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## Comparing Railroad Commission of Texas Flaring Permit Volumes with Satellite Observations and Company-Reported Data

By Andrew Wheat, Texans for Public Justice

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This report was produced as part of a joint project between Commission Shift, Texans for Public Justice, and Rio Grande International Study Center (RGISC). The analysis included feedback and review from Martin Castro (RGISC), Benjamin Lyke (independent consultant), Virginia Palacios (Commission Shift), and Benek Robertson (Environmental Defense Fund).

*Commission Shift is reforming oil and gas oversight by building public support to hold the Railroad Commission of Texas accountable to its mission in a shifting energy landscape.*

*RGISC's mission is to preserve and protect the Rio Grande-Rio Bravo, its watershed and environment, through awareness, advocacy, research, education, stewardship and binational collaboration for the benefit of present and future generations.*

*Texans for Public Justice is a nonprofit that analyzes money in Texas politics and addresses political corruption and corporate abuses.*



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# Introduction

The mounting push to curtail the Texas oil and gas industry’s greenhouse-gas releases has exposed the need for the Railroad Commission of Texas to design a better system for overseeing and enforcing limits on natural gas that is wasted through venting and flaring.<sup>1</sup> Three converging data sources can help Texans better understand—and control—venting and flaring releases. These data are:

- Railroad Commission of Texas data on venting and flaring permits, which authorize oil and gas operators to release specific quantities of waste gas into the atmosphere (so-called Rule 32 exceptions);
- The production reports (PR) that industry operators file with the agency each month, disclosing the amount of gas that they say they actually vented and flared; and
- Satellites and other sensor technologies that independently estimate how much gas is being flared at specific GPS locations.

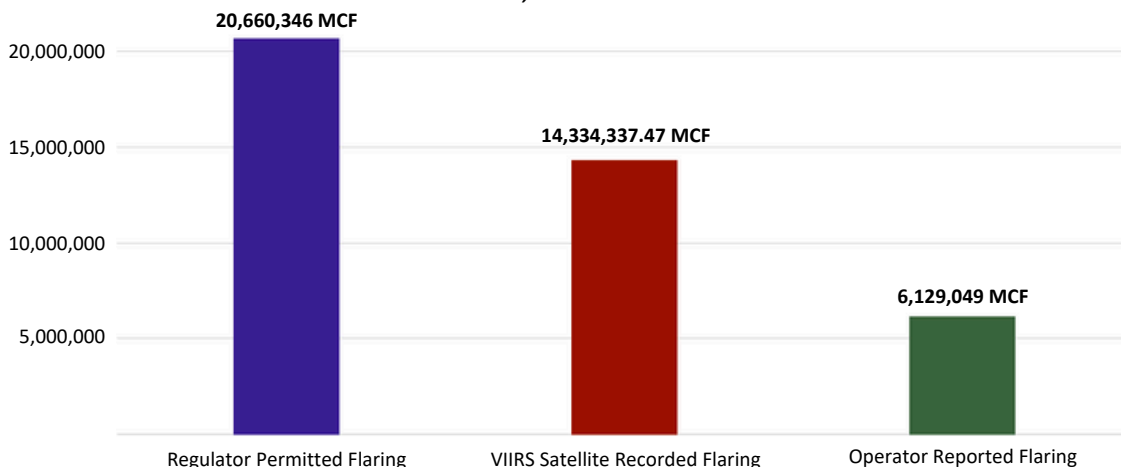
As discussed below, these three sources of venting and flaring data do not measure the exact same streams of greenhouse-gas releases. Nonetheless, triangulating between these data can help reveal:

- The extent to which the agency hands out too many venting and flaring permits authorizing excessive gas releases instead of using permits to restrict waste;
- How the agency can improve venting and flaring permitting and reporting to better understand — and control — releases;
- Where industry and regulators can reduce the most vented and flared gas volumes at the least cost; and
- Potential enforcement cases in which operators either appear to flare gas without a permit or to flare more than their permits allow.

