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Updated analysis of oil and gas methane  
emissions shows growing problem



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A report by Diné CARE, Environmental Defense Fund, Grand Canyon Trust, NAVA Education Project and Western Leaders Network.

## Author

**Renee McVay**

Environmental Defense Fund

## Environmental Defense Fund

Environmental Defense Fund is dedicated to protecting the environmental rights of all people, including the right to clean air, clean water, healthy food and flourishing ecosystems. Guided by science, we work to create practical solutions that win lasting political, economic and social support because they are nonpartisan, cost-effective and fair.

*Cover photo:* Earthworks

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# Executive Summary

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Methane is a potent climate pollutant and the main ingredient in natural gas. Research shows oil and gas companies waste tremendous amounts of natural gas each year due to leaky equipment, deliberate venting, excessive flaring and other practices.

Unfortunately, companies operating on Navajo lands are wasting a disproportionate amount of energy compared to their counterparts across the country – resulting in significant economic and environmental consequences for Navajo communities.

This analysis conducted by Environmental Defense Fund concludes companies waste roughly 1.5 billion cubic feet of natural gas a year — \$4.8 million worth of natural gas that, if captured, could mean as much as an additional \$1.2 million a year in royalties to the Navajo Nation and allottees. This volume of wasted gas is more than enough to meet the annual usage needs of every home on the Navajo Nation for five months. The problem also leads to 21,700 metric tons of methane emissions per year, which is equivalent to 5.2 percent of the total gas produced – an emissions rate more than double the national average.

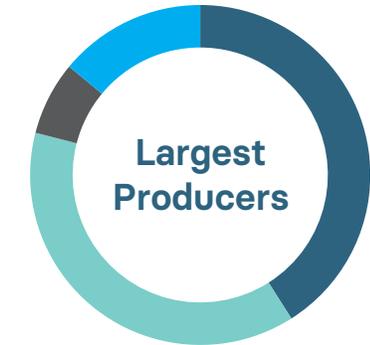
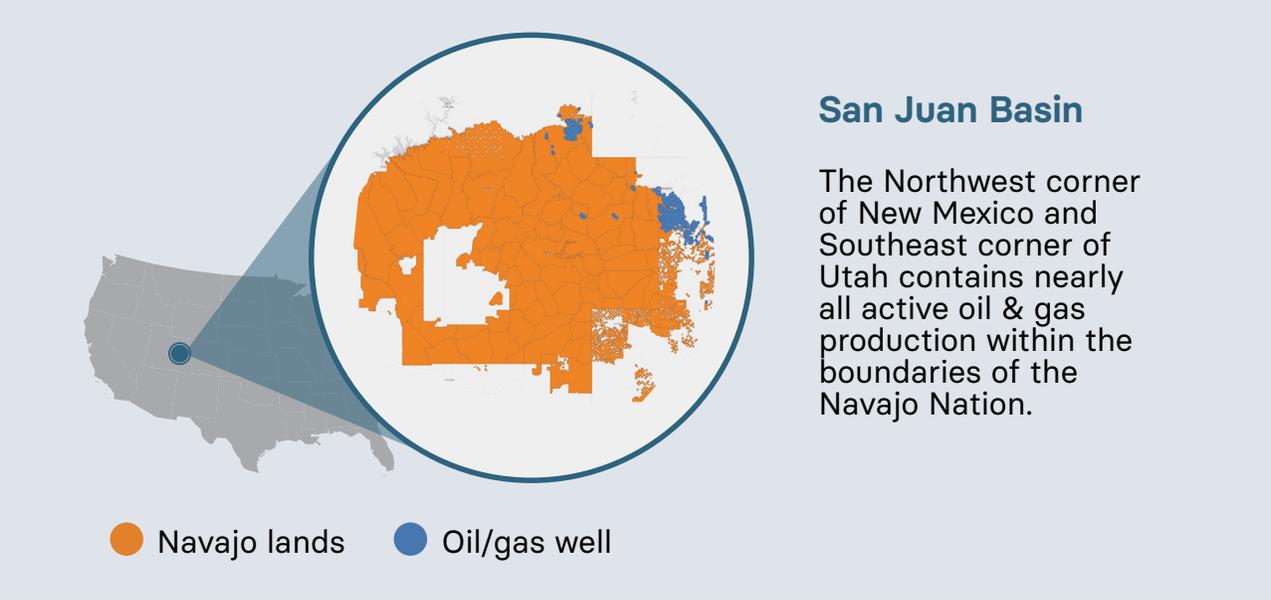
Oil and gas has been produced on Navajo lands since the 1920s and continues to be an important source of revenue to the Navajo Nation. Unfortunately, spills, leaks and other burdens associated with this activity have created health impacts for Navajo communities and raised environmental justice concerns. The methane and associated air pollution impacts discussed in this report are a piece of this larger problem.

