| Comment Code | CSPH Specific Response |
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| W56 | The purpose of the screening level HHRA and the HIA is to protect the public health and as such a conservative "health protective" screening technique was used based on EPA's risk assessment methods was used. This is the same technique CDPHE used in the risk assessments performed in 2007 and 2010 and is the appropriate technique to use when data is limited, as was the case in the for the HHRA for the HIA. While the HHRA is an imperfect tool, it is useful in informing the HIA process. Many other tools and sources of data, in addition to the HHRA were used to support the conclusions and recommendations of the HIA. We note here that information contained in the WSCOGA comments is often incorrect and unsubstantiated and then repeated through several comments in what appears to be an attempt to discredit the HHRA. In the responses below, we have highlighted some of the most misleading information.<br><br>Several of the human health findings presented in the table of this comment are incorrect or misleading, as follows. In the 2002 Community-Based Short-Term Ambient Air Screening study no HIs were presented in the report. In the 2005-2007 human health risk assessment, the highest computed community cancer risk was 1.48E-04 (after adjusting for a 30 year duration and 350 day per year frequency) in Parachute. The HIs for intermediate (2.8) and acute exposures (1.7) exceeded one (HI's greater than 1 indicate adverse health effects may occur) at the Brock sampling station. In addition, the HI of 6.42 for the maximally exposed individual exceeded one. The community cancer risk presented from the Coons and Walker study used only the benzene at concentration measured at 500 meters, which the reviewer states is the set back in Antero's plan. The set back proposed by Antero is 500 feet, not 500 meters as stated in the comment. Using a benzene concentration measured at 500 feet (175 meters) of 16.9 micrograms per cubic meter results in a cancer risk of 5.4E-05.<br><br>The reviewer refers to EPA's "acceptable range" of 1E-6 to 1E-4 for cancer risk. This interpretation is not quite correct. Per EPA Region 8 "The level of total cancer risk that is of concern is a matter of personal, community, and regulatory judgment. In general, the USEPA considers excess cancer risks that are below about 1 chance in 1,000,000 (1×10-6 or 1E-06) to be so small as to be negligible, and risks above 1E-04 to be sufficiently large that some sort of remediation is desirable. Excess cancer risks that range between 1E-06 and 1E-04 are generally considered to be acceptable (see Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions (Memorandum from D. R. Clay, OSWER 9355.0-30, April 1991), although this is evaluated on a case-by-case basis and EPA may determine that risks lower than 1E-04 are not sufficiently protective and warrant remedial action" (http://www.epa.gov/region8/r8risk/hh_risk.html).<br><br>The reviewer also highlights the finding from the Coons and Walker's study that incidence rates of cancer, including leukemia were not higher that expected for the Colorado from 1992 through 2005. The Coon and Walker study provides a baseline cancer incidence for Garfield County and should NOT be construed to mean that the incidence of cancer will not increase as a result of exposures from the gas industry. As pointed out in the Coon and Walker Report (footnoted in the comment), the natural gas industry began rapidly expanding in Garfield County in 2002 and there is a 15-30 year lag time between an exposure and appearance of cancer. If exposures from the natural gas industry resulted in a higher incidence of cancer, it would be observed in the future and would not have been observable in the 1992-2005 dataset. Baseline cancer incidence is appropriately addressed in the HIA.<br><br>The reviewer comments that the increase in absolute cancer rates that may be associated with natural gas operations are small compared to cancer rates for Colorado. The task of the HHRA and HIA is to evaluate the estimated health effects to Battlement Mesa residents from Antero's |

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| | proposed project. The number of background cancers is not applicable. A judgment on whether or not the number of predicted cancers is compelling is out of the scope of the HIA. It is a matter of personal, community, and regulatory judgment. Also, the excess lifetime excess cancer from Antero's project is an involuntary risk that each resident in Battlement Mesa assumes, regardless of the magnitude.<br><br>The reviewer comments that air emissions will decrease because of ongoing and future implementation of new COGCC rules and regulations, as well as Antero's BMPs. There is currently no data available to back up this claim and Antero's BMPs were not available at the time the risk assessment was completed. |
