PUGET SOUND
Clean Air Agency

Working Together for Clean Air

www.pscleanair.org

Aethalometer comparisons to EC, Iron and Manganese

Metro Seattle Region

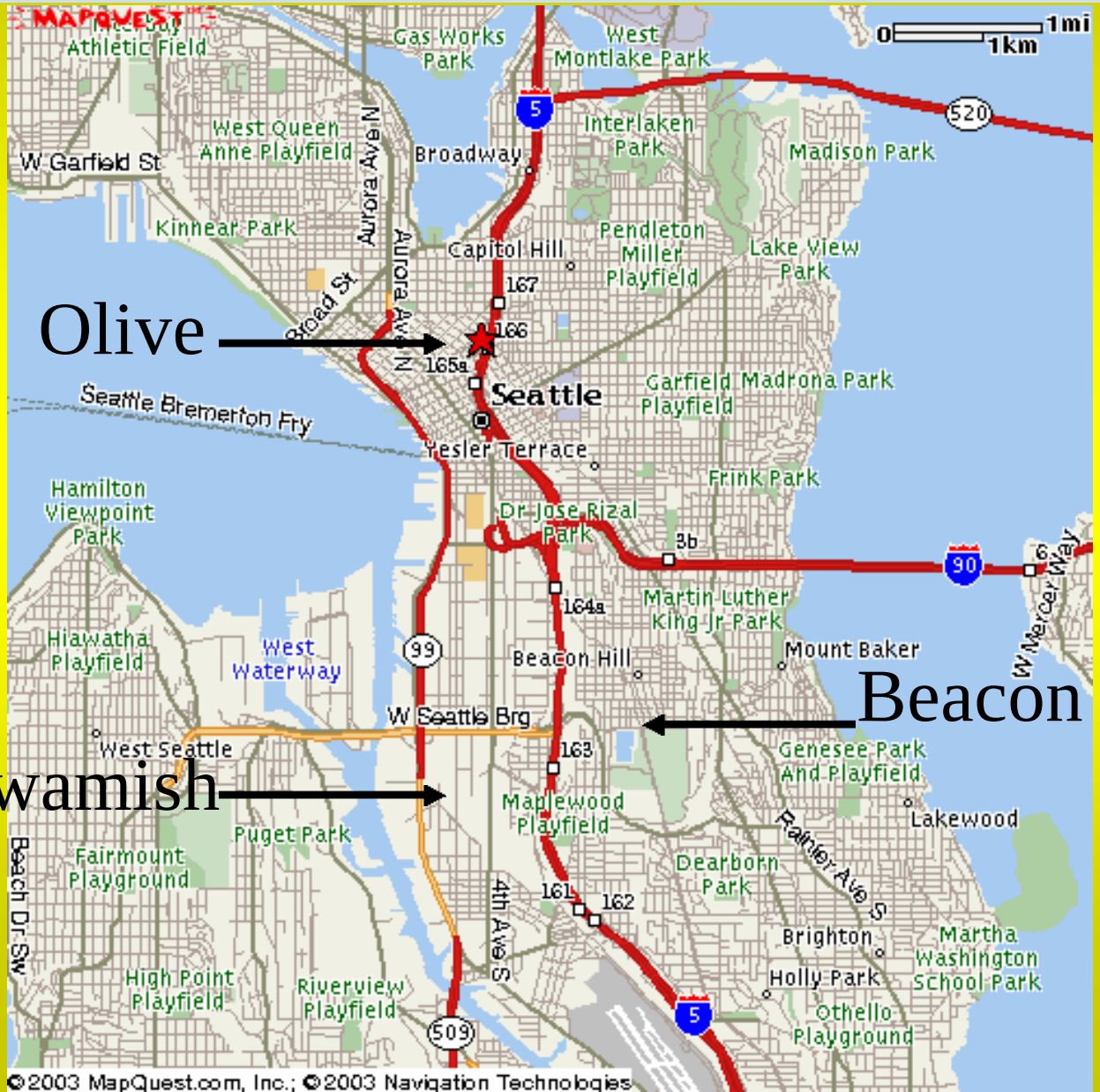
Objectives

- **Discussion on Aethalometer Experience**
  - **Viable Technology?**
  - **Use Strategies**
- **What guidance is out there?**
  - **Does it make sense?**
  - **Relationship to NAAQS**
- **Speciation Sampling**
  - **Cost Comparison**
  - **Quality discussion**
- **Diesel Particulate Matter versus Woodsmoke**

Sites

- **Beacon Hill – WA Dept of Ecology Northwest Region**
  - **PM 2.5 FRM**
  - **Nephelometer**
  - **Speciation Sampler**
  - **Aethalometer**
- **Duwamish – Puget Sound Clean Air Agency**
  - **Co-Located PM 2.5 FRM**
  - **Nephelometer**
  - **Speciation Sampler**
  - **Aethalometer**
  - **FTIR Device (Operated by the University of Washington)**
- **Olive Street – Puget Sound Clean Air Agency**
  - **Nephelometer**
  - **Speciation Sampler**
  - **Aethalometer**

Geographic Location



Seattle Aethelometer network

Wood smoke
L-3 site

Lake Forest Park

Interstate 5
Downtown
center

Urban
L-2 type site
Lowest 2.5 annual avg.

Industrial arterial
Max Concentration site
L-3 site.

