

*ElectroChemical GeoOxidation
of PAH Contaminated Sediment*

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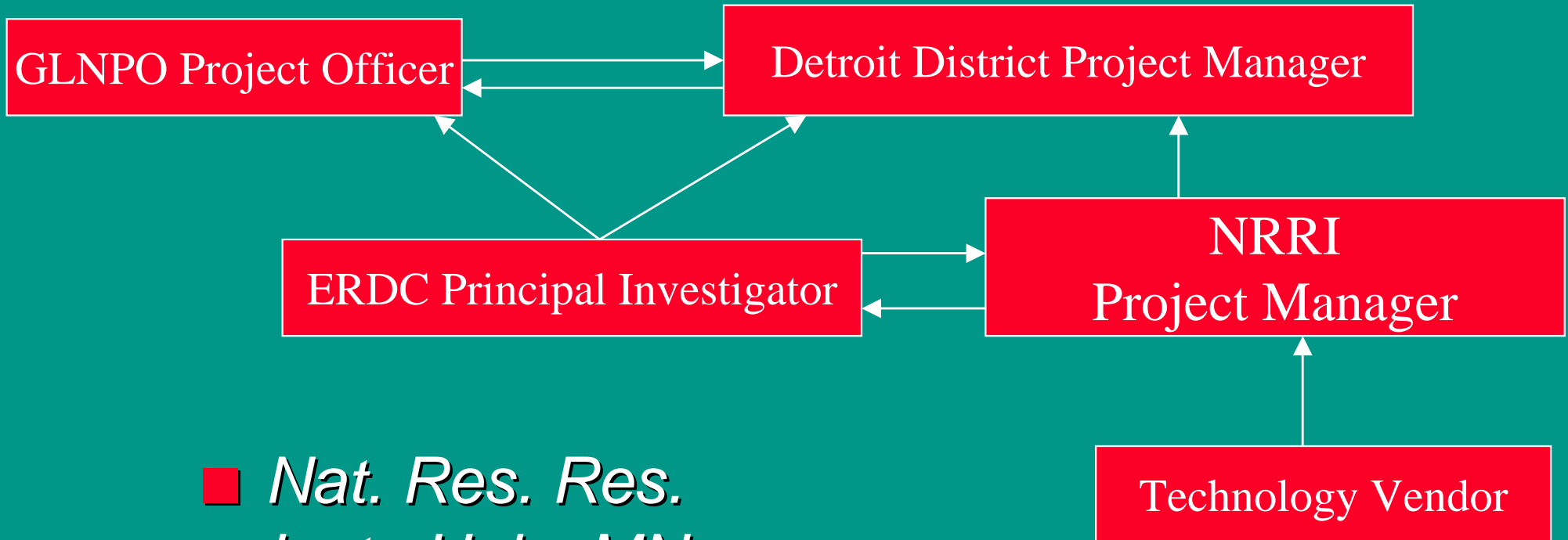
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Office**

PROJECT ORGANIZATION



- *Nat. Res. Res. Inst., Univ. MN – Duluth- Larry Zanko*
- *EPI – Ken Wittle*

STUDY OBJECTIVES

- Proof of concept – can ECGO treat PAHs in Great Lakes sediments,
- Document changes in PAH concentrations over time
- Simulate *in situ* ECGO sediment treatment

