# Heavy Metals and Phosphorus in Parking Lot Run-Off: A Comparison Study

**Tracy Bender**

***The Pennsylvania State University***

# Rationale

- Impervious surface
- Run-off to water sources
- Hazardous to health

# Project Overview

- 8 test sites
- 5 contaminants
  - Phosphorus
  - Cadmium
  - Copper
  - Lead
  - Zinc

# Objective

- Comparison
  - Age
  - Use
  - Condition
  - Length of Time in Lot

# Test Sites

–A lot of construction

–Repaved in 2000

–Seasonal, lightly used

–Cars us

–Tends to

nd go

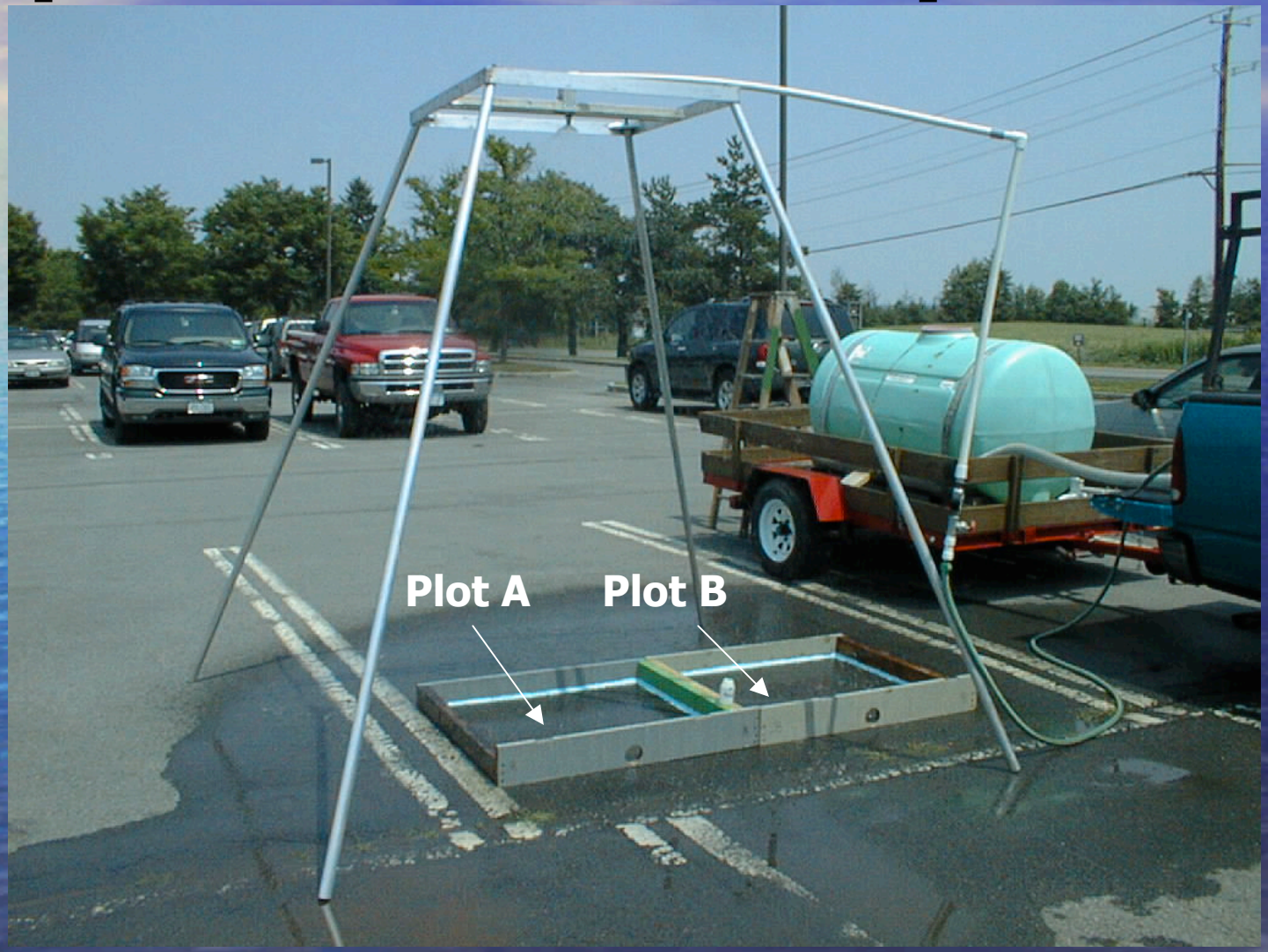
ng

ose proximity to

(TRB)

not used very heavily

# Experimental Set-Up



# Rain Simulation

- Teejet ½ HH-SS50 WSG nozzle
- 82% Uniformity
- Average Intensity – 10.0 cm/hr (3.95 in/hr)

