IAQ Management with a Human Health Score

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Building 4 Health

Building Science Summer Camp

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Hello again. I am busy, we all are busy!

& Luigi

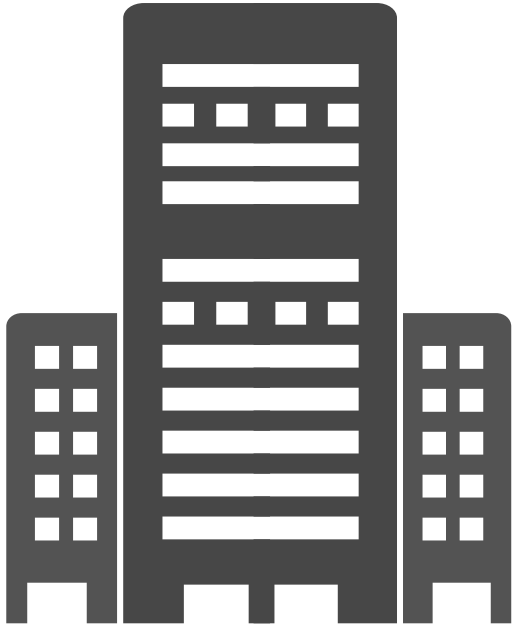
Picking up from last year.....

Me as a medical student, working in Papua New Guinea

Non-hygienic appearing conditions, yet few infections

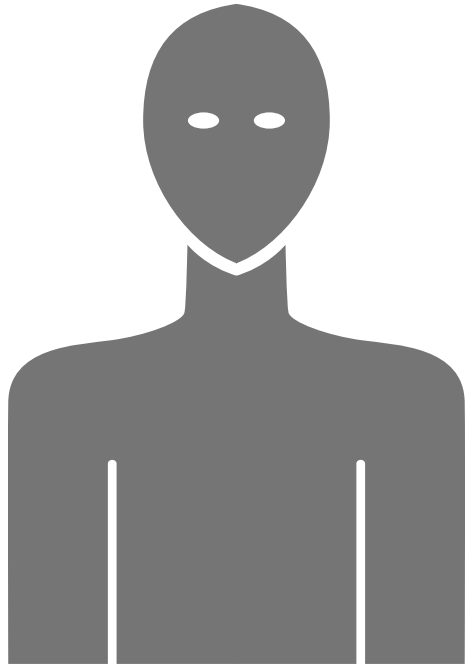
Wewack General Hospital, Papua New Guinea 1983

We have a serious disconnect in managing the human environment for health



Building Management

- Conserve energy
- Avoid disasters
- Follow best practices and codes



Medicine

- Heal patients
- Follow clinical protocols
- Avoid lawsuits

Occupant health should be the focus of IAQ management in occupied buildings!

Indoor exposures are clearly important, but there are additional IAQ influences that also impact health

Impact of IAQ on human immunity

Quantity and infectivity of bio-aerosols (Wells Riley)

Metrics included in a Human Health Score for IAQ

Impact of IAQ on human tissues

Influence of IAQ and building materials on the indoor microbiome

B4H Vital Signs™ is a diagnostic tool that integrates toxicology, epidemiology and medical research to determine the real time influence of IAQ on the human body and microbial transmission.

Identify comprehensive IAQ constituents that alone and in combination impact occupant health

Thermal (temp and RH);

- mucosal hydration
- immune functioning
- heart rate and blood pressure

Particulate matter (3 bins):

- airway irritation, allergic reactions
- clotting (strokes, heart attacks, DVTs)
- bioaerosol carriers and surrogate measurements

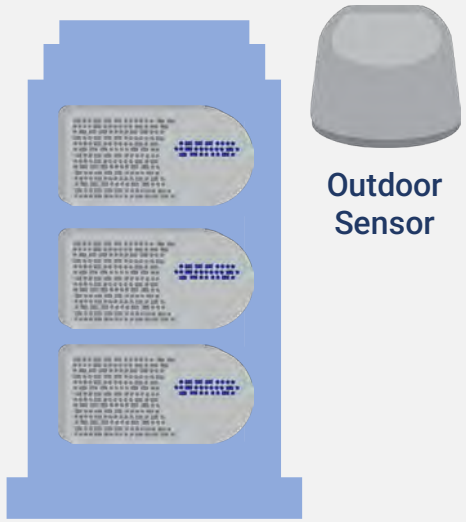
Gases (polar and nonpolar)

