BEFORE THE AIR QUALITY CONTROL COMMISSION

STATE OF COLORADO

IN THE MATTER OF PROPOSED REVISIONS TO REGULATION 7

REBUTTAL STATEMENT OF THE BOARD OF COUNTY COMMISSIONERS OF WELD COUNTY, COLORADO

EXECUTIVE SUMMARY

The Board of County Commissioners of Weld County, Colorado ("Weld County") respectfully submits this Rebuttal Statement in the above-captioned rulemaking proceeding regarding the Air Pollution Control Division's (the "Division") proposed revisions to Colorado Air Quality Control Commission ("AQCC") Regulation Number 7.

The concerns we raised in our Prehearing Statement (PHS) on pages 16-18 remain. Specifically:

- We do not support the pre-production monitoring provisions specified in Part D, Section VI.C of the proposed rule due to the lack of specified monitoring goals and general adherence to EPA's recommended Data Quality Objectives process to develop a monitoring program.
- The proposed Rules relating to disposal operations and emissions reductions from pre-production flowback vessels have significant technical, safety, and economic feasibility issues to resolve.
- The timeline for implementation of all aspects of the rulemaking is unreasonably short. Our concerns on this front are further compounded by Division's PHS which changed the applicability for Part E, Section I.D to be November 14, 2020[1], which less than two months after the Hearing Date for the rule.

We continue to recommend Part D, Section VI.C and relevant aspects of the SBAP be stricken from the proposed changes to Regulation 7 in their entirety as the rule is premature. Instead, as suggested in our PHS at page 5, we recommend the AQCC direct the formation of a workgroup comprised of agencies, industry, monitoring, and public health experts to advise on the design and implementation of an effective monitoring program by following the USEPA's Data Quality Objective (DQO) process.

In conjunction, Weld County volunteers to oversee a pilot study to help inform the workgroup and assess the feasibility of program design elements. A pilot study could systematically and prescriptively evaluate various monitoring technologies as applied to pre-production monitoring in Colorado. The combined advantages of a workgroup and pilot study are numerous. Specifically, this approach provides a science-based approach that improves the quality and usability of collected data and can establish an equitable process to resolve concerns raised by multiple other parties to this rulemaking. Further, a pilot study enables experts to evaluate

[1] *See* Prehearing Statement Regulatory Language of Air Pollution Control Division ("APCD_PHS_REG")

suitability and feasibility of emerging monitoring technologies prior to determining statewide requirements. Importantly, regardless of our position that Part D, Section VI.C is premature, we provide recommendations for critical aspects of a valid program should the AQCC proceed with the rule despite our objection. These recommendations should not be misconstrued as support for the rule or its elements as written.

In addition to our previous concerns, we have reviewed the Divisions' Final Economic Impact Analysis (referred to as the Division's Final EIA) and have additional concerns. Specifically, the Division's Final EIA does not implement the methodologies established in the EPA Air Pollution Control Cost Manual nor was reasonable effort made to obtain current data for cost calculations in accordance with C.R.S. §25-7-110.5(4)(c)(i) – (iii). As a result of these two deficiencies, the Division's Final EIA is an incomplete accounting of both indirect and direct costs.

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I. RESPONSE TO PROPOSED CHANGES IN THE STATEMENT OF BASIS AND PURPOSE

As stated in our PHS, we have significant concerns with the lack of clarity in the "Pre-production and early production monitoring" Statement of Basis and Purpose (SBAP). While these concerns remain, they are expanded by SBAP revisions recommended by the Division, Environmental Defense Fund ("EDF"), the Local Government Coalition ("LGC"), and the Joint Industry Work Group ("JIWG")[2].

A. Division's Proposed Changes to the SBAP

The Division proposes several changes to the SBAP that we do not support because, as stated in our PHS, a pre-production monitoring rule is premature. We recommend Part D, Section VI.C and all relevant aspects of the SBAP be stricken from the proposed changes to Regulation 7 in their entirety pending more thorough study and planning. As we discuss, the Division's recommended changes to the SBAP consistently provide examples of how the pre-production monitoring rule is premature.

For the most part, the Division's proposed changes to the SBAP do not clarify the basis nor the purpose for a pre-production monitoring rule. Specifically, the addition of "This *[sic]* purposes of this air quality monitoring is multi-faceted in that the AQCC anticipates the monitoring program will gather information about the evolving oil and gas monitoring technologies, data about potential emissions during pre-production and early production operations (e.g., ozone precursor emissions, greenhouse gas emissions, hazardous air pollutants), and inform future monitoring efforts"[3] explains that the proposed pre-production monitoring requirements are a data collection effort for an unspecified purpose, not a defined regulatory program.

The proposed revision of the SBAP related to the purpose and intent of the three days of monitoring prior to pre-production activities is contradictory and confusing. Specifically, "The Commission recognizes that three days does not provide a comprehensive or long-term baseline and intends that the air quality monitoring prior to pre-production operations will provide a reference point for interpreting subsequent data."[4] The Division fails to explain the difference between a baseline and a "reference point for interpreting subsequent data". We reiterate the concerns we raised in our PHS on page 11 regarding the use of data collected over a 3-day sampling period whereby data collected from a short period provides no quantitative value beyond the ability to confirm that the monitoring equipment is performing as expected. If the SBAP is revised related to the collection of data prior to pre-production activities, we recommend it be explicitly stated that the data is not intended to be used for quantitative or comparative purposes.

While the Division's additions to the SBAP to explicitly state their desire for program flexibility are helpful to understand their intent, we reiterate our PHS comments on page 10 that it is "important to differentiate flexibility in how a program is implemented from a lack of sufficient

[2] The Joint Industry Work Group consists of members of the Colorado Oil and Gas Association (COGA) and the American Petroleum Institute (API).
[3] *See* Prehearing Statement of Basis and Purpose of Air Pollution Control Division ("APCD_PHS_SBAP"), page 6
[4] *Ibid.*

information. The desire for program flexibility does not supersede the regulatory agency's responsibility to define the monitoring program objectives or to establish monitoring criteria to meet those objectives". The proposed additions to the SBAP demonstrates that the Division does not intend to address fundamental requirements of a monitoring program (such as pollutant to monitor, monitor siting requirements, monitoring frequency, and methodology) in this rulemaking nor in any other programmatic or consistent method. Rather they intend to address these topics on an ad-hoc basis for each site-specific monitoring plan. With sufficient forethought, most monitoring criteria and plan requirements can be established programmatically in advance to provide clarity, certainty, efficiency and efficacy.

The Division goes on to say, "However, the Commission expects that operators will select a monitoring technology that collects measurements at a high-time frequency"[5] without including a formal definition of what constitutes "high-frequency". This contradicts the previous statement allowing for a flexible monitoring program that enables the operators to define the frequency of measurements in the monitoring plan based on monitoring technology. The SBAP language regarding monitoring frequency is confusing and inconsistent.

Further, the Division's proposed changes to the SBAP further illustrate that the program implementation and oversight responsibilities are not well defined. Specifically, the Division's statement "The Commission recognizes that monitoring data often requires *[sic]* additional analysis to interpret the resulting data. Therefore, for this first oil and gas air quality monitoring program, the Commission expects that operators will make the raw data (e.g., monitor/sensor and meteorological readings prior to analysis or processing) available to the Division upon request but submit the analyzed data results in the monthly reports."[6] demonstrates a fundamental mistrust of the quality assurance, data reduction, and data validation programs that the operators might use in the absence of clear standards and guidance that should be provided by the Division. This is a critical concern and further demonstrates how this rulemaking is premature.

If the AQCC proceeds forward with Part D, Section VI.C rules, we do support the Division's addition to the SBAP related to this sentence: "In addition, the Commission expects the Division to work with operators in approving air quality monitoring plan to make sure that local jurisdiction air quality monitoring requirements and COGCC site preparation requirements are considered."[7] This language is appropriate because it acknowledges the need for coordination to uphold other agencies' requirements and is consistent with SB19-181 mandates related to local authority.

The Division's recommended changes to the SBAP consistently provide examples of how the pre-production monitoring rule is premature. Therefore, we recommend Part D, Section VI.C and relevant aspects of the SBAP be stricken from the proposed changes to Regulation 7 in their entirety pending a more thorough evaluation and proposal by the Division.

[5] *Ibid.* page 7
[6] *Ibid.*
[7] *Ibid.*

B. EDF's Proposed Changes to the SBAP

There is confusion among the parties about the purpose and intent of how the new monitoring requirements proposed in Part D, Section VI.C relate to and fulfill the requirements of SB19-181, codified at C.R.S. § 25-7-109 (10)(b)(I)(C), specifically the requirement for the AQCC to "consider adopting a more stringent provision for" the installation and operation of "continuous methane emissions monitors at facilities with large emissions potential, at multi-well facilities, and at facilities in close proximity to occupied dwellings"[8]. To prevent future confusion, we support EDF's recommended changes to the SBAP related to this addition: "However, these proposed revisions do not address the requirements of SB 19-181, Section 3 (codified at Section 25-7-109(10)(b)(I)(c), C.R.S.) that the Commission consider adopting in a rulemaking a requirement that oil and gas operators must install and operate continuous methane emissions monitors at certain facilities, which the Commission will consider at a future date."[9]

We do not support EDF's proposed revisions to the SBAP for the "Pre-production and early production monitoring" that start on page 6 of "EDF_SBAP_REDLINE". Before the Commission can specify monitoring siting criteria as EDF suggests, the monitoring goals must be defined. Further, the statement "evaluate whether the plan utilizes state of the art technology to conduct continuous or high-frequency monitoring"[10] is contradictory to the Division's stated goal of program flexibility and has no basis in statute. In addition, the statement "whenever feasible to allow for leak detection and to gather information on emissions of air toxics"[11] presupposes both monitoring goals that have not been specified by the AQCC or the Division and the capability for defensible source attribution. Further, the statement "As used in the regulation, raw data includes instrument data, meteorological data, and any other data that reflects measurements taken as part of the monitoring plan" adds specificity to the SBAP that is binding before the goals and objectives have been defined, thereby committing the regulators and regulated community before the nature, need or value of such data has been determined. As a last concern, the additional text related to the content of the monitoring plan[12] is redundant with the proposed regulatory language but does not explain the basis or purpose of the proposal. In sum, we do not support any of the additions to the SBAP "Pre-production and early production monitoring" section proposed by EDF.

C. LGC Proposed Changes to the SBAP

The LGC proposed several changes to the SBAP related to pre-production monitoring that we do not support. Specifically, the LGC recommends the addition of the following to the SBAP[13]:

> *The air quality monitoring plan requirements provided in these regulations are minimum requirements for the operator's air quality monitoring plan. The Division must consult with the local government(s) with jurisdiction over the area where the*

[8] C.R.S. § 25-7-109 (10)(b)(I)(C)
[9] *See* Prehearing Statement SBAP of Environmental Defense Fund ("EDF_SBAP_REDLINE"), page 1
[10] *Ibid.* page 7
[11] *Ibid.*
[12] *Ibid.*
[13] *See* Prehearing Statement Exhibit 9 of Local Government Coalition ("LCG_PHS_EX-009"), page 6

operations are located and any other local government unit, where applicable, within 2,000 feet of the proposed oil and gas operations contained within the air quality monitoring plan during the Division's approval process and take into consideration the air quality monitoring plans or programs that may be required by such local governments under their applicable ordinances, rules, or regulations. The consultation process is anticipated to be interactive and for the purpose of ensuring robust and consistent air quality monitoring requirements.

and

The Commission believes these reports will provide valuable information to interested citizens, particularly those who live in close proximity to oil and gas facilities. Therefore, the Commission requests that the Division make this information publicly available in the most efficient means possible, which may include posting on the Division's website individual reports and/or a compilation summary.

The proposal that the monitoring plan is the minimum requirement for operators is unnecessary and exceeds the authority of the AQCC, the Division and local agencies. It is always the discretion of individual operators to voluntarily go beyond regulatory requirements. With regards to the language regarding the local government consultation process, Weld County prefers the Division's proposed language over the recommendation of the LGC. Specifically, the Division's addition: "the Commission expects the Division to work with operators in approving air quality monitoring plan to make sure that local jurisdiction air quality monitoring requirements and COGCC site preparation requirements are considered" is appropriate and provides more clarity than the language proposed by the LGC. With regards to LGC's proposed language related to public availability, Weld County suggests that this language is overly specific relative to the current definition of the purpose and need. Further, the ultimate end use and ideal form of the data availability may change as the program goals are defined. Weld County does not support LGC's proposed changes to the SBAP related to data reporting.

The LGC also recommends the removal of the term "pollutant-neutral" from the statement: "This pollutant-neutral monitoring program is intended as an initial step to help inform future oil and gas monitoring efforts." Weld County recommends the full sentence be stricken from the SBAP because developing and implementing a rule that is specified as an initial step to inform future monitoring indicates that this is a data collection effort, not a defined regulatory program.

D. JIWG Proposed Changes to the SBAP

Similarly, we do not support JIWG's proposed changes to the SBAP because, as stated in our PHS, a pre-production monitoring rule is premature. We recommend Part D, Section VI.C and all relevant aspects of the SBAP be stricken from the proposed changes to Regulation 7 in their entirety pending more thorough study and planning. However, if the AQCC intends to proceed forward with pre-production monitoring requirements, we have the following specific comments on the JIWG's proposed changes to the SBAP.

As discussed above related to the Division's proposed changes to the SBAP, we are concerned about referring to the three days of monitoring prior to pre-production as providing "a reference point for interpreting subsequent data". We recommend it be explicitly stated that the data

collected for a short-term period prior to pre-production is not intended to be used for quantitative or comparative purposes. We support the JIWG's additions stating "The Commission recognizes that monitoring for three days does not provide a comprehensive or long-term baseline but determined that three days strikes an appropriate balance and is consistent with the practices of some local governments and operators who currently conduct monitoring."[14]

We support the JIWG's addition to the SBAP "The Commission intends that when submitting the plan, owners or operators will tell the Division whether the monitoring technology is or has been used in other oil or natural gas pre-production or production applications, if known."[15] This is consistent with recommendations in our PHS at page 13.

We are concerned about the proposal to include Investigation Levels and associated text in the SBAP until the purpose and goals for the monitoring program are defined. This is discussed in detail in Section III of this rebuttal.

We support the JIWG's addition to the SBAP "Recognizing the rapid evolution and emerging development of on-site air quality monitoring and the uncertainty regarding pre-production emissions, the Commission adopts a reassessment provision for these monitoring requirements. The Commission intends that the Division will use the information reported pursuant to the new Section VI.C to reassess its requirements. The Division will begin its reassessment in May 2022 and make recommendations to the Commission in November 2022 regarding whether Section VI.C should be rescinded, superseded, or revised."[16]

II. DISPOSAL OPERATIONS – PROPOSED RULE PART D, SECTION II.C.

A. Air Pollution Control Division Prehearing Statement - Economic Impact Analysis

The Division provided an Economic Impact Analysis (EIA) pursuant to C.R.S. §25-7-110.5(4)(a) which requires that the proponent of a rule, or Division in cooperation with the proponent, provide an initial EIA to the public at the time any request for hearing on a proposed rule is heard by the AQCC. The proponent's EIA must be made based on reasonably available data in accordance with C.R.S. §25-7-110.5(4)(c)(i) – (iii). Weld County asserts that the Division's EIA for disposal operations fails to meet this standard.

