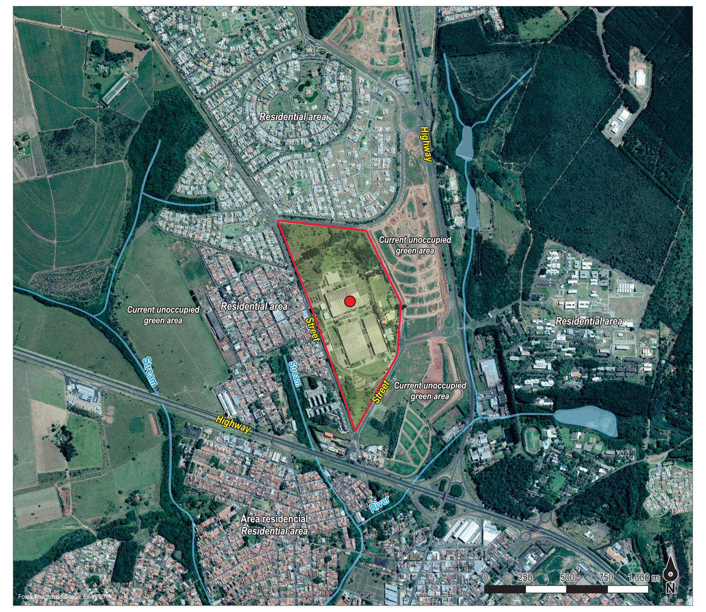
Chlorinated / Boron Bioremediation Challenges in Brazil

Authors: Sidney Aluani (saluani@sgw.com.br), Cristina Spilborghs, Eduardo Pujol, Fabiola Tomiatti, Natália Nascimento, Tatiane Xavier (SGW Services, São Paulo, SP, BRAZIL)
Jim Mueller (Provectus Enviromental Products, – Freeport, IL, USA) - Mike Skalzi and Wade Meese (IET, – Pipersville, PA, USA)

