

Air Quality and Health Information: Challenges and Opportunities for Using Sensors

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Air Quality and Health

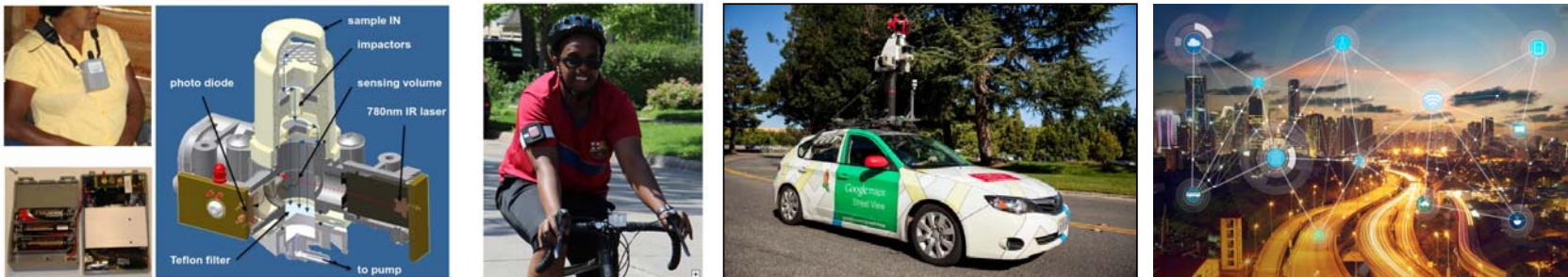
- A critical part of the EPA's mission is protecting public health from potentially serious effects of air pollution exposures
- EPA accomplishes this mission through a combination of regulations, voluntary initiatives, and public communication efforts
- A common theme cutting across these activities is the need to understand relationships between air quality and health



Current Health Evidence

- Much of the available health evidence focuses on air quality or exposure durations lasting hours to weeks (“short-term”) or years (“long-term”)
- Also, many studies characterize air pollution exposures at the population level rather than for specific individuals
- Such studies provide limited insight into the potential health implications of real-time, minute-by-minute air pollution exposures OR the impact of adaptive behaviors

→ *Can sensors fill the gap?*



Sensors: Opportunities and Challenges

- Sensors offer the potential to improve real-time decision making to reduce exposures to air pollution
- Such improvements could be particularly important for people who are at higher risk of air pollution-related health effects (e.g., people with asthma or other diseases, children and older adults)
- However, given the existing evidence for air pollution-related effects, health implications of the very short-term exposure durations that could be captured by some sensors (e.g., 1-min) are unclear



Communicating Air Quality and Health through the Air Quality Index (AQI)

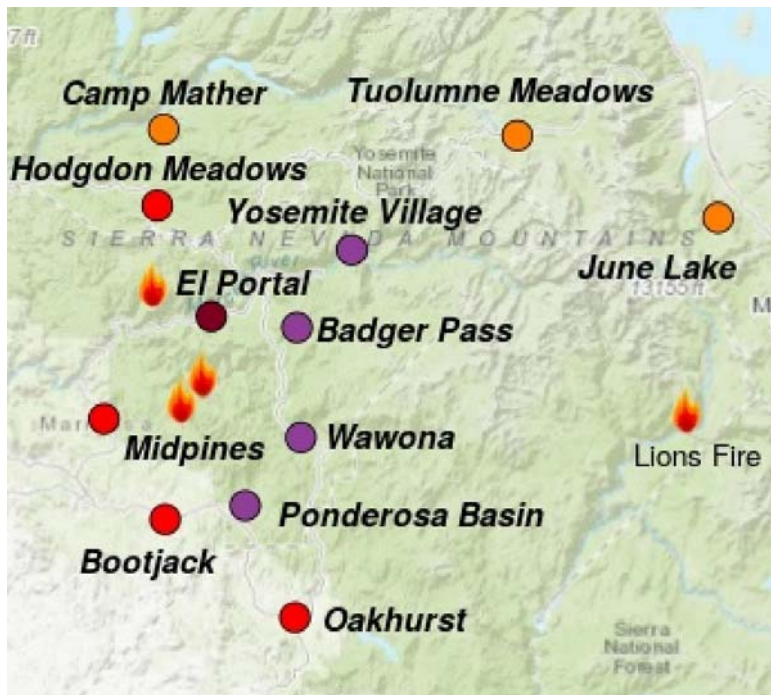


- Since the 1970s, Clean Air Act has required EPA to establish a *uniform air quality index* to inform the public through daily monitoring and reporting
- In 1999, this index became known as the Air Quality Index (AQI), with upgraded capabilities for air quality forecasting and real-time reporting
 - Breakpoints and time averages are based on health information for each pollutant
 - Colors and other features added to make the index media friendly
- Today, EPA uses the AQI as a public health protection tool:
 - Updating the AQI with most recent national air quality standards
 - Improving forecasting methods to better inform the public during changing conditions (“NowCast”)
 - Evaluating behavioral adaptations in response to AQI warnings

