# Personal Air Monitoring and Messaging

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AAPCA Meeting

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# Introduction

**Communicating Sensor Data is Tricky…**

# Introduction

**Emerging air monitoring systems (informal classification)**

existing

Group 1: Regulatory or regulatory-equivalent air monitoring stations
Cost: 100Ks (in thousands), Data reliability = A+

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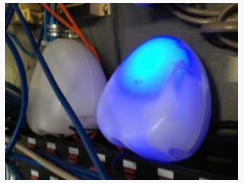
emerging

Group 2: Smaller-footprint monitoring systems for community screening and research studies
Cost: 1-10Ks, Data reliability = B+ (target)



Group 3: Very small, very low cost systems enabling dense sensor networks, citizen science
Cost: 0.1-1Ks, Data reliability = ?

(slide courtesy of Gayle Hagler)

# Introduction

Studies do not support short term (e.g. 1-minute) ***health effects*** messaging

# Introduction

## The Air Quality Index

*Not for use to interpret sensor data*

| Air Quality Index (AQI) Values | Levels of Health Concern | Colors |
|---|---|---|
| *When the AQI is in this range:* | *..air quality conditions are:* | *...as symbolized by this color:* |
| 0-50 | Good | Green |
| 51-100 | Moderate | Yellow |
| 101-150 | Unhealthy for Sensitive Groups | Orange |
| 151 to 200 | Unhealthy | Red |
| 201 to 300 | Very Unhealthy | Purple |
| 301 to 500 | Hazardous | Maroon |

AQI focuses on health effects experienced within a few hours or days

# Introduction

## Sensor Concentration ≠ Air Quality Index

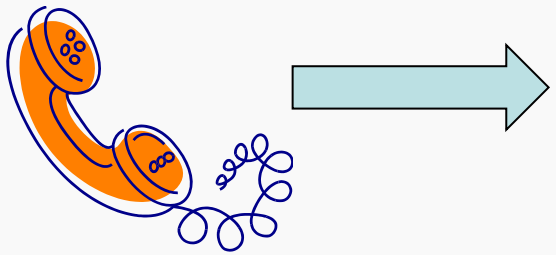
| Sensor Reading |
| --- |
| Concentration |
| Short term (e.g. 1 minute) |
| Data Quality Unknown |

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

# Introduction

**CONTACTS:**

- Local/State Air Agencies
  - NACAA
  - AAPCA
- EPA
- Others



**RESPONSE:**

- Not FEM/FRM Quality (ambient)
- Not an approved test/alternative method (source)
- No action
- Check the AQI

