

Harriet Tubman Middle School

Update: Health Risk Assessment

William Lambert, PhD

Presentation to ETAC

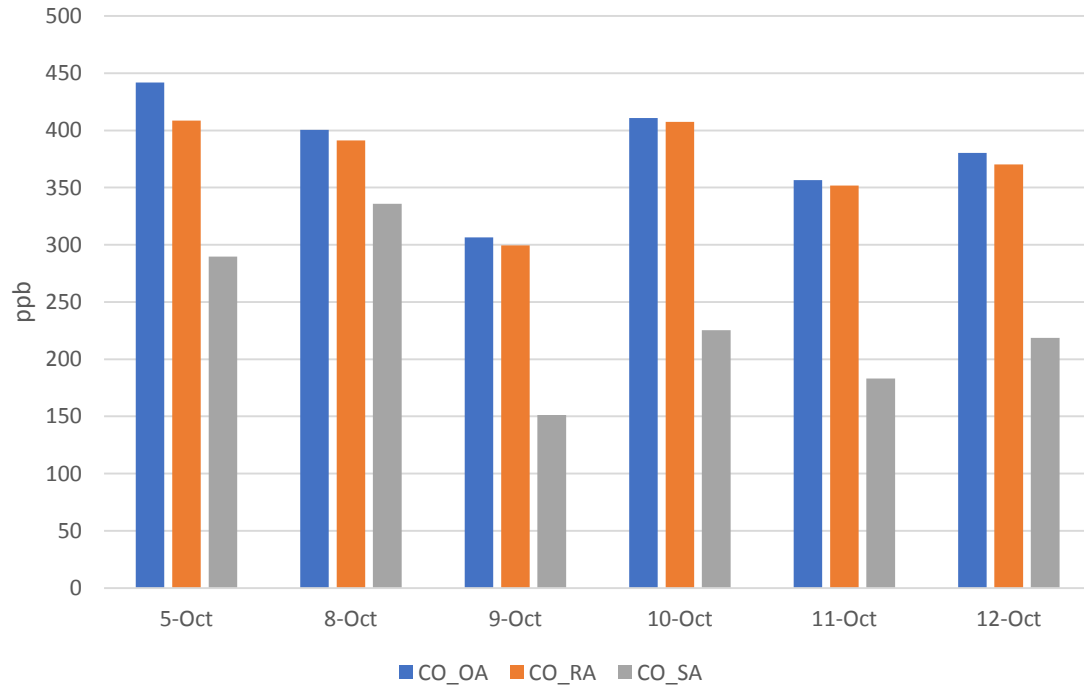
Monday Oct-29-2018

Traffic-related air pollutants of health concern

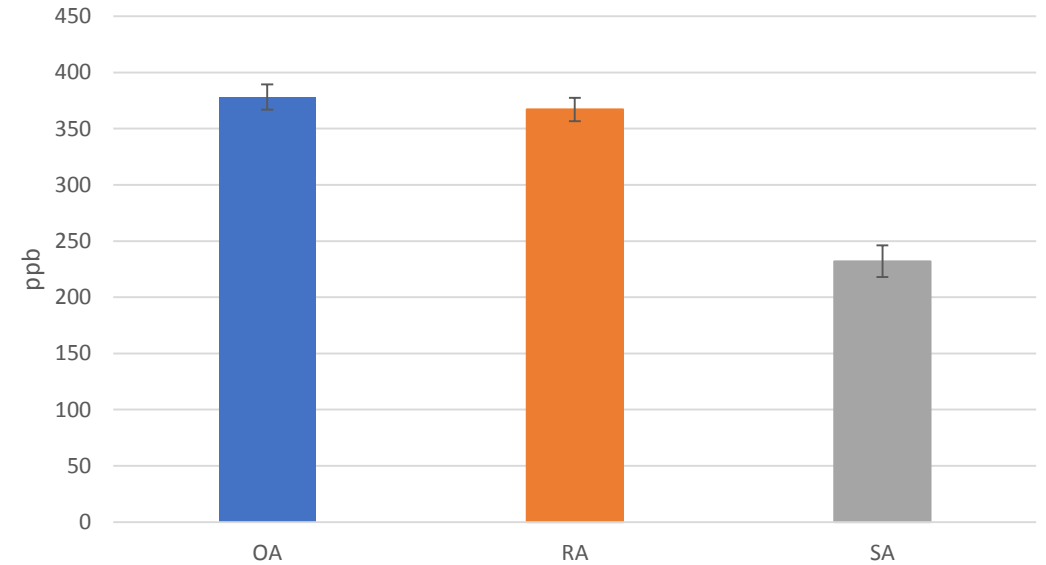
- Carbon monoxide – asphyxiant gas; cognitive functioning
- Nitrogen dioxide – upper airway irritant gas; bronchoconstrictor
- Respirable particulate matter (PM_{2.5}); lung growth and development
- UFP - < 0.1µm; lung growth and development, and possibly cognitive function
- Black Carbon (BC) – UF diesel particulate matter; chronic lifetime exposure cancer risk

Carbon monoxide

CO levels (weekdays from 9AM to 4PM)



