



→ *ISCR for Chlorinated Compound Remediation in  
the Tropics: What to Expect, How to Adjust, Results*

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Twelfth International Conference on Remediation of Chlorinated and Recalcitrant Compounds

G11\_1530\_#298\_Aluani

May 22-26, 2022

# PRESERATION STRUCTURE

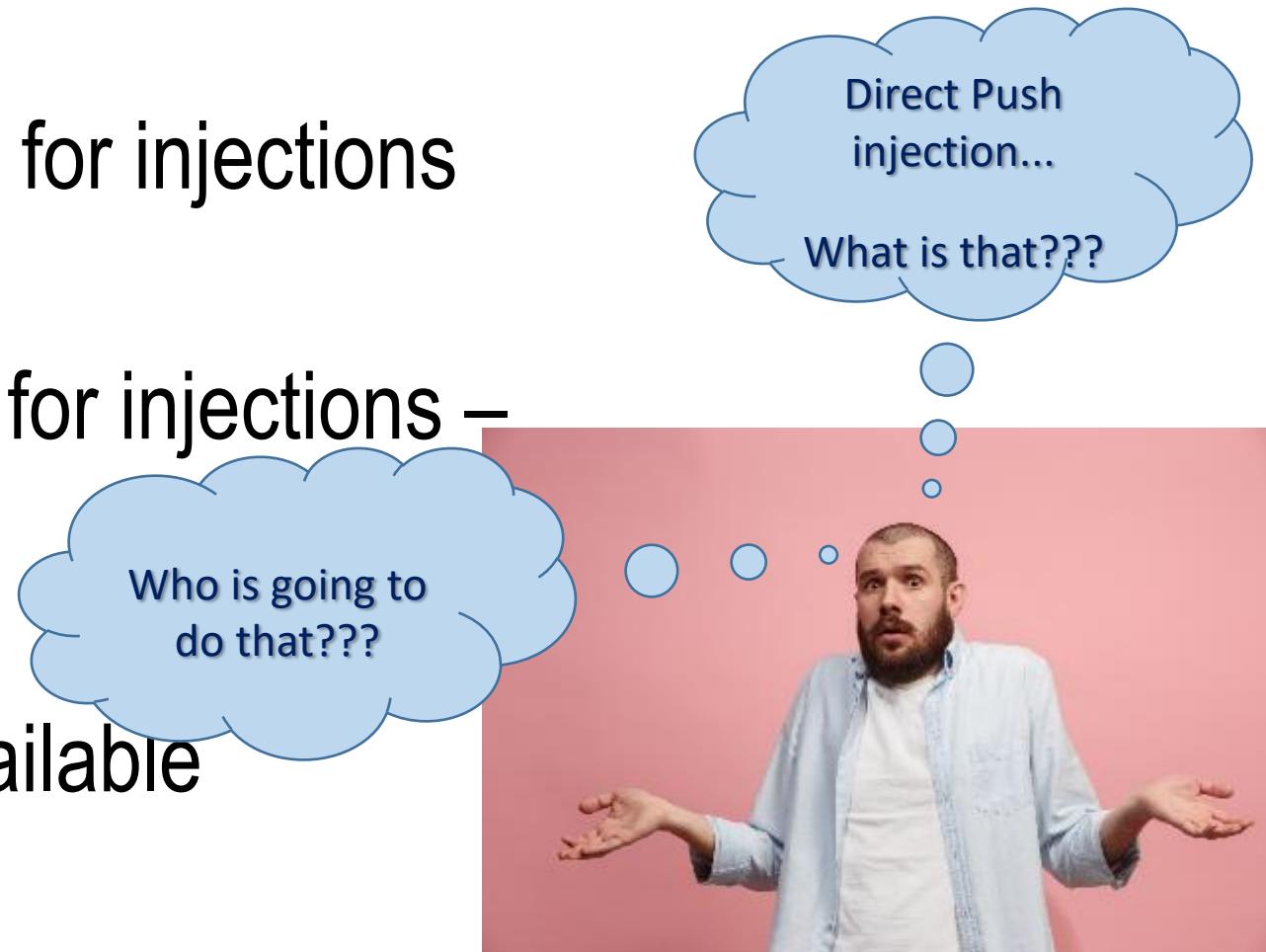
- ✓ Early Days
- ✓ Local Infra Structure
- ✓ Limitations / Extreme Conditions
- ✓ Geology/Lithology
- ✓ Equipments/Tools Adjustment
- ✓ Amendments
- ✓ Performance Temperature/Bacterial Activity
- ✓ Strategy Adjustment
- ✓ Results
- ✓ Next Steps

# EARLY DAYS



# LOCAL INFRA STRUCTURE

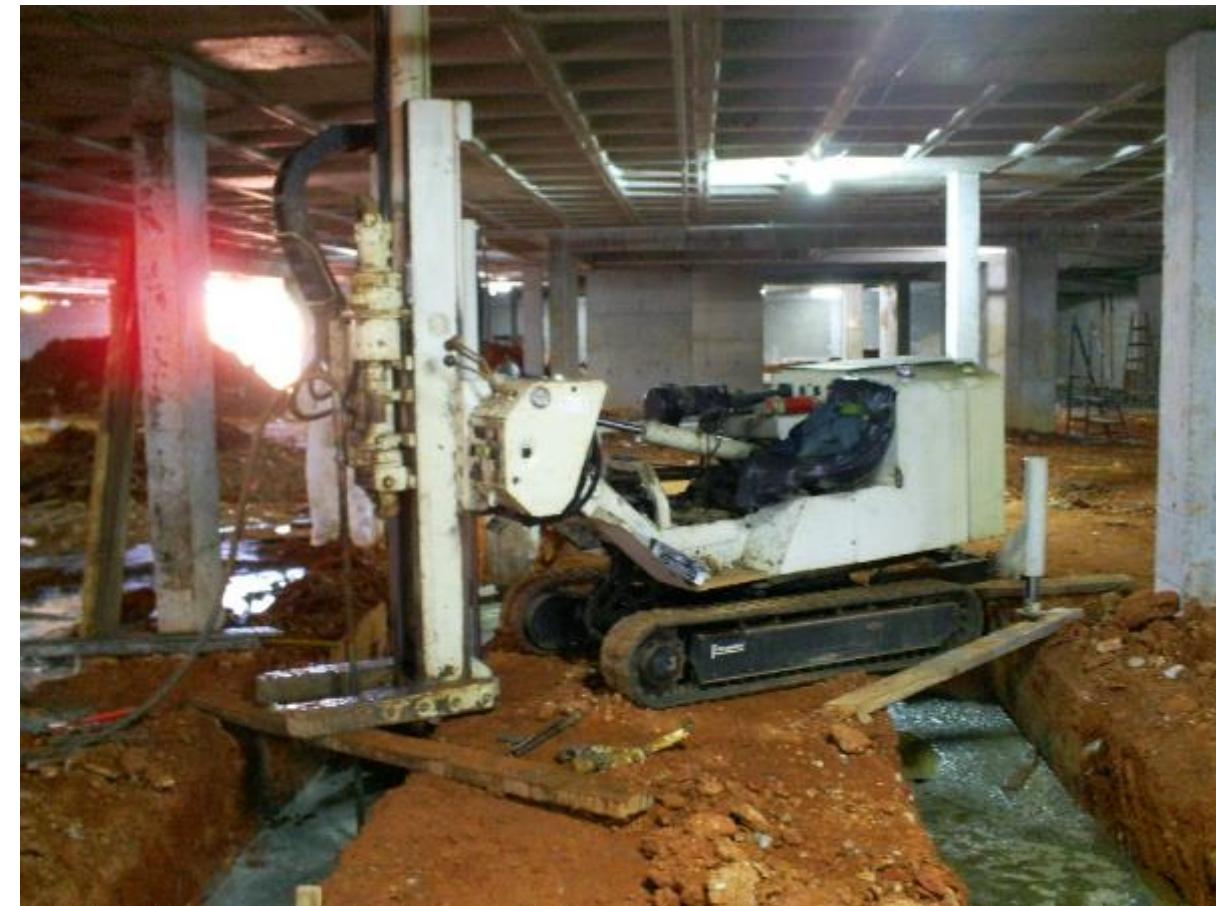
- ✓ No local experience or structure for injections
- ✓ No local equipments availability for injections –  
need to use drilling companies
- ✓ Few direct push equipments available
- ✓ No injection tools available



