

SATURATION PM10 MONITORING  
ABERDEEN, SOUTH DAKOTA  
March - August, 1996

South Dakota Department of Environment and Natural Resources

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## INTRODUCTION

On November 14, 1995 the Brown County commission asked the Department of Environment and Resources to monitor the PM10 concentrations of air in the western part of Aberdeen, on either side of Highway 12. Department personnel reconnoitered the requested monitoring location and found several possible PM10 contributors. Those possible sources included Highway 12, a rock crushing/hot mix asphalt operation, a railroad switching yard, a frequently used unpaved road, and bare agricultural fields.

The types of potential air pollution contributors led to the conclusion that only PM10 should be monitored for. The hot mix asphalt operation gives off fumes, but there are no state or federal regulations concerning these fumes. The US EPA has National Ambient Air Quality Standards for the particulate matter, nitrous oxides, sulfur dioxide, ozone, carbon monoxide, and lead. No suspected major sources of these pollutants, other than particulate matter, were found in the area. Particulate matter was indicated to be the major air pollution contributor in western Aberdeen.

A total of five saturation monitoring sites were chosen (Figure 1) with one site hosting co-located monitors. Monitoring began March 1, 1996 and ended August 31, 1996. Meteorological data was collected from a temporary department station located at the SD Department of Transportation yard on Highway 12 and from the National Weather Service located at the Aberdeen Airport.

A total of 355 valid PM10 samples were collected during the monitoring period. The highest concentration recorded was  $242.7 \text{ ug/m}^3$  and the average PM10 concentration of the study was  $29.7 \text{ ug/m}^3$ . Site 103 recorded the highest PM10 concentrations while site 106 recorded the lowest PM10 concentrations. The South Dakota Standard Operating Procedures manual for Saturation Monitors was followed and all quality assurance checks were completed.

Analysis of the collected data indicates that the highest PM10 concentrations were found in the construction and tourist season, i.e. the months of May, June, July and August. The sites recording the highest PM10 concentrations were those located north of Highway 12, sites 103, 104, and 105. Detailed analysis of each monitor will appear later in this report.

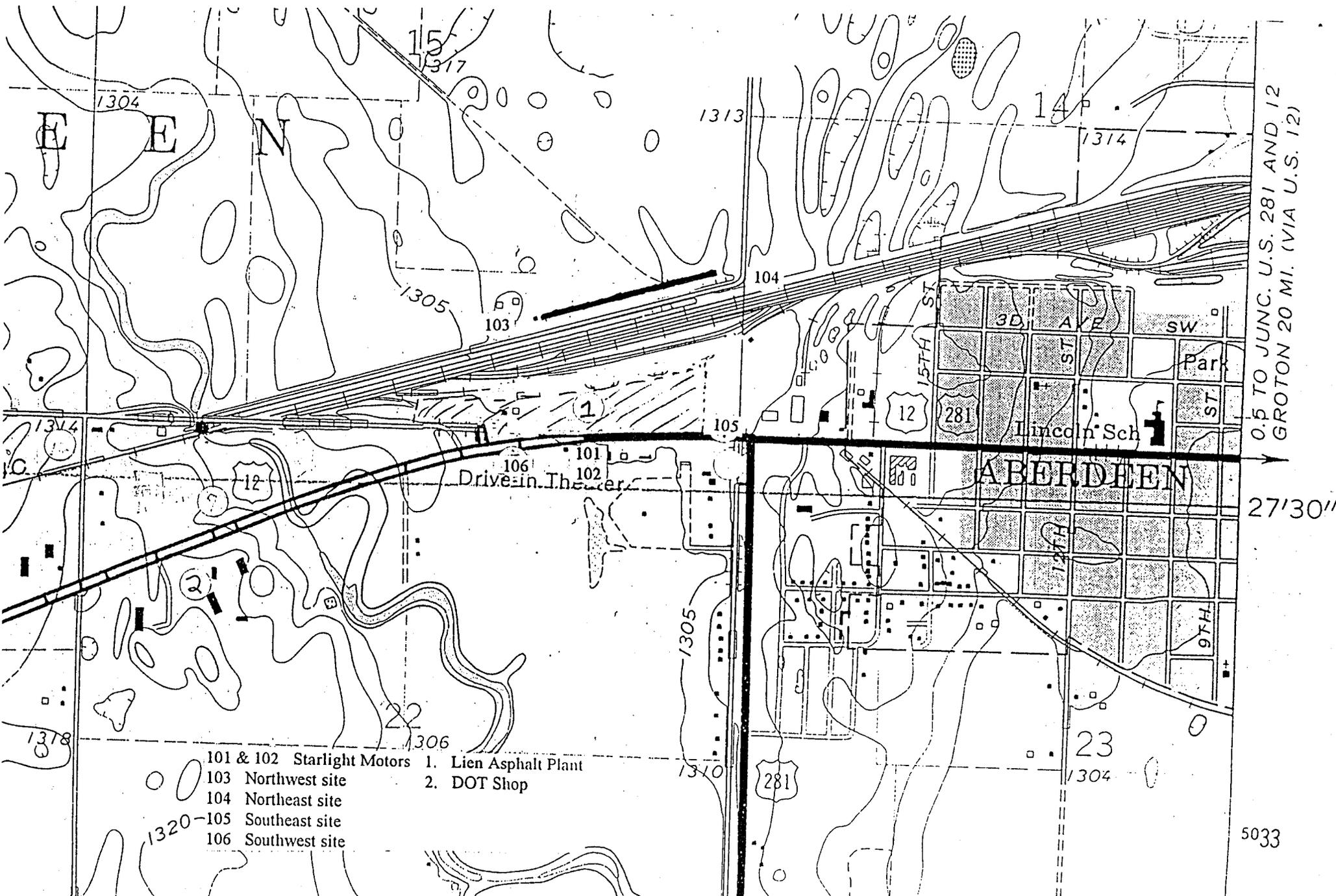


Figure 1. Site map for the Aberdeen Study showing the locations of the saturation monitors.

