No Scientific Evidence to Support SB19-181

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by

Barney Strobel

720-810-3836

bstrobel2@yahoo.com

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Summary

Senate Bill 19-181 directs the Colorado Oil and Gas Conservation Commission to regulate oil and gas in a manner that "protects public health." However, at present, there is no evidence that O&G is doing anything that compromises the public health.

The Commission is using a study from ICF to hold up permits for new O&G facilities because the study claims that under hypothetical conditions using a worst-case scenario, O&G facilities might produce emissions that are higher than EPA regulations. The study used unscientific sampling methods and a model that the authors themselves stated was not appropriate for the worst-case scenario.

CDPHE published their own study in 2017. In that study, scientists took 10,000 actual air samples near existing O&G facilities and did not find even one sample where the emissions exceeded EPA standards.

The Bill directs the Commission to minimize O&G emissions of methane and other hydrocarbons. Ten hydrocarbons, including methane, account for 97.6% of emissions from O&G facilities. These chemicals are non-toxic and do not have threshold health limits from the EPA. Since these chemicals do not pose a threat to the public health, the directive to minimize them exceeds the mandate of the Bill.

The Bill also directs the Commission to minimize O&G emissions of ozone precursors. Methane accounts for 84% of O&G emissions, but methane is essentially non-reactive with regard to ozone. Reducing methane will have no effect on reducing ozone. Based on numbers from the RAQC and APCD, it is likely that volatile organic compounds (VOC) produced by biogenic (natural) sources account for several times as much ozone as VOC emissions from O&G sources.

The RAQC reported that we reduced anthropogenic (man-made) VOC by 33% and anthropogenic oxides of nitrogen (NOx) by 27% from 2011 to 2017, but ozone levels in 2018 were essentially the same as in 2011. Reducing anthropogenic VOC by 169 tpd had no effect on reducing ozone.

It is clear that the air quality agencies do not know what is causing the high ozone levels. There are ozone spikes in the non-attainment area that are not caused by O&G emissions. Writing regulations to reduce VOC emissions from O&G sources will have no effect on reducing the spikes. We will never achieve the EPA ozone standard until we set up monitors to determine what is causing the spikes.

Presentation

Ever since 2008 when Denver was declared non-attainment for ozone, the air quality agencies have been ignoring scientists and engineers to write regulations with no scientific basis whatsoever.

I am here today to give you some examples where the air quality agencies are ignoring the science to write regulations and to offer some possible solutions.

I have a degree in Chemical Engineering from Princeton, and I worked in the air quality field for several years. I have experience with these issues.

Emissions near O&G facilities

Let's start with Senate Bill 181. It says the Commission is directed to regulate oil and gas in a manner that "protects public health."

The bill does not define a standard for what it means to "protect public health." In the absence of a defined standard, it is reasonable to expect that meeting EPA guidelines would constitute protecting the public health. As far as I know, all oil and gas facilities are currently meeting EPA standards, or they would be forced to fix the problem.

However, there is a link on the CDPHE website to a report presented two months ago by ICF (ICF Report) in which they claimed that they have model that shows a hypothetical condition where emissions from O&G would expose people to levels exceeding EPA standards under a worst-case scenario. The ICF Report is 380 pages long, but they chose to put this bombshell in the Executive Summary.

The Commission and CDPHE are now using the study to justify holding up new permits and writing new emissions regulations.

If the Commission and CDPHE had bothered to read just as far as page 3 in the report, they would have found that the authors state explicitly that the model they are using is not appropriate for the conditions under the worst-case scenario. They state that the model exaggerates exposures for worst-case conditions. In effect, they state that the model is defective.

In addition, for the ICF study, even though the authors state at the top of page 11 that acute health effects are based on a one-hour sample, the only samples the scientists took were three-minute samples. If you want to read how flawed this study is, read the explanation of how they derived a one-hour sample, beginning at the bottom of page 10. To create a one-hour sample, they state that they averaged twenty of the three-minute samples. However, in the third paragraph on page 11, they state that they used the highest reading for each VOC for their worst-case scenario.

For a real one-hour sample, there is no such thing as an average maximum and average minimum. There is a single reading for one hour. The approach they used is not scientifically accurate.

