APPENDIX F: RESPONSE TO COMMENTS ON SEPTEMBER 2010 DRAFT HEALTH IMPACT ASSESSMENT

Appendix F
Battlement Mesa Health Impact Assessment
Response to comments made to the September 2010 Draft

Comment Code	CSPH Specific Response
BMSA1	The BMSA's support of the HIA process is appreciated. The HIA team acknowledges that there are other natural gas development sights outside the BM PUD that have the potential to impact the health of the BM residents. It is the responsibility of the COGCC to determine the conditions of approval for permitting and the regulatory enforcement of rules for these wells.
W1	The HIA uses the data that is available and acknowledges that not all conditions are the same between different sites. The studies conducted in Garfield County indicate that natural gas well development produces a variety of air emissions. There are other sources of air emissions, however, it is not the purpose of the HIA to identify mitigation means for other sources.
W2	The HIA team acknowledges limitations in the existing data. The team made every effort to use the best available data. CDPHE, GC department of Public Health, COGCC and USGS were the sources of the environmental data and are expected to be legitimate data sources.
W3	The HIA team used established EPA methods to conduct the health risk assessment. These methods employ default assumptions which, per EPA guidance, are used when there is insufficient data. Use of any other assumption would require additional data gathering efforts and/or agreement from all stakeholders about the assumptions.
W4	The purpose of the HIA is to provide the BOCC with an assessment of t he Antero NG development so that the BOCC may take proactive measures to protect public health. The HIA team acknowledges that there are additional exposures that impact the health of the BM citizens. Inclusion of additional such exposures, including those associated with the gas industry outside the BM PUD were not part of the scope of the HIA. The risk assessment included in the second draft of the HIA provides a baseline assessment of risk using newly available ambient air data from Battlement Mesa.
W5	Although the HIA does not describe every Federal, state and local regulation, the HIA team acknowledges that these regulations exist. Studies conducted in Garfield County, as well as those done in other parts of the country, provide evidence that NG operations emit air pollutants, despite regulations.
W6	The HIA team did not have access to Antero's BMP at the time of the writing of the first draft. The Antero BMP were submitted to the HIA team as part of the Antero response to comments. See the responses to Antero's comments and the air assessment for further details.
W7	The HIA assessments and recommendations are specific to the potential health impacts of the Antero development within the BM PUD. The statements regarding potential applicability beyond the HIA do not constitute expansion of the scope of the HIA; these statements represent the use of this HIA as an example of bringing health into the decision making process.
W8	Although the HIA does not describe every Federal, state and local regulation, the HIA team acknowledges that these regulations exist and in some cases overlap. Studies conducted in Garfield County, as well as those done in other parts of the country, provide evidence that NG operations emit air pollutants and that spills occur, despite regulations. The purpose of the HIA is to identify ways that the project can impact health, whether or not there is a regulation in place.

W9	The conclusions of the risk assessment and the conclusions and recommendations of the HIA are consistent. They both conclude that the natural gas industry is responsible for emissions of a variety of chemicals, some of which are known to cause adverse health impacts. Without mitigation efforts, the Antero project is likely to emit chemicals that will result in adverse health effects, similar to what was experienced with the Watson Pad. The HIA recommends mitigations that to decrease chemical emissions in order to decrease the risk of adverse health effects.
W10	The elimination of the words extensive and extensively (2 and 1, respectively through out the document) will not change the document. On the other hand, the words significant and significantly appear many times (57 and 15, respectively) throughout the document. At times, meaning could be sufficiently understood without such qualifier and the word has been eliminated. At other times, another word (appreciable, considerable, important, substantial) may be a more accurate descriptor. Finally, there are many instances when the word significant is legitimately used as a statistical descriptor.
W11	Please see new Executive Summary and comments to W5 and W6
W12	Please see new Executive Summary and Air Assessment
W13	Please see new Executive Summary and Water Assessment
W14	Please see new Executive Summary
W15	Please see new Executive Summary and Traffic Assessment. Please note that traffic impacts address health risks associated with safety issues (traffic accidents), air emissions, and impacts to that increased traffic may have on quality of life. Efforts the industry has made to repair road damage is not included as part of the health impact of traffic.
W16	The HIA specifically discusses COGCC regulations regarding noise and does not assume unregulated or unmitigated noise. Please see Noise Assessment.
W17	Please see Economic Assessment. The decrease in employment from all sectors is likely to be a stressor. The HIA addresses potential employment by Antero for Battlement Mesa residents in the Economic Assessment.
W18	The HIA team recognizes the efforts made to decrease the likelihood of accidents and malfunctions. The HIA team would like to this opportunity to clarify the definitions of such terms and include another: incident. An accident may be due to unforeseeable circumstances or chance and in this definition implies that prevention of such an occurrence is unlikely; a malfunction may be due a structural failure or breakdown, however, in some instances, preventive actions may prevent the malfunction. An incident may occur as a result of an oversight, error, or failure to comply with rules or laws and prevention possibilities is implied. As such, accidents, malfunctions and incidents are likely to occur in the face of regulations and BMP. The occurrences will be due to failure to comply with regulations, failure to enforce regulations, failure to prevent malfunction, and at times, unforeseeable and chance circumstances.
W19	The HIA team agrees that the Antero project will not cause a boom/bust economy. Positive and negative health impacts of the economy are addressed in the Economic Assessment..

W20	The HIA team believes that further data collection be conducted to further elucidate environmental exposures and health impacts. The HIA team does not feel that a zero development scenario risk assessment is needed as there is little indication that such a scenario is likely. The HIA team further would like to clarify that the purpose of this HIA is to identify ways that the Antero project can impact health and to provide recommendations that could reduce the risk of health effects. The purpose of the HIA is not to validate existing policies, permitting processes, regulations, and BMP. While regulations, BMP, etc. can be protective of public health, many of these are not based on health protection standards. As such, full compliance with regulations and BMP is always protective of health.
W21	While the New COGCC rules allow for CDPHE consultation, the HIA team notes that CDPHE consultation with regard to the BM development has been limited to a request for air sampling during four development scenarios. The HIA purpose of identifying ways that the Antero project can affect health and providing recommendations to reduce risk to public health utilizes a broader health and exposure than that utilized by CDPHE.
W22	The increase in crime and sexually transmitted infection coincided with an increase in population in Garfield county during the years of natural gas development. In the community health profile, numbers of crimes and sexually transmitted diseases are reported because the county agencies responsible for responding to crime and sexually transmitted disease must respond to the number of crimes, not the rate of crime. If crime rate doubles but number of officers does not double, then the potential for strain of social services exists. If crime rate doubles and the county doubles the number of officers but must decrease other services to do so, then strain of social services also exists. In the case of Garfield County, the number of crimes and STI increased, as well as the rate of crimes and STI. This rates can be found in the Appendix C, pages, 35 and 36. Research, cited in the HIA, as well as conversation with law enforcement officials in GC, credits rapid increase in young men with relatively high wages, as a primary contributor to increase in crime and STI rates.
W23	"Hundreds" has been replaced with "many" in the revised HIA. Baseline data ambient air data for Battlement Mesa from September to November 2010 was incorporated into the revised HIA.
W24	See response to W23. The revised HIA does compare estimated health risks to baseline health risks and places more emphasis on what is known and unknown.
W25	Baseline data ambient air data for Battlement Mesa from September to November 2010 was incorporated into the revised HIA.
W26	The COGCC rules are based on odors, not protecting public health from VOC emissions. Rules promulgated by CDPHE are aimed at reducing ozone formation and may not protect residents from exposures to air contaminants, such as benzene. Please see the revised discussion.
W27	Please see response to W24. Comparing risks to other locals is outside the scope of the HIA. However, we have added a comparison of BTEX concentrations to Grand Junction and other ambient air monitoring stations throughout the country.
W28	Please see response to A58.