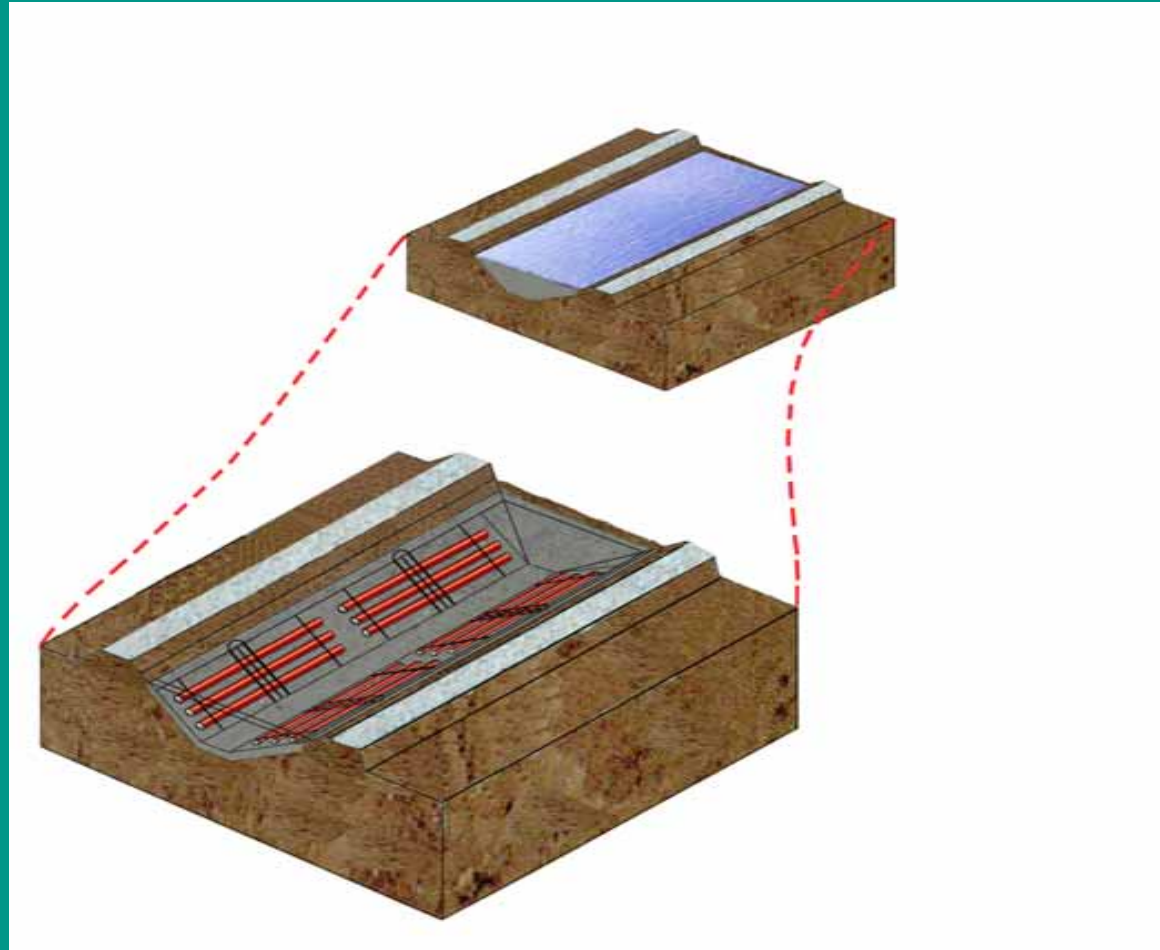
FEATURES

- *Control Cell Required*
- *About 350 cu yds of Material in Each Cell to Characterize and Monitor*
- *Chemically and Physically Heterogeneous Sediment*
- *Soft Muck*
- *QAPP*

DREDGING- Minnesota Slip, Duluth, MN



ECGO Cell Schematic





Sampling Design

- *One Control and One Test Cell*
- *Five Replicate Cores Each Cell*
- *Random Cores*
- *Split Cores into Upper and Lower Layers*
- *Composite*
- *Six Sampling Events: 5 replicates for each layer in each cell on each event*

SAMPLING EVENTS

- *Six Sampling Events –*
- *Summer/Fall 2002: Time zero, 1 month, 2 months, and 3 months*
- *Resting (no treatment) Nov 02 until Jul 03*
- *Restart and Sample Jul 03*
- *Final Sample Nov 03*

Harbor City Propane 624-3633



Analysis of Variance (ANOVA)

