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# **PM<sub>2.5</sub> Monitoring and Reporting in Ontario**

October 20<sup>th</sup>, 2011

Environmental Monitoring and Reporting Branch

# Outline

## Background:

- History of PM Monitoring in Ontario
- Ontario's Real-time PM<sub>2.5</sub> Network

## Next step:

- Federal Equivalency Method (FEM), Class III for Real-time PM<sub>2.5</sub> Monitoring

# History of PM Monitoring

1969 – NAPS program is established – measures TSP ( $<100\mu\text{m}$ ) using hi-vol (filter-based) sampler.

1970- Coefficient of Haze (COH) used for real-time PM monitoring ( $3.5\text{-}4.5\ \mu\text{m}$ )

- COH analyzer was removed from the MOE network in 2004.

24-Hour Dichotomous  $\text{PM}_{10}/\text{PM}_{2.5}$  sampling introduced in 1982.

1990 – R&P Tapered Element Oscillating Microbalance (TEOM<sup>®</sup>) continuous monitor receives Class III Federal Equivalency Monitor (FEM) designation for  $\text{PM}_{10}$  NAAQS reporting.

Ontario deploys 5 R&P TEOM<sup>®</sup> continuous monitors in 1995 and reports on the measurements of  $\text{PM}_{2.5}$  in the Air Quality in Ontario -1996 Report