W29	This text has been clarified. The source of the water in the secondary drinking water wells is not known. This is one reason why a hydrogeological characterization is necessary.
W30	The study noted here is on the Garfield County and COGCC websites. We do not know the outcome of the testimony provided to COGCC and would refer to its conclusions on the validity of the study and WSCOGA's testimony if available in the public record.
W31	Yes, the review of these sample results contained in the USGS database and reports on the COGCC website, as well as data provided by Antero are the basis of the discussion.
W32	The rank is based on the preceding discussion. Please note that loss of the back-up water supply has serious consequences for Battlement Mesa residents.
W33	Please see revised recommendations.
W34	We have removed this recommendation.
W35	The HIA is specific to the changes brought by the natural gas development. In this case, the changes would include workers driving in the residential areas of BM. Workers driving at high speeds would constitute an increased risk, over and above residents driving at high speeds. In addition, increased large truck traffic increases the risk of injury and fatalities and that speed increases the risk further.
W36	It is unclear if the contributions of the natural gas industry to roads and social services is above and beyond the cost to roads and social services, if there is a net gain or a net loss or simply parity. Further research into the cost of road maintenance and social services with and without the expense and contribution of the industry is warranted.
W37	Further study of background noise may be warranted and should be considered as a condition of permitting by the BOCC. In any case, noise above existing background noise can be expected during some stages of natural gas development. Please see Noise Assessment for further details.
W38	As noted above, population growth may increase the number of STI, crime, etc. An increase in the number of STI, crime can strain services, no matter if the reason is due to population growth, natural gas industry or both. In Garfield County, crime and STI rates also rose during the years of natural gas boom, indicating that the rise in numbers was not due simply to more people. In any case, strain on services result from increase in both rise in numbers as well as rates. Furthermore., literature cited in the HIA indicate that itinerant workforce is associated with increase in STI. Please see Community Assessment.
W39	We agree that the physical facilities of schools in Battlement Mesa are not likely to be impacted by the Antero project. There may be other impacts to quality of education if families move in and out of the area at a high rate. Please see the Community Assessment for further details.
W40	These references discuss the ways changes to a community can impact health. While these references do not directly address residential natural gas development, the changes to community resulting from the Antero project may result in health impacts as discussed in these references.
W41	Reference to increases in STI rates in extractive industries (including natural gas) in Canada, are added to the Community Assessment. Rise in STI rates in low and middle income countries may have similar causes, including young male work forces, away from home, with high wages.
W42	The impact to wilderness and public lands was removed from the community assessment.

W43	The numerical ranking system is not used in the second draft of the HIA. Please see the Community Assessment for further details.
W44	The second draft of the HIA includes discussion of the Garfield County Land Values study and the Garfield County Socio-Economic Impact Study. These reports review economic impacts of the natural gas industry. The degree to which county revenues and expenditures have increased as a result of the natural gas industry are not readily available and detailed documentation of natural gas industry economic impacts to Garfield County are beyond the scope of the HIA. The HIA acknowledges the potential employment and revenue impact of the Antero project on Battlement Mesa. Please see Economic Assessment further details.
W45	The second draft of the HIA includes discussion of the Garfield County Land Values study and the Garfield County Socio-Economic Impact Study. Please see Economic Assessment further details.
W46	The HIA did not conduct any data collection for the HIA. There are few businesses in Battlement Mesa, but some of these may see increased business activity as a result of the Antero Project. The presence of 120-150 workers in the PUD will provide indirect economic benefits to some local businesses. However, there are very few businesses in the PUD, therefore this trickle down effect is not likely to have a substantial positive impact on most of the Battlement Mesa citizens
W47	The numerical ranking system is not used in the second draft of the HIA. Please see the Economic Assessment for further details.
W48	Please see Economic Assessment for revised recommendations.
W49	The purpose of the HIA to evaluate the health impacts of Antero's project. As such, the potential positive or negative impacts of the natural gas industry as a whole were not assessed. Documentation of the benefits and costs to the health care infrastructure in Garfield County is not available.
W50	The purpose of the investigating the number of spills in the accident and malfunctions section is to gauge the likelihood of such events occurring. We acknowledge that most spills are adequately contained. However, as evidenced in the COGCC database, some are not.
W51	Please see response to A113.
W52	Please note that the revised HIA does not have a numeric scale. In the revised HIA, accidents and malfunctions are rated as high because of the severe consequences if a catastrophic event were to occur. We acknowledge that the probability of such an event is low.
W53	It is beyond the scope of the HIA to catalog permitting and regulatory requirements of the natural gas industry.
W54	Comment noted.
W55	The demographic information is based upon the 2000 Census. The HIA team acknowledges that demographic information for the time period of 2003-2008 and the time period from 2009-present may be different from that reported. Because of the unincorporated status of Battlement Mesa, there is not additional demographic information available beyond the Census. 2010 Census information is expected in the summer of 2011.

W56	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. 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. 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). 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

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
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. 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. 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
W59	It is not possible to respond to this comment because the reviewer has not provided a reference or any details of the "probabilistic" technique used to calculate the alternative risk. However, it does appear that WSCOGA did use default EPA CTE and RMEs for exposure duration, although EPA RAGS part III specifically advises against doing this (EPA 2001). Also the reviewer only included one out of five carcinogenic COPCs in this calculation.