Their approach is similar to taking sound readings at the end of the runway at Centennial airport. From time to time, fighter jets land at Centennial. If you measure the sound at the end of the runway, there is no question that the noise level exceeds standards for about 30 seconds when a fighter jet takes off. Over the course of an hour, average sound levels may be well within standards, but if you use only the maximum value for the hour, as ICF did, you may conclude that noise levels exceed standards.

The ICF report is irresponsible. The sample technique was flawed, and the authors state that the model they are using is defective under worst-case conditions. At best, their representation that it is possible for a hypothetical condition to exist that might create excess emissions under a worst-case scenario should have been noted in the body of the report or in an appendix. It is not clear what their motive was for putting such an unscientific result in the Executive Summary.

In any event, as a result of the report, Commission Director Jeff Robbins stated that the Commission is going to start testing air pollution near homes.

But why? You can't prove a negative. No matter how much sampling they do, it is not possible to state with 100% certainty that there will never be the worst-case conditions the report used to project exposures that exceed EPA guidelines.

So how long do they expect to do this testing? A week, a month, six months, a year, two years? Does the testing serve any purpose other than to stall new permits?

More to the point, the testing amounts to a duplication of effort. There is another report on the CDPHE website done specifically for CDPHE. For the report presented back in 2017 (2017 Report) scientists collected 10,000 air samples from oil and gas production areas over the course of several years. They took samples in and around oil and gas facilities, including taking samples within 500 feet of existing production facilities. Out of 10,000 samples, they did not find even one that exceeded EPA standards. Note the report is even written on CDPHE stationery.

Director Robbins expects to perform testing near homes, but it doesn't matter if there is a house there or not. The 2017 Study showed that they did not find even one sample where emissions exceeded EPA standards within 500 feet of an existing production facility. Repeating the testing just because there is a house nearby is redundant and a waste of time and money.

How many samples do they need? They already have 10,000 samples showing that emissions do not exceed standards. What do they hope to gain with more samples?

So what can we do about it? Possible actions include:

1. Discredit the ICF report. Invite the authors of the ICF study to justify their conclusions to a legislative committee, and see if they can persuade anyone at all that the methods they used are consistent with the scientific method.

2. Bring back the 2017 report. Invite CDPHE and Director Robbins to explain to a legislative committee what is wrong with the 2017 report and why the conclusions from that report do not sufficiently offset the ICF report.

3. Pass a bill that the oil and gas industry is "innocent until proven guilty." The Committee has a report showing that there was not even one air sample in 10,000 where emissions exceeded EPA standards. There is no justification for withholding new permits based on one hypothetical situation using a defective model.

Bigger problem

While the Commission is using the Bill to hold up new permits for sites near houses, the Bill poses what may be a bigger threat to the viability of O&G facilities. The Bill actually says that the Commission **shall** adopt rules to "minimize" emissions of methane and other hydrocarbons, volatile organic compounds, and oxides of nitrogen from oil and gas facilities.

The concern here is that the Bill directs the Commission to adopt rules to "minimize" emissions without defining a standard. "Minimize" could mean meeting EPA guidelines, it could mean reducing emissions using "Reasonably" Available Control Technology (RACT), it could mean using Best Available Control Technology (BACT), it could mean using Lowest Achievable Emission Rate (LAER), or it could simply mean eliminating all emissions entirely.

It would not be possible to eliminate emissions altogether without shutting down operations. The concept of minimizing emissions for every single piece of equipment would be prohibitively expensive.

Whatever the standard, the directive to minimize emissions exceeds the authority of the Bill. The mandate for SB 181 is to protect the public health. When the Bill says "methane and other hydrocarbons," those are usually code words for greenhouse gas emissions (GHG). Nobody has ever directly linked GHG to public health issues. Any effort to claim that GHG cause climate change, and climate change is affecting the public health, is beyond the scope of the Bill.

From a public health standpoint, "methane and other hydrocarbons" are non-toxic. The EPA has no threshold health limit for these chemicals. The only danger from increased levels of these chemicals is displacing oxygen sufficiently to cause asphyxiation, but concentrations in the north front range non-attainment area (NAA) are only parts per million. There is no justification to reduce "methane and other hydrocarbons" from a toxicity standpoint.

