Trace Elements in Lake Roosevelt Air

Sue Kahle and Michael Majewski

U.S. Geological Survey

Presented at

Lake Roosevelt Water Quality Council Meeting

December 4, 2003

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Problem **- Potential health threat by exposure to airborne contaminants from wind events during reservoir drawdown periods**

Lake Roosevelt at French Rocks, 3/13/01

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Objectives

- **Part I** (Majewski and others, 2003, USGS WRIR 03-4170)
  - Determine the concentrations of trace elements in the fine-grained fraction of exposed beach, bed, and bank sediments from Grand Coulee Dam to the Canadian border
- **Part II**
  - Determine concentrations of trace elements in airborne dust during ambient and dust-event conditions
  - Determine if exposed beach and bed sediments are the source of the airborne trace elements

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Part II - Air Sampling

- To coincide with significant Lake draw-down events
  - Winter - January through June
  - Fall - ~September
- PM10 Sampling - EPA Method IO-2.1
  - Every 6th day during season - Coordinated with SCAPCA air sampling program
  - Sampling began in January 2002
- Dust events

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Air Sampling

- PM10 High Volume Air Samplers
  - 24 h samples
  - Quartz-fiber Filters
  - Every 6th day
  - High Wind Events
- Meteorological Station at Each Site

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Air Sampling

- **Analytical**
  - **42 Trace Elements**
    - **Same suite as analyzed for in 2001 bed sediment survey, except mercury**
    - **Detection Limits**
      - **0.0007 to 5 µg or**
      - **0.0004 to 3 ng/m³**

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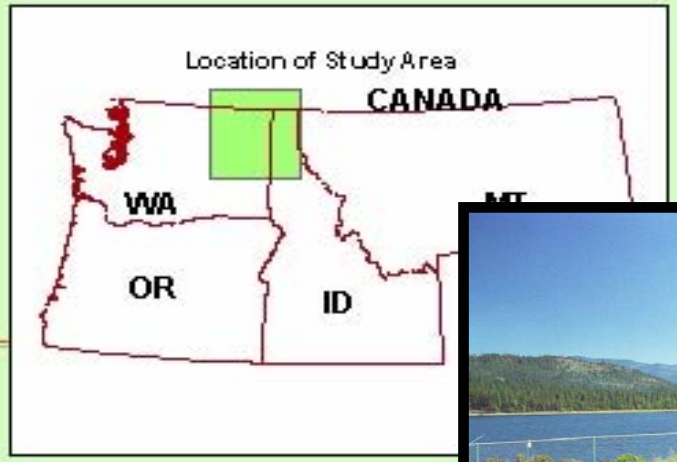

Kettle Falls

Marcus

Inchelium

Seven-Bays

CANADA

Trail

SLAG

IDAHO

WASHINGTON

Kettle Falls

REF2
REF1
SD16
T6
T5
SD15
SD14
REF3
SD13
T4
SD12
SD11
SD10
REF4
SD1
T1
SD3
SD2
SD4
T2
REF5

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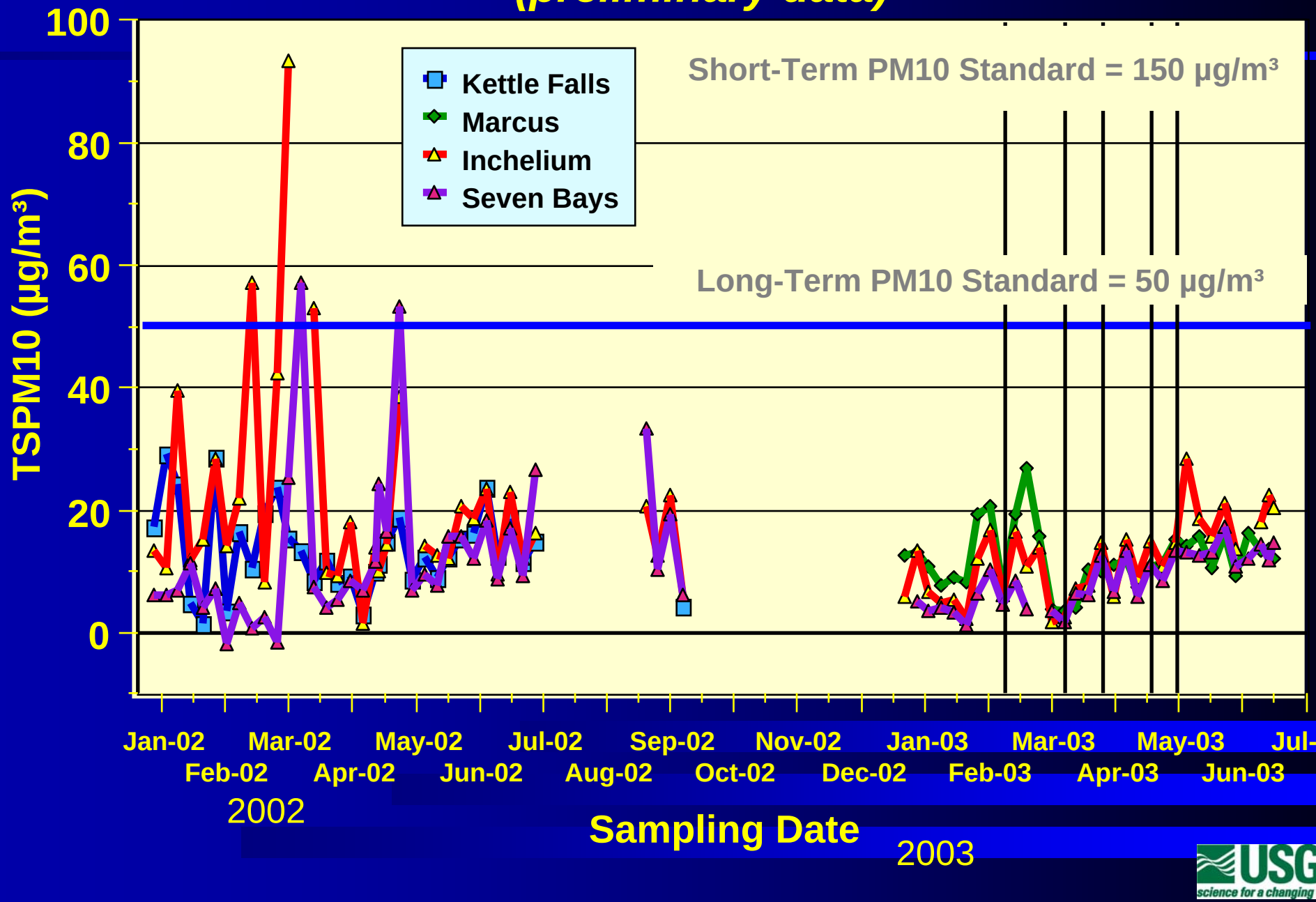
Total Suspended PM 10