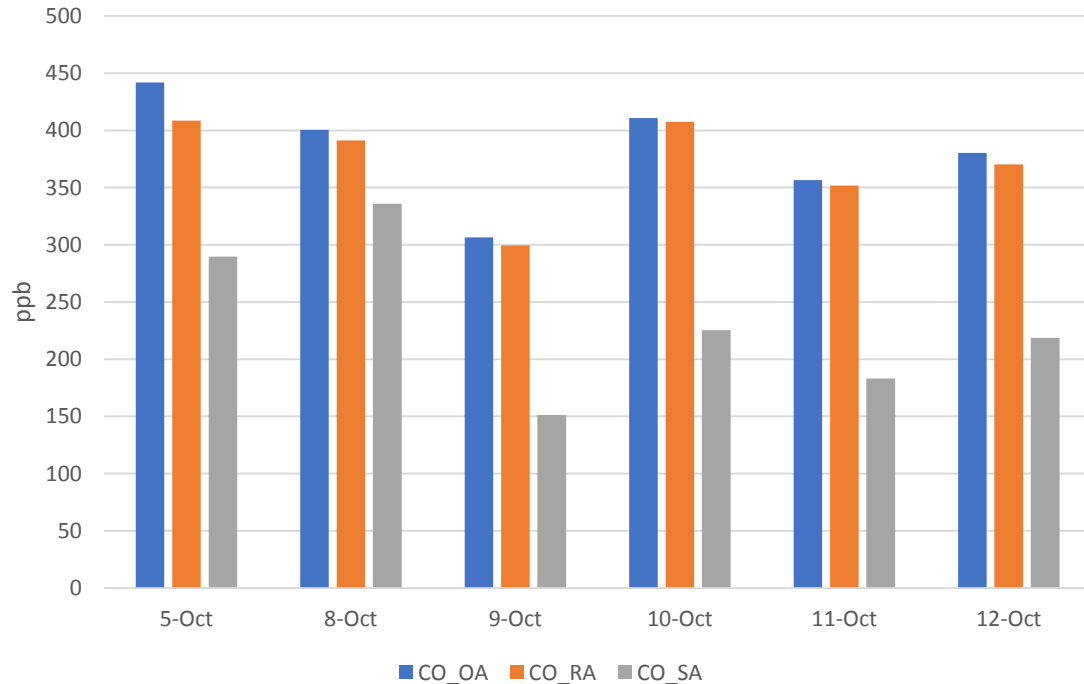
Average weekdays from 9AM to 4PM



Outdoor air hourly average levels were consistently below the 1-hr NAAQS of 35 ppm (35,000 ppb), and well below the 8-hr NAAQS of 9 ppm (9000 ppb).

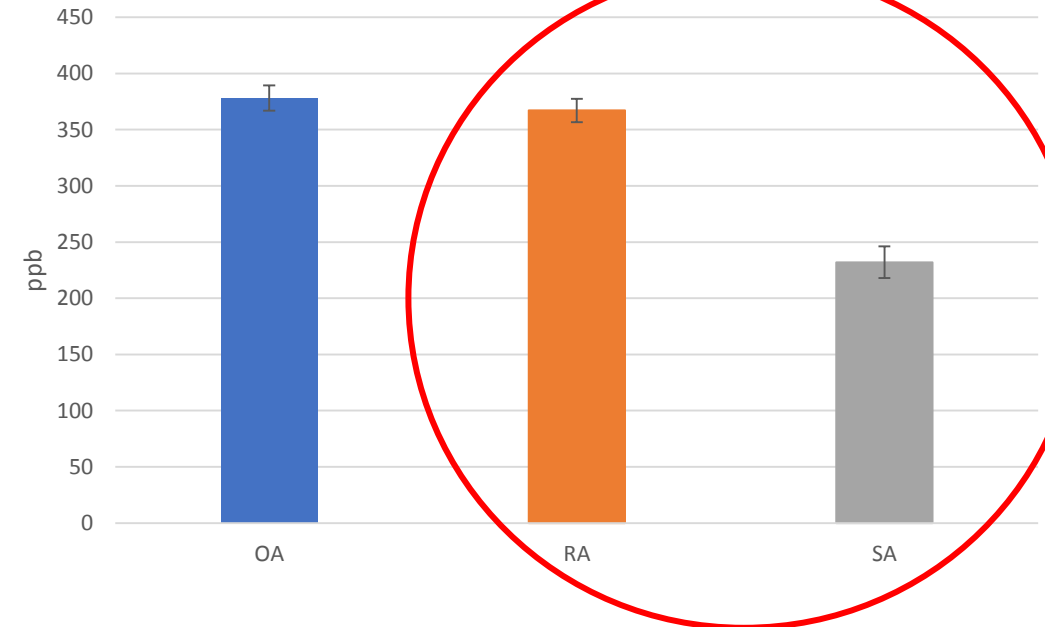
Carbon monoxide

CO levels (weekdays from 9AM to 4PM)



Not scrubbed by filter bed (expected) and infiltration is occurring. Even so, indoor concentrations are well below levels of health concern.

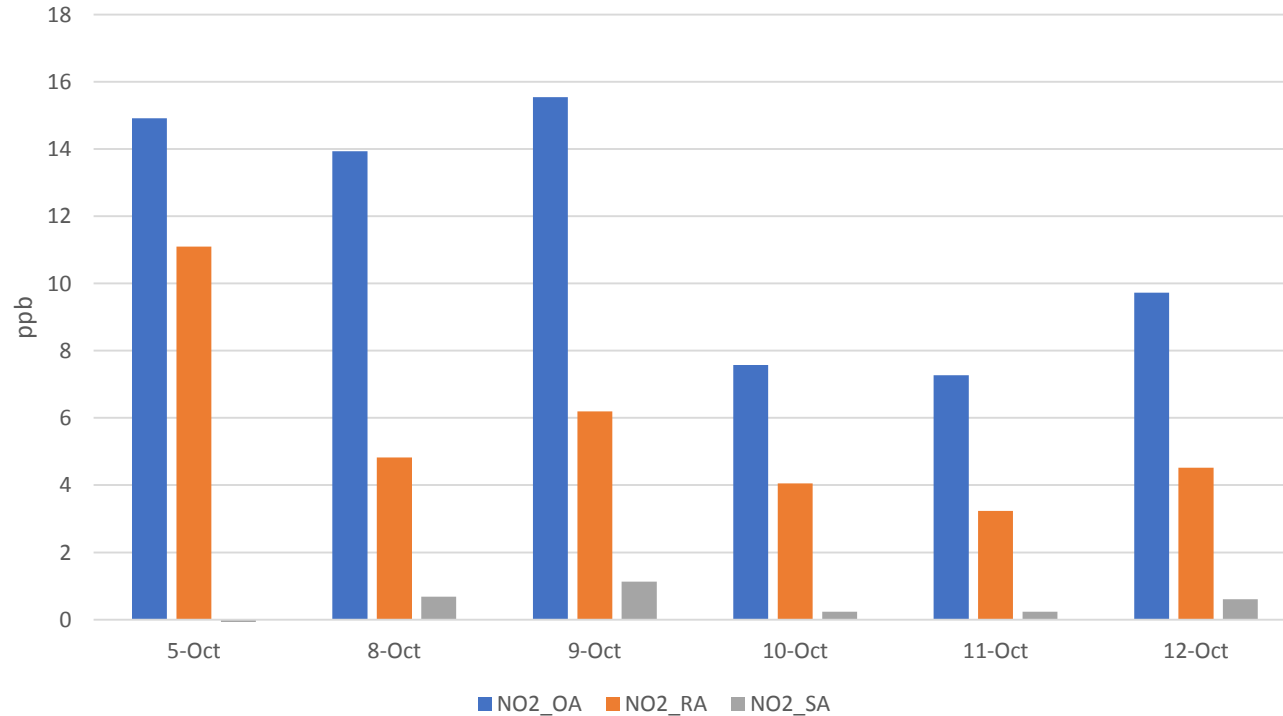
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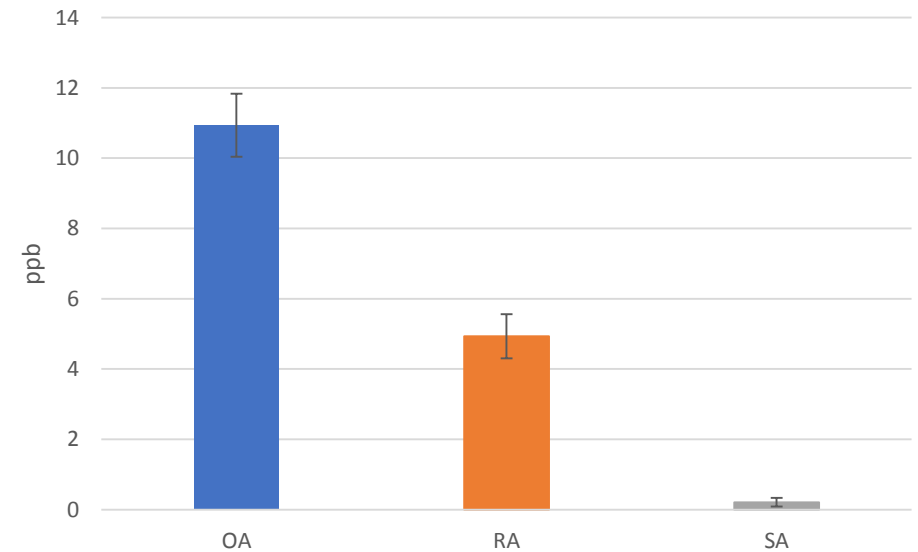
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Nitrogen dioxide

