BEFORE THE ENERGY AND CARBON MANAGEMENT COMMISSION
OF THE STATE OF COLORADO

	CAUSE NO.
PETITION FOR RULEMAKING TO ADOPT A RULE TO INCLUDE THE SOCIAL COST OF CARBON IN CUMULATIVE IMPACT ANALYSIS	
	DOCKET NO.
	TYPE: PETITION FOR RULEMAKING

Petition For Rulemaking to Include Social Cost of Carbon in All Cumulative Impact Analyses

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Petitioners WildEarth Guardians, 350 Colorado, Womxn from the Mountain, Physicians for Social Responsibility, Larimer Alliance, Sierra Club Colorado, GreenLatinos, Earthworks, and the Black Parents United Foundation hereby respectfully request and petition the Colorado Energy and Carbon Management Commission for the promulgation of a rule to include the Social Cost of Carbon in all Cumulative Impacts analyses.

I. Description of Petitioners

WildEarth Guardians is a non-profit conservation organization headquartered in Santa Fe, New Mexico with offices across the western U.S., including in Colorado. Guardians is dedicated to protecting and restoring wildlife, wild rivers, wild places, and health of the American West. Guardians and its members work to reduce harmful air pollution including greenhouse gas pollution in order to safeguard public health, welfare, and the environment. Guardians has more than 100,000 members and supporters, many of whom live, work, or recreate in Colorado.

350 Colorado is a 501(c)3 nonprofit organization with a mission to work locally toward building a global grassroots movement to solve the climate crisis and accelerate the transition to a sustainable future. 350 Colorado has 20,000 members statewide working to address environmental injustice and other root causes of the climate crisis, to address related issues such as air pollution, and to promote equitable and lasting solutions.

Womxn from the Mountain is a 501(c)3/501(c)4 organization with March On, founded by indigenous womxn. We are an inclusive women's group open to women, two-spirit, and commUNITY of all colors and backgrounds. Our goal is to empower our individual, spiritual, physical, emotional, and educational needs through equity, transformative education, and culturally responsive healing arts for Colorado indigenous and disproportionately impacted communities from the transformative lens of decolonization. Currently we are working as climate change organizers and cultural educators for disproportionately impacted communities to create protections and safety with cultural and trauma sensitivity from cumulative impacts of environmental racism on the Equity Analysis subcommittee for the Environmental Justice Action Taskforce Colorado Department of Public Health and Environment ("CDPHE").

The Larimer Alliance for Health, Safety and Environment is an activist alliance (established as 501-C-4 organization) committed to strengthening local and state policies and rules to protect public health, safety, and the environment in matters of oil and gas development impacting Larimer County, in accordance with Colo. S.B. 19-181.

The Sierra Club of Colorado is a powerful collective of grassroots changemakers working together across the state to advance climate solutions, act for justice, get outdoors, and protect lands, water, air, and wildlife. We believe in the power of working together to make change happen.

Physicians for Social Responsibility (PSR) Colorado is a 501-c-3 organization composed of health professionals and allies working to protect human life and the environment from the greatest threats to health and survival. We engage in education, advocacy, and actions to elevate the voice of health professionals to protect the public, and specifically the most vulnerable population, from the present and future health impacts of fossil fuel production, distribution and use; the existential climate crisis; and exposures to radionuclides and other toxic substances. PSR Colorado advocates at the State and local level for solutions to reliance on fossil fuels and nuclear energy.

GreenLatinos is a national non-profit organization that convenes a broad coalition of Latino leaders committed to addressing national, regional and local environmental, natural resources and conservation issues that significantly affect the health and welfare of the Latino community in the United States. GreenLatinos provides an inclusive table at which its members establish collaborative partnerships and networks to improve the environment; protect and promote conservation of land and other natural resources; amplify the voices of minority, low-income and tribal communities; and train, mentor, and promote the current and future generations of Latino environmental leaders for the benefit of the Latino community and beyond. GreenLatinos develops and advocates for policies and programs to advance this mission.

Earthworks is a non-profit organization dedicated to protecting communities and the environment from the adverse impacts of mineral and energy development while promoting sustainable solutions. For more than 20 years, Earthworks has been working with frontline communities in Colorado to advocate for public health and the environment. Earthworks staff engage with state lawmakers and regulatory bodies as well as local governments across Colorado to pass legislation, reform policies and adopt stricter rules that put the lives of people before the interests of industry and promote a managed decline of oil and gas production, including an end to permitting new oil and gas facilities.

Black Parents United Foundation (BPUF) is a 501(c)3 community-based non-profit organization created for parents of black and brown children to empower their children, and to promote equity, diversity, and inclusion through confidence building, community development, and community engagement.

Citizens for a Healthy Community (CHC) is a nonprofit citizens group of 500 individual community members and organizations based in Paonia on the Western Slope dedicated to protecting the North Fork Valley's air, water and foodsheds from the impacts of oil and gas development. CHC represents concerned citizens, farmers, vintners, scientists, healthcare and wellness providers, businesses, and similarly minded nonprofit organizations.

II. Introduction

The primary purpose of this Energy and Carbon Management Commission ("the Commission" or "ECMC") is to "[r]egulate the development and production of the natural resources of oil and gas in the state of Colorado in a manner that protects public health, safety, and welfare, including protection of the environment and wildlife resources." C.R.S. § 34-60-102(1)(a)(I). Colorado recognizes the outsized climate impacts of oil and gas development and has committed to addressing these impacts through regulation. The Commission is mandated to protect public health and the environment by evaluating and addressing cumulative impacts to avoid, minimize, and mitigate negative cumulative impacts from oil and gas operations, including climate change.

Currently, the ECMC collects information related to greenhouse gases ("GHG") and other emissions through its Cumulative Impacts Data Evaluation Repository (CIDER). However the name itself is a misnomer: the ECMC does not "evaluate" the data provided to it by operators. As stated in the annual cumulative impact reports, "CIDER is solely a data repository and not a data evaluation program. CIDER is a compilation of the data entered on the Form 2B."[1]

There are two major problems with the current cumulative GHG and climate impacts reporting required by the ECMC which prevent the agency from fulfilling its statutory mandate to

[1] ECMC, Director's 2023 Report On The Evaluation Of Cumulative Impacts - Rule 904.a (February 2024). Attached as Exhibit 1.

evaluate and address cumulative impacts, to avoid, minimize, and mitigate these impacts to protect public health, safety, and welfare.

First, no quantification of GHG emissions from the proposed development is required from operators nor is it independently performed and reported by the ECMC (nor could it be, given current reporting requirements).[2] This, in itself violates the obligation of the Commission to quantify emissions of greenhouse gases that occur from sources that are controlled or owned by the energy and carbon management operator and from reasonably foreseeable truck traffic from proposed operations.[3] The second major problem is with data quality. Although poor quality of the data supplied by operators has been an issue raised repeatedly to the Commission, the cumulative-impacts data even today remains inscrutable, unscrutinized, and often wildly incredible.

With regard to quantification of GHG emissions – which is required by statute – none is supplied by operators, nor does ECMC independently quantify these emissions. At the Oil and Gas Development Plans ("OGDP") stage (representing close to 100% of all approvals) greenhouse gas emissions are reported on the Form 2B - the "CIDER" inputs. This form contains line item "pre-production" and "production phase" list of potential emission sources along with their expected tons per year value of various air pollutants including the three major GHGs. Anticipated truck traffic is reported on the Form as both "Diesel Vehicle Road Miles" as well as "estimated number of truck trips traveling on or off the Oil & Gas Location" related to anticipated dust impacts. However, it is impossible to arrive at a quantification of climate impacts from the data provided because these data points are not and cannot be "added up" anywhere. For example, the truck miles provided may overlap but there is no way to use those two sets of numbers to arrive at a "true" total number of vehicle miles traveled, nor would 'miles traveled' adequately capture the climate impact from fully loaded semi-truck trips versus lightly loaded gasoline or electric vehicles which might be included as potential dust impacts. For the Form 2B, adding the ((total reported pre-production emissions) to (total production emissions)) x (total months of operation/12), and then adding the (total number of diesel miles anticipated) x (some factor of estimated GHG emissions per diesel mile), a user could arrive at a rough cumulative total of GHG emissions (although exclusive of the non-diesel traffic). We ourselves used this formula to analyze the CIDER data supplied with the 2024 OGDP approvals (*see* Appendix C). It would be difficult to argue that this reporting is sufficient to "quantify" emissions of greenhouse gases that occur from sources that are controlled or owned by the energy and carbon

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[2] The "intensity standard" reporting which is required for some applications cannot fulfill this obligation because it addresses only data from *existing* operations and not the additional impacts that will be created from the proposed operations. *See infra* page 8.
[3] C.R.S. § 34-60-103(23).

management operator and from reasonably foreseeable truck traffic from proposed operations. Additionally, the three greenhouse gasses are extremely different in their impacts and can only be compared by establishing an equivalency factor. Therefore, while the data provided is helpful, it does not provide the real anticipated quantification of climate impacts of the proposed project.[4] Ultimately, a true cumulative impacts analysis must in some way measure and report the anticipated impacts, not just provide a spreadsheet of raw data.

The second major problem is with data quality. Although poor quality of the data supplied by operators has been an issue raised repeatedly to the Commission has taken no steps to ensure the data provided is complete and accurate. Instead, the ECMC has chosen to repeatedly acknowledge the failures of its impact evaluation database while taking no concrete steps to improve it. For example, in the 2024 Cumulative Impact Report, it wrote that "[s]taff acknowledges that the quantitative data in CIDER are not always sufficient to fully evaluate cumulative impacts"[5] – yet in the Cumulative Impacts Rulemaking held just months later did not adopt any rules to correct these acknowledged deficiencies.[6] Furthermore, despite relying primarily on CIDER to fulfil its mandate to "evaluate and address cumulative impacts,"[7] the ECMC has disavowed any responsibility for ensuring the accuracy

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[4] In Appendix C, we report our unofficial analysis of anticipated greenhouse gas emissions from approved 2024 Oil and Gas Development Plan CIDER data. However, because the CIDER data is not truly sufficient to quantify expected climate impacts with a scientific degree of accuracy this analysis can only provide a rough outline. *See* Appendix C.

[5] ECMC, Director's 2023 Report (Feb. 2024), Exhibit 1 at 60. *See also*, *e.g.*, *id.* at 9 ("[m]ore data will be necessary"); *id*. at 38 ("[m]ore information from future OGDPs in this area will be necessary"); *id*. at 49 ("[t]hese efforts are expected to improve the accuracy of CIDER data in future years. . . . ECMC Staff will work closely with the APCD to understand any necessary changes to the Form 2B throughout and as a result of this process."); *id*. at 94 ("as Commissioners' understanding and evaluation of cumulative impacts evolves, the Director intends to accept requests for additional content for future iterations of this report.").

[6] *See* ECMC, Docket No. 240600145, 2024 Cumulative Impacts and Enhanced Systems and Practices Rulemaking, Statement of Basis, Specific Statutory Authority, and Purpose (Oct. 15, 2024) (while certain changes to CIDER inputs were made, particularly revision of Rule 315, at pages 37–43, the fundamental material deficiencies identified in the 2023 Report were not corrected or addressed and ultimately the only substantive reporting change on GHG and air pollution emissions was additional cross-reporting on "intensity" standards, *see infra* page 8).

[7] *See* ECMC, Director's 2023 Report (Feb. 2024), Exhibit 1 at 5, *passim* (discussing the importance and mandatory duty of ECMC efforts to "evaluate and address" cumulative impacts; note that all ECMC data used to populate the Cumulative Impacts Report is reported from the CIDER database).

of the information it relies upon to meet this mandate, saying "CIDER is solely a data repository and not a data evaluation program."[8]

Our analysis of CIDER data submitted with OGDPs approved over the past 12 months show that this data is clearly unreliable and is incapable of fulfilling the Commission's obligation to "evaluate and address" cumulative impacts.[9] We discovered wildly varying estimates of anticipated GHG emissions for the same operations, inconsistencies between the operations described in the Form 2B and operations in the approved Form 2A, and include many instances of operators reporting facially nonsensical numbers *(see* Appendix C for detailed analysis). The Commission cannot simply ignore the fact that some operators submit blank text when required to report anticipated emissions from operations where claims of "zero" emissions are simply *impossible* given the processes and equipment involved. There are many potential regulatory tools available to improve accuracy and provide credible data. The Commission may require operators to "show their work," supporting their data with disclosed methodology and assumptions. The Commission may choose to apply a standardized emissions rate for particular types of operations, and develop its own cumulative emissions estimations based on the permitted activities and infrastructure. The Commission may simply choose to impose penalties for "bad" cumulative impacts data, and then perform audits or partial audits of submitted form 2Bs, particularly when the reported data deviates from expected norms. There are solutions to the demonstrable problem of poor data quality. Interminably engaging in processes revisions (which never end up fixing the problem), or worse – claiming the Commission does not have anything more than an obligation to act as a repository for a collection of assorted numbers– these are not acceptable solutions.

Petitioners request that the Commission fulfill its statutory duty to evaluate and address cumulative climate impacts by adopting a rule requiring the quantification of greenhouse gas emissions from proposed operations, and evaluating cumulative climate impacts (at least in part) through the use of the Social Cost of Carbon ("SCC").

III. The Social Cost of Carbon

Oil and gas production is Colorado's largest contributor to its total greenhouse gas emissions, even excluding the downstream emissions from the combustion of fossil fuels, according to the

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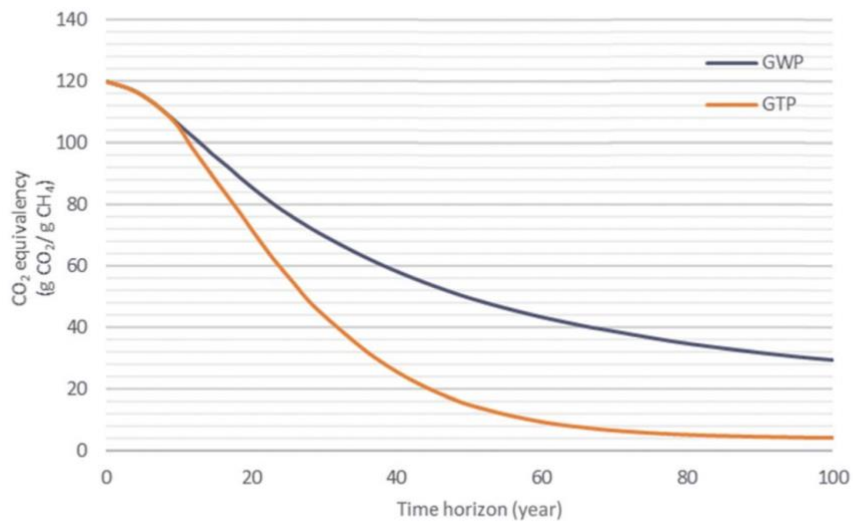
[8] ECMC, Director's 2023 Report (Feb. 2024), Exhibit 1 at 60.