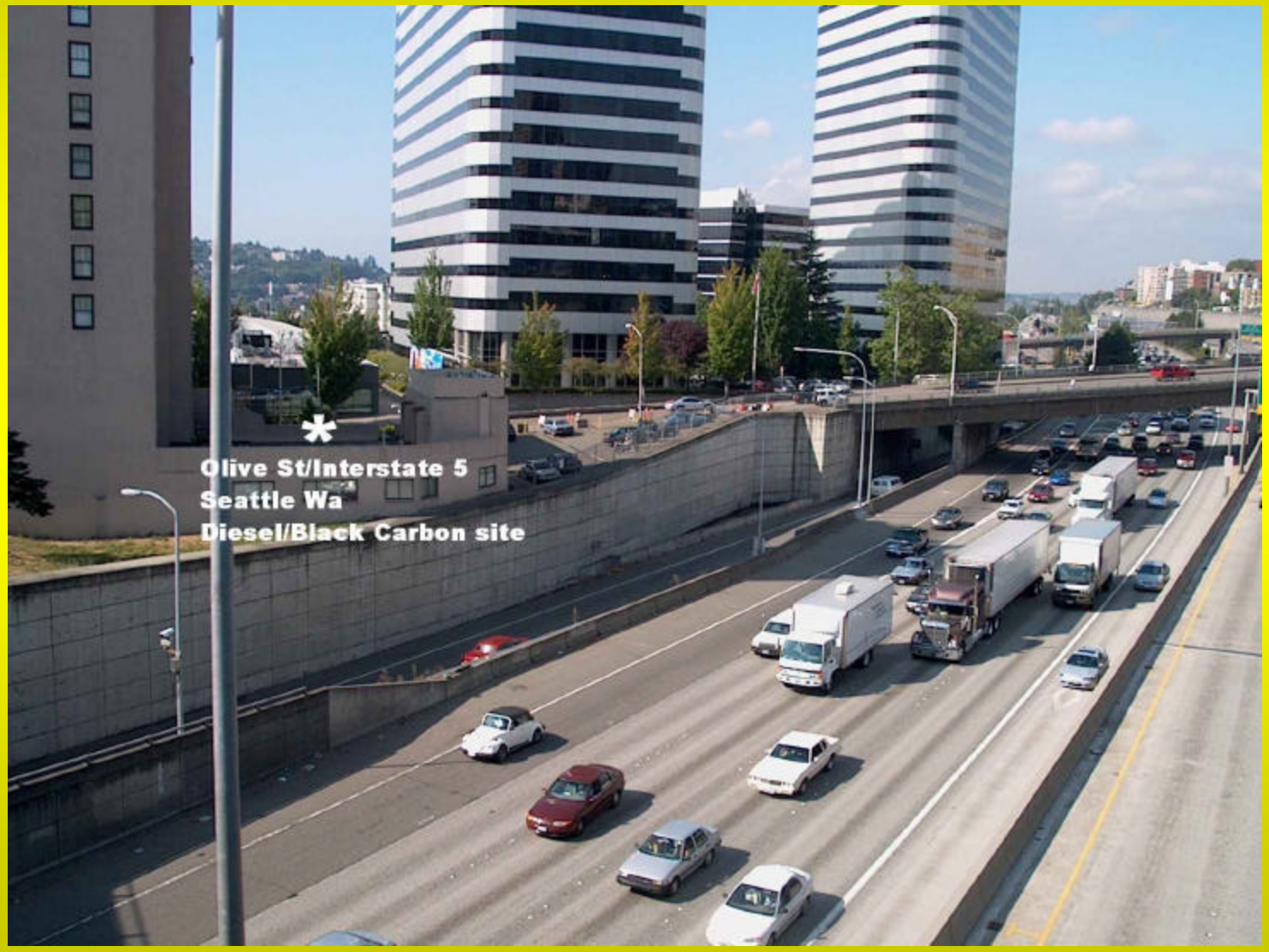
Olive St
I-5

Beacon Hill

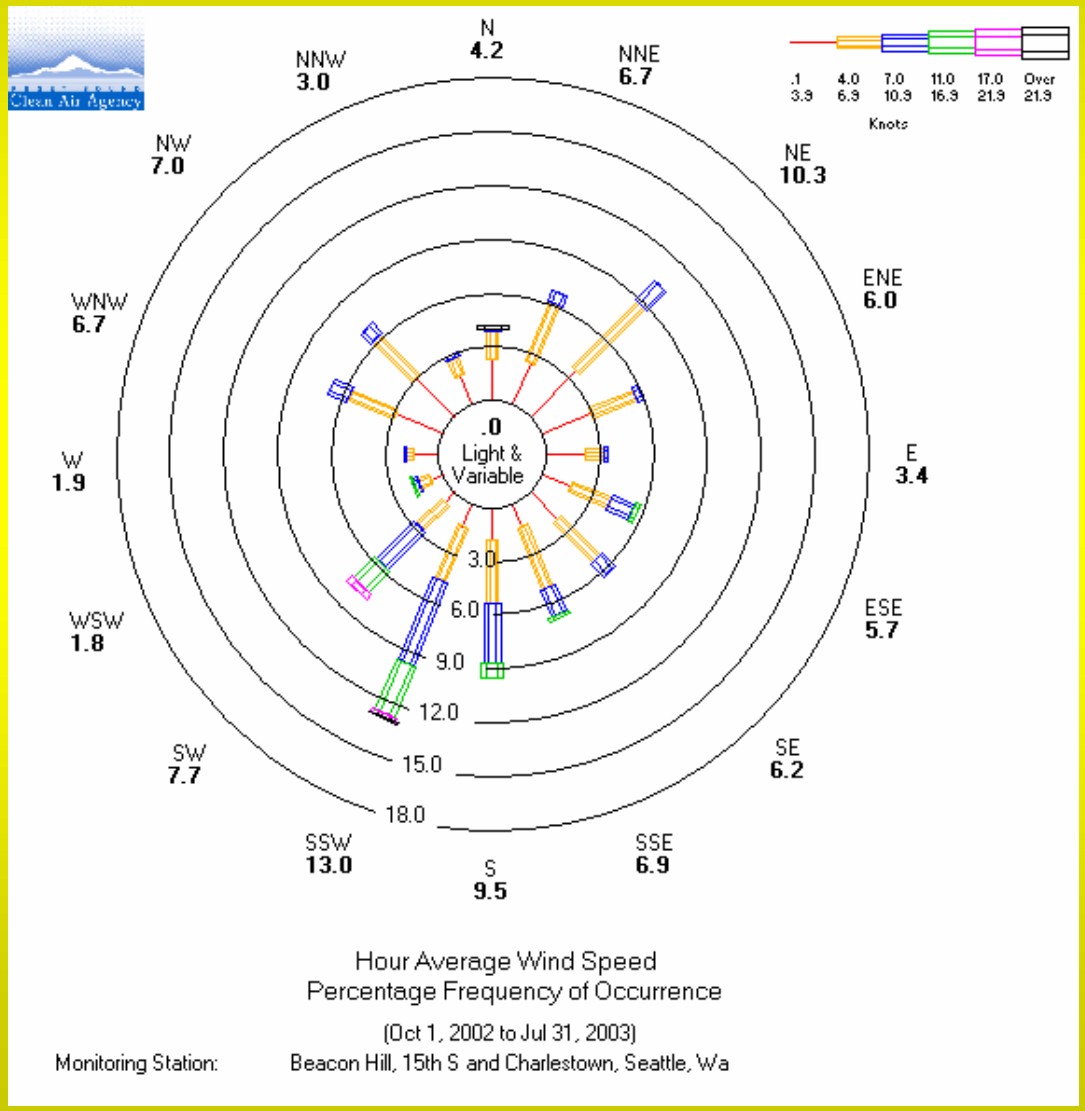
Duwamish

Puget Sound Clean Air Agency

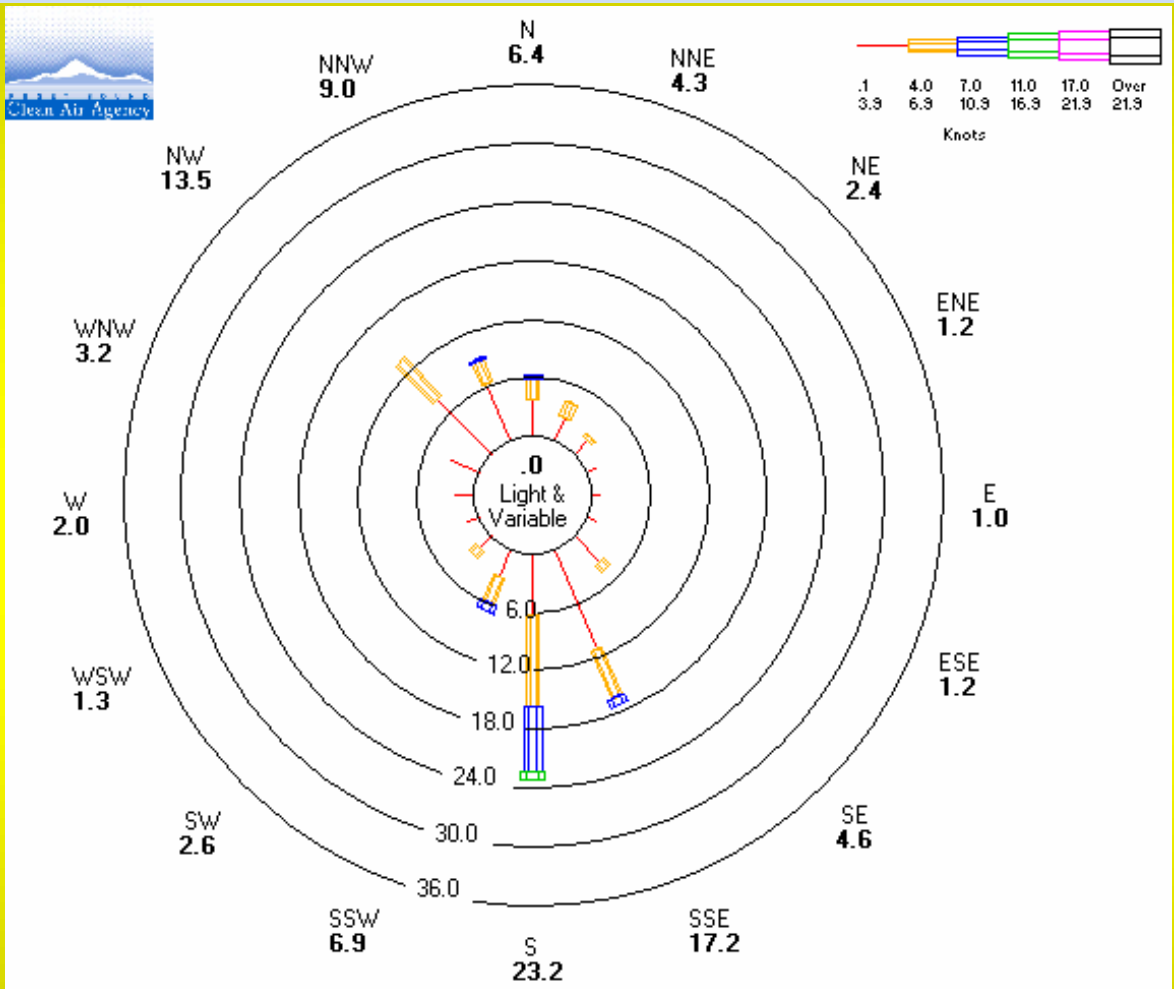
Puget Sound Clean Air Agency



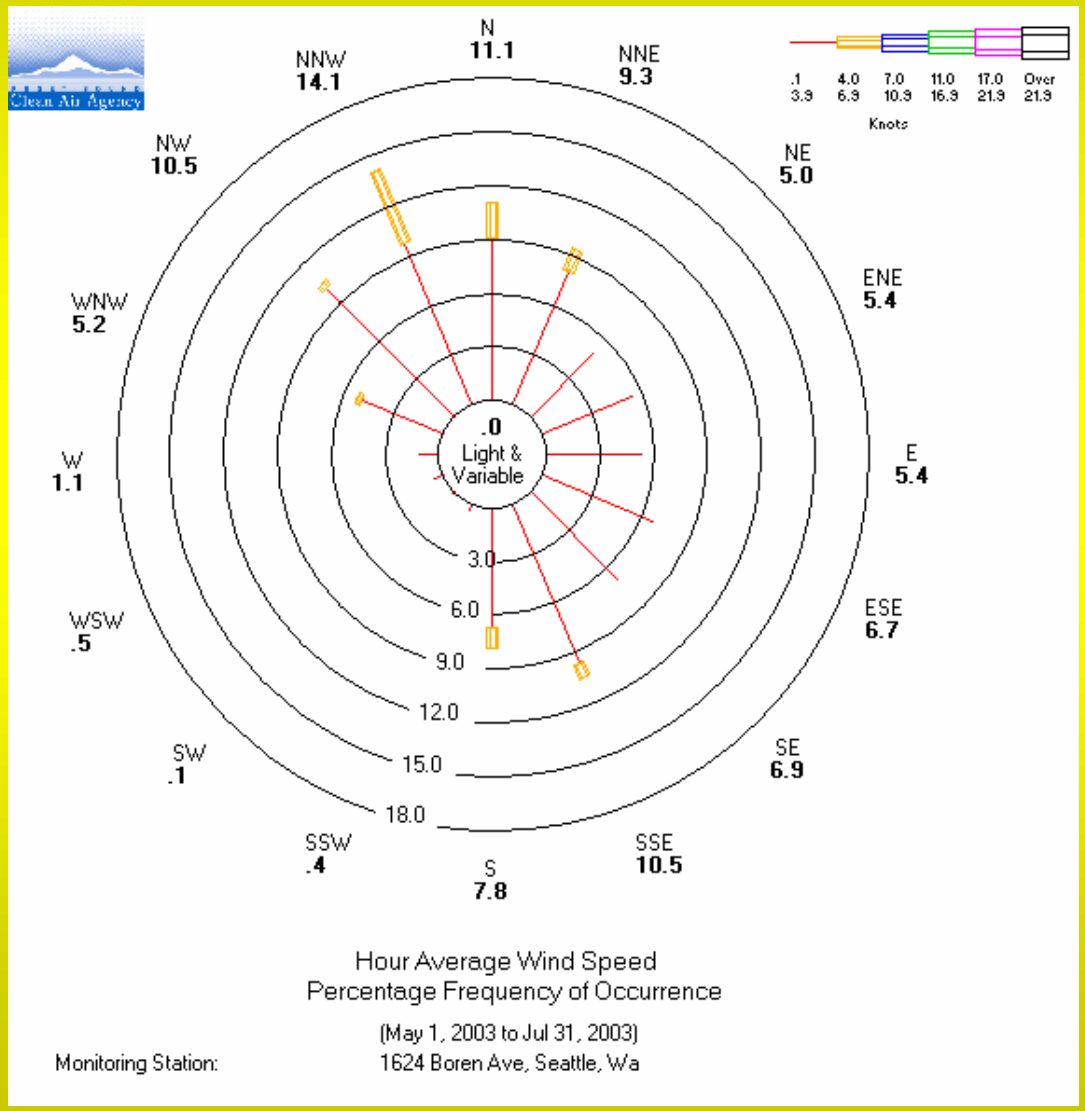
Wind Rose for Beacon Hill



Wind Rose for Duwamish



Wind Rose for Olive Street



Quality Assurance

Nephelometry

- **Zero and Span Precision Checks every 14 Days, and at the beginning and end of a critical reporting period as per WA DOE Procedures.**