When the Bill says volatile organic compounds (VOC) and oxides of nitrogen (NOx), those are usually code words for precursors of ozone. While ozone is a health concern, minimizing "methane and other hydrocarbons" will have little effect on reducing ozone. Methane in particular is essentially non-reactive. You could eliminate 100% of the methane emissions in the NAA, and it would have no effect on reducing ozone. So, there is also no mandate to reduce "methane and other hydrocarbons" for the purpose of reducing ozone.

That has not stopped the air quality agencies in Denver from writing regulations to reduce methane emissions. Specifically, there has been an emphasis on reducing natural gas emissions from pneumatic gas valves that vent natural gas to the atmosphere. Natural gas is mostly methane. It would be meaningful to find out how much natural gas the air quality agencies believe is being vented from pneumatic valves before we allow them to write more nuisance regulations.

Leaving methane aside, why are the air quality agencies targeting emissions from oil and gas facilities? Rather than going out and measuring the concentrations of ozone precursors in the NAA, since 2008 the air quality agencies have taken the approach that they can identify every single source of emissions and establish what level of emissions every source is producing. Once they believe they know what is producing the emissions, they then expect to use models to show what effect reducing emissions from various sources would have on reducing ozone.

For the purposes of the 2008 Ozone State Implementation Plan (SIP), once the air quality agencies had developed a list of all the sources they could identify, they put them in a table called an Emissions Inventory, which became the basis for determining how to reduce ozone. Out of a total of 519 tons per day (tpd) of anthropogenic (man-made) VOC emissions, the top sources were

condensate tanks at 216 tpd, on-road vehicles at 94 tpd, and commercial lawn and garden equipment a distant third at 28 tpd. Obviously, if you believe that reducing anthropogenic VOC levels will reduce ozone, it was an easy decision to force O&G facilities to reduce emissions from condensate tanks.

While the concept of an Emissions Inventory should work in theory, there are several problems with this approach in practice. First of all, it assumes that the air quality agencies have identified every possible source of emissions in the NAA. Second, it assumes all emissions are fairly constant on a day-to-day basis. It does not have a mechanism to allow for intermittent emission sources. Third, it uses models to define emissions levels, and different models produce wildly divergent emissions levels. Fourth, it ignores the relative reactivity of the emissions.

Consider the wide variation in emissions levels produced by models. There is a model called MEGAN that projects the levels of emissions from biogenic (natural) sources. These sources include trees, shrubs, and grasses. Ten years ago APCD used MEGAN to project that biogenic sources produced 694 tpd of VOC emissions in the NAA, and that number was included for the Emissions Inventory for the 2008 SIP when it was written. Note that anthropogenic sources produced only 519 tpd.

The air quality agencies updated the 2008 SIP in 2017. It is disturbing to note that for the updated version, the air quality agencies now show that biogenic VOC emissions in the NAA are only 170 tpd. The updated SIP claims to use the same MEGAN model that was used for the SIP ten years ago. What changed? I see only two possibilities. First, the people who used the MEGAN model ten years ago were incompetent and did not have any idea what they were doing. In that case, they should never have been allowed to write an ozone SIP. Second, the air quality agencies realized in 2017 that, since such high levels of biogenic VOC emissions might make it meaningless to reduce anthropogenic emissions, they have falsified the data.

Ten years ago, ACPD listed the levels of biogenic emissions by county on the CDPHE website. It was meaningful that the levels of biogenic VOC emissions were highest in the counties that had the highest ozone readings, Douglas (Chatfield), Jefferson (Renewable Energy Lab), Jefferson/Boulder (Rocky Flats), and Larimer (Ft. Collins West). In fact, CDPHE showed that one-third of all biogenic VOC emissions in the NAA were produced in Larimer County.

Popular opinion among the air quality agencies is that the high ozone levels in Ft. Collins are caused by VOC emissions from O&G. Apparently, it was inconvenient for the air quality agencies to show that there were such high levels of biogenic VOC emissions in Ft. Collins. By 2012, CDPHE had removed the levels of biogenic VOC emissions by county from their website.

There are more questions about the accuracy of models. There is an engineering study on the RAQC website showing projections for emissions in 2023. Part of the study shows existing emissions levels. The Colorado air quality agencies have used the MEGAN model to project levels of biogenic VOC emissions across the state, and they show biogenic VOC emissions are about 2,800 tpd. In contrast, the EPA has used a model called BEIS, and the EPA projects that biogenic emissions are closer to 5,400 tpd. Obviously, both models cannot be right.