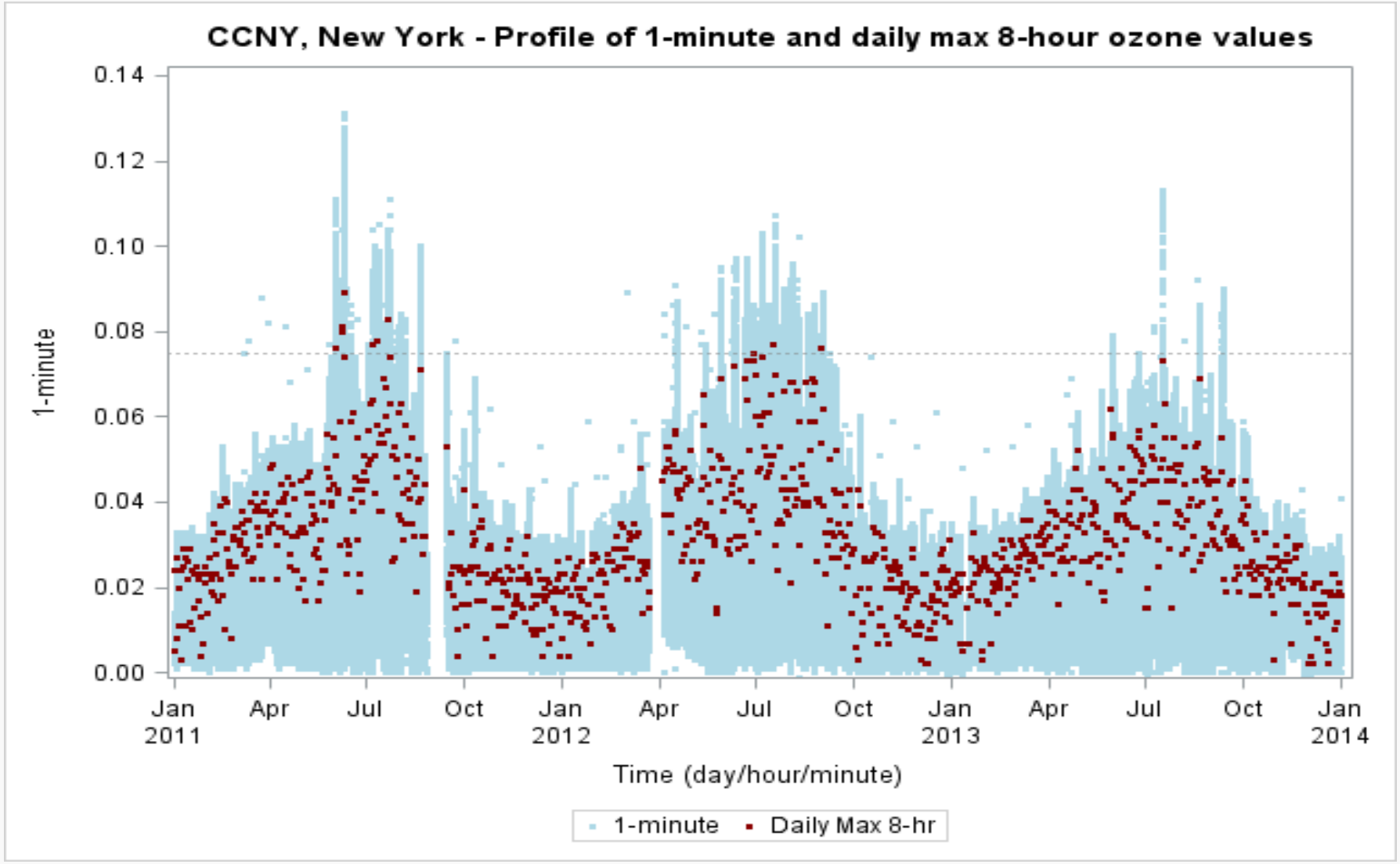
*Inconsistent/inaccurate information without guidance*