The Division states repeatedly throughout the EIA that information was requested from operators for cost estimates of control but they were not provided; however, the Division does not provide any records of request or response. On this basis, the Division states that the information is not reasonably available, and instead relies on a dated study for the 2008 Ozone Action Plan rulemaking adjusted for inflation[17]. The Division provides only summary tables without supporting calculations or data, so it is not entirely clear how control cost estimates are

[14] *See* Prehearing Statement Exhibit 1 of Joint Industry Work Group ("JIWG_PHS_EX-001"), page 28
[15] *Ibid.*
[16] *Ibid.* page 29
[17] *See* Prehearing Statement Final Economic Impact Analysis of Air Pollution Control Division ("APCD_PHS_EIA")

developed. However, it is clear that the methodology used does not seem to align with the methodologies established in the EPA Air Pollution Control Cost Manual, EPA/452/B-02-01, January 2002 Sixth Edition which is traditionally applied when performing BACT and RACT analyses on these technologies. This established approach addresses direct and indirect installation costs which the Division's EIA overlooks such as:

- Foundations and/or structural supports;
- Handling and erection;
- Electrical installation;
- Piping and mechanical installation;
- Insulation and painting;
- Engineering;
- Construction and field expenses;
- Start-up and commissioning;
- Performance testing;
- Freight;
- Sales tax; and
- Contingencies.

Furthermore, the Division's O&M and indirect costs appear to be incomplete and egregiously low. The methodology referenced above typically incorporates the following direct and indirect annual costs into the assessment:

- Operating labor
- Supervisory labor
- Maintenance labor and materials
- Utilities (which are addressed in the Division's assessment)
- Maintenance overhead
- Administrative charges
- Capital recovery
- Property tax
- Insurance

As an example, EPA-452/B-02-01 recommends applying factors of 57% and 35% to the purchased equipment cost (which includes instrumentation costs, freight and tax) to account for one-time direct and indirect installation costs respectively associated with flare installation[18]. The resulting one-time costs associated with this approach significantly exceeds the non-recurring one-time costs identified in Table 18 of the Division's Final EIA. The USEPA provides recommended values and factors to be applied to estimate these direct and indirect annual costs in EPA-452/B-02-01, which similarly significantly exceed those values identified in Table 18[19]. Moreover, the Division provides data in Table 12 and Table 13[20] regarding methane emissions

[18] WeldCo_REB_EX-001, USEPA. 2002 Jan. EPA Air Pollution Control Cost Manual, Sixth Edition, EPA/452/B02-001, Section 3.2, Chapter 1.
[19] *See* APCD_PHS_EIA, page 20
[20] *Ibid.* page 16

from well completion activities but fails to cite any supporting documentation. The Division also fails to consider change in emissions from other regulated pollutants such as VOC or products of combustion (NO_2, CO, etc.)

Therefore, Weld County asserts that the EIA is inadequate, and the Division has not met the requirements of C.R.S. §25-7-110.5(4)(a). As such, the AQCC should direct the Division to revise the EIA to be consistent with established EPA methodologies and common industry practice while providing full disclosure of all reasonably available data considered including detailed calculations and documented sources.

III. PRE-PRODUCTION MONITORING REQUIREMENT – PROPOSED RULE PART D, SECTION VI.C.

A. High-Level Summary of Other Parties' Position and Weld County's Recommendations

1. Definition of Monitoring Goal

A consistent comment by most of the parties to the rulemaking, including Weld County, is the lack of specificity in the proposed pre-production monitoring requirements[21]. It is still Weld County's primary concern that the rule lacks specificity regarding monitoring goals and objective, the most important topics, which will lead to exorbitant cost for little actionable information, distract stakeholders from collecting meaningful data, and will not improve public confidence in the AQCC and Division's protection of public health and welfare. We therefore reaffirm that a pre-production monitoring rule is premature and recommend Part D, Section VI.C be stricken from the proposed changes to Regulation 7 in its entirety.

The Division's PHS indicates a preference to collect an abundance of information. Specifically, the Division's PHS states: "There are many questions asked about oil and gas emissions, such as related to ozone (i.e., VOC and NOx), greenhouse gases (e.g., CH_4), and public health (e.g., HAPs), and data to inform potential responses will require monitoring different pollutants."[22] This preference to collect data on many different pollutants is echoed in the SBAP. However, this is an initial problem statement, not a monitoring goal. An open-ended regulatory requirement to collect any type of data side-steps the significantly more difficult, but critically important, task of defining the purpose and need for pre-production monitoring and corresponding data needs.

As we discussed in our prehearing statement, a monitoring goal and defined data needs are essential to develop any other aspect of a monitoring program. Therefore, the following sections provide an assessment of potential monitoring goals for each of the three groups of pollutants specified by the Division in their SBAP and PHS (i.e., ozone precursors, greenhouse gases [GHGs], and HAPs). We assess: 1) the potential relevance and end use of the data; 2) applicability of monitoring pre-production activities for those pollutants; and 3) regulatory

[21] *See* Prehearing Statements of Adams County ("AdamsCo_PHS"), City of Commerce City ("CommCity_PHS"), Community Organizations ("CO_PHS"), Environmental Defense Fund ("EDF_PHS"), Local Government Coalition ("LGC_PHS"), WildEarth Guardians ("WG_PHS"), and Weld County ("WeldCo_PHS")
[22] *See* Prehearing Statement of Air Pollution Control Division ("APCD_PHS"), page 16

drivers for monitoring. Based on our initial assessment, we recommend that the Division clarify the purpose and intent of a state-wide, pre-production monitoring program is to assess public health. Monitoring for ozone precursors and GHGs would be informative as part of focused initiatives or other planned rulemaking procedures but does not provide relevant information for this rulemaking.

Recommendation: Weld County recommends Part D, Section VI.C be stricken from the proposed changes to Regulation 7 in its entirety. If the AQCC proceeds forward with inclusion of Part D, Section VI.C, Weld County requests that the AQCC require more specificity in Part D, Section VI.C and we have included recommendations regarding where the rule could be improved with more specificity throughout this rebuttal.

2. Ozone precursors (i.e., VOC and NOx)

Given the Denver Metro/North Front Range ozone nonattainment designation, ozone precursor monitoring is relevant, particularly in the ozone nonattainment area and for source sectors that contribute to ozone precursor emissions. Monitoring of ozone precursors could have multiple potential end uses. The end uses that we consider in more detail include: 1) emissions inventory reconciliation, 2) emission factor verification, 3) model evaluation and diagnostic testing, and 4) scientific research. As we elaborate, none of these end uses justifies site-specific, systematic pre-production monitoring of ozone precursors. Instead, the Division could obtain desired ozone precursor information from more selective and focused efforts. If the Division has other end-uses for collecting statewide, systematic pre-production monitoring of ozone precursors that are not considered in the following sections, we recommend this be explicitly discussed during the hearings and identified in the SBAP for Part D, Section VI.C.

First, if the Division's goal for collecting information about ozone precursor is for emissions inventory reconciliation purposes, monitoring of pre-production sources alone will not further this goal because emission inventory reconciliation efforts are, by definition, a comprehensive evaluation of the emissions inventory. Isolated monitoring of pre-production activities, without comprehensive monitoring, would only provide information about the pre-production activities and would not be informative for oil and gas emissions inventory reconciliation (i.e., one cannot assess the accuracy of the emissions inventory by evaluating only a sub-set of the sources). Therefore, it is recommended that this not be a Division monitoring goal for the Part D Section VI.C rule. Instead, if emissions inventory reconciliation is a goal of the Division, we recommend that a special study be conducted. There is a large body of literature available on past emissions inventory evaluation studies, many of which focus on oil and gas sources. We recommend review of Vaughn et al. (2018) and supporting papers to best demonstrate how to develop a successful and informative emissions inventory reconciliation study.[23]

Second, if the Division desires emission factor determination and verification, it is recommended the Division establish a focus group and a monitoring study following a process similar to the oil

[23] WeldCo_REB_EX-002, Vaughn TL, Bell CS, Pickering CK, Schwietzke S, Heath GA, Pétron G, Zimmerle D, Schnell RC, Nummedal D. 2018 Oct 29. Temporal Variability Largely Explains Difference in Top-down and Bottom-up Estimates of Methane Emissions from a Natural Gas Production Region, Proc Natl Acad Sci. DOI: 10.1073/pnas.1805687115

and condensate tank emissions monitoring in 2003 and 2004 by Lesair when emission factors were developed for statewide APEN exemptions[24]. Such a monitoring initiative does not need to be a statewide program. Furthermore, if this goal is not expressly stated, the ability to achieve this goal is compromised. Without a prescriptive study design and consistent monitoring approach, data collected for pre-production sources would not be sufficiently reliable to adequately determine and defend emission factors. If emission factor determination and verification is a goal of the Division, we recommend that the Division establish a focus group, and this not be a Division monitoring goal for the Part D Section VI.C rule.

Third, if the Division would like information for ozone model evaluation and diagnostic testing of models, it has already initiated regional monitoring plans in conformance with EPA requirements for ozone nonattainment areas for this exact purpose.[25] In fact, the Division already plans to deploy more ozone and ozone precursor monitors than are required by EPA. Furthermore, pre-production activities are both spatially and temporally variable. As such, monitoring of pre-production would be temporary and vary spatially throughout the state, and monitoring would not be consistent enough to provide meaningful information for regional modeling evaluation and diagnostic testing. We recommend that this not be a Division monitoring goal for the Part D Section VI.C rule.

Fourth, the Denver Front Range is an area of active investigation by many scientific teams. In fact, the express intent of the recently formed Enterprise Fund, authorized under Senate Bill 20-204, is to provide for rigorous studies with data collection efforts specifically designed to support scientific objectives. Therefore, we recommend that unspecified scientific research not be a Division monitoring goal for the Part D Section VI.C rule.

Finally, ozone is a regional issue that not only includes local formation but regional and global transport and stratospheric intrusion. Statewide, site-specific, pre-production monitoring of ozone precursors does not provide substantial value to either predicting or controlling the ambient concentrations of tropospheric ozone, particularly in light of the extensive costs and potential for other more targeted studies to generate information.

Recommendation: We recommend that the AQCC explicitly exclude collection of ozone precursor pollutants from the Part D Section VI.C rule unless a specific end use is identified by the Division that would justify the collection of statewide, systematic pre-production ozone precursor data.

3. Greenhouse Gases

We recognize that methane monitoring is not comprehensive of all GHGs emitted by the oil and gas industry; however, we have focused our assessment on the relevance and applicability of methane monitoring since this is the pollutant specifically cited by the Division in their PHS. As explained earlier, we recommend that the final SBAP and Regulation 7 language for Part D,

[24] Final study results are available at https://www.onepetro.org/conference-paper/SPE-84155-MS and require payment to access.

[25] WeldCo_REB_EX-003, CDPHE-APCD. 2019 Oct. State of Colorado Enhanced Monitoring Plan for Ozone. APCD-TS-B1.

Section VI.C clarify that methane monitoring is not the focus or intended pollutant of concern for pre-production monitoring, and instead any methane monitoring requirements should be reserved for the continuous methane monitoring rulemaking associated with C.R.S. § 25-7-109 (10)(b)(I)(C) or subsequent rulemaking for the following reasons.

Pre-production methane monitoring has several potential end uses. The end uses that we consider in more detail include: 1) emissions inventory reconciliation, 2) emission factor development and verification for GHG emissions reporting requirements, and 3) leak detection and repair. As we elaborate, none of these end uses justify site-specific, systematic pre-production monitoring of GHGs, instead the Division could obtain desired GHG information from rulemaking associated with C.R.S. § 25-7-109 (10)(b)(I)(C) or subsequent efforts with more selective and focused goals. If the Division has other end-uses for collecting statewide, systematic pre-production monitoring of GHGs that are not considered, we recommend this be explicitly discussed during the hearings and identified in the SBAP for Part D, Section VI.C.

As explained in the "Ozone Precursor" section above, if the Division's goal for collecting information about GHGs is for emissions inventory reconciliation purposes or emission factor development and verification, these end goals would be better served by focused programs or initiatives rather than statewide pre-production monitoring. Therefore, we recommend these not be monitoring goals for the Part D Section VI.C rule.

If the Division would like to monitor methane emissions to enhance existing leak detection and repair programs, the rulemaking associated with C.R.S. § 25-7-109 (10)(b)(I)(C) would be more appropriate to define and implement a methane monitoring program for that purpose. C.R.S. § 25-7-109 (10)(b)(I)(C) already establishes a requirement for the AQCC to "consider adopting a more stringent provision for" the installation and operation of "continuous methane emissions monitors at facilities with large emissions potential, at multi-well facilities, and at facilities in close proximity to occupied dwellings". The provisions of C.R.S. § 25-7-109 (10)(b)(I)(C) are already required and that rulemaking provides an opportunity for a comprehensive methane monitoring program specific to that purpose. Adopting methane monitoring requirements now as part of Regulation 7, Part D, Section VI.C for pre-production activities and then conducting a more comprehensive development of a methane monitoring program in accordance with provisions of C.R.S. § 25-7-109 (10)(b)(I)(C) has the potential for duplicative future continuous methane emissions requirements and disparate recordkeeping and reporting requirements. This is particularly true for methane monitoring at new multi-well facilities which would, by definition, have pre-production activities in addition to normal operations. Therefore, continuous methane monitoring at multi-well pads, if enacted as a result of C.R.S. § 25-7-109 (10)(b)(I)(C), would also include methane monitoring during pre-production activities.

Note that Community Organizations has made the point in their PHS that in order to prepare for the future rulemaking associated with C.R.S. § 25-7-109 (10)(b)(I)(C) "some efforts in methane monitoring should be started now to enable the SB 19-181 rulemaking to commence in the near future."[26] We disagree with this as explained above.

[26] *See* CO_PHS, page 3

Recommendation: We recommend that the AQCC explicitly exclude collection of GHGs from the Part D Section VI.C rule and reserve any methane monitoring rule requirements for the rulemaking associated with C.R.S. § 25-7-109 (10)(b)(I)(C) or subsequent rules for a self-consistent program.

4. Hazardous Air Pollutants

As detailed by other parties in their PHS[27] as well as public comments[28], there are notable concerns about public health during pre-production activities. While previous and on-going monitoring data do not provide consistent scientific evidence for concern[29], most studies examine very specific locations while the range of pollutants and time periods analyzed vary considerably. A highly conservative modeling analysis prepared in 2019 by ICF International for the Division isolated worst-case scenarios during flowback operations and some other preproduction activities, and predicted that benzene, toluene, and ethyltoluenes exceeded acute exposure guideline levels at distances between 500 to 2,000 feet from well pads.[30,31] Importantly, the ICF study found that: 1) modeling based on emissions during both pre-production and production are unlikely to pose sub-chronic (periods ranging from multi-day to a year) or chronic (long-term) health risks, and 2) production activities are unlikely to pose acute risks. The ICF study also acknowledges the limitations of the study including its highly conservative assumptions. Monitoring conducted by both CDPHE and operators substantiate that concentrations of hazardous air pollutants (HAPs) are below sub-chronic or chronic health-based benchmark risk assessment values during both pre-production and production activities and generally below acute benchmarks during production activities[30,31]; however, the highest concentrations monitored have been downwind of pre-production activities.

Furthermore, the COGCC has deferred action on initial plans for pre-production public health monitoring. From this body of information, we conclude that protection of public health is an important driver for pre-production monitoring under Part D, Section VI.C. Therefore, should the AQCC retain the monitoring provisions of Part D, Section VI.C, it should be revised to specify the intent to monitor pre-production activities and remove early production monitoring requirements. Further, the SBAP for the Pre-production monitoring should be revised to support a monitoring goal related to acute exposure during pre-production activities. We also support the JIWG's reminder that monitoring should only be regulatorily required if monitoring is expected to have benefits that are real and cost-effective, consistent with C.R.S. § 24-4-103.

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[27] *See* Prehearing Statements from 350 Colorado ("350CO_PHS"), Local Governments Coalition, Commerce City, JIWG ("JIWG_PHS"), and Community Organizations

[28] *See* public comment submitted to the AQCC on Proposed Revisions to Regulation 7 by Karen Artell

[29] *See* Prehearing Statement Exhibits of Weld County ("WeldCo_PHS_EX-007" and "WeldCo_PHS_EX-008"); Joint Industry Work Group ("JIWG_PHS_EX-004"); Local Government Coalition ("LGC_PHS_EX-004", "LGC_PHS_EX-005", and "LGC_PHS_EX-006"); Occidental Petroleum Corporation ("OXY_PHS_EX-002" and "OXY_PHS_EX-003"); and Western Rural Local Government Coalition ("WRLG_PHS_EX-006")

[30] WeldCo_REB_EX-004, ICF. 2019 Oct. Final Report: Human Health Risk Assessment for Oil & Gas Operations in Colorado. Submitted to CDPHE.