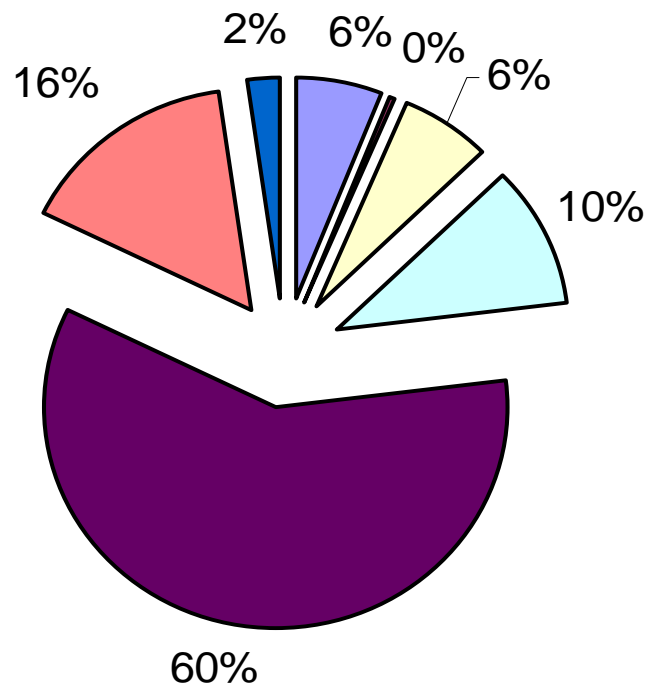
- *2-Way ANOVA*
- *$p < 0.05$ level of significance*
- *Replication Included*
- *6 Sampling Events for PAHs and TOC*
- *Tukey Test – multiple pairwise comparison*

TAKE HOME

- *No Change in PAH with Time*
- *No Decrease in TOC in Control and Test Cells*
- *No Difference in PCB Between Control and Test Cells*
- *PCBs Decreased*

LMW PAH DISTRIBUTION

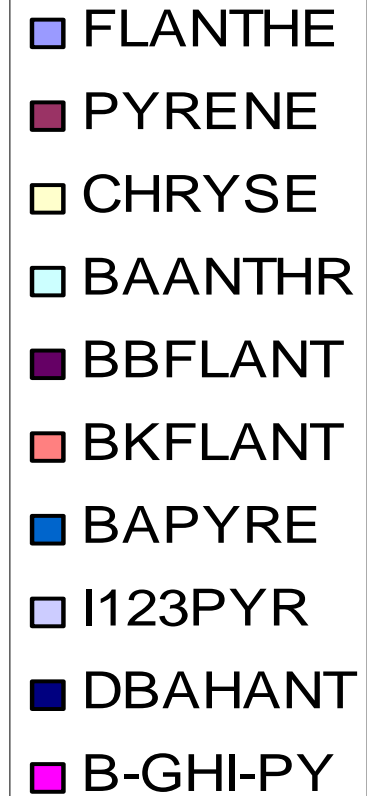
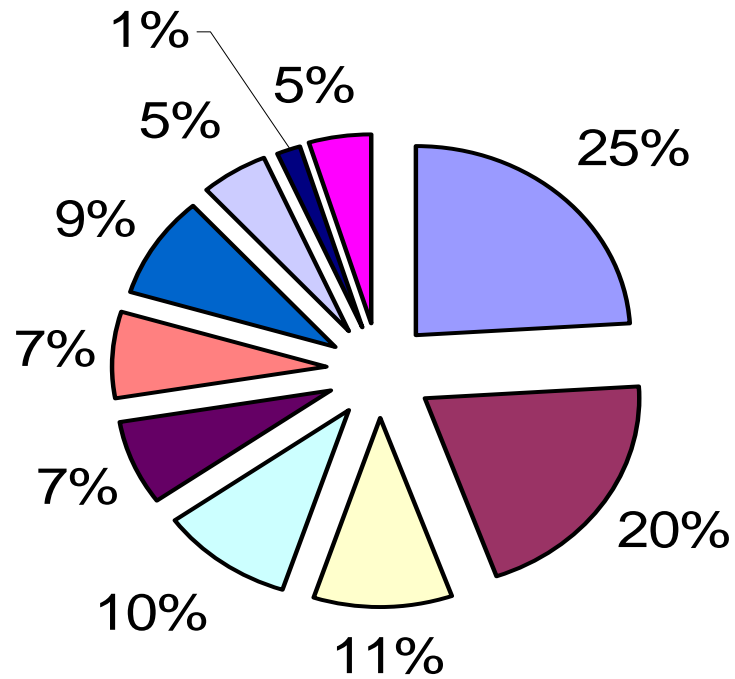
Low Molecular Wt PAHs



