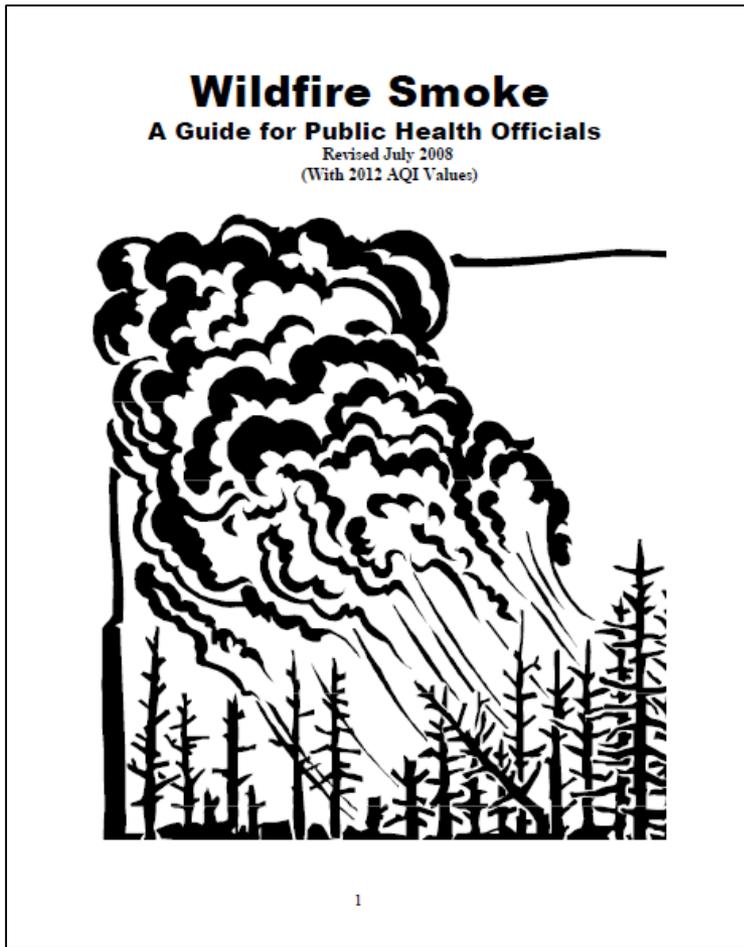# Wildfire Smoke: Guide for Public Health Officials Upcoming Revisions

International Wildland Fire Safety Summit
Boise, ID
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Current Wildfire Guide

Wildfire Smoke
A Guide for Public Health Officials
Revised July 2008
(With 2012 AQI Values)

- Sections
  - Composition and characteristics of smoke
  - Health effects of smoke
  - At-risk populations
  - Strategies for reducing smoke exposure
  - Estimating PM levels
  - Recommendations for public health actions
- Appendices

Revised Wildfire Guide

- Revisions to guide will be led by federal agencies
  - Partners include CDC, EPA, USFS and other federal, state and local agencies
  - Target completion date is this winter (2015-16), prior to 2016 fire season
- Revised guide will reflect recent advances
  - Stronger evidence base, including new PM/fire-related research and recent peer-reviewed assessments from British Columbia CDC
  - New thinking informs use of air quality "snapshots" such as instantaneous air quality readings or visual ranges
  - 2014 deployment of NowCast - responsive hourly AQI metric for $PM_{2.5}$
  - Fires: Current Conditions webpage - linking information from federal, state and local agencies
- Revised guide will reflect concerted effort by federal agencies to provide integrated and consistent messaging for use by state, tribal and local agencies
- CDC will disseminate information to state and local health departments
- This workshop is designed to provide some of the information underlying revisions, as well as to solicit your input for use in the guide