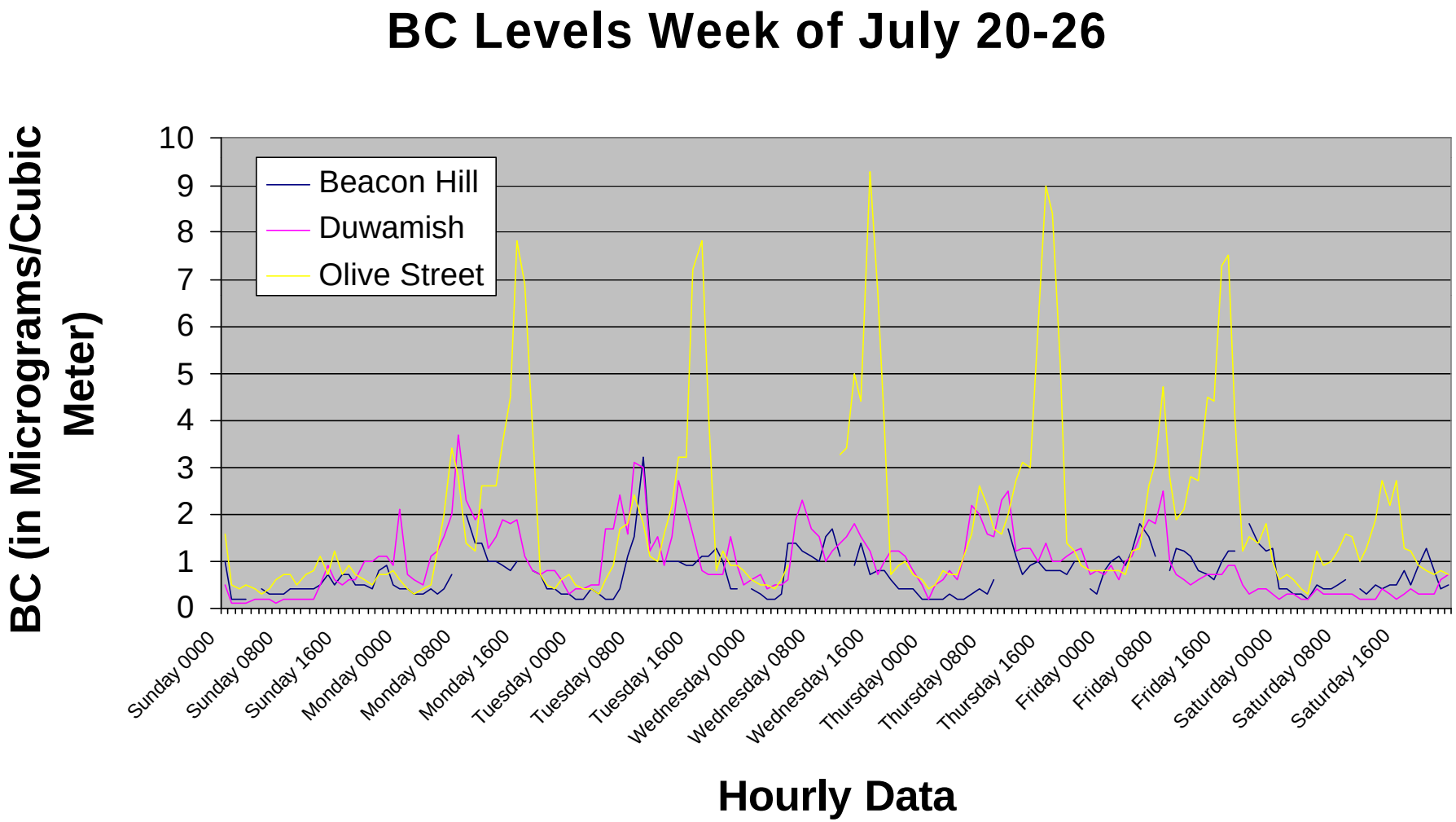
Aethalometry

- **Bi-Weekly Flow Check, Monthly Flow Audit and Optics Test**

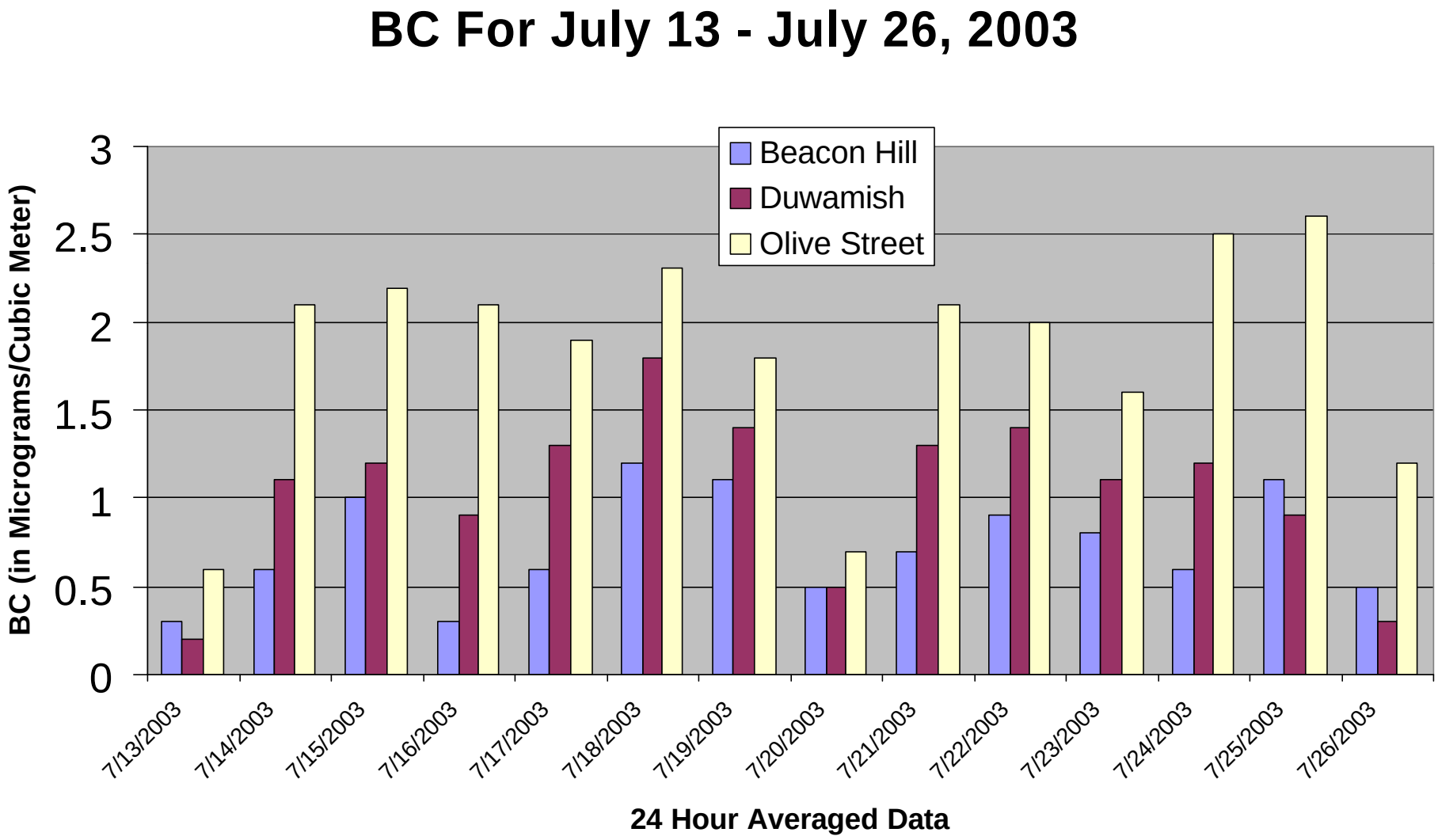
Speciation

- **QA performed at RTI for Laboratory Analysis**
- **Flow Checks and Leak Checks performed per WA DOE Procedures**

