



Midpeninsula Regional  
Open Space District

R-13-69  
Meeting 13-17  
July 24, 2013

## **AGENDA ITEM 4**

### **AGENDA ITEM**

Presentation of Ongoing Air Quality Monitoring Study at Rancho San Antonio Open Space Preserve

### **GENERAL MANAGER'S RECOMMENDATION**

Receive an informational presentation on the air quality monitoring study in process at Rancho San Antonio Open Space Preserve

### **SUMMARY**

Eric Winegar, PhD, of Winegar Air Sciences, will present results from the ongoing air quality monitoring study at Rancho San Antonio Open Space Preserve. The available data from the first half of the year-long study will be presented to the Board, with an opportunity for questions and discussion.

### **DISCUSSION**

On January 9, 2013, the Midpeninsula Regional Open Space District (District) Board of Director's authorized an award of contract, in the amount of \$180,552, to Winegar Air Sciences, to undertake a year-long air quality monitoring study at Rancho San Antonio Open Space Preserve (see Report R-13-11). This study was initiated in response to public and District staff concerns regarding potential air quality impacts within the Preserve related to the adjacent Lehigh Permanente quarry and cement plant.

The Board was previously briefed on the project's progress at the Board meetings of February 13, 2013 and June 26, 2013.

Air quality monitoring stations were established within the Preserve in January 2013 at the Annex (main station), and adjacent to the PG&E Trail, the Preserve trail closest to the Point of Maximum Impact (PMI) as identified in Lehigh's 2011 Health Risk Assessment. These monitoring stations consist of continuous read monitoring instruments to measure PM10 (particulate matter less than 10 micrometers in diameter), PM2.5 (particulate matter less than 2.5 micrometers in diameter), and black carbon (an established surrogate for diesel exhaust). Small particulate matter and diesel exhaust are known to impact human health. Additionally, these two monitoring stations include sampling instruments dedicated for shorter duration, specific

sampling events to measure different particle sizes, as well as specific elemental constituents (e.g. metals). Particle size and elemental analysis can provide a unique signature of various air masses, and can identify plume origin. These parameters are sampled by a DRUM sampler (Davis Rotating Unit for Monitoring), where air samples are imbedded on a continuous tape, run for a six week or twelve week period, with samples processed later at the University of California at Berkeley Synchrotron X-ray fluorescence lab. Additional short-duration sampling instruments are also being utilized to screen for volatile organic compounds and other potential toxics in the air at both locations.

A third monitoring site has been established at the Deer Hollow Farm. This location is set up to monitor PM10, to compare the data with the other two sites. All three sites have weather sensors for wind speed and direction, to help understand air movement and potential plume movement at the Preserve.

The data presented by Dr. Winegar is preliminary data, subject to further change or refinement as the study progresses and as all the data collected are synthesized. The air monitoring study is anticipated to continue through February 2014, with a final report scheduled for completion in April 2014.

### **BOARD COMMITTEE REVIEW**

Committee review is not required for this agenda item.

### **PUBLIC NOTICE**

Public notice was provided as required by the Brown Act.

### **CEQA COMPLIANCE**

The air quality monitoring study at Rancho San Antonio Open Space Preserve does not constitute a project under the California Environmental Quality Act (CEQA).

### **ATTACHMENT**

1. Rancho San Antonio Air Monitoring Update/ Progress Report, July 2013

Responsible Department Manager:  
Kirk Lenington, Natural Resources Manager

Prepared by:  
Matt Baldzikowski, Resource Planner III

Contact person:  
Matt Baldzikowski, Resource Planner III

**Update/Progress Report:  
Air Monitoring at  
Rancho San Antonio Open Space Preserve  
Mid-peninsula Regional Open Space District**

Conducted by:

Eric Winegar PhD  
Winegar Air Sciences  
Gold River, CA

Prepared for:

MROSD Board of Directors

July 2013



## Program Summary

### Purpose of Monitoring

1. Assess potential impact to District employees and public from emissions (point sources, mobile sources, and fugitive emissions) from operations at Lehigh Cement.
2. Compare results to HRA and DEIR

### Test Sites

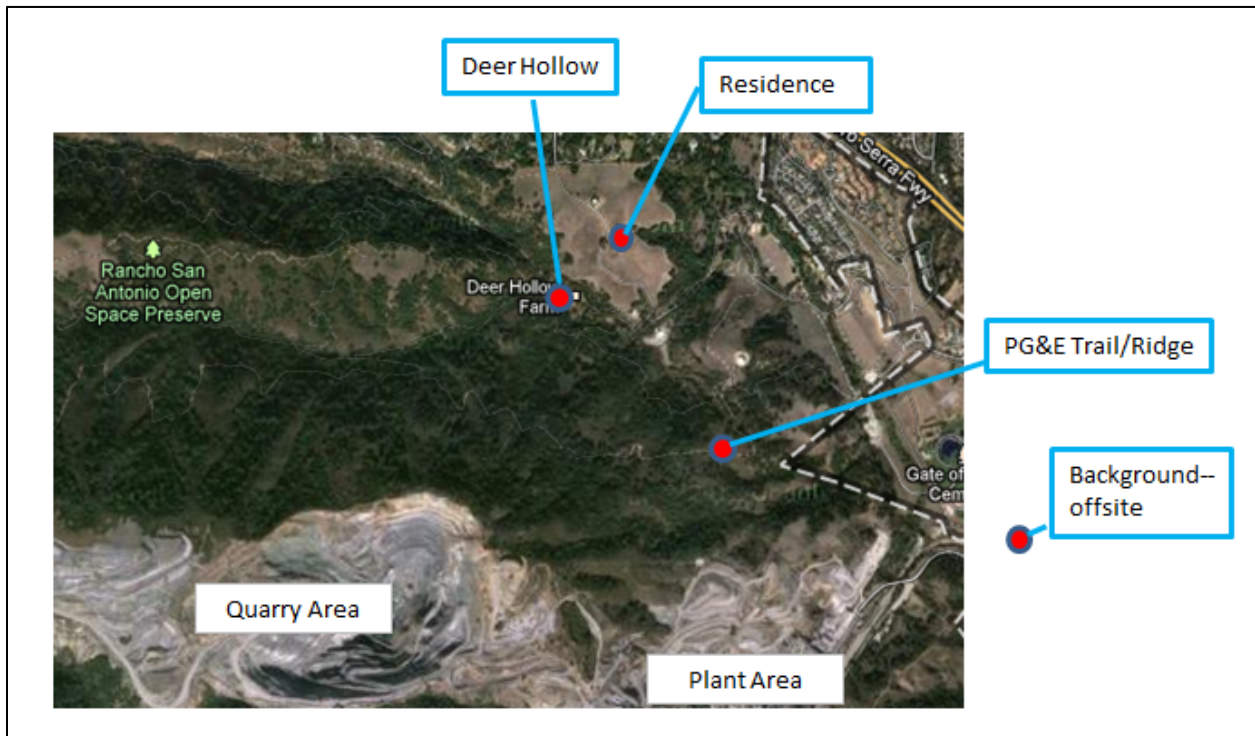


Figure 1. Test locations

### Test Parameters

Annex:

- PM10
- PM2.5 (extra)
- Black Carbon
- Meteorology
- Elements: DRUM (29 elements/3-6 hr resolution/1-8 size cuts); passive samplers
- Toxics (CrVI, mercury, VOCs)

PG&E Trail

- PM10
- Black Carbon

- Elements :DRUM (29 elements/3-6 hr resolution/PM10 size cut); passive samplers
- Toxics (CrVI, mercury, VOCs)

Deer Hollow Farm

- PM10

## Preliminary Results

### I. Annex

#### PM10/PM2.5—Coarse and Fine Particulate

Hourly concentrations of PM10 (coarse PM) and PM2.5 (fine PM) were collected at the Annex site. There were gaps in data, due to onsite power issues, and instrument issues. These issues are not uncommon at the initiation of studies, and the power and equipment deficiencies are now resolved. The monitoring, even with gaps, still represents a fairly rigorous sampling regime, and adequately recorded data with enough coverage to support desired statistical analysis. Nonetheless, the study will be extended, at no additional cost, to provide redundant winter period data. The PM2.5 data is included as an extra, as it was not part of the original scope of work. However, it is useful as a probe for incursion of urban air masses, which are frequently dominated by PM2.5 from combustion (vehicular) sources. PM10 originates from physical process, such as mining and fugitive dust from surfaces, and as such it was used to probe the potential incursion of major plumes from the Lehigh plant and/or mine areas.

