

MANAGING GARFIELD COUNTY'S AIR QUALITY

2008 AIR MONITORING PROPOSAL

Prepared By

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November 2007

Funding Requested: \$135,000
Project Period: January 1, 2008 – December 31, 2008

1.0 EXECUTIVE SUMMARY

In 2005, Garfield County invested in, and embarked on, a 2-year air quality monitoring study to begin characterizing ambient air quality in the County. Up to this point, the study has focused on characterizing air quality from Glenwood Springs to Parachute in order to gather and establish some initial baseline measurements. Ambient air quality has been characterized with specific attention to particulate matter of 10 microns or less (PM₁₀) and volatile organic compounds (VOC).

The intent of the study has not been to replace existing agency or industry programs, but rather provide supplemental information characterizing the county air quality as a whole. Our efforts have been designed to meet the concerns of the Garfield County public, dovetailing with the Colorado Department of Public Health and the Environment (CDPHE) as well as local industry air quality sampling efforts. We believe our data is a critical piece toward developing comprehensive information regarding air quality in an effort to assist the County to make strong decisions with regard to managing air quality impacts from growth.

This proposal is intended to modify our previous air monitoring efforts with the hope of accomplishing the following long-term objectives:

- 1.) Continue characterizing concentrations of local scale air toxics and particulate matter to develop a baseline reference for long-term measuring.
- 2.) Build upon our previous study that has identified data gaps for local source emissions.
- 3.) Implement a more targeted approach with the goal of answering specific questions about the potential relationship between the air quality in Garfield County and human health risk.
- 4.) Further develop the basis for decisions on how Garfield County can best manage impacts of air pollution caused by overall development.
- 5.) Create a comprehensive community-based air quality management plan and implementation strategy based on the best available scientific data and practices.

Our overall monitoring proposal for 2008 suggests a much narrower approach in terms of the number of fixed sampling locations when compared to previous air sampling efforts. However, we and our collaborators (Garfield County Air Quality Technical Workgroup) believe that results from our previous sampling efforts have shown that by narrowing our scope, we will maximize the funding to gather the best data possible and further determine how the Garfield County air monitoring efforts will continue to evolve.

Particulate matter is a well-known contributor to cardio-pulmonary and other respiratory system effects in people. The Colorado Department of Public Health and Environment (CDPHE) will fund the equipment and laboratory analysis involved with continued operation of the existing PM₁₀ monitors in Rifle and Parachute only. The decision to continue this level of monitoring is based on data which indicates that these two areas represent the highest PM₁₀ levels in the County. We will maintain the 3-day sampling schedule that was utilized during our initial study. CDPHE has expressed interest in

assisting the County to develop an approach to monitoring PM_{2.5}. Environmental Health will continue to pursue this effort.

In an effort to better define VOC issues in the community our proposal for 2008 is to begin using EPA Compendium Method TO-12 to measure for non-methane organic compounds (NMOC). Using this analytical method, we will continue to gather data on all of the hazardous air pollutants (HAP) detected in our initial study as well as several other compounds that have been implicated as ozone precursors; an air quality management issue of increasing interest for Garfield County and the State of Colorado. NMOC sampling will be performed for 24-hours on an every six day basis (starting January 2008) at the existing Rifle (Henry Building), Parachute (Old High School), and the Bell Ranch locations. A fourth location will be determined at a later date as another fixed rural location in close proximity to oil and development activities or as a mobile (rotating) location used to respond to local citizens' odor concerns.

We also intend to begin using EPA Compendium Method TO-11A to measure for a variety of carbonyl compounds. Carbonyls have been implicated in the occurrence of eye, skin and respiratory irritation. Carbonyl sampling will be performed for 24-hours on an every twelve (12) day basis (starting January 2008) at the existing Rifle (Henry Building), Parachute (Old High School), and the Bell Ranch, locations. A fourth location will be determined at a later date as another fixed rural location in close proximity to oil and gas development activities or as a mobile (rotating) location used to respond to local citizens' odor concerns.

Metrological monitoring will continue to be monitored continuously for the upcoming year at all proposed locations. Meteorological equipment was previously purchased by Garfield County for the 2 year study and no additional funding will be necessary for this effort.

