

Bioremediation Of Drill Cuttings In An Arid Climate



RemTec 2003

OCTOBER 15-17, 2003

BANFF, ALBERTA



- Project Objectives
- Preliminary Tasks
- Environmental Constraints
- Current Progress

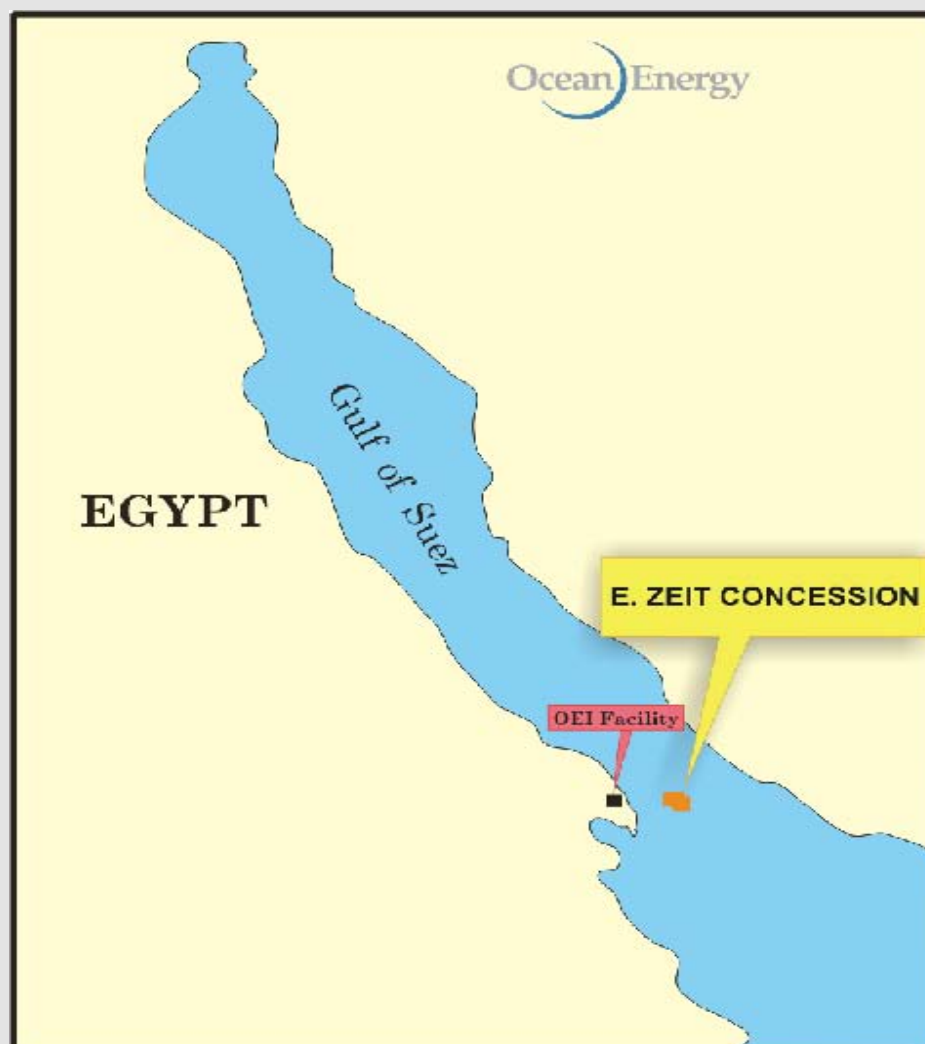


Project Objectives

- Technology transfer with local company
- To conduct the project in a safe and environmentally prudent manner
- To bioremediate the organic constituents in oil-based drill cuttings.
- Determine the most optimum onsite technique.



