Characterization of Particulate Matter (PM_{10}) in Roda, Virginia

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Image on cover portrays coal trucks traveling through Roda, Virginia

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Disclaimer and Acknowledgements

We acknowledge support from Southern Appalachia Mountain Stewards (SAMS)* and the Sierra Club.** We greatly appreciate the time and interest of the many volunteers, scientists, interest groups, and graduate students (Ms. Megan Gore, Mr. William Blinn, and Mr. Ian Rumsey) who assisted us, and shared their knowledge and expertise in the development of the report.

This report contains preliminary results associated with PM_{10} measurements. These data should assist the coal mining facilities, the Virginia Air Resources Control Board, and the Virginia Department of Environmental Quality in developing future plans to help the residents of the community and to ensure the protection of public health according to Virginia and U.S. Environmental Protection Agency air quality standards.

* SAMS, a Virginia non-stock membership corporation based in Appalachia, Virginia, is an organization of concerned community members and their allies who are working to stop the destruction of Appalachian communities by surface coal mining, to improve the quality of life in the region, and to help rebuild sustainable communities.

** Sierra Club is a national nonprofit corporation with more than 1.3 million members and supporters nationwide and more than 16,000 members who reside in Virginia and belong to its Virginia Chapter. Sierra Club is dedicated to exploring, enjoying, and protecting the wild places of the Earth; to practicing and promoting the responsible use of the Earth's resources and ecosystems; to educating and enlisting humanity to protect and restore the quality of the natural and human environment; and to using all lawful means to carry out these objectives. Sierra Club's concerns encompass the exploration, enjoyment and protection of mountains, forests and streams in Virginia.

Executive Summary

This report is intended to inform the Virginia Air Pollution Control Board (Air Board) and the Department of Environmental Quality (DEQ) of the dust problem in Roda and other similarly affected communities in Virginia's coalfields and to urge the Air Board and DEQ to take action to reduce this threat to human health and welfare.

Preliminary air sampling (Particulate Matter i.e. PM_{10}, and meteorological measurements) was conducted for a period of approximately two weeks during early August 2008 in the unincorporated community of Roda, Virginia, at two locations (about a mile apart along Roda Road (Route 685) in Wise County, Virginia). For the purposes of this study (a combination of logistics, resource, and characterization of PM) we sited the PM samplers near the road to ascertain the micro exposure from the road. The results revealed high levels of PM_{10}, (average value of 24-hour mass concentration, and +/- 1 SD at the Campbell Site = 250.2 +/- 135.0 micrograms/m^3; and at the Willis Site = 138.4 +/- 62.9 micrograms/m^3 respectively). The 24 hour U.S. national ambient air quality standard for PM_{10} is 150 micrograms/m^3. Ten out of twelve samples taken from the Campbell site revealed levels of PM_{10} above the national standard, including one sample that was more than three times the national standard. Six out of twelve samples taken from the Willis site revealed levels of PM_{10} above the national standard (*see* figures 5 and 6). The impacts of PM_{10} have decreased substantially in the Eastern United States over approximately the last 30 years. Roda, however, continues to see significant impacts of PM_{10} that are substantially larger than those observed in major cities in the Eastern United States. Elemental analysis for samples collected on Quartz filter paper (on one randomly selected day) at both the sites revealed the presence of antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, and selenium (group of metals common to the US EPA National Ambient Air Toxics Stations program).

Many communities in the coalfields of southwest Virginia suffer from high dust levels caused by coal mining operations hauling coal by truck along roads that pass through residential areas. Many Roda residents suffer from a variety of respiratory ailments that may be linked to or exacerbated by the high dust levels. These residents also report that the dust has made their lives uncomfortable; they are unable to sit on their porches, have to restrict the amount of time they spend outdoors, and have to spend many hours each week contending with daily coatings of dust that cover the exteriors and interiors of their homes.

A separate letter attached to this report as Appendix A (signed by attorneys Walton Morris and Aaron Isherwood) describes the legal authority of the Air Board and DEQ to take action to remedy the dust problem in the coalfields of southwest Virginia. The letter concludes that the Air Board and DEQ have the authority to issue a special order directing the individuals and corporations that cause coal and other materials to be hauled through Roda to take reasonable precautions to prevent particulate matter from becoming airborne, as well as the authority to conduct their own investigation of the dust problem.

I. Introduction: Background and Purpose

The unincorporated communities of Roda and Osaka consist of approximately ninety homes along Roda Road (Route 685) in Wise County, Virginia (36º57'47" N, 82º50'00" W) (Figure 1). Roda Road is a narrow, public road that branches off of Virginia State Route 78 and terminates approximately four miles from where it begins, at the entrance to several surface and underground coal mining operations, which haul coal by truck along Roda Road. The houses in this area are located very close to the road – most a mere 10 or 20 feet away. There are currently nine active surface mining permits with entrances at the end of the road. These mining operations cause heavy trucks to travel on Roda Road; Roda and Osaka residents advise that, while truck traffic varies, there are often at least ten trucks every hour for up to twenty hours per day passing through their communities. These trucks represent the overwhelming majority of traffic on Roda Road; the road otherwise is used almost exclusively by local residents, their families and friends, and by school buses. The trucks carry coal and other materials away from the mining operations.

The trucks frequently track coal, mud, and other debris away from the mine sites and onto the road. When this mud dries it turns to dust, which is then released into the air by the passage of other vehicles. Fugitive dust, including coal fines, is also released directly from the trucks themselves. This dust coats the homes and property of the residents, and is thought to cause respiratory and other health problems (including sinus problems, asthma and emphysema). The dust diminishes the quality of life of local residents and interferes with their use and enjoyment of their property.

The residents of Roda, including Ronnie Willis and Nell Campbell, have filed multiple complaints with the Department of Mines, Minerals, and Energy (DMME) regarding the dust problem. In these complaints, the residents describe their problems with mud tracked onto Roda Road by coal trucks, and with the dust that covers their homes and property (*see* Appendix C). DMME has most frequently responded to these complaints by stating that the mining agency does not have jurisdiction over dust from public roads. In the few instances where DMME has taken action, the agency issued notices of violation to the mine operators for the operators' failure to maintain permitted

haulroads. Any reductions in dust brought about by such agency action have been temporary, and the dust has always returned.

The Town Council of Appalachia, Virginia (an incorporated municipality located within a few miles of Roda) has taken some action in response to complaints by local residents, but the Council's authority is limited. In February 2009 the Council passed a local ordinance regulating the mining of coal and other minerals within the town boundaries (Appendix D). The Council passed this ordinance after recognizing "the need to control, regulate, and limit the mining of coal and other minerals within its boundaries . . . in order to protect the health, safety, welfare and properties of its citizens." Perhaps the most direct effect of coal mining on local residents is the impact of the coal trucks and the dust that they spread. The town's legal authority to address the coal dust problems, however, is quite limited; accordingly, there is an urgent and compelling need for the Air Board and DEQ to take further action. The authority of the Air Board and DEQ to take action to remedy the dust problem in southwest Virginia is analyzed in Appendix A.

Eventually, local residents sought the assistance of Southern Appalachian Mountain Stewards and Sierra Club to address the persistent dust problems. Particulate matter (PM_{10}) sampling was conducted outside the homes of two Roda residents who have each lived in Roda almost fifty years—Ronnie Willis, a retired underground coal miner, and Nell Campbell, a 91-year-old woman. Statements from Mr. Willis and Ms. Campbell describing more fully their situations and the challenges posed to them by the dust are included in Appendix B.

II. Experimental Approach: Sampling and Analysis

The experimental sites (about one mile apart) are located in Roda, Virginia, in the southwestern region of the state where the majority of Virginia's coal mines are located. Observed high dust levels are the result of coal mining operations hauling coal by truck along roads that pass through residential areas. The locations of the PM samplers were selected in order to represent micro to middle scale environments (i.e. exposure that represents scales of up to 100 to 500 meters respectively). These scales are representative of the exposure of the residents in Roda. For the purposes of this study (a combination of

logistics, resource, and characterization of PM) we sited the PM samplers near the road to ascertain the micro exposure from the road (Figure 2). As Figure 2 illustrates, the area is predominantly covered with vegetation (e.g. trees, brush, grass, etc.). One should therefore expect low concentrations of coarse particles ($PM_{10-2.5}$) without any other emissions impacts. One should expect PM_{10} to be very low, and $PM_{2.5}$ to dominate in the Eastern US (US EPA 2005).

A. Particulate Matter Samplers

Two (2) Andersen/GMW Model GUV-16H High Volume air samplers equipped with PM_{10} size selective inlets were employed to collect ambient particulate matter with an effective aerodynamic size of less than 10 microns (PM_{10}) (Figures 2 and 4) (Appendix G). The field sampling was performed in accordance with U.S. EPA's "Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere" (40 CFR Part 50 Appendix J). The samplers were obtained from Cherokee Instruments, Inc., Fuquay Varina, NC 27526. The samplers were provided with volumetric flow controllers for constant flow control, a Dickson circular chart recorder for historical trend of volumetric flow through the sampler, and a mechanical timer and elapsed time indicator for total sampling time indication. Most of the samples were collected onto 8-inch x 10-inch fiber glass filters (glass microfiber filters Whatman Model # EPM 2000). However on one day (determined randomly) an 8-inch x 10-inch quartz fiber filter (Whatman Grade QMA Quartz Filters) was used. All the filters were pre-tared and numbered. The filters were obtained from Eastern Research Group, Inc. Laboratories in Research Triangle Park, NC.

The functionality and calibration of the particulate samplers were verified immediately prior to the field effort at Cherokee Instruments' service center in Fuquay Varina, North Carolina. The instrumentation was then transported to the field location and setup, calibrated and operated onsite at two locations (Site Willis and Site Campbell) in accordance with the manufacturer's specifications and USEPA methodology.

All calibrations were conducted using a High Volume Air Sampler Calibration Kit, Model Andersen/GMW Veriflow (Figure 3). The calibration kit included a calibrated orifice transfer standard that was referenced to a spirometer as well as an 8-inch x 10-

inch mounting plate adapter and water slack tube manometer. The Veriflow orifice is capable of providing various pressure drops across the sampler flow controller in order to simulate particulate matter loading onto the filter. Calibrations were performed on each sampler at site conditions prior to collection of the first sample at each location. These calibrations included volumetric flow verification through the sampler via comparison of the calibrated orifice results to the volumetric flow controller lookup tables.

B. Meteorological Sampler

One (1) Met One Model Automet portable weather station equipped with an onboard data logger was employed to measure and record site weather conditions at one site (Willis site) during the entire measurement period (Figure 2). The meteorological sampler was obtained from Cherokee Instruments, Inc., Fuquay Varina, NC 27526. The meteorological station measured continuously the following: wind speed, wind direction, temperature, and barometric pressure and relative humidity. All sensors were mounted on a portable tripod with telescoping mast such that meteorological data could be obtained at a height of 5- to 10-ft above grade. All the data was collected in real-time and averaged/stored at 15-minute data intervals using the onboard data logger.

The functionality and calibration of the meteorological sensors were verified immediately prior to the field effort at Cherokee Instruments service center in Fuquay Varina, North Carolina. Verification of the individual sensors functionality was accomplished using constant RPM motor, compass, reference thermocouple and local airport barometric pressure. The instrumentation was then transported to the field location and setup and operated onsite at one location (Site Willis) in accordance with the manufacturer's specifications and USEPA methodology. On site calibrations were not performed for the meteorological instruments.

C. Filter Analysis: Gravimetric Analysis, and Inorganic Analysis

High Volume (Hi Vol) 8/10 inch fiberglass filters were analyzed to determine mass. Quartz Hi Vol 8/10 inch filters were analyzed for mass and a group of metals common to the EPA National Ambient Air Toxics Stations program. Appendix H provides a list of the samples received in this project and is listed in the "Analytical

Report for Samples." Results and reporting/detection limits are provided in the "Gravimetric Measurement and Inorganics by Compendium Method IO-3.5" data tables (Appendix H; including a cover page, 3 pages of narrative, 21 pages of filter mass data, and inorganic analysis results). The filter time of exposure data and the total ambient air volume sampled were recorded on the chain of custody ("COC") forms. The ERG LIMS tracking numbers for this study are 8081414 and 8090908. Samples were stored after receipt at ambient temperature in an environmentally controlled room prior to analysis. Inorganic analysis was performed according to ERG's NELAC certification. A copy of the COCs for this sample set is provided in Appendix H. Samples were delivered to ERG on 08/08/08. Samples were equilibrated in an environmentally controlled balance room prior to analysis.

Gravimetric measurements were performed with a Satorius LA 120S equipped with a large area weighing chamber. Calibration was checked with NIST Class S weights. Ambient filters were equilibrated for 24 hours under balance room conditions prior to weighing. Tare weights were recorded prior to filter media shipment and use. Sample plus filter tare weights were measured after 24-hour equilibration under environmentally controlled balance room conditions. Initial and final weights were recorded and entered into the ERG LIMS for subsequent review and reporting. Samples were handled and analyzed in conformity with to 40 CFR 50, Appendix J, Section 9.16 - 9.17.

A 4"x 1" portion was cut from the exposed filter after final filter mass had been determined gravimetrically. This portion of filter was extracted initially in 4% nitric acid via sonication for a total of 90 minutes, followed by the addition 15mL of water and sonicated again for an additional 90 minutes. The extract was analyzed by ICP-MS. The analysis was completed using the manufacturer software.

Analyses were performed on the ELAN 9000 ICP/MS manufactured by Perkin Elmer Corporation. The instrument consists of an inductively coupled plasma source, ion optics, a quadrupole spectrometer, a computer that controls the instrument, data acquisition, and data handling (ELAN Software SCIEX, Version 3.0), a printer, an autosampler (AS-93plus) and a recirculator. The quadrupole

mass spectrometer has a mass range of 2 to 270 atomic mass units (amu). Inorganic analysis followed the requirements in EPA Compendium Method IO-3.5.

D. Inorganic Quality Control

A summary of the quality control requirements that were met except as flagged for inorganic analysis is provided in Table 1 in Appendix H. Standard method quality control includes:

- Method Spikes and Method Spike Duplicates, one per sample batch. The method spikes and method spike duplicates are controlled within <25% RPD of the target values. If the spikes are outside of these limits, calibration and extraction volumes are checked. If no calibration or calculation error is found the samples are re-extracted and reanalyzed.
- Performance Evaluation (PE) Samples from a secondary source. PE samples are prepared and analyzed in the same way as field samples.
- Blanks including:
    - 1) A method blank (MB) that contains all the reagents in the sample preparation procedure. Blanks are prepared and analyzed as a sample to determine the background levels from the instrument.
    - 2) A rinse blank consists of 2% nitric acid in DI water. The rinse blank is used to flush the system between standards and samples. The results must be below the MDL.
    - Initial calibration blanks (ICB) are analyzed immediately following the high standard verification. The absolute value of the instrument response must be less than the method detection limit. Samples results for analyses less than 5 times the amount of the blank are flagged or analysis is repeated.
    - Continuing calibration blanks (CCB) are analyzed following each continuing calibration verification sample. The acceptance criteria for the CCB are the same as the ICB.

- Laboratory Control Spike (LCS) prepared from a secondary source of calibration standards and analyze with each sample batch. The results must be within 80-120% RPD of actual values.

Figure 1: Location of Roda, Virginia

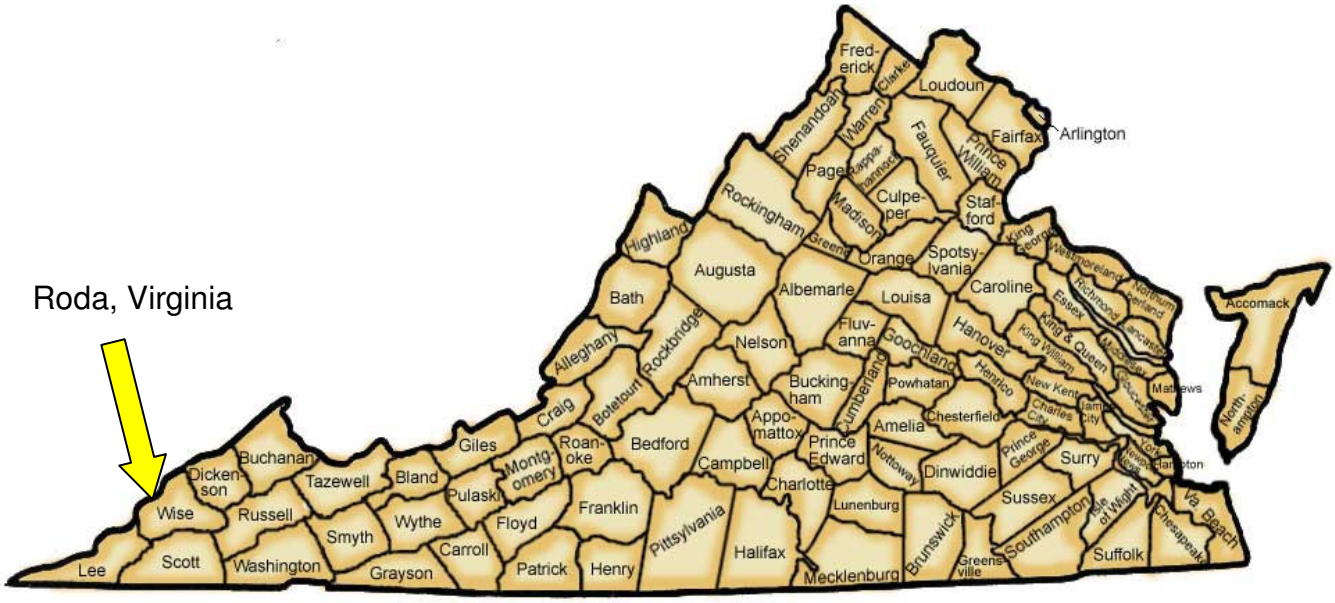

Figure 2: **PM_{10} 24-hour concentration sampler and meteorological station at the Willis site in Roda, VA during August 2008**

Figure 3: **Calibration of PM_{10} 24-hour concentration sampler at the Willis site in Roda, VA during August 2008**

Figure 4: **PM_{10} 24-hour concentration sampler at the Campbell site in Roda, VA during August 2008**

III. Results and Discussions

Ambient particulate matter (PM_{10}) results from direct particle emissions (e.g. carbon, soil dust, etc.). However, fine particulate matter ($PM_{2.5}$) may also be secondary particles (i.e. generated by atmospheric reactions of precursor gas emissions). Particles typically remain in the atmosphere for days to a few weeks, depending on their size and the rates at which they are removed from the atmosphere, for example by dry and wet deposition processes. Particulate matter in any given area may originate locally or from sources hundreds to thousands of kilometers away. Fine PM may also be formed during atmospheric transport from precursor gases originating from sources locally or far away.

The amount of particulate matter (PM_{10}) airborne in Roda on a 24-hour basis exceeds the level of the National Ambient Air Quality Standard for PM_{10} during the sampling period. PM_{10} was sampled at two locations in Roda over the course of about two weeks in early August 2008. The U.S. Environmental Protection Agency (EPA) daily (i.e. 24 hours) concentration limit for PM_{10} is 150 $\mu g/m^3$. Air sampling revealed daily concentrations of PM_{10} that exceeded 150 $\mu g/m^3$ on ten out of twelve days at one location (Figure 5) (Site Campbell), and six out of twelve days at another location (Figure 6) (Site Willis). On one of these days the recorded daily concentration of PM_{10} at the Campbell sampling site was more than three times the national standard, at 469.7 $\mu g/m^3$. The impacts of PM_{10} have decreased substantially in the Eastern United States over approximately the last 30 years. Roda, however, continues to see significant impacts of PM_{10} that are substantially larger than those observed in major cities in the Eastern United States.

Elevated levels of particulate matter have been associated with significant negative effects on human health. A report prepared by Dr. Dudley F. Rochester for the Virginia State Advisory Board – Air Pollution in November 2006 concluded that "fine particulate matter causes significant morbidity (asthma and other respiratory diseases, heart disease and stroke) and premature mortality (adult and infant)." The report also concluded that "[i]nterventions that lower air concentrations of . . . particulate matter are associated with reductions in respiratory illness and overall death rate" (Appendix E).