## MATERIALS AND METHODS

PM10 monitoring in this study was accomplished using the saturation monitor developed by the Lane County Air Authority in Lane County, Oregon. The saturation monitor consists of a lead acid battery, pump motor housing, and size separation inlet head (Figure 2). The saturation monitor is not an US EPA reference method for PM10 attainment designation, but it is recognized by the US EPA as a good investigation tool and its use is encouraged. The monitor's low flow rate (c.a. 5 liters/minute) and liberal siting criteria make it unacceptable for Clean Air attainment designations.

The saturation monitor was chosen because of its portability, ease of maintenance, low operating cost, and easy set-up in areas with difficult siting conditions. Typical use of the saturation monitor is investigation of PM10 concentrations in suspect areas where no previous monitoring has been conducted.

Monitors were either placed on existing electrical poles or attached to portable poles (Figures 3 and 4). Monitor height was 10 -12 feet from ground level with at least 270° of unobstructed air flow around the monitor. Monitoring sites were chosen in an effort to intercept potential PM10 concentrations traveling on the major wind directions.

Monitoring methods and quality assurance procedures used can be found in the Aberdeen-Lien Saturation Study Air Monitoring Sampling Plan for Particulate Matter (Attachment 1).

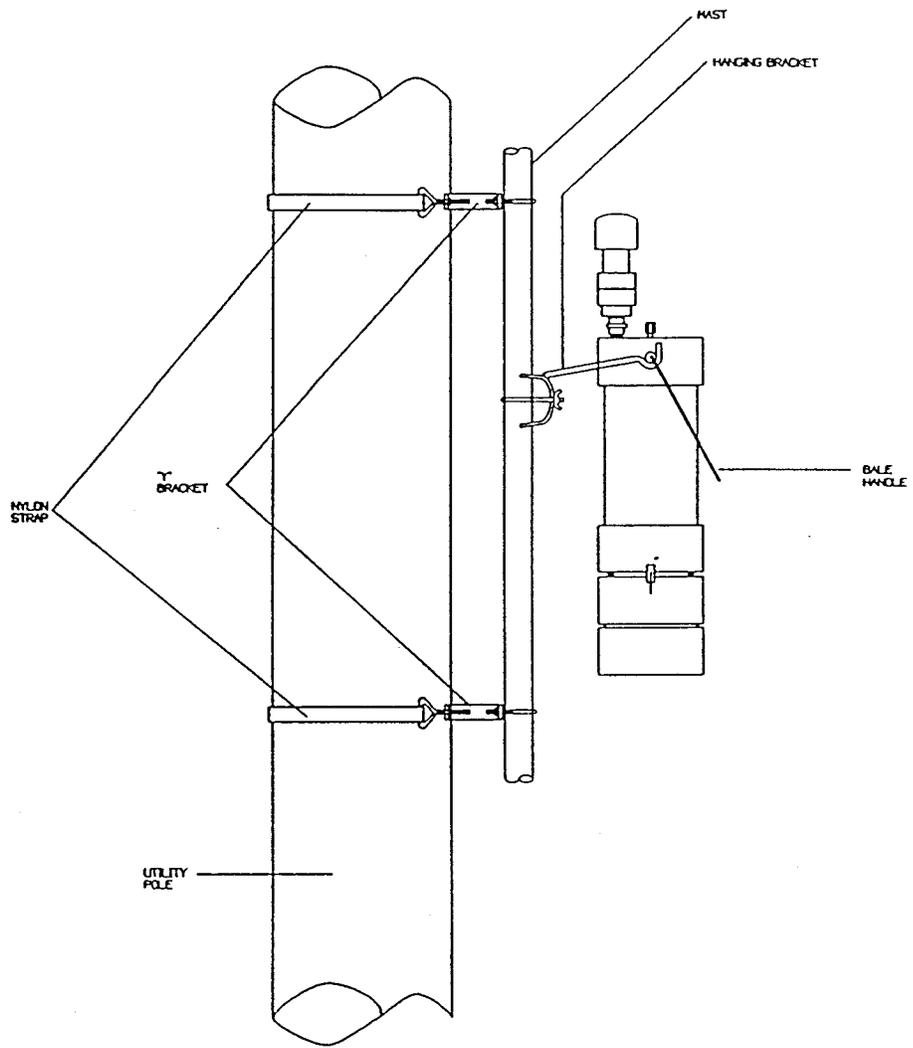


Figure 2. Saturation monitor used for PM10 sampling in the Aberdeen study.

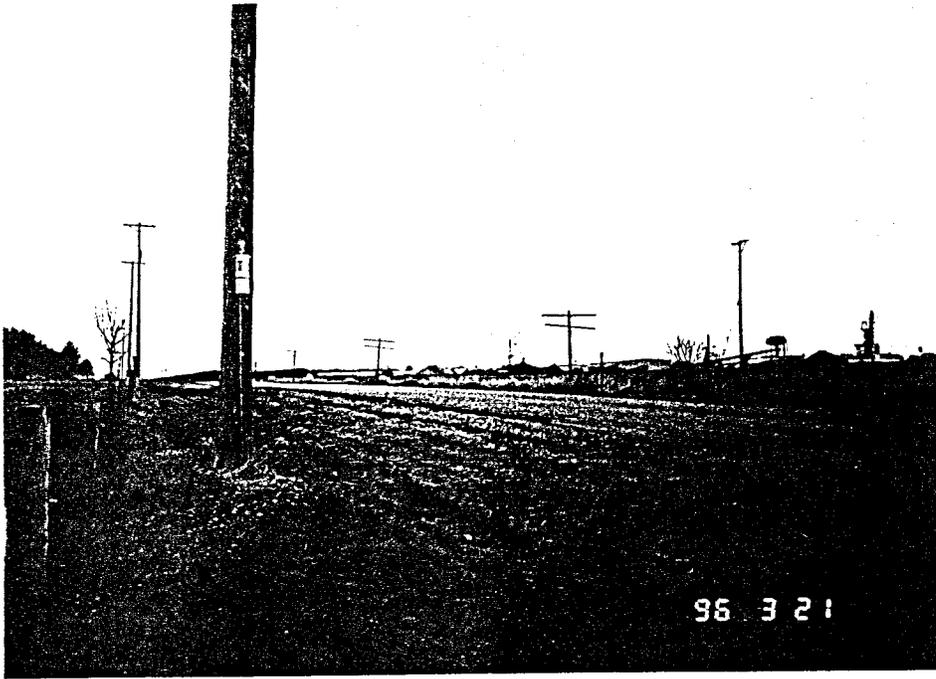


Figure 3. Monitoring Site 103 showing a saturation monitor attached to an electrical transmission pole.

