PCBs in the Hudson River: the Investigation Behind EPA's Record of

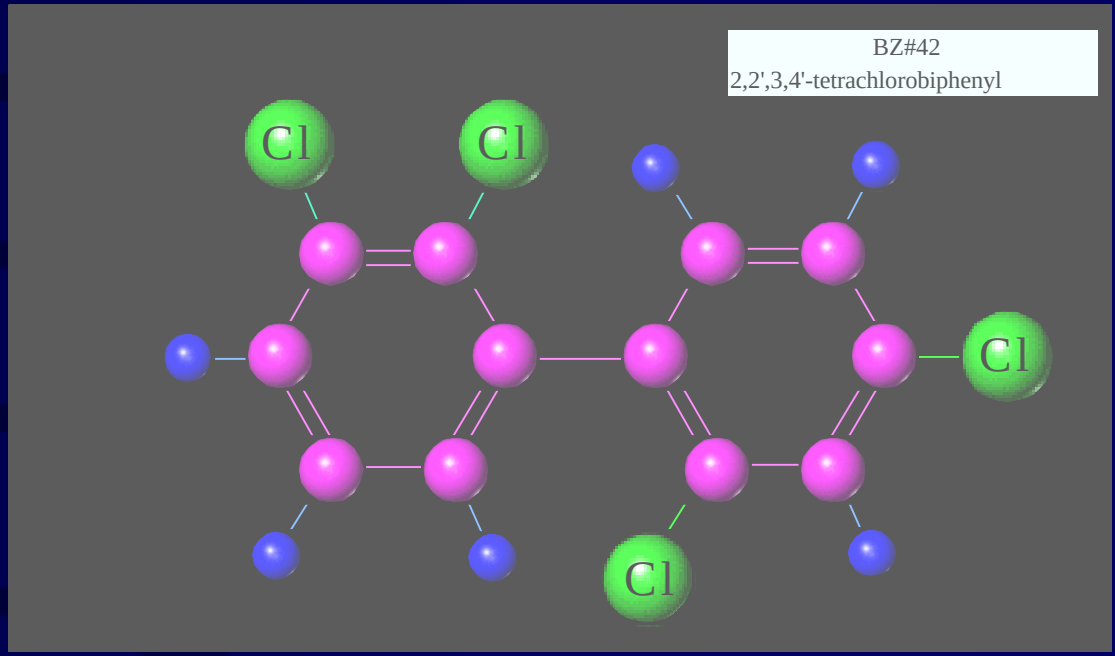
Edward A. Garvey , Hui Pang,
Claire Hunt, and Albert DiBernardo
TAMS Consultants,
an Earth Tech Company

Douglas Tomchuk and Alison Hess
US Environmental Protection Agency
Region 2

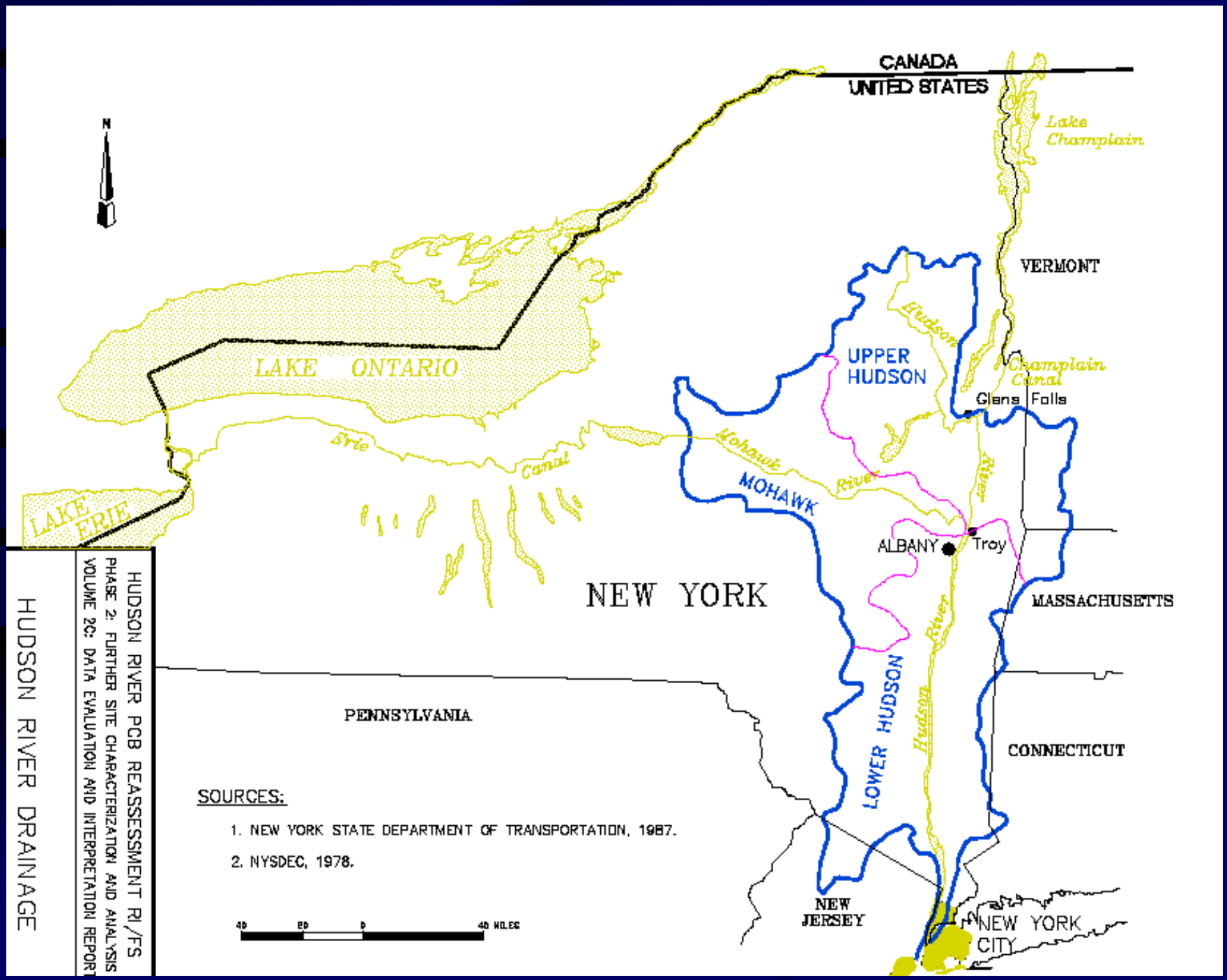
Outline

- Site Background
- Historical Questions
- PCB Releases to the Upper Hudson River
- The Sampling Program
- Water Column Transport
- PCBs in the Sediments of the Hudson
- Fate and Transport Summary
- Implications for the Future

