

Air Quality Update for the Cowichan Valley

November 30, 2016



Ministry of
Environment

Earle Plain, Air Quality Meteorologist

Overview

- Where is air quality measured in the Cowichan Valley?
- What is the data telling us?
- New things
 - Surveillance monitoring
 - SFBDAR

What is Measured in the CVRD?

- Total Reduced Sulphur (TRS) at 3 sites
- Sulphur Dioxide (SO₂) at 1 site
- Nitrogen Oxides at 1 site
- Ground Level Ozone (O₃) at 1 site
- Fine Particulate Matter (PM_{2.5}) at 4 sites
- Meteorology (3 sites)
- Misc studies –rotational surveillance PM_{2.5} and met monitoring (3 sites) 2014-2016



Lake Cowichan



Duncan Cairnsmore Core Station

Shawnigan Lake

Ladysmith



Substation

Georgia Park Hts

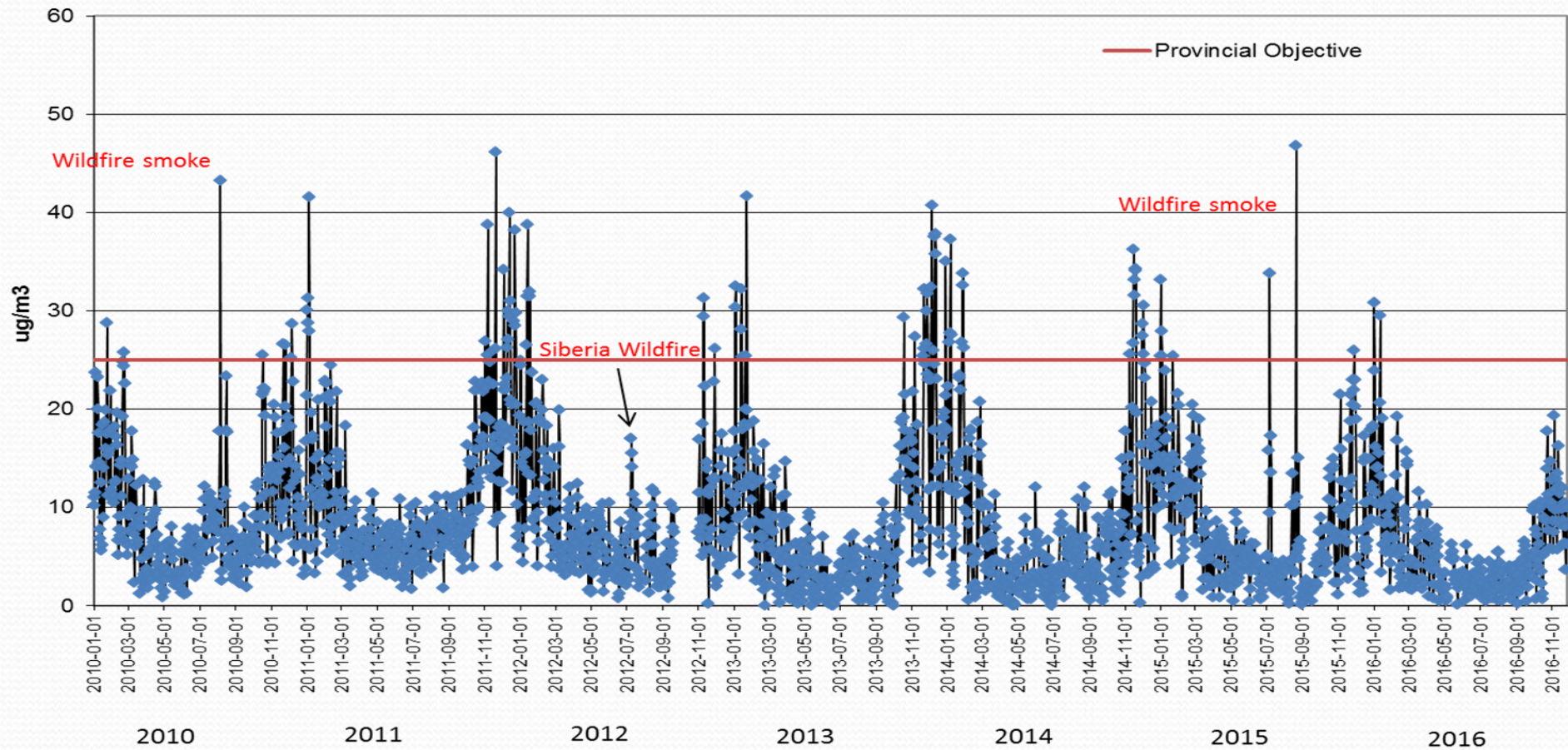
Deykin Avenue



What is the data telling us?

- NO₂, SO₂, and ground level O₃ levels remain well below Provincial objective levels
- TRS concentrations are below Provincial odour objective levels 99% of the time at Quamichan Lake and 96-98% of the time at sites closer to the pulp mill
 - Remains a pollutant of interest
- Fine particulate matter (PM_{2.5}) occasionally exceeds Provincial Air Quality Objectives
 - Main pollutant of concern – health effects, visibility, vegetation

Daily PM2.5 Concentrations at Duncan Cairnsmore January 2010 - November 2016

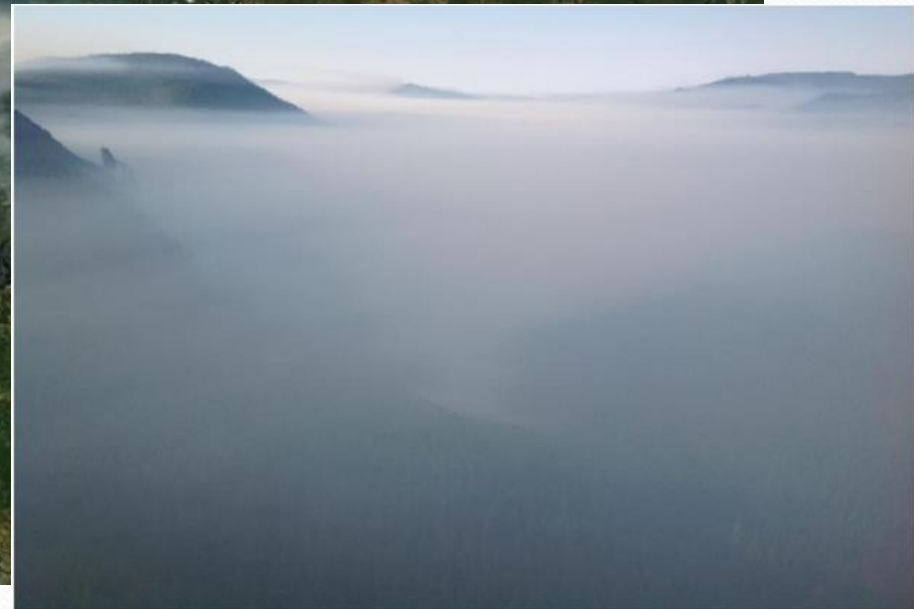




Vancouver
Island



Lower
Mainland



Spring Rd/Lizard Lake fire – Morning of August 13

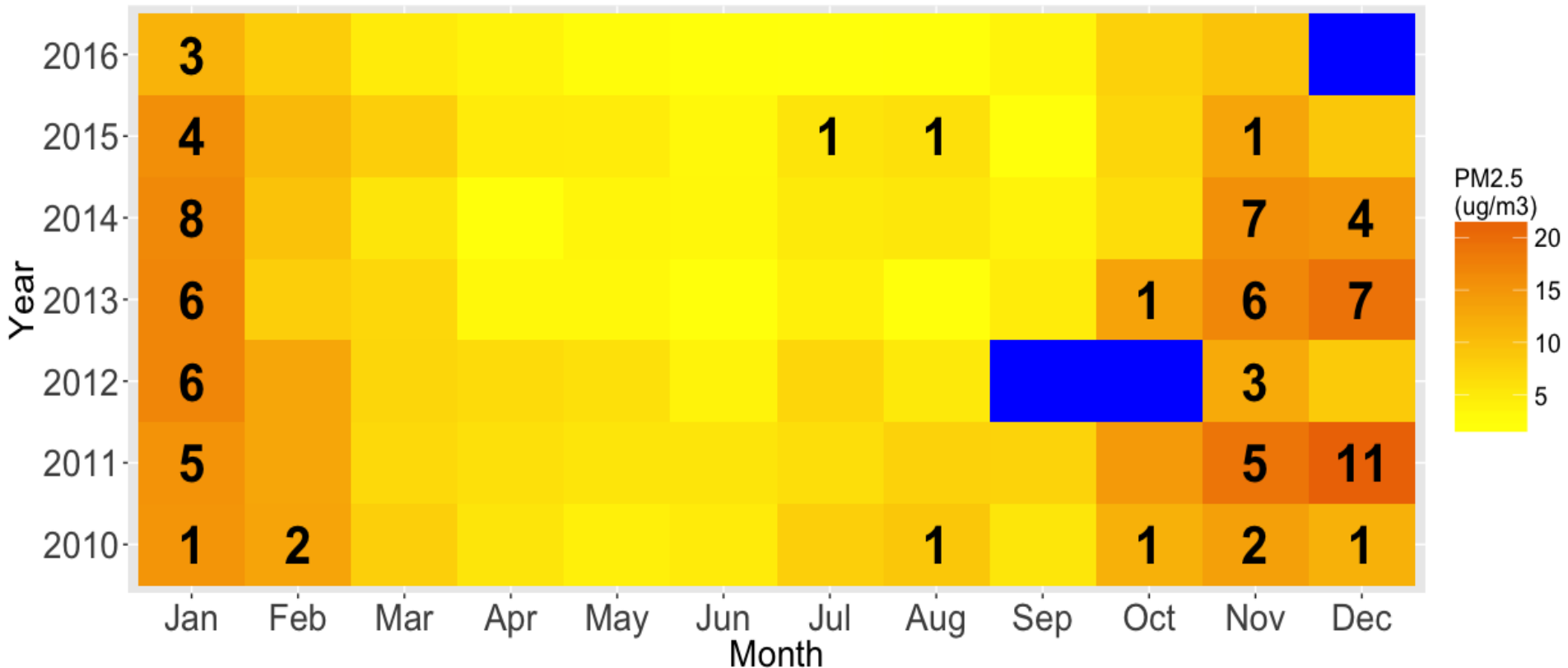
Scales!