On one randomly selected day, Quartz Hi Vol 8/10 inch filters were exposed and analyzed for mass and a group of metals common to the EPA National Ambient Air

Toxics Stations program. Sampling from both sites revealed the presence of antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, selenium (Tables 1 and 2). PM is typically composed of a complex mixture of chemicals, a mixture strongly dependent on source characteristics. All of the metals listed above as present in the samples from Roda are known to be present in coal (Finkelman, R.B., 1995).

The dust problem in Roda and surrounding communities in southwest Virginia is significant. We urge the Virginia Air Pollution Control Board and the Virginia Department of Environmental Quality to address this problem by enforcing state air quality standards and by requiring the operators of coal facilities to employ practices that will prevent dust from being released from trucks and other sources, and that will prevent mud and dust from being tracked onto public roads.

Figure 5: Measurements of PM_{10} 24-hour concentration at the Campbell site in Roda, VA during August 2008

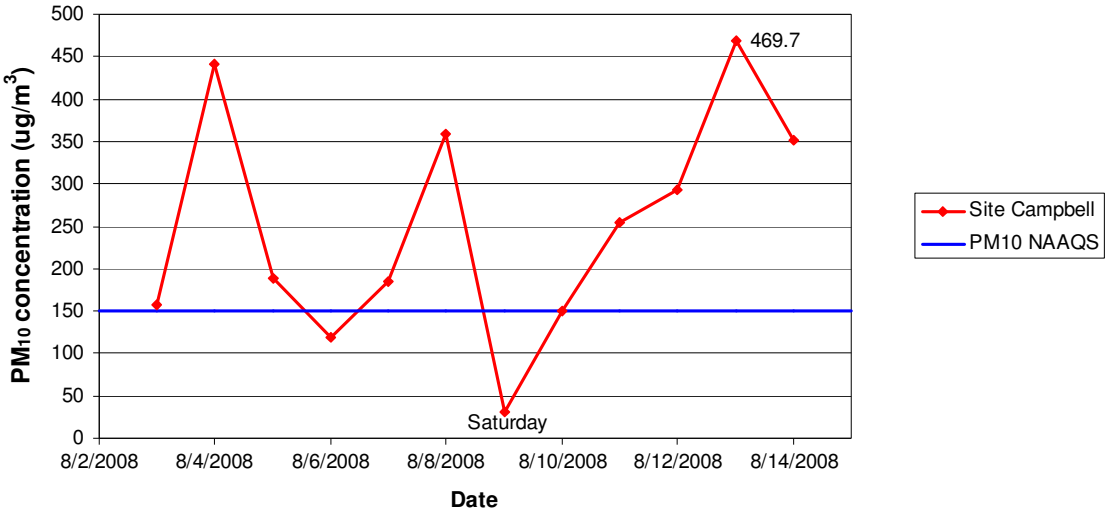

Figure 6: Measurements of PM_{10} 24-hour concentration at the Willis site in Roda, VA during August 2008

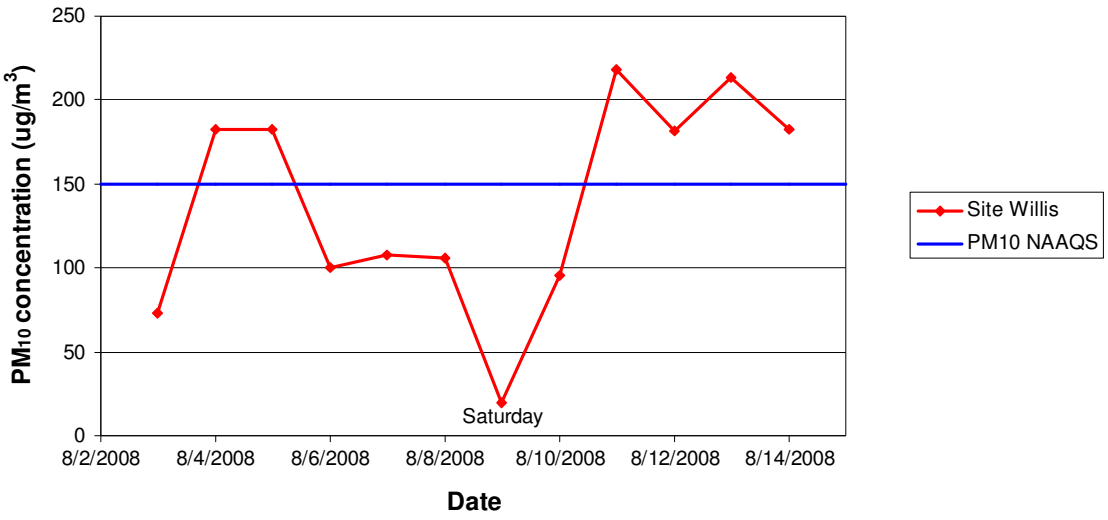

Table 1: Inorganic Analysis of PM_{10} collected on quartz filter at the Roda, VA, Site (Campbell) for sample collected on August 7, 2008. The analysis was performed by ERG, Inc. based on compendium method IO – 3.5

Analyte	PM_{10} Mass concentration collected on the quartz filter paper (ng/m^3)	Time of exposure (h)	Normalized 24h-Mass concentration (ng/m^3)*	Calculated 8h-Mass concentration ($\mu g/m^3$)	ASTDR Standard ($\mu g/m^3$)**	Carcinogens annual ave. (mg/m^3)***	Inhalation Unit Risk ($\mu g/m^3$)****
Antimony	1.83	23.67	1.856	0.000619	0.5	-	-
Arsenic	0.958	23.67	0.971	0.000324	10.0	$2.3x10^{-7}$	$4.3x10^{-3}$
Beryllium	0.067	23.67	0.068	0.000023	2.0	$4.1x10^{-6}$	-
Cadmium	0.263	23.67	0.267	0.000089	5.0	$5.5x10^{-5}$	$1.83x10^{-3}$
Chromium	2.74	23.67	2.778	0.000926	0.5	-	-
Cobalt	0.915	23.67	0.928	0.000309	0.1	-	-
Lead	3.9	23.67	3.954	0.001318	1.5	-	-
Manganese	34.1	23.67	34.575	0.011525	5.0	-	-
Mercury	0.14	23.67	0.142	0.000047	0.1	-	-
Nickel	3.04	23.67	3.082	0.001027	1.0	-	-
Selenium	0.614	23.67	0.623	0.000208	0.2	-	-
PM_{10} Mass	183.432	23.67	185.99	62.0	-	-	-

Volumetric flow rate of ambient air through the quartz filter paper 40 ft^3/min
*** PM_{10} Mass collected on the filter normalized to 24 hour exposure**
****ATSDR - Agency for Toxic Substances and Disease Registry (http://www.atsdr.cdc.gov/toxprofiles/phs4.html). Values based on 8-hour exposure.**
*****North Carolina Department of Environment and Natural Resources – Division of Air Quality – Acceptable Ambient Level (AAL) for toxic air pollutants** (http://daq.state.nc.us/toxics/haps-taps/haps-taps-lookup.shtml)
******US Environmental Protection Agency – Integrated Risk Information System (IRIS)** (http://cfpub.epa.gov/ncea/iris/index.cfm)

Table 2: Inorganic Analysis of PM_{10} collected on quartz filter at the Roda, VA, Site (Willis) for sample collected on August 7, 2008. The analysis was performed by ERG, Inc. based on compendium method IO – 3.5

Analyte	PM_{10} Mass concentration collected on the quartz filter paper (ng/m^3)	Time of exposure (h)	Normalized 24h-Mass concentration (ng/m^3)*	Calculated 8h-Mass concentration ($\mu g/m^3$)	ASTDR Standard ($\mu g/m^3$)**	Carcinogens annual ave. (mg/m^3)***	Inhalation Unit Risk ($\mu g/m^3$)****
Antimony	1.810	23.5	1.849	0.000616	0.5	-	-
Arsenic	0.720	23.5	0.735	0.000245	10.0	2.3x10-7	4.3x10-3
Beryllium	0.041	23.5	0.042	0.000014	2.0	4.1x10-6	-
Cadmium	0.090	23.5	0.092	0.000031	5.0	5.5x10-5	1.83x10-3
Chromium	3.100	23.5	3.166	0.001055	0.5	-	-
Cobalt	0.970	23.5	0.991	0.000330	0.1	-	-
Lead	3.320	23.5	3.391	0.001130	1.5	-	-
Manganese	19.400	23.5	19.813	0.006604	5.0	-	-
Mercury	0.972	23.5	0.993	0.000331	0.1	-	-
Nickel	14.300	23.5	14.604	0.004868	1.0	-	-
Selenium	0.580	23.5	0.592	0.000197	0.2	-	-
PM_{10} Mass	96.853	23.5	98.914	32.971	-	-	-

Volumetric flow rate of ambient air through the quartz filter paper 40 ft^3/min
*** PM_{10} Mass collected on the filter normalized to 24 hour exposure**
****ATSDR - Agency for Toxic Substances and Disease Registry (http://www.atsdr.cdc.gov/toxprofiles/phs4.html). Values based on 8-hour exposure.**
*****North Carolina Department of Environment and Natural Resources – Division of Air Quality – Acceptable Ambient Level (AAL) for toxic air pollutants** (http://daq.state.nc.us/toxics/haps-taps/haps-taps-lookup.shtml)
******US Environmental Protection Agency – Integrated Risk Information System (IRIS)**
(http://cfpub.epa.gov/ncea/iris/index.cfm)

IV. Summary and Conclusions

Roda and the surrounding communities in southwest Virginia face a significant threat from dust generated and transported by coal trucks. Limited preliminary air quality sampling undertaken in Roda in early August 2008 using standard US EPA measurements protocols revealed the presence of particulate matter (PM_{10}) in amounts (24 hour PM_{10} mass concentration) up to three times the national ambient air quality standard. A considerable and growing body of evidence shows an association between adverse health effects and the exposure to ambient levels of PM. Epidemiological studies of large populations have frequently shown a statistical association between elevated levels of PM mass (PM_{10}, $PM_{2.5}$, and $PM_{10-2.5}$) and adverse health effects (McMurry *et al*., 2004).

V. Recommendations

We recommend that the Virginia Air Pollution Control Board and Virginia Department of Environmental Quality take immediate action to address the dust conditions in southwest Virginia. These actions may include but need not be limited to: (1) conducting additional air quality measurements and modeling studies; (2) meeting with residents of affected communities; and (3) requiring mining facilities that contribute to the dust problem, including those that cause coal and other materials to be hauled through Roda to implement reasonable precautions to control fugitive dust. These reasonable precautions include, but are not limited to: (1) installing and operating truck washes; (2) installing rumble strips at the exits of all mining facilities to remove mud and dust from vehicles before they enter public roads; and (3) identifying and using alternate haul routes that bypass residential communities. The Air Board and DEQ should also take any additional steps that they see as necessary to implement best management practices for controlling dust emissions in the region. The authority of the Air Board and DEQ to take these actions is described in Appendix A.

References

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List of Appendices

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Appendix A:

Analysis of the legal authority of the Air Board and DEQ/DAQ

Virginia State Air Pollution Control Board
629 East Main Street
P.O. Box 1105
Richmond, VA 23218

Virginia Department of Environmental Quality,
Division of Air Quality
629 East Main Street
P.O. Box 1105
Richmond, VA 23218

April 17, 2009

Re: Legal Authority of the Virginia State Air Pollution Control Board and the Virginia Department of Environmental Quality's Division of Air Quality to Investigate and Take Action to Remedy the Dust Problem in Southwest Virginia

Dear Sirs and Madams:

As described in more detail in the attached report, the communities of southwest Virginia suffer from the chronic and persistent presence of dust generated by coal mining operations. One aspect of the problem occurs as a result of the operation of large trucks that haul coal through residential areas. Dust from coal trucks creates and exacerbates serious health problems among residents, and interferes with their use and enjoyment of their property. The Sierra Club and the Southern Appalachia Mountain Stewards ("SAMS") present the information in this report to the Virginia State Air Pollution Control Board ("the Board") and the Virginia Department of Environmental Quality Division of Air Quality ("DEQ/DAQ") to inform the Board and DEQ/DAQ about the dust problem and to urge the Board and DEQ/DAQ to take prompt action to address and remedy this situation.

Virginia's air quality statutes grant the Board broad powers to promulgate regulations, conduct inspections, take enforcement action including the issuance of special orders, and otherwise regulate emissions of pollutants into the outdoor atmosphere. Va. Code §§ 10.1-1301, -1306 through -1309.1, -1316, -1322.01. Virginia's statutes empower the Executive Director of DEQ to exercise such authority as granted to him by statute or delegated to him by regulation. These powers include authority similar to that of the Board to conduct inspections and take enforcement action. Va. Code § 10.1-1322, -1322.01; 9 V.A.C. § 5-170-50, -120, -180.

We hereby request that the Board and DEQ/DAQ exercise their authority and take action to remedy the dust situation in Roda and other similarly affected communities in Virginia's coalfields. The primary source of the dust plaguing these communities is trucks hauling coal from mining operations. There are nine permitted mining operations above Roda alone that hire trucks to haul coal through that community. The Virginia Department of Mines, Minerals and Energy, Division of Mined Land Reclamation has consistently refused to regulate the truck traffic and dust emissions, even in response to citizen complaints. (*See* Appendix G). The dust problem in the coalfields of southwest Virginia includes violations of standards and limitations contained within federal and Virginia air quality statutes and regulations, and therefore falls under the authority of the Board and DEQ/DAQ.

I. Ongoing violations of federal and Virginia air quality statutes and regulations

The federal Clean Air Act ("CAA") requires the U.S. Environmental Protection Agency ("EPA") to set National Ambient Air Quality Standards ("NAAQS") for pollutants considered harmful to public health and welfare. 42 U.S.C. § 7409(b). EPA has set a 24-hour national ambient air quality standard ("NAAQS") for "particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers" ("PM-10") of 150 micrograms per cubic meter. 40 C.F.R. § 50.6. As discussed in more detail in the attached report, Sierra Club and SAMS have recorded levels of PM-10 in the unincorporated community of Roda that are greater than three times the NAAQS. Roda, therefore, is beset by air pollution which is or may be injurious to human health, welfare or safety.

Virginia's State Implementation Plan ("SIP"), promulgated by the Board to implement the CAA in Virginia and approved by the EPA, also places limits on the emission of particulate matter. *See* 42 U.S.C. §§ 7604(a)(1)(A), 7604(f)(4); 40 C.F.R. §§ 52.2420 to 52.2465. The Virginia SIP's standard for fugitive dust states that "[d]uring the construction, modification or operation phase of a stationary source or any other building, structure, facility or installation, no owner or other person shall cause or permit any materials or property to be handled, transported, stored, used, constructed, altered, repaired or demolished without taking reasonable precautions to prevent particulate

matter from becoming airborne." 9 V.A.C. 5-50-90. *See also* 9 V.A.C. 5-50-60, 9 V.A.C. 5-50-70(C).

Each of the mine operators that hire trucks to haul coal through Roda (see Figure 1) causes or permits coal and other materials to be transported by truck from its mining facilities without taking reasonable precautions to prevent particulate matter from becoming airborne, in violation of 9 VAC 5-50-90. These trucks cause particulate matter to become airborne by releasing dust and coal fines from their beds and by tracking mud and coal fines onto public roads where the mud dries and is kicked up as dust by additional trucks. Among the reasonable precautions that each mine operator could take, but does not, are (1) the installation and operation of truck washes, (2) the installation of rumble strips at the exits of all mining facilities to remove mud and dust from vehicles before they enter public roads, and (3) the identification and use of alternate haul routes that bypass residential communities. By failing to take these reasonable precautions, each mine operator has allowed the coal trucks traveling through these communities to release into the atmosphere fugitive dust that contains particulate matter in concentrations that exceed the NAAQS for PM-10.

II. Requested Actions:

Because these violations are ongoing, and because the coal dust problem persists in communities across southwest Virginia, the Board and DEQ/DAQ should, at a minimum, take the following actions:

A. Issue a special order requiring coal operators in Roda to cease and desist from permitting or causing dust pollution

The Board is authorized by statute to "issue special orders to . . . owners who are permitting or causing air pollution as defined by § 10.1-1300, to cease and desist from such pollution." Va. Code § 10.1-1309(i). "Air pollution" is defined as "the presence in the outdoor atmosphere of one or more substances which are or may be injurious to human health, welfare or safety, to animal or plant life, or to property, or which unreasonably interfere with the enjoyment by the people of life or property." Va. Code § 10.1-1300. The Board is also authorized by statute to "issue special orders to . . . owners

who have contravened duly adopted and promulgated air quality standards and policies, to cease such contravention and to comply with air quality standards and policies." Va. Code § 10.1-1309(iv).

As described above, the operation of coal trucks in Roda causes air pollution in the form of levels of particulate matter that exceed the national health-based standard for PM-10. In addition, the coal mining operations near Roda have contravened Virginia's fugitive dust standard by failing to take reasonable precautions to prevent particulate matter, including coal and other dust, from becoming airborne. The Board and DEQ/DAQ should initiate the procedures to issue a special order to the companies that cause or permit coal and other materials to be transported by truck from the mining facilities without taking reasonable precautions to prevent particulate matter from becoming airborne. *See* Va. Code § 10.1-1309. These companies include the operators who hold the nine active surface mining permits for mining operations located above Roda (see Figure 1), as well as any other companies – including the operators of coal preparation plants and other receiving facilities – that hire trucks to haul coal along Roda Road/State Route 685 or otherwise contribute to the dust problem. These companies are permitting or causing air pollution as defined under federal and Virginia law (*see* Va. Code § 10.1-1309(i)), and are contravening Virginia's duly adopted and promulgated fugitive dust limitation (*see* Va. Code § 10.1-1309(iv)). The special order should instruct these companies to cease and desist all hauling operations – including the operations of trucking companies and other sub-contractors – unless and until the companies can demonstrate that they are taking reasonable precautions to prevent particulate matter from becoming airborne from the trucks, the roads, or any other sources.

Figure 1: Mine operators with active surface mining permits near Roda, VA

Mine operator	**VCSMCRA permit(s)**
Maggard Branch Coal, LLC	1201828, 1201890, 1201945, 1201972
Nine Mile Spur, LLC	1101990
A&G Coal Corporation	1101914, 1101917
Nally & Hamilton Enterprises, Inc.	1101820, 1701819

B. Conduct an investigation of the dust problem in the coalfields of southwest Virginia

The Board is directed by statute to:

> make, or cause to be made, such investigations and inspections and do such other things as are reasonably necessary to carry out the provisions of this chapter . . . including the achievement and maintenance of such levels of air quality as will protect human health, welfare and safety and to the greatest degree practicable prevent injury to plant and animal life and property and which will foster the comfort and convenience of the people of the Commonwealth and their enjoyment of life and property and which will promote the economic and social development of the Commonwealth and facilitate enjoyment of its attractions.

Va. Code § 10.1-1306.

The statements from local residents included in Appendix F of the attached report illustrate the threat to human health and to "the comfort and convenience of the people of the Commonwealth and their enjoyment of life and property" posed by the pervasive dust that coal trucks generate. The air quality sampling conducted in Roda and described in detail in the attached report demonstrates that levels of particulate matter in Roda are consistently above the national health-based standard (NAAQS) for PM-10.

Because the sampling conducted by SAMS and Sierra Club was restricted to Roda and covered a limited twelve-day time period, we urge the Board and DEQ/DAQ to undertake a thorough investigation of dust and particulate matter across southwest Virginia. Sampling should focus on areas most directly affected by dust from coal trucks, including communities located in areas where mining or coal preparation or loading facilities are active and where coal truck traffic is heavy. As part of such an investigation, SAMS and Sierra Club urge the Board members and/or DEQ/DAQ staff to meet with local residents who are suffering from excessive dust levels in order to learn more about their predicaments. SAMS and Sierra Club would be pleased to arrange such a meeting.

The Board and DEQ/DAQ should then take appropriate action, based on the results of this investigation, necessary to protect human health, welfare and safety. Such action may include promulgating additional regulations to limit the release of dust from

coal trucks, and issuing special orders to the companies responsible for the release of dust from coal trucks.