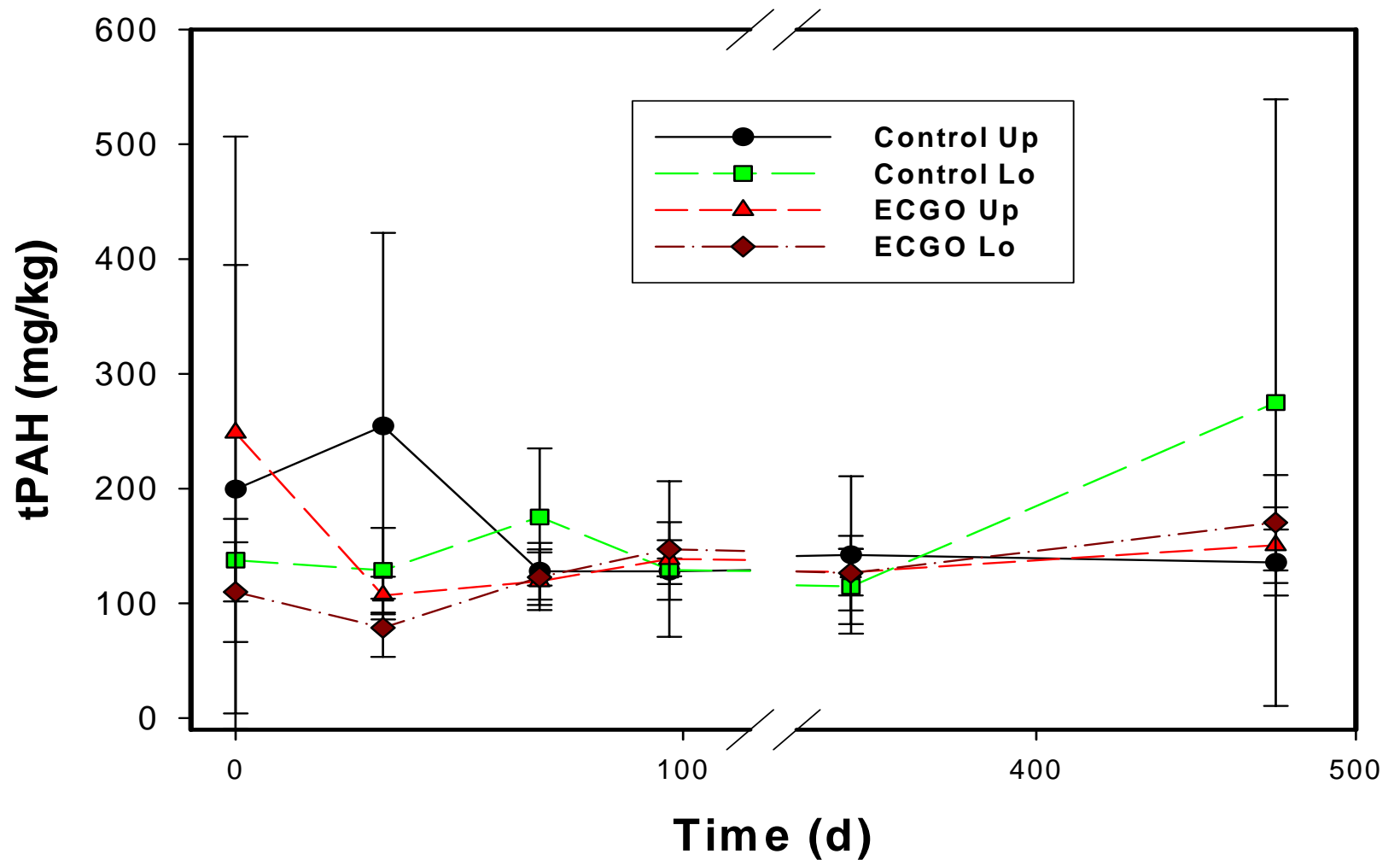
- NAPHTH
- ACENAY
- ACENAP
- FLUORE
- PHENAN
- ANTRAC
- 2MeNAPH