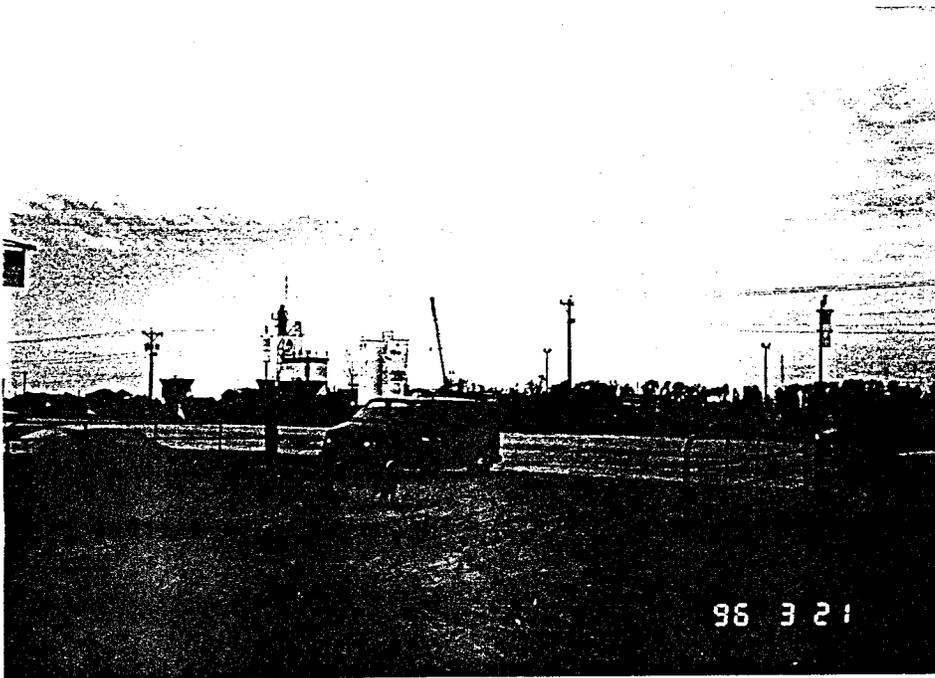


Figure 4. Monitoring Sites 101 and 102 showing saturation monitors attached to portable poles.

## RESULTS

The Aberdeen PM10 saturation study was conducted March - August, 1996. The study was timed to collect data in the pre-construction and the active construction and tourist seasons. Sampling locations were chosen in an effort to sample air masses from all major wind directions. The sampling results have been compiled by site and correlated with each sampling day's average wind speed and resultant direction. PM10 concentrations above  $50.0 \text{ ug/m}^3$  are considered elevated for analysis purposes. (Reader's note: US EPA's national standard for PM10 is  $150.0 \text{ ug/m}^3$  in 24 hours and  $50.0 \text{ ug/m}^3$  averaged over 12 months.)

### Site 101

This site was located on the parking lot of Starlight Motors. This parking lot was just south of Highway 12 and was unpaved. The average PM10 concentration recorded here was  $22.8 \text{ ug/m}^3$ . The highest recorded concentration was  $67.1 \text{ ug/m}^3$  and the low was  $7.2 \text{ ug/m}^3$ . Two sampling days recorded elevated PM10 concentrations at this site. Both of these readings were associated with winds from the north, northwest (Figure 5). Concentrations recorded at this site were less than one-half of US EPA's daily and annual PM10 standards.

### Site 102

This site was located on the parking lot of Starlight Motors and served as the co-located monitor for site 101. The average PM10 concentration recorded here was  $25.3 \text{ ug/m}^3$ . The highest recorded concentration was  $87.0 \text{ ug/m}^3$  and the low was  $5.7 \text{ ug/m}^3$ . Six sampling days recorded elevated PM10 concentrations and these were associated with winds from the north, northwest (Figure 6). Concentrations recorded at this site were one-half of US EPA's daily and annual PM10 standards.

### Site 103

This site was the Northwest location, chosen to intercept winds from the southeast. Site 103 was just north of a frequently traveled, unpaved road. The average PM10 concentration recorded here was  $38.8 \text{ ug/m}^3$ . The highest recorded concentration was  $242.7 \text{ ug/m}^3$  and the low was  $4.0 \text{ ug/m}^3$ . Almost all elevated PM10 concentrations were associated with winds from the south, southeast (Figure 7). One concentration recorded at this site did exceed EPA's 24 hour standard, but averaged concentrations were less than EPA's annual PM10 standard.