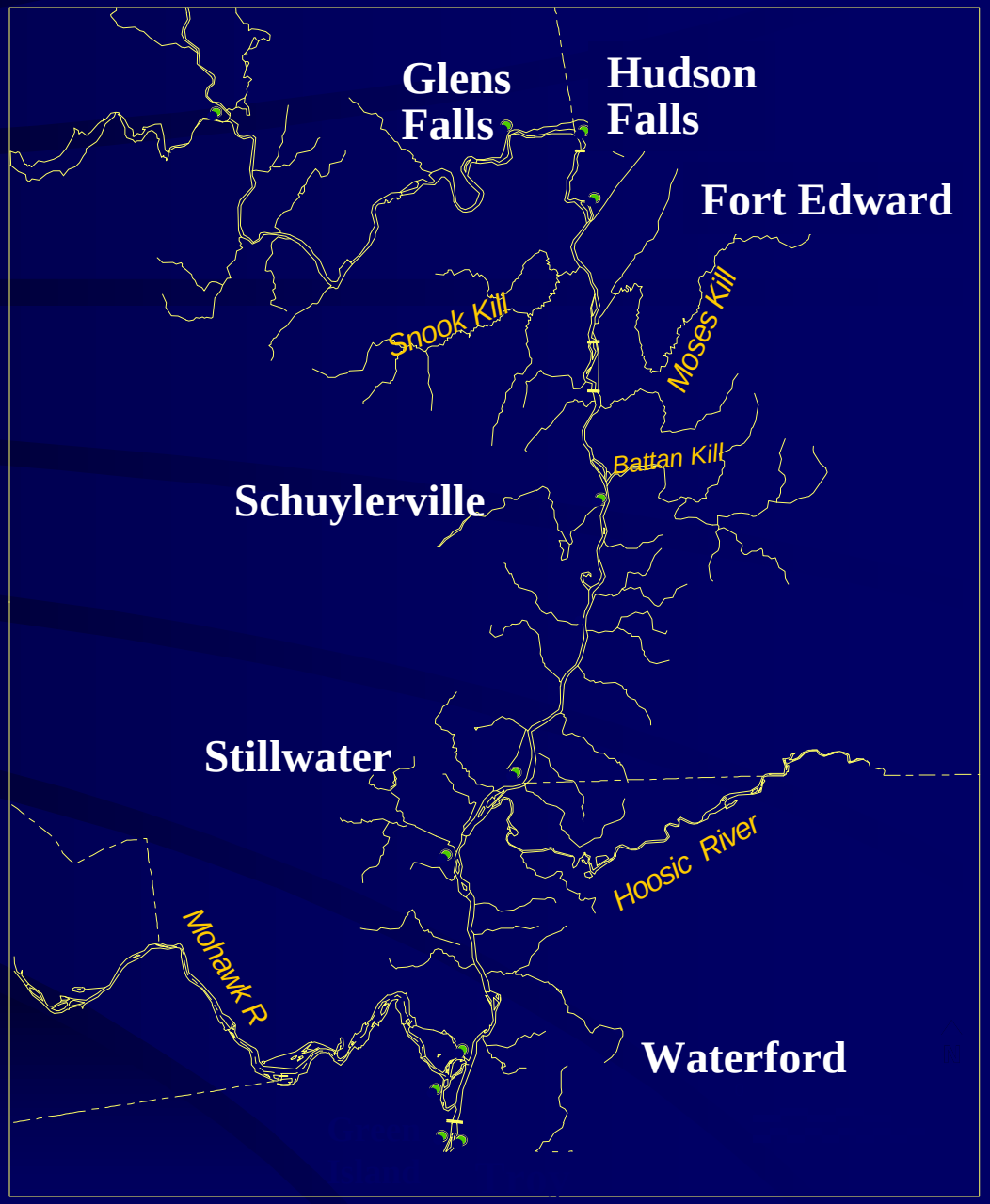
Example PCB Molecule



TAMS/Earth Tech

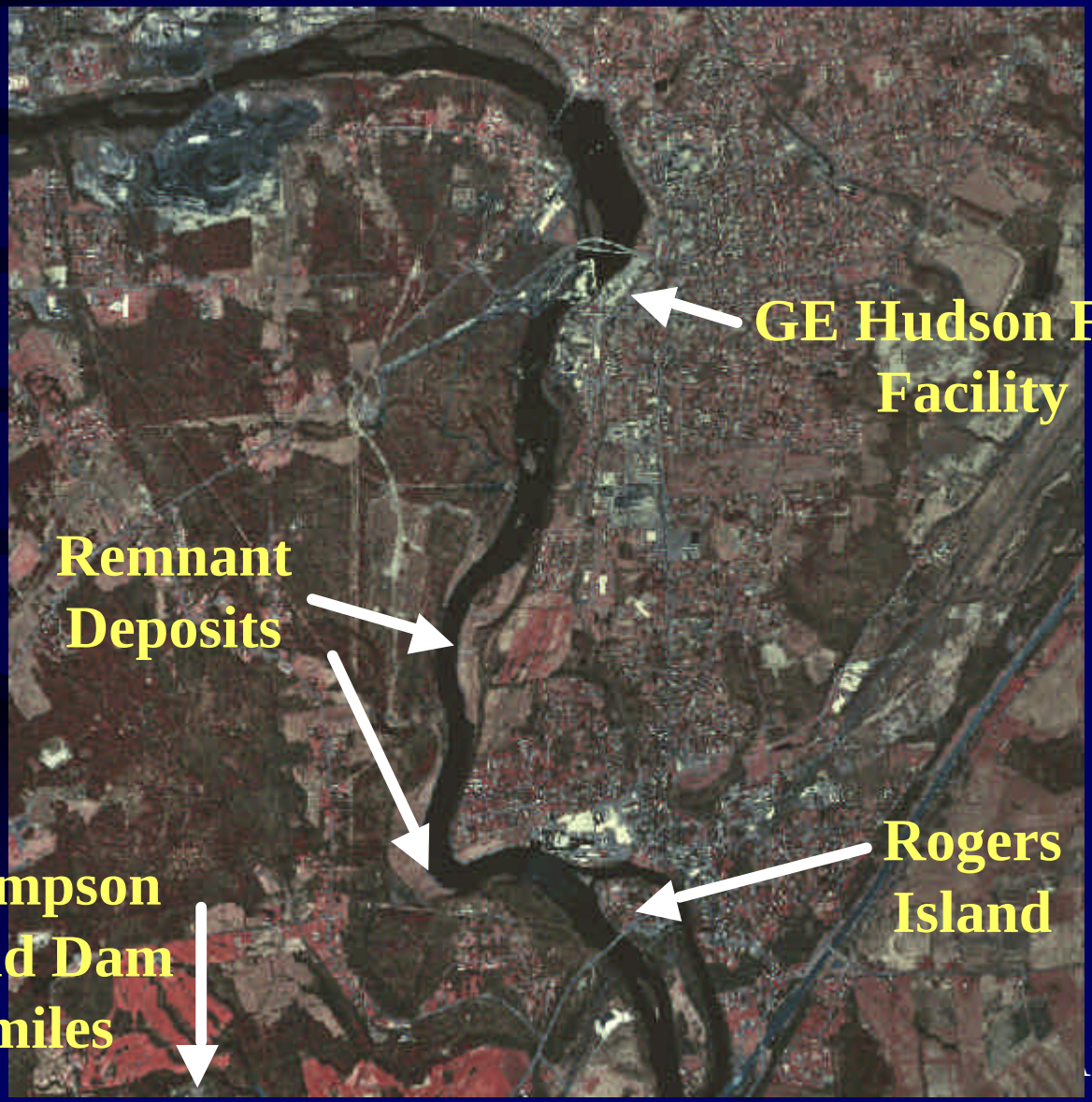

CANADA
UNITED STATES
Lake Champlain
VERMONT
LAKE ONTARIO
UPPER HUDSON
Hudson
Champlain Canal
Glens Falls
Erie Canal
Mohawk River
MOHAWK
Hudson River
LAKE ERIE
ALBANY
Troy
NEW YORK
MASSACHUSETTS
PENNSYLVANIA
LOWER HUDSON
CONNECTICUT
NEW JERSEY
NEW YORK CITY
N
SOURCES:
1. NEW YORK STATE DEPARTMENT OF TRANSPORTATION, 1987.
2. NYSDEC, 1978.
40 20 0 40 MILES
HUDSON RIVER DRAINAGE
HUDSON RIVER PCB REASSESSMENT RI/FS
PHASE 2: FURTHER SITE CHARACTERIZATION AND ANALYSIS
VOLUME 2C: DATA EVALUATION AND INTERPRETATION REPORT

Upper Hudson River



TAMS/Earth Tech

Fort Edward / Hudson Falls Area



History of to the Upper Hudson River

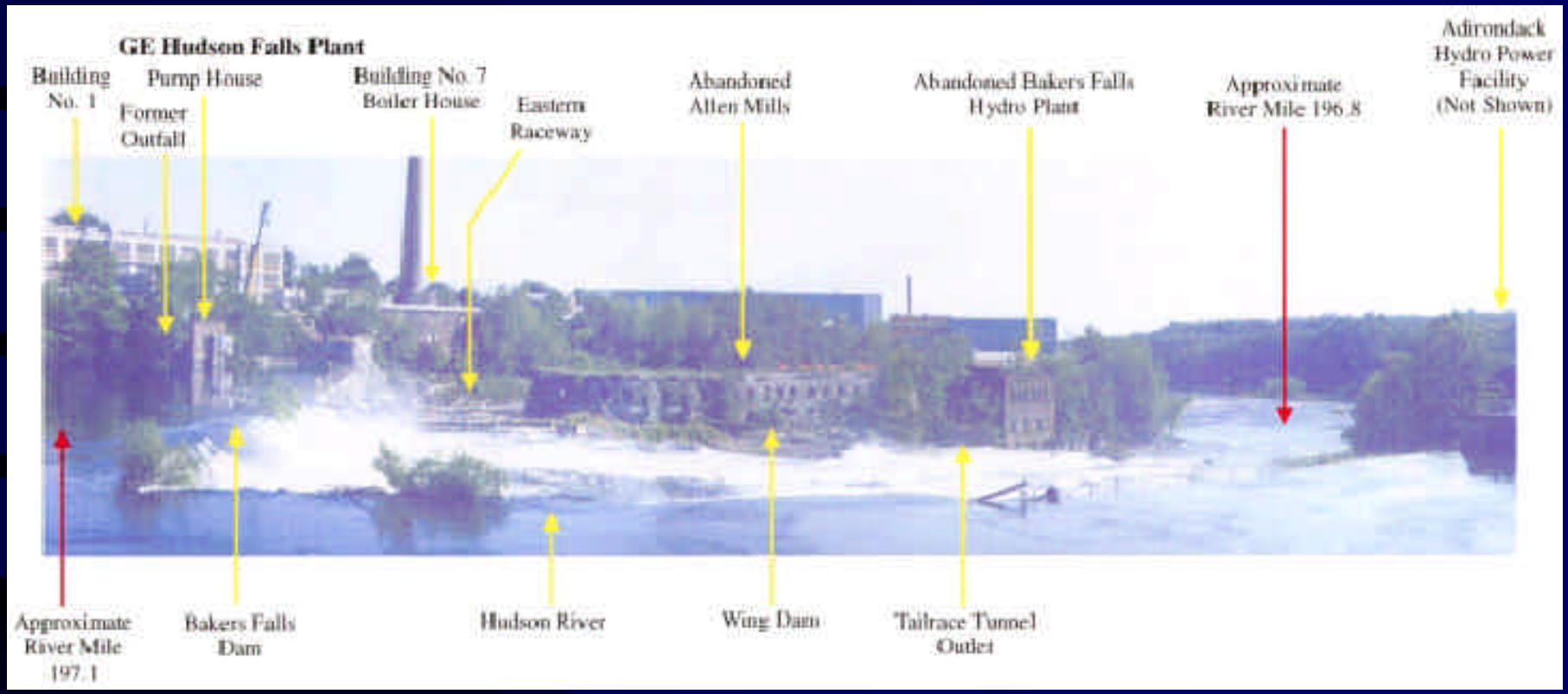
- PCB discharge from General Electric (GE) plants, 1947 – 1977
- Ft Edward Dam removal in 1973 and floods in 1974 and 1976
- Allen Mill event Sept.1991.
- DNAPL leakage though bedrock beneath the GE plant site (probably ongoing since 1970s)

