

Assessment of Potential Public Health Effects from

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Introduction

Colorado's rapidly growing population in parallel with increased oil and gas (O&G) operations in populated areas has created a situation in which many Coloradans now live and work in close proximity to O&G. Over the last several years, multiple published papers have outlined the potential chemical and non-chemical hazards from O&G operations. In addition, studies specifically evaluating the relationship between living near oil and gas operations and the potential for certain adverse health effects have been widely publicized. This information led to heightened public and policy-maker concerns about whether or not harmful health effects occur in people living near oil and gas operations. In 2015, the Colorado Oil and Gas Task Force made several recommendations to the Colorado Department of Public Health and the Environment (CDPHE). Among them was a recommendation to review existing scientific literature and compile a summary of useful findings.

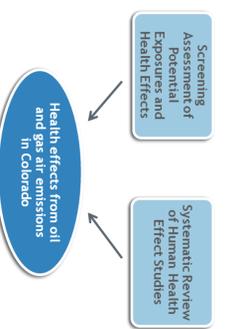
Study Question

Do substances emitted into the air from oil and gas operations result in exposure to Coloradans living near oil and gas operations at levels that may be harmful to their health?

Methods

We integrated components of a quantitative risk assessment framework and a qualitative systematic literature review to evaluate our study question (Figure 1).

Figure 1. Integration of scientific information to evaluate the potential for health effects in people living near oil and gas operations in Colorado



Screening Level Human Health Risk Assessment:

- We compiled over 10,000 ambient air measurements of 62 volatile organic compounds (VOCs) in regions of high oil and gas operations. Data represented 13 different ambient air datasets, 33 different locations in the Denver-Julesburg and Piceance Basins, spanning over eight years (2008-2015).
- The maximum air concentration was used as a surrogate for acute exposures, while the highest average was used as a surrogate for chronic exposures.
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- We compared the air measurements to agency established toxicity values (EPA IRIS, ATSDR, PPRIV, CalEPA, TCEQ).

Systematic Review of Epidemiological Literature:

- We located 12 observational epidemiological studies evaluating the potential health effects associated with living near oil and gas operations that met the pre-determined criteria including original measurements (or estimates) of exposure, and quantification of associations between exposures and outcomes.
- We rated individual study findings as either a low, medium, or high quality of evidence based on the strengths and limitations of that study.
- We grouped each finding into similar health-effect categories and assessed the overall strength of evidence.

Figure 2. Strength of evidence rating scale



Results

Oil and Gas Operations in Colorado

Figure 3. Short-term and long-term risk estimates (hazard quotients) for each substance for non-cancer health effects

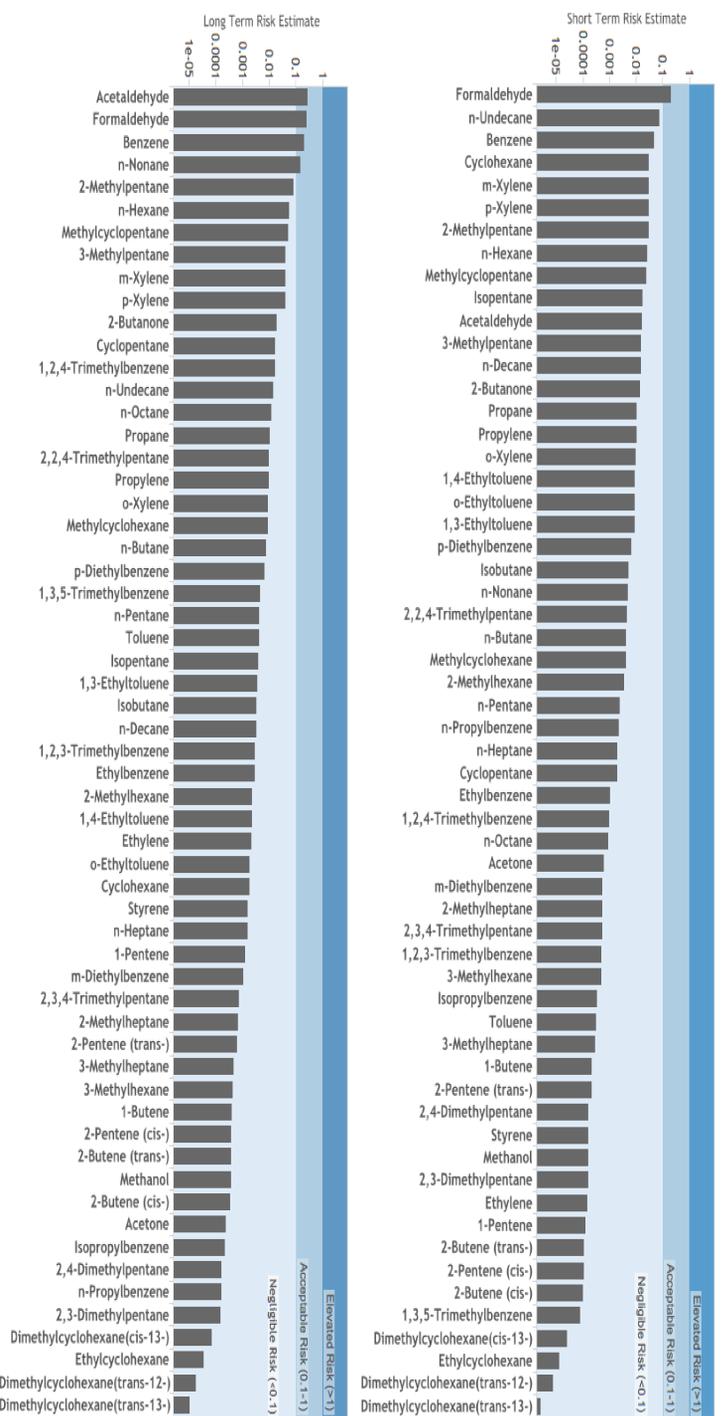


Figure 4. Combined long-term risk estimates (hazard index) by each non-cancer effect category