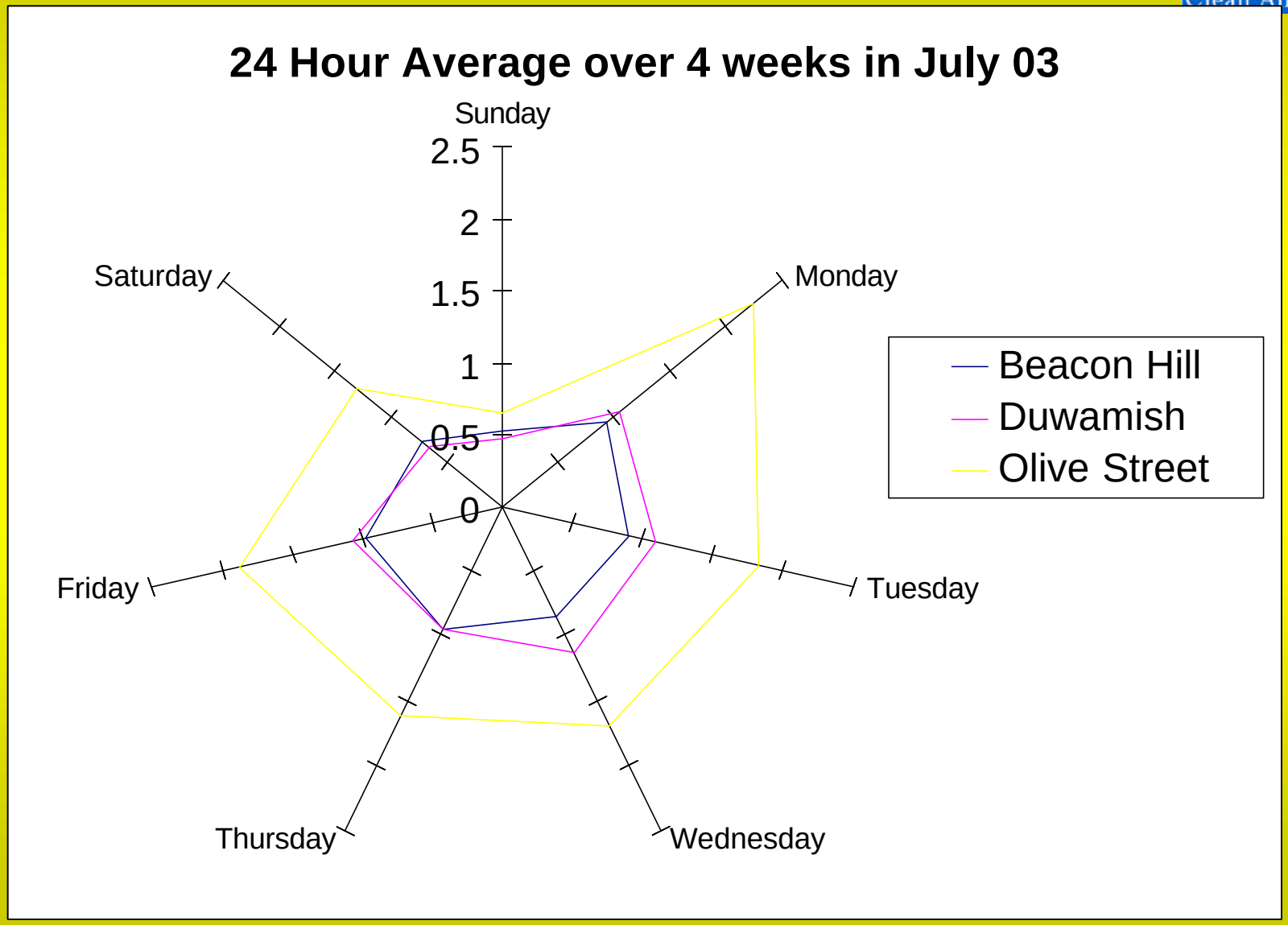
Traffic Patterns (Typical Week)



2 Typical Summer Weeks

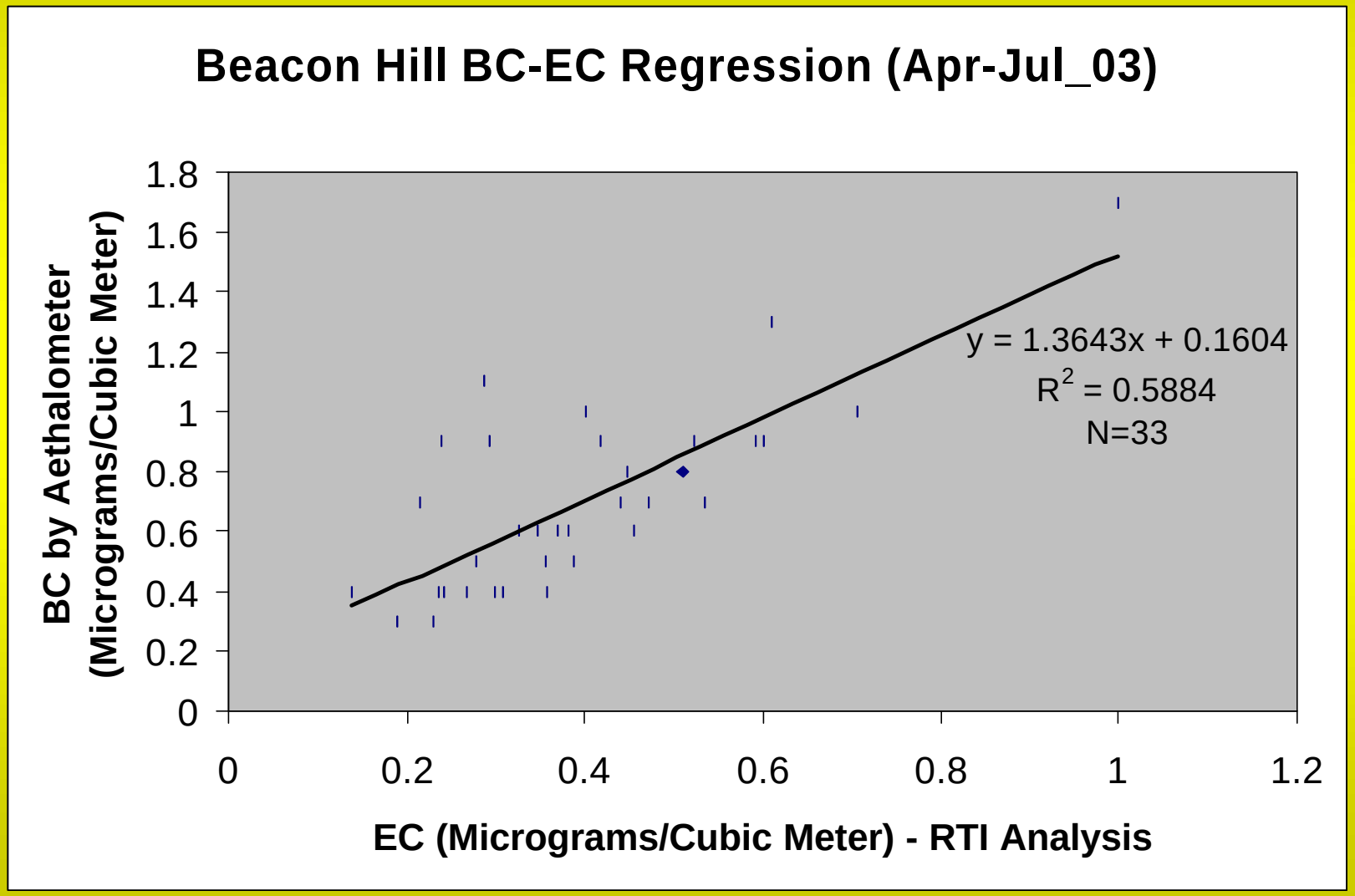


Black Carbon Dependence on Day

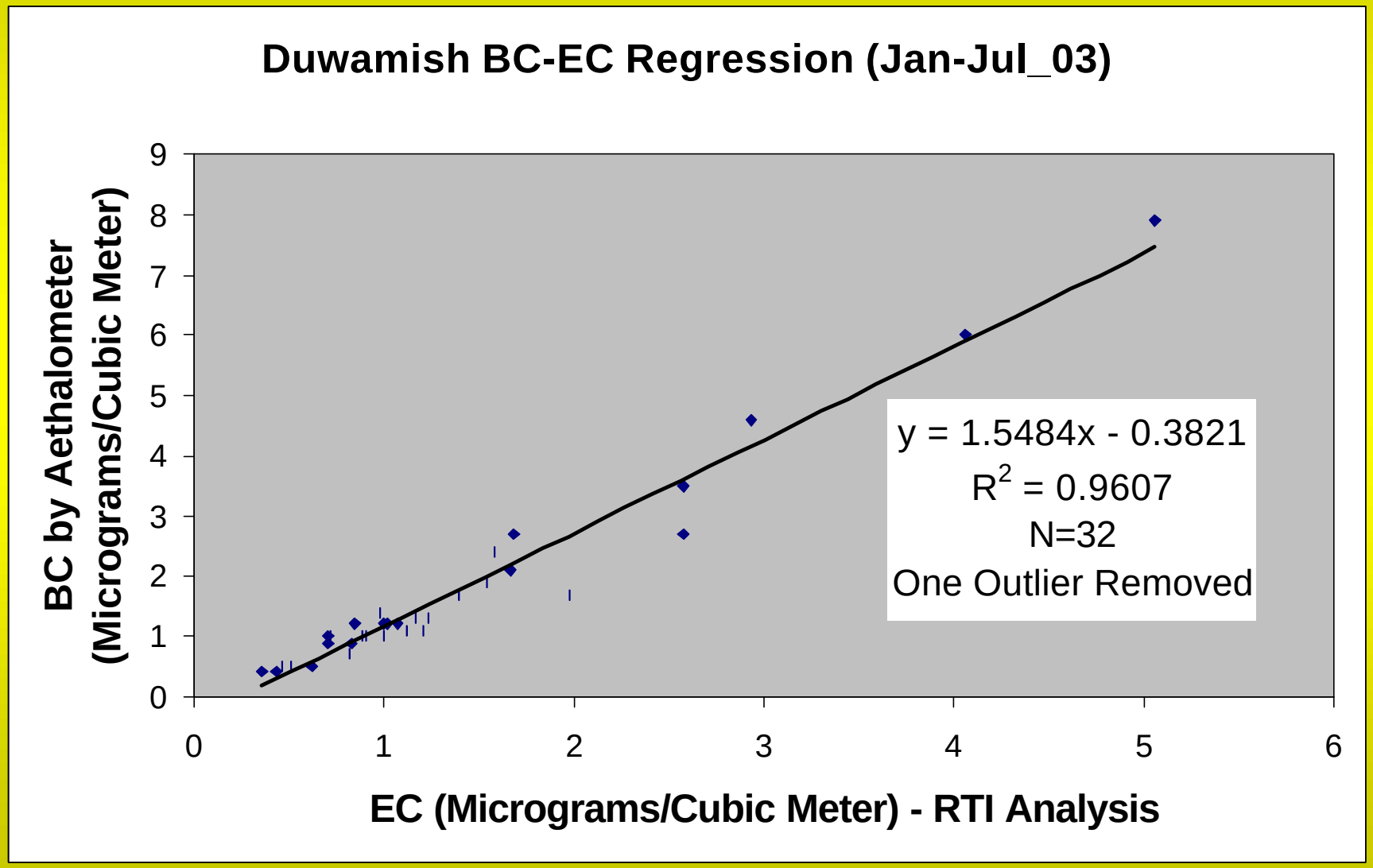


- How does BC Aethelometer compare?