- Independent E& P company
- Operate in 13 Countries
- Operations in Egypt since 1995
- 11,500 BOE/Day
- 165 Employees



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Background



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Background



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Preliminary Tasks:

- Identify local contractors
- Determine site location
- Identify heavy equipment availability
- Collect and analyze soil samples
- Collect and analyze oil-based drill cuttings

Environmental Constraints:

- Arid climate
- High evaporation rate
- Extreme temperatures
- Lack of nutrients
- Lack of microorganisms



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System Design:

- Area: 1 Hectare
- 20 ml liner
- Soil berms-3 ft high
- Plot layout



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Construction



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Construction



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Construction



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Construction





4 Test Amendments

Plastic Cover & Fertilizer 3	Plastic Cover & Manure 4
Straw Cover & Fertilizer 2	Straw Cover & Manure 1

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Treatments





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Treatments



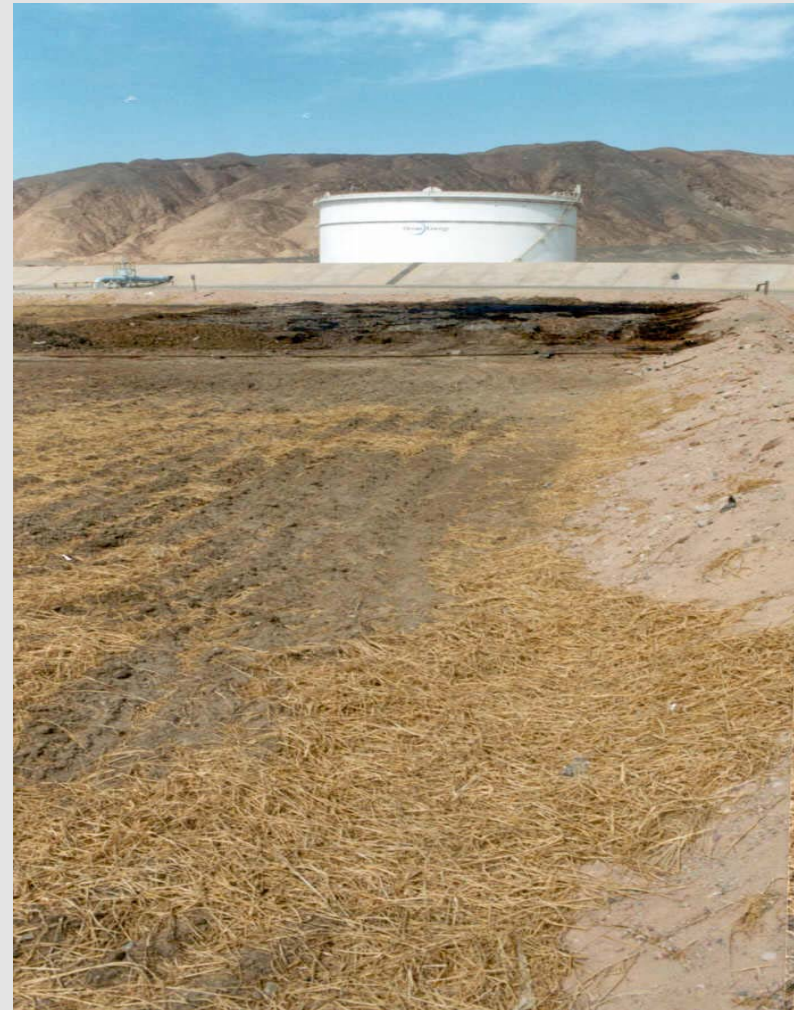
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Treatments



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Treatments





Field Monitoring

- pH
 - Moisture content
 - Temperature
 - Conductivity
-
- Monitoring determined frequency of aeration, watering, and nutrients



Lab Analysis Program:

- Background samples to obtain baseline data of trace metals and chloride concentrations.
- Oil based drill cuttings will be sampled for oil content, trace metals, and chlorides.