[31] WeldCo_REB_EX-005, Holder et al. 2019 Nov. Evaluating Potential Human Health Risks from Modeled Inhalation Exposures to Volatile Organic Compounds Emitted from Oil and Gas Operations. Journal of Air and Waste Management. Volume 69, Issue 12. DOI: https://doi.org/10.1080/10962247.2019.1680459

Several groups commented on health effects in their prehearing statements. For example, 350 Colorado cited a study by McKenzie et al. (2017)[32], and stated that *"*children and young adults who developed acute lymphocytic leukemia [ALL] were four times more likely to have been born in areas with the highest density/proximity of oil and gas operations as compared to those in the lowest density.*"* The McKenzie et al. (2017) study used a case-control study design to compare 87 ALL cases and 50 non-Hodgkin lymphoma (NHL) cases to 528 controls with no hematologic cancers in residents less than 24 years old in rural Colorado. The ALL cases had a two-fold increased odds ratio of living within 16.1 kilometers of oil and gas wells when compared to those who lived more than 16.1 kilometers away. The odds ratios, however, did not increase with the density of wells as measured by well counts per 1.6 kilometers (1 mile), and only the highest category of exposure (>33.6 wells per 1.6 kilometer) resulted in statistically significant finding. No statistically significant associations were observed between well count and NHL. These results are based on the number and proximity of oil and gas wells at the time of cancer diagnosis and do not account for residential mobility from birth. Because cancers take years to develop, exposure at birth is likely more relevant than exposure at diagnosis.

350 Colorado also commented on the study by Casey et al. (2016)[33] stating that "mothers who lived in the most active quartile of drilling and production activity experienced a forty percent increase in the likelihood of preterm birth and a thirty percent increase in the probability of being labeled by an obstetrician as a "high risk" pregnancy." Although this study reported that the odds of preterm birth increased with increasing proximity/density of wells (no radius specified), this is not consistently shown in the body of the literature. Eight studies have evaluated associations between surrogates of exposure to oil and gas development and preterm birth.[33,34,35,36,37,38,39,40] These studies have reported inconsistent results, using different measures of proximity and density, production activity, or production volume. For example, Stacy et al. (2015) found no association between preterm birth and proximity and density of oil and gas wells as measured using inverse distance weighting within a 10-mile radius of maternal residence during the birth year. Even within studies, results are inconsistent: Tran et al. (2020) reported decreased odds of preterm birth associated with high production volume in urban areas, but not rural areas. Finally, although preterm births can carry increased risks, the definition of preterm (how early a baby is

[32] *See* Prehearing Statement Exhibit 1 of 350 Colorado, ("350CO_PHS_EX-001")
[33] *See* Prehearing Statement Exhibit 2 of 350 Colorado, ("350CO_PHS_EX-002")
[34] WeldCo_REB_EX-006, Cushing et al. 2020 July. Flaring from Unconventional Oil and Gas Development and Birth Outcomes in the Eagle Ford Shale in South Texas. DOI: https://doi.org/10.1289/EHP6394
[35] WeldCo_REB_EX-007, Hill, Elaine L. 2018 Aug 13. Shale gas development and infant health: Evidence from Pennsylvania. Journal of Health Economics 61 (2018) 134-150.
[36] WeldCo_REB_EX-008, McKenzie et al. 2014 April. Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado. Environmental Health Perspectives Volume 122 Number 4.
[37] WeldCo_REB_EX-009, Stacy et al. 2015 June 3. Perinatal Outcomes and Unconventional Natural Gas Operations in Southwest Pennsylvania. PLOS ONE. DOI: 10.1371/journal.pone.0126425
[38] WeldCo_REB_EX-010, Tran et al. 2020 June. Residential Proximity to Oil and Gas Development and Birth Outcomes in California; A Retrospective Cohort Study of 2006-2015 Births. Environmental Health Perspectives. DOI: https://doi.org/10.1289/EHP5842
[39] WeldCo_REB_EX-011, Whitworth et al. 2017 July 21. Maternal residential proximity to unconventional gas development and perinatal outcomes among a diverse urban population in Texas. DOI: https://doi.org/10.1371/journal.pone.0180966
[40] WeldCo_REB_EX-012, Whitworth et al. 2018 March 20. Drilling and Production Activity Related to Unconventional Gas Development and Severity of Preterm Birth. Environmental Health Perspectives. DOI: https://doi.org/10.1289/EHP2622

born relative to full term) influences this outcome strongly and cannot simply be implied (as 350 Colorado implies) that "preterm birth can lead to long-term intellectual and developmental disabilities and problems with lungs, brain, eyes, and other organs*."*

350 Colorado referenced a number of other studies stating that: "Other epidemiological studies that demonstrate a risk to public health and safety from oil and gas development have observed an association between density of fracking operations and worsening asthma symptoms[41]; increased cardiac, neurological, urological, cancer-related, and skin-related problems and cardiac hospitalizations[42]; genitourinary tract hospitalizations[43]; increased early signs of cardiovascular disease[44]; significant psychological distress such as depression, and sleep disturbance."[45] However, looking at the body of epidemiological data provides inconsistent evidence of observable health risks in relation to distance to oil and gas development. Many of these studies are hampered by potential bias associated with ecological study designs. The studies did not measure or classify the surrogates of exposure consistently, making it difficult to compare results. In addition, most studies of proximity to well also measured density of wells. In most of these studies, there was little evidence of increased risk among buffers with the lowest density of wells. Further epidemiological studies are needed with improved study designs and measurement and sampling of specific exposures. Based on the studies available to date, the epidemiological evidence is at best suggestive that something might be occurring but does not lead to definitive conclusions.

The Local Governments Coalition cites a document referred to as a "compendium" prepared by the Concerned Health Professionals of New York and the Physicians for Social Responsibility (2019).[46] This document, entitled "Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking" proports to summarize more than 1,500 scientific reports, peer-reviewed studies, and investigative journalism reports about threats to public health from industry sources. However, about half of the "reports, peer-reviewed studies, and investigative journalism" citations are newspaper articles, blogs, and other non-scientific articles that discuss studies about the unconventional oil and gas industry or the compendium itself. While this type of reporting may have value, they are not science-based and may be biased. Approximately a fifth of the "reports, peer-reviewed studies, and investigative journalism" citations are reports in the "gray literature," which are not peer-reviewed. Even among the third of the citations which are peer-reviewed, the majority are not related to health. Only 5% of the citations are peer-reviewed studies related to health, and less than half of these (31 total) are population studies (many of which are discussed above).

The Local Governments Coalition also cites the CDPHE (2019) study as leading to the conclusion that "there is a possibility of negative health impacts at distances from 300 feet out to

[41] *See* Prehearing Statement Exhibit 3 of 350 Colorado, ("350CO_PHS_EX-003")
[42] *See* Prehearing Statement Exhibit 4 of 350 Colorado, ("350CO_PHS_EX-004")
[43] *See* Prehearing Statement Exhibit 5 of 350 Colorado, ("350CO_PHS_EX-005")
[44] *See* Prehearing Statement Exhibit 6 of 350 Colorado, ("350CO_PHS_EX-006")
[45] *See* 350 Colorado_PHS, Prehearing Statement Exhibit 7 of 350 Colorado, ("350CO_PHS_EX-007")
[46] *See* LGC_PHS

2000 feet."[47] Importantly, as outlined above, this study has very conservative assumptions that even the authors point out limit the conclusions that can be drawn. Commerce City also cites the CDPHE (2019) study in their prehearing statement. Neither Local Governments Coalition nor Commerce City acknowledge the significant uncertainties or limitations in citing this study.

Recommendation: We recommend that monitoring provisions be removed from the rule; however, should the AQCC proceed despite our concerns, we recommend that the AQCC explicitly define that Part D Section VI.C is for the purposes of public health protection related to pre-production monitoring only and remove requirements for early production monitoring and any reference to long-term monitoring objectives in the SBAP. The limited evidence provided in the body of scientific literature indicates concern for infrequent and temporary acute impacts from pre-production operations. Monitoring of production operations at this time is not warranted given the lack of evidence to show impacts and the extensive monitoring and controls imposed through other provisions of Regulation 7, federal rules, and state-issued air permits.

5. Summary of Weld County Monitoring Recommendations

Weld County shares the AQCC mission to protect public health, but as we discuss throughout this rebuttal, we recommend Part D, Section VI.C and relevant aspects of the SBAP be stricken from the proposed changes to Regulation 7 in their entirety as the rule is premature. Instead, as suggested in our PHS at page 5, we recommend the AQCC direct the formation of a workgroup comprised of agencies, industry, monitoring, and public health experts to advise on the design and implementation of an effective monitoring program that considers its objectives without placing an undue burden on industry or citizens.

In conjunction with a workgroup, Weld County volunteers to oversee a pilot study to help inform the workgroup and assess the feasibility of the monitoring program design. As mentioned by numerous parties, monitoring technologies are emerging and have not been systematically tested, particularly not in the challenging site conditions associated with pre-production activities. A pilot study could systematically and prescriptively evaluate various monitoring technologies as applied to pre-production monitoring in Colorado. In our rebuttal, we detail how a workgroup and pilot study can help inform the design of the monitoring program. The advantages of this approach include: 1) a workgroup of technical experts can apply and follow a science-based process to establish key elements of the monitoring program, 2) a forum to resolve conflicting concerns raised by parties to the rulemaking, and 3) a process to evaluate suitability and feasibility of emerging monitoring technologies prior to determining statewide requirements.

The benefits of a workgroup focused on program design and implementation are significant, particularly if coupled with a pilot study. A workgroup could help to guide the type of monitoring needed and provide information about multiple aspects of the program such as the pollutants of concern, monitoring frequency, monitoring duration, and monitor siting. All of these are topics that have been raised as concerns by multiple parties to the rulemaking. Further,

[47] *Ibid.*

workgroup participants can provide input regarding past monitoring experiences[48] to help improve future monitoring program design.

If the AQCC proceeds forward with pre-production monitoring requirements despite our concerns about the rule being premature and the flawed process, we have several specific recommendations. Our recommendations are developed based on the preceding discussion related to the importance of monitoring data related to public health impacts during pre-production activities and the lack of a defined reason for collecting statewide pre-production monitoring data for ozone precursors and methane.

Specifically, we recommend the AQCC: 1) refine the language in the SBAP and Part D, Section VI.C to explicitly state that the goal of conducting statewide, pre-production monitoring is for protection of public health[49]; 2) direct the formation of a workgroup comprised of agencies, industry, monitoring, and public health experts to advise on the design and implementation of a public health monitoring program; and 3) explicitly exclude collection of ozone precursors and GHGs from the Part D Section VI.C rule. In addition, it is recommended that Part D, Section VI.C be revised to:

1) Revise the statewide monitoring requirement implementation date to allow the workgroup and pilot study two years to collect data, design a program, and develop guidance before requiring statewide compliance;
2) Add a waiver process for sites that are not in close proximity to occupied dwellings; and
3) Add provisions to Section VI.C to reevaluate the rule after 1 year of implementation if monitoring data does not demonstrate a need for continued monitoring[50].

None of the changes above would preclude the Division or individual operators from conducting additional monitoring above and beyond the requirements specified in Regulation 7; however, additional specificity regarding the monitoring goals, data needs, and the pollutants to be monitored would improve the outcome of the program. Once monitoring goals are defined it is more likely that data collected under a regulatory program would achieve those goals.

6. Lessons Learned from California Refinery Monitoring Rules and Applicability for this Rulemaking

As it becomes clear that the primary and most pressing need for monitoring data stems from a concern regarding public health impacts from pre-production activities, information can be gained by review of the California refinery fenceline monitoring requirements that were initiated over the past several years at both the local and statewide levels.[51] In particular, information related to program design process, timeline for implementation, local agency involvement, real-

[48] *See* Oxy_PHS_EX-002 and Oxy_PHS_EX-003
[49] *See* AdamsCo_PHS, CommCity_PHS, JIWG_PHS, and WG_PHS
[50] *See* JIWG_PHS_EX-001, page 29 and Prehearing Statement of Occidental Petroleum Corporation ("Oxy_PHS"), page 8
[51] South Coast Air Quality Management District. Rule 1180 Refinery Fenceline and Community Air Monitoring; Bay Area Air Quality Management District, Regulation 12 Miscellaneous Standard of Performance, Rule 15, Petroleum Refining Emissions Tracking; and California Assembly Bill No. 1647 (AB-1647) Petroleum refineries: air monitoring systems.

time data access, and cost estimates are very valuable to consider for this rulemaking to improve the program's success. Therefore, in the following sections we detail lessons learned from those rulemakings, highlight relevant available information, and provide recommendations to improve Part D, Section VI.C for the AQCC's consideration.

B. Program Design Considerations

Although clear program objectives and guidelines have not been defined in the SBAP or the proposed rule, there is reasonable indication that the main objective of new proposed pre-production monitoring requirements is for the protection of human health. As we discuss in our PHS, it is possible to better define the purpose and scope of monitoring activities such that robust and useful data is collected once the monitoring goals are defined. Therefore, if the objective of this regulation is to protect public health, we recommend that the AQCC direct the formation of a workgroup to design a monitoring program to collect information for the protection of public health. Formation of a workgroup in lieu of ambiguous rules would address the significant concerns raised by many parties to the rule[52] and provide a more cohesive, technically sound, and well considered monitoring program.

As discussed in our PHS, the Environmental Protection Agency provides information on how to apply systematic planning to generate performance and acceptance criteria for collecting environmental data[53]. EPA guidance document called *Guidance on Systematic Planning Using the Data Quality Objectives Process* describes this planning approach known as the Data Quality Objectives (DQO) Process.[54] As the guidance document states, the "DQO Process is a series of logical steps that guides managers or staff to a plan for the resource-effective acquisition of environmental data. It is flexible and iterative, and applies to decision-making (e.g., compliance/non-compliance with a standard) and estimation (e.g., ascertaining the mean concentration level of a contaminant). The DQO Process is used to establish performance and acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of the study. Use of the DQO Process leads to efficient and effective expenditure of resources; consensus on the type, quality, and quantity of data needed to meet the project goal; and the full documentation of actions taken during the development of the project."[55]

We recommend that the DQO Process be undertaken by a workgroup of experts to design and implement a public health monitoring program. This will help the AQCC provide the necessary detail regarding the type, quality, and quantity of data needed to meet program objectives. This process is a necessary prerequisite to any monitoring requirement.

Consistent with the DQO process, we recommend the following tasks be completed by a workgroup prior to the AQCC requiring statewide monitoring:

1. Identify data needs (e.g., specific compounds of concern, meteorological data)

[52] *See* AdamsCo_PHS, CommCity_PHS, CO_PHS, EDF_PHS, LGC_PHS, WG_PHS, and WeldCo_PHS.
[53] *See* Prehearing Statement Exhibit 5 of Weld County ("WeldCo_PHS_EX-005")
[54] *Ibid.*
[55] *Ibid.*

2. Determine health impact action levels
3. Determine data collection frequency such that data is comparable to health impact exposure durations
4. Establish program duration
5. Establish Data Quality Indicators (DQI) and acceptance criteria (e.g., required detection limits, sensitivity, precision, etc.)
6. Consider site characteristics/constraints (e.g., power availability, connectivity requirements)
7. Standardize monitor siting approach
8. Assess available technologies relative to defined monitoring requirements

The remainder of our rebuttal related to proposed rule Part D, Section VI.C elaborates on each of the elements in the list above to help explain: 1) the concepts, 2) the complexities associated with each element in the context of public health monitoring for pre-production activities, and 3) any important considerations for the workgroup and operators when implementing monitoring programs.