NO2 levels (weekdays from 9AM to 4PM)



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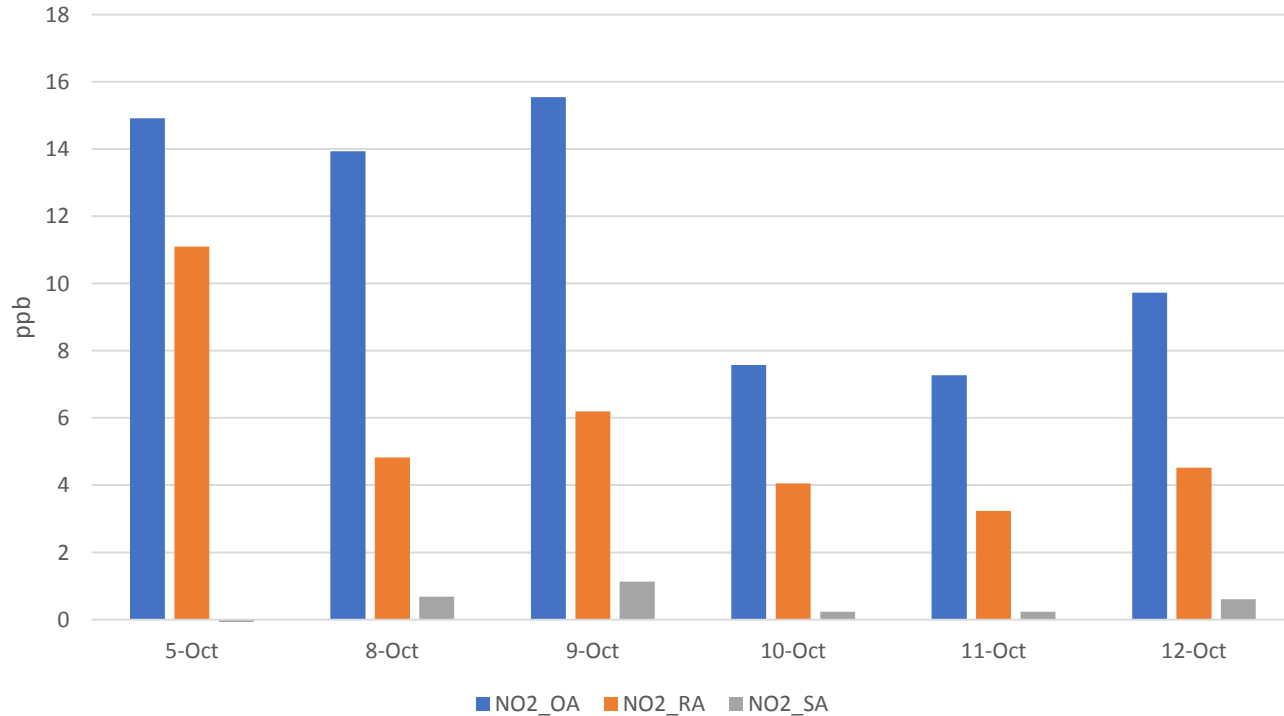


Outdoor hourly average levels were substantially below the 1-hr NAAQS of 100 ppb, and below the annual NAAQS of 53 ppb.

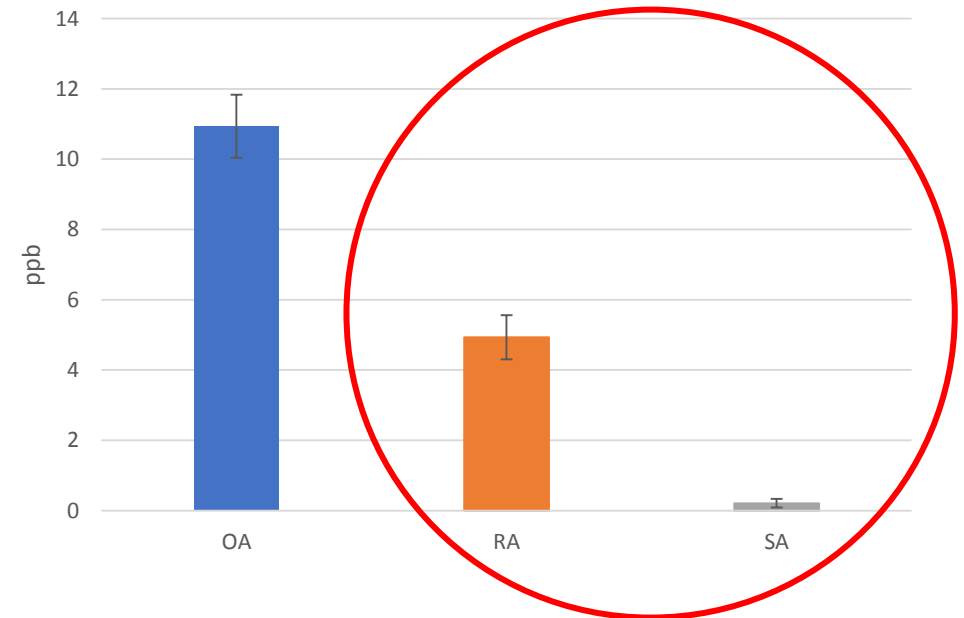
Nitrogen dioxide

Almost completely scrubbed by filter bed, and some infiltration is observed. However, indoor levels are well below the NAAQS.