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. 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. The HI of 2 is not overstated or mishandled. Benzene, the trimethylbenzenes, the xylenes, formaldehyde, and 2-hexanone all have
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, chronic) is not available,
W62	**Data Quality Assurance and Usability:** Quality assurance project plans (QAPPs) and documented QA/QC procedures were in place for the collection of the data used in the risk assessment and are available from CDPHE and Garfield County. CDPHE is responsible for the quality of the data and this data is the same data used in their 2007 and 2010 risk assessments. EPA RAGS do not require a separate QAPP for each time a risk assessment is done. In addition, all samples were collected and analyzed using EPA methods by EPA certified laboratories. Field duplicates were collected and are documented in the 2007, 2008, and 2009 CDPHE reports available on Garfield County's web site. The data used in the risk assessment is reliable and suitable for identifying contaminants of potential concern in screening level risk assessments. A summary of the suitability of the data has been added to Section 2.0 of the HHRA.

W63	**COPC Selection:** This comment shows a lack of understanding of chemicals that may be associated with the natural gas industry and the conceptual site model presented as Figure 3-1 in the HHRA. **Please see response to comment W58 for a discussion on methylene chloride.** It was not possible to eliminate COPCs based on knowledge of association with natural gas operations because many chemicals associated with the operations have not been disclosed (i.e., fracking chemicals). Nor is it appropriate to eliminate organic contaminants as COPCs based on background concentrations. That being said, most of the chemicals listed in this comment have been associated with the industry. Because diesel engines are used in natural gas operations, 1,3-butadiene cannot be eliminated as a COPC. Portable toilets are used on the well pads and 1,4-dichlorobenzene is one of the chemicals used in portable toilets and cannot be eliminated. n-Hexane is one of the chemicals detected in the condensate and gas from natural gas productions. n-Hexane is not a reagent used in EPA method TO-12, which is the method that was used to determine n-hexane.
W64	**Statistical Issues:** This comment incorrectly states that the measurements used in the risk assessment are not independent measures and provides an inappropriate analogy with students. It is standard industry practice to treat air samples collected from the same location as independent samples. This is because air is a dynamic medium. The air sampled on one day at any given location, will not be the same air sampled on another day at the sample location. Therefore, the air samples are independent. All statistics were performed per standard EPA guidance using EPA statistical programs designed for these types of samples. As noted in the comment, some of the numbers of samples collected in Table 2-4 were incorrect. This did not affect the other numbers in the table, nor did the errors cascade into other tables. The calculations are not flawed and the sample numbers have been corrected for the revised HHRA. The comment incorrectly asserts the data was mined and sorted in a manner that is not technically defensible. Exposure point concentrations were determined per EPA guidance, as described in Sections 2 and 3 of the HHRA.
W65	See response to comment W64.
W66	See responses to comment 62 and 63.
W67	EPA guidance specifies the use of default RME exposures in the absence of site-specific data, which is not available for Battlement Mesa. Therefore, we followed the well-established EPA guidance. The 1E-7 risk presented for benzene presented by in this comment was derived by an undocumented procedure using exposure assumptions that are not supported by any data specific to Battlement Mesa and deviated from established EPA guidance. Different assumptions could have been made to arrive at a higher risk. WSCOGA made the following assumptions: - The leeward wind will blow away from the residents most of the time based on a wind rose from the Bell-Melton Ranch monitoring station in Silt. However, the leeward wind could just as well blow towards residences in Battlement Mesa. - An individual will be exposed for 8-9 years (The EPA default is 30 years and Antero's project will last 20-30 years). - Indoor air concentrations will be less than the outdoor air concentrations. No data is provided to support the assumption. With the use of swamp coolers, indoor air concentrations could be higher than outdoor air concentrations. - 12 to 16 hours per day are spent at the residence stating many residents work, attend community functions, shop. No data or reference is provided to support this assumption (The EPA default is 24 hours and would be closely apply to residents that spend most of there time at home such as stay at home parents, families with small children and elderly adults).

W68	See response to comment W63 and Sections 2 and 3 of the HHRA.
W69	See response to comment W61. Also noted in the 2008 risk assessment, the IUR for crotonaldehyde is uncertain (CDPHE 2010). An IUR is not reported in EPA's IRIS for crotonaldehyde. The toxicity of crotonaldehyde was evaluated using a cancer toxicity value derived in the EPA Health Effects Assessment Summary Tables (HEAST) from oral exposure studies. Although conversion of oral dose-response information to inhalation exposure is not optimal risk assessment practice, the alternative would be to omit this substance altogether from any quantitative evaluation. Crotonaldehyde is classified as a possible human carcinogen (Category C). The classification was assigned based on one animal study in which an increase in the incidence of hepatic neoplastic nodules and hepatocellular carcinomas was observed in only one sex of one species. There is insufficient evidence that inhalation is a route that results in crotonaldehyde- induced liver lesions or neoplasia. The uncertainty is discussed, but in our professional judgment and in the professional judgment of the CDPHE risk assessor, this toxicity value was used. We note, that the vast majority of the detected contaminants in the air samples could not be qualitatively considered in the risk assessment.
W70	See responses to comments W56, W57, and W61.
W71	Currently, there is no data showing that the new regulations have reduced emissions of contaminants from natural gas development and production operations. What is available are the documented odor events this summer from Antero's Watson Ranch pad, which was started after the revised rules were in place. Antero did not provide their BMPs for consideration in the draft HIA. Only when data becomes available can it be used in a risk assessment.
W72	See response to comment 56, part of which is repeated here. WSCPGA draws the incorrect conclusion that exposure to natural gas development and production does not cause cancer because the Coons and Walker's study did not find that incidence rates of cancer, including leukemia were 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, 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. Other experts have commented that the level of uncertainty in the HIA risk assessment have led to a substantial underestimation of the actual risk (See comments CIT50-CIT59).
W73	See response to previous comment.
A1	Text will be revised accordingly
A2	Text will be revised accordingly
A3	Text will be revised accordingly
A4	Text will be revised accordingly
A5	Text will be revised accordingly
A6	Text will be revised accordingly