2.0 PARTICULATE MATTER

2.1 PM₁₀ Background (2005-2007)

For the last two (2) years, particulate matter (PM₁₀) was monitored to gauge baseline conditions of the air in both rural and urban areas along with active and planned natural gas fields. It should be noted that PM₁₀ are labeled as "coarse" particles by the U.S. EPA and are generally *emitted from sources such as vehicles traveling on unpaved roads, materials handling, crushing and grinding operations, and windblown dust.*

Garfield County PM₁₀ sampling was initiated in April 2005. Seven (7) of the original PM₁₀ stations (2 sampling units per site) were established in Garfield County (Appendix A). These were located at: Glenwood Springs (County Court House), New Castle (Library), Cox Property (Silt Mesa Road), Rifle (Annex Building), Parachute (Old High School), Bell Ranch (Adjacent to Dry Hollow Road), and the Daley Property. As of June 2007, the Cox location has since been eliminated, thus reducing the number of fixed stations to six (6) altogether. All sites were chosen and installed based on criteria used

throughout the State of Colorado. PM₁₀ particulate monitoring was performed for 24-hours on an every third day basis.

Concentrations of PM₁₀ were compared to National Ambient Air Quality Standards (NAAQS) to determine if public health is potentially being compromised. No exceedances of the Federal National Ambient Air Quality Standard (150 ug/m³) were observed and all 24 hour concentrations were 50% or less of the NAAQS. In general, PM₁₀ concentrations in urban areas were higher than in rural areas. Thus, based on the urban sites having higher concentrations, it is likely that motor vehicles as well as other man-made activities are the largest contributor to PM₁₀ in the area. Overall, pollutant levels were found to be generally low, though individual sources may have impacts.

2.2 2008 Plan for Particulate Matter (PM₁₀)

The plan for 2008 is to reduce the number of fixed PM₁₀ monitors from seven (7) to two (2). The reasons for doing so are as follows:

- 1.) Our 2 year study has indicated higher concentrations of particulate matter in the urban areas of Western Garfield County (particularly Rifle and Parachute) when compared to other areas. Therefore, there is no longer a need to dedicate resources for monitoring PM₁₀ in areas where concentrations are very low.
- 2.) Given that motor vehicles as well as other man-made activities are the largest contributor to PM₁₀ in the area, our focus is to target areas with higher levels of activities that are more closely associated with oil and gas development and population growth.

The CDPHE will fund the equipment and laboratory analysis involved with continued operation of the existing PM₁₀ monitors in Rifle and Parachute only. The decision to continue this level of monitoring is based on data which indicates that these two areas represent the highest PM₁₀ levels in the County. We will maintain the 3-day sampling schedule that was utilized during our initial study.

2.3 2008 Plan for Particulate Matter (PM_{2.5})

Currently, Garfield County is not measuring “fine” particulate matter (PM_{2.5}). PM_{2.5} are labeled as “fine” particles that result from *fuel combustion from automobiles, power plants, wood burning, industrial processes, and diesel powered vehicles such as buses and trucks.* These fine particles are also formed in the atmosphere when gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds (all of which are also products of fuel combustion) are transformed in the air by chemical reactions. Exposures to PM_{2.5} are a health concern because they easily reach the deepest recesses of the lungs. Scientific studies have suggested links between fine particulate matter and numerous health problems including asthma, bronchitis, acute and chronic respiratory symptoms such as shortness of breath and painful breathing. These same fine particles that lead to health effects are also a major cause of visibility impairment in most parts of the United

States. It is estimated that in certain parts of the U.S. the visual range has been reduced by 70% of natural conditions. Because these particles are so small, they can travel great distances affecting areas in other states or even regions. Fine particles also have a great affinity for water thus contributing to acid rain. Acid rain affects all things biological or man made and by thus affecting the environment, can have repercussions to human health. This problematic cycle is why the EPA has taken an initiative to monitor and address fine particles in the atmosphere.

CDPHE has expressed interest in assisting the County to develop an approach to monitoring PM_{2.5}. Environmental Health will continue to pursue this effort.

Localized oil and gas activities produce emissions from diesel truck and oil rig engines that are well within the PM_{2.5} size fraction. In addition, the inventory of mobile source emissions in Garfield County is growing rapidly. The sources of these emissions include diesel powered vehicles servicing industry which often travel on dirt roads passing close to homes of local residents. Emissions from vehicles traveling along Interstate 70 and the Union Pacific Railroad are also growing rapidly. These transport corridors traverse along the Colorado River Valley and are experiencing more frequent and larger numbers of vehicles that supply construction materials demands of the natural gas industry. Thus, PM_{2.5} concerns have developed from nearby residents and we believe they should be evaluated and addressed.