- airway inflammation
- skin penetration
- cognitive impact

MANAGING IAQ WITH A HEALTH SCORE

MEASURE

1 CONTINUOUSLY MONITOR INDOOR & OUTDOOR AIR



Outdoor Sensor

Indoor Sensors

ANALYZE

2 CALCULATE IAQ HEALTH SCORE

B4H Vital Signs

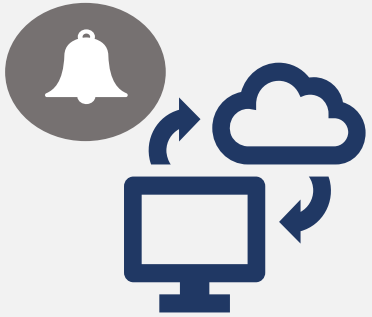
Health Score 1-100

REPORT

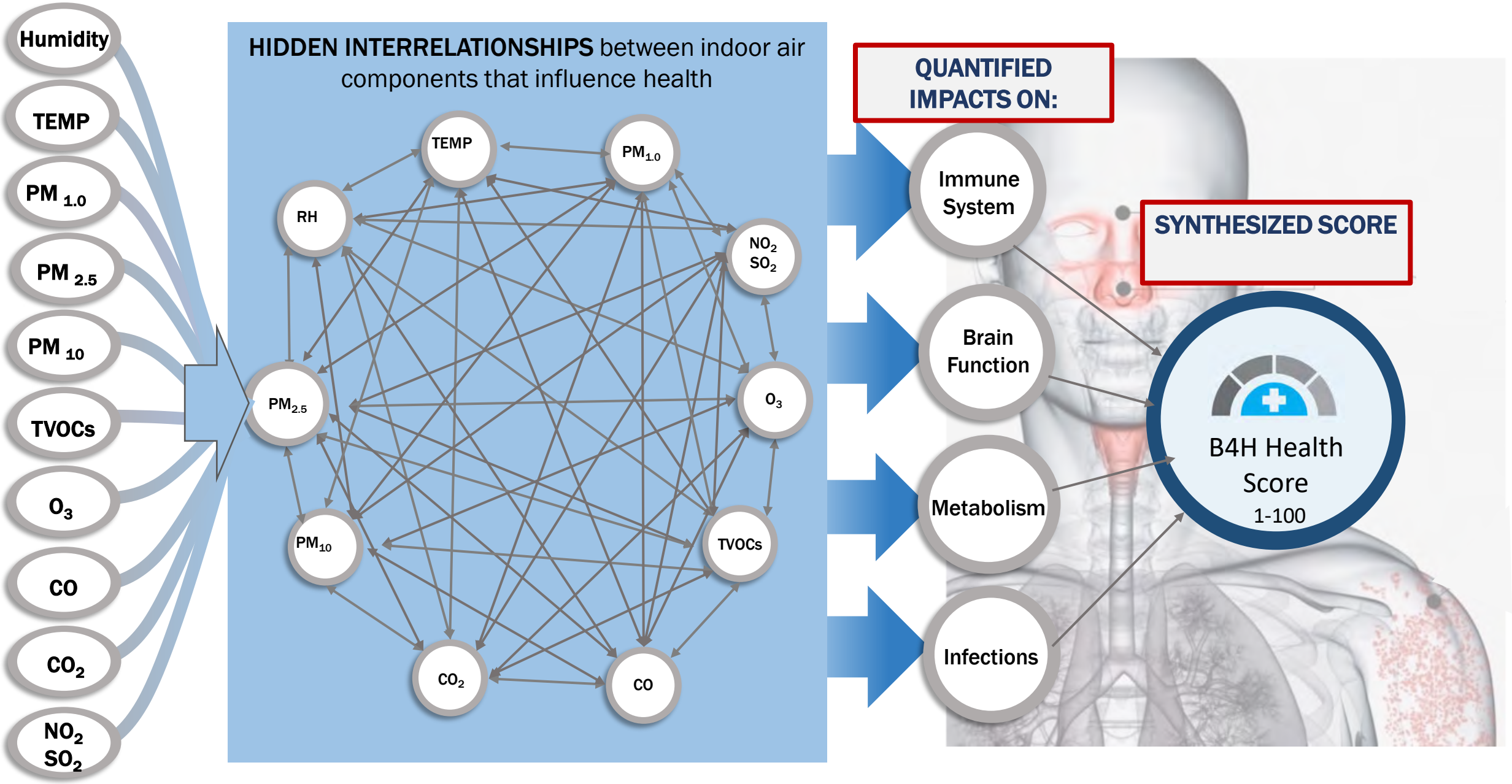
3 REPORT INDOOR & OUTDOOR SCORES

REMEDIATE

4 VENTILATE, FILTER, HUMIDIFY or "CLEAN" the AIR



Holistic Analysis of the Impact of IAQ on Human Physiology



Communicate Findings

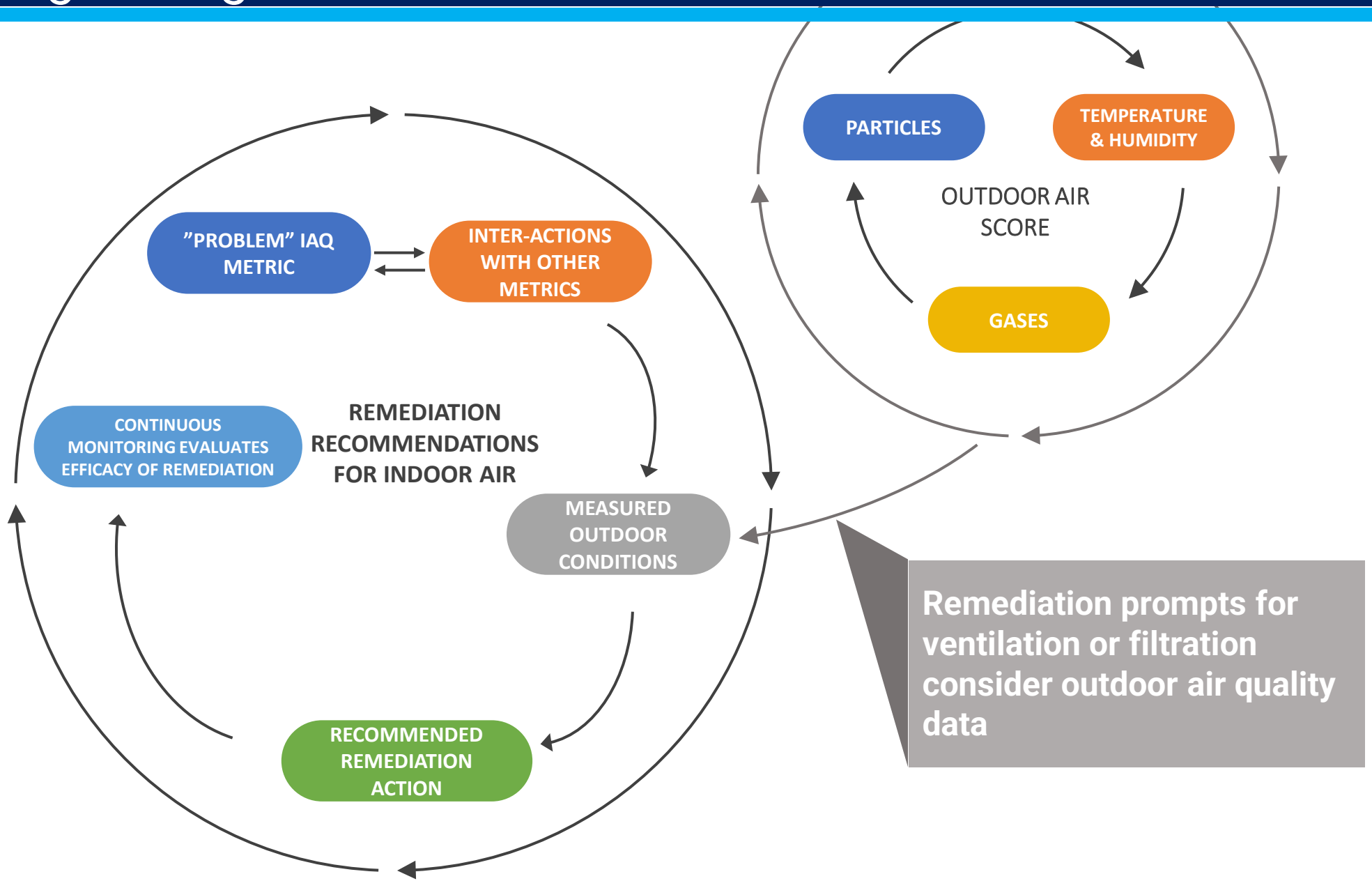
Stream real time indoor and outdoor data from multiple devices to dashboard

Visualize your indoor Health Score and data trends across building and portfolio sensors

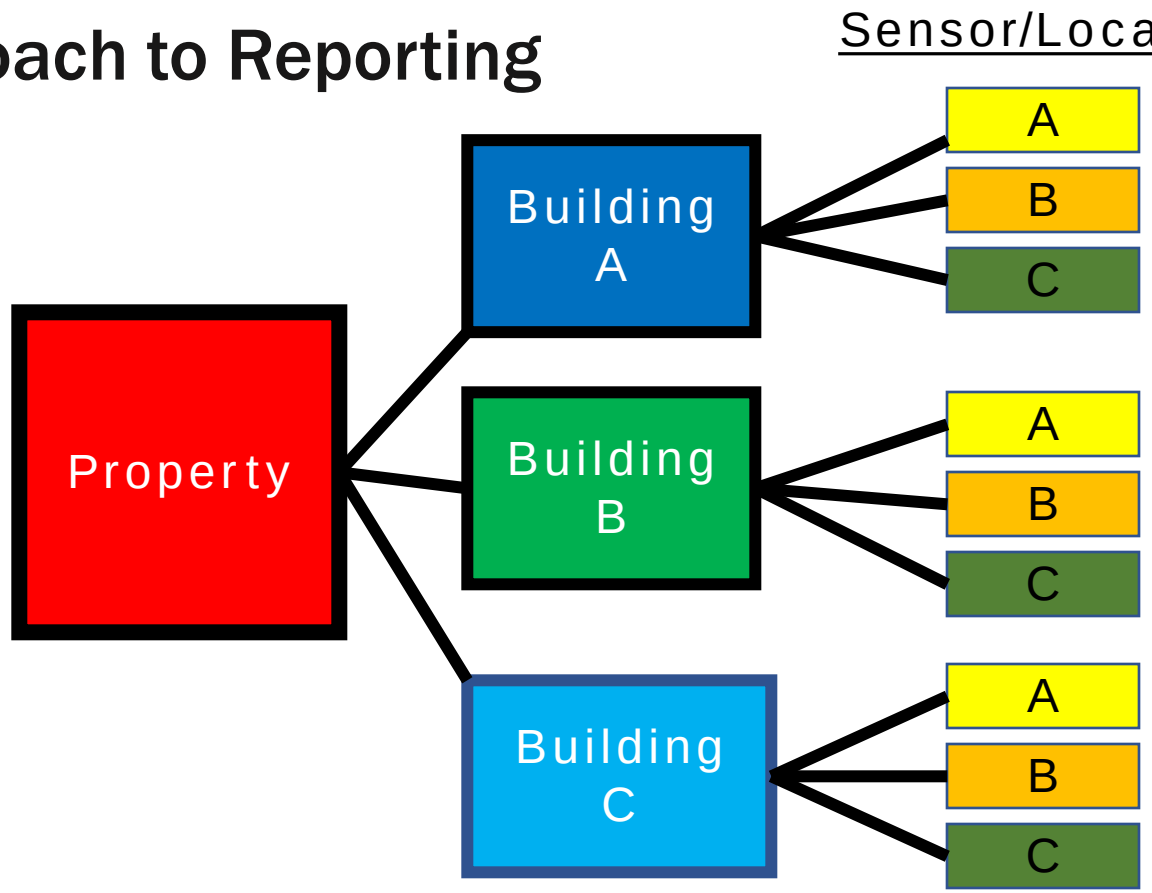
Communicate timely alerts and remediation recommendations