A7	We appreciate Antero's submission of their BMPs and will consider these practices as we refine our recommendations. However, many of the submitted BMPs general and do not appear to be specific to the Battlement Mesa project. We suggest Antero only submit BMPs that they will implement in Battlement Mesa and that the BMPs be specific. For example, one BMP is "electric grid power substituted for diesel engines where possible and economically feasible". If this if possible for the Battlement Mesa project, the BMP should specifically state when and where it will be used instead of "where" possible and "if economically feasible." If it is not possible for the Battlement Mesa project, the BMP should be revised to state why it is not possible or it should be withdrawn. For the reasons above and because we did not receive the BMPs until after the draft HIA was completed, we will not be able to revise the HIA to address the BMPs. We will address the BMPs as we refine the recommendations. We will indicate where the BMPs will need to be more specific as part of the recommendations.
A8	See response to comment A7.
A9	See response to comment A7.
A10	See response to comment A7.
A11	There are common haul routes for all pads and are expected to have truck traffic throughout the five year period.
A12	Comment noted. Whether there are noise impacts should be verified with school staff. See Noise Assessment for further recommendations to address noise associated with traffic in the PUD.
A13	Please see revised Noise Assessment.
A14	Please see revised Noise Assessment.
A15	Please see revised Noise Assessment.
A16	Many commentators found the numeric ranking system to be confusing and misleading. CSPH will replace the numeric rankings with qualitative descriptors in the next version of the HIA.
A17	See response to comment A7.
A18	See response to comment A7.
A19	See response to comment A7.
A20	See response to comment A7.
A21	See response to comment 128
A22	See response to comment A7.
A23	The intent of the regulations is to reduce emissions of ozone precursors. They do not eliminate emissions of ozone precursors. In addition, these regulations do not apply to all operations (such as well development).
A24	The text of this section is revised.
A25	Text will be revised accordingly.
A26	Text will be revised accordingly.
A27	Text will be revised accordingly.

A28	Text will be revised accordingly.
A29	Text will be revised accordingly.
A30	Text will be revised to reflect Antero held 18 community (public) meetings.
A31	Text will be revised accordingly.
A32	Full analysis of chemicals associated with natural gas activities is limited. New Mexico Oil Conservation Division conducted a pit sampling study and found soil and water associated with the pits positive for high levels of lead, mercury and arsenic, and other toxic chemicals. The OCD has issued a new pit rule based on this study. http://www.emnrd.state.nm.us/ocd/
A33	Comment noted.
A34	Dave Neslin's memo confirms the West Divide gas seep contained thermogenic methane related to oil and gas activities and that a separate seep on private property did not contain thermogenic methane. It also acknowledges that in some cases the COGCC has found wells that contain thermogenic methane linked to oil and gas development. The memo does not address Dr. Thymes Report.
A35	See response to comment A35.
A36	See response to comment A7.
A37	See response to comment A7.
A38	Without access to the results, it is not possible to respond to this comment.
A39	Comment noted.
A40	See response to comment A7.
A41	Text will be revised accordingly
A42	These are EPA's maximum reasonable maximum exposure defaults and are used when site specific data is not available. It is expected that Antero's project has the potential to effect air quality in Battlement Mesa for at least 30 years, beginning with preparation of the first pad through abandonment of the last well.
A43	The Garfield County emissions inventory indicates both highway vehicles and the natural gas industry as primary contributors.
A44	This text referring to 1,4-dichlorobenzene and current conditions was removed from the revised HIA. Please see specific responses to comments on the HHRA.
A45	This information was not available for the draft HIA. This new information was used to update this paragraph.
A46	Glycol dehydrators may have similar emissions.
A47	The reference has been corrected.
A48	Comment noted.
A49	Odors in July 2010 were noticed at residences approximately 1/2 mile from the Watson Ranch Pad and samples collected in August 2010 indicated higher BTEX concentrations at 500 feet than 350 feet.
A50	Text has been revised accordingly.
A51	Comment noted.
A52	Comment noted.

A53	In the revised HIA, this section makes no specific reference to cancer risks. The risk assessment is only one of many tools that were used to assess health impacts. See response to comment W56 for a specific discussion on EPA's guidance for cancer risk.
A54	The point of discussing the odor complaints and the NOAV is that residents were effected by odors confirmed by the COGCC to be coming from the Watson Ranch Pad. The resolution of the NOAV is based on corrective actions implemented by Antero after odors were noticed.
A55	Please see response to A53.
A56	A QAPP is recommended so that all Stakeholders can be assured that sampling and analyses are conducted in such a way as to produce meaningful results that are comparable to other results. We are recommending that a QAPP be a condition of the special use permit.
A57	Please see the revised recommendations for specifics.
A58	Antero has listed electric generators in the BMPs submitted with its comments. We have refined this recommendation so that Antero specify what is feasible as a condition of the special use permit.
A59	Please see revised recommendations.
A60	See response to comment A7.
A61	It is commendable Antero has been collecting air monitoring data at the direction of CDPHE and providing results to the HIA team and Garfield County. Data Antero provided since the original HIA have been incorporated into the revised HIA to the extent possible. However, it is important that monitoring requirements be clearly stated in the special use permit so that all stakeholders understand what will be monitored and the party responsible for the monitoring.
A62	The intent of the recommendations is that residents are not impacted by noticeable odors and that their health is protected by proactive measures. Please see the revised recommendations.
A63	Comment noted.
A64	The text has been revised to many chemicals.
A65	Comment noted.
A66	See response to comment A7.
A67	It is the objective of the HIA to evaluate what is possible that could effect health.
A68	Text will be revised to indicate loss of control during well development.
A69	A reference to section 4.8, that discusses the likelihood of such events, will be added.
A70	The cited rule refers to drilling fluids and does not specifically address drill cuttings.
A71	The intent of the recommendation is that Antero should be responsible for communicating the chemicals used in its operations to the residents of Battlement Mesa.
A72	See response to comment A7.
A73	It is true that anyone speeding in the PUD represents a risk to safety. Workers present in the PUD represent additional risk.
A74	Currently there is truck traffic within the PUD for the servicing of well pads outside the PUD. This section has been revised accordingly.
A75	Text has been added acknowledging Antero will consider public input regarding the duration of the well development phase.

