Dispersion Modelling of Open Burning Emissions in the BVLD for Fall 2007

Ben Weinstein
Air Quality Meteorologist

Sept 10, 2008

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Environment

Overview

- What is a model and how does it work
- Results from 2007 modelling exercise
- Significance
- Summary

Purpose of running models

- Supports Goals outlined in Chapter 3.

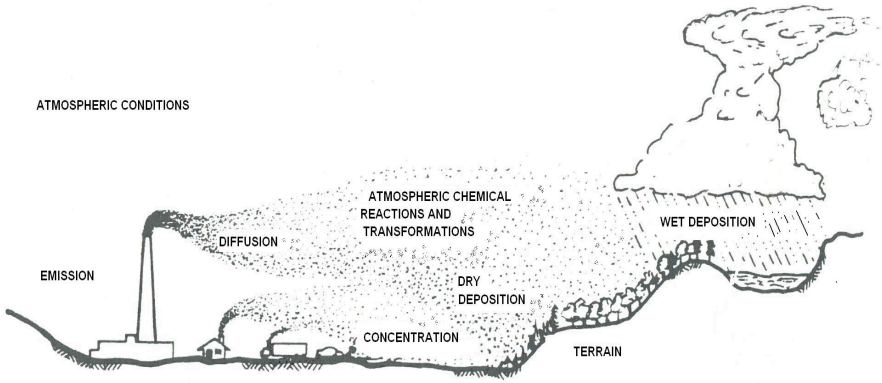
Gain a better understanding of air quality and work towards continuous improve-ment in the Plan Area.

- Reduce or eliminate air quality episodes through source-specific emission strategies.
- Educational and operational changes to improve air quality.
- Emerging research and changing regulations/policies.

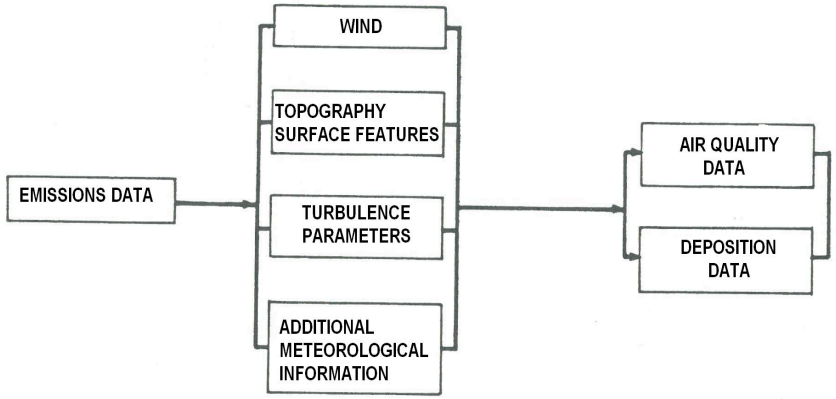
What information does an Air Pollution Model need?

- Information about the topography, mountains, valleys, etc.
- Information about the atmosphere, 3-D winds, temperature, etc.
- Information about the pollution source

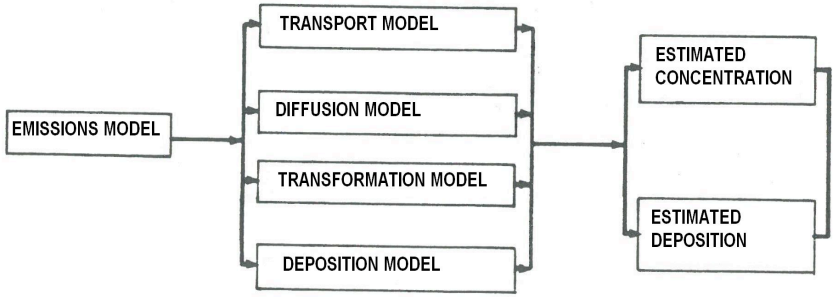
THE ATMOSPHERE (reality)



MEASUREMENT (Input data)



MODELS (simulation)



Why Isn't a Model Perfect?

- We don't have perfect equations to match the movement of the atmosphere (so we use averages).
- We do a lot of averaging! (mostly to save time and keep our computers from frying).
- Measurements used as inputs to the model may not be correct.

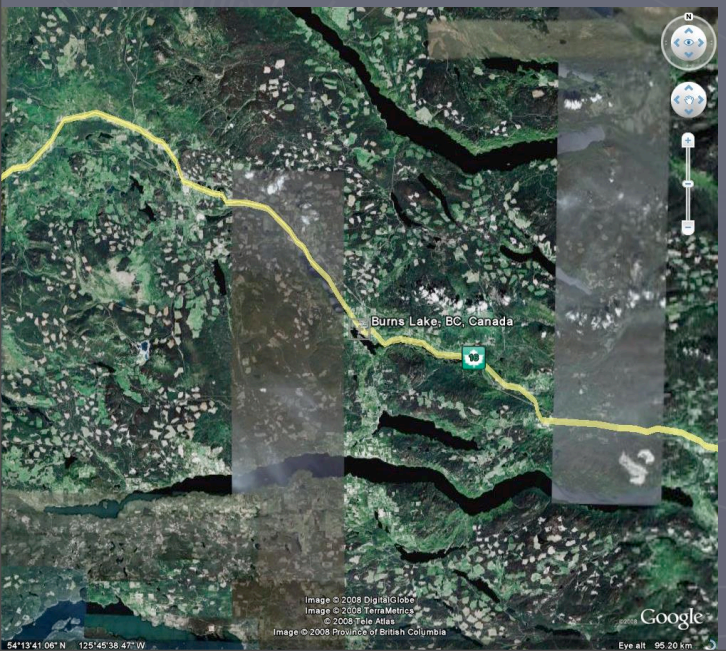
Topography - The BVLD Airshed

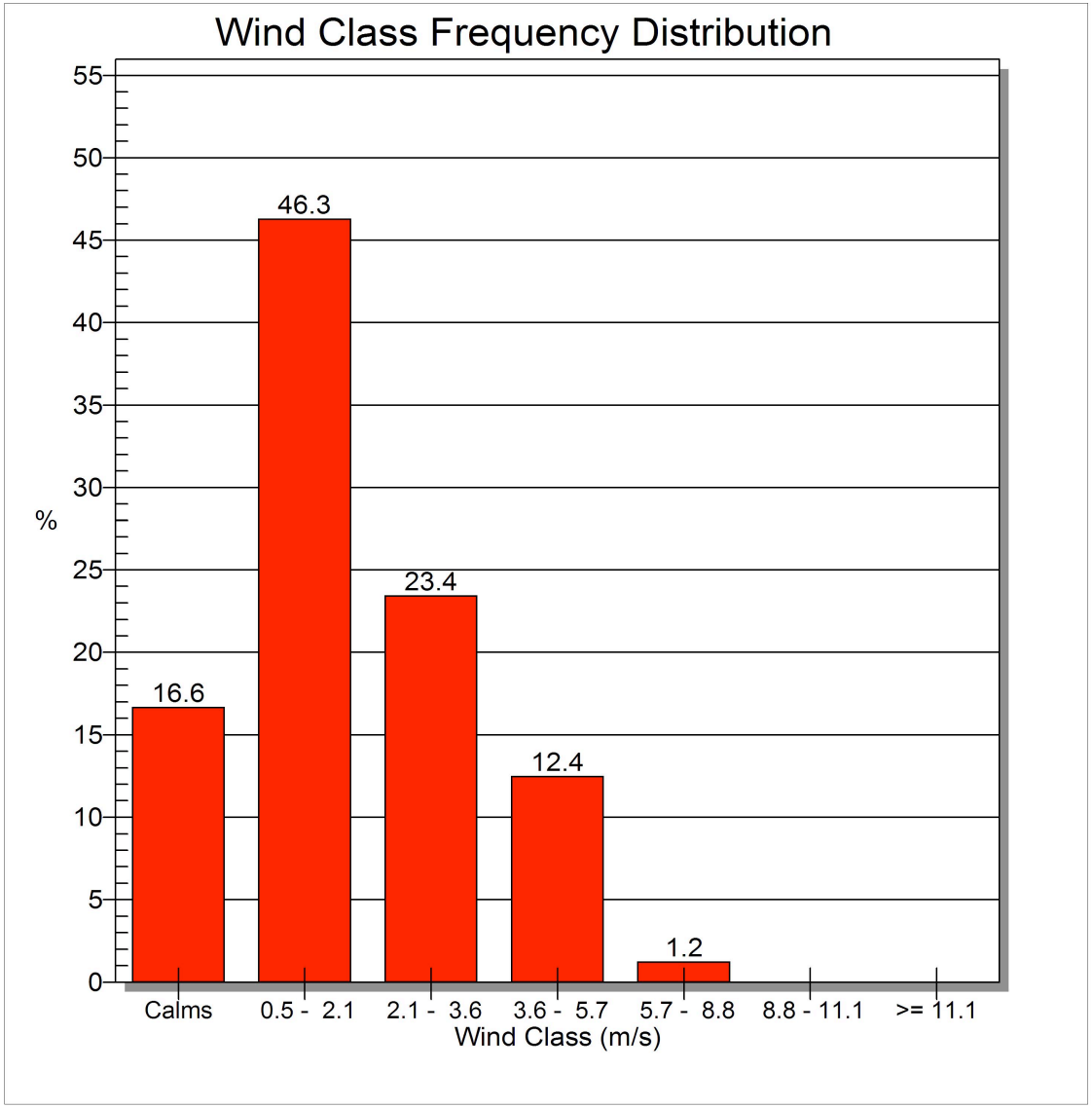
Meteorological Inputs

Date/Time YYYY/MM/DD HH24:MI:SS	Smithers M107005 Hourly Mean Temperature degrees	Smithers M107005 Unit Vector Wind Direction degrees	Smithers M107005 Mean Wind Speed metres per second
2007-01-01 0:00	3.3	189	3.9
2007-01-01 1:00	2.6	191	3.7
2007-01-01 2:00	2.7	198	3.3
2007-01-01 3:00	3.1	203	3.8
2007-01-01 4:00	3.1	194	3.7
2007-01-01 5:00	3.4	192	3.2
2007-01-01 6:00	3.5	186	3.2
2007-01-01 7:00	3.3	173	4
2007-01-01 8:00	3.2	180	3.4
2007-01-01 9:00	3.5	172	2.9
2007-01-01 10:00	3	199	1.9
2007-01-01 11:00	4.8	188	4.3
2007-01-01 12:00	4.9	190	3.8
2007-01-01 13:00	4.7	187	3.7
2007-01-01 14:00	5	192	3.6
2007-01-01 15:00	5.2	196	4
2007-01-01 16:00	5.5	206	4.5
2007-01-01 17:00	4.4	175	3.9

