

1. Introduction

The oil and gas industry in Garfield County has grown rapidly since 2002. Increased oil and gas development activity within Garfield County has generated concerns about the impact on public health. Garfield County Public Health (GCPH) has been monitoring air quality since 2005 in response to residents' concerns regarding the health impacts of increased oil and gas development activities. The GCPH ambient air quality monitoring study, June 2005 to May 2007, and the subsequent screening-level health risk assessment by the Colorado Department of Public Health and Environment (CDPHE) focused on 43 volatile organic compounds (VOCs) with sampling on a once per month or once per quarter basis across 14 monitoring sites (GCPD/CDPHE, 2007; CDPHE, 2007). The findings of the 2007 and 2010 CDPHE health risk assessments of air toxics data suggested potential for cancer and noncancer health effects (CDPHE 2007, 2010).

Based on the results and recommendations of these studies, GCPH has enhanced air quality monitoring since 2008 by analyzing samples for 78 speciated non-methane organic compounds (SNMOCs) and 12 carbonyls, increasing the frequency of sampling to a weekly or bi-weekly basis, and focusing on 4 of the original 14 monitoring sites.

The findings of the subsequent ambient air quality monitoring studies from 2008 to 2011 indicated that some of the primary chemicals (e.g., light alkanes, benzene, toluene, ethylbenzene, and xylene) associated with petroleum and natural gas emission sources were higher in rural Garfield County than in other urban areas (e.g., Grand Junction) outside the County (GCPH, 2009, 2010a, 2010b, and 2012). The measured concentrations of these compounds from 2008 to 2011 were also found to be higher in Garfield County than the urban U.S. averages measured by EPA's urban network (GCPH, 2012) However, the 2011 air quality monitoring study indicated consistently decreasing concentrations of many compounds at some monitoring sites since 2008 (e.g., cyclohexane, the xylenes, n-hexane, n-nonane, 1,3,5-trimethylbenzene, n-propylbenzene, acetaldehyde, methylcyclohexane, and toluene). Overall, no compounds at any of the Garfield County monitoring sites have shown consistent increases since monitoring began in 2008 (GCPH, 2012). In addition, the 2012 air quality monitoring report indicated that a number of compounds, including benzene, showed statistically significant decreasing annual average trends at all sites (GCPH, 2013). In 2012, a number of additional compounds, including formaldehyde, showed statistically significant decreasing trends at the Parachute and Bell sites, but insignificant trends at the more urban Rifle site (GCPH, 2013). However, styrene measurements were much higher in 2012 than previous years, which may require further investigation (GCPH, 2013). Overall, according to the 2012 air monitoring report, SNMOCs concentrations have been decreasing since 2008 for sites (i.e., Bell, Parachute, and Rifle) that were monitored all five years (GCPH, 2013).

1.1 CDPHE Role

The CDPHE provides technical assistance to local agencies on an as needed basis. As part of this commitment, Air Pollution Control Division (APCD) and Disease Control and Environmental Epidemiology Division (DCEED) staff of the CDPHE are members of the Garfield County Air Quality Technical Workgroup, providing technical assistance to the Garfield County Public Health Department since 2002. In this capacity, APCD staff provides technical assistance regarding the ambient air quality monitoring issues and DCEED staff provides assistance regarding the health evaluation issues. In 2007, for example, APCD analyzed the 2005 to 2007 ambient air quality monitoring data and DCEED conducted the screening-level human health risk assessment. This report is a part of the ongoing joint APCD and DCEED assistance to the GCPH.

1.2 Purpose

Most recently, the GCPH requested that the CDPHE evaluate the impact of a trend in decreasing concentrations of air toxics between 2008 and 2012 on health risk estimates. This evaluation will help better understand if residents in Garfield County are being exposed to airborne concentrations of measured air toxics such as SNMOCs and carbonyls that may pose health risks via inhalation. The findings of this health risk assessment are designed to help guide risk management decision-making and future air monitoring by the GCPH.

1.3 Risk Assessment Approach

A human health risk assessment process attempts to understand potential for adverse health effects from exposures to measured pollutants emitted into the air from sources of interest and any uncertainties associated with the assessment. This risk assessment is prepared in accordance with the U.S. Environmental Protection Agency (EPA) *Residual Risk Report to Congress and the EPA Risk Assessment Reference Library*, (EPA, 2004). According to the EPA, risk assessment is generally a four-step process consisting of hazard identification, exposure assessment, dose-response assessment, and characterization of risk based on the combination of results of the three previous steps, and the associated uncertainties.

This risk assessment represents a “snapshot” in time for characterizing health risks from exposure to only a select number of organic compounds. It does not take into account potential changes in emissions on a daily basis. It is also not designed to characterize risks sufficiently from inhalation of all types of air toxics (e.g., all VOCs, semi-VOCs, and metals). Additionally, the risk assessment is limited to inhalation risk from outdoor sources and it does not characterize risks through pathways other than inhalation of contaminated outdoor air (i.e., indirect exposure pathways). In air toxic risk assessment, the inhalation pathway is commonly assessed. However, indirect exposure pathways can be significant for chemicals which are relatively persistent in the environment.

The principal sections of this risk assessment are:

1. Introduction
2. Exposure Assessment
3. Toxicity Assessment (dose-response assessment)
4. Risk Characterization
5. Uncertainty Analysis
6. Summary of Findings
7. Conclusions
8. Knowledge Gaps
9. Recommendations
10. References
 - Appendix A—2008 data summary and chronic risk calculation
 - Appendix B—2009 data summary and chronic risk calculation
 - Appendix C—2010 data summary and chronic risk calculation
 - Appendix D—2011 data summary and chronic risk calculation
 - Appendix E—2012 data summary and chronic risk calculation
 - Appendix F—Acute risk evaluation
 - Appendix G—Toxicity values

1.1.1 Utility of Risk Assessments

It is important to note that health risk assessments provide predictions of hypothetical health risks that are intended as screening tools for risk managers and cannot be used to make realistic predictions of health outcomes. As such, risk estimates cannot be used to determine whether someone who already has cancer or any other disease is ill because of a past exposure. In addition, risk assessments only provide one of several important tools in the whole risk management process. EPA's regulatory process also calls for consideration of non-scientific factors (e.g., economic, social, political, and legal factors) in decision-making (EPA, 2004).