This study explores how these three flaring data troves can be combined to better measure and curtail flaring by the Texas oil and gas industry. It does so through a pilot project comparing 2022 data on flaring permits, production report data, and satellite flaring data covering four South Texas counties: Dimmit, La Salle, McMullen, and Webb. These comparisons reveal significant data-comparison problems that the Railroad Commission of Texas should fix in order to legitimately oversee and limit venting and flaring.

## Total volumes of flaring releases permitted by regulators, reported by operators, and recorded by VIIRS satellites in four South Texas counties, 2022

MCF = 1,000 Cubic Feet



The accompanying chart compares total volumes of flaring releases associated with these three flaring data sources in the four counties in 2022. The smallest volume of such releases was the 6.1 thousand cubic feet (MCF) of gas that oil and gas operators reported that they flared in the four counties that year. Meanwhile, Visible Infrared Imaging Radiometer Suite (VIIRS) satellites recorded nighttime flaring volumes of flaring releases that were more than twice that size in the same counties that same year. Finally, the Railroad Commission issued permits that authorized oil and gas operators in those counties to flare almost 21 thousand cubic feet of gas that year — far more than the industry appeared to need or use.



# Comparing Flaring Permits to Production Reports

The Railroad Commission’s flaring permit data and its production report data can be compared on the basis of individual lease numbers or, more broadly, by the names of the companies that operate those leases. A total of 15,855 leases run by 329 operators filed production reports with the Railroad Commission for the four studied counties during 2022. Of those, 5,123 leases (32%) tied to 51 operators (15%) filed production reports that disclosed venting or flaring greenhouse gasses in 2022. Those leases and operators reported venting or flaring 6,129,049 MCF of gas in the four counties that year.

Significantly, no 2022 flaring permits could be found for 5,085 leases tied to all 51 operators that nonetheless reported flaring or venting a total of 5,619,726 MCF in 2022. The three operators that reported flaring the most gas despite having no apparent flaring permits in the four counties were Silverbow Resource Operating, LLC, SN EF Maverick, LLC, and SN Operating, LLC. These three operators reported releasing a total of 897,473 MCF from leases for which no 2022 permits were found. Together, these three operators accounted for 15% of the volume of all the flared gas disclosed on 2022 production reports covering the four counties.

## These three operators reported flaring the most gas in the four counties in 2022, when no flaring permits could be found for them.

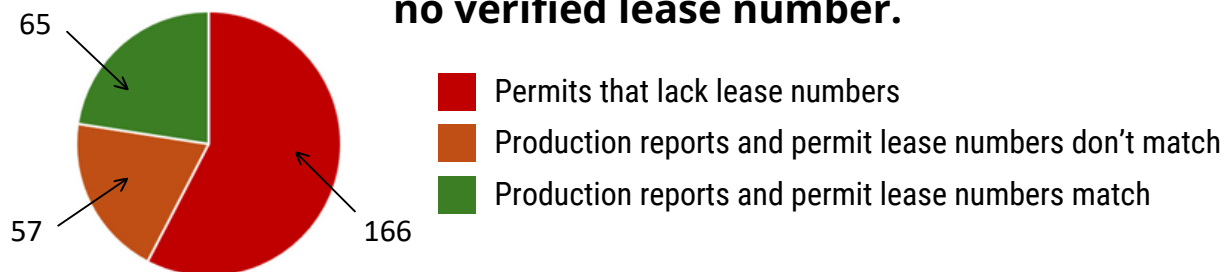
MCF = 1,000 Cubic Feet

Operator	2022 Reported Flaring Volume	Number of Leases Reporting the Releases
Silverbow Resource Operating, LLC	714,406 MCF	192
SN EF Maverick, LLC	136,537 MCF	1,399
SN Operating, LLC	46,530 MCF	425
<b>TOTAL</b>	<b>897,473 MCF</b>	<b>2,016</b>

## Lease Comparisons

The Railroad Commission issued 288 flaring permits authorizing flaring in the four studied counties for all or part of 2022.<sup>2</sup> Just 122 of those flaring permits (42%) reported lease numbers. The lease numbers included on the flaring permits matched 97 oil and gas leases in the RRC’s well database (with some leases obtaining multiple flaring permits that year).<sup>3</sup> Finally, just 65 of the 122 flaring permit lease numbers (23%) matched lease numbers found on 2022 production reports filed with the agency.