Largely avoidable methane emissions can also lead to forms of pollution with serious

health problems for tribal communities, and action to cut these methane emissions will lessen the burden from these other forms of pollution as well. Emissions from oil and gas production also contain toxic, even deadly, gases like hydrogen sulfide, toluene, xylene and benzene. These Hazardous Air Pollutants (HAPs) total 214 tons per year on the Navajo Nation. Methane leaks also allow volatile organic compounds (VOCs) to be released. These VOCs are one of the main building blocks of ozone pollution, which can harm the respiratory system, trigger asthma attacks and worsen emphysema. Ozone levels in New Mexico's San Juan County are close to surpassing federal health standards—putting communities there at risk. The 21,700 tons of methane wasted every year by oil and gas operations on Navajo lands are largely avoidable and equal to the pollution caused by 400,000 automobiles per year.

The Navajo Nation Environmental Protection Agency has the opportunity to increase tribal sovereignty and revenue through comprehensive requirements to reduce methane pollution and waste levels. The agency has proposed a good set of requirements that could be strengthened further with targeted improvements that build upon what other leading jurisdictions have successfully implemented. Limiting natural gas waste represents a natural continuation of the Navajo Nation's strong record of responsible resource management. The Navajo Nation has the opportunity to exercise its sovereignty and its commitment to preserving the health of its people, while protecting its resources and curtailing a potent source of greenhouse gases.

# Oil & gas production on the Navajo Nation



- Elk Petroleum 41%
- Enduring Resources 38%
- Hilcorp Energy 7%
- Other 14%



- Reservation 27%
- Off-reservation Trust Land 73%

## 2018 Annual Figures

- Total methane emissions **21,700 tons**
- Total natural gas wasted **1,500,000 mcf**
- Value of wasted gas **\$4,800,000**
- Value of lost royalty **\$600,000-\$1,200,000**

# Emission sources and key takeaways

SEGMENT	SOURCE	EMISSIONS (MT CH4)	% OF TOTAL
Production	Associated Gas Venting and Flaring	40	0.2%
Production	Centrifugal Compressors	5	0%
Production	Combustion Exhaust	180	0.8%
Production	Dehydrators	20	0.1%
Production	Equipment Leaks	1400	6.5%
Production	Other Flaring	57	0.3%
Production	Oil and Gas Well Completions and Workovers	66	0.3%
Production	Liquids Unloading	790	3.7%
Production	High-bleed Pneumatics	87	0.4%
Production	Intermittent Bleed Pneumatics	420	1.9%
Production	Low-Bleed Pneumatics	1500	6.9%
Production	Malfunctioning Pneumatics	3000	13.9%
Production	Pneumatic Pumps	50	0.2%
Production	Produced Water Tanks	600	2.8%
Production	Reciprocating Compressors	34	0.2%
Production	Abnormal Process Conditions	7400	34.2%
Production	Oil and Condensate Tanks	1300	6.0%
Gathering & Boosting	Gathering Blowdowns	190	0.9%
Gathering & Boosting	Gathering Lines	540	2.5%
Gathering & Boosting	Gathering Stations	2500	11.6%
Transmission & Storage	Leaks	110	0.5%
Transmission & Storage	Reciprocating Compressors	340	1.6%
Transmission & Storage	Centrifugal Compressors	88	0.4%
Transmission & Storage	Pneumatic Controllers	24	0.1%
Transmission & Storage	Abnormal Process Conditions	370	1.7%
Transmission & Storage	Other	360	1.7%
Transmission & Storage	Pipeline venting	150	0.7%