- Different emission sources affect exposure on different scales
 - In space / time
- Industrial burning: valley-wide / mostly autumn
- BY burning and land clearing: neighbourhood & community impacts / mostly autumn but can be sporadic throughout cold season
- Industrial sources: community / all year
- Woodstoves: neighbourhood & community / autumn, winter, spring

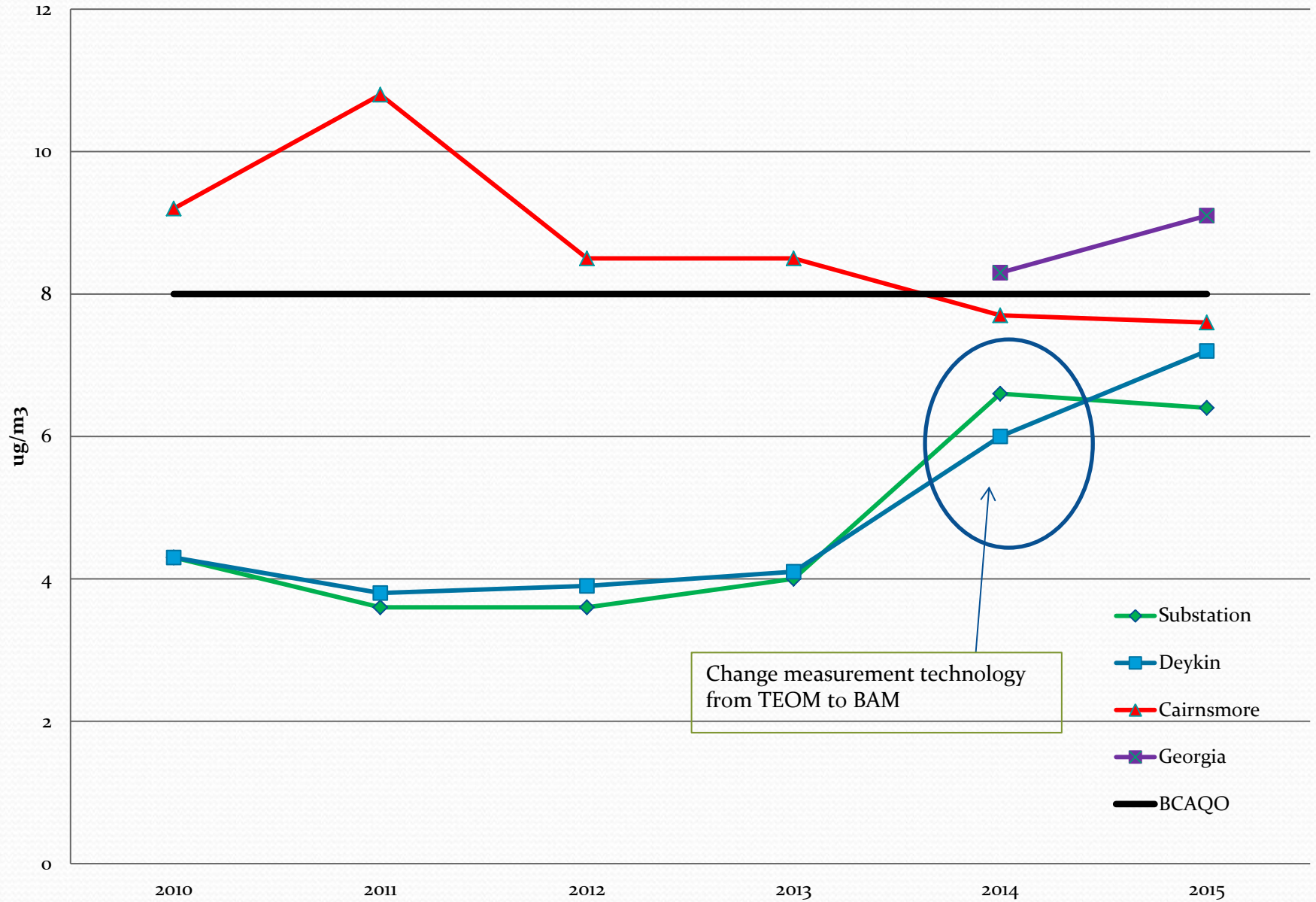


The data: exceedances and months

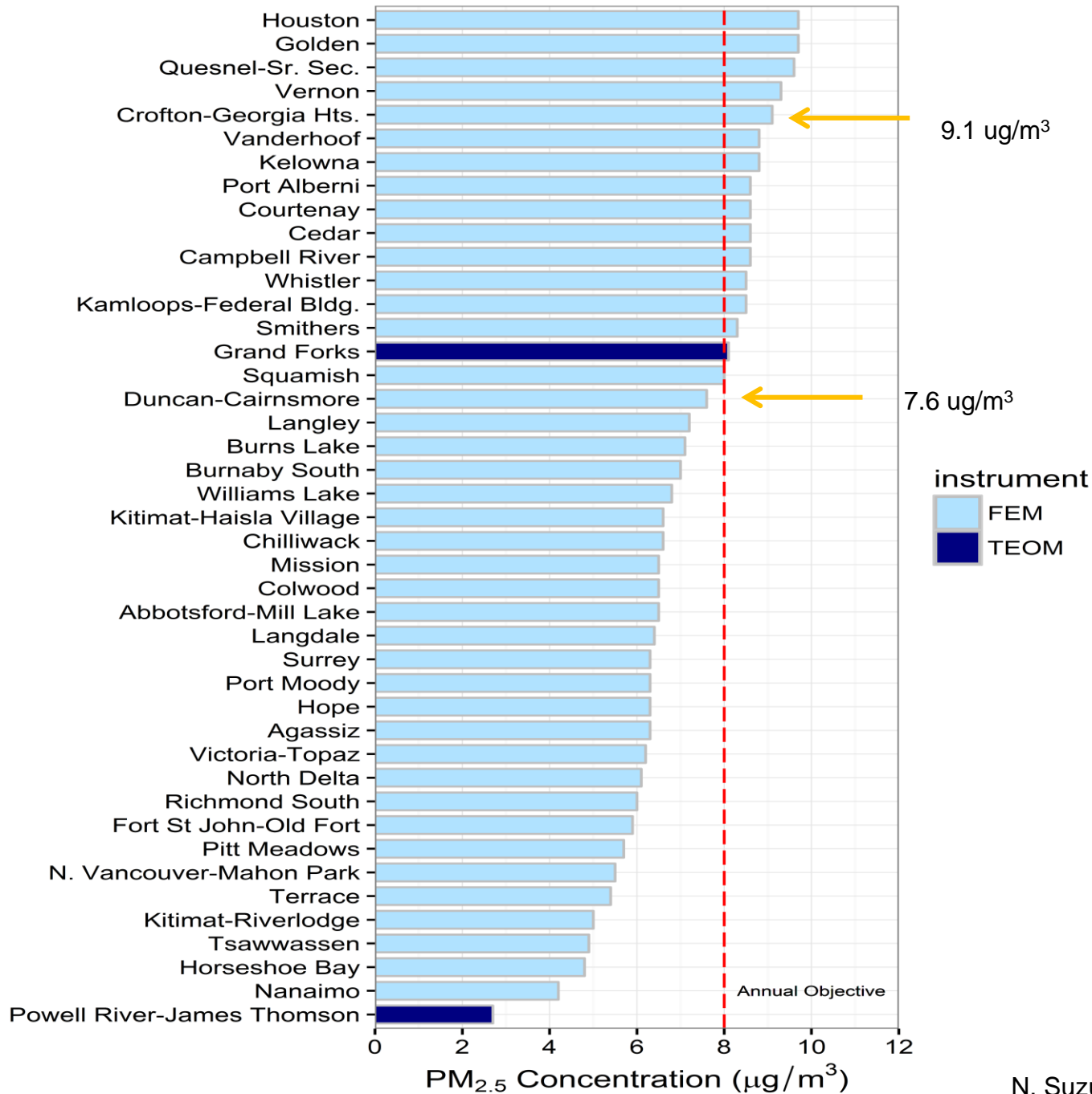
Duncan: Monthly Average PM2.5 Concentration and # Days Exceeding Daily Objective (2010 to Nov 2016)