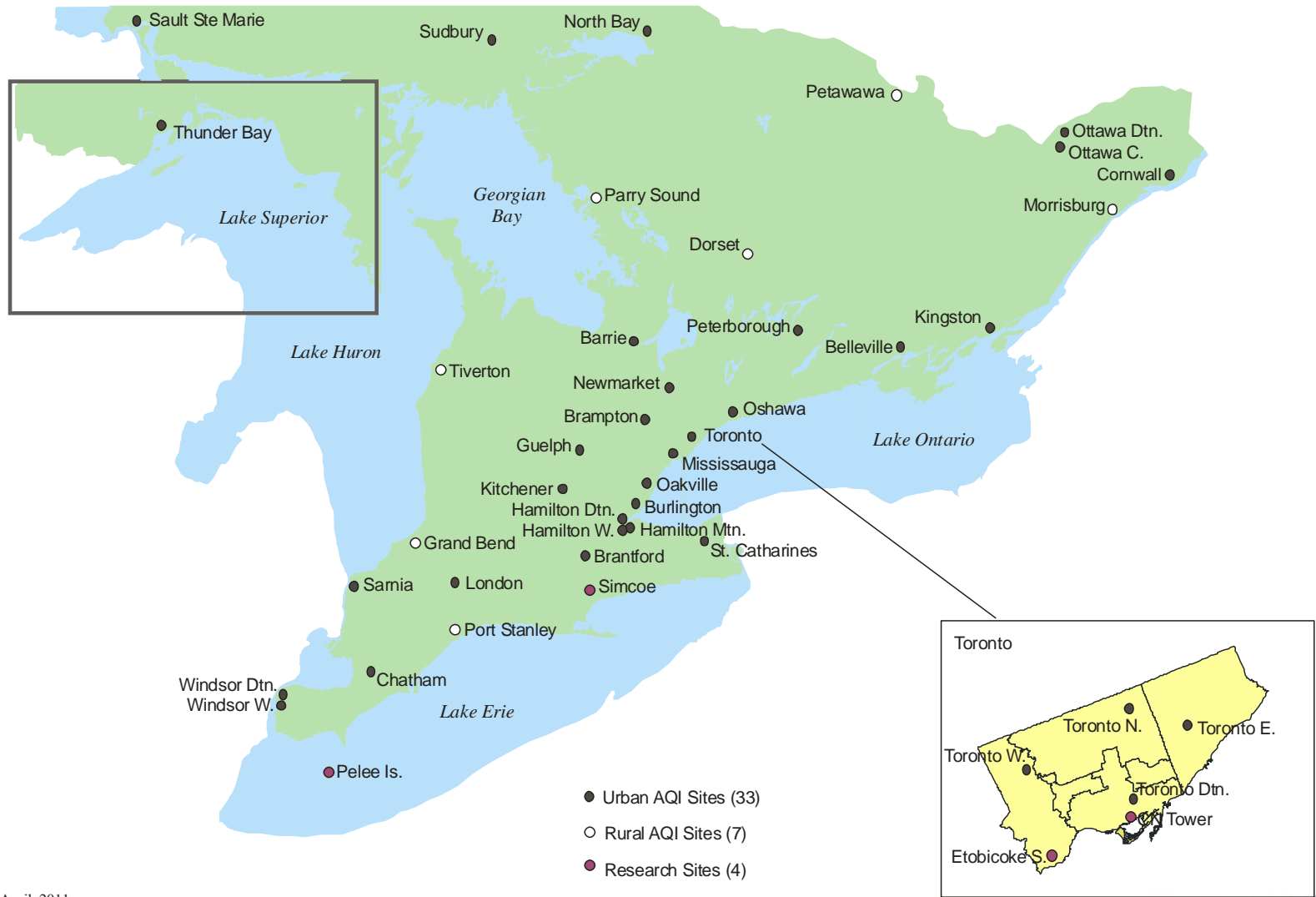
# History of PM Monitoring – from 2000

- 2002 – First PM<sub>2.5</sub> Continuous Monitoring Workshop held – agree to remove TEOM “offset”, add sample driers and lower operating temperature to 30°C.
- 2003 – Ontario includes PM<sub>2.5</sub> in the AQI Program
- 2008 – NAPS Managers agree that U.S. FEM Class III designation meets Canadian performance criteria for CWS reporting. Met-One BAM 1020 first to receive FEM designation.
- 2009 – Four monitors (Thermo 1400ab/FDMS, 1405F, 5014i, SHARP5030) receives PM<sub>2.5</sub> FEM designation.
- 2010 - Ontario deploys SHARP 5030, SHARP5030i, BAM 1020 and GRIMM 180 monitors for field evaluation.

# Ontario's Real-time PM<sub>2.5</sub> Monitoring Network

# Air Quality Index & Research Monitoring Sites in Ontario

(2011)



\*Reflective April, 2011

# **How well does TEOM perform in Ontario? FRM versus TEOM-SES (2006-2008) for Ontario**

Determine the variability of warm and cold season measurements for TEOM-SES when compared to FRM.

Develop a potential cold weather data transformation for TEOM-SES values specific for MOE reporting applications (i.e. CWS).

# PM<sub>2.5</sub> Measurement Comparison for FRM vs TEOM-SES (2006-2008)

## FRM Network (7 stations)

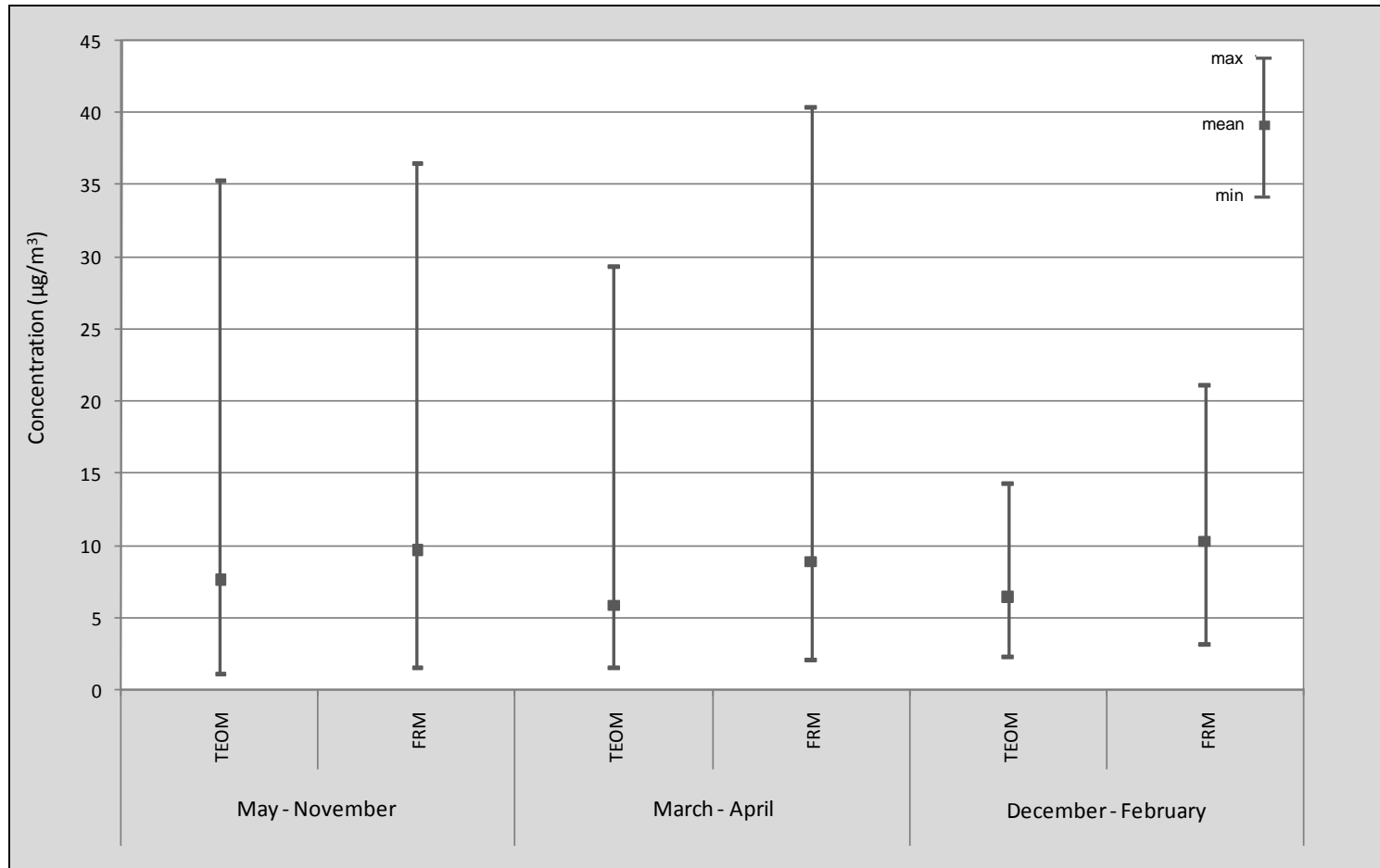
PM <sub>2.5</sub> Measurement Method	Regression (Time Base: 2006-2008)	R <sup>2</sup>	n
TEOM-SES (Warm Season, May-Nov)	$0.9928 * TEOM - 0.145$	0.9051	831
TEOM-SES (Cold Season, Dec-Feb)	$1.5534 * TEOM + 0.5974$	0.8142	392
TEOM-SES (Transition Months, Mar-Apr)	$1.3347 * TEOM + 0.3602$	0.9043	221