Lab Analysis Program Continued:

- Chemical and biological analysis
- TPH
- Heavy metals (leachable)
- Chloride (or major anions)
- Phosphates
- Nitrates
- Standard Plate Count



Microbial Identification:

Chicken Manure

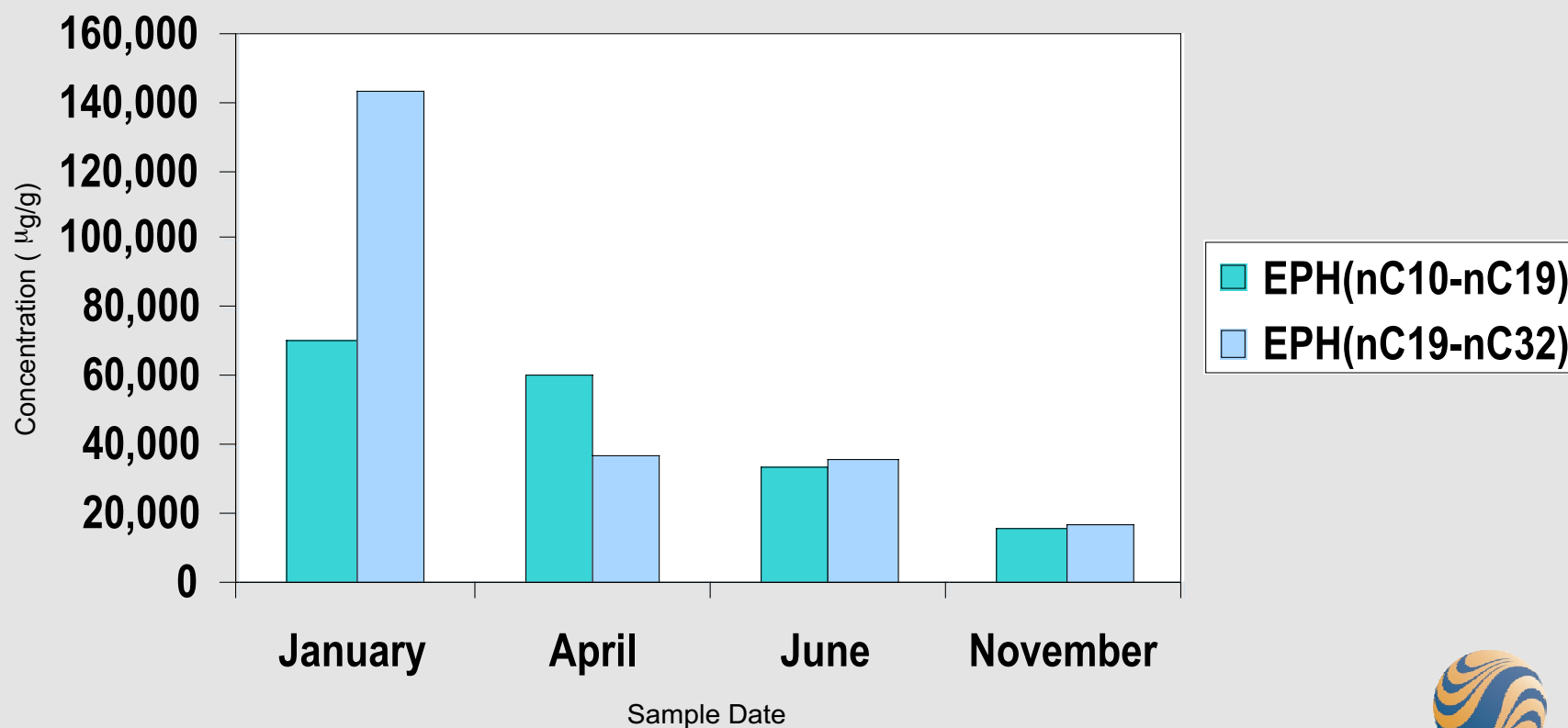
- Curtobacterium Albidum Bacillus sp
- Thiobacillus versutus
- Enterobacter agglomerans aerogenic