Background / Objectives

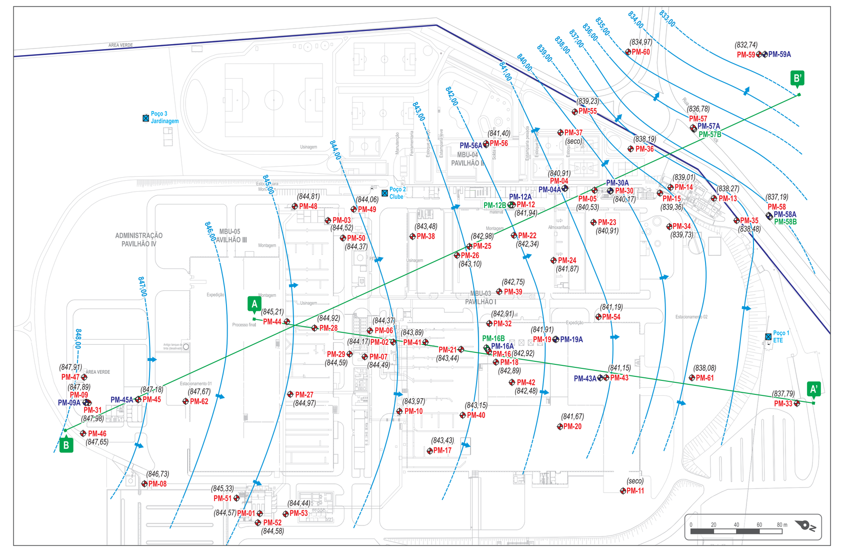


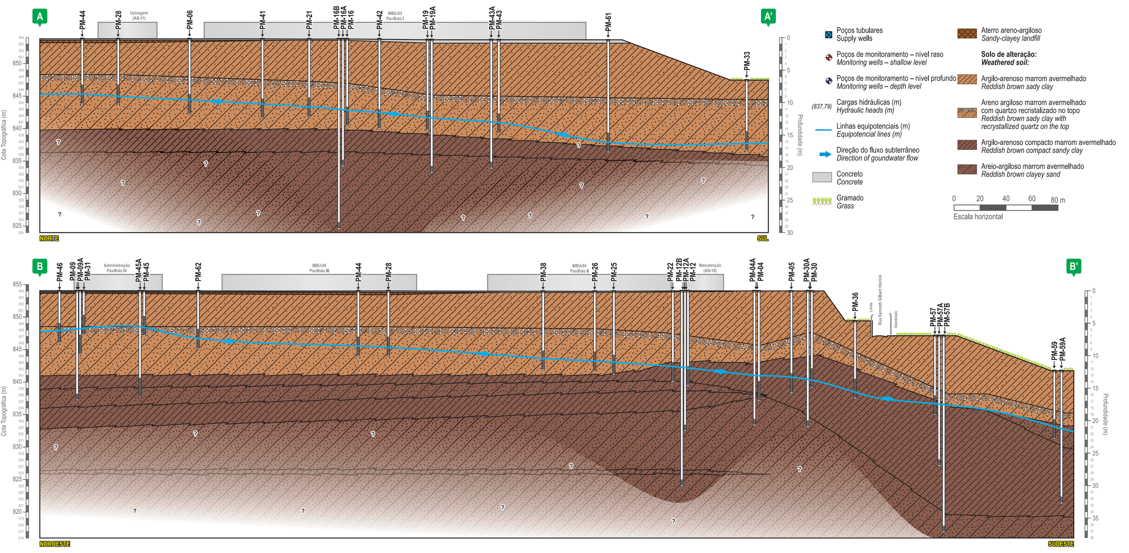
An appliance industrial plant in Sao Paulo, Brazil is impacted with combined **TCE** and **Metals** plumes in groundwater. Plumes are going off site, and the site is located on the **Guarany aquifer recharge area.**

The main goals were to control the plumes horizontally and vertically to protect both the external receptors and **South America main aquifer**.

Hydrogeological Model

Starting with a complete **site investigation**, the plumes were delimitated and revealed a critical situation. In order to remediate both TCE and Metals plumes, mainly Boron, we decided to use **Provect-IRM** (Provectus ISCR amendment for metals).