- Scalable
- Cloud-based
- Latest security protocols
- WiFi Enabled
- API Availability
- Graphing and reporting

Continuous monitoring of indoor and outdoor metrics guides efficient IAQ and building management



B4H Approach to Reporting



- For Selected Buildings, Compare Sensors in Different Locations
  - >Levels
  - >Trends
  - >Events

Identify Problem Locations, & Issues to identify causes & Define Remedies

- Compare Buildings
  - >Levels
  - >Trends
  - >Events

Identify Buildings With Potential Health Risks

Healthier Environment

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Sensor Locations

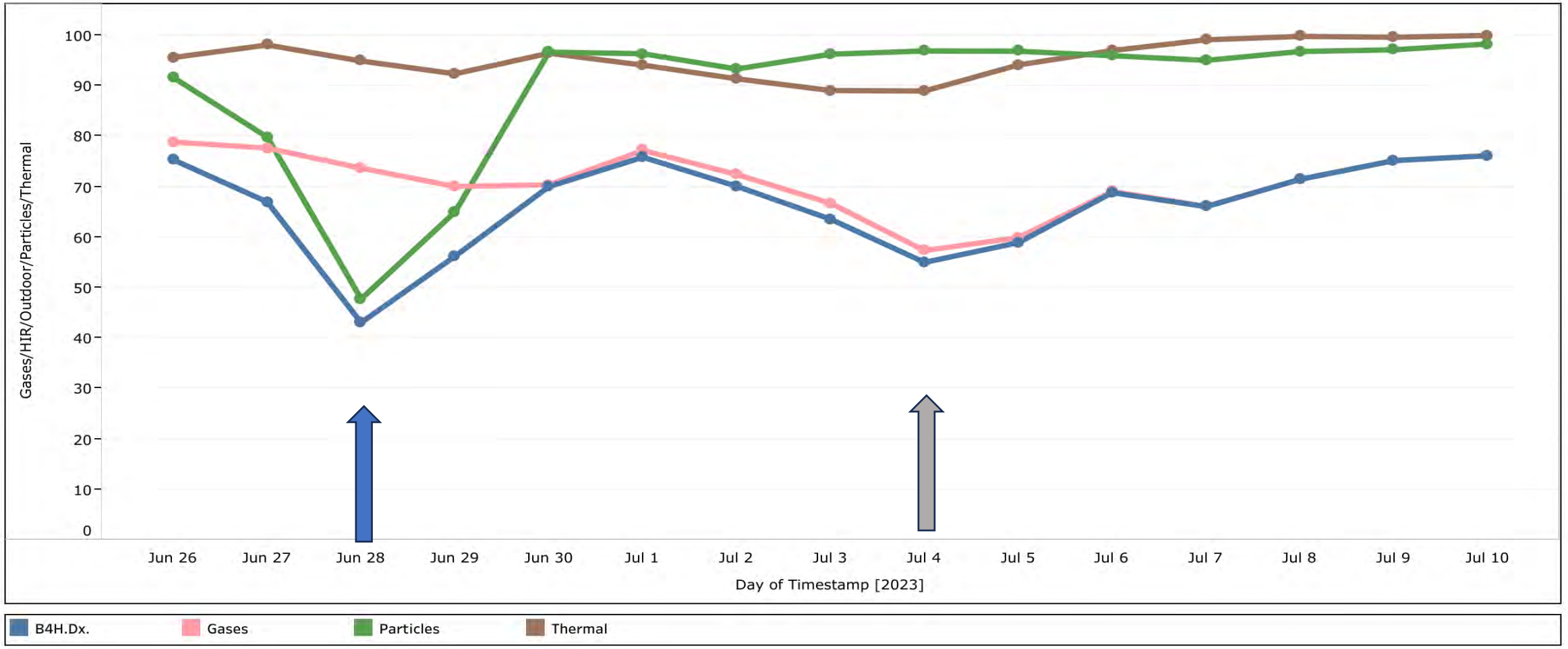
Reporting Period 06. 26. 2023 – 07.10.2023

Building Details

Plymouth, MN

SENSOR #81442313006	Maple Conference Room 2nd Floor
SENSOR # 81442313008	Aspen Dining Room 1st Floor
SENSOR # 81442313049	Maple Dining Room 2nd Floor
SENSOR # 81442313053	Tamarac Dining Room 3rd Floor
SENSOR # 81442313053	Office / IT Room Lower Level
SENSOR # 8145002314050	Outdoor Sensor

