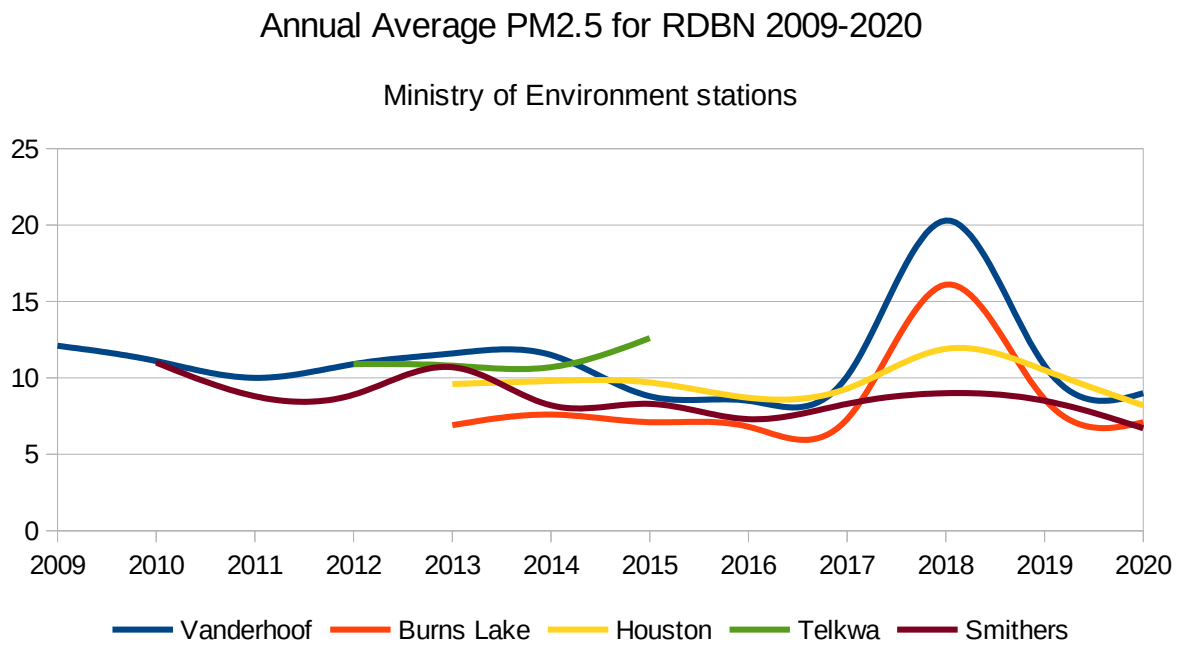
August 20, 2021

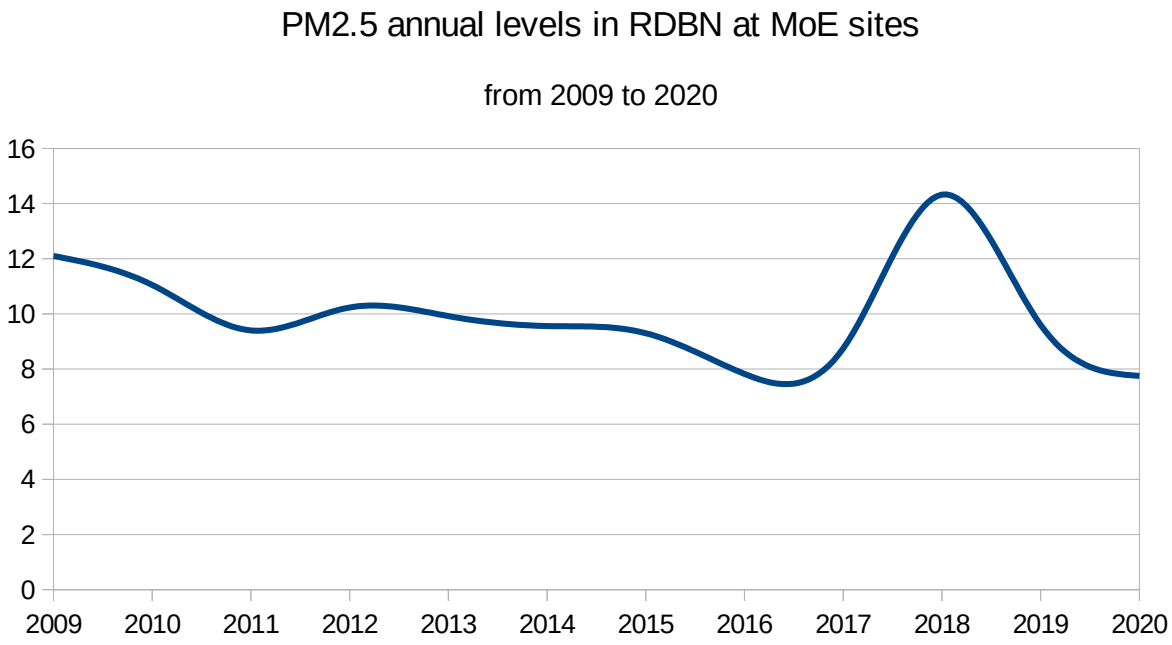
Liliana Dragowsksa on behalf of the Protective Services Department of the Regional District of Bulkley Nechako asked for information about, “Annual Average PM2.5 Concentrations in the BVLD, up-to-date stats on Figure 3-3 pg 17 of the BVLD Cleanair Plan” This request came in response to a referral from BC MoE. The document referenced as the Cleanair Plan is from 2012 and can be found here: http://cleanairplan.ca/wp-content/uploads/2017/06/cleanairplan2012.pdf and the figure and page number are in that document.

The information below provides this information as best I am able with a couple of caveats. PM2.5 has pretty much entirely replaced PM10 as an episode management measurement so that’s