

# Measurement of Airborne Particulates around Sand Mines and Processing Plants

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## Introduction

Hydraulic fracturing has become a popular method for extracting natural gas from shale deposits below the earth's crust. It requires high amounts of 'frac' sand which is harvested and processed largely in the Midwest. The geology of Wisconsin has optimal sand deposits for the process. The sand is used in the extraction as a proppant to hold open the fractured shale while the removal takes place.

## Study and Purpose

Mining and processing plants scatter the landscape of rural communities in the upper Midwest. Numerous reports of dust accumulation at people's homes and businesses have led to a rise in consideration of investigating the air quality surrounding those facilities, regarding potential microscopic air-borne particulates. The sand harvested at the plants may be composed partly by crystalline silica. On the microscopic scale crystalline silica has been extensively researched and suggested to be a chronic human carcinogen. Particulate size of 2.5 microns (PM2.5) can penetrate the lower respiratory tract. Therefore there is concern in the scientific and public health community that silica could increase the risk of health infractions such as silicosis, tuberculosis, or renal failure. Our study was to quantitatively characterize the PM2.5 and PM10 particulate concentrations in the air and evaluate the risk as compared to national standards.

## Methods

Data collection occurred near local sand mining, processing, and transport sites in the Chippewa Valley area. Sampling downwind was optimal and wind direction/speed were recorded for each data point. Also recorded was exact coordinate location, relative humidity, and time. The DustTrak was used to sample for both PM2.5 and PM10 particulates for 1 to 2 minute snapshots, in units of micrograms per cubic meter. Measurement intervals were approximately 10 meters apart. The DPS meter flows air past a particulate filter which was massed prior to sampling and after the sample time is completed. The DPS samples the surrounding air continuously for one to two hours. We recorded flow rate, volume, time, and air pressure prior to sampling. Along with the mass difference of the particulate filter we could relate surrounding air conditions to a set exposure time.

## Instruments



<http://www.dawsonassoc.com/images/TS%20DustTrak.jpg>

DustTrak

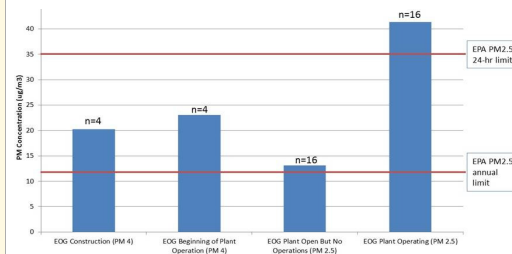


[http://www.airmet.com.au/Details/DPS\\_02.jpg](http://www.airmet.com.au/Details/DPS_02.jpg)

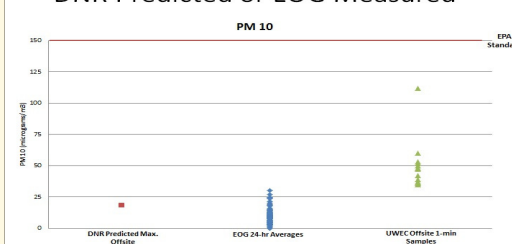
DPS

## Data Presentation

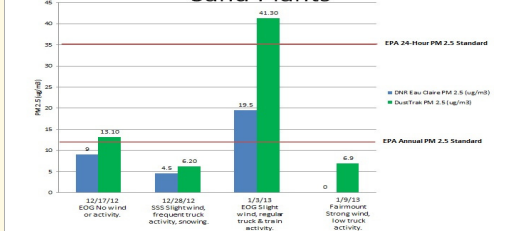
### Operations Show Strong Evidence of Increased Levels of Air-borne Particulates



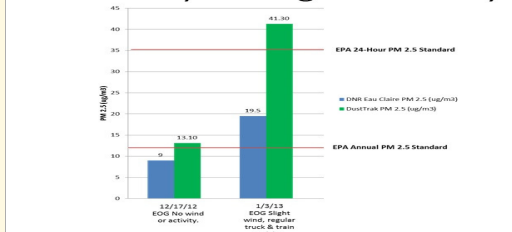
### UWEC Measured PM10 Higher Than DNR Predicted or EOG Measured



### PM 2.5 Increases Over Background at Sand Plants



### No Activity vs. Regular Activity



## Locations

- EOG Resources – Chippewa Falls, WI
- Superior Silica Sand – near Howard, WI
- Fairmount Mine – Menomonie, WI



<http://www.fracsandequipment.com/wp-content/uploads/2011/06/20-40-Frac-Sand.jpg>

## Results

### EOG Resources

- ❖ No Operations
  - December 17, 2012
  - Avg PM2.5=13.1 µg/m<sup>3</sup>
  - Avg PM10=16.8 µg/m<sup>3</sup>
- ❖ Operations
  - January 2, 2013
  - Avg PM2.5= 41.3 µg/m<sup>3</sup>
  - Avg PM10= 47.1 µg/m<sup>3</sup>

### Fairmount Mine

- ❖ Operations
  - January 9, 2013
  - Avg PM2.5= 6.9 µg/m<sup>3</sup>
  - Avg PM10= 11 µg/m<sup>3</sup>

### Superior Silica Sand

- ❖ Operating
  - December 28, 2012
  - Avg PM2.5=6.2 µg/m<sup>3</sup>

**EPA Standards**  
 PM2.5 12 µg/m<sup>3</sup>  
 PM10 150 µg/m<sup>3</sup>

## Interpretation

The data suggest higher levels of air-borne particulates than EPA standards for most data sets, except for PM10 size particulates. Data show strong positive relationship of particulate concentration levels associated with operation. Factors such as weather and wind show an effect on the levels of PM2.5. All of our levels exceed DNR predicted maximum offsite levels of PM10. Proximity to site plays a role in level of PM2.5.

## Conclusion

From the interpretation of the data frac sand mining and processing is not a completely clean procedure. Knowing that the results indicate particulate emissions, it could become a major public health issue. It is intensified by the rapid growth of the industry in Wisconsin. The elevated levels raise concern for proximate residents and workers at the facilities. Further investigation is to be completed to determine the content of crystalline silica in these particulates.

## References

- Dr. Crispin Pierce, UWEC:  
<http://www.uwec.edu/CONHS/programs/enph/silica/silicaresearch1.htm>
- EPA:  
<http://www.epa.gov/airquality/particlepollution/designations/index.htm>
- Wisconsin DNR:  
<http://dnr.wi.gov/topic/Mines/documents/SilicaSandMiningFinal.pdf>