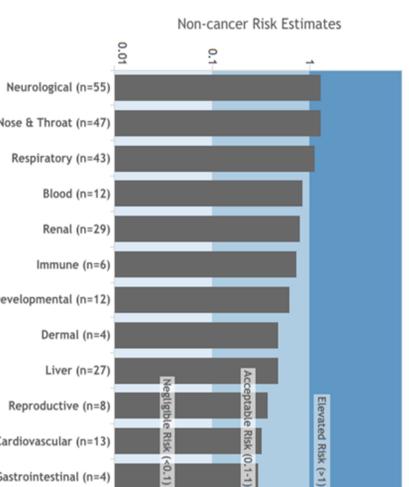


Figure 5. Cancer risk estimates for each type of cancer

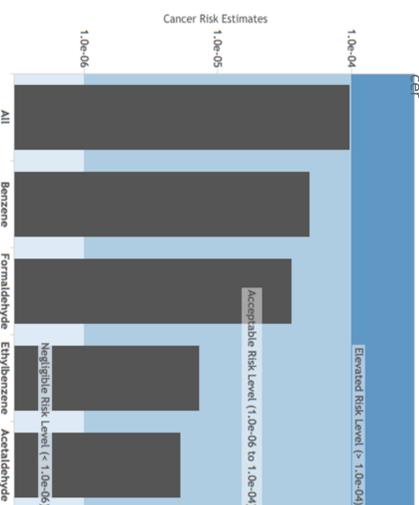


Table 1. Summary of overall strength of evidence for epidemiological studies by health effect

Health Effects Categories	Number of studies	Health Effects	Strength of Evidence
Birth outcomes	4	Preterm birth	Mixed
		Low APGAR	Mixed
		Small for gestational age	Mixed
Birth Defects	1	Birth weight (LBW & mean)	Mixed
		Congenital heart defects	Insufficient
		Oral Clefts	Insufficient
Respiratory	6	Neural tube defects	Insufficient
		Multiple, self-reported symptoms	Mixed
		Hospitalizations	Limited
Neurological	5	Asthma exacerbations	Mixed
		Hospitalizations	Mixed
		Multiple, self-reported	Insufficient
Cancer	4	Migraine/severe headache	Mixed
		Overall childhood cancer incidence	Insufficient
		Childhood Hematological Cancers	Mixed
Dermal	2	Childhood CNS tumors	Insufficient
		Hospitalizations	Mixed
		Multiple, self-reported	Limited
Psychological	4	Multiple, self-reported	Failing to show an association
		Hospitalizations	Insufficient
		Hospitalizations	Insufficient
Cardiovascular	2	Hospitalizations	Insufficient
		Multiple, self-reported	Insufficient
		Hospitalizations	Insufficient
Gastrointestinal	3	Multiple, self-reported	Failing to show an association
		Hospitalizations	Insufficient
		Hospitalizations	Insufficient
Musculoskeletal	2	Multiple, self-reported	Insufficient
		Hospitalizations	Mixed
		Hospitalizations	Mixed
Blood/Immune	2	Multiple, self-reported	Mixed
		Hospitalizations	Mixed
		Hospitalizations	Mixed

Limitations

- To conduct a screening level assessment, air data collected in regions with substantial oil and gas operations as a substitute for a persons exposure was used. Although these are the best available data, they may not represent individual and community level exposures to people living near oil and gas operations.
- Average and maximum values across all studies are more likely to represent the high end of average long-term exposures, but there is less confidence that these values represent the short-term exposure scenario.
- The air data represents a person's total outdoor air exposure to both oil and gas and non-oil and gas sources of emissions, such as emissions from vehicles, gas stations, industrial waste landfills or other industries.
- The standard health-based reference values do not account for substantive interactions other than additivity.
- A relatively small number of epidemiological studies have been published that evaluate these associations. The majority of findings were ranked as low quality, primarily due to limitations of the study designs making it difficult to establish clear associations.

Conclusions

1. Based on currently available air monitoring data, the risk of harmful health effects is low for residents living near oil and gas operations.
2. Studies of populations living near oil and gas operations provide limited evidence of the possibility for harmful health effects. This needs to be confirmed or disputed with higher quality studies.
3. At this time, results from exposure and health effect studies do not indicate the need for immediate public health action, but rather indicate the need for more detailed exposure monitoring and systematic analyses of health effects of residents living near oil and gas operations.

Ongoing Program Activities

- Continued monitoring of exposures to people living near oil and gas through collection of real-time air samples in communities near oil and gas operations using our Colorado Air Mobile Monitoring Laboratory (Figure 6) to better characterize short-term exposures.
- Comprehensive health risk assessment using data from Colorado State University that directly measured rates of emissions of substances from all phases of oil and gas operations.
- Review of high-quality epidemiological studies with improved characterization of exposures to directly assess the possibility of health effects in communities with substantial oil and gas operations.



Figure 6. CDPHE's Colorado Air Mobile Monitoring Laboratory (CAMML)

- Continued citizen reporting of health concerns to the CDPHE Oil and Gas Health Information and Response Program to monitor for trends in health effects that may be not be related to exposure.

CDPHE Official Report

The official report from the Oil and Gas Health Information and Response Program: Assessment of Potential Public Health Effects from Oil and Gas Operations in Colorado, can be found at:
<https://www.colorado.gov/oghealth>