[9] This is additionally supported by the number of references in the 2023 Report to problems and insufficiencies with the CIDER dataset. *See supra* fn. 5.

updated 2023 Colorado Greenhouse Gas Inventory Report.[10] Upstream oil and gas emissions are primarily in the form of methane (CH_4) which has a much larger impact on the climate than carbon dioxide (CO_2) over the short-term, as shown in the graph below of the relative global warming potentials ("GWP") along with the global temperature change potential ("GTP").[11]



In 2019 Colorado enacted Senate Bill 181, which states that the Commission must adopt rules to "evaluate and address the potential cumulative impacts of oil and gas production." As a result, this Commission adopted a set of rules related to cumulative impacts in its Mission Change rulemaking in 2020, primarily concerned with the collection of evaluative data. In 2021, after the Mission Change rulemaking, the Commission created a form to capture data related to cumulative impacts to populate its Cumulative Impacts Data Evaluation Repository.[12] This form (Form 2B) requires operators to submit data related to preproduction and production emissions of several pollutants, including the three greenhouse gasses common to oil and gas production - carbon dioxide, methane, and nitrous oxide (N_2O). While this data is helpful, it does not include a total quantification of GHG emissions associated with a proposed operation, Additionally, serious deficiencies exist in ensuring full and accurate emissions reporting. At the same time, the Commission also adopted rules requiring "cumulative impacts plans" which were primarily descriptions of how operators planned to avoid,

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[10] Matthew Twyman et al., *2023 Colorado Statewide Inventory of Greenhouse Gas Emissions and Sinks* (2023), Colorado Air Pollution Control Division. Attached as Exhibit 2.
[11] Paul Balcombe, et al., *Methane emissions: choosing the right climate metric and time horizon*, 20 Environ. Sci.: Processes Impacts 1323, 1328. Attached as Exhibit 3.
[12] This form was revised in January of 2025 to reflect the new Cumulative Impact rules adopted in 2024, but the section on pre-production emissions, production emissions, and diesel vehicle miles was unchanged.

minimize, mitigate, and offset cumulative impacts.[13] Between 2022 and 2024, the Commission has released three Cumulative Impact Reports based on the CIDER data from the previous year.[14]

Then, in 2024, the state enacted House Bill 1346, which required the Commission to promulgate additional rules to address cumulative impacts and provided a legislative definition of "cumulative impacts":

> 'Cumulative Impacts' means the effects on public health and the environment, including the impacts to air quality, water quality, climate, noise, odor, wildlife, and biological resources, caused by the incremental impacts that a proposed, new, or amended operation regulated by the commission pursuant to this article 60 would have when added to the impacts from other past, present, and reasonably foreseeable future development of any type on the impact area or on a disproportionately impacted community.

C.R.S. § 34-60-103(7)(a). Further defining "impacts to climate" as "the quantification of emissions of greenhouse gases . . . that occur from sources that are controlled or owned by the energy and carbon management operator and from reasonably foreseeable truck traffic, as well as reductions in greenhouse gas emissions, associated with the proposed operation." C.R.S. § 34-60-103(23).

As a result of HB 24-1346 the Commission conducted a more comprehensive cumulative impacts rulemaking ("CI rulemaking") to further evaluate and address cumulative impacts. However, the Commission did not, in the CI rulemaking, adopt new rules requiring operators to report additional climate data, or to quantify the total emissions of greenhouse gasses associated with proposed operations beyond the simple data submissions already required by Mission Change. In the Statement of Basis and Purpose for the rulemaking, the Commission acknowledges that Rule 314.e.(10) was the only rule adopted to address the climate requirements set forth by C.R.S. § 34-60-103(23). This rule refers back to a different agency rule —"Regulation 7"— implemented by the Air Quality Control Commission, which requires operators only to report the CO_2, CH_4, and N_2O emissions from their *existing* operations as well as their existing hydrocarbon production to obtain a "carbon intensity" value through which an operator's production efficiency could be determined. In other words, in the 2024 CI rulemaking, the Commission ignored the legislative mandate to quantify impacts to the climate from proposed oil and gas operations, instead requiring operators to report their production efficiency.

[13] ECMC Rule 304.c.(19).
[14] Attached as Exhibit 4 (2022), Exhibit 5 (2023), and Exhibit 1 (2024).

The Social Cost of Carbon is one such solution to improve the accuracy and credibility of emissions data. The SCC is an estimate of the total damage caused by the emission of one additional ton of carbon dioxide into the atmosphere, taking into account the long-term impacts of climate change like sea level rise, extreme weather events, and agricultural losses. The SCC essentially puts a price on the environmental harm caused by carbon emissions. The social cost of the emission of one ton of CO_2 is currently valued at $89 in Colorado, while the social cost of CH_4 and N_2O are currently set at $2,500 per ton and $33,000 per ton, respectively (at least within CDPHE). 5 CCR 1001-31 Part A II.B.

The use of the SCC in cumulative impacts analysis is not foreign to the Commission. At the tail end of 2024 this Commission conducted a rulemaking to advance the development and utilization of carbon capture and storage ("CCS"). A prerequisite to that rulemaking was the publication of a safety study to analyze the potential impacts of the deployment of CCS in Colorado, which the Commission did. In that study, the Commission deeply considered and analyzed the SCC as it related to the decarbonization of industrial emissions through CCS. In *Carbon Capture and Storage: Safety and Impact Considerations from Source to Sequestration*, the ECMC used the SCC as a means of quantifying the beneficial climate impacts of carbon sequestration.[15] Specifically, the Commission analyzed nine facilities which emit CO_2, to determine "the direct, local health and broader climate benefits of carbon capture." *Id.* at 31.

According to the ECMC's findings in its *Safety and Impact Considerations study*,

> one additional method of evaluating the benefits of capturing CO_2 is the social cost of carbon (SCC), which represents public health and other social harms avoided by reducing greenhouse gas emissions. In other words, the SCC represents the net social benefits of removing CO_2 emissions to a variety of impacts such as agriculture, human health, flooding, and natural disasters. Therefore, the potential health benefits modeled in this study are only a portion of the overall benefit of capturing carbon. Colorado currently uses a SCC of $89/t, with expectations of seeing those numbers rise as federal guidance changes. While installing capture equipment at certain facilities could have economic challenges and will have site specific considerations, the removal of criteria pollutants and CO_2 from the atmosphere can provide significant and continued benefit to the local and global environment. The cumulative benefits of carbon capture, year over year, create a compelling story, especially when coupled with other non-climate net

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[15] ECMC, *Carbon Capture and Storage: Safety and Impact Considerations from Source to Sequestration* (Feb. 2024). Attached as Exhibit 6.

> benefits, such as job creation, use of low emission materials, and sustainable industrial activity. Carbon capture may not be the best solution for certain facilities, but *any evaluation of the impact of installing these technologies should include the wide range of benefits to the environment, society, and the global climate*.

Id. at 45 (internal citations omitted) (emphasis added). However, rather than using the SCC to measure the cumulative *harms* arising from contributing to climate change, the Commission used the SCC as a means of quantifying the *beneficial* climate impacts of carbon sequestration. Specifically, the Commission analyzed nine facilities which emit carbon dioxide (one of the main drivers of climate change) to determine "the direct, local health and broader climate benefits of carbon capture." *Id.* at 31. The ECMC acknowledges that recapturing and permanently *storing* carbon dioxide will have enormous benefits for the climate – and by extension public health and the environment – yet it fails to even evaluate (let alone 'address') the total quantifiable *emissions* of greenhouse gases from proposed oil and gas production operations in its cumulative impacts analysis as is required by law. Because the SCC was developed to measure the damage of carbon emissions it is ridiculous that the ECMC would use it only in the context of crediting the sequestration of carbon and completely ignore its use in the Commission's primary role of regulating the development of oil and gas in Colorado.

Importantly, in that carbon storage rulemaking the use of the SCC for Cumulative Impacts Analysis was strongly supported by industry (including the Chamber of Commerce ("the Chamber")), ECMC staff, and multiple other state agencies, in addition to the local governments represented. The Chamber, in its prefiled testimony and repeated in its party presentation in chief, stated that the Commission should "allow operators to consider the economic and community benefits of sequestration in cumulative impact analyses (including the global benefits of CO_2 sequestration) and using the social cost of carbon to conduct a cost-benefit analysis of these projects."[16] Agency officials from CDPHE and the Colorado Energy Office ("CEO") made an unusual request to reopen the record in order to add testimony in support of utilizing the SCC in cumulative impacts analysis for carbon storage projects. These officials testified to the Commission that "the Social Cost of Carbon remains the best quantitative tool available to estimate the climate impacts of a project that *produces or reduces* greenhouse gas emissions, including carbon capture projects" (emphasis added).[17] Additionally,

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[16] Colorado Chamber of Commerce, *Prefiled Written Testimony*, Class VI Rulemaking DN 241000246, p. 11. Colorado Chamber of Commerce, Hearing Presentation, Class VI Rulemaking DN 241000246, p. 24, 27.

[17] Colorado Energy Office, Colorado Dept. of Pub. Health & Env., *Joint CDPHE/CEO Statement on Social Cost of Carbon as it relates to the 2024 ECMC Class VI Rulemaking*, Class VI Rulemaking DN 241000246 at 2 (Dec. 11, 2024) (emphasis added). Attached as Exhibit 7.

CDPHE testified: "Because some of the benefits from a Class VI well-project will accrue outside of the location of the project, failing to use the SCC would underestimate a proposed project's benefits to society and prevent a more complete accounting of a project's true impact."[18] In response to this testimony, quoting these officials, the Chamber proposed adding to the SBP that "the SCC is a tool the Commission may use to quantify the climate and GHG-reduction benefits. If using the SCC as part of a Rule 1410.d analysis, the Commission will work with the Air Pollution Control Division to ensure consistency across regulatory programs."[19]

Carbon Storage Solutions ("CSS"), another industry group, added robust arguments in support of broadening the commitment to use of the social cost of carbon as a cumulative impacts metric to evaluate carbon storage projects.

> Staff proposed revisions to the Statement of Basis and Purpose ('SBP') on December 11, 2024 specifying that the Commission intends to consider the climate and GHG-reduction benefits associated with the Geologic Storage Projects and that 'the use of the SCC is worthy of additional study and that the Commission does not intend to prohibit its use.' This is not an endorsement of the relevance and appropriateness of using the SCC as a factor in evaluating impacts and benefits of Class VI projects and falls far short of the testimony so clearly provided by Claybourne Clarke and CEO Director Will Toor. CSS agrees with and endorses the testimony given by Claybourne Clarke, CDPHE, and believes Staff's revisions unjustifiably kick the can down the road on the use of the SCC in evaluating Class VI projects. Instead, ECMC should adopt affirmative language about the use of SCC in a cumulative impacts analysis because the SCC (1) reflects an analysis on the effects of climate change converted into a widely used unit of measure, (2) quantifies harm to society broadly, including local communities, and (3) provides consistent evaluation of greenhouse gas ("GHG") impacts in Colorado.[20]

In a footnote, CSS pointed out that "it is unclear why such study is needed when the SCC is recognized as '[a] robust and scientifically founded assessment of the positive and negative impacts

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[18] *Id.* at 1.

[19] Colorado Chamber of Commerce, *Colorado Chamber of Commerce's Response to Social Cost of Carbon Testimony* at 2, Class VI Rulemaking DN 241000246.

[20] Carbon Storage Solutions, *Response Statement of Carbon Storage Solutions to Additional Testimony on the Social Cost of Carbon* at 2, Class VI Rulemaking DN 241000246. Attached as Exhibit 8.

that an action can be expected to have on society" and "provides important insights in the policy-making process.'"[21]

> CSS supports the joint testimony of CDPHE and CEO that the SCC measures the climate benefits to society of removing one ton of carbon dioxide. CSS also adds that the SCC converts these benefits into a widely used metric – dollars per ton. This metric helps decisionmakers understand the impact of their decisions in a way familiar to them, and this is common in environmental and health policy and regulation, as indicated by Director Toor's reference to use of the [CO-Benefits Risk Assessment Health Impacts Screening and Mapping, known as] COBRA tool to assess the health benefits of pollution reduction.
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> The use of SCC alone is not an economic analysis. An economic analysis would require a comparison of project costs (or, as CDPHE is familiar with, costs to comply) against the SCC. The SCC metric is a measure of avoided damage from reducing CO2-equivalent emissions.[22]

Pointing out that the use of the SCC would provide regulatory consistency across the state, CSS noted that:

> The Colorado Air Act requires the Air Quality Control Commission, the Public Utilities Commission, and the Department of Transportation to use the SCC for agency analyses.[23] . . .. As the joint testimony points out, the SCC is one of many criteria to assist the Commission in making a holistic decision. Inclusion of this essential criterion then would promote climate policy consistency between sister agencies as well as allow for ECMC to consider all relevant environmental and public health factors involved in a project.[24]

Other parties also chimed in support for using the Social Cost of Carbon. The Allied Local Governments wrote strongly in favor using the SCC "widely . . . by the ECMC in assessing cumulative

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[21] *Id.* at fn.2 (citing Interagency Working Group on Social Cost of Greenhouse Gases, *Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide* at 2 (Feb. 2021) ("IWG TSD"), attached as Exhibit 9).
[22] *Id.* at 2–3.
[23] (citing Colo. Rev. Stat. § 25-7-110.5(4)(f) (requiring these agencies to include an analysis of the social cost of GHGs related to the estimated emission reductions from a proposed rule)).
[24] *Id.* at 4–5.

impacts of any proposed projects."[25] The group, including Boulder County, City of Aurora, City and County of Broomfield, City of Longmont, Larimer County, and Colorado Communities for Climate Action "agree with the joint statement from the CEO and CDPHE that, 'The Social Cost of Carbon remains the best quantitative tool available to estimate the climate impacts of a project that produces or reduces greenhouse gas emissions, including carbon capture projects.' Certainly, the tool should be used by the ECMC to assess cumulative impacts of various proposed or existing energy projects on the climate."[26]

IV. Statement of Basis and Purpose

This section provides the basis and purpose for proposed amendments to the Colorado Energy and Carbon Management Commission Rules of Practice and Procedure, 2 C.C.R. § 404-1, to include the Social Cost of Carbon in cumulative impacts analysis.

On January 14, 2019 the Colorado Supreme Court held in *COGCC v. Martinez* that the duty of the then-called Oil and Gas Conservation Commission was: (1) to foster the development of oil and gas resources, protecting and enforcing the rights of owners and producers, and (2) in doing so, to prevent and mitigate significant adverse environmental impacts to the extent necessary to protect public health, safety, and welfare, but only after taking into consideration cost-effectiveness and technical feasibility. 433 P.3d 22, 25 (Colo. 2019). Less than three months later the state enacted Senate Bill 19-181, completely upending the previous version of the Act. SB 19-181 directs the Commission to prioritize protecting public health, safety, welfare, the environment, and wildlife, including addressing cumulative impacts. C.R.S. § 34-60-106(2.5)(a).

The term "minimize adverse impacts" was amended to remove the words "wherever reasonably practicable" and replace it with "to the extent necessary and reasonable to protect public health, safety, and welfare, the environment, and wildlife resources, to: (a) Avoid adverse impacts from oil and gas operations; on wildlife resources; and (b) Minimize and mitigate the extent and severity of those impacts that cannot be avoided." Therefore, the first operative word in (2.5)(a) is "protect" and the first operative word in the definition of 'minimize' is "avoid." SB 19-181 requires the Commission to adopt rules to evaluate and address cumulative impacts. C.R.S. § 34-60-106(11)(c)(II).

