# Initial Sand Mine and Processing Plant Particulate Levels

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# Sampling Instruments: DustTrak Aerosol Monitor

DustTrak model 8520 aerosol monitor, zero-calibrated, flow rate set to 1.7 L/min, PM 2.5, PM 10 or cyclone respirable size filter used. Samples of 1-5 minutes were collected.

***Instrument specifications:***

- **Sensitivity:**
- Sensor type:..... 90° light scattering, laser diode
- Range: ..... 0.001–100 mg/m3 (calibrated to respirable fraction of standard ISO 12103-1, A1 test dust)
- Resolution: ..... ±0.1 % of reading or ±0.001 mg/m3, whichever is greater
- Zero stability:..... ±0.001 mg/m3 over 24 hours using 10-second time-constant
- Particle size range: ..... 0.1–approximate 10 µm (Upper limit is dependent on flow rate)
- Flow rate range: ..... 1.4–2.4 L/min.
- Temperature coefficient: .. +0.001 mg/m3 per °C (for variations from temperature at which DUSTTRAK monitor was zeroed)
- **Instrument Temperature Range:**
- Operating range: ..... 0°C to 50°C (32°F to 120°F)
- Storage range: ..... -20°C to 60°C (-4°F to 140°F)
- **Time Constant:**
- Range:..... Adjustable from 1 to 60 seconds
- **Data Logging:**
- Data points: ..... >31,000 (21 days logging every minute)
- Logging interval:..... Adjustable from 1 second to 1 hour

# Sample Siting Protocol

- EPA Sample siting protocol: **Title 40: Protection of Environment,** PART 58-AMBIENT AIR QUALITY SURVEILLANCE, Subpart G-Federal Monitoring, **Appendix E to Part 58-Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring** (http://www.gpo.gov/fdsys/pkg/CFR-2007-title40-vol5/pdf/CFR-2007-title40-vol5-part58-appE.pdf).
- Protocol dictates the following:
  - Height from ground to probe between 2-7 meters.
  - Distance between probe and any horizontal or vertical supporting structure must be > 2 meters.
  - Distance between probe and dripline of nearest tree must be > 10 meters.

# Results: DustTrak Aerosol Monitor

30-31 July 2011 EOG Construction Sampling:

- **The five-minute DustTrak mass samples found that respirable aerosols upwind were 22 and 17 (average = 19.5) µg/m3 and downwind were 27 and 15 (average = 21) µg/m3.**
- **Site average = 20.2 µg/m3.**

11-12 November 2011 EOG Beginning of Plant Operation Sampling:

- **The five-minute DustTrak particulate mass samples found that respirable aerosols upwind were 11 and 35 (average = 23) µg/m3 and downwind were 14 and 32 (average = 23) µg/m3.**
- **Site average = 23 µg/m3.**

- 17 Dec. 2012 EOG Plant Open But No Operations:
  - **16 PM2.5 one-minute samples had an average of 13.1 µg/m3 (range 6-23 µg/m3).**
- 28 Dec. 2012 Superior Silica Sands Plant Operating (Snowing):
  - **10 PM2.5 samples had an average of 6.2 µg/m3 (range 4-8 µg/m3).**

- 2 Jan. 2013 EOG Plant Operating:
  - **16 PM2.5 samples had an average of 41.3 µg/m3 (range 33-57 µg/m3).**
  - **16 PM10 samples had an average of 47.1 µg/m3 (range 35-112 µg/m3).**
- 9 Jan. 2013 Fairmount Mine (Menomonie) Minimal Activity (High Winds):
  - **11 PM2.5 samples had an average of 6.9 µg/m3 (range 4-14 µg/m3).**
  - **11 PM10 samples had an average of 11 µg/m3 (range 4-33 µg/m3).**