| W57 | The reviewer has misrepresented EPA guidance by cutting and piecing parts of the text on reasonable maximum exposures. The full text reads "Actions at Superfund sites should be based on an estimate of the reasonable maximum exposure (RME) expected to occur under both current and future land-use conditions. The reasonable maximum exposure is defined here as the highest exposure that is reasonably expected to occur at a site. RMEs are estimated for individual pathways. If a population is exposed via more than one pathway, the combination of exposures across pathways also must represent an RME. Estimates of the reasonable maximum exposure necessarily involve the use of professional judgment. This chapter provides guidance for determining the RME at a site and identifies some exposure variable values appropriate for use in this determination. The specific values identified should be regarded as general recommendations, and could change based on site-specific information and the particular needs of the EPA remedial project manager (RPM). Therefore, these recommendations should be used in conjunction with input from the RPM responsible for the site. In the past, exposures generally were estimated for an average and an upper-bound exposure case, instead of a single exposure case (for both current and future land use) as recommended here. The advantage of the two case approach is that the resulting range of exposures provides some measure of the uncertainty surrounding these estimates. The disadvantage of this approach is that the upper-bound estimate of exposure may be above the range of possible exposures, whereas the average estimate is lower than exposures potentially experienced by much of the population. The intent of the RME is to estimate a conservative exposure case (i.e., well above the average case) that is still within the range of possible exposures. Uncertainty is still evaluated under this approach. However, instead of combining many sources of uncertainty into average and upper-bound exposure estimates, the variation in individual exposure variables is used to evaluate uncertainty (See Section 6.8). In this way, the variables contributing most to uncertainty in the exposure estimate are more easily identified. (EPA RAGs 1989)" The RME's provided in EPA's risk assessment guidance for Superfund (RAGS) (EPA 1989) were used in the HHRA, per this EPA guidance and are standardly used in risk assessments when site-specific information on exposures is unavailable, as was the case in the HHRA. The data on which to base modification of these standard values is not currently available. Comprehensive studies of the Battlement Mesa Community and contaminant concentrations would be necessary to provide justification for modifying these values. It also is noted that RMEs of 30 years for duration of exposure and 350 days per year for exposure frequency are lower than those or 70 years and 365 days per year used in CDPHE's 2007 and 2010 risk assessments. While using the standard values and assumptions may overestimate risk, the lack of toxicity data on most the contaminants and the lack of results for several contaminants that are suspected to be associated with natural gas operations (i.e. fracking chemicals and PAHs) lead to an underestimate of the risk. As implied in the last paragraph of this comment, the RME approach is appropriate for conducting a screening level risk assessment. The HHRA is a screening level risk assessment and will not be used as a sole justification to formulate regulatory policy or requirements intended to allow or disallow natural gas development. |
| W58 | For ambient air, the BM-HHRA used data collected by Garfield County and CDPHE. This is the same data that CDPHE used in their 2007 and 2010 risk assessments. The quality assurance project plans for the collection of the 2005-2007 data is available through CDPHE. The QAPPs for collection of the 2008 through 2010 data is available on the Garfield County web site. This data, along with the data collected by Antero in 2010, is suitable for use in a screening level risk assessment. A discussion of the suitability of the data has been added to Section 2. |

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| | It is not possible to respond to the comment about the inability to recalculate results without knowing which information could not be duplicated, what is discrepant, or the technical or conceptual flaw. All data used in the revised HHRA is available upon request. Data for various sources is routinely compiled and combined in the risk assessment process per EPA RAGS Chapter 5 (EPA 1989). Please also see response to comments W64.