(preliminary data)



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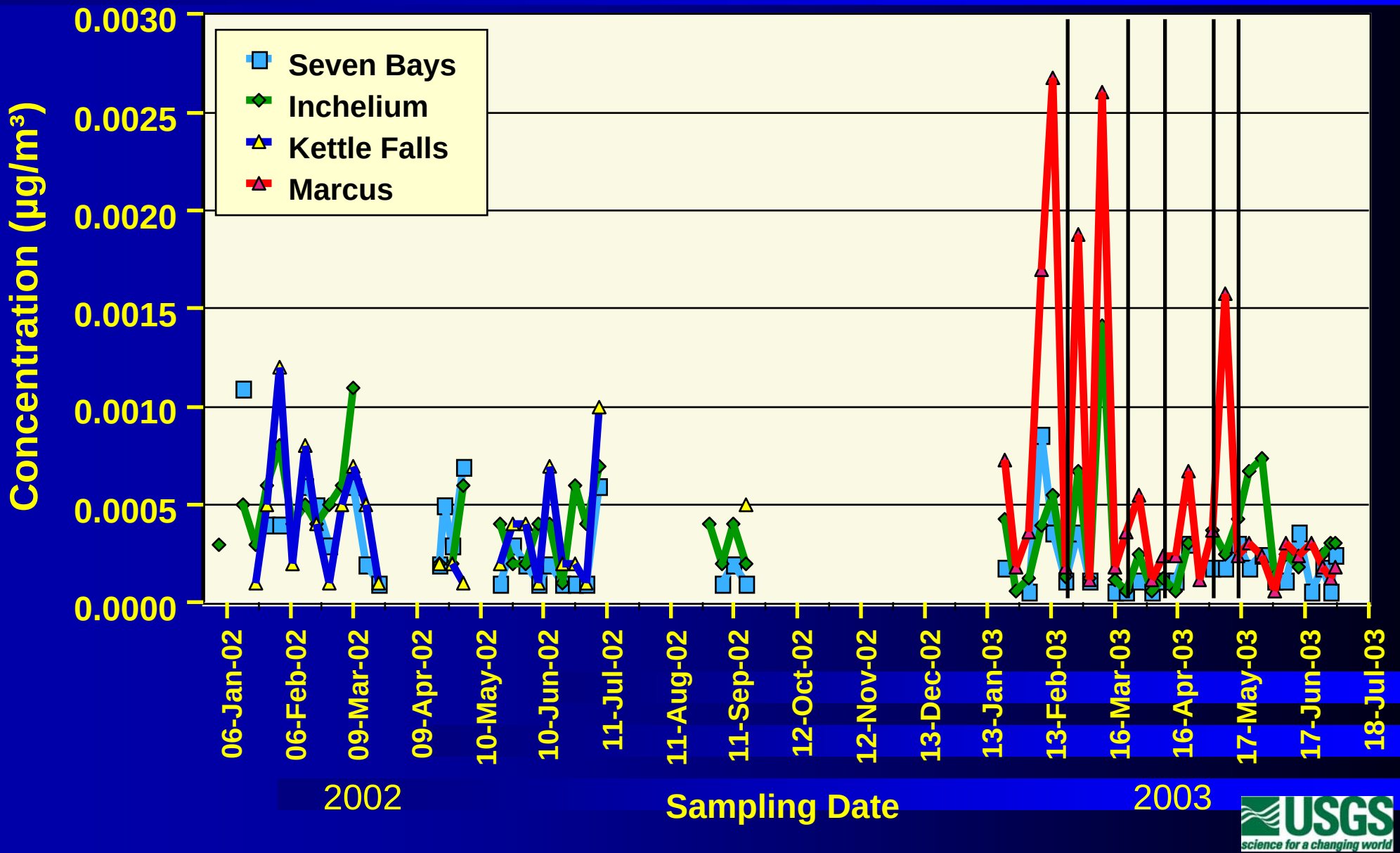
Arsenic

(preliminary data)