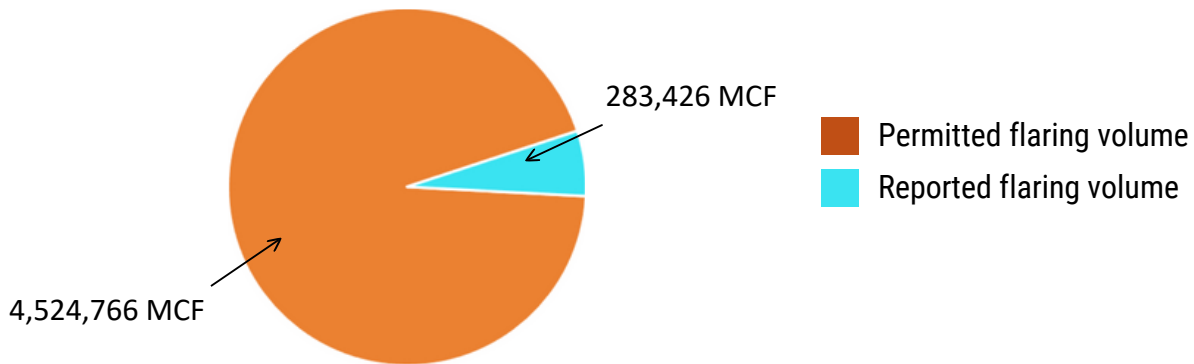
## The Railroad Commission issues flaring permits with no verified lease number.



Just 23% of the 288 flaring permits from 2022 in the four counties had lease numbers that matched production reports. Where flaring permit and production report lease numbers did match, the Railroad Commission typically authorized those leases to flare much more gas than those leases actually reported flaring.<sup>4</sup> Operators in 92% of those cases reported flaring less than half the gas volume that the agency authorized them to release. For all of the months that these leases were authorized to flare (many flaring permits did not cover the entire calendar year), the leases released an average of just 18% of what their permits allowed. The agency appears to authorize the industry to flare much more gas than operators actually need. Over-permitting venting and flaring volumes by such a high magnitude indicates that the agency’s application of its rules doesn’t function to limit wasteful releases.

## Railroad Commission permitted flaring volumes compared to operator-reported flaring volumes, 2022

MCF = 1,000 Cubic Feet



Where 2022 flaring permit and production report lease numbers matched, operators were authorized to release 16 times more than they reported releasing. 52 operators of 5,085 leases reported releasing 5,619,726 MCF of gas in the four counties without a permit. That accounted for 91% of all reported releases in those counties in 2022. The RRC's patchwork of rules vary on which kinds of flaring require a permit or need to be reported to the agency. Gas releases that generally don't require a permit but do need to be reported include flaring:

- During first 10 days of a well cleaning;
- During first 24 hours of a well unloading or shut down;
- Gas from equipment during start-ups;
- Gas produced for up to 10 days after a workover;
- For at least 24 hours following a plant or pipeline upset (sometimes longer); and
- Low-pressure separator gas (<15 mcf per day per gas well or <50 mcf per day per oil lease or commingled).

Overall, just 31% of flaring permits could be matched to production reports by lease number; these permits accounted for just 22% of all authorized 2022 flaring volumes in the studied counties. Just seven of the 65 leases with permit-production report matches reported releases that exceeded their apparent permitted annual volumes in 2022. And just four of these leases exceeded their apparent permitted volumes in any given month. Again, the agency generally appears to award permits to flare much more gas than operators require.