## Hamilton Downtown (29000)

PM <sub>2.5</sub> Measurement Method	Regression (Time Base: 2006-2008)	R <sup>2</sup>	n
TEOM-SES (Warm Season, May-Nov)	$0.9404 * TEOM + 1.516$	0.9298	73
TEOM-SES (Cold Season, Dec-Feb)	$1.5313 * TEOM + 0.5974$	0.9275	31
TEOM-SES (Transition Months, Mar-Apr)	$1.2179 * TEOM + 0.3602$	0.8792	20



# Comparison of Seasonal Summary Statistics for TEOM and FRM at Hamilton Downtown (2006-2008)



# Analysis of the CWS PM Reporting for 2006-2008 Impact on CWS Metric when transformations\* applied

Station		2006	2007	2008	CWS
Oakville	TEOM	23.6	27.5	20.8	24
	Modified	26	27.5	23.4	26
Burlington	TEOM	25.0	27.5	22.8	25
	Modified	25.9	27.5	23.5	26
Hamilton	TEOM	28.3	31.1	26.6	29
	Modified	28.3	31.1	29.5	30
Oshawa	TEOM	24.3	29.1	20.8	25
	Modified	24.3	29.1	22.0	25

\*Transformation rules, as calculated from the Hamilton Downtown Station data:

- No correction applied for the period of May to November
- 1.2 times correction applied for the period of March to April
- 1.5 times correction applied for the period of December to February

# Next Step

# Current PM<sub>2.5</sub> Policy Initiatives

## New Canadian Ambient Air Quality Standard (CAAQS) for 24-hour and annual PM<sub>2.5</sub> for 2015 and 2020

- Ontario is participating in a process to develop an Air Quality Management System (AQMS) for the country
  - Key components of the AQMS include: CAAQS for PM<sub>2.5</sub> and ozone, Base-Level Industrial Emission Requirements, and Air Zone Management and Airshed Coordination
- Proposed CAAQS expected by year end 2011
- 24-hour PM<sub>2.5</sub> CAAQS will be more stringent than the existing Canada-wide Standards of 30 mg/m<sup>3</sup>
- First national annual PM<sub>2.5</sub> standard in Canada

## FEM Monitoring

- To determine achievement of the PM<sub>2.5</sub> CAAQS, it is recommended jurisdictions strive to **deploy FEM instruments or its equivalent by 2013**
- This recommendation aligns with the direction of the NAPS monitoring agencies that all new purchases of continuous PM<sub>2.5</sub> monitors for the NAPS network should be restricted to those that receive EPA Class III FEM designation or equivalent

## PM<sub>2.5</sub> Review

- Ontario regulates precursors of PM<sub>2.5</sub>; however it does not currently regulate direct emissions of PM<sub>2.5</sub>
- In January 2010, the ministry received an "Application to Require a New Air Pollution Act or Regulation" under section 61 of the Environmental Bill of Rights (EBR), requesting a review for a new Act or regulation that addresses PM<sub>2.5</sub>, including direct emissions of PM<sub>2.5</sub>
- In November 2010, the ministry announced it would undertake a scoped review to examine how Ontario regulates PM<sub>2.5</sub>
- Final draft report will be posted for comment on the Environmental Registry by March 2012