NO2 levels (weekdays from 9AM to 4PM)

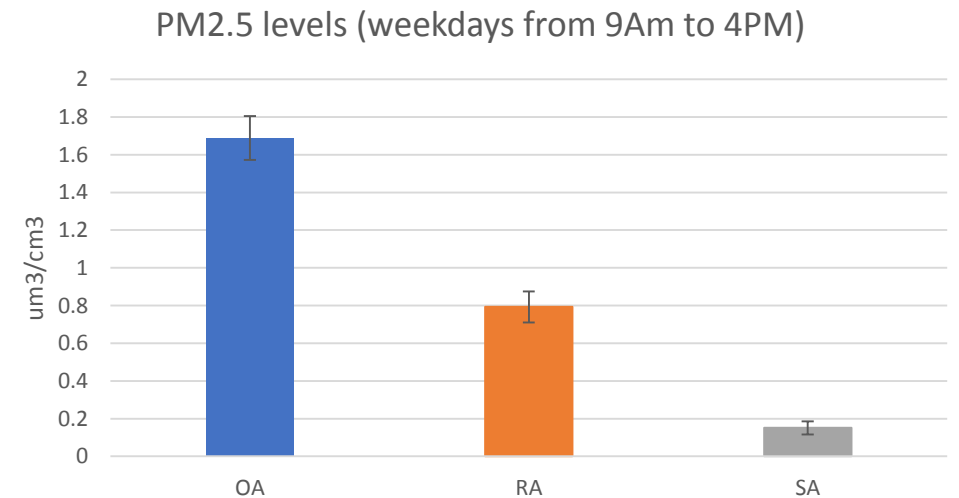
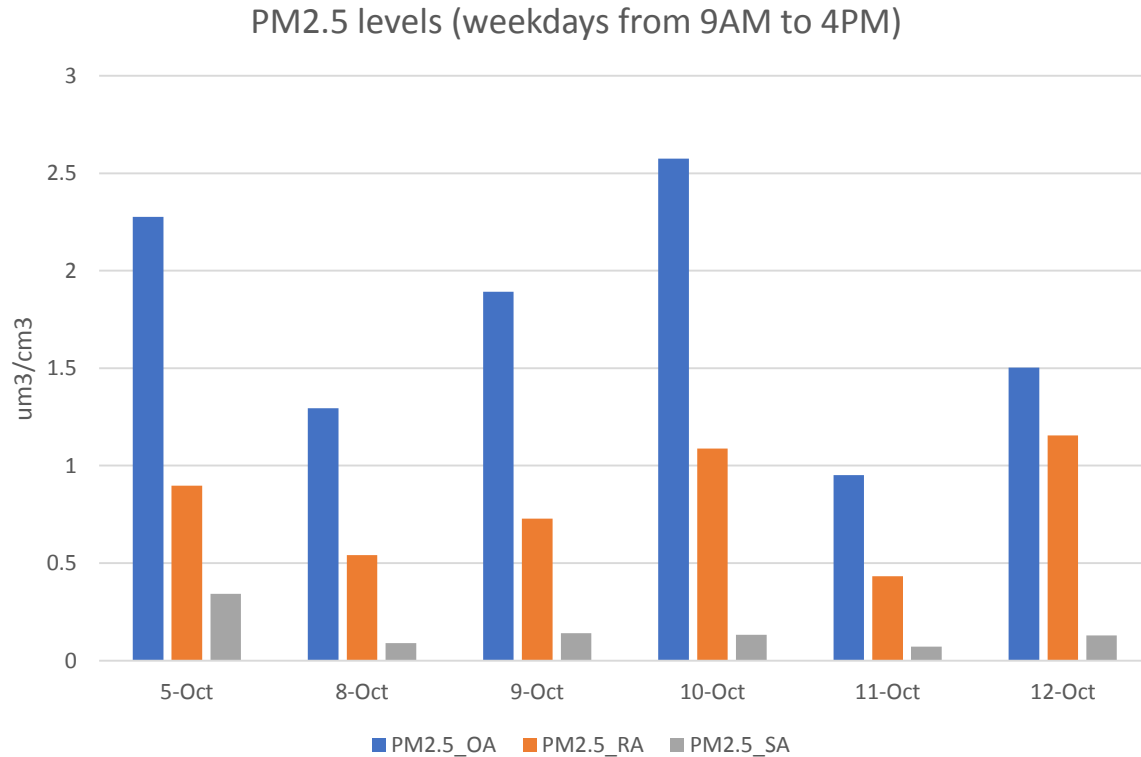