# Data Analysis

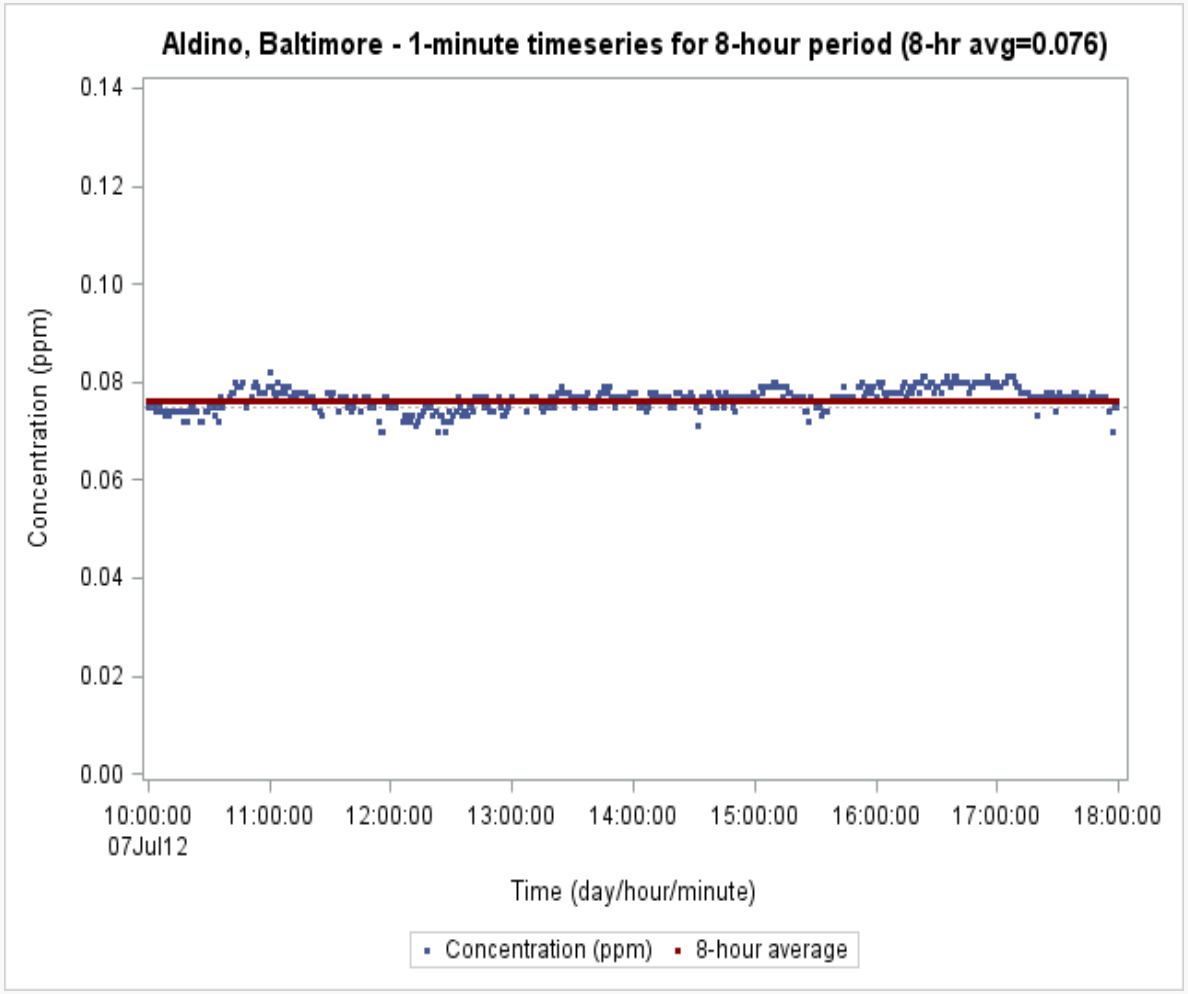
## Ozone and $PM_{2.5}$ 1-minute Analysis