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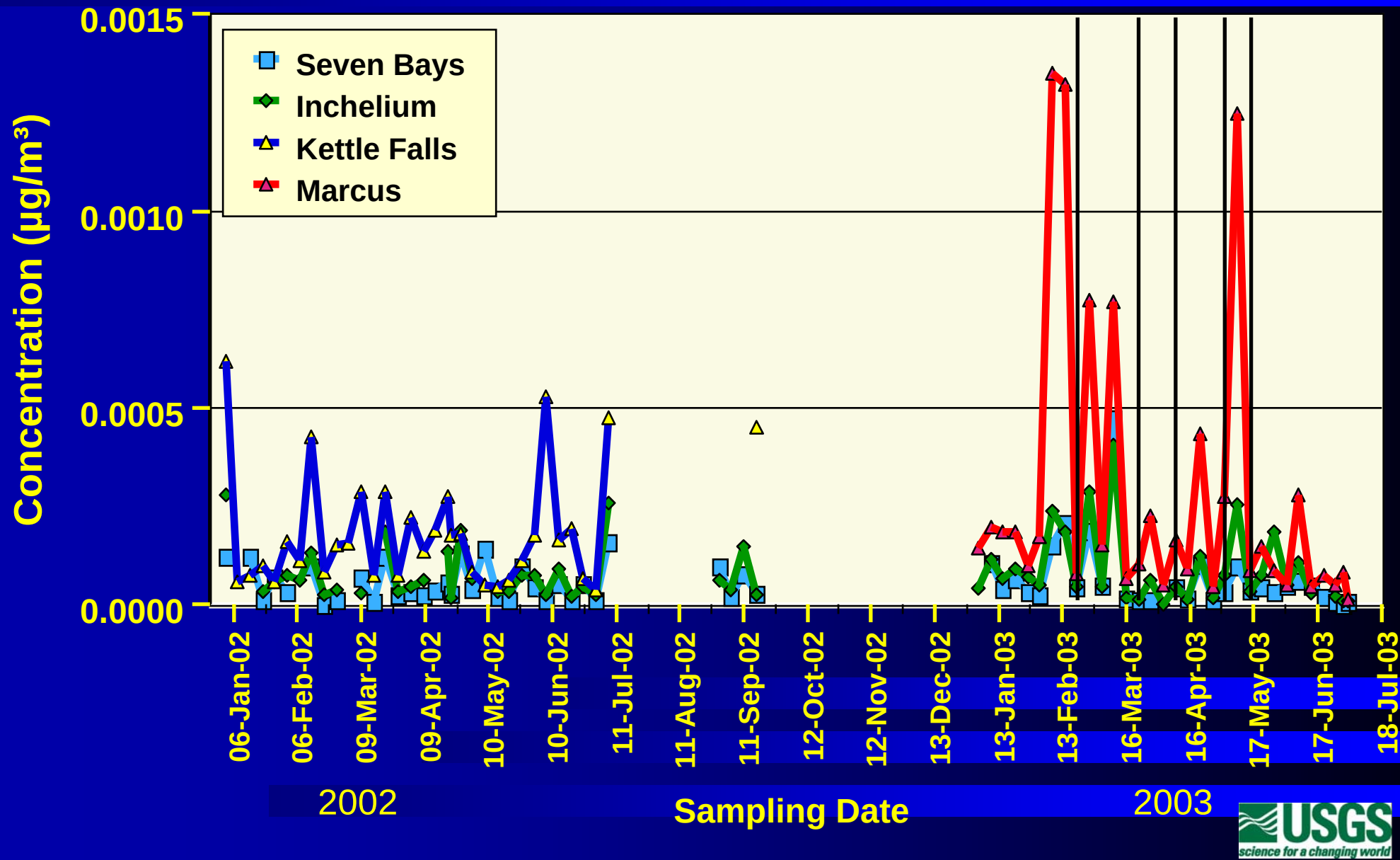
Cadmium

(preliminary data)



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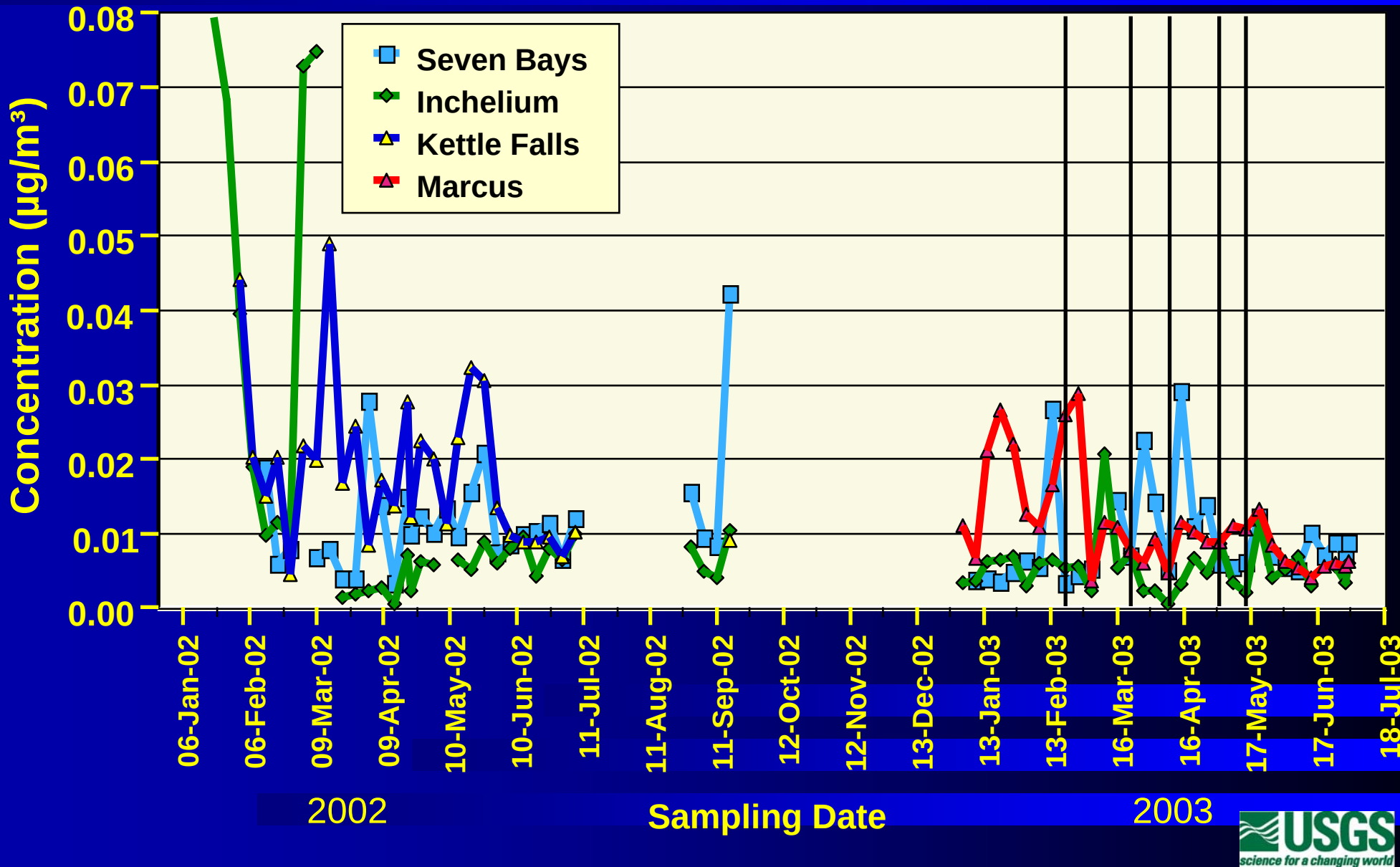
Copper