Hydrocarbon Degradars

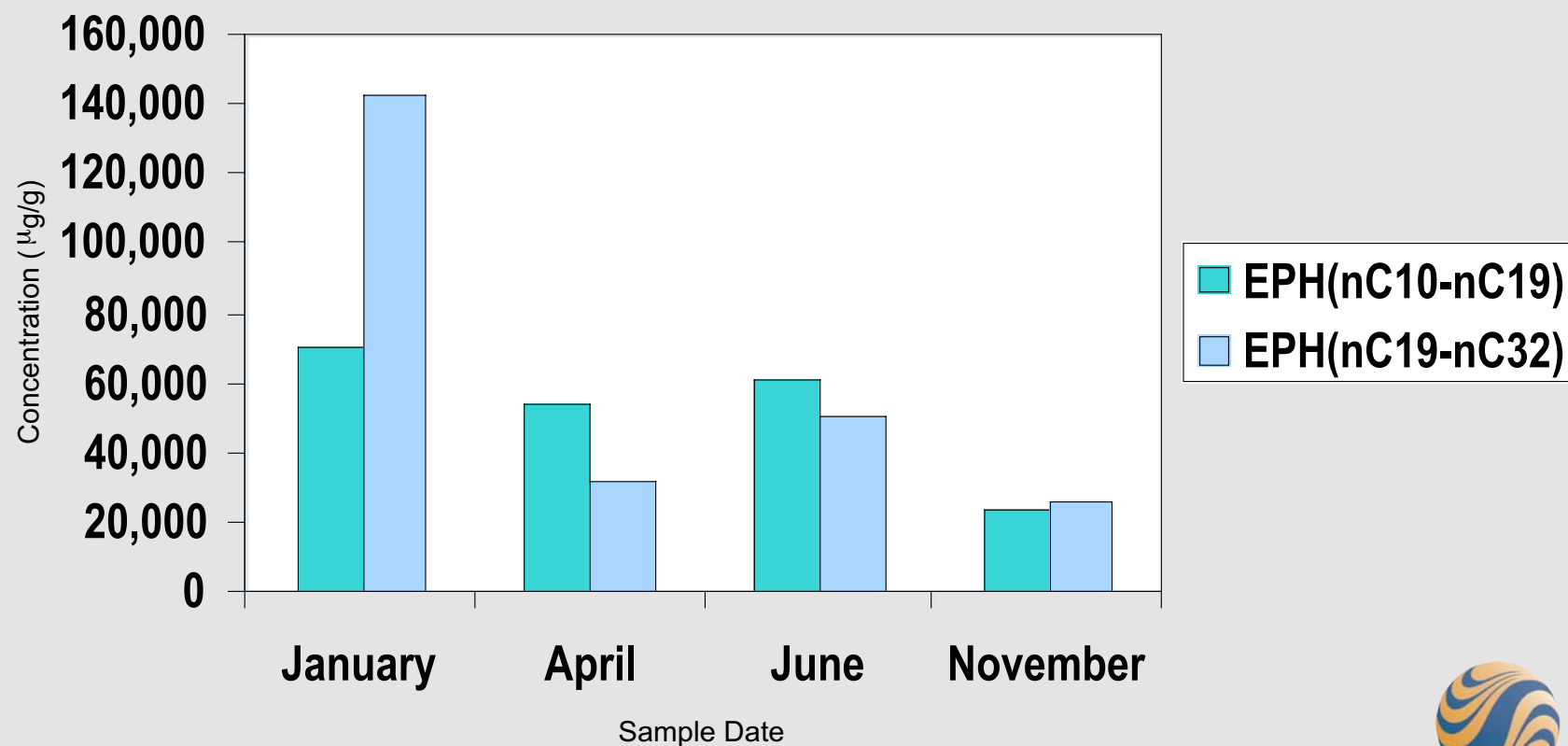
- Acinetobacter lwoffii
- Pseudomonas putida
- Pseudomonas aminovorans