A76	The text has been revised accordingly.
A77	The text has been revised accordingly.
A78	The text has been revised accordingly.
A79	A reference to Antero's BMPs has been added.
A80	This statement has been removed from the revised HIA.
A81	The text has been revised to indicate the maximum that was calculated from Antero's traffic assessment and to indicate some days rather than a day.
A82	This recommendation suggests a program within Antero to encourage safe driving and discourage unsafe driving. Such a program would involve workers involved in the Antero project in the PUD.
A83	Comment noted
A84	COGCC rules allow industrial noise levels at 350 feet during well development activities. However, because well development activities are expected in Battlement Mesa for an extended time period, CSPH recommends that Anterouse sufficient noise mitigation to achieve the 55 dBA day and 50 dBA night levels at 350 feet for all activities. Industrial noise levels for the extended well development period is not health protective.
A85	Please see Noise Assessment for discussion of Antero noise monitoring and modeling. In brief, although permissible, noise at industrial levels for extended well development periods is not expected to be health protective.
A86	OSHA standard applies only to the working population and only addresses hearing loss. This standard is not applicable for residential noise consideration.
A87	The majority of Battlement Mesa residents are more than 1 mile from I-70. Noise from well pad development will be heard above background for residents both within 1 mile or farther than 1 mile.
A88	Antero BMP noted. See Noise Assessment for discussion of noise mitigation and recommendations.
A89	See response to A84
A90	Antero BMP noted. See Noise Assessment for discussion of noise mitigation and recommendations.
A91	Comment noted
A92	Noise may be within COGCC permissible levels but may be above levels that can impact health. Noise likely to be above current background levels during well development.
A93	Comment noted and assessment modified. CSPH recommends that noise impacts be verified with school staff.
A94	See Noise Assessment for discussion of Antero noise measurements and modeling.
A95	See response for A93.
A96	Comment noted.
A97	See Noise Assessment recommendations, as well as Community Assessment recommendations for discussion of Community Advisory Board.
A98	The HIA states that the Antero project will not cause a boom/ bust scenario. Please see revised Economic Assessment
A99	Employment impacts on Battlement Mesa residents is discussed in the Economic Assessment.

A100	Please see revised Economic Assessment for discussion of employment impacts on Battlement Mesa residents. There may be some Battlement Mesa residents that become employed by the Antero project but this is not expected to have large impact on overall employment in the community,
A101	See response to comment A100
A102	See response to comment A98
A103	See response to comment A98
A104	Please see Economic Assessment. There are now 2 tables that characterize positive health effects and negative health effects separately.
A105	It is not likely that the positive economic impacts will affect most members of the community. It is likely however that the negative impacts to property values will impact most members of the community. Therefore, it is expected that the positive health impacts will be low and the negative health impacts will be low to high.
A106	Please see revised Economic Assessment.
A107	Please see revised Economic Assessment.
A108	Please see revised Economic Assessment.
A109	Please see revised Economic Assessment.
A110	Comment noted Please see revised Economic Assessment.
A111	Comment noted.
A112	These statements provide examples of the potential magnitude and consequences that can be associated with catastrophic events. While we acknowledge that the probability of such of an event caused by Antero's project is small, such an event could occur.
A113	Reporting spills to COGCC is an important component of COGCCs oversight responsibilities and the COGCC rules rely on self-reporting of such spills.
A114	Because the NOAVs are a part of the public record, CSPH believes it is best to summarize all the NOAVs. This is to show that all NOAVs were reviewed.
A115	See response to comment A115.
A116	Comment noted.
A117	Comment noted, at the time of the revised HIA we have not seen these plans.
A118	Comment noted.
A119	Comment noted.
A120	See response to comment A7.
A121	Please see revised Traffic Findings and Recommendations and Traffic Assessment
A122	Please see revised Air Quality Findings and Recommendations and Air Quality Assessment
A123	Comment noted and text revised accordingly.
A124	Revised accordingly.
A125	Section 1.2.2 is a summary of the findings from the 2007 risk assessment conducted by CDPHE, not the conclusions of the current HHRA.

A126	See response to comment A126.
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 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
A128	Text summarizing uncertainties in the HHRA has been added to Section 7. Section 6 of the HHRA does contain a discussion of the uncertainty involved in the crotonaldehyde and 1,4-dichlorobenzene toxicity factors. The International Agency for Research on Cancer (IARC) has classified ethylbenzene as possibly carcinogenic to humans, based on sufficient evidence in animal studies (IARC 2000) and EPA specifies ethylbenzene as a carcinogen in their Regional Screening Levels Table. As noted in Section 6 of the revised HHRA the uncertainty in the IURs used for 1,4-dichlorobenzene, crotonaldehyde, and ethylbenzene would not effect the overall conclusion that the chronic risk for all residents is estimated to be similar to the baseline risk, that potential health risks for residents living near well pads are higher than the baseline risk and the chronic risk for all residents, and that there is a higher potential for short term to subchronic health risks during well completion activities.
A129	See response to comment A129.
A130	Section 6 of the HHRA has been revised.
A131	Section 6.2.1 of the HHRA is revised to just state that the risk may be underestimated.
A132	Some PAHs, such as naphthalene are volatile organic compounds. Windy can carry dust considerable distances. PAHs also are associated with diesel engine exhaust and the diesel engine trucks that will be used in Antero's project will not be limited to the well pads. Therefore, it is reasonable to consider the potential for PAH contamination of both ambient air and surface soil. The word "significant" has been removed from this text in the revised HHRA.
A133	The HHRA did not intend to misrepresent CDPHE's conclusion. It is true that crotonaldehyde was significant risk driver in the 2010 CDPHE risk assessment. However, even without crotonaldehyde, the risk was greater than 1 in a million and CDPHE stated the risk was likely underestimated To avoid possible misrepresentation, the entire conclusion has been added to the HHRA Section 1.2.4 as follows. "These total risk estimates are based on all carcinogenic chemicals including crotonaldehyde, for which there is high uncertainty in the inhalation unit risk factor. However, the total cancer risks at all monitoring sites remain above the mid-point of EPA's acceptable cancer risk range of 1E-06 to 1E-04 even when crotonaldehyde is excluded. The major contributors to this risk are formaldehyde and benzene. The estimated risks with and without crotonaldehyde indicate a low to moderate increased risk of developing cancer during a lifetime. Overall, it is important to note that the cancer risks are likely to be underestimated in this assessment because cancer toxicity values are only available for a small number of air toxics."