TAMS/Earth Tech

Questions to be Resolved

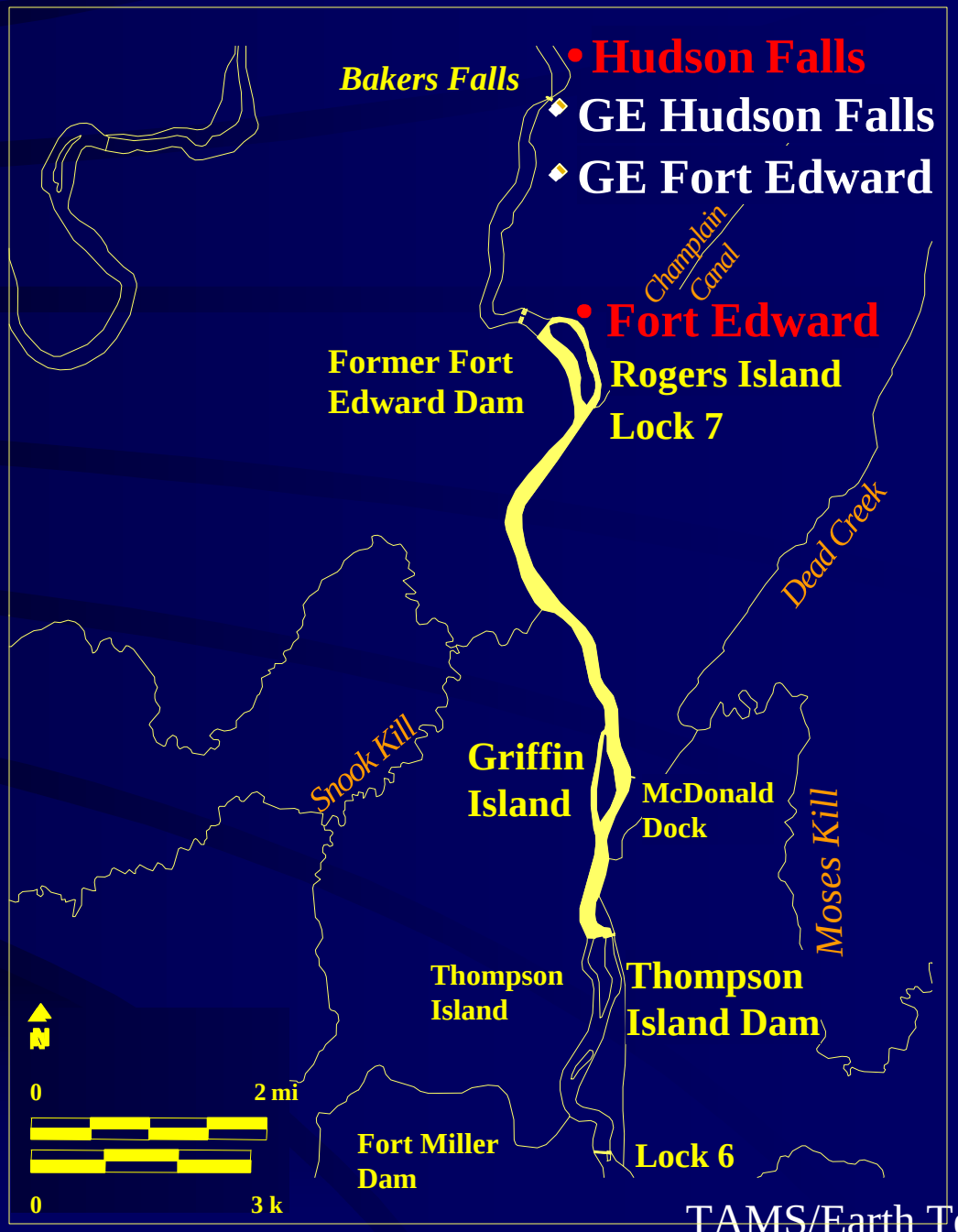
- What were the major sources of PCBs to the Hudson?
- How important were the sediments?
- If the sediments are important, where is the contamination found?
- What is the long-term fate of PCBs in the Hudson?