Meteorological Outputs - Frequency

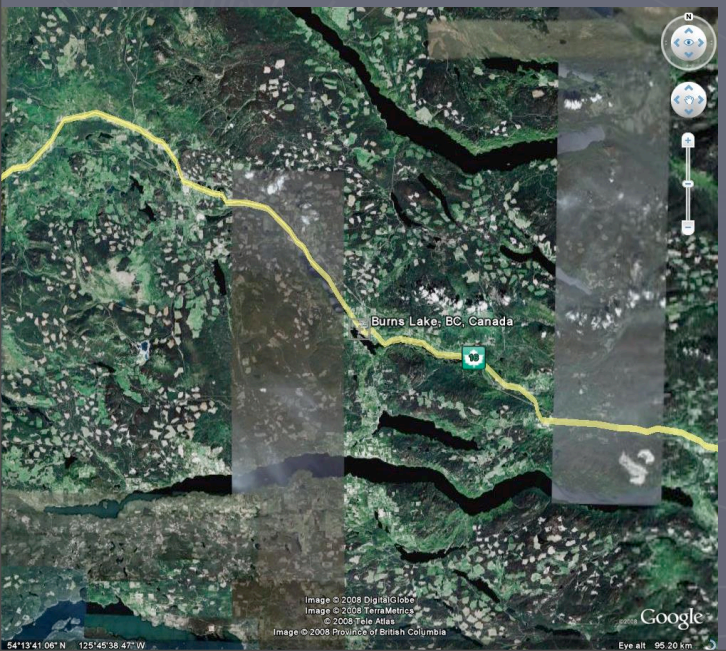
- Burns Lake Dec 2007

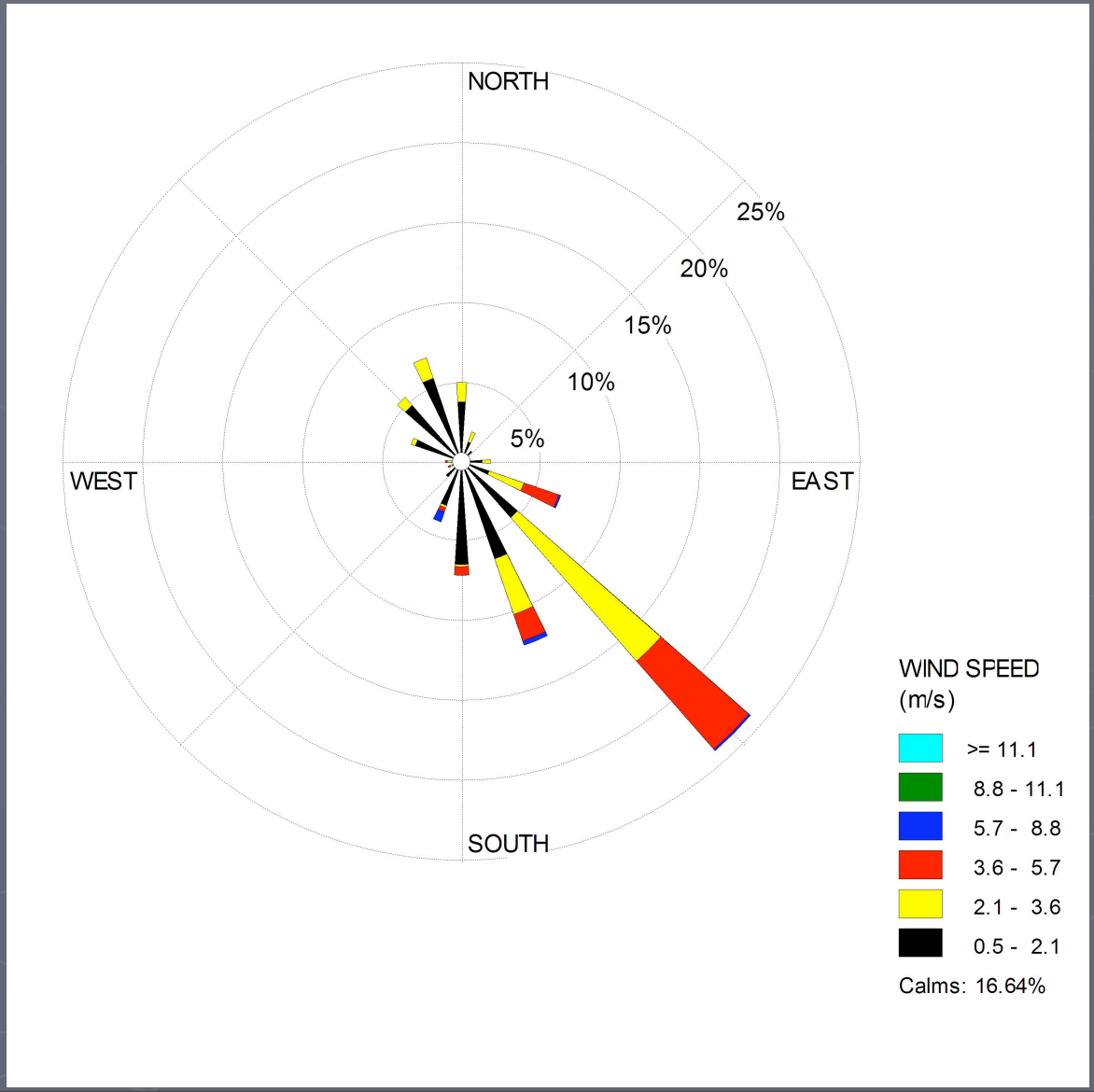




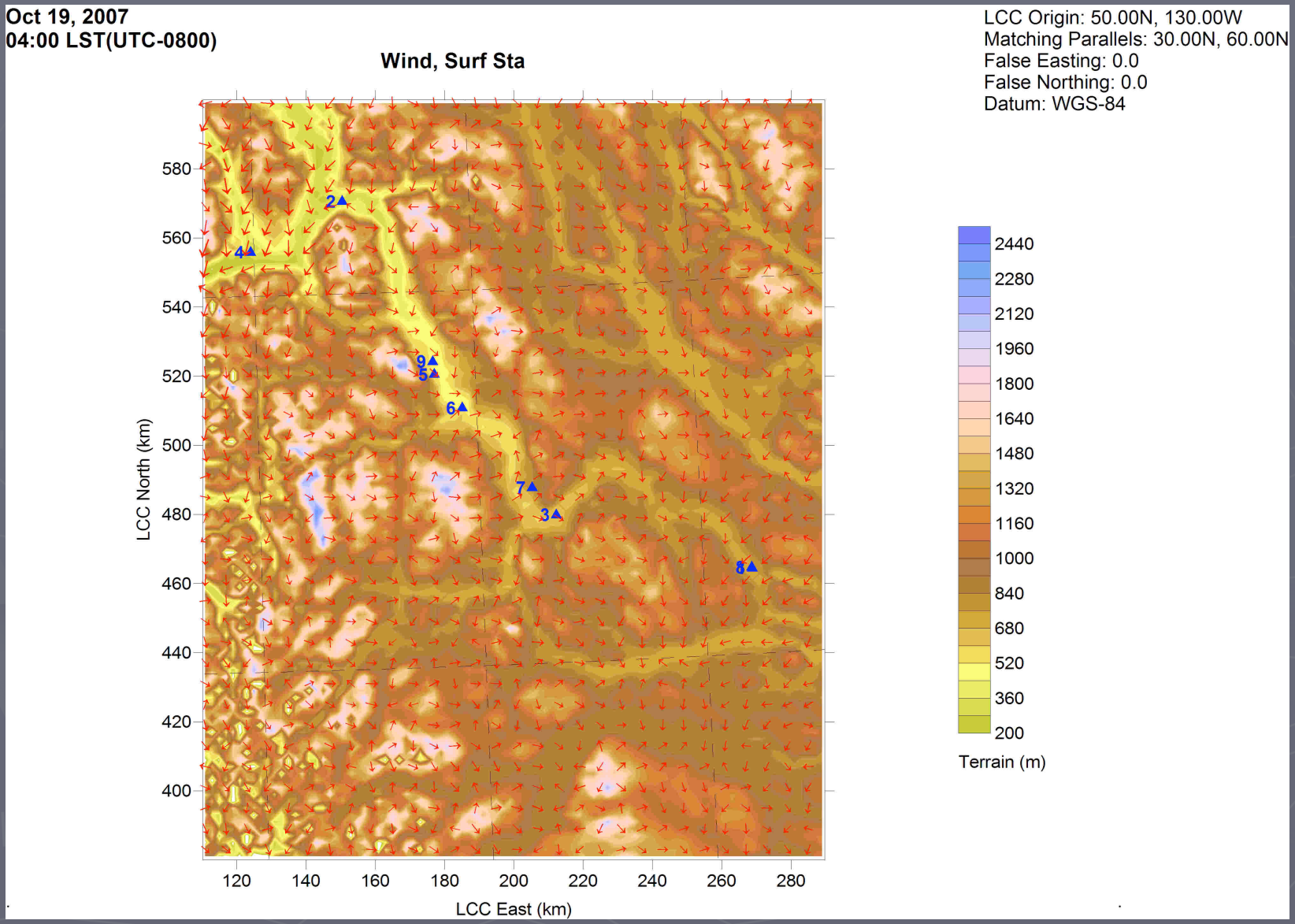
Meteorological Outputs - Windroses

- Burns Lake Dec 2007





Meteorological Outputs - CALMET



Source – Emissions Data

- This is part of the reason you send us pile data before and after the burn season

