



# Distribution of Chemical Contaminants within a Large Wastewater Treatment Plant and in Downstream Surface Waters

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## Things I plan to talk about...

- Objective of distribution study
- Sampling at a large WWTP
- Removal or degradation processes
- Sources to WWTP
- Receiving stream



# Objective of Distribution Study

- Fate of toxic substances throughout a WWTP
  - ◆ Solid and hydraulic cycles
- Degree of treatment effectiveness across treatment processes
- 3 sampling events
  - ◆ Approximately 11 aqueous and 11 sludge samples per event
  - ◆ Between 140 and 300 analytes per sample
  - ◆ **Over 12,000 data points!**
- Strengthen collaborative ventures



## Things I plan to talk about...

- Overview of distribution study
- **Sampling at a large WWTP**



# Calumet Water Reclamation Plant



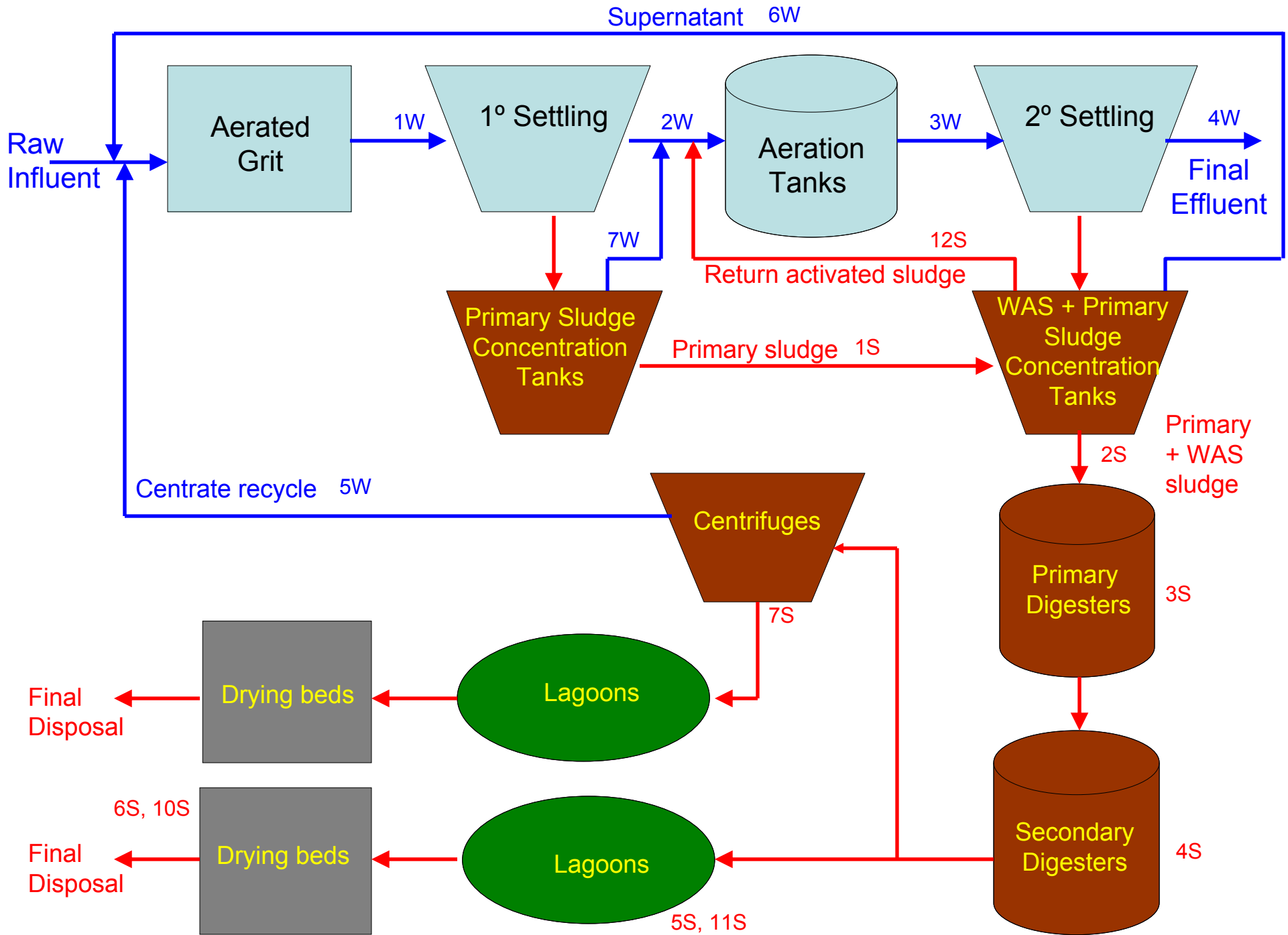
Image © 2007 NASA

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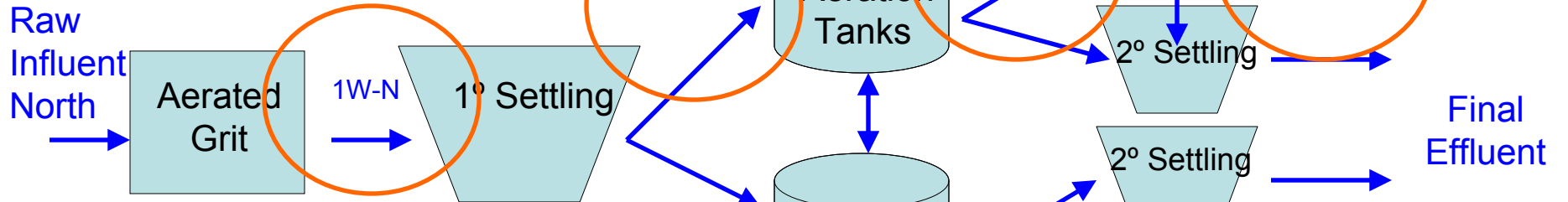
Pointer 41°39'58.29" N 87°36'17.12" W