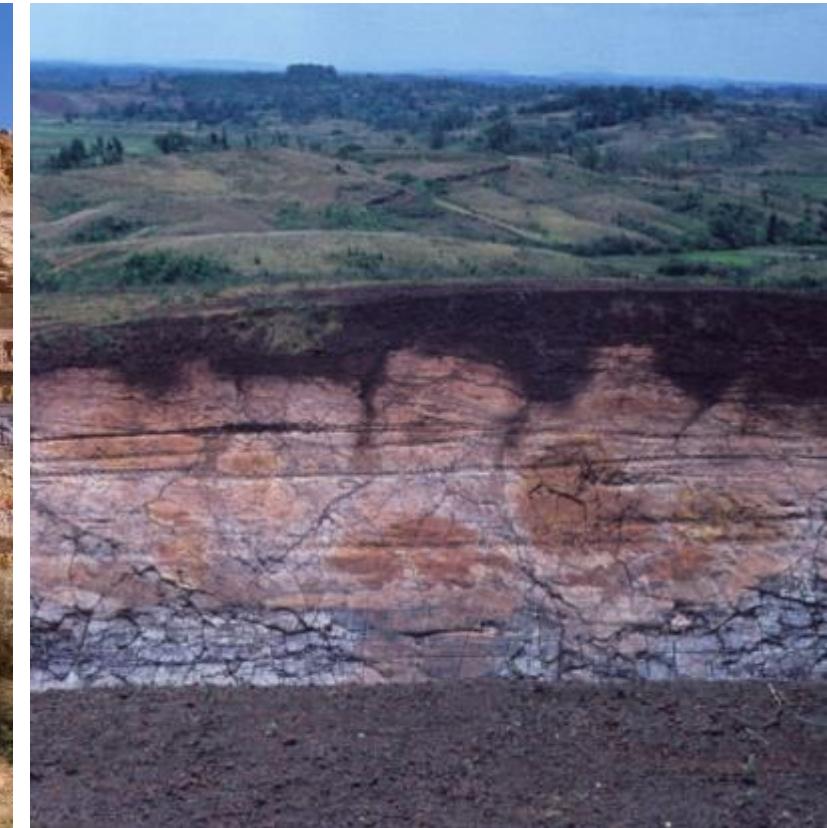
# ACCESS LIMITATIONS



# EXTREME CONDITIONS



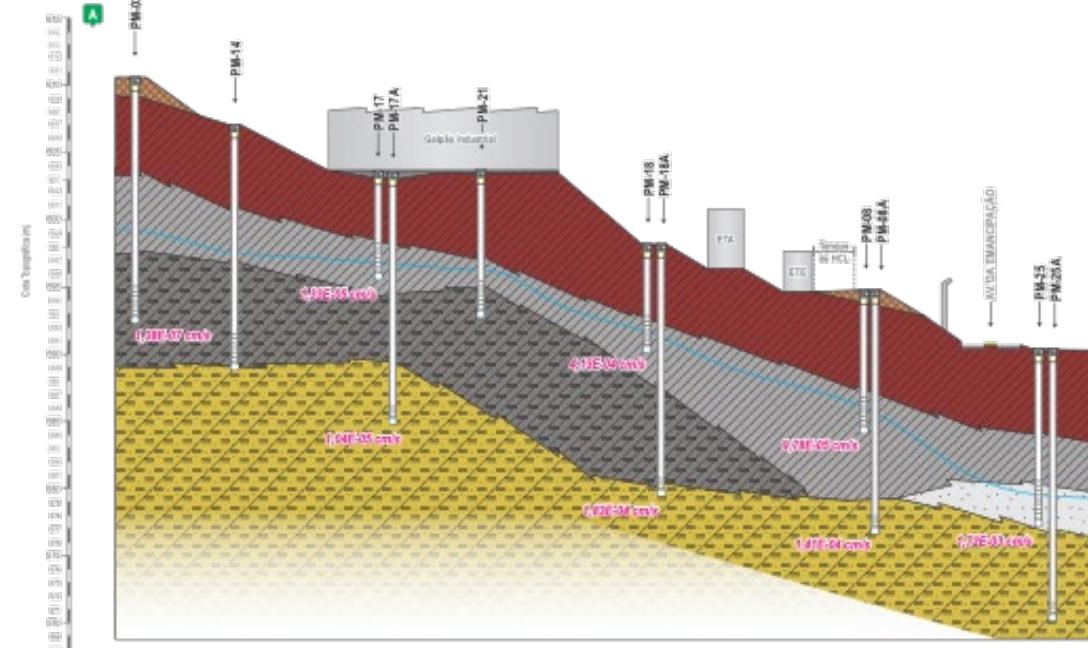
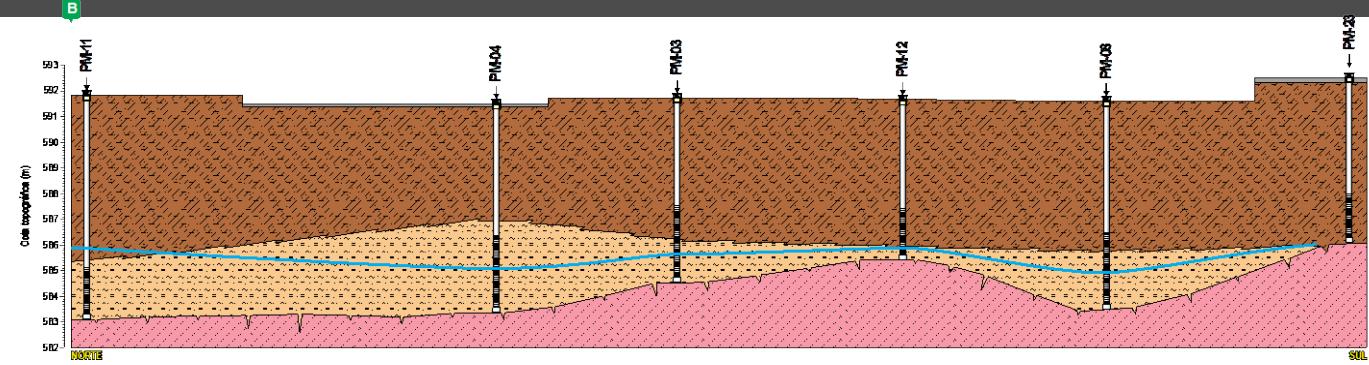
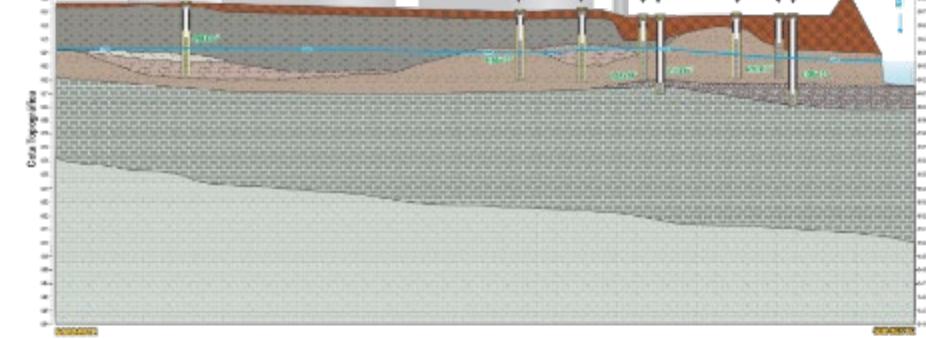
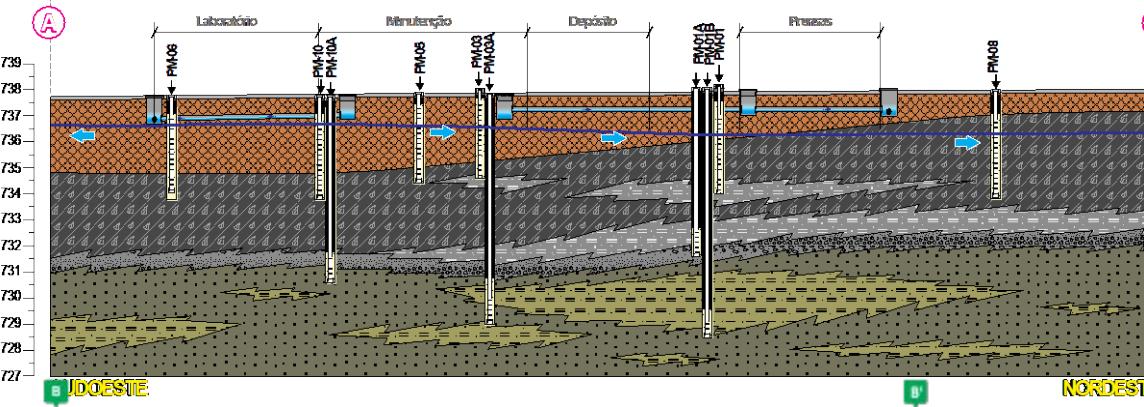
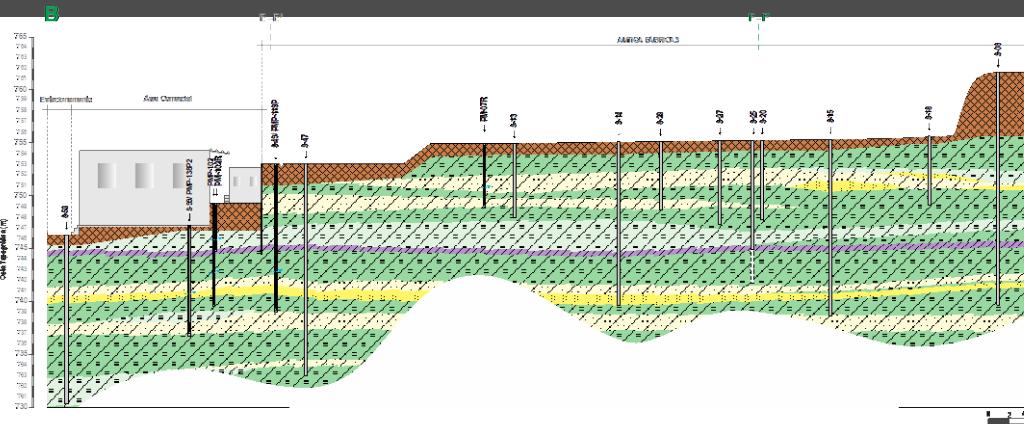
# GEOLOGY / LITHOLOGY