HMW PAH DISTRIBUTION

High Molecular Wt PAHs



Total PAH Results

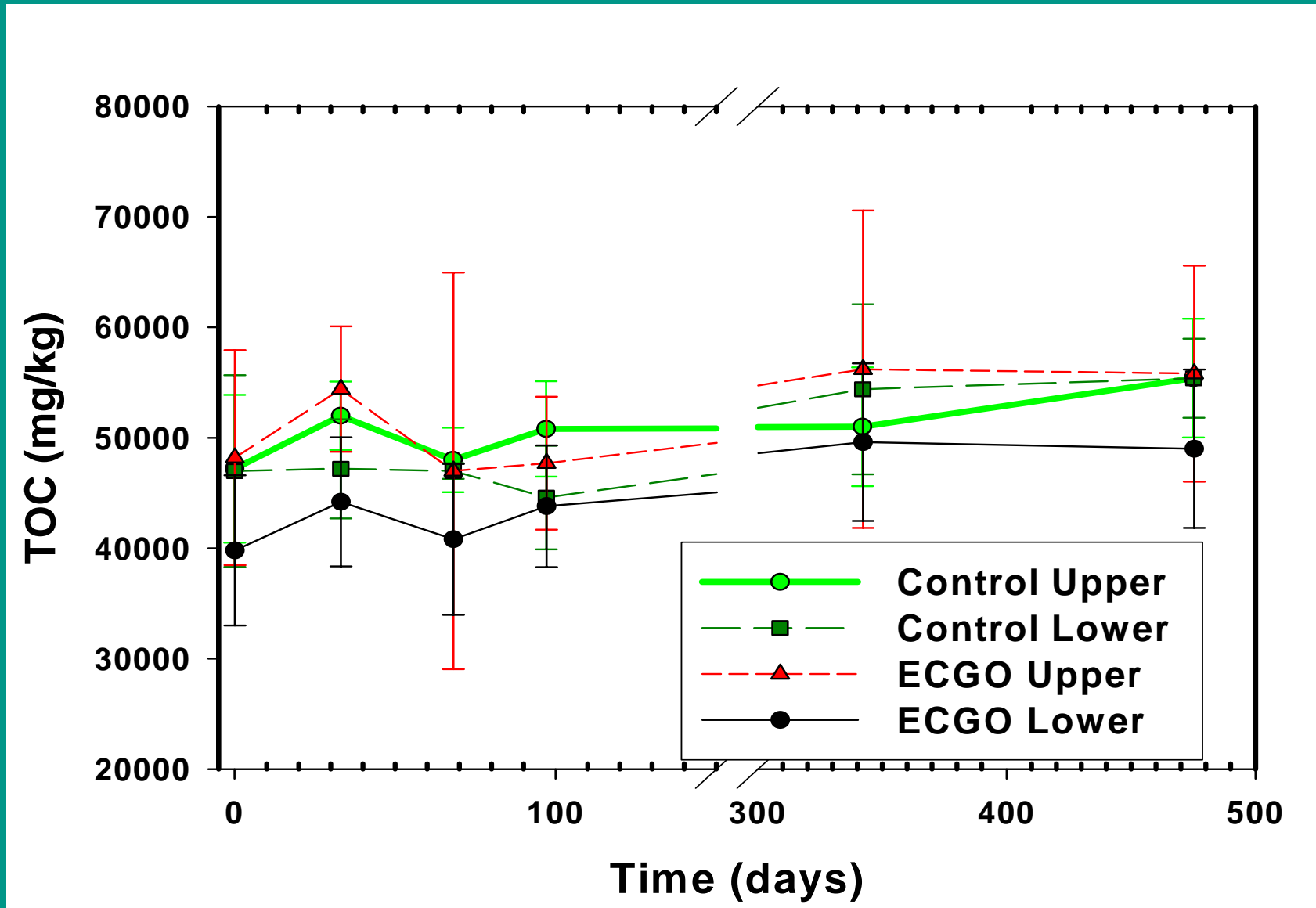


Analysis of Variance (ANOVA)

PAHs

- *Differences in mean values among the different layers were less than would be expected by chance*
- *Differences with time were less than would be expected by chance*
- *No significant differences*