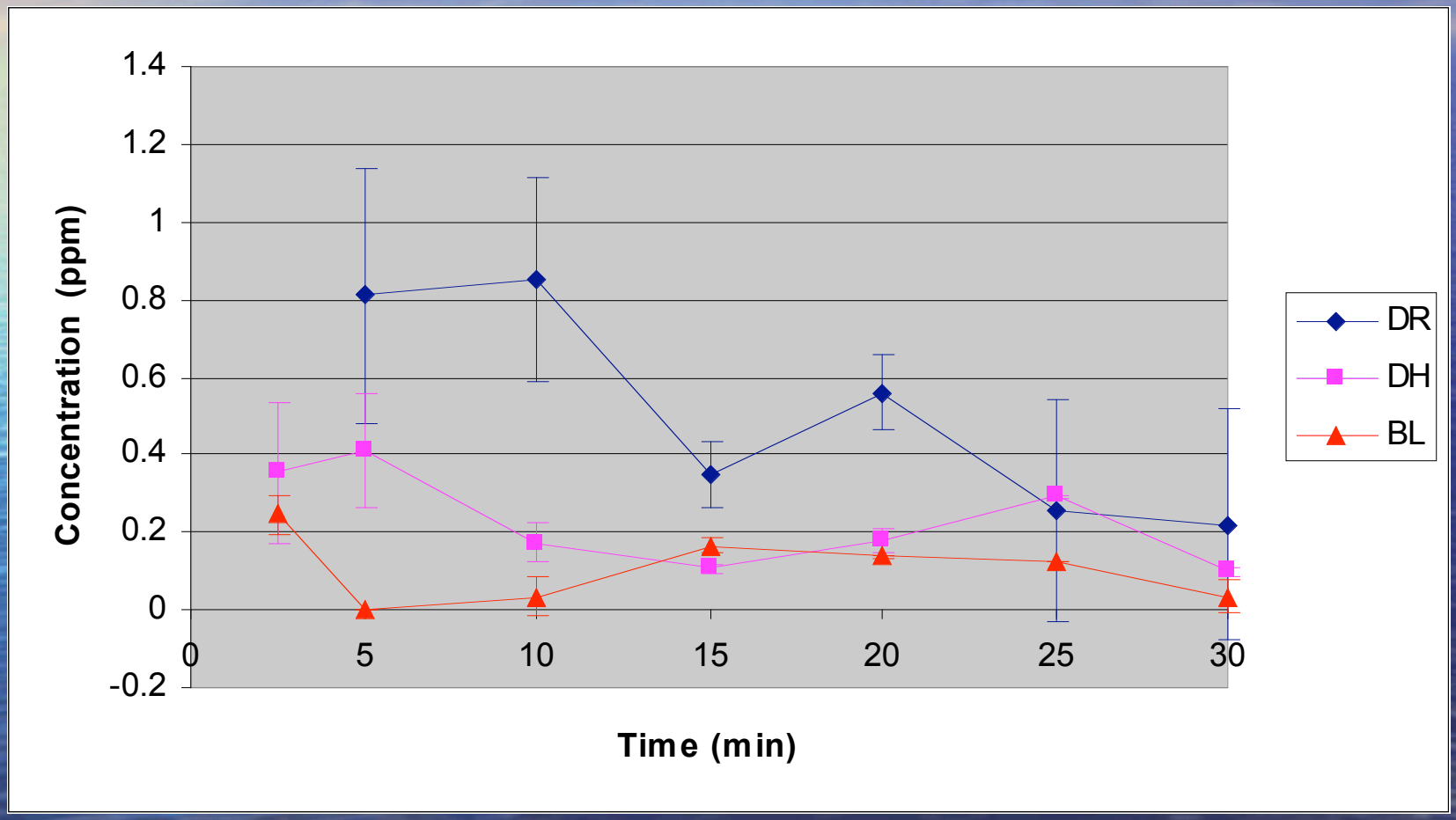
# Sample Analysis

- Total Metal, Dissolved Metals, Total Phosphorus – ICP
- Dissolved Phosphorus – FS 3000 Phosphorus Analyzer