# Ontario Decision: Next Generation of PM Monitors

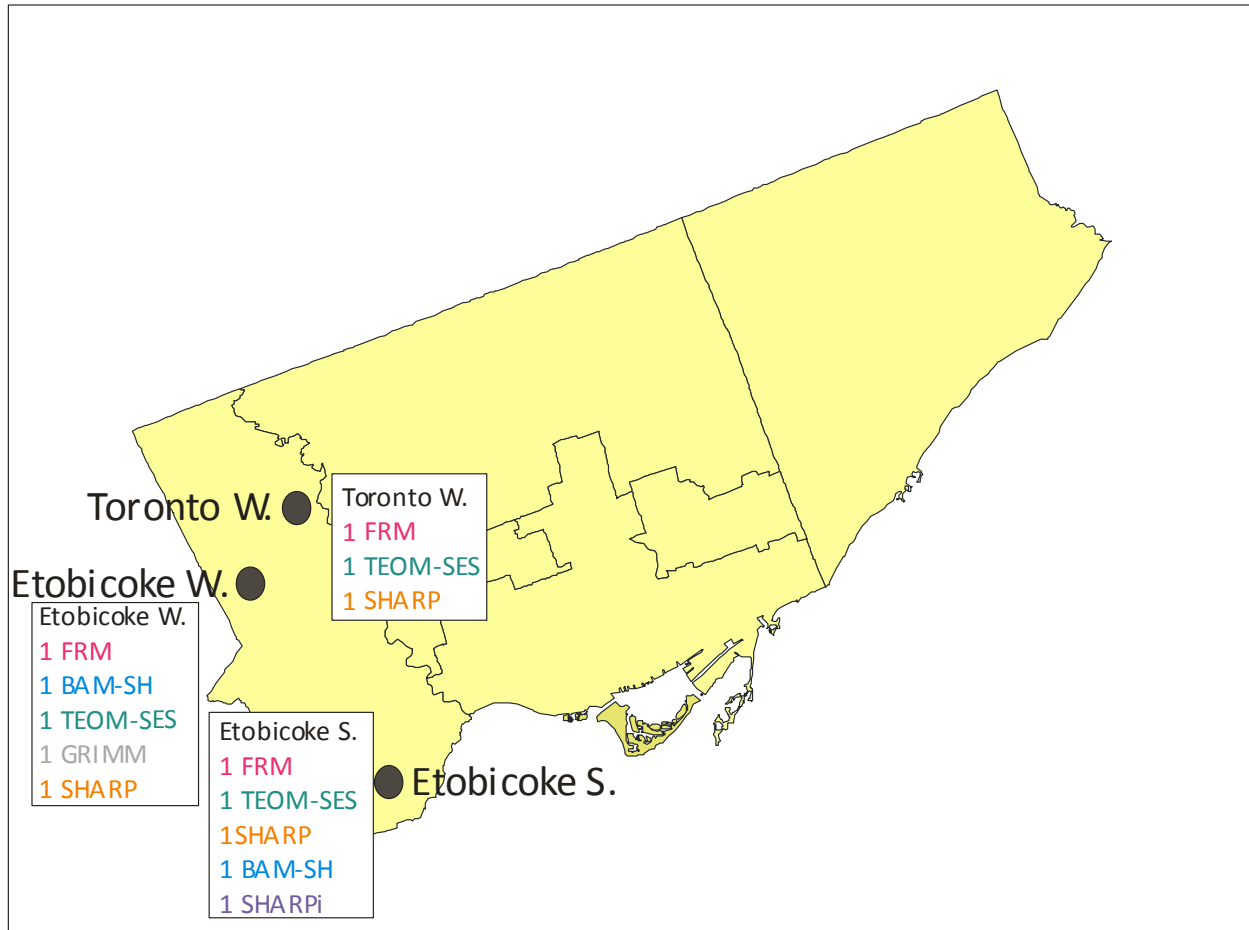
## Evaluate FEM Class III designated monitors for:

- Overall performance
- Ease of installation and operation
- Total cost of ownership

