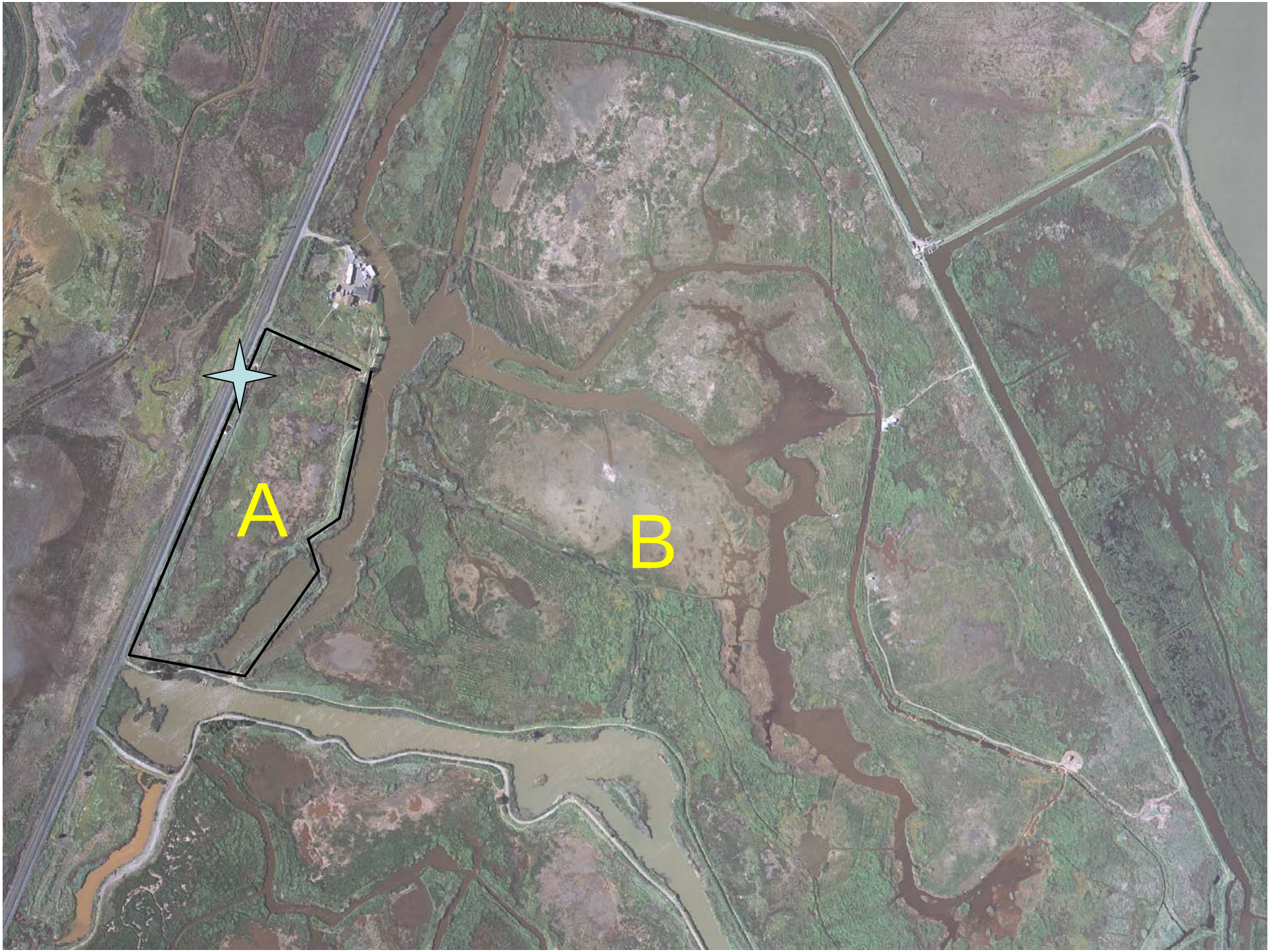
Bioremedation of Diesel Range Organics in the Suisun Marsh