(preliminary data)



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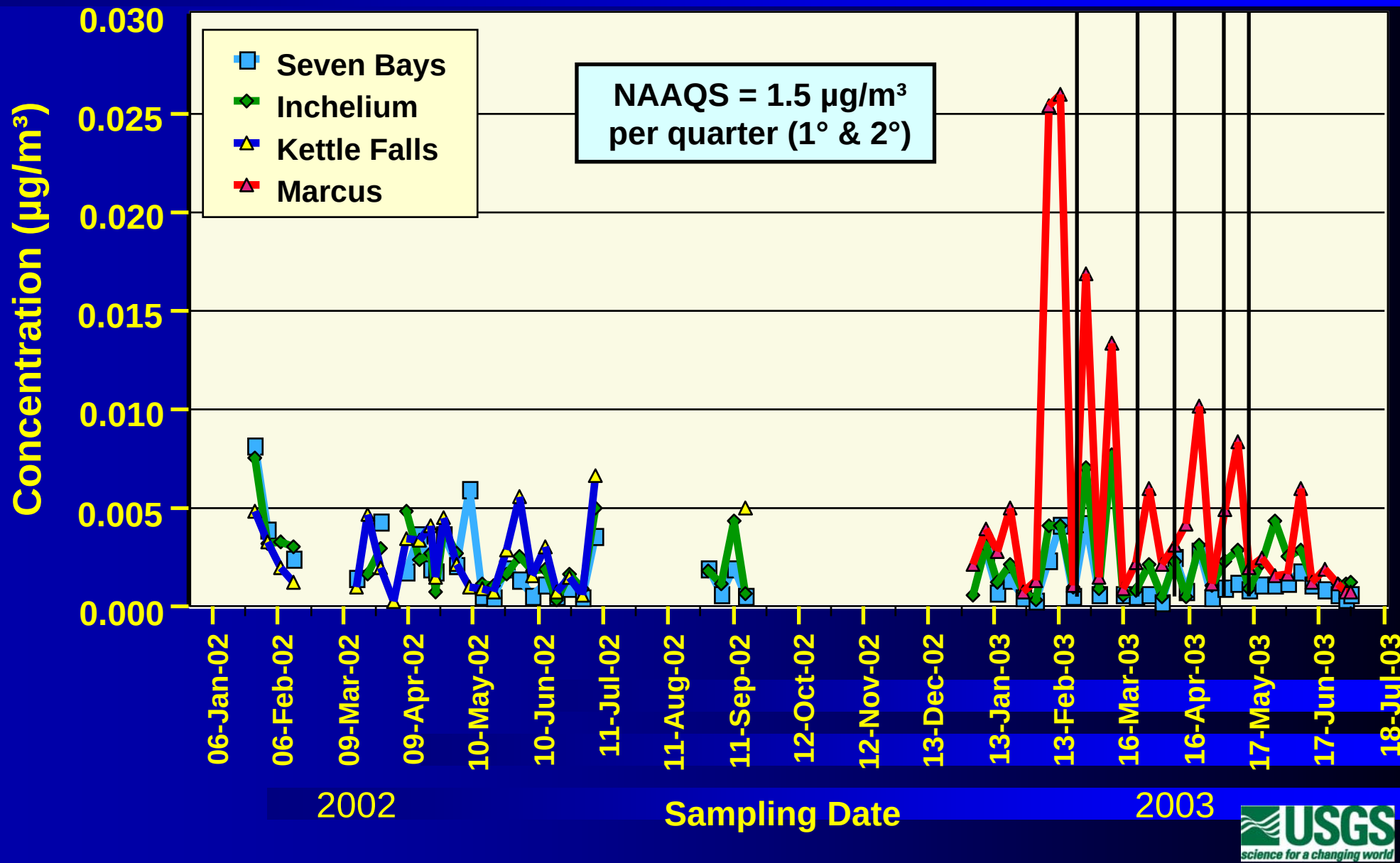
Lead

(preliminary data)