Instead of using models that produce such wide variations in projected emissions levels, the air quality agencies should go out and measure what the levels really are.

In order to determine how to reduce ozone levels, it is critical to consider the relative reactivity of the chemicals in the emissions. As an example, imagine collecting a sample of air and then adding hydrogen to the mixture. Air is about 78% nitrogen and 21% oxygen. Under certain conditions, hydrogen will react with nitrogen to form ammonia (NH3), but under normal atmospheric conditions, even though there is far more nitrogen in the mixture than oxygen, hydrogen is far more likely to react with the oxygen (think "explosion").

The same concept applies to VOC emissions in the NAA. It does not matter how much of a certain chemical is in the air if it does not react to form ozone. Conversely, even if there is a significant amount of a certain chemical in the air, if it does not react to form ozone, then reducing that chemical will not reduce ozone.

The chart below shows why we still have high ozone. It would be helpful to look at the chart while reading the following explanation.

The first two columns show the make-up of emissions from oil and gas facilities based on the 2017 report that collected 10,000 actual air samples around O&G facilities. Note that only ten chemicals make up 97.6% of all emissions. (I have included benzene, which is a health concern, to show relative emission levels.)

The third column shows the percent by weight of the compounds considered to be VOC that actually react to form ozone. Note that even though methane and ethane make up the bulk of the emissions as measured, they are considered to be non-reactive with regard to forming ozone, and as a result they are excluded from the VOC emissions inventory.

Note that the 2017 report did not measure levels of biogenic chemicals. The two primary chemicals that make up biogenic VOC emissions are isoprene and monoturpenes. In Colorado, for sake of analysis, and in the absence of actual measurements, it should be reasonable to assume that most of the monoturpenes are alpha-pinene, which comes from pine trees. As the chart shows, it really does not matter what the relative proportions are for isoprene and pinene, but I have used a 50/50 split.

The fourth column shows the actual tons per day for each reactive VOC. In February of 2019, the RAQC published a report showing that VOC emissions from O&G sources are 154 tpd. The actual production levels in column 4 are based on the RAQC's total number of 154 tpd and then using the composition distribution actually measured in the 2017 report. For example, out of 154 tpd of total VOC from O&G, 33.8%, or 52 tpd, is propane.

The total level of biogenic VOC at the bottom of column 4 is from the updated 2008 SIP APCD published in 2017. They project that there are 170 tpd of biogenic VOC emissions, and the numbers in column 4 assume a 50/50 split between isoprene and pinene.

Column 5 is extremely important. It shows the relative reactivity of the various chemicals that make up the O&G emissions. Column 5 shows how many pounds of ozone are created if an additional pound of each chemical is added to the air. Column 6 shows normalized relative reactivity based on methane having a reactivity of 1.

There are several points to note. First, adding a pound of methane to the air mix makes essentially no ozone, which is why it is not included as a VOC. Adding a pound of butane to the mix would create 65 times as much ozone as a pound of methane, but still not very much. A pound of ethylene would create 550 times as much ozone as a pound of methane. A pound of isoprene would create 800 times as much ozone as a pound of methane.

Note also the converse here. If adding a pound of methane produces very little ozone, then taking a pound of methane away reduces ozone levels by very little.

Methane and other alkanes, which have only single carbon-carbon bonds, and which make up more than 96% of O&G emissions, do not produce even a pound of ozone from a pound of VOC. On the other hand, the alkenes, including ethylene, propylene, pinene, and isoprene, have more-reactive double carbon bonds, and they produce more than a pound of ozone from a pound of VOC, because the reaction of these chemicals creates additional chemicals that can continue to react.

Column 7 shows how many tpd would be produced from each chemical based on the distribution from the 2017 report and the reactivity shown in column 5. Note that the production levels assume that there is an adequate amount of NOx for the VOC to react with. Obviously, if there is not enough NOx, then production levels would be lower. Column 8 shows what percentage of total anthropogenic ozone is made by each VOC.

Note that even though propane makes up 33.8% of the weight of O&G emissions, it produces very little ozone, because it has such a low reactivity. Note also that even though propylene makes up less than 4% of O&G emissions, it produces the highest amount of ozone from all anthropogenic sources.