## Four systems under evaluation:

- Met-one BAM 1020
- Thermo SHARP5030i
- Thermo SHARP5030
- GRIMM EDM 180

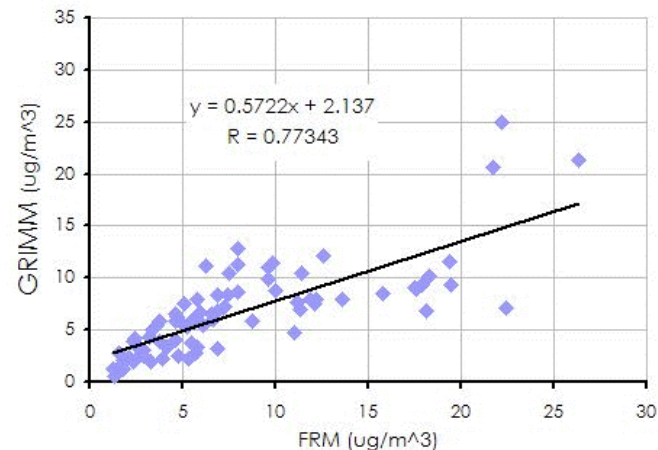
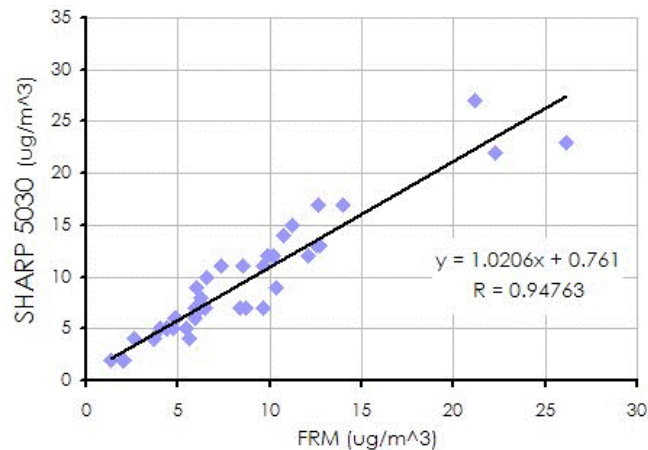
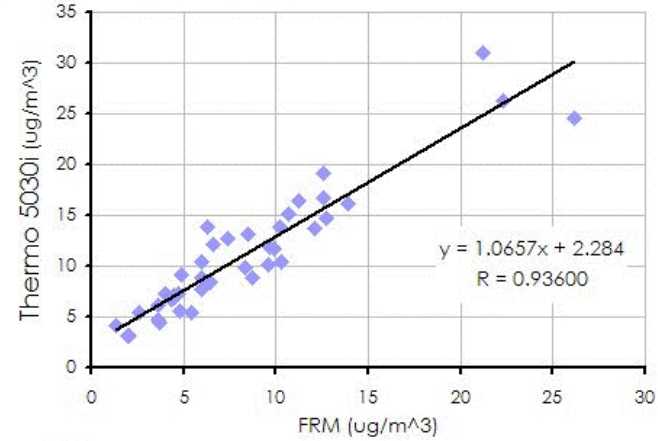
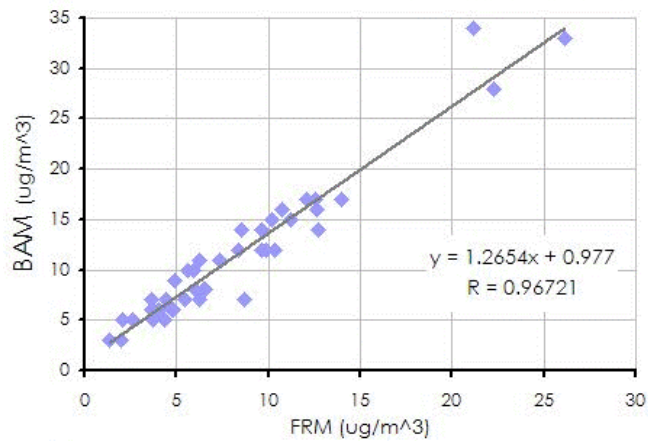
# Ontario PM<sub>2.5</sub> Research Network