Total Soil Bacteria Count - 11,000,000 MPN/gm

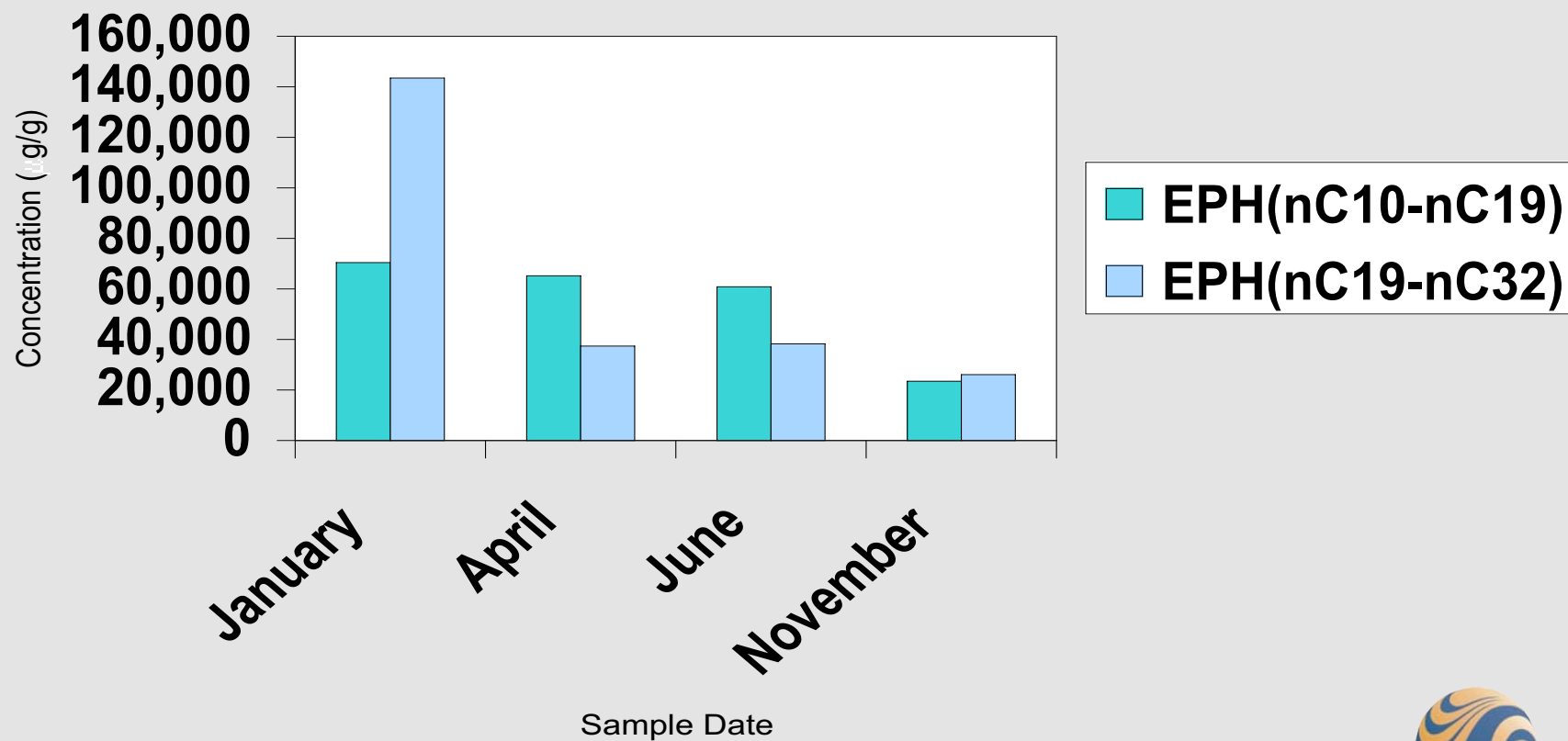
Section 1 - 2001



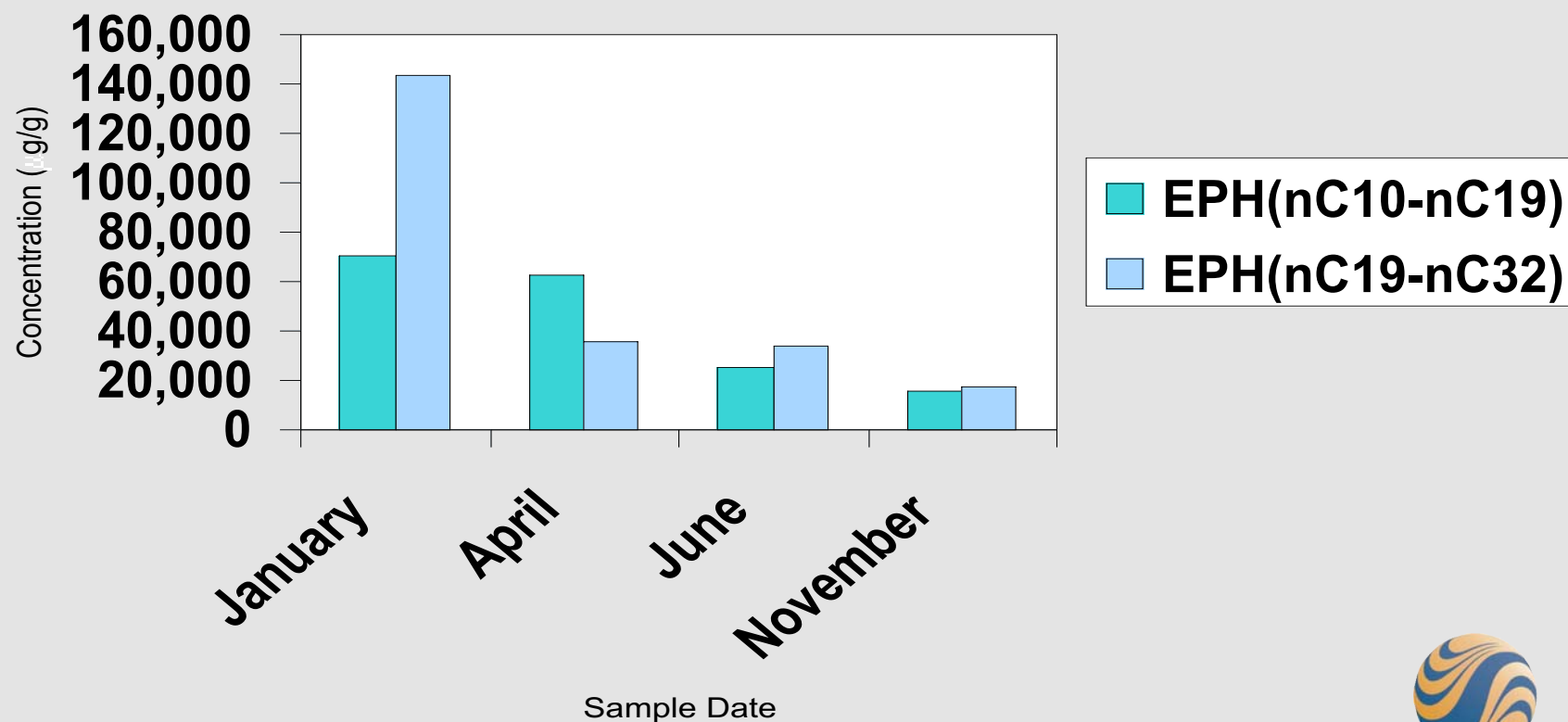