For a reputable program, the AQCC needs to follow DQO monitoring guidance for development of a monitoring program, otherwise the data collected will be of questionable validity and limited use. This rule is premature, as such Weld County reaffirms its position that the provisions of Part D, Section VI.C be stricken in their entirety. Should the AQCC proceed with this rule, we have provided specific examples and suggestions related to program design and key elements of the program. Our reason for providing this information is first and foremost to showcase the complexities involved with monitoring program design. It is our hope that by providing such detailed and specific information, the AQCC more fully understand just how far Part D, Section VI.C is from a rule that would enable a successful monitoring program.

Importantly, regardless of our position that Part D, Section VI.C is premature, we provide recommendations for critical aspects of a valid program should the AQCC proceed with the rule despite our objection. These recommendations should not be misconstrued as support for the rule or its elements as written.

Recommendation: Establish a workgroup comprised of agencies, industry, monitoring professionals and public health experts to define monitoring program objectives, develop program design to meet those objectives, and provide detailed monitoring guidelines and data quality objectives prior to statewide implementation of monitoring requirements.

C. Identify Data Needs

As discussed extensively in our PHS, before establishing which pollutants to monitor, the regulation needs to define the monitoring objective and design the monitoring program to meet that objective. This is important because a monitoring program with the aim of reducing greenhouse gas emissions, for example, will require different data needs than a program aimed to protect public health. As described in the EPA Guidance, the DQO Process is used to help

develop a clear understanding of data needs to support decisions[56]. The regulation must first develop clear objectives and criteria to assure appropriate and robust data are collected for decision-making. A key part of the DQO process will involve decisions related to what pollutants to monitor and if meteorological data is necessary to support the monitoring goals. We discuss these two topics in more detail below as related to comments raised by other parties.

Recommendation: Convene a workgroup of experts comprised of both air quality and health experts to establish and define the pollutants of concern for protection of public health prior to the AQCC requiring statewide monitoring. Further, establish if there is a need for collecting meteorological data, if any, and the purpose of that data.

1. Pollutants to monitor

We reiterate that we do not support the adoption of Part D, Section VI.C and the associated aspects of the SBAP. However, should the AQCC proceed, we provide our comments on concerns and suggestions raised by other parties in their PHS related to the type of pollutants to monitor. Many other parties, including the Division, suggest Part D, Section VI.C include methane monitoring either for undefined purpose, or for purposes of leak detection and repair[57]. As discussed earlier, continuous emissions monitoring requirements associated with SB19-181 codified in C.R.S. § 25-7-109 (10)(b)(I)(C) will be addressed in future rulemaking. For this reason, we do not support including methane monitoring as part of this rulemaking, either explicitly or implicitly.

Commerce City suggested monitoring of benzene and other HAPs (including, potentially, ethylbenzene, and toluene) in their PHS[58]. Before specifying pollutants of concern in the rule, there needs to be a systematic review of the pollutants that may impact health of nearby communities originating from oil and gas development sites. In defining the pollutants of concern for subsequent monitoring, it is also important to realize that many of these pollutants have other sources, such as mobile sources, and the program design should not simply attribute all measured concentrations to oil and gas sources. We recommend that the rule be silent on the requirement for specific speciated measurements and the AQCC direct a workgroup to define this.

Commerce City also suggests the rule be modified to require continuous monitoring methods and establish a trigger to collect speciated canister event sampling[59]. As described in the comment by Commerce City in their PHS Exhibit 2, this methodology is intended to capture robust quantitative data during a suspected event using a canister sample. The AQCC should direct a workgroup to define whether the monitoring objective is to capture event-specific sampling or routine (continuous) sampling. For either type of sampling campaign it will be necessary to gather speciated information on VOCs in order to evaluate any health impacts. There are several monitoring technologies that could potentially be used as suggested by Commerce City, pending

[56] *Ibid.*
[57] *See* AdamsCo_PHS page 6, Pehearing Statement of Exhibit 2 of Community Organizations ("CO_PHS_EX_002") page 13, APCD_PHS, and WG_PHS page 8
[58] *See* CommCity_PHS, page 3
[59] *See* Prehearing Statement Exhibit 2 of Commerce City ("CommCity_PHS_EX-002"), page 2

further evaluation by a workgroup. Below we describe two potential monitoring methods (an automated field gas chromatography instrument coupled with canister sampling and sensor technology coupled with canister sampling) and describe the pros and cons of each related to pre-production monitoring. Our assessment is for illustrative purposes only and is not intended as a comprehensive review nor to require a specific technology as part of the final rule. A comprehensive review of available monitoring technologies should be conducted by the workgroup to determine if the approach proposed by Commerce City would meet program goals, DQOs, desired flexibility, and feasibility criteria for a pre-production monitoring program. We do not recommend Part D, Section VI.C be revised to have specific requirements for continuous monitoring coupled with a trigger to collect speciated canister event sampling as this is premature. Further analysis of the suitability and feasibility of this approach is warranted.

One potential monitoring method could use an automated field gas chromatography instrument (Auto-GC) to capture continuous 1-hour data on speciated VOCs and use the Auto-GC to trigger a canister sample when the Auto-GC measures levels above a pre-determined threshold. Integrated concentrations of individual compounds collected by the canisters can be quantified with EPA Method TO-15. This method is currently used by the South Coast Air Quality Management District as part of the Rule 1180 Community Air Monitoring Plan for public health protection.[60] An overview of their program is available on-line.[61] This methodology allows for both continuous and event-specific speciated VOC measurements and can provide the type of data important for public health protection and many of the other types of criteria suggested to be important by other parties to the rulemaking such as high-frequency measurements, speciated samples, real-time data, etc.; however, other aspects of using Auto-GCs coupled with canister sampling may constrain the application of this method related to pre-production monitoring. For example, this equipment is significantly more expensive than other types of equipment and could be cost-prohibitive to deploy at individual sites or in an array at individual facilities, making high-density monitoring unfeasible. Also, this method requires power, which is unlikely to be available at all pre-production sites statewide.

Another potential monitoring method that applies the methodology suggested by Commerce City is a fenceline monitoring device developed by the EPA called the SPod[62]. The US EPA Office of Research and Development has been researching Next Generation VOC Emissions Monitoring Technologies for many years and recently has been focusing on the SPod. The SPod is intended to detect fenceline plumes and help identify the source by functioning similarly to the method described in Commerce City's comment. A recent advancement in EPA SPod research is the development of the VOC Emissions Tracker (VET). The VET is a combination of three VOC measurement technologies: the SPod to detect and locate VOC plumes; a miniaturized, field-deployable Auto-GC used to monitor a specific VOC pollutant of concern; and a canister

[60] WeldCo_REB_EX-013, SCAQMD. 2019. DRAFT Rule 1180 Community Air Monitoring Plan. Los Angeles: South Coast Air Quality Management District. Retrieved from: http://www.aqmd.gov/docs/default-source/fenceline_monitroing/r1180_draft_community_monitoring_plan_final_111919.pdf?sfvrsn=8

[61] WeldCo_REB_EX-014, SCAQMD. Rule 1180 Community Air Monitoring. Locations of monitors and monitored values in SCAQMD are available at https://xappprod.aqmd.gov/Rule1180CommunityAirMonitoring/

[62] WeldCo_REB_EX-015, Ramboll, 2020. SPod Technical Summary.

triggering system that can collect whole air samples when a plume has been detected[11]. Additionally, since SPods are relatively inexpensive, an array of monitors can be deployed at sites relatively cost effectively. However, this technology has to be customized for a specific compound and is still in the testing and development phase. Therefore, since this technology is emerging, it may not be suitable for a program to protect public health at pre-production facilities without further testing and analysis. For more information about the SPod, see Exhibit 15.[63] A related technology using metal oxide sensors (MOx) was deployed in the Colorado Front Range during the 2014 Front Range Air Pollution and Photochemistry Experiment (FRAPPE) campaign. The MOx sensors were co-located with a Proton Transfer Reaction – Mass Spectrometry instrument, which is a high-resolution instrument capable of measuring speciated VOCs at very low concentration levels[64]. The study investigated the ability of MOx sensors to quantify benzene using sensors and a multiple linear regression model for field calibration. The method resulted in a greater than 30% relative error. Similar to the SPod, this technology is also still in the testing and development phase and may not be suitable for a program to protect public health at pre-production facilities.

Similarly, the City and County of Broomfield have a monitoring program that is generally consistent with the approach recommended by Commerce City. The City and County of Broomfield deployed an Air Quality Monitoring Program where speciated VOC sampling occurs on a weekly basis instead of collection by a trigger.[65] Week-long time-integrated canister sampling allow for continuous collection (not continuous reporting) of air sample and a more feasible schedule of canister swapping on a weekly basis. This project does not use high frequency speciated VOC sampling. Other speciated approaches include canister samples collected from the mobile "plume tracker" or semi-speciated sampling BTEX (sum of benzene, toluene, ethylbenzene, and xylene) from the mobile plume tracker. [66]

Recommendation: We recommend the formation of a workgroup to define the specific target compounds based on monitoring objectives and use standardized health-based thresholds and monitor siting protocols to allow comparability across all sites. We do not recommend Part D, Section VI.C be revised to define specific target compounds nor requirements for continuous monitoring coupled with a trigger to collect speciated canister event sampling because this is premature. Program design parameters should be determined by a workgroup of experts and through a pilot study prior to the AQCC requiring statewide monitoring.

2. Need for Meteorological Data Collection

In addition to our concerns raised in our PHS regarding the purpose and need for collecting meteorological information (page 12), other parties offered recommendations for how to make the rule more specific with respect to meteorological data collection requirements. Specifically, 1) Community Organizations suggest that the rule be revised to explicitly require the use of an

[63] *Ibid.*
[64] WeldCo_REB_EX-016, Collier-Oxandale AM et al. 2019 Mar 5. Understanding the ability of low-cost MOx sensors to quantify ambient VOCs, Atmos Meas Tech. DOI: 10.5194/amt-12-1441-2019
[65] *See* LGC_PHS_EX-004, LGC_PHS_EX-005, and LGC_PHS_EX-006
[66] *Ibid.*

on-site anemometer, or comparable technology, and retain 1-min data;[67] and 2) the JIWG suggested language to allow for the use of representative meteorological data from another source and that 1-hour frequency measurements were sufficient.[68] We reiterate that we do not support the adoption of Part D, Section VI.C and the associated aspects of the SBAP. However, should the AQCC proceed, we believe any reference to meteorological data collection should be stricken from the rule until the explicit purpose and need for meteorological data has been established that can help to define the type of data and frequency of measurements that are necessary. Furthermore, as we explained in our PHS, the meteorological data collected by sensors is of unknown quality.

Recommendation: We recommend that the AQCC direct the formation of a workgroup to define the purpose and need, if any, for meteorological data collection. We recommend Part D, Section VI.C be revised to remove all references to the collection and reporting of meteorological data until the purpose of such data has been defined.

D. Establish Health Impact Action Level

Comments from other parties' PHS suggest requirements for speciated sampling based on site-specific thresholds.[69] We do not support those recommendations. Thresholds, or health impact action levels, or Investigation Levels should be determined based on monitoring program objectives. As we discuss above, we suggest that the goal of conducting statewide, pre-production monitoring is for protection of public health. Once the monitoring objective is decided, thresholds can be determined to meet those objectives. For the protection of public health, thresholds can be defined based on health-based objectives and a health-protective ambient air threshold would be the same regardless of site characteristics. Therefore, there is not a technical need for variable site-specific thresholds. It is not clear based on the comments provided why different sites should be held to different site-specific thresholds.

As discussed throughout this rebuttal, all parties subject to the regulation should use standardized monitor siting criteria and protocols, technology criteria for the compounds of interest, and data quality objectives to meet the monitoring requirement. Instead of calling generally for speciated sampling, it is recommended that a workgroup define exactly the compounds of interest and define thresholds for those compounds to be protective of public health. Since monitoring would be intended for health protection, there is only a need to monitor where people are located, not in uninhabited areas. Further, standardized monitoring methods are critical so that all areas are being measured equally and so that two different monitors can be cross-compared. Monitoring methods and guidelines that are accurate at the anticipated ambient concentrations should be defined prior to regulation so that all parties subject to the regulation are properly deploying monitoring that produces robust data to meet monitoring program objectives. With monitoring guidelines in place and data quality objectives controlled, it will be possible to compare data between facilities and against uniform standards.

[67] *See* CO_PHS_EX-002, pages 15 and 16
[68] *See* JIWG_PHS_EX-001, pages 21 and 22
[69] *See* AdamsCo_PHS and CommCity_PHS

Recommendation: Specific pollutants of concern should be defined by a workgroup instead of a generic call for speciated sampling. Thresholds should not be site-specific but should be determined based on protection of public health for each compound of concern.

E. Monitoring Frequency Requirements

Several parties suggested specific monitoring frequency requirements be added to the rule, including suggestions for 1-minute measurement frequencies as well as 1-hour frequencies. Prior to assessing any technology limitations to meeting this requirement, the exact compounds of interest and sensitivities must first be defined. After understanding monitoring objectives and compounds of interest, the necessity and feasibility of various monitoring frequency requirements can be evaluated.

It is important to note that if monitoring frequency requirements are more restrictive than necessary to meet the monitoring goals, the frequency criteria could inadvertently eliminate the most reliable or suitable technologies. For example, achieving highly sensitive speciation of multiple HAPs often is better served by long-term time-integrated sampling using either flow-regulated canister samples or passive monitoring methods. There is no health-based need for high frequency (such as 1-minute) sampling because it will need to be averaged to hourly concentrations for comparison with acute health exposure limits. Health effects based on short-term (acute) exposures are commonly evaluated at a 1-hour exposure averaging time. Sub-hourly exposure limits, such as Occupational Safety and Health Administration Short-Term Exposure Levels (STEL) assessed at 15-minute time weighted average exposure, or EPA's Acute Exposure Guideline Levels (AEGLs) are intended for occupational health and safety or incident safety, not for ambient air monitoring for protection of public health. For this reason, hourly measurements are sufficient to meet the objective of acute health effect protection and other longer averaging periods.

We have conducted an initial review of available monitoring technologies to elaborate on the technical feasibility of collecting 1-minute frequency speciated VOC measurements. Table 1 in Exhibit 17 generally summarizes various monitoring types and methods while Table 2 in Exhibit 17 lists equipment specifications for a cross-section of instruments.[70] Our review focuses on speciated VOC sampling methods rather than instruments that measure total VOC because without VOC speciation, regulators and health experts cannot characterize health impacts. Continuous monitoring of total VOC provides very limited information with respect to health-based evaluations. A literature review of portable and low-cost sensors was completed by Spinelle et al. (2017).[71] Their work provides an in-depth review of commercially available low-cost sensors and is complementary to information in Exhibit 17. As such, our review of low-cost VOC sensors was cursory. We recommend that a working group review available VOC

[70] WeldCo_REB_EX-017, Ramboll, 2020. VOC Technology Review.
[71] WeldCo_REB_EX-018, Spinelle L, Gerboles M, Kok G, Persijn S, Sauerwald T. 2017 June 28. Review of Portable and Low-Cost Sensors for the Ambient Air Monitoring of Benzene and Other Volatile Organic Compounds. MDPI Journal Sensors. DOI: 10.3390/s17071520

monitoring technology in order to assess the feasibility of collecting data at 1-minute sampling resolution.

Of the instruments analyzed in Table 2 in Exhibit 17, 28 of 34 instruments are capable of 1-minute sampling frequency. Importantly these 28 instruments do not include the most sensitive technologies such as automated gas chromatography (AGC) and canister samples. AGCs collect time-integrated samples and canisters perform a one-time "grab" sample. Of the 34 instruments analyzed, 14 technologies can achieve speciation of one or more VOCs while 20 technologies collect non-speciated VOC samples (i.e., "total VOC" measurement). A total of 10 of the 34 technologies tabulated are capable of both speciated VOC sampling and 1-minute sampling resolution. Importantly, some of these 10 instruments use technologies are still emerging and may not be suitable for other reasons (i.e. reliability, etc.).