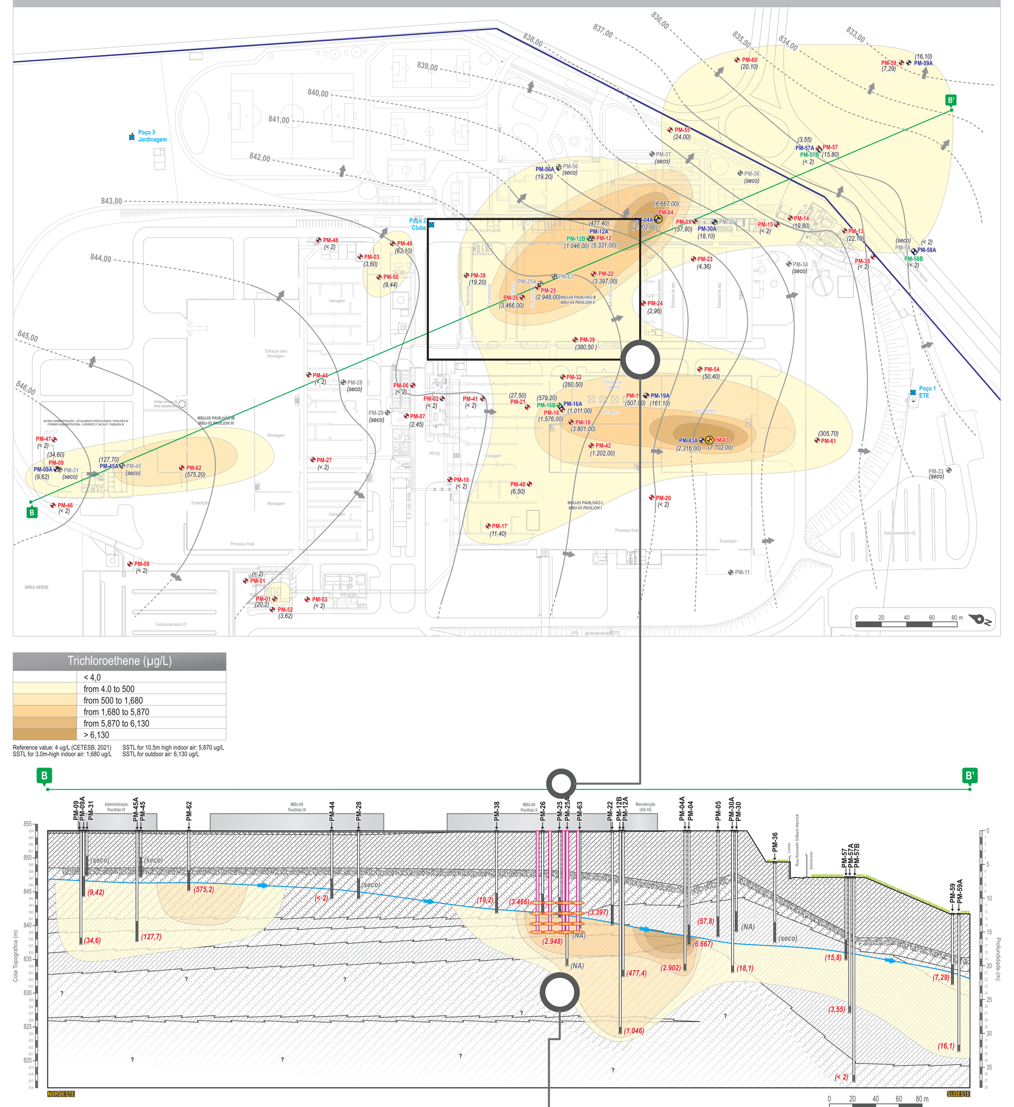




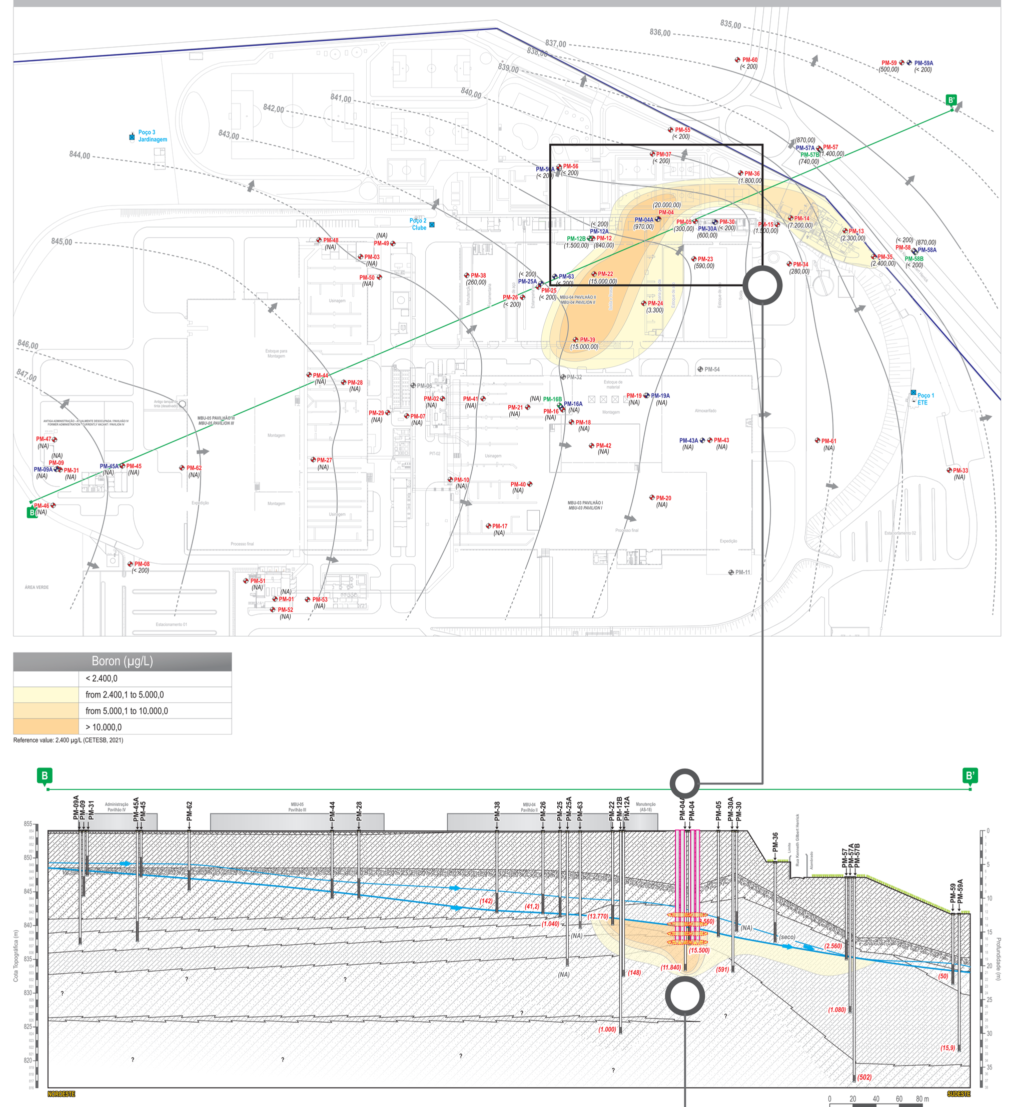
The **Guarani aquifer** is a large underground freshwater reserve that occupies an area of 1.2 million km^2 in the south-central part of **South America**, covering parts of **Brazil, Argentina, Paraguay and Uruguay**. It is the second largest source of freshwater underground in the world and has great economic, social and environmental importance for the countries that share it. It **supplies about 15 million inhabitants** and 200 Brazilian cities. It faces problems of soil and water pollution due to urbanization and industrialization.