Harry L. Allen, U.S. EPA

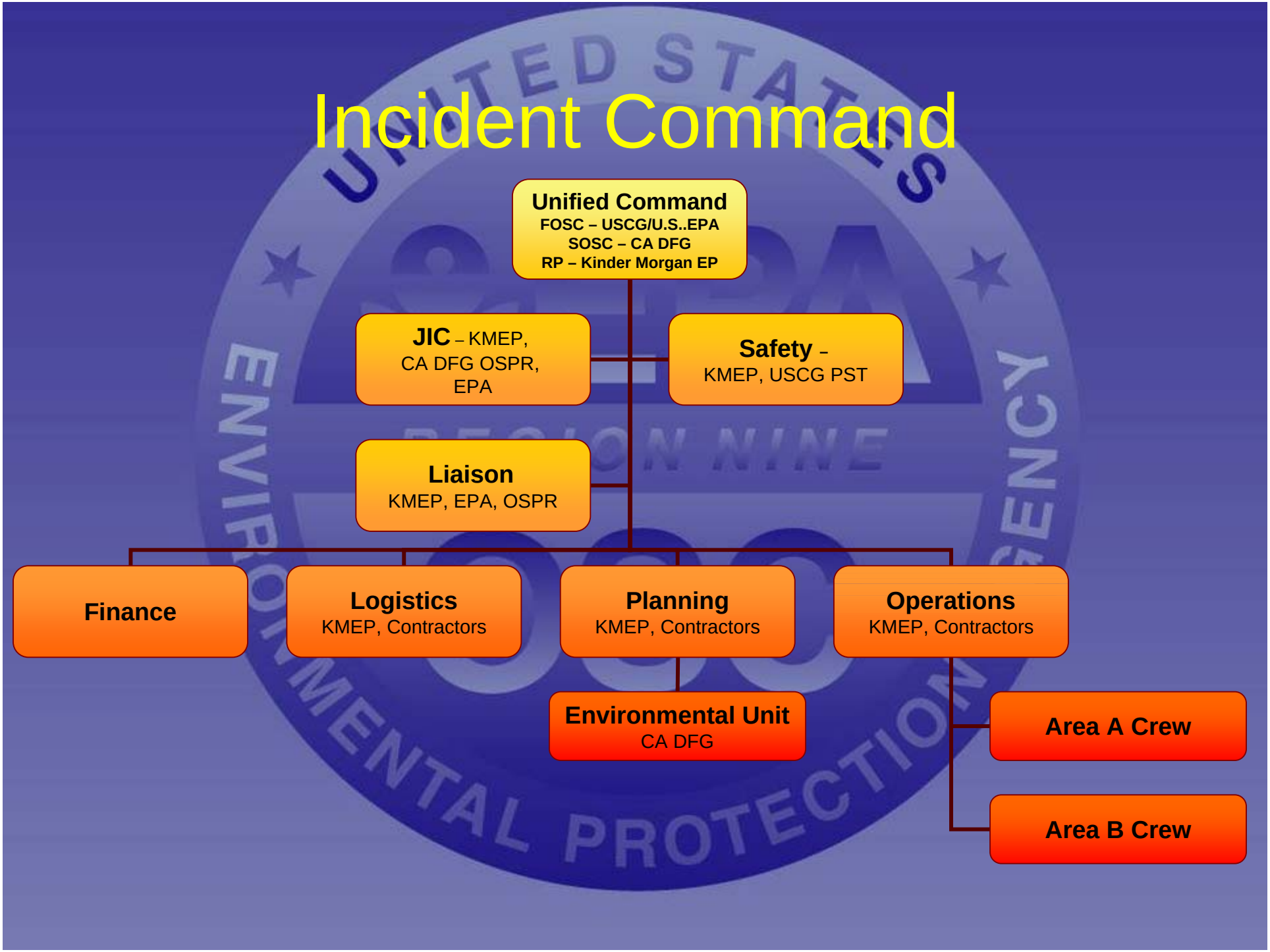
Region 9 FOSC

Background

- Pipeline spill occurred on April 27, 2004
- Greater than 100,000 gallons of diesel fuel released to a wetland
  - Area is approximately 242 acres in size and is managed as a duck hunting clubs
  - Water levels controlled by levees and gates
  - Responders designated 2 divisions: A (a brood pond) and B (a shooting area)



Incident Command



Response Strategies

- Mechanical
  - Booming, absorbent materials, skimming, and excavation
  - Water level management
    - Tide gate adjustments were utilized to drain Division B


CAUTION CAUTION

Response Strategies

- An evaluation of cleanup alternatives determined that bioremediation was highly feasible and cost effective
  - Add polyphosphate (Div A) & di-ammonium phosphate (Div B) to affected soils to facilitate biodegradation of diesel in soil
  - Tilling for aeration

Response Coordination

- State:
  - Department of Fish & Game and Regional Water Quality Control Board
- Federal:
  - NOAA, U.S. Fish & Wildlife Service
    - Endangered Species Issues
  - DOI
    - Cultural and Historic Properties Issues
  - Regional Response Team
    - Approval of nutrient addition


CAUTION


CALIFORNIA
DEPARTMENT
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Will bioremediation work…. before winter arrives?