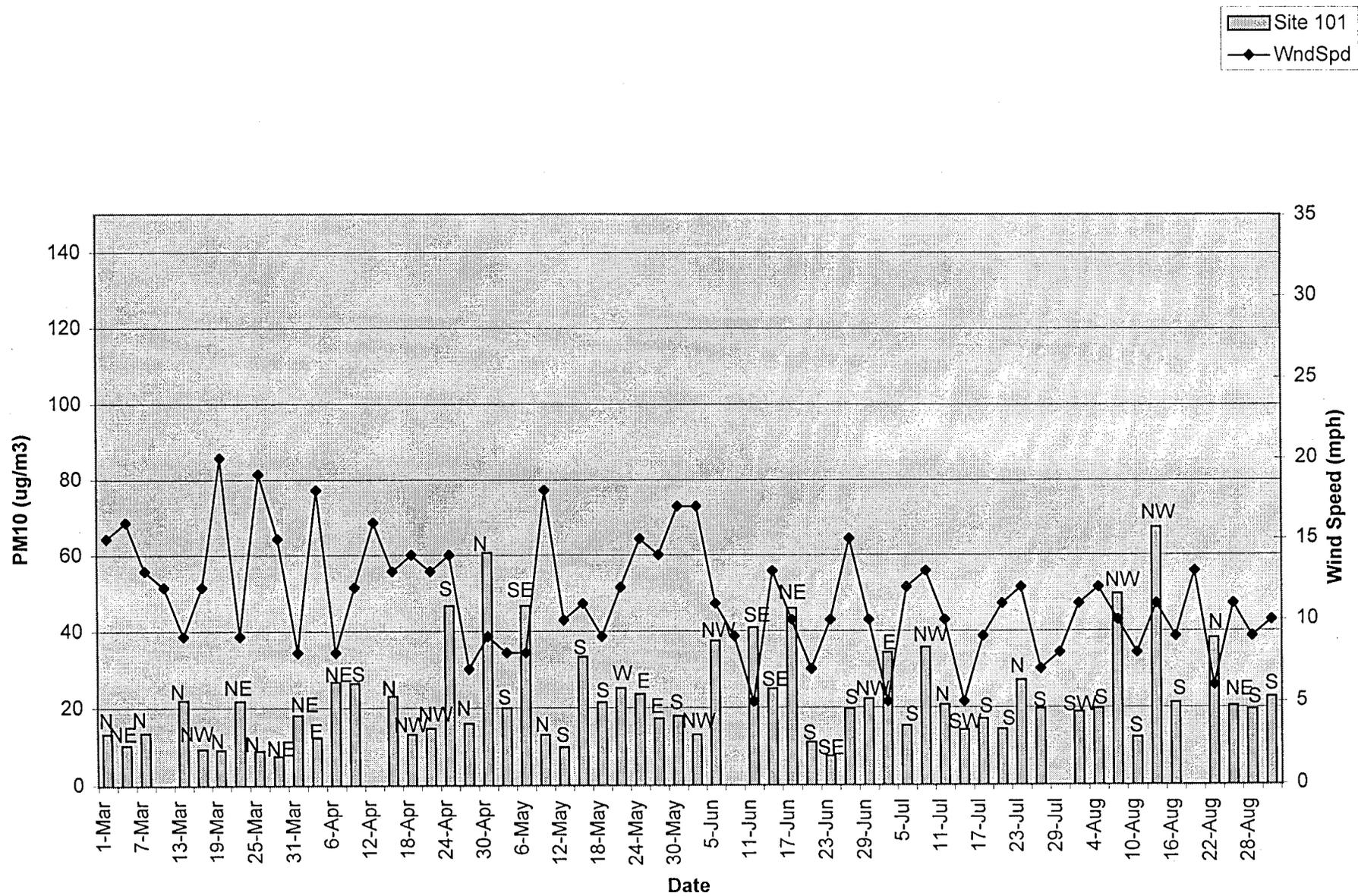


Figure 5. PM10 and meteorological data from the Aberdeen Study - Site 101.

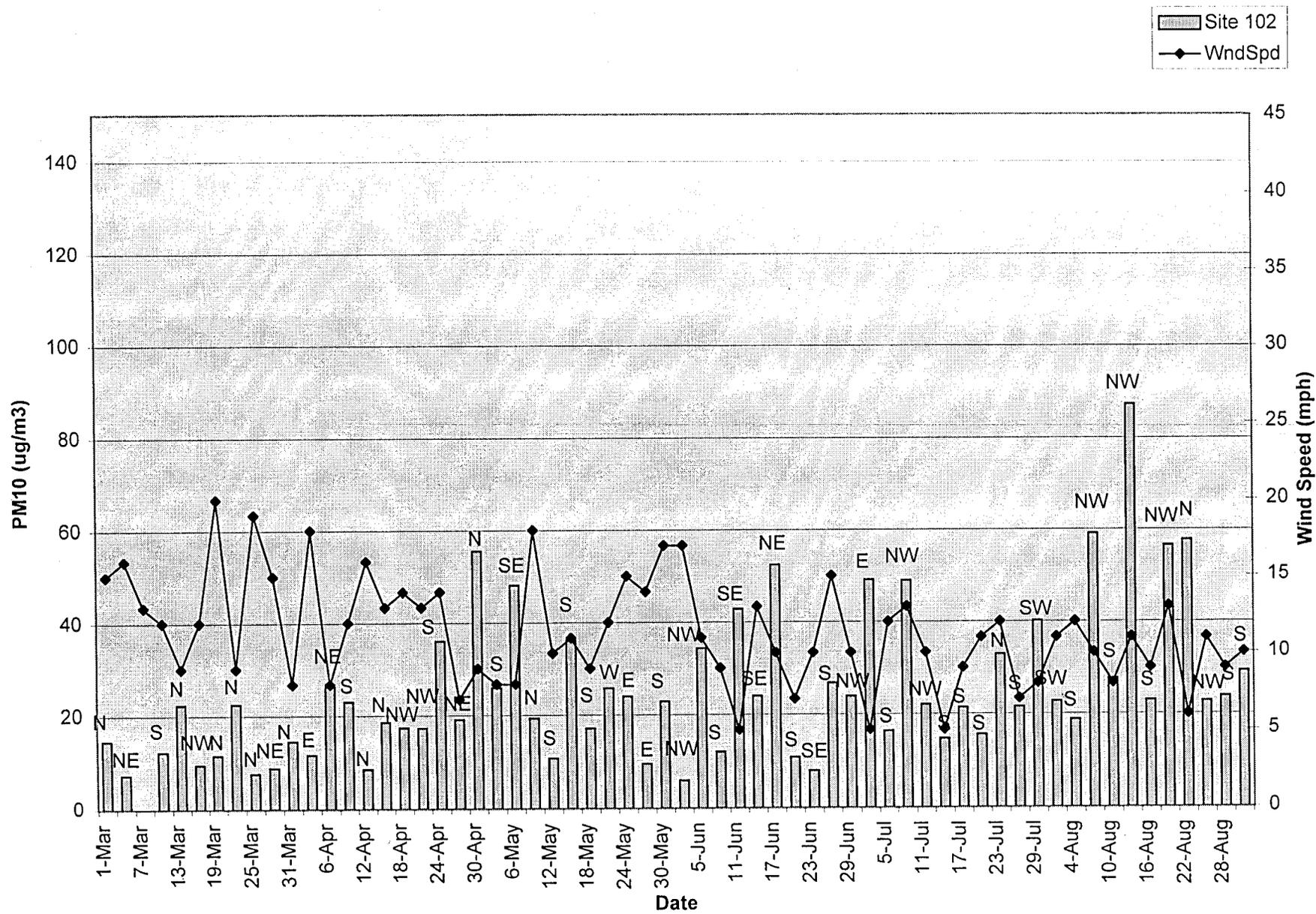


Figure 6. PM10 and meteorological data from the Aberdeen Study - Site 102.