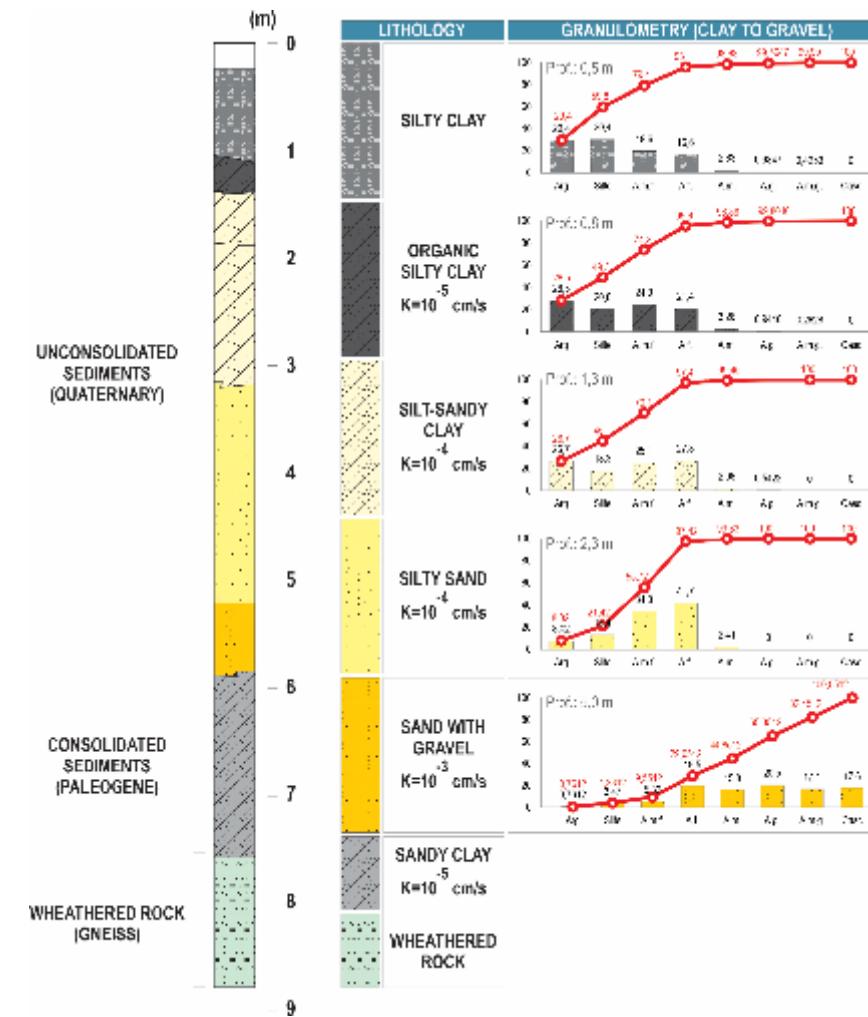
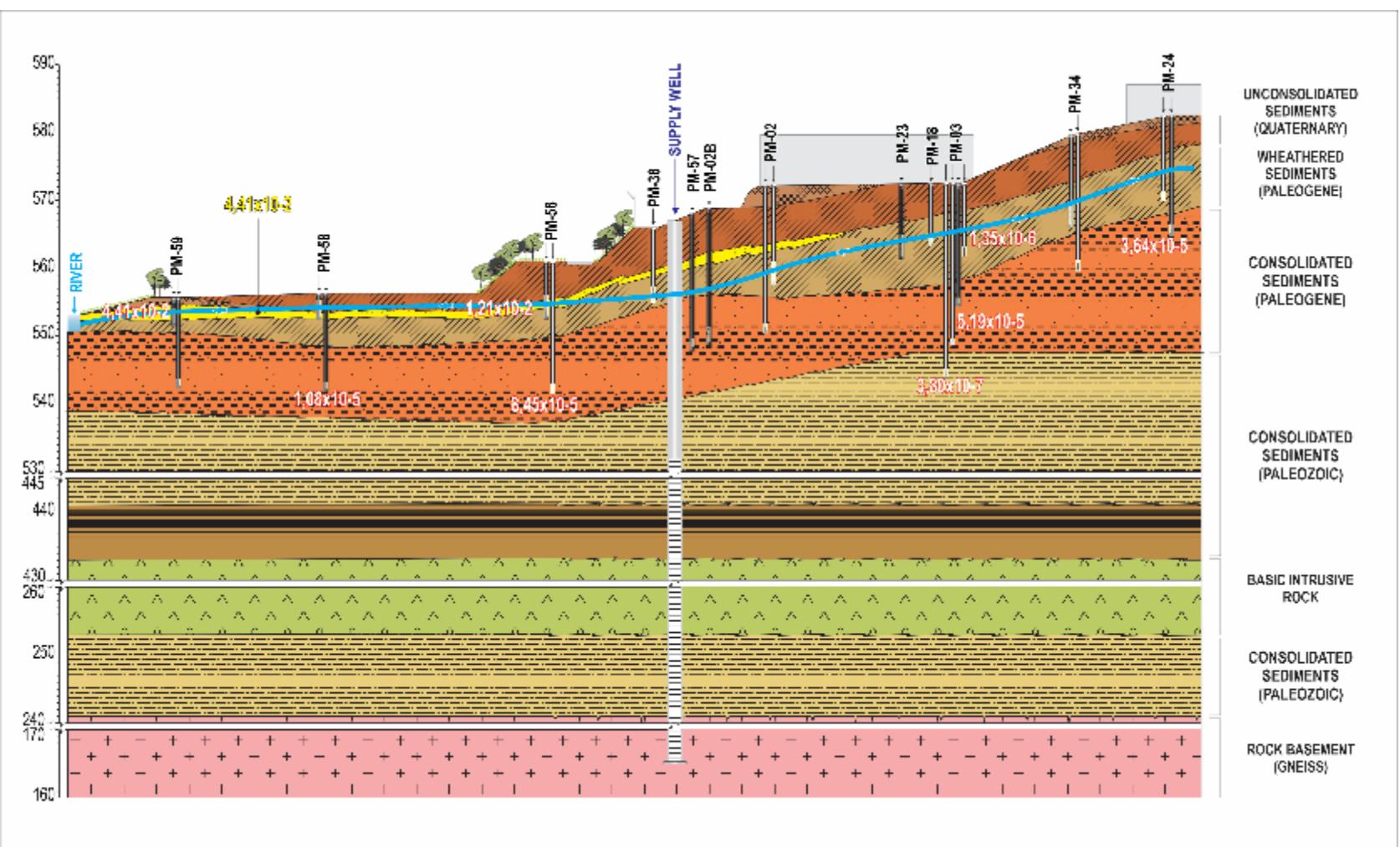
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