Calculating Emissions

- Total Emissions = Base Quantity x Emission Facor
  - Base Quantity = Pile number x Pile mass
  - Pile Mass = Pile volume x Pile denisty
    - (pile size and shape)
    - (tree species, moisture content)
  - Emission Factor depends on wood species, and pile cleanliness

$$E_{PM} = BQ \times \frac{EF_{PM}}{1000}$$

$$BQ = \#Piles \times M_{W/P}$$

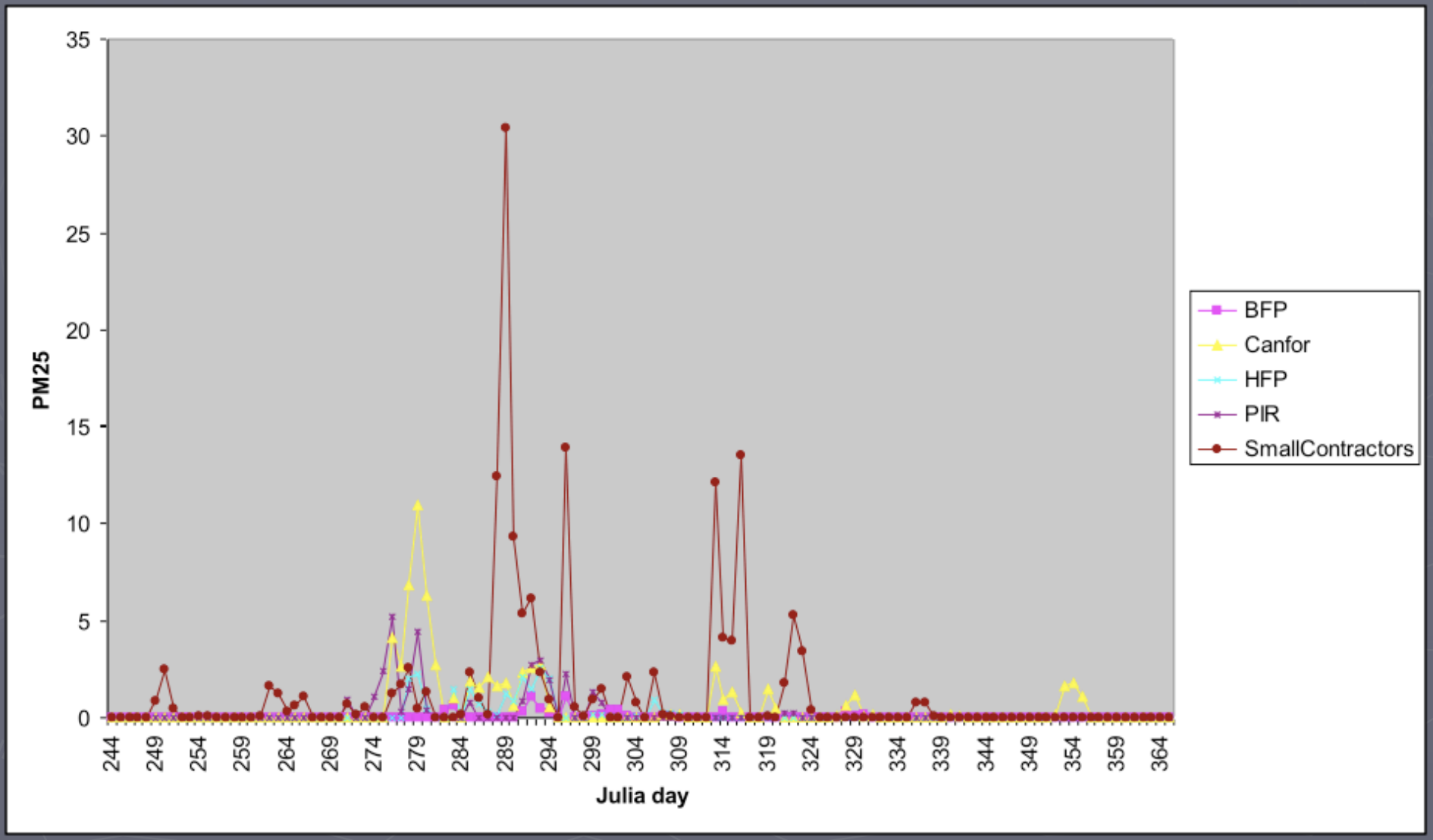
$$M_{W/P} = V_{W/P} \times \rho$$

Emissions Summary: Fall 07

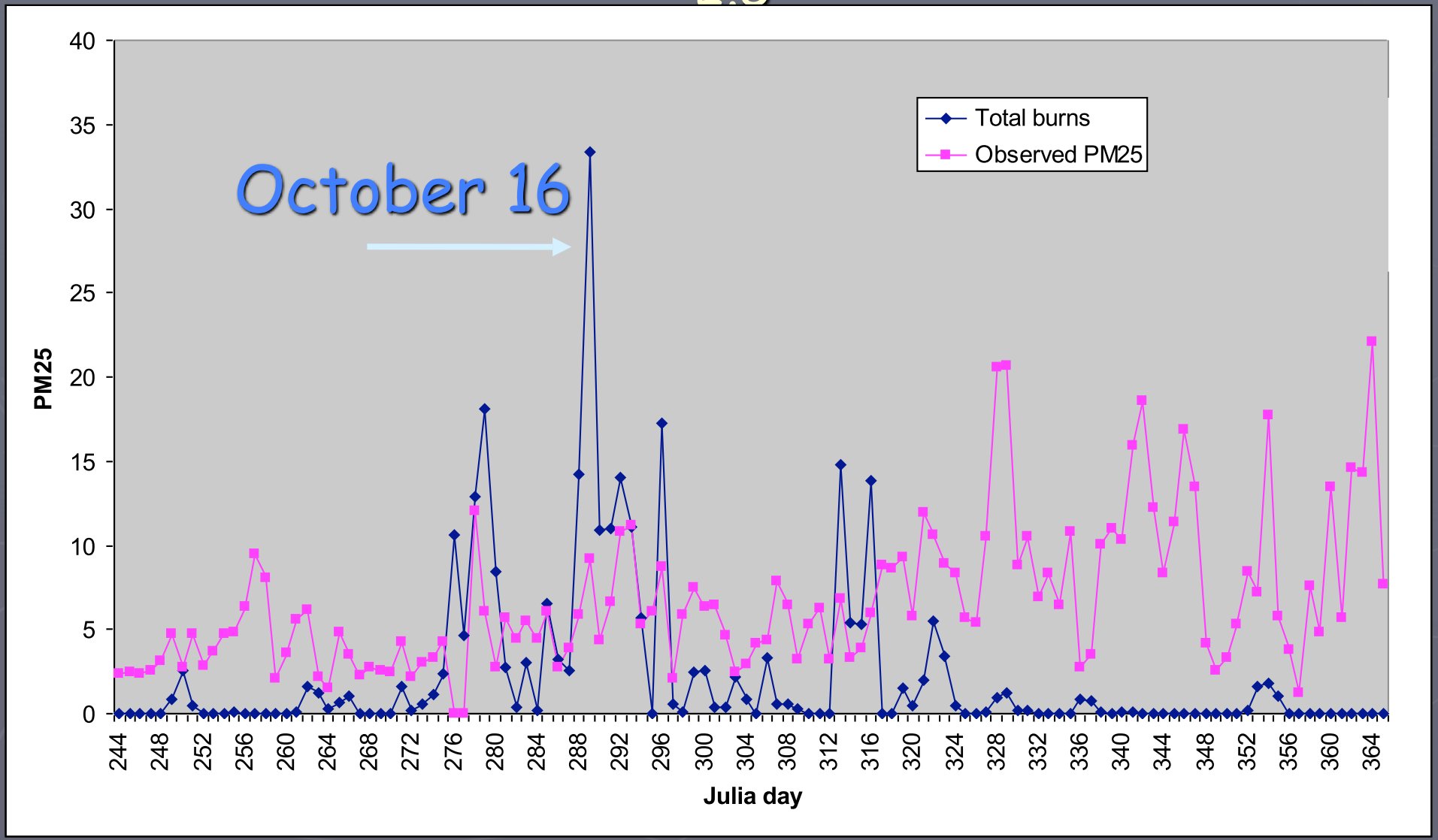
- Canfor: 7,246 Piles
  - 1,106.87 tonnes $PM_{2.5}$
- HFP: 3,700 Piles
  - 444 tonnes $PM_{2.5}$
- PIR: 6,637 Piles
  - 732 tonnes $PM_{2.5}$
- BFP: 1,509 Piles
  - 226 tonnes $PM_{2.5}$
- Other: 12,414
  - 1,850 tonnes $PM_{2.5}$