III. Conclusion

The Board and DEQ/DAQ have the authority to remedy the dangerous dust situation faced by the residents of Roda and other communities in southwest Virginia. We hope that the Board and DEQ/DAQ will recognize the seriousness of the dust problem and take prompt action to address it. Otherwise, Sierra Club and SAMS will consider taking direct legal action against those individuals and corporations responsible for causing the release of dangerous levels of dust in Roda and the surrounding communities.

Sincerely,

Walton D. Morris, Jr.
Morris Law Office, P.C.

Aaron Isherwood
Senior Staff Attorney
Sierra Club

Appendix B:

Statements of Roda residents Ronnie Willis and Nell Campbell

TESTIMONY OF RONNIE C. WILLIS

I currently live at 1712 Roda Road, Appalachia, Virginia, 24216, and have lived here for approximately 47 years. I was born in this hollow 70 years ago and have lived here most of my life. I am a retired coal miner and worked in the area's underground mines for 28 years.

My home is adjacent to Roda Road, and trucks hauling coal from the surrounding mines to the processing facility in Stonega, VA and elsewhere drive by my house at all hours of the day. They often come through late at night and wake me up. My home is only about 20 feet from the road and, as a result, I am subjected to noise and dust from this incessant coal truck traffic. The trucks are often speeding; they drive much faster than the speed limit of 35 miles/hour.

The amount of coal mining in this area has increased significantly over the last decade and consequently, so has the amount of coal truck traffic and dust. Previously, mining operations were not conducted near peoples' homes and communities, and the mining was mostly underground as opposed to the destructive forms of surface mining that are used today.

From August 3 to August 14, 2008, I had dust monitoring equipment installed on my property. A scientist analyzed the air and found the dust levels to be above acceptable levels for human health. I am very concerned that the coal dust coming off the haul trucks is harming my health. I have been diagnosed with emphysema and black lung and the coal dust exacerbates my condition. I used to go for walks along the road but had to stop because the coal dust was getting into my eyes and burning them terribly. I am also concerned about being hit by speeding coal trucks. Sometimes the trucks pass each other, which I believe is very dangerous on such a narrow road.

I am hardly ever able to enjoy sitting on my front porch with family and friends because the dust from the trucks is so bad. I used to sit on the front porch every morning and drink coffee; it upsets me that I can no longer engage in this pleasant pastime. On the rare days that I do get to sit there, I have to dust off the chairs first on account of all the coal dust that collects on them. I also cannot hang clothes out to dry on the line because doing so would defeat the purpose

of washing them to begin with. I cannot even open my windows because the dust is so bad. I opened my windows only a few times last spring after first sticking filters in them to trap the coal dust.

The coal companies do little to minimize the dust and, as a result, my home is filthy all of the time. I have a pressure washer which I use several times a year to wash off my porch. I don't wash my siding or windows as much because it would be useless. Each time I clean them, they are covered in dust again in a matter of days. I would like to be able to relax and enjoy my home more.

For the past 6 years, I have been vacuuming the coal dust in my house and labeling and dating the vacuum bags to document the continuous presence of coal dust inside my home. I also save my furnace filters and label and date them because they too demonstrate that coal dust is persistently in my home. Each month I have to change the furnace filter because it gets clogged with coal dust mixed with other kinds of fugitive dust.

In March 2005 I called the Department of Mines, Minerals, and Energy (DMME) to make a complaint about mud deposited on my driveway by coal trucks traveling down the road. I was told by DMME that they had no jurisdiction to require the coal companies to remove the mud from my driveway. I called DMME again in July 2005 to make another complaint about the noise and dust from speeding coal trucks. I told DMME that the coal trucks did not slow down during my wife's funeral, even when I helped carry her casket to the hearse. They did not show any respect for my wife. I suggested several things that the coal companies could do to correct the dust problem, including trucking the coal around an old strip bench in front of my house, installing truck washers, installing a sprinkler system to wet down the road, and making the trucks maintain a safe speed limit of 15 mph. Again DMME told me that they could not do anything because they only have jurisdiction over the haul roads.

After years of requests, the Virginia Department of Transportation finally built a ditch on the other side of the road from my house, which helps collect mud and dust. Street cleaning

machines periodically vacuum up some of this dust and wet the road, but this provides only partial and infrequent relief.

A better solution would be to hose off the truck bodies and wheels to remove the dust and mud before they are allowed to drive through town. About 4 years ago, the Virginia Department of Mines, Minerals and Energy (DMME) collected about $35,000 in fines from some coal companies for permit violations. DMME asked the community for suggestions on how to use the money to reduce the coal dust problem. We requested a truck washer but have only received years of excuses for why it hasn't been built. I believe a washer would drastically improve conditions in the community.

I also believe that speed bumps would improve the dust problem because it would slow the trucks down and reduce the amount of dried mud and dust that gets stirred up into the air by the trucks. A third way the coal companies could reduce the problem is by using a different route – a nearby haul road built in the 1950's or 60's – which would enable them to bypass traveling through Roda, Osaka, and Stonega altogether. This would likely require only minor road improvements along this alternate route.

Ever since Carl Ramey, a friend of mine and a respected member of the community, challenged a coal company for conducting mining operations too close to his home and was told to stop harassing the coal company and ordered to pay their attorney fees, a lot of people in the community are afraid to challenge the coal companies that are harming our health and wellbeing. But I am not afraid to stand up for myself and my community. I want the mining companies to be held accountable for the coal dust problem they are creating, which is harming the quality of life and health of local residents including myself. I want the coal companies and DMME to take actions to rectify the problem, such as operating a truck washer, installing speed bumps, cleaning the road more frequently, or avoiding Roda Road altogether by using an alternate haul route.

I've thought about moving several times, but each time decided that home wouldn't be home if it were anywhere else. I wish to live in my home in Roda for the rest of my life. I know

all my neighbors and enjoy the community spirit I feel here. I am 70 years old and not getting any younger; I do not want to move and start over somewhere else.

I also know firsthand how difficult it would be to sell my home. I also owned a house across the road from mine and it took me 3 years to sell it, finally to a family member. I invested a great deal of time and money into remodeling the home and believe I sold it for less than I could have if the coal trucks didn't haul through the community and pollute the air. I believe I faced difficulty selling it because prospective buyers did not wish to live in a community full of coal dust and diesel fumes. I thus believe that the coal dust problem has decreased the value of my home. If air conditions do not improve, I would consider moving away to escape the dust if a coal company offered to buy my home for a fair market price or moved me to another home in the area. But no mining company has offered to buy me out or relocate me.

By: Ronnie C Willis
Ronnie C. Willis

Date: 4-15-09

TESTIMONY OF NELL CAMPBELL

I currently live at 1482 Roda Road, Appalachia, Virginia, 24216. I am 91 years old and have lived in this house here for about 50 years. This place feels like home to me.

My home is located very near Roda Road, and a lot of trucks hauling coal come by my house all the time. I don't know how many there would be a day but once I told my girls, "I looked out my blinds, and there was six coal trucks lined up in each direction. They couldn't pass each other. They had to stop."

The dust coming off of the trucks is a problem. The well-being of the community has been diminished. You know it can't be good for anyone's health to breathe coal dust. From August 3 to August 14, 2008, I had a dust monitor installed on my property. A scientist analyzed the air and found the dust to be at levels that are unsafe for human health. I am very concerned that the coal dust coming off the haul trucks is harming my health.

The community has been deprived of its use of the outdoors. We used to have coffee with our neighbors out on the porch and sometimes on my neighbors' porches. That's not been possible for the last five years because of the dust. There is practically no such thing as sitting on your porch now. But I do go outside on my back porch on Sunday now to sit because the trucks aren't around – the noise and the dust die down for at least that one day.

For about five years now, I have been unable to go outside because the coal dust is unbearable. My grandchildren would come visit pretty often until a year ago when they moved away, but when they would visit they couldn't play outside for all the dirt and dust. The little children can't get out and play in the yard because it is too dusty. When driving through New Town [which is ¼ to ½ mile before you get to Roda from Appalachia], you could see little children playing outside all the time but now you don't see any children. I also worry about the children's safety. It's just too dangerous for the children because of the coal truck traffic. Children come through my yard to go to the school bus and I don't care because it's just too

dangerous for the children to be walking along the road. I won't be here all these years but the children will.

For the last couple of years, I haven't been physically able to work in my flower garden, but before that the dust outside kept me from working in my flower garden. I used to work outside all the time. Our community used to be a happy community but you hardly see anyone anymore. Everyone stays in their houses because of the dust. When I go out now to go to the store, I go out and get in the car, that's it.

What they're doing makes our home worthless. If you wanted to sell it, someone would come and look, they'd see all this dust and dirt, and think they wouldn't want their family to live here. You can clean it up tonight and it's dirty again in the morning. Last year, my neighbor Ronnie Willis came and washed my house down with his pressure washer, but it didn't stay clean long. I used to enjoy being outside. Before the dust became such a problem, you could just use the water hose to wash off the porch and it would stay clean for a pretty good while. Now you could do it today and do it again in the morning and really you wouldn't be able to pay the water bill.

There was talk in the community for awhile about the coal companies making us move. I could go live with my daughters but I want to stay home. There were hints of them buying us out. But with what they'd give you for your property; you couldn't go anywhere and buy a home worth having.

I think it would be better for the community if we could solve the dust problems. I called the Department of Mines, Minerals, and Energy in March 2004 to make a complaint about mud tracked onto the road in front of my house by the coal trucks. The mud was so bad I couldn't even get to my mailbox. One of the coal companies did come down and wash off the road in front of my house and put gravel in front of my driveway. I don't believe anything more was done by the Department or the companies to prevent more problems from happening in the future. I didn't feel that the agency responded adequately. It would be great if there was something more the companies could do to keep the trucks from carrying all this dust into the

communities. Maybe then we could return to the outdoors, to sit outside, and the truck drivers could still keep their jobs. I hate to see anyone lose their job and I don't think anyone has to lose their job. I just want the coal companies to keep the dust levels down so our community has a safe place to live.

BY: Nell Campbell

Nell Campbell

DATE: 04/15/2009

Appendix C:

Complaints filed by Willis and Campbell with DMME

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINED LAND RECLAMATION
P.O. DRAWER 900, BIG STONE GAP, VA 24219
TELEPHONE: (276) 523-8198

COMPLAINT INVESTIGATION

OFFICE USE ONLY
COPIED TO:
___ Complainant
___ Company
___ P.R. Manager
___ Technical Section
___ Other (specify)

COMPLAINT NO.	INVESTIGATION NO.	PERMIT NO.	DATE/TIME RECEIVED	DATE OF REPORT
0500060	5197 (RDS0004538)	1101914	3/18/05 04:00 PM	3/23/05

COMPLAINANT NAME, ADDRESS, PHONE	COMPANY/PERMITTEE NAME, ADDRESS, PHONE
Willis, Ronnie 1712 Roda Road Appalachia, VA 24216 (H) (276)565-3421	A & G COAL CORPORATION P. O. BOX 1010 WISE, VA 24293 (276)328-3421

LOCATION	COUNTY(S)	WISE
Roda		

COMPLAINT STATUS/DATE	COMPLAINT TYPE	INVESTIGATION TYPE
RESOLVED 3/21/05	HAULROAD	INITIAL CLOSE OUT

ENFORCEMENT			
TYPE OF ACTION	ACTION NUMBER	COMPLAINANT NOTIFIED	REQUEST TO ACCOMPANY
		3/31/2005 12:50 PM	NO

ATTACHMENT(S): 2
Photographs, Map

COMMENTS FROM:		
COMPLAINANT	Willis, Ronnie	3/18/2005
COMPANY OFFICIAL	Jerry Hamilton	3/21/05 10:15 AM
INVESTIGATOR/SIGNATURE	STANLEY, RANDY	

COMPLAINANT'S COMMENTS	Willis, Ronnie	3/18/2005

The complainant called to say that mud from coal trucks traveling down SR 685 have caused mud to be deposited on his driveway.

COMPANY OFFICIAL'S COMMENTS	Jerry Hamilton	3/21/05 10:15 AM

I met with Jerry Hamilton on March 21, 2005 to discuss this situation. Mr. Hamilton said he met with the complainant on Friday, March 18, 2005. The complaint was in regard to mud on the complainant's driveway. Mr. Hamilton said that he told the complainant he would get with Virginia Department of Transportation (VDOT) to see if they would spread gravel on the shoulders of the state highway if A & G provided the gravel. Mr. Hamilton said that the complainant wanted him to place gravel on his driveway but that due to liability concerns A & G could not do this. He said that A & G would also provide a stockpile of gravel for public use below the rail road crossing near the complainant's house. Mr. Hamilton said that he met today at 9:00am with VDOT Road Supervisor Eddie Westmoreland. He said they discussed repairing the shoulders of SR 685 from the end of state maintenance to the confluence of Mudlick Creek and Callahan Creek. Mr. Westmoreland said that VDOT would also place gravel on other driveways where possible. A & G will provide gravel for surfacing as directed by VDOT. Mr. Hamilton said that he would replenish public use stockpiles as they became depleted. Material will be disposed of on A & G Coal Corp PN 1101914. Mr. Hamilton said that he would continue to work on this problem.

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINED LAND RECLAMATION
P.O. DRAWER 900, BIG STONE GAP, VA 24219
TELEPHONE: (276) 523-8198

COPY: 5197

COMPLAINT INVESTIGATION

INVESTIGATOR'S DESCRIPTION, COMMENTS, AND RECOMMENDATIONS	STANLEY, RANDY

I conducted this complaint investigation for DMLR Inspector Eddie Varner. The lower portion of the haulroad on PN 1101914 that connects to SR 685 is paved and was in good condition at this time. Inspector Eddie Varner advised the complainant when he spoke with him on Friday, March 18, 2005 that DMME had no jurisdiction to require removal of mud from his driveway. No violations were cited and this complaint investigation is hereby closed out.

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINED LAND RECLAMATION
P.O. DRAWER 900, BIG STONE GAP, VA 24219
TELEPHONE: (276) 523-8198

COPY: 5197

COMPLAINT INVESTIGATION

In accordance with 4 VAC 25-130-842.15 of the Virginia Coal Surface Mining Reclamation Regulations (Review of Decision not to Inspect or Enforce):

(a) Any person who is or may be adversely affected by a coal exploration or surface coal mining and reclamation operation may ask the Director to review informally an authorized representative's decision not to inspect or take appropriate enforcement action with respect to any violation alleged by that person in a request for an inspection under ' 4 VAC 25-130-842.12. The request for review shall be in writing and include a statement of how the person is or may be adversely affected and why the decision merits review.

(b) The Division shall conduct the review and inform the person, in writing, of the results of the review within 30 days of his receipt of the request. The person alleged to be in violation shall also be given a copy of the results of the review.

(c) Informal review under this Section shall not affect any rights which a citizen may have to formal review under Section 45.1-249 of the Act[1], or a citizen's right to file suit pursuant to Section 45.1-246.1 of the Act.

(d) Any person who requested a review of a decision not to inspect or enforce under this Section and who is or may be adversely affected by any determination made under Subsection (b) of this Section may request review of that determination by filing an application for formal review and request for hearing under the **Virginia Administrative Process Act** Section **2.2-4000A** et seq of the Code of Virginia.

A request for a review of the complaint investigation and/or for a formal hearing should be addressed to the attention of the:

Hearings Coordinator
Division of Mined Land Reclamation
P. O. Drawer 900
Big Stone Gap, Virginia 24219

[1] Virginia Coal Surface Mining Control and Reclamation Act of 1979, as amended.

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINED LAND RECLAMATION
P.O. DRAWER 900, BIG STONE GAP, VA 24219
TELEPHONE: (276) 523-8198

COMPLAINT INVESTIGATION

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___ Company
___ P.R. Manager
___ Technical Section
___ Other (specify)

COMPLAINT NO.	INVESTIGATION NO.	PERMIT NO.	DATE/TIME RECEIVED	DATE OF REPORT
0500120	5281 (CEV0004324)	1101914	7/1/05 09:50 AM	7/1/05

COMPLAINANT NAME, ADDRESS, PHONE	COMPANY/PERMITTEE NAME, ADDRESS, PHONE
Willis, Ronnie 1712 Roda Road Appalachia, VA 24216 (H) (276)565-3421	A & G COAL CORPORATION P. O. BOX 1010 WISE, VA 24293 (276)328-3421

LOCATION	COUNTY(S)	WISE
Roda		

COMPLAINT STATUS/DATE	COMPLAINT TYPE	INVESTIGATION TYPE
RESOLVED 7/1/05	HAULROAD NOISE	INITIAL CLOSE OUT

ENFORCEMENT			
TYPE OF ACTION	ACTION NUMBER	COMPLAINANT NOTIFIED	REQUEST TO ACCOMPANY
		7/1/2005 02:45 PM	NO

ATTACHMENT(S): 2
Photos

COMMENTS FROM:		
COMPLAINANT	Willis, Ronnie	7/1/2005 10:25 AM
COMPANY OFFICIAL	Jerry Hamilton	7/1/05 03:00 PM
INVESTIGATOR/SIGNATURE	VARNER, CHARLES	

COMPLAINANT'S COMMENTS	Willis, Ronnie	7/1/2005 10:25 AM

I am calling to complain about the speeding coal trucks coming by my house and the excessive noise they make. The dust problem is getting worse. The trucks run all night long. The trucks start gearing down in front of my house and use their Jacobs brake before crossing the bridge below the house. This creates excessive noise which they wouldn't have to do if they slowed down. My wife died on Wednesday and I helped carry her out to the hearse. The funeral home had signs put up on the road and the coal trucks never slowed down for them. They did not show any respect for my wife. The funeral home director even mentioned that the trucks were not slowing down. I took pictures of the funeral home signs and my name on the mailbox so you could see it. They are still up today.
There are several things the company could do to correct this problem. They could truck the coal around the old strip bench in front of my house to the Wentz Prep Plant. They could put in a truck washer. The trucks should be slowed down to 15mph. They could put in a sprinkler system up and down the road to keep the dust down.
I sweep my porch off everyday but you can't tell it. I plan on washing my house down.

COMPANY OFFICIAL'S COMMENTS	Jerry Hamilton	7/1/05 03:00 PM

I have talked with some of the owners of trucking companies about the coal trucks traveling through the Roda Community. I can't do anything about the trucks speeding down the State Road. I keep a man full time on our permitted haulroad sweeping and watering the road as necessary to suppress the dust. I water the State Road as far down as I can but I can only do so much due to constraints concerning liability and insurance considerations.

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINED LAND RECLAMATION
P.O. DRAWER 900, BIG STONE GAP, VA 24219
TELEPHONE: (276) 523-8198

COPY: 5281

COMPLAINT INVESTIGATION

INVESTIGATOR'S DESCRIPTION, COMMENTS, AND RECOMMENDATIONS	VARNER, CHARLES

DMLR Inspector Eddie Varner investigated the nature of this complaint today and talked with the complainant in detail. At 2:30PM on the afternoon of 7/1/05 I visited the complainants home and talked with the complainant in person. I took several pictures of coal truck traffic on State Route #685. All of the houses along State Route #685 are located very close to the road and dust from traffic is a problem for the residents. The complainant lives approximately 1.5 miles SE from the entrance to the coal haulroad permitted by A & G Coal Corp. #1101914. Trucks traveling down the straight stretch pick up speed prior to crossing the bridge located just below the complainants home. Dust is generated from the shoulders of the road in addition to blowing off the trucks themselves.

I inspected the permitted coal haulroad which has been paved at the point where it intersects State Route #685. This road was adequately surfaced and is watered down periodically everyday as needed to suppress the dust. The ditchline had been cleaned out as well. There were no maintenance problems noted with this haulroad today.

I explained to the complainant that the DMLR had jurisdiction on permitted coal haulroads, but had no jurisdiction once the trucks entered onto the State Road. I explained that speeding coal trucks fell under the jurisdiction of the State Police. The complainant understood this and stated he had to start somewhere. There were no violations noted as a result of this investigation. This complaint investigation is hereby closed out today.