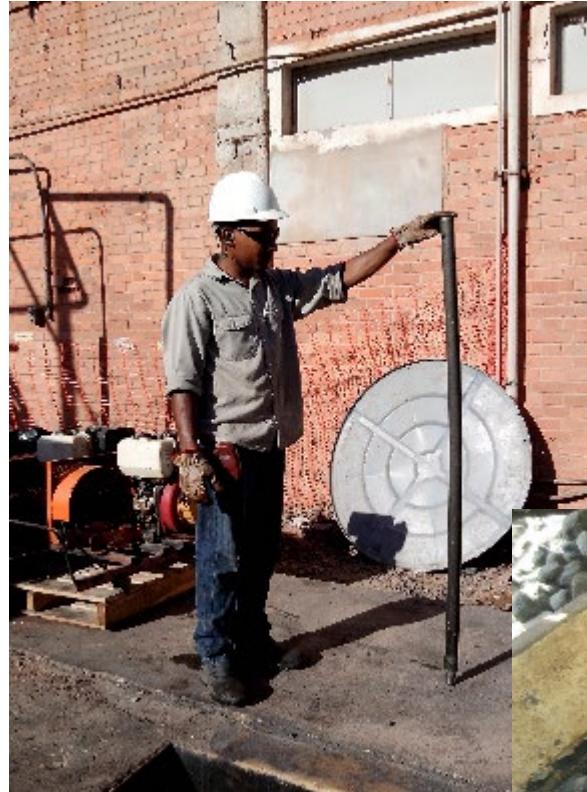
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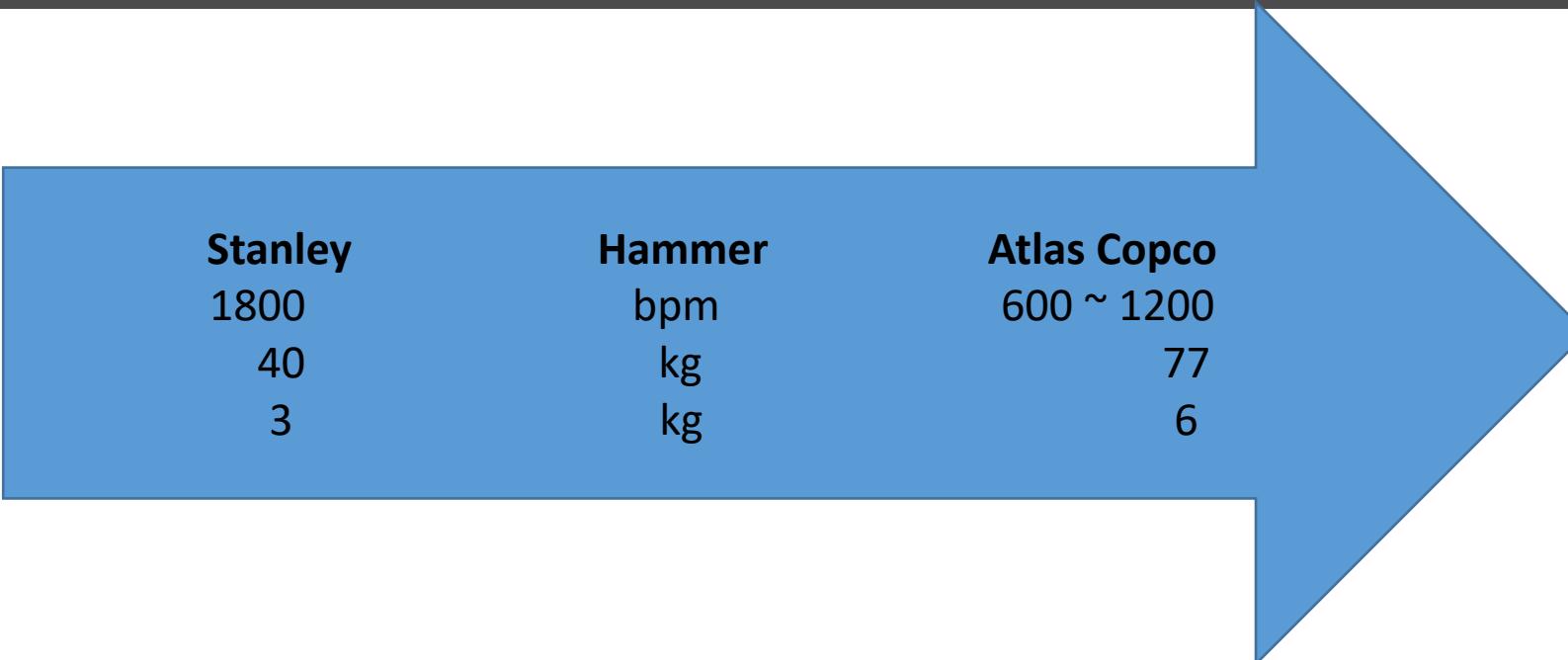
# GEOLOGY / LITHOLOGY