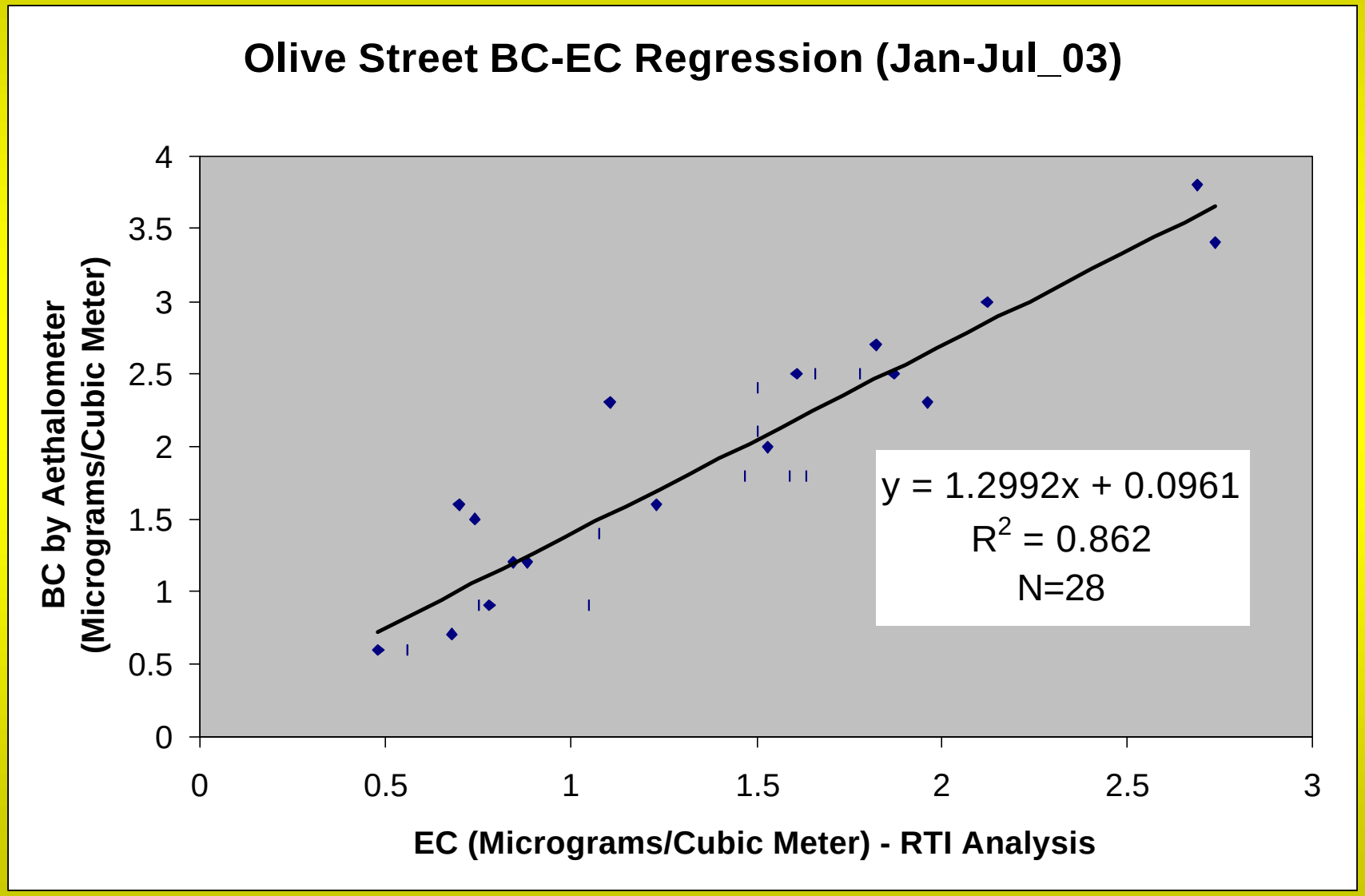
Black Carbon and Elemental Carbon



Black Carbon and Elemental Carbon

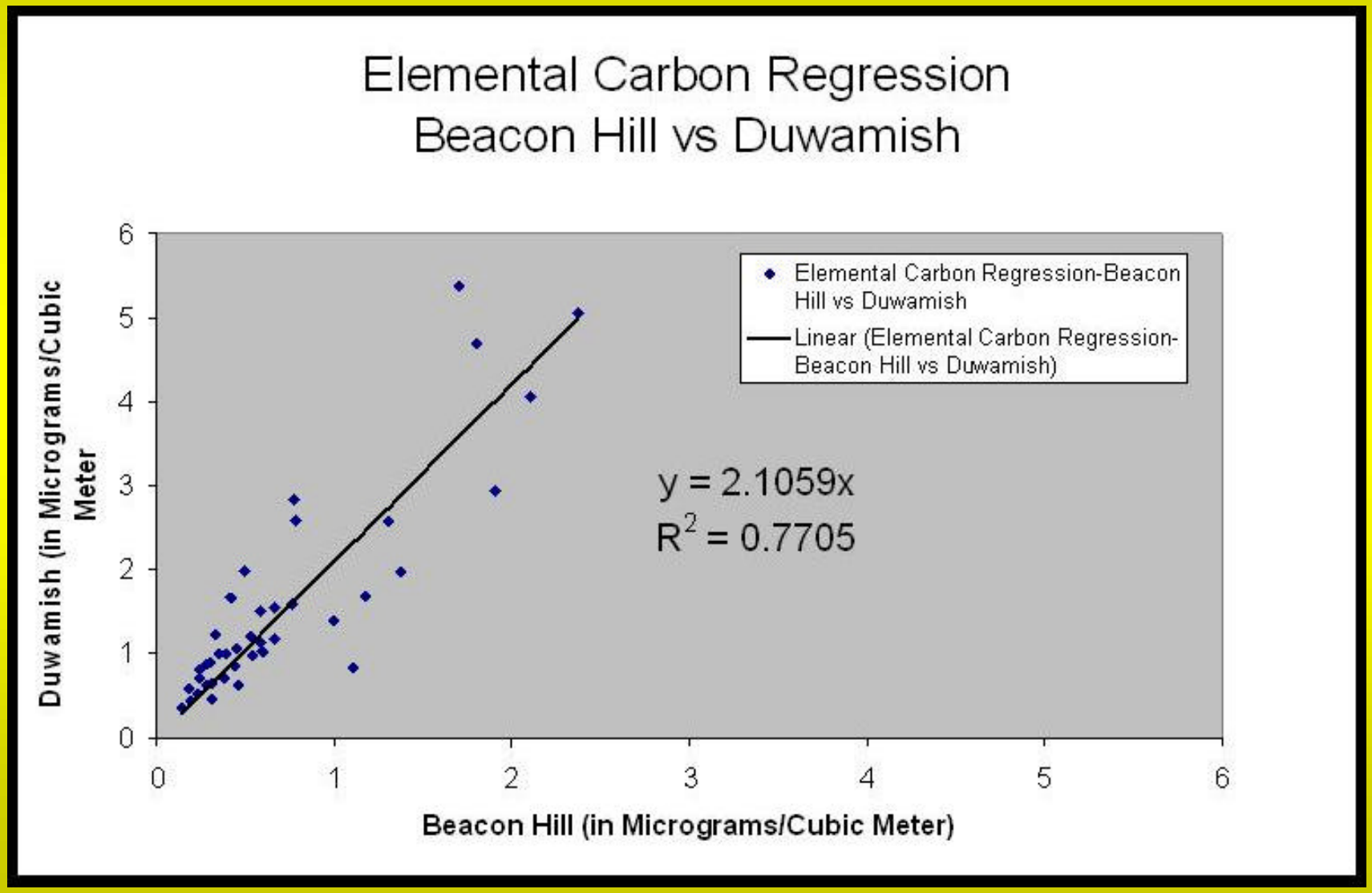


Black Carbon and Elemental Carbon

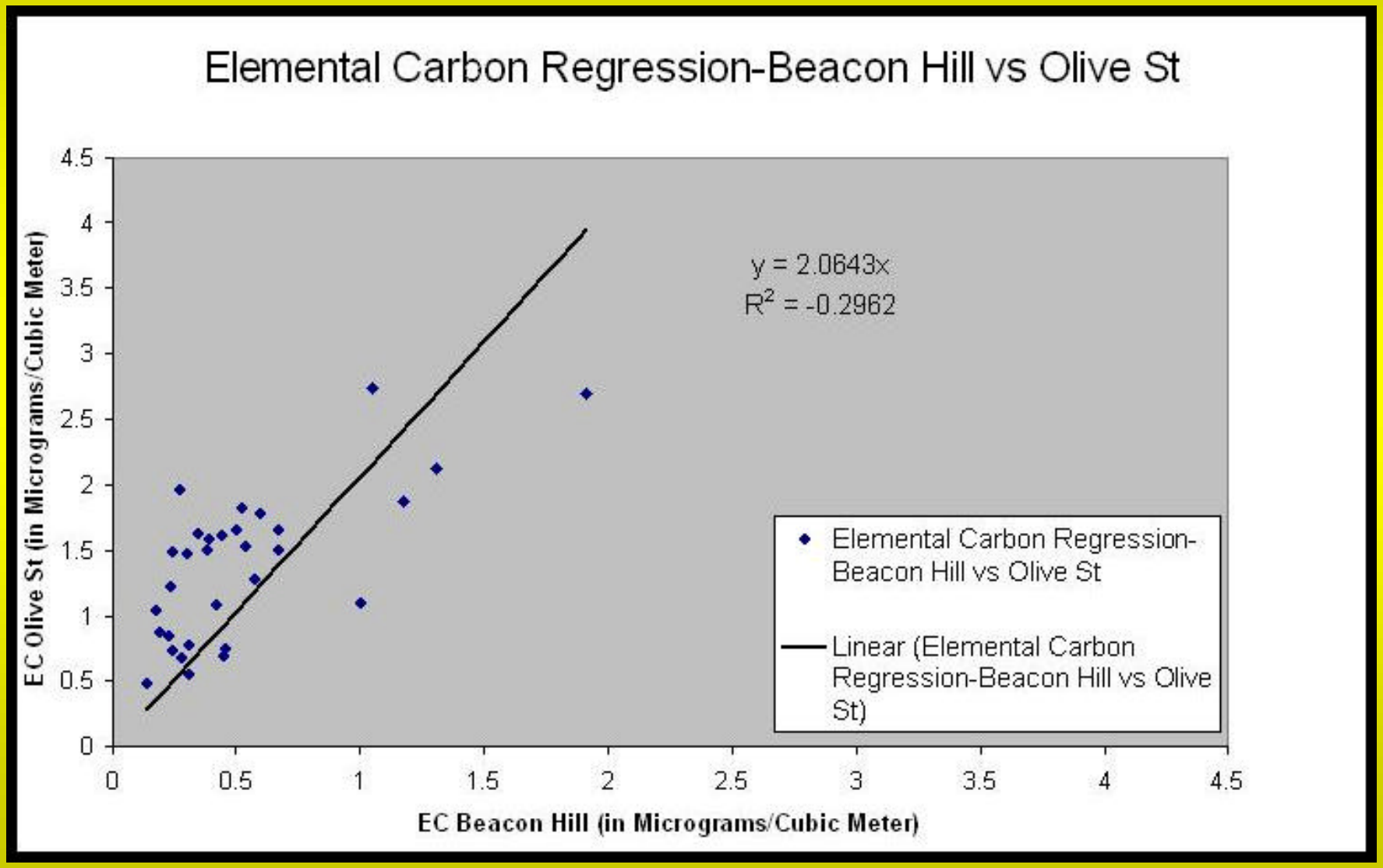


BC Comparison to EC

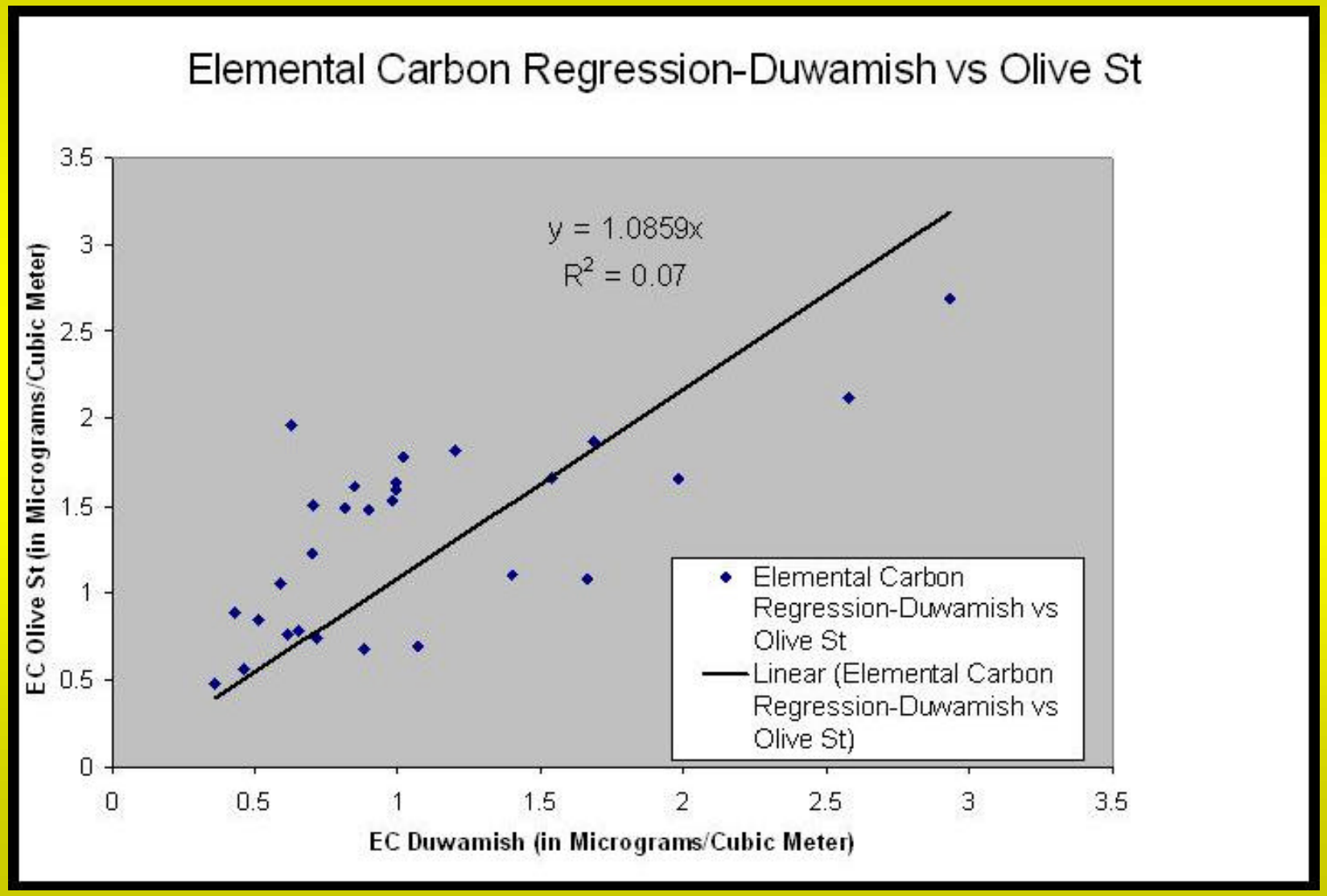
Elemental Carbon Regression (N=41)



Elemental Carbon Regression (N=31)