**Abnormal process conditions, pneumatics, and gathering stations are the largest sources of emissions.**

**Approximately 5.9% of gas produced on Navajo lands is wasted—5.2% is emitted and 0.8% is flared.**

# Navajo leaders speak out for efforts to cut natural gas waste

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"Impacts such as air pollution are no longer just in one area of Navajo lands, it is everywhere. It seems like no matter how much we Diné make noise about our air pollution on our homelands, no one listens. With all the pollution in our air, no wonder we do not have or get any rain.

The companies that come onto Navajo lands know how they can make short cuts with very little oversight. There has to be a way for our leadership to listen and understand the impacts of allowing extractive companies to come onto Navajo lands to extract minerals. They need to be involved and look out for their relatives and people."

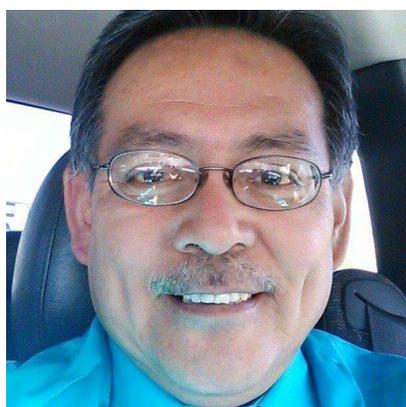
**Samuel Sage, Diné C.A.R.E**

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"Stopping methane and air pollution is critical for the health of our planet and our people and the economic wellbeing of the Navajo Nation. The oil and gas industry must clean up its act, and it is up to us, as native peoples, to affirm our autonomy and protect our communities.

We need strong rules to reduce methane and air pollution at the state and federal, and tribal government level. The Navajo Nation Environmental Protection Agency should be applauded for exercising tribal sovereignty by enacting rules with targeted improvements that hold the oil and gas industry accountable for its waste and pollution."

**Anita Hayes, Tse Daa K'aan Chapter Manager**



"Being good stewards of the land is central to Navajo people. It makes no sense to waste resources like natural gas – it's bad for our communities because we lose revenue and suffer the effects of increasing methane and air pollution.

The Navajo Nation is making important progress to apply strong rules to oil and gas operators on our lands."

**Herman Farley, Red Mesa Chapter President**



## Conclusion and policy recommendation

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Efforts to cut methane pollution from oil and gas development on Navajo lands will increase tribal revenue needed to fund education, roads, bridges and other important projects, as well as better protect the health of local communities. This analysis shows that the Navajo Nation currently bears a disproportionate share of methane waste and pollution. In addition to federal regulations that are in the process of being restored by the Biden administration, the Navajo Nation is moving to exercise its sovereign authority by proposing rules to limit waste and protect Navajo communities from pollution.

In 2019, the Navajo Nation Environmental Protection Agency began consideration of establishing a minor source air pollution permitting program. This effort could be a strong, positive step toward better regulation of oil and gas development and reduced pollution on tribal lands. The establishment of robust general permit requirements can help reduce the emissions that lead to harmful methane and VOC pollution. These requirements can also set a strong standard for future efforts to address methane pollution from existing oil and gas sources.