# EQUIPMENTS / TOOLS SITUATION



# EQUIPMENTS / TOOLS ADJUSTMENT



# AMENDMENTS – LEGAL LIMITATIONS

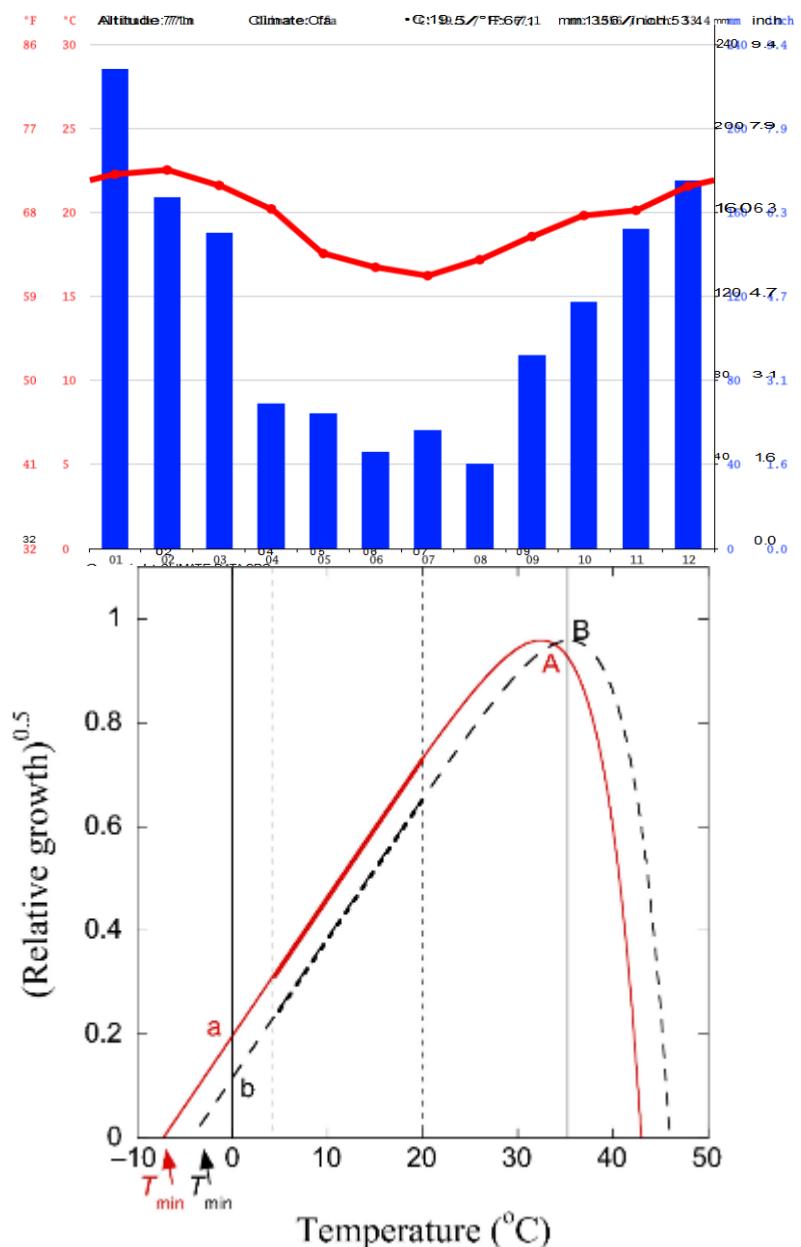


- ✓ IBAMA Permit – any in Situ reagent must be previously approved by the Federal Environmental Agency
  - ✓ approval process take years
- ✓ Bio augmentation is NOT allowed

- ✓ Different formulation:
  - ✓ Lack of some raw materials availability
  - ✓ Geochemistry demanded different formulation for performance
  - ✓ Lots of bench scale and pilot tests
- ✓ Development of manufacturing suppliers – finer reagents
- ✓ Soil pH adjustment in formula

# PERFORMANCE – FAVORABLE NATURAL CONDITIONS

- ✓ Avarage temperatures 74° F (more stable year round);
- ✓ Soil rich in organic matter
- ✓ Soil with much more nutrientes naturally available
- ✓ Soil with high humidity and GW level variation
- ✓ Generally, pH in a favorable range for the microbiology activity