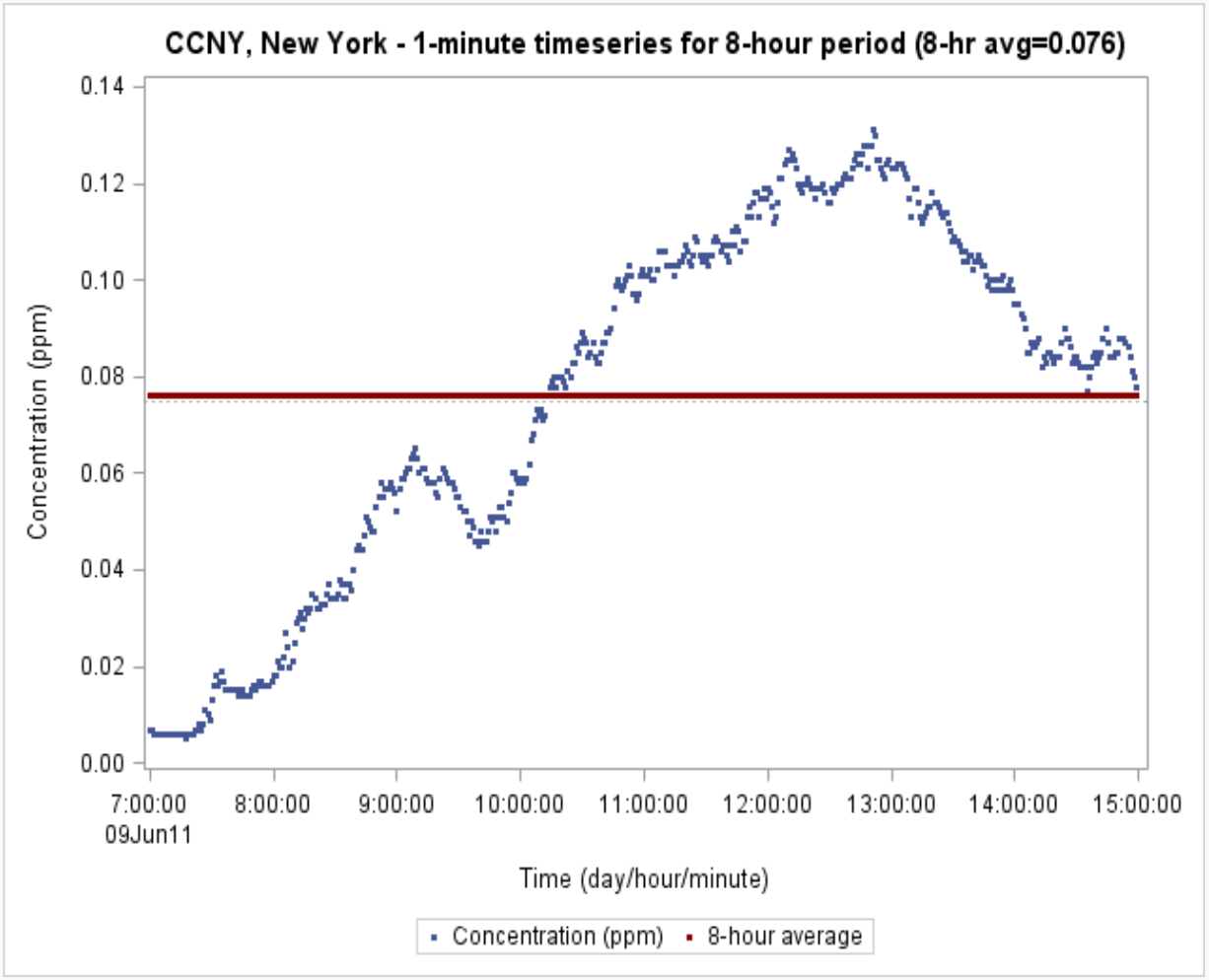
- **Analysis covers 12 sites in 5 cities:**
  - San Francisco – 2 sites, 2013 (ozone only)
  - Baltimore – 4 sites, 2011-2013 (ozone only)
  - Boston – 2 sites, 2011-2013 (ozone only)
  - New York – 2 sites, 2011-2013 (ozone and $PM_{2.5}$)
  - Denver – 2 sites, 2012-2014 (ozone and $PM_{2.5}$)
- **13 million FRM 1-minute values altogether**
- **Cities were chosen based on data availability and geographical diverseness**
- **Each city has at least one "higher" concentration site and one "lower" concentration site**