Vital Signs Average Score for All Indoor Sensors

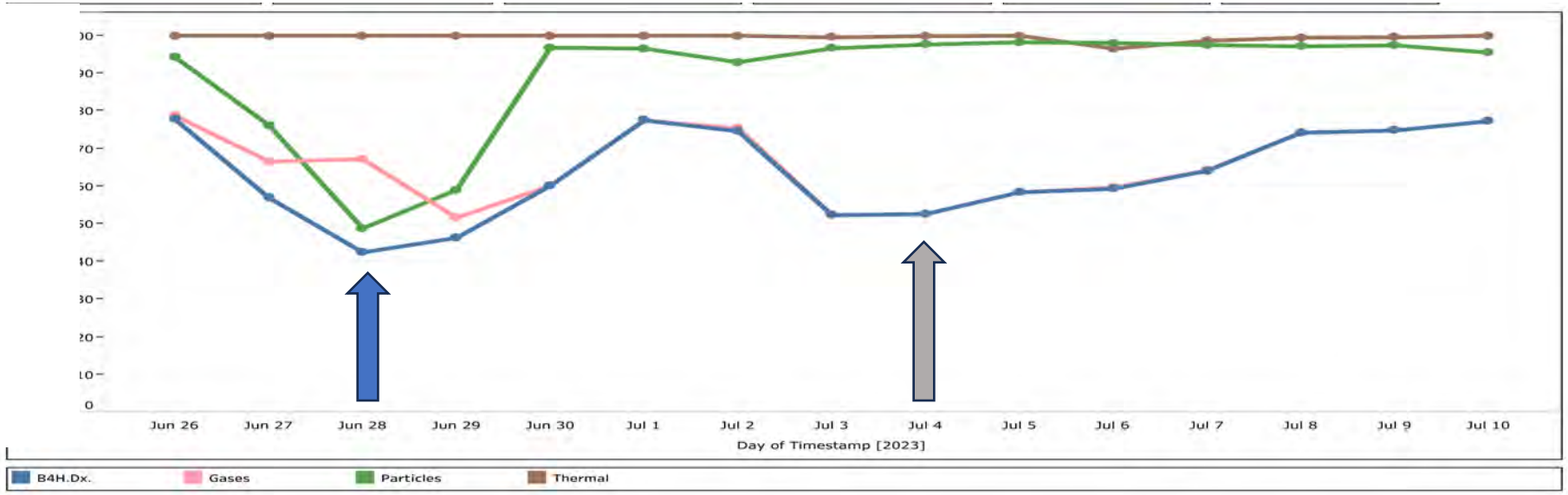


Something happened June 28, driven by particles

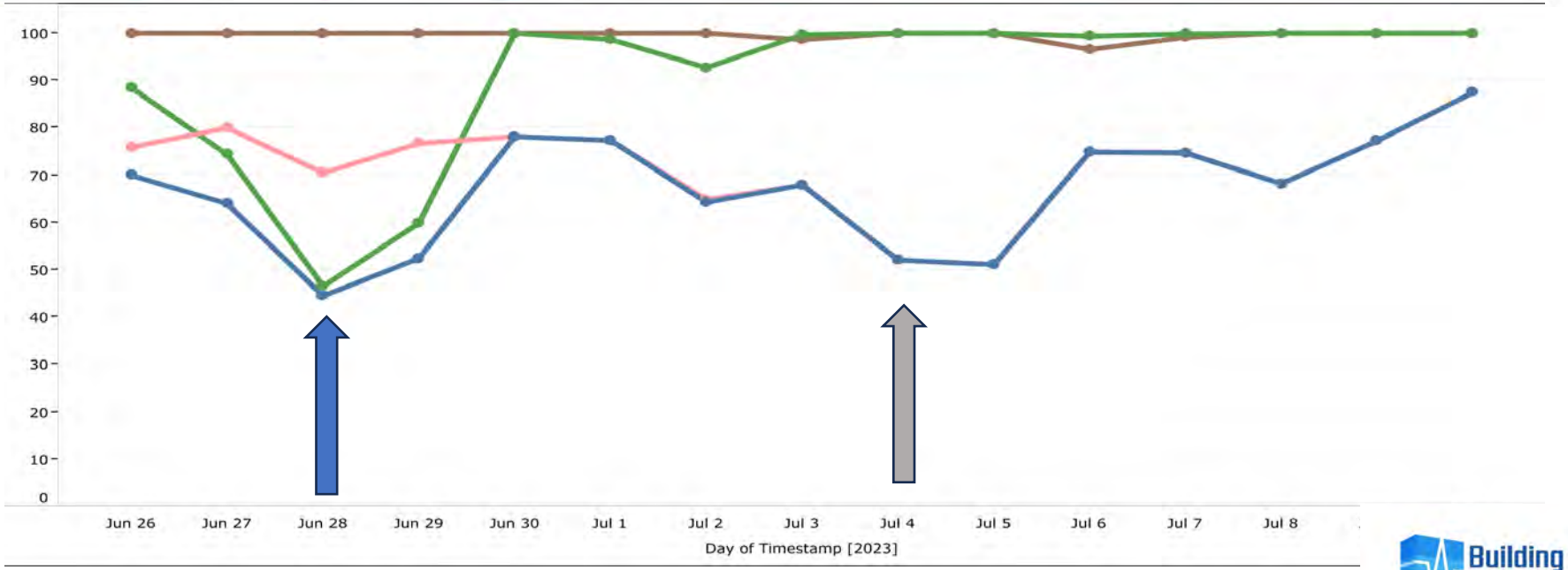
Something happened July 4, driven by gases

Vital Signs Scores for Individual Indoor Sensors Reporting Period 06.26 – 07.10.2023

Maple Conference Room
2nd Floor



Maple Dining Room
2nd Floor



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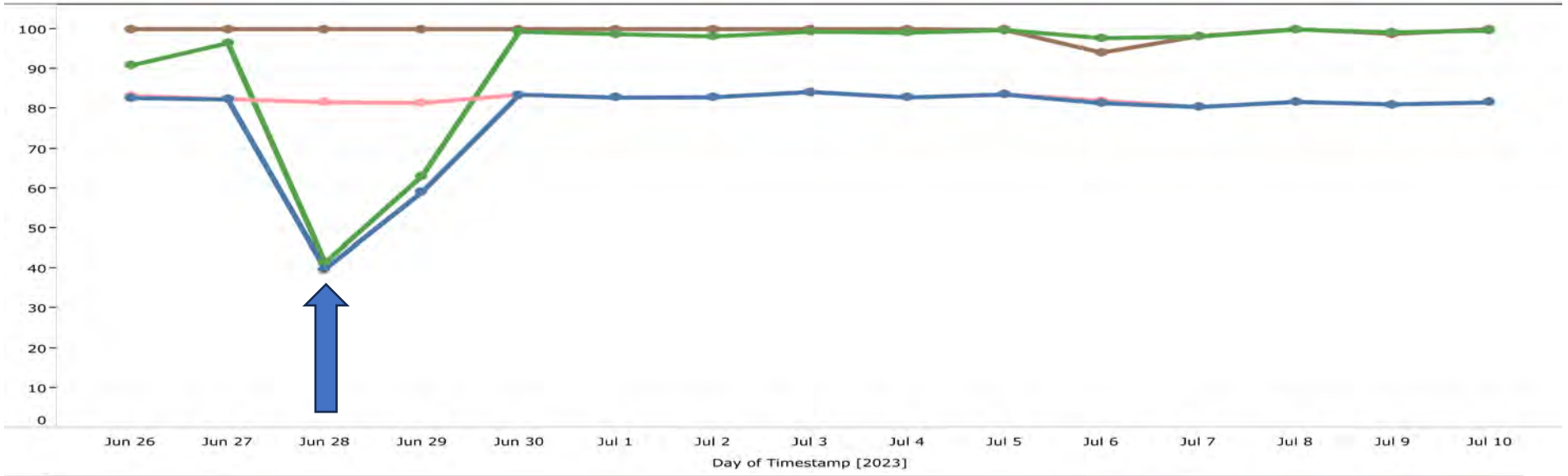
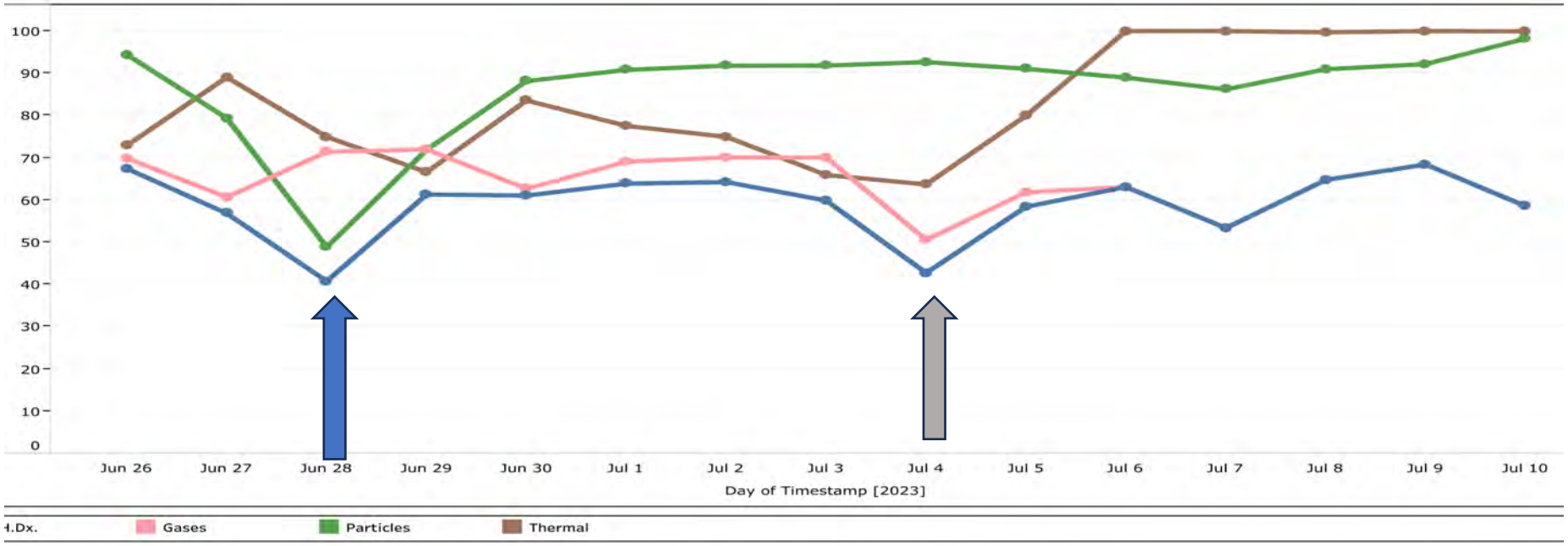
Vital Signs Scores for Individual Indoor Sensors Reporting Period 06.26 – 07.10.2023