# PM2.5 Levels May be the Best Indicator of Public Health Risk

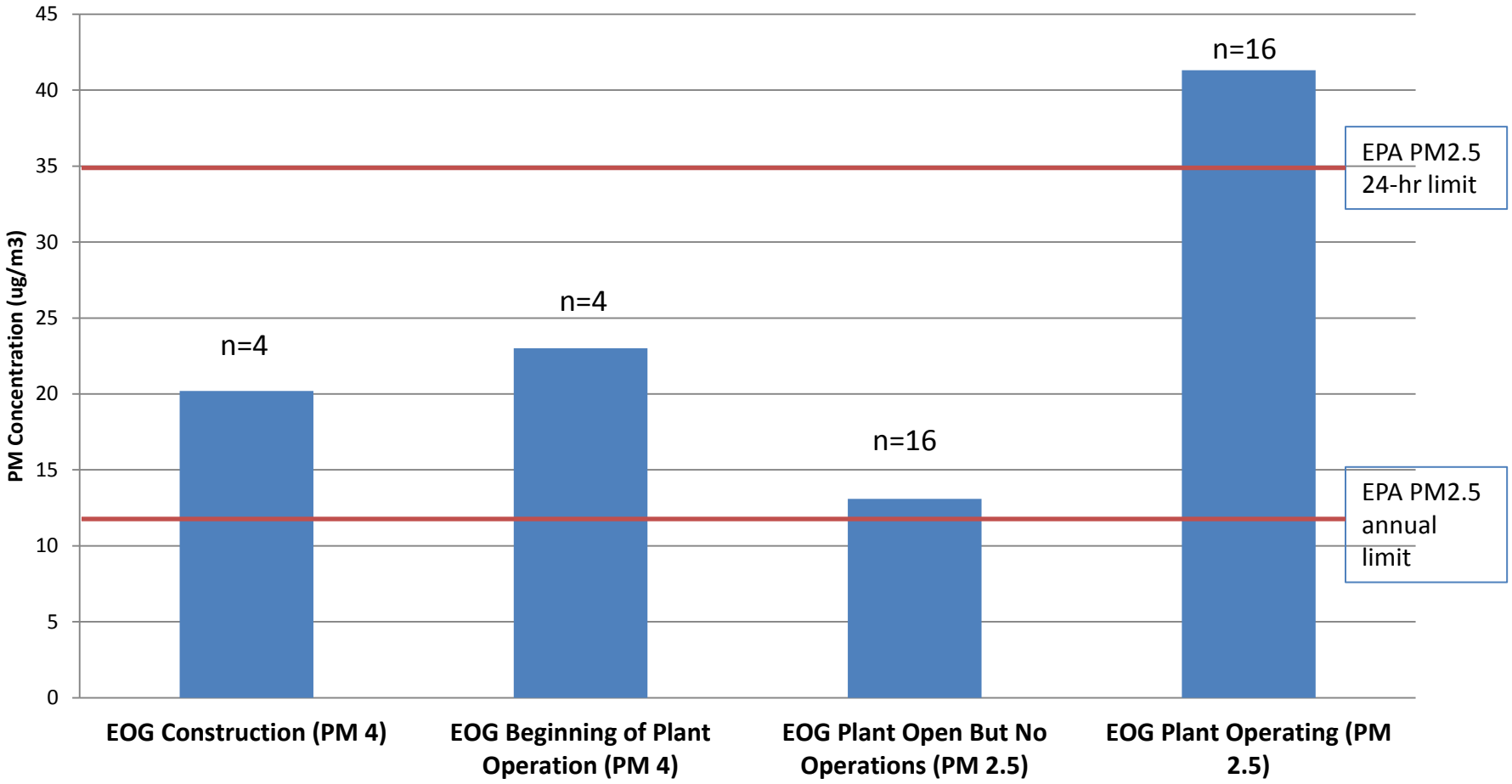
- A 1995 American Cancer Society study, 2002 follow-up, and published 2012 study of six cities found that each 10-microgram per-cubic-meter increase in long-term average PM2.5 concentration was associated with,
  - a 4-14% increased risk of death from all natural causes,
  - a 6-26% increased risk of death from cardiopulmonary/cardiovascular disease, and
  - an 8-37% increased risk of death from lung cancer.