Approach / Activities

Trichloroethene in Groundwater - October/2022

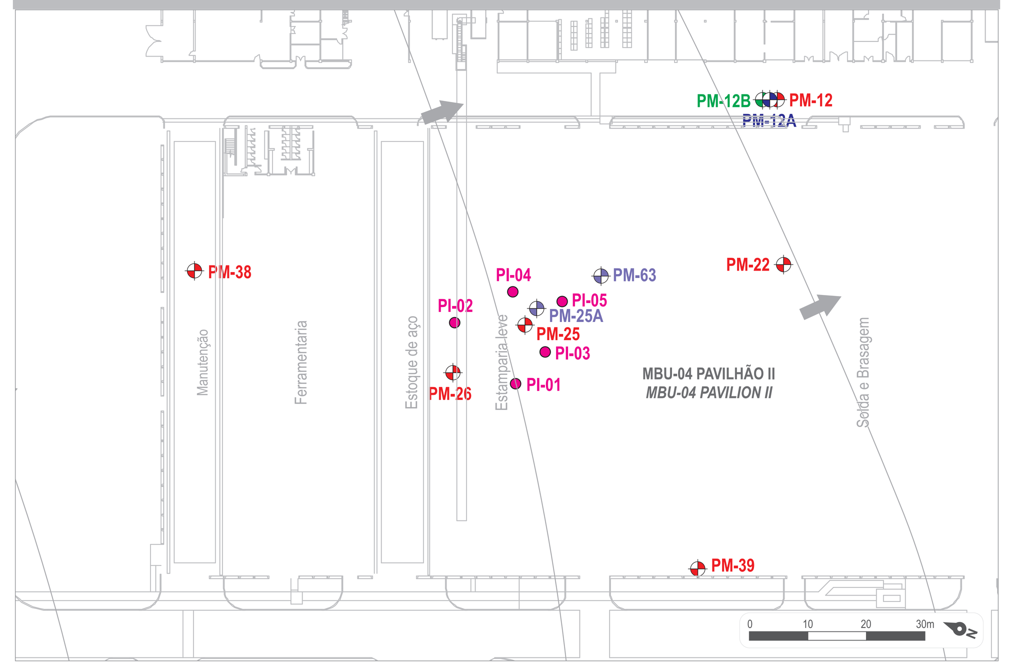


Boron in Groundwater - October/2022



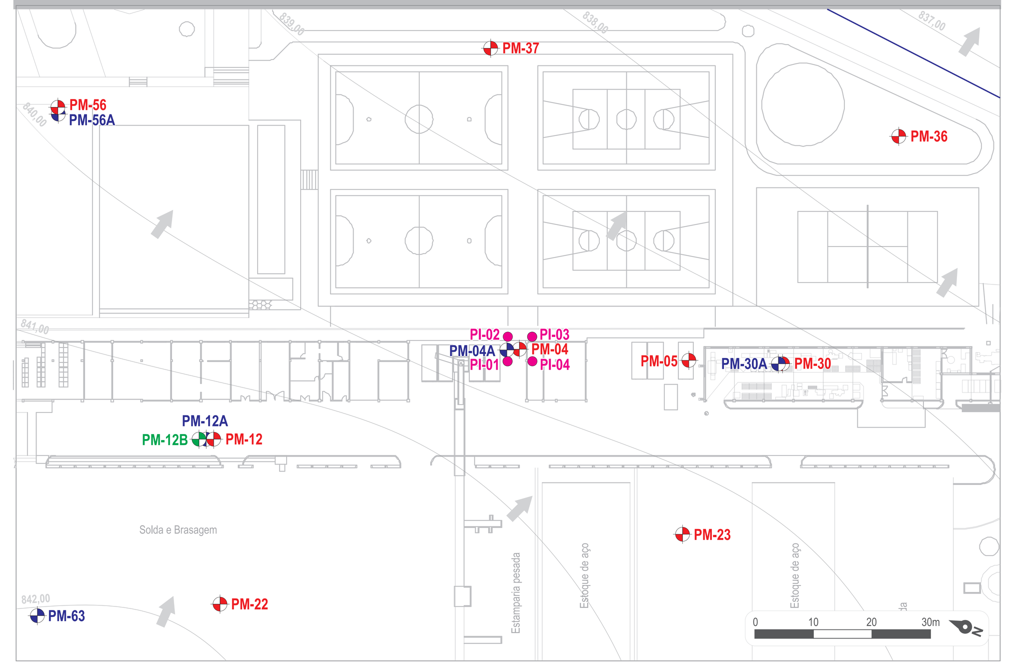
Water level | Pilot test injection points | Schematic representation of the injection zones

1st Pilot Test - August, 2021



The first pilot test failed due to a extremely **rare dry season** (~2,00 m), keeping the **groundwater level lower** than the existing monitoring wells.