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINED LAND RECLAMATION
P.O. DRAWER 900, BIG STONE GAP, VA 24219
TELEPHONE: (276) 523-8198

COPY: 5281

COMPLAINT INVESTIGATION

In accordance with 4 VAC 25-130-842.15 of the Virginia Coal Surface Mining Reclamation Regulations (Review of Decision not to Inspect or Enforce):

(a) Any person who is or may be adversely affected by a coal exploration or surface coal mining and reclamation operation may ask the Director to review informally an authorized representative's decision not to inspect or take appropriate enforcement action with respect to any violation alleged by that person in a request for an inspection under ' 4 VAC 25-130-842.12. The request for review shall be in writing and include a statement of how the person is or may be adversely affected and why the decision merits review.

(b) The Division shall conduct the review and inform the person, in writing, of the results of the review within 30 days of his receipt of the request. The person alleged to be in violation shall also be given a copy of the results of the review.

(c) Informal review under this Section shall not affect any rights which a citizen may have to formal review under Section 45.1-249 of the Act[1], or a citizen's right to file suit pursuant to Section 45.1-246.1 of the Act.

(d) Any person who requested a review of a decision not to inspect or enforce under this Section and who is or may be adversely affected by any determination made under Subsection (b) of this Section may request review of that determination by filing an application for formal review and request for hearing under the **Virginia Administrative Process Act** Section **2.2-4000A** et seq of the Code of Virginia.

A request for a review of the complaint investigation and/or for a formal hearing should be addressed to the attention of the:

Hearings Coordinator
Division of Mined Land Reclamation
P. O. Drawer 900
Big Stone Gap, Virginia 24219

[1] Virginia Coal Surface Mining Control and Reclamation Act of 1979, as amended.

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINED LAND RECLAMATION
P.O. DRAWER 900, BIG STONE GAP, VA 24219
TELEPHONE: (276) 523-8198

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COMPLAINT INVESTIGATION

OFFICE USE ONLY
3-4-04
COPIED TO:
- ✓ Complainant
- ✓ Company
- ✓ P.R. Coordinator
- ___ Technical Section
- ✓ Other (specify) Delegate Enid Phillips

COMPLAINT NO.	INVESTIGATION NO.	PERMIT NO.	DATE/TIME RECEIVED	DATE OF REPORT
0400061	CEV0003562	1701819	3/2/04 04:30 PM	3/4/04

COMPLAINANT NAME, ADDRESS, PHONE	COMPANY/PERMITTEE NAME, ADDRESS, PHONE
Campbell, Nell 1482 Roda Road Appalachia, VA 24216 (H) (276)565-1062	NALLY & HAMILTON ENTERPRISES, INC. P. O. BOX 157 109 SOUTH FOURTH STREET BARDSTOWN, KY 40004 (502)348-0084

LOCATION	COUNTY(S)	WISE
Roda		

COMPLAINT STATUS/DATE	COMPLAINT TYPE	INVESTIGATION TYPE
RESOLVED 3/4/04	HAULROAD	INITIAL CLOSE OUT

ENFORCEMENT			
TYPE OF ACTION	ACTION NUMBER	COMPLAINANT NOTIFIED	REQUEST TO ACCOMPANY
		03/04/04 08:55 AM	NO

ATTACHMENT(S): 2
Photos

COMMENTS FROM:		
COMPLAINANT	Campbell, Nell	03/03/04 08:45 AM
COMPANY OFFICIAL	Tracy Creech	3/3/04 10:45 AM
INVESTIGATOR/SIGNATURE	VARNER, CHARLES Charles Varner	

COMPLAINANT'S COMMENTS	Campbell, Nell	03/03/04 08:45 AM

I don't want to cause anyone any problems, but mud along the road is so bad I can't get to my mailbox. Coal truck traffic is very heavy and they get over on the shoulders of the road to pass each other and drag it out onto the road.

COMPANY OFFICIAL'S COMMENTS	Tracy Creech	3/3/04 10:45 AM

No comment.

INVESTIGATOR'S DESCRIPTION, COMMENTS, AND RECOMMENDATIONS	VARNER, CHARLES

DMLR Inspector Eddie Varner investigated the nature of this complaint today and discussed the matter with the complainant by phone. The complainant is located 1450' from the entrance of Nally & Hamilton Ent., Inc. #1701819. I inspected Haulroad A this morning for compliance with haulroad requirements. Nally & Hamilton are not hauling coal over this section of road but three other companies haul coal over this road. The coal haulroad was surfaced with stone so as to prevent mud from being tracked onto the State Road. Company representatives from A & G Coal Corp. applied additional gravel and graded the haulroad while I was on site. This haulroad had been watered this morning when I arrived on site.

I met at the Roda Church with Mr. Joe Buchanan of A&G Coal Corporation to discuss the nature of this complaint and the status of the coal haulroad. It is my understanding the coal haulroad will be relinquished to another permit in the near future and plans are being finalized to get this done as soon as possible. Once the road has been relinquished to another company, additional measures will be implemented on the permitted coal haulroad to reduce the possibility of

offsite impacts. Mr. Buchanan informed me that the company had 300 tons of gravel stockpiled on the site to be used on the shoulders of the State Road. VDOT was to have started work on Monday (3/1/04) but were delayed due to the recent rain.

A&G Coal Corp. is currently sweeping and watering State Route #685 on an as needed basis. Coal truck traffic on this road has significantly increased over the last two or three years. There are currently two deep mines and a surface mine in the Mudlick Creek watershed which haul coal out of Roda Hollow on State Route #685. There are plans to open up at least two more deep mines which will haul out on State Route #685. The heavy volume of truck traffic has deteriorated the road to the point where major maintenance is needed on the State Road. There are numerous pot holes in the pavement, broken pavement, shoulders need reworking, and ditchlines cleaned/pulled. There are several tractor trailers which haul over the road. These trucks have to get over on the shoulder of the road to pass. When they get off the hardtop, mud is tracked onto the road which adds to the problem. In several locations along this road near Roda Church there is no way for the water on the roadbed surface to drain off the hardtop. There is an old railroad track running parallel to the State Road on the right side (traveling North) which prevents the water from draining off the road. This track needs to be removed so an adequate shoulder can be constructed.

On 2/23/04, I talked with Jackie Christian of the Wise VDOT Office about the deteriorated condition of this road and explained the situation to him. Mr. Christian stated VDOT had been meeting with some of the coal companies which use this road about doing some maintenance on St. Rt. #685. Mr. Christian was aware of this problem and stated this work was high on their priority list and they had plans for paving and shoulder work this season. Mr. Christian stated the bid would have to be let and it would be sometime in April or May at the earliest before any work could be done.

On the morning of 3/4/04 I made a site inspection of State Route #685 at the complainants home to check the status of the road. Mr. Joe Buchanan of A & G Coal Corp. had washed off the edge of the State Road in front of the complainants home, washed off the mailboxes, and put gravel down in front of the driveway and along the edge of the road. Gravel had also been put down at other residences along the road and the Roda Church parking lot had been graveled. I talked with the complainant on the morning of 3/4/04 and she was well pleased with what had been done.

There were no violations noted concerning the coal haulroad on CSMO #1701819 and no enforcement action taken. This complaint investigation is hereby closed out today.

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINED LAND RECLAMATION
P.O. DRAWER 900, BIG STONE GAP, VA 24219
TELEPHONE: (276) 523-8198

CEV0003562

COMPLAINT INVESTIGATION

In accordance with 4 VAC 25-130-842.15 of the Virginia Coal Surface Mining Reclamation Regulations (Review of Decision not to Inspect or Enforce):

(a) Any person who is or may be adversely affected by a coal exploration or surface coal mining and reclamation operation may ask the Director to review informally an authorized representative's decision not to inspect or take appropriate enforcement action with respect to any violation alleged by that person in a request for an inspection under ' 4 VAC 25-130-842.12. The request for review shall be in writing and include a statement of how the person is or may be adversely affected and why the decision merits review.

(b) The Division shall conduct the review and inform the person, in writing, of the results of the review within 30 days of his receipt of the request. The person alleged to be in violation shall also be given a copy of the results of the review.

(c) Informal review under this Section shall not affect any rights which a citizen may have to formal review under Section 45.1-249 of the Act[1], or a citizen's right to file suit pursuant to Section 45.1-246.1 of the Act.

(d) Any person who requested a review of a decision not to inspect or enforce under this Section and who is or may be adversely affected by any determination made under Subsection (b) of this Section may request review of that determination by filing an application for formal review and request for hearing under the **Virginia Administrative Process Act** Section **2.2-4000A** et seq of the Code of Virginia.

A request for a review of the complaint investigation and/or for a formal hearing should be addressed to the attention of the:

Hearings Coordinator
Division of Mined Land Reclamation
P. O. Drawer 900
Big Stone Gap, Virginia 24219

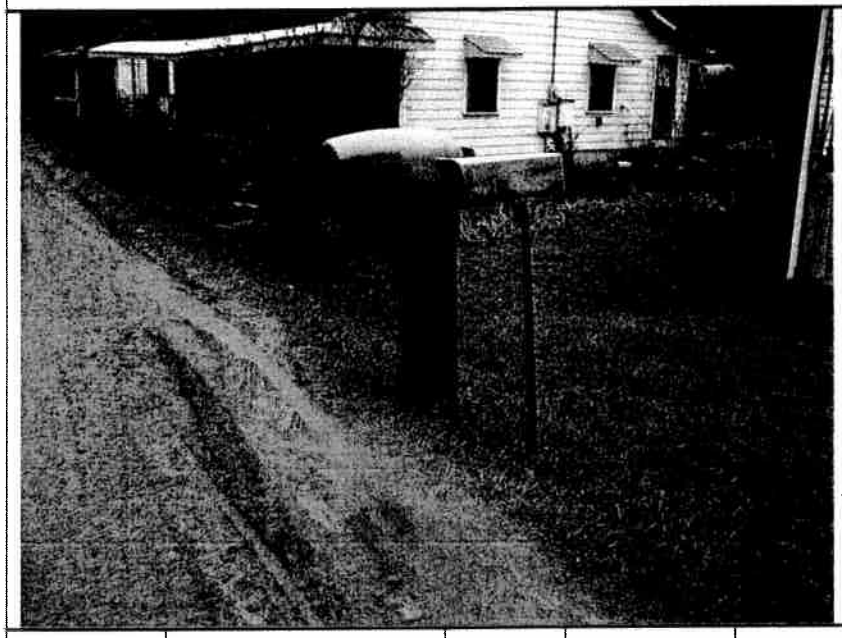
[1] Virginia Coal Surface Mining Control and Reclamation Act of 1979, as amended.

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF MINES, MINERALS AND ENERGY
DIVISION OF MINED LAND RECLAMATION
P. O. DRAWER 900; BIG STONE GAP, VA 24219
TELEPHONE: (540) 523-8198

Photographic Documentation

Permittee	Nally & Hamilton Ent., Inc.			**Permit No.**	1701819
File ID	107-0720	**Date**	3/3/04	**Taken by**	Eddie Varner

Photo of – 1 of 2



Comments/Observations

Picture shows complainants mailbox and edge of State Route #685 before cleanup was done.

File ID	107-0739	**Date**	3/4/04	**Taken by**	Eddie Varner

Photo of – 2 of 2

Comments/Observations

Picture shows complainants mailbox after cleanup was done on the evening of 3/3/04.

Signature	Eddie Varner

Appendix D:

Appalachia Town Ordinance No. 2009-1

ORDINANCE NO. 2009-1, 2009

AN ORDINANCE OF THE TOWN COUNCIL OF THE TOWN OF APPALACHIA, VIRGINIA REGULATING THE MINING OF COAL AND OTHER MINERALS WITHIN THE TOWN OF APPALACHIA BOUNDERIES AND OTHER OWNED PROPERTIES

WHEREAS, The Town Council of the Town of Appalachia, Virginia recognizes that it is responsible for the health, safety, welfare and properties of it's citizens, and

WHEREAS, The Town Council of the Town of Appalachia, Virginia recognizes the need to control, regulate, and limit the mining of coal and other minerals within it's boundaries and other owned properties in order to protect the health, safety, welfare and properties of it's citizens, and

WHEREAS, The Town Council of the Town of Appalachia, Virginia recognizes that the mining of subsurface or surface coal and other minerals and related blasting should be permitted in the Town of Appalachia and other owned properties only after a thorough procedural review by Town Officials to include applications for a Town mining permit, public hearings and final review of the mining plans by the Town Council of the Town of Appalachia, Virginia.

NOW THEREFORE BE IT ORDAINED AND ENACTED, as follows.

1. It shall be unlawful for any person, corporation or any other entity to strip-mine, open-pit mine, auger-mine or deep-mine *coal* or *any other minerals* within the boundaries of the Town of Appalachia or the properties owned by or controlled by the Town of Appalachia until a thorough review of the mining plan, including blasting plans, is conducted by Town Officials.

2. Any violations of this Ordinance shall be punishable as a Class 1 Misdemeanor and The Town shall reserve the right to seek injunctive relief against the defendant in order to force compliance of this ordinance.

3. PROCEDURAL REVIEW:

   (a) Any person, corporation or other entity seeking to mine minerals outlined in 1. above shall first notify Town Officials of such intentions and submit documentation pursuant to that notification. To include (a) copies of such mining documentation to be submitted to the Division of Mines, Minerals and Energy pursuant to obtaining a mining permit from that organization, (b) copies of documentation to be submitted to other state and federal organization required by them in order to commence operations, (c) detailed copies of blasting plans related to the mining operations (d) copies of plans concerning any tree removal or deforestation concerning

the mining operation and (e) complete and submit a Town of Appalachia mining permit application to Town Officials.

(b) The permit application as well as related documentation and a fee of _____ shall be submitted by Town Officials to the Town of Appalachia Planning Commission for a review and comments to the Town Council of the Town of Appalachia concerning the application. During the course of the Planning Commission review at least one public hearing shall be conducted following advertisement as required by the Town of Appalachia Zoning Ordinance.

(c) Upon completion of the review, comments concerning the application shall be forwarded to the Town Council of the Town of Appalachia for further review. If the Town of Appalachia Planning Commission for whatever reason is unable to conduct the review, then the Town Council shall conduct the review. A duly advertised public hearing shall be conducted by the Town Council before rendering a final opinion on the matter.

4. The requirements of this ordinance are considered reasonable regulatory measures to protect and inform the citizens of the Town of Appalachia and nothing contained herein shall be construed as to violate, replace or usurp the rules of federal or state laws concerning mining.

Appendix E:

Report of Dr. Dudley F. Rochester

OUTDOOR AIR POLLUTION, HEALTH AND HEALTH COSTS IN VIRGINIA

Report for State Advisory Board - Air Pollution
Dudley F. Rochester, M.D. (November 2006)

Introduction, Mission Statement & Scope

The 2006 State Advisory Board – Air Pollution asked SAB member Dudley F. Rochester, M.D., to prepare a report on a) the impacts of outdoor air pollution on human health and health costs, and b) the effects of interventions to lower air pollution.

The mission is to review the relevant medical, epidemiological and economic data in literature related to health effects of outdoor air pollution, to organize and interpret the findings of these articles, and to present the results in a format that emphasizes the impacts of outdoor air pollution on health and health costs in Virginia.

Most of the available articles reviewed for this report focused on ozone and particulate matter. The report summarizes data about direct effects of ozone and/or particulate matter on human health, health and other related costs, and impacts of interventions that lower air pollution levels on health and health costs.

This report does not cover a) economic impacts of ambient air pollution such as damage to farm animals, crops and forests, or loss of tourism business; b) indoor air pollution; and c) mercury, which is the subject of a separate 2006 report by the State Advisory Board – Air Pollution.

Executive Summary

- Outdoor air pollution from ozone and fine particulate matter causes significant morbidity (asthma and other respiratory diseases, heart disease and stroke) and premature mortality (adult and infant). The death rate attributable to air pollution is approximately 45% of that attributable to tobacco, and 8% of overall mortality.

- Direct medical costs in the United States come to approximately $400 per year per Medicare recipient, and overall health costs are approximately $800 a year per adult. In Virginia that comes to $4.8 billion per year, or 1.6 % of Virginia's gross domestic product.

- Interventions that lower the air concentrations of ozone and particulate matter are associated with reductions in respiratory illness and overall death rate. In Virginia, a 33% reduction in current levels of ambient particulate matter and ozone would reduce respiratory illnesses in children by approximately one-third. Premature deaths would fall by 21 per 100,000 of the population per year (approximately 2.5% of the total death rate). Reducing medical costs would save $1.6 billion per year.

Ozone & Particulate Matter (PM)

Ozone precursors. Volatile organic compounds (VOC) are substances such as paint thinners, gasoline, solvents and many other organic chemicals, from nature as well as from human endeavor, that evaporate into the air. Oxides of nitrogen (NOx) are produced by burning fossil fuels in electric power plants, other types of factories and in internal combustion engines located on- and off-road. Approximately 45% of VOC and 63% of NOx come from mobile sources. Ozone is formed in the troposphere, the part of the earth's atmosphere that is close to the ground, through chemical reactions powered by sunlight and involving VOC and NOx. Ozone can be transported by wind currents to hundreds of miles away from its source. Sulfur dioxide (SO_2) and NOx are important precursors of $PM_{2.5}$ formed in the atmosphere.

Sources of Particulate Matter. Some fine particles come from disruption of the earth's crust by sandstorms, excavation, volcanic activity and other phenomena. Although the mass of particles of crustal origin is approximately four times that of particles resulting from the combustion of fossil fuel, we inhale many more of the latter because they are finer particles. Fine particles originating from fossil fuel combustion are formed in stationary sources such as power plants and factories, as well as in mobile sources such as internal combustion engines on- and off-road, locomotives, construction equipment, farm and yard equipment, boats, airplanes etc. In addition, fine particles are formed by chemical processes in the atmosphere involving gases emitted by burning fossil fuels.

Classes of Particulates. Particulate matter (PM) exists in multiple classes. The term black smoke (BS) refers to a mixture of sizes, measured optically. Another group is total suspended particulates (TSP). Smaller particulates are referred to by their size, specifically, by their diameter in micrometers (μ). The two principal groups of particulates monitored by US EPA and Virginia DEQ are those with a mean diameter under 10 μ (PM_{10}) and particles with a mean diameter less than 2.5 μ ($PM_{2.5}$). PM_{10} and $PM_{2.5}$ are referred to as fine particles. On average, $PM_{2.5}$ particles comprise about 70% of PM_{10} by mass. However, PM2.5 particles are 10 to 100 times more numerous, and owing to their smaller size, they have a higher ratio of surface to volume.

The concentrations of the different types of particulate matter in air tend to vary up and down together. BS concentration is easily determined by absorption of light by particulate matter, and the BS level can be used as an indicator of diesel exhaust emissions (Gotschi 2002).

Particulates Relevant to Health. Most of the reports that deal with health effects of particulate air pollution concern PM_{10} and $PM_{2.5}$. These are the particulates that are most harmful to human health, especially those produced in motor vehicles (Laden 2000, Lanki 2006). The technology for measuring $PM_{2.5}$ levels in air was not widely available until the mid-1990s, so some studies report only on TSP, BS and other particulates.

Air Concentration Trends in Virginia

Emissions of PM_{10}, NOx, sulfate (SO_2) and VOC fell by 10 to 46% from 1990 to 2002. In like fashion, air concentrations of ozone, PM_{10}, NOx and SO_2 fell by 12 to 39 % from 1993 to 2003. However, between 2004 and 2005 the air concentrations of ozone, PM_{10} and $PM_{2.5}$ increased by approximately 5 to 12% in Virginia (Table 1). The utilization of electric power is projected to grow until 2050, the population of Virginia increased approximately 33% between 1980 and 2000, and vehicle miles traveled increased 99% during the same period. Recently adopted EPA diesel, gasoline and emissions standards may ameliorate the rise in emissions of $PM_{2.5}$ over coming decades. However, if trends in population, power consumption and vehicle miles traveled continue upward, one can expect that particulate emissions and air concentrations will either continue to grow or at least remain high.

