



EARTHWORKS

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For more than 25 years, Earthworks has been documenting the impacts of oil and gas operations nationwide through comprehensive research, involvement with frontline communities, and since 2014, with [optical gas imaging](#) (OGI) technology - a powerful tool which makes 20 normally invisible oil and gas pollutants, including the carcinogens benzene and toluene, and methane, visible. Earthworks collaborates with scientists, government agencies, regulators, and residents. All of our thermographers (OGI camera operators) receive the same training and certification through the [Infrared Training Center \(ITC\)](#) as the oil and gas industry and regulators to do the same work of detecting and documenting pollution.

Our thermographers have spent hundreds of hours in the field filming a wide range of pollution sources and reviewing OGI footage. Our cameras are the same model used by industry and government agencies to detect leaks and chronic pollution, and our camera operators receive the same training. We have a highly qualified team to write about and publicize the resulting videos and related information.

With video evidence in hand, Earthworks' team of experts uses these videos to file official complaints with state and national regulators and/or help communities inform decision makers and put democracy to work to better protect community health.

To date in Colorado, our team has conducted almost 1900 surveys of 800 oil and gas facilities and has shared 365 observations of potential compliance issues supported by OGI evidence with regulators at Colorado's Air Pollution Control Division (APCD) and Energy and Carbon Management Commission.

Dedicated to protecting communities and the environment from the adverse impacts of mineral and energy development while promoting sustainable solutions.

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Uncontrolled release of hydrocarbons from a storage tank at an oil and gas facility in Brighton, CO

Inefficient Combustion in Enclosed Combustion Devices (ECDs) in Colorado

Since January 2022, we have conducted 1317 OGI surveys of oil and gas facilities in Colorado and have documented 352 emissions events ranging from emissions due to leaks and malfunctions, emissions from temporary sources during drilling and completions operations, and emissions due to intentional releases and maintenance activities. 98 of these observations of emissions events at 65 different oil and gas facilities were of emissions due to inefficient combustion in ECDs.¹

OGI cameras designed to visualize airborne hydrocarbons² such as FLIR GF320 cameras can detect these compounds from combustion devices on oil and gas facilities when those devices are inefficient and fail to destroy these compounds before they are released into the atmosphere. Combustion efficiency in this case is a measure of how effectively a combustion device destroys hydrocarbon compounds to control emissions. When ECDs are inefficient, their utility as control devices is undermined and they release more pollution than is desired. ECDs are intended to achieve a 95-98% combustion efficiency, which would mean only a minimal amount of hydrocarbon pollution would escape the combustion process. Whether this efficiency is actually being achieved on the ground in Colorado has not yet been determined by widespread testing and verification. In the meantime, we continue to observe significant plumes of emissions from ECDs with our OGI cameras.

It is important to note that OGI cameras cannot speciate and struggle to accurately quantify emissions. This means that while we can observe emissions from inefficient combustion, we cannot determine the quantity of specific compounds and therefore cannot make a determination about the actual efficiency of a combustion process using this observation alone. In other words, OGI evidence of emissions due to inefficient combustion is not sufficient in itself to verify that an ECD is not achieving the desired combustion efficiency.

When we observe emissions due to inefficient combustion using an OGI camera, our primary course of action is to share that evidence with compliance staff at APCD and have them prompt the operator of the site where the observation was made to investigate and assess whether an ECD is functioning properly. Of the 98 observations we have made of emissions due to inefficient combustion in ECDs since January 2022, we shared OGI evidence of 69 of those observations with APCD compliance staff using a public process for sharing air quality concerns with the agency.³

13 (19%) of those 69 investigations, consisting of observations from eleven different oil and gas facilities,⁴ resulted in operators reportedly taking corrective actions to resolve issues that may have contributed to inefficient combustion in an ECD.⁵ The most common corrective action reported by

¹ This total excludes observations of inefficient combustion in elevated flares.

² Includes such compounds as methane, ethane, propane, benzene, toluene, etc.

³ A variety of factors influence whether we share observations with regulatory agencies including quality of video/documented evidence, assessment of whether observation represents a potential compliance issue, etc.

⁴ Two facilities both account for two separate observations of inefficient combustion that led to corrective actions

⁵ Does not include instances where operators reported no issues but performed “preventative maintenance”

operators was the performance of general maintenance on ECDs such as cleaning dirty burners and/or pilot lights. In a few cases, operators reported taking action to correct over pressurization in vapor recovery systems, and, in one case, an operator reported working with the manufacturer of an ECD to correct a host of issues including repairing wiring, replacing valves, and repositioning the pilot light. Importantly, on subsequent observations of these same eleven facilities, we continued to make observations of emissions due to inefficient combustion at five of them even after the reported corrective actions were performed.⁶ At two of these five facilities, additional corrective actions were performed following our subsequent observations.