<br><br>Because many chemicals that may be associated with the natural gas industry are unknown (i.e. fracking chemicals), it is not possible to remove detected contaminants from consideration in the risk assessment process (see response to comment W63). For example, methylene chloride could be a laboratory artifact or it could be from a solvent used by the industry. It is noted that methylene chloride is not likely to be a laboratory artifact in air samples analyzed in laboratories specially designed for the analysis of air samples, as was the case for samples used in the HHRA analysis. In addition, the fact that methylene chloride was not observed in most samples analyzed makes it much less likely to be a laboratory artifact. This is not enough information available to rule out methylene chloride as a COPC. The approach to identify COPCs conforms to EPA guidance per RAGS Chapter 5.<br><br>The statements in the last paragraph of this comment are not supported with any examples from the HHRA and are unsubstantiated. In no instance was the database sifted to identify maximum concentrations. Please refer to Sections 2 and 3 of the revised HHRA for explanation on how data was taken from the database. |
| W60 | As detailed in Sections 2 and 3 of the HHRA a time weighted average using maximum concentrations from Garfield County's 2008 Air Toxics study and the 95 percent upper confidence limit of the arithmatic mean from the 2005 through 2010 ambient air studies was used to from the chronic exposure for residents living near a well pad. In no instance were maximum concentrations "mined". The maximum detected concentrations were observed in the sample collected downwind of an Antero well during flow back operations. Because flow back is one of the operations with the greatest potential for emissions of contaminants, this maximum concentration assigned as the EPC. In addition, samples were collected over a 24-hour interval which may have diluted out peak emissions during flow back operations.<br>The reviewer incorrectly perceives the time-weighted average as a subchronic exposure scenario nested in a chronic scenario. This is a standard approach to determining the concentration of a contaminant an individual may be exposed over the entire 30-year duration period.<br>The HI of 2 is not overstated or mishandled. Benzene, the trimethylbenzenes, the xylenes, formaldehyde, and 2-hexanone all have similar affects and target organs. Therefore breaking out the HI would not have lowered the value. It is noted that EPA does not have an acceptable range of "non-cancer" health risks. |
| W61 | As stated in the HHRA, this is an estimate of the maximally exposed individual and this approach is not new. For example, CDPHE used this approach in their 2007 risk assessment. It is suitable for risk management decisions as it best representation available for odor events that documented as being associated with natural gas operations. The wind rose presented for the Bell-Melton station is not applicable to Battlement Mesa. In the summer, when windows are open, indoor and outdoor concentrations could be similar. If windows are closed and swamp coolers in use, indoor air concentrations could be higher than outdoor concentrations. The relevance of the air pollution alert to which the reviewer refers is questionable. The HIA authors are unaware of such an alert system being employed by the natural gas industry in Garfield County. It is plausible that an infant, a small child, or elderly adult could reside on a major wind vector and not leave the residence for 7-days. As documented in the risk assessment, subchronic reference concentrations were used if available. If not available, chronic reference concentrations were used and the uncertainty involved in their use is addressed, per EPA RAGS part F "In situations where the desired reference value (e.g., acute, subchronic, |

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| | chronic) is not available, risk assessors may use a reference value based on the next longer duration of exposure as a conservative estimate that would be protective for a shorter-term ED (USEPA, 2002c). For example, if a risk assessor determines that an ED at a site is subchronic, but no subchronic toxicity value is available, a chronic RfC can be used to assess hazard. (EPA 2009)". In the revised HHRA, acute and intermediate toxicity factors were used for this acute exposure scenario. |
| CD11 | The HIA correctly states that the 8-hour standard was exceeded once, as documented and stated in the 2008 Garfield County Air Emissions report. The HIA does not state that that the standard was violated. While ozone precursors may come from other sources as well as other counties, however, the CDPHE APCD 2009 Technical Support Document for Recommended 8 Hour Ozone Designations reports that in 2006 Garfield County had the highest VOC levels and the second highest NOx levels of the western slope counties. Garfield County VOC levels were the third highest in the state (Weld County being the highest). The Garfield County 2009 Emission inventory indicates oil and gas sources are the major sources of nonbiogenic VOC, benzene, NOx, SOx, and the second highest source of CO. Furthermore, while a variety of emissions (including ozone precursors) from many major sources such as highway vehicles have decreased, emissions from oil and gas sources increased in the period studied (up to 2007). The Emissions Inventory also compares Garfield County with other counties. Generally, Garfield County has higher total emissions, stationary emissions and O&G related emissions than nearby rural counties. While it is likely that emissions from western counties combine to affect regional air quality, emissions from Garfield County oil and gas sources are likely to be a major contributor to air quality compromise within and outside of the county. |
