Executive Summary

Introduction

Over the last several years, multiple published papers have outlined the potential chemical and non-chemical hazards from oil and gas 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. That same year, CDPHE established the Oil and Gas Health Information and Response Program to respond to citizen health concerns and conduct evaluations of the exposure and health science related to oil and gas. An evaluation of the potential routes of exposures and types of public concerns reported to the program indicated that the greatest public health priority for evaluation was related to potential health effects from exposures to substances emitted into the air from oil and gas operations. Therefore, the scope of this report was to evaluate existing scientific data to answer the following question:

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

Because each source of scientific information has strengths and weaknesses, an integrated approach used existing information from multiple sources. This report combines two evaluations of scientific information to assess the strength of evidence to answer the main 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
Section 1: Screening Assessment of Potential Exposures and Health Effects

Sixty-two substances that are likely emitted, though not exclusively, from oil and gas operations were identified as priority substances for analysis. More than 10,000 air samples that measured these substances in regions of Colorado that have substantial oil and gas operations were combined. These data were used to estimate potential air exposures to people living near oil and gas operations (defined as 500 feet or greater from an oil and gas site). These exposures were compared to standard short- and long-term health-based reference values (i.e. “safe” levels) related to cancer and non-cancer effects.

- The screening health risk assessment of these substances found:
  - All measured air concentrations were below short- and long-term “safe” levels of exposure for non-cancer health effects, even for sensitive populations.
  - The concentrations of a small number of substances (benzene, formaldehyde, acetaldehyde) in the air surrounding oil and gas operations were 4-5 times lower than standard short- and long-term health-based reference values for non-cancer effects.
  - The concentrations of the other substances were 5-10,000 times lower than the standard short- and long-term health-based reference values for non-cancer effects.
  - Cancer risks for all substances were within the “acceptable risk” range established by the U.S. EPA.
  - Although well within the acceptable risk range for cancer and non-cancer effects, benzene, acetaldehyde and formaldehyde had the highest estimated risk levels and are high priority for continued monitoring.
  - Overall, available air monitoring data suggest low risk of harmful health effects from combined exposure to all substances.

Section 2: Systematic Review of Human Health Effect Studies

A standard systematic method was used to review all relevant studies that investigated health effects in communities near oil and gas operations. Using this method, the current level of scientific evidence was evaluated for whether or not living near oil and gas operations is related to harmful health effects.

- The review included twelve epidemiological studies with 27 different health effects and the following major conclusions were made:
  - No substantial or moderate evidence for any health effects.
  - Limited evidence for two health effects - self-reported skin symptoms and exacerbation of asthma. Limited evidence means modest scientific findings that support an association, but there are significant limitations.
  - Mixed evidence for 11 health effects, including four different birth outcomes, hematological childhood cancers, hospitalizations for cancer, migraines, self-reported respiratory symptoms and musculoskeletal symptoms, and hospitalizations for neurological, hematological and immune diseases. Mixed evidence means there are
findings that both support and oppose an association between the exposure and the outcome, with neither direction dominating.

- A lack of evidence for three health effects, including respiratory hospitalizations and self-reported psychological symptoms and gastrointestinal symptoms. A lack of evidence means that the outcome has been researched without evidence of an association.
- Insufficient evidence for 11 health effects, including three different birth defects, self-reported neurological symptoms, cardiovascular effects, overall childhood cancer incidence and hospitalizations for psychological, musculoskeletal and gastrointestinal symptoms. Insufficient evidence means that the outcome has not been adequately studied.

Conclusions

- Based on currently available air monitoring data, the risk of harmful health effects is low for residents living near oil and gas operations.
- 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.
- 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.

Recommendations

- Continued monitoring of exposures to people living near oil and gas including:
  - Continued evaluation of ambient air levels of priority substances in areas with substantial oil and gas operations to assess the potential for community-wide health impacts.
  - Collection of air samples in communities near oil and gas operations using our Colorado Air Mobile Monitoring Laboratory to better characterize short-term exposures for those living in close proximity to oil and gas operations.
- Continued evaluation of health risk using more comprehensive exposure data such as data from the Colorado State University studies that directly measured emissions of substances from oil and gas operations in Garfield County and the north Front Range and data collected by the Colorado Air Mobile Monitoring Laboratory.
- Continued monitoring of health effects in areas with substantial oil and gas operations including:
  - 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.
o 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 related to exposure.