Streaming ||||| 100%

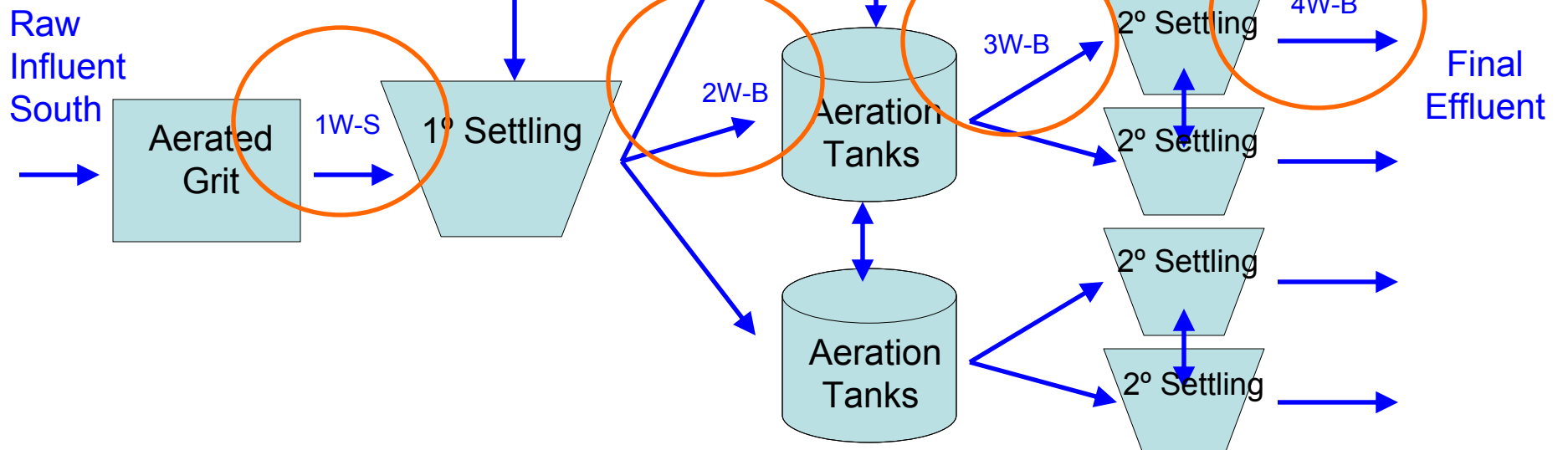
Eye alt 6078 ft



### E Batteries



### A,B, and C Batteries





## Things I plan to talk about...

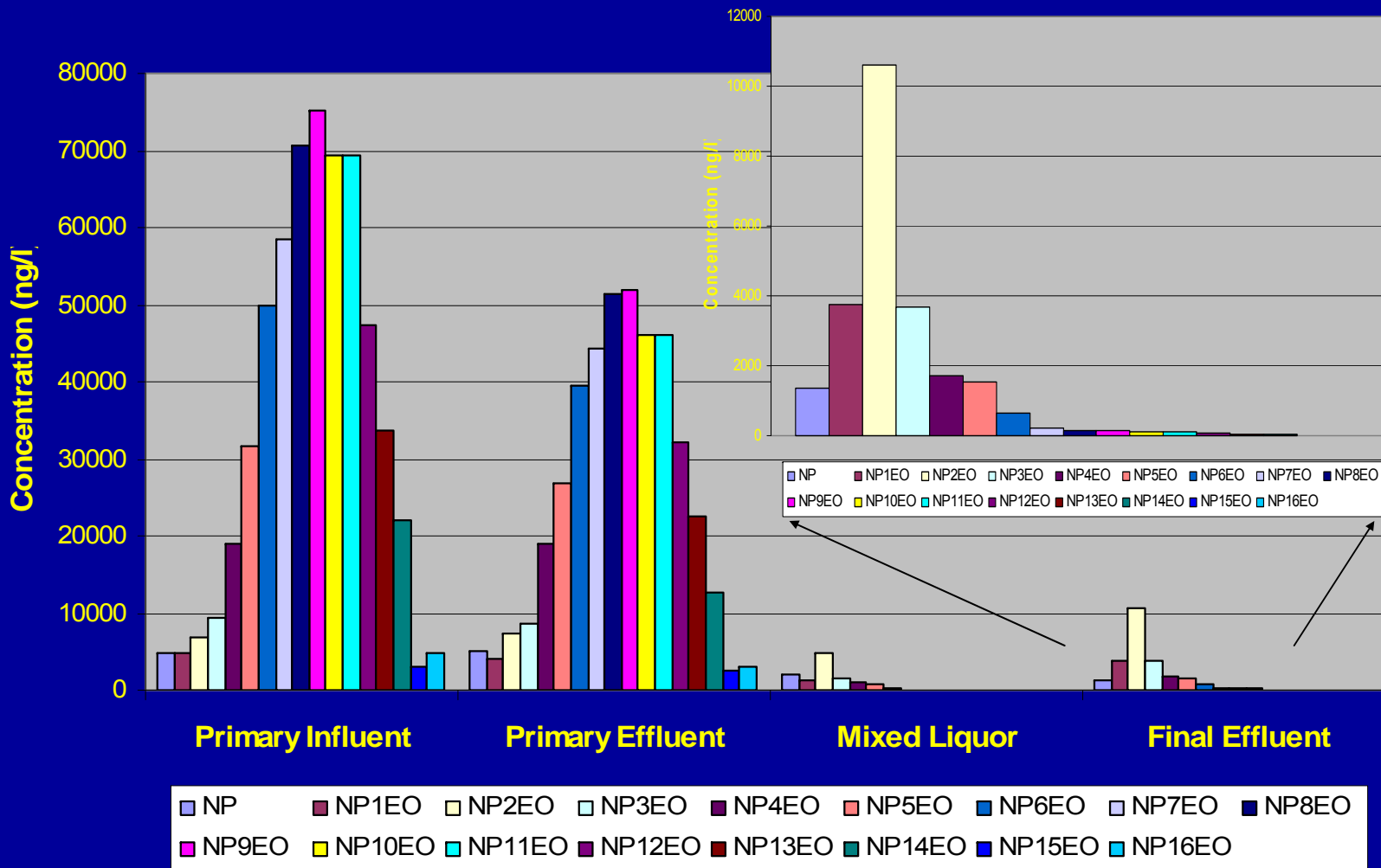
- Overview of distribution study
- Sampling at a large WWTP
- **Removal or degradation processes**