Stronger Evidence Base

Guidance for BC Public Health Decision Makers During Wildfire Smoke Events
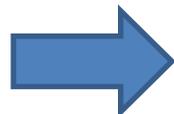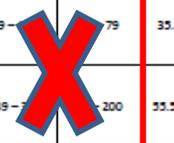
September 2014
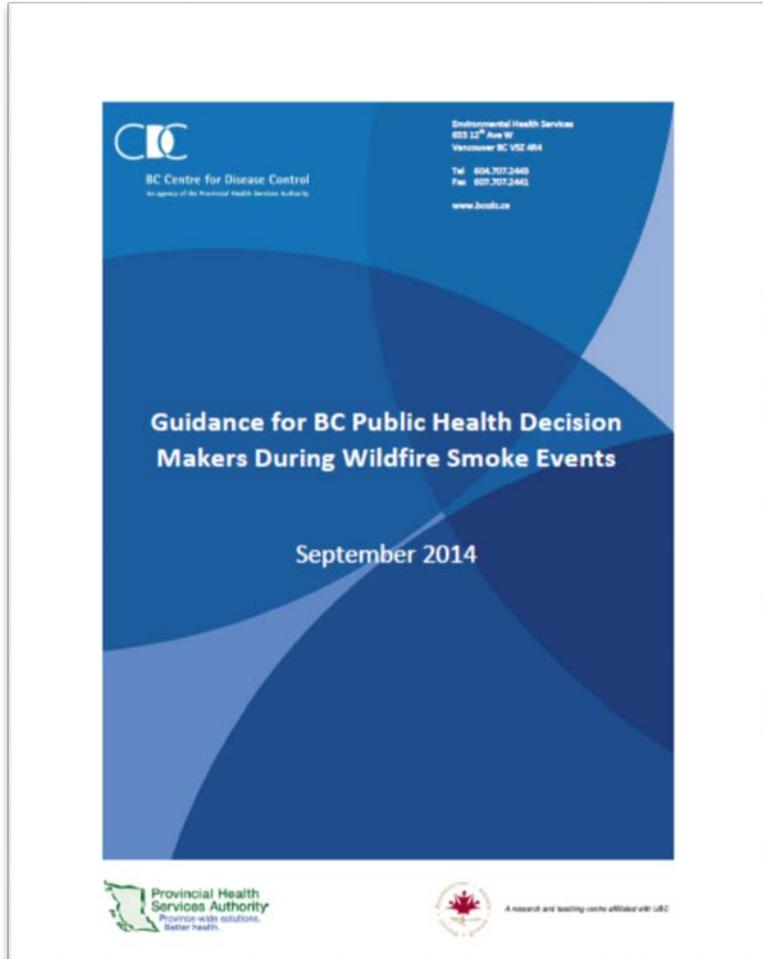
- New fire-related research, some of which has been presented here today
- British Columbia Centre for Disease Control peer-reviewed documents
  - Guidance for BC Public Health Decision Makers During Wildfire Smoke Events
  - Evidence reviews about: clean air shelters; reducing time outdoors, and smoke and public health risk
- EPA review of the PM national ambient air quality standards
  - Kick-off meeting held February 9-11, 2015

Changes to Table with Recommended Actions for Public Health Officials

Table 3. Recommended Actions for Public Health Officials [2,3]

AQI Category (AQI Values)	PM2.5 or PM10 Levels (ug/m³)			Visibility - Arid Conditions (miles)	Recommended Actions
	1-3hr avg	8 hr avg	24 hr avg[1]		
Good (0 to 50)	0 – 38	0 – 22	0 – 12	≥ 11	• If smoke event forecast, implement communication plan
Moderate (51 to 100)	39 – 88	23 – 50	12.1 – 35.4	6 – 10	• Issue public service announcements (PSAs) advising public about health effects and symptoms and ways to reduce exposure • Distribute information about exposure avoidance
Unhealthy for Sensitive Groups (101 to 150)	89 –	– 79	35.5 – 55.4	3 – 5	• If smoke event projected to be prolonged, evaluate and notify possible sites for cleaner air shelters • If smoke event projected to be prolonged, prepare evacuation plans
Unhealthy (151 to 200)	139 –	– 200	55.5 – 150.4	1.5 – 2.75	• Consider "Smoke Day" for schools (i.e., no school that day), possibly based on school environment and travel considerations • Consider canceling public events, based on public health and travel considerations
Very Unhealthy (201 to 300)	352 – 526	201 – 300	150.5 – 250.4	1 – 1.25	• Consider closing some or all schools (Newer schools with a central air cleaning filter may be more protective than older, leakier homes. See "Closures", below.) • Cancel outdoor events (e.g., concerts and competitive sports)
Hazardous (> 300)	> 526	> 300	> 250.5-500	< 1	• Close schools • Cancel outdoor events (e.g., concerts and competitive sports) • Consider closing workplaces not essential to public health • If PM level is projected to remain high for a prolonged time, consider evacuation of sensitive populations

[1] Revised 24 hour average breakpoints from the Revised Air Quality [...] ds for Particle Pollution and Updates to the Air Quality Index, US Environmental Protection Agency, December 14, [...] ailable at http://www.epa.gov/airquality/particlepollution/actions.html#dec[...]