Modifying Behavior due to Smoke

2018 Ferguson Fire Smoke Outlook

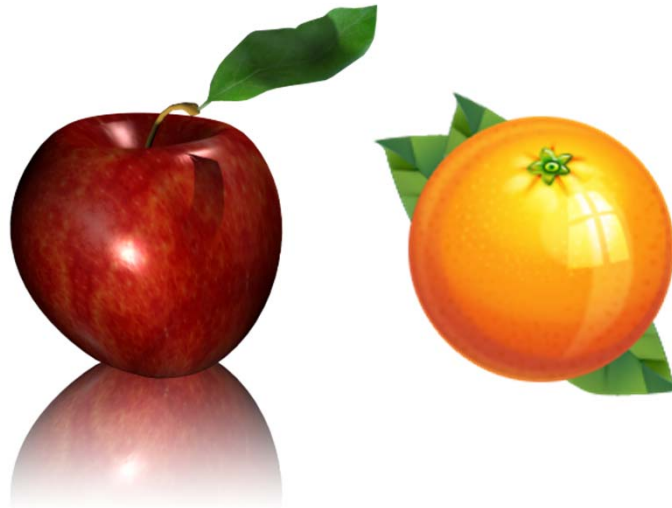
AQI Forecast



Site	Hourly PM _{2.5}			AQI
	6a	noon	6p	
Yosemite Village	[Bar chart showing low PM2.5 levels]			Low (Purple)
Hodgdon Meadows	[Bar chart showing moderate PM2.5 levels]			High (Red)
Camp Mather	[Bar chart showing moderate PM2.5 levels]			High (Orange)
Tuolumne Meadows	[Bar chart showing moderate PM2.5 levels]			High (Orange)
Badger Pass	[Bar chart showing low PM2.5 levels]			Low (Purple)
June Lake	[Bar chart showing very low PM2.5 levels]			Very Low (Yellow)
El Portal	[Bar chart showing high PM2.5 levels]			Very High (Dark Red)
Midpines	[Bar chart showing high PM2.5 levels]			High (Red)
Wawona	[Bar chart showing low PM2.5 levels]			Low (Purple)
Bootjack	[Bar chart showing high PM2.5 levels]			High (Red)
Ponderosa Basin	[Bar chart showing high PM2.5 levels]			High (Red)
Oakhurst	[Bar chart showing high PM2.5 levels]			High (Red)

The Difference Between Sensors Data and AQI Data

Sensor Reading
Concentration
Short term (e.g., 1 minute)
Data Quality Unknown



Air Quality Index
Index Color
Averaged (e.g., 8- hour, 24-hour)
Data Quality Assured

“Little Johnny Wants To Play”



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- AQI = **Good**
- Sensor = **High**

Decisions

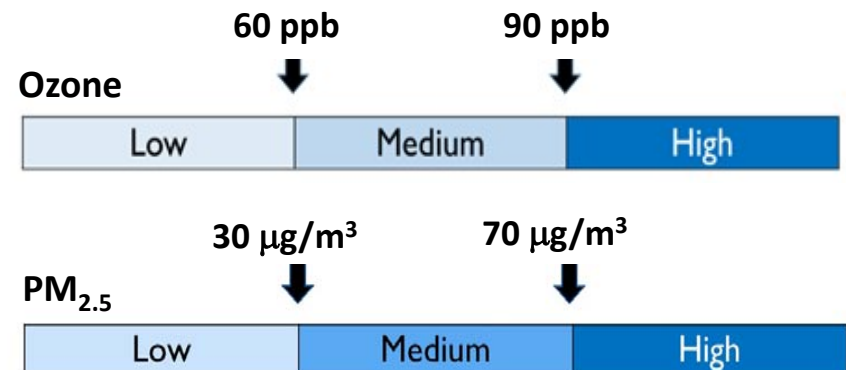
1. Which reading is correct?
2. Should the school have outside recess?

Bridging the Divide: EPA's Pilot Sensor Scales

Goals of Sensor Scales:

- ✓ Be consistent with available health effects information, air quality data, and current communications tools (i.e., AQI)
- ✓ Provide behavioral messages that give users actions to consider based on sensor readings
- ✓ Encourage the use of scales by sensor developers

Pilot Sensor Breakpoints



Research Opportunities

- Promote future research that couples sensor technology with health outcomes
 - Improve understanding of personal exposures to air pollution, especially for at-risk populations
 - Combine air quality sensor data w/ biometric data (or human activity data like inhaler use) to explore the link between short term exposures and health effects
- Promote on-going research related to sensor evaluation, including long-term field testing

Moving Forward

- Continue to promote high quality sensor data
- Continue to promote clear messaging on air pollution measurements from non-regulatory sensors to advance public health protection
- For wildland fires, continue exploring the use of sensors to:
 - Better characterize rapidly changing air quality
 - Quickly gather and communicate air pollution data



<https://www.epa.gov/air-sensor-toolbox>

How to Use Air Sensors



What Do My Sensor Readings Mean?



Thank you!