Annual Average PM_{2.5} Cowichan Valley 2010-2015



2015 PM_{2.5} Levels in B.C.

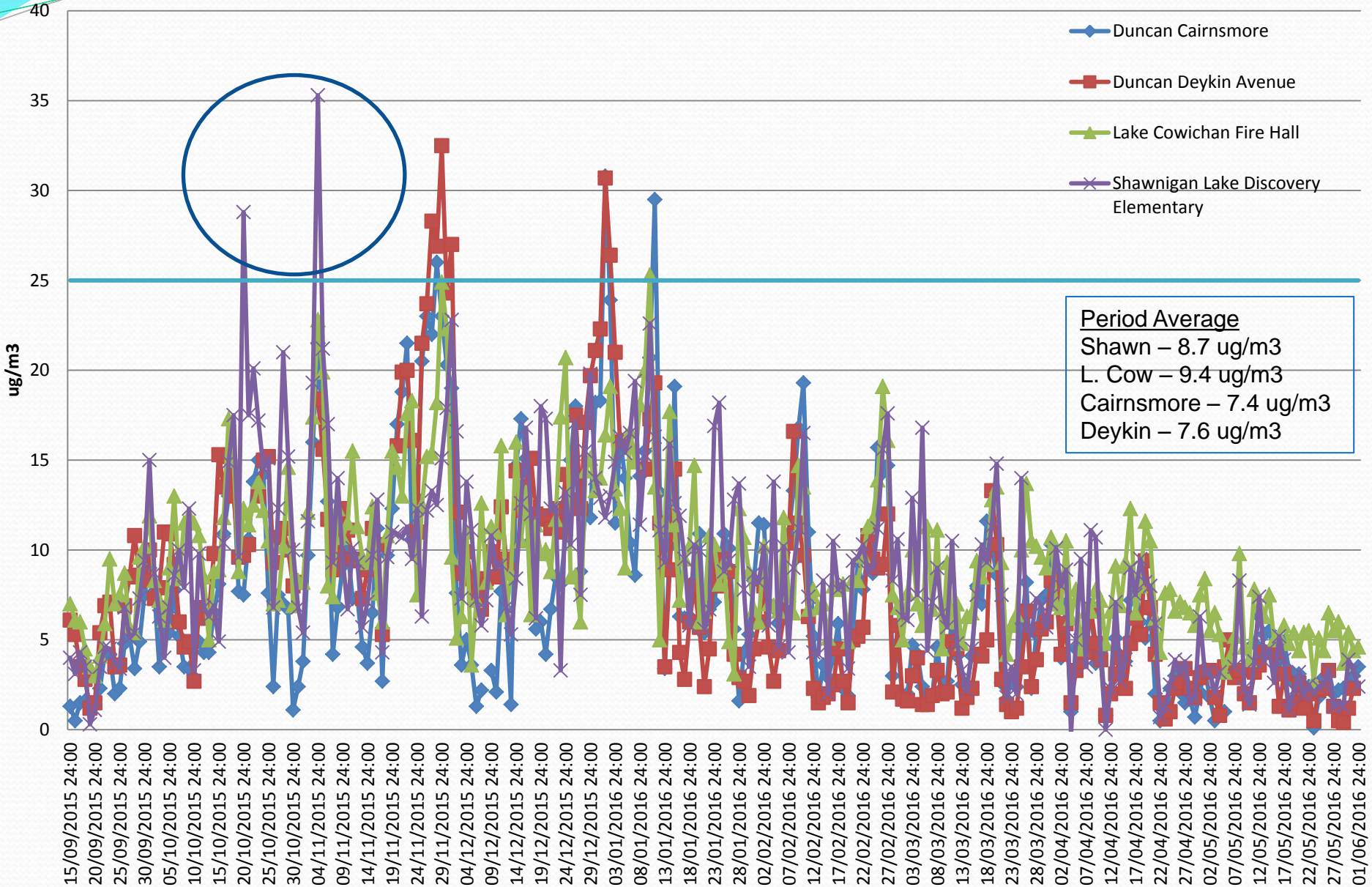


Rotational PM2.5 Monitoring

- Lake Cowichan & Shawnigan Lake – September 1, 2015 to June 1, 2016
- Ladysmith – September 1, 2016 to present

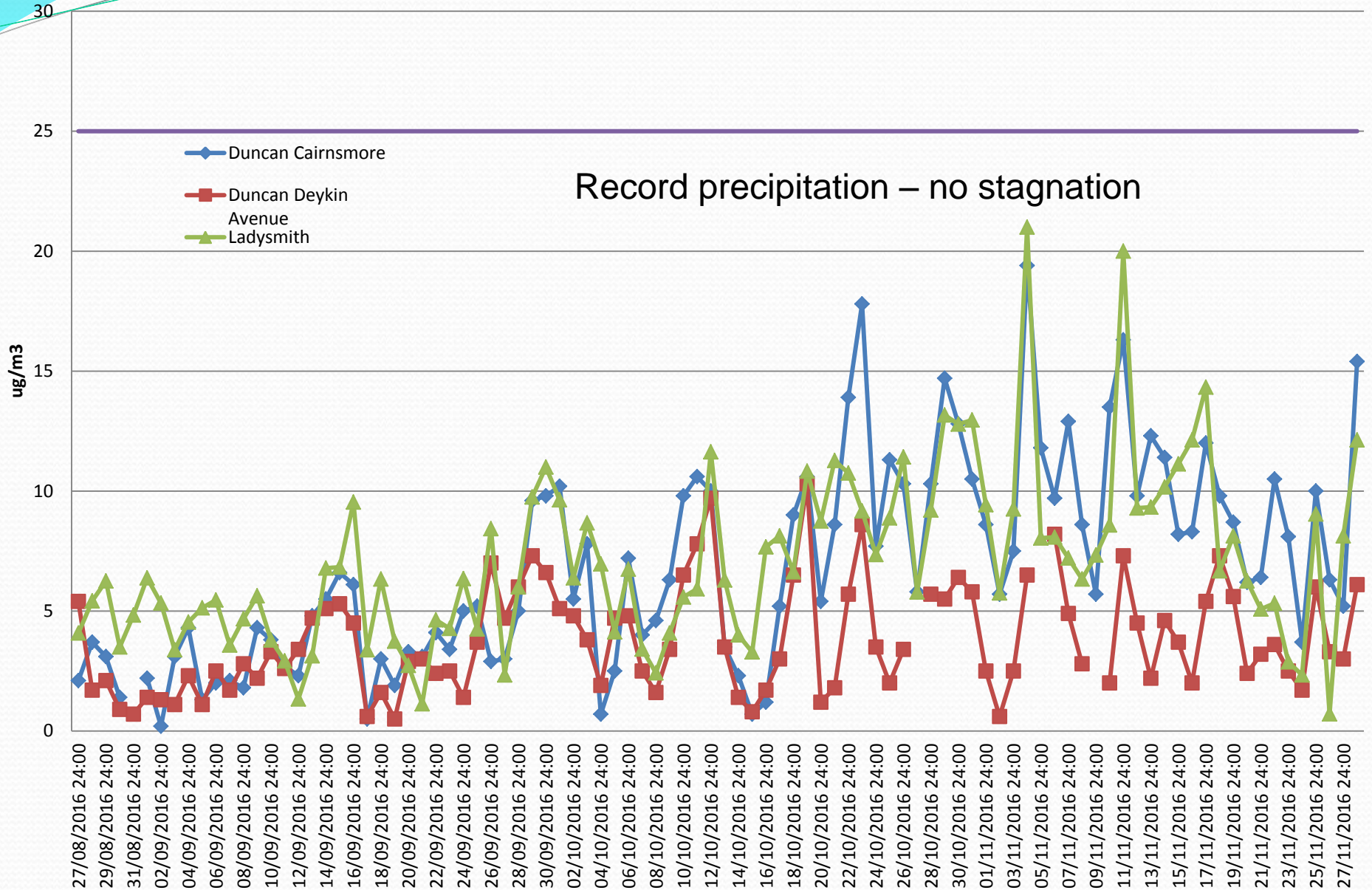
Daily PM2.5 Levels Shawnigan and Lake Cowichan Select CVRD Sites

September 15 2015 - June 01, 2016



Daily PM2.5 Levels Ladysmith vs. Select PM2.5 sites in the CVRD

August 27-November 28, 2016



Updated - Solid Fuel Burning Domestic Appliance Regulation (SFBDAR)

- See bcairquality.ca for detailed FAQ.
- Ensures that solid fuel burning appliances sold in BC are the cleanest they can be – new appliance emissions down to 4.5 g/h by March 2017 and 2.5 g/h by 2020
- Closes loopholes for some appliance that were previously excluded
- Phases out non-certified outdoor boilers and provides setbacks for new installations

Purple Air Sensor Testing

PurpleAir – <http://www.purpleair.org/>



An air quality monitoring network built on a new generation of Laser particle counters. PurpleAir Sensors use WiFi to report local air quality in real time to the PurpleAir Map.

In the fall of 2015, Air Quality Monitors were installed along the Wasatch Front in the greater Salt Lake valley. The unique bowl shaped geography experiences frequent winter inversions and traps air pollution. Our goal was to understand and track these changes to air quality.

Update - August 18 2016

PurpleAir has been hard at work building, deploying and building more sensors. We are grateful to all our hosts and supporters who have helped us get to the 100 sensors online mark that we just passed!

We designed a whole new prototype sensor that we can make in larger quantities. Unique to PurpleAir, the new design features dual laser detectors to ensure reliability and help us to detect any potential faults with the sensors. This hugely increases the reliability of the readings. The case is an experiment and a way to make them in larger quantities before we get more advanced, 3rd generation housings designed and made. This new housing would bring together experiences with PurpleAir sensors deployed in the field.

SCAQMD results are out and it's good news: The first generation of PurpleAir sensors scored extremely well against "federal equivalent methods".

Find the SCAQMD report here: <http://www.aqmd.gov/aq-spec/product/purpleair>
As a result of these first stage tests, the SCAQMD is putting PurpleAir sensors through exhaustive lab tests that will show more performance related details. PA-II, dual laser counter models testing is already underway and we will share those results as we get them.

Getting a PurpleAir Sensor

Buy one now: The new, PurpleAir version 2 sensors with dual laser counters are available for \$180 (contact us for more information on quantities discount).