Tamarac Dining
3rd fl. (3053)

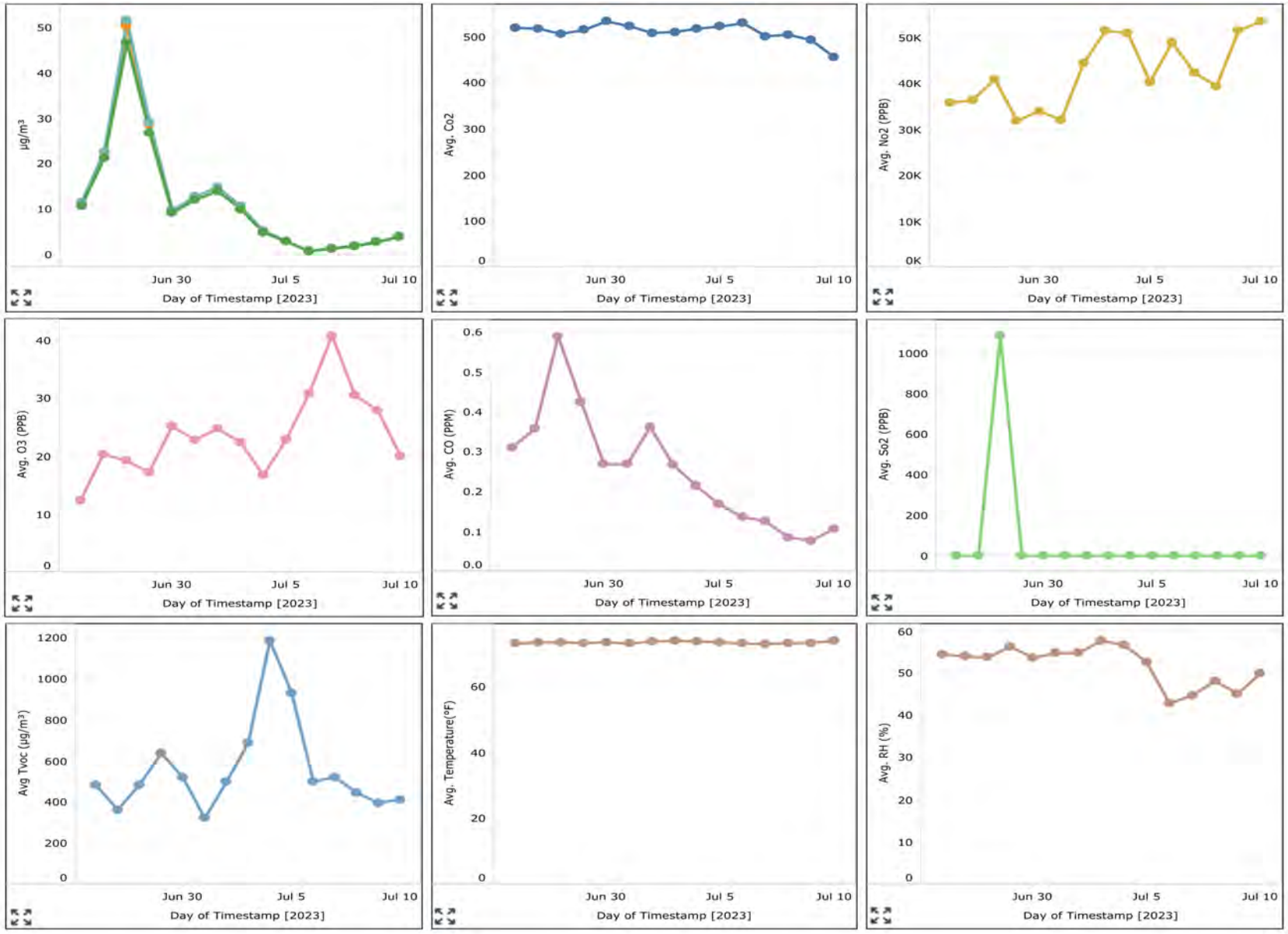


Office/IT (3054)