Table 1, based on data supplied by the EPA website for cities and counties in Virginia, shows air concentration data for ozone, PM_{10} and $PM_{2.5}$ for years 2004 and 2005. The values for PM_{10} and $PM_{2.5}$ are annual means; and the values for ozone are 8-hour maxima. The EPA standard is 50 micrograms per cubic meter of air ($\mu g/m^3$) for PM_{10}, 15 $\mu g/m^3$ for PM2.5, and 80 parts per billion (ppb) for ozone.

Table 1: Average values for ozone, PM_{10} and $PM_{2.5}$ in Virginia

		Year		Percent
Pollutant	Units	2004	2005	Difference
Ozone	ppb	75	79	+5.3
PM_{10}	$\mu g/m^3$	18.8	21.0	+11.7
$PM_{2.5}$	$\mu g/m^3$	13.2	14.1	+6.8

The average values from all monitoring sites in the state for ozone and $PM_{2.5}$ are close to the EPA standards. In the large metropolitan areas of Virginia, the 8-hour ozone standard is often exceeded, and the $PM_{2.5}$ standard is sometimes exceeded.

Assessment of Health Effects

The impact of air pollution on health can be assessed in multiple ways. Questionnaires distributed to patients and/or their families provide information about respiratory symptoms such as wheezing, shortness of breath, tightness in the chest, cough and production of sputum. The function of the lungs can be assessed by various breathing tests. Such data can be recorded over many years to determine if there are long-term decrements in lung function. Events such as the number of asthma attacks, visits for emergency care and hospitalizations can be tabulated. Death rates from asthma, chronic obstructive pulmonary diseases (COPD) and lung cancer can be related to short-and long-term exposure to ozone and fine particulates.

Mechanism of Air Pollution-Induced Illness

Particle deposition in the lungs: Respiratory and other illnesses may be related to the presence of fine particulate material in the lungs. In a study that compared findings in Mexican and Canadian cities, the lungs of women who died of non-respiratory diseases were studied for their particle content. The prevailing level of PM_{10} in the air was 4.7 times higher in Mexico City than in Vancouver, and the lungs examined in Mexico City contained 7.4 times more particles than lungs from Vancouver. The particles in the lungs had characteristics of diesel exhaust (Brauer 2001).

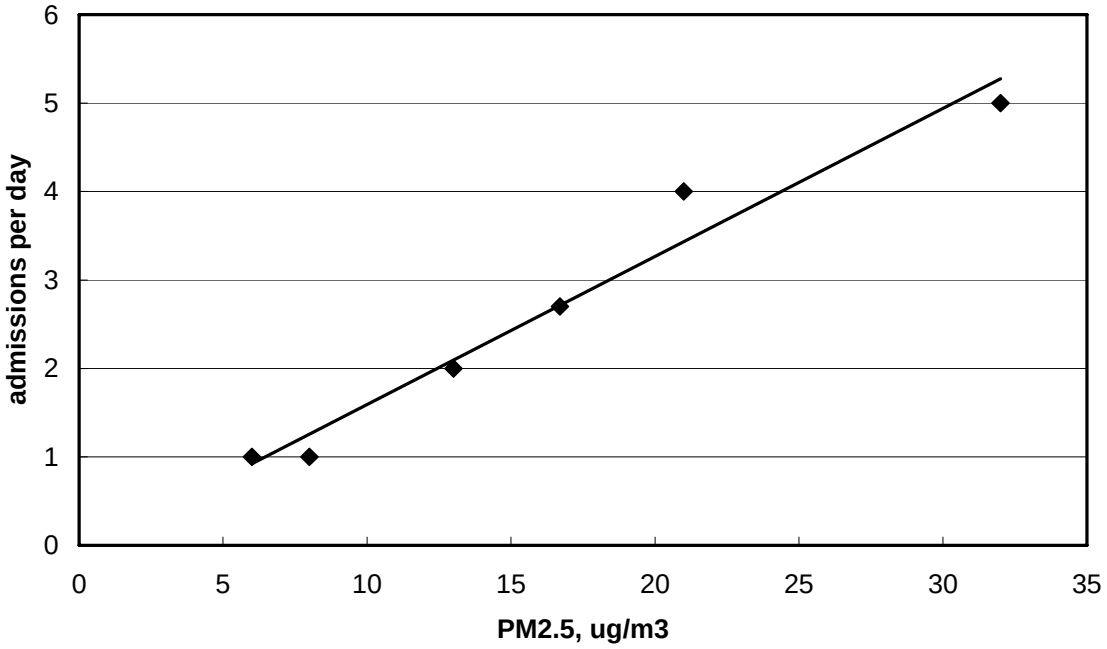
Inflammation. Ozone is a highly reactive substance that reacts with biological compounds to form oxygen free radicals. These radicals are also highly reactive, promoting inflammation and damaging living tissues. Fine particulate matter contains heavy metals and endotoxin which can also initiate inflammation (Ghio 2001, Long 2001, Tolbert 2002, Schaumann 2004). Instillation of fine particles into the lungs of human volunteers evokes an inflammatory response characterized by the appearance of inflammatory cells and substances called cytokines in the lungs (Ghio 2001, Schaumann 2004). Humans who inhaled fine particulate matter developed biochemical markers of inflammation in their blood and urine (Fujii 2001, Ruckeri 2006, Rabinovitch 2006).

The thickness of the inner and middle lining of the human carotid artery, which is related to inflammation in the lining, is proportional to the concentration of $PM_{2.5}$ (Kunzli 2005). Cardiovascular mortality related to air pollution is thought to be mediated by inflammation (Pope 2004).

Respiratory Illness

Morbidity. The prevalence of respiratory illness in children is related to levels of ozone and fine particulate pollution (Romieu 1996, Sheppard 1999, Gent 2003, Rabinovitch 2006). In addition to $PM_{2.5}$ and PM_{10}, TSP, SO_2 and NOx are also involved (Zhang 2002). Deaths from asthma are related to NOx and ozone (Sunyer 2002). Figure 1, based on data from Sheppard (1999) illustrates the number of hospitalizations per day in Seattle for asthma as related to the concentration of $PM_{2.5}$. Hospitalization rates for adults with respiratory diseases are also related to ozone and PM_{10} (Atkinson 2001, McGowan 2002).

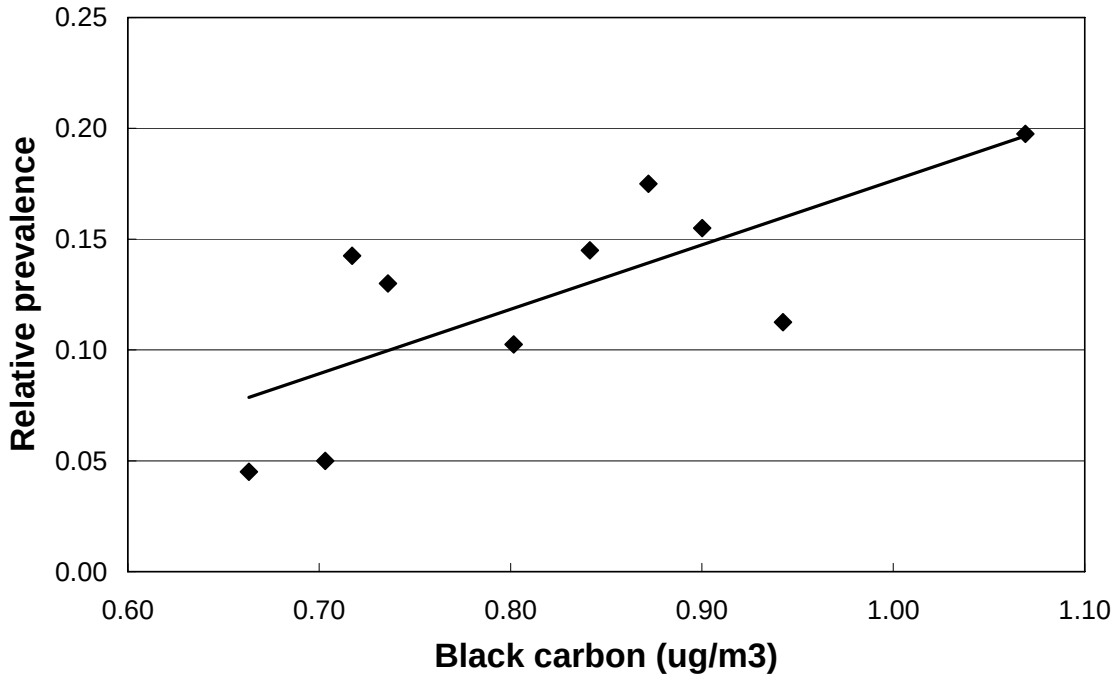
Figure 1. PM2.5 and Hospitalizations for Asthma



Lung function. As children grow, their lungs become larger and the numerical values for tests of lung function also increase. Several studies involving three to eight years of follow-up have shown that deficits in the growth of lung function, as assessed by lung function tests, are related to exposure to ozone, fine particulates, NOx and acid vapor (Gauderman 2002, 2004, Horak 2002).

Influence of traffic. Respiratory illness in children and adults is higher in areas adjacent to high motor vehicle traffic (Hoek 2002, Garshick 2003, Kim 2004, McConnell 2006). Figure 2 (Kim 2004) shows the effect of the concentration of black carbon in the air on the prevalence of bronchitis in school children. Each point on the graph is one school in Southern California. It is clear that the higher the black carbon concentration in the air, the higher is the prevalence of bronchitis (a 40% increase in black carbon doubles the relative prevalence).

Figure 2. Black Carbon & Bronchitis in Schools



Infant Morbidity & Mortality

Low birth weight, a predictor of infant mortality, is associated with maternal exposure to SO_2 and TSP during the third trimester of pregnancy (Wang 1997). Exposure to CO, PM10 and NOx is associated with increased mortality in infants aged 1-12 months (Ritz 2006). Maternal exposure to ambient air pollution is associated with a variety of fetal abnormalities (Bocksay 2005, Perera 2002). Cardiac defects in fetuses are associated with exposure of mothers to carbon monoxide and ozone in the first trimester of pregnancy (Ritz 2002).

Infant mortality increases with increasing levels of PM_{10} (Ha 2003). In US metropolitan areas, mortality from all causes, sudden infant death syndrome and childhood respiratory diseases increase in proportion to PM_{10} concentrations in the air (Kaiser 2004).

Cardiovascular Disease & Stroke

Fine particulate pollution is associated with an increase in the incidence of heart attacks and precipitation of congestive heart failure (Wellenius 2005a, Wellenius 2006, Dominici 2006), and in the incidence of ischemic strokes (Hong 2002a, 2002b, Wellenius 2005b, Low 2006). The number of emergency admissions for heart attack and the risk of death from heart attacks both increase when $PM_{2.5}$ increases (Zanobetti 2005, Dominici 2006). High levels of exposure to $PM_{2.5}$ lead to atherosclerosis, which underlies both ischemic stroke and heart attacks (Kunzli 2005). The probability of having a heart attack is increased by exposure to traffic (Peters 2004).

Adult Mortality

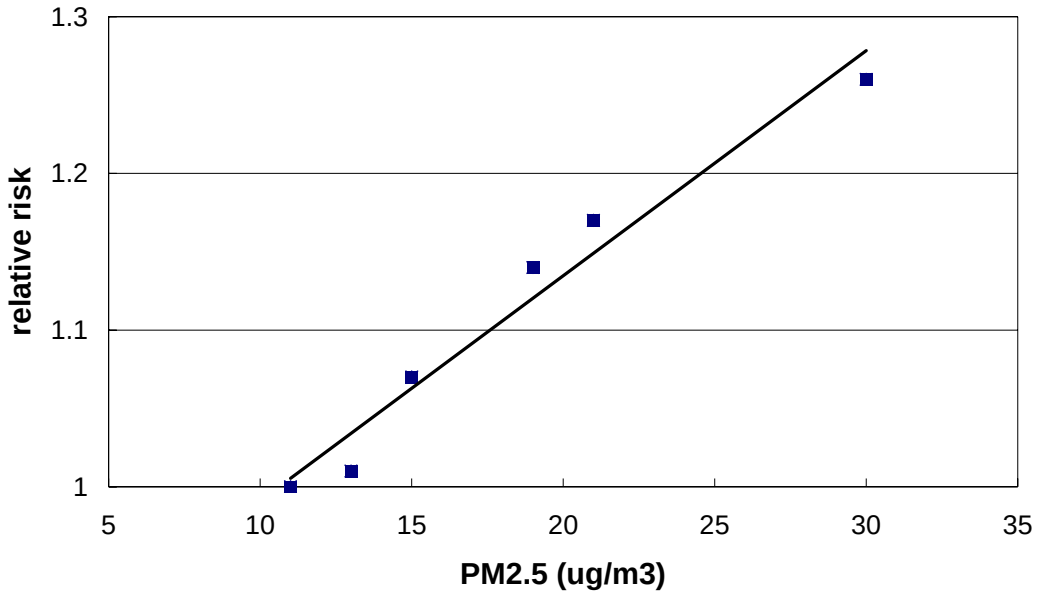
The association between fine particulate air pollution and increased risk of dying from all causes other than trauma has been demonstrated repeatedly (Schwartz and Dockery 1992, Dockery 1993, Pope 1995, Samet 2000, Goldberg 2001a, Goldberg et al. 2001b, Valois 2001, Pope 2002, Ballester 2002, Medina 2004, Jerrett 2005). The relative risk from of an exposure to equal mass concentrations is much higher for $PM_{2.5}$ than from PM_{10} (Samet 2000, Pope 2002). Exposure to ozone carries a finite risk of mortality unrelated to exposure to particulates (Gryparis 2004, Bell 2005). The risks of dying from COPD, lung cancer and heart disease after exposure to air pollution are substantially higher than the risk for all-cause mortality.

Worldwide, $PM_{2.5}$ causes about 3% of mortality from cardiopulmonary disease, 5% of mortality from cancer of trachea, bronchus and lung, and about 1% of mortality from acute respiratory infections in children under age 5 years. It amounts to 0.8 million premature deaths (1.2 %) and 6.4 million years of life lost (Cohen 2005). Even short-term exposure to particulates increases the mortality rates beyond the effect of hastening the death of the most vulnerable people (Zanobetti 2002, Hoyos 2003).

The data in Figure 3 (see below) are taken from the original six cities study (Dockery 1993). Each point in the graph represents a single city. The six cities are located in the eastern and Midwestern parts of the United States. The mean air concentrations of $PM_{2.5}$ ranged from 11 $\mu g/m^3$ of air in the least polluted city to 30 $\mu g/m^3$ in the most polluted.

In the six cities study, the relative risk of dying is highest in the most polluted city. These findings have not been altered by extensive reanalysis and follow-up (Dockery 1993, Laden 2000, Laden 2006). By way of comparison, the relative risk of dying prematurely is 2.3 for a current smoker, 1.5 for a former smoker and 1.3 from PM2.5 in a heavily polluted city.

Figure 3: Relative Risk of Dying



The relationship between daily death rate and the concentration of either ozone or $PM_{2.5}$ is linear, i.e. relative risk of dying varies directly with the level of pollutant. Statisticians find no evidence for a threshold, i.e. a little air pollution is bad and more is worse (Goldberg et al., 2001a, Schwartz 2002, Gryparis 2004, Bell 2006). The magnitude of the relationship depends on duration of exposure (Dominici 2003, Goodman 2004).

Table 2 shows the death rates in the United States. The overall death rate in the United States is approximately 830 per 100,000 of the population per year. The death rate from tobacco use is approximately 17% of the US total (US Census Bureau). Air pollution accounts for approximately 8%, with a range of 12 to 146 and a median value of 64 deaths per year per 100,000 of the population (Pope 1995, Samet 2000, Kunzli 2000, Pope 2002, Clancy 2002, Ballester 2002, Medina 2004, Jerrett 2005). Note that the rate for air pollution exceeds the rate for alcohol, firearms and motor vehicle accidents combined.

Table 2: Comparison of Mortality Rates in the United States		
Cause of death	Rate/100,000	Percent
US total	830	100
Tobacco	150	18
Air pollution	64	8
Alcohol, firearms, & motor vehicle accidents combined	57	7

Health Costs of Air Pollution

There is a strong correlation between the concentration of PM_{10} in the air and utilization of outpatient and inpatient medical services by Medicare recipients in the United States (Fuchs and Franks 2002). These investigators estimated that reducing the concentration of PM_{10} by 10 $\mu g/m^3$ would lead to a savings of $177 per year per senior citizen. Given the currently prevailing level of PM_{10}, the total direct medical cost would be approximately $370 per Medicare recipient per year.

In southern California, the total cost of school absences related to air pollution was approximately $245 million (Hall 2003). It was estimated that the reductions in air pollution estimated to occur by 2010 will result in fewer children visiting emergency rooms, fewer hospitalizations, a reduction in number of low birth rate infants, with an annual medical savings of approximately $267 million for children (Wong 2004).

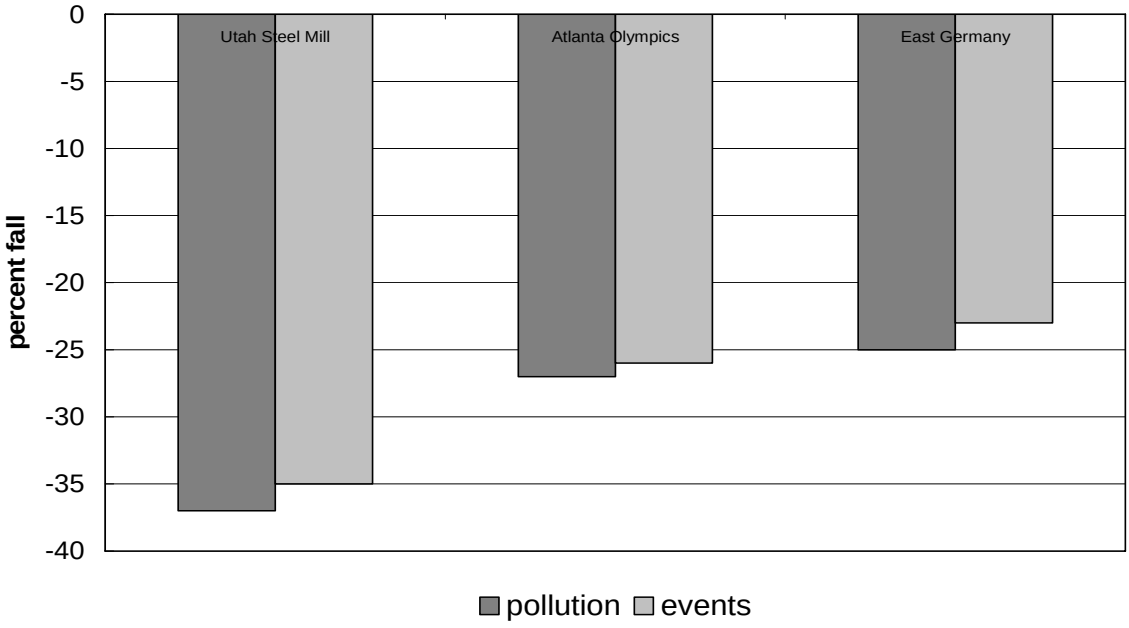
Studies based on large populations indicate that total health costs of air pollution, which include the impact of premature deaths, range from $600 to $1,000 per adult per year (Hall 1992, Levy 2001, Kunzli 2002, Hall 2006). The average is approximately $800 per adult per year. In Virginia that would come to approximately $4.8 billion per year, or 1.6 % of Virginia's gross domestic product.

Effect of Interventions

Rate of fall. When emissions of air pollutants cease, air pollution levels drop rapidly. In a 2003 power outage that affected mid-Atlantic states there were 50-90% reductions in SO_2, ozone and light scattering particles within 24 hours (Marufu 2004).

Morbidity. In several places local or regional levels of particulate air pollution fell for several weeks or longer. Studies of these events have yielded valuable information on the impact of interventions on pollution-related illnesses. In the Salt Lake City area a steel plant was closed for a year for economic reasons (Pope 1989). In East Germany, particulate pollution fell substantially after reunification (Heinrich 2000). The downtown area of Atlanta was closed to traffic for several weeks during the 1996 summer Olympic Games (Friedman 2001). The results of these studies are depicted in Figure 4 on page 10. Note that for each percent decrement in air pollution (dark grey bars), there is a nearly identical decrement in respiratory illness (light grey bars).