Now for the elephant in the room. According to APCD, biogenic sources create 170 tpd of VOC emissions in the NAA. Regardless of what the actual split is between isoprene and pinene, biogenic sources are creating several times as much ozone as anthropogenic sources.

To complete the chart, column 9 shows the relative reaction time for various VOC. The chart shows how long it would take for an equal amount of each VOC to react 100% under the same conditions. The chart shows that a certain amount of propane would take 13 days to react completely. It shows that the same amount of isoprene would react completely in 1.8 hours. It also shows that the same amount of methane would take 12 **years** to react 100%, which is why it is considered non-reactive. Clearly, methane is not a meaningful contributor to ozone in the NAA.

OZONE PRODUCTION BY VOC

	Emissions as Measured			Em. Inv.	Rel Reactivity		Tot Ozone Produced		Rel Rxn
	ppb	Vol %	Wt %	tpd	O3/VOC	Norm	tpd	% Anth	Time
notes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ANTHROPOGENIC				154					
Methane	3500	83.9%			0.004	1			12 yrs
Ethane	208	5.0%			0.061	15			60 day
Propane	152	3.6%	33.8%	52	0.128	32	6.66	11.9%	13 day
Butane	74	1.8%	21.7%	33	0.260	65	8.68	15.6%	6.1 day
Isobutane	33	0.8%	9.7%	15	0.330	83	4.91	8.8%	
Pentane	37	0.9%	13.5%	21	0.290	73	6.01	10.8%	
Isopentane	30	0.7%	10.9%	17	0.380	95	6.38	11.4%	
Hexane	11	0.3%	4.8%	7	0.280	70	2.06	3.7%	
Ethylene	11	0.3%	1.6%	2	2.200	550	5.27	9.4%	1.8 day
Propylene	16	0.4%	3.4%	5	3.000	750	15.68	28.1%	7 hrs
Benzene	2	0.0%	0.8%	1	0.112	28	0.14	0.2%	12 day
	4072	97.6%		154			56		
BIOGENIC				170					
a-pinene	?	50% ?	67% ?	114	1.110	278	126		3.4 hrs
Isoprene	?	50% ?	33% ?	56	3.200	800	180		1.8 hrs

(1) Average of maximum ppb based on 10,000 samples

(2) Percent by volume based on total of 4171 ppb VOC measured

(3) Percent by weight based on only the VOC chemicals listed. No other chemicals meaningful.

(4) Total tpd based on the RAQC total of 154 tpd from O&G and APCD total of 170 tpd from biogenics

(5) Relative reactivity showing how many pounds of ozone are made per incremental pound of VOC

(6) Reactivity normalized to 1 for methane. A pound of propane makes 32 times more ozone than a pound of methane

(7) Ozone tpd produced by each anthropogenic VOC source based on RAQC tpd and relative reacitvity

(8) Percent of anthropogenic ozone produced by each VOC based on RAQC tpd and relative reactivity

(9) Relative reaction time showing how long an equivalent sample size of each VOC would take to react 100%

The numbers used in the chart come from APCD, RAQC, and the research institutes that developed relative reactivity based on production and reaction time. If the numbers from APCD and RAQC are at all accurate, then it should be clear that the concerted effort to force O&G to reduce VOC emissions will have little to no effect on reducing ozone. That has not stopped the air quality agencies from writing regulations to force O&G to reduce emissions anyway.

Ten years ago, when the RAQC was writing the 2008 ozone SIP, they used the Emissions Inventory showing that the single largest source of VOC emissions in the NAA comes from condensate tanks. They wrote a regulation requiring O&G to reduce emissions from condensate tanks by 46 tpd.

At the time they were writing that regulation, the RAQC had in hand a study done by Alpine Geophysics and Environ that included a sensitivity analysis which showed how much ozone would be reduced under various scenarios of reducing precursors. The study showed that even if we reduced VOC emissions from O&G sources as much as 96 tpd, or more than twice as much as the regulations required, it would have no effect on reducing ozone.

Given that the RAQC had this study, how did the RAQC make a decision to go ahead and write the regulation? How did the RAQC Board accept the regulation? How did APCD sit by and allow the regulation to be written, when they knew that it would not reduce ozone? And most disturbing, why did the EPA accept the regulation as our only plan to reduce ozone?

