Air Quality in Mining and Non-Mining Areas of West Virginia, April to June 2008

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Summary

From late April to early June 2008, air quality sampling tests were conducted in nine rural locations around West Virginia that either have or do not have coal mining activity. Measures of air quality included PM 2.5, PM 10, and Total Suspended Particles (TSP). Results showed that air quality was significantly worse in mining locations versus non-mining locations. The poorest air quality was found near mountaintop removal mining sites, followed by community sites close to other mining activity; both of these settings had worse air quality compared to non-mining locations. Higher levels of air pollution in coal mining locations may pose human health hazards.

Background and Methods

Air quality samples were collected in nine rural locations around West Virginia between April 27 and June 4, 2008. These locations included those characterized by coal mining activity within ½ mile or less of the sampling location, as well as locations in counties where no coal mining takes place. Coal mining sites included mountaintop removal mining, coal processing plants, and coal transportation routes by train or truck. The purpose of the sampling was to determine whether levels of air pollution were higher in the mining locations, and whether air pollution varied according to the type of mining activity.

Air quality was measured using Aerocet 531 particle mass air monitors, manufactured by Met One Instruments. These monitors estimate particle mass for standard Environmental Protection Agency (EPA) indicators including PM 2.5, PM 10, and Total Suspended Particles (TSP), expressed in micrograms per cubic meter. In particular, PM 2.5 and PM 10 measure particles small enough to be inhaled into the lungs; the presence of higher levels of these particles in the atmosphere are well established health hazards, increasing the risk for various diseases, including COPD, heart failure, lung cancer and others. Inhaling particulate matter may make existing health conditions worse, or may contribute to causing these diseases to develop.

Samples were collected from nine communities around West Virginia. A total of 3,925 distinct air samples were collected on 29 sampled days. Each sample takes two minutes to collect. All of the communities are in rural areas, and vary in population from about 100 to about 2,300 people. Six of the communities are characterized by proximity to one or more activities of the mining industry: Jodie, Kayford, Madison, Mannington, Sylvester and Twilight. The other three locations are in communities where no coal mining occurs in the county: Millstone, Moorefield, and Spencer. Within these nine

communities, samples were taken from a total of 14 separate locations. Samples were taken during various days, including both day time hours and overnight sampling. Mining and non-mining locations both included smaller and larger towns, and sampling during day and night hours. Statistical analysis of sampling results included tests to control for variation in temperature and humidity, and to examine air pollution variation by type of site.

Results

Three types of analyses were conducted. One analysis compared mining locations to non-mining locations. A second compared three types of location: mountaintop removal sites, other mining activity, and non-mining locations. A third conducted tests of air quality around the Kayford Mountain site at different distances from the site.

Comparison of mining and non-mining sites. Air quality was significantly worse in mining locations versus non-mining locations. This difference was found for PM 2.5, PM 10, and TSP. Table 1 summarizes the findings. These results show averages for the two groups after adjusting statistically for variation in temperature and humidity.

Comparison of mountaintop removal sites, other mining activity, and non-mining sites. Air quality was poorest at mountaintop removal mining sites (Kayford and Twilight), was intermediate in other mining sites, and was best in non-mining sites. These differences were found for PM 2.5, PM 10, and TSP. Table 2 summarizes the findings. These results show air quality averages after adjusting statistically for variation in temperature and humidity.

In addition to averages, the maximum observed levels of pollution were recorded for each site. Table 3 shows the maximum levels of PM 2.5, PM 10 and TSP at each of the three location types. The highest maximum readings were found at the mountaintop removal sites, followed by other mining locations and then non-mining sites.

PM10 by distance to mountaintop removal mining. The highest readings at any site were found at Kayford Mountain. Additional air samples were taken at several distances from this mining site: 0 miles, .5 mile and .7 mile; levels of PM10 and TSP were higher as proximity to the site increased. Table 4 shows these results.

Conclusions

Because air quality is typically at its worse during hot summer months, samples taken during late April to early June might have underestimated pollution levels that would be found during the summer; additional samples at different seasons of the year should be collected. These results document worse air quality in rural coal mining communities in West Virginia, especially near mountaintop removal mining activity, compared to non-mining rural areas of the state. Worse air quality in mining locations may constitute a human health hazard, and policies to enforce stricter air quality standards around coal mining activity may be beneficial.

Table 1. Average air quality results for coal mining and non-coal mining locations in rural West Virginia communities.

	Mining Locations	*Non-Mining Locations*	*P< **
PM 2.5	2.9	1.3	.0001
PM 10	16.2	4.5	.0001
TSP	21.8	4.8	.0001

* Results are least square means tested using general linear models and controlling for variation in temperature and humidity.

Table 2. Average air quality results for mountaintop removal sites, other coal mining sites, and non-coal mining locations in rural West Virginia communities.

	Mountaintop Removal Mining Locations	*Other Mining Locations*	*Non-Mining Locations*	*P< **
PM 2.5	3.4	2.6	1.3	.0001
PM 10	19.6	13.4	4.7	.0001
TSP	27.2	17.4	5.1	.0001

* Results are least square means tested using general linear models and controlling for variation in temperature and humidity.

Table 3. Maximum air quality results for mountaintop removal sites, other coal mining sites, and non-coal mining locations in rural West Virginia communities.

	Mountaintop Removal Mining Locations	*Other Mining Locations*	*Non-Mining Locations*
PM 2.5	138	47	6
PM 10	544	127	27
TSP	812	157	40

Table 4. Air quality at 0 miles, .5 mile and .7 mile distant from the Kayford Mountain mining site.

	0 miles	*.5 mile*	*,7 mile*	*P<*
Pm 2.5	3.5	6.9	2.7	ns
PM 10	47.4	27.0	14.0	.05
TSP	79.9	37.7	19.0	.05