The USEPA Office of Research and Development is actively researching VOC sensing technologies and have determined that the current state of VOC sensor technologies generally is more qualitative than quantitative (mostly reporting total VOC, not speciated VOC) and that detection limits tend to be too high for ambient/outdoor applications[72]. Current EPA research is investigating combination total VOC measurement which trigger flow-adjusted canister samples for leak/plume detection as discussed in detail in Exhibit 15[73]. Methods are not yet established or standardized and are being researched on a case-specific basis[74]. Due to potential reliability issues with some technologies capable of high frequency sampling and potential restrictions of highly selective and sensitive methods, the regulation should carefully consider the monitoring objective and data quality objectives when defining a sampling frequency. Additionally, higher sampling frequency can require more stringent power requirements so this regulation should also consider feasibility and power availability when designing the program.

Recommendation: We recommend that the AQCC direct the formation of a workgroup to determine the sample frequency necessary to meet the purpose and needs of the monitoring program. For protection of public health and comparison with acute exposure limits, monitoring frequency is recommended to be integrated over an hour. Sub-hourly monitoring frequency may be averaged to hourly for comparison with acute exposure limits, but sub-hourly requirements should not be mandated so as to not restrict usage of some of the most sensitive or possibly more suitable technologies.

F. Monitoring Duration

Several parties to the rulemaking have specific recommendations regarding the length of time needed to monitor prior to pre-production and following pre-production. Similar to other aspects of the monitoring program design, our recommendation is that monitoring goals need to be specified before establishing the monitoring duration requirements; therefore, we do not support specification of the monitoring duration in the rule. If the AQCC proceeds forward with pre-

[72] WeldCo_REB_EX-019, USEPA. 2019. Air Quality Sensors. Region 6 Ambient Air Regional Partners Meeting. Washington, D.C.: U.S. EPA Office of Research and Development. Retrieved from: https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=539775&Lab=CEMM
[73] *See* WeldCo_REB_EX-015
[74] *Ibid.*

production monitoring requirements despite our concerns that the rule is premature, we recommend that the rule be silent regarding the monitoring duration and instead direct a workgroup to define the monitoring duration that meets the monitoring goals and data needs.

1. Duration prior to pre-production

Several parties recommended the duration of monitoring prior to starting pre-production be changed from three days to longer periods.[75] Monitoring for three days before the start of pre-production operations would help operators confirmation that instruments are operating properly and as expected; however, a three-day period is insufficient to establish a baseline assessment, where meteorological and seasonal variability must be carefully considered. While it is in the interest of operators to collect representative baseline conditions in order to be able to quantify and isolate the background, we do not recommend this be a regulatory requirement as it is not the objective of the program. Therefore, we do not support recommendations made by Commerce City or Community Organizations that called for 90 days and 30 days of baseline data, respectively.[76] Since the objective of the program is for protection from acute health impacts and not for quantifying impacts from pre-production activities, there is no need for a baseline assessment if monitoring thresholds are set based on acute exposure limits.

2. Duration following pre-production

Several parties, us included, recommend the duration of monitoring following pre-production be changed.[77] The monitoring duration must be determined based on the program objective. For example, evaluating effects of long-term exposures on residents in nearby communities often involves periodic time-integrated sampling across various seasons and possibly various years whereas emissions characterization campaigns or acute effects of catastrophic events may involve one-time continuous sampling campaigns of days to weeks long. With the understanding that the monitoring program may be for protection of public health from acute exposures during pre-production activities, it is our position that monitoring is only needed while pre-production activities are in progress and additional monitoring would be an added burden for unspecified benefit. Therefore, we do not support recommendations made by Commerce City who requested 3 years of monitoring, or Community Organizations who suggests monitoring until there has been at least ninety (90) days without a monitored emission that triggered a speciated sample or corrective action.[78]

Recommendation: We recommend that the rule be silent regarding the monitoring duration and instead direct a workgroup to define the monitoring duration that meets the monitoring goals and data needs.

[75] *See* CommCity_PHS_EX-002, page 3; CO_PHS_EX-002, page 13
[76] *Ibid, page*
[77] *See* CommCity_PHS_EX-002, page 3; CO_PHS_EX-002, page 13; JIWG_PHS_EX-001, page 19; Prehearing Statement Exhibit 1 of Weld County ("WeldCO_PHS_EX-001"), page 2
[78] *See* CommCity_PHS_EX-002, page 3; CO_PHS_EX-002, page 13

G. Data Quality Indicators and Acceptance Criteria

Data quality indicators (DQI) and acceptance criteria are part of the DQO process and should be specified in the quality assurance plan for any monitoring project. DQI include the following:

- Detection limit/sensitivity – How low and high will the instrument measure reliably for the pollutants of concern?
- Bias/Accuracy – Does the instrument routinely measure high or low with respect to the true value? How should monitoring personnel assess bias and correct for it in its quality assurance procedures? Some established methods such as EPA Method TO-15 have common quality objectives that specify an accuracy of +/- 25%.
- Precision – How similar are the measurements from multiple units of the same type? If we are comparing measurements across multiple units, what constitutes significant difference given instrument precision?
- Data completeness – What is the reliability of the instrument? How much data is required to meet quality objectives including QA samples?
- Comparability – Are methods comparable across samples?
- Calibration – Do instruments respond in a systemic fashion as concentrations change?
- Response time – How fast does the response vary with concentration changes? How quickly do we need it to?
- Selectivity/specificity – To what compounds does the instrument respond? Does it respond to anything else?
- Interferences – Does anything besides the target compound(s) impact instrument response?
- Poisoning and expiration – How long will the sensor/monitor be useful?
- Drift – How stable is the response?
- Climate susceptibility – Do meteorological parameters such as relative humidity, temperature, and solar radiation impact data quality?
- Response to loss of power – What happens when the instrument loses power?

Acceptance criteria is defined as part of the DQO process to develop appropriate DQIs as part of the sampling and analysis design. Acceptance criteria is often defined as a percent tolerance for each DQI parameter.

Recommendation: We recommend that the AQCC direct the formation of a workgroup to determine the DQI and acceptance criteria necessary to meet the purpose and needs of the monitoring program.

H. Site Characteristics/Constraints

Several operators provided comments regarding their past experiences with monitoring that are important to consider. In this section we discuss characteristics of pre-production monitoring sites that could potentially constrain the feasibility of deploying some monitoring systems. We provide this information to support future assessments that may be conducted by workgroup and/or operators. The site characteristics that could be important to consider when assessing the

feasibility of monitoring technologies include: on-site power availability, connectivity availability, ease of deployment (i.e. the feasibility of deploying a technology at the site within a logistically-required timeline), monitoring duration, and site topography. The remoteness of some pre-production sites may severely restrict the type of equipment that is feasible to deploy.[79] For example, not all pre-production sites have access to electrical power, so when the workgroup is considering program design is it important to evaluate if there are suitable technologies that do not require electrical power. Similarly, not all pre-production sites have reliable cellular services to enable equipment connectivity to transmit data in real-time. Further, it is important to consider the relatively short-duration of pre-production activities (i.e., typically around two months of activities or less) and the logistical timing constraints for short duration monitoring programs. Some monitoring technologies such as optical path instruments require the ability to have line of sight between instruments. This could be challenging in areas of steep terrain.

Recommendation: We recommend that the workgroup consider the unique siting characteristics and potential constraints associated with monitoring pre-production activities as part of a feasibility check when evaluating monitoring program design.

I. Monitor Siting

As we state in multiple places, we do not support the adoption of Part D, Section VI.C and the associated aspects of the SBAP. However, should the AQCC proceed forward with the rule, we provide our comments on concerns and suggestions raised by other parties in their PHS related to monitor siting including: 1) to focus monitoring requirements in areas where there are occupied dwellings in proximity to the site,[80] and 2) to require fenceline monitoring.[81]

1. Monitoring applicable to locations in proximity to occupied dwellings only

Consistent with our previously stated position, we recommend that monitoring goals be defined before specifying monitoring siting requirements; therefore, we do not support specification of the monitoring locations in the rule. If the AQCC proceeds forward with pre-production monitoring requirements despite our concerns that the rule is premature, we recommend that the rule be silent regarding the monitoring locations and instead direct a workgroup to define the monitoring locations that meets the monitoring goals and data needs. While we support limiting the monitoring requirements to areas with occupied dwellings (provided that a goal of protection of public health is specified) there is significant uncertainty regarding the relevant distances to analyze. Specification of distances between pre-production sites and dwellings would be a key criterion for the workgroup to define.

2. Monitoring must include a fenceline requirement

Fenceline monitoring systems are typically used to quickly respond to incident-based releases that threaten public health and to determine possible impacts on health for communities that

[79] Note that other program design considerations (such as a decision to monitor only at exposure receptor locations) could establish that there is not a need to conduct monitoring in remote locations and thus logistical considerations associated with monitoring at remote locations would no longer be a concern.
[80] *See* JIWG_PHS_EX-001 and LGC_PHS
[81] *See* CommCity_PHS-EX-002 page 3, CO_PHS page 6, EDF_PHS page 10, and LGC_PHS page 14

reside in proximity to a facility fenceline. If this is the intention of the monitoring program, the monitoring framework needs to include a clear definition of what a "fenceline" is and how a signal will be atrributed to the originating source in order to rapidly respond. If multiple fencelines exist in close proximity, it will be challenging to properly attribute and respond quickly and efficiently. If the nearest receptor is far from a source, fenceline data does not provide information about exposure. The objective of a fenceline monitoring requirement and the conditions under which the fenceline monitoring is required should be clearly defined. Without careful and deliberate guidance and instruction on monitoring and data quality objectives, there is a risk that data will not be useful for drawing meaningful conclusions or taking appropriate actions[82]. For public health protection, monitors should be located where they are representative of community exposure, not at a fenceline. A fenceline measurement cannot be used to assess health impact since people do not reside in that location.

Furthermore, well pads are often surrounded by high temporary walls to block sound and light during the pre-production period and the placement of these walls will make monitoring challenging due to the impact on meteorology and dispersion of pollutants. Weld echoes the concerns discussed by Zimmerle and Riddick in their public comments,[83] that the regulation should carefully consider the presence of these sound walls in the definition of a "fenceline" should the AQCC choose to include a fenceline requirement in the rule.

Recommendation: We recommend that monitors should be sited where representative community exposure occurs for protection of public health, not at a fenceline where measurements cannot be compared to health standards.

J. Monitoring Methods

As we state in multiple places, we do not support the adoption of Part D, Section VI.C and the associated aspects of the SBAP. However, should the AQCC proceed forward with the rule, we recommend the scope of the rule clarify the intent to conduct monitoring using ground-based monitors. Further, we provide an overview of how the technical feasibility of monitoring methods could be assessed by a workgroup to help inform program design and confirm feasibility of implementation. We provide this information to support future assessments that may be conducted by workgroup and/or operators.

1. Focus scope on ground-based measurements

As we were concerned with in our prehearing statement (pages 7 and 8), the vagueness of the proposed rule has led to a variety of comments that are not focused on specific goals and objectives. In particular, 350 Colorado provided the following comment: "Data shows that quantifying methane using satellite imaging and atmospheric inverse modeling is capable of providing in-depth information about a particular site or area that field observations are not able to capture."[84] If the AQCC proceeds forward with pre-production monitoring requirements

[82] *See* WeldCo_PHS_EX-005
[83] *See* Zimmerle and Riddick. 2020. Public Comments submitted to AQCC on Proposed Revisions to Regulation 7.
[84] *See* Prehearing Statement of 350 Colorado ("350CO_PHS")

despite our concerns that the rule is premature, we recommend that the rule SBAP be revised to specify that the intent of the rule is to focus on ground-based measurements.

While the use of the TROPOspheric Monitoring Instrument (TROPOMI) satellite and sophisticated inverse modeling to estimate emissions from oil and gas operations is a viable top-down emissions estimation approach, it likely does not meet the purpose and needs of a pre-production monitoring program. There are pros and cons to satellite and surface observations. One is not necessarily more in-depth than the other. TROPOMI captures total atmospheric column methane. There are advantages and disadvantages to this. In the column total, it will "observe" plumes aloft associated with the sources of interest but also methane associated with distant sources. Additional, complex calculations are required to estimate surface concentrations from a column total. TROPOMI has more-or-less continuous spatial coverage, compared with surface observations at fixed points. Surface observations will typically have greater precision and accuracy, use direct measurement methods, and do not have the problems associated with clouds and viewing angles that can limit the temporal completeness of satellite-based measurements.

TROPOMI data is constrained by the 7 by 7-kilometer pixel size, and this might be too large for characterization of emissions or nearby concentrations at an individual well or facility. Furthermore, the research described in the paper sited by 350 Colorado should be considered a pilot study as it does not represent a turnkey capability.

Higher resolution satellite methane observations are available. The GHGSat-D[85], for example, is a very high-resolution instrument operated by a private corporation. It has a pixel resolution of 50 by 50 meters. Jacob et al. (2016)[86] indicated that this instrument can conceivably detect sources as small as about 0.25 metric tons of methane per hour, but many oil and gas well operations emit at much lower rates. The Jet Propulsion Laboratory operates an aircraft-mounted sensor that can measure methane sources with a 3 by 3 meter pixel resolution[87]. The JPL measurements were used for California Air Resources Board assessments of methane emissions. Pilot studies would be needed to assess the applicability of high-resolution aircraft or satellite-mounted sensors to address the requirements of the proposed rule. It is not yet clear that these could completely replace ground-based concentration measurements.

Recommendation: We recommend that the rule SBAP be revised to specify that the intent of the rule is to focus on ground-based measurements. The use of satellite or aerial platforms are beyond the scope of Regulation 7 to monitor emissions from individual regulated sources of ozone precursors. Further, they cannot meet the need for public health monitoring of receptors

[85] WeldCo_REB_EX-020, GHGSat, 2020. Global Emissions Monitoring. Retrieved from: https://www.ghgsat.com/
[86] WeldCo_REB_EX-021, Jacob, Daniel J., Alexander J. Turner, Joannes D. Maasakkers, Jianxiong Sheng, Kang Sun, Xiong Liu, Kelly Chance, Ilse Aben, Jason McKeever, and Christian Frankenberg, 2016. Satellite Observations of Atmospheric Methane and Their Value for Quantifying Methane Emissions, Atmospheric Chemistry and Physics 16 (22): 14371–96. DOI: https://doi.org/10.5194/acp-16-14371-2016.
[87] WeldCo_REB_EX-022, NASA Jet Propulsion Laboratory, 2019, Nov 6. A Third of California Methane Traced to a Few Super Emitters.

and sources. While these platforms represent great scientific opportunity for study, they are inappropriate for regulating sources.

2. Technical Feasibility Assessment

Prior to finalizing a monitoring program with specific design criteria, an important final step is to assess the technical feasibility of implementing the monitoring program to assure that the program specifications can be met. A list of feasibility criteria should be developed based on monitoring objectives and common site characteristics. For example, power availability may be limited in some locations limiting the use of many technology types. There may also be combinations of regulation requirements that limit the feasibility of the program, such as combinations of pollutant selectivity and sensitivity with high frequency data reporting. A more well-defined program objective and design will enable feasibility criteria to be established and assessed prior to implementation. Once feasibility criteria have been developed, there should be an assessment of available technologies relative to each criterion. This will inform whether there are sufficient technology options that meet all feasibility criteria or if feasibility restrictions cause a necessary change in program design in order to meet objectives. This step is particularly important to enable the Division to realize the goal of a flexible monitoring program whereby multiple technologies are both suitable for the monitoring goals and are also feasible to deploy at pre-production sites statewide.