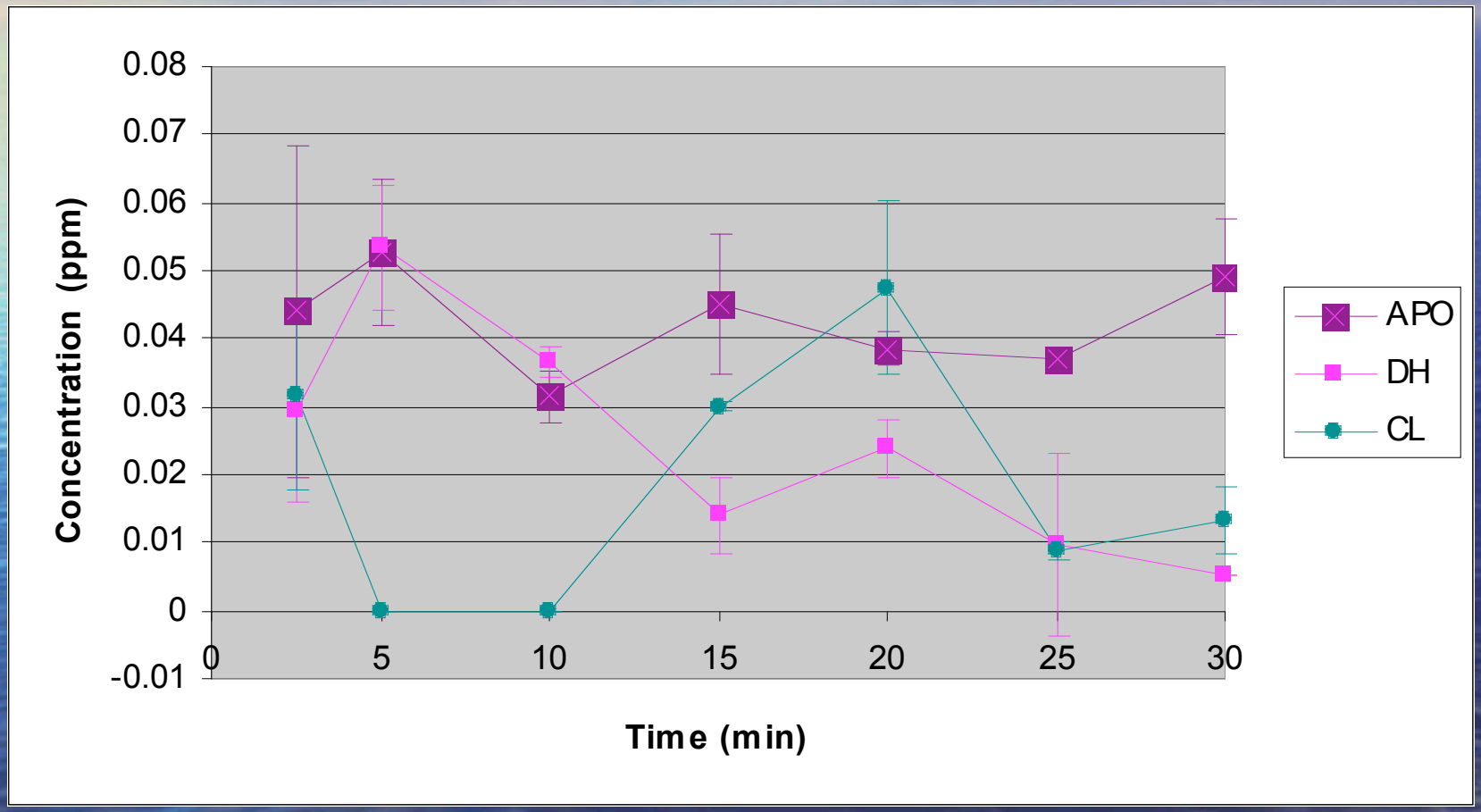
# Cadmium

- Below detection limits

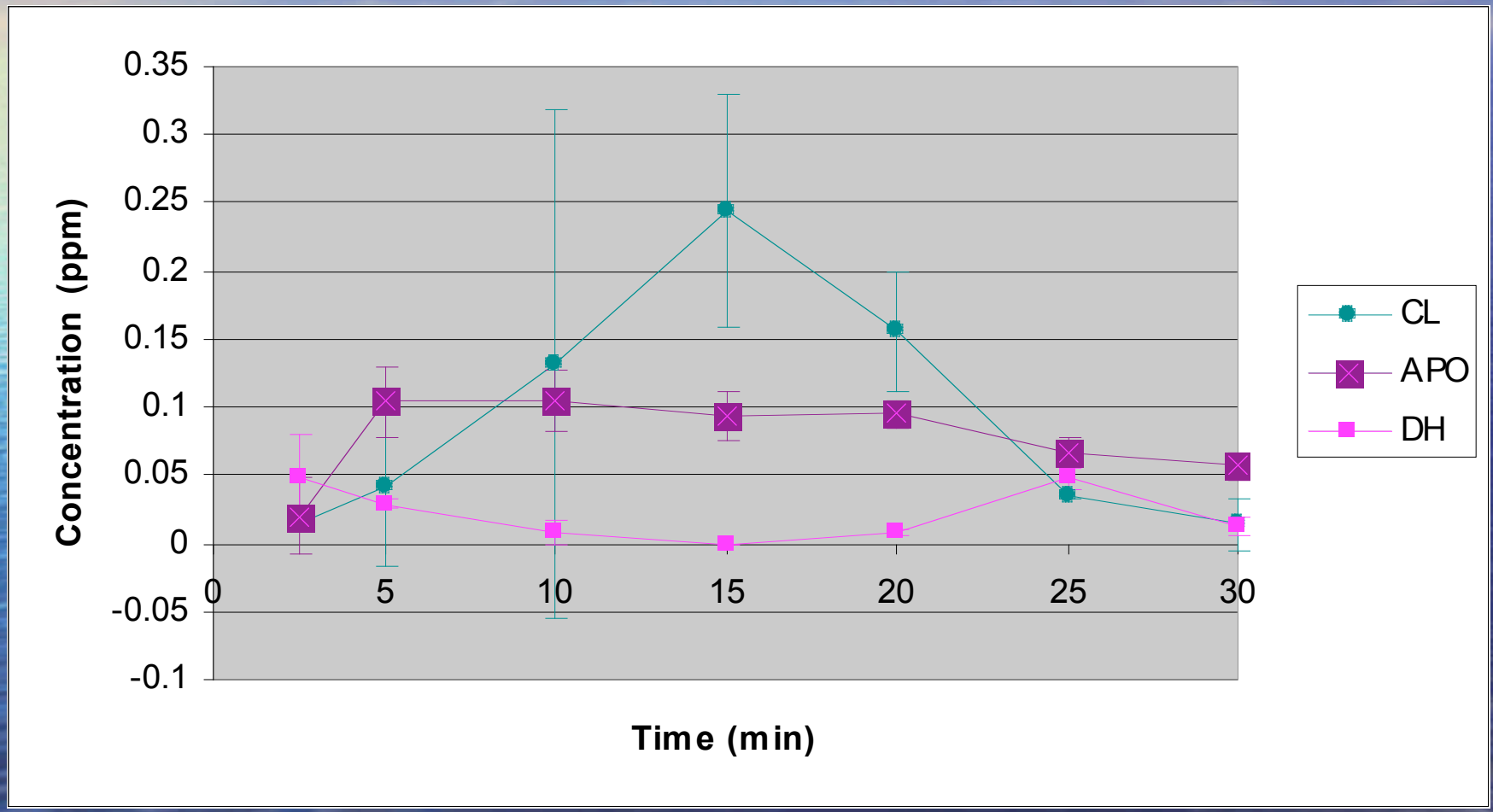
# Total Phosphorus



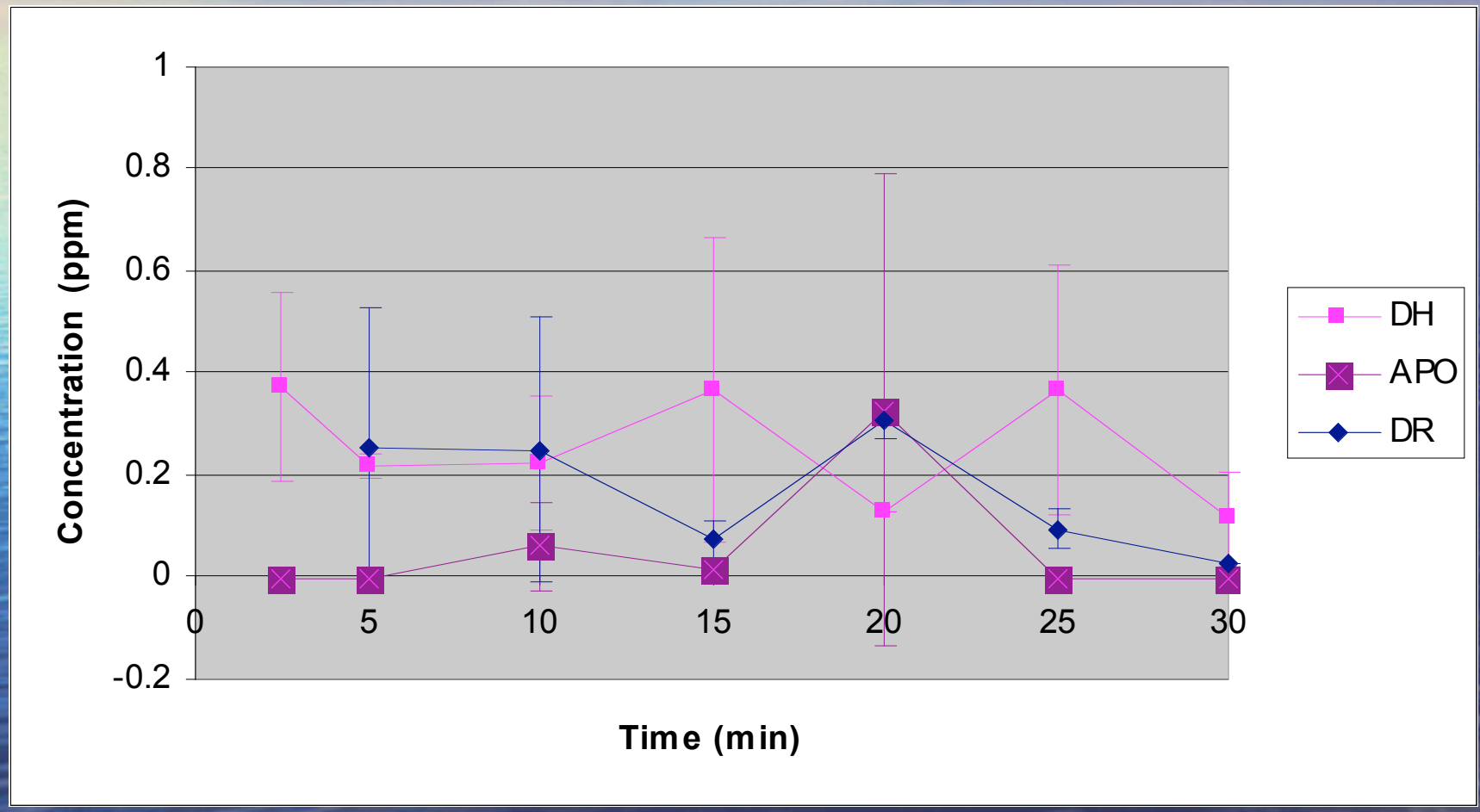
# Total Copper



# Total Lead


0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
Concentration (ppm)
0
5
10
15
20
25
30
Time (min)
CL
APO
DH

# Total Zinc


1
0.8
0.6
0.4
0.2
0
-0.2
0
5
10
15
20
25
30
Concentration (ppm)
Time (min)
DH
APO
DR

# Statistical Analysis

- T-test: Two-Sample Assuming Unequal Variances – Microsoft Excel, t Stat compared to t Critical two-tail

- Age
- Use
- Condition
- Amount of Time in Lots

# Age

- New (DR, BL, TRB) vs. Old (RR, CL, DH)
  - age unknown for HB and APO, DH and CL assumed old since the lots not in good condition

- P NOT different
- Pb different
- Cu different
- Zn NOT different