| CD20 | Sections 2 and 3 of the HHRA discuss the datasets that were used. As shown in Figure 2-1, BTEX emissions have been fairly constant through November 2010, with consistent seasonal fluxes. For example, from 2005 to 2010 the mean benzene concentration was 1.47 µg/m3, and the maximum concentration of 13.6 µg/m3 was observed in July 2008. The mean benzene concentration from 2008 to 2010 was 1.2 µg/m3. Therefore the data for evaluating chronic risk from the 2005 to 2007 study and 2008-2010 study was combined, per EPA Risk Assessment Guidance (EPA 1989). All data for the chronic risks was from 24-hour integrated samples. The available data suggests that the greatest potential for acute hazards is from emissions during well development activities for those living within a 1/2 mile of the activities. Therefore, the most appropriate data for evaluating subchronic risks is that which was collected from 24-hour integrated samples during well development activities, as was done in the revised HHRA. In the revised HHRA, an acute scenario is evaluated using only 15-second grab samples. The contribution of benzene in air to the acute hazard for the maximum exposed individual is 6 and does not differ from the acute hazard reported for the maximum exposed individual in the 2007 risk assessment. Both used the same benzene result collected from a 15-minute grab sample. The CSPH notes that when a hazard index exceeds one, the interpretation is that health effects may occur and that results greater than one are subject to a semi-quantitative evaluation. Both a hazard index of 6 and 2 are greater that one and both imply health effects may occur. Please see the revised HHRA. The revised HIA emphasizes that the HHRA is one of many tools that was used to evaluate health effects and provides only the overall conclusions of the HHRA in the air assessment. |
| A127 | Per EPA guidance, no background corrections were made and no chemicals were eliminated based on background. "In general comparison, comparison with naturally occurring levels is applicable only to inorganic chemicals, because the majority of organic chemicals found at a Superfund site are not naturally occurring (even though they may be ubiquitous" (EPA 1989). "Anthropogenic levels are ambient concentrations resulting from human (non-site) sources. Localized anthropogenic background is often caused by a point source such as near by factory. Ubiquitous anthropogenic background if often from non-point sources, such as automobiles. In general do not eliminate anthropogenic chemicals because at many sites, it is extremely difficult to conclusively show at this stage of the site investigation that such chemicals are present at the site due to operations not related to the site or surrounding area (EPA 1989)." While the COPCs identified in the risk assessment, such as benzene, may be ubiquitous in air at some level, in ambient air, they are not naturally occurring chemicals. The risk assessment did make qualitative |

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| | comparisons for background in Section 5. Baseline data for Battlement Mesa became available for the revised HHRA and estimated project risks also are compared to baseline risks in the revised HHRA. |
| CIT50 | Detection limits for 15 out of 147 chemicals were less than their respective EPA regional screening levels. The risk assessment does address the uncertainty this adds to the risk assessment. It is important to note that risk assessments never have a complete data set with all chemicals that could possibly be in the environment measured with detection levels below EPA regional screening levels. The reasons for this include both technological and budget constraints. For example, available analytical methods may not be able to detect some chemicals at levels less than the EPA regional screening levels and there are not well established analytical methods for many chemicals. Different sampling and analytical methods are required for differing classes of chemical compounds and this directly affects the cost of analysis. This must be weighed in deciding the number of samples to collect and for what chemicals the samples will be analyzed. The lack of this information does not invalidate a risk assessment, but it is part of the inherent uncertainty that is part of the risk assessment process. If trichloroethene, tetrachloroethene and vinyl chloride were present in ambient air at the 1.5 ug/m3 detection limit, the cancer risk would increase from 7.1E-5 to 7.9E-5 which would not increase the overall conclusions of the HHRA or of the HIA. |