Total Organic Carbon Results

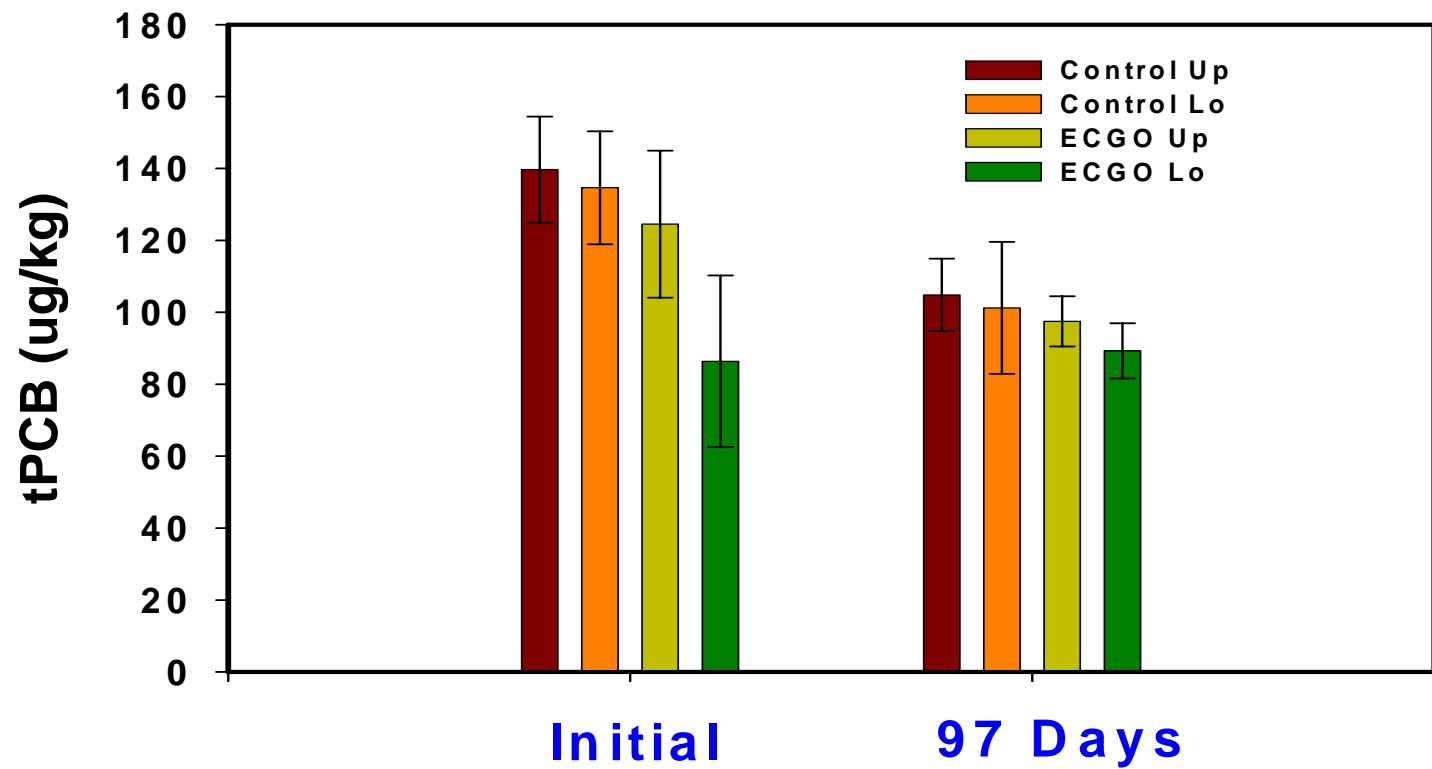


ANOVA – TOC

Followed by Tukey Test

- *Means for the 2003 sampling dates were significantly different from the means for 2002 sampling*
- *ECGO Lower Layer was significantly different from some of the other compartments*

Total PCB Results



ANOVA – PCB

Followed by Tukey Test

- *Initial and 97 day tPCB concentrations were significantly different in all but the ECGO lower compartment*
- *ECGO Lower Layer was significantly different from the other compartments*

CONCLUSIONS

- *No Statistically Significant Difference in PAH Concentrations Between Control and ECGO Cells.*
- *No Statistically Significant Changes in PAH Concentrations Over Time*
- *No Decrease in TOC*
- *PCBs Decreased, but not in response to ECGO*