[...] These 1- and 8-hr PM2.5 levels are estimated using the 24-hr brea[...] f the PM2.5 Air Quality Index included in the February 7, 2007 issue paper (http://www.epa.gov/airnow/aqi_issu[...]_020707.pdf) by dividing the 24-hr concentrations by the following ratios: 8-hr ratio is 0.7, 1-hr ratio is 0.4. Visibility is [...]h 1-hr values. If only PM10 measurements are available during smoky conditions, it can be assumed that the PM10 [...] osed primarily of fine particles (PM2.5), and that therefore the AQI and associated cautionary statements and adviso[...] PM2.5 may be used. This assumption is reflected in the column headings for Table 3.

[...] Washington and Montana have developed more precautionary bre[...]s, which can be found at: http://www.deq.mt.gov/FireUpdates/BreakpointsRevised.asp and [...]w.ecy.wa.gov/programs/air/pdfs/WAQA.pdf

Section on visibility guidelines

Smoke Management Guide

Table 1. Air Quality Index categories (AQI) with actions recommended for public health protection during a wildfire smoke incident.[a]

Category (AQI Values)	PM2.5 or PM10 Levels (µg/m3) 24 hr avg[b]	Recommended Actions
Good (0 to 50)	0 – 12	• If smoke event forecast, implement communication plan
Moderate (51 to 100)	12.1 – 35.4	• Issue public service announcements (PSAs) advising public about health effects and symptoms and ways to reduce exposure • Distribute information about exposure avoidance
Unhealthy for Sensitive Groups (101 to 150)	35.5– 55.4	• If smoke event projected to be prolonged, evaluate and notify possible sites for cleaner air shelters • If smoke event projected to be prolonged, prepare evacuation plans
Unhealthy (151 to 200)	55.5 – 150.4	• Consider "Smoke Day" for schools (i.e., no school that day), possibly based on school environment and travel considerations • Consider canceling public events, based on public health and travel considerations
Very Unhealthy (201 to 300)	150.5 – 250.4	• Consider closing some or all schools (Newer schools with a central air cleaning filter may be more protective than older, leakier homes. • Cancel outdoor events (e.g., concerts and competitive sports)
Hazardous (> 300)	> 250.5-500	• Close schools • Cancel outdoor events (e.g., concerts and competitive sports) • Consider closing workplaces not essential to public health • If PM level is projected to remain high for a prolonged time, consider evacuation of sensitive populations

[a] Not all states agree entirely with the values and/or recommendations given in this table. Check with your state or county health department before using or distributing.
[b] Revised 24 hour average (midnight to midnight) breakpoints from 2012 updates to the Air Quality Index

Using Visual Range to Estimate PM$_{2.5}$ Levels

- Visual ranges are rough estimates of instantaneous PM$_{2.5}$ levels
- Use of instantaneous estimates
  - Visual ranges (or 1-minute sensor readings) provide a "snapshot" of air quality. They don't necessarily tell you what an area's overall air quality is – and one minute isn't enough data to tell you what health effects you may experience
  - Using these ranges or sensor readings can be helpful, by indicating when pollution is high and when you may want to change your outdoor activities to reduce your air pollution exposure. They also can tell you when air quality is good – a great time to open the windows or to get some exercise outside
- Visual range approach should be consistent with air quality sensor messaging
  - We are working to develop messages for air quality sensors that provide data in 1-minute increments; for an example of these sensors see Village Green Project, at: http://villagegreen.airnowtech.org/welcome
  - Because science does not support linking 1-minute exposures with health outcomes, we will not be using the 24-hour Air Quality Index for these devices
  - But we recognize that people will want to understand whether they should take action based on sensor readings, and we are working to develop messages that are scientifically supportable and easy to understand
  - The same is true for visual ranges, and we think there should be consistency between the two approaches as discussed by Susan O'Neill (Malm and Schichtel, 2013)