### Leases Reporting Releasing More Gas Than Their Apparent Permits Allowed In Any Given Month of 2022

MCF = 1,000 Cubic Feet

Operator	Lease Number	Reported Production (MCF)	Permitted (MCF)
Murphy Exploration and Production Co.	15532	17,663	7,892
Murphy Exploration and Production Co.	15725	10,537	9,078
Murphy Exploration and Production Co.	16356	2,472	1,488
Trinity Operating (USG), LLC	19092	1,136	926
Total		31,808	19,384

# Comparing Flaring Permits to Visible Infrared Imaging Radiometer Suite (VIIRS)

Satellites estimate global flaring releases from space through the Visible Infrared Imaging Radiometer Suite (VIIRS) by recording flares that can be observed through near to short-wave infrared imaging. Satellite observations that show the flare without cloud cover and at the best angle to show all of the flared methane are used to estimate the volume being flared with a flare's brightness correlating to the volume of gas combusted.<sup>5</sup> The estimated volumes from the VIIRS observations are then scaled up to a full day and from there monthly and yearly flaring volumes can be calculated.<sup>6</sup>

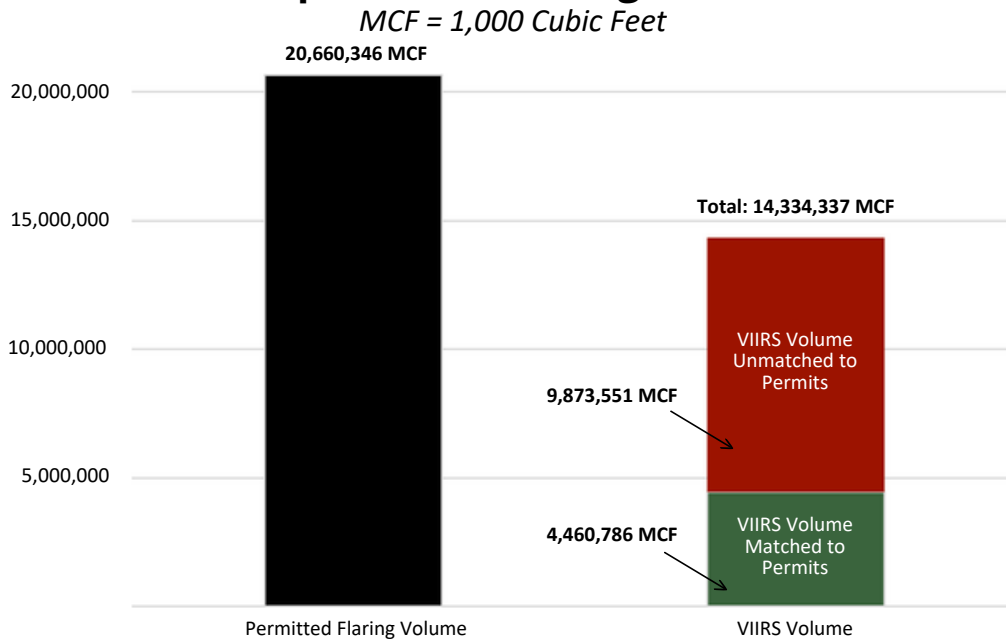
Satellite flaring data can be tied to geographic coordinates within a specific area. This allows satellite-flare data to be tied to specific operators using GPS data (though crowded oil fields present confounding data-overlap issues). This report uses satellite VIIRS data that the World Bank has associated with specific oil and gas operators by looking at oil and gas operator fields within 4 km of VIIRS observations. Where a VIIRS observation is within 4 km of multiple operator fields, the World Bank attributes that release to the closest operator (VIIRS observations that are not within 4 km of an operator field are not attributed to an operator). The World Bank's 2022 VIIRS data contains flaring-release volume estimates for 190 different observations located within the four counties.

While these VIIRS data contain GPS location information, Railroad Commission flaring-permit data do not. Using Railroad Commission Well Layers and API numbers, however, researchers can associate GPS coordinates with wells identified in flaring permits. Nonetheless, oil and gas leases in the studied counties are positioned too close together to effectively match flaring permit data to the VIIRS data. Each VIIRS data point is considered to be accurate within a 415-meter radius. It's not unusual for multiple leases to occur within 415 meters of each VIIRS recording.<sup>7</sup> This confounds attempts to compare VIIRS to flare permit data for most individual leases at this time.

