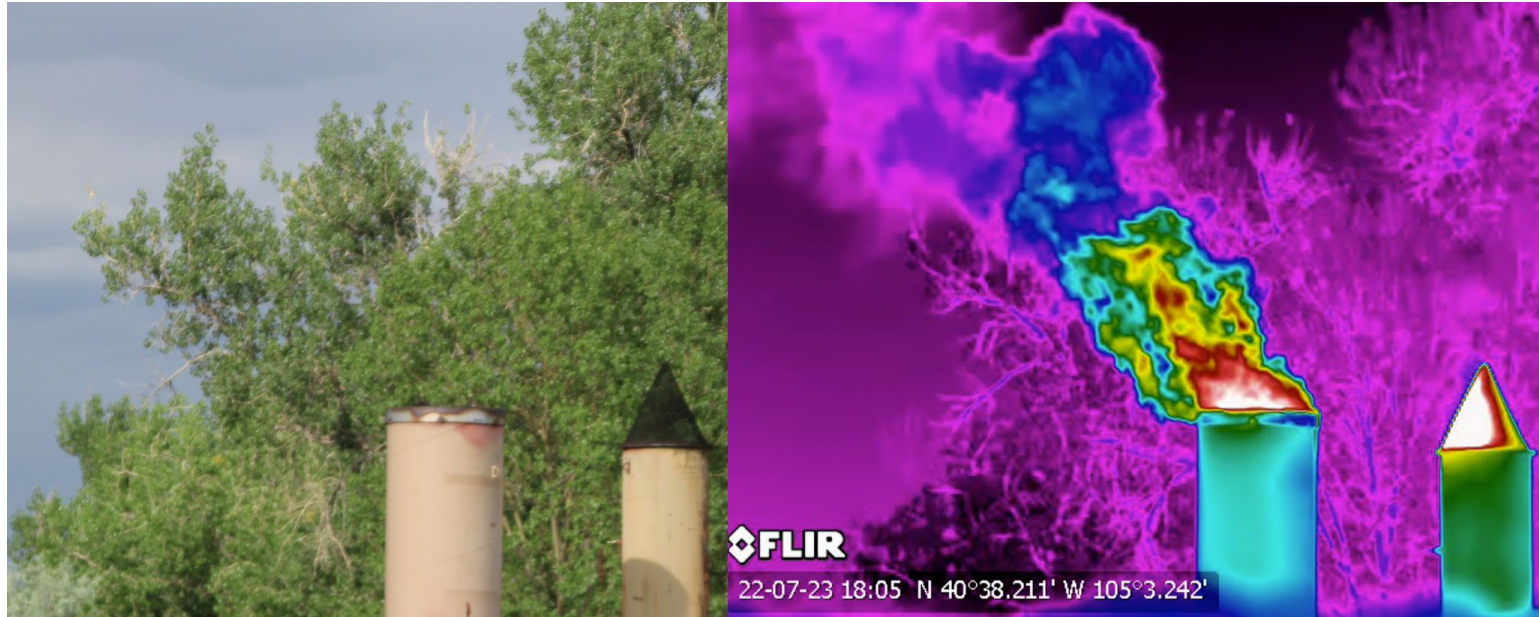


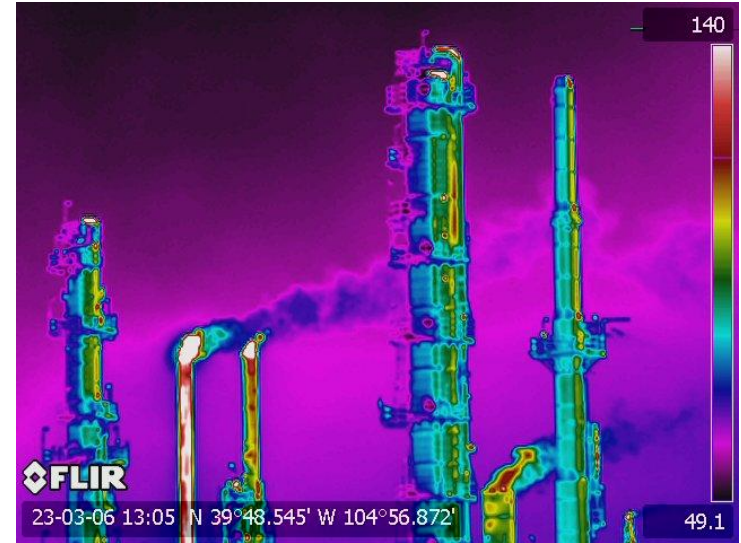
# Emissions from Pre Production Activities



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# Optical Gas Imaging (OGI) Makes Invisible Gas VISIBLE

- A FLIR GF320 OGI camera visualizes methane and other volatile organic compounds
- Camera **does not** quantify emissions or speciate
- OGI is used to detect leaks, malfunctions, and emissions events