- Heterotrophic plate count and respirometry study (KMEP – lead)
  - High populations of TPH degraders present
  - Populations increase in presence of oxygen
- Bench-scale tests (EPA – lead)
  - Up to 40% degradation observed in bench flasks after 14 days
- Preparations!
  - Construction
  - Mouse catching

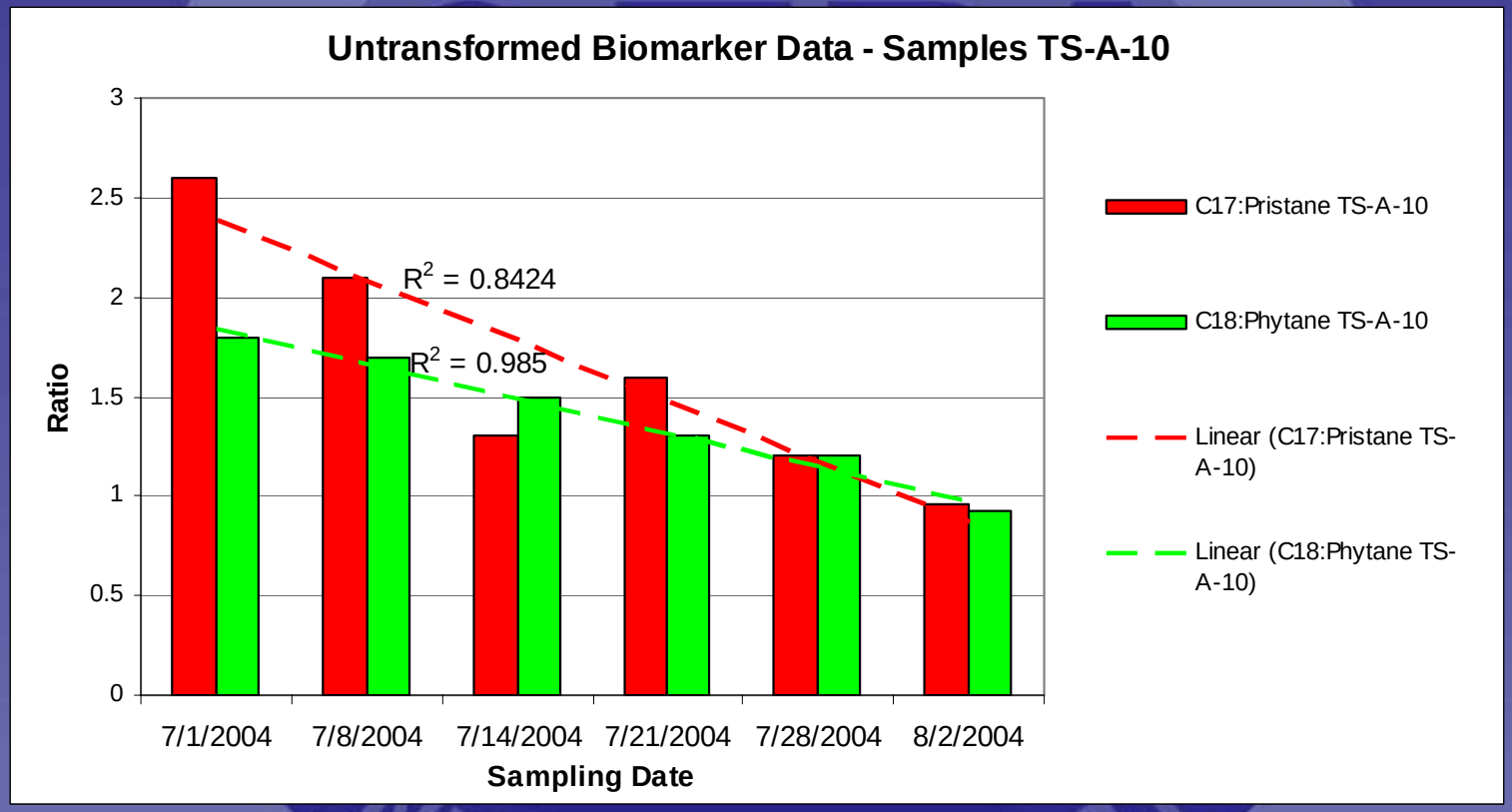
Monitoring

- Water and soil samples collected regularly by EPA and KMEP