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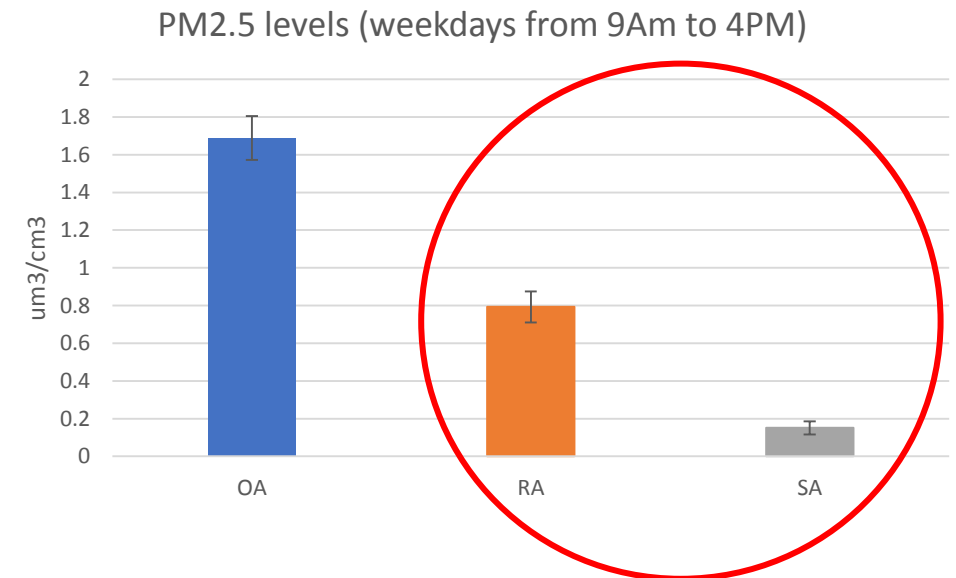
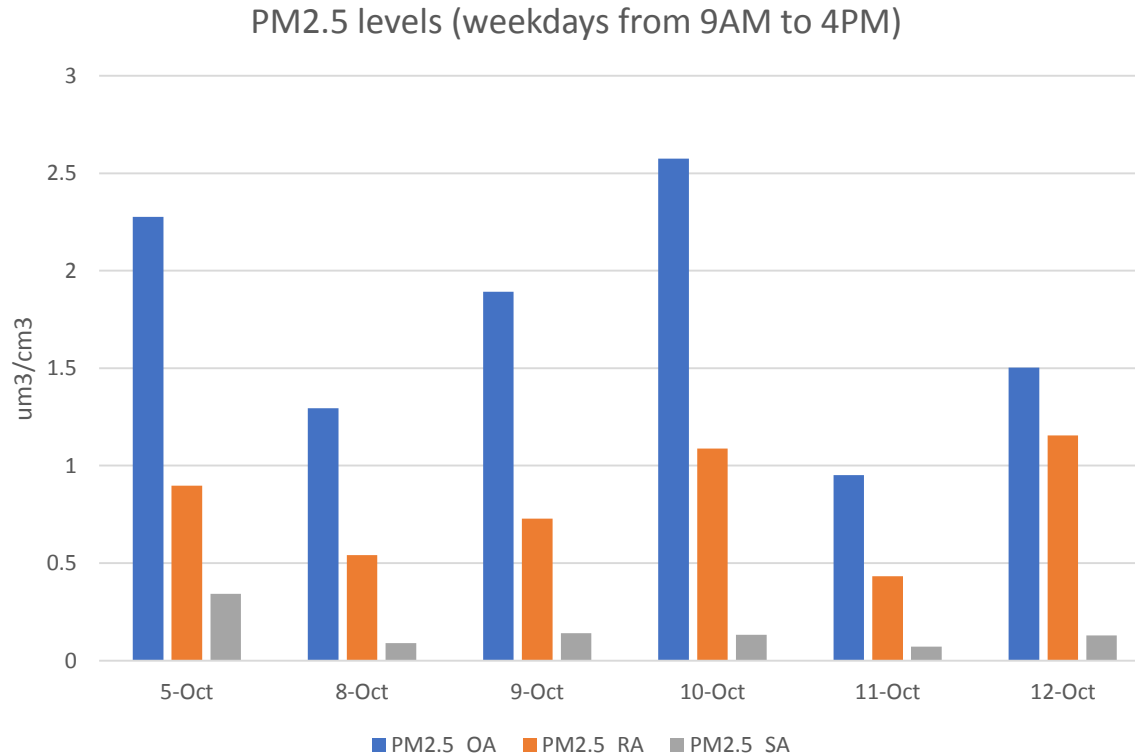
PM_{2.5}



Outdoor hourly average levels were substantially below the 1-hr NAAQS of 35 $\mu\text{g}/\text{m}^3$ and well below the annual NAAQS of 12 $\mu\text{g}/\text{m}^3$.

PM_{2.5}

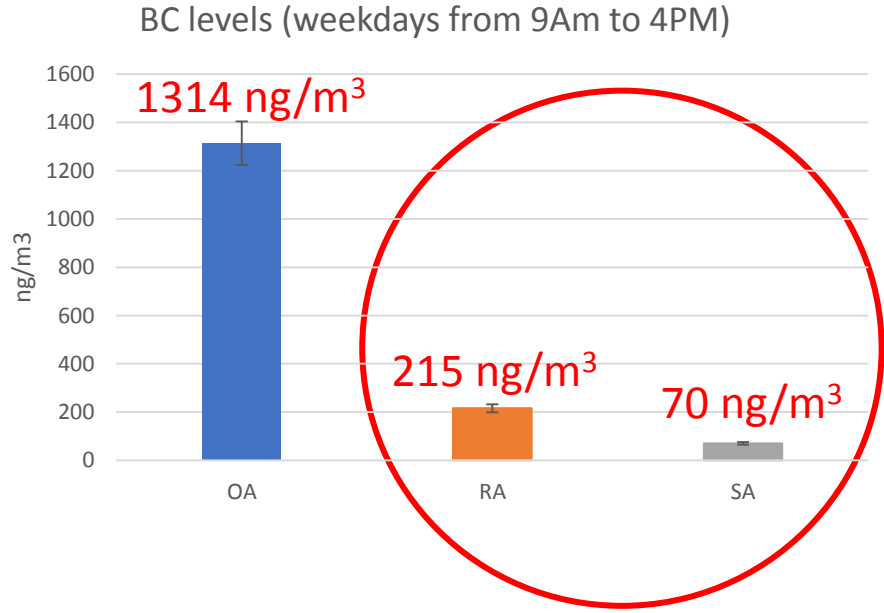
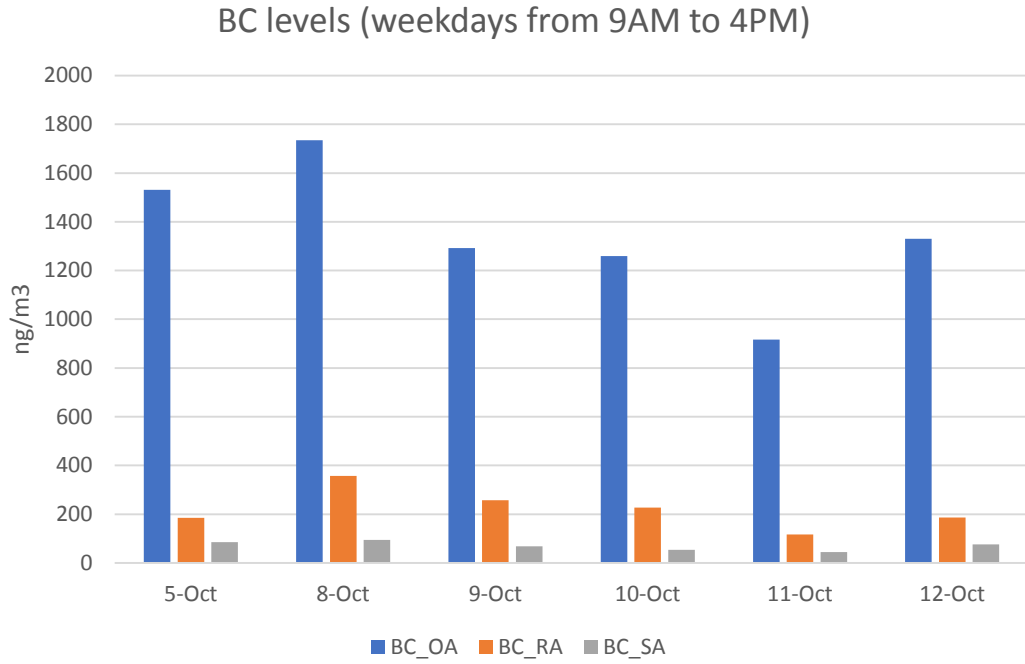
Even the low outdoor levels are well scrubbed by filter bed, but some infiltration is observed. Even so, indoor levels are well below the NAAQS.