- Total: 31,506 Piles
  - 4358 tonnes $PM_{2.5}$
- In contrast, in 2002 all BVLD beehive burners emitted a total of
  - 708 tonnes $PM_{2.5}$

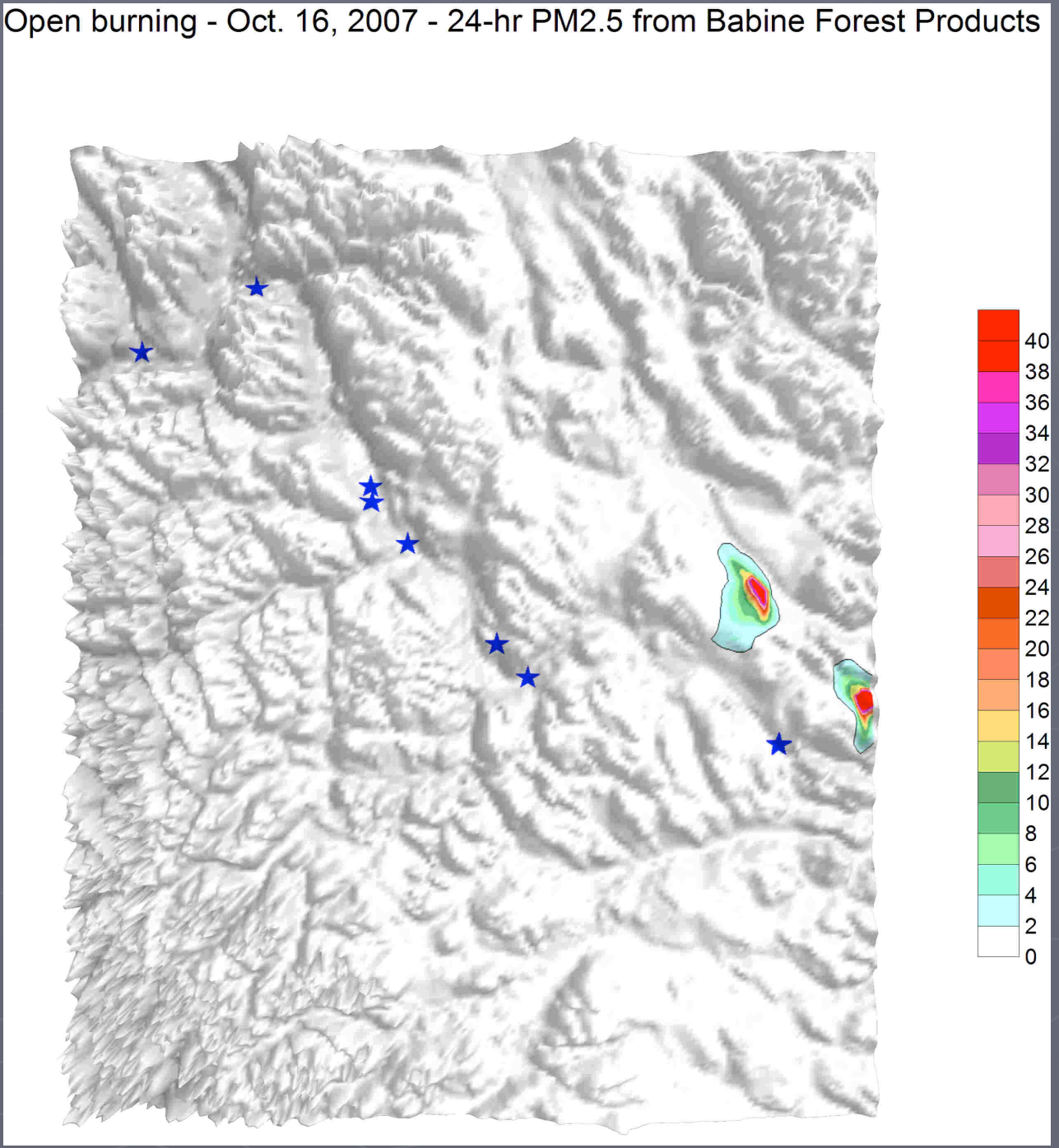
Model Results – Individual Licensees at Smithers



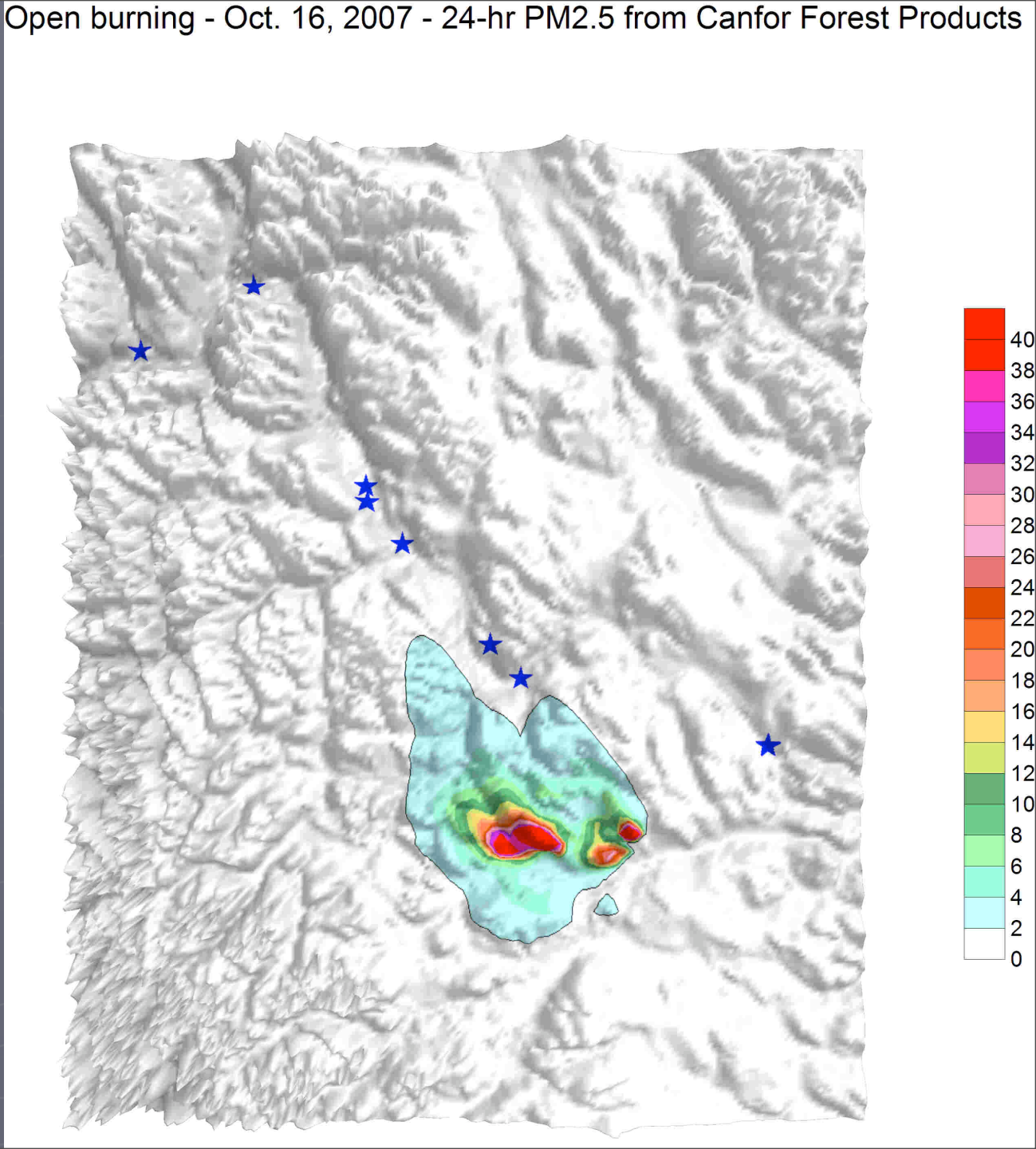
Model Results – Model and Observed $PM_{2.5}$ at Smithers