PA-II
PurpleAir Particulate Sensor with dual laser counter and outdoor, 33 foot power supply *

Price: \$180.00 USD
Shipping: \$20 USD

View the PurpleAir Map Live

Choose a starting point:

Summary

- SO₂, NO₂ and O₃ remain below Provincial and National ambient air quality objective levels
- PM_{2.5} levels continue to indicate generally good AQ in summer and degraded AQ during cold months due to meteorology and additional emission sources
- Improvement in annual average PM_{2.5} in Duncan; still some short-term exceedances of the AAQO; New Georgia Hts station above AQO; Deykin below AQO
- Lake Cowichan and Shawnigan similar patterns to Duncan with open burning impacts more prevalent in Shawnigan; Ladysmith similar to Duncan
- Need to improve PM_{2.5} levels by managing wood smoke/combustion sources in Airshed and through continuous improvement at permitted facilities



Extra Slides

AQ Data Collection

- Analyzers maintained by MOE & Permittee AQ technicians
 - Continuous measurements; polled hourly and undergoes validation checks by technical staff in Region and in Victoria before being placed in central database
 - Used to issue Air Quality Advisories; compliance with Objectives and standards; regulatory purposes; public reports
- Raw data posted to bcairquality.ca for near real-time access by the public

PM_{2.5} Annual Data Summary

– Duncan Cairnsmore

Year	Annual Average	Annual 98 th Percentile of daily values	Max daily value	# of Daily values > 25 ug/m ³	% of time > 25 ug/m ³
2010	9.2 ug/m ³	25.1 ug/m ³	43.3 ug/m ³	6	1.7
2011	10.7 ug/m ³	30.8 ug/m ³	46.2 ug/m ³	21	5.8
2012	8.5 ug/m ³	29.4 ug/m ³	38.8 ug/m ³	9	2.9
2013	8.6 ug/m ³	32.4 ug/m ³	41.7 ug/m ³	19	5.3
2014	7.7 ug/m ³	31.6 ug/m ³	37.3 ug/m ³	19	5.3
2015	7.6 ug/m ³	23.9 ug/m ³	46.8 ug/m ³	5	1.9

Provincial Air Quality Objectives for PM_{2.5}:

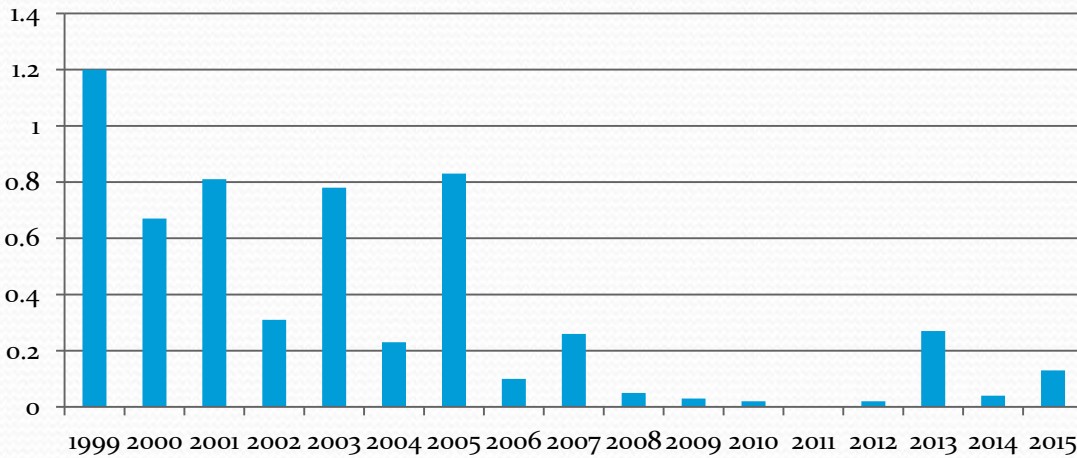
- 8 ug/m³ – Annual
- 25 ug/m³ – Applies to Daily average and to 98th percentile Daily average annually

Total Reduced Sulphur -TRS

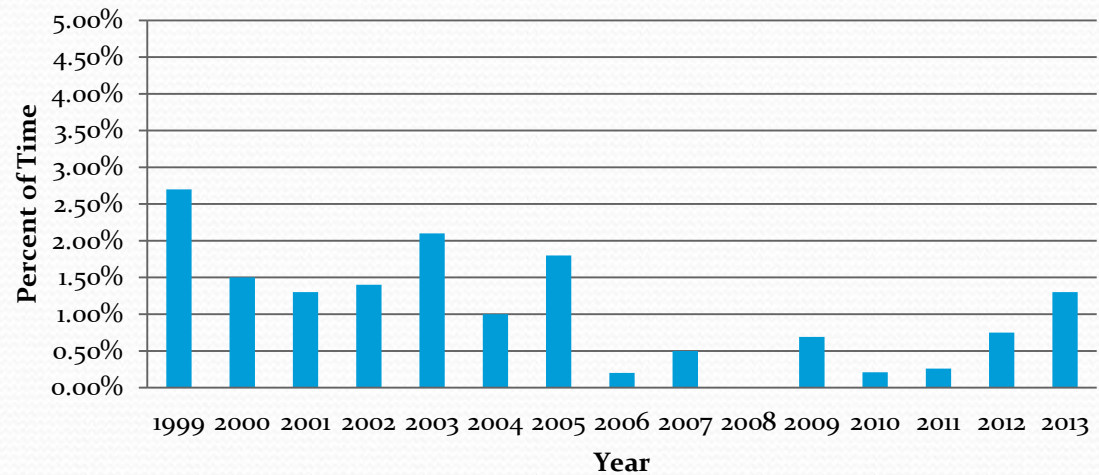
- TRS includes hydrogen sulphide, mercaptans, dimethyl sulphide, dimethyl disulphide and other sulphur compounds
- Rotten eggs or cabbage smell
- Sources in Cowichan Valley include pulp mill emissions, sewage treatment facilities, swamps, bogs and marshes



Percent of Time Hourly TRS Values are Greater Than Provincial Level A at Deykin Avenue 1999-2015



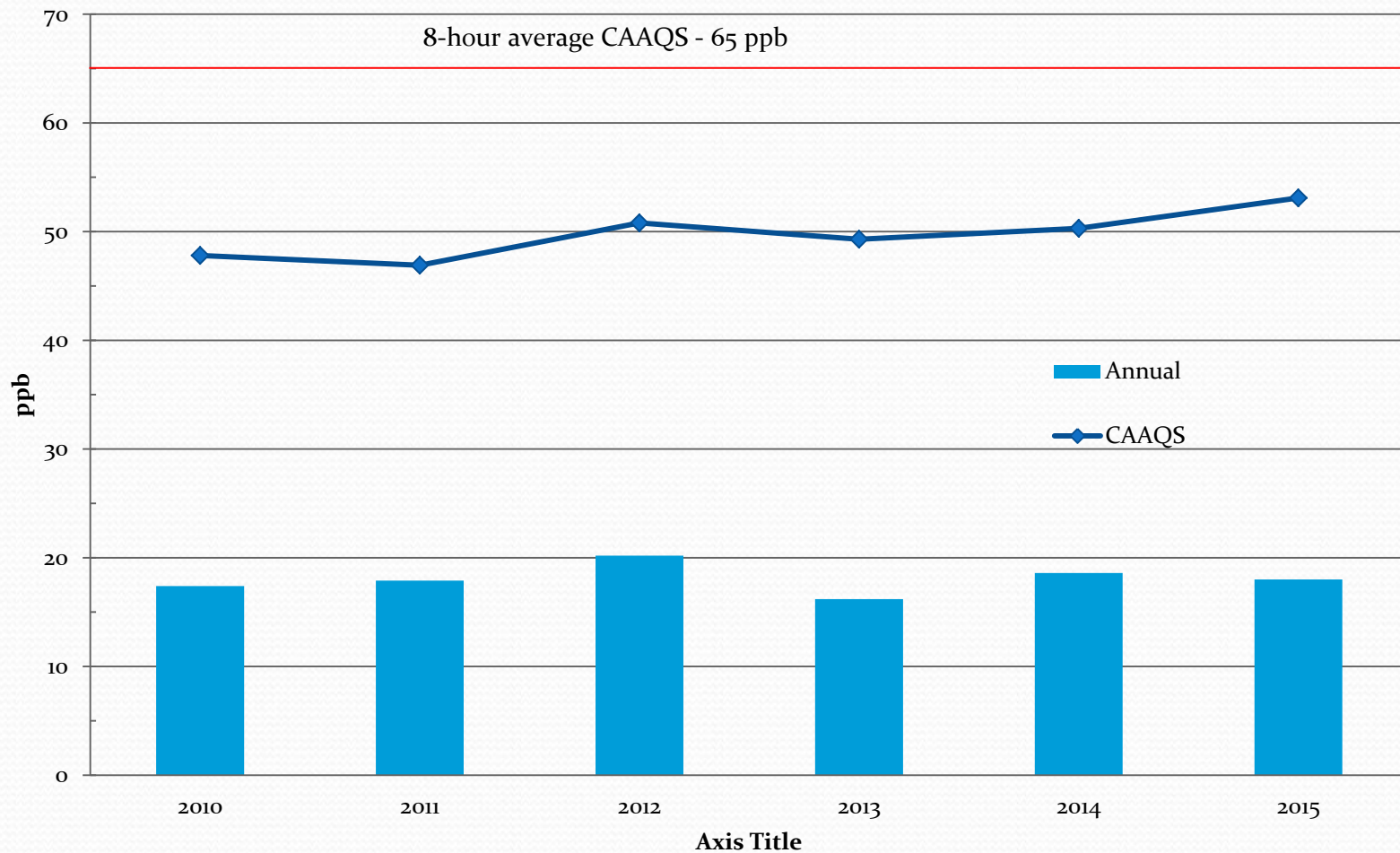
Percent of Time that Hourly TRS Values Above Provincial Level A Objective at Crofton South 1999-2013



