- **COPCs for Quantitative risk characterization–** EPCs for 23 COPCs with available toxicity values are summarized in Tables 4 and 5 and details are provided in Tables A1, A1.1, B1, B1.1, C1,C1.1, D1, D1.1, E1, and E1.1

- **COPCs for Semi-quantitative risk characterization**– EPCs for 50 COPCs are included in Tables A2, A2.1, B2, B2.1, C2, C2.1, D2, D2.1, E2, and E2.1
    - evaluated using USEPA's fractional approach for complex mixture of aliphatic and aromatic petroleum hydrocarbons: aliphatic C_5–C_8; aliphatic C_9–C_{18}; and aromatic C_9–C_{16}

- **COPCs for Qualitative risk characterization–**EPCs for 17 COPCs with no toxicity values are included in Tables A3, A3.1, B3, B3.1, C3, C3.1, D3, D3.1, E3, and E3.1

Trends in air concentrations over time

As already mentioned above, no chemicals at any of the Garfield County monitoring sites have shown consistent increases since monitoring began in 2008 (GCPH, 2012). However, a slight increase in styrene annual average air concentration was observed in 2012 (GCHPD, 2013). In addition, a slight tendency toward increasing annual average air concentrations for 1, 3-butadiene was observed from 2008 to 2012 at all monitoring sites except the Parachute monitoring site (Table 5).

3 Toxicity Assessment

3.1 Overview

The basic objective of a toxicity assessment is to identify the adverse health effects and dose-response relationships for specific chemicals.. In addition, the toxic effects of a chemical frequently depend on the route of exposure (oral, inhalation, dermal), the duration of exposure (acute, intermediate, chronic or lifetime), age, sex, diet, family traits, lifestyle, and state of health.

The toxicity assessment process is usually divided into two parts: the first characterizes and quantifies the cancer effects of the chemical, while the second addresses the noncancer effects of the chemical. This two-part approach is employed because there are typically major differences in the risk assessment methods used to assess cancer and noncancer effects. For example, cancer risks are expressed as a probability of suffering an adverse effect (cancer) during a lifetime and noncancer hazards are expressed, semi-quantitatively, in terms of the hazard quotient (HQ), defined as the ratio between an individual's estimated exposure and the reference concentration (RfC) (see below). HQs are not an estimate of the likelihood that an effect will occur, but rather an indication of whether there is potential cause for concern for adverse health effects. Both cancer risks and hazard quotients estimate risks at the population level and not to a particular individual (i.e., personal risk).

For carcinogens, toxicity measurements are generally expressed as a risk per unit concentration (e.g., an inhalation unit risk (IUR) in units of risk per $\mu g/m^3$). For noncancer effects, toxicity benchmarks are generally expressed as a concentration in air (e.g., an inhalation RfC in units of $\mu g/m^3$ air). The reference concentration is an exposure that is believed to be without significant risk of adverse noncancer health effects in a chronically exposed population, including sensitive individuals.

3.2 Toxicity Values

The following hierarchy was used to compile a list of cancer and noncancer toxicity values for this report. To start, inhalation values established specifically by the State of Colorado were given priority over all other sources of toxicity values. The second source, used to identify relevant toxicity values, was EPA's Regional Screening Levels (RSLs) website (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm) and Air Toxics Website (http://www.epa.gov/ttn/atw/toxsource/summary.html). If values were not available from Colorado or the RSL and Air Toxics Websites, an effort was made to fill these data gaps using (in order of preference) EPA's Integrated Risk Information System (IRIS), EPA's Provisional Peer-Reviewed Toxicity Values (PPRTVs), and other applicable secondary sources (e.g.,Office of Environmental Health Hazard Assessment/ California EPA; Agency for Toxic Substances and Disease Registry).

Various types of toxicity values are available depending upon the duration of exposure (e.g., acute, subchronic, and chronic). Generally, acute and subchronic toxicity values are used for characterizing potential noncancer effects associated with shorter-term exposures. According to the US EPA guidelines, subchronic toxicity values (Reference Concentrations) should be used to evaluate the potential noncancer effects of exposure periods between 2 weeks and 7 years (USEPA, 1989). Chronic toxicity values should be used to evaluate the potential noncancer effects of exposure periods between 7 years and a lifetime (USEPA, 1989). The length of exposure to evaluate acute effects can be up to 14 days; for example, ATSDR develops acute toxicity values (Minimal Risk Levels) for 14 days or less and California EPA develops acute toxicity values (Inhalation Reference Exposure Levels) for a 1-hour exposure duration.

As shown in Table 1, inhalation toxicity values were available for 23 out of the 90 detected COPCs for quantitative estimation of risk (Table F1). As shown in Table 2, 50 COPCs were evaluated using EPA's fractional approach for complex mixtures of aliphatic and aromatic hydrocarbons (USEPA, 2009). This approach uses the toxicity values of a surrogate aliphatic or aromatic hydrocarbon or compound to represent the toxicity for the entire mass of the fraction including aliphatic (C_5–C_8 and C_9–C_{18}) and aromatic (C_9–C_{16}) hydrocarbons (Table F1). Then, health risk for hydrocarbons was estimated using chemical mixture risk assessment methodology in which dose-addition or response-addition was assumed across or within the fractions. In this evaluation, the following aliphatic and aromatic hydrocarbon fractions were evaluated semi-quantitatively:

- *The C_5–C_8 aliphatic fraction* of the total petroleum hydrocarbons was based on a provisional inhalation reference concentration and a provisional inhalation unit risk