The Commission conducted a set of initial rulemakings in 2020, otherwise known as the "Mission Change" rulemakings. At that time, the Commission adopted cumulative impact rules

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[25] Allied Local Governments, *Allied Local Governments' Response to Introduction of Social Cost of Carbon* at 1, Class VI Rulemaking DN 241000246. Attached as Exhibit 10.
[26] *Id.* at 2 (quoting the *Joint CDPHE/CEO Statement on Social Cost of Carbon* at 2 (Exhibit 7).

primarily focused on information gathering to 'evaluate' impacts while acknowledging that future rulemaking was warranted to address the impacts after a period of data collection. In August of 2022 a coalition of environmental and environmental justice organizations petitioned the Commission for a rulemaking to address cumulative impacts, including climate change. The Commission denied that petition, but stated that it intended to quickly notice its *own* cumulative impacts rulemaking to address the issues raised in the petition, after it conducted additional stakeholding. In 2024 the state enacted House Bill 1346, which required the Commission to promulgate additional rules to address cumulative impacts (with a deadline later the same year) and clarified the meaning of "cumulative impacts":

> 'Cumulative Impacts' means the effects on public health and the environment, including the impacts to air quality, water quality, climate, noise, odor, wildlife, and biological resources, caused by the incremental impacts that a proposed new or amended operation regulated by the commission pursuant to this article 60 would have when added to the impacts from other past, present, and reasonably foreseeable future development of any type on the impact area or on a disproportionately impacted community.

C.R.S. § 34-60-103(7)(a). Further defining "impacts to climate" as "*the quantification of emissions of greenhouse gases* . . . that occur from sources that are controlled or owned by the energy and carbon management operator and from reasonably foreseeable truck traffic, as well as reductions in greenhouse gas emissions, associated with the proposed operation." C.R.S. § 34-60-103(23) (emphasis added).

In 2024, the Commission conducted a CI rulemaking to further evaluate and address cumulative impacts. However, contrary to the requirements of SB 24-1346, the Commission did not adopt a rule requiring operators to quantify the emissions of greenhouse gasses associated with proposed operations. In the SBP for the rulemaking, the Commission acknowledges that Rule 314.e.(10) is the only cumulative impact rule adopted to satisfy the climate requirements set forth by C.R.S. § 34-60-103(23). Rule 314 refers back to a rule—"Regulation 7"—implemented by the Air Quality Control Commission which requires operators only to report the CO_2, CH_4, and N_2O emissions from their *existing* operations as well as their existing hydrocarbon production to obtain a "carbon intensity" value against which an operator's production *efficiency* could be determined. Other minor changes replaced the narrative "cumulative impact plan" of Rule 304.c.(19) with new "resource impact descriptions" in Rule 315.b.2.E.iii, but these apply only at the location and well application stage and require only descriptions and estimates, not quantifications.

In other words, the Commission improperly ignored the legislative mandate to quantify impacts to the climate from proposed oil and gas operations, instead requiring operators to report their current production efficiency (ratio of production/climate pollution). An "intensity standard" which is retrospective in that it relates to the measurement of an operator's total existing emissions cannot even arguably quantify climate impacts from new proposed projects. Furthermore, in the case of oil and gas production operations, both the production of hydrocarbons *and* the release of climate causing pollutants from upstream operations – both sides of the ratio – add to our climate crisis. An intensity standard may be met either by lowering pollution (in which case total GHG emissions would be lower) or by increasing production. The second method of achieving an intensity standard is doubly harmful in that it likely leads to additional upstream emissions in Colorado and certainly leads to increased total atmospheric carbon as those fuels are combusted downstream.

To fulfill the statutory mandate of the Act to evaluate and address impacts to climate from all operations and proposed operations regulated by the Commission as required by C.R.S. § 34-60-106(11)(c)(II) and revised C.R.S. § 34-60-103(7)(a) and C.R.S. § 34-60-103(23), in accordance with the Commission's obligation to "protect and minimize adverse impacts to public health, safety, and welfare, the environment, and wildlife resources and shall protect against adverse environmental impacts on any air, water, soil, or biological resource resulting from oil and gas operations" under C.R.S. § 34-60-106(2.5)(a), the Commission should adopt the following revised regulations:

V. <u>Proposed Rule</u>

Existing rule language in BLACK, proposed rule language in RED.

315. CUMULATIVE IMPACTS DATA AND ANALYSIS

a. Cumulative Impacts Data Evaluation Repository.

(2) Resource Impacts.

B. Public Health. An evaluation of incremental adverse impacts to public health due to the proposed Oil and Gas Operations, including:

i. A quantitative evaluation of the incremental increase in total hazardous air pollutant emissions [. . .]

ii. A quantitative evaluation of the incremental increase in specific hazardous air pollutant emissions with known health impacts [. . .]

iii. A qualitative evaluation of any potential acute or chronic, short- or long-term incremental impacts to public health as a result of such emissions.

iv. Whether the proposed Oil and Gas Development Plan includes any proposed Oil and Gas Locations or Wells within a Disproportionately Impacted Community.

v. An affirmation that the operator will not use PFAS Chemicals or any of the chemical additives prohibited by Rule 437 in their Hydraulic Fracturing Fluid.

vi. A quantitative evaluation of the incremental increase in greenhouse gas emissions, including a total quantity measured using Colorado's Social Cost of Carbon, from the extraction, processing, and transportation of the produced hydrocarbons, as well as reasonably foreseeable truck traffic associated with the proposed operation.

(8) Data quality assurance. Operators must provide data underlying reported quantitative evaluations, including but not limited to assumptions, formulas, emissions factors, and calculations, used in their cumulative impact analyses.

b. Cumulative Impacts Analysis.

(2) Cumulative Impacts Analysis

E. Resource Impact Descriptions.

iii. Evaluation of Cumulative Impacts – Climate. The Operator will provide the following information regarding its evaluation of Impacts to Climate in the Area of Evaluation:

aa. Statement describing whether the Operator is below, has met, or is in exceedance of its Greenhouse Gas Intensity Targets as of the date of the relevant application or form submission;

bb. ~~Estimate~~ A quantitative evaluation of the incremental increase of the Greenhouse Gas emissions, measured using Colorado's Social Cost of Carbon, expected to occur from the extraction, processing, and transportation of the produced hydrocarbons from sources that are controlled or owned by the Operator, as well as reasonably foreseeable truck traffic, associated with the Oil and Gas Location(s);

cc. Any reductions in Greenhouse Gas emissions directly attributable to the Oil and Gas Location(s); and dd. Description of Best Management Practices that would avoid, minimize, or mitigate adverse Impacts to Climate from the Oil and Gas Location(s).

(5) Review of Cumulative Impacts Analysis

A. If a Cumulative Impacts analysis is submitted pursuant to Rules 315.b.(1).B–~~D~~E, the Director will review an Operator's Cumulative Impacts analysis, including the underlying data, calculations, and methodologies used in producing their analyses, and determine whether the analysis adequately evaluates and addresses the Cumulative Impacts of the proposed Oil and Gas Operations.

VI. Request for Rulemaking

Petitioners, for the reasons, basis, and purpose stated above, respectfully request that the Colorado Energy and Carbon Management Commission initiate a rulemaking proceeding to adopt the proposed amendments to the Commission's Rules of Practice and Procedure, 2 C.C.R. § 404-1, to incorporate the Social Cost of Carbon into cumulative impacts analyses.

Specifically, Petitioners request that the Commission:

1. **Initiate Notice-and-Comment Rulemaking:**
   Pursuant to C.R.S. § 24-4-103, the Commission is requested to conduct a formal notice-and-comment rulemaking process to consider the adoption of the proposed rules.

2. **Adopt Rules Incorporating the Social Cost of Carbon:**
   Incorporate the Social Cost of Carbon into all relevant cumulative impacts analysis, including but not limited to:
   - Oil and Gas Development Plans (OGDPs),
   - Comprehensive Area Plans (CAPs),
   - Individual well applications, and
   - Any other project or operation under the Commission's jurisdiction that contributes to cumulative greenhouse gas emissions.

3. **Establish Data Quality Standards:**
   Require operators to submit data, including assumptions, formulas, emissions factors, calculations, and methodologies, used in their cumulative impacts analysis.

4. **Ensure Regulatory Consistency:**
   Ensure the integration of the Social Cost of Carbon is applied consistently across all relevant analyses to enhance transparency, accountability, and environmental protection.

5. **Provide Guidance for Implementation:**
   Develop clear guidelines for calculating and applying the Social Cost of Carbon to ensure consistency and reliability of analyses.

Petitioners respectfully request that the Commission act promptly to initiate the proposed rulemaking, consistent with its statutory obligations to protect public health, safety, welfare, the environment, and wildlife.

Respectfully submitted this May 6, 2025,

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Appendix A: The Social Cost of Carbon

Climate change, caused by anthropogenic greenhouse gas emissions, is a major – if not **the** major – threat to public health, safety, and welfare in Colorado and globally. Colorado has already experienced high levels of warming, as discussed below in Appendix B. To avoid the worst-case scenarios of warming, government decision-making regarding proposed climate-affecting projects must take into account the full range of environmental, economic, and social costs.[27] One critical tool for integrating these considerations is the Social Cost of Carbon (SCC), a metric that quantifies the economic harm caused by emitting one additional ton of carbon dioxide (CO_2) into the atmosphere. It represents the present value of future economic impacts from climate change caused by these emissions. These impacts include, but are not limited to, increased healthcare costs due to climate-related illnesses, damage to infrastructure from rising sea levels, declines in agricultural productivity, and the loss of biodiversity.

The inclusion of the SCC in environmental assessments and regulatory decision-making is essential to ensure that the long-term costs of carbon emissions are factored into governmental approvals of oil and gas projects. This enables policymakers to appropriately weigh these costs against the purported benefits of economic activities such as oil and gas production.

In its current form, the SCC is typically calculated using integrated assessment models that combine climate science, economic models, and projections of future damages. These models estimate the future impacts of greenhouse gas emissions based on different climate scenarios and discount rates (i.e., the rate at which future costs and benefits are adjusted to reflect their present value), which account for the time value of money.[28] While the dollar per ton value of carbon can vary depending on the model and assumptions used, the SCC is a scientifically validated and legally recognized tool for incorporating the economic damages caused by climate change as one factor in agency decision-making.[29]

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[27] *See*, *e.g.*, National Research Council, *Climate Change*, HIDDEN COSTS OF ENERGY: UNPRICED CONSEQUENCES OF ENERGY PRODUCTION AND USE 248–308 (2010). Attached as Exhibit 11.

[28] *See*, *e.g.*, Interagency Working Group on Social Cost of Greenhouse Gases (2021). Exhibit 9.

[29] *See*, *e.g.*, U.S. EPA, Supplementary Material for the Regulatory Impact Analysis for the Final Rulemaking, Standards of Performance for New, Reconstructed, and Modified Sources and Emissions Guidelines for Existing Sources: Oil and Natural Gas Sector Climate Review: EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances (November 2023). Attached as Exhibit 12.

During the 2019 legislative session, Colorado's General Assembly enacted revisions to several Colorado Revised Statutes in Senate Bill 19-181 (SB 19-181) ("Concerning Additional Public Welfare Protections Regarding the Conduct of Oil and Gas Operations") that included directives for both the Oil and Gas Conservation Commission (OGCC) and the Air Quality Control Commission (AQCC). In the same session, the General Assembly enacted House Bill 19-1261 (HB 19-1261), setting statewide greenhouse gas (GHG) reduction goals. The General Assembly declared in HB 19-1261 that "climate change adversely affects Colorado's economy, air quality and public health, ecosystems, natural resources, and quality of life[,]" acknowledged that "Colorado is already experiencing harmful climate impacts[,]" and that "many of these impacts disproportionately affect" certain disadvantaged communities. The goals set in HB 19-1261 require a 26% reduction of statewide GHG emissions by 2025; 50% reduction by 2030; and 90% reduction by 2050, as compared to 2005 levels. The GHG Pollution Reduction Roadmap ("GHG Roadmap) developed by the Colorado Energy Office (CEO) and Colorado Department of Public Health and Environment (CDPHE) identifies the largest contributors to state GHG emissions and quantifies the baselines from which these reduction percentages are to be estimated.

Colorado already incorporates the SCC in some regulatory contexts. Years before Colorado had adopted GHG emissions reductions goals, in 2017 Colorado's Public Utility Commission ("PUC") required Xcel Energy to use $43 per ton of generated CO_2 pollution starting in 2022 and to set a schedule for ramping that up to $69 per ton by 2050 (although these numbers are outdated compared to current federal or Colorado carbon valuations).[30] In 2021 the state legislature enacted HB 21-1266, which mandates that "for [an AQCC] rule that implements [HB 19-1261] that may materially affect greenhouse gas emissions, the economic impact analysis required by this subsection (4) must include an analysis of the social cost of greenhouse gases related to the estimated emission reductions from the proposed rule." Pursuant to that law,

> The analysis must use the most recent assessment of the social cost for those greenhouse gases for which the federal government has determined the cost, and the consideration of the social cost of greenhouse gases must be consistent with existing law and include use of a discount rate of no more than two and one-half percent; except that the social cost of greenhouse gases that is used may not be lower than that established in 2016, using a two and one-half percent discount rate, by the federal interagency working

[30] Decision No. C17-0316 (Colo. P.U.C. Mar. 23, 2017), *Proceeding No. 16A-0396E*, in the Matter of the Application of Public Service Company of Colorado for Approval of its 2016 Electric Resource Plan, Phase I Decision Granting, with Modifications, Application for Approval of 2016 Electric Resource Plan, mailed Apr. 28, 2017.

group on the social cost of carbon or than the final social cost of greenhouse gases, using a two and one-half percent or lower effective discount rate, established by the federal Interagency Working Group on the social cost of greenhouse gases pursuant to federal executive order 13990, dated January 20, 2021, whichever is higher.

C.R.S. § 25-7-105(4)(f).[31]

In 2010, under President Obama, the Interagency Working Group (IWG) on Social Cost of Carbon estimated the social cost of carbon as $43 per ton of CO_2.[32] President Trump disbanded the IWG in his first term, and President Biden later reinstated it. On January 20, 2021, President Biden issued Executive Order 13990, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis (Federal Register 86:7307). Section 1 of Executive Order 13990 establishes an administrative policy to, among other things, listen to the science, improve public health and protect our environment, ensure access to clean air and water, reduce GHG emissions, and bolster resilience to the impacts of climate change. Section 2 of the Executive Order calls for federal agencies to review existing regulations and policies issued between January 20, 2017, and January 20, 2021, for consistency with the policy articulated in the order and to take appropriate action. Consistent with Executive Order 13990, the Council on Environmental Quality (CEQ) rescinded its 2019 "Draft National Environmental Policy Act Guidance on Considering Greenhouse Gas Emissions" and has begun the review process for updating its "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews" issued on August 5, 2016 (2016 GHG Guidance) (Federal Register 86:10252). Section 5 of Executive Order 13990 emphasized the importance for federal agencies to "capture the full costs of greenhouse gas emissions as accurately as possible, including by taking global damages into account".