The RAQC wrote the regulation forcing O&G to spend tens of millions of dollars for new control equipment, and what happened? According to a RAQC report in February of 2019, from 2011 through 2017, O&G actually reduced VOC emissions by 126 tpd, or three times as much as the regulation required, but just as the engineering companies projected, even a reduction in VOC from O&G that large had no effect on reducing ozone.

The EPA evaluates ozone based on the day with fourth highest measurement. In other words, they give us a pass for the three highest days. Ozone is then measured as the average over eight hours. Remember that the EPA 8-hour standard at the time was 75 ppb. This chart shows the comparison between the 4th highest 8-hr ozone for the four problem monitors from 2011 to 2018:

	4th max 8-hr Ozone, ppb	
	2011	2018
Chatfield	82	83
Renew. Energy Lab	83	80
Rocky Flats North	81	81
Ft. Collins West	80	81

According to the RAQC, from 2011 through 2017, we reduced VOC by 33% and NOx by 27%, but it had no effect on reducing ozone. The RAQC wrote regulations that the engineering companies said would have no effect, but they went ahead anyway, and they wasted eight years during which we could have actually been working to reduce ozone.

The fact that we have reduced anthropogenic ozone precursors by about 30% with no effect on reducing ozone raises some questions.

First, is the RAQC wrong, and we have not reduced emissions? Given that O&G has in fact installed controls on condensate tanks, emissions from on-road vehicles have gone down through attrition of older, dirtier cars, and a coal-fired power plant was shut down, it does seem reasonable that emissions have gone down.

Second, are anthropogenic sources not the primary cause of ozone in the NAA? That issue was discussed above.

Third, are there sources that APCD has not included in the Emissions Inventory? There is plenty of evidence that there are in fact emissions sources not accounted for in the Emissions Inventory. It is not clear whether the new sources are solely intermittent sources.

On July 23, 2019, we had an ozone spike in the Denver area which resulted in a high ozone day. This chart shows the hourly ozone readings in ppb at monitors from south to north:

	Chatfield	Welch	CAMP	Welby	Rocky Flats
11 am	57	51	55	52	56
12 pm	69	65	70	64	64
1pm	78	73	80	74	75
2 pm	85	85	90	77	76
3 pm	81	92	86	68	75
4 pm	103	88	70	66	70
5 pm	93	75	68	64	63

There was a light breeze from the northeast to the southwest during the day, and the temperatures were in the mid 80's. The CAMP monitor is more or less at the Convention Center, and the Welby monitor is in Thornton. That means that the Welby monitor was directly upwind of the CAMP monitor. The monitors are about 5 miles apart.

During this ozone spike, every monitor south of I-70 hit 90 ppb of ozone, but no monitor north of I-70 exceeded 77 ppb. Clearly the source of this high ozone episode was south of Welby, but north of CAMP. The most obvious source of the emission is the Suncor refinery. That is not to say that the refinery had to be the source, and since there are no monitors in the area, we can't say for sure.

What is very clear is that the source of this spike was not in Weld County. Since the breeze was from the northeast, if the source had been in Weld County, then there would have been high ozone at the Welby monitor as well.

This ozone spike is clear evidence that APCD has not identified all of the sources of precursors in the NAA. This spike appears to be caused by an intermittent source. While it may be difficult to write regulations for intermittent sources, it is **not** possible to write regulations for steady-state sources in order to try to reduce emissions from intermittent sources.

As mentioned above, popular opinion is that the high ozone at Ft. Collins West is caused by emissions from oil and gas. Note that even APCD acknowledges that the high ozone at Chatfield is probably not caused by emissions from oil and gas. What that means is that the air quality agencies are making a concerted effort to reduce emissions from oil and gas with the full understanding that such actions will not have any effect on achieving the EPA ozone standard throughout the NAA.

Worse still, the science shows that reducing steady-state emissions from oil and gas is not going to lower ozone levels at Ft. Collins West, either. There are two types of high ozone in Ft. Collins. First there is what I call the rising tide ozone, where ozone rises steadily to a point in the mid 70's and stays in the mid 70's for long enough to exceed the standard. The second type is similar to the spike shown above, where ozone rises sharply to level well into the 80's and 90's. The following charts show the difference. Please note that APCD does not take weather readings at the West monitor. The temperature, wind direction, and wind speed are from the monitor at CSU, about three miles away.