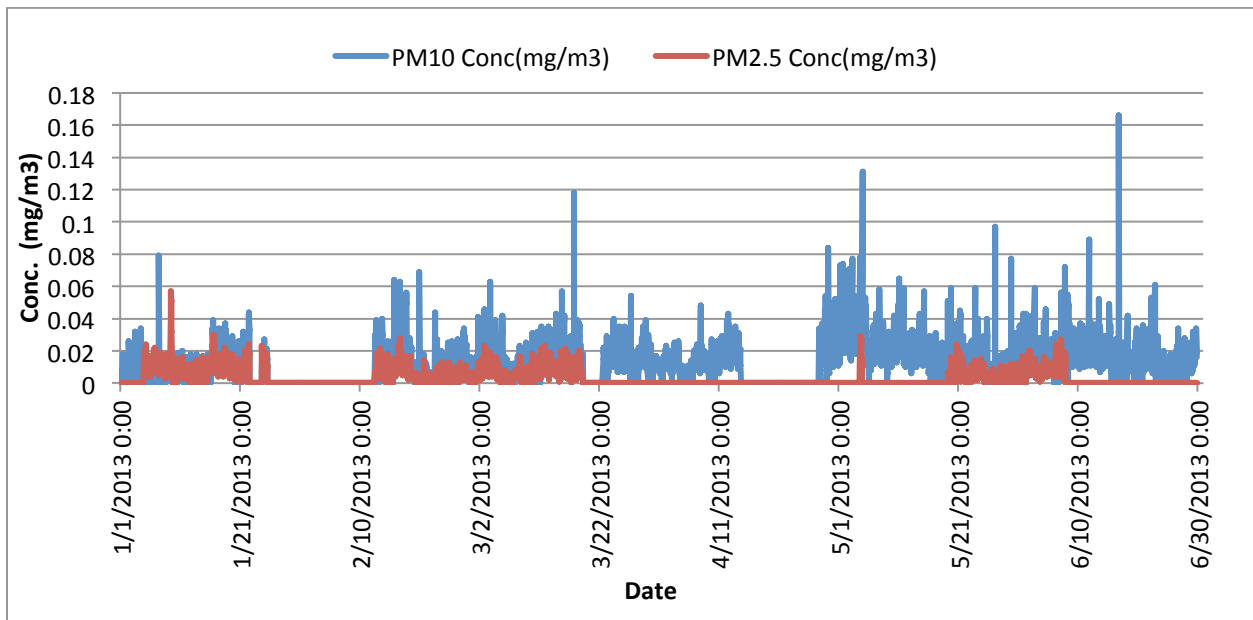


Figure 2. PM10/PM2.5 Results

The averages for this first period of monitoring were:

PM10: 0.018 mg/m<sup>3</sup>

PM2.5: 0.008 mg/m<sup>3</sup>

Both averages are below California Air Quality Standards (0.020 mg/m<sup>3</sup>, and 0.012 mg/m<sup>3</sup>) respectively. However, there were a few instances of relatively high concentrations, but these were short-lived and possibly due to localized (within a few hundred feet of the monitor inlet) events. Further analysis of these data in conjunction with other parameters (wind, black carbon, DRUM data) and other locations (PGE Trail) may shed some insight into the origin of the spikes.

There appears to be a daily pattern due to meteorology. These possible trends and aspects will be examined in more detail in coming periods, in combination with data interpretation of the data sets as an ensemble.

However, a preliminary conclusion is that overall, there are no major areas of concern evident related to particulate matter, at the Annex location at this time, relative to the health and safety objectives of the program.

### Black Carbon

Black carbon was continuously monitored at the Annex site as well and is useful as a tracer of urban air masses, specifically diesel particulate matter (DPM).

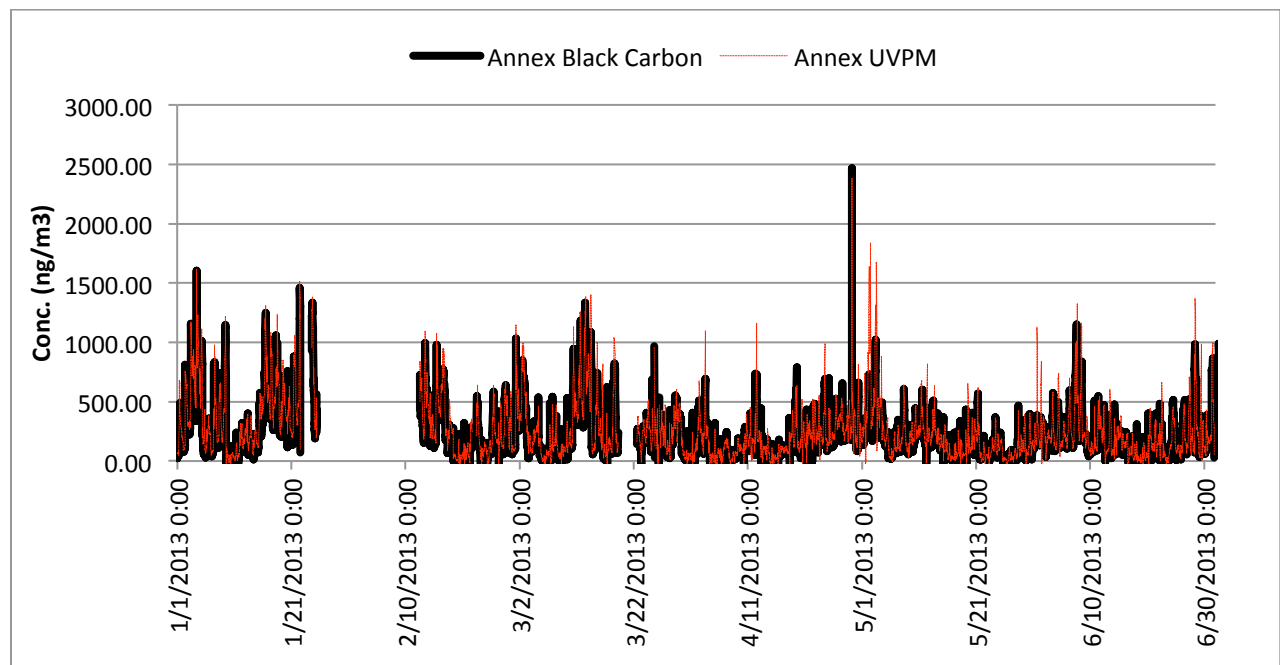


Figure 3. Annex Black Carbon Concentrations

The average concentration of black carbon was 224 ng/m<sup>3</sup>, and for UVPM (an indicator for 'fresh' diesel exhaust) was 254 ng/m<sup>3</sup>. These levels are well below typical urban areas (approx. 1000 ng/m<sup>3</sup>), but the relatively high concentration of UVPM compared to black carbon suggests some effect from nearby vehicular sources, such as I-280. However, these concentrations are similar to remote areas, which are generally less than 500 ng/m<sup>3</sup>. Therefore, it is concluded that any urban contribution is substantially diluted by clean air masses, from the west and northwest.

DRUM data from the Annex will be presented later in this report. In addition, a separate presentation of the toxics data for all sites is presented later as well.

## II. PGE Trail

The PG&E Trail site is closer to the Lehigh mine operation, and as such does receive a higher impact. However, this impact is substantially mitigated on average by the dominant dilution effect from upwind clean air masses.