what is used here, and there were no PM2.5 figures for 2007 and 2008 so these charts start in 2009. All data taken from MoE Envista data management.

Charts for historical values of PM2.5 in the RDBN



In the first table in this document there is an annual average across all RDBN station as the bottom line. Here is its chart:

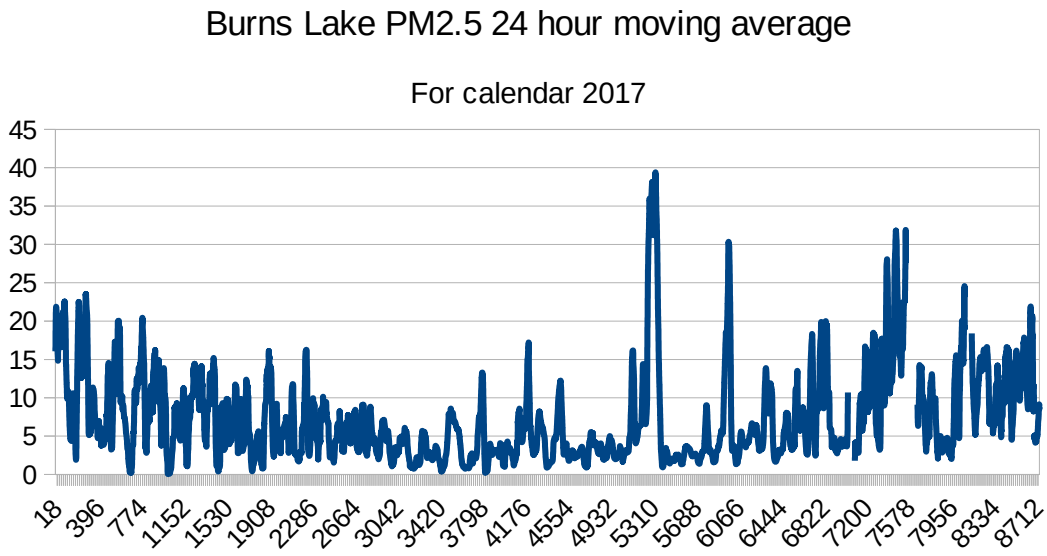


If it weren't for those pesky wildfires we'd have a declining trend.

These tables and charts are graphical representations of numbers that represent measurements of physical phenomena. As far as possible they do so accurately. There are relevant standards for annual measurements of PM2.5 and to the best of my knowledge the data represented here conforms to those standards. They are not, however, without shortcomings.