CDPHE Ozone charts for Ft. Collins West for July 9, 2018, to July 11, 2018.

Mon 9

*Hour (MST)	TEMP degF	WD deg	WS mph	O3 PPB
1 am	71	342	3	40
2 am	68	336	3	35
3 am	67	322	2	36
4 am	66	336	2	33
5 am	64	303	1	33
6 am	65	318	1	31
7 am	72	175	1	33
8 am	77	165	1	38
9 am	81	138	2	42
10 am	85	162	2	55
11 am	87	138	3	66
noon	88	160	4	76
1 pm	90	134	4	75
2 pm	93	114	3	73
3 pm	93	140	4	73
4 pm	94	118	3	72
5 pm	94	131	3	74
6 pm	94	134	3	70
7 pm	90	140	2	65
8 pm	83	111	1	59
9 pm	78	162	1	54
10 pm	75	55	1	48
11 pm	71	50	1	41
mid	69	23	1	36
8-hour average				72

Tu 10

*Hour (MST)	TEMP degF	WD deg	WS mph	O3 PPB
1 am	66	288	1	35
2 am	65	329	2	34
3 am	62	301	2	35
4 am	62	333	3	34
5 am	62	336	3	31
6 am	62	324	2	33
7 am	68	336	2	36
8 am	74	21	2	41
9 am	78	357	3	50
10 am	83	88	2	59
11 am	86	132	3	70
noon	87	153	4	79
1 pm	90	149	4	89
2 pm	93	173	4	92
3 pm	97	149	3	96
4 pm	97	107	3	86
5 pm	98	131	3	81
6 pm	96	144	3	72
7 pm	88	105	1	64
8 pm	81	162	1	60
9 pm	77	260	1	54
10 pm	75	63	1	48
11 pm	72	31	2	44
mid	69	309	2	41
8-hour average				83

We 11

*Hour (MST)	TEMP degF	WD deg	WS mph	O3 PPB
1 am	67	326	2	40
2 am	65	309	2	39
3 am	64	325	2	38
4 am	64	330	2	39
5 am	64	324	2	43
6 am	63	161	1	32
7 am	71	186	2	35
8 am	74	165	3	
9 am	78	169	3	46
10 am	83	154	2	58
11 am	88	133	3	70
noon	90	147	4	67
1 pm	92	122	3	70
2 pm	93	112	4	75
3 pm	95	122	3	74
4 pm	95	139	3	72
5 pm	95	109	3	70
6 pm	93	90	3	70
7 pm	88	80	2	65
8 pm	82	89	2	61
9 pm	80	81	2	57
10 pm	80	181	4	56
11 pm	75	98	1	56
mid	72	185	1	44
8-hour average				71

On Monday, July 9, 2018, the ozone rose from an overnight low in the mid 30's to a level in the mid 70's and stayed in the mid 70's for 7 hours. The highest reading was only 76 even though the temperature rose as high as 94 degrees.

On Tuesday, July 10, 2018, the ozone was again in the mid 30's overnight, but the ozone jumped from 59 to 79 to 89 to 96. Clearly, there were higher emissions on 7/10 than 7/9. Note that the overnight and daytime wind direction, wind speed, and temperature were about the same on both days, but on 7/10, the 8-hour average was 11 ppb higher, and the peak was 20 ppb higher.

To confuse the issue further, note that the ozone conditions on Wednesday, July 11, 2018, were again about the same as they were on 7/9. Wind speeds, wind directions, temperatures, and ozone readings were almost identical.

There are a couple of important points to note. First, with the low wind speeds, it is clear that the ozone on 7/10 did not come from out of state or from China. There had to be a local source. Second, note on 7/10 that the ozone had risen to 79 by noon. The wind direction was from the northwest through 9 am, and then switched to be from the southeast from 10 am to noon (and more). The wind speed was 2 mph, 3 mph, and 4 mph for these three hours, but these wind speeds and directions are for the CSU monitor. The West monitor, where the ozone is measured, is about 3 miles farther downwind. That means that the high ozone levels at noon had to come from a source that is no more than 6 miles southeast of CSU. That means that the high ozone could not have come from Weld County.