President Trump has since disbanded it again in his second term, expressing.the intent to abolish the use of the SCC in federal decision-making. *See*, *e.g.*, Executive Order 14154, Unleashing American Energy (January 20, 2025). Shortly before the change in federal administrations, the

[31] *See also* CDPHE, Regulatory Analysis: Regulations 7 & 22 (Dec. 9, 2021). Attached as Exhibit 13.
[32] *See*, *e.g.*, Dana Nuccitelli, *The Trump EPA is vastly underestimating the cost of carbon dioxide pollution to society, new research finds*, Climate Connections (July 30, 2020). Attached as Exhibit 14.

Department of the Interior released new guidance on the "best available science" regarding the SCC.[33]

Year of emission		2020			2050		
Source of estimates		IWG (2021)	EPA (2023)	EPA (2023)	IWG (2021)	EPA (2023)	EPA (2023)
Discount rate		2.5%	2.5%	2.0%	2.5%	2.5%	2.0%
Carbon dioxide	CO_2	$76	$117	$193	$116	$205	$308
Methane	CH_4	$2,000	$1,257	$1,648	$3,800	$3,547	$4,231
Nitrous oxide	N_2O	$27,000	$35,232	$54,139	$45,000	$65,635	$92,996

Fig. 1. Comparing Estimates in IWG (2021) and EPA (2023): SC-GHG/t (2020-$).[34]

At the federal level, the SCC has become a political football, with Democratic administrations establishing and applying the SCC in regulatory decisionmaking and Republican administrations attempting to diminish the dollar value or eliminate its use altogether. More concerning are the recent changes in federal policy regarding data. Entire datasets have been removed, access portals have been closed, and critical information is disappearing from the public record.

However, the Social Cost of Carbon has been widely used for years by policymakers at both the state and federal level to understand the full impact of regulated activities, including downstream emissions resulting from the end-use combustion of extracted hydrocarbons. The Bureau of Ocean Energy Management ("BOEM") has applied full life-cycle SCC analysis since at least 2014.[35] According to BOEM: "As a part of its environmental analyses, BOEM has historically estimated the direct GHG emissions resulting from oil and gas operations on the [Outer Continental Shelf, or] OCS. . . . To better inform the public, this report discloses GHG emissions and the social cost of those emissions from the production, processing, storage, transportation, and ultimate consumption of OCS oil and gas resources that could be produced."

The Bureau of Land Management (BLM) has also been utilizing the social cost of carbon protocol in the context of oil and gas approvals for over a decade. For example, in a 2014 Environmental Assessments (EA) for oil and gas leasing in Montana, the agency estimated "the annual SCC associated with potential development on lease sale parcels."[36] In conducting its analysis, the BLM used a 3 percent average discount rate and year 2020 values, presuming social costs of carbon to

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[33] U.S. Dept. of Interior, *Informal Memorandum re: DOI comparison of available estimates of social cost of greenhouse gases (SC-GHG)* (October 16, 2024). Attached as Exhibit 15.
[34] *Id.* at 2.
[35] U.S. Dept. of Interior, *OCS Oil and Natural Gas: Potential Lifecycle Greenhouse Gas Emissions and Social Cost of Carbon* (November 2016). Attached as Exhibit 16.
[36] U.S. Bureau of Land Mgmt., *Environmental Assessment for October 21, 2014 Oil and Gas Lease Sale*, DOI-BLM-MT-0010-2014-0011-EA (May 19, 2014) at 71–76. Attached as Exhibit 17.

be $46 per metric ton. *Id*. Based on its estimate of greenhouse gas emissions, the agency estimated total carbon costs to be $38,499 (in 2011 dollars). *Id*. In Idaho in 2015, the BLM utilized the social cost of carbon protocol to analyze and assess the costs of oil and gas leasing. Using a 3% average discount rate and year 2020 values, the agency estimated the cost of carbon to be $51 per ton of annual carbon dioxide equivalent (CO_2e) increase.[37] Based on this estimate, the agency estimated that the total carbon cost of developing 25 wells on five lease parcels to be $3,689,442 annually. *Id.* at 83.

[37] *See*, U.S. Bureau of Land Mgmt., *Little Willow Creek Protective Oil and Gas Leasing*, EA No. DOI-BLM-ID-B010-2014-0036-EA (February 10, 2015) at 81. Attached as Exhibit 18.

<u>Appendix B: Climate Change and the Cumulative Impact of Oil and Gas</u>

Table of Contents:

I. <u>Introduction</u>

The impacts of climate change, both in Colorado and around the world, are increasingly severe, pervasive, and all-encompassing. Climate change is an existential crisis. Its impacts occur on local, regional and global levels, in a web of interrelated and inseparable factors that affect one another, including human health and safety, degradation of ecosystems and loss of biodiversity, and even the choices humans make in their responses.

This Appendix draws heavily from the "Summary for Policymakers" of what is widely recognized as the most up-to-date and comprehensive source on climate change: the 2022 report from the Intergovernmental Panel on Climate Change (IPCC) Working Group II.[38] The 2022 full report is by 270 authors from 67 countries, has 675 contributing authors, contains over 34,000 cited references, and had 62,418 expert and government review comments (IPCC 2022).[39] Also cited in this Appendix are U.S. and Colorado sources including Center for Disease Control (CDC) reports, Environmental Protection Agency (EPA) reports, the National Climate Assessment (NCA), and reports by the State of Colorado, as well as primary sources (peer-reviewed research studies). References are listed alphabetically at the end of the Appendix, with in-text citations in author/date format.

II. <u>Fossil fuels' contribution to climate change</u>

Research on the atmospheric warming associated with carbon dioxide and fossil fuels developed for more than a century before the government reports and fossil fuel companies' internal reports, briefings, and speeches in the 1960s, 70s, and 80s concerning the connection between fossil

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[38] IPCC, 2022. "Summary for Policymakers" [H.-O. Pörtner, et al. (eds.)]. In: *Climate Change 2022: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. Attached as Exhibit 19.

[39] IPCC, 2022. "Climate Change: a Threat to Human Wellbeing and Health of the Planet. Taking Action Now Can Secure Our Future." Attached as Exhibit 20.

fuels and dangerous global warming (Franta 2021). The warming effect of carbon dioxide was first noticed in 1856 by Eunice Newton Foote: "An atmosphere of [carbon dioxide] would give to our earth a high temperature; and if as some suppose, at one period of its history the air had mixed with it a larger proportion than at present, an increased temperature...must have necessarily resulted" (Foote 1856). In 1938, Guy Callendar published research pointing to a 0.003 degree Celsius temperature rise per year, associated with the burning of fossil fuels (Callendar 1938). By 1958, American Charles David Keeling had built a sensor for measuring CO_2 in the atmosphere, and over the next few decades systematically monitored CO_2 levels, proving that CO_2 levels were steadily rising (American Chemical Society National Historic Chemical Landmarks). In the 1970s the Keeling group studied carbon isotopes to determine that the cause of the rising CO2 was the burning of fossil fuels (*id*).

Despite early knowledge and understanding, both by governments and fossil fuel executives, of the likely danger of global warming to both human society and the environment, the production and burning of fossil fuels continued unabated, and indeed increased. After a 1980 briefing at the American Petroleum Institute's (API) "CO2 and Climate Change" task force, in which Stanford scientist John Lauerman told the API that continuing to burn fossil fuels would have "globally catastrophic effects" by 2060, the API called on governments to triple coal production worldwide and insisted there would be no negative effects (Franta 2021). 34.81 billion metric tons of carbon dioxide have been emitted into the atmosphere from 1750 to 2020, most of them since 1970 (Tiseo 2022), resulting in a 48% increase of carbon dioxide levels in the atmosphere since the industrial revolution began in 1750, with methane levels doubling during the same time period (EPA 2022(f)). Carbon levels have risen from 310 ppb in 1958, when Keeling began monitoring, to 414 ppb in 2021, higher levels than any time in the past 800,000 years (Id.). The increase of carbon levels in the atmosphere is accelerating. The National Oceanic and Atmospheric Administration reports that the CO_2 level in 2021 was 414.7, an increase of 2.66 over 2020, marking the 10th straight year that annual levels increased more than 2 ppb–the fastest sustained rate of increase since monitoring began 63 years ago (NOAA 2022).

"Fossil fuels – coal, oil and gas – are by far the largest contributor to global climate change, accounting for over 75 percent of global greenhouse gas emissions and nearly 90 percent of all carbon dioxide emissions" (United Nations 2025). Between 1980 and 2000 about 75% of the human caused emissions of CO_2 were from burning fossil fuels (IPCC 2001). In the US in 2019, fossil fuels contributed 94% of total US carbon dioxide emissions, and 80% of total U.S. greenhouse gas emissions from human activity. "Burning fossil fuels changes the climate more than any other human activity" (EPA 2022(e)).

It is not only the burning of fossil fuels but also their release into the atmosphere during pre-production, extraction, transmission, and refining that contributes to greenhouse gas emissions. Methane, with a global warming potential 84 times greater than CO_2, has increasingly been to blame for greenhouse gas emissions increases. 2020 and 2021 mark a record rise in annual methane levels, with increases of 15.3 ppb in 2020 and 17 ppb in 2021 (NOAA 2022). The main global sources of anthropogenic methane are agriculture and fossil fuel production, especially fracking (Id.). The primary method of oil and gas extraction in Colorado, fracking is a major contributor to the rise of global methane emissions, especially in the U.S: fracking in the U.S. has contributed about one-third of the total increased emissions from *all sources globally* between 2008 and 2018 (Howarth 2019). Colorado, as the 5th highest producer of oil and the 7th highest producer of gas in the U.S. bears a large part of that responsibility.

III. <u>Greenhouse gas emissions from oil and gas operations in Colorado</u>

According to the most recently updated 2023 Colorado Greenhouse Gas Inventory Report ("Inventory"), in 2020 "Natural Gas and Oil Systems" were the highest emitting sector in Colorado at 30.670 MMT CO_2e, producing about 22.6% of Colorado's greenhouse gas emissions (Twyman et al. 2023). This percentage likely underestimates the true responsibility of Colorado's Oil and Gas emissions for warming, considering that the emissions from "Natural Gas and Oil Systems" were 96% methane, and the Inventory uses the IPCC AR5 100-yr GWP factor of 28 for methane rather than the 20-year factor of 84 (Twyman 2023, p. iv). Using the more accurate GWP factor would show more accurately the CO_2 equivalent emissions from oil and natural gas in Colorado, resulting in a far larger share of statewide emissions. The Report also shows what emissions totals would be using the 20-year factor, for comparison purposes. Using the 20-year factor, NG & O contribute 88.928 MMT CO_2e (Twyman 2023, Table 8-8), making up 50.4% of Colorado's total emissions of 176.577 MMT CO_2e.

Far beyond being the largest contributor to statewide emissions, the oil and gas industry in Colorado, as the 4th highest producer of oil and the 8th highest producer of gas in the U.S., according to the United States Energy Information Administration, plays a surprisingly large role in global emissions: fracking in the U.S. – fracking being the primary method of oil and gas extraction in Colorado – has caused one-third of global emissions between 2008 and 2018 from *all sources* (Howarth 2019).

Although Colorado law does not yet require out-of-state combustion of Colorado-produced oil and gas to be counted as 'statewide' emissions, it is important to consider the responsibility of the oil and gas sector in this context. Most of the emissions from combustion of Colorado's oil and gas takes place outside Colorado, thus are currently not counted as in-state emissions. Combustion of the oil produced in 2019 in Colorado and exported was estimated to create 68.04 MMT CO_2e, and combustion of the gas produced in 2019 in Colorado and exported was estimated to create 71.74 MMT CO_2e, for a total of 139.78 MMT CO_2e. Combined with the 20.260 MMT CO_2e from in-state oil and gas operations, oil and gas operations were responsible, directly and indirectly, for 160.04 MMT CO_2e of greenhouse gas emissions in 2019, whereas all other sources combined equal only 105.914 MMT CO_2e (Taylor 2021, 5).

IV. General climate change impacts on public health, safety, welfare, and the environment

Health

Climate change already threatens the health of Americans significantly and every American is vulnerable to these impacts (USGCRP 2016). Already the following health impacts of climate change are affecting the public and are expected to increase as climate change worsens: heat stress from heat waves; injuries and drowning from extreme weather events; vector-, food- and water-borne diseases from droughts, floods and increased mean temperature; food/water shortages and malnutrition from drought and ecosystem change; respiratory disease exacerbations from increases in ground-level ozone, airborne allergens and other air pollutants; and mental health issues from extreme events and climate change generally (USGCRP 2016). Compounding these impacts, climate-caused extreme weather events such as floods disrupt health services (IPCC 2022, B.1.4).

Climate change is expected to continue to worsen air quality, especially particulate matter and ozone, due to changes in temperature, humidity, precipitation, intensity and length of warm seasons, and increases in wildfires and windblown dust (EPA 2021, 20). Declining air quality has serious health impacts: particulate matter was estimated to have caused more than 8 million deaths globally in 2018 (Vohra et al. 2021), and ozone is associated with major health risks including hospitalization and death. Low-income communities and people of color are more likely to be affected by air pollution, and this disparity exists across states, across income levels and in both rural and urban locations (Tessum et al. 2021).

In "Over half of known human pathogenic diseases can be aggravated by climate change,"Mora et al. analyzed more than 3,200 scientific works and determined that 218 diseases–over half of 375 infectious diseases studied–have become more dangerous due to climate change, finding that there are more than 1,000 ways that climate change has spurred disease transmission. Rising temperatures are the biggest cause of increased disease transmission; other factors include precipitation, floods, drought, and habitat change and disruption (Mora et al. 2022).

Human health, safety, and well-being are inextricably tied to the many factors described below in this Appendix. For instance, changes to ecosystems and biodiversity can affect people's ability to produce food, leading to malnutrition and food scarcity. Changes to the climate can affect livelihood and economic security, leading to impacts on health and well-being (IPCC). People and societies are making choices that degrade ecosystems, which then increases their vulnerability to climate change. Extreme heat, other extreme events, rise in temperature average, decrease in food security, ecosystem degradation, and other factors can lead to widespread climate-induced migration, which stresses societies and leads to political instability, further endangering individuals and society.

Ecosystem Degradation and Biodiversity Loss

Damage to ecosystems and biodiversity loss has already occurred due to climate change, and are key risks for every region (IPCC 2022, B.4.1, Exhibit 19).

> Climate change has caused substantial damages, and increasingly irreversible losses, in terrestrial, freshwater and coastal and open ocean marine ecosystems (high confidence). The extent and magnitude of climate change impacts are larger than estimated in previous assessments (high confidence). Widespread deterioration of ecosystem structure and function, resilience and natural adaptive capacity, as well as shifts in seasonal timing have occurred due to climate change (high confidence), with adverse socioeconomic consequences (high confidence). Approximately half of the species assessed globally have shifted polewards or, on land, also to higher elevations (very high confidence). Hundreds of local losses of species have been driven by increases in the magnitude of heat extremes (high confidence), as well as mass mortality events on land and in the ocean (very high confidence) and loss of kelp forests (high confidence). Some losses are already irreversible, such as the first species extinctions driven by climate change (medium confidence). Other impacts are approaching irreversibility such as the impacts of hydrological changes resulting from the retreat of glaciers, or the changes in some mountain (medium confidence) and Arctic ecosystems driven by permafrost thaw (high confidence).[40]

Broadly, climate change has caused substantial damages, and increasingly irreversible losses, in terrestrial, freshwater and coastal and open ocean marine ecosystems (high confidence) (*id* at B.3.1). The extent and magnitude of climate change impacts are larger than estimated in previous assessments

[40] IPCC 2022, B.1.2. Exhibit 19.