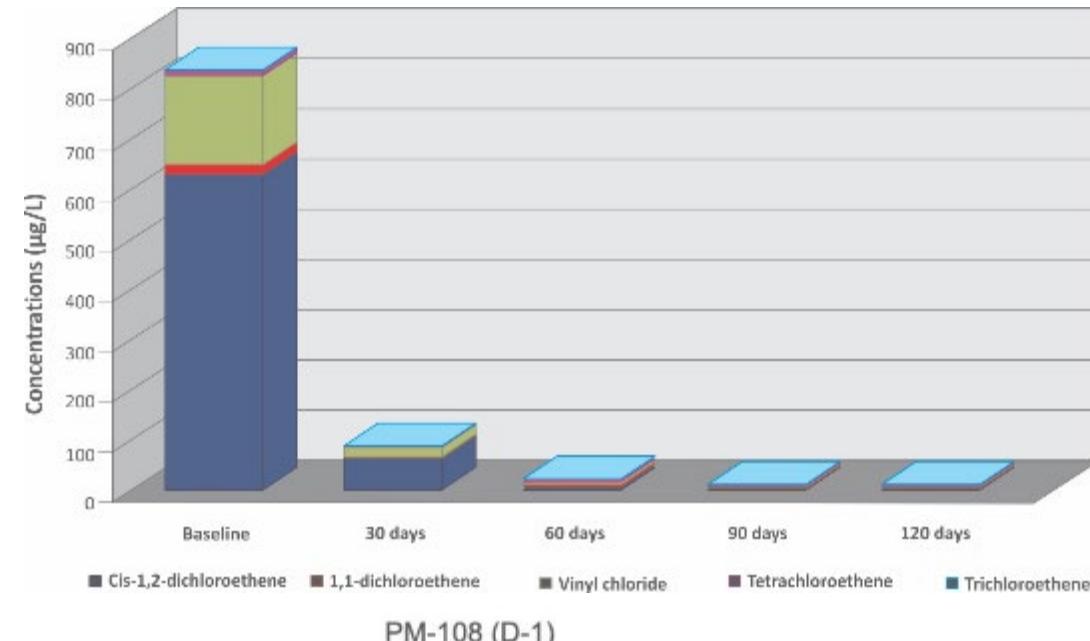
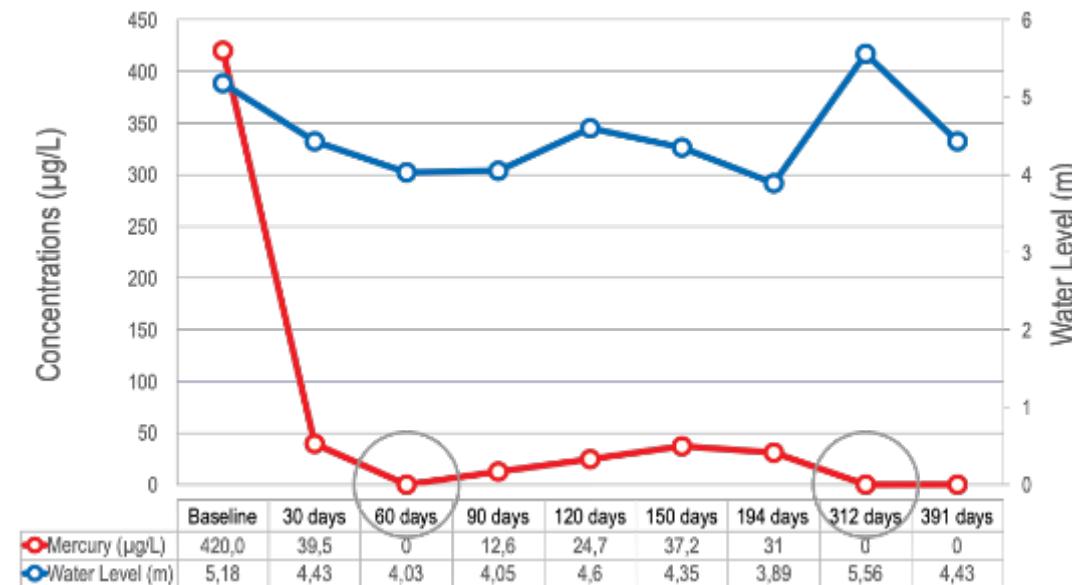


# REMEDIATION STRATEGY ADJUSTMENT

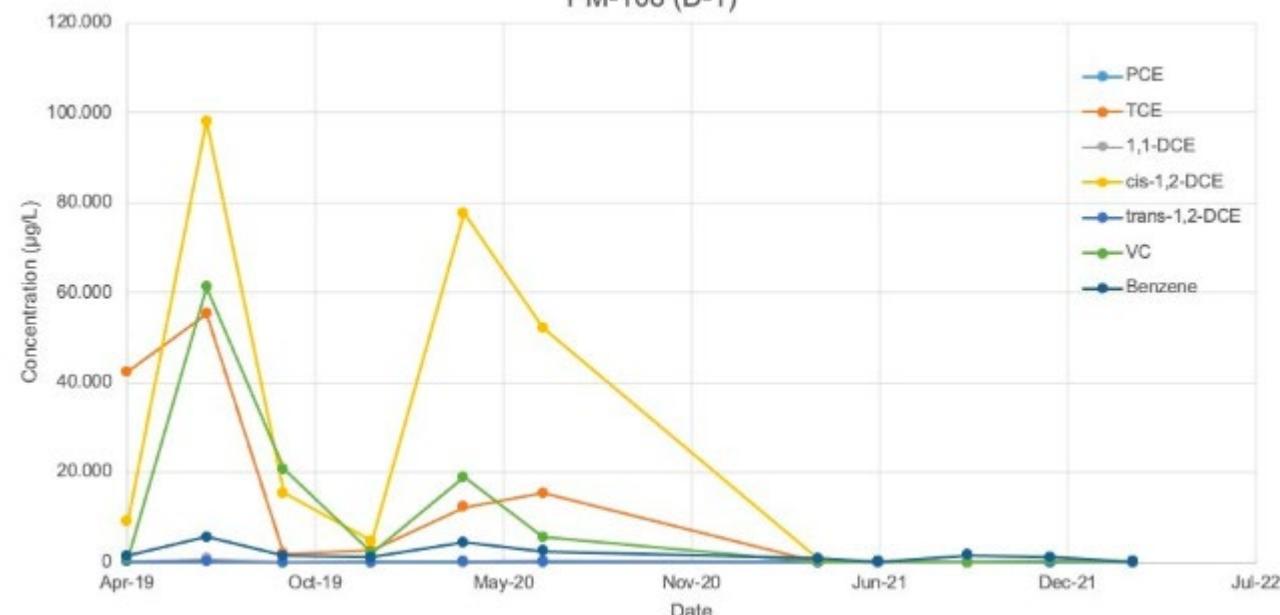
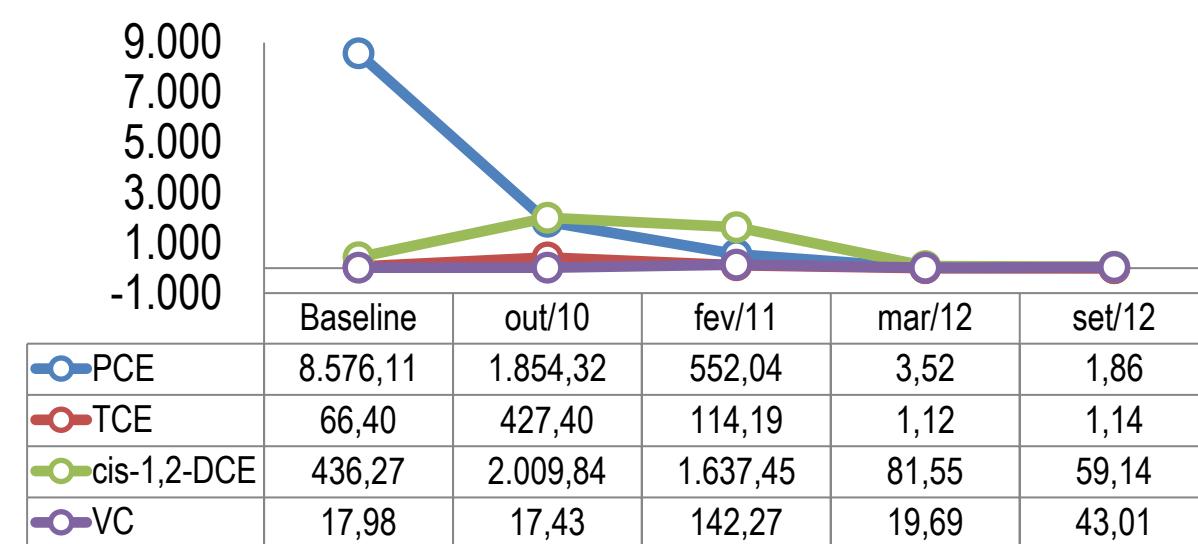
- ✓ Inheriting former remediation trials
  - ✓ Several ISCO sites
    - ✓ ↓ pH
    - ✓ ↑ ORP
    - ✓ ↓ microbiology
- ✓ Use of biostimulators
- ✓ Amendments formula adjusted for pH and ORP conditions