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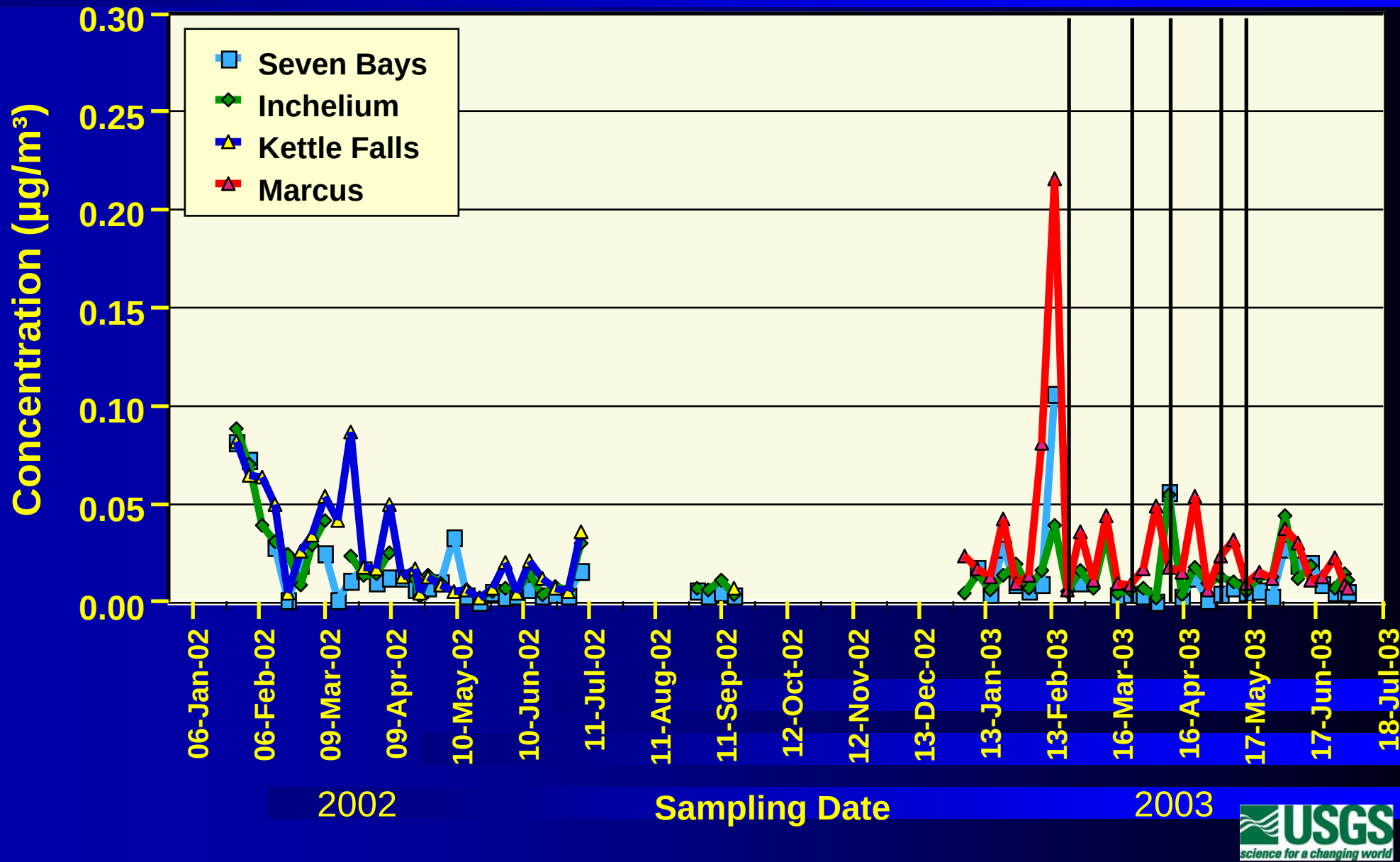
Zinc

(preliminary data)



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Urban Air Toxics - Metals

- Arsenic Compounds
- Beryllium and Compounds
- Cadium Compounds
- Chromium Compounds
- Lead Compounds
- Manganese Compounds
- Mercury Compounds
- Nickel Compounds

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Chronic Inhalation Risks

•Arsenic	0.03 µg/m³	CalEPA
•Beryllium	0.02 µg/m³	RfC
•Cadmium	0.01 µg/m³	CalEPA
•Chromium (VI)	0.1 µg/m³	RfC
➢ 8×10^{-5} µg/m³	EPA 1:million cancer risk	
•Lead	Oral doses only	
•Manganese	0.05 µg/m³	RfC
•Mercury	Species specific	
•Nickel	0.05 µg/m³	CalEPA

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Summary - Air Monitoring

- Air Monitoring program began in 2002
  - Operating from January through June, and September
- TSPM10 concentrations did not exceed the Short-Term Standard of 150 µg/m³
  - The Long-Term Standard of 50 µg/m³ was not exceeded
- Air concentrations of slag related trace elements were low
  - Lake levels in '02 and '03 were not as low as in 2001
  - Number of significant dust events was also low

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2004 Sampling

- One objective of study is to sample high wind-dust events
  - Currently not being satisfactorily met
- What can we do in 2004 to sample more high wind-dust events?
  - Increase the sampling frequency from every 6th day to every 3rd day?
    - Will also double sampling and analytical costs
    - Will still miss some, potentially significant events