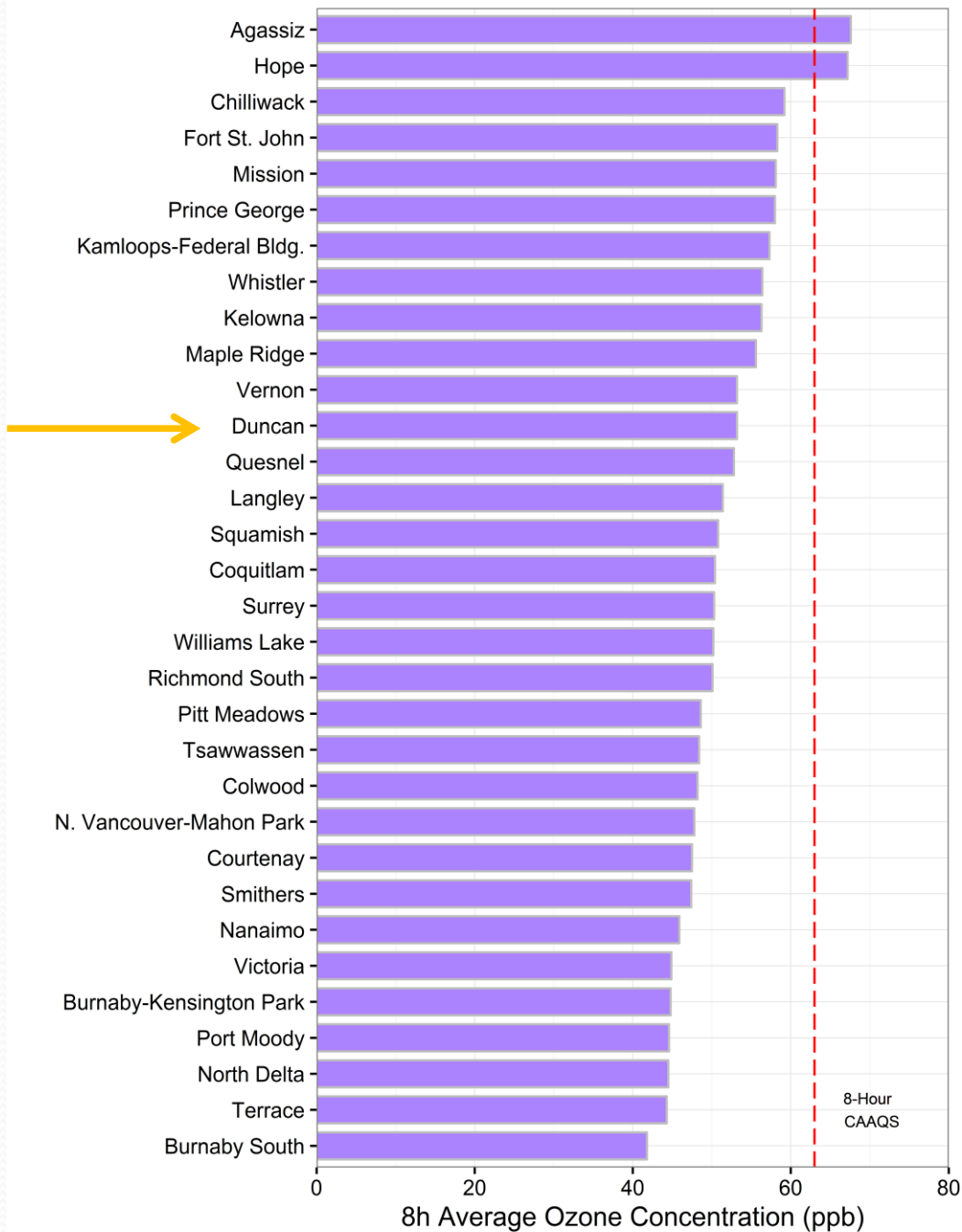
Ground Level Ozone

- O_3 is a major component of urban smog.
- Ground-level ozone is not emitted directly into the atmosphere. It results from photochemical reactions between oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight and warm temperatures. Highest levels typically occur from May to September, between noon and early evening.
- Health effects (respiratory tract and eyes), vegetation damage, visibility (smog)

Annual Average and 8-hour (CAAQS) O₃ at Duncan Cairnsmore 2010-2015



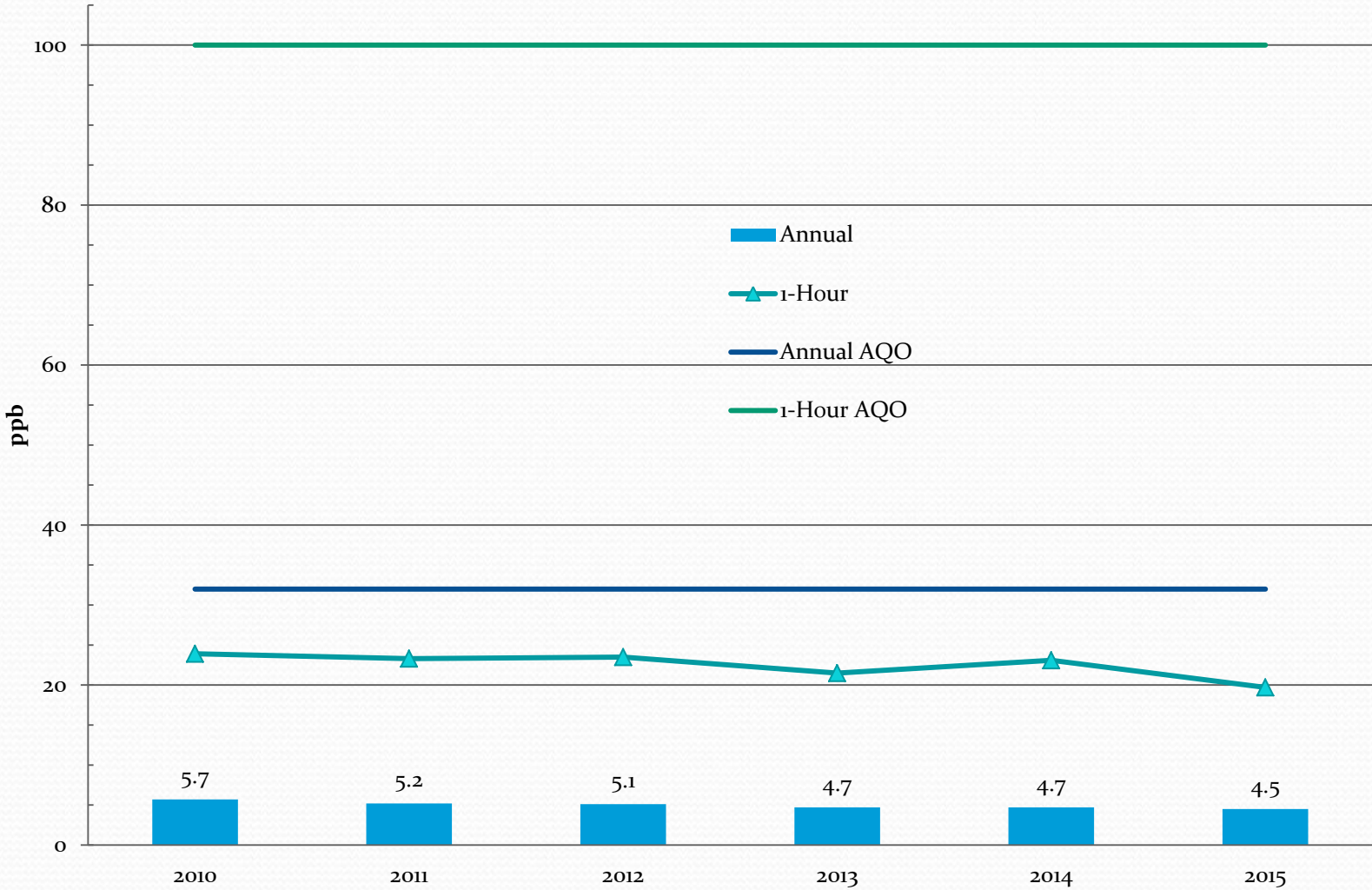
2015 Ozone Levels in B.C.