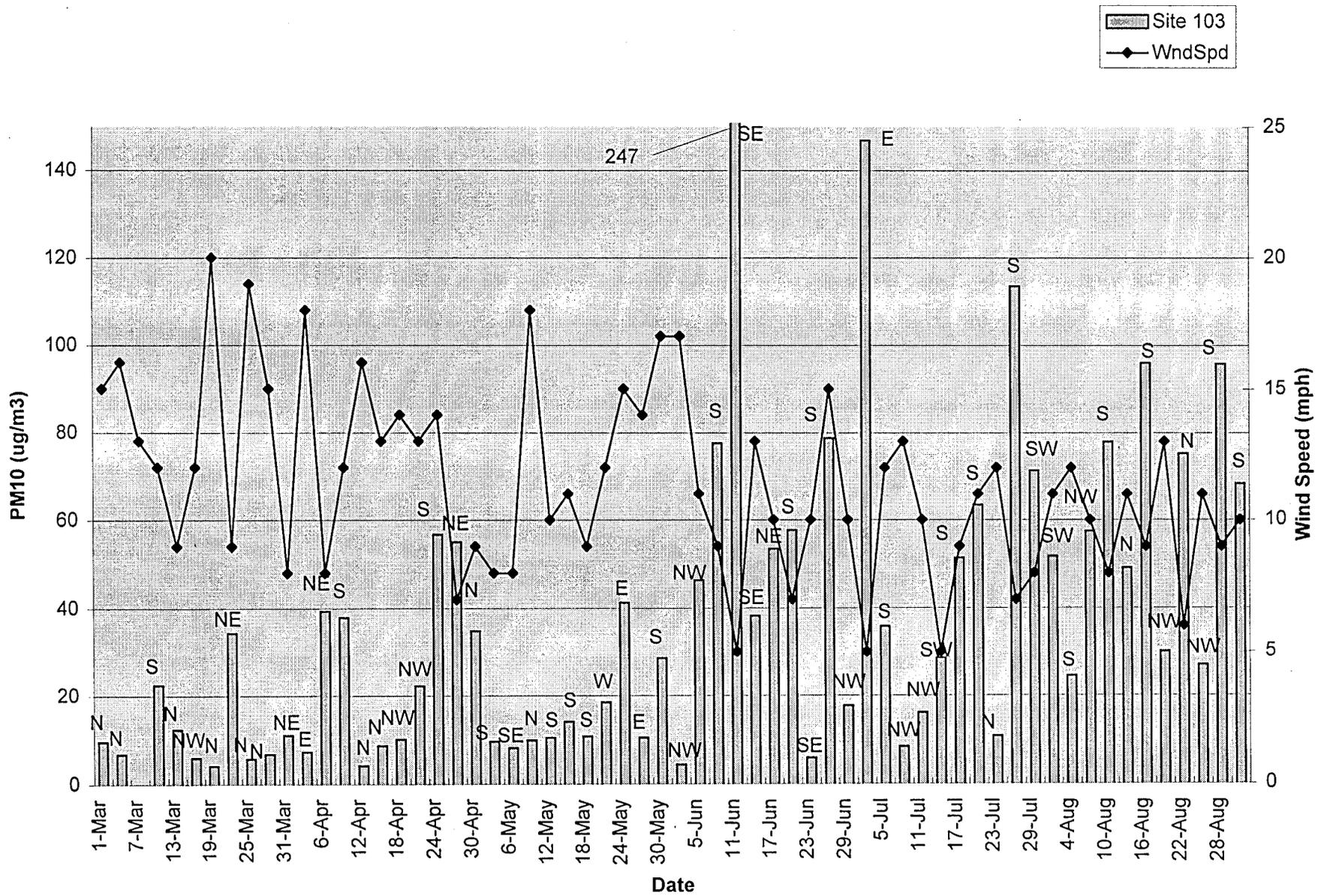


Figure 7. PM10 and meteorological data from the Aberdeen Study - Site 103.