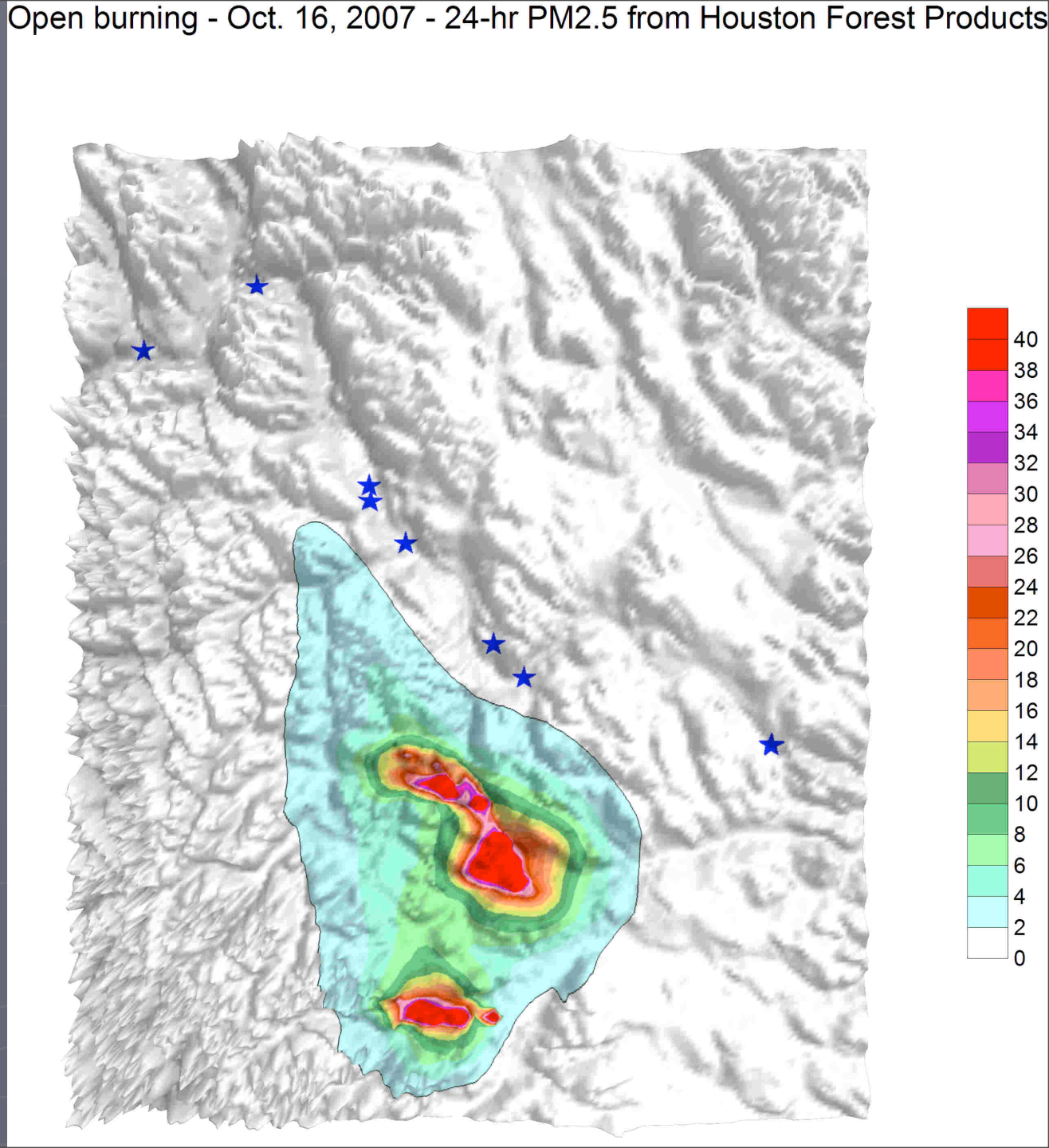
October 16th - BFP



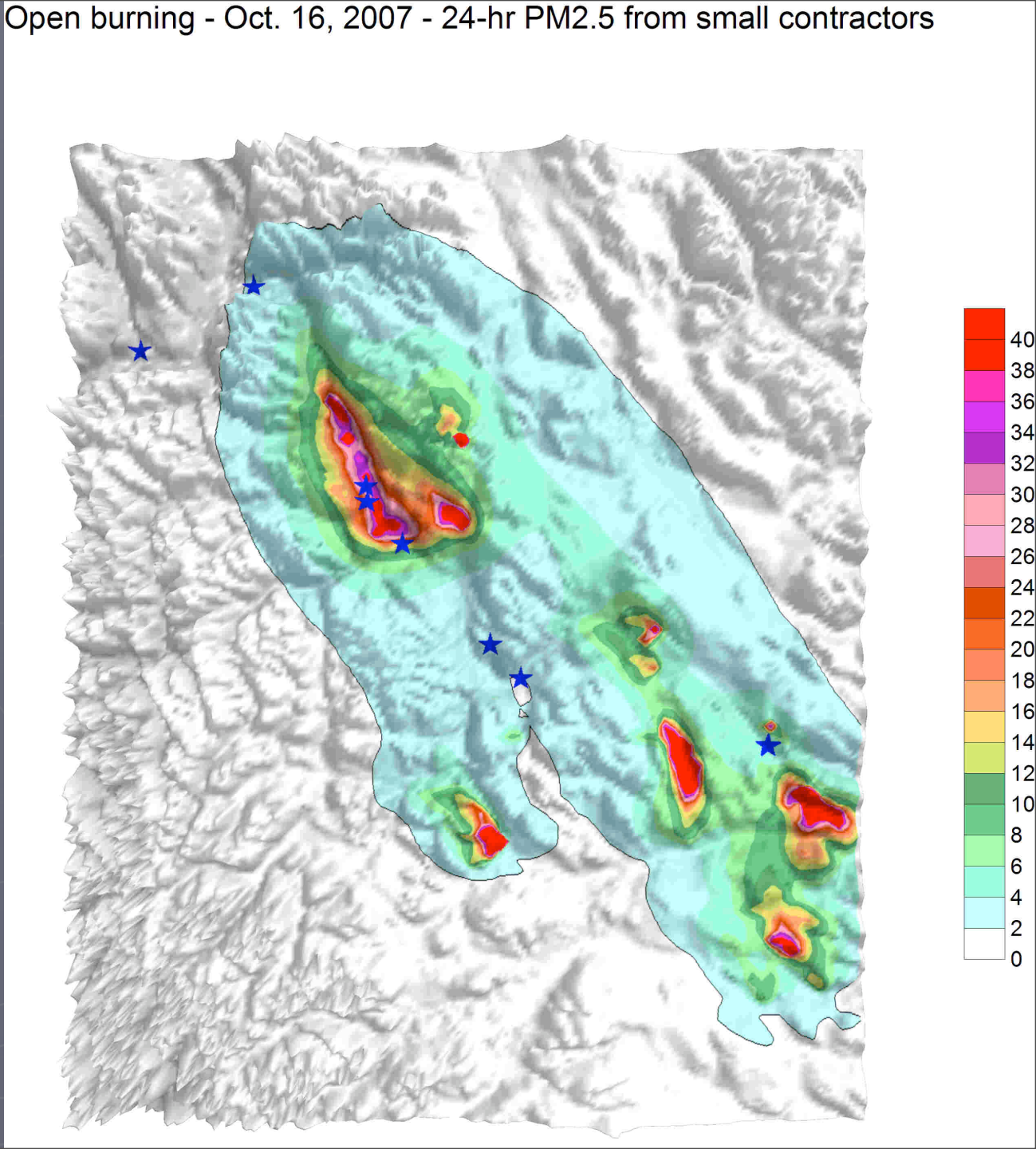
October 16th - Canfor



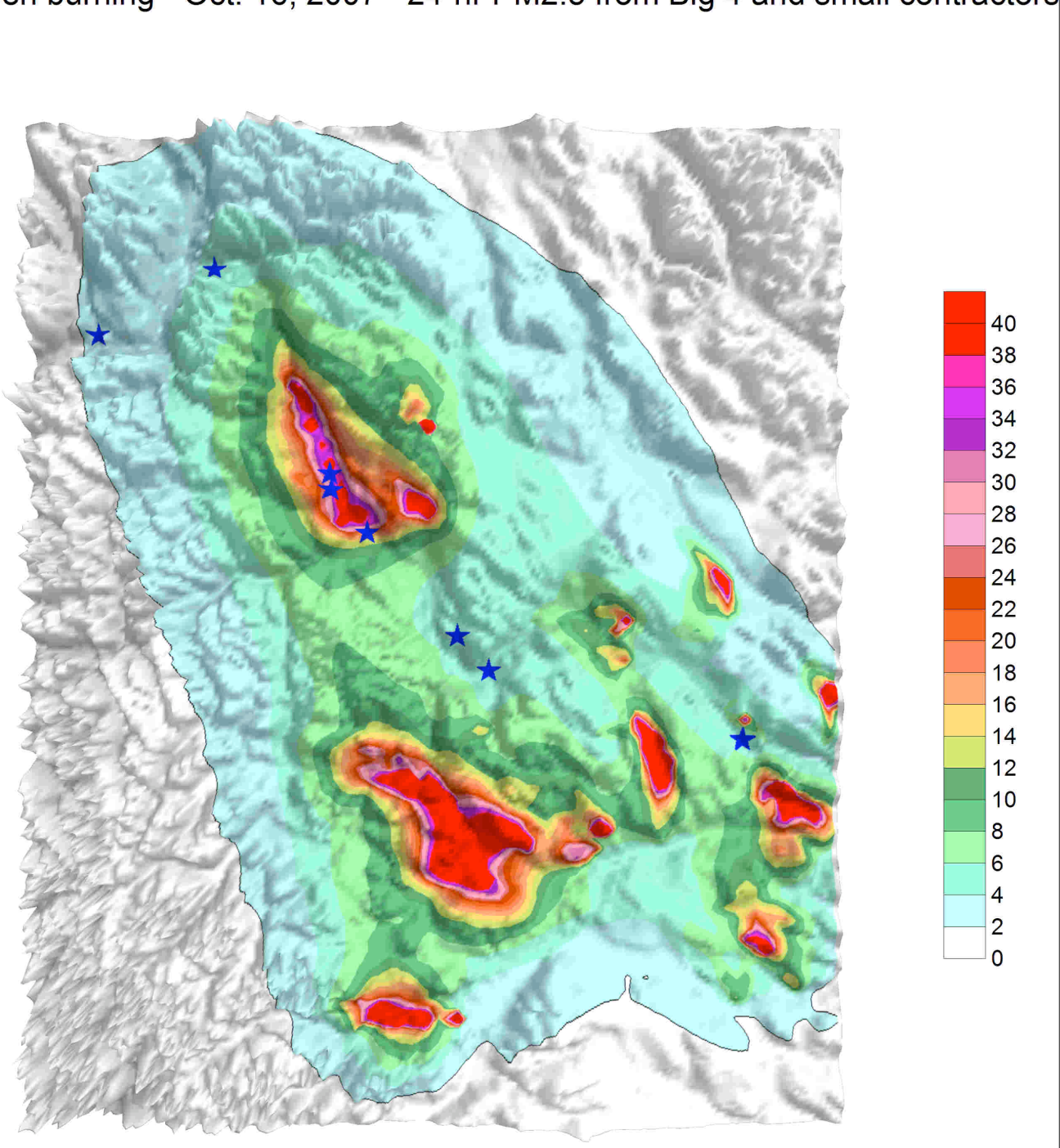
October 16th - HFP