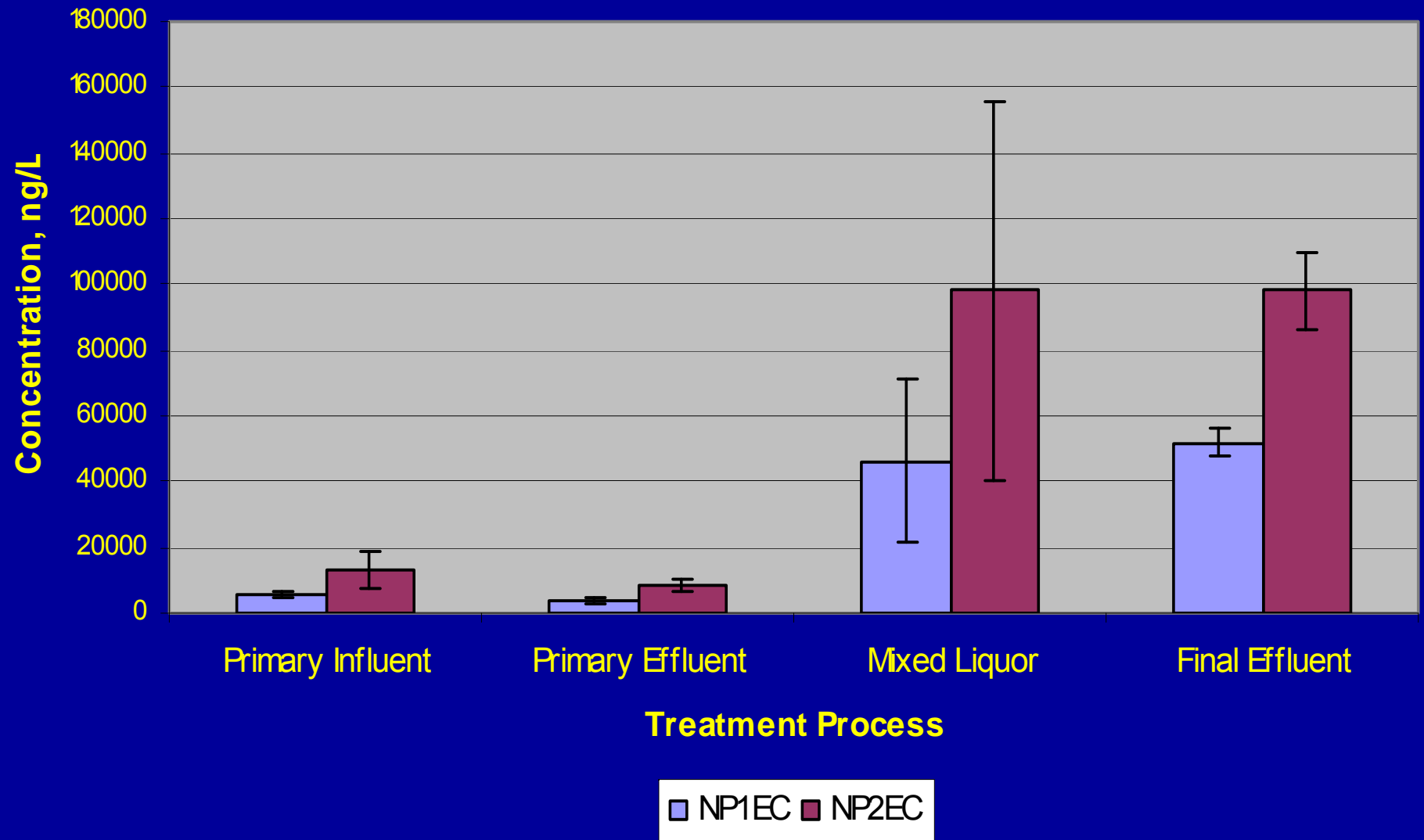
**Most action occurs in the aeration tanks!**