Outdoor hourly average levels were substantially below the 1-hr NAAQS of $35 \mu\text{g}/\text{m}^3$ and well below the annual NAAQS of $12 \mu\text{g}/\text{m}^3$.

Black Carbon

Outdoor levels of BC, which is primarily associated with diesel, are well scrubbed by the filter bed, but some infiltration is observed. Despite some infiltration, indoor levels of BC remain very low.

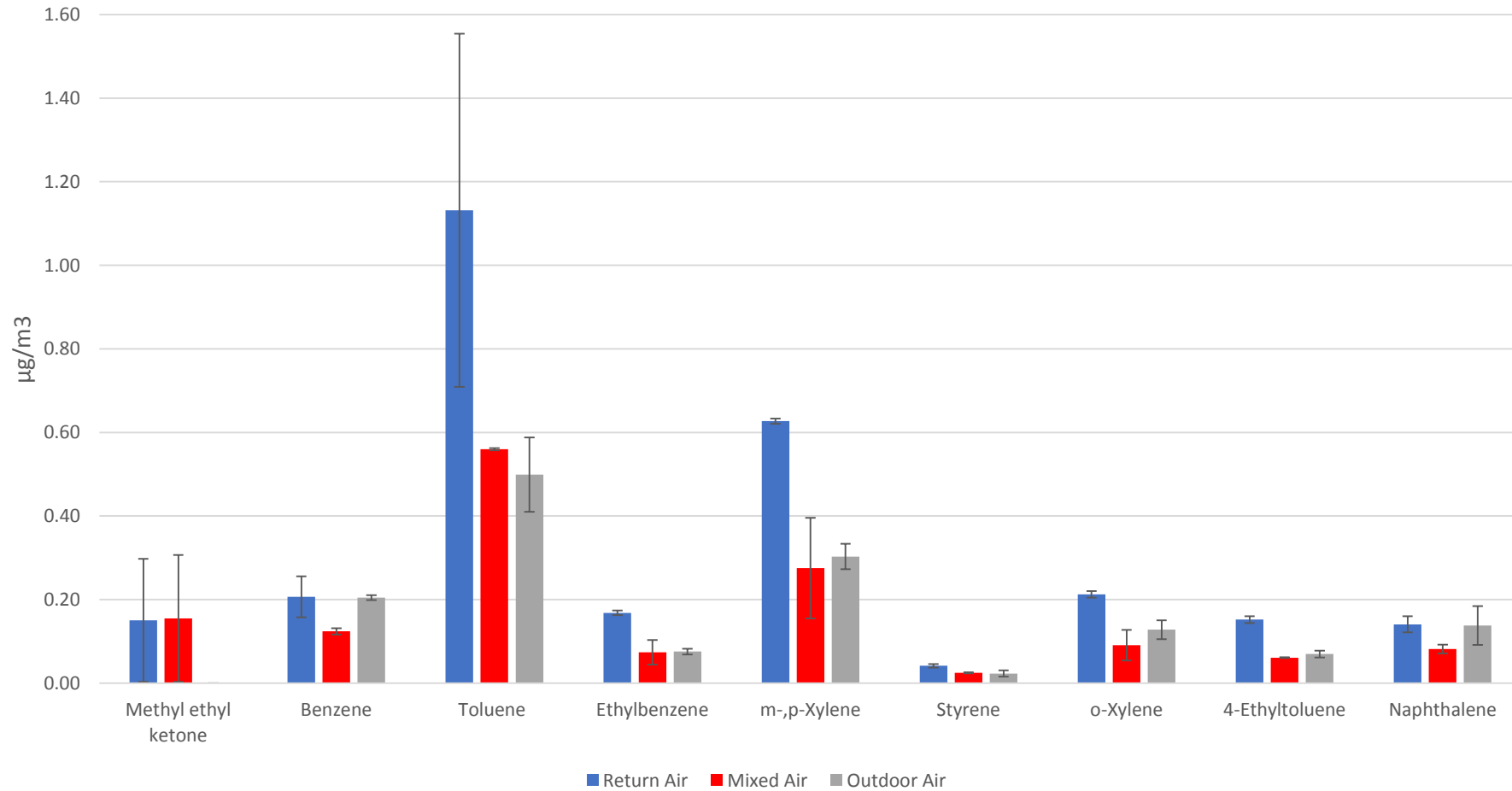


Indoor hourly average levels are low and closely approach the Oregon DEQ's ABC of 100 ng/m³.

Volatile Organic Compounds (VOCs)

Date: 11-12 Sept 2018

Comparison Upstream/Downstream



Average 2 replicates

VOCs

September monitoring (pre-Oct-06)

1. VOC levels indoors appear to be decreasing post-renovation
2. Some measured removal efficiencies are below the 99% stated design:
 - Benzene: 67%
 - Toluene: 49%
 - Xylene: 94%
 - Ethylbenzene: 91%
3. Continued testing post-renovation and possible optimization of flowrates and residence time in the carbon filter bed

Chemical	Portland Backgrnd $\mu\text{g}/\text{m}^3$	Oregon DEQ ABC $\mu\text{g}/\text{m}^3$	Outdoor Air $\mu\text{g}/\text{m}^3$	Return Air $\mu\text{g}/\text{m}^3$
Benzene	0.59	0.13	0.20	0.21
Toluene	1.12	400	0.50	1.13
Xylene(s)	1.28	700	0.84	0.43
Ethylbenzene	0.3	0.4	0.08	0.17

Indoor average levels of VOCs are below the Oregon DEQ's ABCs, except for benzene. However, indoor benzene levels are substantially reduced.

VOCs

ABCs represent protection against 1 excess cancer in-a-million over a 70-year exposure.