(high confidence). Widespread deterioration of ecosystem structure and function, resilience and natural adaptive capacity, as well as shifts in seasonal timing have occurred due to climate change (high confidence), with adverse socioeconomic consequences (high confidence) (*id* at B.1.2).

Approximately half of the species assessed globally have shifted polewards or, on land, also to higher elevations (very high confidence) (*id* at B.1.2). Hundreds of local losses of species have been driven by increases in the magnitude of heat extremes (high confidence), as well as mass mortality events on land and in the ocean (very high confidence) and loss of kelp forests (high confidence) (*id* at B.1.2). Some losses are already irreversible, such as the first species extinctions driven by climate change (medium confidence) (*id* at B.1.2). Other impacts are approaching irreversibility such as the impacts of hydrological changes resulting from the retreat of glaciers, or the changes in some mountain (medium confidence) and Arctic ecosystems driven by permafrost thaw (high confidence) (*id* at B.1.2).

Existing impacts are already substantial, and many ecosystems are at high or very high risk of further biodiversity loss, due to near-term warming and increased frequency, severity, and duration of extreme events (*id* at B.3.1). Every increment of global warming will accelerate these risks (*id* at B.4.1). Loss of ecosystems has cascading effects on people globally, especially Indigenous Peoples and local communities who are directly dependent on the ecosystem to meet basic needs (*id* at B.2.1).

Oceans and wetlands

Oceans absorb both heat and carbon, leading to profound changes in the ability of the oceans and wetlands to support animal and human life. Acidification, warmer temperatures, rise in sea level, and changes in salinity are among the effects, causing degradation of coral reefs, species range shifts, timing changes that are disruptive, loss of coastal land, and coastal flooding (EPA 2022(a); EPA 2022(b)).

Ocean surface heat has risen over 15 joules since 1990 (EPA 2022(a)). To put that in context, 1 joule is equal to 17 times the total amount of energy used by all the people on Earth for one year (EPA 2022(a)). Sea level rise is resulting from the rise in ocean temperature, both through melting of ice and the expanded volume of warmer water (EPA 2022(a)). Higher temperatures are also causing greater frequency and intensity of tropical storms, leading to changes in ocean currents, which disrupts and damages ecosystems (EPA 2022(a)).

The absorption of carbon dioxide by the oceans has increased ocean acidity, interfering with some marine animals' ability to build their shells and skeletons; this affects ocean ecosystems, fish populations and the people who depend on them (EPA 2022(b)). Coral reef ecosystems are especially at risk from this acidification, and they are also impacted by warming, sea level rise, and changes in storm patterns and ocean currents, all of which are caused by climate change (NOAA 2021).

The rise of sea level is already affecting coastal ecosystems and communities, destroying wetlands, contributing to coastal flooding, eroding shorelines, forcing salt-water into estuaries and groundwater, and damaging infrastructure (EPA 2022(c)). A 2019 study shows that by 2050, if we do not mitigate global warming, the sea will permanently cover land currently occupied by 150 million people, with an additional 300 million people living on land that will flood annually: this impact would affect thousands of square miles of land in the U.S. alone (Kulp and Strauss 2019). On the U.S. Atlantic coast, 10 million people live in a coastal floodplain, at risk from increasing storms and by continued sea level rise (EPA 2022(d)).

As coastal wetlands are swallowed by rising sea level, coastal areas will become even more vulnerable to storms: healthy wetlands are a crucial buffer from storm and wave damage (EPA 2022(d)). Entire ecosystems contained in these wetlands are also at risk (EPA 2022(d)). About 35% of the world's wetlands were lost between 1970 and 2015, and the loss is accelerating since 2000 (United Nations 2018).

Food and water security

Millions of people have already been exposed to food insecurity and reduced water security due to climate change (IPCC 2022, B.1.3). Water demand has increased 1% per year since 1980, while climate change will dramatically reduce water supplies (Institute for Economics and Peace 2020, 76). More than 2 billion people live in countries with high water stress, and about 4 billion experience severe water scarcity for at least one month out of the year (Institute for Economics and Peace 2020, 4). Water scarcity affects food security: it reduces agricultural food production, which is also impacted by extreme weather and climate events such as floods. Food production from the ocean has been impacted by ocean acidification and ocean warming (IPCC 2022, B.1.3). Disruptions to agricultural and oceanic food production affect local food security and livelihoods and also impact the global food supply. If we fail to keep warming under 1.5 degrees Celsius, food security risks will worsen, due to increases in frequency, intensity and severity of droughts, floods and heat waves, and continued sea level rise (*id* at B.4.3).

Extreme and slow-onset events caused by climate change

Climate and weather extremes such as extreme heat, heavy precipitation, drought, and fire weather are occurring with greater intensity and frequency and are attributed to human-induced climate change (IPCC 2022). Vulnerable areas in parts of Africa, South Asia, Central and South

America, Small Island Developing States, and the Arctic are hit hardest: between 2010 and 2020, extreme events killed 15 times more people in vulnerable areas than in other parts of the world (*id* at B.2.4). Weather and climate extremes are causing economic and societal impacts globally through supply chains, markets, and natural resource flow (*id* at B.5.3).

Slow-onset impacts attributed to climate change include increasing temperature means, desertification, regional decrease in precipitation, loss of biodiversity, land and forest degradation, glacial retreat, sea level rise and salinization, and ocean acidification (*id* at B.1.1). Accelerating sea level rise will lead to submergence and loss of coastal communities (*id* at B.3.1): a billion people are expected to be at risk from coastal climate hazards in the next few decades (*id* at D.3.3).

Climate migration and political instability

Impacts of climate change lead to greater rates of migration. As coastal and marine ecosystems experience biodiversity loss and as oceanic and agricultural food production is affected due to heat and lack of water, people migrate (The White House 2021). Exposure to danger from extreme heat also forces migration as does gradual mean temperature rise. Extreme weather events such as tropical storms and both coastal and inland flooding lead to sudden, forced migration. Currently, an average of 30 million people annually migrate due to extreme weather events and conflicts, the two largest causes of forced migration (The White House 2021, 7).

Climate change impacts are a destabilizing force in themselves to vulnerable countries (White House 2021), and this instability can be compounded by conflict, resource scarcity, and migration. Conflict is often correlated with or caused by climate change (The White House 2021, p. 7). An estimated 2.26 billion people live in areas with high or very high exposure to climate hazards, of which, 1.24 billion reside in 40 countries with already low levels of peacefulness (Institute of Economics and Peace 2020, 71). Massive climate migrations are highly likely to lead to increased political instability around the globe (The White House 2021). Migration, political instability, and conflict have ramifications for not only health and safety but also for food security worldwide (Mehrabi et al. 2022), as we are currently seeing with the threat of food shortages from the Russian invasion of Ukraine.

V. Colorado-specific impacts of climate change

Colorado's Greenhouse Gas Pollution Reduction Roadmap summarizes the impacts of climate change in Colorado: decreased snowpack and earlier runoff, less water availability, lower water quality, risks of increased flooding, increased drought and drier soil, decreased crop yields, smaller herd size, increased insect, disease and drought impacts on trees and crops, increased risk of wildfires, increased area burned, heat-related health risks, health impacts from ozone, increased risk of asthma and other respiratory diseases, increased risk of vector-borne diseases, wildlife population impacts, and increases in invasive species. Numerous reports detailing the disproportionate effects of climate change in Colorado show that the state will be gravely impacted in numerous areas (*see*, *e.g.*, Bolinger 2024).

Disproportionately Impacted Communities

As discussed above, the most vulnerable people and systems are disproportionately affected by adverse impacts of climate change. This global pattern of unequal distribution of impacts can also be seen in the U.S., including Colorado. The EPA found that low-income people and people of color are more likely to a) live in areas where they suffer health impacts from air quality associated with climate change (such as asthma onset for children and death from older adults), b) lose labor hours for extreme weather, and c) risk death from extreme temperatures (EPA 2021) all creating an inequitable health and safety impacts for generations.

Heat extremes and air pollution affect cities more severely, with economically and socially marginalized residents experiencing more of these effects (IPCC 2022 B.1.5). For Colorado, with 90% of its people residing in cities, this disproportionate effect also holds true. A 2021 study shows that in U.S. cities, including in Denver and Colorado Springs, people of color are more likely to be exposed to heat intensity in urban "heat islands" (Hsu et al. 2021) People with lower incomes and people of color are more likely to lack air conditioning (Mann and Schuetz 2022). Vulnerable populations are more likely to be exposed to climate extremes at work, especially in outdoor jobs, and to lack adequate access to health care (Jordan 2022). Historically overburdened by the health impacts of pollution and other systemic injustices, climate change exacerbates existing health conditions for DI communities who have fewer resources to deal with them.

In the aftermath of extreme weather events white counties showed an increase in wealth, while predominantly non-white communities saw a wealth decline (Howell and Elliott 2018). Economic impacts caused by climate change can further these disparities and create worsening health and safety harms to the most overburdened DIC.

Certain geographical areas of Colorado are being impacted more severely by warming with a rate of warming double the national average, at 1.5 to 2.4 average annual warming. Many of these counties are oil and gas producing, and this region is in the Colorado River Basin, exacerbating drought conditions.

Indigenous People

People have been living in Colorado since time immemorial. At the time of colonization the land we call Colorado was and continues to suffer educational erasures and environmental harms of these communities and their living descendants: the Ute, Arapaho, Cheyenne, Apache, Shoshone, and several tribal nations up to 48 known have relations to these homelands. These people continue to exist and resist despite a century and a half of attempts to dispossess them of their land, lives, and culture which continue to today, and are legitimized by the settler-imposed legal system which evolved to justify and facilitate these dispossessions and over burdens creating continued harms as the original DIC. Colorado has two federally recognized tribes, and an estimated population of 54,000 Indigenous people (Sadler 2020). The Fourth National Climate Assessment finds that Native Americans are at high risk from climate change, often experiencing the worst effects because of higher exposure, higher sensitivity, and lower adaptive capacity for historical, socioeconomic, and ecological reasons (Gonzales et al. 2018). The effects of climate change are compounded by the historical relegation of Indigenous peoples to lands with limited water, and struggles with federal water rights (Gonzales et al. 2018). Further, climate change affects traditional plant and animal species, sacred places, traditional building materials, and other material cultural heritage, which affects the overall health and well-being of Indigenous peoples, who rely on these vulnerable species and materials for their livelihoods, subsistence, cultural practices, ceremonies, and traditions (Gonzales et al. 2018).

Drought

As of 2014, Colorado had already warmed over 1.1 degrees Celsius (Lukas et al. 2014). The higher temperatures and early spring warmth associated with this change in the climate has caused decreases in snowpack and its water content, all of which exacerbate hydrologic drought (Gonzales et al. 2018), and indeed Colorado and the West are currently experiencing the worst mega-drought in 1200 years (Williams et al. 2022). In the Colorado River Basin, high temperatures have contributed to lower runoff and the record-setting streamflow reductions that occurred between 2000 and 2014 (Gonzales et al. 2018). In 2022, below-average snowpack, above average temperatures, low run-off forecasts, and dry soil and atmosphere continue: "Aridification is a trend that has been observed in the Colorado River Basin over the last 22 years, and the 'mega-drought,' as it has come to be called, is not abating," says Dave Kanzer, Director of Science and Interstate Matters in the Colorado River District (Colorado River District 2022). In 2022, Lake Powell has sunk so low that the capability of the hydropower production of Glen Canyon Dam is threatened (Colorado River District 2022). Hydrologic conditions in the entire River Basin are facing strain, and local reservoirs are not expected to fill (Colorado River District 2022). Higher temperatures will cause more frequent and severe droughts in the Southwest, and lead to drier conditions for the region in the future (Gonzales et al. 2018).

Wildfires

Climate change has caused an increase in wildfire season length, wildfire frequency, and burned area (USGCRP 2018). Between 1984 and 2015, the area in the West burned by wildfires was twice what it would have been without climate change (Gonzales et al. 2018), and the frequency, intensity and acreage of wildfires has increased since then. In Colorado, the 20 largest fires in recorded history all occurred since 2000, with the three largest in 2020, and in 2020 over 650,000 acres burned– the largest amount on record (Office of Governor Polis 2021, 10). Wildfires directly and indirectly impact the health of Coloradans as described in "*Health*" section below. Wildfire has also exacerbated the spread of invasive plant species and damaged habitat (Gonzales et al. 2018). Areas damaged by wildfire are vulnerable to events such as the I-70 mudslide disaster in 2021 and the 2013 flood triggered by a 1000-year rainfall event in Northern Colorado, which was exacerbated by hillsides previously burned and weakened by wildfires.

Ecosystems and Biodiversity

Colorado has forest, freshwater, mountain and terrestrial ecosystems, systems which are at risk of biodiversity loss according to the IPCC (IPCC 2022). In addition to the wildfire-related harm to ecosystems described above, climate change leads to biodiversity loss in Colorado ecosystems in many other ways. For instance, as species need to move to higher elevations to escape heat exposure and find food, the food chain is disrupted, and eventually species will run out of habitat (University of Colorado 2021). Earlier snowmelt exposes wildflowers to more frequent frost kills, leading to a much smaller population of mountain wildflowers that birds, insects and mammals depend on for food and shelter (*id.*). Rising water temperature and the changing chemistry of alpine lakes and streams are making it harder for trout, amphibians, water bugs and aquatic plants to survive, and their decline will destabilize entire ecosystems (*id.*). Climate change has also contributed to increased forest pest infestations. Bark beetle infestations, due in part to winter warming and drought caused by climate change, killed 7% of western U.S. forest area from 1979 to 2012 (Gonzales *et al.* 2018). Forest ecosystems will continue to be at risk from climate change impacts as "further increases in heat and drought could kill many more trees, especially affecting piñon pine, whitebark pine, and tall old-growth trees. Drought hastens tree mortality over a wide range of temperatures" (Gonzales et al. 2018).

Health

In the United States, direct and indirect impacts of climate change on human health are a public health emergency, according to the American Public Health Association (APHA 2017). Nationwide, extreme weather events such as floods and wildfires directly injure people, and also disrupt the health system, which can worsen pre-existing conditions (American Public Health Association and Complexly 2022). Higher heat averages and heat waves are leading to more heat related illnesses, especially in agricultural workers, who are already 20% more likely to suffer from this issue. Increased allergens are exacerbating chronic respiratory illnesses (APHA 2017). Fleas, ticks and mosquitos multiply, increasing the risk of vector-borne diseases, such as West Nile Virus, and Lyme Disease in Colorado (APHA 2017). Higher temperature and heavy rainfall increase bacteria growing on crops, increasing the risk of food-borne illness (APHA 2017). Temperature changes and major weather events disrupt the food distribution chain, raising prices, with the limited and expensive food leading to greater rates of food insecurity (APHA 2017).