Figure 4. Effect of Interventions



Mortality. In Dublin, Ireland the sale of bituminous coal for home space and water heating was banned in 1990. Mortality ascribable to air pollution was studied for 6 years before and 6 years after the ban. The concentration of black smoke (BS) in the air fell by 70%. Death rates from all causes except trauma fell by 5.7%, respiratory deaths fell by 15.5 % and cardiovascular deaths fell by 10.3%. Approximately 75 deaths per year per 100,000 population could be attributed to air pollution (Clancy 2002).

Consequences of Lowering Air Pollution in Virginia

A one-third reduction in current levels of ambient particulate matter and ozone would be expected to reduce asthma and bronchitis in children by approximately one-third. Premature deaths would fall by 21 per 100,000 of the population per year, or approximately 2.5% of the total death rate. The savings from reduced medical costs would come to approximately $1.6 billion per year.

Progress to Date

The data presented in the references cited do not take into account measures taken in recent years to ameliorate outdoor air pollution. In the United States, measures have already been in effect for several years to reduce emissions from on-road vehicles and power plants. Internal combustion engines are more efficient. As of October 2006, diesel fuel has 90% less sulfur. In 2007, emissions from selected off-road vehicles will be curtailed.

Summary

Fine particulate matter and ozone have the greatest impact on human health. At levels prevailing in Virginia, they are responsible for increased morbidity and mortality. The death rate from air pollution is approximately 40% of that for tobacco use. The health costs are approximately $4.8 billion (1.6% of Virginia's gross domestic product).

Interventions that reduce air pollution are accompanied by a comparable percentage fall in respiratory illness in children, and a substantial decrease in death rate. A one-third reduction of air pollution in Virginia could lower children's respiratory illnesses by approximately one-third, reduce death rate by 3% and save Virginia 1.6 billion dollars per year.

Recommendations

Use Energy Efficiently

Home: Insulate. Adjust thermostats for less cooling in summer and less heating in winter. Conserve water and use hot water judiciously.

Architecture: Build environmentally compatible residential and commercial buildings.

Energy supply: Utilize renewable sources (solar, wind, geothermal, etc.).

On-road vehicles: Maintain proper tire inflation. Keep engine tuned. Minimize unnecessary idling (idling engines pollute excessively). Drive within the speed limits (fuel consumption increases drastically above 65 mph). Avoid excessive acceleration and braking.

Enact Legislation

Off-road vehicles: Develop and enact emissions standards for off-road vehicles that parallel standards for on-road vehicles.

Control idling and speed limits: Excessive idling and speeding waste fuel. Banning idling and putting in place lower speed limits would signal the public that energy efficiency is an important component of environmental health.

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Appendix F:

CV of Dr. Viney P. Aneja

BIOGRAPHICAL SKETCH

Viney P. Aneja

Viney Aneja is a Professor in the Department of Marine, Earth, and Atmospheric Sciences, North Carolina State University. He obtained his B. Tech. degree in Chemical Engineering from the Indian Institute of Technology, Kanpur, India; and MS and Ph.D. degrees from the Department of Chemical Engineering, N. C. State University, Raleigh, N.C. Before joining the faculty of the Department of Marine, Earth, and Atmospheric Sciences at N. C. State in 1987, he conducted and supervised research at Corporate Research and Development, General Electric Company, New York, and Northrop Service, in Research Triangle Park in the areas of environmental engineering and separations technology. In 2001 he was also appointed Professor of Environmental Technology, Department of Forestry and Environmental Resources. In addition, he has been a visiting professor at the University of Uppsala, Sweden in 1979; at Jawahar Lal Nehru University in New Delhi, India in 1980; and at the Arrhenius Laboratory in Stockholm, Sweden in 1985.

Dr. Aneja's industrial and academic research contributions have been extensively recognized. He won the Noryl Division Proprietary Innovation Award from General Electric in 1983, the Air Pollution Control Association Award for Distinguished Service in 1984, the General Electric Managerial Award in 1986, and at North Carolina State University he received the 1991-92 Outstanding Extension Service Award. In 1998 the Air and Waste Management Association gave him its Frank A. Chambers Award, the Association's highest scientific honor; in 1999 he became a Fellow of the Association; in 2001 he received the Association's Lyman A. Ripperton Award for distinguished achievement as an educator. He is the recipient of the 2007 North Carolina Award in Science, the highest award a civilian can receive from the Governor of North Carolina.

At North Carolina State University Dr. Aneja has developed one of the nation's leading agricultural air-quality research programs (http://www.meas.ncsu.edu/airquality). He has published over 140 scientific papers, 116 book chapters and conference proceedings scientific papers, 5 US patents, and two books on his research. Dr. Aneja has directed 7 post doctoral fellows, 11 doctoral dissertations and 37 masters' theses.

Much of his work has focused on the science needed to make important decisions on environmental policies in North Carolina and the nation. He has conducted research on natural and anthropogenic emissions of nitric oxide, ammonia, and sulfur compounds and demonstrated the important roles of these substances in ozone formation and gas-to-particle conversion. His research on atmospheric photochemical oxidants in the North Carolina mountains has clarified the role of long range transport of pollutants and impact of these compounds on the formation of acid rain and on the damage to trees at high elevation. His most recent research has concentrated on the critical issue of the contribution of animal feeding operations to air quality; quantifying the emissions, transformation, transport and fate of pollutants in the environment. His contributions have been featured on CNN, ABC, CBS, NBC, National Public Radio, Public Broadcasting Service, The New York Times, Associated Press, Environmental Manager, and Fortune magazine. Dr. Aneja's research has enjoyed

support from a broad base of public and private sources. While conducting his extensive research, Dr. Aneja has maintained a heavy teaching load. He teaches a large and popular introductory course (Introduction to Weather and Climate), an upper division air quality course (Fundamentals of Air Pollution), and graduate courses, and has also given numerous short courses to public and private sector audiences.

Dr. Aneja has a long and distinguished record of public service, and he has been frequently sought as a lecturer and consultant to the Federal and State governments, professional societies, international organizations, and the private sector on issues related to environmental science and public policy. He was invited to visit the University of Munich, Germany in 1988 to discuss the problem of forest decline; to Berlin, Germany, during 1992 to discuss environmental issues in Eastern Europe; the Ministry of International Trade and Industry, Japan, in 1994 to discuss urban and rural air quality; to the University of Sydney, Australia, and Hebrew University, Jerusalem, Israel in 1996 to discuss environmental issues; and the Ministry of Agriculture, Rome, Italy, in 1999 to discuss the role of intensively managed agriculture on the environment. In 2000 he was a member of the North Carolina Delegation to the Netherlands on Agricultural Air Quality, and in 2001 he was leader of the U.S. Department of State Delegation to France on Environment Science and Technology. In 1990 Dr. Aneja served on the NASA panel for the selection of NASA Specialized Centers for Research and Training; and from 1994 to 2000 he served on the Exam Advisory Committee of the Institute of Professional Environmental Practice. From 1987-90 he served as the Site Director for the Mountain Cloud Chemistry Program. In 1990 he was appointed the Mission Scientist for the "Southern Oxidant Study"; in 1994 he was appointed Program Scientist for the U.S. EPA and NSF funded Project "NOVA"; in 1996 he was appointed the Science Team Leader for the North Carolina Department of Environment and Natural Resources Program on "Atmospheric Nitrogen Compounds: Emissions, Transport, Transformation, Deposition, and Assessment," and in 2001 he was appointed Program Scientist and Principal Investigator for the Animal and Poultry Waste Management Center/ Smithfield Foods funded Program OPEN (Odor, Pathogens, and Emissions of Nitrogen). He served as a member of the Technical Advisory Committee on North Carolina Environmental Defense Fund, a member of the North Carolina Progress Board; and serves as a Director of the Air and Waste Management Association, and Chair of the Association's Education Council. He has served on the editorial boards of the journals *Environmental Pollution, Chemosphere, Journal of the Air and Waste Management Association,* and *Environmental Manager;* and currently serves as Associate Editor for *International Journal of Air Quality, Atmosphere, and Health; International Journal of Applied Environmental Sciences; The Open Environmental & Biological Monitoring Journal* and the *Scientific Journals International*; and on the Reader Advisory Panel of *Nature*.

Appendix G:

Particulate Matter (PM_{10}) and Meteorological Sampling

Cherokee Instruments, Inc.
901 Bridge Street
Fuquay Varina, NC (USA) 27526
(919) 552-0554 Tel
(919) 552-3991 Fax
(800) 399-4236 Toll Free
sales@ampcherokee.com
www.ampcherokee.com

April 8, 2009

Dr. Viney P. Aneja
Professor Air Quality
North Carolina State University

RE: Ambient Air Sampling Equipment
Cherokee Rental Order No. ????

Dear Dr. Aneja:

North Carolina State University, acting on behalf of the Sierra Club, arranged for the procurement of some ambient air monitoring devices to support an ambient air sampling project. This document serves as a summary of the ambient air equipment procured and pertinent calibration information.

Particulate Matter Samplers

Two (2) Andersen/GMW Model GUV-16H High Volume air samplers equipped with PM10 size selective inlets were employed to collect ambient particulate matter with an effective aerodynamic size of less than 10 microns (PM10). The samplers were provided with volumetric flow controllers for constant flow control, a Dickson circular chart recorder for historical trend of volumetric flow through the sampler, and a mechanical timer and elapsed time indicator for total sampling time indication. Samples were collected onto 8-inch x 10-inch quartz fiber filters that were obtained from and pre-tared at (insert laboratory).

The functionality and calibration of the particulate samplers was verified immediately prior to the field effort at our service center in Fuquay Varina, North Carolina. Dr. Viney Aneja of NC State University witnessed the initial testing of these instruments. The instrumentation was then transported to the field location and setup, calibrated and operated onsite various locations in accordance with the manufacturer's specifications and USEPA methodology.

All calibrations were conducted used a High Volume Air Sampler Calibration Kit, Model Andersen/GMW Veriflow. The calibration kit included a calibrated orifice transfer standard that was referenced to a spirometer as well as 8-inch x 10-inch mounting plate adapter and water slack tube manometer. The Veriflow orifice is capable of providing various pressure drops across the sampler flow controller in order to simulate particulate matter loading onto the filter. Calibrations were performed on each sample at site conditions prior to collection of the first sample at each location. These calibrations included volumetric flow verification through the sampler via comparison of the calibrated orifice results to the volumetric flow controller lookup tables.

Meteorological Sampler

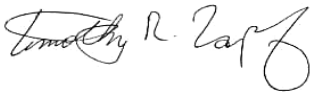
One (1) Met One Model Automet portable weather station equipped with an onboard datalogger was employed to measure and record site weather conditions during sampling events. The station was provided with wind speed, wind direction, temperature, and barometric pressure and relative

humidity sensors. All sensors were mounted on a portable tripod with telescoping mast such that meteorological data could be obtained at a height of 5 to 10-ft above grade. All data was collected in real-time and averaged/stored at 15-minute data intervals using the onboard datalogger.

The functionality and calibration of the meterological sensors were verified immediately prior to the field effort at our service center in Fuquay Varina, North Carolina. Verification of the individual sensors functionality was accomplished using constant RPM motor, compass, reference thermocouple and local airport barometric pressure. The instrumentation was then transported to the field location and setup and operated onsite at various locations in accordance with the manufacturer's specifications and USEPA methodology. No site calibrations were performed.

Please let me know if I can send you any additional information. If I can be of any further assistance, do not hesitate to give me a call at (800) 399-4236. Thank you for considering Cherokee Instruments for your equipment needs.

Regards,



Timothy Zapf
Operations Manager
Cherokee Instruments, Inc.

PM 10 High Volume Samplers
PM 10 Size Selective High Volume Sampling Systems

Andersen/GMW's High Volume PM 10 Sampling Systems meet all Federal Reference Method Performance specifications for the measurement of PM 10 and have been EPA designated as an approved Method for the determination of ambient PM 10 particulate concentrations. Each PM 10 Sampler bears an identification label with the FRM designation number RFPS-1287-063. Volumetric and Mass Flow Controlled Systems are available for 24 hour ambient PM 10 measurements.

Mass Flow Controlled High Volume Air Sampling Systems

The Mass Flow Controlled High Volume Samplers feature accurate collection of total suspended particulates and PM 10, meeting EPA specifications. Air flow through the system is maintained at a constant rate by an electronic probe which automatically adjusts the speed of the blower/motor to correct for variations in line voltage temperature, pressure, and filter loading.

Adjustable over a range from 20CFM to 60CFM, air flow is controlled at a constant standard condition of 25°C temperature and 760 mm Hg pressure within plus or minus 1 CFM. By maintaining an exact air flow rate through the sampler, the particulate concentration is extremely accurate and reliable.

The high volume air sampler incorporates a pressure recorder or a well type manometer for flow verification. The elapsed time indicator is calibrated in hours, tenths, and hundredths. A wide variety of electronic and mechanical timers are available, along with the Flow Manager (see specification sheet for Flow Manager).

FEATURES

- Accurately Samples Aerodynamic Diameter of Particles Less than 10 Micrometers (PM 10)
- All Weather, Outdoor Shelter Constructed of Anodized Aluminum
- High Speed Motor Designed for 24-Hour Continuous Sampling
- Rugged electronic circuit and mass flow probe for accurate sampling
- Optional brushless blower motor available
- Electronic Flow Manager available for data logging and sampler field data

GRASEBY

Graseby Andersen Division • 500 Technology Court • Smyrna, GA 30082 USA
TEL: 770-319-9999 • FAX 770-319-0336
1-800-241-6898

Volumetric Flow Controlled Air Sampling Systems

The Andersen/GMW Volumetric Flow Controller (VFC) is a critical flow orifice venturi device used to control gas flow. When applied to a high volume air sampler, this flow control principal incorporates a smooth-wall venturi orifice that gradually opens to a recovery section. Vacuum is provided by a blower/motor downstream of the venturi. Over 95% of the energy lost in differential pressures across the restricting orifice is recovered in this design.

Flow control is accomplished by restricting, and thus accelerating the air flow through the venturi. At a point in the flow stream, air velocity will equal the acoustic velocity, or speed of sound, and critical flow will be achieved. As long as downstream changes are small, all conditions at the venturi (including the flow rate) are determined by upstream conditions. This is referred to as "choking" and is a characteristic of all VFC's. The PM 10 utilizes this principle of choked or critical flow to maintain a constant actual flow rate of 40 ACFM (1.13 ACMM) over the sample period. Since critical flow through the venturi is not greatly affected by changes in the filter loading, ambient temperature or barometric pressure, a stable "Volumetric flow" rate is maintained.

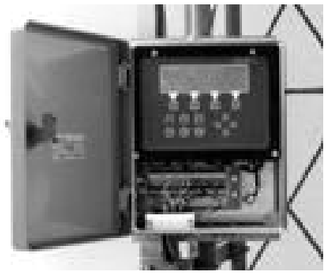
The orifice used in this system can also be described as a well documented Critical Venturi Meter (CVM). CVM is a specially machined nozzle or restriction device designed to react to a specific pressure ratio expressed in absolute terms. When air reaches the speed of sound in the throat (smallest diameter) of the CVM, a sound pressure barrier is set up that will not allow more air through under the existing temperature and pressure conditions. This is the "critical flow" point of the meter, thus the name Critical Venturi Meter. The Volumetric Flow Controller regulates flow at a constant but unadjustable rate without any moving parts or electronic components. Each PM 10 Sampler bears an identification label with the EPA designation number RFPS-1287-063.

FEATURES

- Accurately Samples Aerodynamic Diameter of Particles Less than 10 Micrometers (PM 10)
- All Weather, Outdoor Shelter Constructed of Anodized Aluminum
- High Speed Motor Designed for 24-Hour Continuous Sampling
- Optional Brushless Blower Motor Available
- Meets All Federal Reference Method Performance Specifications for the Measurement of PM 10
- No Electronic Components
- Electronic Flow Manager Available for Data Logging and Sampler Field Data

Specifications:	Mass Flow Control	Volumetric Flow Control
Motor:	HP 0.6	HP 1.0
Amperage:	6.25	7.0
Wattage:	750	840
Flow Set Point:	20 to 60 ACFM	40 ACFM
Flow Control Accuracy:	+/- 2.5%	<1% Deviation over 24-hour period
Power Source:	115v,60Hz or 220v,50/60Hz	115v,60Hz or 220v,50/60Hz
Net Weight:	112 lbs.	136 lbs
Shipping Sizes & Weights:		
Shelter:46" x 20" x 23"	70 lbs.	74 lbs.
Inlet: 32" x 32" x 26"	65 lbs.	58 lbs.
VFC, Blower & Filter Holder:		
28" x 21" x 19"	N/A	27 lbs.
Federal Reference Method		
Designation Number:	RFPS-1287-063	RFPS-1287-063

Met One Instruments



INSTALLATION
Installation is a snap with the AutoMet. Each system is pre-tested and certified. Measurements may be easily added in the future using any AutoMet™ Sensor. The supplied tool kit enables anyone to do the installation.

For portable applications, AX carrying cases provide convenient transport and the "Easi-Up" tripod takes less than 5 minutes to deploy.

CONSTRUCTION
The AutoMet sensor array is solidly constructed of aluminum alloy and finished with a protective gloss white powder coat paint.

The electronics data package is housed in a non-ferrous Nema 4 enclosure. All electronics are conservatively rated, circuit boards are environmentally coated, with built-in surge protection.

INPUTS
8 analog, and 1 pulse (Rain)

POWER REQUIREMENTS
12 VDC from internal battery pack, external expansion battery, solar panel or 115/230 VAC using the power module.

Met One Instruments

Sales & Service: 1600 Washington Blvd., Grants Pass, OR 97526
Phone 541/471-7111, Fax 541/471-7116
Regional Service: 3206 Main St., Suite 106, Rowlett, TX 75088
Phone 214/412-4747, 214/412-4715, Fax 214/412-4716
http://www.metone.com

AutoMet™

AutoMet™ is a complete, self-contained, Digital Meteorological Monitoring System that provides instant access to weather information. It is ideal in situations when it is necessary to monitor and collect reliable data requiring extreme ease of installation without complicated programming.

FEATURES
- Meets or exceeds PSD regulatory requirements
- User-friendly plug-n-play configuration
- Rapid deployment– installs in minutes
- Low operating cost
- Rugged–all metal sensor array
- Keyboard/Display
- Lasting accuracy, 20,000 hour MTBF
- 200-Day storage capacity
- Data retrieval through RS-232 port, modem, radio/cellular phone
- Direct printer output
- Palm size Data Transfer Module

Met One Instruments

AutoMet™

Met One Instruments

- WIND SPEED
- WIND DIRECTION
- TEMPERATURE
- RELATIVE HUMIDITY
- SOLAR RADIATION
- BAROMETRIC PRESSURE
- PRECIPITATION
- AND MORE, CONSULT FACTORY

AUTO-PROGRAMMING
Gathering reliable data has never been easier. AutoMet features a unique self-configuring interface allowing it to program itself. Simply plug in an AutoMet™ Sensor and AutoMet identifies the sensor type, determines its range, and writes the programming to record the sensor data.

AUTOMET™ SENSORS
AutoMet sensor array consists of selected sensors that incorporate the unique AutoMet interface.

STANDARD SENSORS
AutoMet will also work with a wide variety of standard sensors. Standard sensors are used with your logger, their logger or any of our other standard loggers.

Optional Automatic Direction Alignment (ADA) unit allows the system to collect valid wind data without the necessity of manual compass alignment procedures.

PASSWORD PROTECTION
Set-up files are protected by 4-character passwords to ensure data integrity. Passwords may be changed at any time.

AVERAGING PERIODS
Quick and easy setting of flexible averaging periods of 1, 5, 15 or 60 minutes ensures compliance with regulatory requirements.

AUTOMATIC ALARMS
Two automatic alarms may be set at any measurement channel to signal personnel about hazardous conditions or to turn equipment on or off in the event that measurement falls above, below, or within predetermined ranges.