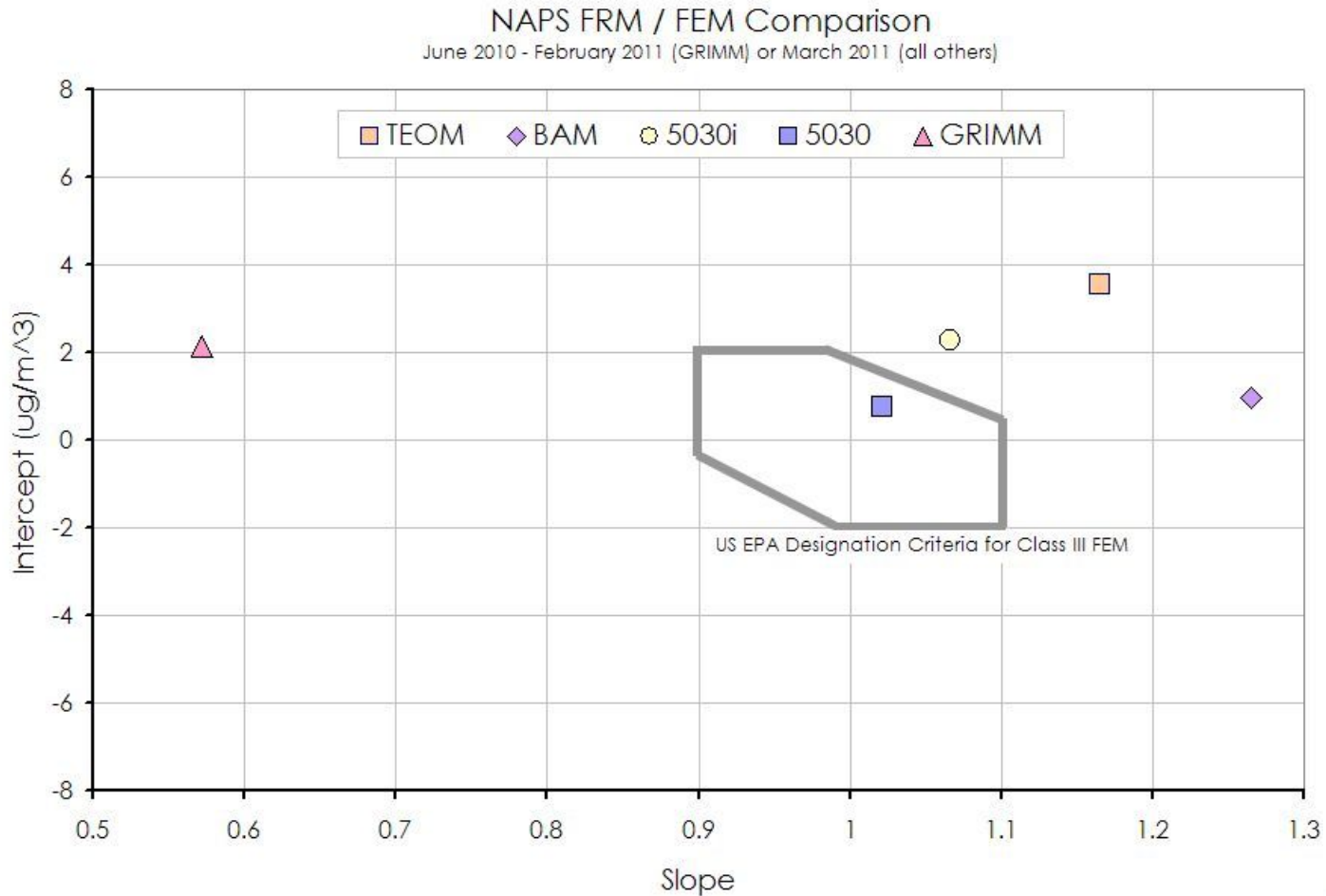
# Evaluating Performance of FEM Methods

## Regression Analysis - FEM / FRM

June 2010 - February 2011 (GRIMM) or March 2011 (all others)