The PM10 monitoring at the PGE Trail site shows a slightly higher concentration than at the Annex, with an average of 0.024 mg/m<sup>3</sup>, an increase of approximately 25% compared to the Annex average of 0.018 mg/m<sup>3</sup>. That concentration of 0.024 mg/m<sup>3</sup> is above the California standard of 0.020 mg/m<sup>3</sup>. For comparison, a typical annual average PM10 concentration in the Bay Area is between 0.025 and 0.030 mg/m<sup>3</sup>.

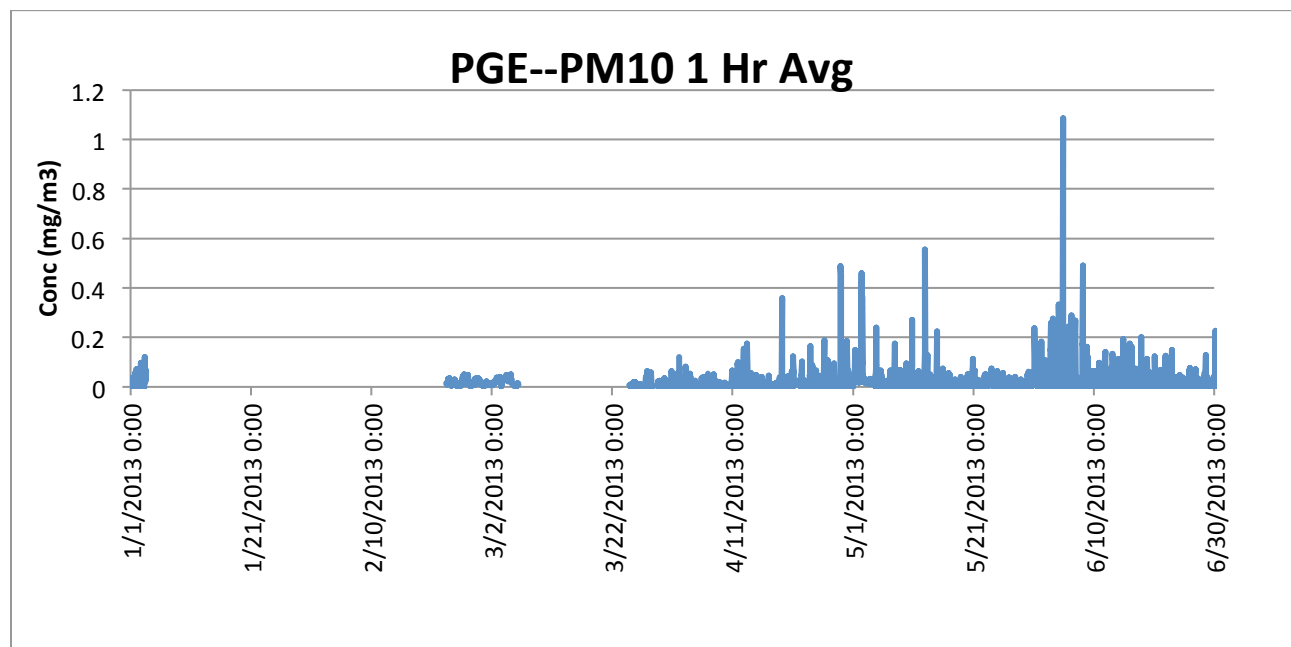


Figure 4. PGE Site PM10

The gaps present in the early months are due to equipment malfunction and/or rejection of poor quality data as a result of these malfunctions. However, the trend of available data shows that the concentrations increase over from the wet winter season to the drier summer season, with some short-term peaks of very high concentration. This will be re-evaluated through the extended study period, adding an additional winter season.



Figure 5 shows an examination of one of those short-term periods, along with wind data.

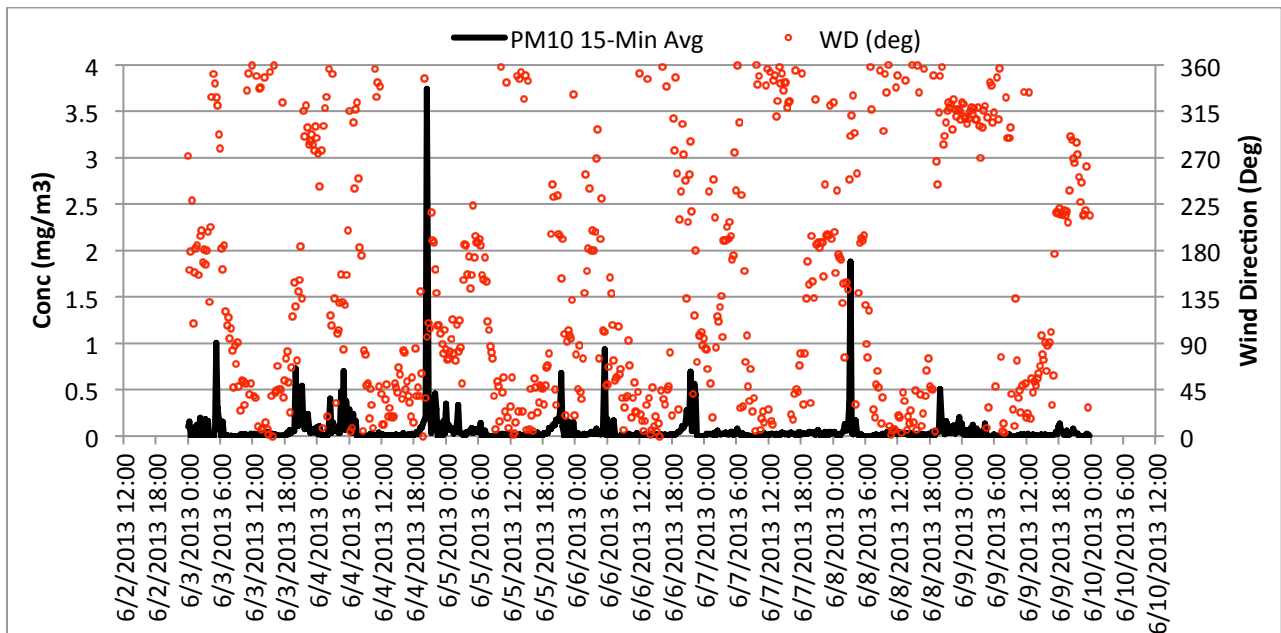


Figure 5. PGE Site Data—15 min PM10 Concentrations and Wind Direction

One such concentration period is the period from June 2, 2013 to June 10, 2013. The 15-min short-term concentrations from the monitor show regular high peaks above 0.5 mg/m<sup>3</sup>, with several very high peaks around or above 1 mg/m<sup>3</sup>. The wind direction data is not clear-cut in terms of originating from the mine direction (southerly, or around 180 degrees). However, much of the high concentration data occurs during periods of low wind speeds (not represented here) which tend to facilitate near-source transport. While these high concentration events occur regularly (some of which seem to be tied to recurring quarry or plant activities) the overall average when combined with the dominance of many more lower concentrations results in a much lower long-term average. It is these long-term averages that are compared against air quality standards, which are oriented towards long-term exposure.

Other data collected at PGE shows the slightly higher impact due to proximity to the quarry/cement plant area. The average black carbon concentration at PGE was also seen to be slightly higher than at the Annex at 278 ng/m<sup>3</sup> (compared to 254 ng/m<sup>3</sup>).