PM_{2.5} particulate monitoring would most likely be performed for 24-hours on an every third day basis following the EPA sample calendar (starting January 2008). Sampling will take place at either the existing Rifle (Henry Building) or Parachute (Old High School) locations. Both sites have existing electrical power sources and access.

3.0 VOLATILE ORGANIC COMPOUNDS (VOC)

3.1 VOC Background (2005-2007)

Monitoring for volatile organic compounds was conducted at fourteen (14) fixed sites (Appendix A) for 24-hours on a once per month or once per quarter basis. In addition, grab samples were also collected for volatile organic compounds at a number of locations based on odor complaints. Two source-specific grab samples were also collected.

Collectively, VOC concentrations were found to be generally low and no compound was detected 100 % of the time, although several VOC sampling locations did detect toluene in 100% of the samples. In general, for the 24-hour samples, concentrations of detected compounds were higher in rural oil and gas development areas than in the urban areas. Sampling was performed in accordance with an EPA Compendium Method (TO-15) which targeted 43 different VOC. Monitoring recorded detectable concentrations of 17 of the 43 compounds measured. Compounds that were detected in the highest concentrations were acetone and the BTEX group (benzene, toluene, ethylbenzene and xylenes). The BTEX group of VOC is commonly associated with motor vehicles. Thus it is no surprise to find these in the urban areas of Glenwood Springs, New Castle, Rifle and Parachute. However, the grab samples, and in particular the source-specific grab samples,

show that the BTEX compounds are very much associated with the oil and gas development activities in the area as well.

Currently, there are no National Ambient Air Quality Standards (NAAQS) or any other ambient air standards for VOC. Instead, for these chemicals, emissions limits on industrial sources have been set. EPA has developed a set of risk factors for both acute and chronic exposures to a long list of hazardous air pollutants. In addition, risk factors from the Agency for Toxic Substances and Disease Registry (ATSDR), the California Air Resources Board (CARB) and others may also be used to determine potential risks from exposure to VOC's. People exposed to toxic air pollutants in the BTEX group at sufficient concentrations and durations may have an increased risk of experiencing cancer or other health effects.

3.2 - 2008 Plan for Volatile Organic Compounds (VOC)

The plan for 2008 is to reduce the number of VOC sampling locations from fourteen (14) to four (4). The reasons for doing so are as follows:

- 1.) Our 2 year study indicates that the EPA Compendium Method TO-15 has provided quality baseline data, and we see no additional need for this effort.
- 2.) Many of the sites utilized during the 2005-07 study showed that the presence of VOC at these sites was very low or virtually non-existent.
- 3.) We hope to further characterize the differences between local scale air toxics commonly associated with urban motor vehicle activity and that which is associated with rural oil and gas development activities.

Our proposal for 2008 is to begin using EPA Compendium Method TO-12 to measure for non-methane organic compounds (NMOC). In addition to total NMOC monitoring we plan on performing speciation for the 54 individual compounds. Many of the NMOC are implicated as ozone precursors; an air quality management issue of increasing interest for Garfield County and the State of Colorado and we intend to continue collaborating with all agencies focused on state and regional ozone issues.

NMOC sampling will be performed for 24-hours on an every six day basis (starting January 2008) at the existing Rifle (Henry Building), Parachute (Old High School), and the Bell Ranch locations. A fourth location will be determined at a later date as another fixed rural location in close proximity to oil and development activities or as a mobile (rotating) location used to respond to local citizens' odor concerns. This equates to 264 total NMOC samples (including duplicates) for the upcoming year (Table 1).

In addition, to NMOC, our group has an increased interest to measure and analyze formaldehyde, acetaldehyde, acetone, and other carbonyl compounds (both aldehydes and ketones). Carbonyl compounds, especially low molecular weight aldehydes and ketones,

have received increased attention in the regulatory community due in part to their effects on humans and animals. Exposure to formaldehyde and other specific aldehydes (acetaldehyde, acrolein, and crotonaldehyde), even short term, has proven to cause irritation of the eyes, skin, and mucous membranes of the upper respiratory tract. High concentrations of carbonyls, especially formaldehyde, can injure the lungs and may contribute to eye irritation and affect other organs of the body. Aldehydes may also cause injury to plants. Some carbonyl compounds are emitted directly to the atmosphere as primary pollutants, such as solvent evaporation, or incomplete combustion of fuels. In addition, carbonyl compounds may be formed in ambient air through the atmospheric oxidation of hydrocarbons; hence some carbonyl compounds may also be secondary pollutants.