# Data Analysis



# Data Analysis



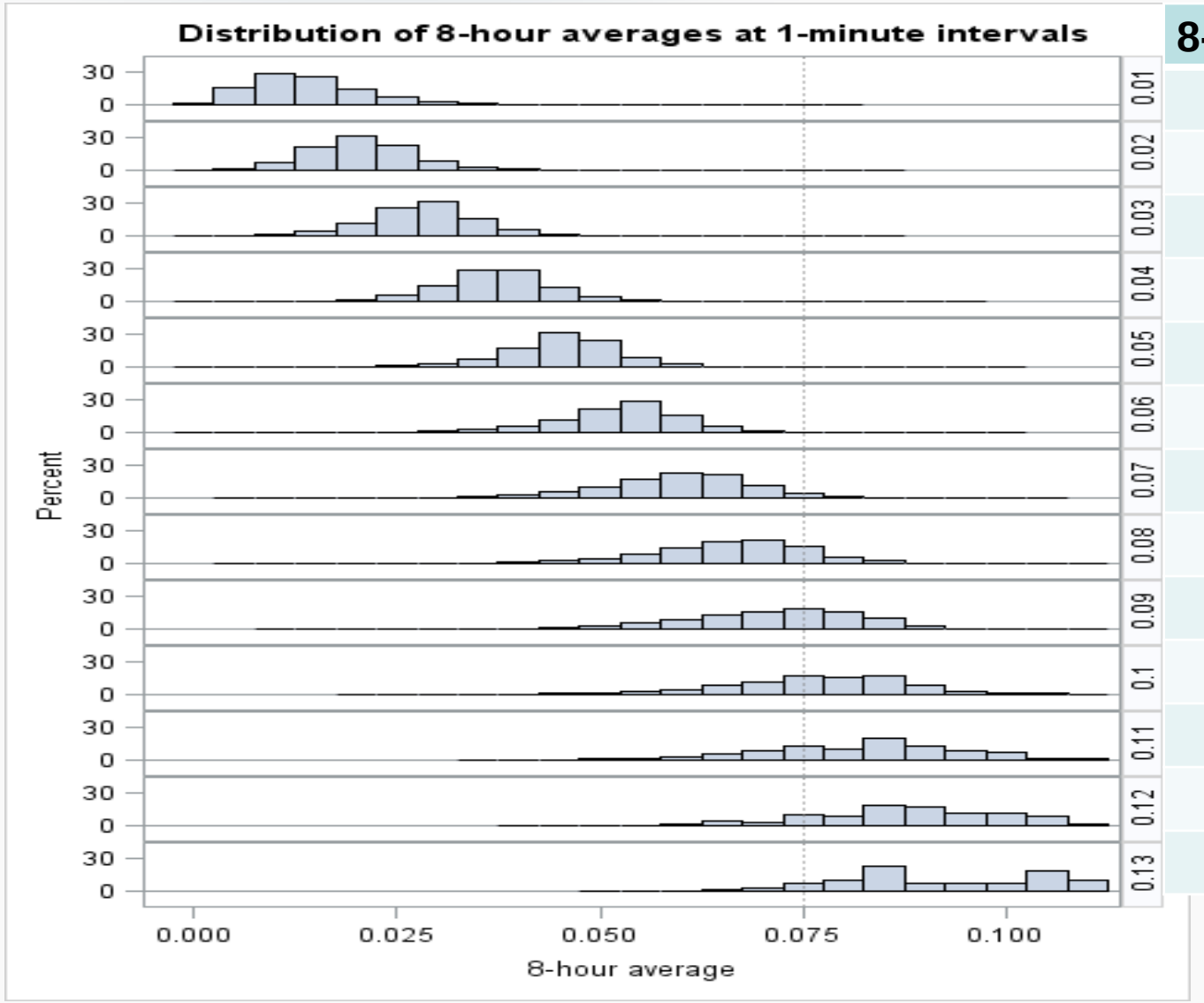



# Data Analysis

**Question:**
If I see a 1-minute value of x, what's the "likelihood" it is part of an 8-hour average that is above a level of concern (e.g. 0.075 ppm)?

**Answer:**
Let's look at the distribution of 8-hour averages at 1-minute intervals from .01 to .13...

# Data Analysis




| 8-hr averages > .075 ppm (%) |
|---|
| ~ 0 |
| ~ 0 |
| ~ 0 |
| ~ 0 |
| ~ 0 |
| 0.5% |
| 5% |
| 19% |
| 37% |
| 56% |
| 70% |
| 84% |
| 89% |

# Messaging

- Village Green *(funded by E-Enterprise)*
  - Incorporate real-time, 1-minute ozone and $PM_{2.5}$ sensor data into AIRNow tech
- Selected Sites (in addition to Durham, NC pilot site)
    - Washington, DC – installed in February 2015
    - Philadelphia, PA – installed in March 2015
    - Kansas City, KS – installed in March 2015
    - Oklahoma City, OK – to be installed in September 2015
    - Hartford, CT – to be installed in November 2015
  - Monitor additional pollutants (VOCs and $NO_2$)
  - Fulfill Agency priority goal for two real time air quality data streams to the public

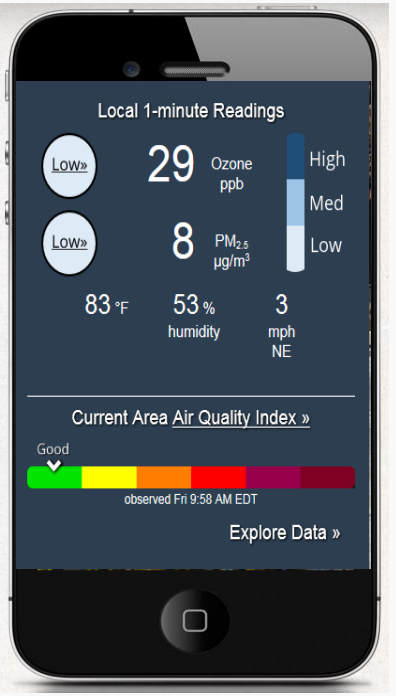
# Messaging

- Four Groups ~10 people (2 in DC, 2 in Oakland, CA)
- Moderators Guide
  - Air Quality Awareness
  - Definition of Sensors
  - Review of Messages
  - Mobile Website