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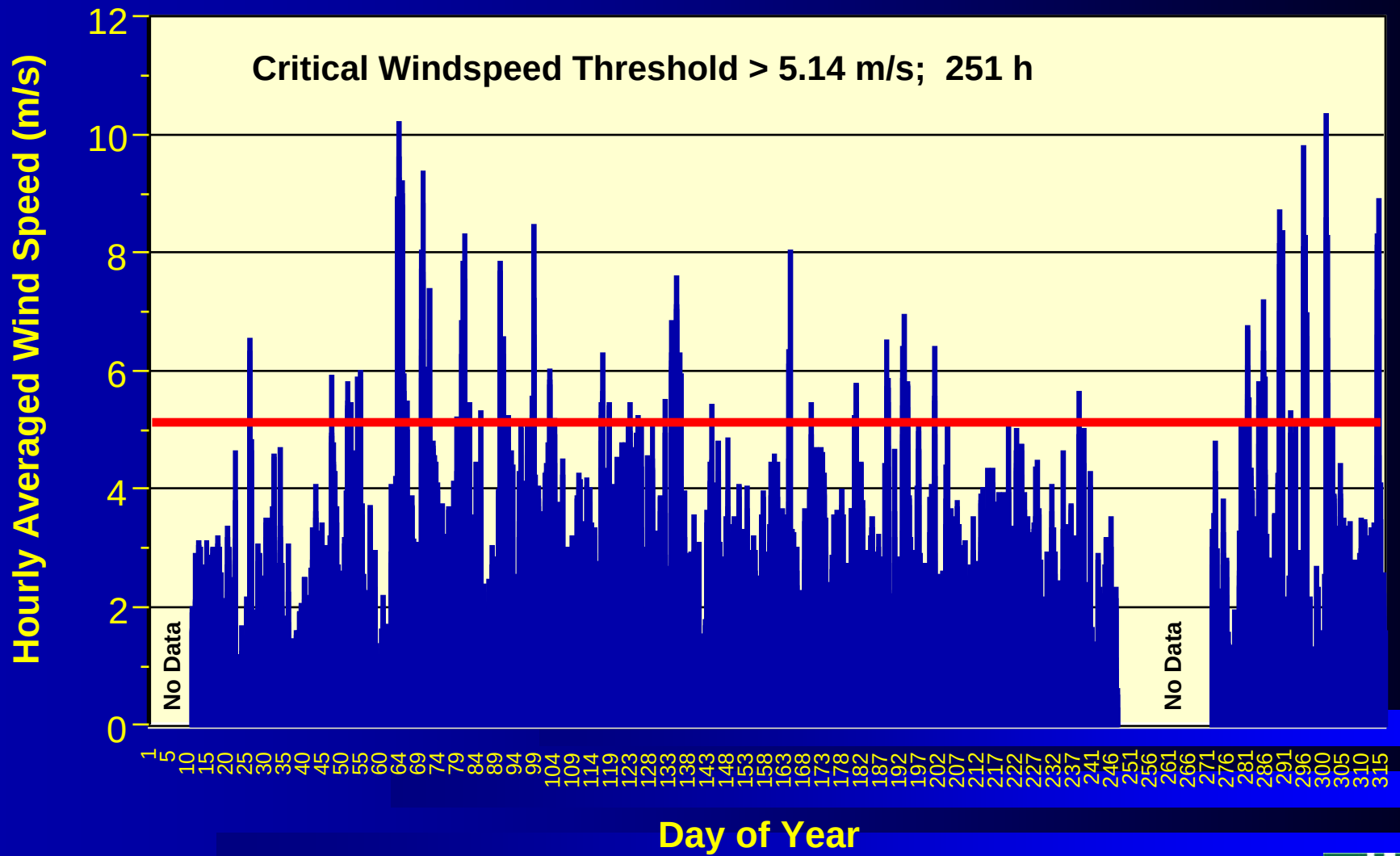
Seven-Bays Sampling Site



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Seven-Bays Sampling Site

- Number of hours > 5.14 m/s:
  - 251
- Number of days with 4 or more hours of wind above 5.14 m/s:
  - 13 (Jan - June) / 10 (July- Nov)
- Number of High Wind Events Coinciding with a 6th day sampling:
  - 3 (Jan - Jun) / 2 (July - Nov)
- Number of High Wind Events Coinciding with a 3rd day sampling:
  - 2 (Jan - June) / 0 (July - Nov)

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Seven-Bays Sampling Site

- **High Wind Event Days by Month (days with 4 or more hours at > 5.14 m/s) by Month:**

➢ January	- 1	February	- 2
➢ March	- 6	April	- 1
➢ May	- 2	June	- 1
➢ July	- 3	August	- 0
➢ September	- 0	October	- 6
➢ November	- 1 (as of 7 Nov)		
➢ December	-		

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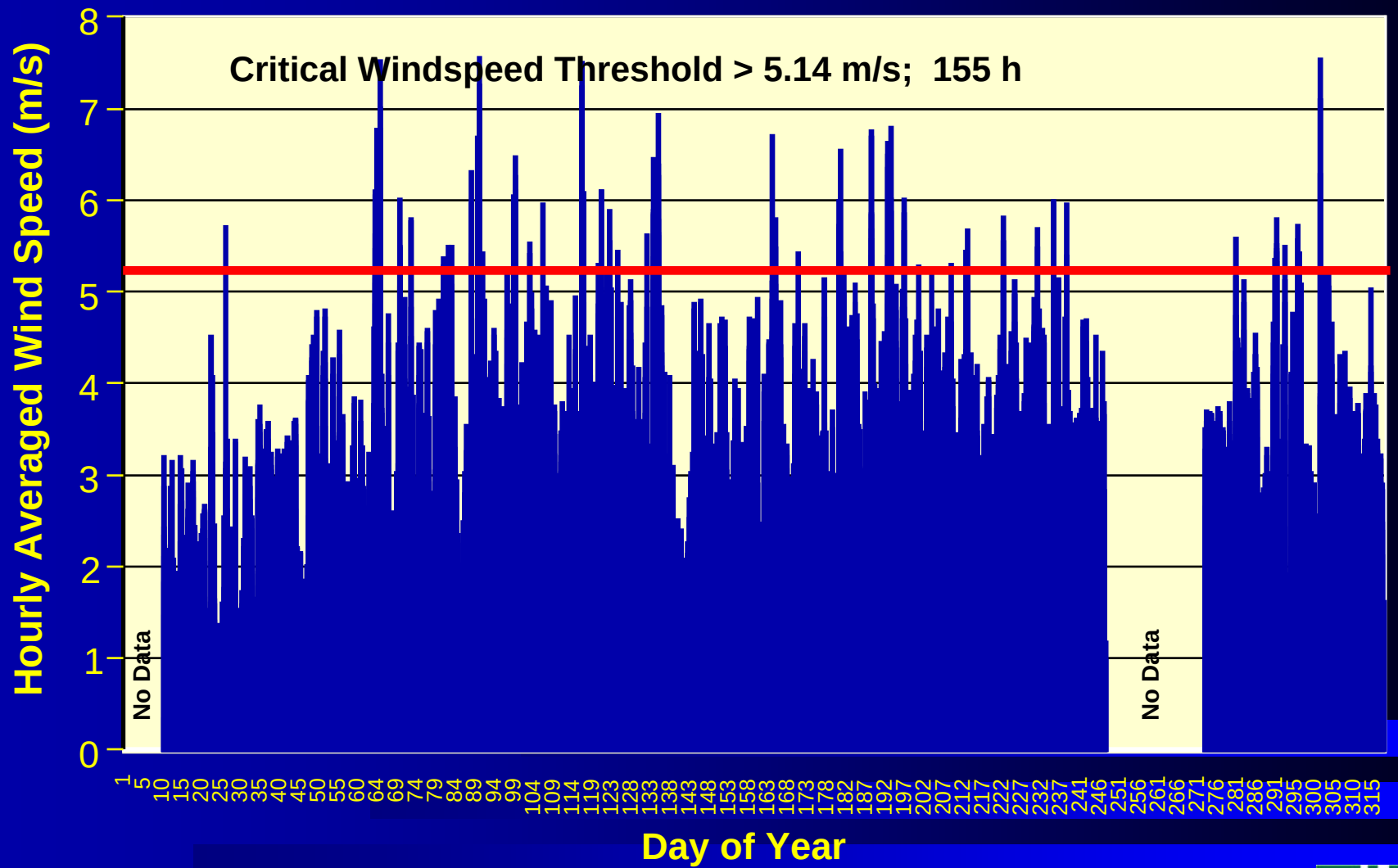
Inchelium Sampling Site