Air Quality Index

- Pollutant-specific health effects and cautionary statements address the question, "who will be affected?" based on health information from review of U.S. national ambient air quality standards; $PM_{2.5}$ sub-index based on 24-hour average exposures

Dose = Concentration x Ventilation Rate x Time

- **C** - be active outdoors when air quality is better

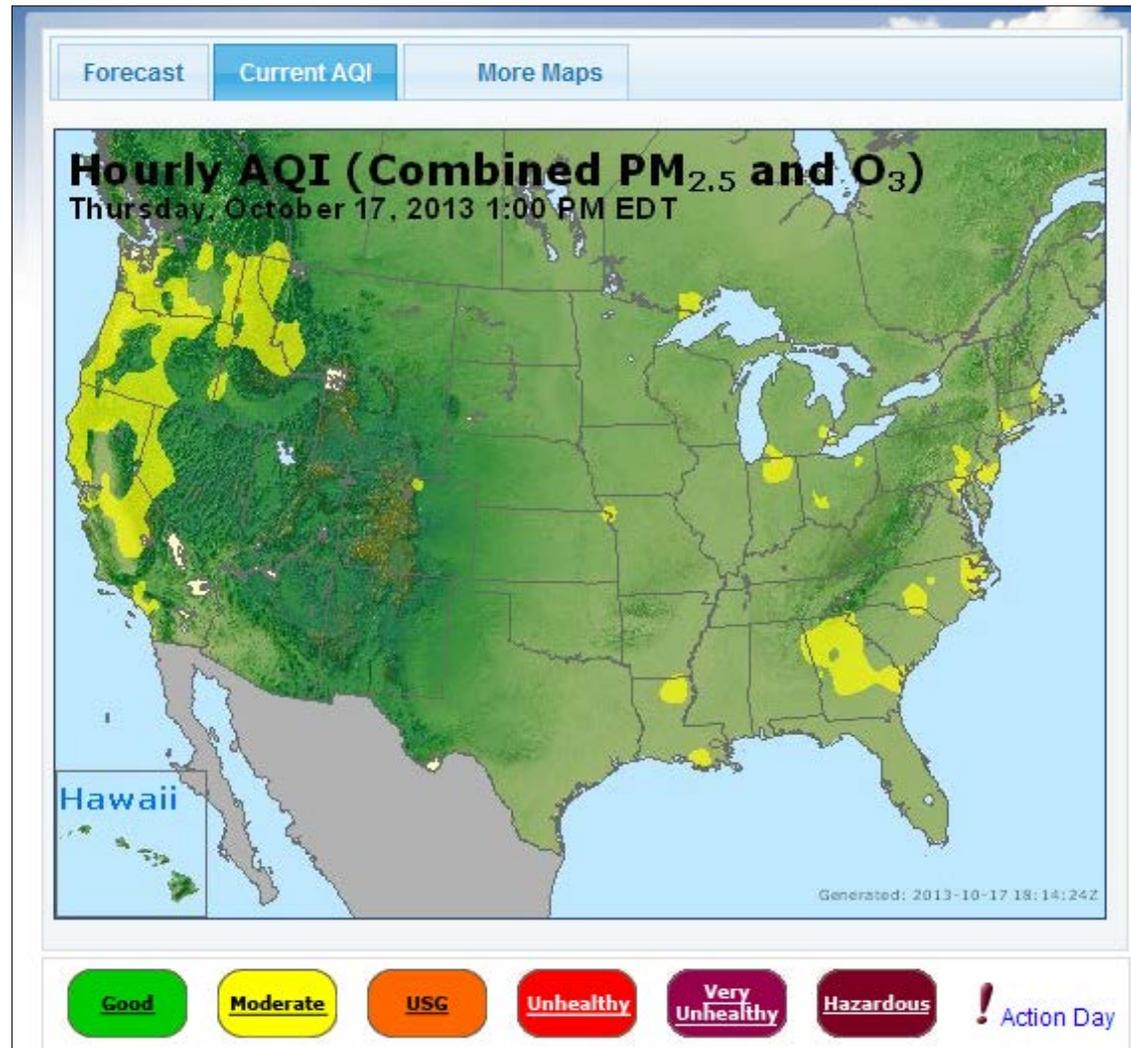- **V** - take it easier when active outdoors when air quality is poor