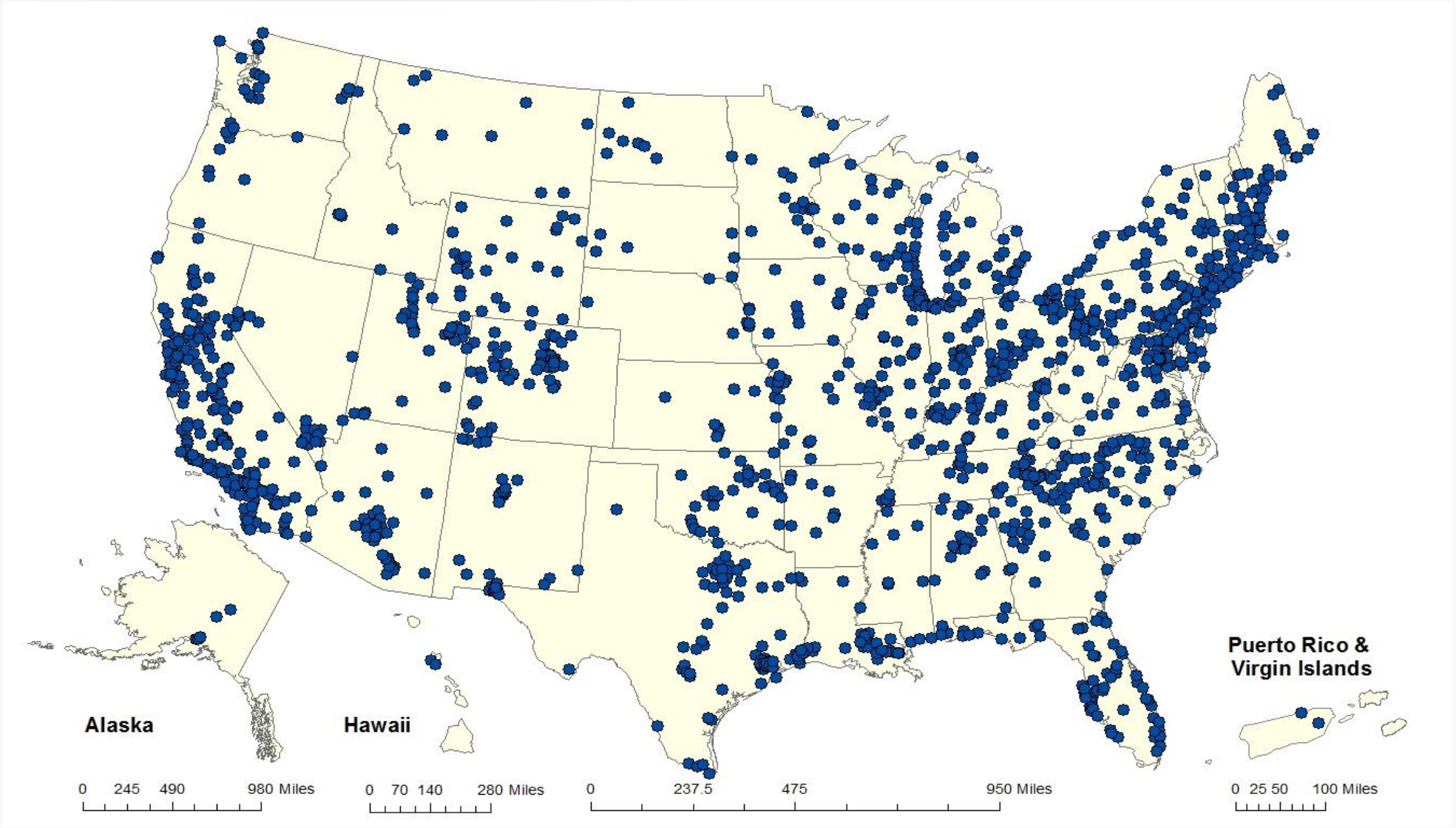
  24.104.117.6
  - Messaging Static Website

# Messaging

- Application is intuitive, easy to navigate
- Location services desired
- Mixed reviews on actual text, concentration readings, additional messages, color scale, and legend
- Need steps to check sensor
- Define “sustained” or “prolonged” exposure
- Request clear connection for the end-user between 1-minute readings and 8-hour or 24-hour averages regarding health risk



# Messaging


Alaska
Hawaii
Puerto Rico &
Virgin Islands
0 245 490 980 Miles
0 70 140 280 Miles
0 237.5 475 950 Miles
0 25 50 100 Miles

# Acknowledgements


## OAQPS Air Sensors Team

**Team Lead: Kristen Benedict**

- Alison Davis
- Susan Stone
- David Mintz
- Melissa Dreyfus
- Michelle Wayland
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- Melissa Payne
- Elizabeth Mannshardt
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