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Inchelium Sampling Site

- Number of hours > 5.14 m/s:
  - 155
- Number of days with 4 or more hours of wind above 5.14 m/s:
  - 9 (Jan - June)/ 9 (July - Nov)
- Number of High Wind Events Coinciding with a 6th day sampling:
  - 3 (Jan - June)/ 4 (July - Nov)
- Number of High Wind Events Coinciding with a 3rd day sampling:
  - 1 (Jan - June)/ 1 (July - Nov)

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Inchelium Sampling

- **High Wind Event Days by Month (days with 4 or more hours at > 5.14 m/s) by Month:**

➢ January	- 0	February	- 0
➢ March	- 4	April	- 2
➢ May	- 3	June	- 0
➢ July	- 4	August	- 3
➢ September	- 0	October	- 2
➢ November	- 0 (as of 7 Nov)		
➢ December	-		

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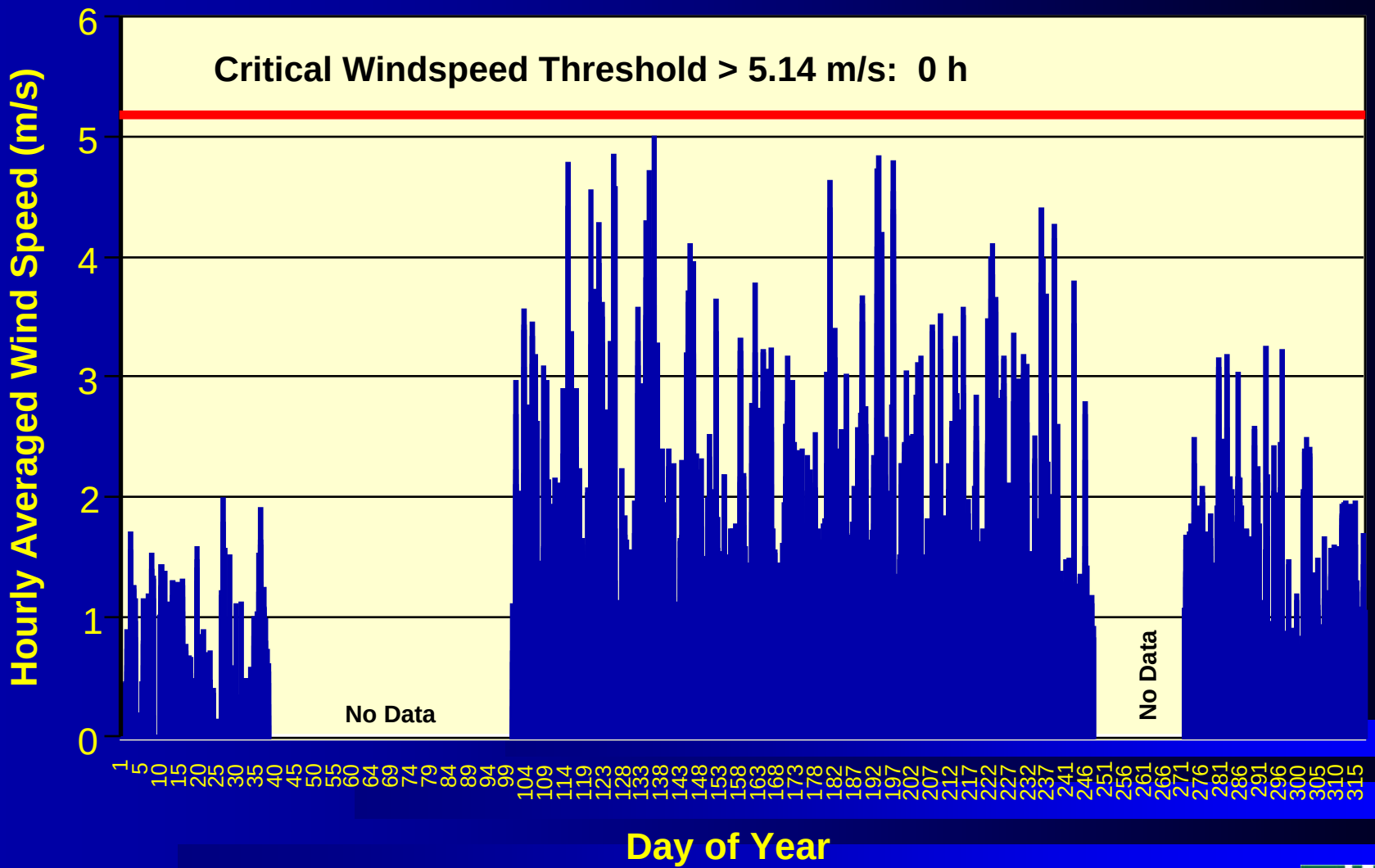
Marcus Sampling Site



