

What is Air Index Now ?

Pima County Department of Environmental Quality is adopting the EPA's Air Now reporting of the Air Quality Index (AQI). This report is just a modification of the original AQI which we are calling the Air Index Now report.

The original AQI will be used for historical daily statistics only.

The Air Index Now is used for the hourly updates of what the public is breathing at that moment. This index is calculated using modifications to the AQI to give the most accurate estimate of what is in the air at that particular point in time. The formulas that are used by EPA for ozone is called the real-time ozone surrogate. The formula for the PM2.5 is called the PM2.5 Nowcast.

EPA's Air Now web site is located at <http://www.airnow.gov/>

Ozone

An explanation of the real-time ozone surrogate is available on the AirNow.gov FAQ page: <http://airnow.supportportal.com/link/portal/23002/23002/Article/16115/How-are-your-ozone-maps-calculated>.

Essentially, the ozone surrogate is used until a full 24 hours of hourly ozone data are available to calculate true 8-hour averages. The ozone surrogate uses the latest hourly ozone reading to estimate an 8-hour average, based on historical one to eight-hour ozone relationships. The link information is copied here:

The Air Quality Index (AQI) for ozone is based on the 8-hour average ozone concentration, which is computed by averaging the measured hourly ozone concentrations over an 8-hr period. In real time, eight hours of data are not available, so a method was devised to estimate the 8-hr AQI from hourly ozone data using a midpoint approach.

The midpoint average is calculated as follows: at a given hour X, the 8-hr average is calculated by averaging 1-hr data from hours X-4, X-3, X-2, X-1, X, X+1, X+2 and X+3. For example, the 8-hr average for 4 PM is the average value from 12 PM through 7 PM. 8-hr calculations work fine when all of the data are available, but fail when trying to compute an 8-hr average for the current hour in real time.

A valid 8-hr average can still be computed even when just six or seven hours of 1-hr data are available, but not for a fewer number of hours. For the midpoint calculation approach, this means that the 8-hr average for the current hour has only five data values available; the previous 4 hours and the current hour. This means that the 8-hr concentration needs to be estimated.

To estimate the 8-hr average based on the current 1-hr concentration, linear regression was performed on historical data to develop an equation for the relationship between the 1-hr and 8-hour concentrations. The relationship is explained by the following equation:

$$\text{value} = ax + b$$

where:

value = 8-hr surrogate ozone concentration

a = multiplier used for 1-hr ozone value "x"

b = offset

PM₁₀ and PM_{2.5}

An explanation of the PM_{2.5} Nowcast is also available on the AirNow.gov FAQ

page: <http://airnow.supportportal.com/link/portal/23002/23002/Article/16118/How-Does-AirNow-Make-the-Current-PM2-5-Air-Quality-Index-AQI-maps>.

The NowCast is a weighted 12-hour average used to report a PM_{2.5} AQI in real time. The current NowCast has been used since August 2013 and is much more responsive to rapidly changing air quality conditions. The link information is copied here:

1. Compute the concentration range (max-min) over the last 12 hours. This tells us how much the air has changed, but relative to what? We need to scale it.
2. Divide the range by the maximum concentration in the 12-hour period
3. Compute the weight factor by subtracting the scaled rate of change from 1. The weight factor must be between .5 and 1. The minimum limit approximates a 3-hour average. If the weight factor is less than .5 then set it equal to .5.
4. Multiply each hourly concentration by the weight factor raised to the power of how many hours ago the concentration was measured (for the current hour, the factor is raised to the zero power)
5. Compute the NowCast by summing these products and dividing by the sum of the weight factors raised to the power of how many hours ago the concentration was measured.

Example 12-hour period

50 80 75 90 82 53 64 74 21 10 16 13

Range = 90-10 = 80 ug/m³

Scaled rate of change is 80/90.

Weight factor is $1 - 80/90 = .11 \rightarrow$ less than .5, so use .5

$$13*(.5)^0 + 16*(.5)^1 + 10*(.5)^2 + 21*(.5)^3 + 74*(.5)^4 + \dots$$

$$\frac{13*(.5)^0 + 16*(.5)^1 + 10*(.5)^2 + 21*(.5)^3 + 74*(.5)^4 + \dots}{(.5)^0 + (.5)^1 + (.5)^2 + (.5)^3 + (.5)^4 + \dots} = 17.4 \text{ ug/m}^3$$