These data can be compared on the wider basis, however, based on corresponding operator names. The World Bank's Global Gas Flaring Tracker collected 190 annualized VIIRS observations in the four counties in 2022.<sup>8</sup> It traced these 190 VIIRS observations to 41 different operators. Although just seven of those operators had 2022 flaring permits, those seven operators nonetheless accounted for 286 of the 288 flaring permits in effect that year. The 286 permits of those seven operators corresponded to 118 of the 190 VIIRS flaring observations in the four counties that year (62%). The permits effective in 2022 authorized operators to release 20,660,346 MCF of gas in 2022, over 6 million MCF more than the total of 14,334,337 MCF that VIIRS observations recorded. Here again, the Railroad Commission appeared to authorize flaring volumes that greatly exceeded what the industry required.

Meanwhile, the World Bank tied 72 annualized VIIRS flaring observations to 34 operators for whom no 2022 permits could be found. VIIRS estimated that those operators flared 9,873,551 MCF of gas. Callon Petroleum Co. had the largest VIIRS-recorded releases for an operator with no apparent permit. VIIRS estimated that Callon released 7,011,755 MCF of gas, or roughly 48% of the total volume of releases that VIIRS observed in the four counties in 2022.

## Nighttime satellite flaring volumes observed compared to RRC-permitted flaring volumes



In total, the flaring volume that VIIRS satellites observed in the four counties in 2022 amounted to just 69% of what the Railroad Commission authorized to be released for that year. VIIRS observed total releases of 14.3 billion cubic feet from all 190 sources in the four counties in 2022. This amount fell well below the 20.7 billion cubic feet that Railroad Commission permits authorized in the four counties that year.

## Comparing VIIRS Satellite Data to Production Reports

Comparing VIIRS satellite data to what operators reported flaring on their Railroad Commission production reports also proved to be problematic at the individual lease level. In this case the main problem is that the VIIRS data points — which are certain within a 415-meter radius — often overlap multiple leases in South Texas’ crowded oil and gas fields. As a result, comparisons between VIIRS observations and operator-reported flaring volumes could not be made at the lease level. Nonetheless, the two datasets could be compared on the much broader basis of operator names.

Fifty-one operators filed production reports that disclosed flaring releases from 5,123 leases in the four studied counties in 2022. Of those, 2,697 flaring leases (53%) run by 21 operators (42%) could be matched to VIIRS recordings on the basis of operator names. Possible reasons for these mismatches could stem from:

- Problems with how the World Bank ties VIIRS data to operator names; or
- Problems with the Railroad Commission updating operator-name records following lease transfers or operator mergers and acquisitions.<sup>9</sup>

For the flaring leases with matching operator names, the 21 operators filed production reports for 2,697 leases that disclosed releasing a total volume of 4,435,270 MCF of gas in the four counties in 2022. Those reported releases were less than half of the 9,711,182 MCF that VIIRS estimated that the same operators flared from those leases that year. The discrepancy has several possible explanations, that we are aware of:

- Operators are under-reporting the volumes of releases they are required to report.
- Operators are not required to report certain types of releases, and these non-reportable releases are contributing significantly to the total volume of gas released.
- The World Bank’s VIIRS attribution to operators is incorrectly attributed and is estimating higher volumes of gas releases than actually occurred.

Just six of the 21 operators reported flaring more gas than the VIIRS data recorded that year. Together, they reported flaring 256,199 MCF more gas than what VIIRS recorded.