GE Hudson Falls Facility



TAMS/Earth Tech

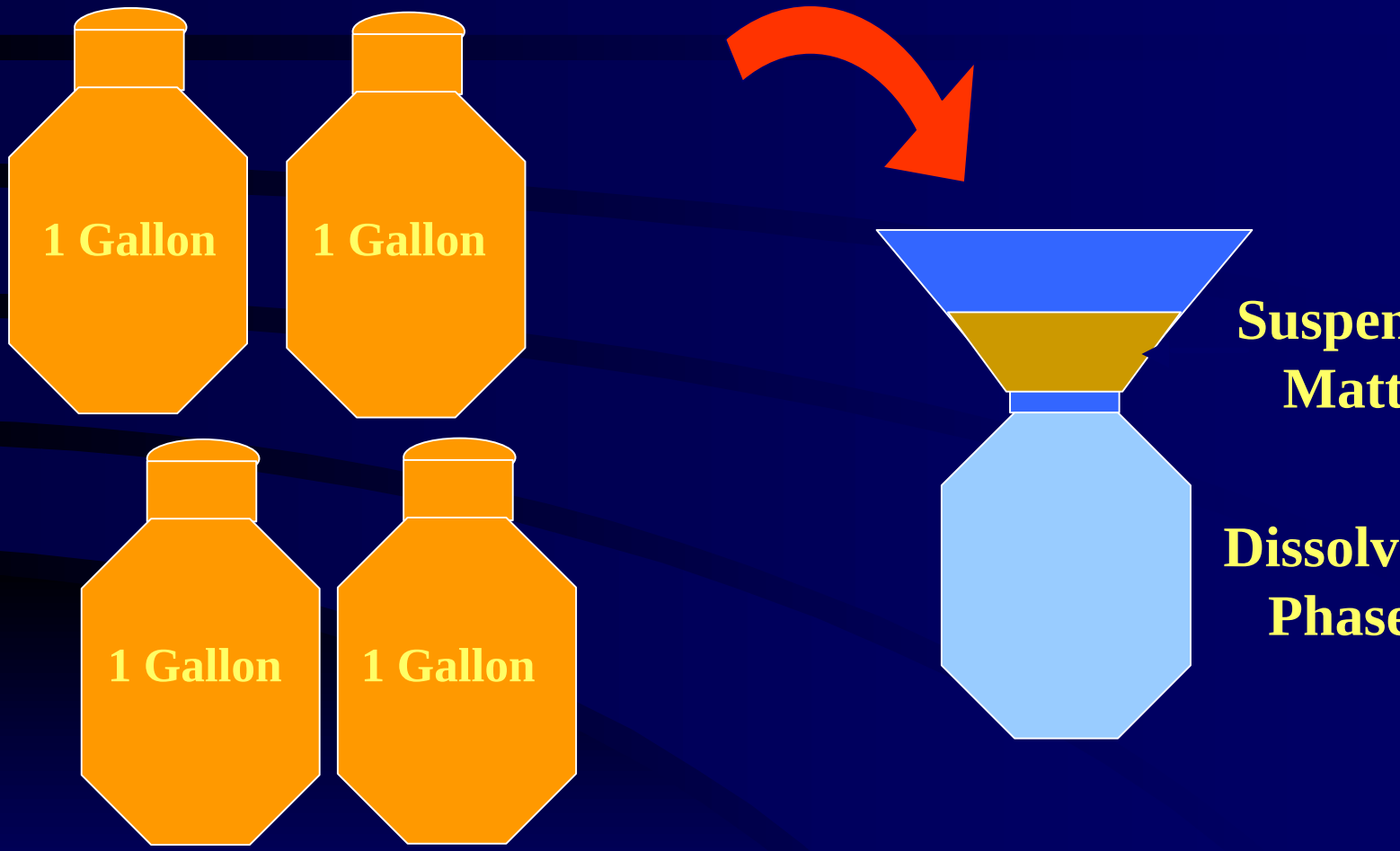
Bakers Fall to TI Dam



TAMS/Earth Tech

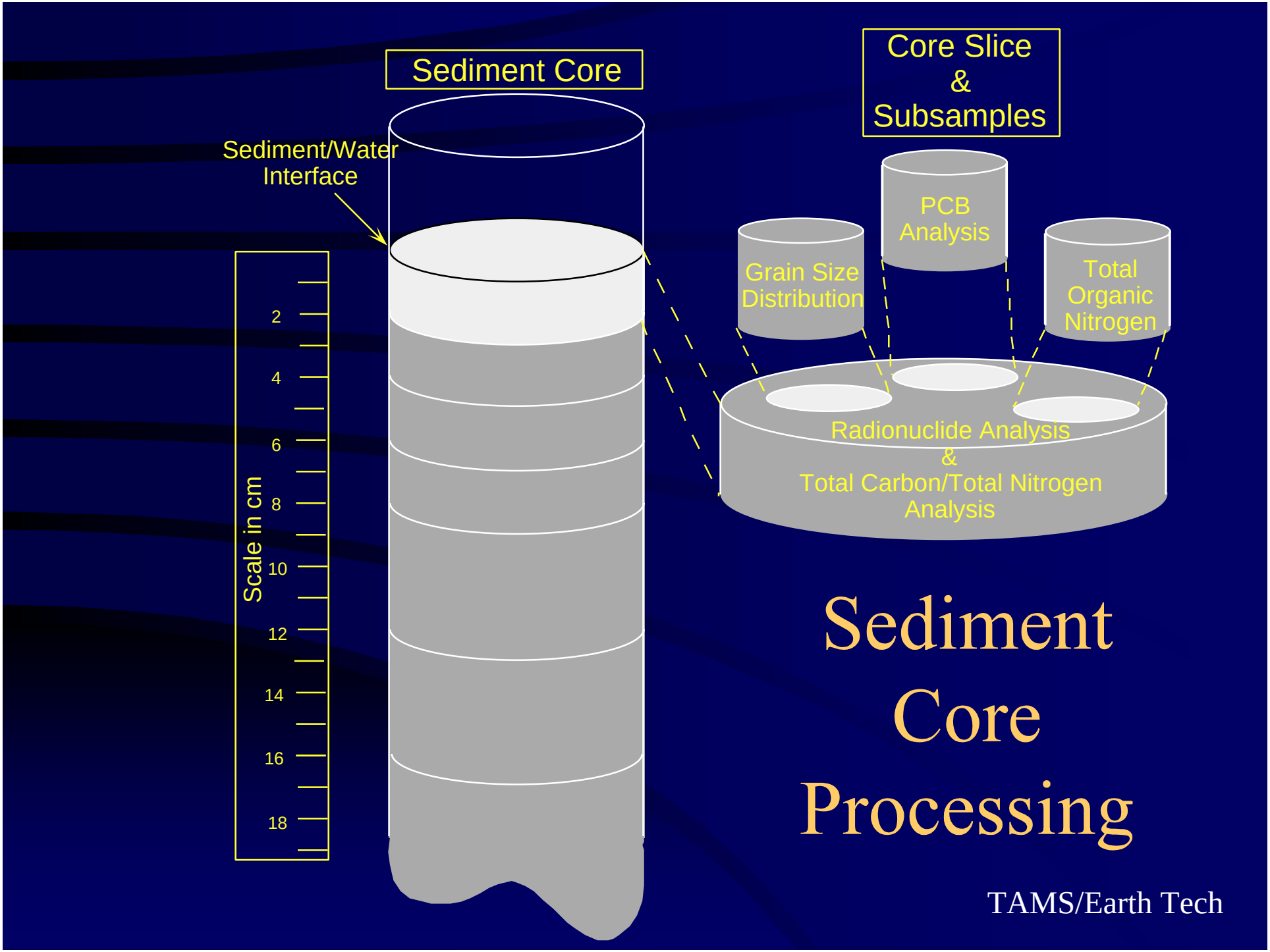
Measurement Techniques

Water Column Sampling

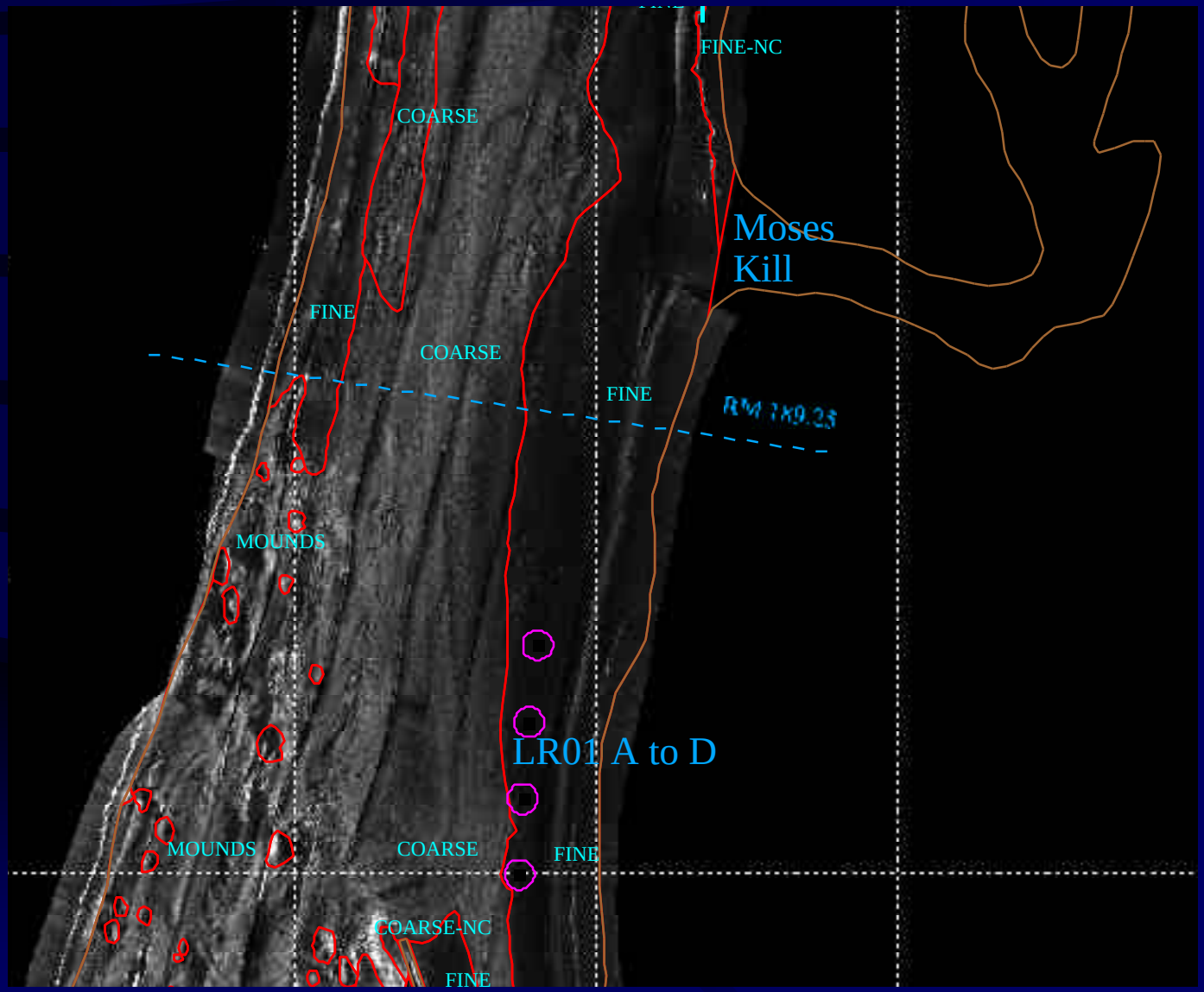


Sediment Coring

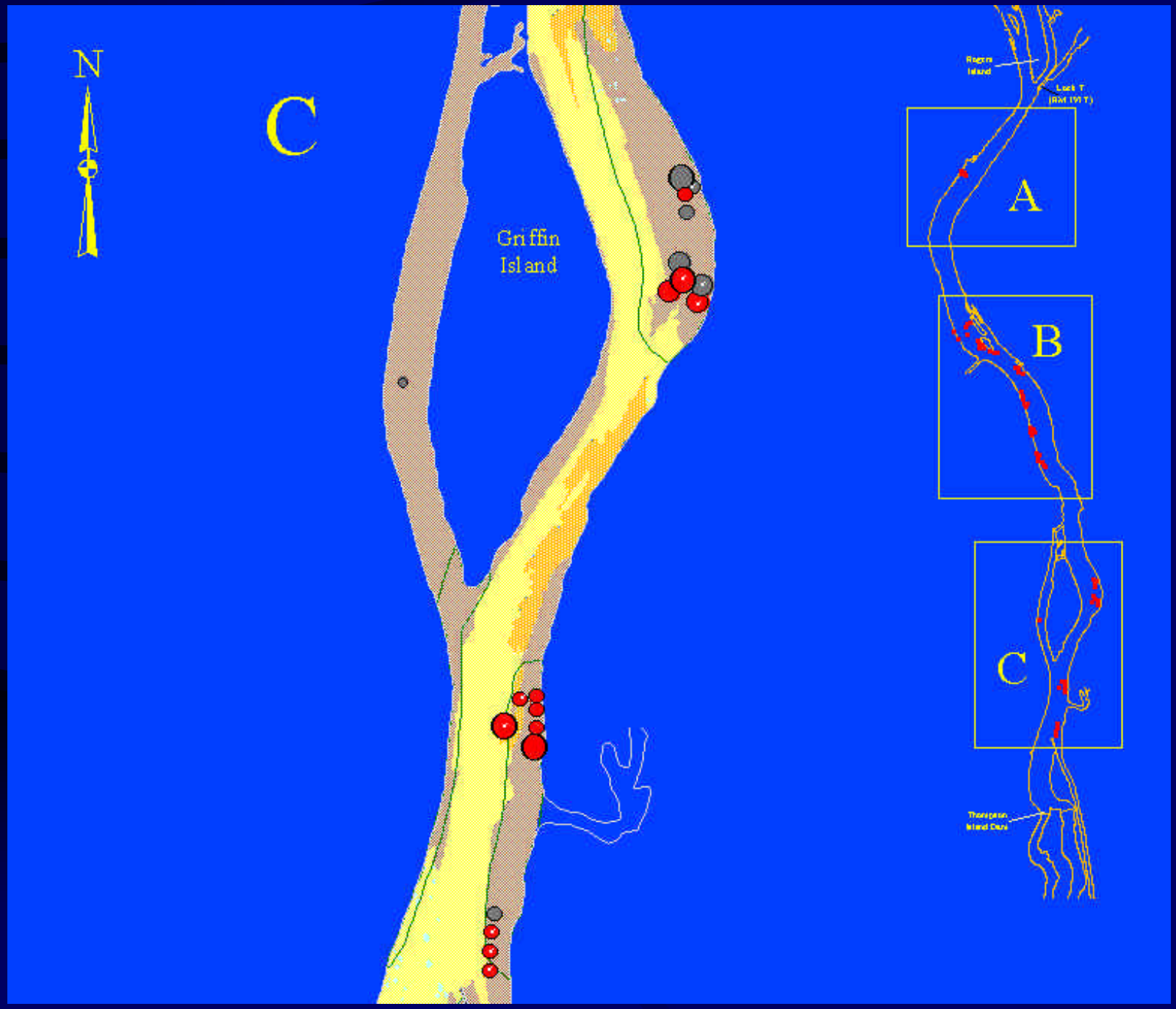
TAMS/Earth Tech


Sediment Core
Core Slice
&
Subsamples
Sediment/Water
Interface
PCB
Analysis
Grain Size
Distribution
Total
Organic
Nitrogen
Radionuclide Analysis
&
Total Carbon/Total Nitrogen
Analysis
Scale in cm
2
4
6
8
10
12
14
16
18
Sediment
Core
Processing
TAMS/Earth Tech