Photo of row of ECDs on Extraction Kodak well pad in Windsor, CO



OGI evidence of emissions from inefficient combustion in ECDs on the Extraction Kodak well pad on 6/12/24 (left) and 9/11/24 (right). Following the observation on 6/12/24 the operator reportedly found buildup on ECD components and cleaned them. The observation on 9/11/24 occurred after these reported corrective actions were performed.

⁶ At two of the ten facilities additional observations have not been possible because one facility has been shut-in and at the other the ECD where we observed inefficient combustion was retired following our observations

The 56 investigations that did not result in corrective actions being performed resulted instead in operators reviewing our video evidence and/or reportedly conducting an inspection⁷ of any ECDs in question and concluding that the equipment was operating normally. However, no additional data beyond this assurance from the operator⁸ was provided to demonstrate that an ECD was achieving the intended combustion efficiency. In fact, on numerous occasions, the conclusion from operators appeared to be that our OGI evidence actually demonstrated combustor efficiency rather than inefficiency, with operators claiming that “in their opinion” a video “showed a pretty complete burn on ECDs”⁹ or that following review of a video “[the operator] believes the ECDs are burning completely.”¹⁰

This is a flawed interpretation of the evidence because, as we have already discussed, OGI evidence alone is not sufficient to determine whether the desired combustion efficiency is being achieved. Indeed, in our correspondence with APCD compliance staff regarding our observations, there is an acknowledgement that “the issue we run into is we are viewing this control equipment with an IR camera that shows us something is coming out of these stacks, but can neither identify or quantify what the substance is,” which is one reason why Colorado regulations began requiring performance testing of ECDs starting in 2022 to “give [APCD] some more information as to what these control devices are achieving in real world situations.”¹¹

However, even when compliance staff at APCD are acknowledging that more data is necessary to better understand efficiency, they seem to also be operating under a flawed presumption that if operators report having conducted a general inspection of an ECD to confirm that valves are open, burners are not clogged, the pilot light is lit, etc., “there is no way to determine that the 95% control efficiency standard is not being met.”¹² In other words, the determination is that the combustion efficiency standard is likely achieved so long as an operator reports that an ECD is being maintained properly. This determination conveniently ignores the fact that there is little solid evidence, such as the results of widespread performance testing, provided by operators to guarantee that the efficiency standard is actually being met consistently. It also ignores the evidence we outlined above of continued observations of emissions due to inefficiency at facilities where operators reportedly conducted maintenance on ECDs to address emissions.

⁷ These inspections typically involve checking that valves are open, burner tips are clear of clogging or debris, pilot lights are lit, and that there is no over pressurization in the vapor control system

⁸ Infrequently, APCD compliance staff may conduct an onsite inspection with an OGI camera as well

⁹ Response from operator conveyed to APCD via email after reviewing our OGI evidence of inefficient combustion in ECDs at Crestone’s Grande 1AH well pad in Aurora, CO on May 22, 2022

¹⁰ Response from operator conveyed to APCD via email after reviewing our OGI evidence of inefficient combustion in ECDs at Extraction’s Ardery well pad in Greeley, CO on July 26, 2022

¹¹ Emailed correspondence with APCD compliance staff on August 22, 2022 in response to observation of inefficient combustion at Fulcrum Energy’s Oxbow facility in Jackson County, CO

¹² Emailed correspondence with APCD compliance staff on February 27, 2024 in response to observation of inefficient combustion at Crestone’s Grande 1AH well pad in Aurora, CO



OGI evidence of emissions from inefficient combustion in an ECD on the Extraction Vetting well pad in Greeley, CO on 6/12/24 (left). The operator claimed that no issues could be identified with the ECD but preventative maintenance was performed. A subsequent observation on 9/7/24 identified minimal emissions from the ECD (right).

In summary, we have had some success in using OGI evidence of emissions due to inefficient combustion to prompt investigations that result in operators identifying issues with ECDs. A fifth of the observations of inefficient combustion in ECDs that we have shared with APCD compliance staff since January 2022 have resulted in such an outcome. However, even this outcome is not a guarantee that ECDs are actually achieving the desired efficiency standard. This is especially true because of our continued observations of emissions from some facilities where operators have identified and corrected issues with ECDs. Yet operators and compliance staff at APCD seem to assume that the standard is met so long as operators assert that ECDs are generally being maintained. There are requirements that will eventually result in performance tests for all ECDs but many have not been tested yet, and tests are not performed in response to our observations.

This means we are left with a lot of uncertainty about the efficacy of these control devices. We have a significant body of evidence that suggests emissions from ECDs in operation across Colorado are a frequent occurrence and can point to issues with general maintenance. At the same time, we are unable to determine if these emissions are typically the result of ECDs that are performing below the desired standard or are instead the emissions associated with the desired combustion efficiency. Critically, and most importantly, operators and APCD compliance staff are also unable to make a conclusive determination in this regard given the data that is currently available.