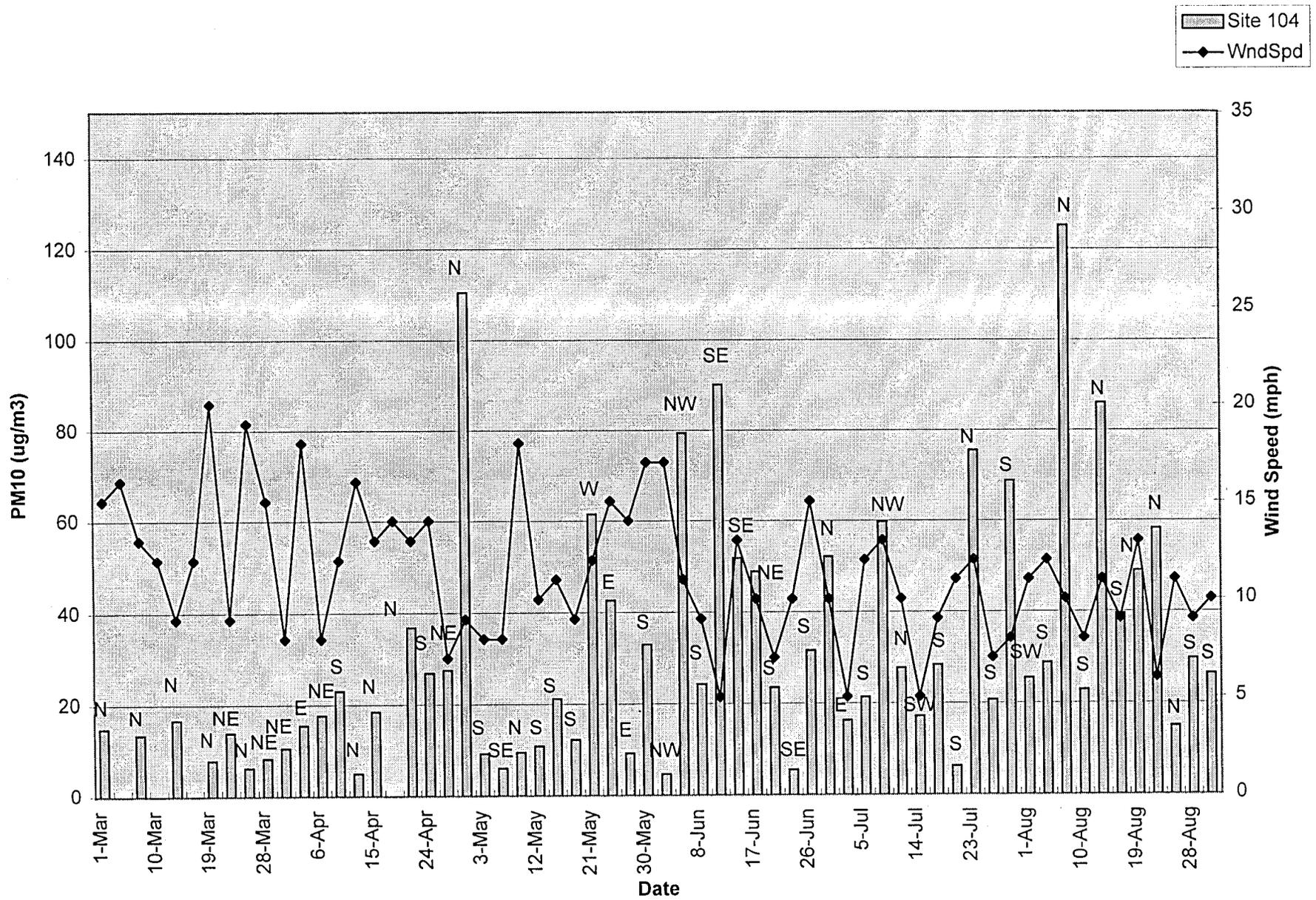


Figure 8. PM10 and meteorological data from the Aberdeen Study - Site 104.

### **Site 104**

This site was the Northeast location, chosen to intercept winds from the southwest. Site 104 was located just north of an unpaved railroad yard access road that had infrequent usage, but south of Site 103's unpaved road. The average PM10 concentration recorded here was 31.7 ug/m<sup>3</sup>. The highest recorded concentration was 125.0 ug/m<sup>3</sup> and the low was 4.4 ug/m<sup>3</sup>. Almost all elevated PM10 concentrations were associated with winds from the north, northwest (Figure 8). Concentrations recorded at this site were less than US EPA's daily and annual PM10 standards.

### **Site 105**

This site was the Southeast site, chosen to intercept northwest winds. Site 105 was located just north of Highway 12 on a road turnout. The average PM10 concentration recorded here was 35.2 ug/m<sup>3</sup>. The highest recorded concentration was 122.8 ug/m<sup>3</sup> and the low was 5.0 ug/m<sup>3</sup>. Almost all elevated PM10 concentrations were associated with winds from the south, southeast (Figure 9). Concentrations recorded at this site were less than US EPA's daily and annual PM10 standards.

### **Site 106**

This site was the Southwest site, chosen to represent background PM10 concentrations. Site 106 was located just south of Highway 12 on a road turnout. The average PM10 concentration recorded here was 18.5 ug/m<sup>3</sup>. The highest recorded concentration was 65.9 ug/m<sup>3</sup> and the low was 4.7 ug/m<sup>3</sup>. All elevated PM10 concentrations were associated with winds from the north, northwest (Figure 10). Concentrations recorded at this site were less than one-half of US EPA's daily and annual PM10 standards.