With the understanding that the intended objective of the regulation is for the protection of public health, we consider a monitoring program designed to assess acute community exposure to benzene and toluene from pre-production as an example of how the AQCC or a workgroup could step through the program design process in order to assess technical feasibility of program implementation. In this example, to align with the monitoring objective of evaluating acute health impact, the collection frequency must be at least 1-hour resolution for comparison with acute health impact action levels. To evaluate acute health impact throughout the entire period, the monitoring program should operate continuously throughout pre-production activities. For this example, we evaluate which technologies are suitable for this conceptual monitoring program. Table 2 in Exhibit 17 contains 34 VOC monitoring instruments that represent a reasonable range of commercially available technologies across all monitoring technology types. Only 14 of the 34 instruments are capable of sampling speciated VOC including benzene or toluene. These instruments include AGC, open path and optical remote sensing technologies, and PID (with upstream compound filtering/separation) technologies.

To evaluate ambient levels of benzene and toluene, suitable instruments would need detection limits in the 0.1-2 ppb range for benzene and in the 10's of ppb for toluene. Thirteen of 34 technologies are capable of meeting these requirements. It should be noted that not all 13 technologies can meet the requirements for both benzene and toluene. For example, Fourier transform infrared spectroscopy (FTIR) detection limits for benzene are too high for acute health impact action levels (because gas-phase water interferes with this measurement). For benzene, the most suitable technologies that meet required detection limits include AGC, canister samples, and UV-DOAS technologies.

The 13 instruments that meet detection limits for either benzene or toluene are all capable of hourly data collection frequency. Most of the instruments can sample at a frequency on the order of minutes with the exception of AGC and canister sampling which are either time-integrated over a period of 45 minutes to an hour or are a grab sample, in the case of a canister sample. An AGC is considered a continuous measurement method with hourly data collection frequency, while canister sampling is not continuous and intended for event-specific sampling. With the objective defined as continuous acute exposure monitoring, canister sampling does not meet that program requirement, thus 12 of 34 instruments meet the requirements for this conceptual monitoring program.

Site characteristics may also constrain the selection of a feasible monitoring instrument. Of the 12 remaining continuous speciated VOC technologies in Table 2 of Exhibit 17, most technologies would not meet siting criteria related to ease of deployment and power requirements. While extractive FTIR can be deployed by two highly experienced personnel in about one to two days, UV-DOAS can require significant effort to implement due to challenges with alignment of optics and reflectors[88]. This deployment limitation may be enough of a constraint that UV-DOAS implementation cannot be achieving in a reasonable timeframe. All remaining technologies in the table, including FTIR, AGC, Proton Transfer Reaction – Mass Spectroscopy (PTR-MS), and Solar Occultation Flux (SOF) technologies all require on-site power or use power from a carrier vehicle (in the case of some of the mobile methods). Therefore, at remote pre-production sites, there may be no suitable monitoring technology that meets all program requirements.

This conceptual program design exercise illustrates the many constraints that may be faced in monitoring plan design and emphasizes why a workgroup comprised of agencies, industry, monitoring, and public health experts is needed to advise on the design and implementation of a public health monitoring program to ensure program objectives are successful. If a feasibility assessment is not conducted as part of the rulemaking or the workgroup DQO process, there is a risk that the final monitoring program rule could be overly restrictive and no monitoring technologies would meet all data quality criteria and also be feasible to implement.

Recommendation: We recommend the AQCC direct a workgroup to evaluate monitoring feasibility as part of the monitoring program design process. A pilot study can help to inform the workgroup's assessment and final findings.

K. Monitoring Plan Components and Approval Process

Many parties to the rulemaking have specific recommendations regarding the monitoring plan components and approval process. Similar to other aspects of the monitoring program design, we recommend that monitoring goals be specified before establishing the monitoring plan requirements. Therefore, we do not support Part D, Section VI.C and the specification of a monitoring plan and plan components. If the AQCC proceeds forward with pre-production

[88] WeldCo_REB-EX-023, USEPA, 2011. EPA Handbook: Optical Remote Sensing for Measurement and Monitoring of Emissions Flux. Research Triangle, North Carolina: U.S. Environmental Protection Agency Office of Air Quality Planning and Standards.

monitoring requirements despite our concerns that the rule is premature, we have provided specific recommendations for changes to the monitoring plan components in our PHS Exhibit-001. We have addressed other parties' specific recommendations related to the monitoring plan elsewhere throughout this rebuttal (e.g. specification of monitoring duration, location, pollutants, event sampling, etc.) and do not address those issues further here.

We also believe that specification of the plan approval process is premature until the monitoring goals are specified and a workgroup has sufficient time to provide input regarding program design. If the AQCC proceeds forward with pre-production monitoring requirements despite our concerns that the rule is premature, we provide our comments on concerns and suggestions raised by other parties in their PHS related to the plan approval process.

1. Local government involvement in monitoring plan review processes

In their PHS and exhibits, the LGC requested that local governments be included in the monitoring plan review process[89]. If the AQCC proceeds forward with Part D, Section VI.C rules, we support the Division's addition to the SBAP related to local government involvement rather than the language proposed by LGC. Specifically, we support the addition of this statement: "In addition, the Commission expects the Division to work with operators in approving air quality monitoring plan to make sure that local jurisdiction air quality monitoring requirements and COGCC site preparation requirements are considered."[90] This language is appropriate because it acknowledges the need for coordination to uphold other agencies' requirements and is consistent with SB19-181 mandates related to local authority.

Considering every local government agency has different levels of technical expertise and resources, a standardized programmatic approach should be defined in the regulation to guide local government through the participation in the review process. For standardized and efficient review, local government should have a framework of what criteria is to be reviewed and what constitutes "meeting" that criteria. The technical capability of the agency should also be considered. With a standardized "checklist" of monitoring plan criteria, all monitoring plans will undergo fair and equal review processes.

A good example of standardized and programmatic approach taken by a state agency is the California Air Resources Board (CARB) Community Air Protection Blueprint[91] that provides a process for meeting California Assembly Bill 617's requirements to develop strategy and monitoring plans for the CARB consideration, review, and approval. The Blueprint specifically outlines the many processes, including specific criteria for air monitoring plans, to meet the legislation requirements. By defining the program objectives and requirements in a Blueprint document, there is a clear mechanism and checklist for standardized review of each monitoring plan and a process for multi-agency review. This is an example of some of the best practices that should be considered for this regulation to ensure equal and efficient involvement and review

[89] *See* Prehearing Statement Exhibit 9 of Local Government Coalition ("LGC_PHS_EX-009"), page 6
[90] *Ibid.*
[91] WeldCo_REB_EX-024, California Air Resources Board. 2018. Community Air Protection Blueprint. Retrieved from: https://ww2.arb.ca.gov/sites/default/files/2020-03/final_community_air_protection_blueprint_october_2018_acc.pdf

across the state. Another consideration is that while defining a clear programmatic approach increases the chances of successful implementation of a regulation, it is a process that will continue to evolve. For the CARB Blueprint example provided above, it should be noted that the state agency conducted outreach and engagement of the legislation through a multi-stakeholder Consultation Group. In a meeting of the Consultation Group as recently as August 5, 2020, the Group is proposing a number of updates to the Blueprint document.[92] This provides a good example for the AQCC when considering the development of monitoring regulations in that, even with a clear process and defined monitoring objectives, a flexible process is necessary, and changes are inevitable as technologies evolve.

2. Monitoring plan approval and disproval process

A number of parties raised concerns about the monitoring plan approval process.[93] For efficient and effective implementation, the regulation should clearly define acceptance criteria for the approval and disproval of monitoring plans. This will require more detailed guidelines and documentation to guide facilities in the design of monitoring plans. The approval process should also be designed to be implemented in a reasonable timeframe. Weld County and the JIWG raised concerns that the monitoring plan would not be approved with sufficient time to implement the monitoring.[94] Community Organizations and the LGC suggest in their PHS that the rule be revised to have more time to review the monitoring plan.[95] Without clear guidelines and criteria, there is a risk of significant delay during the monitoring plan approval process.

The current requirement set forth in Part D, Section VI.C of submitting a monitoring plan 45 days prior to initiating pre-production activities is ambitious and most likely does not provide sufficient time for a review and approval process until a well-defined procedural monitoring plan design and approval process is put in place. Implementation of a pilot study prior to finalizing a monitoring rule will allow for the development of improved monitoring plan review and approval processes.

3. Addition of Investigation Levels

The JIWG has recommended the monitoring plan include pollutant-specific "Investigation Levels" and actions that would be taken if levels are exceeded.[96] While we support this concept and this would be consistent with the goal of protecting public health, we continue to suggest that this rulemaking is premature; therefore, we do not support the proposed revisions to Part D, Section VI.C until the monitoring goals are defined.

Recommendation: Define standardized review and acceptance criteria for monitoring plans for efficient approval and disproval processes and clearly define local government participation and review in a standardized, procedural way.

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[92] WeldCo_REB_EX-025, California Air Resources Board. 2020 Aug 5. Meeting of the Assembly Bill 617 Consultation Group: August 5, 2020. Retrieved from: https://ww2.arb.ca.gov/resources/fact-sheets/meeting-assembly-bill-617-consultation-group-august-5-2020

[93] *See* CO_PHS, LGC_PHS, WG_PHS, and JIWG_PHS

[94] *See* WeldCo_PHS and JIWG_PHS

[95] *See* CO_PHS and LGC_PHS

[96] *See* JIWG_PHS and JIWG_PHS_EX-001

L. Data Reporting

We do not support public display of instantaneous "real-time" data since it has not yet been quality assured and may be subject to change after quality assurance procedures. Any data collected for regulatory purposes has compliance implications and must undergo thorough quality assurance and quality control procedures prior to being made publicly available. Communication of what the data means in terms of thresholds, limits, or health impact will need to be clearly defined for effective public understanding and engagement.

If data is required to be provided in "real-time", it will not undergo quality assurance and quality control procedures. If the AQCC proceeds with requiring "real-time" updates, there must be clear communication of the limitations of "real-time" data. In the case of South Coast Air Quality Management District Rule 1180 Community Air Monitoring, the following disclaimer is written on the web application:

> *Data directly reported through the automatic South Coast AQMD real time monitors have not been validated extensively, and is therefore subject to change. The results from these monitors alone cannot be used to infer health effects, but they do provide a general sense of how much of the measured pollutants are in the community at a given time. Use of South Coast AQMD's air quality monitoring data is at the user's discretion and should be done with caution. Data, information, and maps from this community air monitoring network only provide air quality information at the time of the measurements and may not adequately represent air quality conditions experienced over longer time periods. Measurements from continuous instruments may be disrupted for periodic maintenance and quality checks, as well as unforeseen power failures and instrument malfunctions. Local environmental conditions (e.g. meteorology) can vary widely across the region and may also have a substantial impact on the air quality measurements. South Coast AQMD provides no guarantee, either express or implied, as to the accuracy, reliability or completeness of data furnished via the website. Further, South Coast AQMD shall not be liable under any circumstances for any direct, special, incidental or consequential damages with respect to any claim by any user or third party as a result of, or arising from, the use of this data.*[97]

A disclaimer such as this should accompany any real-time data that has not undergone quality assurance and control procedures.

The regulation must carefully consider the feasibility of real-time data access. Real-time data requires sufficient power and connectivity at the monitoring site (which is a challenge in some remote locations) as well as significant effort to design and architect the data structures and websites to display this information in a useful and understandable way. In the case of California refinery fenceline and community monitoring rules, implementation of public access to data for fixed sites with line power and connectivity availability has ranged from one to several years for

[97] *See* WeldCo_REB_EX-014

implementation after approval of monitoring plans.[101,100] Timelines such as this are not feasible for the shorter duration of monitoring programs during pre-production activities.

M. Timeline for Feasible Implementation

As described above in detail, monitoring plans and associated implementation require careful consideration and planning and these steps take time to do well. We provide a review of the California refinery fenceline monitoring rules related to implementation timing to further support our suggestion that the AQCC consider a pilot study and delay implementation of Part D, Section VI.C.

Over the past five years, California has developed and implemented three rules requiring monitoring at refineries. Under Regulation 12-15, set forth by the Bay Area Air Quality Management District (BAAQMD),[98] Bay Area petroleum refineries must operate fenceline and community monitoring networks. Systems were required to be operational within one year of BAAQMD approval of air monitoring plans. In April 2016, the BAAQMD published guidelines for meeting the requirements of Regulation 12-15 which included an in-depth report on air monitoring approaches, capabilities, and limitations for various monitoring objectives prepared by the Division of Atmospheric Sciences of the Desert Research Institute[99]. Approved monitoring plans were published by September 2017.[100] Not all refineries were able to have fenceline monitoring systems operational within one year. As of August 2020, all refineries in the Bay Area have operational fenceline monitoring systems but not all community monitoring systems are operational.

South Coast Air Quality Management District (SCAQMD) Rule 1180 requires all large petroleum refineries to monitor at or near their fenceline and provide data quickly to the public. This rule was adopted by the SCAQMD Governing Board on December 1, 2017. The timeline set forth in the Rule was that monitoring operations would need to start within 12 months after monitoring plan approval. As of August 2020, there are still monitoring plans that have not been fully approved (SCAQMD has issued partial approvals).[101]

A concurrent statewide legislation, California Assembly Bill 1647 (approved on October 8, 2017),[102] required refinery-related community air monitoring systems be operational by January 1, 2020. None of the eight refineries in the SCAQMD air basin fully met the January 1 deadline although some had portions of their systems operational.

Together, these fenceline monitoring rules consistently demonstrate the challenges involved in designing and deploying a monitoring network and this past experience is important for the

[98] Bay Area Air Quality Management District, Regulation 12 Miscellaneous Standard of Performance, Rule 15, Petroleum Refining Emissions Tracking
[99] WeldCO_REB_EX-026, BAAQMD, 2016. Air Monitoring Guidelines for Petroleum Refineries. San Francisco: Bay Area Air Quality Management District.
[100] WeldCO_REB_EX-027, BAAQMD, 2017. Fenceline Monitoring Plans. Bay Area Air Quality Management District. Retrieved from: https://www.baaqmd.gov/plans-and-climate/emission-tracking-and-monitoring/fenceline-monitoring-plans
[101] South Coast Air Quality Management District. Rule 1180 Refinery Fenceline and Community Air Monitoring
[102] California Assembly Bill No. 1647 (AB-1647) Petroleum refineries: air monitoring systems

AQCC to consider. Even with published guidelines, monitoring plans required more than a year for approval, and implementation and deployment of monitoring systems spanned another year or more. The AQCC should carefully consider the implementation timeline for Part D, Section VI.C and promote consistent and efficient generation and approval of monitoring plans with well-defined monitoring plan guidelines.

N. Economic Impact Analysis

The Division provided an EIA pursuant to C.R.S. §25-7-110.5(4)(a) which requires that the proponent of a rule, or Division in cooperation with the proponent, provide an initial EIA to the public at the time any request for hearing on a proposed rule is heard by the AQCC. The proponent's EIA must be made based on reasonably available data in accordance with C.R.S. §25-7-110.5(4)(c)(i) – (iii). Weld County asserts that the Division's EIA for monitoring fails to meet this standard.