Our proposal for 2008 is to begin using EPA Compendium Method TO-11A to measure for a variety of carbonyl compounds. Carbonyl sampling will be performed for 24-hours on an every twelve (12) day basis (starting January 2008) at the existing Rifle (Henry Building), Parachute (Old High School), and the Old Bell Ranch, locations. A fourth location will be determined at a later date as another fixed rural location in close proximity to oil and development activities or as a mobile (rotating) location used to respond to local citizens' odor concerns. This equates to 180 total carbonyl samples (including blanks and duplicates) for the upcoming year (Table 1).

4.0 - METEOROLOGICAL MONITORING

Metrological monitoring was performed for the 2 year ambient air quality study (2005-2006) and will continue to be monitored continuously for the upcoming year at all proposed locations. Meteorological equipment was previously purchased by Garfield County for the 2 year study and no additional funding will be necessary for this effort.

5.0 - SUMMARY OF 2008 GARFIELD COUNTY AIR MONITORING PLAN

Table 1. Number of Samples for the 2008 Garfield County Air Monitoring Plan

Site Location	*PM ₁₀ (24-hr, every 3 days)	*PM _{2.5} (24-hr, every 3 days)	NMOC (24-hr, every 6 days)	Carbonyls (24-hr, every 12 days)	MET Station (Real Time)
Parachute ¹	120	TBD	66	45	Continuous
Rifle ²	120	TBD	66	45	Continuous
Bell Ranch ³	-	-	66	45	Continuous
Location ⁴ TBD	-	-	66	45	Continuous

*CDPHE will fund the equipment and laboratory analysis involved with continued operation of the existing PM₁₀ monitors in Rifle and Parachute only. They have also expressed interest in potentially funding PM_{2.5} monitoring at 1 Garfield County site

1. *Parachute (Old High School, 100 E. 2nd Street)*. A small urban center within very close proximity to oil and development activities. Parachute is also a hub of industrial support businesses and experiences heavy industrial, commercial and commuter traffic on a daily basis. The town is bisected by Interstate 70 and is subject to heavy daily railroad activity

supplying materials to the oil and gas industry. Parachute has a population of 1360 (July 2005 population estimate). This is an increase of 1.6 percent from the 2000 census. The Parachute PM₁₀ monitor has been in operation since May 2000.

2. *Rifle (Henry Building, 144 3rd Street)*. A rapidly growing urban center within very close proximity to oil and development activities. Rifle is also a hub of industrial support businesses and experiences heavy industrial, commercial and commuter traffic on a daily basis. The town is bisected by Interstate 70 and is subject to heavy daily railroad activity supplying materials to the oil and gas industry. Rifle has a population of 8118 (July 2005 population estimate). This is an increase of 4.6 percent from the 2000 census.

3. *Silt - Old Bell Ranch (512 Owens Dr.)*. A rural homestead approximately 4 miles south of the town of Silt in currently in close proximity to moderate oil and development activities.