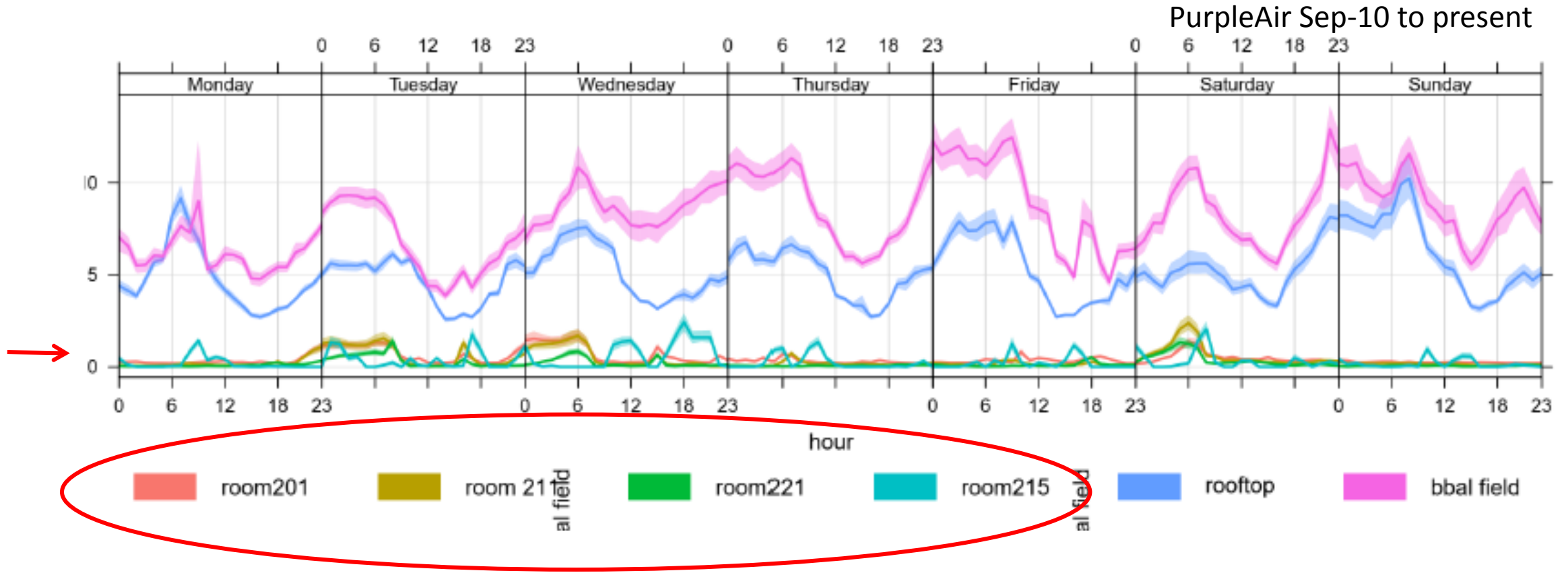
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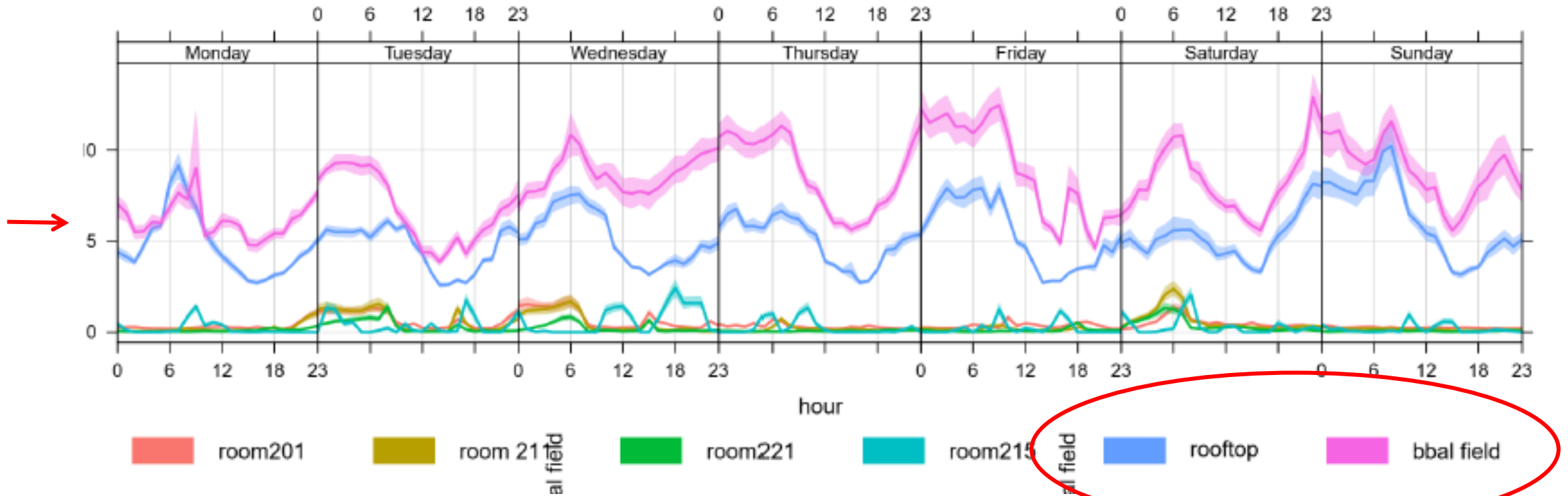
Classroom levels of PM_{2.5}



- Classroom levels of PM_{2.5} were generally less than 10% of outdoor levels.
- No substantive difference was observed I-5 relative to Flint Avenue side.
- Indoor levels are well below the 24-hr NAAQS of 35 µg/m³ and annual NAAQS of 12 µg/m³.