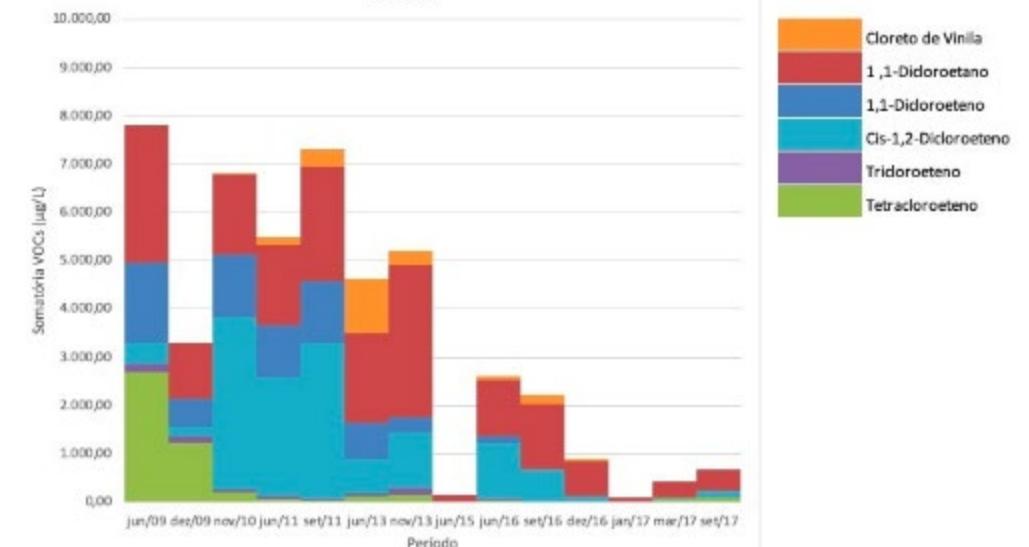
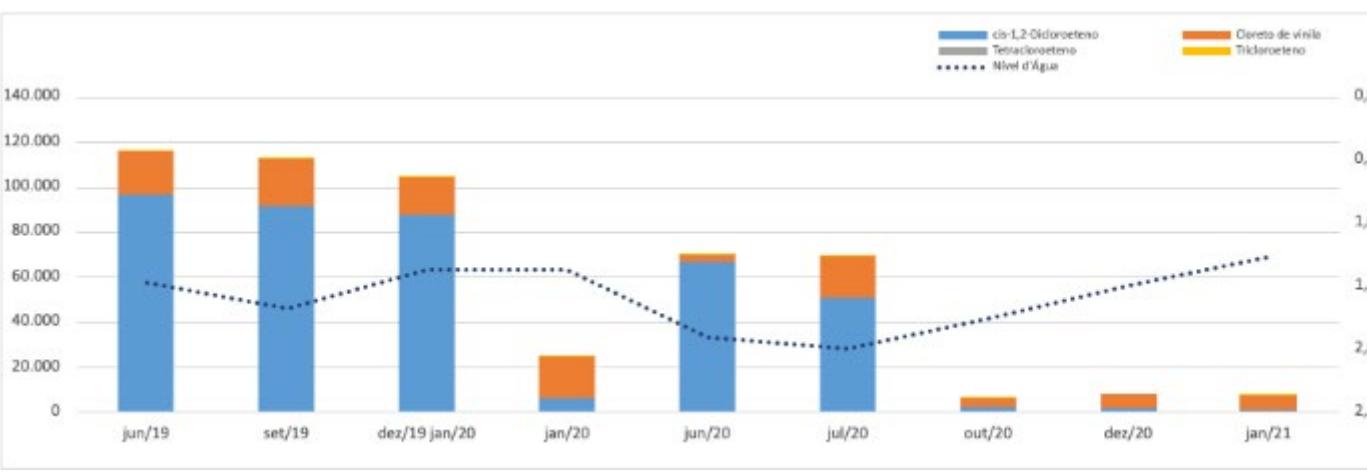
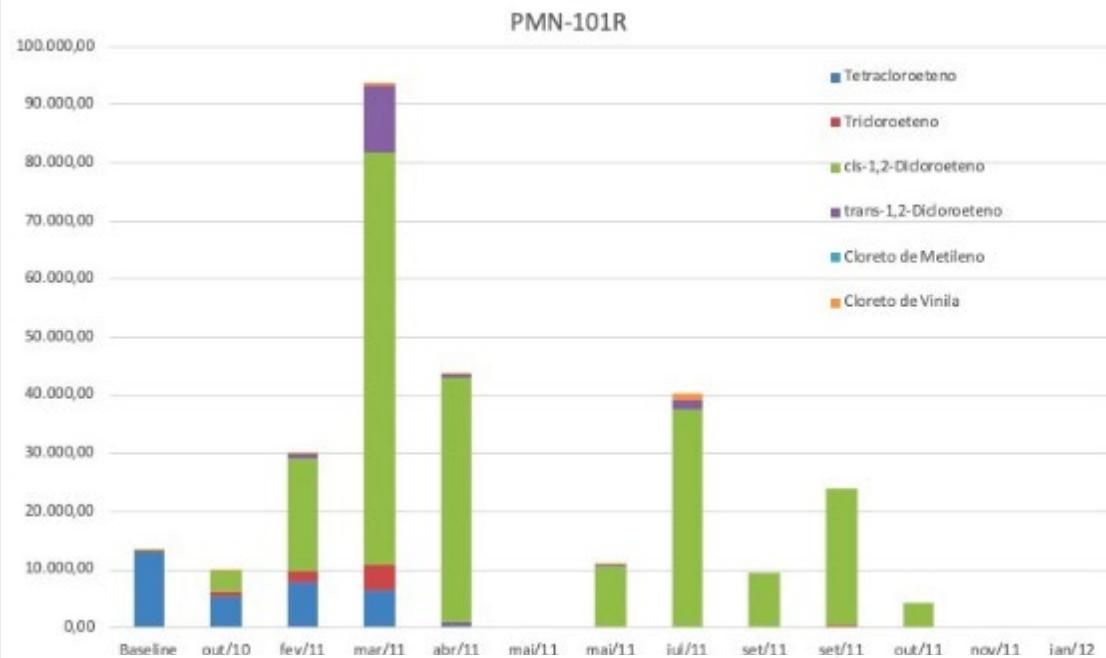
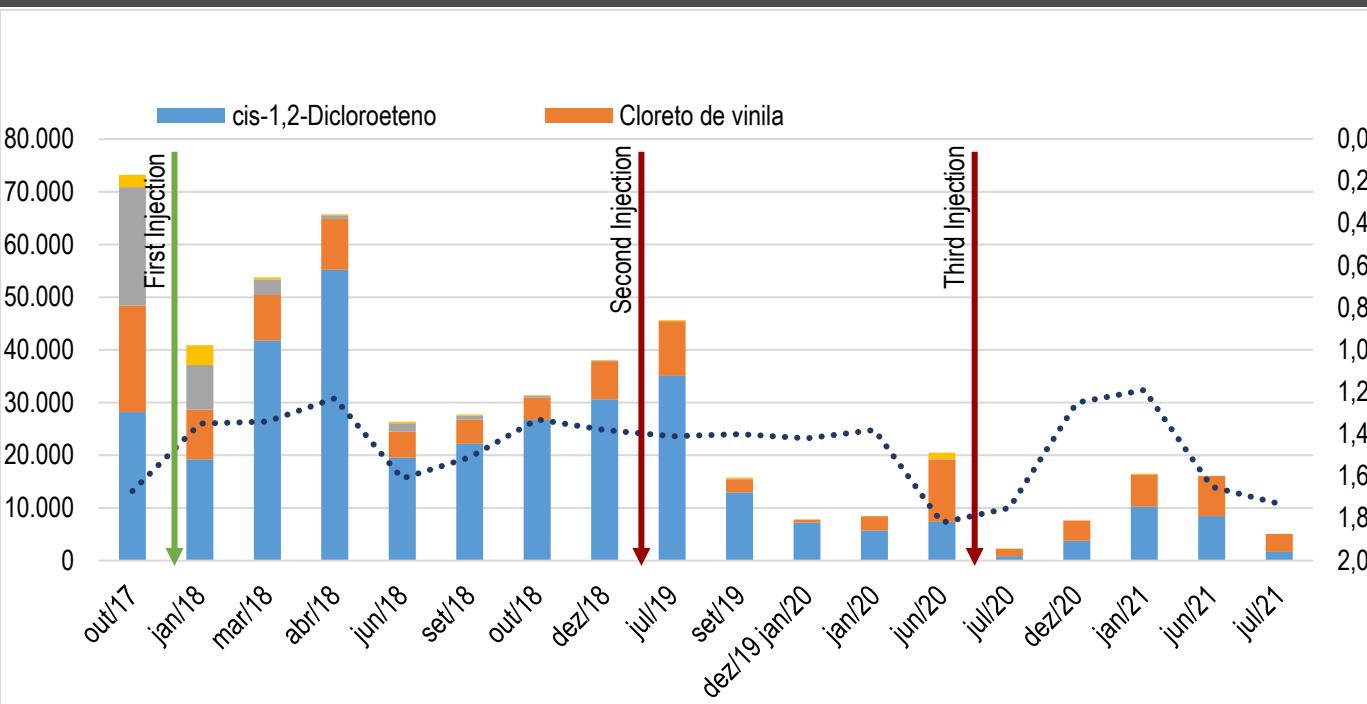
# RESULTS