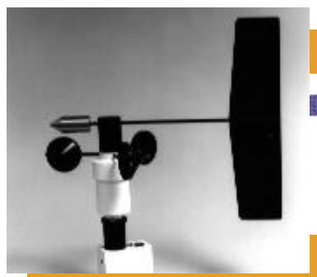
DATA STORAGE
Internal memory module is sufficient to collect data for a period in excess of 200 days, when data is recorded on an hourly basis.

FIELD DIRECT DATA
Collecting real time or historical data from a field site has never been easier. Data can be read on site using the built-in display, your portable computer, printer, or carried off site by using Data Transfer Module.

DATA TRANSFER MODULE
The palm size Data Transfer Module may be used to transfer data from the AutoMet to any computer equipped with an RS-232 communications port.

DESKTOP DATA
Data is available on command using AutoMet and any of the communications options available. Data may be transferred to desktop computer directly via cable, radio telemetry or by a dial-up modem.

TELEMETRY OPTIONS
A license free spread spectrum radio system provides a high reliability data link between the sensor array control unit and the remote display module.

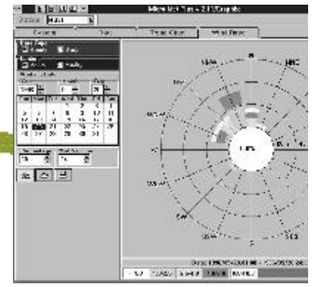


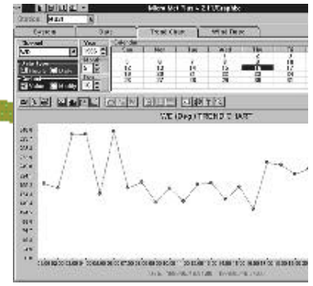
LARGE BUILT-IN DISPLAY
AutoMet includes a keyboard with 8 X40 character back-lit LCD display which allows system configuration, operation, and retrieval of data with simple menu-driven commands and context sensitive hot-keys.

Prompted display provides the easiest, quickest way to set up and scan data. Special calibration mode marks data gathered during calibration periods.

SOFTWARE
AutoMet Software is a complete package of communications, data collection, and data reporting tools with a windows-like operating environment. AutoMet Software provides complete environmental reporting in compliance with EPA and other requirements. Software support for modem, radio, direct connection, and Data Transfer Module are provided.

Summary reports are generated by AutoMet Report using monthly data files. The operator selects the period to be printed with beginning and ending prompts. Report footers provide the summary scalar averages, vector averages and percentage of data collection. AutoMet Plus Software, operates under both Windows 3.1® and greater, and Windows 95®. It provides the same reporting functions plus full graphic capabilities. Data may be reported, graphed and wind rose plots may be produced.





1600 Washington Blvd
Grants Pass Or 97526
Tel # 541-471- 7111
Fax # 541 -471 -7116

Met One Instruments

System Test Certification

Central Region Sales & Service
3206 Main St. Suite 106
Rowlett, Texas 75088
Tel # 972- 412- 4747

Job Number 72571 **Customer** CHEROKEE INSTRUMENTS

Test Date 6/30/2008 **Calibration Due** 6/30/2009 **Tested By** Laurie Thurn

Model # 466A **Ser#** H6261 **Customer Station**

Measurement	Expected	Actual	Error	Spec	Notes
Wind Speed	Tested W/	034A	Ser#	N/A	Tested on ch 1
Zero 0.00 Hz	0.3 m/s	0.3 m/s	±0.0 m/s	± 0.3 m/s	
Mid 26.82 Hz	21.7 m/s	21.9 m/s	+0.2 m/s	± 0.3 m/s	
Span 53.65 Hz	43.1 m/s	43.4 m/s	+0.3 m/s	± 0.3 m/s	
Sensor	8.3 m/s	— m/s	— m/s	± 0.4 m/s	
Wind Direction	Tested W/	034A	Ser#	N/A	Tested on ch 2
Zero 0.000 Vdc	0 °	0 °	± 0 °	± 2 °	
Mid 0.950 Vdc	137 °	136.8 °	-0.2 °	± 2 °	
Mid 2.500 Vdc	360 °	359.9 °	-0.1 °	± 2 °	
Sensor 10°	10 °	— °	— °	± 3 °	
90°	90 °	— °	— °	± 3 °	
180°	180 °	— °	— °	± 3 °	
270°	270 °	— °	— °	± 3 °	
350°	350 °	— °	— °	± 3 °	
Air Temperature	Tested W/	083C-1-35	Ser#	N/A	Tested on ch 3
Zero 73449 ohm	-30.0 °C	-29.8 °C	-0.2 °C	± 0.3 °C	
Mid 17092 ohm	30.0 °C	30.0 °C	±0.0 °C	± 0.3 °C	
Span 10545 ohm	50.0 °C	49.9 °C	-0.1 °C	± 0.3 °C	
Sensor	— °C	— °C	— °C	± 0.4 °C	
Relative Humidity	Tested W/	083C-1-35	Ser#	N/A	Tested on ch 4
Zero 0.000 Vdc	0.0%	0.0 %	±0.0 %	± 0.3%	
Mid 0.500 Vdc	50.0%	49.9 %	-0.1 %	± 0.3%	
Span 0.950 Vdc	95.0%	94.9 %	-0.1 %	± 0.3%	
Sensor	— %	— %	— %	± 3.0 %	
System Pwr Req	< 50 mA				
					Page # 1 of 2

1600 Washington Blvd
Grants Pass Or 97526
Tel # 541- 471- 7111
Fax # 541 -471 -7116

Met One Instruments

System Test Certification

Central Region Sales & Service
3206 Main St. Suite 106
Rowlett, Texas 75088
Tel # 972- 412- 4747

Job Number	72571	**Customer**	CHEROKEE INSTRUMENTS
Test Date	6/30/2008	**Tested By**	Laurie Thurn

Measurement	Expected	Actual	Error	Spec	Notes
Baro Pressure	Tested W/	090D	Ser#	N/A	880.5/1083.6 mbar
Zero 0.000 Vdc	880.5 mbar	880.5 mbar	±0.0 mbar	± 0.6 mbar	Tested on ch 5
Mid 0.500 Vdc	982.1 mbar	982.0 mbar	-0.1 mbar	± 0.6 mbar	
Span 0.950 Vdc	1073.5 mbar	1073.5 mbar	±0.0 mbar	± 0.6 mbar	
Sensor	— mbar	— mbar	— mbar	± 0.8 mbar	

Model # 466A **Ser#** H6261

AutoMet System Configuration

CHEROKEE INSTRUMENTS	72571	6/30/2008

MODEL 466A SERIAL NO. H6261

MEASUREMENT	SENSOR	CABLE	UNITS	DATALOGGER OFFSET	DATALOGGER MULTIPLIER	SOFTWARE OFFSET	SOFTWARE MULTIPLIER	NOTES
Wind Speed	034A	3013	m/s	0.3	44.7	0.3	44.7	1
Wind Direction	034A	3013	Deg	0.0	360.0	0.0	360	1
Air Temperature	083C-1-35	2348	°C	-73.0	178.9	-73.0	223.62	2
Relative Humidity	083C-1-35	2348	%	0.0	100.0	0.0	250	1
Baro Pressure	090D	1169	mm	880.5	203.2	880.5	507.98	1
Battery Voltage			VDC	0.0	15	0.0	37.5	1
Sigma Theta			Deg	0.0	120.0	0.0	120.0	3

NOTES:

1) ALL CHANNELS ARE SET TO MANUAL EXCEPT WIND SPEED. SET WIND SPEED TO COUNTER #1. SET COUNTER #1 F.S.FREQ TO 56.0 Hz AND LO FREQ.

2) AIR TEMPERATURE SLOPE SET TO Y (INVERSE SLOPE)

3) SIGMA THETA IS COMPUTED IN THE DATALOGGER AS THE STANDARD DEVIATION OF WIND DIRECTION USING THE YAMARTINO ALGORITHM.

Met-One System QA/QC Check

Cherokee Instruments, Inc.

Analyzer Type	Wheather station	Analyzer Asset #	3363
Analyzer Model	Met One	Manual with Instrument?	Y
Analyzer Serial No.	H6261	Power Cord and Signal Cable?	Y
Case No.			

Barometric Pressure sensor	X1609
Radiation sheild	
Relative humidity sensor	X1399
Data transfer module	A4998

	TYPE	UNITS	PREC	MULT	OFFSET	VOLT	INV SLOPE	VECT/SCAL	MODE
CH 1	WS	MPH	1	100	0	2.5	N	V	Count 1
CH 2	WD	DEG	1	360	0	2.5	N	V	Manual
CH 3	AT	C	1	178.9	-72.9	2	Y	S	Manual
CH 4	RH	%	1	100	0	1	N	S	Manual
CH 5	BP	Hg	2	6	26	1	N	S	Manual
CH 6	BV	VDC	1	15	0	1	N	S	Manual
CH 7	no								
CH 8	no								
CH 9	Rain	IN	2	0.01	0	1	N	S	Manual

				Acutal	Recorded	
Wind sensor	works		*Air temp*	30	30	Deg C
Wind direction	0°	Y				
	90°	Y	*Relative humidity*			
	180°	Y				
	270°	Y	*Baro Pressure*	29	29	mmHg
			Rain	0	0	in

Technician: MJH Date: 7/11/2008

Cherokee Instruments, Inc.
Particulate Sampler Calibration
Volumetric Flow Controller

Site		**Calibration Orifice**	
Location:	???	Make:	???
Date:	???	Model:	???
Tech.:	???	Serial:	???
Sampler:	???	Slope:	???
Serial #:	???	Int.:	???

Temp (deg F):	???	Elevation (ft):	???
Ta (deg K):	255	SL Press (in Hg):	???
Ta (deg C):	-18	Pa (mm Hg):	0

Run Number	Orifice "H2O	Qa m3/min	Sampler "H2O	Pf mm Hg	Po/Pa	Look Up m3/min	% of Diff
1	3.20	#DIV/0!	17.30	32.287	#DIV/0!	1.193	#DIV/0!
2	3.15	#DIV/0!	19.10	35.646	#DIV/0!	1.186	#DIV/0!
3	3.10	#DIV/0!	19.70	36.766	#DIV/0!	1.185	#DIV/0!
4	3.10	#DIV/0!	21.10	39.378	#DIV/0!	1.180	#DIV/0!
5	3.00	#DIV/0!	29.90	55.802	#DIV/0!	1.150	#DIV/0!

Calculations

Calibrator Flow (Qa) = 1/Slope*(SQRT(H20*(Ta/Pa))-Intercept)

Pressure Ratio (Po/Pa) = 1-Pf/Pa

% Difference = (Look Up Flow-Calibrator Flow)/Calibrator Flow*100

Appendix H:

PM_{10} sample mass and chemical analysis

10 October 2008

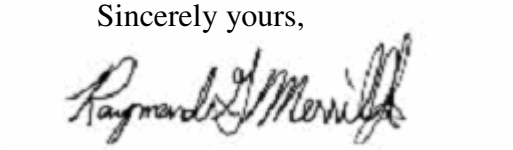
Viney P. Aneja
North Carolina State University
5136 Jordan Hall Room 5136
Raleigh, NC 27695-8202

RE: PM-10 Filter Analysis 7-2008

Enclosed are the results of analyses for samples received by the ERG laboratory on or after 08/08/08. High Volume (Hi Vol) 8/10 inch fiberglass filters were analyzed to determine mass. Quarts Hi Vol 8/10 inch filters were analyzed for mass and a group of metals common to the EPA National Ambient Air Toxics Stations program. A list of the samples received in this project is listed in the **ANALYTICAL REPORT FOR SAMPLES**. Results and reporting/detection limits are provided in the **GRAVIMETRIC MEASUREMENT** and **INORGANICS BY COMPENDIUM METHOD IO-3.5** data tables in this report. Data has been reported using the total sample volume provided by your staff on chain of custody forms. The ERG LIMS tracking numbers for this work are 8081414 and 8090908. Samples were stored after receipt at ambient temperature in an environmentally controlled room prior to analysis. This report includes a cover page, 3 pages of narrative, 21 pages of filter mass data and inorganic analysis results. Inorganic analysis was performed according to our NELAC certification. A copy of the COCs for this sample set is also provided as an attachment.

ERG remains committed to serving you in the most effective manner. Should you have any questions or need additional information and technical support, please contact me at (919) 468-7887. Thank you for choosing ERG as a part of your analytical laboratory support team.

Sincerely yours,



Raymond G. Merrill
ERG Project Manager and
Laboratory Technical Director

Narrative

The Analytical Report of Samples table lists samples received by ERG's laboratory tracked under ERG LIMS numbers 8081414 and 8090908. Samples were received on 08/08/08. Samples were equilibrated in an environmentally controlled balance room prior to analysis. Our analysis procedure covers the determination of metals on PM10 or TSP filters used to sample ambient air and submitted to the laboratory.

Gravimetric Analysis

Gravimetric measurements are performed with a Satorius LA 120S equipped with a large area weighing chamber. Calibration is checked with NIST Class S weights. Ambient filters are equilibrated for 24 hours under balance room conditions prior to weighing. Tare weights are recorded prior to filter media shipment and use. Sample plus filter tare weights are measured after 24 hour equilibration under environmentally controlled balance room conditions. Initial and final weights are recorded and entered into the ERG LIMS for subsequent review and reporting. Samples are handled and analyzed conforming to 40 CFR 50, Appendix J, Section 9.16 - 9.17.

Inorganic Analysis

A 4"x 1" portion is cut from the exposed filter after final filter mass has been determined gravimetrically. This portion of filter is extracted initially in 4% nitric acid via sonication for a total of 90 minutes, followed by the addition 15mL of water and sonicated again for an additional 90 minutes. The extract is analyzed by ICP-MS. The analysis is completed using the manufacturer software.

Analyses were performed on the ELAN 9000 ICP/MS manufactured by Perkin Elmer Corporation. The instrument consists of an inductively coupled plasma source, ion optics, a quadrupole spectrometer, a computer that controls the instrument, data acquisition, and data handling (ELAN Software SCIEX, Version 3.0), a printer, an autosampler (AS-93plus) and a recirculator. The quadrupole mass spectrometer has a mass range of 2 to 270 atomic mass units (amu). Inorganic analysis follows the requirements in EPA Compendium Method IO-3.5.

Inorganic Quality Control

A summary of the quality control requirements that were met except as flagged for inorganic analysis are provided in Table 1. Standard method quality control includes:

- Method Spikes and Method Spike Duplicates, one per sample batch.

The method spikes and method spike duplicates are controlled within ∀25% RPD of the target values. If the spikes are outside of these limits, calibration and extraction volumes are checked. If no calibration or calculation error if found the samples are re-extracted and reanalyzed.

- Performance Evaluation (PE) Samples from a secondary source. PE samples are prepared and analyzed in the same way as field samples.
- Blanks including:
  - 1) a method blank (MB) that contains all the reagents in the sample preparation procedure. Blanks are prepared and analyzed as a sample to determine the background levels from the instrument.
  - 2) A rinse blank consists of 2% nitric acid in DI water. The rinse blank is used to flush the system between standards and samples. The results must be below the MDL

  - Initial calibration blanks (ICB) are analyzed immediately following the high standard verification. The absolute value of the instrument response must be less than the method detection limit. Samples results for analyses less than 5 times the amount of the blank are flagged or analysis is repeated.
  - Continuing calibration blanks (CCB) are analyzed following each continuing calibration verification sample. The acceptance criteria for the CCB are the same as the ICB.

- Laboratory Control Spike (LCS) prepared from a secondary source of calibration standards and analyze with each sample batch. The results must be within 80-120% RPD of actual values.

Narrative Table 1. Summary of Quality Control Procedures for Metals Analysis

Parameter	Frequency	Acceptance Criteria	Corrective Action
Initial calibration standards (IC)	Daily, at least 4 calibration points	Correlation coefficient ∃ 0.995	1) Repeat analysis of calibration standards. 2) Reprepare calibration standards and reanalyze.
Initial calibration standards (ICAL)	Daily, at least 4 calibration points	Correlation coefficient 0.995	1) Repeat analysis of calibration standards. 2) Reprepare calibration standards and reanalyze.
Initial calibration blank (ICB)	Immediately after HSV	Must be ≤ MDL	1)Locate and resolve contamination problems before continuing. 2) Reanalyze
High standard verification (HSV)	Before ICB	Recovery from 95 to 105%	1) Repeat analysis of HSV. 2) Reprepare HSV.
Initial calibration verification (ICV)	Immediately after calibration	Recovery 90-110%	1) Repeat analysis of calibration check standard. 2) Repeat analysis of calibration standards. 3) Reprepare calibration standards and reanalyze.
Interference Check Standard (ICS)	Following the ICV/QCS, every 8 hours and at the end of each run	Recovery from 80 to 120%	1) Repeat analysis of ICS. 2) Reprepare ICS.
Continuing calibration verification (CCV)	Analyze before the 1st sample, after every 10 samples, and at the end of the run	Recovery 90-110%	1) Repeat analysis of continuing calibration verification sample. 2) Reprepare continuing calibration. 3) Reanalyze samples since last acceptable continuing calibration verification.
MB	1 per 20 samples, a minimum of 1 per batch	Analytes below MDL	1) Reanalyze. 2) Reprepare blank and reanalyze. 3) Repeat analyses of all samples since last clean blank.
LCS	1 per 20 samples, a minimum of 1 per batch	Recovery 80-120%, with the exception of Ag and Sb	1) Reprepare sample batch. 2) Reanalyze.
MS/MSD	1 per 20 samples per sample batch	Recovery 75-125%, with the exception of Ag and Sb	1) Reprepare sample batch. 2) Reanalyze.
Serial Dilution	1 per batch	Recovery 90-110% of undiluted sample	1) Reprepare dilution 2) Flag data.