References: http://toxicology.usu.edu/endnote/1132.pdf, http://**dx.doi.org/10.1289/ehp.1104660**

# Measured Levels of PM2.5/4 Increased from EOG Plant Construction Through Full Operation

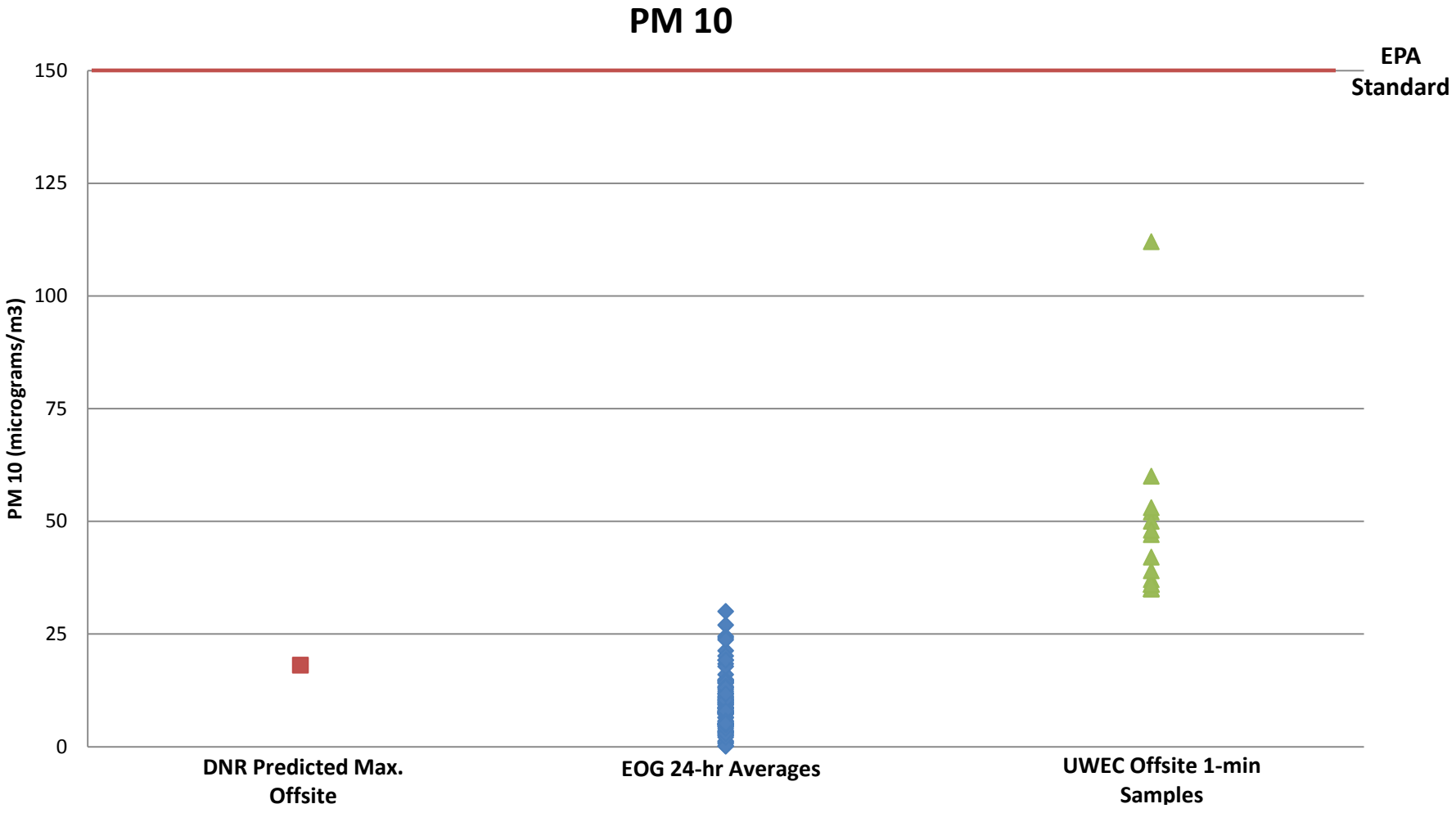
- Our 1- to 5-minute multiple “snapshot” samples found the following:
  - Measured values of PM 2.5 or PM 4 increased across sampling dates between 30-31 July 2011 and 2 January 2013.
  - Measured values during full operation were above the EPA annual and 24-hour PM2.5 standards.