- **T** - spend less time being active outdoors when air quality is poor

- Reduce these factors (C,V,T) to reduce dose
- Pay attention to symptoms
- People with asthma – follow asthma action plan
- People with heart disease – check with your doctor
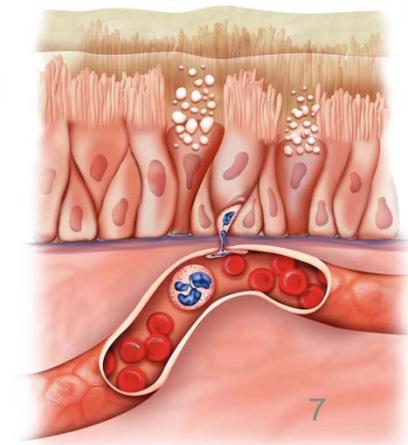
Hourly Air Quality Index

The updated "NowCast"

Background

- Previous NowCast method was developed in 2003

- Designed so "current conditions" represent the 24-hour $PM_{2.5}$ standard as closely as possible

- At the time the current method was developed, EPA and our partners had little experience reporting $PM_{2.5}$ values to the public. We also had less information at that time about $PM_{2.5}$ health effects associated with shorter averaging periods; newer health information indicates that 24 hours is still the appropriate health metric

- The original method was slow to respond when air quality changed rapidly

- EPA-OAQPS developed an updated NowCast method for $PM_{2.5}$ that responds more quickly to rapidly changing air quality conditions, such as those we see during fire.

- We analyzed millions of data points in developing the updated NowCast method.

- August 2014 we launched updated $PM_{2.5}$ NowCast on AirNow.gov; currently using the same approach for PM_{10} and will start using similar approach for O_3 this year

NowCast Method

- Represents a shorter average (target 3-hour) when air quality is changing rapidly
  (A 3-hour average from continuous monitors is more stable than a 1-hour average.)

- Reflects a longer-term average when air quality is stable

- Will work anywhere in the U.S.