Indoor Sensor – Raw Data Values

Reporting Period 06.26 – 07.10.2023

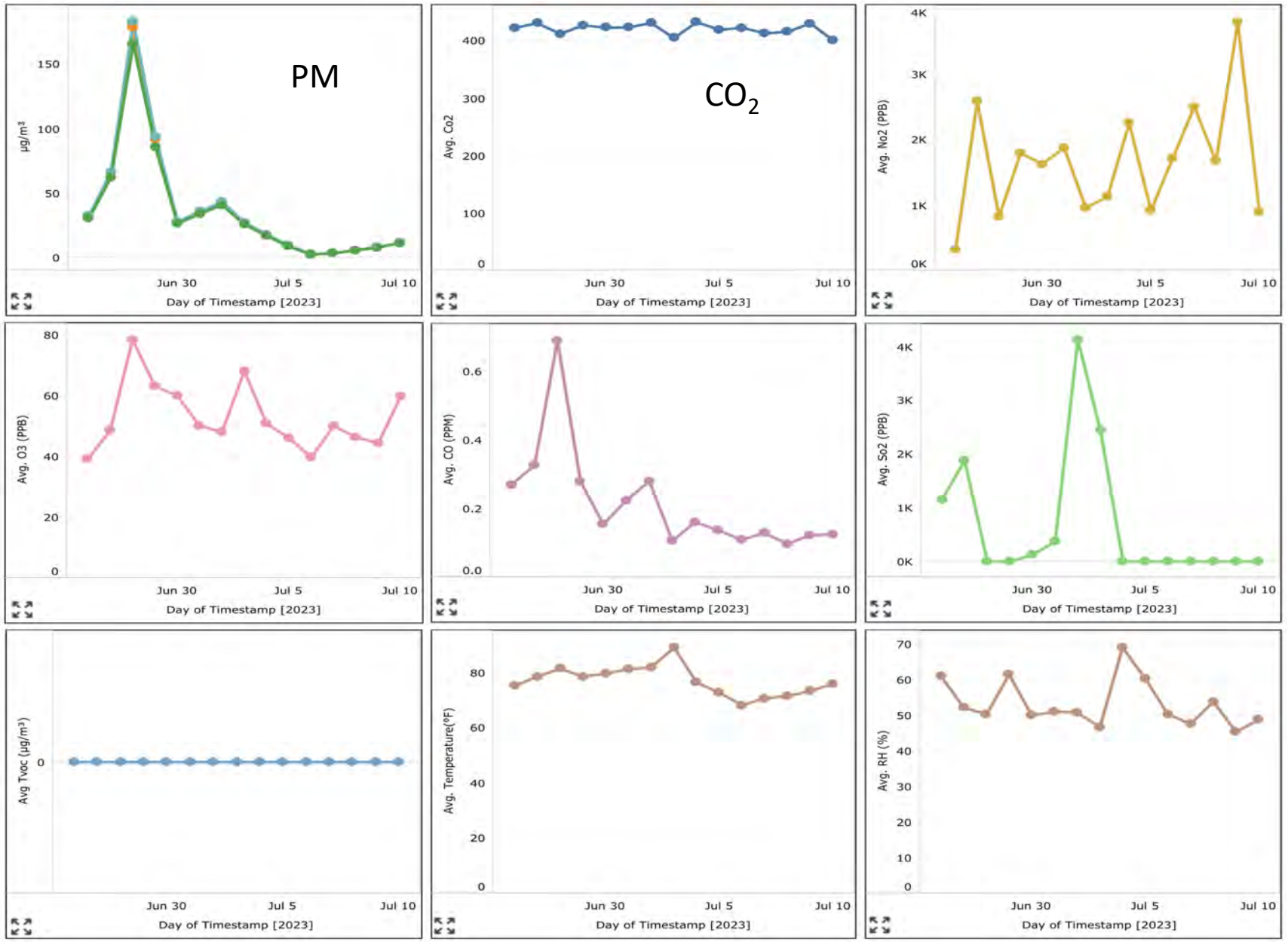


Outdoor Sensor Vital Signs Reporting Period 06.26 – 07.10.2023

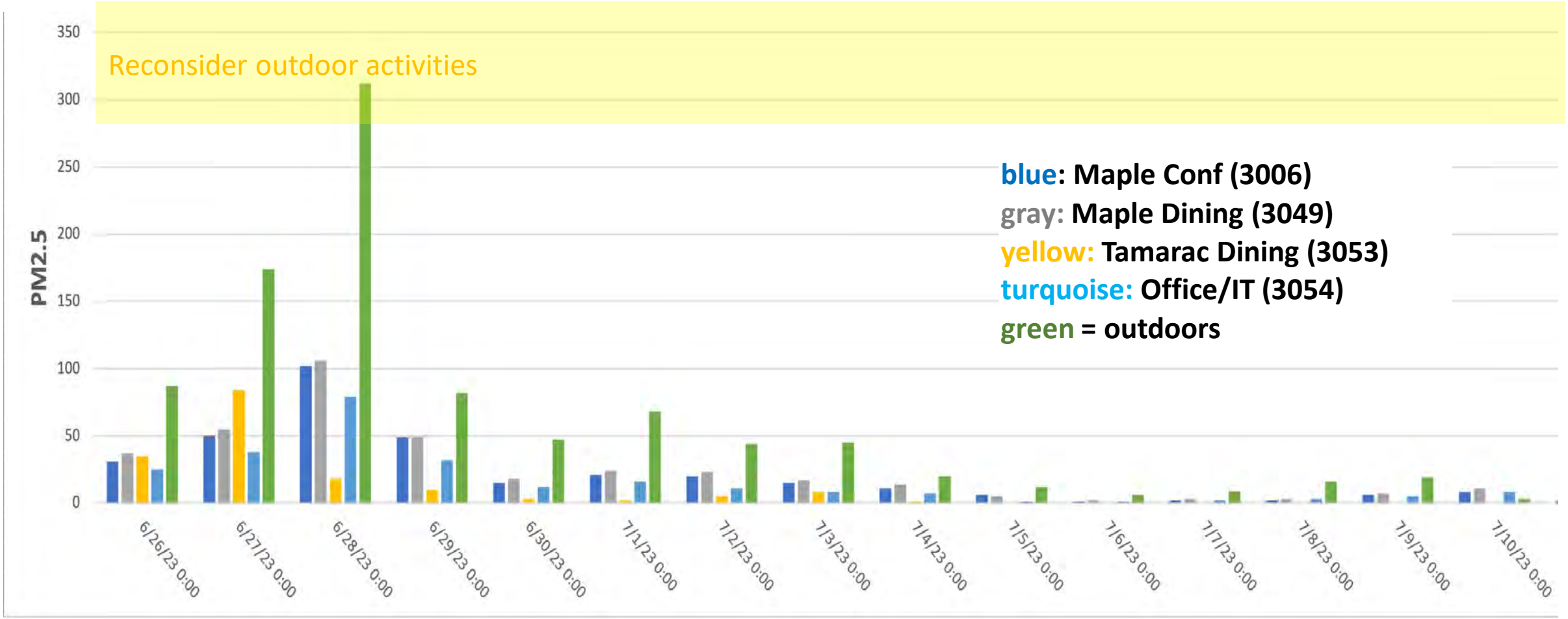
Decline in outdoor score is due to particles, most likely from wildfires

Outdoor Sensor Reporting Period 06.26 – 07.10.2023

Raw data

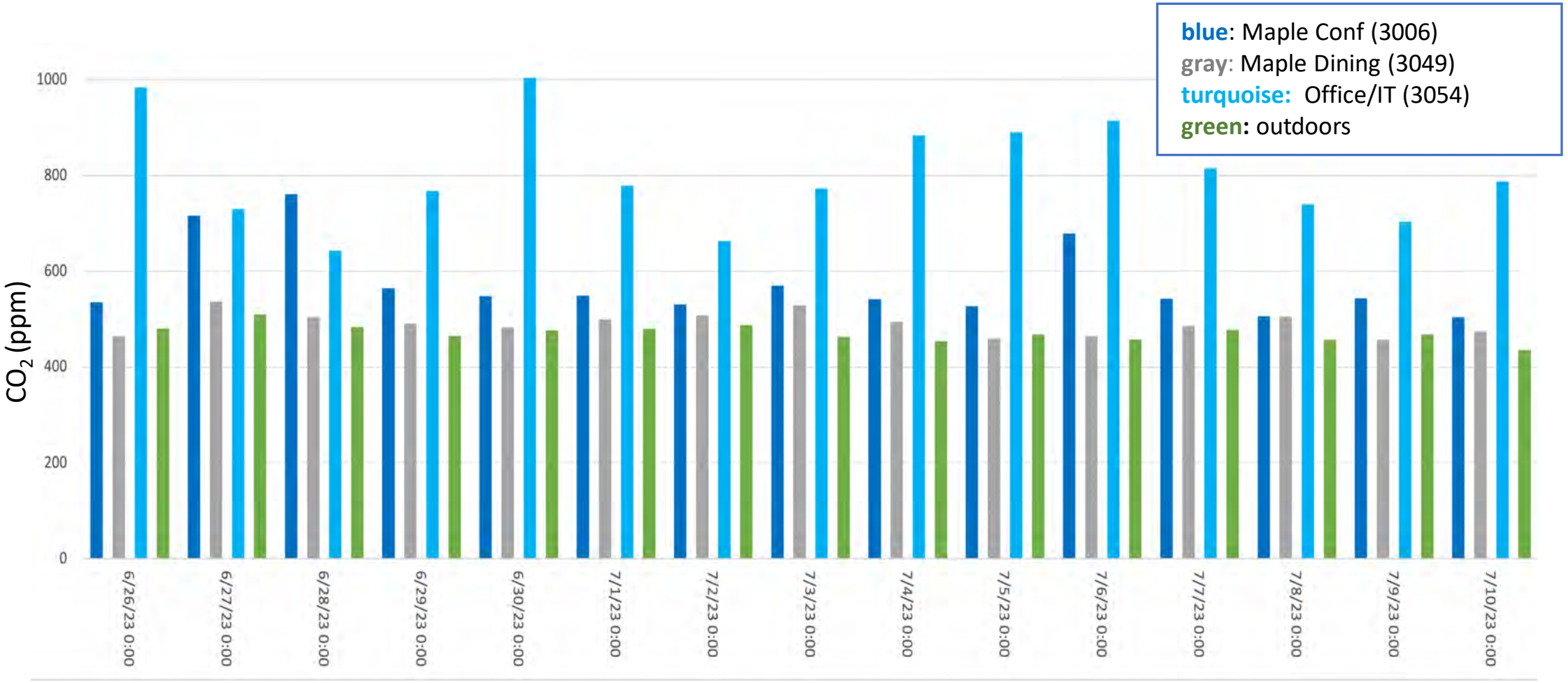


Outdoor & Room Sensors Raw Data: $PM_{2.5}$ – Reporting Period 06.26 – 07.10.2023