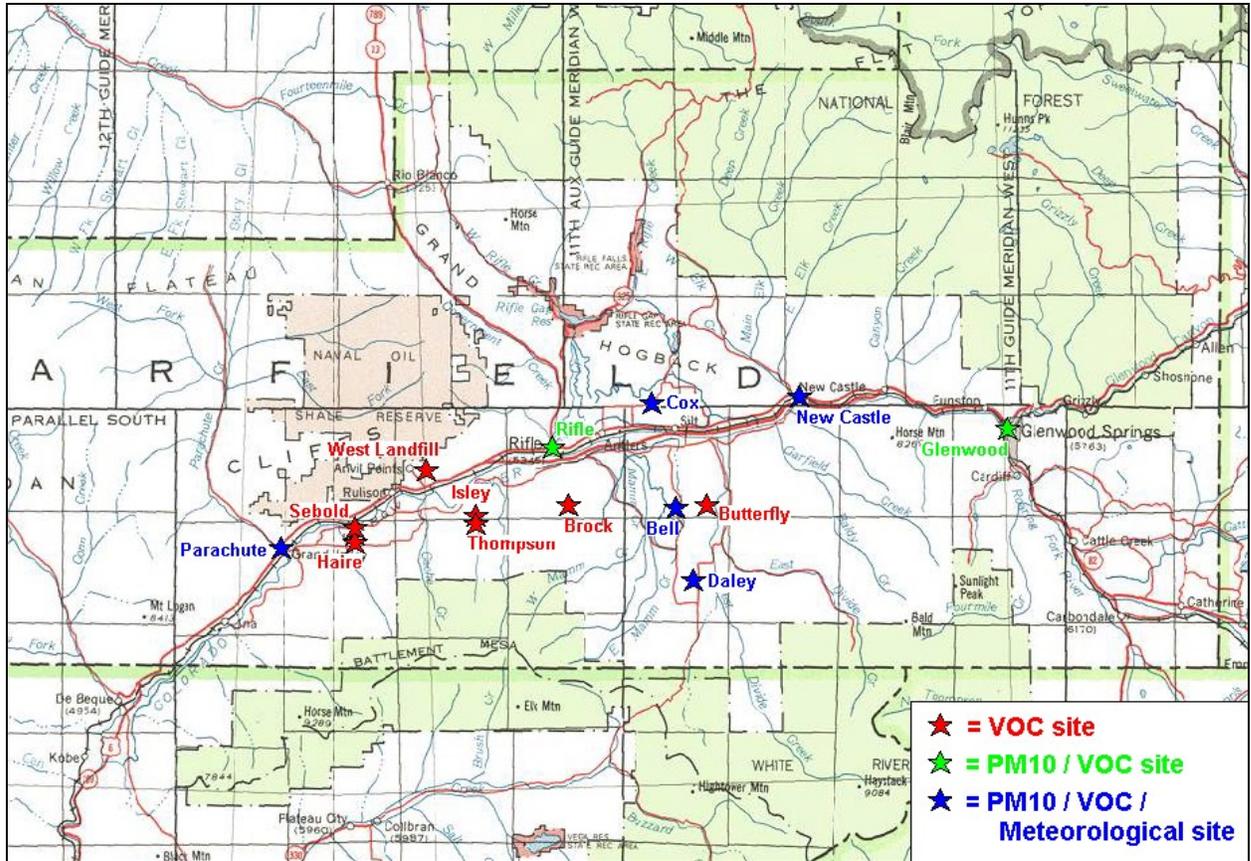
4. *4th Location (To be Determined)*. This site will either be a fixed rural location in close proximity to oil and development activities or a mobile (rotating) location used to respond to local citizen odor concerns.

6.0 - 2008 Monitoring Plan Budget

Unit	Cost per Unit or Sample	# of Units or Samples	Total
Equipment (SNMOCs)			
Veriflo 24-hr Passive Orifice Rental (Flow Controllers)	160.00	5	800.00
Canister Rental	1440.00	5	7200.00
		SNMOC Equipment Total	8000.00
Analysis (SNMOCs)			
PAMS Canister Sample analysis following the TAD	298.00	264	78672
Canister Cleaning, Handling			
VOC analysis using the GC/FID with MSD verification			
Monthly data validation and reporting			
AQS entry within 90 days of the end of each calendar quarter	30.00	264	7920
Shipping (both ways)			
		SNMOC Analysis Total	86592
		SNMOCs (Equip+Anal)	94592.00
Equipment (Carbonyls)			
SKC Universal Pump, PCXR8, 5-Pack Kit, NiCad, With Multi-Charger, 115/230V □	3780.48	1	3780.48
Sep-Pak Ozone Scrubber 20/Box	126.00	9	1134.00
Universal Pump Battery Eliminator, 110V (AC Adapter)	99.00	5	495.00
Volumetric Pump Calibrator	1235.00	1	1235.00
Tubing, Tygon, 1/4" ID, 10 Feet	31.00	2	62.00
Shipping	70.54	1	70.54
		Carbonyl Equipment Total	6777.02
Analysis (Carbonyls)			
Carbonyl Sample Analysis Using TO-11A, Including Sample Cartridge	129.00	180	23220
Purchase and handling of DNPH cartridges			
Carbonyl Analysis using TO-11A for 16 Target compounds			
Purchase & Distribution of DNPH Cartridges			
Monthly data validation and reporting	8.00	180	1440
AQS entry within 90 days of the end of each calendar quarter			
Shipping (both ways)		Carbonyl Analysis Total	24660
		Carbonyl (Equip+Anal)	31437.02
Other Analysis/Equipment			
PM2.5 Speciation Analysis or other (TBD)	TBD	TBD	8970.98
		2008 Budget Total	135000.00

Appendix A

Figure 1. Map of Site Locations (2005 – 2007)



Appendix B

Figure 2. Map of Site Locations (2008)