**Nonylphenol Ethoxylates in the Calumet WRP**

Nonylphenol Ethoxylates in the Final Effluent



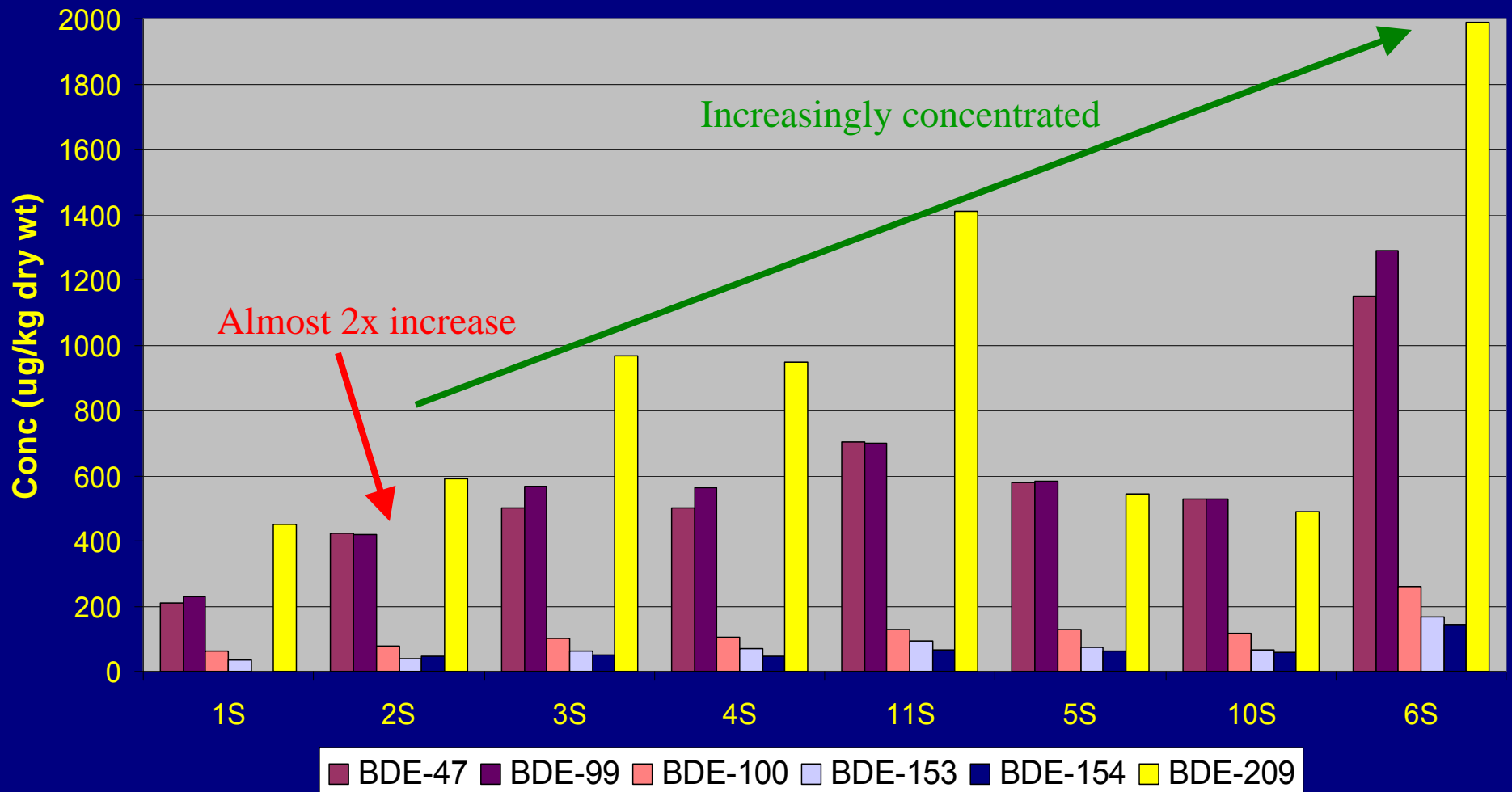
## Nonylphenol Carboxylates in the Calumet WRP





