS

The Update work scope incorporated the following tasks:

1. Revising our *PRISM*™ RVP modeling to incorporate new or refreshed refinery information and the restart of the Cenovus Superior refinery
2. Updating the 2023 Study's cost basis[4]
3. Adding Missouri to the Region's supply and demand balances
4. Updating the Region's overall balances from the original 2019 basis to 2023[5]

Baker & O'Brien sent a follow-up request to the original survey recipients, specifically asking if they made refining or logistic capital investments in anticipation of the summer 2025 gasoline season and if the inclusion of Missouri added costs or raised concerns. We held follow-up meetings to clarify written survey responses. The Update incorporates feedback from 80% of the key identified refining capacity supplying gasoline to the Region.

[2] "Low RVP CBOB" refers to CBOB that meets a gasoline RVP specification of 9.0 psi after ethanol blending.
[3] 89 Fed. Reg. 14,760 (Feb. 29, 2024).
[4] When applicable both 2022 and 2023 results are summarized in tables, compared to the 2019 cost basis.
[5] At the time, the EIA's 2019 data was the most up-to-date information, excluding COVID-related demand impacts.

As described in the 2023 Study, supplying refined products to the Region relies on consistent refinery production and pipeline operations. A single CBOB grade throughout the region is highly fungible, enabling refining and distribution networks to respond to planned and unplanned supply outages. Requiring two RVP CBOB grades reduces fungibility, and refinery and pipeline constraints will limit supply options for Low RVP CBOB and exacerbate supply disruptions caused by unplanned outages. Adding Missouri as a Low RVP state is expected to put additional pressure on the supply and distribution system, potentially increasing the consumer impact related to supply disruptions. The primary changes to the 2023 Study included:

- The 2023 Study was based on EIA's summer 2019 finished state gasoline consumption volumes. The Update is based on EIA's 2023 state gasoline consumption volumes. This basis change lowered the initial seven-state regional demand by 44,000 barrels per day (b/d). Adding Missouri increased overall consumption within the Region by 124,000 b/d. These changes increased gasoline consumption by 80,000 b/d versus the 2023 Study, from 860,000 b/d to 940,000 b/d.
- Estimated near-term Low RVP CBOB supply costs increased to 9-12 cents per gallon (cpg) (vs. 8-12 cpg) due to higher estimated market RVP costs compared to the 2023 Study and updated survey responses.
- Considering the updated survey responses and other changes, there is a potential for an overall CBOB production decrease of up to 131,000 b/d in the Region. This reduction is 6,000 b/d more than the 2023 Study's 125,000 b/d reduction. This potential reduction would result from a combination of high RVP blending gasoline component rejection strategies and potential crude cuts to manage butane rejection within logistical capabilities.
- The overall potential impact would be an estimated reduction of up to 131,000 b/d of gasoline and up to 39,000 b/d of diesel supply to the Region, equivalent to a sustained outage at a large PADD2 refinery. Supplemental supply will need to come from refineries outside the Region, particularly

PADD3/US Gulf Coast refineries. Losing in-Region supply reduces product availability for outages and other unforeseen circumstances.

- Baker & O'Brien estimates a potential $0.7 to $0.9 billion per year consumer cost increase based on our near-term assessed costs and market demand under normal supply conditions.[6] If supply disruptions occur, consumer costs could increase by as much as $1.2 billion annually.

CONCLUSION

No refiner communicated that they could produce Low RVP CBOB without incurring additional costs. Baker & O'Brien expects most of the higher refinery production costs, estimated at $0.7 to $1.2 billion per year, to be passed on to consumers. Some refiners indicated they had started capital investments to reduce these costs and improve their capability to produce Low RVP CBOB. Only one refiner indicated that storage facility investments will be completed by the 2025 summer gasoline season to allow conventional and Low RVP CBOB sales. Certain smaller refiners indicated they would not be ready to meet the 2025 summer gasoline season RVP requirements and would not make Low RVP CBOB.

Baker & O'Brien also spoke with previously surveyed midstream operators to assess readiness for the 2025 summer gasoline season. One midstream operator indicated it could accommodate the additional gasoline grades within the Region by the proposed deadline. The midstream operator is furthermore investing tens of millions of dollars to improve its flexibility with increasing gasoline grades, but these projects will not be complete in time for the 2025 summer gasoline season. Even with these projects, adequate supply throughout the entire Region is not assured as other refinery and pipeline constraints will remain. Moreover, increasing the number of gasoline grades reduces the system's overall fungibility, which capital investments cannot entirely overcome. Reduced fungibility exposes the system to more severe and pronounced supply disruptions, likely increasing consumer costs in more isolated parts of the Region.

[6] Approximately $100 to $200 million increase from the 2023 Study results.

Baker & O'Brien believe the proposed 2025 summer gasoline season RVP change will potentially reduce available supply and increase refined product (gasoline and diesel) costs for consumers. This change will also increase the likelihood and impact of supply disruptions. The primary factors are reduced supply interchangeability due to the additional Low RVP CBOB grades within the common systems, reduced refinery throughputs, and added refiner costs. Additionally, managing planned and unplanned outages will be more challenging as refiners prioritize the production of specific grades of gasoline over others. We believe the expected capital investments to be completed by 2026 and later will not eliminate the supply constraints and additional consumer costs. Near-team supply constraints and their associated cost impacts could potentially be reduced by $100 to $300 million by delaying the enactment of the Low RVP CBOB waiver.

RESPONSE TO EPA COMMENTS

In February 2024, EPA issued its Response to Comments to the "Request from States for Removal of Gasoline Volatility Waiver" ("Response")[7] and a supporting Technical Support Document and Cost Analysis (TSD).[8] The Response to Comments extensively addressed Baker & O'Brien's original February 24, 2023 analysis (2023 Study). Baker & O'Brien reviewed the Response, and we offer the following initial observations:

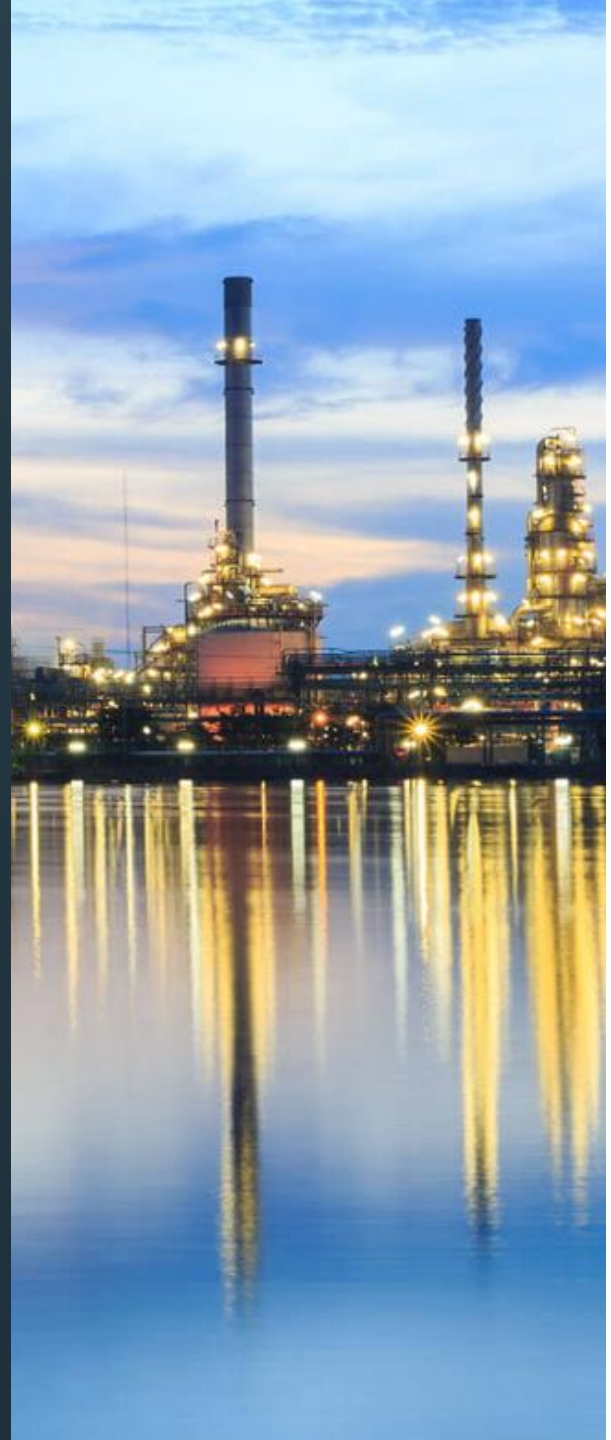
- After reviewing the Baker & O'Brien 2023 Study, EPA increased its estimate of the reduction in gasoline production from the removal of the 1 psi waiver from 20,000 b/d to 30,000-80,000 b/d, as compared with Baker & O'Brien's original estimate of 88,000-125,000 b/d. EPA's lower production loss estimate is largely attributable to its conclusion that refineries would not reduce crude oil throughput with the elimination of the 1 psi waiver. However, if refineries cannot acquire additional rail cars[9] to remove higher volumes of butane, buy high octane, low RVP blending components,

[7] EPA Comments on Request from States for Removal of Gasoline Volatility Waiver February 2024.pdf
[8] EPA Technical Support Document on Request from States for Removal of Gasoline Volatility Waiver February 2024.pdf
[9] Several respondents relayed concern about rail car availability

or invest in new tankage or butane recovery systems, curtailing crude runs to reduce light-end production remains a likely outcome.

- In addition, while EPA suggested refiners could shift to heavier crude slates to manage excessive light ends, crude switching comes with significant economic costs, and the EPA did not address that issue. Moreover, due to the extensive use of diluent in heavy crude oil, increasing heavy crude inputs could make it more difficult to manage light ends disposition.
- EPA concluded that some terminals and pipelines would handle only one grade of BOB, which would result in the need to supply low RVP CBOB to non-petitioning states.
- EPA cited that volume loss as a reason for Baker & O'Brien's gasoline production impact being higher. However, Baker & O'Brien's volume impact assessment is based only on petitioning states' Low RVP demand and did not assume any low RVP CBOB was sold into non-petitioning states. EPA also suggested that terminals could blend butane into low RVP CBOB to increase the supply of high RVP material. However, such blending likely requires significant investment, and we do not expect butane blending at terminals to be a near-term solution.

Baker & O'Brien



MIDWEST STATES

GASOLINE RVP – 1 PSI WAIVER STUDY

UPDATE

Report for:

American Fuel & Petrochemical Manufacturers

November 6, 2024

Legal Notice

Baker & O'Brien, Inc. (Baker & O'Brien) prepared this update to its 2023 RVP Study report (the "Update") for the sole benefit of the American Fuel & Petrochemical Manufacturers (AFPM) association to inform its advocacy on low RVP gasoline and as provided in our engagement agreement dated August 14, 2024. Except as provided in the engagement agreement, Baker & O'Brien makes no warranties either expressed or implied and assumes no liability with respect to the use of any information or methods disclosed in this report.

The opinions and findings in this report are based on Baker & O'Brien's experience, expertise, skill, research, analysis, discussions, and related work to date. This report also relies upon public and proprietary data available to Baker & O'Brien at the time this report was prepared. In the event that additional information should subsequently become available that is material to the conclusions presented herein, Baker & O'Brien reserves the right to supplement or amend this report. AFPM acknowledges and understands that all forecasts and projections contained in this report represent Baker & O'Brien's best judgment utilizing its skill and expertise and are inherently uncertain due to the potential impact of factors or future events that are unforeseeable at this time or beyond Baker & O'Brien's control.

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Baker & O'Brien used our proprietary *PRISM*™ refinery analysis software and database in order to quantify implications in terms of costs and operations to the refining system. *PRISM* is a trademark of Baker & O'Brien, Inc. All rights reserved. All other trademarks are the property of their respective owners.