- Will make alerts more timely

Air Quality

Less variable   More variable

⟵——————————————————⟶

~ 12-hour average   ~ 3-hour average

NowCast

NowCast Performing Well

Surrogate vs. NowCast Estimates
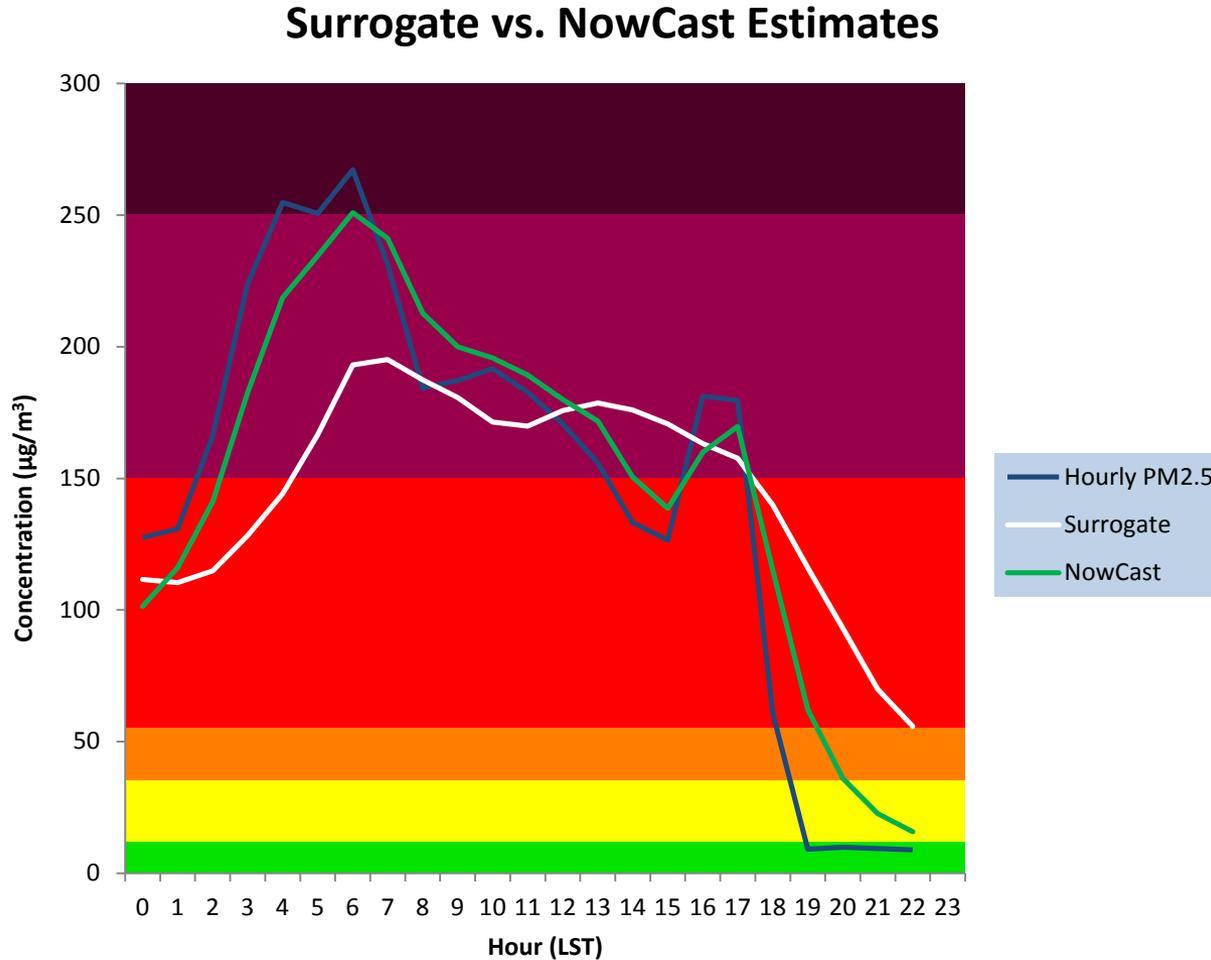
PM$_{2.5}$ Hourly values, Surrogate, and NowCast (µg/m^3) for Medford, Oregon on August 1, 2013. Background shading represents Air Quality Index (AQI) categories.

How Well Do Methods Match AQI Categories?