Section 2 - 2001



Section 3 - 2001



Section 4 - 2001



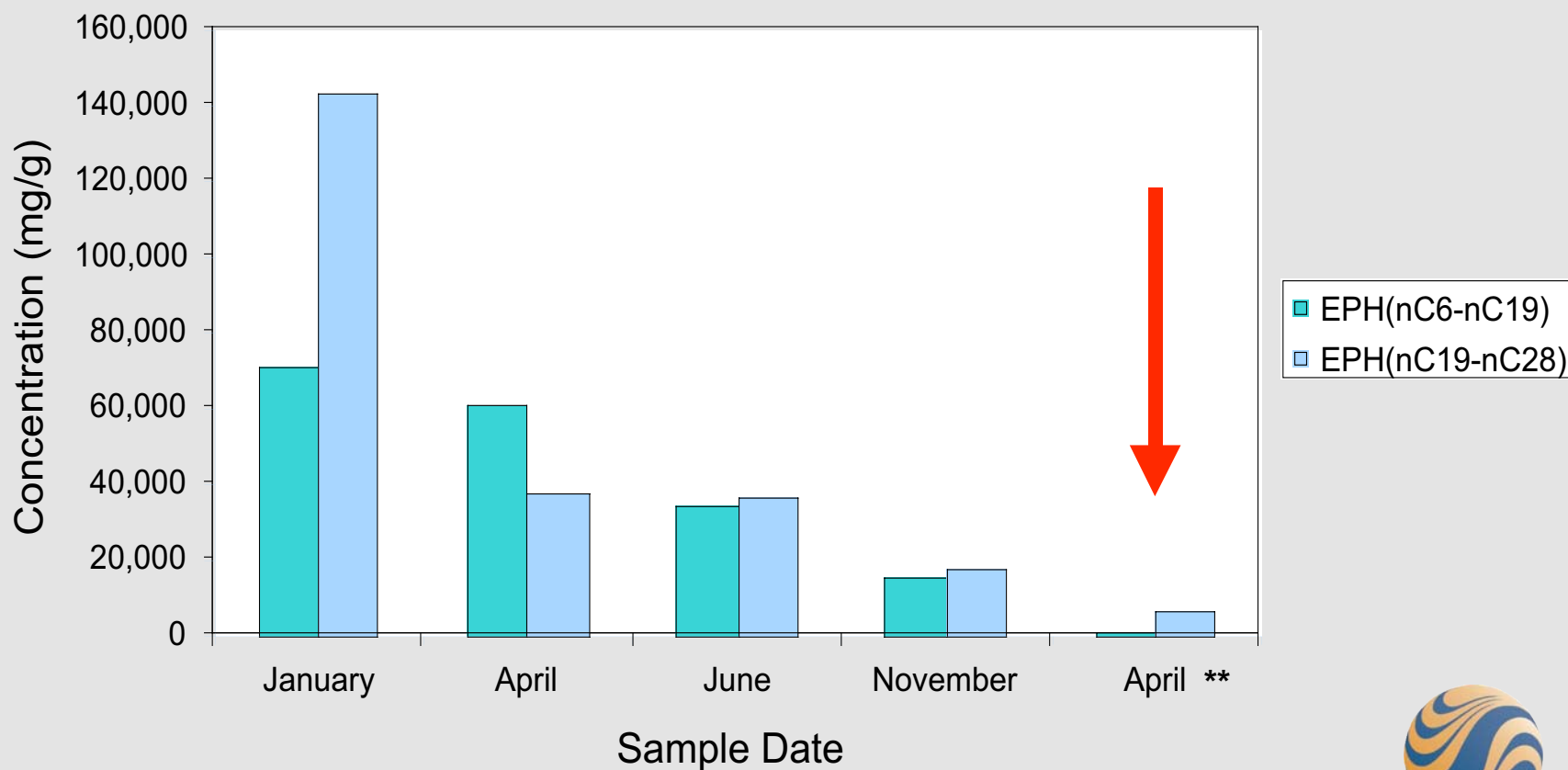
System Re-design:

- Plastic covering was discontinued and straw was replaced.
- Fertilizer was discontinued and manure was continued.