Geophysical Survey Imaging



TAMS/Earth Tech


N
C
Griffin
Island
A
B
C

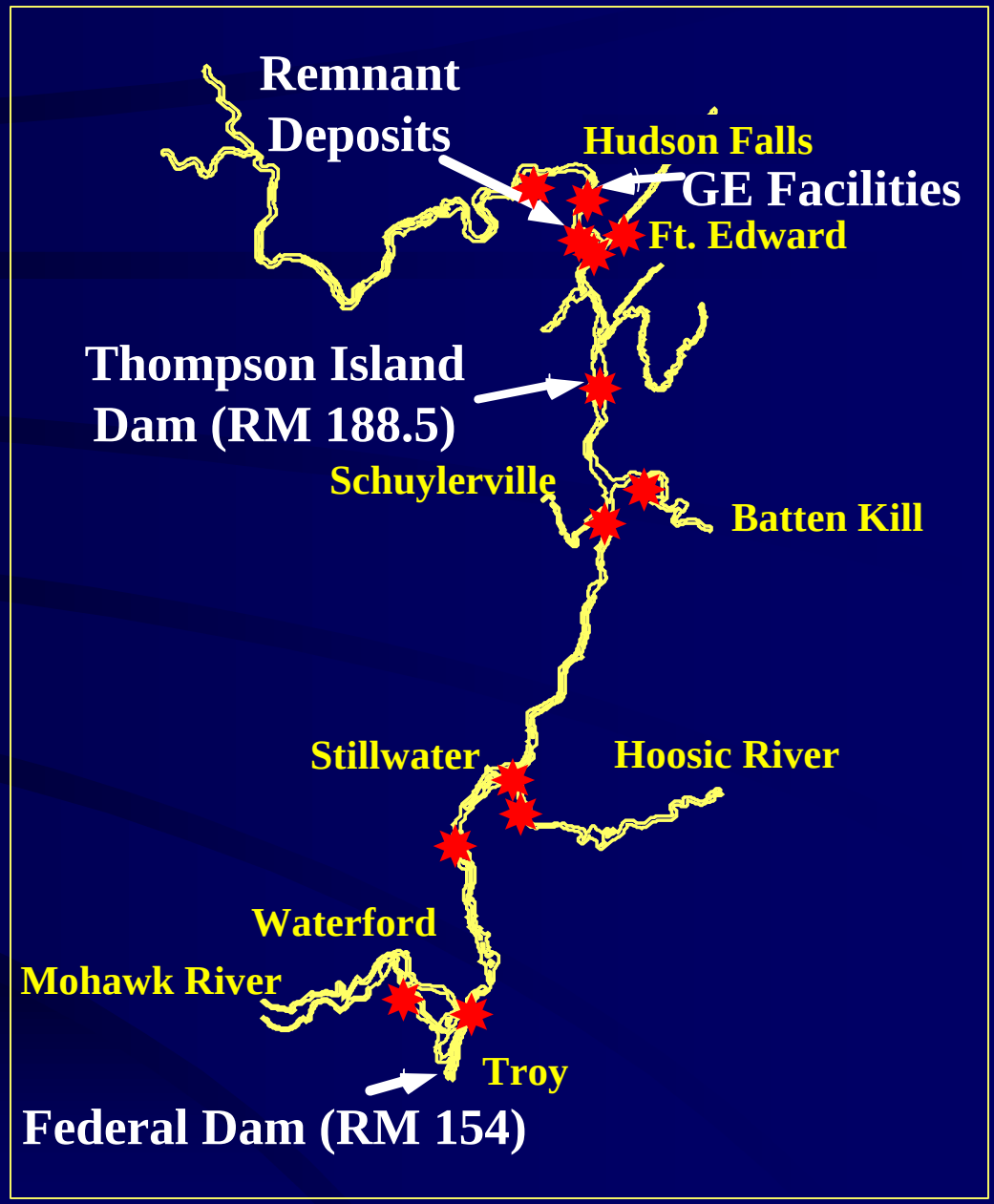
Results

PCBs in the Water Column

Measurements provide clear evidence for sediment release to water column

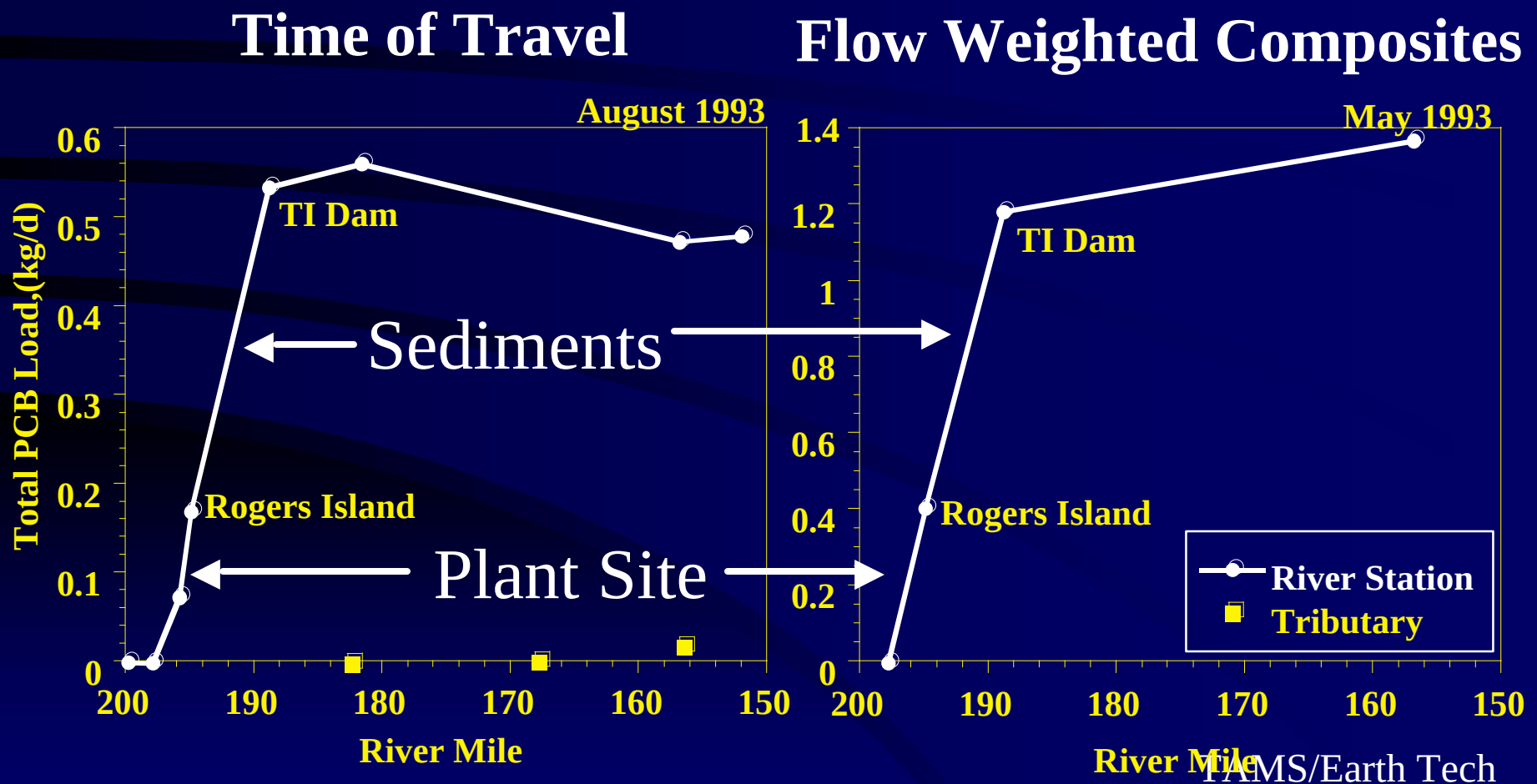
- Load gain
- Increased concentrations
- Changes on congener/homologue pattern
- Absence of significant watershed contributions