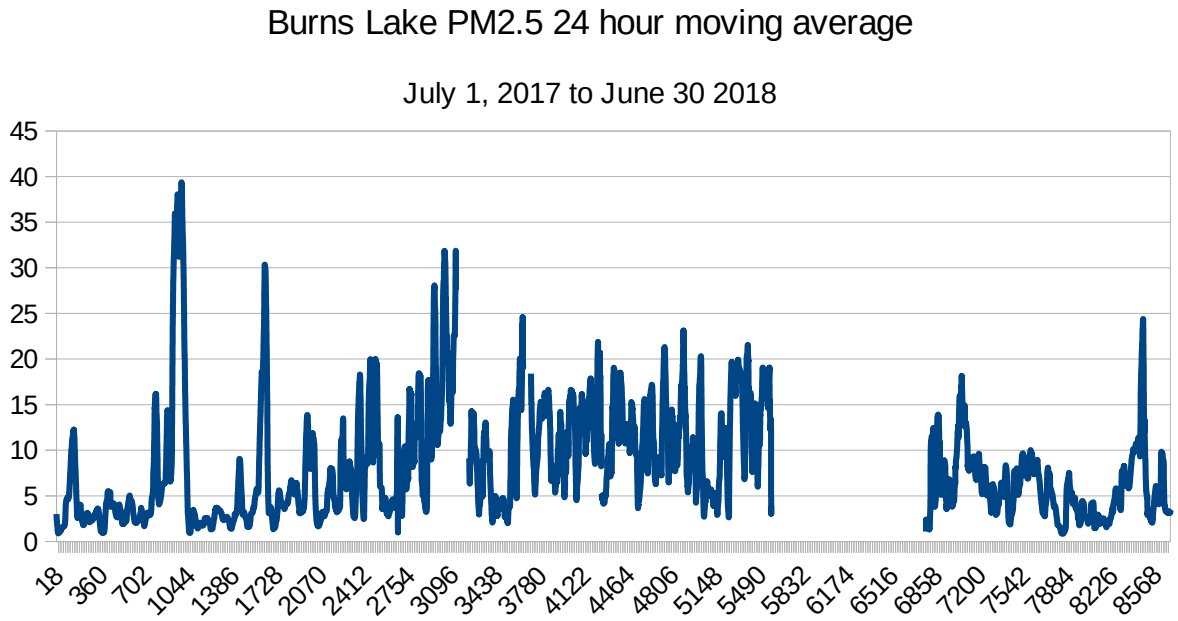
Data analysis and interpretation are not value-free actions. People bring their values and purposes with them and routinely come away better informed and, it may be, changed. *The purpose of computation is insight, not numbers.* Different analytic and graphical displays will reveal different aspects of the phenomena being examined as one's purposes dictate. Ben W's graph from the Clean Air Plan (and those above) show annual averages as they change from year to year. The ordinary span of time is a calendar year. This is clear, consistent and standardized and makes it easy to compare readings in different places. Their statistical significance can be easily established, their human significance is not so easy.

A couple of examples may make this clearer. Below are two charts taken from MoE's Envista data facility for Burns Lake. The first is for calendar 2017.



This is a pretty ordinary pattern with high levels at the left reflecting conditions in early winter, followed by moderate conditions in Spring, Summer and early Fall, then climbing again toward colder weather at year end. The high levels in this chart are divided, half on the left, half on the right. The average is 7.3. The wildfire smoke spike in August shows clearly.

The next chart shows a different time and pattern, from July 1, 2017 to June 30, 2018.



Here the bulge is in the centre, in winter conditions, with the right and left ends in cleaner conditions. The wildfire spikes can be seen on the left and right. The missing data is treated as absent in calculating the average. Nonetheless the average is 8.2. Adding in the missing values would raise the average further.