Average Concentrations ( $\mu\text{g/L}$ )

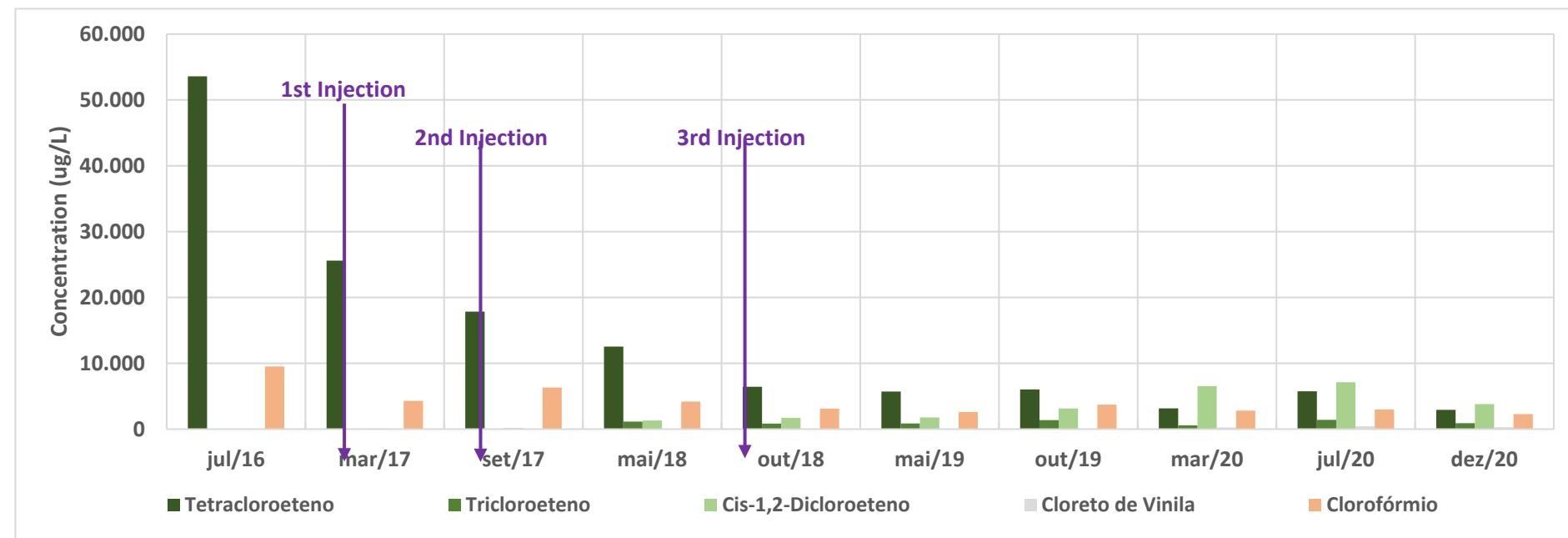
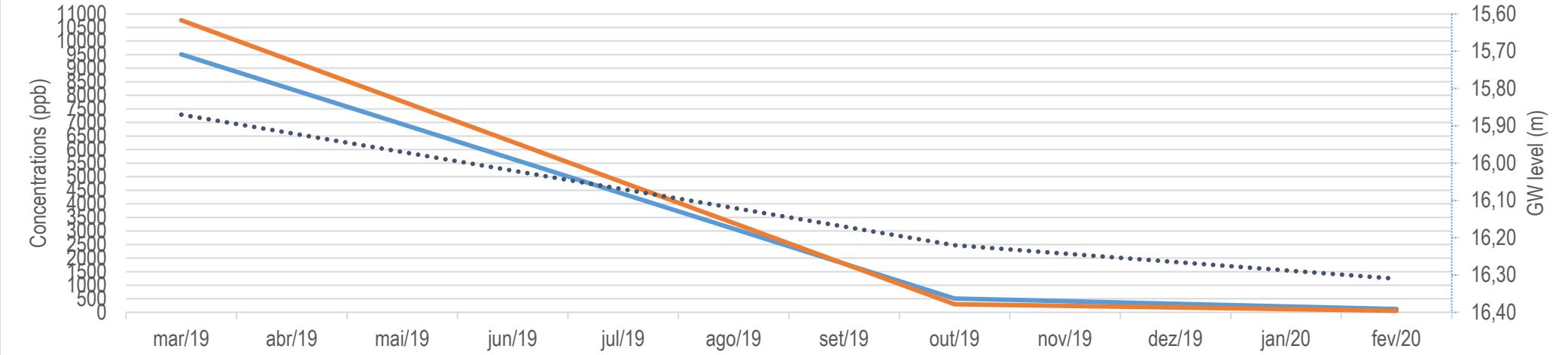


# RESULTS



# RESULTS

Total and Hexavalent Chrome Concentrations



- ✓ Focussing in performance:
  - ✓ Microbiology studies
  - ✓ New formula adjustment – enhance abiotic reaction
  - ✓ Direct push equipment and injection tools upgrade

A photograph of an underwater scene. Sunlight filters down from the surface, creating bright highlights on the sandy bottom and illuminating various rock formations and marine life. The water is clear, allowing for a good view of the ocean floor.

# THANKS

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