# Measured EOG PM2.5/4 Increased During Operation



# Measured PM10 Levels During Operation Were Higher than the DNR Model-Predicted Maximum Concentration and the EOG 24-Hour Measured Levels

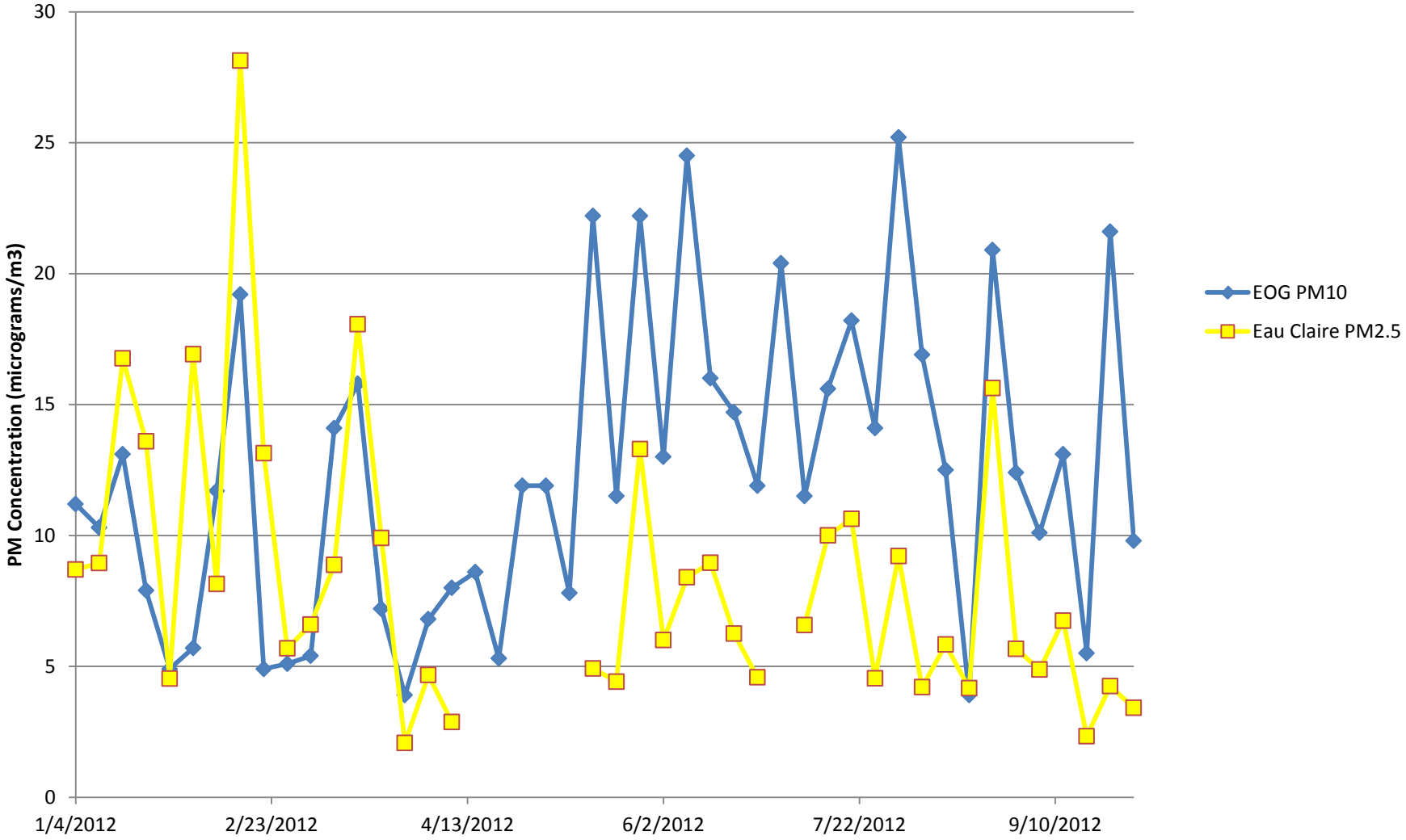
# UWEC Measured PM10 Higher Than DNR Predicted or EOG Measured