# Aeration Tanks are also effective at removing PBTs - due to partitioning

## PBDEs in Sludge at CWRP

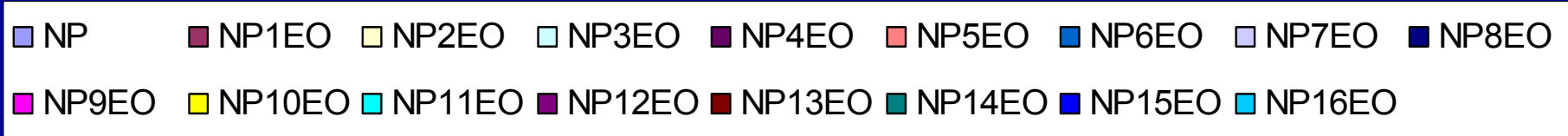
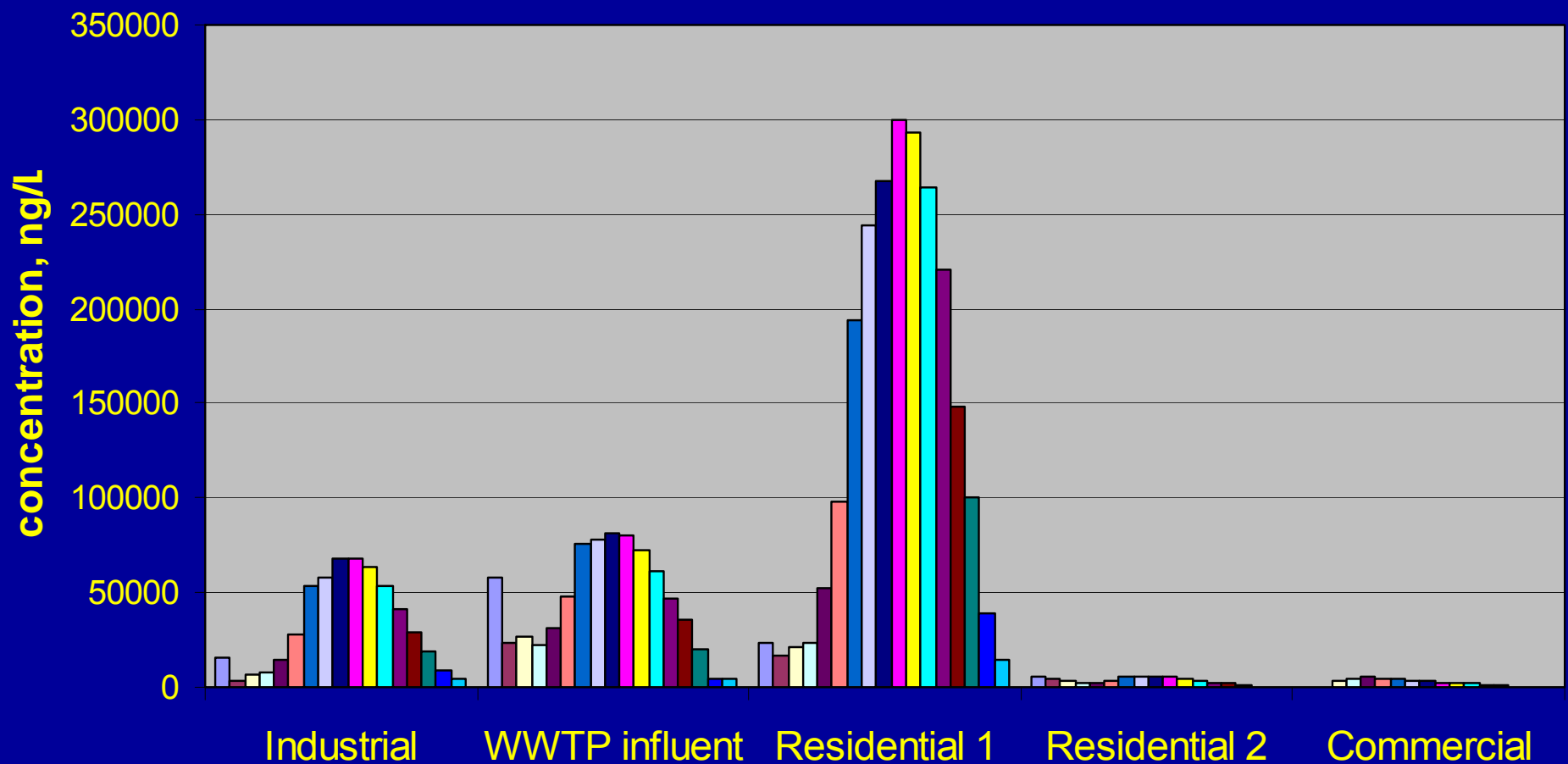