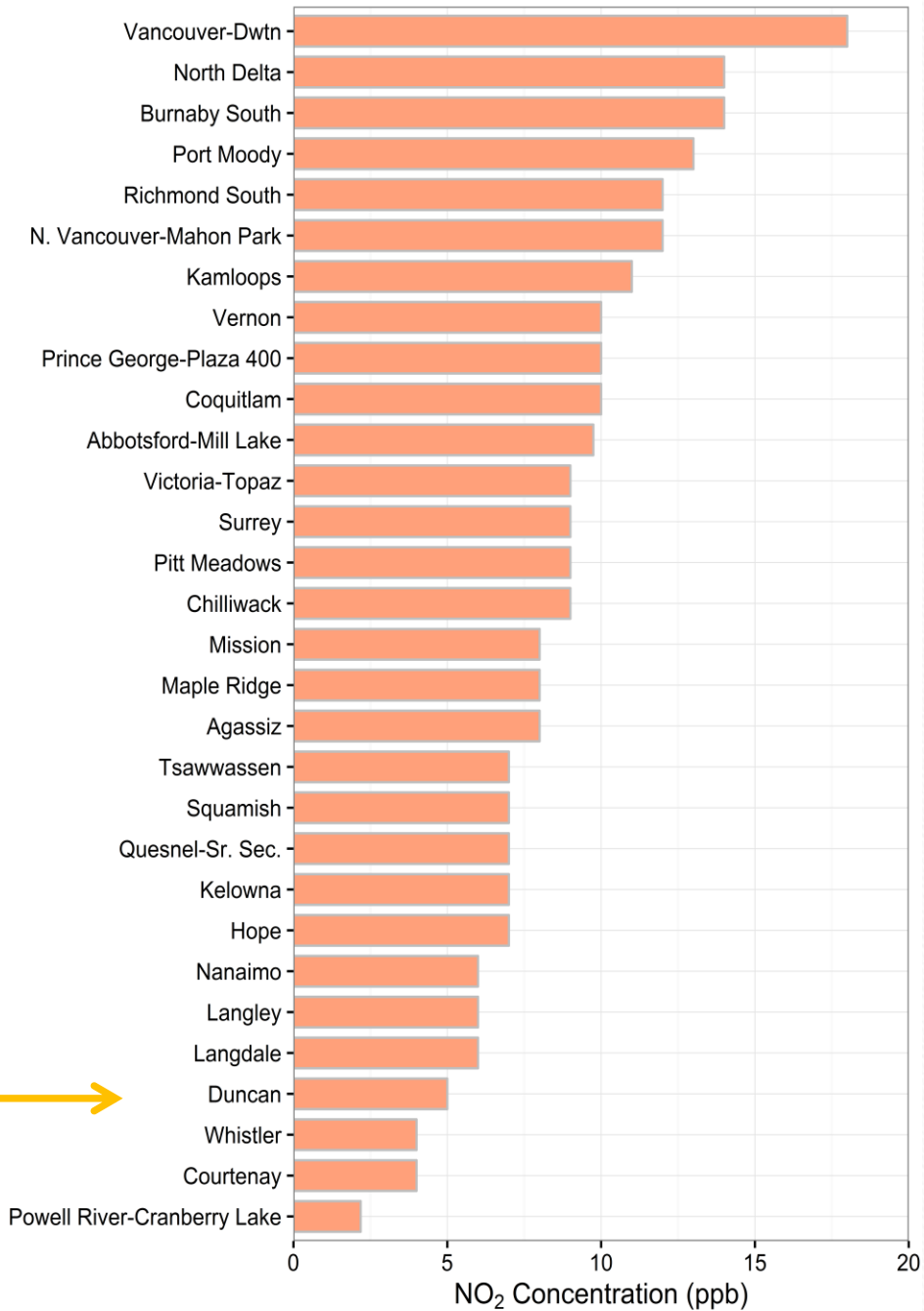
Nitrogen Dioxide – NO₂

- NO₂ plays a major role in atmospheric reactions that produce ground-level ozone, a major component of smog. Also a precursor to nitrates, which contribute to increased fine particle levels in the atmosphere.
- Sources – any kind of combustion in air; industry, mobile sources, wood burning, etc.
- Health effects (respiratory), vegetation effects, O₃ formation, acidification, secondary fine particle production

Annual and 98th Percentile of daily 1-Hour Maximum 2010-2015



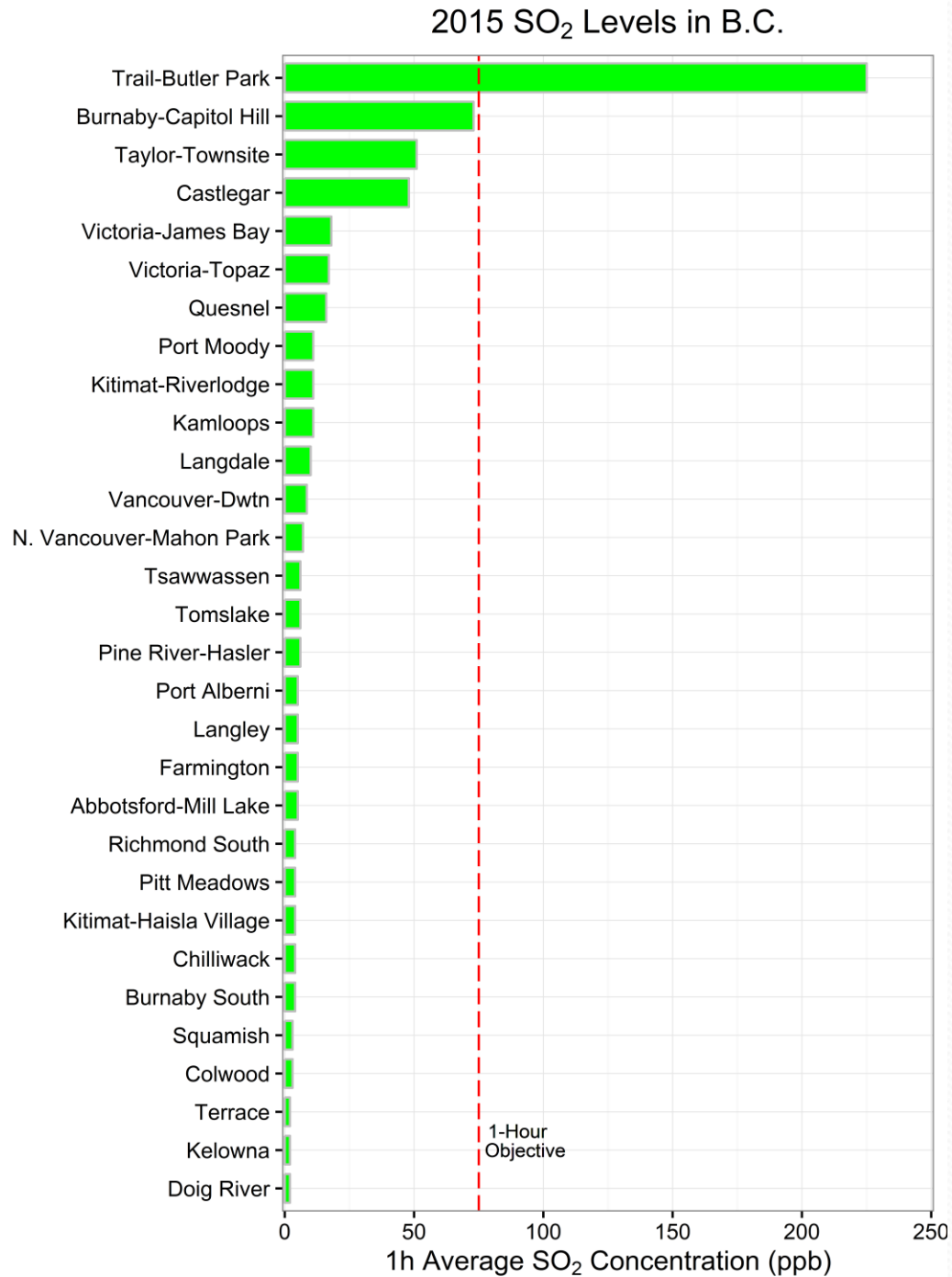
2015 NO₂ Levels in B.C.



Sulphur Dioxide

- Sulphur dioxide (SO_2) is a colourless gas with a pungent odour (like burnt matches) at higher concentrations.
- Sources – pulp mill, combustion of fossil fuels containing sulphur.
- High levels - health effects (respiratory), vegetation damage, acidification, fine particulate formation, visibility degradation.
- Results - No exceedances of Provincial or National Objectives at any monitoring location.

Crofton Georgia
Hts 2015 99th
percentile of daily
1-hour max – 50.5
ppb

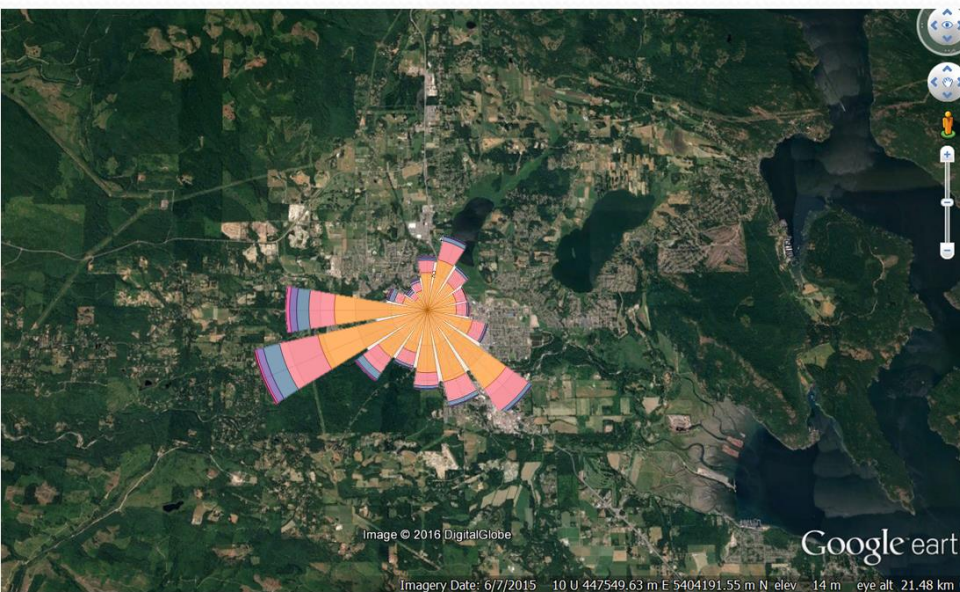




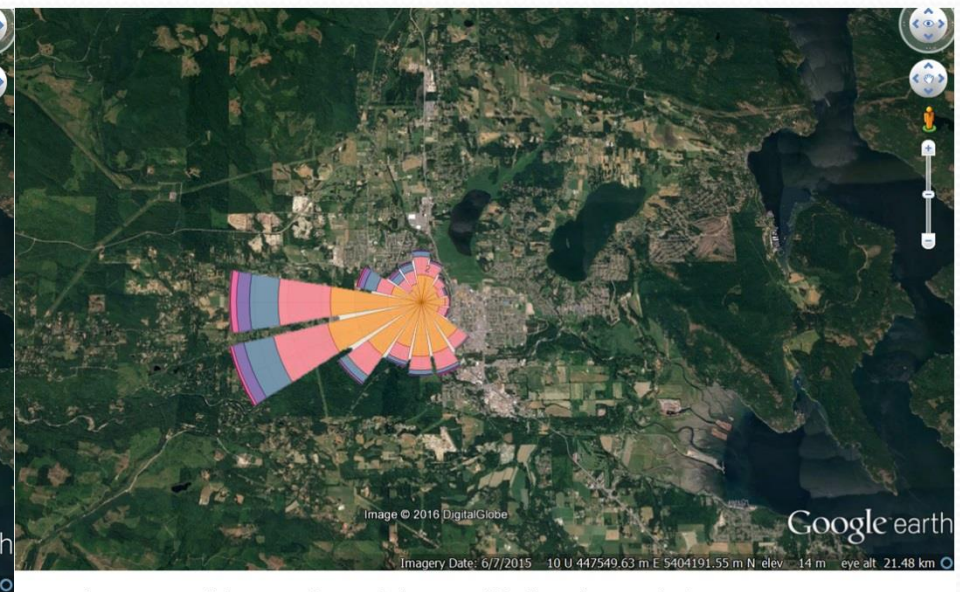
Duncan [Cairnsmore](#) PM2.5 Pollution Rose – [Spring](#) months (Mar, Apr, May) for all years (2010-2015 data).