Helpful Acronyms and Definitions

BOB	"Blendstock for Oxygenate Blending" - gasoline product from refineries before ethanol is blended
CBOB	Conventional BOB (typically 8.8 psi RVP in summer) includes 1 psi RVP waiver when blended with 10% ethanol
CPG	Cents Per Gallon
E10/E15	Gasoline blends composed of 10% and 15% ethanol by volume, respectively. 10% to 15% blends of ethanol add roughly 1 psi to the RVP of gasoline. "E10, E15 10% Ethanol, 15% Ethanol" refers to ethanol content by volume
HIGH RVP CBOB	Traditional CBOB (typically 8.8 psi RVP) includes 1 psi RVP waiver when blended with 10% ethanol
LOW RVP CBOB	CBOB (estimated 7.8 psi RVP in summer) with no RVP waiver when blended with ethanol
RBOB	Reformulated BOB - BOB with low RVP (typically 6.2 psi RVP) per local/regional requirements
EIA	The United States Energy Information Administration
EXTENDED COST MODEL	A model that sums all costs to meet a change in gasoline RVP for a specific refinery plus the logistics costs to deliver to market
EPA WAIVER OPT-OUT STATES	Eight Midwest states proposing to opt out of the EPA's 1 psi RBP waiver for gasoline during summer months: Iowa, Illinois, Minnesota, Nebraska, Ohio, South Dakota, Missouri, and Wisconsin
LSR (ALSO C5, NATURAL GASOLINE)	Light Straight Run is a light, high RVP gasoline blendstock in a refinery which contains mixed butanes (C4), pentanes (C5), hexanes (C6), and other light components. Natural gasoline is a purchased component with similar qualities
MBPD	Thousands barrels per day
RVP	Reid Vapor Pressure is the specification for gasoline vapor pressure measured in pounds per square inch (psi)
RVP COST MODEL	The cost of adding or subtracting butane to meet gasoline RVP specifications
USGC	United States Gulf Coast, Large refinery hubs located in costal Texas, Louisiana and Mississippi

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Gasoline RVP - 1 psi Waiver Update

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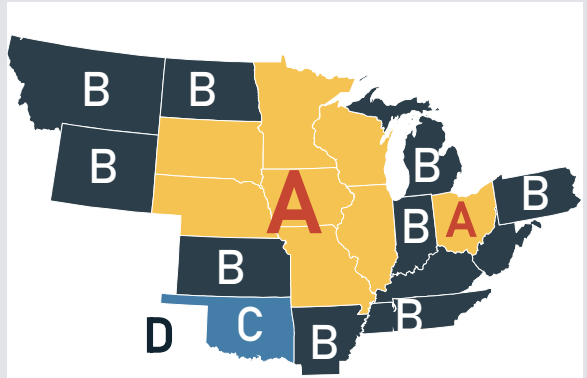
EXECUTIVE SUMMARY

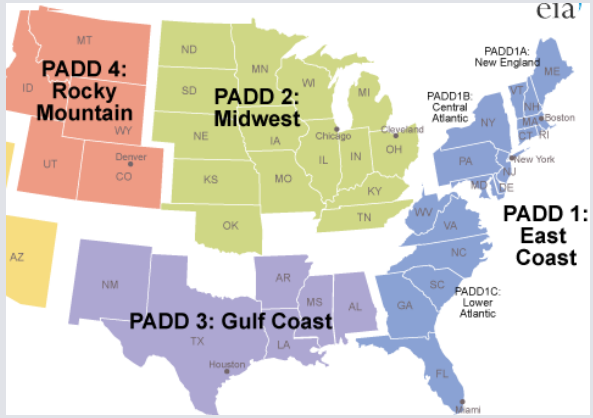
Introduction

- As of December 21, 2022, the eight EPA Waiver Opt-Out States (Group A) joined a petition to remove the existing 1 psi waiver for 10% ethanol by volume gasoline starting in the 2025 summer ozone season
- Blending 10% volume ethanol into gasoline blendstock adds roughly 1 psi to the RVP
  - U.S. EPA 1 psi waiver allows finished gasoline containing 10 % ethanol to exceed the 9.0 RVP limit and meet a 10.0 psi limit
  - Refineries typically produce an 8.8 psi CBOB to meet the 10.0 psi summer RVP limit
  - Removing the 1 psi RVP waiver lowers the RVP of the CBOB that refiners produce to approximately 7.8 psi ("Low RVP CBOB")
- The 1 psi waiver removal in Group A affects product costs/balances in other states:
  - Group B (Neighboring states) that Group A supplies and receives refined products from (or both)
  - Group C (Oklahoma) which supplies refined products to Group A and Group B
  - Group D (Texas and Louisiana) that can provide "swing" refined products to Groups A, B, C
- This Update evaluates near-term (2025-26) and long-term (2026+) effects on:
  - Gasoline supply and costs, including costs for refiners to produce Low RVP CBOB and costs to store and distribute fuel in Groups A, B, C, and D
  - Other gasoline and diesel supply chain impacts

Waiver in Group A (yellow) states impacts supply and costs in Regions B, C, D



Group A states are in EIA's PADD 2



This Update presents costs derived from publicly sourced data, aggregated and anonymized individual surveys, and Baker & O'Brien's professional judgment. Each refinery is unique in its ability to refine products and will face different costs and market conditions that impact the ability to recover these costs.

Market Indication of Supply Costs

PADD 2 (home to all the Group A states) refining complex has evolved to serve gasoline markets under the 1 psi ethanol waiver

- Due to legacy RVP specifications, many PADD 2 refineries do not maximize recovery and control of high RVP components
- Typical RVP cost model studies do not capture extended processing costs, especially at low RVP blends
  - Refineries with equipment designed for higher RVP blends cannot easily make low RVP blends
- Evaluating actual refiner and pipeline company capabilities and market RVP costs is critical
  - Urgent/short implementation timeline does not allow refiners to understand constraints fully
  - Pipeline companies and refining companies cannot readily segregate High and Low RVP CBOB products

Market evidence provides insight into the costs of RVP (using gasoline grade price differentials)

- Comparing Chicago gasoline market RBOB and CBOB prices provides an apples-to-apples RVP cost indication (see Appendix)
  - Summer RVP "cost" averaged 8 cpg per 1 psi (cpg/#) in 2019 and 12 cpg/# in 2023
  - Generally, estimated PADD 2 RVP historical costs at 8-12 cpg/# for producing Low RVP CBOB
- Other market evidence suggests elevated costs for supplying boutique fuels during PADD 2 market shortages (see Appendix)
  - RFG gasoline is currently excluded from 1 psi waiver – requires BOB with 6.2 psi RVP (RBOB)
  - Retail RFG markets are much more susceptible to severe price increases during unexpected supply shortages
  - Recent PADD 2 supply disruptions demonstrate a potential retail price differential spike more than 60 cpg
  - Reduction of PADD 2 CBOB production will increase potential for supply shortages

Supply Cost Impacts - Summary

- The Low RVP CBOB supply cost is assessed by considering three approaches
  1. Typical **RVP cost model** that largely relies on the cost of butane rejection
  2. The **observed market price differentials** for different gasoline RVP grades in Chicago
  3. The 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 in Groups A, B, C, and D ("**Extended Cost Model**")
     - The broadest range of responses results in costs from 3 to 12 cpg
  4. **Assessed near-term supply** costs consider all three approaches and account for the supply/demand balances and market realities in the region
     - Assessed near-term supply costs range from 9 to 12 cpg with a total summer cost of $0.7 to $1.0 billion

Low RVP CBOB Supply Cost (above High RVP CBOB)

cents per gallon

RVP Cost Model	2019 / 2023 Observed Differential (Chicago)	Extended Cost Model	Assessed Near Term Cost
2 - 10	8 / 12	3 - 12	9 - 12

- **The spot market price of Low RVP CBOB in the Group A states is expected to reflect additional costs to produce Low RVP CBOB and additional costs associated with storing and distributing the product**

This Update presents costs derived from publicly sourced data, aggregated and anonymized individual surveys, and Baker & O'Brien's professional judgment. Each refinery is unique in its ability to refine products and will face different costs and market conditions that impact the ability to recover these costs.

Typical RVP Cost Model vs. Extended Cost Model

The Update compares two approaches for calculating additional refiners' supply costs for Low RVP CBOB (over High RVP CBOB)

1. A typical RVP cost model relies largely on the cost of butane rejection
   - Estimated using 2019 PRISM model arm's length/desktop analysis for individual refineries
   - Excess butane rejected and sold with zero operating costs or constraints
   - Ignores that some refineries cannot remove enough butane below 9.0 psi
   - If butane rejection by itself was adequate, **incremental production costs approach 3 cpg**
2. An extended cost model accounts for costs in addition to butane rejection: LSR removal, blendstock purchases, production cuts, infrastructure costs, distribution, etc.
   - Developed from refinery-specific surveys and discussions
   - **For individual refineries in Groups A, B, C, and D, the near-term total additional costs for supplying Low RVP CBOB ranges between 3 and 12 cpg**

Considered two timeframes for refineries and midstream operators:

1. Summer 2025: Generally too early to implement: capital modifications
2. Summer 2026: May allow time to implement capital modifications:
   - Additional fractionation and storage of butane and LSR
   - Logistics assets (tanks, pipes, etc.) to produce, store, distribute additional gasoline grades

Range of Costs of Producing and Distributing Low RVP CBOB, cpg

	RVP Model [1]		Extended Cost Model [2]				Pipeline Systems Additional Costs	
	2023Q3		Near term		Long term		Long Term[3]	
Group	Low	High	Low	High	Low	High	Low	High
A	2	10	3	12	3	12	0	2
B	2	4	3	12	3	8	0	2
C	2	3	4	10	4	5	0	2
D	2	2	4	4	4	4	0	2

(1) For each refinery, PRISM assumes efficient fractionation, stream flexibility, and logistics capabilities (similar to other refinery production models)
(2) Costs include refinery-operation adjustments, downgrades, fractionation, refinery storage, and component logistics. In some cases, costs include lower CDU runs
(3) Midstream companies will pass through amortized capital costs only in the long term

The Update reveals shortcomings of a typical RVP cost model only

1. Typical RVP models assume "ideal" operation and "average" properties
2. Typical RVP models do not consider refinery-specific capabilities and the constraints on infrastructure and distribution downstream from the refinery
3. Surveyed costs significantly exceeded butane rejection costs

This Update presents costs derived from publicly sourced data, aggregated and anonymized individual surveys, and Baker & O'Brien's professional judgment. Each refinery is unique in its ability to refine products and will face different costs and market conditions that impact the ability to recover these costs.

Supply Cost Estimates

The assessed total cost to supply (produce, store, and distribute) Low RVP CBOB is expected to range from 9-12 cpg in the near term over current High RVP CBOB price with variations for individual suppliers[1]

- Based on current operating conditions, marginal costs of production, and distribution costs; does not include capital investments
  - Calculated using an extended cost analysis which includes responses from surveyed refiners and historical market RVP costs
  - Significant volumes from marginal cost suppliers will be required to fulfill the market demand
- Some refineries must reduce crude oil throughput to manage high RVP components that can no longer be blended into CBOB
  - Diesel production reduced at refineries with crude throughput reductions
- A two-week unplanned supply disruption could raise estimated average summer consumer costs by as much as 5 cpg

The total incremental cost to supply Low RVP CBOB is between $0.7 billion to $1.2 billion per year

- Costs include EIA estimated volumes of CBOB consumption for 185 days during summer gasoline season
  - $0.7- $0.9 billion assumes expected higher Low RVP CBOB supply cost of 9 - 12 cpg absent any supply disruptions
  - Supply disruptions push supply costs higher - $1.2 billion assumes a two-week summer shortage and consumer price spike in PADD 2 (*See Appendix for details)*

Studies that ignore the actual process and logistic constraints and use only typical RVP cost models will underestimate actual costs

- These models typically assume butanes and other high RVP components are separated before blending
  - Some refineries don't have the ability to adequately remove light components before blending
- Such capabilities are largely limited to refineries that produce significant volumes of RFG and low-RVP fuels

[1] Each refinery is unique in its ability to refine products and will face different costs and market conditions that impact the ability to recover these costs

Capital Cost Estimates

Surveyed refiners indicated investments required for more efficient production of Low RVP CBOB

- Necessary investments differ widely but may include new fractionation, tanks, and piping
- Two refiners indicated investments could not be justified and they may not produce Low RVP CBOB (supply risk)

Surveyed refiners provided preliminary capital cost (CAPEX) estimates

- Typical preliminary capital cost estimates per surveyed refinery are $50 to $75 million
- Amortized refinery investment capital cost per gallon of 0 to 2 cents per gallon of Low RVP CBOB

Capital investments at refineries, pipelines, and terminals will take two or more years to implement

- Sizeable capital projects typically require at least two years from management approval to final implementation
- In addition to the two-year capital project timing, refiners and pipeline operators are hesitant to pre-invest due to the uncertainty regarding changes to RVP specifications or extension of the 1 psi waiver to E15 gasoline blends
- Before spending capital, pipeline operators require commitments regarding volumes, qualities, and markets served to formulate optimal capital investment plans