## Operators that reported flaring more gas than VIIRS attributed to them in the four counties in 2022

MCF = 1,000 Cubic Feet

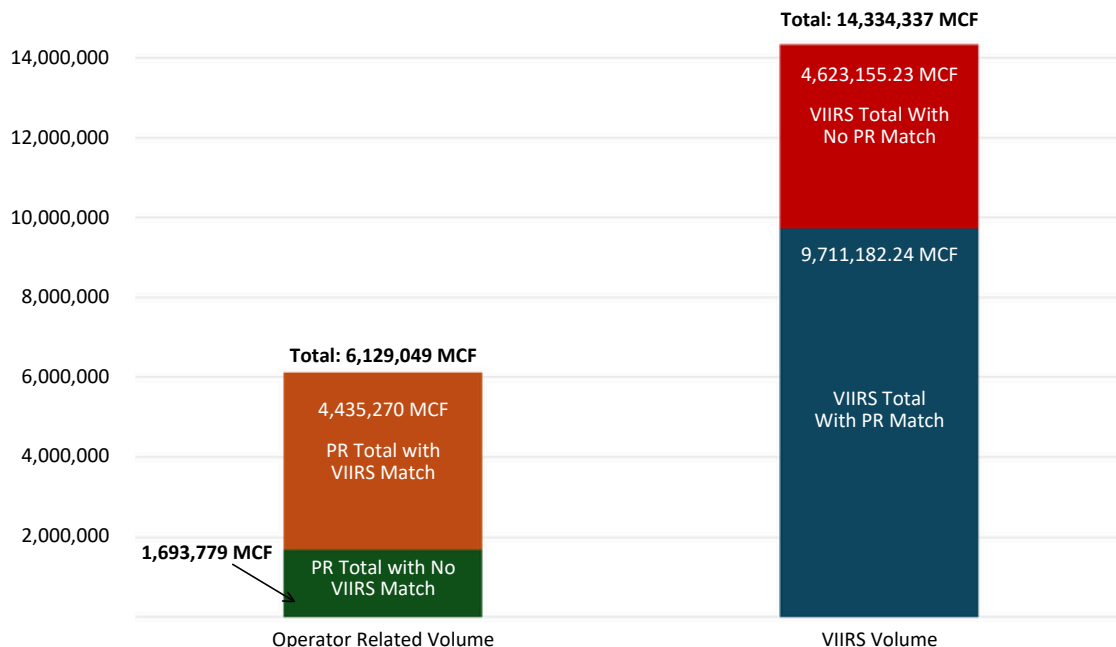
Operators That Reported Flaring More Gas Than VIIRS Attributed to Them in the Four Counties in 2022		
Operator	VIIRS Recorded Volume (MCF)	Reported Volume (MCF)
EP Energy	216,647	260,381
Blackbrush Oil & Gas, LLC	150,986	151,095
Texas American Resource Co.	47,357	74,931
Gulftex Energy, LLC	38,530	196,043
Endeavor Natural Gas LP	28,928	35,900
Matador Production Co.	10,029	30,326
Total	492,477	748,676

Based on operator-name matches, VIIRS data could not be tied to 29 operators of 2,625 leases that filed production reports disclosing that they flared 1,693,779 MCF in the four counties that year. Conversely, VIIRS data detected 51 flares totaling 4,623,155 MCF in 2022 that could not be matched to any production reports based on operator names.

Even if all VIIRS entries matched the production report (PR) data, the production reports disclosed a total of 6,129,049 MCF. That is just 43% of the 14,334,337 MCF that VIIRS recorded in that same region in 2022.

## Total volumes of flaring releases reported by operators and recorded by VIIRS satellites in four South Texas counties in 2022

MCF = 1,000 Cubic Feet



# Conclusion

Comparing Railroad Commission flaring permit and production report data to VIIRS data is an emerging tool to quantify and control flaring releases, while aiding enforcement of flaring violations. A comparison of these data for four South Texas counties in 2022 reveals some preliminary findings. First, the 6.1 billion cubic feet of gas that operators reported flaring there accounts for less than half of the gas that VIIRS detected being flared there that year (14.3 billion cubic feet). This suggests that the Railroad Commission does not have an accurate assessment of the volumes of gas flared in Texas. This is particularly relevant, considering that the commission has repeatedly reported that flaring has declined in recent years,<sup>10</sup> and the agency has continued to file lawsuits seeking to prevent increased federal regulation of methane and flaring.<sup>11, 12</sup>

Meanwhile, both operator-reported and satellite-observed volumes fall far short of the 20.7 billion cubic feet of gas that Railroad Commission permits authorized operators to release in the four counties in 2022. This suggests that the agency is too indulgent in handing out flaring permits and has failed to use flaring permits as a tool to limit flaring releases, nor does the agency have an effective process for monitoring flaring rates and enforcing flaring limits.