U.S. data, 2008-2012
(24 million data points)
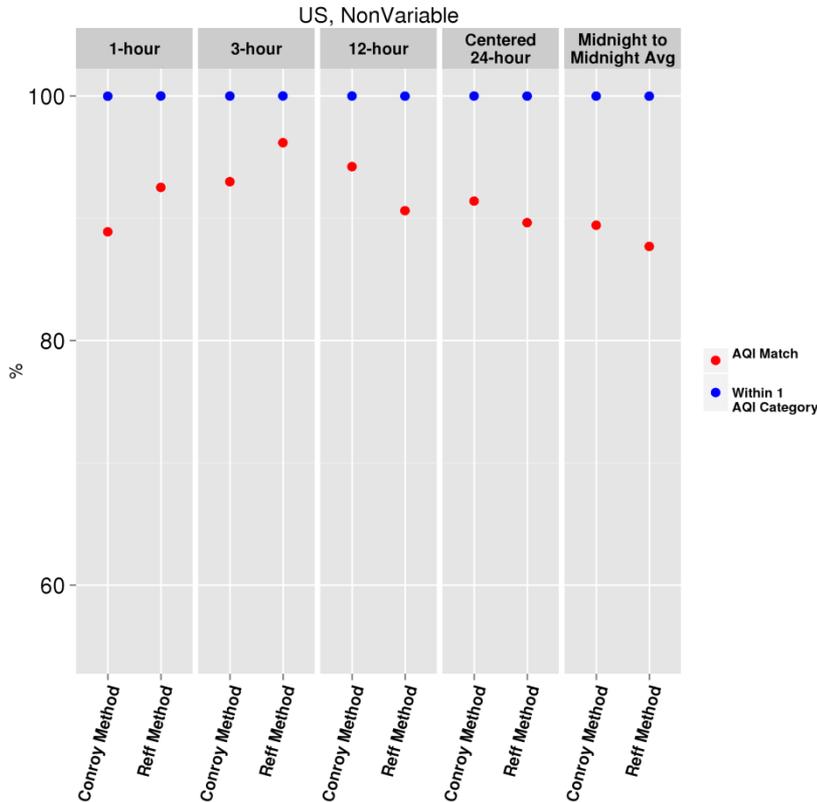
On **non-variable** days, we'd expect the Reff method to track the longer-term averages, and it seems to do that well, almost as well as the previous method.
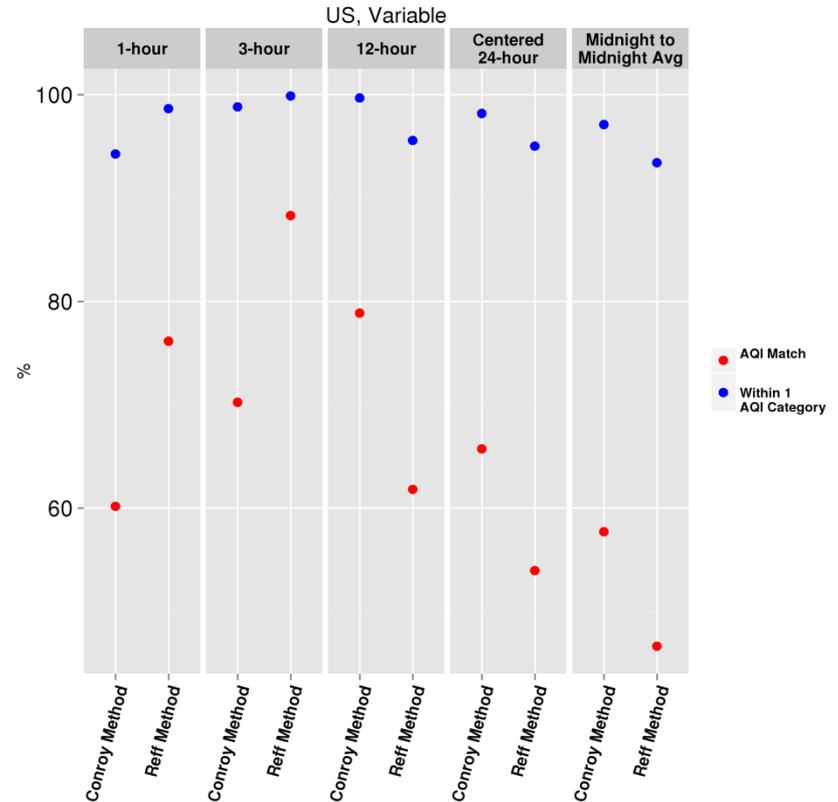
On **variable** days, we want the Reff Method to track the 3-hour average, and it does that considerably better than the previous method.

What We Concluded

- After evaluating each method, we agreed that the updated NowCast (or Reff) method best matches the desired characteristics:
  - Responds to rapid changes in air quality yet still reflects a longer-term average when air quality is stable
  - Works in any location and for any air quality situation
  - Gives public the best possible estimate of a 24-hour exposure
  - Allows us to caution people in time for them to take protective action and reduce their 24-hour exposure
  - Ensures that AQI maps on AirNow more closely match what people see

- As a bonus:
  - Because it can be adapted to track various averaging times, the NowCast is also being used for PM_{10} and soon will be used for O_3, and possibly other AQI pollutants in the future
  - A single method = less cost to implement (no need to update statistical models) and maintain in AirNow and also AirNow-I

The Nowcast and Health

The AQI is a 24-hour index; how can the NowCast accurately represent that?