Potential Gasoline Supply Reductions

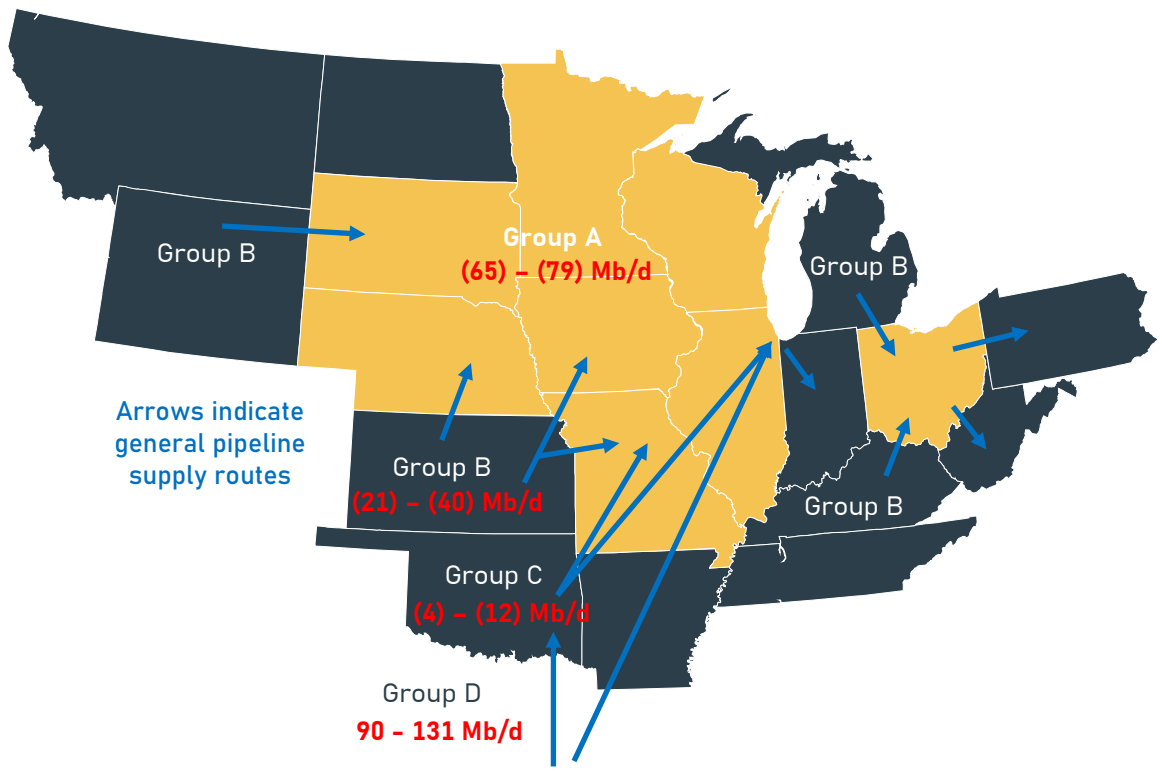
Reduced supply and risk of shortages

Less refined products production in Groups A, B, C

Reduction of CBOB and Distillates Production (Mb/d)		
Group	Reduced CBOB Volume	Reduced Distillate Volume
A	65 - 79	16 - 26
B	21 - 40	6 - 10
C	4 - 12	2 - 3
Additional from D	90 - 131	24 - 39

- Replacement supply must come from Group D
  - Logistics limitations north of Texas
  - Only one RVP product north of Kansas
  - Limited pipeline capacity (often "full" in summer)
- Loss of system "robustness" especially in 2025-26
  - Additional "Low RVP" grade reduces fungibility
  - More frequent and longer supply disruptions
    - Higher risk of price spikes and shortages

CBOB and distillates short-fall in Groups A, B, C must be supplied from Group D



Overall Supply Impacts

Currently, 40% of the gasoline market in PADD 2 is CBOB sold into 1 psi waiver markets

- Summer CBOB (at 8.8 psi to meet 10.0 psi finished gasoline specification) is highly fungible - produced, stored, and transported throughout the region
- PADD 2 refining and distribution networks have evolved to efficiently supply 8.8 RVP CBOB
  - Current ability to adapt to "normal" supply/demand swings
  - Current ability to respond to planned and unplanned supply interruptions (e.g., refinery outages)

Several respondents noted that two RVP CBOB grades are significantly less fungible than one current grade

- Nebraska, Iowa, South Dakota, and southern Wisconsin do not have refineries
  - Many remote areas rely on one pipeline source
- Refinery and pipeline constraints limit supply options for Low RVP CBOB
  - High RVP CBOB cannot be moved to Low RVP CBOB markets
  - More expensive Low RVP CBOB could be supplied into high RVP CBOB markets if needed
    - Due to logistics constraints, some High RVP CBOB areas will only be supplied with Low RVP CBOB, especially in the first two years

Estimated gasoline supply reduction in and into Group A states is up to 131,000 b/d and up to 39,000 b/d for diesel

- Reductions equate to an outage at a large PADD 2 refinery
- Per surveys, it is uncertain if the pipelines can currently replace lost volumes reliably while supplying multiple CBOB grades

Distributing refined products across PADD 2 relies on consistent refinery production and pipeline operations

- Reducing CBOB fungibility will exacerbate consequences of unplanned supply disruptions such as a refinery outage
- Local pricing could adjust to reflect higher trucking costs from more distant refineries and terminals

Other Supply Impacts

Denver 2024 specifications changed to RFG 2024 –Oklahoma, Kansas, Colorado refinery/pipeline impacts

- Refiners emphasized the difficulty to supply Denver RBOB and Low RVP CBOB for Nebraska, Iowa, and other Northern PADD 2 markets without additional investments
- Some Kansas and Oklahoma refineries may not be able to supply Low RVP CBOB markets unless strong market signals that offset the expense of lower total production capacity

Limited ability for pipelines/terminals to segregate additional grades of gasoline without investment

- Could result in High RVP markets supplied with more expensive Low RVP CBOB
  - States not opting in may pay a higher price than they would under the current harmonized market
  - Examples may be areas in Indiana and Michigan currently supplied from Chicago, or areas of North Dakota and Kansas

Near-Term and Long-Term Implications

Near-Term Implications

Summers 2025/2026

- Many refineries will increase butane and LSR sales to contain RVP components in CBOB sales
- Some refiners may reduce crude runs to control the amount of high RVP gasoline components blended in the gasoline pool
- The Low RVP CBOB specification will reduce total CBOB production in PADD 2
  - Distillate production may also be lowered due to crude throughput cuts
- Increased volumes of CBOB and distillate will likely be shipped from Gulf Coast refineries to the Midwest
  - Low RVP CBOB specifications will complicate logistics with lower total available stored volumes of CBOB
- In some cases, refiners will need to secure additional transportation for allocating rejected light ends, via rail, truck, or pipeline, depending upon their location
- Some refiners will begin planning to spend CAPEX in fractionation, storage, distribution, and transportation, in order to handle the rejected light ends from the gasoline pool

Long-Term Implications

Summer 2027 or Later

- Although refiners and midstream companies will make incremental changes to optimize production and delivery of Low RVP CBOB, production will continue to be constrained by low RVP specifications and multiple products
- Some refiners and midstream operators will need to implement investments to secure long-term production of lower RVP CBOB

  Such investments will include:
  - Adding tanks (storage) to balance light ends and new gasoline blend needs
  - Adding piping, pumps, and other equipment to accompany additional fractionation and storage
  - In some cases, refiners will need to secure additional transportation for allocating rejected light ends, via rail, truck or pipeline, depending upon their location
- Pipeline operators will add tanks, piping, and logistics capabilities to handle multiple grades

Gasoline RVP - 1 psi Waiver Update

02

METHODOLOGY, BACKGROUND AND APPROACH

Update Methodology

Baker & O'Brien was engaged by the American Fuel & Petrochemical Manufacturers (AFPM) association to assess the cost of producing conventional gasoline blendstock (CBOB) for gasoline without a 1 psi RVP waiver (Low RVP CBOB) for eight Midwest states (Opt-out States) during the summer months (the "Update").

The Update considered how the proposed specification change would impact gasoline production and distribution systems in several United States (U.S.) Midwest markets. To complete this Update, Baker & O'Brien modeled a robust and representative number of refineries supplying the petitioning states using our proprietary *PRISM* refinery simulator and database to quantify implications in terms of costs and operations to the refining system. We defined a "Base Case" which represented current summer specifications at 8.8 psi CBOB to meet the 10.0 psi finished gasoline specification with the 1 psi federal waiver, and a "Study Case" which modeled typical changes required to produce 7.3 psi CBOB in March (needed for the RVP transition) and 7.8 psi CBOB to meet the 9.0 psi finished gasoline specification without the federal 1 psi waiver for the rest of the summer season. This traditional approach relies largely on butane rejection to accomplish the RVP reduction. However, assessing only butane rejection was eventually deemed inadequate to capture full cost impacts. Due to the potentially unprecedented low RVP specification, some refineries cannot remove additional volumes of butane, requiring more costly measures to reduce RVP.

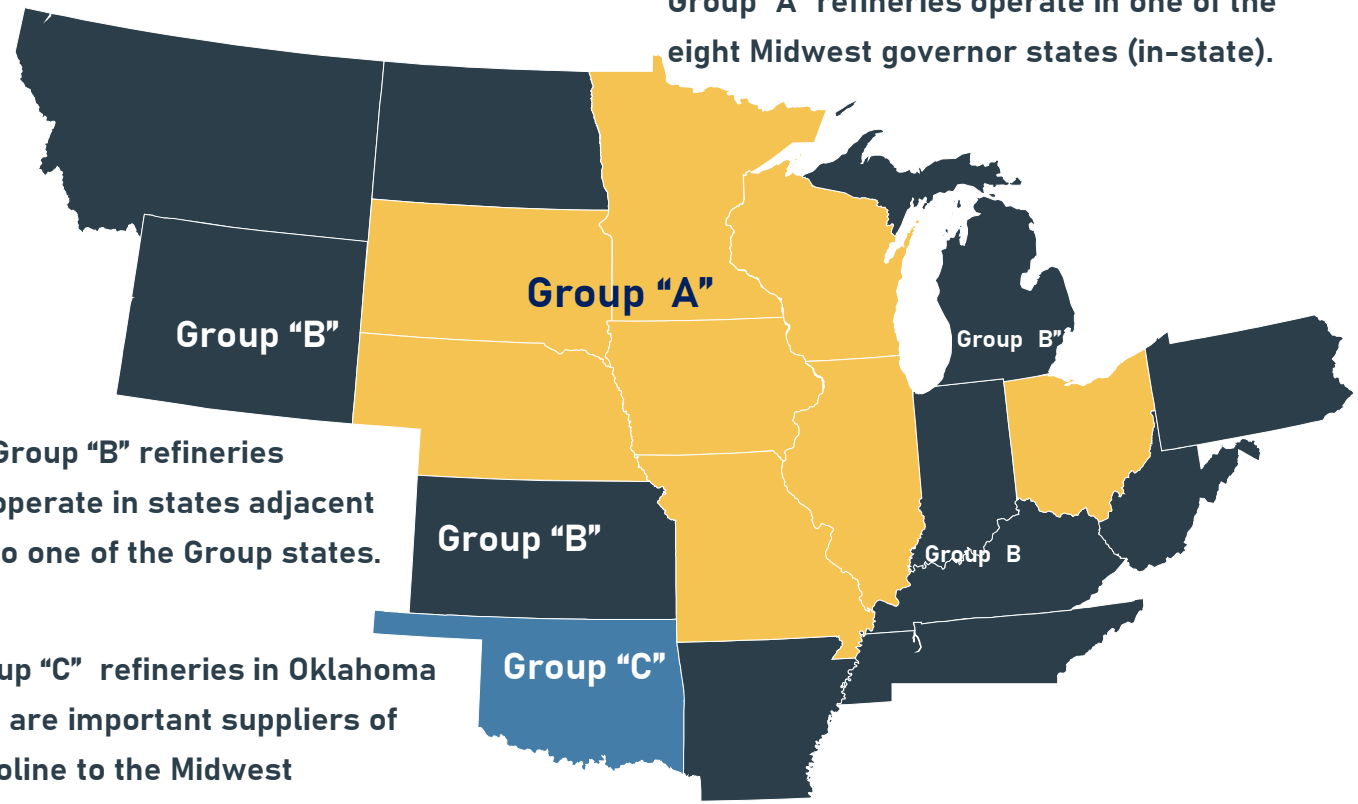
We surveyed key staff at representative refineries throughout the region to identify bottlenecks or implications that each asset would encounter when producing a lower RVP blend. As part of these surveys, we also obtained insight into commercial considerations, as well as storage and logistics conditions that the RVP change would impact.

The Update's modeling and survey results are completely anonymous in nature. Readers of this report cannot identify which specific refineries were modeled or surveyed. All individual results and answers are strictly confidential The Update presents costs derived from publicly sourced data, aggregated and anonymized individual surveys, and Baker & O'Brien's professional judgment. Each refinery is unique in its ability to refine products and will face different costs and market conditions that impact the ability to recover these costs.