2nd Pilot Test - October, 2022



The second pilot test considered the fluctuation of the water table and **revealed very low bacterial activity**. So, the remediation reaction was basically abiotic.

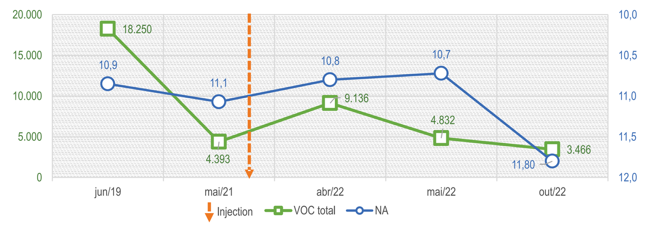
Results / Lessons Learned

We went back to the bench scale and found that the **Boron high concentration** (> 20,000 ppb) was promoting a **bactericide effect**, that combined with fluctuation in water table, which reduces even more the microbial activity, **further impair the biotic process** in reductive dechlorination.

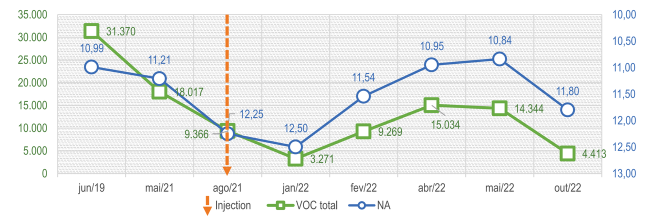
Bioaugmentation is not an option since it is forbidden in Brazil.

Absence of Water in the 1st Pilot Test

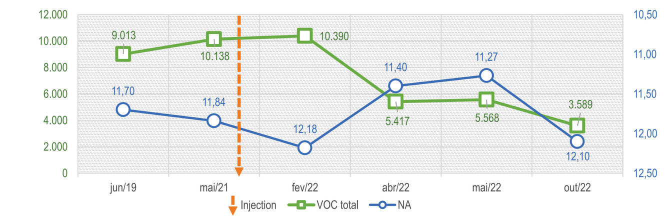
PM-26 - Injection Upstream Well



PM-25 - Injection Target Well



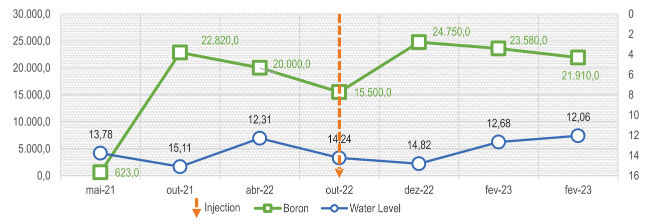
PM-22 - Injection Downstream Well



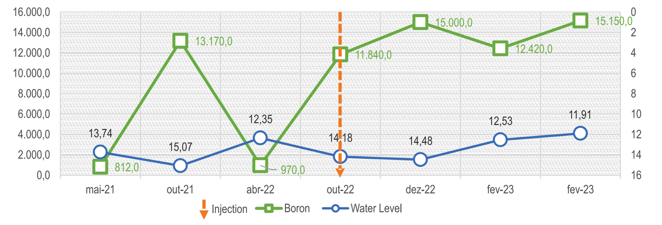
PM-25		PM-04	
Bacteria (UFC/g ST)		Bacteria (UFC/g ST)	
S-01 (10,1m)	300	S-02 (12,3m)	< 31
S-01 (11,1m)	58	S-02 (13,3m)	< 31

High Concentration of Boron in the 2nd Pilot Test

PM-04 Boron vs Water Level



PM-04A Boron vs Water Level



Sometimes the best strategy is **to take a stepwise in remediation approach**. In this project, we **split the remediation into 2 steps**, first focusing on **abiotic reactions for TCE and Boron** plumes abatement, then going to a **full scale ISCR remediation with both abiotic and biotic stages.**

SGW Services
The Soil and Groundwater Company
+55 11 3217-6300 | sgwservices.com

SGW Services is a Brazilian environmental consultancy specialized in engineering, assessment and remediation of contaminated areas, audit and licensing. With solid technical skills and large experience in environmental projects in Brazil and Latin America, operates in the most diverse sectors of market in an efficient, transparent and responsible way.

Know other SGW Services projects presented at 2022 Bioremediation Symposium