Duncan [Cairnsmore](#) PM2.5 Pollution Rose – [Summer](#) months (Jun, Jul, Aug) for all years (2010-2015 data).

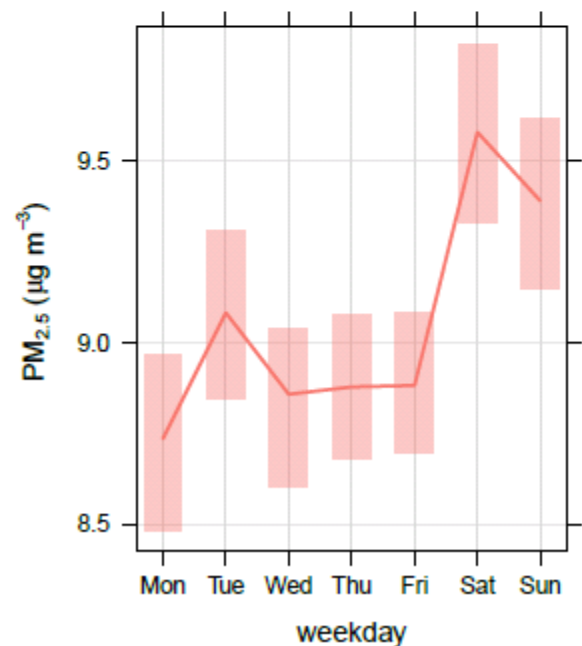
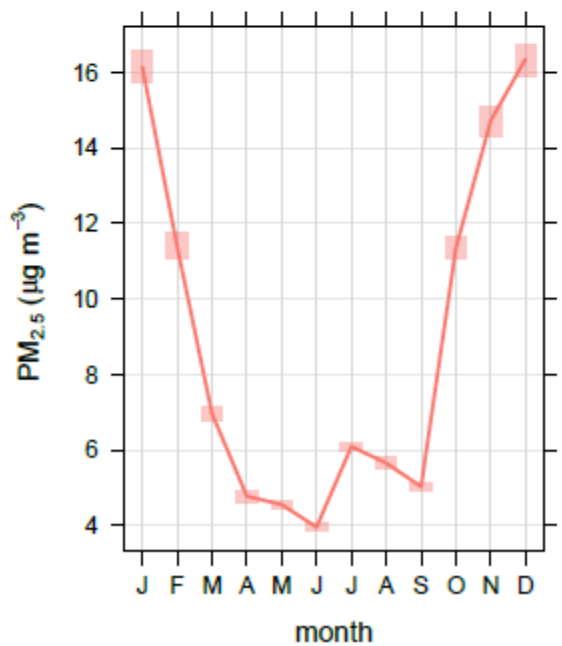
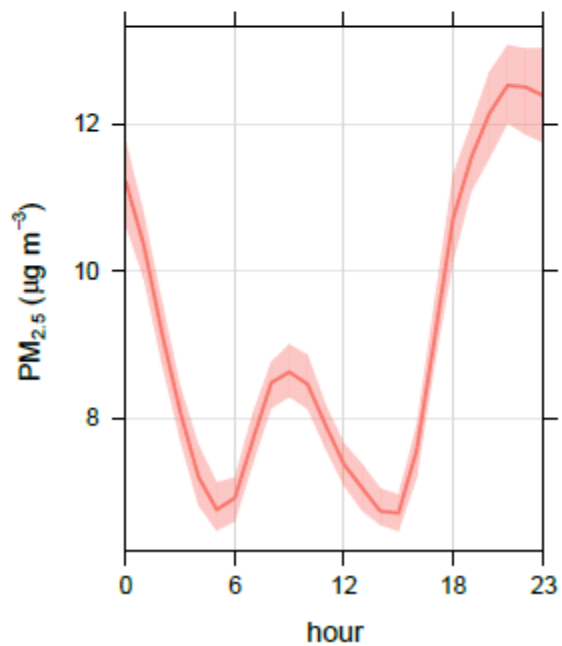
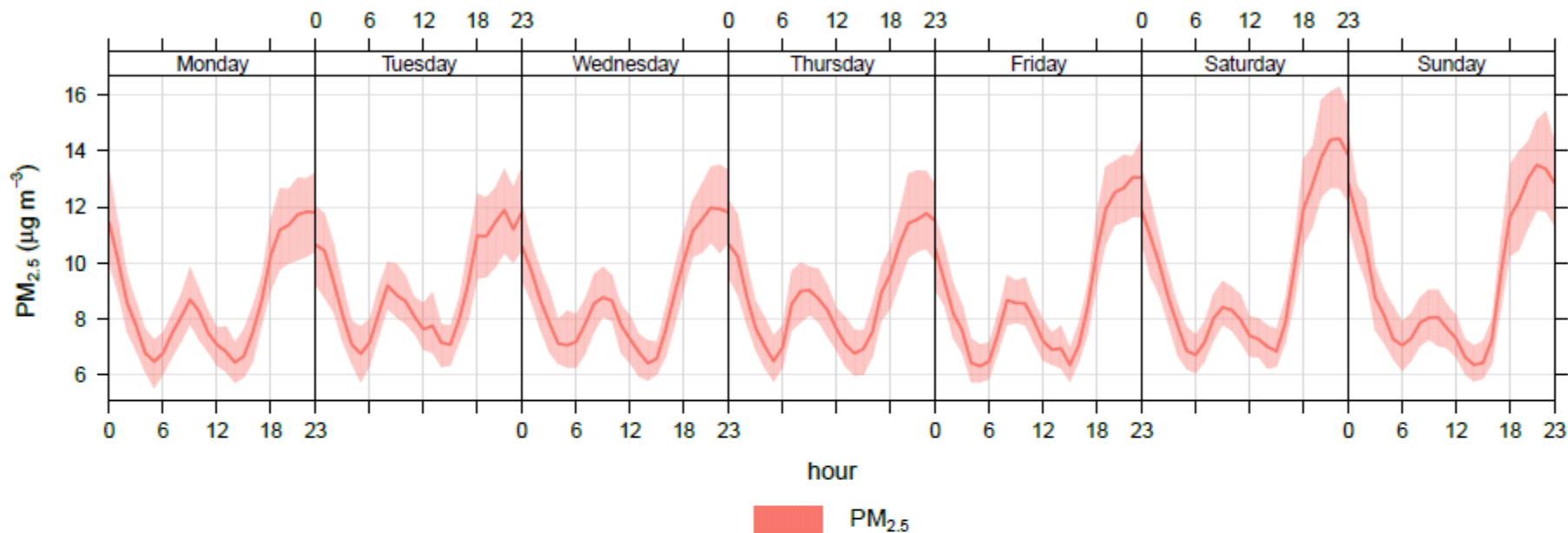


Duncan [Cairnsmore](#) PM2.5 Pollution Rose – [Fall](#) months (Sep, Oct, Nov) for all years (2010-2015 data).



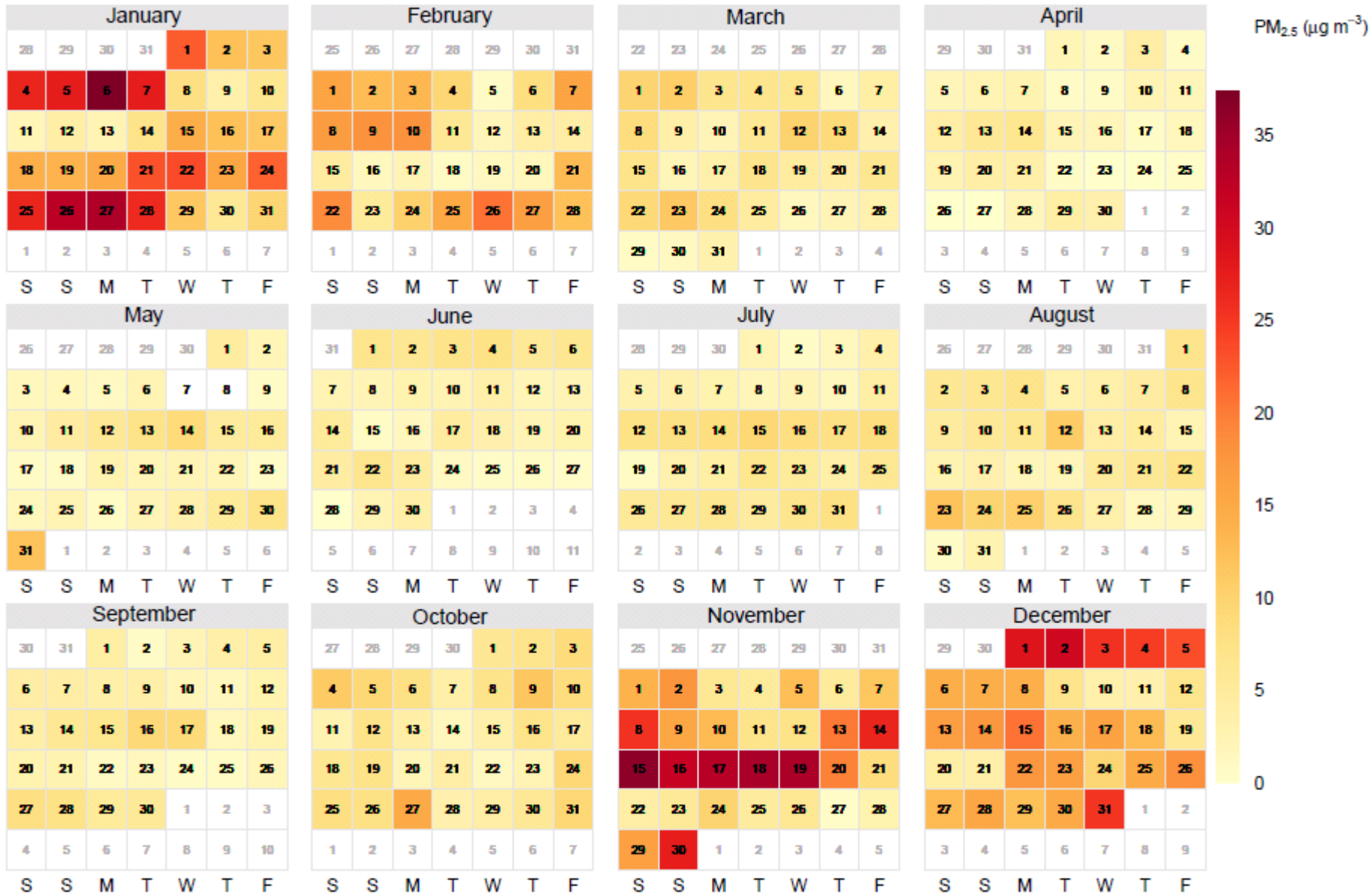
Duncan [Cairnsmore](#) PM2.5 Pollution Rose – [Winter](#) months (Dec, Jan, Feb) for all years (2010-2015 data).