# EOG PM10 Measurements are Unreliable Estimates of PM2.5

- Measured PM10 values from EOG were compared to averages of the 24 hours of DNR Eau Claire regional PM2.5 values for the same days.

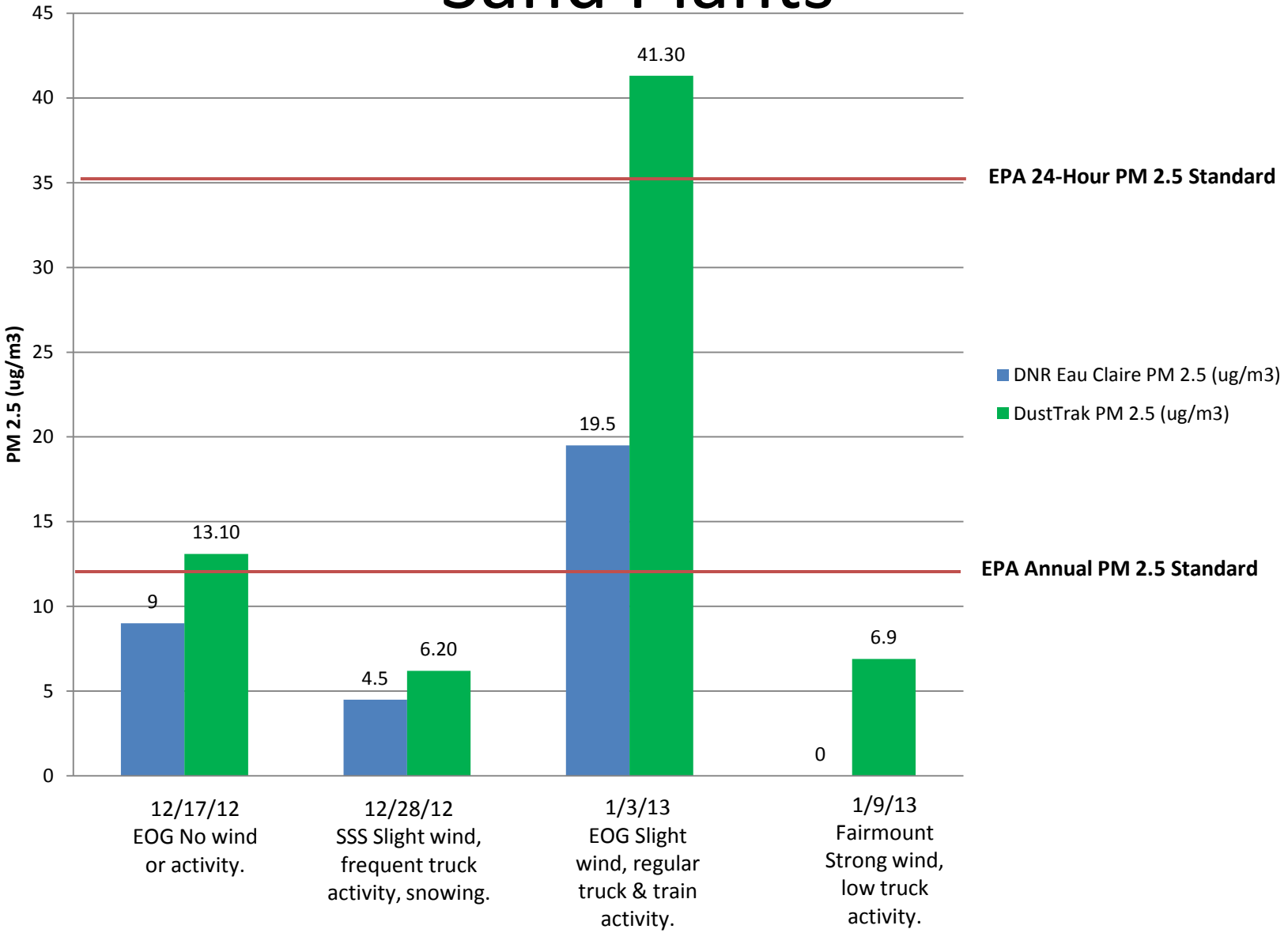
# DNR PM 2.5 vs. EOG PM 10 Concentrations