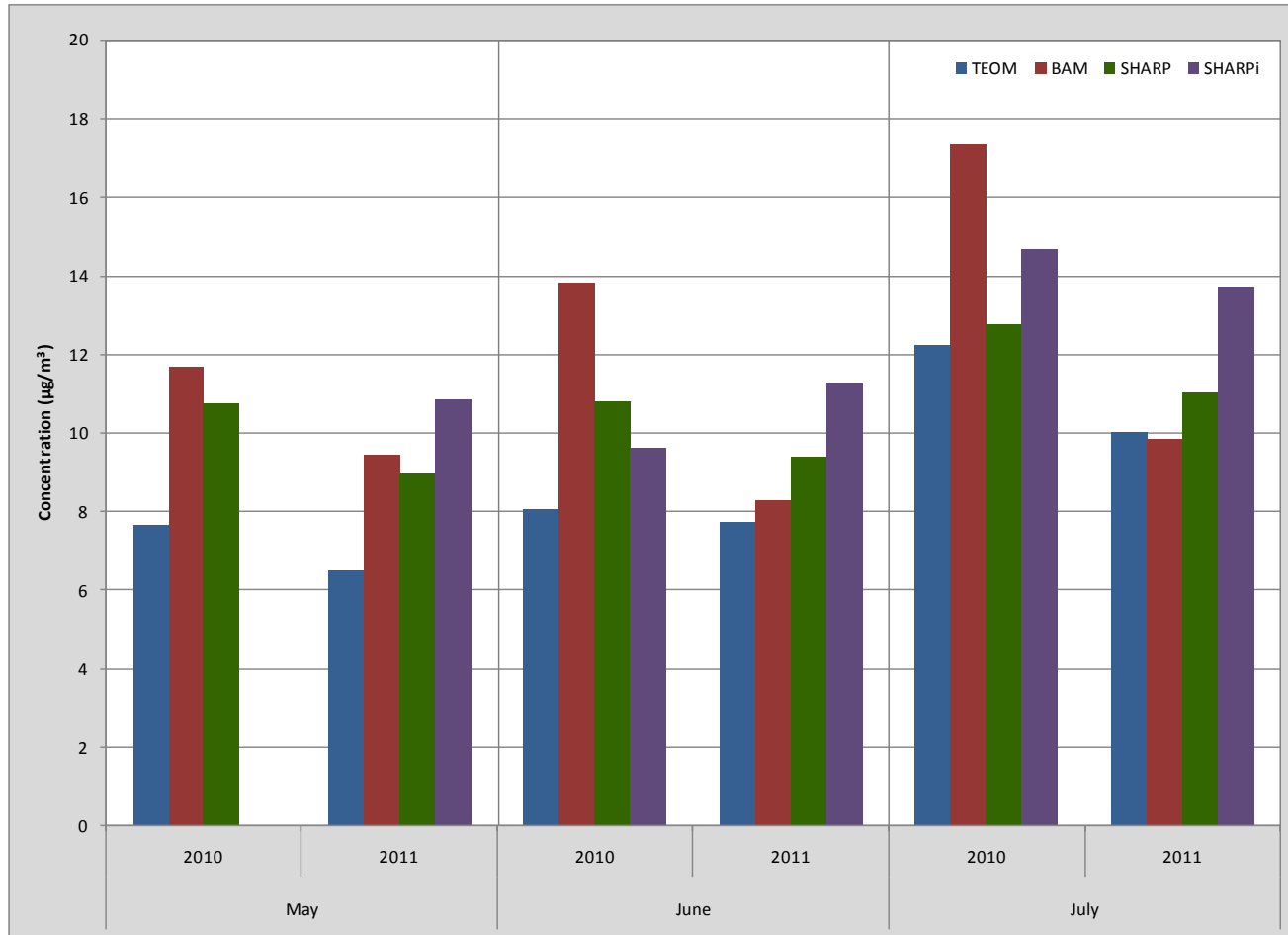


# FEM Methods Compared

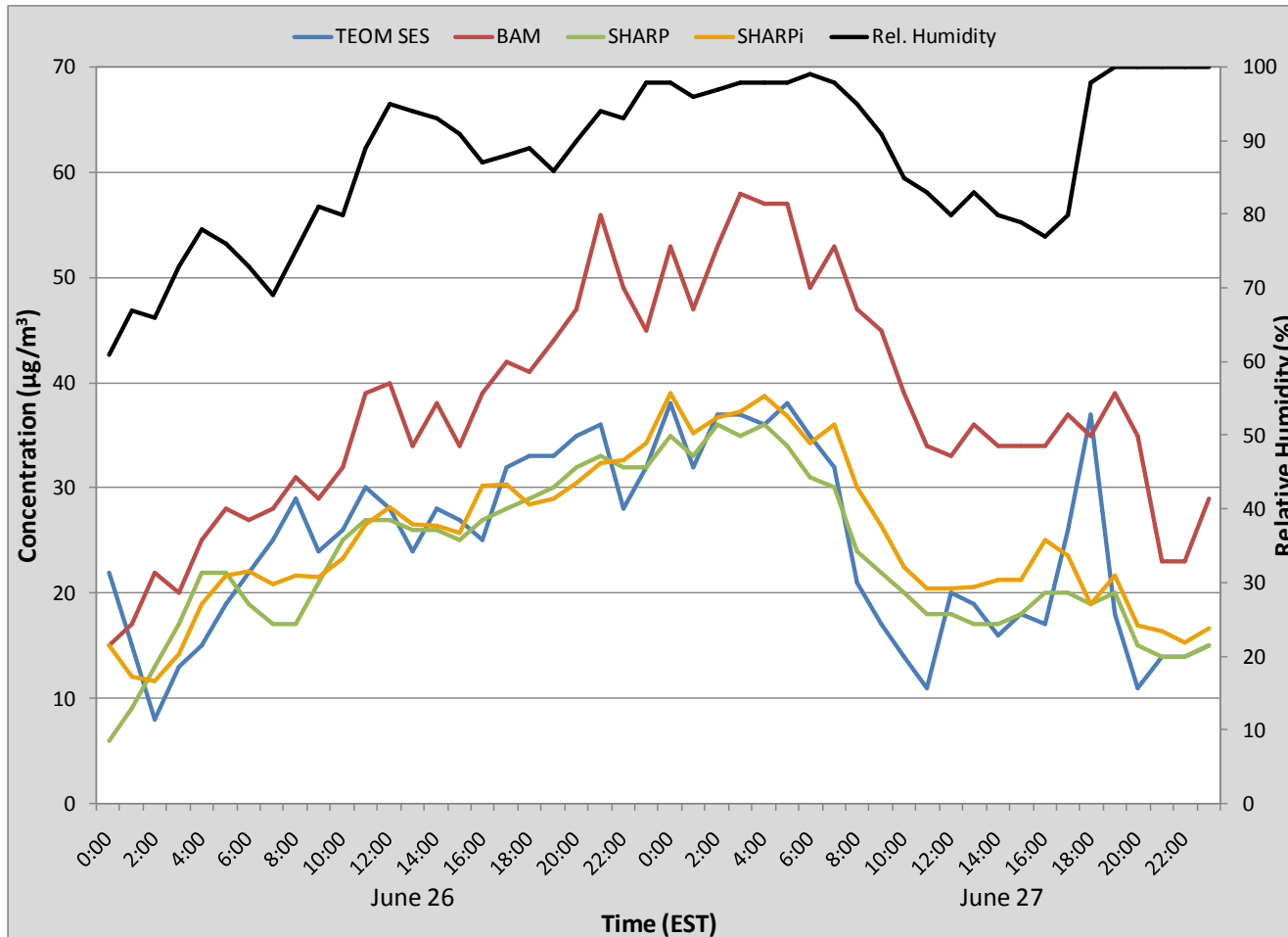




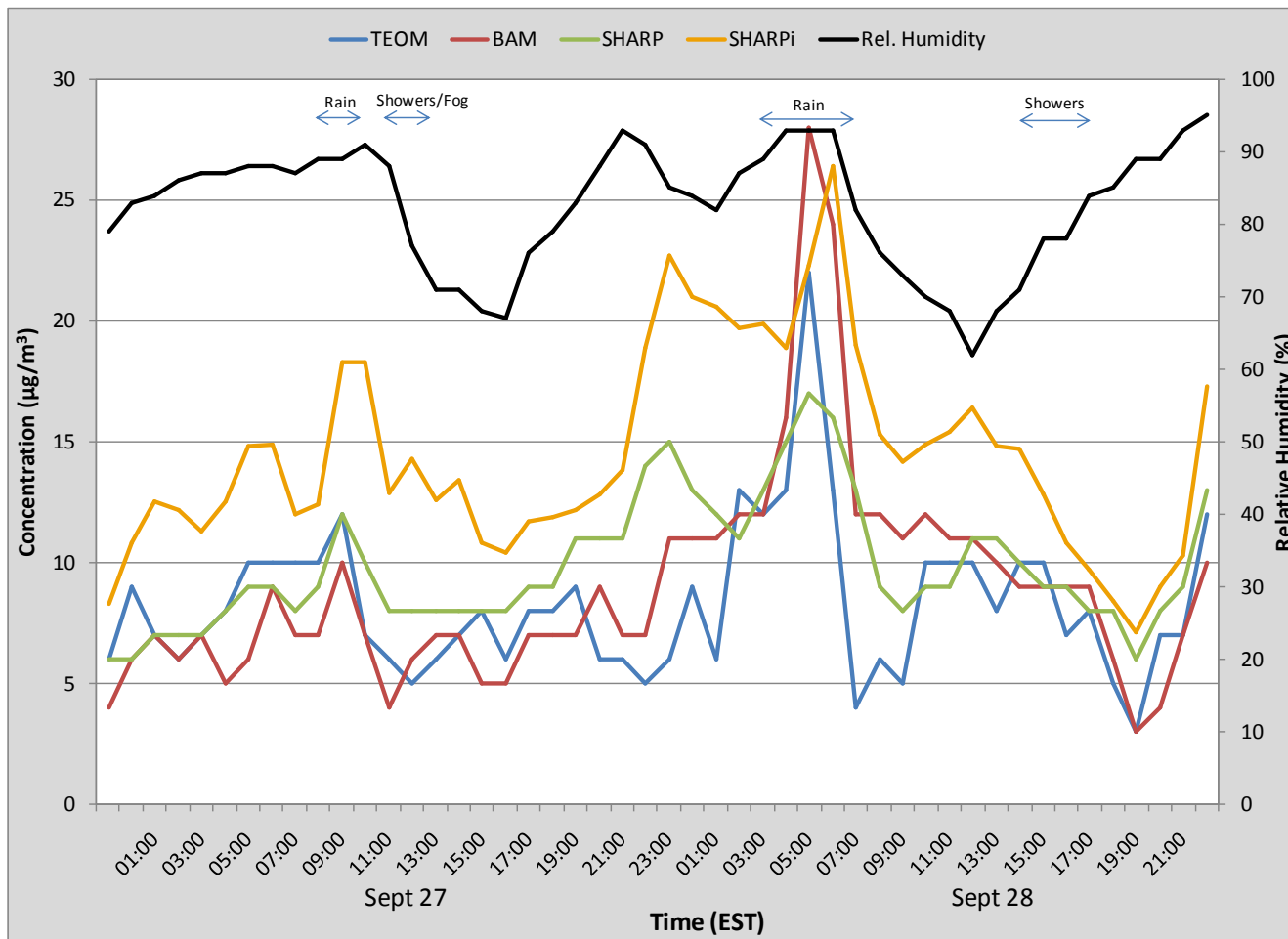
# Monthly Average PM<sub>2.5</sub> Concentrations at Etobicoke South Measured Using TEOM, BAM, SHARPi and SHARP Instruments May to July, 2010 and 2011



# PM<sub>2.5</sub> Concentrations Measured with TEOM SES, Met-One BAM, SHARP and SHARPi Instruments at Etobicoke South Along with Relative Humidity June 26-27, 2010



# PM<sub>2.5</sub> Concentrations Measured with TEOM SES, Met-One BAM, SHARP and SHARPi Instruments at Etobicoke South Along with Relative Humidity September 27-28, 2011



# Conclusion

- Further evaluation of the FEMs is required due to the variability observed between the NAPS FRM and FEM Methods
- Ontario does not have a clear choice for the next generation PM<sub>2.5</sub> monitor