- Not all emissions events violate air quality regulations. But all emissions impact air quality



Hydrocarbon emissions  
from Suncor facility in  
Commerce City

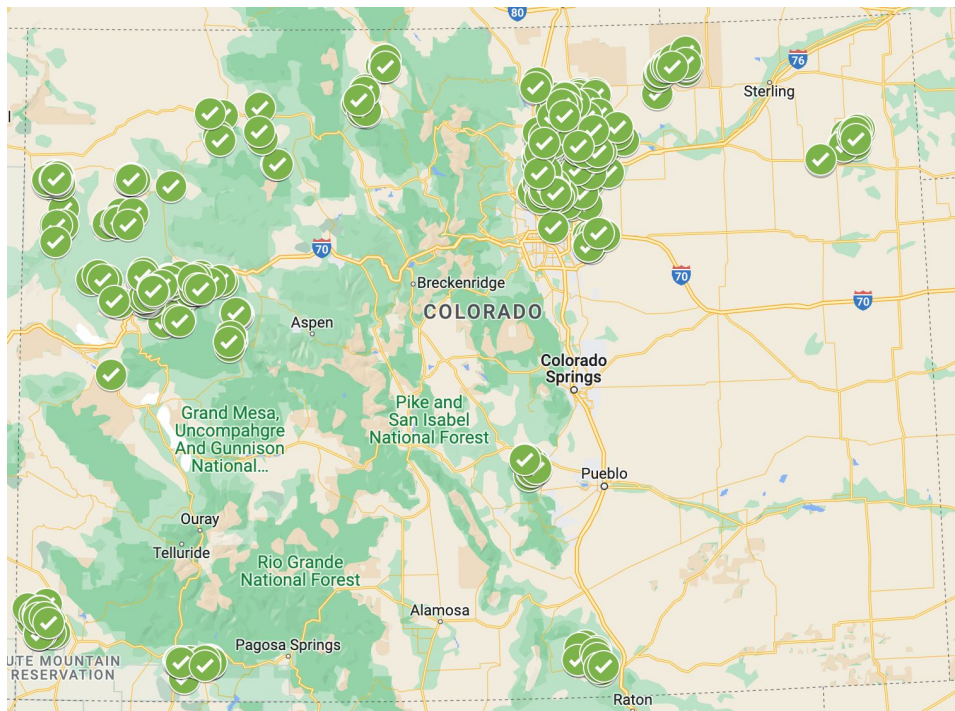
# How Earthworks uses OGI cameras

- Survey oil and gas facilities
- Document emissions and identify sources
- Provide evidence to state regulatory agencies
- Evaluate: are rules being enforced? Is industry being held accountable?