North Carolina State University	Project: PM-10 Filter Analysis 7-2008	
5136 Jordan Hall Room 5136	Project Number: 3290.00.133.001	**Reported:**
Raleigh NC, 27695-8202	Project Manager: Viney P. Aneja	10/10/08 14:26

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
6735808	8090908-01	Air	08/03/08 23:59	09/01/08 16:14
6735899	8090908-02	Air	08/03/08 23:59	09/01/08 16:14
6735830	8090908-03	Air	08/04/08 23:59	09/01/08 16:14
6735833	8090908-04	Air	08/04/08 23:59	09/01/08 16:14
6735832	8090908-05	Air	08/05/08 23:59	09/01/08 16:14
6735859	8090908-06	Air	08/05/08 23:59	09/01/08 16:14
6735833	8090908-07	Air	08/06/08 23:59	09/01/08 16:14
6735834	8090908-08	Air	08/06/08 23:59	09/01/08 16:14
Q0164739	8090908-09	Air	08/07/08 23:59	09/01/08 16:14
Q0164738	8090908-10	Air	08/07/08 23:59	09/01/08 16:14
6735839	8090908-11	Air	08/08/08 23:59	09/01/08 16:14
6735840	8090908-12	Air	08/08/08 23:59	09/01/08 16:14
6735835	8090908-13	Air	08/09/08 23:59	09/01/08 16:14
6735836	8090908-14	Air	08/09/08 23:59	09/01/08 16:14
6735837	8090908-15	Air	08/10/08 23:59	09/01/08 16:14
6735838	8090908-16	Air	08/10/08 23:59	09/01/08 16:14
6735841	8090908-17	Air	08/11/08 23:59	09/01/08 16:14
6735842	8090908-18	Air	08/11/08 23:59	09/01/08 16:14
6735843	8090908-19	Air	08/12/08 23:59	09/01/08 16:14
6735844	8090908-20	Air	08/12/08 23:59	09/01/08 16:14
6735845	8090908-21	Air	08/13/08 23:59	09/01/08 16:14
6735846	8090908-22	Air	08/13/08 23:59	09/01/08 16:14
6735847	8090908-23	Air	08/14/08 23:59	09/01/08 16:14
6735848	8090908-24	Air	08/14/08 23:59	09/01/08 16:14

North Carolina State University	Project: PM-10 Filter Analysis 7-2008	
5136 Jordan Hall Room 5136	Project Number: 3290.00.133.001	**Reported:**
Raleigh NC, 27695-8202	Project Manager: Viney P. Aneja	10/10/08 14:26

Gravimetric Measurement

Eastern Research Group

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
6735808 (8090908-01) Air	**Sampled: 08/03/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.19800	0.0000	g	1	B8J1006	08/03/08	10/10/08	NA	
6735899 (8090908-02) Air	**Sampled: 08/03/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.45520	0.0000	g	1	B8J1006	08/03/08	10/10/08	NA	
6735830 (8090908-03) Air	**Sampled: 08/04/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.24990	0.0000	g	1	B8J1006	08/04/08	10/10/08	NA	
6735833 (8090908-04) Air	**Sampled: 08/04/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.66130	0.0000	g	1	B8J1006	08/04/08	10/10/08	NA	
6735832 (8090908-05) Air	**Sampled: 08/05/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.29530	0.0000	g	1	B8J1006	08/05/08	10/10/08	NA	
6735859 (8090908-06) Air	**Sampled: 08/05/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.28520	0.0000	g	1	B8J1006	08/05/08	10/10/08	NA	
6735833 (8090908-07) Air	**Sampled: 08/06/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.15950	0.0000	g	1	B8J1006	08/06/08	10/10/08	NA	
6735834 (8090908-08) Air	**Sampled: 08/06/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.18990	0.0000	g	1	B8J1006	08/06/08	10/10/08	NA	
Q0164739 (8090908-09) Air	**Sampled: 08/07/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.15480	0.0000	g	1	B8J1006	08/07/08	10/10/08	NA	

Gravimetric Measurement

Eastern Research Group

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
Q0164738 (8090908-10) Air	**Sampled: 08/07/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.29530	0.0000	g	1	B8J1006	08/07/08	10/10/08	NA	
6735839 (8090908-11) Air	**Sampled: 08/08/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.15200	0.0000	g	1	B8J1006	08/08/08	10/10/08	NA	
6735840 (8090908-12) Air	**Sampled: 08/08/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.57520	0.0000	g	1	B8J1006	08/08/08	10/10/08	NA	
6735835 (8090908-13) Air	**Sampled: 08/09/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.0301	0.0000	g	1	B8J1006	08/09/08	10/10/08	NA	
6735836 (8090908-14) Air	**Sampled: 08/09/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.0499	0.0000	g	1	B8J1006	08/09/08	10/10/08	NA	
6735837 (8090908-15) Air	**Sampled: 08/10/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.14680	0.0000	g	1	B8J1006	08/10/08	10/10/08	NA	
6735838 (8090908-16) Air	**Sampled: 08/10/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.23610	0.0000	g	1	B8J1006	08/10/08	10/10/08	NA	
6735841 (8090908-17) Air	**Sampled: 08/11/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.34920	0.0000	g	1	B8J1006	08/11/08	10/10/08	NA	
6735842 (8090908-18) Air	**Sampled: 08/11/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.40730	0.0000	g	1	B8J1006	08/11/08	10/10/08	NA	

North Carolina State University	Project: PM-10 Filter Analysis 7-2008	
5136 Jordan Hall Room 5136	Project Number: 3290.00.133.001	**Reported:**
Raleigh NC, 27695-8202	Project Manager: Viney P. Aneja	10/10/08 14:26

Gravimetric Measurement

Eastern Research Group

Analyte	Result	Reporting Limit	Units	Dilution	Batch	Prepared	Analyzed	Method	Notes
6735843 (8090908-19) Air	**Sampled: 08/12/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.28410	0.0000	g	1	B8J1006	08/12/08	10/10/08	NA	
6735844 (8090908-20) Air	**Sampled: 08/12/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.45930	0.0000	g	1	B8J1006	08/12/08	10/10/08	NA	
6735845 (8090908-21) Air	**Sampled: 08/13/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.32690	0.0000	g	1	B8J1006	08/13/08	10/10/08	NA	
6735846 (8090908-22) Air	**Sampled: 08/13/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.73510	0.0000	g	1	B8J1006	08/13/08	10/10/08	NA	
6735847 (8090908-23) Air	**Sampled: 08/14/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.28510	0.0000	g	1	B8J1006	08/14/08	10/10/08	NA	
6735848 (8090908-24) Air	**Sampled: 08/14/08 23:59**	**Received: 09/01/08 16:14**							
Weight (gm)	0.56150	0.0000	g	1	B8J1006	08/14/08	10/10/08	NA	

Ray Merrill, Technical Director

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Eastern Research Group

The results in this report apply only to the samples analyzed in accordance with the chain of custody document. This analytical report must be reproduced in its entirety.

Ray Merrill, Technical Director

CERTIFICATE OF ANALYSIS

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FILE #: 3290.00.133.001
REPORTED: 10/08/08 16:18
SUBMITTED: 08/08/08 to 09/01/08
AQS SITE CODE:
SITE CODE: PM-10 Filter Analysis 7-2008

Description: Q0164739 **Lab ID:** 8090908-09 **Sampled:** 08/07/08 23:59
Matrix: Air **Sample Volume:** 1631.05 m^3 **Received:** 09/01/08 16:14
Comments: **Analysis Date:** 09/23/08 15:23

Inorganics by Compendium Method IO-3.5

Analyte	CAS Number	Results ng/m³ Air	Flag	MDL ng/m³ Air
Antimony	7440-36-0	1.81	D	0.006
Arsenic	7440-38-2	0.720	D	0.010
Beryllium	7440-41-7	0.041	D	0.012
Cadmium	7440-43-9	0.090	D	0.008
Chromium	7440-47-3	3.16	D	0.178
Cobalt	7440-48-4	0.697	D	0.009
Lead	7439-92-1	3.32	D, B	0.107
Manganese	7439-96-5	19.4	D	0.021
Mercury	7439-97-6	0.972	A-01, D, B	0.024
Nickel	7440-02-0	14.3	D	0.110
Selenium	7782-49-2	0.568	D	0.024

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FILE #: 3290.00.133.001
REPORTED: 10/08/08 16:18
SUBMITTED: 08/08/08 to 09/01/08
AQS SITE CODE:
SITE CODE: PM-10 Filter Analysis 7-2008

Description: Q0164738 **Lab ID:** 8090908-10 **Sampled:** 08/07/08 23:59
Matrix: Air **Sample Volume:** 1631.05 m³ **Received:** 09/01/08 16:14
Comments: **Analysis Date:** 09/23/08 15:31

Inorganics by Compendium Method IO-3.5

Analyte	CAS Number	Results ng/m³ Air	Flag	MDL ng/m³ Air
Antimony	7440-36-0	1.83	D	0.006
Arsenic	7440-38-2	0.958	D	0.010
Beryllium	7440-41-7	0.067	D	0.012
Cadmium	7440-43-9	0.263	D	0.008
Chromium	7440-47-3	2.74	D	0.178
Cobalt	7440-48-4	0.915	D	0.009
Lead	7439-92-1	3.90	D, B	0.107
Manganese	7439-96-5	34.1	D	0.021
Mercury	7439-97-6	0.140	A-01, D, B	0.024
Nickel	7440-02-0	3.04	D	0.110
Selenium	7782-49-2	0.613	D	0.024

Raymond L. Merrill

Authorized Signature(s)

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FILE #: 3290.00.133.001
REPORTED: 10/08/08 16:18
SUBMITTED: 08/08/08 to 09/01/08
AQS SITE CODE:
SITE CODE: PM-10 Filter Analysis 7-2008

Inorganics by Compendium Method IO-3.5 - Quality Control

Batch B8H2805 - ICP-MS Extraction

Analyte	Result	PQL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Blank (B8H2805-BLK1)				Prepared: 08/28/08 Analyzed: 09/10/08						
Antimony	ND	0.006	ng/m³ Air							U
Arsenic	ND	0.010	ng/m³ Air							U
Beryllium	ND	0.012	ng/m³ Air							U
Cadmium	ND	0.008	ng/m³ Air							U
Chromium	ND	0.178	ng/m³ Air							U
Cobalt	ND	0.009	ng/m³ Air							U
Lead	ND	0.107	ng/m³ Air							U
Manganese	ND	0.021	ng/m³ Air							U
Mercury	ND	0.024	ng/m³ Air							U
Nickel	ND	0.110	ng/m³ Air							U
Selenium	ND	0.024	ng/m³ Air							U
LCS (B8H2805-BS1)				Prepared: 08/28/08 Analyzed: 09/10/08						
Antimony	4.23	0.006	ng/m³ Air	4.50		94.0	75-125			
Arsenic	2.14	0.010	ng/m³ Air	2.25		95.1	75-125			
Beryllium	2.26	0.012	ng/m³ Air	2.25		100	75-125			
Cadmium	2.16	0.008	ng/m³ Air	2.25		96.0	75-125			
Chromium	10.8	0.178	ng/m³ Air	11.2		96.4	75-125			
Cobalt	2.22	0.009	ng/m³ Air	2.25		98.7	75-125			
Lead	10.5	0.107	ng/m³ Air	11.2		93.8	75-125			
Manganese	10.7	0.021	ng/m³ Air	11.2		95.5	75-125			
Mercury	1.01	0.024	ng/m³ Air	1.12		90.2	75-125			
Nickel	11.2	0.110	ng/m³ Air	11.2		100	75-125			
Selenium	2.20	0.024	ng/m³ Air	2.25		97.8	75-125			
LCS Dup (B8H2805-BSD1)				Prepared: 08/28/08 Analyzed: 09/10/08						
Antimony	4.24	0.006	ng/m³ Air	4.50		94.2	75-125	0.236	20	
Arsenic	2.14	0.010	ng/m³ Air	2.25		95.1	75-125	0.00	20	
Beryllium	2.27	0.012	ng/m³ Air	2.25		101	75-125	0.442	20	
Cadmium	2.17	0.008	ng/m³ Air	2.25		96.4	75-125	0.462	20	
Chromium	10.8	0.178	ng/m³ Air	11.2		96.4	75-125	0.00	20	
Cobalt	2.20	0.009	ng/m³ Air	2.25		97.8	75-125	0.905	20	
Lead	10.5	0.107	ng/m³ Air	11.2		93.8	75-125	0.00	20	
Manganese	10.7	0.021	ng/m³ Air	11.2		95.5	75-125	0.00	20	
Mercury	1.02	0.024	ng/m³ Air	1.12		91.1	75-125	0.985	20	
Nickel	11.2	0.110	ng/m³ Air	11.2		100	75-125	0.00	20	
Selenium	2.20	0.024	ng/m³ Air	2.25		97.8	75-125	0.00	20	

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FILE #: 3290.00.133.001
REPORTED: 10/08/08 16:18
SUBMITTED: 08/08/08 to 09/01/08
AQS SITE CODE:
SITE CODE: PM-10 Filter Analysis 7-2008

Analyte	Result	PQL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Inorganics by Compendium Method IO-3.5 - Quality Control										
Batch B8I1102 - ICP-MS Extraction										
Blank (B8I1102-BLK1)				Prepared: 09/11/08 Analyzed: 09/29/08						
Antimony	ND	0.006	ng/m³ Air							U
Arsenic	ND	0.010	ng/m³ Air							U
Beryllium	ND	0.012	ng/m³ Air							U
Cadmium	ND	0.008	ng/m³ Air							U
Chromium	ND	0.178	ng/m³ Air							U
Cobalt	ND	0.009	ng/m³ Air							U
Lead	0.518	0.107	ng/m³ Air							
Manganese	ND	0.021	ng/m³ Air							U
Mercury	0.161	0.024	ng/m³ Air							
Nickel	ND	0.110	ng/m³ Air							U
Selenium	ND	0.024	ng/m³ Air							U
LCS (B8I1102-BS1)				Prepared: 09/11/08 Analyzed: 09/29/08						
Antimony	4.29	0.006	ng/m³ Air	4.50		95.3	75-125			
Arsenic	2.11	0.010	ng/m³ Air	2.25		93.8	75-125			
Beryllium	2.25	0.012	ng/m³ Air	2.25		100	75-125			
Cadmium	2.17	0.008	ng/m³ Air	2.25		96.4	75-125			
Chromium	10.7	0.178	ng/m³ Air	11.2		95.5	75-125			
Cobalt	2.18	0.009	ng/m³ Air	2.25		96.9	75-125			
Lead	11.2	0.107	ng/m³ Air	11.2		100	75-125			B
Manganese	10.6	0.021	ng/m³ Air	11.2		94.6	75-125			
Mercury	1.01	0.024	ng/m³ Air	1.12		90.2	75-125			A-01, B
Nickel	11.0	0.110	ng/m³ Air	11.2		98.2	75-125			
Selenium	2.22	0.024	ng/m³ Air	2.25		98.7	75-125			
LCS Dup (B8I1102-BSD1)				Prepared: 09/11/08 Analyzed: 09/29/08						
Antimony	4.27	0.006	ng/m³ Air	4.50		94.9	75-125	0.467	20	
Arsenic	2.12	0.010	ng/m³ Air	2.25		94.2	75-125	0.473	20	
Beryllium	2.23	0.012	ng/m³ Air	2.25		99.1	75-125	0.893	20	
Cadmium	2.16	0.008	ng/m³ Air	2.25		96.0	75-125	0.462	20	
Chromium	10.7	0.178	ng/m³ Air	11.2		95.5	75-125	0.00	20	
Cobalt	2.19	0.009	ng/m³ Air	2.25		97.3	75-125	0.458	20	
Lead	11.3	0.107	ng/m³ Air	11.2		101	75-125	0.889	20	B
Manganese	10.6	0.021	ng/m³ Air	11.2		94.6	75-125	0.00	20	
Mercury	1.00	0.024	ng/m³ Air	1.12		89.3	75-125	0.995	20	A-01, B
Nickel	11.0	0.110	ng/m³ Air	11.2		98.2	75-125	0.00	20	
Selenium	2.23	0.024	ng/m³ Air	2.25		99.1	75-125	0.449	20	

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FILE #: 3290.00.133.001
REPORTED: 10/10/08 16:23
SUBMITTED: 08/08/08
AQS SITE CODE:
SITE CODE: PM-10 Filter Analysis 7-2008

Inorganics by Compendium Method IO-3.5 - Quality Control

Batch B8H2805 - ICP-MS Extraction

Analyte	Result	PQL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Matrix Spike (B8H2805-MS1)	**Source: 8081323-01**			Prepared: 08/28/08		Analyzed: 09/10/08				
Antimony	6.95	0.006	ng/m³ Air	4.29	4.11	66.2	75-125			
Arsenic	2.98	0.010	ng/m³ Air	2.15	1.01	91.6	75-125			
Beryllium	1.97	0.012	ng/m³ Air	2.15	0.013	91.0	75-125			
Cadmium	2.08	0.008	ng/m³ Air	2.15	0.173	88.7	75-125			
Chromium	12.9	0.178	ng/m³ Air	10.7	3.19	90.7	75-125			
Cobalt	2.31	0.009	ng/m³ Air	2.15	0.336	91.8	75-125			
Lead	19.4	0.107	ng/m³ Air	10.7	10.9	79.4	75-125			
Manganese	22.5	0.021	ng/m³ Air	10.7	12.4	94.4	75-125			
Mercury	0.685	0.024	ng/m³ Air	1.07	0.066	57.9	75-125			
Nickel	10.9	0.110	ng/m³ Air	10.7	0.803	94.4	75-125			
Selenium	8.77	0.024	ng/m³ Air	2.15	6.52	105	75-125			
Matrix Spike Dup (B8H2805-MSD1)	**Source: 8081323-01**			Prepared: 08/28/08		Analyzed: 09/10/08				
Antimony	6.81	0.006	ng/m³ Air	4.29	4.11	62.9	75-125	2.03	20	
Arsenic	2.91	0.010	ng/m³ Air	2.15	1.01	88.4	75-125	2.38	20	
Beryllium	1.94	0.012	ng/m³ Air	2.15	0.013	89.6	75-125	1.53	20	
Cadmium	2.05	0.008	ng/m³ Air	2.15	0.173	87.3	75-125	1.45	20	
Chromium	12.7	0.178	ng/m³ Air	10.7	3.19	88.9	75-125	1.56	20	
Cobalt	2.29	0.009	ng/m³ Air	2.15	0.336	90.9	75-125	0.870	20	
Lead	18.9	0.107	ng/m³ Air	10.7	10.9	74.8	75-125	2.61	20	
Manganese	21.6	0.021	ng/m³ Air	10.7	12.4	86.0	75-125	4.08	20	
Mercury	0.727	0.024	ng/m³ Air	1.07	0.066	61.8	75-125	5.95	20	
Nickel	10.8	0.110	ng/m³ Air	10.7	0.803	93.4	75-125	0.922	20	
Selenium	8.49	0.024	ng/m³ Air	2.15	6.52	91.6	75-125	3.24	20	

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FILE #: 3290.00.133.001
REPORTED: 10/10/08 10:56
SUBMITTED: 09/01/08
AQS SITE CODE:
SITE CODE: PM-10 Filter Analysis 7-2008

Inorganics by Compendium Method IO-3.5 - Quality Control

Batch B8I1102 - ICP-MS Extraction

Analyte	Result	PQL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Notes
Matrix Spike (B8I1102-MS1)	**Source: 8082911-01**			Prepared: 09/11/08 Analyzed: 09/29/08						
Antimony	4.74	0.006	ng/m³ Air	5.36	1.43	61.8	75-125			D
Arsenic	2.88	0.010	ng/m³ Air	2.68	0.543	87.2	75-125			D
Beryllium	2.38	0.012	ng/m³ Air	2.68	ND	88.8	75-125			D
Cadmium	2.63	0.008	ng/m³ Air	2.68	0.342	85.4	75-125			D
Chromium	14.1	0.178	ng/m³ Air	13.4	2.33	87.8	75-125			D
Cobalt	2.56	0.009	ng/m³ Air	2.68	0.141	90.3	75-125			D
Lead	19.3	0.107	ng/m³ Air	13.4	7.79	85.9	75-125			D, B
Manganese	17.3	0.021	ng/m³ Air	13.4	5.41	88.7	75-125			D
Mercury	1.03	0.024	ng/m³ Air	1.34	0.378	48.7	75-125			A-01, D, B
Nickel	14.0	0.110	ng/m³ Air	13.4	1.91	90.2	75-125			D
Selenium	2.51	0.024	ng/m³ Air	2.68	0.176	87.1	75-125			D
Matrix Spike Dup (B8I1102-MSD1)	**Source: 8082911-01**			Prepared: 09/11/08 Analyzed: 09/29/08						
Antimony	4.74	0.006	ng/m³ Air	5.36	1.43	61.8	75-125	0.00	20	D
Arsenic	2.90	0.010	ng/m³ Air	2.68	0.543	87.9	75-125	0.692	20	D
Beryllium	2.41	0.012	ng/m³ Air	2.68	ND	89.9	75-125	1.25	20	D
Cadmium	2.63	0.008	ng/m³ Air	2.68	0.342	85.4	75-125	0.00	20	D
Chromium	14.0	0.178	ng/m³ Air	13.4	2.33	87.1	75-125	0.712	20	D
Cobalt	2.57	0.009	ng/m³ Air	2.68	0.141	90.6	75-125	0.390	20	D
Lead	19.3	0.107	ng/m³ Air	13.4	7.79	85.9	75-125	0.00	20	D, B
Manganese	17.2	0.021	ng/m³ Air	13.4	5.41	88.0	75-125	0.580	20	D
Mercury	1.02	0.024	ng/m³ Air	1.34	0.378	47.9	75-125	0.976	20	A-01, D, B
Nickel	14.0	0.110	ng/m³ Air	13.4	1.91	90.2	75-125	0.00	20	D
Selenium	2.53	0.024	ng/m³ Air	2.68	0.176	87.8	75-125	0.794	20	D

CERTIFICATE OF ANALYSIS

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FILE #: 3290.00.133.001
REPORTED: 10/10/08 10:56
SUBMITTED: 09/01/08
AQS SITE CODE:
SITE CODE: PM-10 Filter Analysis 7-2008

Notes and Definitions

U	Under Detection Limit
D	Data reported from a dilution
B	Analyte is found in the associated blank as well as in the sample (CLP B-flag).
A-01	Method Blank Subtracted
ND	Analyte NOT DETECTED at or above the Method Detection Limit (MDL)
NR	Not Reported
RPD	Relative Percent Difference
MDL	Method Detection Limit