Background: CBOB Product Supply Groups

In February 2024, the EPA finalized regulations to remove the 1-pound psi RVP waiver for summer gasoline-ethanol blended fuels containing 10 percent ethanol by volume in eight Midwestern states (Group A)

- It was necessary to consider gasoline production and balances not only in Group A states but also in the overall market. Adjoining states import or export gasoline to Group A states through shared pipeline connections
- Baker & O'Brien classified the refineries under consideration into the geography-based categories displayed on this map



Background: Refiner Options for Reducing RVP

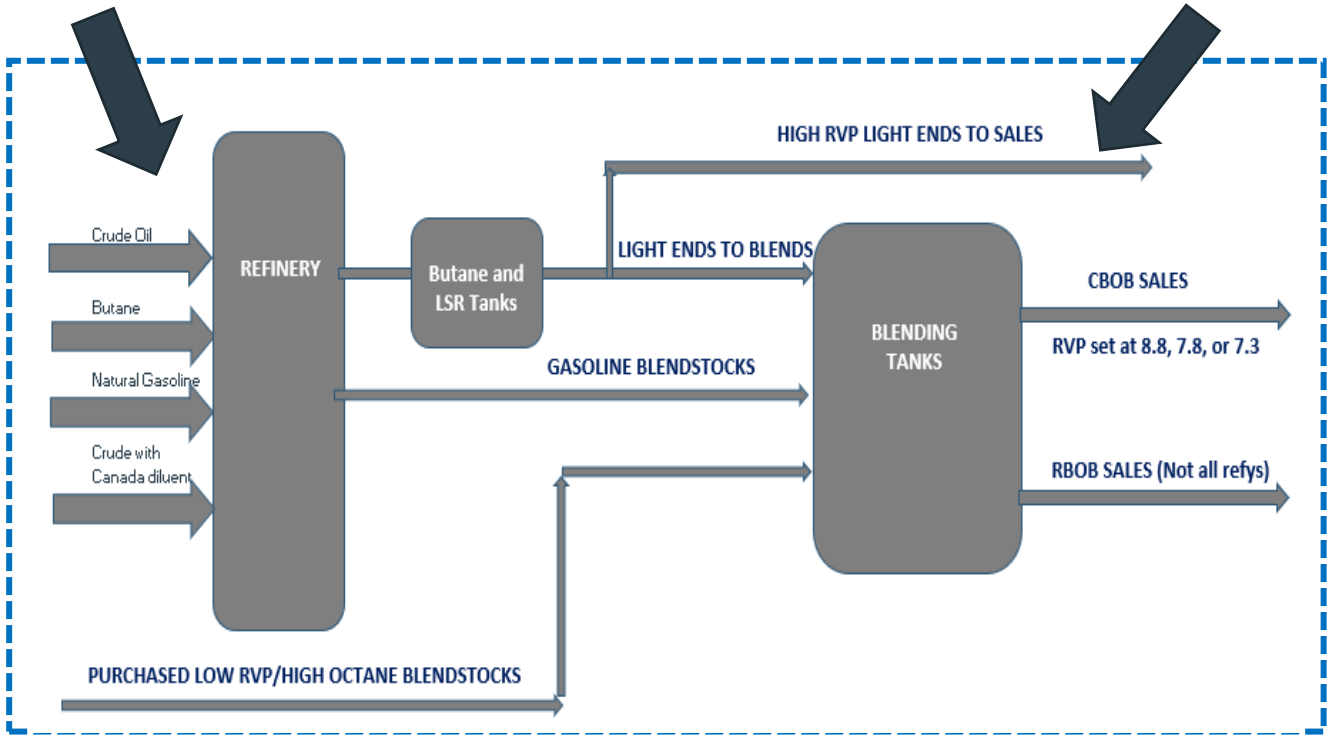
Reducing light components in refinery feed:

- Modifying crude slate (less optimal crudes)
- Reducing crude runs (less throughput)

- Most refineries are configured to run specific crude types with limited capability for major crude slate changes
- Around 30% of refineries would potentially reduce runs to produce 1 psi lower CBOB
- Other refineries could buy expensive blend stocks to soak up RVP

Reducing light components in the gasoline pool:

- Fractionation and extraction before blending
- Selling or storing excess components



- New fractionation requires investment
- Component rejection creates transportation and storage challenges for excess butane and LSR at depressed prices
  - New tanks
  - Additional railcars, more trucking, or new pipelines

Update Approach – Refinery Surveys

Baker & O'Brien prepared a questionnaire (see Appendix) to capture insight regarding operational, commercial, and logistics considerations with specific questions pertaining to:

- Operating costs related to the lower RVP production
- Gasoline blending costs
- Crude throughput constraints
- Capital costs
- Logistics costs
- Light ends disposition costs
- Product flexibility

Midstream companies were surveyed with questions pertaining to:

- Logistics constraints for handling two different products
- Market supply scenarios
- Capital costs
- Response or transit time

Update Approach – Refinery Modeling

Used the Q3 2019 *PRISM* simulator for each of the surveyed refineries (See Appendix):

- *PRISM* is a typical RVP Cost model that assumes standard butane recovery and RVP values for gasoline components
- Third quarter of 2019 used to represent summer operations from a pre-Covid operating year
- RVP costs are calculated on both Q3 2019 and Q3 2023 refinery gate pricing basis
- Analysis is presented in a manner to preserve confidentiality and ensure antitrust compliance– absolute capacities and production figures are not stated in this report

Analytical Approach

1. Gasoline blend components RVP unchanged, maintained to standard *PRISM* simulator assumption
2. Adjusted RBOB to 7.4 psi RVP RFG target or 6.2 psi RVP RBOB (standard began in the summer of 2021)
3. Developed four *PRISM* cases for each refinery responding to the survey
   - Base case summer month CBOB at 8.8 RVP (to meet 10.0 psi finished gasoline RVP) and Low RVP CBOB at 7.8 RVP (for 9.0 psi finished gasoline RVP)
   - March transition month reduced by 0.5 psi: base case CBOB at 8.3 CBOB and Low RVP CBOB at 7.3 RVP
4. RVP cost of production = (Base Case Variable Income – Low RVP CBOB Variable Income) / (Low RVP CBOB case volume)

Gasoline RVP - 1 psi Waiver Update

03

TYPICAL RVP COST MODEL RESULTS

Model Results – Typical RVP Cost Model

Baker & O'Brien's RVP cost model relies largely on the cost of butane rejection (See Appendix)

- Estimated RVP costs using 2019 *PRISM* model for refineries, arm's length/desktop analysis
- Excess butane is rejected and sold with zero operating costs or logistics constraints
- In some refineries, natural gasoline purchases were reduced to contain high RVP components

Adjustment for 2022 & 2023 Prices

- The 2022 & 2023 summer month prices were applied to the volume results of the 2019 *PRISM* model runs
- 2020 and 2021 years were ignored due to the pandemic recovery
- 2022 costs were about 20% higher than 2019; 2023 was similar to 2022
- In summary, the Group A Low RVP CBOB costs, which were based largely on the cost of butane rejection, were roughly 4 cpg

Shortcomings of a typical RVP cost model only

- Some refineries cannot remove adequate amounts of butane to achieve CBOB RVP targets below 8.8 psi
- Many refineries were not designed to segregate adequate amounts of butane prior to blending tanks
- Typical RVP cost models assume "ideal" operation and "average" properties
- Does not capture refinery-specific capability and operations, such as LSR removal, additional logistics costs, CAPEX for fractionation or logistic investments

Cost of Low RVP CBOB, cpg			
	RVP Model (1)		
Group	2019 Q3 Avg	2022 Q3 Avg	2023 Q3 Avg
A	2.4	3.0	3.7
B	1.9	2.3	2.5
C	2.0	1.9	2.2
D	1.7	2.2	2.2
Wtd Avg	2.2	2.6	3.1

(1) For each refinery, PRISM assumes efficient fractionation, stream flexibility, and logistics capabilities (similar to other refinery production models)

As explained in the Appendix, for comparison, the market reported RVP price premium for Chicago was:

- 8 cpg per psi in the summer 2019
- 10 cpg per psi in the summer 2022
- 12 cpg per psi in the summer of 2023
- 10 cpg per psi in the summer of 2024

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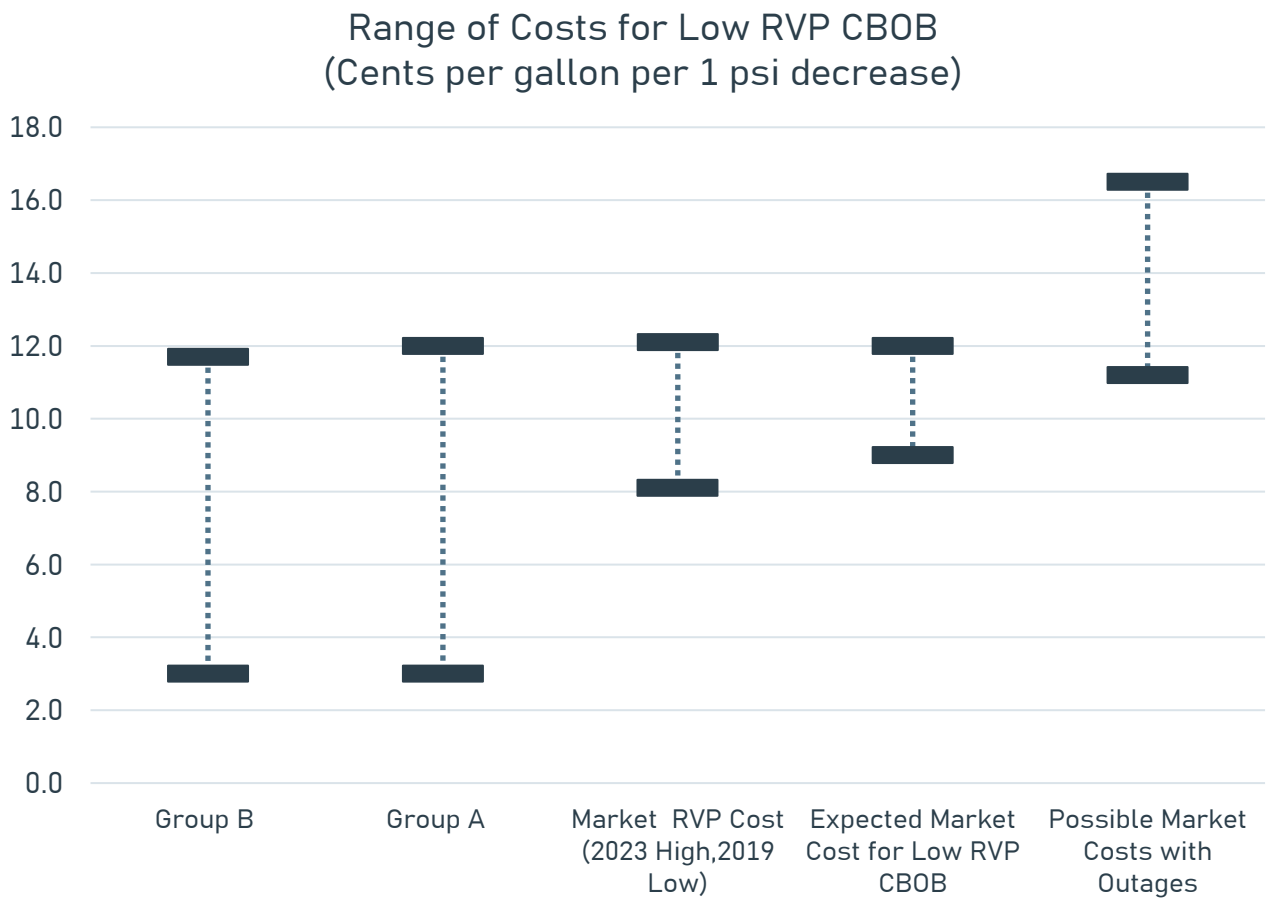
Gasoline RVP - 1 psi Waiver Update

04

MARKET OBSERVATIONS

Chicago Historical Market RVP Premium Applied to Low RVP CBOB

- The historical market costs of a 1 psi decrease in RVP was 8 cpg in 2019 and 12 cents per gallon in 2023 (Chicago basis), as explained in the Appendix
- Survey responses were generally aligned with the summer 2022 summer price drivers
- Accounting for different market pricing environments, the near-term market RVP cost range is expected to be 9 - 12 cents per gallon
- Based on historical retail price spikes between RFG and conventional gasoline prices in PADD 2, consumers of Low RVP CBOB could face a similar spike that could disrupt supply for two weeks and add as much as 5 cents per gallon to the average price for the summer



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Potential Costs of Low RVP CBOB