A134	See response to comment A134. We correctly reflect CDPHE's conclusion that the HQ from each of the individual chemicals is less than one and that the sum of the hazards from the individuals chemicals is less than one.
A135	The HHRA has been revised accordingly.
A136	The HHRA has been revised accordingly.
A137	As provided in the HHRA, there are studies supportive of synergistic effects of mixtures of air contaminants. The HHRA authors were unable to find studies supporting antagonistic effects of mixtures of air contaminants. However, the text has been revised to acknowledge the theoretical possibility of antagonistic effects.
A138	As discussed in Section 5.3.2 of the HHRA, more COPCs without toxicity values in the well completion data set exceeded background threshold values then in the data evaluated for overall exposure and the data evaluated for baseline. This is the reason for the difference between these discussions. The word significant has been removed from this text in the revised HHRA.
A139	The raw data is available upon request. The HHRA used the 95% UCL recommended by EPA's pro UCL program that was most appropriate for the distribution of each data set.
A140	A revised HHRA with Table 2-7 was posted on the Garfield County Web site in the first week of October. This table was available to WSCOGA, who made no comment on the table.
A141	The EPA guidance sited in this is not applicable to selecting COPCs. Rather, it is applicable to calculating the exposure point concentration after a COPC has been selected. If the detection frequency is low (such as less than 30%), it may not be appropriate to calculate a 95% UCL for the exposure point concentration. In these cases, the guidance recommends using the maximum detected concentration, as was done in the HHRA. Per EPA guidelines, the use of using a five percent detection frequency in selecting COPCs is a matter of professional judgment. CDPHE does not use the five percent filter in selection of COPCs and selects all detected chemicals exceeding the screening threshold as COPCs. In this HHRA, this was done for chemicals that were detected that had an EPA regional screening level. If a chemical was detected, but did not have an EPA RSL, it was not selected as a COPC if it had a detection frequency of less than five percent. COPC selection does not apply to Background Threshold Values.
A142	The differences in the two comparisons are primarily due to the differences in exposure point concentrations for the two exposure scenarios. A statistical comparison of the two datasets has been added to Section 2 of the revised HHRA. For most COPCs tested, the two data sets were found to be significantly different at an alpha level of 0.05.
A143	These samples were collected when residents observed odors they attributed to natural gas activities and the text has been revised to clarify this point. As evidenced in odor complaints filed with the COGCC in July 2010, odor events were associated with well completion activities on the Watson Ranch Pad. In addition, the 2008 Air Toxics study showed that higher concentrations of air toxics were emitted during well completion activities, which is supported by the statistical comparison in Section 2 of the revised HHRA. The results from samples collected during noticeable odor events were used to estimate a worse case exposure for a maximally exposed individual and the potential for overestimation is noted in the referenced section of the HHRA.

A144	If the population density is higher, ambient concentrations from other sources maybe higher and therefore, the overall risk to Battlement Mesa residents may be higher. The text in this bullet has been revised for clarification. The HHRA process is not designed to separate out the risk from one particular source.
A145	This is beyond the scope of the HIA. The HIA does reference the reader to the HHRA from information on toxicity. Please note that the revised HIA contains an extensive discussion on information gaps in the air assessment.
A146	See response to A146
A147	The toxicity factors used in the HHRA were selected using EPA's hierarchy for selecting toxicity factors and are those used as standard practice in the HHRAs. They also are the same toxicity factors, with a few updates, that CPDHE's toxicologist used in the 2007 and 2010 ambient air risk assessments for Garfield County.
A148	The toxicity of a chemical will vary based on the route of entry. Chemicals that have toxicity when inhaled, such as acetylaldehyde, may not be toxic when ingested.
A149	The toxicity factors used in the HHRA were selected using EPA's hierarchy for selecting toxicity factors and are those used as standard practice in the HHRAs. A theological discussion of derivation of each toxicity factor is beyond the scope of the HHRA.
A150	Baseline data from Battlement Mesa that was collected after the release of the first version of the HHRA was used to calculate a baseline risk in the revised HHRA. As pointed out in this comment, the Silt-Cox and Silt-Daley sites may not be applicable to Battlement Mesa and are not used to estimate baseline risk in the revised HHRA. Please also see response to comment A145.
A151	This risk is presented as a "maximally exposed individual" which represents a worse case scenario. Surface run off has been observed at well pads and exposure point concentrations were from a sample of this run-off (HHRA 3.5.3). Samples were collected from residences during the odor events, so it is assumed that were at least 150 feet from the well pad, if not more.
A152	Without specific engineering controls, completion activities, and meteorological data it is not appropriate to further expand on the uncertainties
A153	Based on activities observed at the Watson Ranch Pads, well completion activities occur over 5 to 6 months per pad and in Battlement Mesa is likely that some residents will be exposed to completions on more than one pad. Based on this information, the 10-month exposure has been increased to 20-months in the revised HHRA and is reasonable. Please note, that for the subchronic exposure scenario in the revised HHRA the length of the exposure does not change the subchronic risk from inhalation exposure.
A154	The specific purpose of the HIA for Battlement Mesa is to access baseline conditions in Battlement Mesa and potential health impacts of Antero's proposal to develop approximately 200 natural gas wells within the Battlement Mesa Planned Urban Development (PUD). Many other activities in the region, such as indoor air and fueling cars can impact public health. However, it is outside the scope of the HIA to address these impacts.
CD1	An urban area with higher risk could indicate that measures are needed to lower the exposures of that urban area. The fact that an urban area has higher risk should not imply that no action is necessary in the rural area. Also voluntarily assumed risk and involuntary risks are not comparable. However, there is comparison of ambient air measurements in the Air Assessment.

CD2	Topography and meteorlogic conditions are likely to play a part in exposure, but at this time there is not any data specific to Battlement Mesa that would support adjusting the estimated health risk up or down. Both topography and meteorology could theoretically decrease or increase exposure conditions at the same location. Since the release of the draft HIA, meteorological data specific to Battlement Mesa. This data will be used in a discussion of how meteorology may effect exposures to emissions from trucks and well pads.
CD3	Generally speaking, the number of significant figures reflects the precision of a number or measurement. For example 31 and 3.1 have the same number of significant figures. We reported hazard indices to one significant figure and cancer risks to two significant figures, per EPA guidance. Percentages are reported to 2 or 3 significant figures.
CD4	The HHRA will be revised accordingly.
CD5	We will perform an edit of the document for the next version.
CD6	The HIA will be revised accordingly.
CD7	Evaluation will be used in place of monitoring, as appropriate. Note, there are cases in the HIA when monitoring is the correct term. We will use implementation and next steps as appropriate.
CD8	We agree that more data is needed to fully address acute risks and will add a reference here to the sections of the HIA that discuss the need for additional data. However, we do not agree that limited data indicates a low risk for acute (short-term) health effects. The limited available data indicates a moderate to high risk that acute health effects are likely to occur if well development were to proceed as it has historically.
CD9	This statement will be clarified to indicate the HIA PROCESS (rather than RESULTS) may have implications beyond Battlement Mesa.
CD10	This comment is in an agreement with our statement on ozone on this page. No revisions are necessary.
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
CD12	It is unfortunate CDPHE did not have time to review the human health risk assessment. It was the intent of the CSPH to have the HIA process benefit from the expertise available at CDPHE prior to the release of the draft document.
CD13	Many commentators found the numeric ranking system to be confusing and misleading. We have replaced the numeric rankings with qualitative descriptors in the revised HIA.
CD14	The text was revised accordingly.