Original Fertilizer 2	Original Manure 1	
Holding Area for Future Cuttings	4	3



Section 1 - 2003

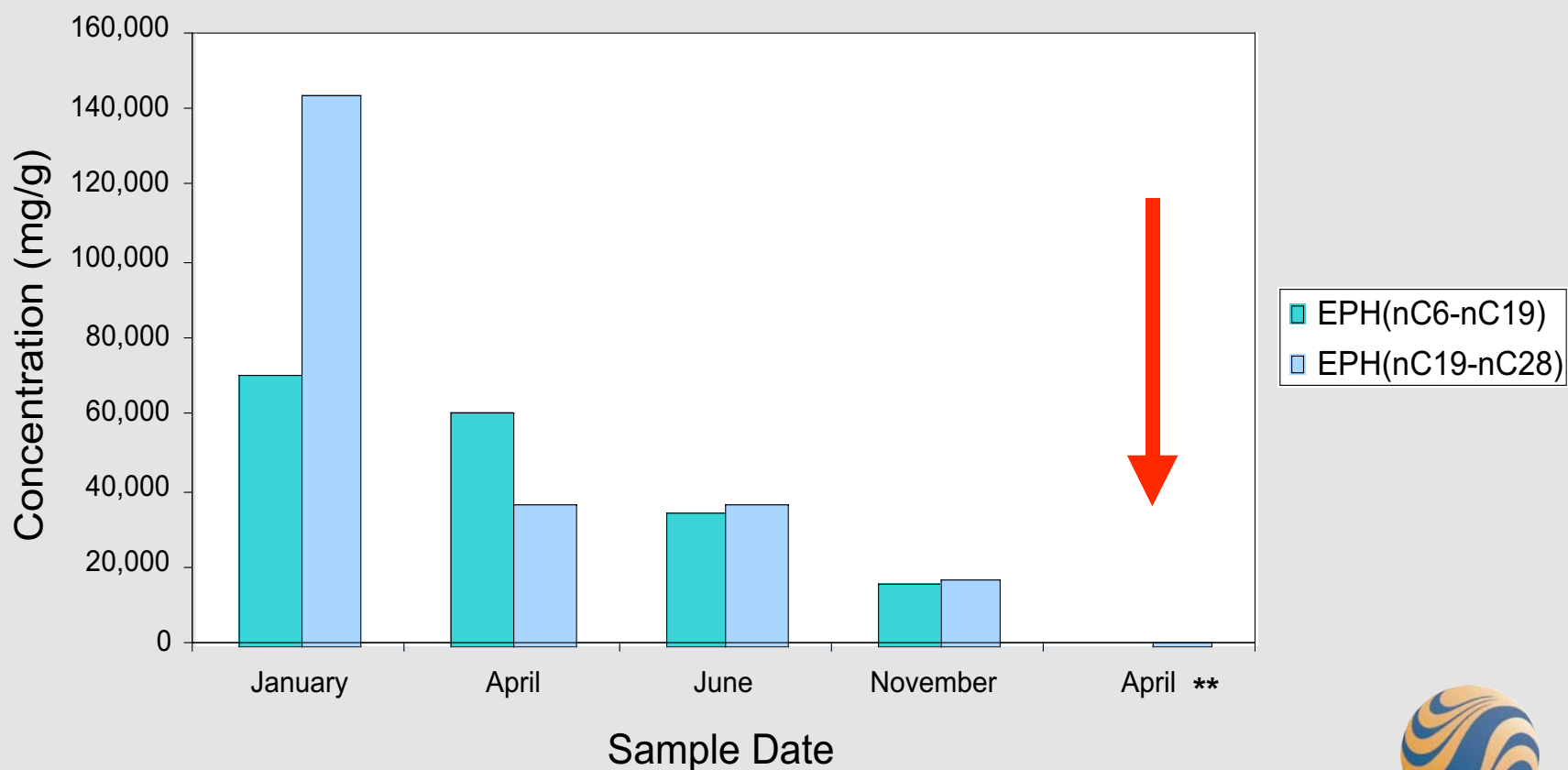


** April stats are TPH (nC6-nC12) and TPH (nC12-nC28) Total TPH (C6-C35) = 7600



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Section 2 - 2003



**** April stats are TPH (nC6-nC12) and TPH (nC12-nC28) Total TPH (C6-C35) =1200**



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Project Objectives:

Initial Goal	Achieved	Not Achieved
Technology transfer		✓
Conduct project safely	✓	
Bioremediate OBM	✓	
Determine optimum technique	✓	

- September 2003: Started C-1 OBM Cuttings bioremediation.
- Bioremediation has become the Devon's preferred waste management method in Egypt.
- Bioremediation has been approved by Egypt's EEAA permitting process.



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Comments & Questions



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