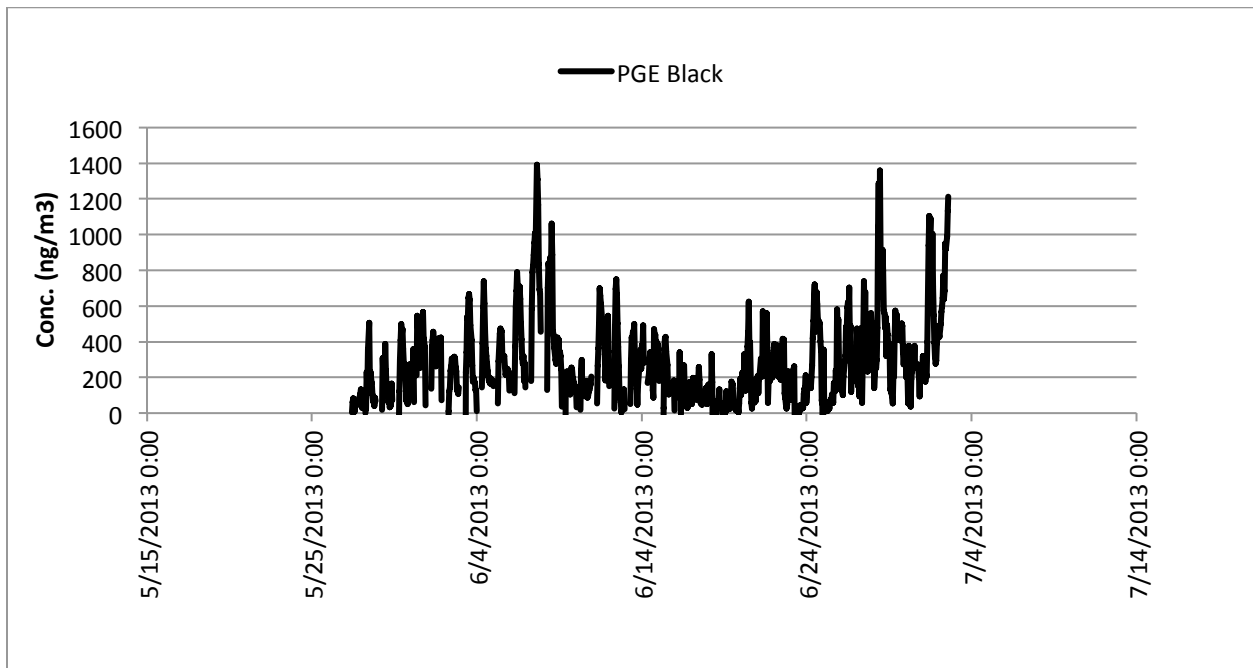


Figure 6. Black Carbon at PGE Site

This slightly longer distance of this site to the local traffic (e.g., I-280) suggests lower concentrations, while the proximity to the Lehigh mine suggests a higher impact. The difference is difficult to separate without more analysis, particularly of wind data. This analysis will be conducted for future reports.

Preliminary conclusions are, however, that the concentrations seen are reflective of non-urban areas without major emission sources and are low compared to typical urban areas.

One DRUM sample has been collected at the PGE site, and awaits analysis.

In addition to the active sampling and monitoring, passive sample collection has been conducted via the flat solar panels, which are currently oriented at a nearly level angle due to the position of the sun. These panels have been collecting dust fallout for extended periods, which has been collected and will be analyzed along with the DRUM samples. It is expected to see an enhancement from Calcium above typical local soil values due to impact from quarry operations.

### III. Deer Hollow

The PM10 monitoring conducted at Deer Hollow appears to show mainly the effect of its remote and sheltered location as well as periodic localized effects.

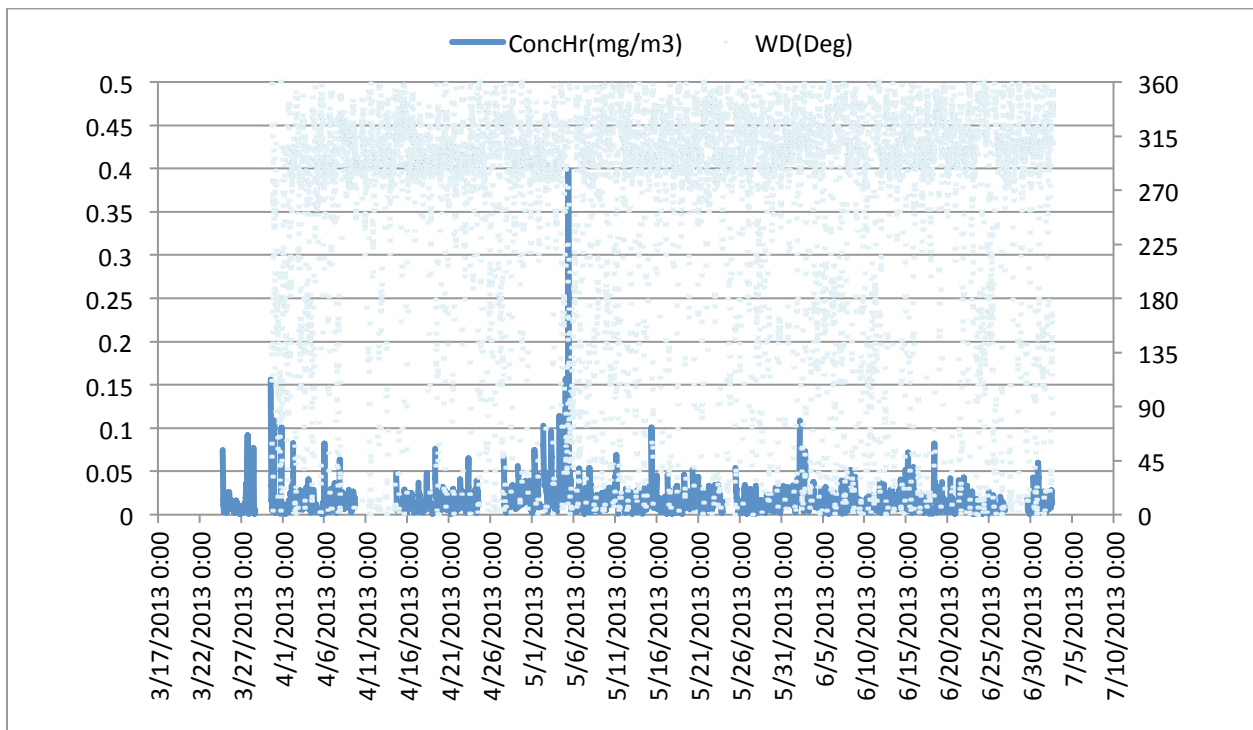


Figure 7. Deer Hollow Site

These data show an overall low concentration average (0.017 mg/m<sup>3</sup>), similar to the Annex, but punctuated with short-term spikes of moderate to high levels. When these spikes are examined, it shows that a) they are regular and consistent with site activities, such as early-morning actions by local staff, and b) they are not correlated with wind direction. The wind direction shows a dominant north to northwest wind direction, consistent with the incursion of clean air. There is relatively low impact from the southerly direction, suggesting that there is little to no effect from mine operations at this site. With the removal of the spike concentrations, the overall average would in fact be somewhat lower, suggesting a very clean and isolated location.

## **Preliminary DRUM Results—Aerosol Detection by Size, Time and Element**

As of the beginning of July, four DRUM samples have been collected. Two have been analyzed in the laboratory, with the data from the sample collected in the 'wet' season at the Annex, from January 1, to February 15, 2013, presented below. The following information is preliminary, based on the first examination of the data.

### **Aerosol analysis at the Annex site**

Summary: The UC Davis DELTA Group 8 DRUM sampler ran from Dec. 31, 2012 to February 23, 2013. There were several power outages due to – Jan 6 – 7, Jan 22 – 24, Jan 25 to Feb 12, and Feb 21 – 22, 2013. These gaps were taken into account in the data processing.

The samples were analyzed for mass and roughly 40 elements. The results show that all the usual soil derived elements (with one exception, Calcium) behaved as shown below for silicon and iron. The soil was keyed to wind velocity, with a strong diurnal pattern. However, to have soil like this, there must be substantial exposed soil without any vegetation, such as is found in the mine area.

The preliminary results show clear evidence of re-suspended soil in general and calcium consistent with limestone that was seen in the data in numerous instances.