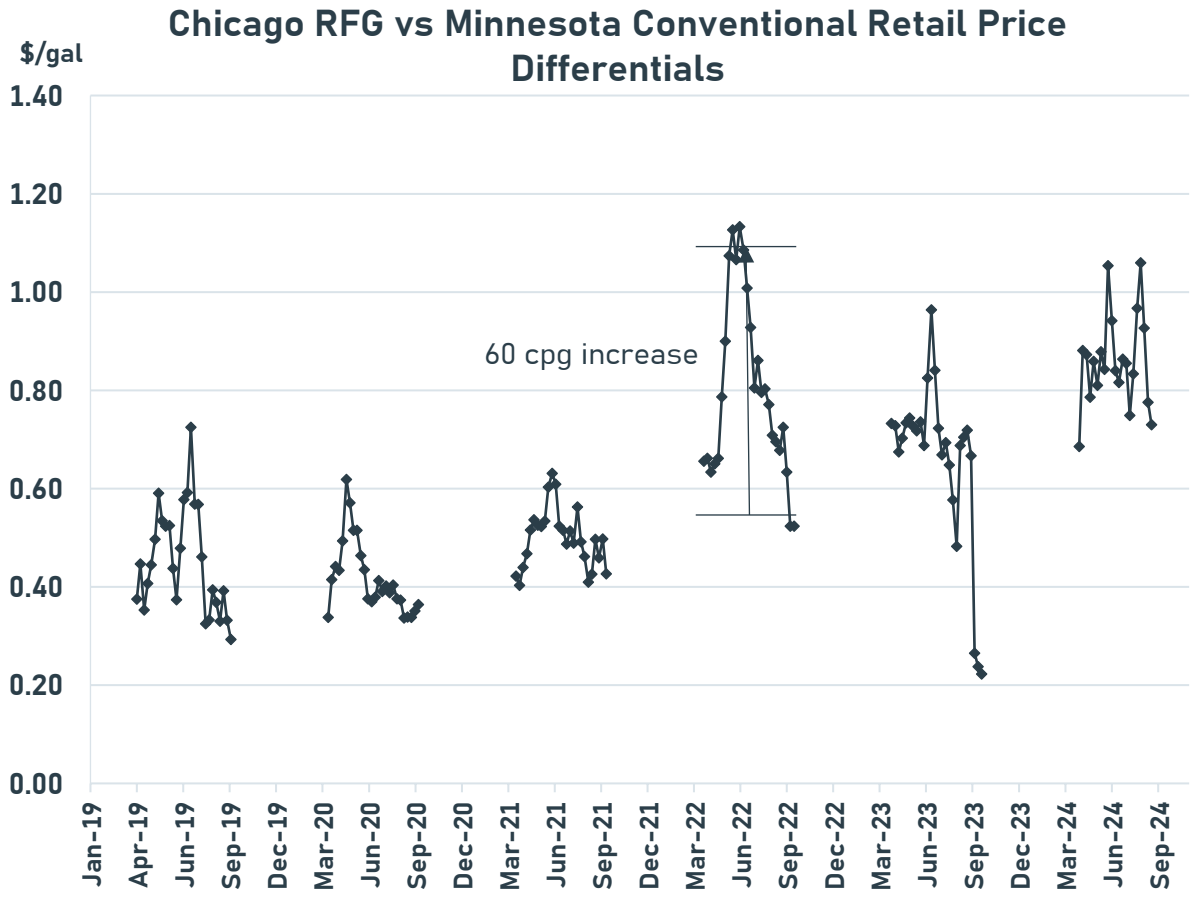
The total additional supply cost including storage and distribution of Low RVP CBOB is between $0.7 billion to $0.9 billion per year

- Costs based on EIA estimated volumes of CBOB consumption for 185 days during summer gasoline sales season
  - $0.7 - $0.9 billion assumes an expected additional production and distribution costs for Low RVP CBOB of 9 - 12 cpg
  - Basis is 7.3 billion gallons of summer Low RVP CBOB Demand

Low RVP CBOB is not fungible and will likely be subject to isolated retail price spikes as observed historically in the RFG markets

- The adjacent chart of retail RFG/Conventional market differences demonstrates up to a 60 cpg spike in RFG markets over several weeks
- For the sake of example, a similar two-week summer shortage of Low RVP CBOB and a similar 60 cpg retail price spike within the Low RVP CBOB markets could equate to an average cost increase of as much as 5 cpg over a 185-day summer season
- This temporary price spike would increase the total summer incremental supply cost to $1.2 billion

Refer to the Appendix for a more detailed methodology regarding retail RFG price spikes



Retail prices from the EIA

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Gasoline RVP - 1 psi Waiver Update

05

REFINERY AND MIDSTREAM OPERATORS' SURVEY RESULTS

Survey Results: Refinery Supply Cost Implications

- As expected, many of the surveyed refineries currently operate near a physical or economic limit for removing light ends from the summer gasoline pool
  - The RVP of gasoline blendstocks generally need to be under the gasoline RVP specification for effective blending (except butane and LSR); some PADD 2 refineries do not have ideal blendstock RVPs to meet the 7.8 psi CBOB specification (required for 9.0 psi finished gasoline)
- Most refiners expressed the need to sell incremental high RVP streams to comply with 1 RVP lower CBOB. The removal of low-priced, high RVP components inherently raise the cost of producing Low RVP CBOB
  - Some of the surveyed refiners noted current physical limitations and therefore a need to implement an augmented mode of butane or LSR sales such as truck, rail or pipeline deliveries
  - Some of the surveyed refiners stated that Low RVP CBOB will move the annual butane balance from balanced to long (currently, many refineries are short butane in the winter and long butane in the summer and balanced on an annual basis)
- Production cuts - Some refiners may have to:
  - Reduce gasoline sales overall
  - Reduce high octane gasoline production
  - Reduce crude unit utilization rates, thus lowering gasoline and distillates production
- Octane loss mitigation - Removal of high-octane butane reduces gasoline pool octane
  - All refiners surveyed already maximized alkylation unit throughput
  - Some refiners have the flexibility to increase reformer rate or severities, while others are already maximized
  - Some refiners may have to purchase high octane blendstocks, such as alkylate or toluene
- Some refiners may also need to invest in fractionation, piping, and storage
  - A survey respondent has indicated that they have installed additional tankage to allow for multiple grades

Survey Results: Midstream Operators' Input

- Baker & O'Brien surveyed multiple major pipeline and terminal operators who provide storage and transportation services to Midwest states
- Pipeline systems are optimized based on typical refinery production and distribution history
- Systems have limited ability to segregate Low and High RVP CBOB
  - Several pipeline segments will need to be dedicated to Low RVP CBOB exclusively
  - Terminals that continue to serve High RVP CBOB markets would not be available for Low RVP CBOB storage
  - This will create distribution inefficiencies and more volatility in supply and prices
  - Localized out of stock situations during refinery outages will be more likely and will require RVP waivers to allow high RVP CBOB to be supplied into Low RVP terminals
  - Pipeline transit from Group D refineries directly to Group A terminals is about 14 days, which corresponds to a two-week delayed response to an outage
  - Pipeline transit time from Group D refineries directly to the northern tier of Group A terminals is about 21 days
- Capital projects will take 18-24 months to implement after a final go-ahead decision
  - The final go-ahead decision cannot be made without input and commitments from the shippers and refiners. Issues include:
    - How much of each grade of CBOB will be supplied and to which markets?
    - Will CBOB currently distributed to any of the potential low RVP CBOB states be diverted to states that will remain 9.0 psi markets?
  - If Congress approves a national ethanol 1 psi waiver for E15, then investments to accommodate both Low and High RVP grades of CBOB would be unnecessary
    - Therefore, refining and pipeline companies will likely defer Low RVP CBOB-related final capital investment decisions until clarity is achieved regarding a possible national extension of the ethanol 1 psi waiver for E15

Survey Results: March RVP Transition Summary

Seasonally, the PADD 2 gasoline market will transition from high RVP winter grades to lower RVP summer grades in March

The pipelines manage this by requiring a lower summer RVP than the specification requires in March to ensure product quality – the pipeline surveys indicated that 7.3 psi CBOB would be required

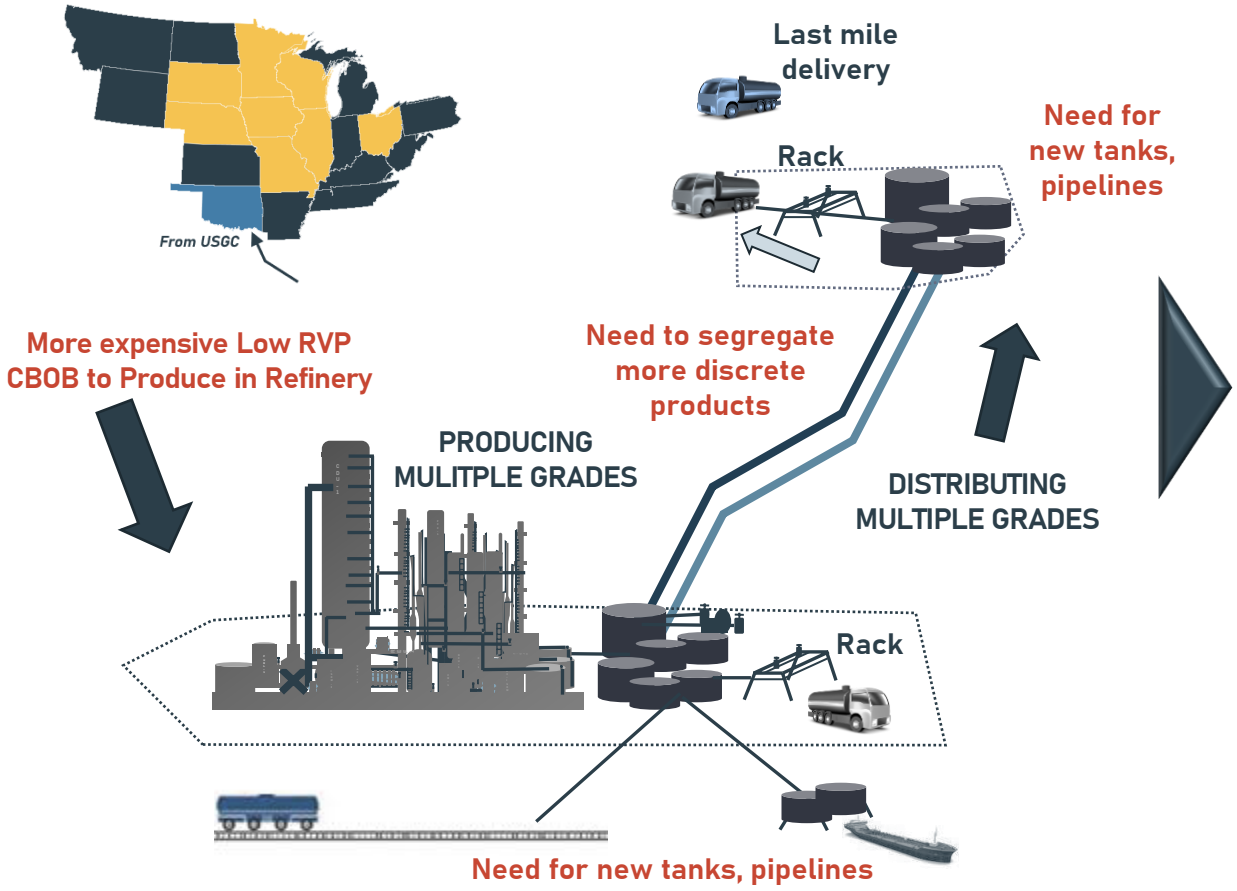
The *PRISM* analysis suggested an additional 0.3 to 0.5 cpg of costs could be incurred during the transition period

None of the refinery survey respondents evaluated the 7.3 psi CBOB transition case

- Most respondents indicated that the transition month could be handled using similar production adjustments as for the entire summer, however, they intend to use more severe operational adjustments with existing equipment (e.g., remove even more LSR than in the summer)
- A small number of respondents indicated that the 7.3 psi CBOB transition month would present extreme challenges, but these same refineries are unlikely to produce Low RVP CBOB

Survey Results: Logistics Implications and Costs

Logistics Implications



- Some refiners indicated a need for more tanks, fractionation, and additional piping to produce an additional gasoline grade
  - Tank costs were estimated at $7 - $10 million each
  - Typical surveyed refinery costs total between $50 to $75 million
- Some refiners require logistics investments, such as dock or rail facilities
- Pipeline operations will require smaller batches of multiple discrete products requiring new tanks, pipes, and other logistics investments
- To avoid cross-contamination, some pipeline operations will forgo shipments of High RVP CBOB and only ship higher cost Low RVP CBOB
- The consensus of the time frame required for capital investments is at least two years
- As some Group A and B refiners will need to reduce crude unit utilization rates, decreases in product supply will be back-filled from Groups C and D
- Denver converted from Conventional to RFG in 2024, which will further constrain Kansas refineries and midstream assets

Survey Results: Low RVP CBOB Subject to Price Spikes

- The creation of another specialty ("boutique") product (Low RVP CBOB) will require additional segregation and result in less fungible inventory to draw upon during supply disruptions