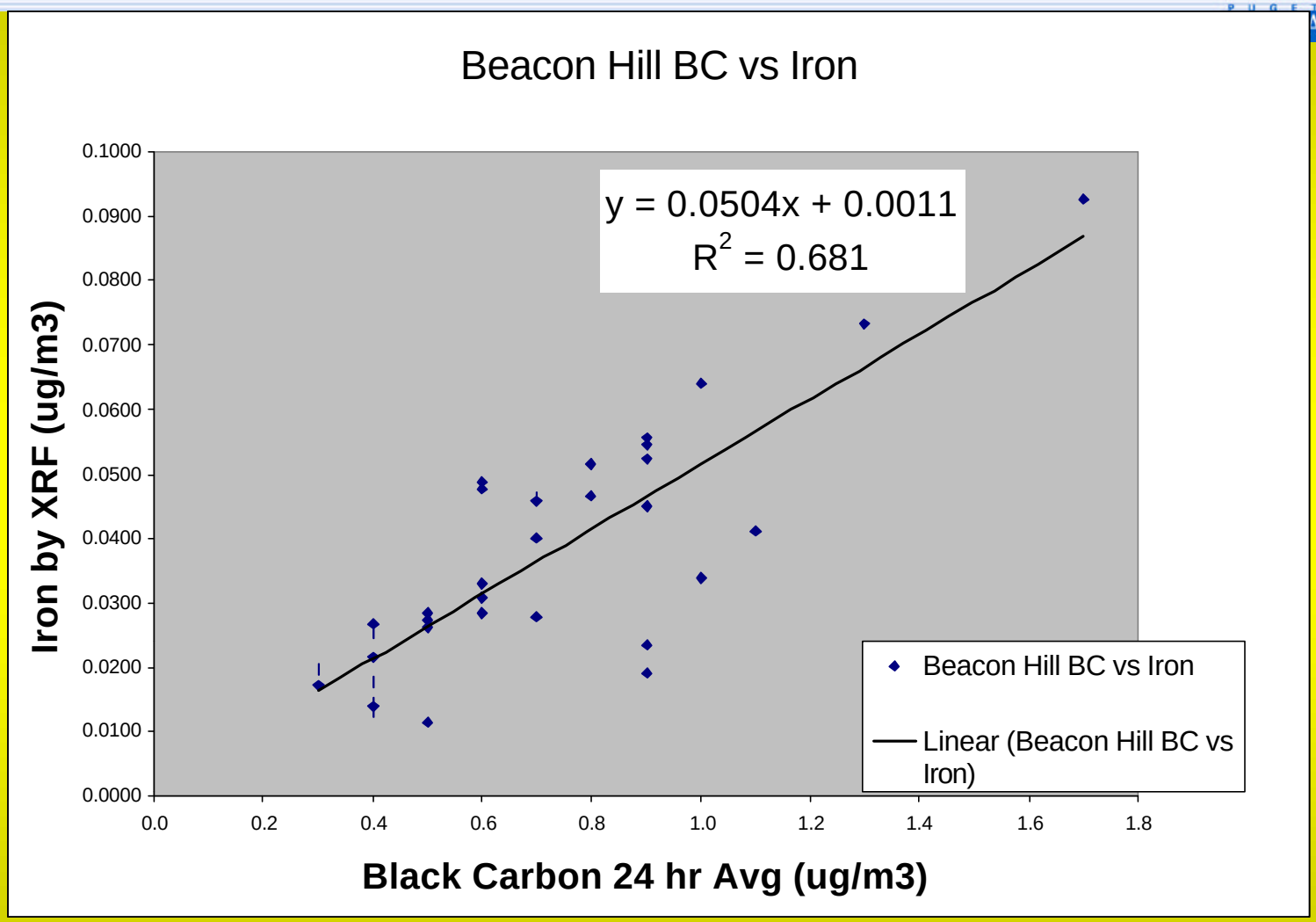


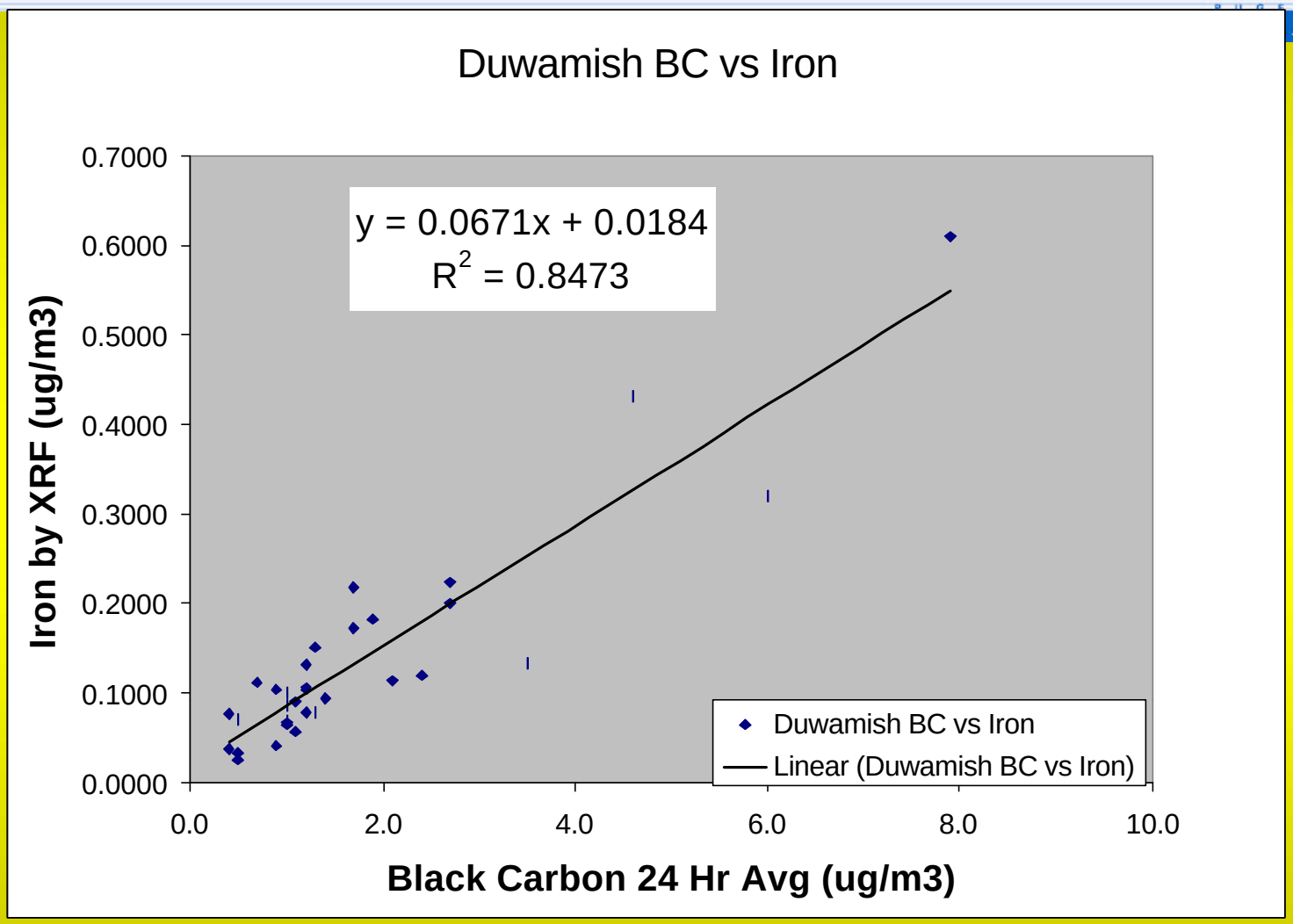
Elemental Carbon Regression (N=28)