The plots presented below present substantial information related to these preliminary conclusions. No in-depth explanation will be provided at this point, but will follow in later reports along with more complete interpretations.

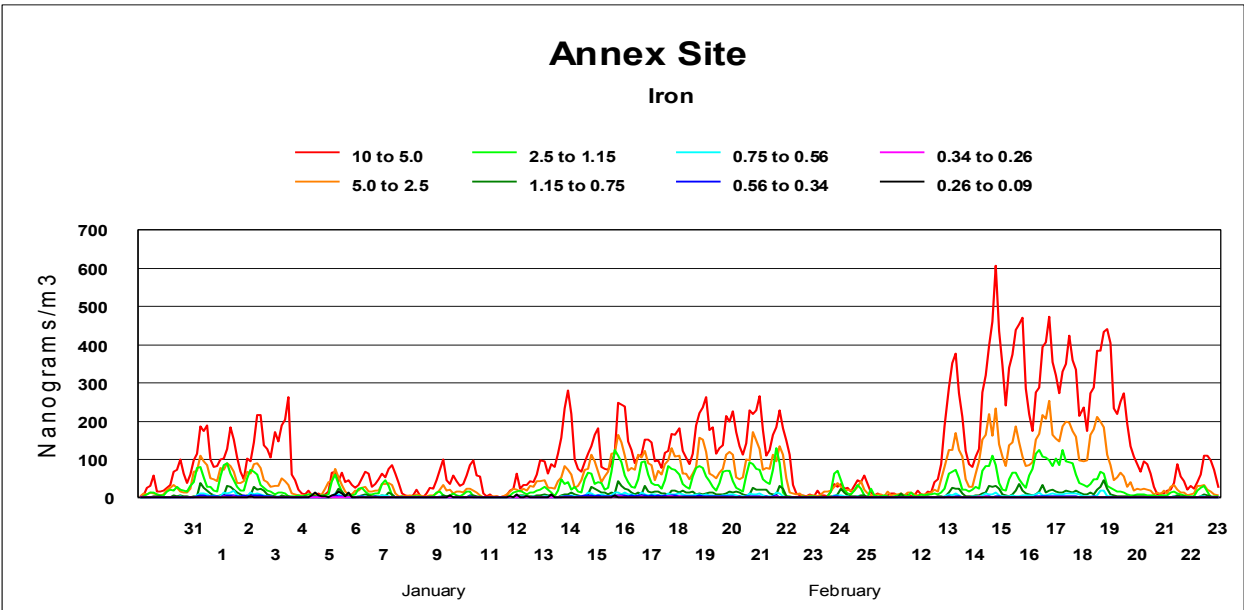
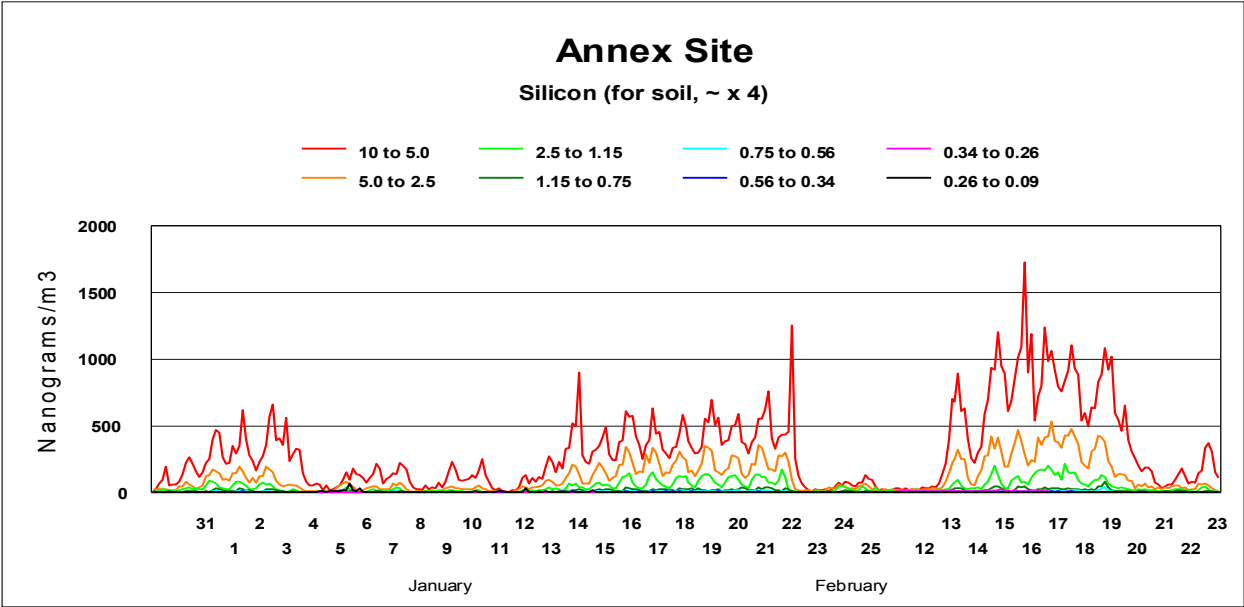


Figure 8. Annex Site DRUM data for Soil and Soil-derived Elements

As noted, the soil elements (iron and silicon) were indicative of typical fugitive soil dust emissions. However, the situation is very different for calcium, as shown below. The pattern of all the other soil elements is not reproduced indicating another source of calcium different than the re-suspended soil. This suggests fugitive dust from quarry or cement operations.

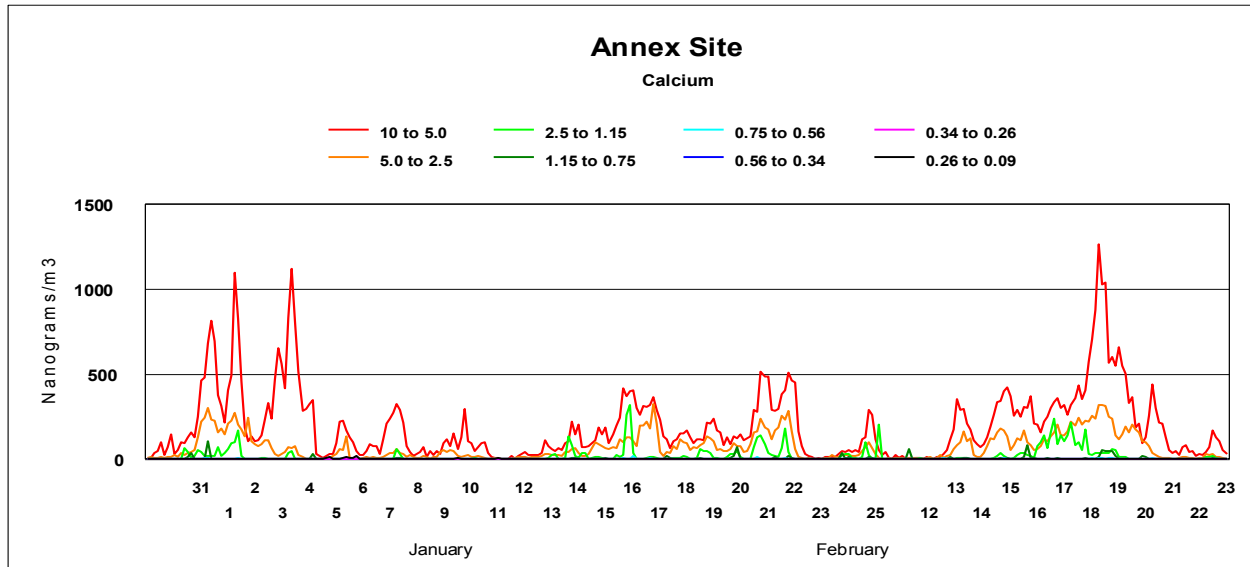


Figure 9. Calcium at Annex Site

To illustrate the difference, we have taken the silicon values and divided by 3, which is the ratio used in the US EPA IMPROVE network. If the calcium is all from soil, the two graphs should lie directly on top of each other. In the four graphs below, we do this for particles 10 to 5.0, 5.0 to 2.5, 2.5 to 1.15, and 1.15 to 0.75 µm aerodynamic diameter. This usual superposition of the various elements is not found, indicating an enrichment from a non-soil source.