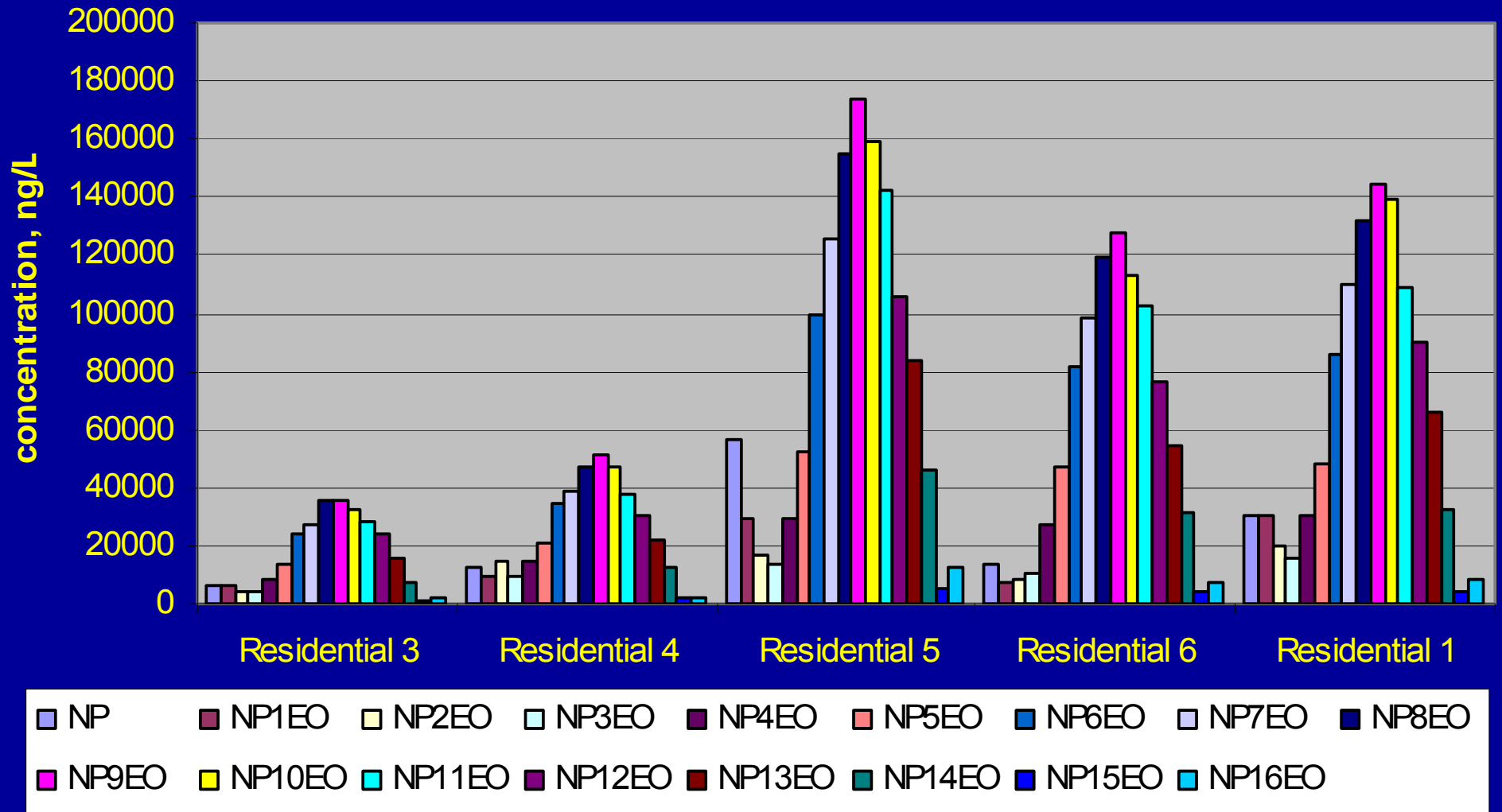
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- **Sources to WWTP**