# Measured Levels of PM2.5 at EOG, Superior Silica Sands (Auburn), and Fairmount Mine (Menomonie) Were 1.7-22 micrograms/m3 Higher Than Concurrent DNR Regional Levels

- Average measured PM2.5 levels were compared to listed Eau Claire DNR PM2.5 levels over the same hourly periods.

# PM 2.5 Increases Over Background at Sand Plants



# Measurement and Enforcement of the Current EPA 12 micrograms/m3 PM2.5 Standard is Likely to Protect Against Silicosis Risk

- Measured 14.5% silica concentration in 41 respirable dust samples collected in Wisconsin by MSHA.
- State of California OEHHA reference concentration of 3 micrograms/m3 respirable crystalline silica.
- 12 micrograms/m3 PM2.5 x 14.5% = 1.74 micrograms/m3.

# MSHA Sampling Results

| Date | Location | Job | Contaminant | Concentration (mg/m3) | PEL (mg/m3, varies by %SiO2) | %SiO2 | SiO2 Concentration (mg/m3) | Sand Mining/Processing Company |
|---|---|---|---|---|---|---|---|---|
| 2/18/2009 | M - Drying & Roasting | Kiln/Dryer Operator | Quartz, respirable, >1% Qtz | 0.34 | 0.28 | 33.7142857 | 0.114628571 | A F Gelhar Co Inc |
| 2/11/2009 | M - Drying & Roasting | Mechanic | Quartz, respirable, >1% Qtz | 0.36 | 2.47 | 2.048583 | 0.007374899 | Badger Mining Corporation |
| 12/16/2009 | M - Dry Screening | Dry Screen Plant Operator | Quartz, respirable, >1% Qtz | 0.13 | 0.64 | 13.625 | 0.0177125 | Badger Mining Corporation-Fairwater Plant |
| 11/8/2011 | S - Active Production | Washer Operator | Quartz, respirable, >1% Qtz | 0.32 | 2.35 | 2.25531915 | 0.007217021 | Barton Sand & Gravel Co |
| 6/6/2012 | S - General | Electrician | Quartz, respirable, >1% Qtz | 0.13 | 0.56 | 15.8571429 | 0.020614286 | EOG Resources, Inc |
| 3/27/2012 | Laboratory | Lab Technician | Quartz, respirable, >1% Qtz | 0.23 | 0.4 | 23 | 0.0529 | " |
| 3/27/2012 | M - Washing & Screening | Washer Operator | Quartz, respirable, >1% Qtz | 0.6 | 0.53 | 16.8679245 | 0.101207547 | " |
| 3/27/2012 | S - General | Electrician | Quartz, respirable, >1% Qtz | 0.82 | 0.57 | 15.5438596 | 0.127459649 | " |