CD15	The statement in the HIA that PM 2.5 may be a carcinogen is supported by the conclusion in EPA's Integrated Science Assessment of Particulate matter: "Collectively, the evidence from epidemiologic studies, primarily those of lung cancer mortality, along with the toxicological studies that show some evidence of the mutagenic and genotoxic effects of PM is suggestive of a causal relationship between long-term exposures to PM2.5 and cancer" (EPA 2009).
CD16	The text was revised accordingly.
CD17	We incorporated ambient air data that became available for Battlement Mesa and removed the discussions on the Silt-Cox and Silt-Daley sites.
CD18	This discussion has been removed from the revised HHRA. Specific sources are discussed on page 11 of the Garfield County Ambient Air Quality Monitoring Study June 2005 to 2007 which reads "To summarize the PM10 chemical speciation samples, it is evident that geologic material is the primary constituent of PM10 in the ambient air. It also appears that lighter weight fossil fuel combustion is the main source of carbon in the samples. This is likely from a combination of oil and gas production and building heating." For clarification, we will include the entire quote in the HIA.
CD19	This discussion is specific to baseline conditions in Battlement Mesa. The ozone data from the canyon station, which is in the midst of gas development activities would not be representative of baseline conditions in Battlement Mesa.
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
CD21	Since the draft HHRA, CSPH has been able to find sub-chronic toxicity values for several of the COPCs in the risk assessment. In addition, the averaging time of 365 days for the acute risk was incorrect and that the averaging time should be 7 days. The acute risk has been re-calculated with these corrections. Please refer to the revise HHRA.
CD22	Please see response to CD21.
CD23	This paragraph has been revised with information provided by Antero in its comments.
CD24	The text was revised accordingly.
CD25	See response to comment CD24. All of the condensate tanks are expected to have greater than 5 tons of uncontrolled VOC emissions and most are located within 1/2 mile of a residence. In addition, the 1/4 distance may not be protective of health. Data is needed to determine to determine at what distance emissions no longer effect health.
CD26	The text was revised accordingly.
CD27	Comment noted.

CD28	It was CSPH's intent to have a child receptor represent the maximum exposed individual. However, based on several comments, CSPH will add a maximum exposed individual scenario for an adult and an elderly adult aged 65 or more years.
CD29	CSPH agrees that that "adjacent well" needs to be better defined and will define adjacent to a well pad as within ½ mile, based on odor complaints filed with the COGCC in July and August 2010.
CD30	See responses to comments CD1 and CD2.
CD31	See response to comment CD34.
CD32	See response to comment CD14. Also, the revised HIA contains a discussion on uncertainty and what is not known.
CD33	The magnitude of risk in the Air Assessment has been modified to "Low to High" to reflect possible less severe health effects as well as more severe effects.
CD34	A more extensive discussion of the limitations of the HHRA interpretation has been added to both the HIA and HHRA.
CD35	Please see response to CD35.
CD36	The text was revised accordingly.
CD37	Please see revised recommendations.
CD38	Please see revised recommendations. Please also note that it is the objective of the HIA to make recommendations for the purpose of protecting health. It is not the purpose of the HIA to determine economic feasibility.
CD39	Please see response to A58.
CD40	Please see response to comment CD26.
CD41	Please see the revised recommendations.
CD42	The table was revised accordingly.
CD43	This section has been revised.
CD44	Please see response to comment CD30.
CD45	Please see response to comment CD29
CD46	References to the two ATSDR reports were added to Section 1 of the revised HHRA.
CD47	The text was revised accordingly.
CD48	The text was revised accordingly.
CD49	The text was revised accordingly.
CD50	See response to comment CD21
CD51	See response to comment CD5
CD52	The text was revised accordingly.
CD53	Please see response to CD30. CSPH also notes that the results from Antero's most recent air sampling during well completion activities indicated higher concentrations of BTEX at 500 feet than 350 feet.
CD54	Please see response to comment CD29
CD55	Please see response to comment CD22.
CD56	The 2005-2007 report lists these as rural sites only
CD57	The text was revised accordingly.
CD58	The text has been revised to include the 15 second time.

CD59	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.
CD60	Because the HIA is specifically for an Antero project, it does have bearing in this circumstance.
CD61	The text was revised accordingly.
CD62	The text has been revised to indicate this is the minimum of the range.
CD63	The text will be revised to state the PM2.5 exceedences were observed at the Rifle monitoring station and that they were observed in December and January.
CD64	See response to comment CD2
CD65	See responses to BCC comments
CIT1	Comment Noted.
CIT2	Comment Noted.
CIT3	Comment Noted
CIT4	Comment Noted.
CIT5	Comment Noted
CIT6	The HIA does recommend collecting additional data and studies as part of a EHMS.
CIT7	Comment Noted.
CIT8	Comment Noted.
CIT9	Comment Noted. References to the scale of the Antero project are made in comparison with the size of the natural gas industry in Garfield County as a whole. As noted in the HIA, despite the relative small size of the project, it will be the only industrial activity in the community and therefore is a large industry for Battlement Meas.
CIT10	Elderly and children are considered vulnerable groups from a community wellness standpoint. Please see revised Community Assessment.
CIT11	Elderly and children are considered vulnerable groups from a community wellness standpoint. Please see revised Community Assessment.
CIT12	Elderly and children are considered vulnerable groups from a community wellness standpoint. Please see revised Community Assessment. Collection of data from Battlement Mesa was beyond the scope of the HIA.
CIT13	Elderly and children are considered vulnerable groups from a community wellness standpoint. Please see revised Community Assessment. Collection of data from Battlement Mesa was beyond the scope of the HIA. Comments provided by citizns regarding mental health impacts are discussed in the revised Community Assessment.
CIT14	Please see revised Community Assessment.
CIT15	Please see revised Community Assessment.
CIT16	The HIA team made several attempts to document real estate conditions in Battlement Mesa, but there is no data available.
CIT17	Comment noted. This reference had been corrected.
E1	While unlikely, the potential for widespread impacts to surface and groundwater does exist.
E2	Baseline is now available for Battlement Mesa and has been incorporated into the risk assessment.