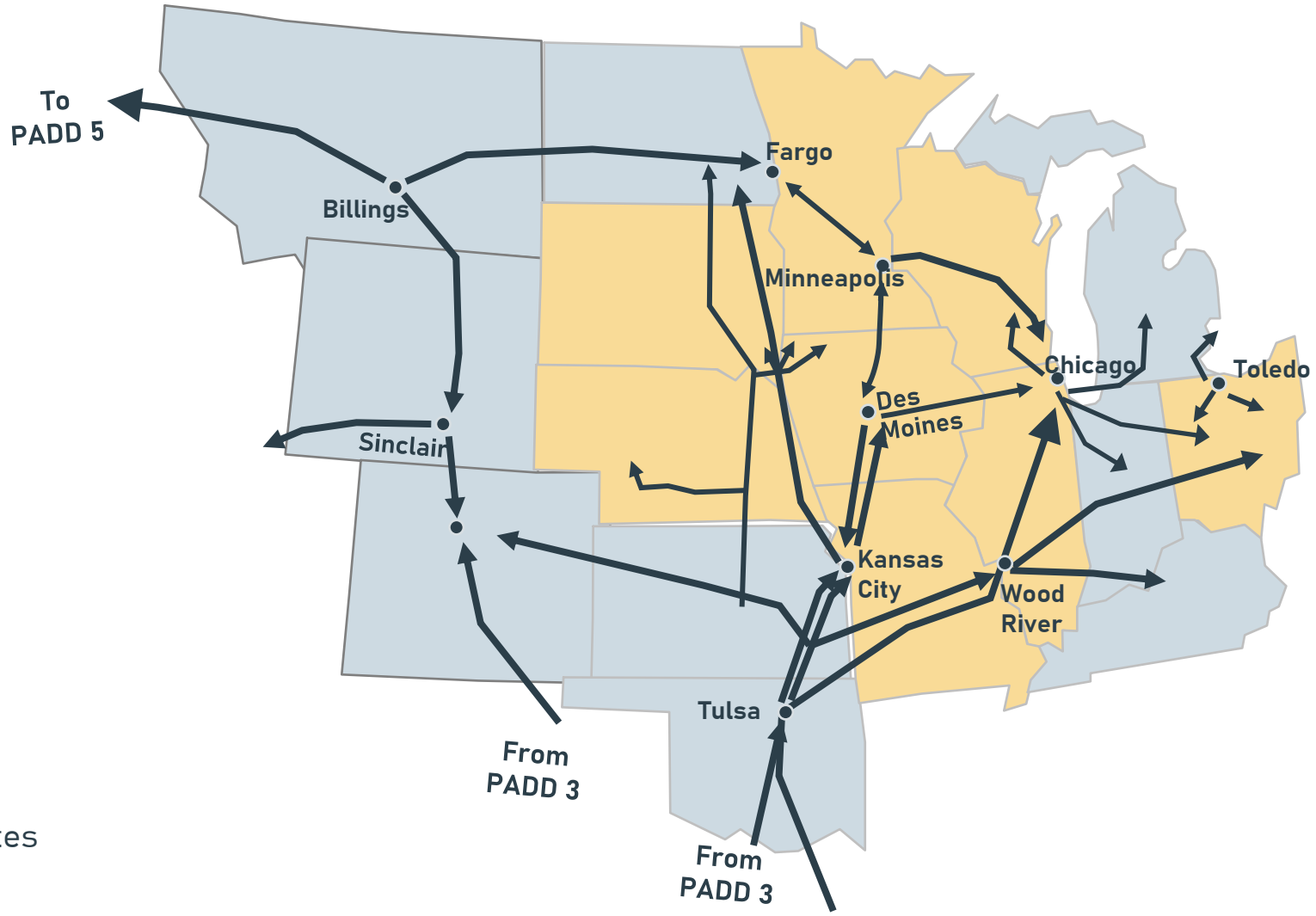
- Non-fungible boutique fuels are more prone to retail price spikes
  - Generally lower available inventory (total volume and days of supply)
  - Longer response times and fewer options for sourcing distant supplies

- Historical observations on RBOB (another boutique fuel) provide insight on possible market effects of Low RVP CBOB
  - Since 2022, retail data from the EIA suggests that the summer average Chicago RFG premium to Minnesota conventional gasoline has been higher than previous summers by 20-30 cents per gallon, (refer to the Appendix)
    - Over 60 cents per gallon spikes observed over shorter periods
  - PADD 2 relies on transfers of RBOB from PADD 3 for price stability

- Similar to RBOB, Low RVP CBOB will not be fungible and PADD 2 will likely rely on transfers from PADD 3
  - Low RVP CBOB will likely face more frequent price spikes that will not be observed in fungible, high RVP CBOB markets
  - A summer price spike in PADD 2 due to a supply disruption could result in a significant 2 week increase in retail prices of 60 cents per gallon (similar to that observed with RBOB) which could raise the summer average retail price by as much as 5 cents per gallon

CBOB distribution Before the 1 RVP low transition

Currently, gasoline flows move up to PADD 2 markets from refiners in Kansas, Oklahoma and the USGC

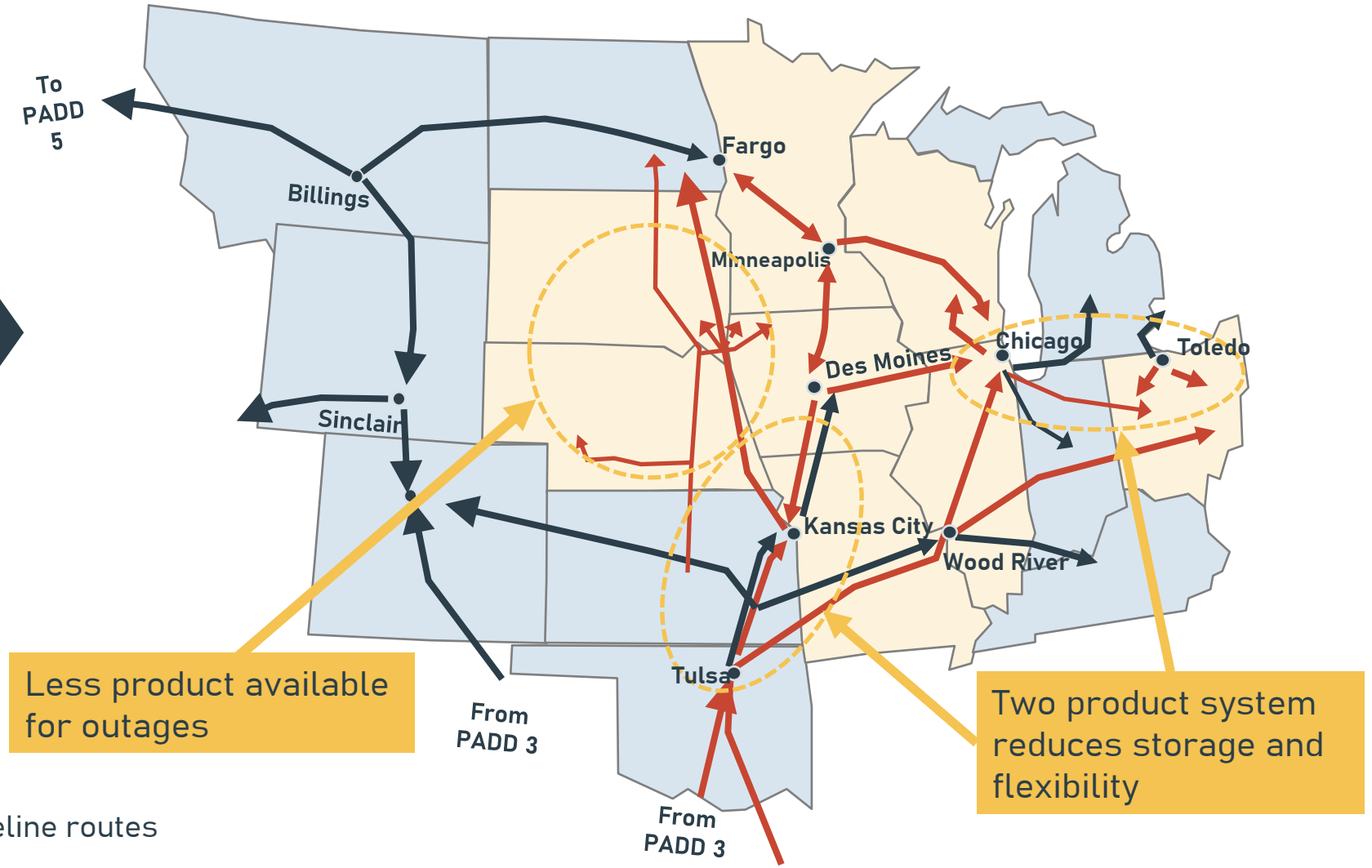


9.0 RVP CBOB

Arrows indicate general pipeline routes

Possible CBOB Distribution After the 1 RVP Low Transition

Implementing the RVP waiver will mean several distribution assets will need to move completely to 7.8 RVP CBOB, which will effectively weaken operational response capacity for the entire distribution system

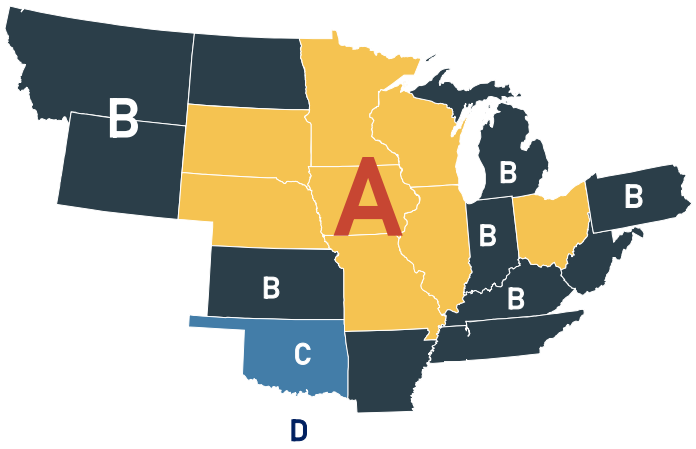


8.8 RVP CBOB

7.8 RVP CBOB

Arrows indicate general pipeline routes

Survey Results: Lower Volume of CBOB Production



Reduction of CBOB and Distillates Production (Mb/d)		
Group	Reduced CBOB Volume	Reduced Distillate Volume
A	65 - 79	16 - 26
B	21 - 40	6 - 10
C	4 - 12	2 - 3
Additional from D	90 - 131	24 - 39

- Since PADD 2 refinery summer utilization is typically above 90%, there is no excess capacity to increase production
- Volumes are estimated through refinery surveys responses and analysis of volume supplies between Groups
- Reductions of Group A, B, and C product supplies will be made up from Group D. The only region with discretionary production volume is the USGC (for export markets)
- The allocation of volume from the USGC will likely come from multiple refineries and pipelines based on both costs and logistics
- Further volume demand analysis can be found in the Appendix.

Survey Results: Refinery Capital Investments

- Multiple refineries indicated that capital investments would be necessary to either optimize or produce Low RVP CBOB
- Some refineries indicated very high capital costs and may not produce Low RVP CBOB as they primarily serve high RVP CBOB markets (about 85% of total gasoline production)
- The refineries that would invest capital have a total CBOB production rate of 339,000 B/D and indicated preliminary estimates for CAPEX of $125 million. This total does not include higher costs from the refineries that will not invest.
- If each refinery produces at the 50% share of the Low RVP CBOB market
  - The five-year amortized cost of the capital investments (20% annual capital recovery) equates to 2 cpg of Low RVP CBOB produced
- Assumed investments will reduce long term Low RVP CBOB production costs by 2 to 3 cpg

Gasoline RVP - 1 psi Waiver Update

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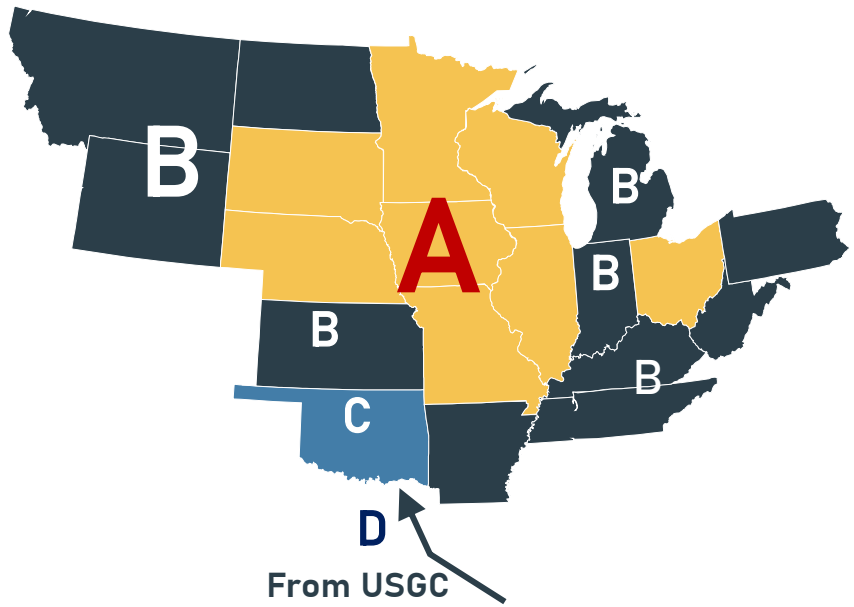
EXTENDED COST MODEL RESULTS AND LOW RVP CBOB COST ASSESSMENT