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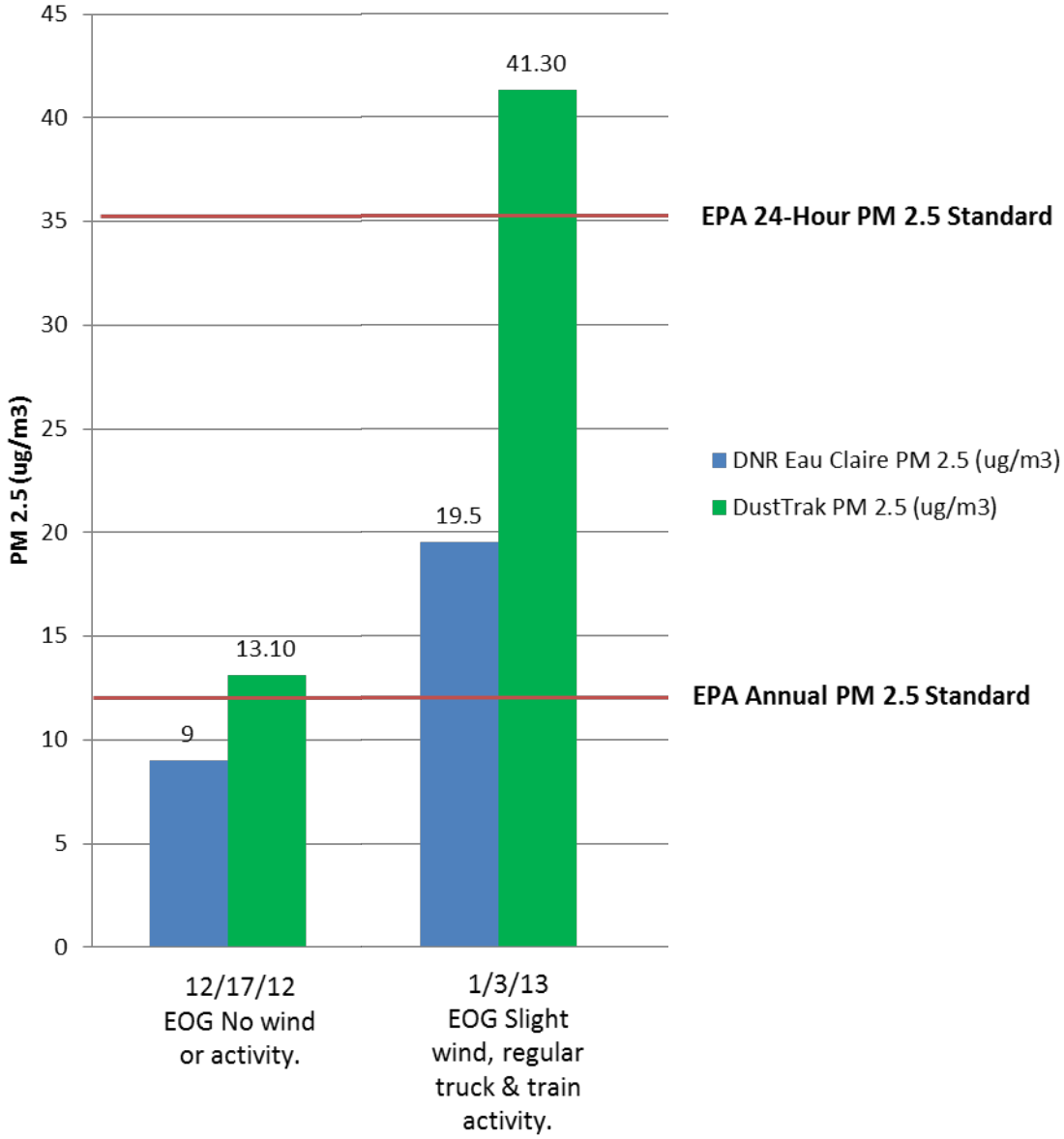
|---|---|
| MIN | 1.24675325 |
| MAX | 39.6666667 |
| AVERAGE | 14.517322 |
| s.d. | 10.434715 |

# Snow, Wind and Degree of Plant Activity Appear to Influence Measured PM2.5 Levels

# No Activity vs. Regular Activity



# Questions?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- http://www.uwec.edu/CONHS/programs/enph/silica/silicaresearch1.htm