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Marcus Sampling Site

- Reasons for No High Wind Events at This Site?
  - Farthest upstream site
    - Predominant wind direction is from the south
  - Located at lake level
    - Other sites are elevated
  - Other?

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2004 Sampling

- **What can we do in 2004 to sample more high wind-dust events?**
  - **Focus sampling to periods when bed sediments are exposed**
  - **Not sample as frequently early in the season when the bed sediments are still covered with water, and increase sampling frequency later in the season, i.e.,**
    - **Sample every 12th day in January and February**
    - **Sample every 6th day from March to mid-April**
    - **sample every 3rd day from mid-April to early June**

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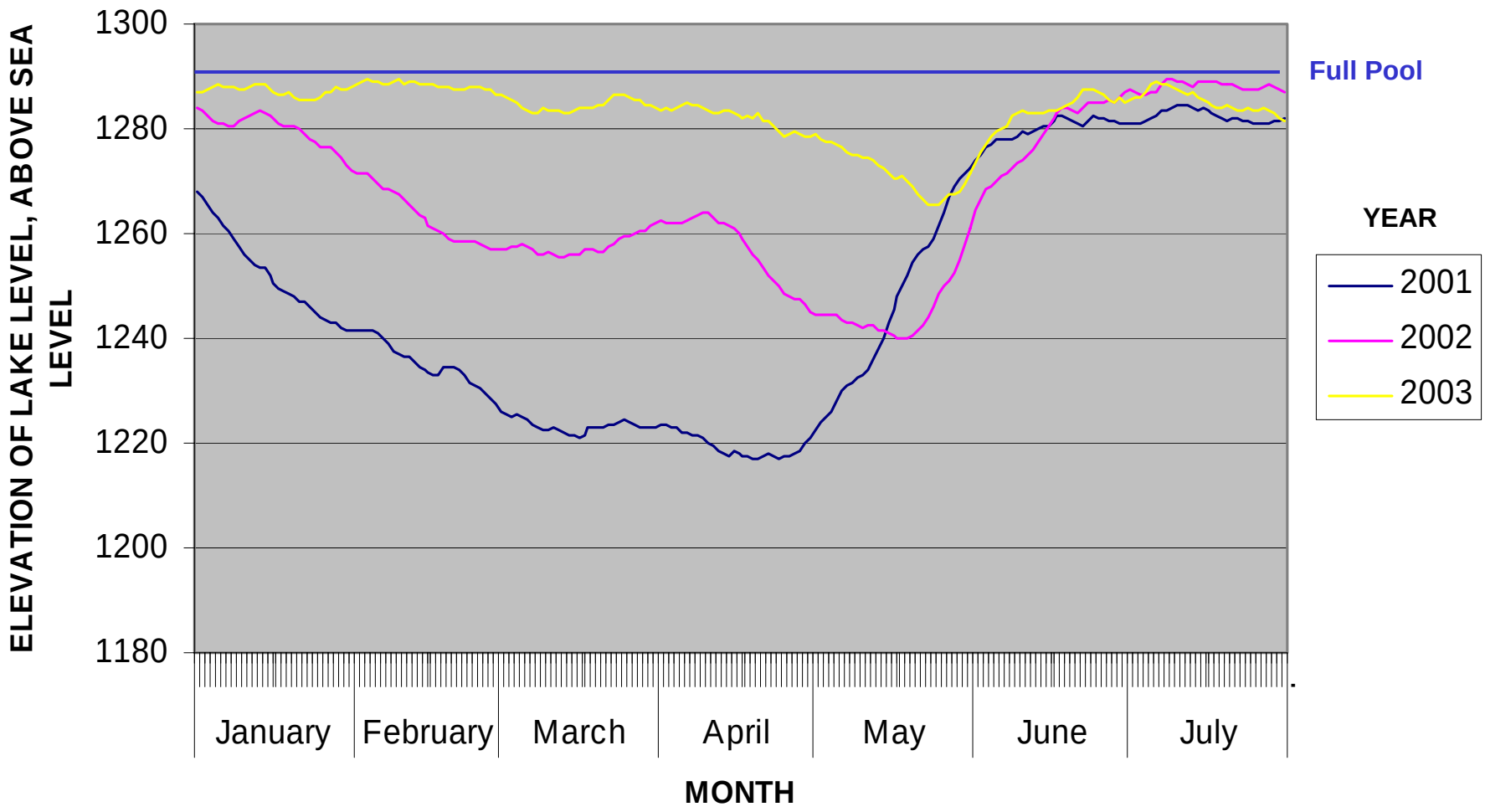
Water-surface elevation of FDR Lake at Grand Coulee Dam (USGS gage 12436000)



2004 Sampling

- What can we do in 2004 to sample more high wind-dust events?
  - Spend more effort on predictions
  - Enlist the help of other agencies to aid us in predictions
    - U.S. Weather Service
    - NOAA
    - Universities
    - Others?

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Discussion

- What to do?

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