Extended Cost Model Results

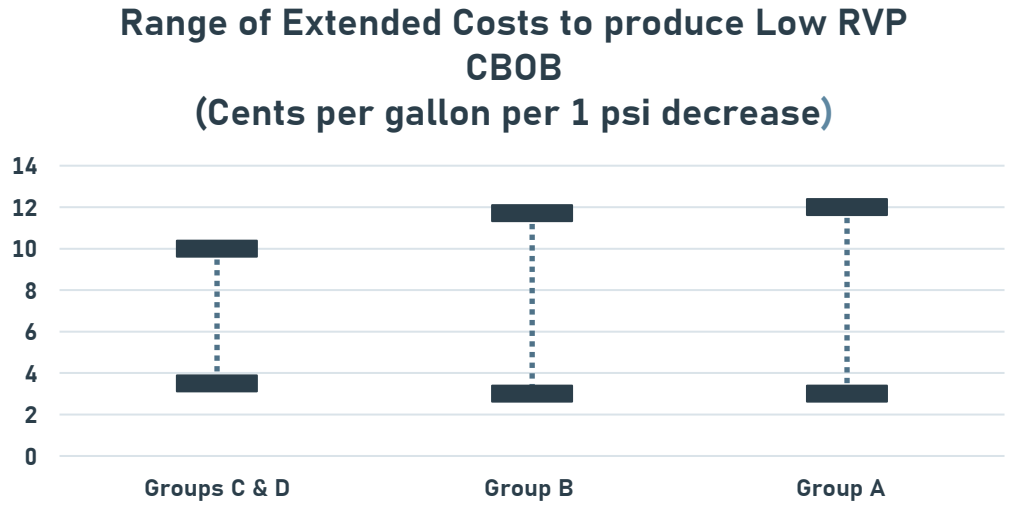


Range of Costs of Producing Low RVP CBOB, cpg				
	Extended Cost Model [1]			
	Near Term		Long Term	
Group	Low	High	Low	High
A	3	12	3	12
B	3	12	3	8
C	4	10	4	5
D	4	4	4	4

(1) Costs include refinery-operation adjustments, downgrades, fractionation, refinery storage, and component logistics. In some cases, costs include lower CDU runs. Potential long term pipeline tariff increases have been excluded.

- The extended cost model results in 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 market in Groups A, B, and C
- The broadest range of responses result in costs from 3 to 12 cpg
- In the long-term, refiners will add capital investments, such as additional piping, manifolds, pumps, and tanks, which are expected to lower their supply costs, up to 4 cpg

This Update presents costs derived from publicly sourced data, aggregated and anonymized individual surveys, and Baker & O'Brien's professional judgment. Each refinery is unique in its ability to refine products and will face different costs and market conditions that impact the ability to recover these costs.



Low RVP CBOB Cost Assessment

- Based on surveys, interviews, and our analyses which include observed market costs and the extended cost model, we assess near-term supply cost increases of 9-12 cpg to comply with lower RVP CBOB production from each refinery to the affected market in Groups A, B, and C. These results incorporate the following:
  - PADD 2 refineries typically operate at high summer utilization to fulfill market demand
  - The PADD 2 supply system is currently optimized for only one RVP product (High RVP CBOB)
  - Most of the Low RVP CBOB production in Group A is estimated to cost at least 9 cpg more than High RVP CBOB
  - Normal operating conditions with no supply disruptions

This Update presents costs derived from publicly sourced data, aggregated and anonymized individual surveys, and Baker & O'Brien's professional judgment. Each refinery is unique in its ability to refine products and will face different costs and market conditions that impact the ability to recover these costs.

Gasoline RVP - 1 psi Waiver Update

07

APPENDIX

Appendix: United States Gasoline Emission Standards and RVP Impact

Overview

- National gasoline emission standards set by the federal Clean Air Act
- Allows states to adopt unique fuel programs intended to address local air quality issues (under a State Implementation Plan or SIP)
  - The EPA also refers to these state fuels as boutique fuels. Boutique fuels are not fungible with standard grades and present production and distribution challenges. In a sense, federal RFG is also a boutique fuel due to the limited number of RFG markets in PADD 2
  - The initial 2006 list of state boutique fuels was extensive, with numerous regions adopting low (7.0, 7.2, & 7.8 psi RVP standards) but now only 5 low RVP regions exist(1)
    - RVP of 7.8 psi: Clark and Floyd Counties, Indiana; 95 East Texas Counties
    - RVP of 7.0 psi: Lenawee, Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw and Wayne Counties Michigan: Jefferson and Shelby Counties, AL; El Paso County, TX
- The SIP-approved fuel programs of Maine, New York, Texas, and Vermont do not participate in the ethanol 1 psi ethanol waiver program

Comparison of Summer Gasoline RVP (psi)

Fuel	Program	1 psi Ethanol Waiver?	Maximum RVP Retail	Maximum RVP BOB[1]
Reformulated	Federal	No	7.4	6.2
Conventional	Federal	Yes[3]	9.0/10.0	8.8
Conventional	Indiana SIP	Yes[3]	7.8/8.8	7.6
Conventional	TX SIP - East Texas	No	7.8	6.6
Conventional	Detroit SIP	Yes[3]	7.0/8.0	6.8
Conventional	TX SIP - El Paso	No	7.0	5.8
Conventional	Petitioned[2]	No	9.0	7.8

[1]RBOB or CBOB, prior to ethanol blending.
[2]Petition of the 8 Midwest states to opt-out of the waiver.
[3]RVP standard before waiver / Retail RVP after 1 psi waiver

(1) Source: EPA

Appendix: Refinery Survey Questions

A. Operating Costs
   1. Please describe the refinery's processes to remove light ends from gasoline streams
      a. What blending stream (or streams) set the minimum RVP?
      b. Are these processes currently limited in the summer?
      c. What are the dispositions of the light ends?
   2. Please describe the costs of removing the light ends to produce Low RVP CBOB.
      a. Do you have a rough estimate of these costs?

B. Gasoline Blending Costs
   1. Please describe the RVP blending limits for the refinery's gasoline pool.
   2. Please provide your typical blendstock RVP and octane qualities
   3. What would be the impact of Low RVP CBOB on gasoline blendstock purchases or sales?
   4. If necessary, could you increase naphtha reformer unit severity/throughput for additional octane?
   5. Could you increase alkylation unit throughput if necessary?
   6. Is the gasoline pool typically constrained by high temperature distillation (e.g., T90) or drivability specifications?
      a. If so, will further light ends removal
         i. Increase blend costs to mitigate high temperature distillation limits?
         ii. Require heavy components' sales or purchases of other blend stocks (if so, what type)?
         iii. Do you have a rough estimate of these costs?
   7. Please describe any additional purchased blendstocks (e.g., toluene by rail) that may be required to produce Low RVP CBOB.

C. Capital Costs
   1. Will the refinery require new or revamped equipment to produce Low RVP CBOB?
      a. Please describe the modifications.
      b. Do you have a rough estimate of these costs?

D. Logistics Costs
   1. To accommodate Low RVP CBOB, please describe additional handling requirements.
      a. A refinery may ship gasoline to states outside of the Region, which may require the refinery to co-produce two summer CBOB grades. Will the refinery completely replace 9.0 CBOB with Low RVP CBOB or will it need to produce both blends simultaneously or in batches?
   2. Will the refinery require new tanks or other logistics costs?
      a. If so, please describe.
      b. Do you have a rough estimate of these costs?

E. Light Ends Disposition Costs
   1. Please describe the current disposition of light ends, (e.g., rail Normal Butane to Conway, etc.)
   2. Please describe the expected volume and disposition of incremental light ends (e.g., rail Light Straight Run to Mont Belvieu) and typical costs to market.
   3. Is your refinery currently constrained on light component storage or export logistics?
   4. Does the refinery have other methods of using/consuming light blending components such as butane?

F. Product Flexibility
   1. Given the refinery's costs with a switch to Low RVP CBOB,
      a. Would your refinery decrease domestic gasoline sales and increase gasoline exports?
      b. Would your refinery decrease in-state Low RVP CBOB sales and increase out-of-state sales?
   2. What is the likelihood that the refinery will cease selling summer gasoline into the Region if Low RVP CBOB is required?

Appendix: Refinery Survey Response Methodology

TOPIC	SOURCE/METHODOLOGY
Refinery Surveys	Baker and O'Brien sent out 27 surveys to refineries in the study groups.
Survey Responses	A significant majority representing 80% of the A, B & C study group's crude capacity responded. In addition to interviews, most refineries answered with indicative costs. Greater than 60% of the original respondents providing follow-up in this recent update. As well as additional respondents who did not participate in the original study.
Interviews	Key topics included cost of production ranges with and without investments, possible crude run cuts, estimated volumes of lost gasoline, RVP of typical blendstocks, logistics and infrastructure needed for Low RVP CBOB, purchased high octane components, disposition of excess light ends, yield responses, and market price drivers. Where applicable, indicative estimates of capital investments were provided. The interview process confirmed that the refiners considered both prompt and long-term conditions.
Low RVP Cost of Production	Based on each refiner's input, the expected short term and long-term cost of production were summarized for each refinery. Before accepting refiners' initial cost assumptions, we discussed and evaluated the refiners' technical explanations and their responses to market price drivers. Where appropriate, we adjusted for prompt and long-term cost differences. If not articulated, we used the refiners' technical descriptions of operational and logistics modifications to estimate costs.
Lost Gasoline Production – Before Crude Rate Cuts	Many, but not all, refinery respondents indicated the potential loss of gasoline from producing Low RVP CBOB. Typically, the range was 5%-10% of current summer CBOB production, with some lower and some higher. For refiners not providing an estimate of the lost gasoline production, we used the surveyed cost of Low RVP CBOB and lost volumes to estimate potential lost gasoline volumes. Ranges are made from allowing 50%-100% of the Group B production to be impacted and 25%-100% of the Group C production.
Lost Production – Crude Cuts	We observed that some respondents indicated that crude rate reduction changes were likely but were not considered at this time. Discussing further with the refiners, a 3%-5% crude rate reduction was assumed for refineries indicating that crude cuts were likely. This was used to estimate the lost gasoline from crude cuts (50% yield) and distillate (35-40% yield). No adjustments were made to the costs associated with the production of Low RVP CBOB.

Appendix: Baker & O'Brien *PRISM* Methodology

TOPIC	SOURCE / METHODOLOGY
***PRISM* Simulator**	Q3 2019 *PRISM* simulator database
Gasoline Blending	Standard *PRISM* gasoline blend component RVP assumptions. Adjusted RBOB to 7.4 psi RVP RFG target or 6.2 psi RVP RBOB
Refineries Modeled	Modeled each refinery responding to the survey with representation in each of the four study groups.
Base Cases	Two Base cases: 8.8 RVP CBOB for summer months, 8.3 RVP CBOB for March transition month
Low RVP CBOB cases	Two Low RVP CBOB Cases: 7.8 RVP CBOB for summer months, 7.3 RVP CBOB for March transition month
Cost of RVP Calculation	For summer and transition months: (Base case variable income - Low RVP CBOB variable income) / (Low RVP CBOB case volume)
Cost of RVP Pricing Basis	Calculated on Q3 2019, Q3 2022, and Q3 2023 *PRISM* refinery gate pricing basis
Group Results	Only reporting volume-weighted average of the *PRISM* results for each refinery by Group and Overall for confidentiality

Appendix: Market RVP Costs Assessment Methodology

The EPA "Fuel Streamlining rule,"[(1)] finalized on December 4, 2020, simplified the RFG summer volatile organic compound (VOC) standard by replacing it with a 7.4 psi RVP standard for RFG (6.2 psi RBOB)

- Allows RBOB and CBOB prices to be used directly in the summer season to determine the market cost of RVP, with no VOC impacts
- After this rule was finalized, Platts introduced new product codes that indicate the RVP adjustment for 1 psi
- Prior to 2021, RBOB and CBOB prices can be used in the summer season to estimate the market cost of RVP but with possible impacts from the VOC standard

With the ethanol waiver, 8.8 psi CBOB has an effective finished gasoline RVP of 10.0 psi

- The delta RVP between CBOB and RBOB: 8.8 psi - 6.2 psi = 2.6 psi

Market cost of RVP formula (prices in cents per gallon):