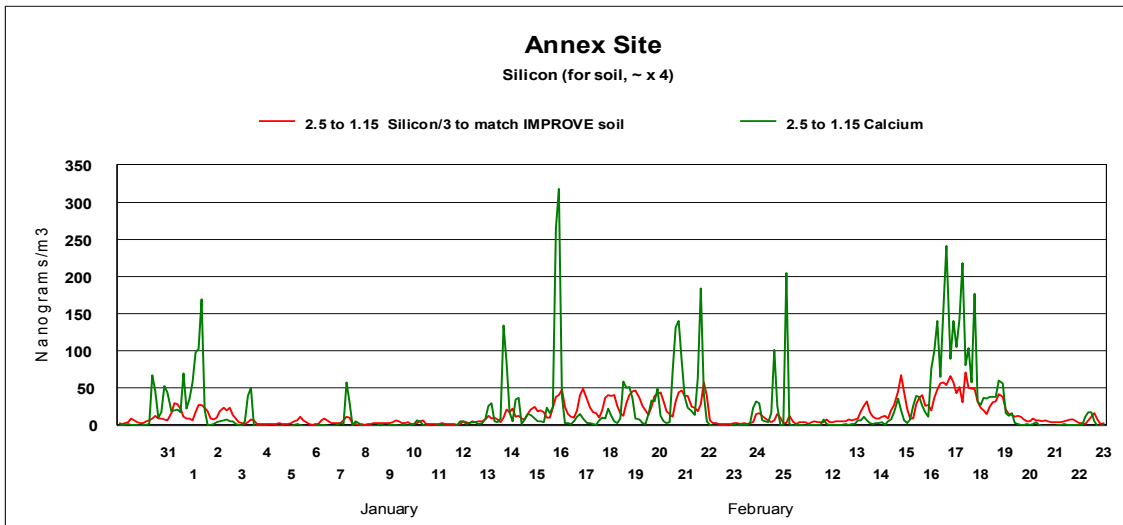
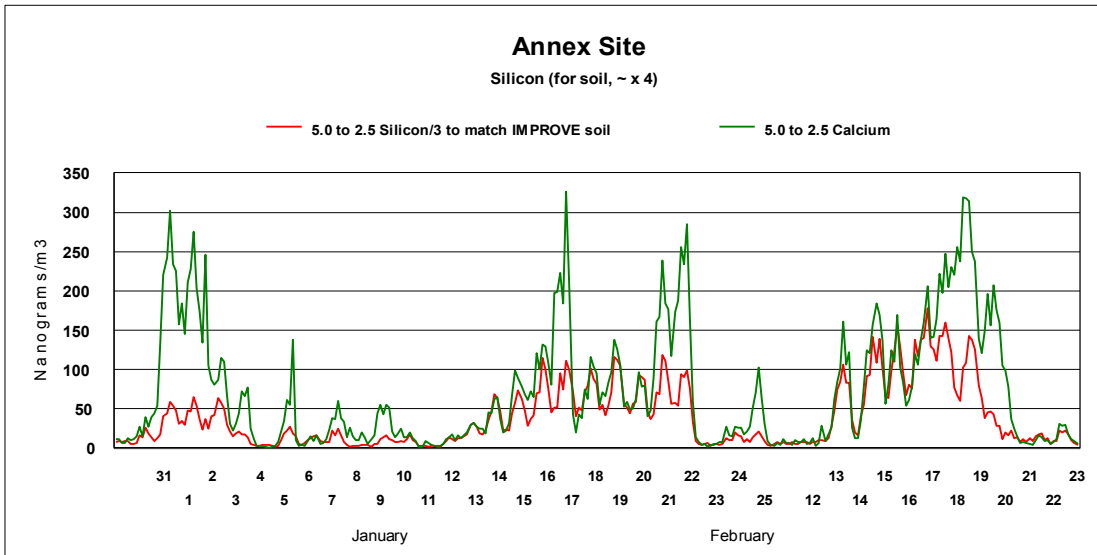
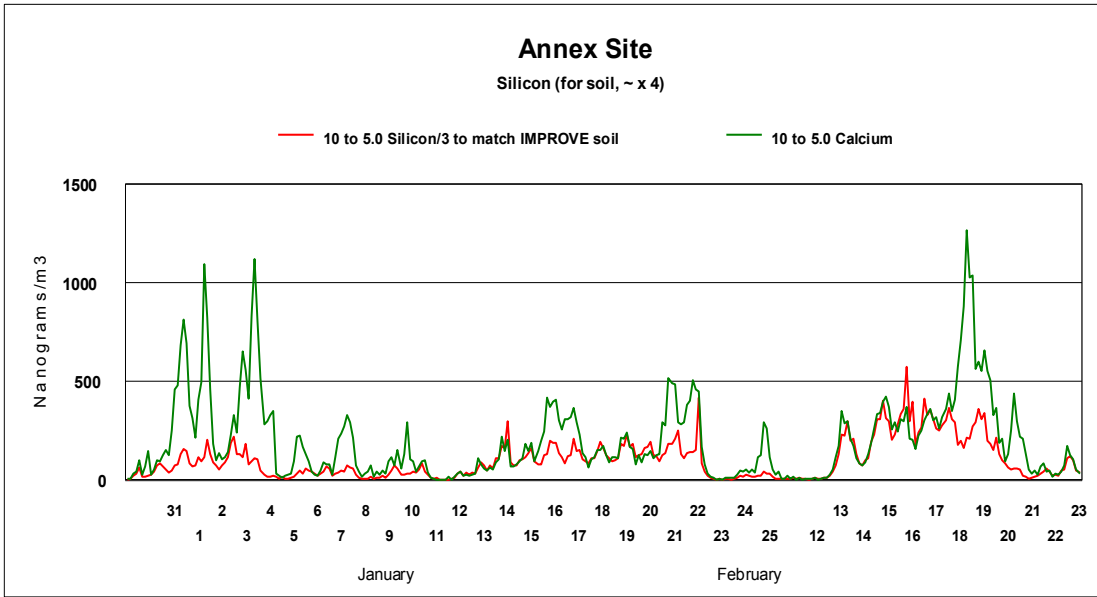