Routt County staff and community members using OGI camera

# 695 Sites Surveyed in Colorado since 2014



# Pre Production Emissions

- Pre production includes all activities prior to production: drilling, fracking, flowback
- Sources of emissions can include:
  - Fracking engines
  - Drilling mud, drill cuttings, fracking fluids
  - Flaring and venting
- Air Pollution Control Division does not regulate emissions during drilling and fracking. ECMC does not directly regulate emissions



Hydrocarbon emissions from incomplete combustion at well pad during drilling in 2018





Photo of Extraction Interchange A & B pads from 2019 during pre production.



Despite best management practices (BMPs) in place we have filmed significant emissions, nearby residents have filed dozens of complaints, and air quality monitors have detected elevated levels of benzene



Photo of Interchange A taken from adjacent residential neighborhood in 2022.





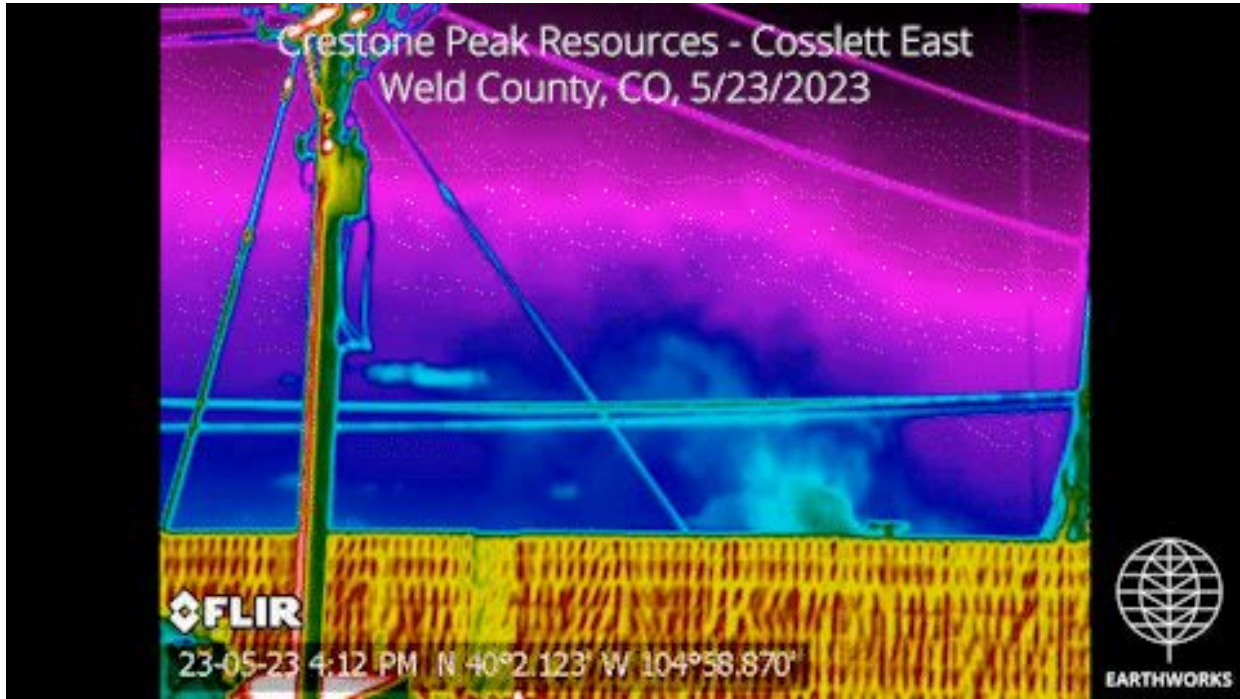
OGI video from same vantage point in early 2022 during drilling phase. Plume of unheated hydrocarbon emissions visible over sound wall



OGI video of same pad a few months later in 2022 during fracking phase. Emissions from fracking engines



Video of emissions during fracking phase from a different facility owned by a different operator last year.



Video of emissions during drilling phase from yet another facility from only a few months ago.



Video of significant uncontrolled emissions from temporary storage tank following pre production





Video of significant emissions released from storage tanks during maintenance event