The Division's analysis of direct costs is deficient. Estimated costs range from $100s to $10,000s per sensor and system to comply with the proposed monitoring requirements with typical costs considered to be less than $2,500. The Division cites several sources for these costs for a myriad of different monitors:

> *For example, California's South Coast AQMD Air Quality Sensor Performance Evaluation Center (AQ-SPEC) program gas-phase sensor evaluations summary table lists twenty-two gas-phase (O_3, NO_2, CO, SO_2) sensors that ranging from $200 to $10,000. AQ-SPEC's PM sensor evaluations summary table lists 50 PM sensors ranging in estimated costs from $100 to $7,000. Similarly, Methane Observation Networks with Innovation Technology to Obtain Reductions (MONITOR) projects on Advanced Research Projects Agency-Energy's (ARPA-E) website list monitoring systems ranging from $300 to $3,000. In addition, while real-time data air monitoring during oil and gas production has only been occurring in recent year, refineries have been monitoring air quality for several years. EPA revised its National Emission Standard for Hazardous Air Pollutants (NESHAP) from Petroleum Refineries, 40 CFR Part 63 Subpart CC, in 2015 to include a fenceline monitoring work practice standard to improve the management of fugitive emissions. EPA evaluated a fenceline passive diffusive tube monitoring requirement and estimated the annualized costs for three model plants at $41,000 (18 monitoring sites), $47,600 (26 monitoring sites), and $52,500 (32 monitoring sites) per year.*"[103]

This cost estimate is incomplete and misleading. Accurate cost estimates would include more than just the equipment costs. Accurate cost estimates would also include costs for site preparation, equipment operation, reporting, and monitoring plan development and approval as they did for the SCAQMD refinery rule. While $100 could be the cost of a NOx sensor, as we have discussed and described, NOx monitoring of pre-production activities at every site is not value added and can instead be handled through an emission factor evaluation study. The SCAQMD costs are more representative of potential costs to industry than the Division's

[103] *Ibid.* page 14

estimate, particularly if the rule is determined to be for the protection of public health. In addition, the AQCC should note that AQ-SPEC does not have evaluations for VOC sensors, and that their summary tables show how some sensors are still unreliable[104]. This information was omitted from the Division's analysis.

The Division notes the USEPA has not approved a low-cost sensor and that sensor costs would vary greatly depending on the objectives of monitoring such as "pollutant of interest, field conditions, device specifications, duration of data collection, type of measurements needed, and the quality of measurements." [105] The Division goes on to acknowledge that the monitoring program is so undefined that they cannot even develop defensible costs, and instead, circumvent their statutory responsibility by deferring to operators in their monitoring plans. They further admit that "because the Division is not proposing a particular monitoring technology or method, the Division is unable to quantify the economic impact on supporting businesses and sectors."[106] Moreover, the Division does nothing to identify pollutants of interest let alone quantify the magnitude of emissions reductions necessary to assess the benefits against the costs. In sum, this EIA fails to meet even the most basic requirements of C.R.S. §25-7-110.5(4)(a) and further demonstrates that the monitoring provisions of the proposed rule are ill-conceived and premature. As such, the AQCC should remove the monitoring provisions pending a more thorough analysis and definition by the Division that complies with the statutory mandate.

IV. EMISSIONS REDUCTION FROM PRE-PRODUCTION OPERATIONS - PROPOSED RULE PART D, SECTION VI.D.1.A

A. Feasibility

The Division's assertion that the use of permanent tanks are technically feasible but not preferred fundamentally misunderstands the concept of technical feasibility.[107] While operators are physically able to route flowback to permanent tanks, it presents significant operational, environmental and safety risks that are outlined in Weld's PHS as well as PHS from experienced operators. DJBOG and Occidental both provided examples, especially during drill-out period, of safety and economic concerns of using permanent enclosed storage tanks to receive well flowbacks. Based on these comments[108] and those made by Weld County in its prehearing statement, the amount of added throughput and characteristics of the fluids will jeopardize the capability of permanent storage tanks to safely accommodate flowback. The use of temporary vessels designed for the specific purpose of flowback is not a preference but an imperative to protect the citizens and environment of Weld County.

Further, the Division ignores vapor control options on temporary vessels and dismisses them without sufficient analysis or cause. Though not "leak-tight", vapor controls on temporary

[104] WeldCo_REB_EX-028, SCAQMD, 2020. AQ-SPEC Summary Tables and Reports. Retrieved from: http://www.aqmd.gov/aq-spec/evaluations/summary-gas
[105] *See* Final Economic Impact Analysis Air Pollution Control Division ("APCD_PHS_EIA"), page 13
[106] *Ibid.* page 15
[107] *See* APCD_PHS, page 17
[108] *See* OXY_PHS, page 6; *See* Denver-Julesburg Basin Operator Group Prehearing Statement ("DGB-OG_PHS"), page 5

vessels will achieve effective and non-trivial control without the operational burden, environmental impacts, and safety risks of permanent tanks. The Division should substantiate its assertions regarding controls on temporary tanks. As brought by Oxy in their PHS[109], temporary equipment is inspected, tested and if-necessary refurbished before being placed in use on a new facility.

Altogether, the Division should revise or provide to the public a better explanation on their prehearing statement "industry commenters have stated that there may be reasons where the use of permanent tanks as flowback vessels is technically feasible but not preferred" as it conflicts with the PHS provided by operators.

B. The Division Does Not Address Safety Concerns Raised by Operators

The Division's PHS and revisions to SBAP acknowledges but fails to address the safety considerations presented by operators including Occidental, JIWG, and the DJBOG. The Division notes that the "Commission recognizes [that liquids generated drill-out phase have] a high ratio of solids to liquids.[110]". The operators share the concerns we expressed in our PHS that the entrained solids generated during drill-out would be problematic for safety reasons including:

- The requirement to control drill-out tanks limit the ability to visually monitor drill-out liquids and vessels to maintain wellbore integrity and well control;[111] and
- Enclosing and controlling drill-out tanks requires frequent and dangerous confined space entry and requires earth-moving equipment to safely remove.[112, 113,114]

Moreover, all of these operators have indicated that emissions during drill-out are minimal and that the minimal emissions controls are not worth the risk to operator personnel and public safety. Weld considers the safety of its residents and those conducting business within its jurisdiction to be an imperative, and not a preference. As such, we strongly concur with Occidental, JIWG, and the DJBOG and request that, <u>at a minimum</u>, Section VI.A. exclude drill-out emissions.

C. Economic Impact Analysis

The Division provided an EIA pursuant to C.R.S. §25-7-110.5(4)(a) which requires that the proponent of a rule, or Division in cooperation with the proponent, provide an initial EIA to the public at the time any request for hearing on a proposed rule is heard by the AQCC. The proponent's EIA must be made based on reasonably available data in accordance with C.R.S. §25-7-110.5(4)(c)(i) – (iii). Weld County asserts that the Division's EIA fails to meet this standard. First, the Division's analysis of emissions is limited to methane only and ignores emissions of VOC and NOx whose control is the purpose of Regulation 7. The Division admits that "Flowback activities likely emit other hydrocarbons, including VOCs, although the Division

[109] *See* Occidental Petroleum Prehearing Statement, Exhibit 004 ("OXY_PHS_EX-004")
[110] *See* APCD_PHS_SBAP, page 7
[111] *See* DGB-OG_PHS, page 5
[112] *Ibid.*
[113] *See* JIWG_PHS, page 11
[114] *See* OXY_PHS, page 6

does not have sample data to understand the magnitude of the VOC emissions."[115] Methane is the most volatile hydrocarbon and when hydrocarbons start evolving, methane would be the first to produce. VOC would be significantly lower for flowback operations. Additionally, the Division does not address increases in products of combustion of captured vapors. The Division's analysis is incomplete, and this EIA should not be used to regulate ozone and its precursors.

The costs in this EIA only appear to consider the cost of tankage and does not consider the costs for enclosed combustion devices, flares, vapor recovery units, or compression to capture or destroy the vapors. Further, the costs proposed in this analysis suffer from the same flaws as described in Section II.C.A of this rebuttal in that they ignore or deviate from the EPA Cost Control Manual in the calculation of direct and indirect capital, operating and maintenance costs. The simplistic approach provided by the Division is egregiously low.

Weld County asserts that the EIA is inadequate, and the Division has not met the requirements of C.R.S. §25-7-110.5(4)(a). As such, the AQCC should direct the Division to revise the EIA to be consistent with established EPA methodologies and common industry practice while providing full disclosure of all reasonably available data considered, including detailed calculations and documented sources.

V. NATURAL GAS-FIRED ENGINES EMISSIONS STANDARDS - PROPOSED RULE PART E, SECTION I

A. Economic Impact Analysis

The Division provided an EIA pursuant to C.R.S. §25-7-110.5(4)(a) which requires that the proponent of a rule, or Division in cooperation with the proponent, provide an initial EIA to the public at the time any request for hearing on a proposed rule is heard by the AQCC. The proponent's EIA must be made based on reasonably available data in accordance with C.R.S. §25-7-110.5(4)(c)(i) – (iii). Weld County asserts that the Division's EIA for disposal operations fails to meet this standard.

The Division states repeatedly throughout the EIA that information was requested from operators for cost estimates of control but they were not provided; however, the Division does not provide any records of request or response. On this basis, the Division states that the information is not reasonably available, and instead relies on a series of dated studies rulemaking adjusted for inflation[116]. The Division provides only summary tables without supporting calculations or data, so it is not entirely clear how control cost estimates are developed. However, it is clear that the methodology used does not seem to align with the methodologies established in the EPA Air Pollution Control Cost Manual, EPA/452/B-02-01, January 2002 Sixth Edition which is traditionally applied when performing BACT and RACT analyses on these technologies. This

[115] *See* APCD_PHS_EIA, page 16

[116] The Division cites "ELRE Cost Study for Retrofit Legacy Pipeline Engines to Satisfy ½ g/BHP-hur NOx". May 2009; "Control Costs for Reciprocating Internal Combustion Engines at Major and Area Sources". Alpha-Gamma Technologies. April 2006; "Technical Support Document for Controlling Emissions from Stationary Reciprocating Internal Combustion Engines and Turbines". Illinois EPA. 2007. All adjusted for inflation using Department of Labor CPU-I data.

established approach addresses direct and indirect installation costs which the Division's EIA overlooks such as:

- Foundations and/or structural supports;
- Handling and erection;
- Electrical installation;
- Piping and mechanical installation;
- Insulation and painting;
- Engineering;
- Construction and field expenses;
- Start-up and commissioning;
- Performance testing;
- Flow modeling;
- Training;
- Freight;
- Sales tax; and
- Contingencies.

Furthermore, the Division's O&M and indirect costs appear to be incomplete and egregiously low. The methodology referenced above typically incorporates the following direct and indirect annual costs into the assessment:

- Operating labor
- Supervisory labor
- Maintenance labor and materials
- Annual performance testing
- Catalyst cleaning and replacement
- Utilities (which are addressed in the Division's assessment)
- Maintenance overhead
- Administrative charges
- Capital recovery
- Property tax
- Insurance

As an example, for rich burn RICE applications that apply NSCR, EPA-453/R-93-032 recommends applying factors of 45%, 33% and 20% to the purchased equipment cost (which includes freight and tax) to account for direct installations costs, indirect installation costs, and contingency respectively to represent the total one-time capital investment cost, which is usually about double the purchased equipment cost. The USEPA provides recommended values and factors to be applied to estimate these direct and indirect annual costs in EPA-452/B-02-01, which similarly significantly exceed those values identified in Table 2, Table 5, and Table 8[117]. Additionally, these tables are unclear regarding the calculation of annualized total costs as amortized capital expense, depreciation, non-recurring one-time costs, operation and

[117] *See* APCD_PHS_EIA, pages 5, 7, and 10

maintenance do not add to the annualized costs. The formulae used to derive these costs were not disclosed. Also, some NOx abatement technologies create a backpressure on the RICE that diminishes the Brake Specific Fuel Consumption (BSFC), or otherwise impose a fuel and/or performance penalty that should be captured in any cost analysis.

Therefore, Weld County asserts that the EIA is inadequate, and the Division has not met the requirements of C.R.S. §25-7-110.5(4)(a). As such, the AQCC should direct the Division to revise the EIA to be consistent with established EPA methodologies and common industry practice while providing full disclosure of all reasonably available data considered including detailed calculations and documented.

VI. REBUTTAL TO CONCEPTUAL COMMENTS

Other parties commented more broadly regarding air quality concerns not specific to the rule language. In some cases, these comments are misleading and it is important to correct misinterpretations as we do for three topics below.

A. Climate Change

The following statements are in response to comments made about climate change by NPCA[118,119], EDF[120], and LGC[121]. GHG emissions reductions measures are not the objective of these rulemaking and are already being addressed by other bills including, but not limited to SB 19-181, SB 19-096, and HB 19-1261. Additionally, the State of Colorado has initiated a GHG Roadmap. The GHG Roadmap is a roadmap of potential actions to curb GHG emissions from a variety of source sectors including transportation, electricity generation, structural, oil and gas, non-oil and gas industry, and agriculture (Energy + Environmental Economics 2020)[122]. During the June 2020 AQCC Meeting, the model inputs used for the GHG Roadmap were presented and model results are expected to be available in October 2020. Currently, the public feedback period has ended and AQCC is updating the GHG Roadmap based on feedback.

Importantly, in Colorado, the oil and gas sector is not the largest source of GHG emissions. In Colorado, the oil and gas sector ranks third in overall GHG emissions, behind on-road mobile and non-road sources. With respect to the comment from NPCA on page 25 of their PHS that "oil and gas engines contribute significantly to Colorado's climate problem, and are among the top sources of greenhouse gas emissions from the oil and gas sector" it is important to note that engines associated with oil and gas sector are significant within the oil and gas sector; however, based on previously stated sector ranking contributions, engines are not the primary source of GHG emissions statewide. Furthermore, greenhouses gases effecting climate change include methane (CH_4), nitrous oxide (N_2O), carbon dioxide (CO_2), and fluorinated gases and do not include nitrogen oxide (NOx) emissions. Additionally, oil and gas VOC emissions have decreased by roughly 50% from 2011-2017 and are projected to decrease further by 2020

[118] *See* Prehearing Statement of National Parks Conservation Association ("NPCA_PHS"), page 3
[119] *See* NPCA_PHS, page 25
[120] *See* EDF_PHS, Page 6
[121] *See* LGC_PHS, Page 7
[122] WeldCo_REB_EX-029, Energy + Environmental Economics, 2020. CO GHG Roadmap Scenarios.

(RAQC 2020)[123]. Flaring operations, which are major contributors to GHG emissions nationwide, are significantly below the national average in Colorado. It is estimated that 0.20% of gas is flared in Colorado versus 4.75% on a national average[124].

B. Concern that Oil and Gas Methane Emissions are Not Decreasing

In their PHS, EDF raised a concern that oil and gas emissions in Colorado are not decreasing despite new control requirements. EDF specifically stated "Analyses of three different emissions studies conducted by aircraft in the Denver-Julesburg Basin show no indication of a decreasing oil and gas methane emissions trend".[125] It is our view that the studies in question cannot be used to determine oil and gas methane emissions trends, and this assertion is not supported by long-term CDPHE monitoring data collected at Platteville.