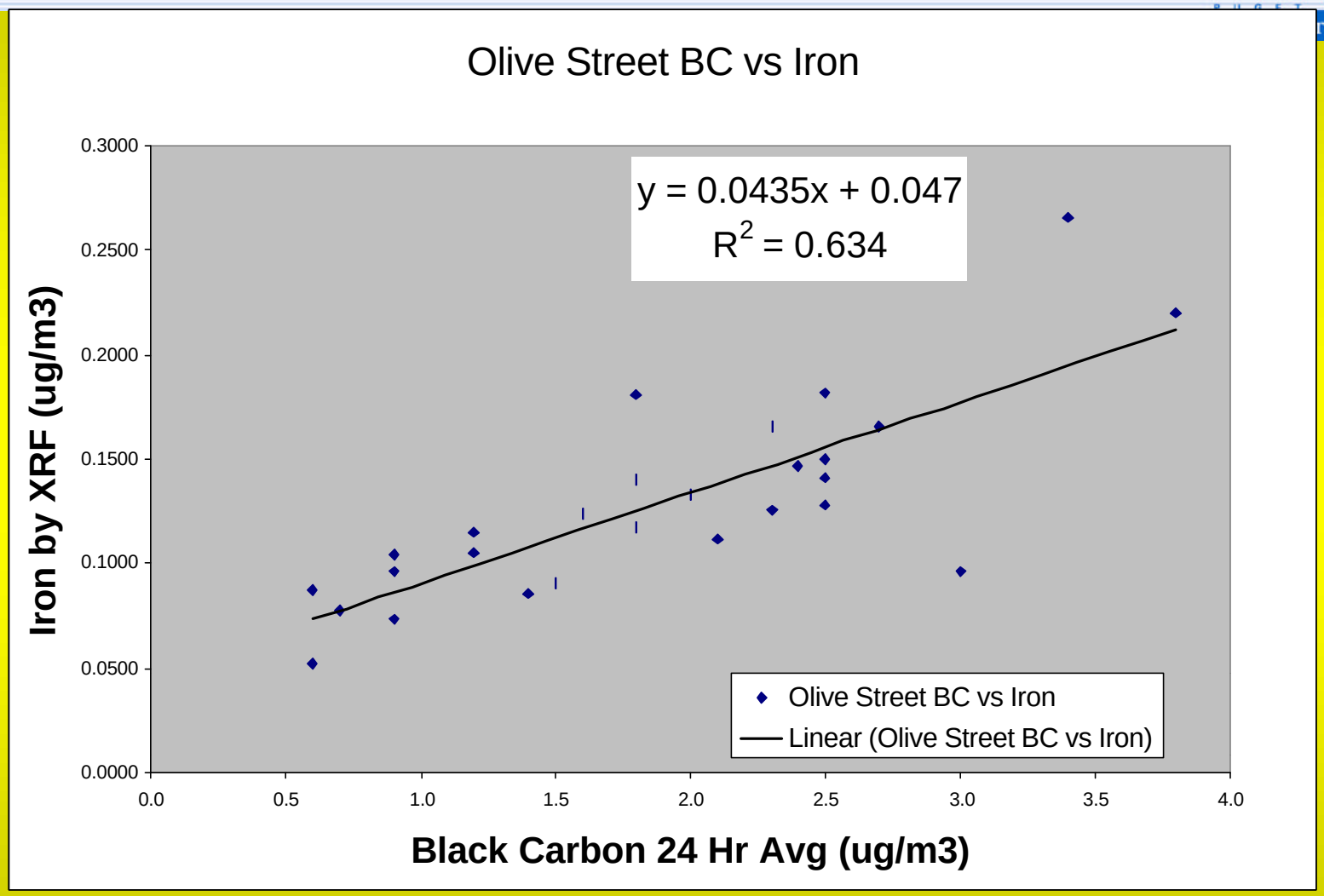


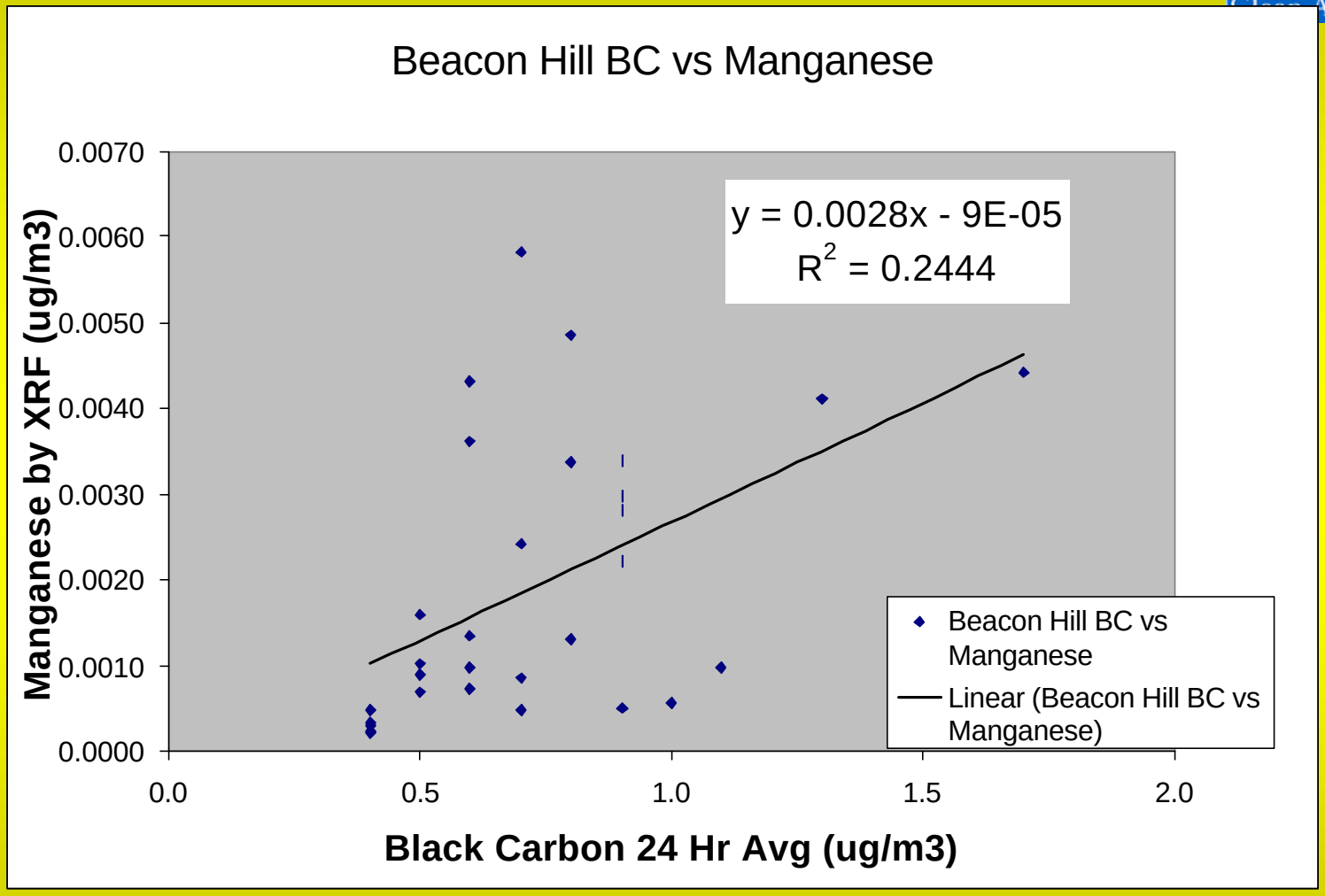
Other Parameters

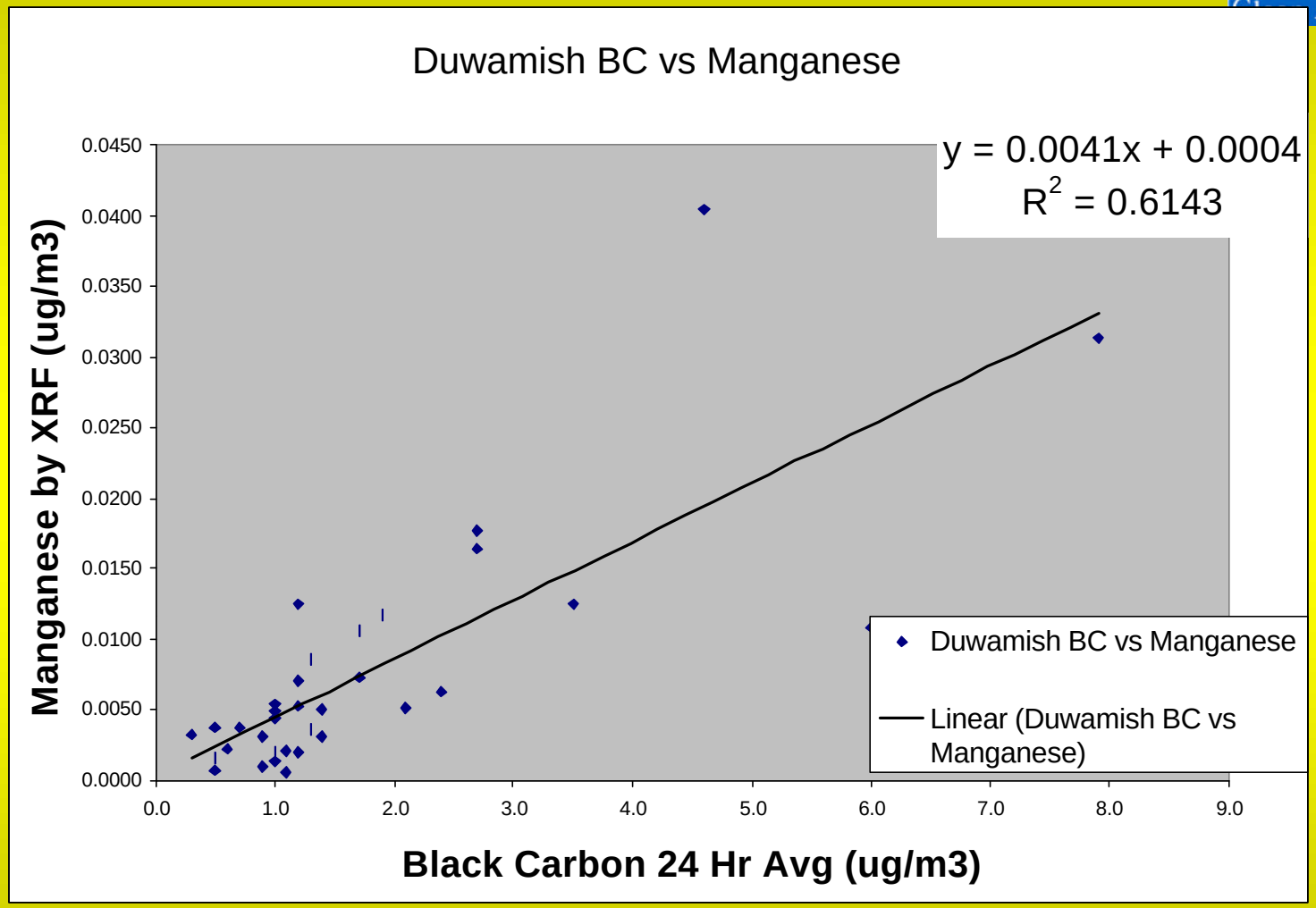
- **Are there other markers to add weight that Aethalometers are credibility “seeing diesel soot” ?**

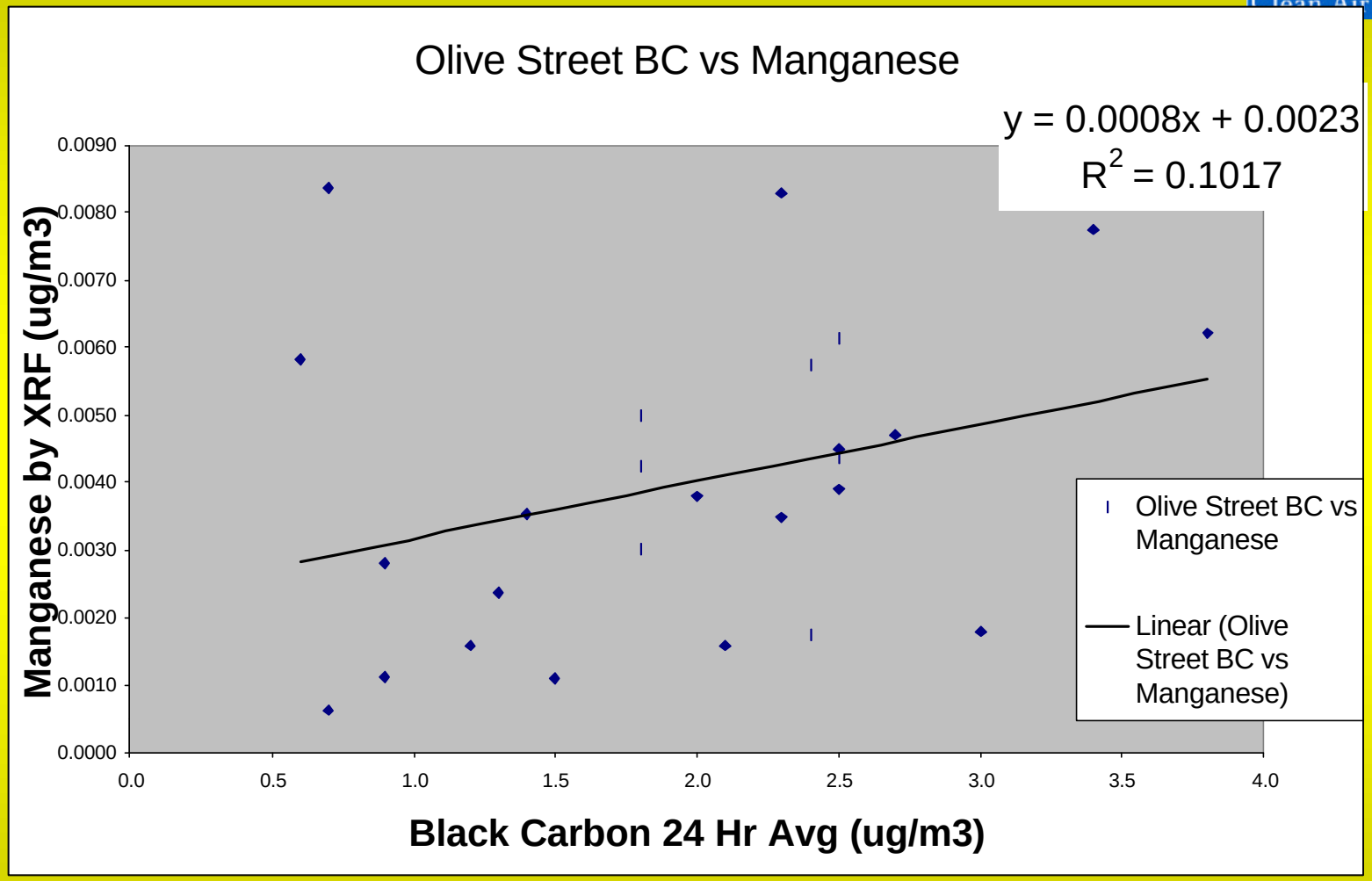

Beacon Hill BC vs Iron
y = 0.0504x + 0.0011
R2 = 0.681
Iron by XRF (ug/m3)
0.1000
0.0900
0.0800
0.0700
0.0600
0.0500
0.0400
0.0300
0.0200
0.0100
0.0000
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
Black Carbon 24 hr Avg (ug/m3)
Beacon Hill BC vs Iron
Linear (Beacon Hill BC vs Iron)


Duwamish BC vs Iron
y = 0.0671x + 0.0184
R2 = 0.8473
Iron by XRF (ug/m3)
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
0.0
2.0
4.0
6.0
8.0
10.0
Black Carbon 24 Hr Avg (ug/m3)
Duwamish BC vs Iron
Linear (Duwamish BC vs Iron)


Olive Street BC vs Iron
y = 0.0435x + 0.047
R2 = 0.634
Iron by XRF (ug/m3)
0.3000
0.2500
0.2000
0.1500
0.1000
0.0500
0.0000
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Black Carbon 24 Hr Avg (ug/m3)
Olive Street BC vs Iron