Water Column Monitoring Locations



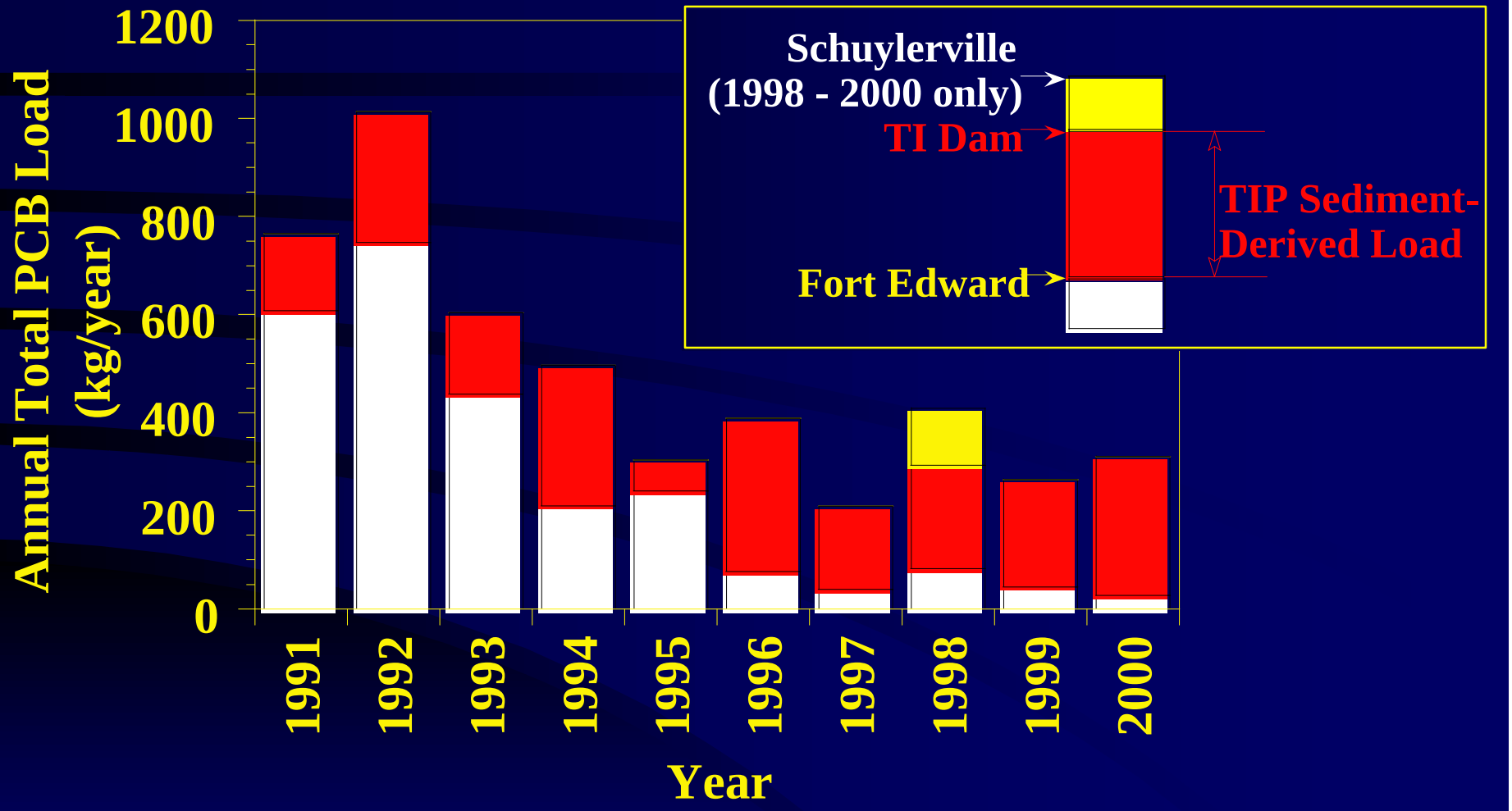
TAMS/Earth Tech

Water Column Loads in the Upper Hudson River: Hudson Falls to Troy



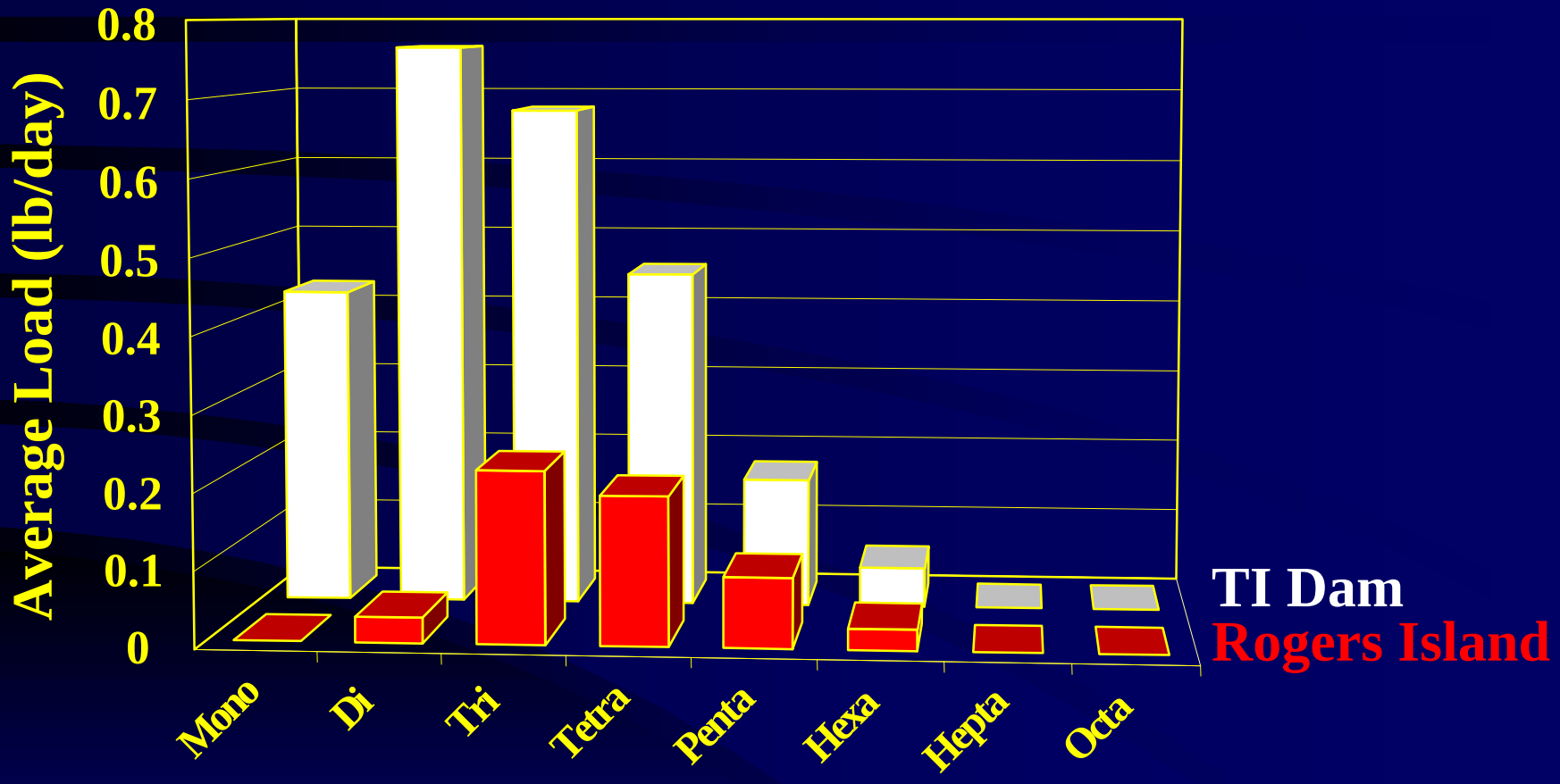
TAMS/Earth Tech

Annual Water Column Loads in the Upper Hudson River



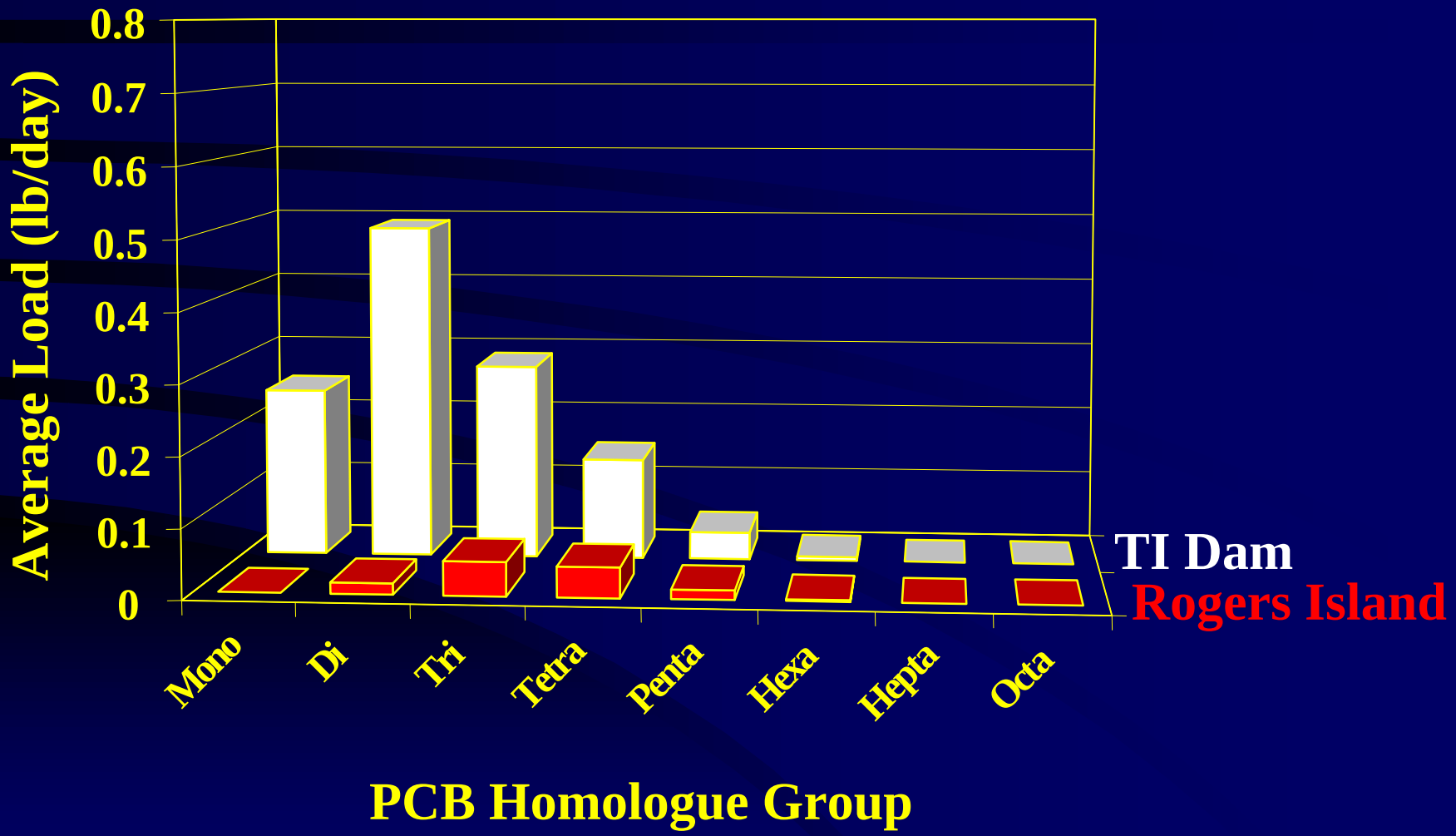
TAMS/Earth Tech

Sediment Contribution Evident in Both Load and Pattern Summer 1993



TAMS/Earth Tech

Sediment Contribution Evident in Both Load and Pattern Summer 1999



TAMS/Earth Tech

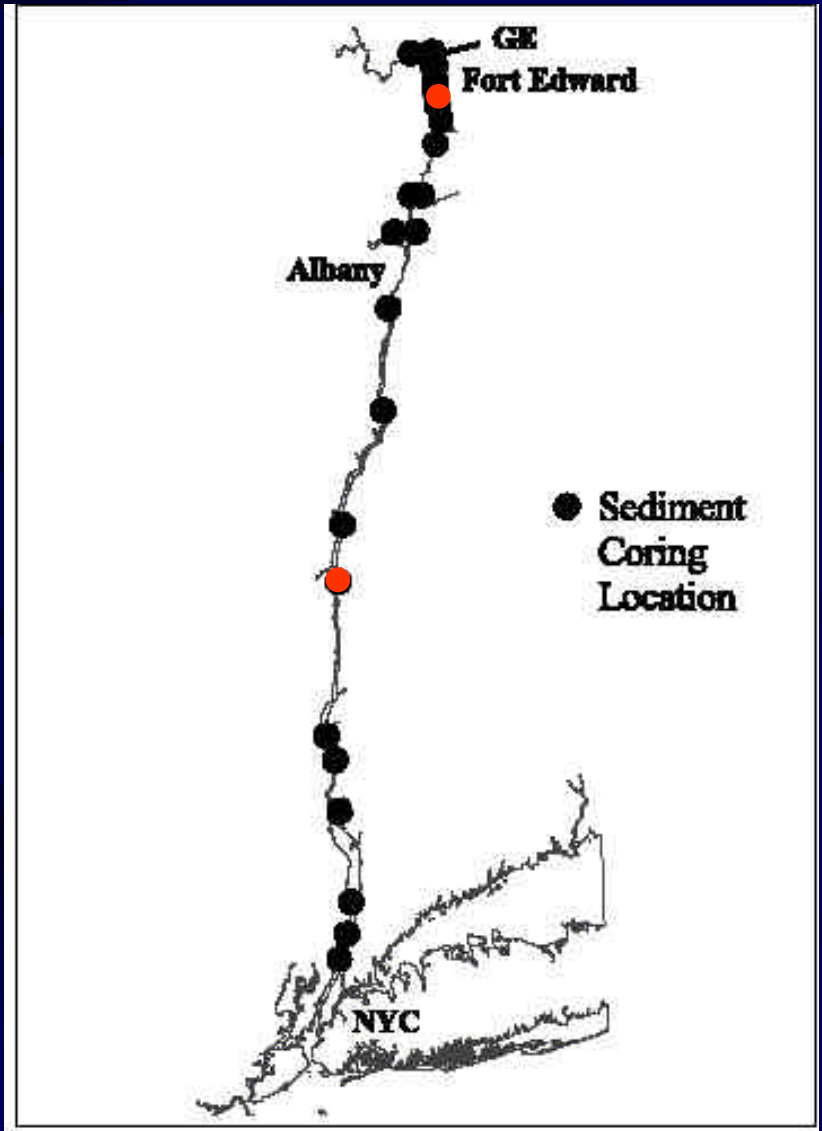
Water Column Observations

- Sediment responsible for 200 kg/yr PCB release to the water column or total 2 tons of PCB release in the past ten years
- Sediment contribution readily demonstrated by its magnitude and PCB congener signature.
- Transport to Lower Hudson determined by sediment in the first 15 miles downstream of GE facilities.

The History of Recorded in the Sediment

- Sediment core samples collected in 1992
  - 28 locations throughout the Hudson River
  - 2 to 4 cm slices and typically 15 samples / core
  - Radiocesium (Cs-137) to establish chronology
  - Congener-specific PCB analysis