  - Effectiveness of response measures will be determined by decreases in Total Petroleum Hydrocarbon (TPH analysis) and by “sheen tests”
  - Bioremediation will be measured specifically by Modified GC/MS “fingerprint” analysis
    - Biomarker ratios will be derived
      - C17:Pristane
      - C18:Phytane
      - Pristane:Phytane

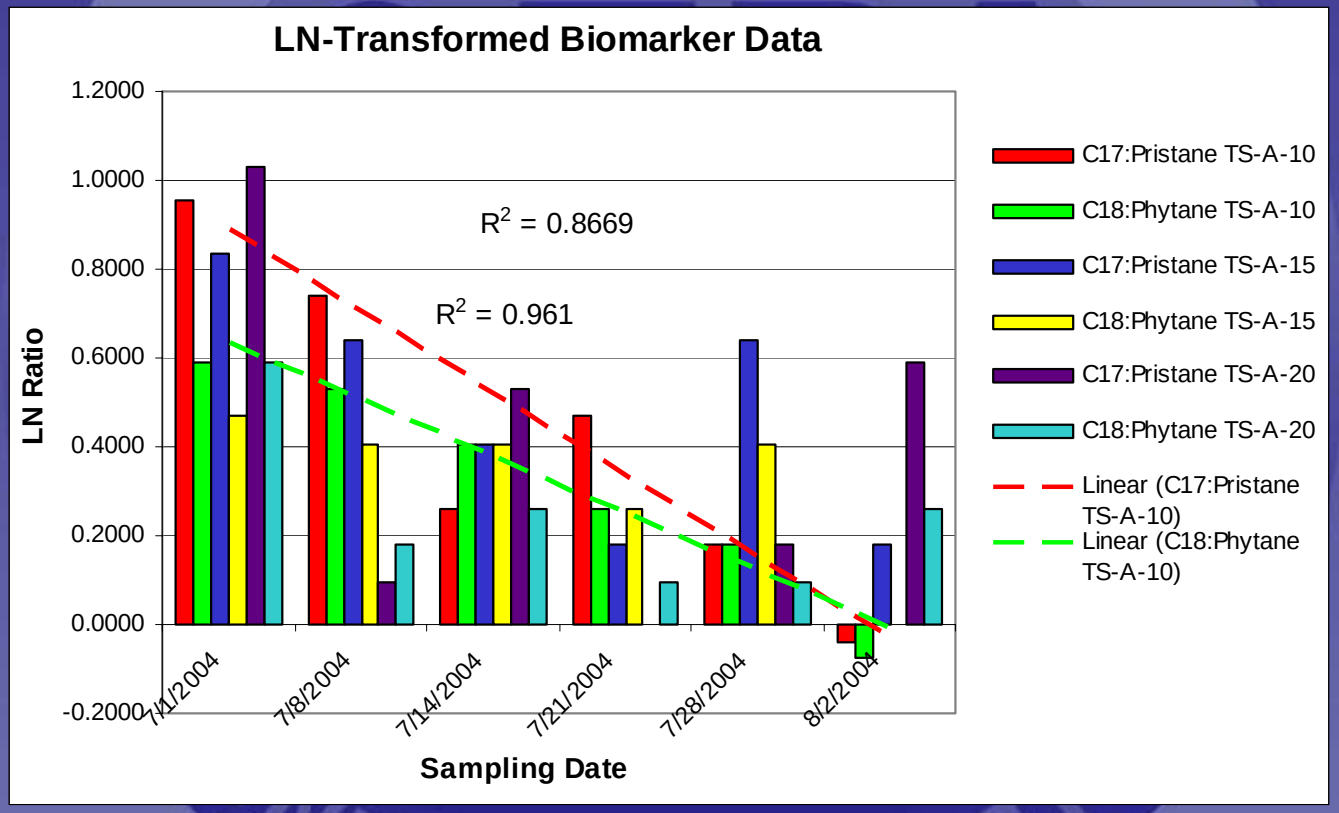
Soil Sampling Results (Division A)