- (RBOB-CBOB) / 2.6 = Market RVP Cost in cents per gallon per psi

Note in the July 2022 example, the Chicago Market RVP costs are 3.3 cents per gallon above the USGC

Example Calculation - Market Cost of RVP (Cents per gallon)

	Jul-22
Platts Chicago RBOB	343.6
Platts Chicago CBOB	313.9
RBOB- CBOB, Chicago	29.7
Divide by Delta RVP	2.6
Market Cost of RVP, per psi	11.4

	Jul-22
Platts USGC RBOB	317.2
Platts USGC CBOB	296.3
RBOB- CBOB, USGC	21.0
Divide by Delta RVP	2.6
Market Cost of RVP, per psi	8.1
Platts USGC RVP Adjustment (1)	8.1

: (1) Platts" *USGC CBOB RVP Adjustment minus 1 psi cts/gal"*

(1) https://www.epa.gov/gasoline-standards/reformulated-gasoline

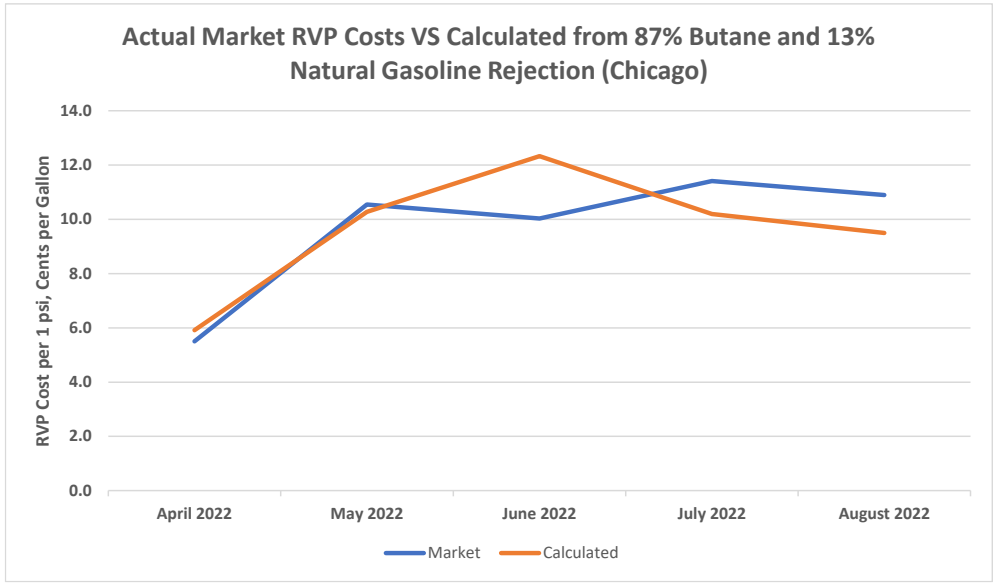
Appendix: Chicago Market RVP Costs – Fundamentals

- The estimated Chicago Market cost of RVP was 8.1 cpg per psi in the summer of 2019 and 9.7 cpg per psi in the summer of 2022, peaking at 12.1 cpg in 2023
  - In general, the range has been 8-12 cents per gallon per psi
  - 2020 and 2021 are not evaluated due to the pandemic impacts
- The market cost of RVP is linked to the economics of rejecting butanes from RBOB and natural gasoline from PBOB, which is the calculated cost
  - Natural gasoline is a market pricing proxy for refinery-produced light naphtha
- During summer months, 87% of the Chicago market RVP cost has been, on average, explained by butane rejection costs, and 13% has been explained by natural gasoline rejection (the calculated cost trend shown)

Chicago Market RVP Costs (1)
(cents per gallon per 1 psi RVP decrease)

	2019	2022	2023	2024
April	6.9	5.5	13.1	9.2
May	10.0	10.5	12.7	10.1
June	10.6	10.0	12.8	8.8
July	8.4	11.4	9.7	11.0
August	4.5	10.9	12.1	5.1
Average	8.1	9.7	12.1	8.9

Notes: (1) Chicago (RBOB-CBOB)/(2.6)



(1) https://www.epa.gov/gasoline-standards/reformulated-gasoline

Appendix: Lost Gasoline and Diesel Volume Methodology

Reduced CBOB Production – Before Crude Cuts

- Remaining refineries not surveyed given the same % loss as its Group
- Existing *PRISM* database used to source CBOB production and crude rates for the remaining refineries not surveyed

Reduced CBOB Production – From Crude Cuts

- Surveyed refinery estimates from *PRISM* crude runs, using a 5% High / 3% Low crude rate reduction and a yield of 50% gasoline and 40% diesel
- Remaining refineries assumed that the same percentage (% surveyed in the adjacent table) would likely reduce crude runs under the same yield assumptions as above

Total Lost Distillate from Crude Cuts

- Based on the yield assumptions, the total volume is simply the reduced gasoline production from crude cuts multiplied by (40% distillate / 50% gasoline)
- Total reduction in distillate is calculated: (42 MB/D of gasoline reduction) x 40/50 = 33 MB/D in the high case

Reduced CBOB Production - Before Crude Cuts

	% Loss	High Mb/d	Low Mb/d
Group A	5.8%	45	45
Group B	4.7%	28	15
Group C	5.0%	9	3
Total		82	63

Reduced CBOB Production - From Crude Cuts

	High Mb/d	Low Mb/d
Group A	34	20
Group B	12	6
Group C	3	1
Total	49	27

Total Potential Reduced CBOB Production

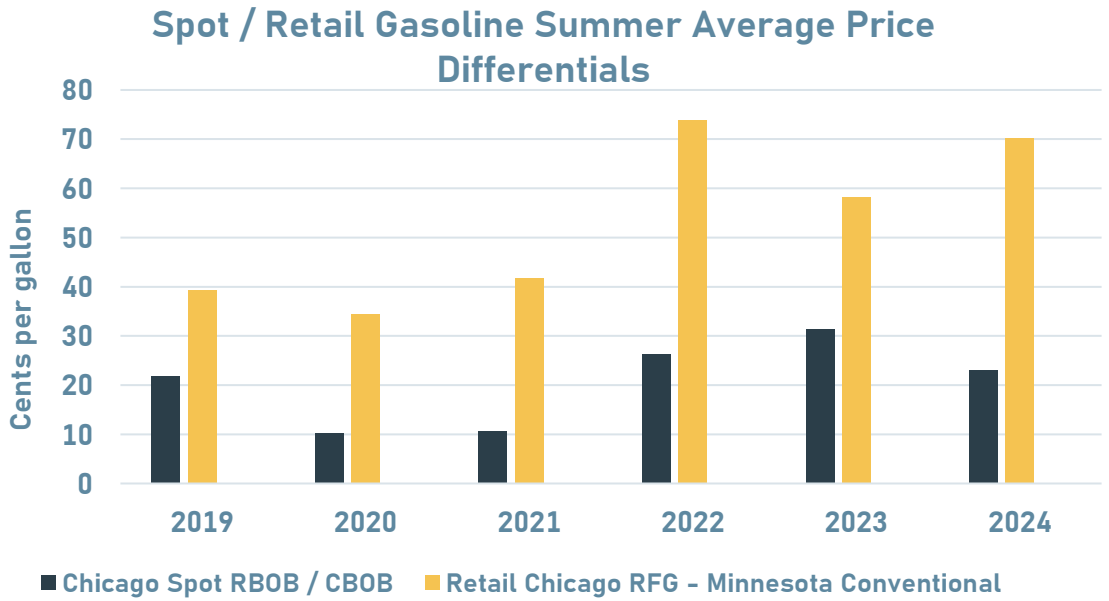
	High Mb/d	Low Mb/d
Group A	79	65
Group B	40	21
Group C	12	4
Total	131	90

Appendix: Total Low RVP CBOB Supply Cost Methodology

TOPIC	SOURCE / METHODOLOGY
State Gasoline Demand	Used 2023 Summer Basis, from EIA data of Finished Gasoline by state
RFG Demand by State	Used 2023 Summer Basis, from EIA data of Reformulated Finished Gasoline by state
Conventional Gasoline Demand By State	Calculated by subtracting the RFG Finished gasoline sales from the Finished Gasoline sales by state
Ethanol Deduction	10 volume % ethanol assumed in the Finished gasoline
CBOB Demand by state	Finished Conventional Gasoline x 90%
Estimated Summer CBOB Demand, by State MB/D	Ohio - 305; Minnesota - 144; Wisconsin - 107; Missouri -124: Illinois - 104; Iowa - 73; Nebraska - 54, and South Dakota - 29; 940 Mb/d Total
Number of Summer Days	Based on survey discussions, 185 days have been assumed for the summer gasoline season.
Summer Demand, Gallons	185 days * 940,000 B/D * 42 gallons per barrel = 7.30 billion gallons
Total Cost increase based on a 9-12 cpg total supply cost increase for Low RVP CBOB[1]	Total Supply Cost Increase = 9 - 12 cents per gallon. If the costs were passed on to the consumer, it would result in an additional consumer cost of (9-12) * Dollars/100 cents *7.30 billion gallons = $0.7 - $0.9 Billion.

[1] Each refinery is unique in its ability to refine products and will face different costs and market conditions that impact the ability to recover these costs

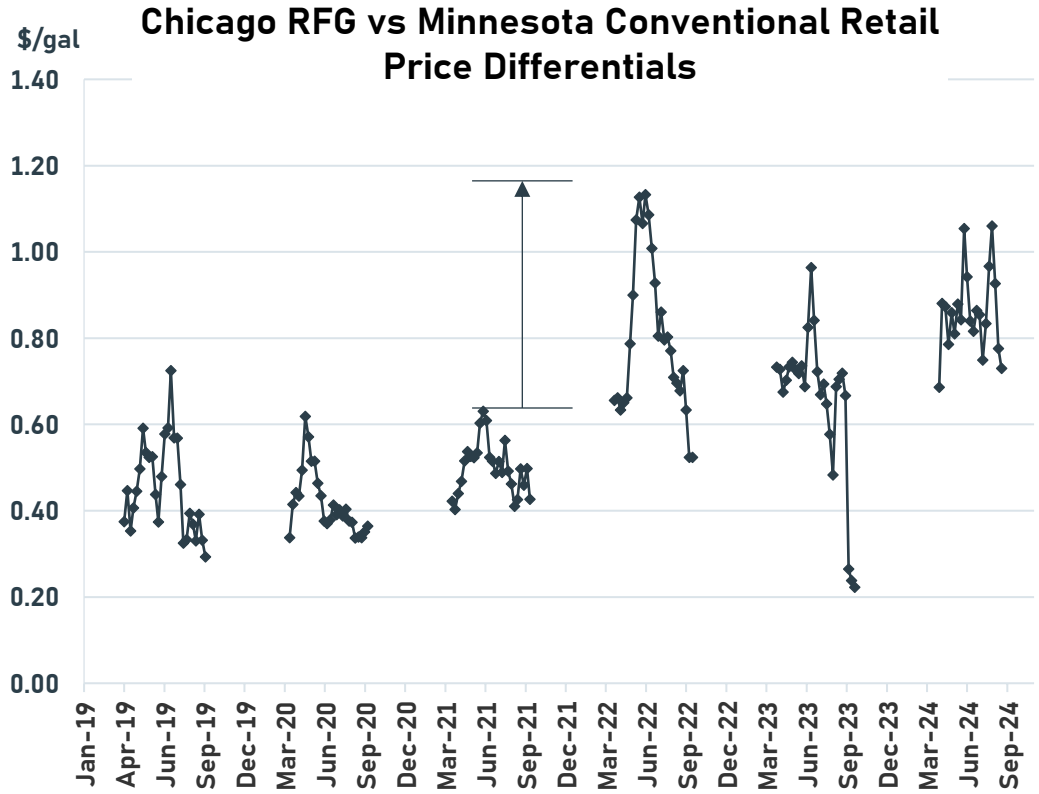
Appendix: Retail RFG prices spikes are an example of boutique fuel price volatility



Top figure: Before 2022, spot Chicago RBOB/CBOB differentials ranged from 10-20 cents per gallon. After adjusting for differences in state gasoline taxes at the retail level, the Chicago RFG / Minnesota Conventional differential ranged from 30- 40 cents per gallon. The average retail price of RFG relative to conventional spiked in 2022 and has remained elevated

Adjacent Figure: In 2022, the retail price of RFG relative to conventional gasoline spiked to very high levels, short-term peaks are 50-60 cents per gallon higher than in earlier years; high spikes continued in 2023 and 2024

(1) https://www.eia.gov/dnav/pet/pet_pri_gnd_a_epm0_pte_dpgal_w.htm



Retail prices from the EIA[1]

Spot Prices are sourced from Argus Media Ltd.

THANK YOU

Baker & O'Brien