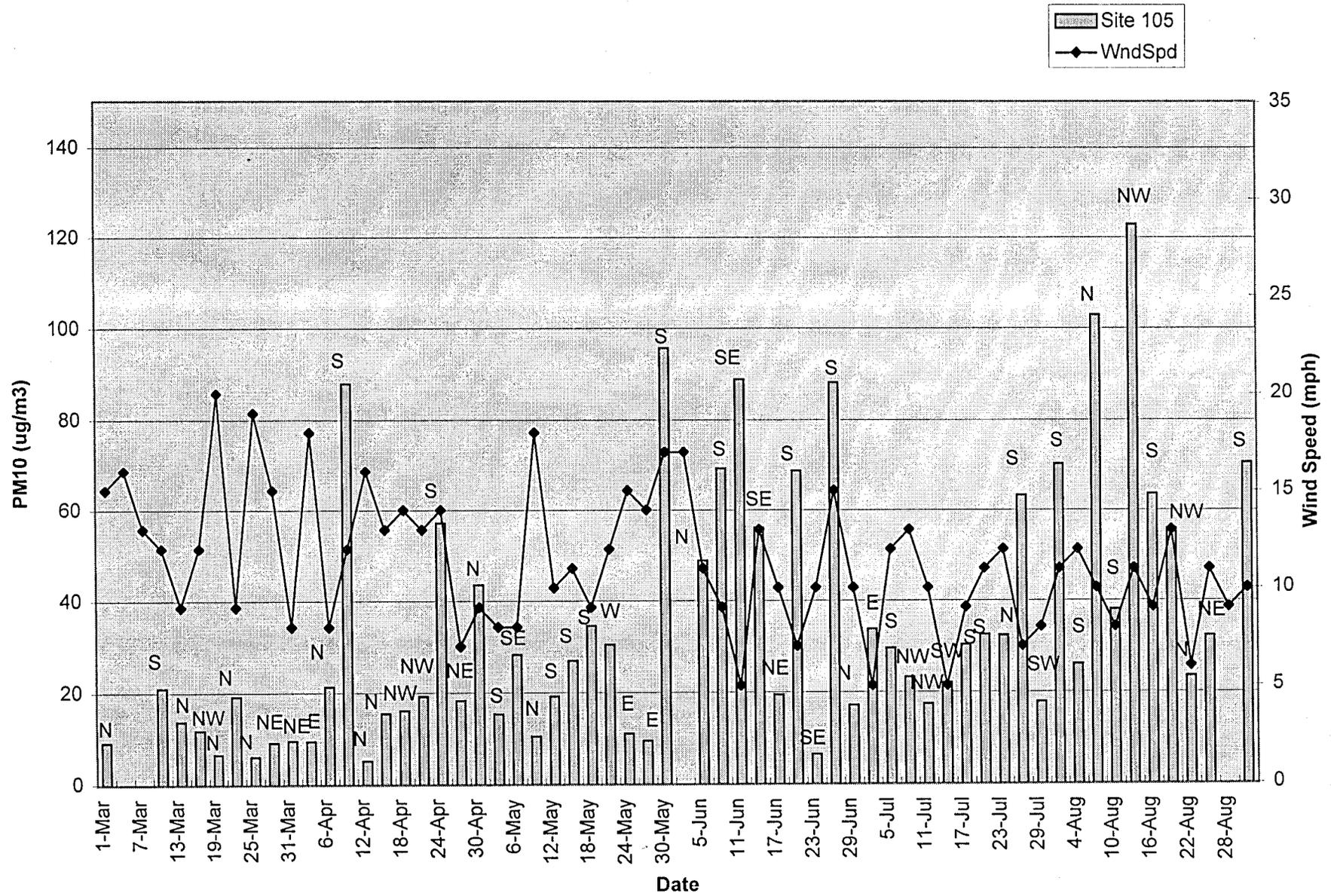


Figure 9. PM10 and meteorological data from the Aberdeen Study - Site 105.

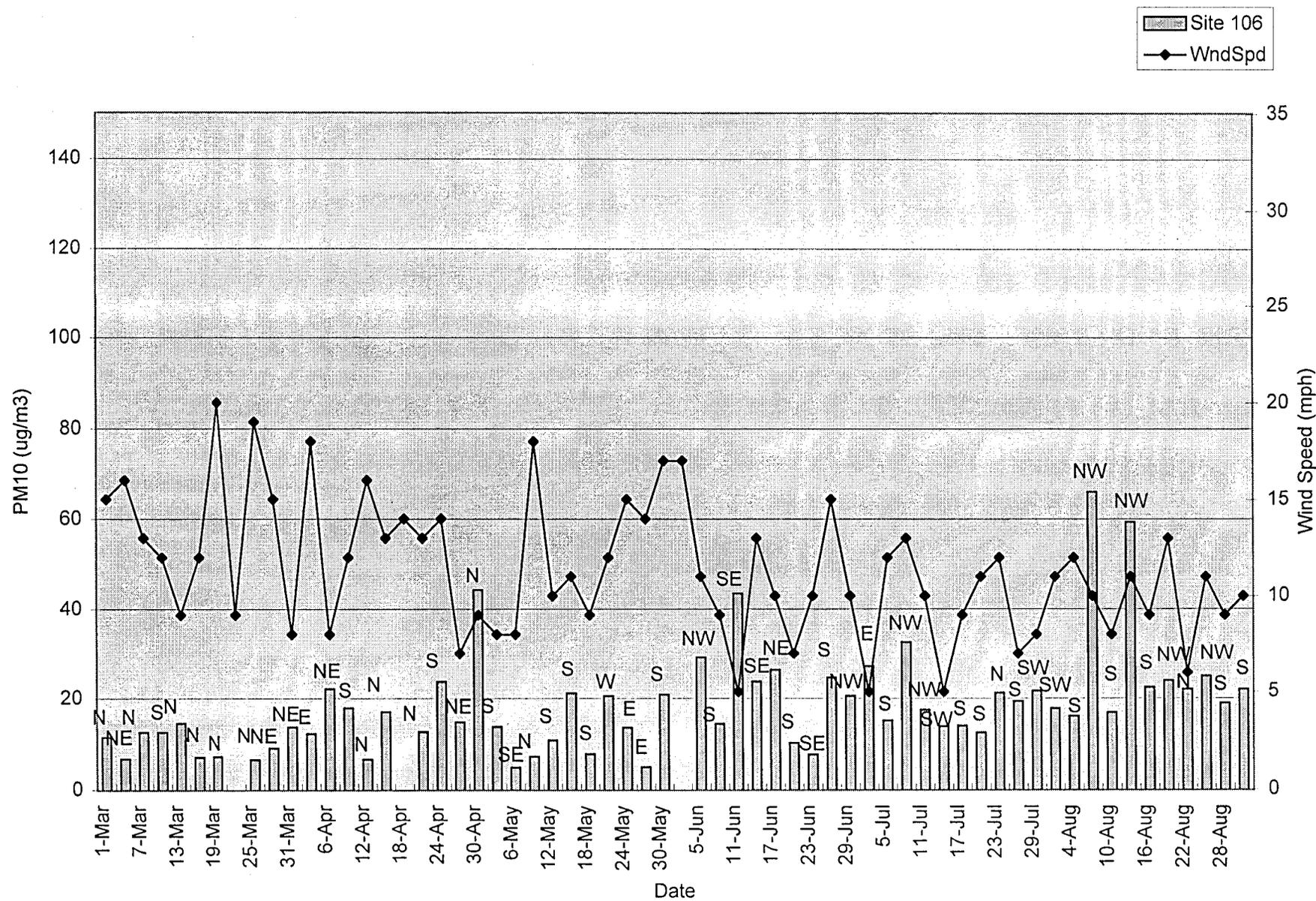


Figure 10. PM10 and meteorological data from the Aberdeen Study - Site 106.

## DISCUSSION

Overall, monitoring results indicated relatively low levels of PM10 pollution in the area sampled. One monitoring day did exceed the US EPA's national ambient air quality standard. This occurred at Site 103. Average PM10 concentrations at all sites were far below US EPA's standard for annual average. The reader is reminded the saturation monitor is used only for survey purposes and no air quality attainment status can be inferred from the results of these instruments.

The PM10 monitoring in Aberdeen produced successful survey results. Sites 101 and 102 showed relatively low PM10 concentration results. North of these sites is a railroad switching yard and a rock crushing/hot mix asphalt operation. Elevated readings at Sites 101 and 102 were associated with winds from the north/northwest, but all measured concentrations were far below federal standards.

Elevated PM10 concentrations found at Site 103 were almost always associated with south/southeast winds. This would seem to be expected as south of this site are the railroad switching yards, a well traveled unpaved road, and a rock crushing/hot mix asphalt industry. Elevated PM10 concentration at Site 104 were associated with winds from the north/northwest. To the south/southwest of this site are the railroad switching yards and rock crushing/hot mix asphalt operation and to the north is the unpaved road. Wind speeds recorded on elevated concentration days show relatively low speeds, i.e. 5-12 mph.