All of the national impacts described above, and general impacts of climate change described in section I affect Coloradans, either directly or indirectly, but considering information specific to Colorado gives a more complete picture. The Colorado Health Institute examines rising temperature, worsening air quality, and extreme weather and how they are already impacting the lives and health of Coloradans (Colorado Health Institute 2022).

Rising heat has serious implications for health in Colorado. The number of extreme heat days, the average state temperature, and the number and severity of heat waves have all increased (CHI 2022). Nine of Colorado's twelve warmest years on record have occurred since 2000 (Office of Governor Polis 2021, 8) Extreme heat can cause heat stress/heat stroke, and exacerbate asthma, kidney disease, cardiovascular disease, respiratory illness, and complications of diabetes. conditions (CHI 2022). As climate change continues and worsens, the Southwest region of the US, including Colorado, is predicted to have the highest increase of risk of heat-associated premature deaths in the country (Gonzales et al. 2018). Western Colorado has already warmed double the national average, with average annual warming from 1.5 to 2.4 degrees Celsius (see Appendix D). It is not only the extreme daytime temperatures that impact health. On the whole, nighttime highs are rising faster than the daytime highs, and this has an even bigger effect on human health, animal health, crop health and plant health (Trent 2022). Warmer water temperatures caused by rising heat are causing more frequent occurrences of large-scale blooms of algae in Colorado's larger water bodies, some of which create toxins dangerous to humans, animals, and the ecosystem (State of Colorado 2018). Rising temperatures in Colorado also impact health by causing drought, worsening air pollution, and changing ecosystems.

The southeast, south-central and western slope regions of Colorado are particularly likely to have dust storms, which are made markedly worse by climate-caused drought (State of Colorado 2018). The increased particulate matter caused by blowing dust presents a health risk, and at high levels can be fatal (State of Colorado 2016). Climate change also impacts other air pollutants such as carbon dioxide and leads to an increase in common allergens (Colorado Health Institute 2022). The effect of climate change on ozone is discussed in Appendix A. All Coloradans are at risk from this increased air pollution caused by climate change, but especially DI communities and vulnerable populations including children, people with asthma, people with respiratory illnesses, people with allergies, people with COPD and other cardiovascular diseases, with risks including increased hospitalization and death (Colorado Health Institute 2022).

Wildfires are increasing in Colorado, as discussed above, and are impacting health in many ways. There are the obvious impacts of burning and killing people. They impact water quality, water supply, and increase deadly air pollution (Colorado Health Institute 2022). They cause heart issues, and respiratory problems including lung cancer, chest pain, asthma and COPD and also cause PTSD, impacting mental health (Colorado Health Institute 2022). The number of Coloradans living in wild-land urban interface areas with high risk has more than doubled from 2000-2012 to over 2 million people (Colorado Health Institute 2022). Colorado's wildfires also lead to indirect effects on health. Firefighting foam contains PFAS (U.S. EPA 2023), which according to the CDC may lead to lowered immune system, increased cholesterol levels, changes in liver enzymes, increased risk of high blood pressure or pre-eclampsia in pregnant women, decrease in infant birth weight, and increased risk of kidney or testicular cancer (ATSDR 2022). Some fire departments in Colorado have taken advantage of the State's PFAS buyback program, but 159 facilities still use or store PFAS as registered by the State (CDPHE 2022). Wildfires can pollute drinking water, as happened in Fort Collins after a 2012 wildfire, when fire-caused debris including cancer-causing trihalomethane entered the water system (Gonzales *et al.* 2018).

VI. Conclusion

Oil and gas operations in Colorado are one of the largest contributors of in-state greenhouse gas emissions. Climate change, which is a known cumulative effect of greenhouse gas emissions, is already causing impacts to public health, safety, welfare and the environment world-wide, and also in Colorado. Global emissions of carbon dioxide, methane, and other greenhouse gases continue to rise, making it increasingly likely that the world will reach catastrophic levels of warming, and intensifying the urgent need to act. Without mitigation leading to an immediate decrease in emissions, the climate crisis will continue to worsen, multiplying the risks to people and the environment.

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Appendix C: 2024 OGDP CIDER Data

In 2024 the ECMC approved 52 new Oil and Gas Development Plans (excluding helium production operations[41]). Collectively, these OGDPs contained approximately 1155 new petroleum wells. We reviewed the approved CIDER Form 2Bs for these OGDPs, and found significant problems with the data reported by operators to the ECMC including:

1. Little consistency between the reported cumulative impacts data on greenhouse gas emissions between OGDPs, even relative to operations of similar size in similar locations with similar types of wells.
2. Operators often reported zero emissions for processes known to result in emissions. Emissions data that was reported requires greater study to determine whether these numbers have a relationship with actual emissions. Currently reported data appears to lack indicia of reliability.
3. When compared with available emissions reporting to the Colorado Department of Health, Air Pollution Control Division, there was found to be very little correlation between emissions reported to the two different agencies, with no discernible pattern. While some emissions reporting to APCD was slightly lower than emissions reported to CIDER (within an order of magnitude), the larger observed variances occurred where APCD permitted emissions limits were larger than anticipated emissions reported to CIDER (by as much as two orders of magnitude).

In total, in 2024, the ECMC approved over 1150 new petroleum wells with operator-reported upstream-only GHG emissions amounting to a social cost of carbon roughly valued at just over $875 million, using the current social cost of carbon in Colorado.[42] This compares to 2023, when ECMC approved 689 new petroleum wells, with upstream-only reported GHG emissions amounting to just over $985 million. While 2022 data is still under investigation, there is a clear trend toward increased approval of new petroleum development particularly in the DJ basin while scrutiny of cumulative impacts — particularly related to climate and air quality — is falling below acceptable thresholds.

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[41] Helium production operations do not target geological formations with petroleum, and their production does not result in a large amount of greenhouse gasses - often by one or two orders of magnitude. While these helium operations do add incrementally to the amount of GHGs being released in Colorado, they were omitted from analysis because their much smaller impacts could distort the findings related to the impacts of petroleum development specifically.

[42] The methodology for using CIDER data to arrive at a very rough SCC calculation is described below.

Issue 1: Consistency between OGDPs

The social cost of carbon for each OGDP approved in 2024 was estimated by the following process. Every approved Form 2B Cumulative Impacts Data Evaluation Repository form was collected and reviewed. From those forms, all preproduction emissions of GHGs - N_2O, Methane, and CO_2 were added to achieve a preproduction total. Production emissions for the same, which are reported on an annual basis, were then multiplied by reported anticipated "years of production" and added to the preproduction totals. Diesel truck miles were included at a standard GHG equivalency rate of $1 per mile.[43] Non-diesel truck miles were excluded due to a lack of information about possible overlap with reported diesel miles, type of trucks included, or average weights.

In these OGDPs we can see that the social cost of carbon, when averaged out by the number of wells in each OGDP, range from a low of $84,326 for the wells at Federal RG 22-24-299 to as high as $10,870,387 for the single-well Einspahr.

Operator Name	OGDP Name	wells	SCC	SCC/well
VECTA OIL & GAS LTD	Einspahr	1	$10,870,387	$10,870,387
CRESTONE PEAK RESOURCES OPERATING LLC	Chico North OGDP	8	$7,603,573	$950,447
NOBLE ENERGY INC	GC1	42	$34,890,048	$830,715
KERR MCGEE OIL & GAS ONSHORE LP	TULIP	31	$7,658,875	$247,060
NOBLE ENERGY INC	Colt OGDP 6	150	$ 52,313,161	$348,754
FUNDARE RESOURCES OPERATING COMPANY LLC	Wildhorse 4-7	27	$15,751,584	$583,392
VERDAD RESOURCES LLC	Hornet 0136	9	$11,478,919	$1,275,435

[43] No single standard GHG equivalency per diesel truck mile exists, to our knowledge. For greenhouse gas reporting it seems that a "ton mile" may be a more useful metric, since it accounts for the fuel efficiency differences in hauling full and empty trucks of various sizes. *See*, *e.g.* Environmental Defense Fund: Business, *Green Freight Math: How to Calculate Emissions for a Truck Move*, *available at* https://business.edf.org/insights/green-freight-math-how-to-calculate-emissions-for-a-truck-move/ (accessed Apr. 3, 2025) (four step formula to determine CO2e for freight traffic, 1. determine the total amount of ton-miles, 2. get the weight-based truck emissions factor for a freight truck. The average freight truck in the U.S. emits 161.8 grams of CO2 per ton-mile. 3: Multiply this emissions factor with the total ton-miles, 4. convert the total grams into metric tons. There are 1,000,000 grams in a metric ton. To convert our answer from step three we divide it by 1,000,000).

NOBLE ENERGY INC	OGDP East Pony	20	$4,536,346	$226,817
ST CROIX OPERATING INC	Buckhorn	2	$809,892	$404,946
TEP ROCKY MOUNTAIN LLC	NR 41-3	39	$25,802,236	$661,596
KERR MCGEE OIL & GAS ONSHORE LP	LARKSPUR FED	10	$4,340,510	$434,051
PDC ENERGY INC	Mountain View 4N67W3 1-24 OGDP	24	$9,735,356	$405,640
NOBLE ENERGY INC	GC2	22	$3,391,550	$154,161
BISON IV OPERATING LLC	Benelli 12	7	$5,739,534	$819,933
CRESTONE PEAK RESOURCES OPERATING LLC	Aspen North/South OGDP	16	$25,426,115	$1,589,132
BISON IV OPERATING LLC	Remora	16	$54,947,437	$3,434,215
NOBLE ENERGY INC	Colt OGDP 5	72	$33,427,150	$464,266
LARAMIE ENERGY LLC	2023 Laramie 0993-29-01 OGDP	16	$4,171,245	$260,703
GREAT PLAINS ENERGY OPERATING LLC	Great Plains Extension	2	$829,518	$414,759
KERR MCGEE OIL & GAS ONSHORE LP	FILLY	74	$24,393,250	$329,639
CAERUS PICEANCE LLC	ELU M12-496	34	$7,315,562	$215,164
CHEVRON USA INC	OGDP SKR 698-10-BV	2	$7,886,545	$3,943,272
MDS ENERGY DEVELOPMENT LLC	MDS Energy 8-59 OGDP	7	$18,617,966	$2,659,709
GMT EXPLORATION COMPANY	Invicta 3-65 28	8	$7,514,757	$939,345
VERDAD RESOURCES LLC	Boydston 3535	17	$4,418,780	$259,928
BISON IV OPERATING LLC	Fiscus 23	15	$12,514,878	$834,325
FULCRUM ENERGY OPERATING LLC	Janet OGDP	11	$30,456,450	$2,768,768
KERR MCGEE OIL & GAS ONSHORE LP	Hickory	12	$4,971,682	$414,307
ANSCHUTZ EXPLORATION CORP	Mohee Fed 0297-17	8	$51,693,005	$6,461,626
MULL DRILLING COMPANY INC	Williams 1-24	1	$1,291,722	$1,291,722
CAERUS PICEANCE LLC	RNPU FED H28-197	21	$2,041,636	$97,221
PDC ENERGY INC	Raton	40	$8,883,867	$222,097
BONANZA CREEK ENERGY OPERATING COMPANY LLC	Pronghorn OGDP	26	$ 32,158,188.00	$1,236,853

BISON IV OPERATING LLC	Sandy Bay	23	$81,977,876	$3,564,255
ST CROIX OPERATING INC	Prairie Ridge	4	$883,704	$220,926
ANSCHUTZ EXPLORATION CORP	Sylvester Fed 0397-12	6	$35,082,313	$5,847,052
CRESTONE PEAK RESOURCES OPERATING LLC	Lussing Trust North OGDP	7	$30,366,052	$4,338,007
VERDAD RESOURCES LLC	Hill 2527	10	$1,986,358	$198,636
CAERUS PICEANCE LLC	EXPANDED LIBERTY UNIT 396-6A1	9	$1,986,358	$220,706
PRAIRIE OPERATING CO LLC	Genesis	72	$9,887,088	$137,321
KERR MCGEE OIL & GAS ONSHORE LP	SPROUT	43	$17,944,314	$417,310
TRUE OIL LLC	Wright	2	$2,000,283	$1,000,142
KERR MCGEE OIL & GAS ONSHORE LP	Colt OGDP	67	$24,262,701	$362,130
VERDAD RESOURCES LLC	Ruh State OGDP	14	$53,995,013	$3,856,787
KERR MCGEE OIL & GAS ONSHORE LP	OAK	35	$12,524,594	$357,846
EXTRACTION OIL & GAS INC	Maverick 7N67W - West OGDP	4	$10,214,386	$2,553,596
LARAMIE ENERGY LLC	2023 Currier BCU 0993-16-07	23	$5,927,865	$257,733
TEP ROCKY MOUNTAIN LLC	Federal RG 22-24-299	2	$168,652	$84,326
BONANZA CREEK ENERGY OPERATING COMPANY LLC	North Platte 13-24-25 OGDP	15	$34,334,854	$2,288,990
TEP ROCKY MOUNTAIN LLC	TR 32-28-597	18	$8,950,696	$497,261
RED HAWK PETROLEUM LLC	Roth 2-11	11	$ 23,321,861	$2,120,169
				average per well
		1155	**$883,696,692**	**$765,105**

Some variability in the emissions rates may be explained by unavoidable physical and geological differences - a coal bed methane operation could not be expected to have a similar emissions profile to a deep hydraulically fractured well system. That is the case here for the Federal RG 22-24-299, which is an OGDP with a single location with two injection wells and no associated infrastructure.

However, some of the differences can seem to be attributable to the issues raised below – Issue 2, which is clearcut non-reporting of anticipated emissions, and Issue 3, which is that operators seek different permit emissions limits from APCD than they reported to ECMC when seeking the OGDP approval, indicating that numbers provided to CIDER are not reliable data.

Omissions of emissions data were frequent. For example, the RNPU FED H28-197 Form 2B omitted any production related emissions, despite the development of 21 new wells. The operator, Caerus Pieceance, indicated that all of the production from the wells would be piped to "PCU FED A27-197"[44] which is already generating 8.4 tons of methane and almost 900 tons of CO_2 every year from the existing 22 wells at that location (per the Form 2B provided in *that* OGDP). In another case, the Bonanza Creek Pronghorn Form 2B omitted any reported production emissions from Stationary Engines or Turbines, Fugitives, Combustion Control Devices, Non-Road Internal Combustion Engines, or Well Maintenance despite the development of 26 new wells (also inside the nonattainment area) and the presence at the locations of significant levels of production infrastructure including four ECDs, 26 VOC combustors, a flare, 25 gas or diesel motors, and much more.[45] These flagrant omissions were frequent and are discussed more below.

By far, most of the approved OGDPs were located in the Denver Metro/North Front Range 8 hour ozone nonattainment area – over 80% of all the approved wells.[46] While it's hard to draw definite conclusions as to the source of the wide discrepancies between similar seeming OGDPs, an examination of two adjacent OGDPs is instructive. The Filly is a 74 well OGDP across four locations with a calculated $24.4 million social cost of carbon. Approximately 20 miles north is the Genesis, a 72 well OGDP across two locations with a calculated $9.9 million social cost of carbon - less than half of the climate impact for similar facilities located relatively close by.