Comparing these three data sets presents analytical challenges. Steps to better facilitate these comparisons going forward should include:

- Better resolution and geospatial locating of VIIRS observations to more precisely tie those data to specific GPS locations, leases, and operators; and
- The Railroad Commission mandating that flaring permits and production reports include current operator data, lease numbers, and GPS coordinates of flare stacks.

These improvements would allow much tighter triangulations between flaring permits, production reports, and VIIRS satellite recordings. That, in turn, would facilitate better enforcement of flaring permit violations, tighter regulatory control of wasted gas, and reduced flaring volumes.



# Endnotes

1. Commission Shift. September 2024. Permission Granted: Texas Oil and Gas Regulators On Track to Allow More Flaring Waste Than Ever. <https://commissionshift.org/wp-content/uploads/2024/09/Permission-Granted-Texas-Oil-and-Gas-Regulators-On-Track-to-Allow-More-Flaring-Waste-Than-Ever.pdf>
2. Some longer permits were issued in the 2010s with shelf lives extending into 2022.
3. None of the flaring permits reported API numbers.
4. In the four counties in 2022, permitted volumes exceeded reported volumes for 94% of the permits, which were awarded to 65 leases.
5. These flare-detecting satellites do not record methane that is vented instead of flared off.
6. Multidisciplinary Digital Publishing Institute (MDPI). Dec. 25, 2015. Methods for Global Survey of Natural Gas Flaring from Visible Infrared Imaging Radiometer Suite Data. <https://www.mdpi.com/1996-1073/9/1/14>
7. The maximum geospatial distance cited by flaringmonitor.org is 415 meters.
8. World Bank Group. Global Flaring and Methane Reduction Partnership (GFMR) <https://www.worldbank.org/en/programs/gasflaringreduction/global-flaring-data>
9. Railroad Commission ownership data generally appeared to be more up to date than the World Bank's VIIRS ownership information, though neither are infallible. VIIRS continued to list Callon (Eagle Ford) LLC as an operator, for example, after that entity was acquired by Ridgemar Energy Operating LLC in 2023. Meanwhile, the Railroad Commission continued to list Burlington Resources as an operator long after its 2006 acquisition by Conoco Phillips.  
Market Screener. July 2, 2023. Ridgemar Energy Operating LLC completed the acquisition of Callon (Eagle Ford) LLC from Callon Petroleum Company. <https://www.marketscreener.com/quote/stock/CALLON-PETROLEUM-COMPANY-12156/news/Ridgemar-Energy-Operating-LLC-completed-the-acquisition-of-Callon-Eagle-Ford-LLC-from-Callon-Petro-44271330/>  
Natural Gas Intelligence. Aug. 22, 2006. ConocoPhillips Completes \$35.6B Purchase of Burlington Resources. <https://naturalgasintel.com/news/conocophillips-completes-356b-purchase-of-burlington-resources/>
10. Railroad Commission of Texas. Dec. 13, 2024. Christian: EPA Report on Methane Reduction Proves Biden's Methane Policies are Another Lie and Unjustified Assault on Oil & Gas. <https://www.rrc.texas.gov/news/121324-christian-epa-report-on-methane-reduction-proves-biden-s-methane-policies-are-another-lie-and-unjustified-assault-on-oil-gas/>
11. Railroad Commission of Texas. Mar. 8, 2024. Texas Challenges Controversial Federal Methane Rule. <https://www.rrc.texas.gov/news/030824-texas-challenges-controversial-federal-methane-rule/>
12. Railroad Commission of Texas. Jan. 14, 2025. Christian Calls on TCEQ to Stop Biden's Methane Rule Roll Out in Texas. [https://www.rrc.texas.gov/news/011425-christian\\_callson\\_tceq\\_bidenmethanerule\\_jan\\_2025/](https://www.rrc.texas.gov/news/011425-christian_callson_tceq_bidenmethanerule_jan_2025/)