These two sites appear to show contradictory sources of PM10 pollution. Land usage would indicate that potential PM10 pollution sources would be the railroad switching yards (unpaved roads and high activity) and the rock crushing/hot mix asphalt industry (fugitive dust). Site 103 would seem to follow this expectation, but Site 104 is completely contradictory to this expectation. A possible explanation for these results is the heavily used, unpaved road that runs between Sites 103 and 104. The contradictory wind directions on elevated PM10 concentration days and the low wind speeds on these days strongly indicates the saturation monitors were recording road dust.

Site 105 also demonstrated monitoring results contradictory to expected results. This site was chosen to intercept northwest winds moving PM10 pollution from the rock crushing/hot mix asphalt operation and the railroad switching yards. Elevated concentration days at this site were associated with winds from the south/southeast. South of Site 105 is a truckstop with a large unpaved parking lot and Highway 12 and southeast are residential properties. Elevated PM10 pollution concentrations measured at Site 105 could have come from these sources.

Monitoring results from Site 106 appear to confirm this to be a good background monitoring location. All recorded concentrations were far below federal standards, regardless of wind direction.

Data analysis by month demonstrates seasonal PM10 trends. No site recorded elevated concentrations in the month of March and all sites recorded elevated concentrations in the month of August. The highest PM10 concentration sampling days

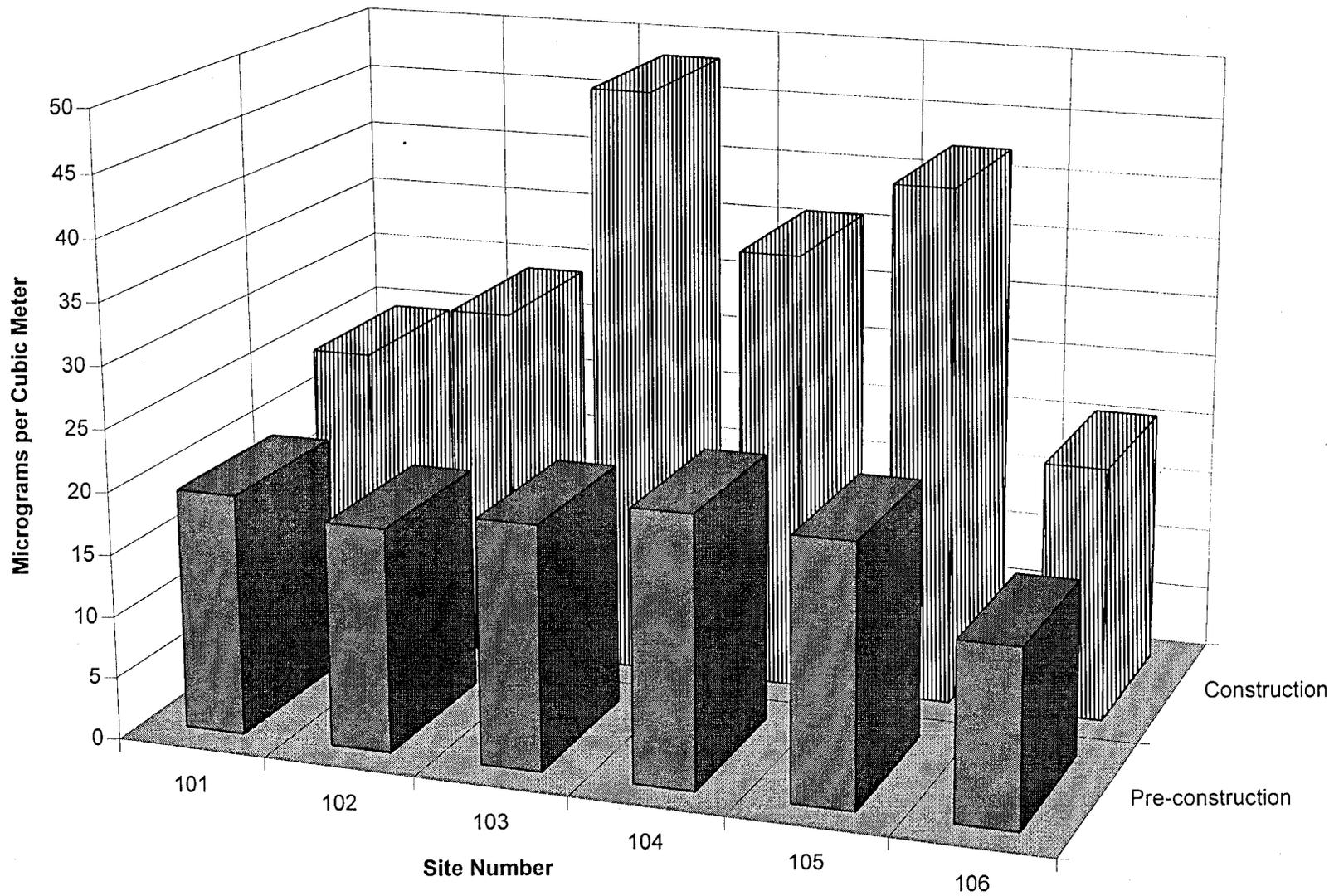


Figure 11. Average PM10 concentrations measured at each monitoring site before and during the construction season.

occurred in the months of May, June, July, and August. Figure 11 demonstrates a very clear difference in measured PM10 concentrations in the pre-construction versus the construction seasons. Average PM10 concentrations were higher at all monitoring sites during the construction season. These results appear reflect greater construction, tourist, and agricultural activity.

Results of this PM10 monitoring effort in Aberdeen indicate non-industrial sources as the largest contributor of particulate matter. Combining wind direction data with measured PM10 concentrations indicates elevated pollution levels were most probably the result of unpaved roads and parking lots. Industrial sources likely made contributions to the measured particulate levels, but wind directions correlated with PM10 concentrations at Sites 103, 104 and 105 indicate large roadway contributions. This study clearly indicates that reduction of PM10 concentrations in western Aberdeen could best be achieved by either stabilizing or paving the road north of the railroad switching yard and the truckstop parking lot south of Highway 12.

Attachment 1

Aberdeen-Lien Saturation Study  
Air Monitoring Sampling Plan for  
Particulate Matter