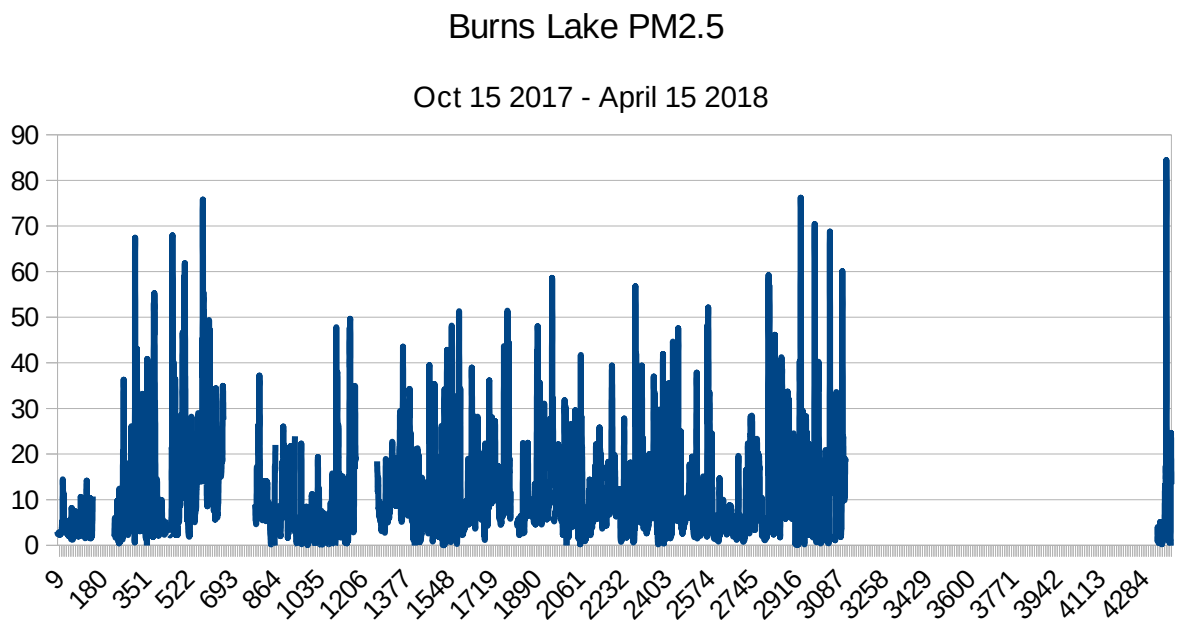
Assessing human health impacts on an annual average basis is a mistaken approach. The nice clean air in summer dilutes concerns by biasing the average lower. But adverse health effects are caused by extreme values, no-one can breathe an average.

To see how this works here's an example.

Values	2	7	11	5					Average out to 6.25
Values	2	7	11	5	1	0	0	1	Average out to 3.375

But the harmful effects are from the high values. So reading about annual averages needs some head scratching to bear in mind what's important[1]. Speeding tickets are not issued based on annual averages – everyone knows that you put it in the ditch with excessive speed not average speed.

One more chart for illustration. If we take a subset of the values illustrated in the previous chart, leaving off the clean mid-year months, we can graph values measured from October 15, 2017 to April 15, 2018, omitting the 2017 wildfire season as well. The average level then is 11 micrograms. Very different threat picture and different measures are called for.



And there's the data gap once again lowering the apparent average.

In assessing PM levels in RDBN communities reference is often had to standards.

1 Jim Pattison and Dave Stevens have an annual average income of $175 million. My cheque has been held up in the mail.

The word standard is ambiguous. It may be either descriptive or prescriptive. A prescriptive standard stipulates action to be performed or to not be performed – a limit is set out. One might find in an air emissions permit language like, “flow rate from dryer stack number 3 is not to exceed 85 cubic metres per second.” So that is a prescriptive standard. Or a descriptive air pollution standard from the CCME[2] might set out statistical procedures for determining the annual average level of PM2.5.

These are easily confused. If the CCME standard is 8 micrograms annually *this is not a health based standard*, up to which it is ok to pollute, nor is it a bright line below which pollution levels are ok. They may, if lower, be legal, but they are harmful to some degree. The degree of harm depends critically on the characteristics of the exposed population, which is not known. Broadly speaking, if you can measure it it will hurt someone in a large population – babies, say. This is the right place for the precautionary principle to be invoked.

2 Canadian Council of Ministers of the Environment, a standard setting intergovernmental body