- Outdoor $PM_{2.5}$ are driving indoor levels
- On worst day, remediation was needed

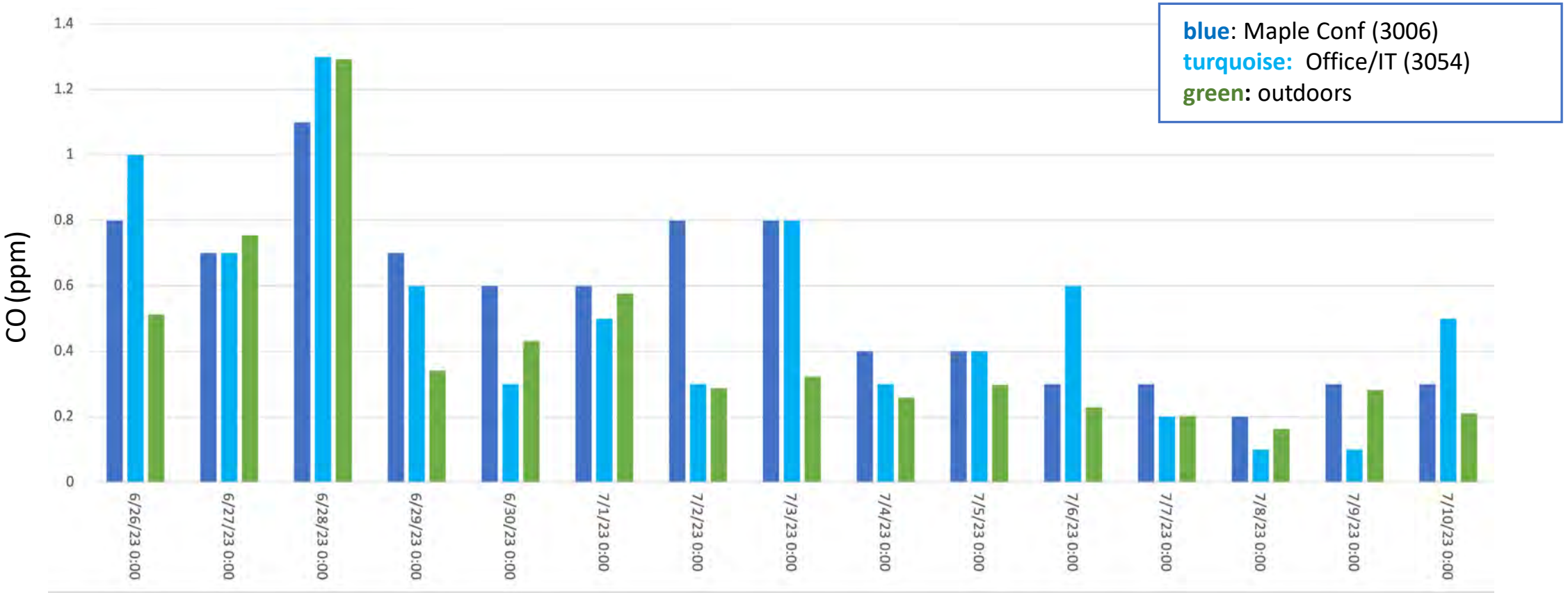
Outdoor & Room Sensors Raw Data: Carbon Dioxide – Reporting Period 06.26 – 07.10.2023



Conclusions:

- Levels are acceptable
- Maple conf room and office have indoor CO_2 sources (probably occupants)

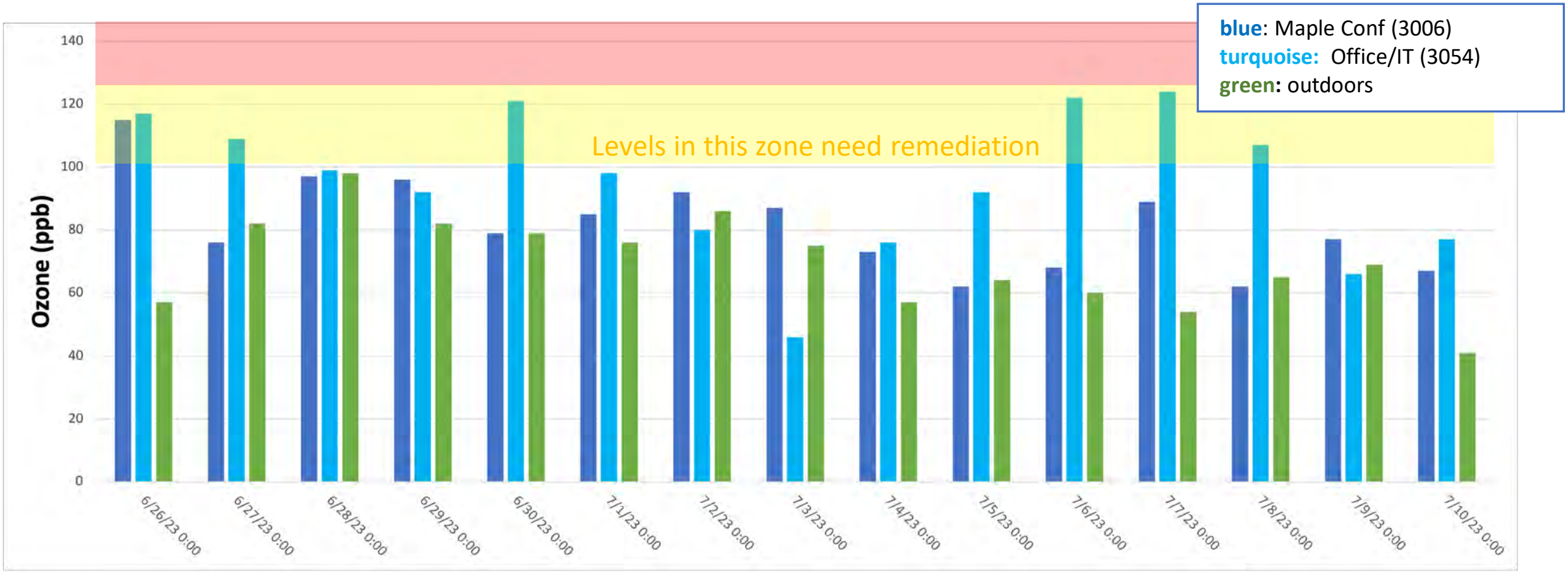
Outdoor & Room Sensors Raw Data: Carbon Monoxide – Reporting period 06.26 – 07.10.2023



Conclusions:

- Levels are acceptable for non-vulnerable populations
- Maple conf room and office have intermittent indoor CO sources or ventilation intakes near outdoor combustion sources (parking lot)