Outdoor levels of PM_{2.5}

PurpleAir Sep-10 to present

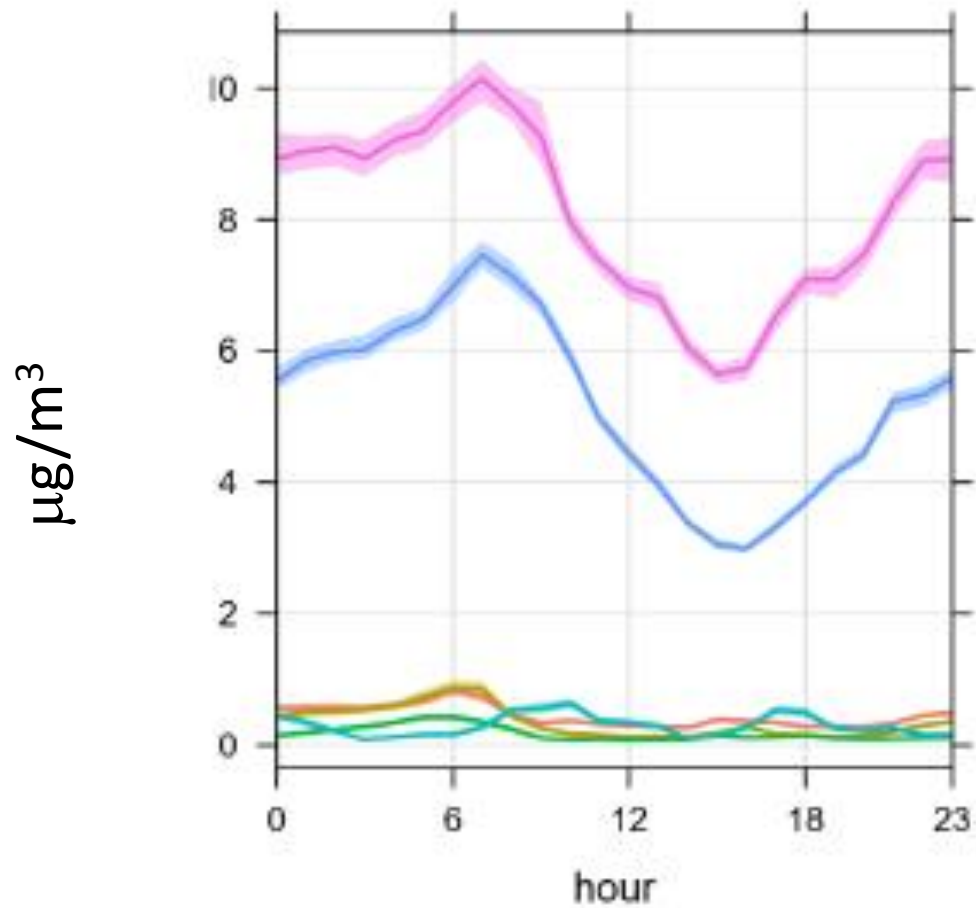


- Hourly outdoor pollution levels followed patterns consistent with those observed in March-April.
- Concentrations drop by late morning.
- Basketball court levels are higher than the rooftop near HVAC intake.
- Levels are below 24-hr NAAQS of 35 µg/m³ but closer to annual NAAQS of 12 µg/m³.

Walking transects and UFP counts

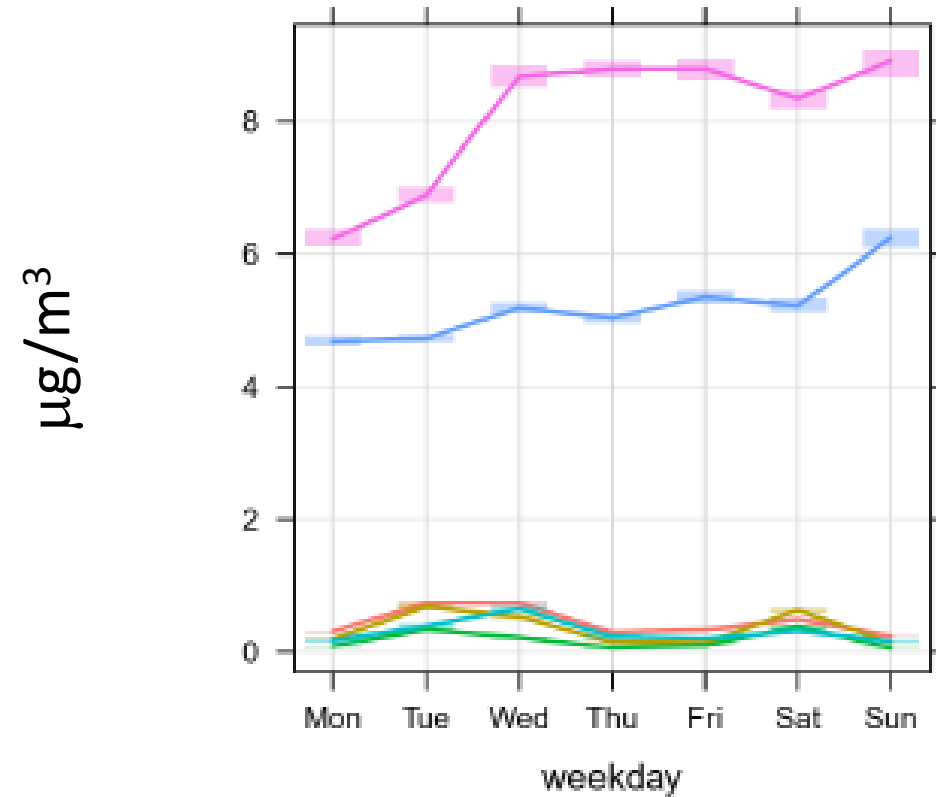
Location	Time	Ultrafine Particle Counts (median)	
		Wed Oct-10	Mon Oct-15
Park	Morning 8-9 AM	13,000	39,000
Park	Morning 9-10 AM	26,000	43,000
Lunch 1	Noon hour 11:15-12 PM	10,000	15,000
Lunch 2	Noon hour 12-12:45 PM	8,000	16,000
Park	Afternoon 1-2 PM	13,000	14,000
Dismissal on Flint Ave	Afternoon 3:34-4:15 PM	6,800	6,600
Neighborhood	Afternoon 4:15 PM & later	---	5,400

Daily patterns of PM_{2.5}



AVERAGE BY HOUR OF WEEKDAY

PurpleAir Sep-10 to present



AVERAGE 9am – 4 PM BY WEEKDAY

Limitations

- Further monitoring is needed to evaluate the consistency of HVAC performance over a longer period of time.
- Adjustments in the delivery of filtered air to various indoor zones may further reduce infiltration of particles and NO₂ through walls and windows.
- Adjustment of flow rates in the air handling system may optimize residence time to achieve greater removal of VOCs in the carbon bed.

Preliminary Conclusions

- Early monitoring provides evidence that the HVAC system is generally performing according to design specifications.
- The air delivered to indoor locations in the school is safe and supportive of health for students and staff.
- As we observed in March-April, the highest outdoor levels of roadway pollutants occur in the morning hours.
- Even though the outdoor levels of the major pollutants are elevated, they remain below levels of health concern as compared against the available federal health standards.
- The HVAC filtration and carbon bed system reduces these levels even further.

Questions and Discussion