Mean Concentration	8653	1907	1380	606	352
Time (days)	T0	T27	T32	T62	T99
Percent Removal	NA	77.96	84.04	92.99	95.93
Maximum Concentration	160000	13000	8700	1600	860

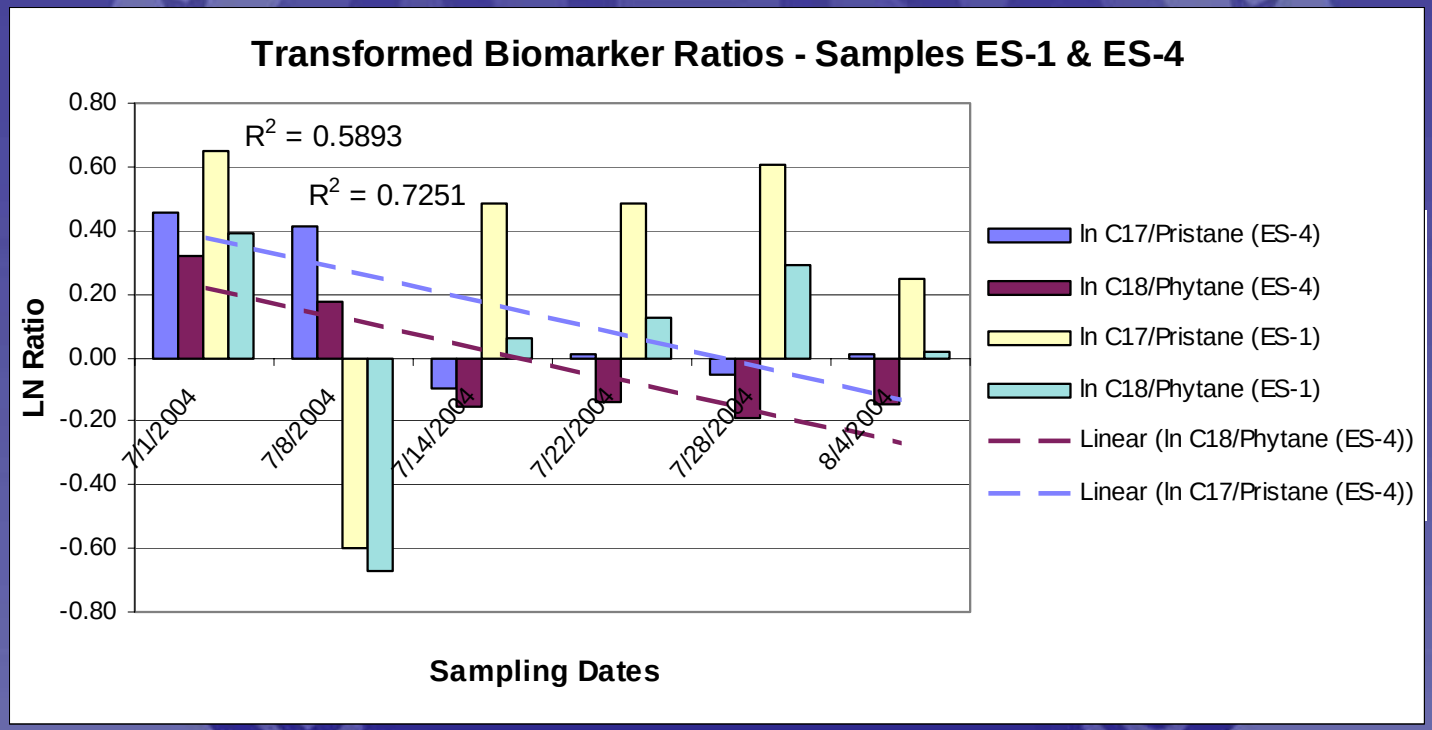
Biomarker Ratio Trends – Division A



Biomarker Ratio Trends – Division A



Biomarker Ratio Trends – Division B



Bioremediation Lessons Learned

- Start early!
  - A more timely application of nutrients in future spills will allow for improved evaluation.
- Response measures achieved interim remediation goals but raise questions
  - Was nutrient addition necessary?
- Consider other lines of evidence prior to crediting the specific approach as clearly successful.
  - TPH data should be normalized to reduce potential errors.

Keep in Touch

Harry Allen, OSC

Phone: 415-972-3063

Email: Allen.HarryL@epa.gov

Website: www.epaosc.org