## Total NP0-16EO Concentrations (dissolved + particulate) in grab sewer samples (May 2005)



## Total NP0-16EO Concentrations (dissolved + particulate) in composite sewer samples (August 2005)

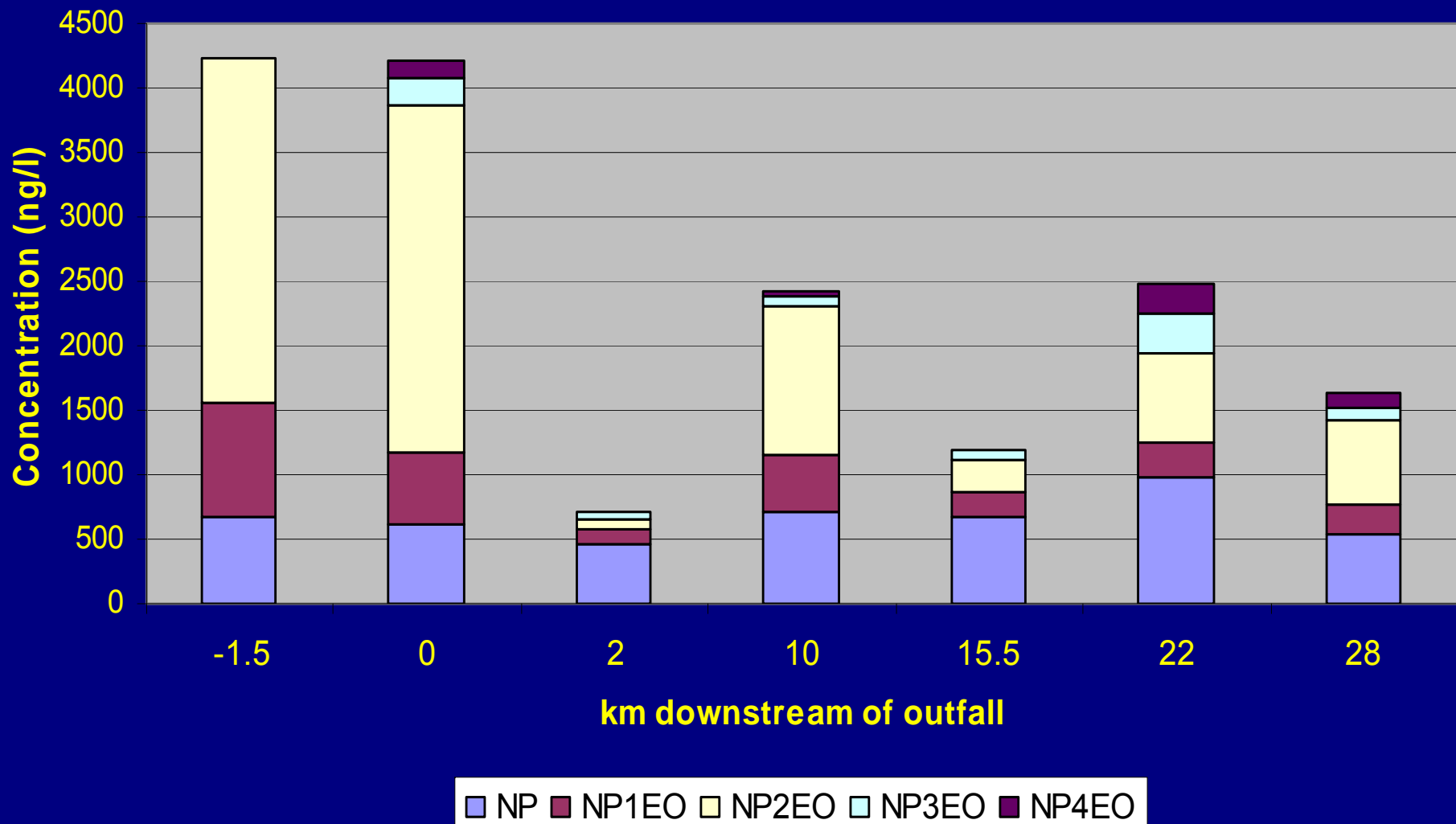




## Things I plan to talk about...

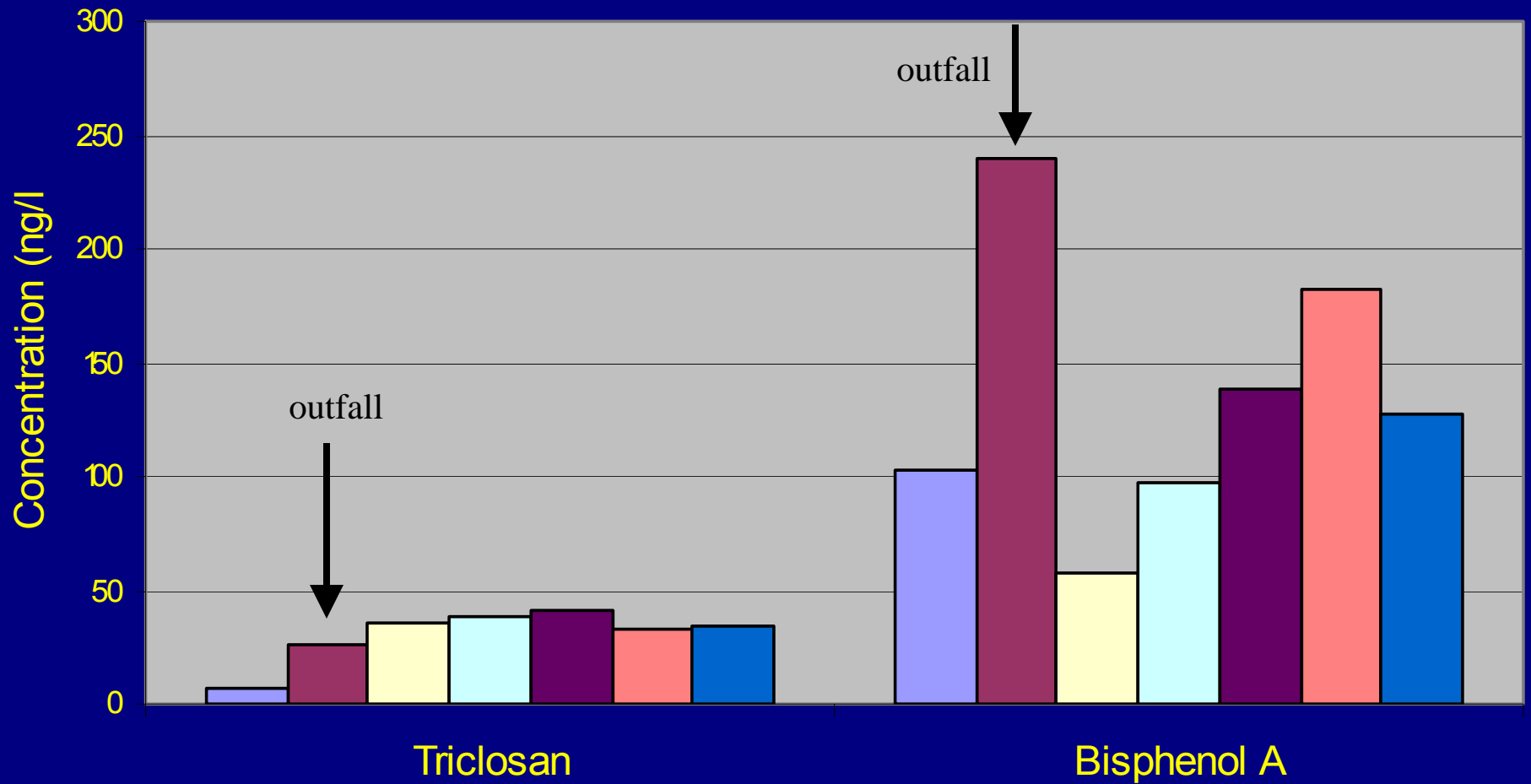
- Overview of distribution study
- Sampling at a large WWTP
- Removal or degradation processes
- Sources to WWTP
- **Persistence in receiving stream**