The 2020-2021 pandemic hit the Navajo Nation hard and underlined the need to protect members of the Navajo Nation from the harmful health impacts of air pollution, which creates and exacerbates underlying health conditions. We hope the agency will consider the suggestions below regarding control requirements that will help to ensure VOC and methane emissions are rigorously controlled using modern pollution control technologies:

- Standards and requirements to address emissions of all hydrocarbons (both VOCs and methane).
- At least quarterly leak inspections of all sources including malfunctioning pneumatics using optical gas imaging cameras or other equipment capable of delivering equivalent emission reductions, coupled with expeditious repair timeframes and detailed record-keeping and reporting.
- Robust requirements that reduce designed and unintentional venting from all sources with the potential to vent VOCs and methane, including storage tanks, pneumatic devices, flares and glycol dehydrators (E.g., 98 percent control of emissions from flares, combustion devices, storage tanks and zero bleed pneumatic devices).
- Requirements that prohibit routine venting and flaring from oil wells and that ensure flares are lit and operating at maximum efficiency.
- Robust requirements to reduce pollution during liquids unloadings.
- Detailed record-keeping and reporting requirements in order to demonstrate compliance and provide transparency.
- Robust public involvement and notice requirements giving ample opportunities for impacted communities and chapters to meaningfully engage



Photo: Bill Vorasate

## Methodology

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This report is based on production and emissions for 2018.

### Production

Oil and gas production on the Navajo Nation for 2018 is calculated using a combination of data from Enverus/DrillingInfo and the Arizona Department of Environmental Quality. Well sites in the Navajo Nation are identified with ArcGIS using a shapefile from the Census Bureau. For this analysis, we use only currently-producing active wells, defined as wells that reported nonzero production in 2018.

### Emissions

Emissions are calculated by county for each of the counties that encompass the Navajo Nation using the model described in Alvarez et al. 2018, described briefly below. County emissions are then multiplied by the percentage of production in those counties occurring on Navajo Nation land in order to calculate the emissions on the Navajo Nation.

Production emissions are estimated for each year using two separate methods: total site-level emissions based on direct measurements and component-level emissions based on the EPA GHGRP. The difference between these two emissions estimates is attributed to 'abnormal process conditions', emissions that are difficult to quantify with inventory based approaches.

Total site-level production emissions are estimated based on measured site-based emission factors from six production areas in the U.S. Although the underlying data do not include site-level measurements from the San Juan Basin, Alvarez et al 2018 reports that analogous estimates of San Juan Basin 2015 emissions agree closely with basin-level, aircraft-based measurements from the region (Smith et al 2017), suggesting that this combined dataset is broadly representative of the region. Emission factors vary with production and are used to calculate total production emissions for each county.

Component-level production emissions are calculated using GHGRP data for each year. Reported data are analyzed with a statistical model to extrapolate emissions from reporting GHGRP facilities to non-reporting facilities. For some sources, we use GHGRP activity data and other emissions data to estimate emissions. For example, pneumatic controller emissions are based on adjusted GHGRP controller counts and emission factors from Allen et al. 2014.

Gathering and boosting emissions are estimated from Drillinginfo gas production and state-specific emission rates reported in Marchese et al. , adjusted to better account for heavy-tail emissions.

Transmission & Storage emissions by source are taken from the GHGI, and an abnormal emissions category is added using the Zimmerle et al. estimate of 200 Mg/station/yr.

## Flares

Flared gas volumes are from the NOAA VIIRS 2018 dataset. Flares on the Navajo Nation are identified by mapping flaring locations with the Navajo Nation shapefile from the Census Bureau.

## Wasted Gas and Lost Revenue

Wasted natural gas is calculated by summing the flared gas volumes and the methane emissions, converted to natural gas volumes. The gas price used is the average Henry Hubs natural gas spot price for 2018, \$3.17/ MMBtu.

The lost royalty revenue is calculated as a range because individual royalty rates vary by lease. As a lower bound, we assume a royalty rate of 12.5%, equivalent to the federal royalty rate. As an upper bound, we assume a royalty rate of 25%, based on conversations with various stakeholders.

The equivalent number of households for that volume of natural gas is calculated using the number of households in the Navajo Nation (from the 2019 American Community Survey from the Census) and the gas usage per households in New Mexico (from the EIA).