Duncan Cairnsmore 2014

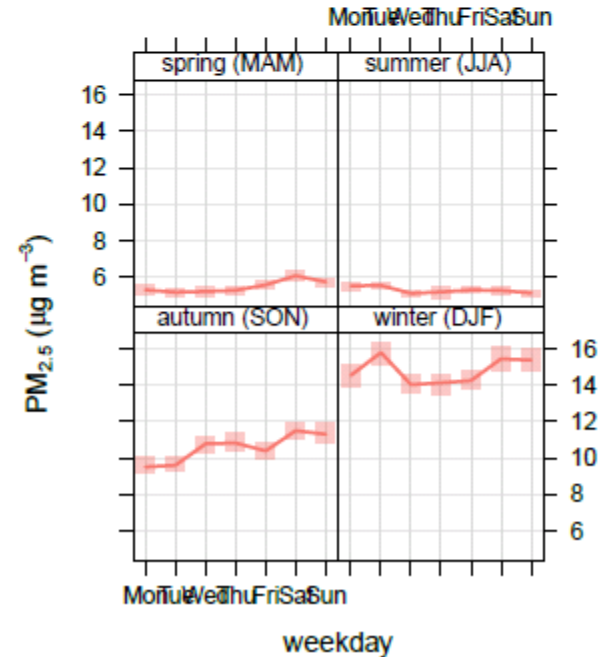
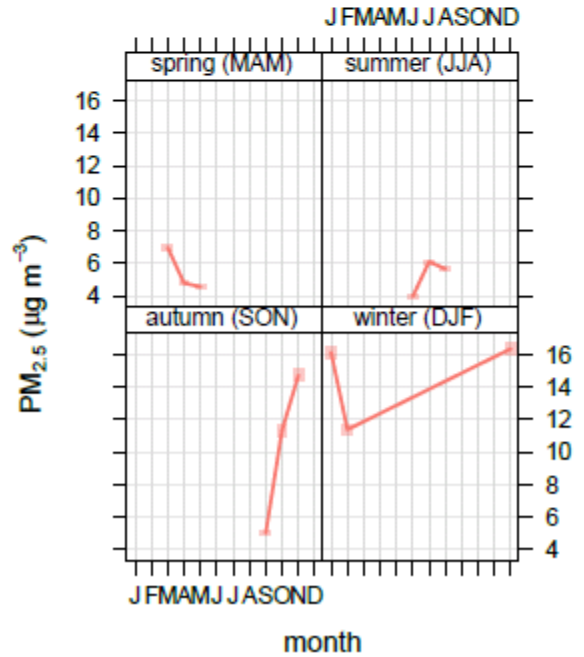
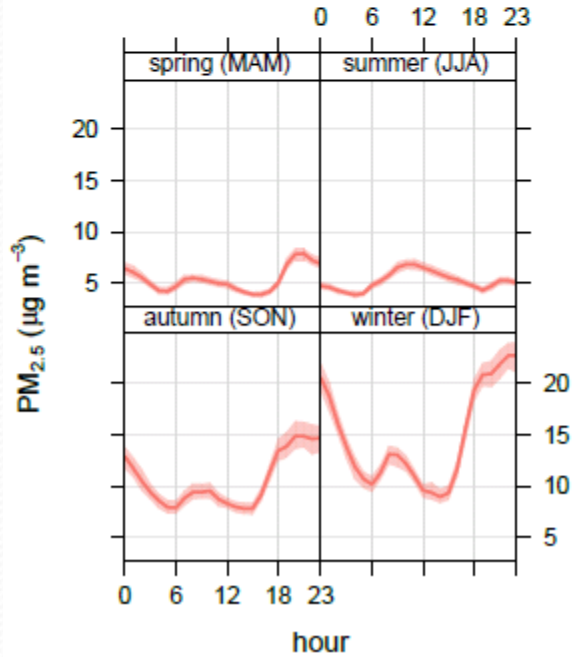
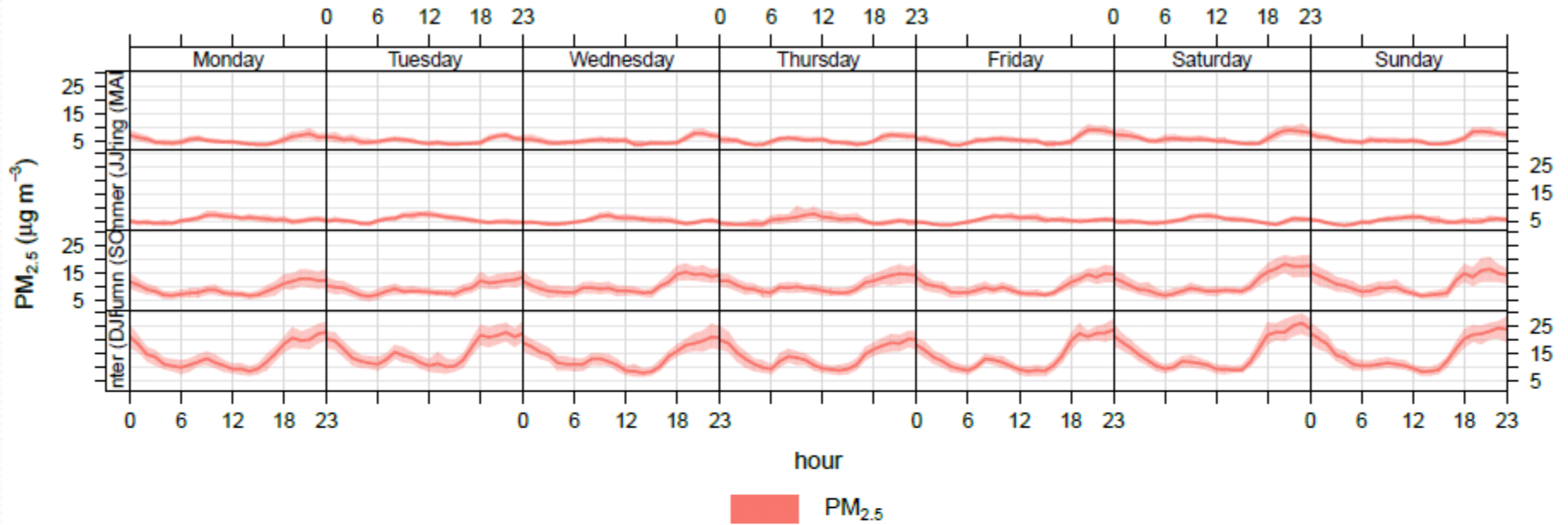


mean and 95% confidence interval in mean

Duncan Cairnsmore 2014



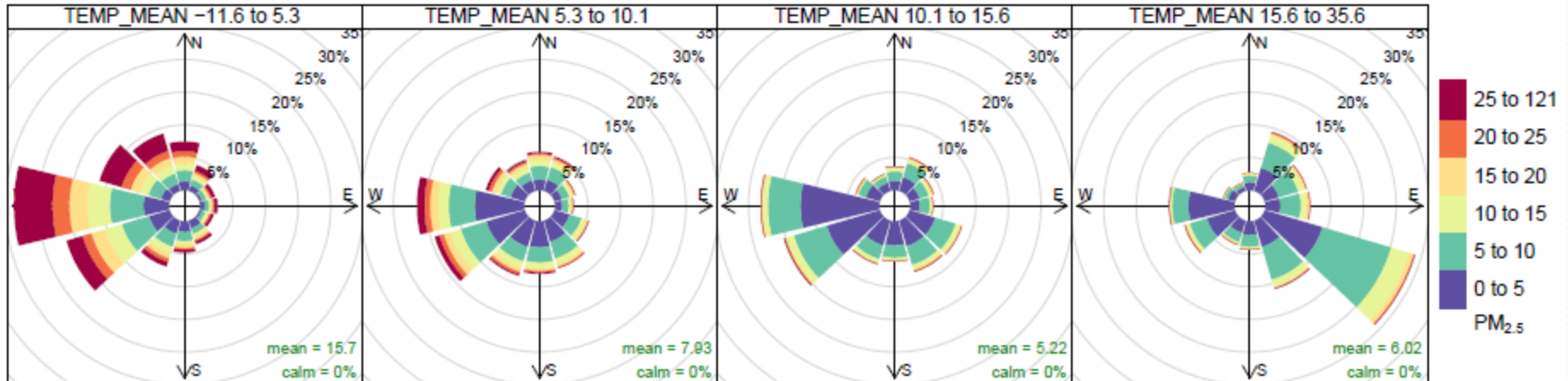
Duncan Cairnsmore 2014



mean and 95% confidence interval in mean

Duncan Cairnsmore 2014

Duncan



Frequency of counts by wind direction (%)