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[44] Presumably this refers to location 485796 ("PCU FED/A27-197 CDP"). This location was part of an OGDP approved in 2023, the "RNPU Phase 1," the Form 2A was approved January 1, 2024 and work commenced here in June of 2024. For comparison, Caerus reported the 22 wells in the Phase 1 OGDP would result in production emissions from this location, significantly 8.4 tons of methane and 898.54 tons of CO_2 annually for the next 25 years.

[45] Between the four locations within the OGDP, Bonanza reported 16 gas compressors, 25 pump jacks, 25 oil tanks, 76 condensate tanks, 25 water tanks, 32 separators, one dehydrator unit, three heat-treaters, 12 pigging stations, 12 electric generators, 25 gas or diesel motors, four enclosed combustion devices, 26 VOC combustors, and one flare.

[46] The choice to exclude helium production OGDPs did not significantly skew this number, because there were only a handful of these and the total number of wells in this type of OGDP was low - typically just one or two.

Prairie Operating - Genesis Emissions tpy)							
Preproduction Emissions	**NOx**	**CO**	**VOCs**	**Methane**	**Ethane**	**CO_2**	**N_2O**
Process Heaters or Boilers	0.07	0.02	0.00	0.00	0.00	0.00	0.00
Storage Tanks	0.00	0.00	1.47	0.00	0.00	0.00	0.00
Venting or Blowdowns	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Combustion Control Devices	0.05	0.24	0.00	0.12	0.13	157.80	0.00
Non-Road Internal Combustion Engines	261.02	257.42	14.12	3.91	0.00	93,244.41	0.78
Drill Mud	0.00	0.00	0.39	0.60	0.12	0.00	0.00
Flowback or Completions	0.00	0.00	1.07	0.25	0.28	1.01	0.00
Loadout	0.00	0.00	1.88	0.00	0.00	0.00	0.00
TOTAL:	**261.14**	**257.68**	**18.93**	**4.88**	**0.53**	**93,403.22**	**0.78**
Production Emissions							
Stationary Engines or Turbines	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Process Heaters or Boilers	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Storage Tanks	0.00	0.00	5.45	0.03	0.08	0.29	0.00
Dehydration Units	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pneumatic Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pneumatic Controllers	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Separators	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fugitives	0.00	0.00	2.13	0.04	0.05	0.01	0.00
Venting or Blowdowns	0.01	0.01	1.94	0.16	0.19	0.20	0.00
Combustion Control Devices	0.11	0.51	0.08	0.10	0.13	270.94	0.00
Loadout	0.00	0.00	3.71	0.00	0.00	0.00	0.00
Non-Road Internal Combustion Engines	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well Bradenhead	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Well Maintenance	0.00	0.00	0.30	0.06	0.08	0.02	0.00
annual total	**0.12**	**0.52**	**13.61**	**0.39**	**0.53**	**271.46**	**0.00**
TOTAL: (*years of production)	**3.48**	**15.08**	**394.69**	**11.31**	**15.37**	**7,872.34**	**0.00**

Fig. 1

Kerr McGee - Filly Emissions (tpy)							
Preproduction Emissions	**NOx**	**CO**	**VOCs**	**Methane**	**Ethane**	**CO_2**	**N_2O**
Process Heaters or Boilers	4.40	0.68	0.20	0.04	0.01	656.96	0.01
Storage Tanks	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Venting or Blowdowns	0.08	0.31	1.92	2.47	0.88	141.94	0.00
Combustion Control Devices	0.04	0.16	0.12	0.32	0.12	25.20	0.00
Non-Road Internal Combustion Engines	547.16	609.59	70.03	1.91	0.68	60,614.67	0.34
Drill Mud	0.36	1.69	3.22	7.78	0.95	38.44	0.00
Flowback or Completions	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Loadout	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL:	**552.04**	**612.43**	**75.49**	**12.52**	**2.64**	**61,477.21**	**0.35**
Production Emissions							
Stationary Engines or Turbines	3.72	32.12	1.72	0.04	0.01	950.68	0.01
Process Heaters or Boilers	3.72	3.12	0.20	0.08	0.12	4,452.00	0.08
Storage Tanks	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dehydration Units	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pneumatic Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pneumatic Controllers	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Separators	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fugitives	0.00	0.00	2.46	2.01	0.72	0.17	0.00
Venting or Blowdowns	0.00	0.00	29.20	37.70	13.37	3.17	0.00
Combustion Control Devices	0.04	0.16	0.28	0.68	0.24	25.24	0.00
Loadout	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-Road Internal Combustion Engines	0.74	0.49	0.00	0.00	0.00	90.05	0.00
Well Bradenhead	0.00	0.00	0.01	0.01	0.00	0.00	0.00
Well Maintenance	0.00	0.00	11.89	15.37	5.45	1.29	0.00
annual total	**8.22**	**35.89**	**45.76**	**55.90**	**19.92**	**5,522.60**	**0.09**
TOTAL: (*years of production)	**238.38**	**1,040.81**	**1,327.06**	**1,621.01**	**577.64**	**160,155.43**	**2.56**

Fig. 2

One difference between the Filly and the Genesis was reported truck miles - Prairie Operating reported only about 800,000 miles of diesel truck traffic for the Genesis OGDP, while Kerr McGee reported over 3 million miles for the Filly. Kerr McGee also reported emissions from multiple pieces of equipment not listed on site at the locations, including non-road engines, combustion control devices, and stationary engines, which are presumably located off-site. Conversely, Prairie reported their Genesis sites will operate four gas compressors, nine separators, four hear-treaters, and four enclosed combustion devices, yet reported an anticipated zero production emissions from separators or process heaters. Furthermore, other inconsistencies exist which are not well explained, such as Prairie's annual well maintenance emissions of methane of just 0.39 tpy from 72 wells, compared to 15.37 tpy reported by Kerr McGee for their 74 wells. There are two possible reasons for this. One is faulty data, which would be a significant problem. The other is that Prairie Operating is utilizing a much cleaner process for maintaining their wells, which would be entirely unjustifiable for the ECMC not to require Kerr McGee to employ as well.

The lack of consistency in emissions reporting, it seems from the data, is due more to differences in reporting than differences in geology, physical and social topography, OGDP size, or equipment choices. The lack of consistency in emissions reporting is itself a major indicia that CIDER data is unreliable, and that it skews toward underestimating true emissions particularly from the production phase.

<u>Issue 2. Underreporting of Emissions</u>

It's difficult for non-technical experts to prove that emissions are underreported when they are greater than zero. Is 0.39 tpy of methane a "normal" amount for annual maintenance for 72 wells? Is 15.37 tpy normal for 74 wells? There are *orders of magnitude* between those numbers.

However, what is clear from the 2024 OGDP data is that operators frequently report zero emissions from approved facilities and operations. The most frequent categories of nonreporting in the preproduction categories were venting/blowdowns (only 14 of 52 OGDPs reported these), flowback or completions (23 of 52 reported), and loadout (24 of 52 reported). The most frequent categories of production nonreporting were pneumatic pumps and controllers (0 and 1 operators reporting, respectively, possibly because of changes to air quality regulations). Only two operators reported emissions from dehydration units, and only seven reported emissions from separators. Eleven operators reported emissions from non-road IC engines, and 19 reported emissions from stationary engines. Many emissions categories were frequently reported as zero by operators even when they simultaneously reported on site use of the equipment listed in the emissions inventory which could not be explained by reporting elsewhere (i.e., such as in the OGDPs using multiple "well only" locations serviced by a "production only" location) or reporting in a separate category (for example, reporting separator emissions in the process heating category). For example, the Bonanza Creek Pronghorn OGDP reported zero emissions from "stationary turbines or engines" and zero emissions from "non-road internal combustion engines" at each and every of their four locations despite the presence of gas or diesel generators at each location (25 altogether). They also reported "zero" emissions from dehydrator units, fugitives, combustion control devices, or well maintenance. Another type of non-reporting was non-reporting of specific pollutants from

There are a total of 22 Air Resources emissions inventory categories on the Form 2B, 8 for preproduction and 14 for production. Operators reported non-zero emissions from an average of 5.1 out of 8 preproduction emissions categories and 6.26 out of 14 production emissions categories. While some outliers can be explained as clear exceptional circumstances, such as the injection only OGDP, no clear explanations appear from the bulk of the data despite significant investigation. For example, although almost every OGDP included petroleum production wells, only 28 out of 51 operators reported anticipated non-zero well maintenance emissions - significantly fewer than the number of operators who reported non-zero emissions from process heaters/boilers (40). Combustion control device emissions were also reported as "zero" by 19 operators, although combustion is the primary means by which operators control pollution from point sources and on closer inspection of the Form 2B and cumulative impacts plans the use of combustion control was referenced by nearly all non-reporters.

In sum, there is strong evidence supporting the conclusion that underreporting of emissions is widespread through fairly routine non-reporting. In other words, operators are frequently declaring an intent to use – and receiving permitting authority for – equipment and methodology which are known to result in non-zero emissions which they intend to use for project lifespans of 20 to 30 years without reporting any associated emissions as cumulative impacts of their activities.

As mentioned in the first paragraph, it is much easier to prove that anticipated emissions cannot reasonably be accurately reported as non-zero than it is to prove that non-zero numbers are inaccurate. Certainly, many of the numbers are highly suspect. One point in this regard is that there is extremely high variability in emissions reporting. Where there is high variability in reporting, with a lack of any notable "clustering" (e.g., showing differences between basins or) or trend lines (e.g., a trend toward lower per well emissions associated with larger numbers of wells), there are only two options. Either the data is an accurate reflection of real emissions, in which case some operators are truly emitting an order of magnitude (or two, or three, or four) less pollution per well placed into production in which case these operations should be studied and adopted as standard practice. Or the data is inaccurate, and cannot satisfy the obligation to understand the pollution impacts of these operations and address them to avoid, minimize, and mitigate impacts to protect public health, safety, and welfare.

The two most frequently reported emissions categories are non-road IC engines used in preproduction (52 of 52 non-zero reports) and fugitive emissions from production (48 of 52 non-zero reports). Within those categories, the most frequently reported pollutants were CO_2 from engines and VOCs from fugitive sources.

Preproduction Emissions: CO_2 from Non-Road Internal Combustion Engines

Of the 52 petroleum OGDPs evaluated, every Form 2B reported non-zero CO_2 from non-road internal combustion engines, totalling over 1.1 million tons of CO_2. Absolute values ranged from 155,836 tons (Colt OGDP - the largest of any approved in 2024) to 47.52 tons (for the single well Williams 1-24). Because the engines are used primarily for powering equipment to drill, frack, and perform other operations to bring wells into production it seems correct that OGDPs with more wells would result in more emissions, which is very roughly seen in the data visualization.

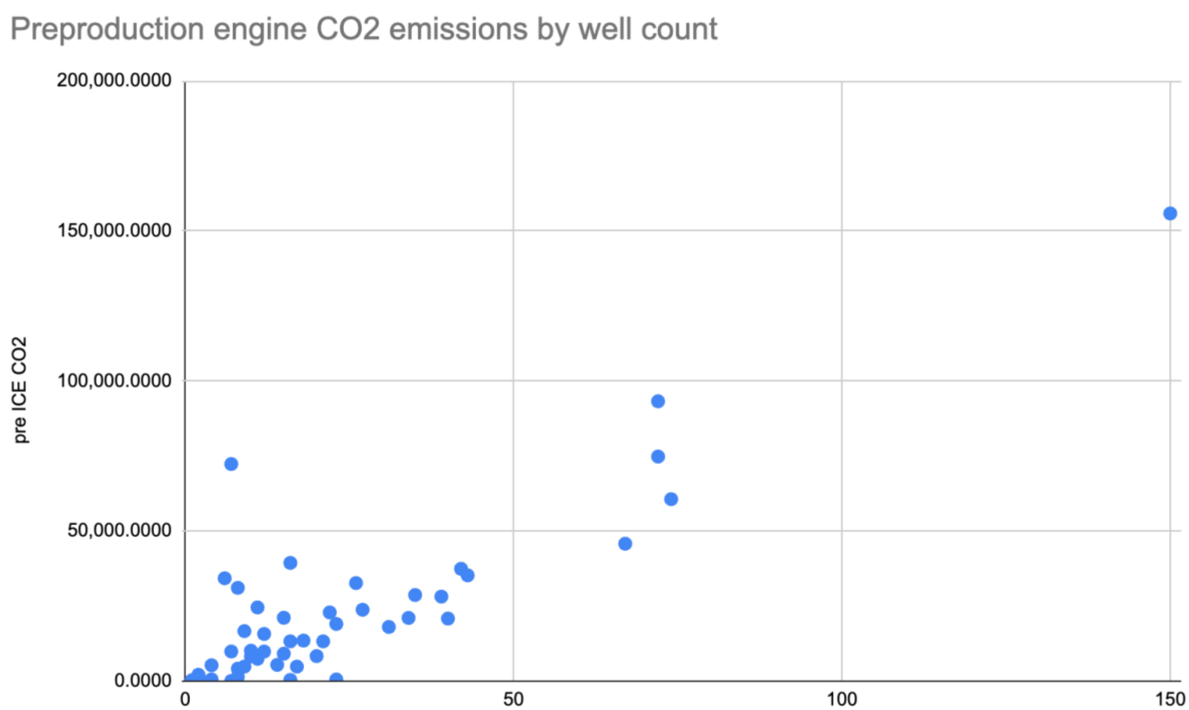


Fig. 3. A comparison of total reported preproduction non-road IC engines CO_2 emissions (y axis) with the number of wells in each OGDP (x axis).

However, when these emissions were divided by the number of wells to arrive at a "pre production internal combustion engine CO_2 emissions per well" the actual discrepancies came into focus. When pre production emissions of CO_2 were divided by the number of wells high variability emerged, ranging from a high of almost 2,500 tons per well (the 11 well Janet OGDP) to a low of just 1.05 tons per well (the 7 well MDS Energy 8-59 OGDP). More operators reported values at the low end (below 500 tons per well) than the high end (above 1,500 per well).