It certainly appears that APCD has not identified the source for whatever caused the ozone spike on 7/10, but it is clear that it was not oil and gas.

So where did the higher ozone come from on 7/10, and where did it go on 7/11? One of the problems the people living the NAA have is that the air quality agencies do not know what is causing the ozone spikes. The bigger problem, though, is that the air quality agencies don't care, and they don't want to know. Their plan is to use the steady-state emission inventory to write regulations, and they intend to ignore the high ozone caused by these spikes.

During the 2018 ozone season at Ft. Collins West, there were 12 days when the ozone rose to levels similar to 7/9 above, where ozone was in the mid 70's, but the peak never reached 80 ppb. There were also 7 days when the ozone spiked as on 7/10, with the peak ozone reaching 85 ppb and higher. These are two different types of high ozone, and we are never going to be able to meet the EPA standard without knowing what is causing the spikes.

According to the ICF study, the authors claim that the period with the highest level of emissions is during flowback activities. Certainly that makes sense. If some or all of the ozone spikes in Ft. Collins are caused by flowback activities, then it should be clear that it is not possible to meet the EPA standard by regulating steady-state oil and gas facilities like condensate tanks.

The only way to determine what is causing the ozone spike at Ft. Collins is to set up a grid of monitors to find out.

Conclusion

The primary directive of SB 181 is to protect the public health. With that goal in mind, there is no scientific basis whatsoever for the Commission to take any action to increase regulations on oil and gas. A CDPHE study demonstrated that existing oil and gas facilities are not exceeding EPA standards for emissions adjacent to the facilities. The fact that the primary emissions from oil and gas are non-toxic and relatively unreactive with regard to ozone means that reducing emissions from oil and gas will have no effect on the public health. That conclusion is supported by the fact that oil and gas reduced VOC emissions by 126 tpd from 2011 to 2017, and there was no change in ozone levels.

Even though the Denver area was declared non-attainment eleven years ago, the air quality agencies still have not measured what the levels of VOC and NOx are at the problem monitors. I went to a RAQC meeting back in 2009 to recommend that they put in monitors so that they would actually know what is causing the ozone, but the RAQC claimed that it was too expensive to put in more monitors.

Instead of spending perhaps a few hundred thousand dollars themselves to determine what is really causing the ozone, the RAQC forced the oil and gas industry to spend tens of millions of dollars to put in new controls even though the engineering company stated that it would not reduce ozone.

This past summer I priced out monitors. I could buy portable monitors for $25,000 each, and perhaps less if I buy several. If we start soon enough, we could install a small grid of monitors upwind of Ft. Collins and upwind of Chatfield before the upcoming ozone season, and we would know more about what is causing the ozone by the end of the summer than the RAQC or APCD have figured out over the past ten years.

The concept of establishing an Emissions Inventory and using models to project reductions in ozone has not worked for ten years. The RAQC and APCD have wasted ten years instead of making any effort to determine what is really causing the ozone, and they are planning to continue this failed approach.

Our air quality agencies have no accountability. For eight years then-Governor Hickenlooper sat back and said nothing while the air quality agencies did nothing. Now Governor Polis has forced the issue by withdrawing the request to postpone the “serious” designation so that the air quality agencies can start forcing new regulations on O&G with absolutely no scientific basis whatsoever.

At the very least, the air quality agencies should be forced to prove that any regulations will actually achieve a benefit before they are allowed to enact the regulation. I hope this presentation demonstrates that the concept of an Emissions Inventory and models does **not** constitute scientific proof.

All of the air quality agencies report to the governor. The RAQC and the AQCC report directly, and APCD reports through CDPHE. The governor has proven that he has no more intention to reduce ozone than Governor Hickenlooper had. The best chance we have of reducing ozone within the next three years and also protecting oil and gas from frivolous regulations is either to take control of at

least one of the air quality agencies away from the governor or to set up a new entity that will evaluate the scientific merit of regulations objectively outside of the governor's control.

With a Democratic majority in both chambers, it may be difficult for the legislature to accomplish much this session, but I believe that the Republicans can take the issue of ozone directly to the voters. The Democrats have done nothing to improve our air quality for the past ten years. If we want cleaner air, it's time to elect Republicans so that we can stop focusing a hundred percent of the attention on oil and gas and start controlling what is really causing the ozone.