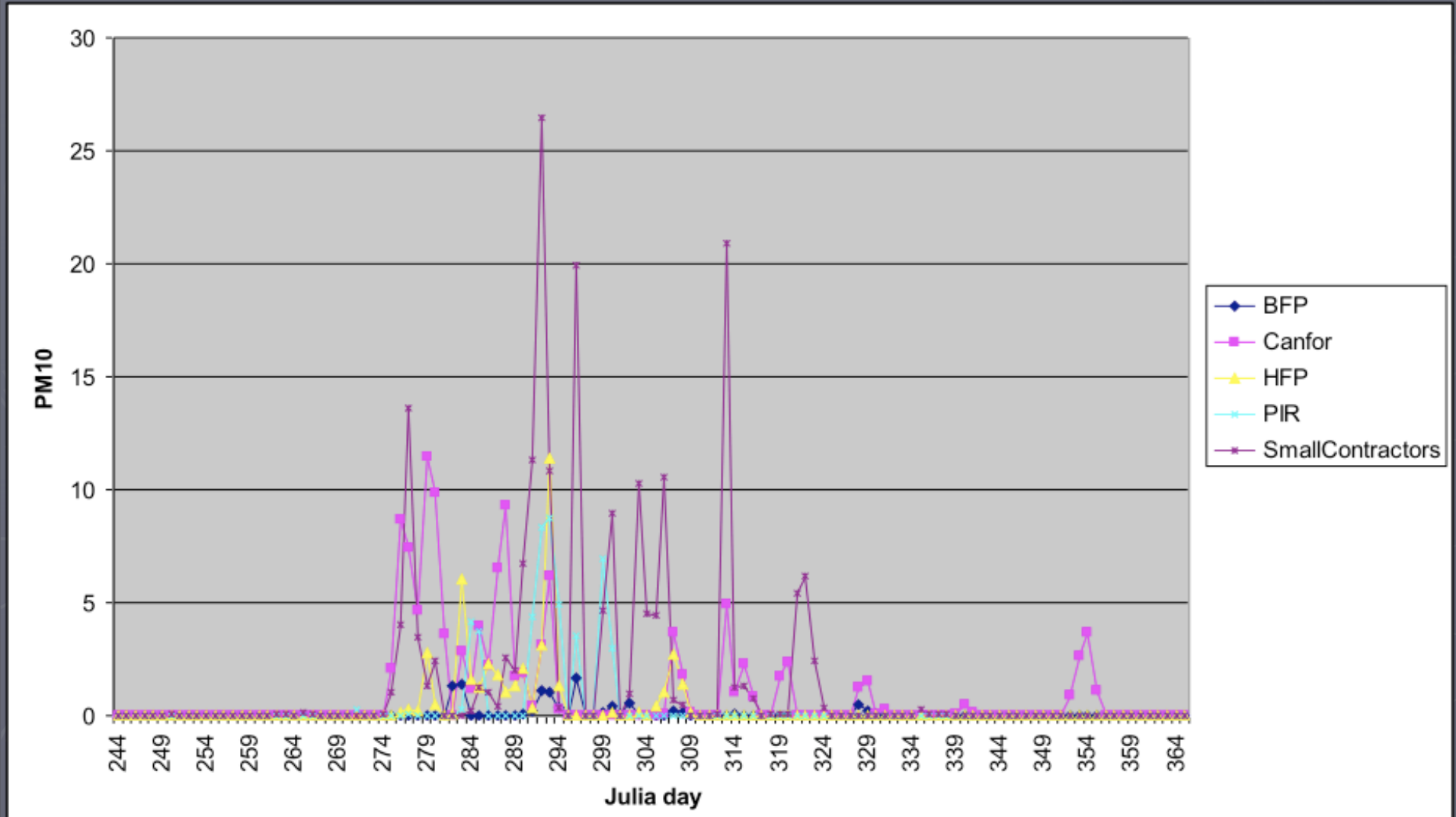
October 16th – Small contracts



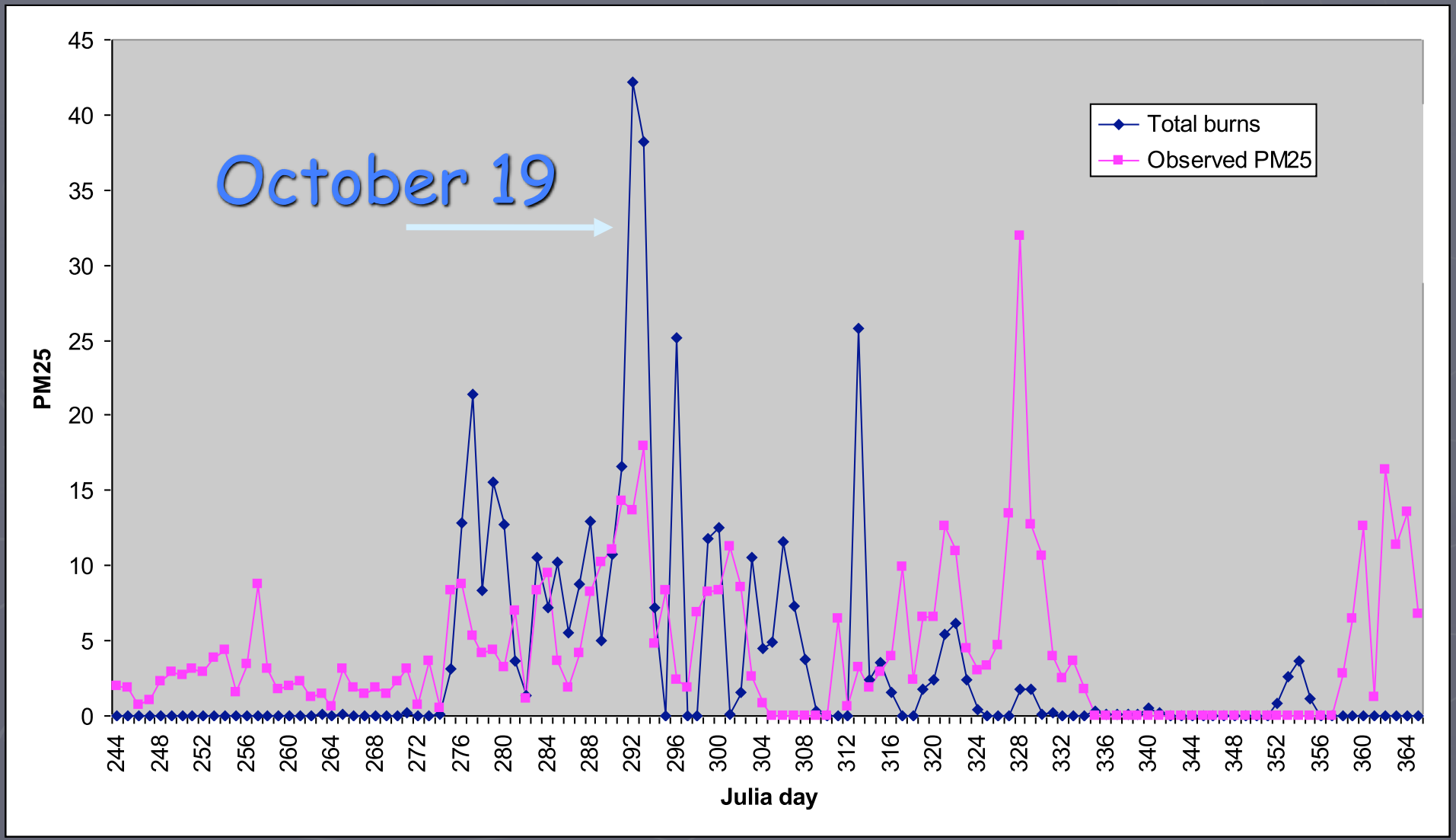
October 16th - All



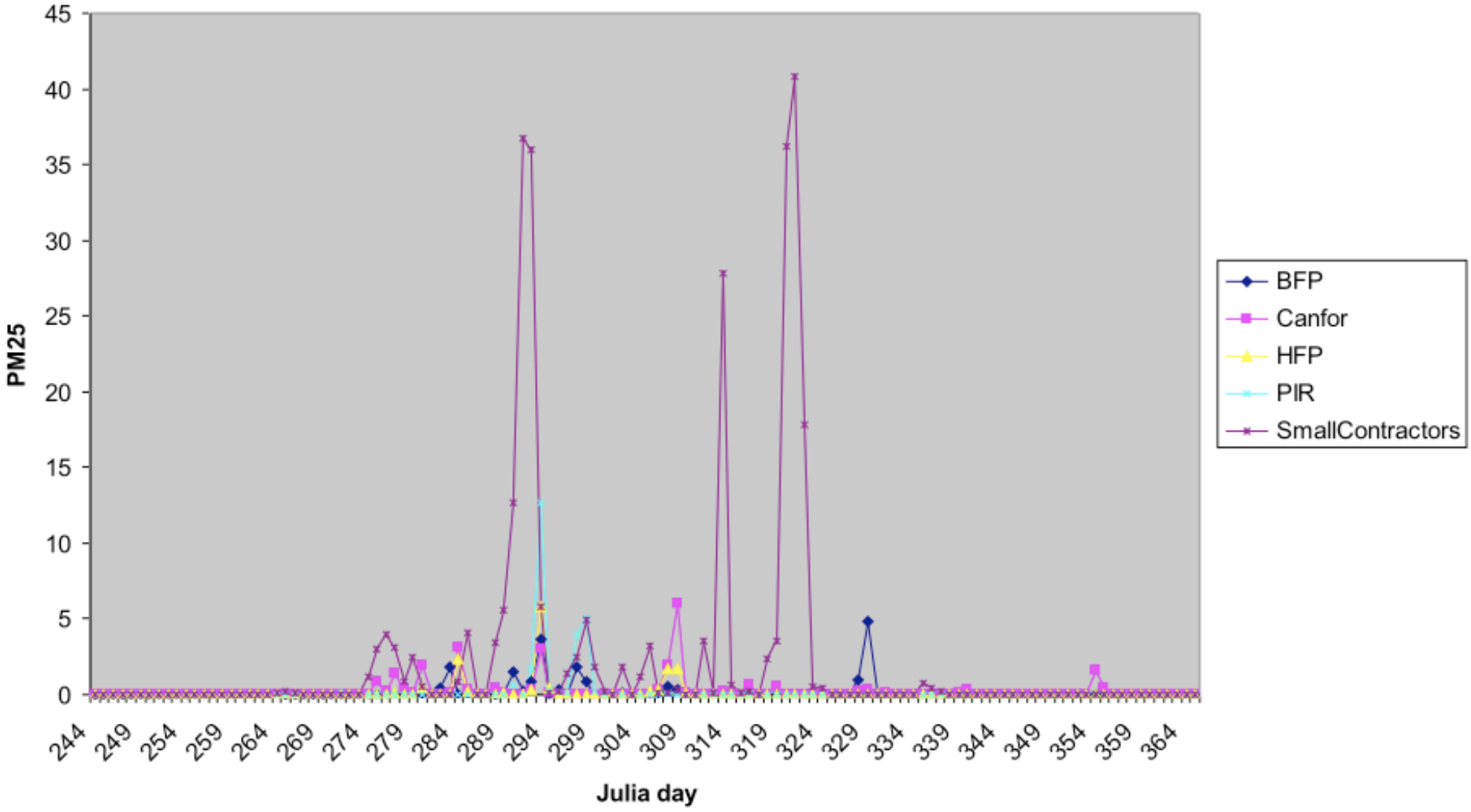
Model Results – Individual Licensees at Houston