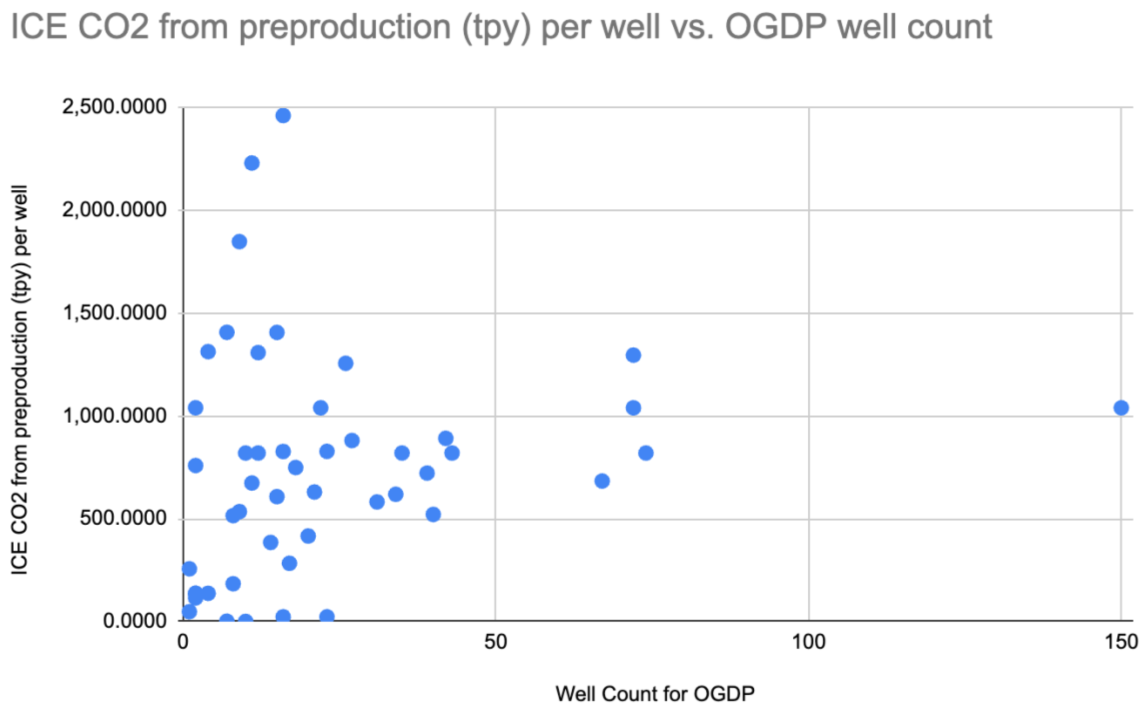
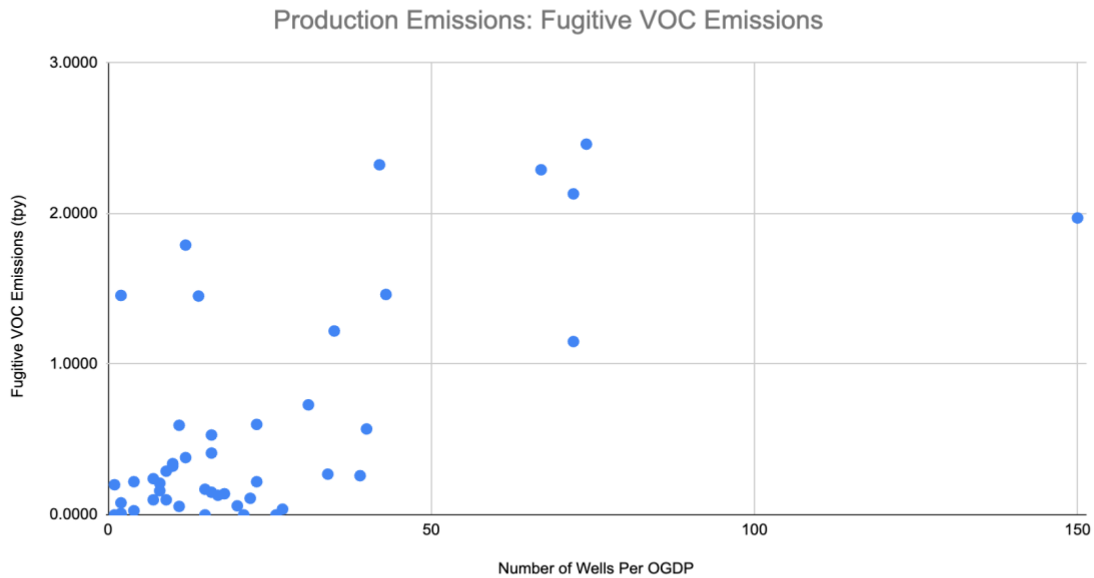


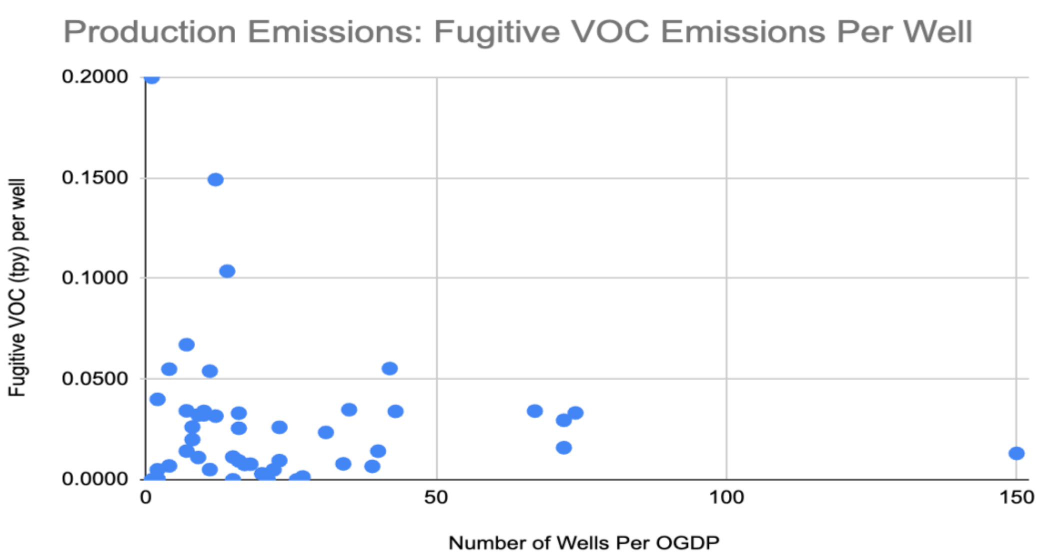
Fig. 4. A comparison of reported pre production engine CO_2 emissions adjusted on a per well basis (y axis) with the number of wells in each OGDP (x axis).

Preproduction Emissions: Fugitive VOC Emissions

For fugitive VOC emissions, the second most frequently non-zero reported production emissions, the trend – or lack thereof – was more apparent. Again, there was a rough upward trend in reported fugitive VOC emissions compared with OGDP size.



When the absolute fugitive emissions were divided by the number of wells there was a complete breakdown in the data. First, three extreme outliers had to be removed to achieve a legible chart. The Anschutz Mohee Fed 0297-17, an 8 well OGDP reported fugitive VOC emissions of 9.26 tons for an average of 1.16 tpy per well. The Anschutz Sylvester Fed 0397-12, a 6 well OGDP, reported fugitive VOC emissions of 7.93 tpy, for an average 1.32 tpy per well. Lastly, the True Oil Wright OGDP with 2 wells reported 1.46 tpy for an average of 0.728 tpy. These dwarfed the fourth highest average emissions rate of approximately 0.2 tpy per well. The average per well fugitive VOC rate was reported as closer to 0.02 tpy.



Is 0.02 tpy fugitive VOCs per petroleum well a reasonable figure? One method for roughly evaluating whether operators' figures are reasonable is the application of standard emissions factors for particular pieces of equipment. In 2015 California's South Coast Air Quality Management District ("AQMD") put out a document called "Guidelines for Reporting VOC Emissions from Component Leaks" (attached as Exhibit 77). The AQMD requires facilities operating under District permit to annually report their emissions from all equipment (permitted and non-permitted). 0.02 tons is 44 pounds. For some examples of what AQMD uses for standard fugitive emissions rates from "Oil/Gas Production and Chemical Plants" facility components:

SOURCES TYPE	Emission Factors (lbs/source/yr)
Production Facility – Valves in ROG vapor service	12
Others (fittings, hatches, sight-glasses, meters, etc.)	4.9
Production Facility – Valves in light liquid service.	47
Production Facility – Valves in heavy liquid service.	4.4
Production Facility – PRVs to atmosphere (no rupture disc)	567
Gas Plant – Valves in ROG service	12
Gas Plant – PRVs to atmosphere (no rupture disc)	193
Pumps in light liquid service.	432
Pumps in heavy liquid	86
Compressors in vapor recovery service	145
Compressors in gas injection service	437

Because all OGDPs possess equipment, typically at least several valves, meters, pumps, compressors – and often much more – it appears that 44 pounds per year per well (with all associated infrastructure and operations) is likely not a realistic expectation for fugitive VOCs.

In short, the best reported emissions data points toward chronic and severe underreporting, punctuated by possible instances of overreporting. At a minimum, additional analysis is warranted.

Issue 3. Little Correlation with Available Air Pollution Control Division Emissions Reporting

We searched for Air Pollution Control Division records related to OGDPs approved in 2024. However it appears that many 2024-approved OGDPs have not yet reached the registration or permitting phase at APCD, and therefore we reached back to OGDPs approved in 2023 to compare CIDER data reported to ECMC with APCD records for those facilities. When compared with available emissions reporting to the Colorado Department of Health, Air Pollution Control Division, there was found to be very little correlation between anticipated emissions reported to the two different agencies, varying widely even between different pollutants reported by the same operator and facility. As yet, there is no discernible pattern in the discrepancies and no explanation has appeared. It was noted that sources of pollution were occasionally reported to APCD that were not included on ECMC inventory lists. Additionally, APCD does not track pre-production emissions – at least not from any of the 2023 or 2024 OGDPs we reviewed. APCD permitting also tracks different pollutants than CIDER - methane, CO_2, and N_2O are not reported in the permitting documents. The APCD system for tracking GHGs *does* collect data from operators' existing facilities which are then reported to the public "ONGAEIR" however these cannot be tracked back to individual facilities through the public dashboard system.

The comparative analysis of ECMC CIDER data with APCD permitting records was slow and laborious. ECMC does not maintain links between its records databases and the APCD databases. APCD uses unique identifiers (the AIRS ID and permit numbers) which are wholly distinct from ECMC identifiers (facility IDs and real names). Additional work would certainly yield more insight, however sufficient records were located to demonstrate that CIDER data is significantly unrelated to APCD permitting data. This finding is surprising because both datasets are based on calculations of anticipated emissions as opposed to monitoring and actual emissions post-development.

The best sources of data available from APCD were full permit approvals. Other forms containing "facility-wide emissions inventories" were also highly relevant. Some forms did not contain facility-wide emissions inventories, but did contain emissions inventories for discrete equipment which could be compared to CIDER data provided for that equipment.

In 2023 the ECMC approved an OGDP from PDC Energy Inc., the "Chatfield" OGDP. PDC reported to CIDER in March of 2023 (and ECMC then approved those CIDER inputs in November of 2023), that its single 18-well location would result in annual production emissions of 2.29 tpy of VOCs, 1.49 tpy of NO_x, and 0.312 tpy of CO. The OGDP is located inside the DMNFR 8-hour ozone nonattainment area. In September of 2024 the APCD approved a General Permit 10 for the location, with permit limits for VOCs of 19.2 tpy, 2 tpy of NOx, and 8.8 tpy of CO.

PDC Chatfield OGDP CIDER data emissions report vs. APCD permit limits:

	NOx (tpy)	CO (tpy)	VOCs (tpy)
CIDER emissions	1.49	0.312	2.29
GP10 permit limits	2	8.8	19.2
Permit as % of CIDER	*134.23%*	*2820.51%*	*838.43%*

Additionally, when examined by emissions category the data provided to ECMC further departs from the air permit issued by APCD.

ECMC CIDER	NOx (tpy)	CO (tpy)	VOCs (tpy)
Process Heaters or Boilers	*1.45*	*0.122*	*0.08*
Storage Tanks	*0*	*0*	*0.59*
Venting or Blowdowns	*0*	*0*	*1.21*
Combustion Control Devices	*0.04*	*0.19*	*0.05*
APCD GP10			
Condensate & Produced Water Tanks	*1.9*	*11.6*	*8.2*
Hydrocarbon Liquid Loading	*0*	*0.6*	*0.1*
Routine Venting	*0.1*	*7.0*	*0.6*

While the Chatfield OGDP appears to be an outlier in terms of the magnitude of the difference between the CIDER reported emissions data and the CDPHE air permitting data, it is not alone. Some other examples are:

		ECMC CIDER (tpy)	APCD Permitting (tpy)	% difference
2023 Bison CE OGDP	NOx	2.2	4.89	222%
	CO	4.06	4.39	108%
	VOCs	4.92	17.05	347%
2023 Anschutz Coyote Fed OGDP	NOx	10.73	22.1	206%
	CO	41.39	52.1	126%
	VOC	27.55	45.1	164%
2023 Bubba Federal 5 (ECMC location 484681)	NOx	1.49	0.3	20%
	CO	1.42	1.5	106%
	VOCs	1.8	10.2	567%
2024 Red Hawk Roth 2-11	NOx	1.48	0.6	40%
	CO	3.16	2.7	86
	VOCs	11.69	20.5	175%

Year Over Year Cumulative Impacts Reporting

The ECMC has released three annual Cumulative Impacts Reports – in 2022, 2023, and 2024. The report states that "CIDER is solely a data repository and not a data evaluation program. CIDER is a compilation of the data entered on the Form 2B."[47] The ECMC has a statutory duty to "evaluate and address" cumulative impacts in order to "avoid, minimize, and mitigate" negative cumulative impacts, in order to protect public health, safety, and welfare. This obligation is not satisfied by the mere passive collection of data which is notably 1) inconsistent and likely unreliable, and 2) obviously underreported in many instances. Furthermore, the ECMC has evidence supplied by the operators

[47] ECMC, Director's 2023 Report On The Evaluation Of Cumulative Impacts - Rule 904.a (February 2024) at 60. Exhibit 1.

themselves that enormous cumulative impacts are occurring. Operators are reporting hundreds and even thousands of tons of new pollution, without question or comment from the Commission – let alone sufficient enforceable requirements for Best Management Practices or Conditions of Approval.

In its 2023 Cumulative Impacts Report stated that: "[t]he evaluation of emissions estimates . . . was conducted with the information contained in CIDER, which is limited to total emissions estimates per OGDP Location, and was designed to be comparable to ONGAEIR pollutants and categories." In fact, the ONGAEIR (CDPHE's Oil and Natural Gas Annual Emission Inventory Reporting) system was developed after the CIDER system.[48] ECMC goes on to state that:

> ONGAEIR, as well as subsequent APCD permit applications, will contain additional information that may further help explain the emissions from these locations. In 2022, the APCD began looking closer at the estimated emissions being provided by operators during their consultations with the ECMC related to CAPs. APCD reviewed with operators specific inputs, calculation methodologies, and assumptions that went into these calculations. For example, the air permit applications submitted to APCD and actual emissions reported to ONGAEIR may utilize site-specific or representative samples. Without this tailored information, some operators may be utilizing state default emission factors, which may be higher than the actual emissions once a site specific factor is applied, resulting in the potential for CIDER emission estimates to be higher than emissions limits later provided in APCD permit applications.

APCD currently makes ONGAEIR data available to the public, however not in a way that allows the public to evaluate individual facilities or compare these reports to CIDER data. It is concerning that ECMC has focused on whether emissions are being *overreported* to CIDER based on the ability of operators to change emissions factors in their calculations for certain facilities, rather than evaluating their own dataset's systemic underreporting or questioning whether APCD dataset itself may contain gaps.

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[48] ONGAEIR was implemented by revisions to 5 CCR 1001-9, AQCC Regulation 7, Part B Section V, (adopted Feb. 18, 2021). CIDER was first created in the ECMC (then Colorado Oil and Gas Conservation Commission) Mission Change Rulemaking in 2020.