To support their statement, EDF PHS provides an exhibit (Exhibit 5) that cites an executive summary of Boulder Reservoir Air Monitoring Study Results[126]. This exhibit indicates that oil and gas methane emissions are not decreasing but does not provide sufficient information or citations to support this conclusion. EDF Exhibit 5 references a presentation that was not include in the record; however, we have inferred that the three studies referenced are likely based on 2 aircraft and one tower study included in a recent paper by Helmig (2020).[127] Helmig (2020) presents data for these three studies. The studies were short-term studies conducted in 2008, 2012, and 2015. The study in 2008 was for the summer, the 2012 study was for 2 days in May, and the 2015 study was for March. The uncertainties listed for these results are substantial. Helmig (2020) indicates that these "data points are too few, and uncertainties are too large, to make statements about potential trends in the methane flux over this time window with statistical certainty." Vaughn et al. (2018) state that "direct comparison of emission estimates from methods covering widely different timescales can be misleading", and this clearly applies to the three studies in question.[128]

Most importantly, the concern that oil and gas emissions are not decreasing is not supported by long-term monitoring conducted by CDPHE at Platteville, Colorado. Trends in ethane, propane, and n-butane monitored at Platteville show substantial downward trends with reductions of 64%, 68%, and 71%, respectively, for the period 2013-2018.[129] Ethane, propane, and n-butane are all compounds emitted by the oil and gas industry. Methane monitored at Platteville declined by 71% during the same period; however, we note that the reliability of reported methane

[123] WeldCo_REB_EX-030, RAQC, 2020. Draft Serious State Implementation Plan for the Denver Metro and North Front Range Ozone Nonattainment Area. August 7, 2020. Regional Air Quality Council. Page ES-4. Available at: https://raqc.egnyte.com/dl/1jnuIp02fH/FinalDraft_SeriousOzoneSIP2008NAAQS_2020-08-07_ab.pdf_

[124] WeldCO_REB_EX-031, Colorado Oil and Gas Information System (COGIS). Retrieved from Colorado Oil and Gas Conservation Commission: https://cogcc.state.co.us/data.html

[125] *See* EDF_PHS, page 4

[126] *See* Prehearing Statement Exhibit 5 of Environmental Defense Fund ("EDF_PHS_EX-005"), page 2

[127] *See* Prehearing Statement Exhibit 9 of 350 Colorado ("350CO_PHS_EX-009")

[128] *See* WeldCo_REB_EX-002

[129] WeldCo_REB_EX-032, Ramboll, 2020. Fact Sheet: Decline in Measured Volatile Organic Compound Concentrations in Southwestern Weld County

concentrations is compromised by laboratory errors. These measured VOC reductions are significant. Furthermore, these monitored reductions are generally consistent with estimated decreases in oil and gas VOC emissions between 2011 and 2017 reported by the Regional Air Quality Control Council (RAQC)[130].

Given its location and long-term monitoring record, the Platteville monitoring site is more suitable than other measurements to assess the efficacy of oil and gas VOC emission reduction measures. To show that the Platteville data is representative and can be used to assess the effects of emissions reductions, Ramboll completed an in-depth analysis of the representativeness of this site.[131] Ramboll used the National Oceanic and Atmospheric Administration (NOAA) HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) atmospheric transport and dispersion modeling system to calculate back trajectories for select days in 2018 at the Platteville site. The results clearly show that air masses sampled at Platteville are representative for a wide area of the basin and are not unduly representative of local sources near the monitor. Overall, Platteville station monitoring data and RAQC emissions inventory data indicate that emission control measures on the oil and gas industry have reduced VOC concentrations in northern Colorado, contrary to the concerns raised in EDF's PHS.

C. Emissions Transport in the North Front Range

The Local Government Coalition expressed concern about the transport of pollution from oil and gas sources into their jurisdictions, specifically commenting that:

> *"Interpretations with three different data analyses approaches consistently found much higher VOC pollutants coming from northeast of the monitor location. Oil and gas operations are very concentrated in Weld County, which is located to the northeast of the monitoring site. Air transported from oil and gas regions brings in elevated VOC levels. The source region for VOCs overlaps with the source region for high ozone occurrences, which strongly suggests that oil and gas emissions contribute significantly to exceedances of the ozone standard at the Boulder Reservoir monitoring site."*[132]

The Northern Front Range Metropolitan Area (NFRMA) is located between the Rocky Mountains (west) and the High Plains (east) with an elevation variance of 1,500 up to 4,300 meters. In summer months, the local meteorology is primarily controlled by thermally driven, terrain-induced, diurnal flow patterns (Toth & Johnson, 1985)[133]. This meteorology has a unique

[130] *See* WeldCo_REB_EX-032, page 1 and 2
[131] WeldCo_REB_EX-033, Ramboll, 2020. Memorandum: Platteville Back Trajectory Analyses.
[132] See LGC_PHS, page 12
[133] WeldCo_REB_EX-034, Toth, J. J., & Johnson, R. H.,1985. Summer surface flow characteristics over northeast Colorado. Monthly Weather Review, 113(9), 1458–1469. DOI: https://doi.org/10.1175/1520-04932

effect on transport, mixing, and photochemical processing of local emissions[134,135,136]. During the night, radiative cooling of the surface causes downslope drainage flows from the Continental Divide in the West, far into the Eastern Plains. This meteorology can cause pooling of nighttime emissions from urban, agricultural, and oil and gas development sources in the lower elevations. A modeling analysis by Pfister et al. (2017) indicates that emissions from the Denver metro area pool in the Platte River Valley. That is to say that urban emissions pool in the area with a high density of oil and gas sources. During the morning hours, solar heating of the ground and mountain slopes causes upslope flow to develop. After sunrise, these emissions become subject to photochemical processing and transport to the northwest, west, and southwest (across the urban area) after the onset of the upslope flows. Fresh emissions from the NFRMA, mixed with these partially processed air masses from the Platte Valley, are then transported into the mountains during the day. Mountain Plains solenoid circulations[137] , can bring ozone and its precursors eastward and aloft and these can be mixed down to the surface over the Plain. A regime of local circulations continuing for days can lead to the buildup of local ozone and its precursors.

These thermally induced circulations are pronounced when synoptic winds are weak and flows from the east and northeast are common at the Boulder Reservoir. Importantly, these meteorological conditions are also conducive to ozone formation. At the Boulder Reservoir, northeasterly daytime flows transport the air that pooled in the Platte Valley during the night and early morning hours. In other words, ozone is high at Boulder Reservoir when the flow is northeasterly or easterly because these conditions are conducive to high ozone and source composition is complex due to the pooling of emissions from sources throughout the Denver Metro/North Front Range.

Importantly, singling out Weld County oil and gas emissions in the context of the LGC comment is unwarranted and unsupported. Weld County has analyzed ozone source regions for multiple monitors in the North Front Range and presents a map of the ozone source region for the Boulder Reservoir monitor in Figure 1that shows the area to the east-southeast of Boulder Reservoir has the greatest influence on peak ozone concentrations at the monitor during the 2017-2018 period. The areas with the greatest influence on monitored ozone at Boulder Reservoir are shown in orange and yellow colors and is referred to as the "ozone source region". The ozone source region is determined based on a higher frequency of back trajectories that passed through those

[134] WeldCo_REB_EX-035, Flocke, F., et al., 2019. Air Quality in the Northern Colorado Front Range Metro Area: The Front Range Air Pollution and Photochemistry Experiment (FRAPPE), JGR Atmospheres. DOI: https://doi.org/10.1029/2019JD031197

[135] WeldCO_REB_EX-036, Pfister, G.G., P. Reddy, M.C. Barth, F.F. Flocke, A. Fried, S.C. Herndon, B.C. Sive, J.T. Sullivan, A.M. Thompson, T.I Yacovitch, A.J. Weinheimer, A. Wisthaler. 2017. Using observations and source specific model tracers to characterize pollutant transport during FRAPPÉ and DISCOVER-AQ, J. Geophys. Res., DOI: 10.1002/2017JD027257, 2017.

[136] WeldCo_REB_EX-037, Reddy, P. J., & Pfister, G. G., 2016. Meteorological factors contributing to the interannual variability of midsummer surface ozone in Colorado, Utah, and other western U.S. states. J. Geophys. Res. Atmos., 121, 2434–2456. DOI: https://doi.org/10.1002/2015JD023840

[137] WeldCo_REB_EX-038, Sullivan, J. T., et al., 2016. Quantifying the contribution of thermally driven recirculation to a high-ozone event along the Colorado Front Range using lidar, J. Geophys. Res. Atmos., 121,10,377–10,390, DOI:10.1002/2016JD025229.

areas. Importantly, this analysis clearly shows that the ozone source region for Boulder Reservoir is predicted to be an area that encompasses eastern Boulder County, Broomfield County, southwest Weld County, and northwest Adams Counties. This analysis not only reveals LGC's technical inaccuracies in its PHS, it also shows obvious bias in its attempts to unduly single out Weld County in the face of contrary scientific evidence. Such failure to acknowledge the contributions of its member agencies is either a gross oversight or deliberate attempt to mislead the AQCC.

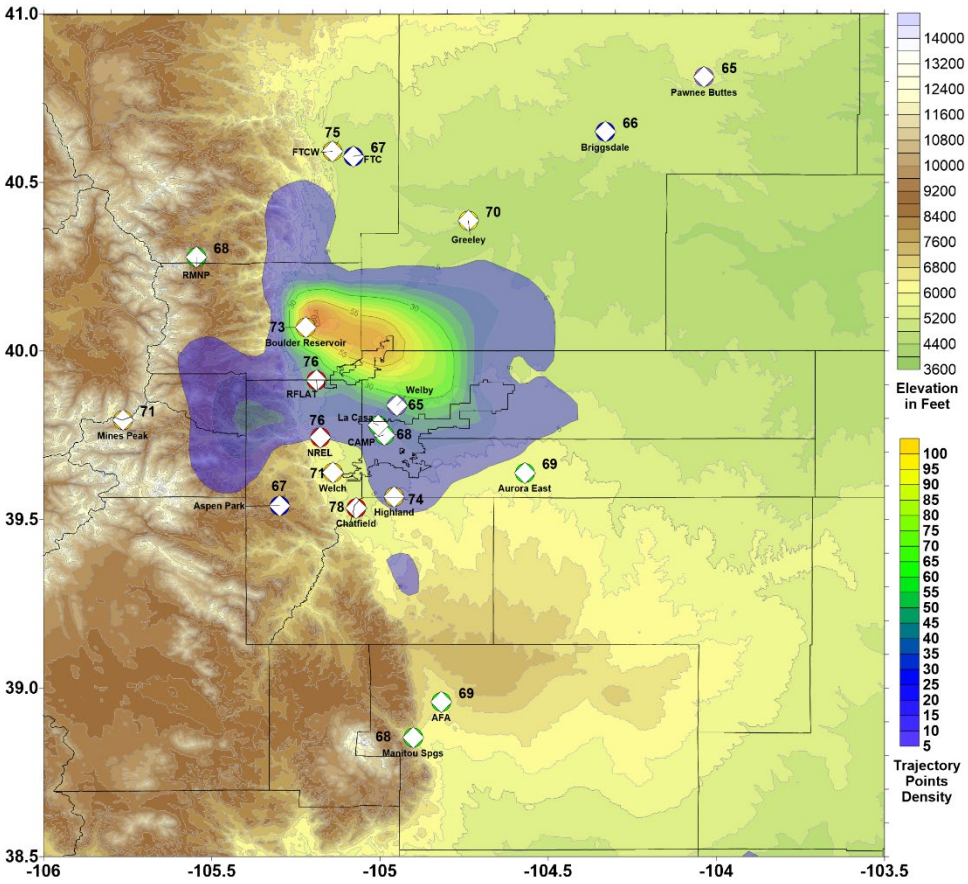

Figure 1 Boulder Reservoir Ozone Source Region Map

The data shown in Figure 1 was generated based on back trajectories for Boulder Reservoir. Back trajectories were estimated using the NOAA HYSPLIT model. The HYSPLIT model was run for those days in 2017 and 2018 with the four highest daily average 8-hour (MDA8) ozone concentrations monitored at Boulder Reservoir. For each day, a 24-hour back trajectory was generated with points for each hour in each 8-hour period contributing to the MDA8. The HYSPLIT model was initiated with 100-meter arrival heights and the EDAS 40 km meteorological fields with vertical motion. The vertical motion feature in the EDAS 40 km data set is particularly informative to establish relationships between surface concentrations and local sources because this tends to result in flows that are nearly terrain-following in most situations. After all the back trajectories were obtained, the number of points in each 0.1-degree latitude by 0.1-degree longitude grid were summed and these counts were then contoured on a map of the

Front Range region. The resulting map shows regions that are most likely to have the greatest influence on peak monitored ozone concentrations (i.e. the "ozone source region"). Figure 1 also shows existing ozone monitoring sites (shown as diamonds) with each monitor's three-year average of the annual fourth highest MDA8 for the 2017-2019 period (values are in ppb).

Pfister et al. (2017) indicate that "the analysis of wind roses does not necessarily provide sufficient information on the origin of air masses arriving at a certain location." All of the complex factors that govern transport at the surface and aloft, mixing, and dilution affect what is measured at a site and how concentrations are related to emissions upwind. Also, year to year trends in ozone from certain wind directions may be strongly influenced by trends in other aspects of summer meteorology. A few years of data insufficient for trend analyses.

VII. LIST OF EXHIBITS

1. **WELDCO_REB_EX-001 USEPA 2002**
2. **WELDCO_REB_EX-002 VAUGHN 2018**
3. **WELDCO_REB_EX-003 CDPHE-APCD 2019**
4. **WELDCO_REB_EX-004 ICF CDPHE 2019**
5. **WELDCO_REB_EX-005 HOLDER 2019**
6. **WELDCO_REB_EX-006 CUSHING 2020**
7. **WELDCO_REB_EX-007 HILL 2018**
8. **WELDCO_REB_EX-008 MCKENZIE 2014**
9. **WELDCO_REB_EX-009 STACY 2015**
10. **WELDCO_REB_EX-010 TRAN 2O2O**
11. **WELDCO_REB_EX-011 WHITWORTH 2017**
12. **WELDCO_REB_EX-012 WHITWORTH 2018**
13. **WELDCO_REB_EX-013 SCAQMD 2019**
14. **WELDCO_REB_EX-014 SCAQMD**
15. **WELDCO_REB_EX-015 RAMBOLL 2020**
16. **WELDCO_REB_EX-016 COLLIER-OXANDALE 2019**
17. **WELDCO_REB_EX-017 RAMBOLL 2020**
18. **WELDCO_REB_EX-018 SPINELLE 2017**
19. **WELDCO_REB_EX-019 USEPA 2019**
20. **WELDCO_REB_EX-020 GHGSAT 2020**
21. **WELDCO_REB_EX-021 JACOB 2016**
22. **WELDCO_REB_EX-022 NASA JPL**
23. **WELDCO_REB_EX-023 USEPA 2011**

24. **WELDCO_REB_EX-024 CARB 2018**
25. **WELDCO_REB_EX-025 CARB 2020**
26. **WELDCO_REB_EX-026 BAAQMD 2016**
27. **WELDCO_REB_EX-027 BAAQMD 2017**
28. **WELDCO_REB_EX-028 SCAQMD 2020**
29. **WELDCO_REB_EX-029 ENERGY + ENVIRONMENTAL 2020**
30. **WELDCO_REB_EX-030 RAQC 2020**
31. **WELDCO_REB_EX-031 COGCC**
32. **WELDCO_REB_EX-032 RAMBOLL 2020**
33. **WELDCO_REB_EX-033 RAMBOLL 2020**
34. **WELDCO_REB_EX-034 TOTH & JOHNSON 1985**
35. **WELDCO_REB_EX-035 FLOCKE 2019**
36. **WELDCO_REB_EX-036 PFISTER 2017**
37. **WELDCO_REB_EX-037 REDDY & PFISTER 2016**
38. **WELDCO_REB_EX-038 SULLIVAN 2016**
39. **WELDCO_REB_EX-030 RAMBOLL 2020**
40. **WELDCO_REB_EX-040 RAMBOLL 2020**

VIII. LIST OF WITNESSES

In addition to Courtney Taylor, identified previously in WeldCo_PHS, Weld County offers the following witnesses:

Julia Luongo, Ph.D., will testify about monitoring technology options. A resume for Dr. Luongo is attached as WeldCo_REB_EX-039.

Debra Kaden, Ph.D., ATS will testify about toxicology and health effects of air pollution. A resume for Dr. Kaden is attached as WeldCo_REB_EX-040.

Respectfully submitted this 25th day of August, 2020.

BOARD OF COUNTY COMMISSIONERS
OF WELD COUNTY, COLORADO

s/Bruce T. Barker

Bruce T. Barker, Weld County Attorney

CERTIFICATE OF SERVICE

This is to certify that I have duly served the within REBUTTAL STATEMENT OF THE BOARD OF COUNTY COMMISSIONERS OF WELD COUNTY, COLORADO, upon all parties herein by email this 25th day of August 2020, addressed as follows:

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s/ Bruce T. Barker, Weld County Attorney