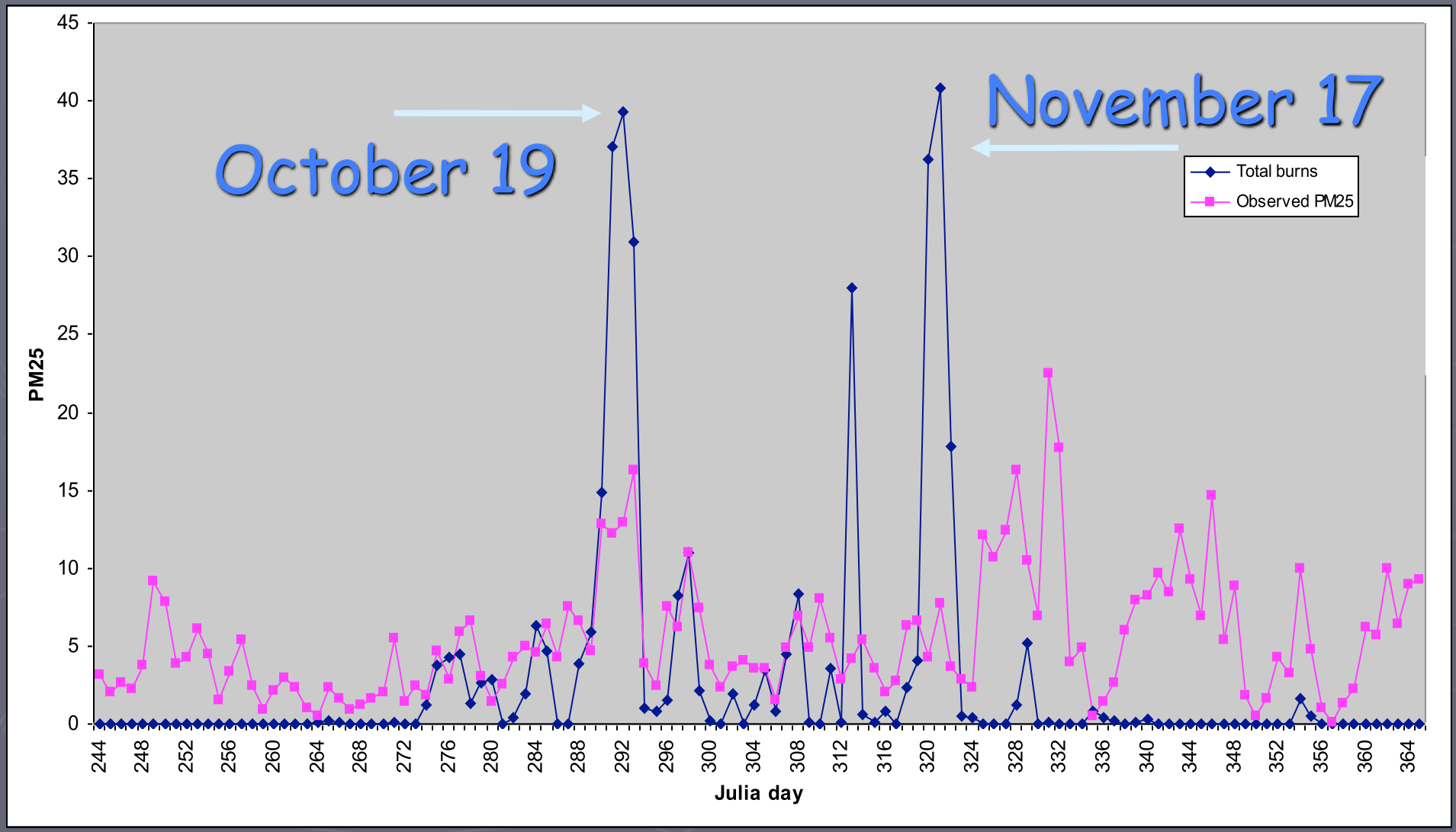
Model Results – Model and Observed $PM_{2.5}$ at Houston



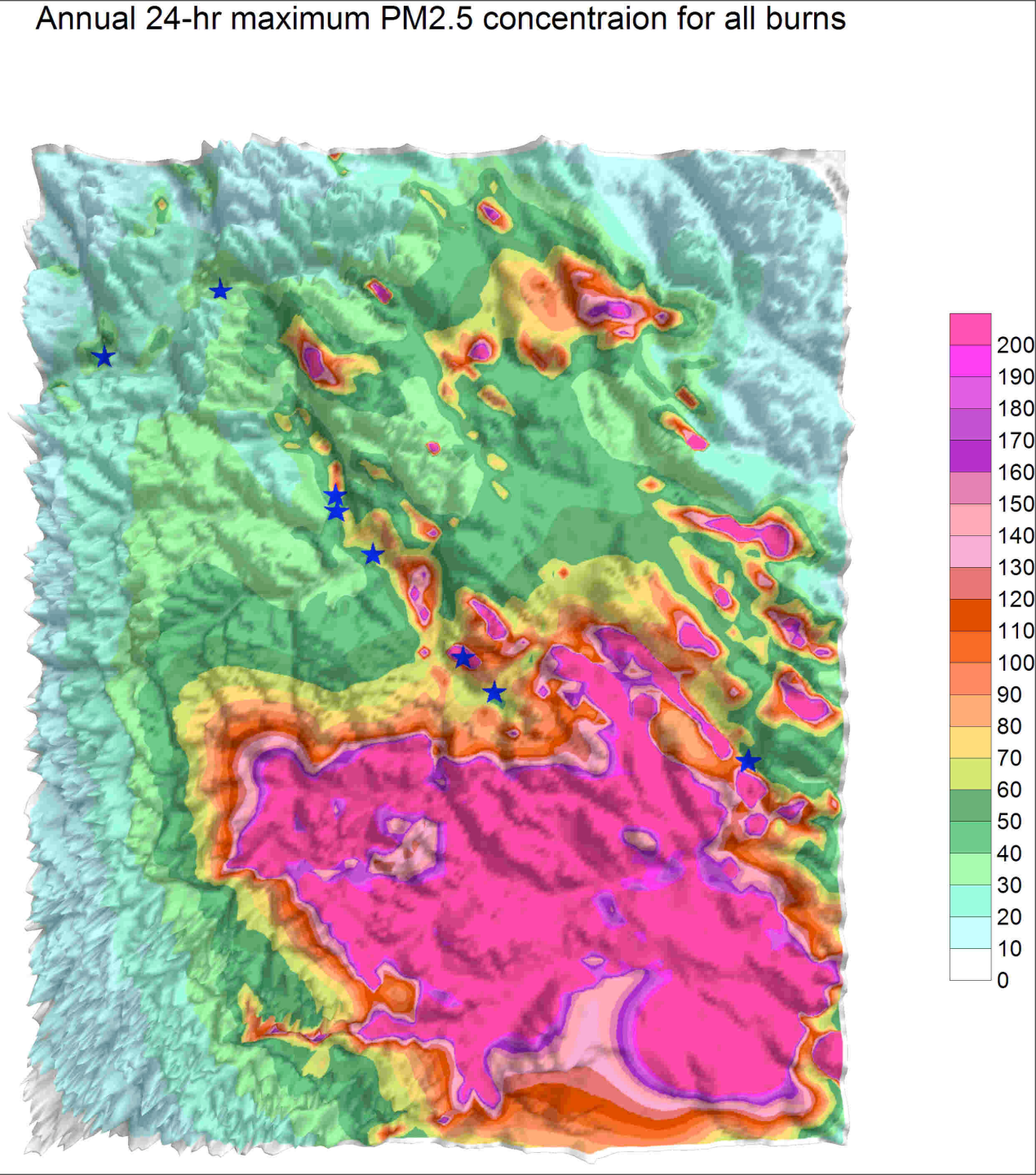
Model Results – Individual Licensees at Burns Lake