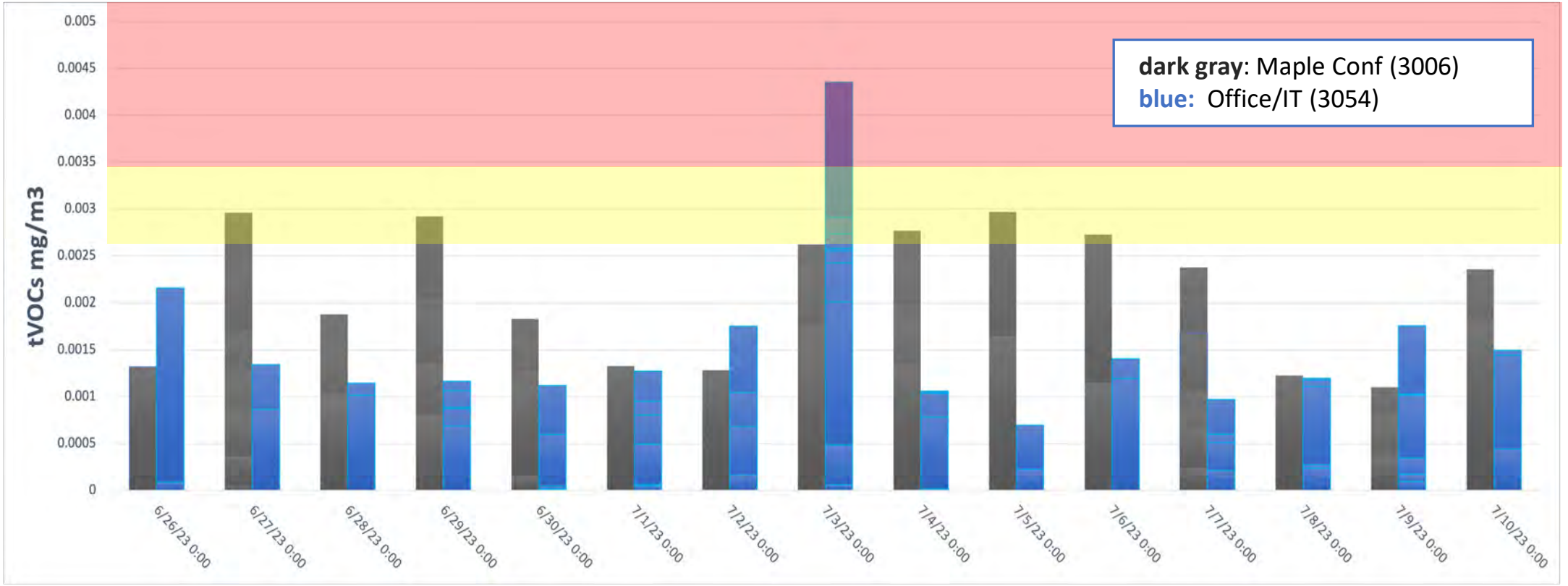
Outdoor & Room Sensors Raw Data: Ozone – Reporting Period 06.26 – 07.10.2023



Conclusions:

- Levels are *mostly* acceptable for non-vulnerable populations, although office needs intervention
- Maple conf. room and office have intermittent indoor ozone sources or increased levels driven by sunlight

Outdoor & Room Sensors Raw Data: tVOCs - Reporting Period 06.26 – 07.10.2023



Conclusions:

- Levels are *mostly* acceptable for <u>non</u>-vulnerable populations, except office needs intervention
- Maple conf room and office have intermittent tVOC levels that are too high

CONCLUSIONS

- In general, indoor health scores are acceptable for non- vulnerable populations
- Office has highest carbon dioxide and ozone
- First floor rooms have a lower scores than higher floors

SUGGESTIONS

- Decrease ventilation during periods when outdoor score is low, using indoor air recirculation and appropriate filtration
- Use indoor interventions such as UVC, localized filters or other strategies to increase effective air change rates
- Identify sources of indoor CO and CO_2
- Increase ventilation when outdoor score is high and indoor scores drop

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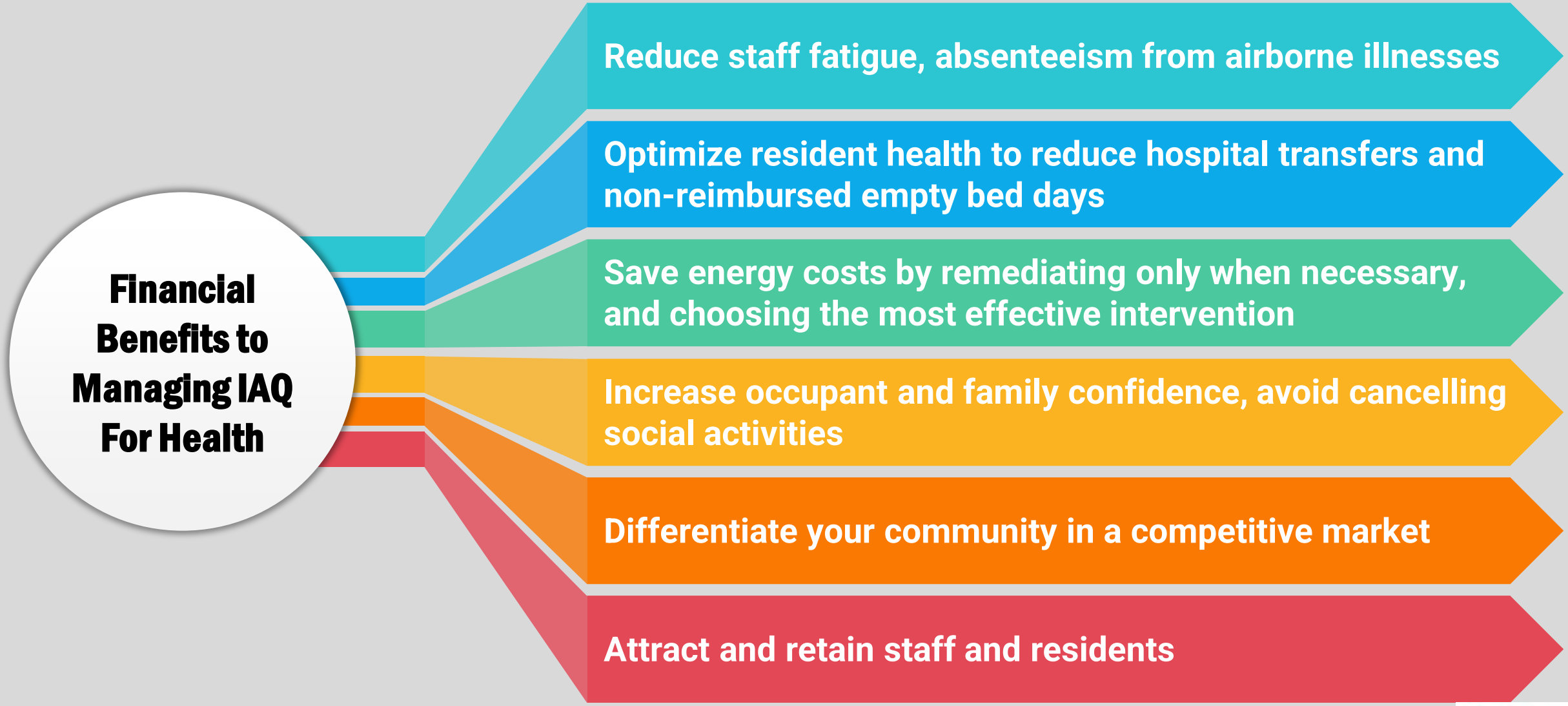
Unlock the Value of IAQ and Outdoor Air Data for Better Health and Building Efficiency

ROI of Healthy Occupants in Senior Living Communities



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Thank you!

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