## Nonylphenol and its Ethoxylates in the Cal-Sag Channel

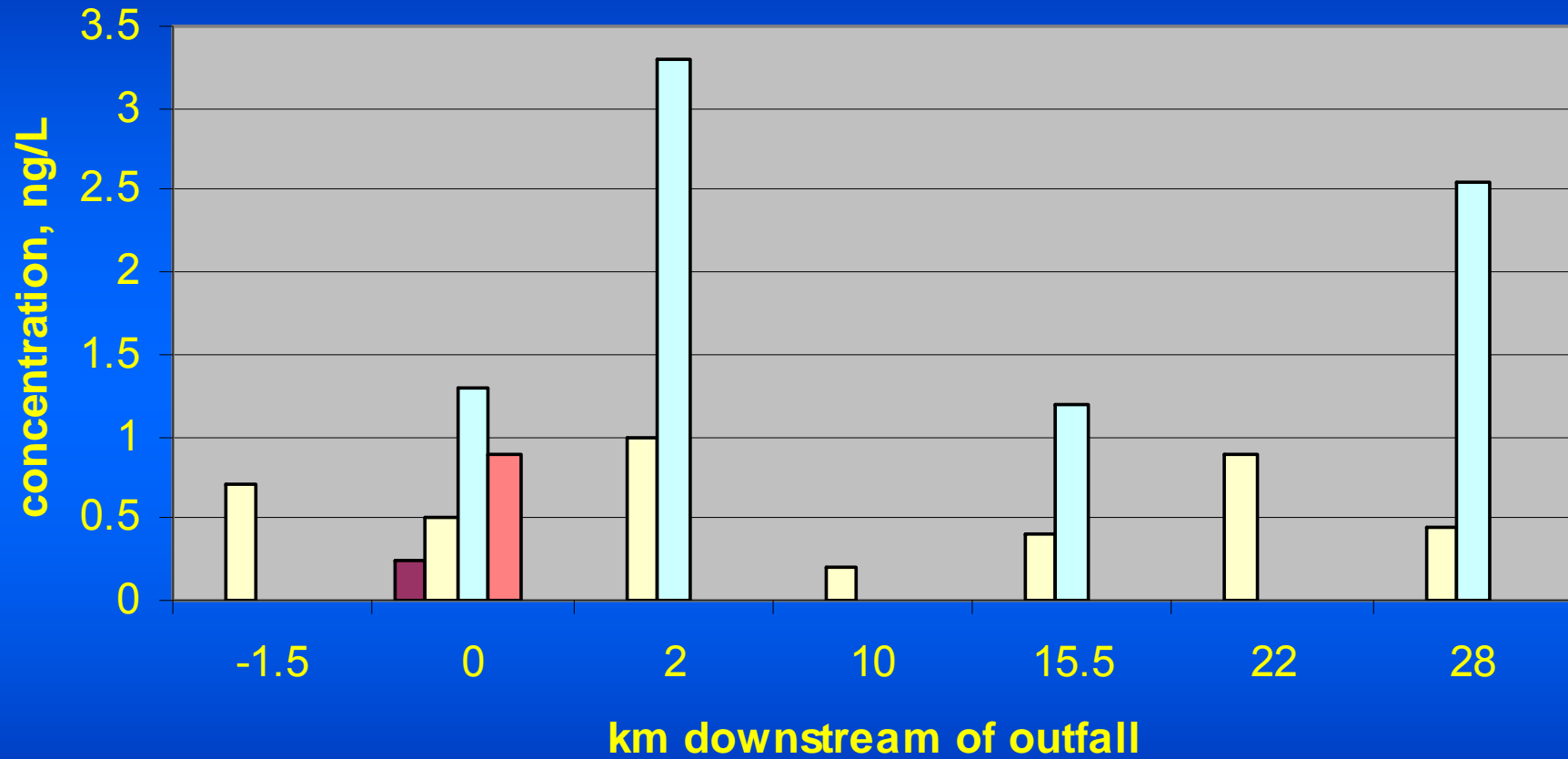




## Downstream Persistence in the Cal-Sag



## Estrogens in Cal-Sag (August 2005)



■ 17α-Estradiol □ 17β-Estradiol □ Estrone ■ 17α-Ethinyl estradiol □ Estriol



# Summary

- Sampling is a HUGE challenge
- Low-level analysis in complex matrices is also a HUGE challenge
- Removal mechanisms can be degradation, partitioning, and/or others
  - ◆ Consider the by-products and additives!
- Many compounds persist well downstream of outfall
  - ◆ What is the significance?



## Acknowledgements

- Many thanks to all the MWRDGC employees that helped collect and analyze samples
- Also, many thanks to the MWRDGC R&D staff for all their support and efforts on this research issue



**Thank You!**



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