Sediment Coring Locations

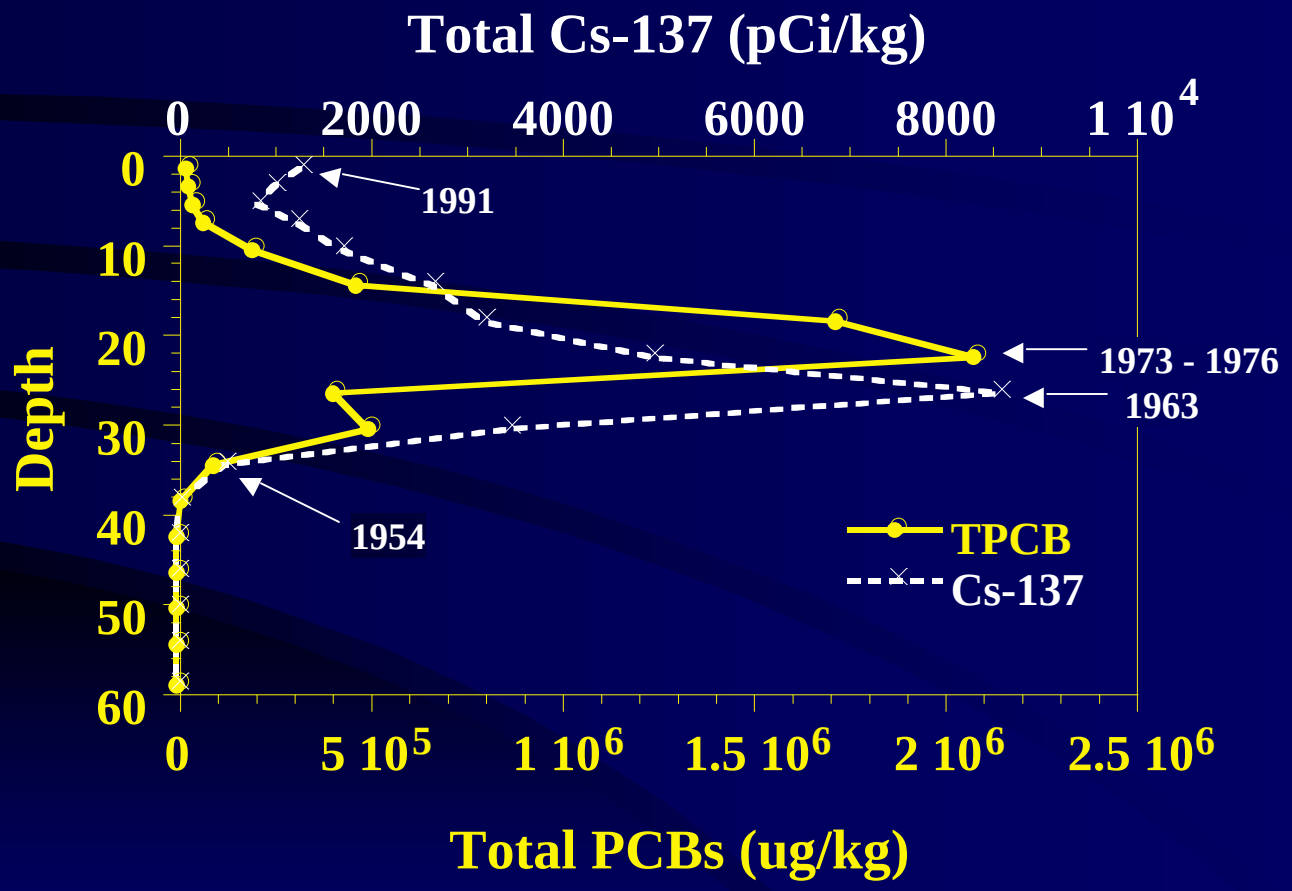


Site Map and Sediment Coring Locations

TAMS/Earth Tech

Same History of Deposition Shown by Two Cores 100 Miles Apart

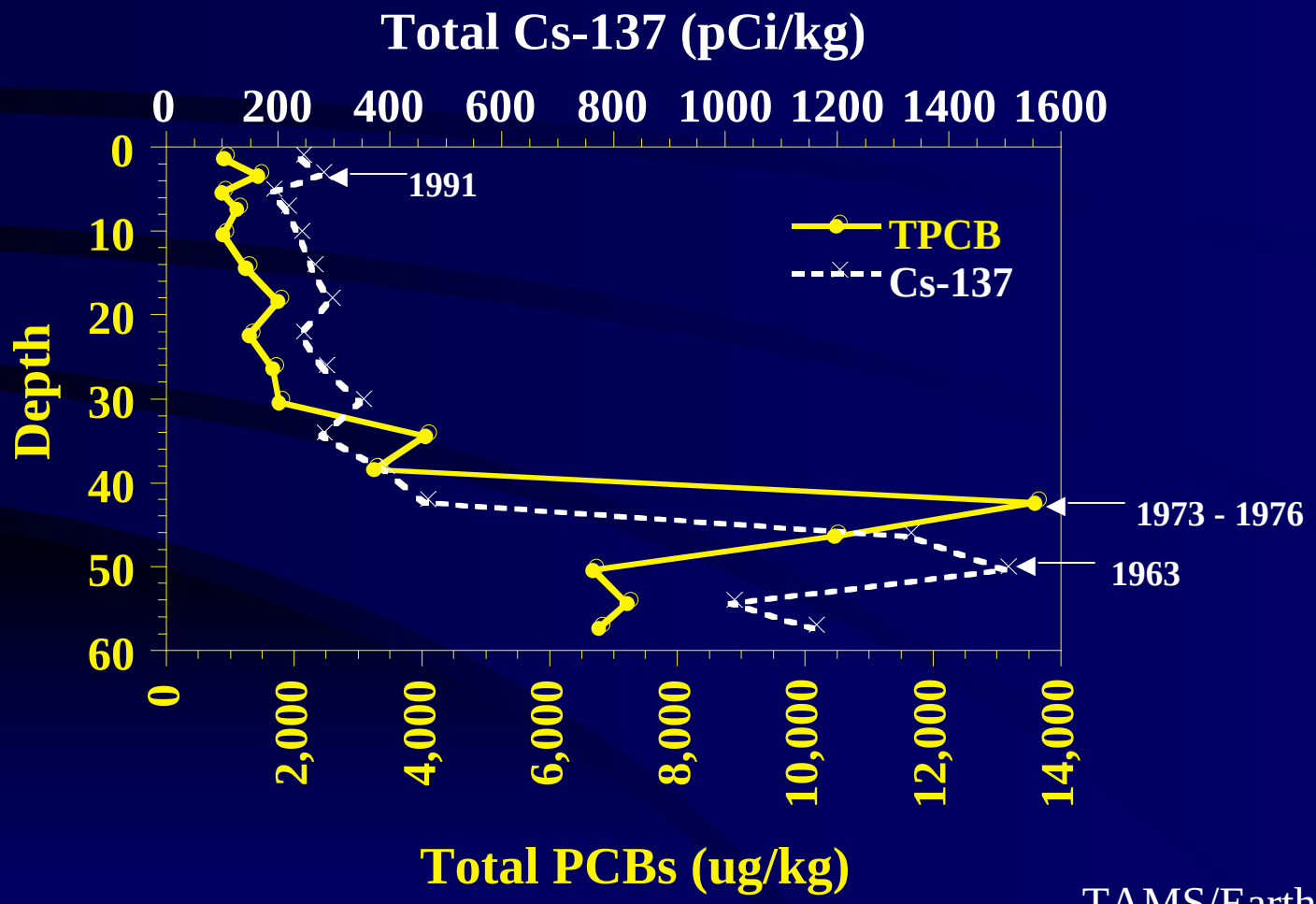
1. Core 19 (RM 188.5)



TAMS/Earth Tech

Same History of Deposition Shown by Two Cores 100 Miles Apart

2. Core 10 (RM 88.5)

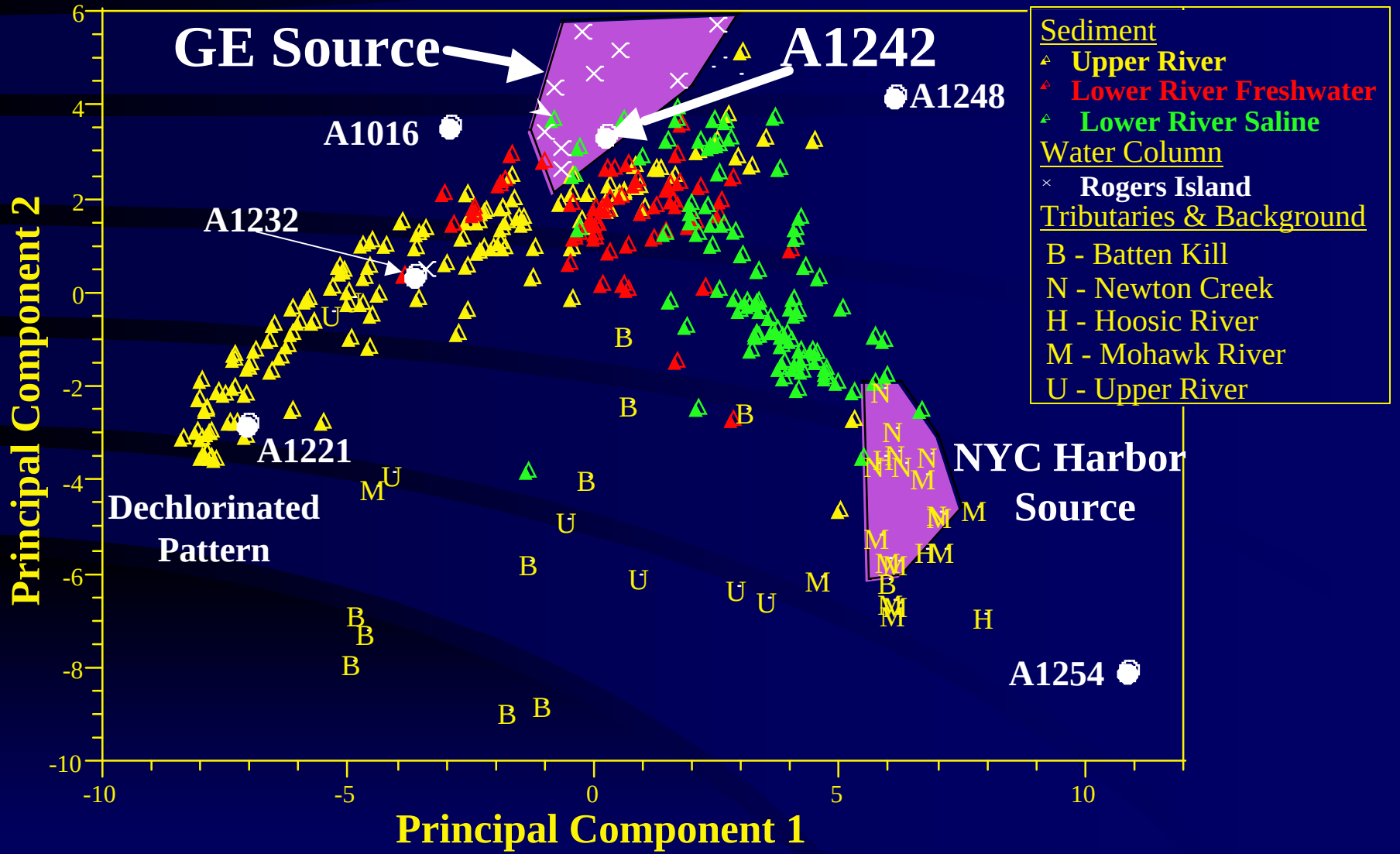


TAMS/Earth Tech

PCB “Fingerprinting”

- All main stem Hudson core segments from RM 198 to RM 0
- Sediment core data integrates information on PCB sources over time
- Dechlorination serves to produce mono- and di- chloro congeners from original mixture.

Principal Component Analysis



TAMS/Earth Tech

Fate and Transport Summary

- GE source dominates freshwater Hudson PCB for 50 years
- Dechlorination limited to most highly contaminated sediments. Process stops after initial reduction (deepest ≠ most dechlorinated)
- Sediment release to water column unabated over last 10 years
- Sediment release controls ambient conditions during biologically important period of the year.

Implications

- Sediments represent a large, uncontrolled source to regions downstream.
- Other sources to the freshwater Hudson are unimportant.
- Rapid abatement of the sediment source appears unlikely despite GE control measures at plant sites.
- Remediation is necessary to shorten the recovery of the river.

Record of

- Dredge 400 acres of the Upper Hudson
  - 80 percent of remediation occurs in first 15 miles
- Remove 2.6 M cy of sediments
  - Ship to off-site facilty
- Remove 150,000 lbs of PCBs
- Estimated cost $490M