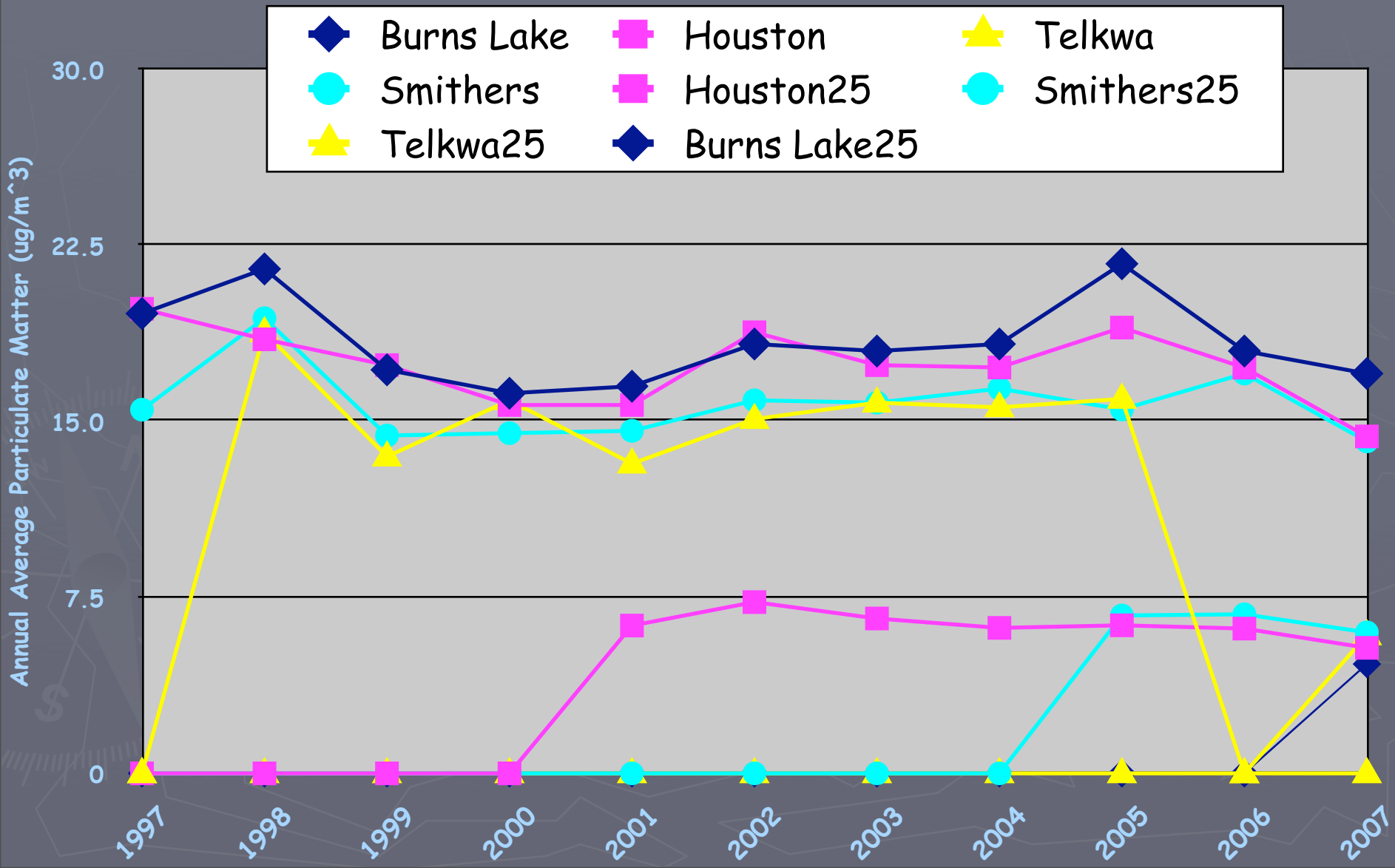
Model Results – Model and Observed $PM_{2.5}$ at Burns Lake



Annual Maximums



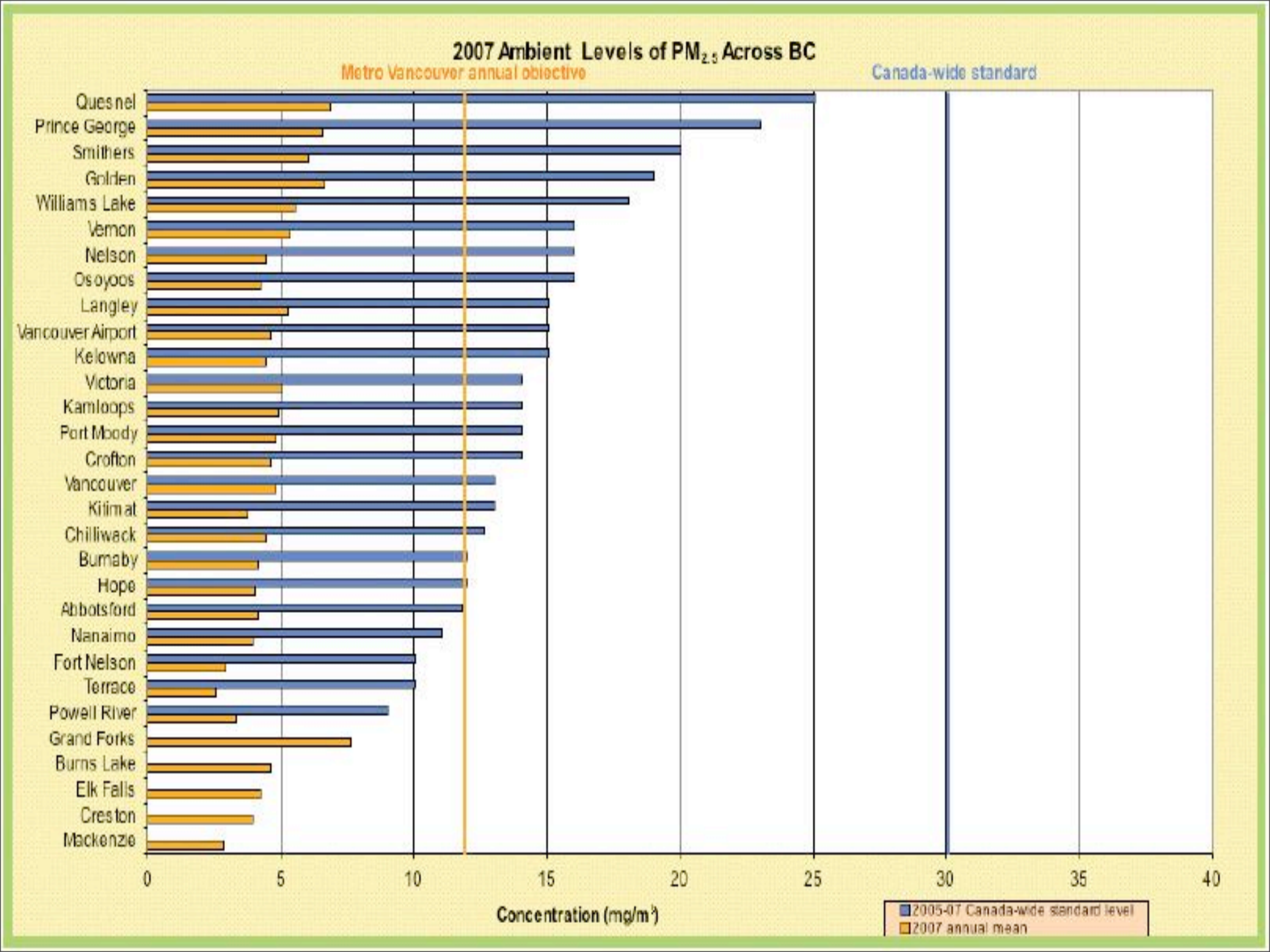
BVLD Annual Average Air Quality



Canada Wide Standard

Houston
Smithers

Note: Telkwa and Burns Lake will have CWS values in 2009


2007 Ambient Levels of PM2.5 Across BC
Metro Vancouver annual objective
Canada-wide standard
Quesnel
Prince George
Smithers
Golden
Williams Lake
Vernon
Nelson
Osoyoos
Langley
Vancouver Airport
Kelowna
Victoria
Kamloops
Port Moody
Crofton
Vancouver
Kitimat
Chilliwack
Burnaby
Hope
Abbotsford
Nanaimo
Fort Nelson
Terrace
Powell River
Grand Forks
Burns Lake
Elk Falls
Creston
Mackenzie
0
5
10
15
20
25
30
35
40
Concentration (mg/m3)
2005-07 Canada-wide standard level
2007 annual mean

Significance and Summary

- Open burning is largest emission source in BVLD
- Must be managed in a way that allows for business and protects health
- Fall 2007 was successful year for licensees and air quality
- More work needed for dispersion model results to be QA/QC but initial runs display good correlation.