- While the AQI for $PM_{2.5}$ is appropriately a 24-hour index; we want to give people tools to reduce their exposures to protect their health. To do that, they need to take action

- So we use the NowCast to approximate the 24-hour AQI for $PM_{2.5}$ in any given hour. This gives people the power to take action. They can use this information to reduce their exposure – if PM levels are high, reducing exposures for only during a few hours a day will help reduce a person's 24-hour exposure

- NowCast means our current conditions maps will align more closely with what people are seeing/experiencing. We believe this will increase individual action to reduce exposure

AirNow Public Smoke Page
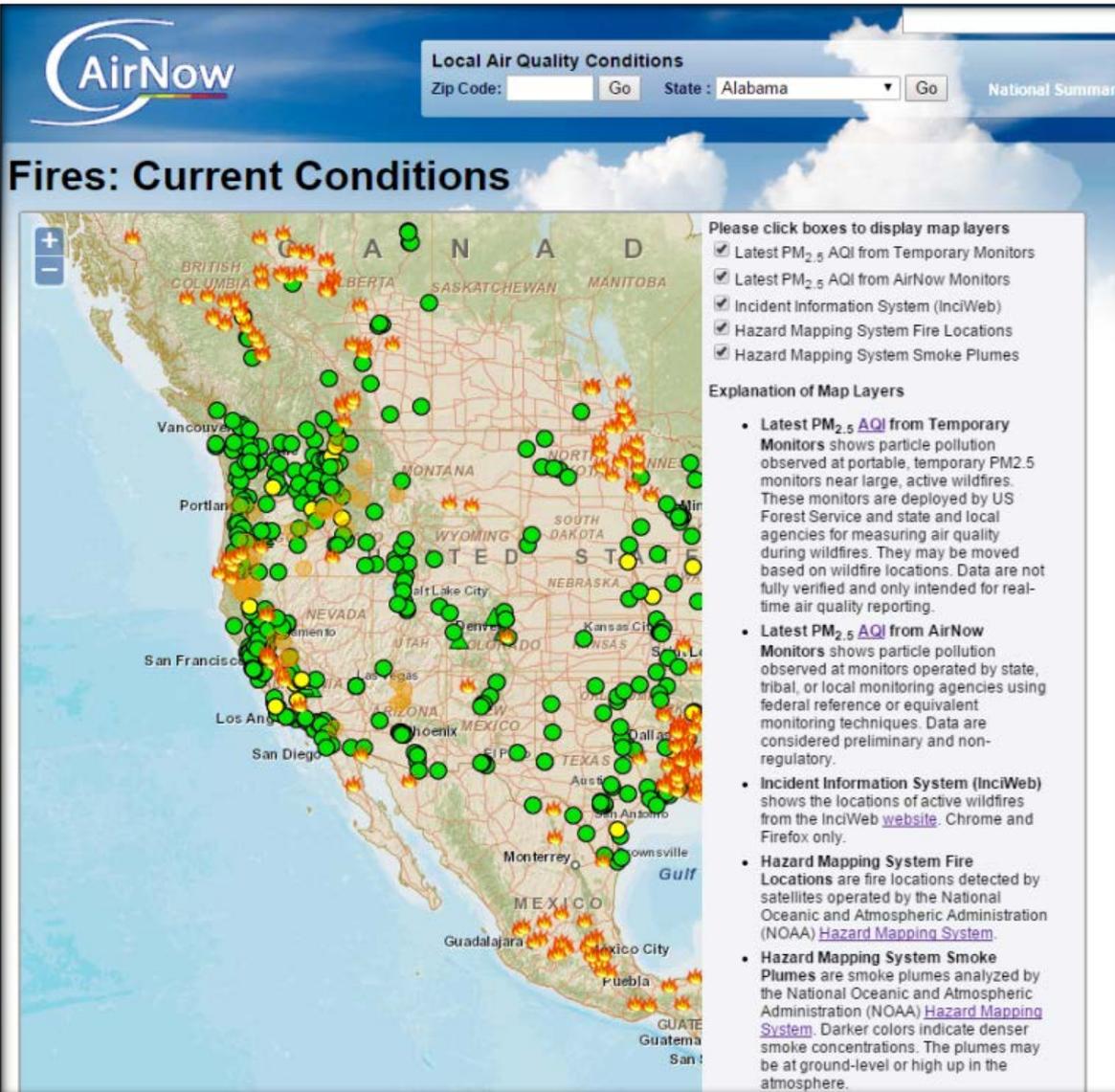
- Live in 2014
  - Flexible, adaptable system
  - Mobile data input and display
  - Rapid product creation
- Can display $PM_{2.5}$ data from temporary monitors sited by USFS and state/local agencies
- Can also show fire locations and smoke plumes
- With agreement from state(s), data can be shown on AirNow main page

Links to Fire and Smoke Information