Figure 10. Size Modes for Soil and Calcium

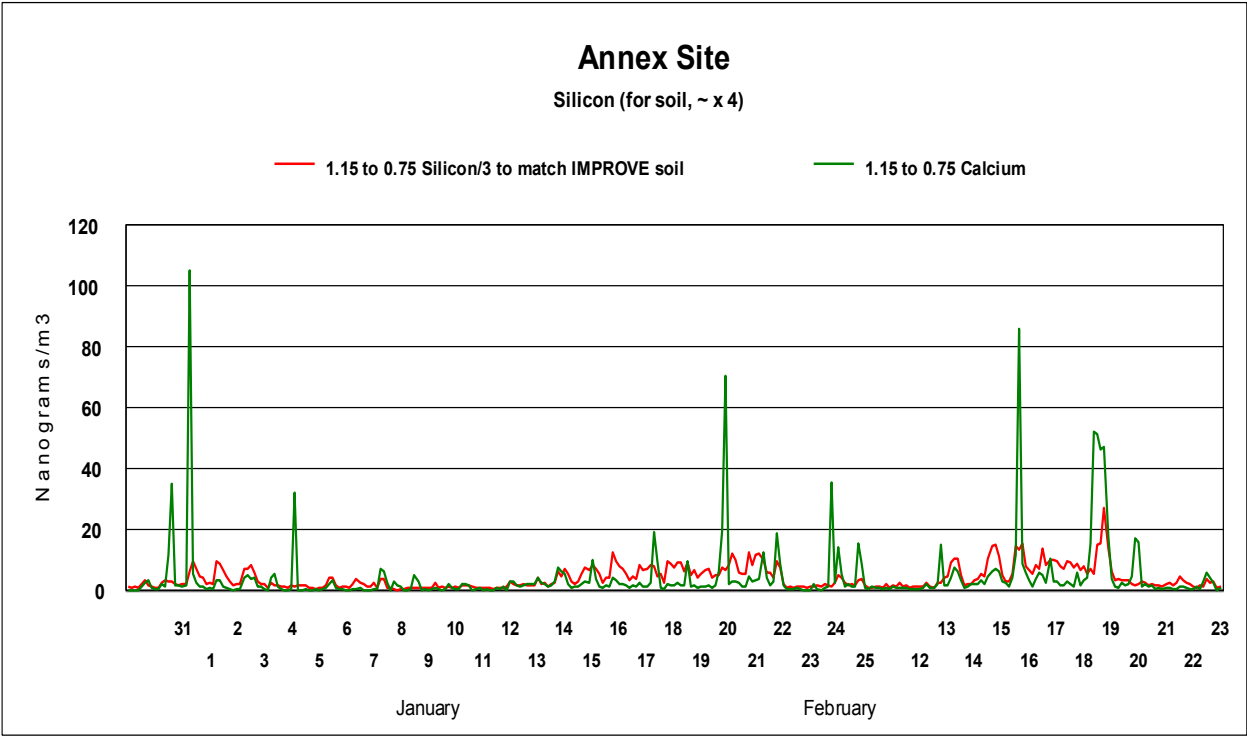


Figure 11. Calcium vs. Soil Elements

In all cases, there is excess calcium, even to particle sizes much smaller than usual for soil. These fine particles can get into the bronchial tract and upper lung, unlike the coarsest stages that are normally handled by nose and throat. They are also much more effective in forming hazes. The potential health effects have not been examined, and the impact of the various size fractions will be examined in further detail in subsequent data interpretation activities.



## Annex Size Fractions

Besides the results from the elemental analysis on a size basis, an examination of the entire sample site on a size basis alone shows similar results. Figure 12 shows enriched calcium, different from typical soil. The coarse fraction (larger than 2.5  $\mu\text{m}$ ) shows a higher ratio of calcium to other typical soil elements, which is indicative of a calcium-rich source material, i.e., limestone.

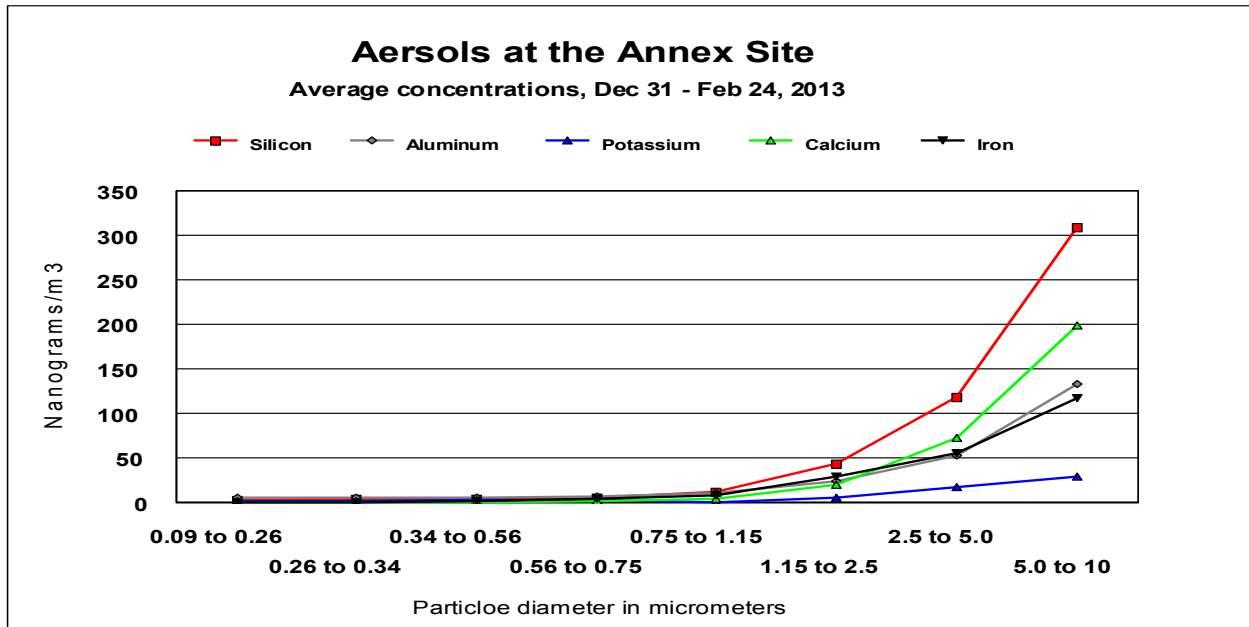


Figure 12. Typical soil elements, but enhanced by factor of 2 for calcium

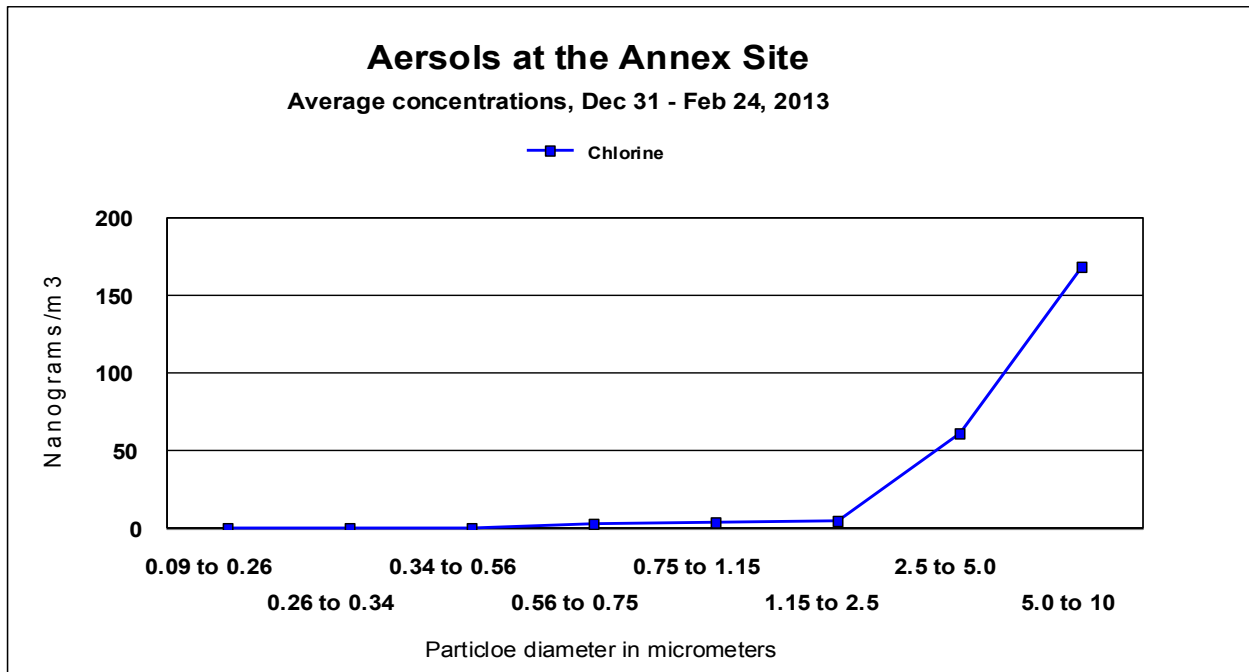


Figure 13. High levels of coarse chlorine from marine dominated air mass

Although the calcium results show an effect from an enriched calcium source, other data show the presence of oceanic influences (the presence of coarse chlorine), due to the original source of the background air masses to the area to the west and northwest. These winds result in a dilution of any near-by effect from operations.