Linear (Olive Street BC vs Iron)


Beacon Hill BC vs Manganese
y = 0.0028x - 9E-05
R2 = 0.2444
Manganese by XRF (ug/m3)
0.0070
0.0060
0.0050
0.0040
0.0030
0.0020
0.0010
0.0000
0.0
0.5
1.0
1.5
2.0
Black Carbon 24 Hr Avg (ug/m3)
Beacon Hill BC vs Manganese
Linear (Beacon Hill BC vs Manganese)


Duwamish BC vs Manganese
y = 0.0041x + 0.0004
R2 = 0.6143
Manganese by XRF (ug/m3)
0.0450
0.0400
0.0350
0.0300
0.0250
0.0200
0.0150
0.0100
0.0050
0.0000
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
Black Carbon 24 Hr Avg (ug/m3)
Duwamish BC vs Manganese
Linear (Duwamish BC vs Manganese)


Olive Street BC vs Manganese
y = 0.0008x + 0.0023
R2 = 0.1017
Manganese by XRF (ug/m3)
0.0090
0.0080
0.0070
0.0060
0.0050
0.0040
0.0030
0.0020
0.0010
0.0000
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Black Carbon 24 Hr Avg (ug/m3)
Olive Street BC vs Manganese
Linear (Olive Street BC vs Manganese)

What's next?

- **Adding 3 more devices at wood smoke sites**
- **Chamber test at U of Washington**
  - **Diesel**
  - **Wood Smoke**