E3	Public safety is part of the public health
E4	Data not available for similar circumstances (i.e. same gas resource, community density, etc.)
E5	Comment noted
CIT18	Comment noted
CIT19	Comment noted
CIT20	Comment noted
CIT21	Comment noted
CIT22	Comment noted
CIT23	This recommendation has been added to the HIA.
CIT24	Comment Noted.
CIT25	Recommendations in the HIA addressing this concern have been clarified.
CIT26	
CIT27	Comment noted.
CIT28	Comment noted.
CIT29	Comment noted.
CIT30	This recommendation has been added to the HIA.
CIT31	This recommendation has been added to the HIA.
CIT32	Comment noted
CIT33	This recommendation is in the HIA.
CIT34	This recommendation is in the HIA.
CIT35	Air monitoring recommendatons are included in the HIA
CIT36	This recommendation is in the HIA.
CIT37	This recommendation is in the HIA.
CIT38	This recommendation has been added to the HIA.
CIT39	Comment noted
CIT40	Comment noted
CIT41	This recommendation has been added to the HIA.
CIT42	Comment noted
CIT43	Comment noted
CIT44	Comment noted
CIT45	Comment noted
CIT46	Comment noted
CIT47	Comment noted
CIT 48	Please see recommendations in Economic Assessment regarding requirement for specfic plan from Antero.

CIT49	It was CSPH's intent to have a child receptor represent the maximum exposed individual. However, based on Dr. Kornberg's comments and other comments, CSPH has added a maximum exposed individual scenario for an elderly adult. In addition, the increased vulnerability of elderly adults to health effects associated with air pollution has been added to Section 6 of 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
CIT51	CSPH has added a statement to the uncertainty section that the MSDS sheets may not include all chemicals associated with their operations, such as those considered as proprietary. The HIA recommends full disclosure of all chemicals.
CIT52	CSPH does recommend collection of data for use in such a model in the HIA itself. We also have added a this to the data gap discussion in Section 7 of the revised HHRA. However, it is important to note that no model will be 100 percent accurate.
CIT53	The "well" qualifier will be removed from this sentence and the following text will be added to the risk assessment for prospective. "Guidance from USEPA Region 8 states that "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 1 and a million and 1 in 10,000 are generally considered to be acceptable, although this is evaluated on a case-by-case basis and EPA may determine that risks lower than 1 in 10,000 are not sufficiently protective and warrant remedial action" (http://www.epa.gov/region8/r8risk/hh_risk.html).”"
CIT54	The scope of the HIA was to use available data to estimate potential health hazards and risks from Antero's proposed project. The CSPH has stated in both the HHRA and HIA that there is much uncertainty in the risk estimates. Please note that the HHRA is one of many tools that was used to support the conclusions and recommendations in the HIA.
CIT55	See response to comment CIT49
CIT56	The data for such a model is not available. Please see the revised data gap discussion in Section 7.
CIT57	See response to comment CIT56
CIT58	Comment noted
CIT59	There will be an opportunity to comment following the release of the next version of the HIA.
CIT60	We appreciate the commenter adding this information to the HIA process. We have reconsidered the ranking of the accidents and malfunctions. Please see the response to comment BCC23 and the revised accident/malfunctions assessment.

CIT61	Currently, there is not data to support this recommendation. It is not known what set-back distance would be protective of public health. Please see the revised air assessment and recommendations
BCC1	Antero has indicated that there will be no open pits on the well pads. They have referred to a "pond" on the water treatment and storage pad. In the revised HIA we have made several recommendations in the water and air assessments concerning the water storage facility. In the revised HIA we encourage to explore closed loop systems.
BCC2	A recommendation encouraging Antero to implement closed loop vapor recovery systems rather than flaring was in the original HIA and is in the revised HIA. Note: While closed loop vapor recovery is most protective of public health, flaring (with the use of auto-igniters) does reduce public health impacts. Also the energy used to operate closed loop systems and accompanying emissions need to be considered when comparing vapor recovery to flaring.
BCC3	The revised HIA recommends that the water storage facility and pipeline network be installed and fully functional prior to any drilling in the PUD.
BCC4	Battlement Mesa ambient air data is now available and will be added to the HIA. Please see the revised air assessment for recommendations on monitoring requirements throughout the life of Antero's project.
BCC5	Please see response to comment BCC5.
BCC6	Please see Next Steps Recommendations
BCC7	Sulfur was not detected Antero's analysis of the natural gas resource.
BCC8	We have added a recommendation that the BOCC assign a county inspector responsible for ensuring Antero complies with the special use permit and that the special use permit contain regulatory actions for non-compliance.
BCC9	We have added recommendations to the air assessment for preventing odor events and actions to be taken in the event of an odor event.
BCC10	Several of these dust mitigation recommendations are in the surface use agreement between BMSA and Antero, such as graveling access roads and use of dust suppressants. We have added a recommendation that these measures be made a part of the special use permit. In addition, there are recommendations for the removal of mud from trucks before they leave the well pad site, covering truck loads, and covering drill cuttings.
BCC11	It is out of the scope of the HIA to make this recommendation.
BCC12	It is out of the scope of the HIA to make this recommendation.
BCC13	As noted in the risk assessment, soil is a pathway of concern. A specific recommendation for characterizing baseline soil at each well pad, prior to any activities, as well as part of closing the well pads has been added to the HIA in the water and soil assessment.
BCC14	We have added a recommendation in the revised HIA that a separate haul route be built outside the PUD and that truck traffic be routed off of Stone Quarry Road and other residential streets.
BCC15	This recommendation was in the original HIA and is in the revised HIA.
BCC16	Please see Next Steps Recommendations
BCC17	This will be one of the objectives of the Environmental and Health Monitoring Study.
BCC18	The CSPH team is not aware of data to support this claim.
BCC19	Comment noted.

BCC20	This is now emphasized in the recommendations.
BCC21	It is out of the scope of the HIA to make this recommendation.
BCC22	Please note, that based on this and other comments, the numeric ranking scale has been replaced with qualitative descriptors. In response to this comment and others, more emphasis has been added to the potential health impacts from accidents and malfunctions.
BCC23	This recommendation has been added to the HIA.
BCC24	Please see recommendations in the accident/malfunction assessment.
BCC25	We have added a recommendation to the revised HIA that the fire department inspect all well pad locations and make recommendations to prevent the spread of fires from the well pads.
BCC26	The paragraph has been revised as follows: "Using this scientifically based, methodological approach we found that air emissions are likely to occur at levels that can cause human health impacts, especially to vulnerable populations. Increased traffic, particularly increased truck traffic, will be a safety risk to Battlement Mesa residents and contribute to increased air and noise pollution. Industrial accidents/malfunctions are likely and some may impact health, but incidents of this nature are difficult to predict. Increased noise may annoy some residents, but at current and anticipated future levels it is not likely to cause health impacts. Should water contamination occur, it could also cause important health impacts to Battlement Mesa residents, but this type of event is not likely to occur.
BCC27	Comment noted, please see revised Conclusions section.
CIT62	Comment noted
CIT63	Please see revised Water Assessment
CIT64	Comment noted
CIT65	Comment noted
CIT66	Please see recommendations in the accident/malfunction assessment.