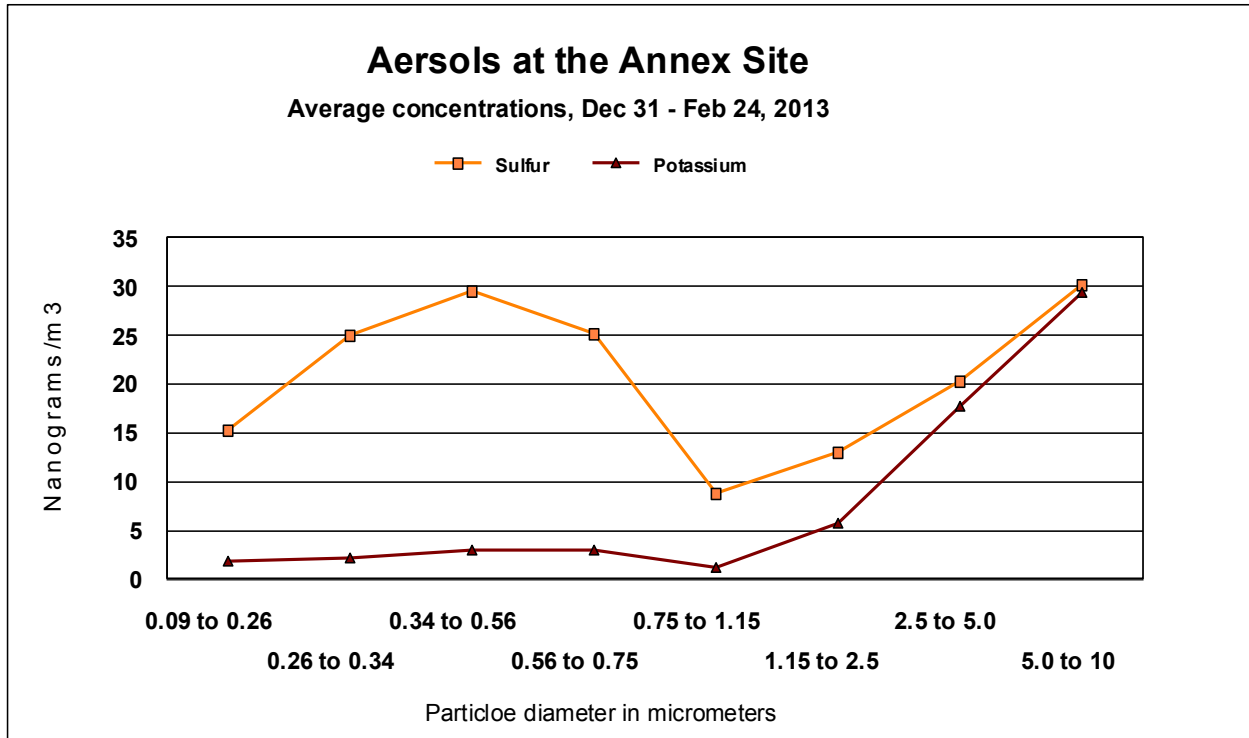


Figure 14. Low levels of sulfur and fine potassium

The question of urban impact is addressed by the presence of sulfur and fine potassium in particular. Fine potassium is a tracer for wood smoke, which was not seen, and would have been present in the January to February time period of sample collection. This suggests the sampled air was not from urban air masses to a significant degree.

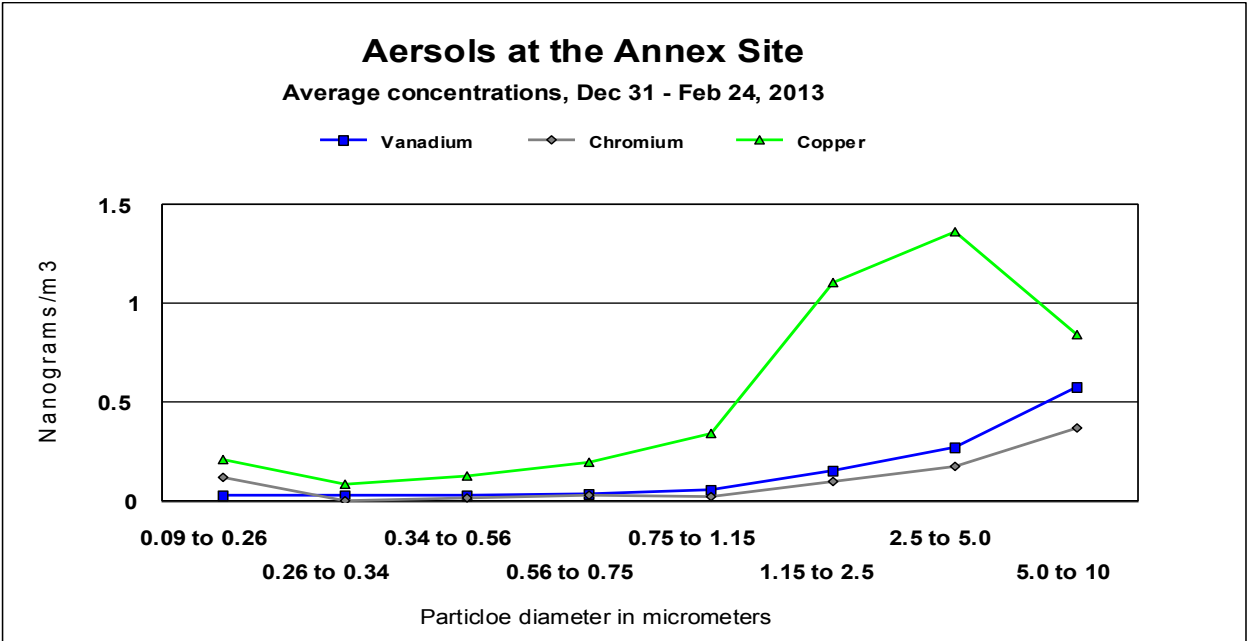


Figure 15. Low levels of toxic metals

The possible presence of toxics metals was seen to be low, as shown in Figure 15.

## **Toxics**

Several toxic sampling events have been performed or are in progress currently. The remaining time for the program will include regular sampling for these parameters, in conformance with the scope of work. Other discussion relating to enhancements of the program to address these issues are noted below.

### VOCs

Canister samples (24-hr average) for full-speciation analysis (an enhancement from the original scope for just benzene) have been collected at the Annex and PGE sites. The results show low levels of a small number of organic species, at levels consistent with relatively clean areas. The PGE site showed slightly higher levels than at the Annex, again which is consistent with other data. However, the concentrations were nearly all in the sub-ppbv concentration range, below what is considered for enhanced risk from inhalation.

### Hexavalent Chromium

Samples in progress.

### Mercury

Samples in progress.

## Program Analysis

1. Overall, the objectives of the program are being met: Data is being collected for major parameters at the three sites. The data is providing information about exposure, transport, and possible impact to site visitors and workers.
2. However, gaps in data collection and recovery have occurred, these factors have not affected the overall quality of the individual data points. The 'big picture' result remains intact, with a consistent level of confidence in the overall data quality.
3. As a result of these recognized gaps, several enhancements to the program at no additional cost are proposed in order to address the gaps and fill in as possible:
  - a) Institute more frequent regular visits. (In progress.)
  - b) Conduct toxics sampling during these visits (In progress)
  - c) Add parameters to enhance data coverage:
    - Sulfur dioxide, as a direct tracer of the plant emissions
    - Particle count, as a diagnostic for high concentration events, particularly at PGE site
    - Full VOC analysis, expanding from benzene alone to the full spectrum of volatile air toxics
  - d) Enhanced deployment of passive samplers
  - e) Lengthen the duration of the program, to include first quarter 2014, to address gaps in that time period for 2013.