# Use

- High (BL, TRB, HSB, DH) vs. Low (RR, CL, DR, APO)

- P NOT different
- Pb different
- Cu different
- Zn NOT different

# Condition

- Good (DR, APO, BL, TRB, RR) vs. Poor (HSB, DH, CL)

- P NOT different
- Pb NOT different
- Cu NOT different
- Zn NOT different

# Length of Time in Lot

- All Day (BL, DR, TRB) vs. In and Out (HSB, DH, RR).
  - No information available for CL or APO

- P NOT different
- Pb NOT different
- Cu different
- Zn NOT different

# EPA Limits

| Cd | | Cu | | Zn | | Pb | |
|---|---|---|---|---|---|---|---|
| Peak | EPA | Peak | EPA | Peak | EPA | Peak | EPA |
| 0.003 | 0.005 | 0.066 | 1.3 | 0.66 | 5 | 0.30 | 0.015* |

* The EPA's MCLG for lead is zero.

# Conclusions from Graphs

- Parking lots are different in amounts of pollutants they have
- Newer lots have more phosphorus
- Lightly used during summer lots have more zinc and copper
- Winter use lots have the most lead (although this could be contributed to the construction equipment that has been in the lot recently)

# Conclusions from Statistics

- Old lots have more Pb and Cu
- Low use lots have more Pb and Cu
- No differences based on condition
- Lots with cars in and out have more Cu

# Future Work Considerations

- More information about the lots could be useful in comparing them
- Lots built around the same time and with differences in use would make a better comparison

# Acknowledgements


- Todd Walter – advising
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- Doug Caveney – simulator construction
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- Shree Giri – ICP
- Bob Chiang & Jeff Gregrow – parking lot information


Questions?