

## Installing and Operating a Thermal Remediation System at an Active Industrial Site in Brazil

Thomas Keijzer (thomas.keijzer@lighting.com) (Philips Lighting, Eindhoven, the Netherlands)  
Antonio Sérgio Egydio Rameh (sergio\_rameh@grupoepa.com.br),  
Antonio Sérgio Moreno (sergio\_moreno@grupoepa.com.br), and  
**Teresa Roza** (teresa\_roza@grupoepa.com.br) (Grupo EPA, Sao Paulo, Brazil)  
Patrick Jacobs ([patrick.jacobs@tauw.com](mailto:patrick.jacobs@tauw.com)) (Tauw GmbH, Berlin, Germany)  
Jacob Seeman (jseeman@thermalrs.com) (TRS Group, Longview, WA)

**Background/Objectives.** The project objective was to remediate a source zone using electrical resistance heating (ERH) at an active industrial site located in Brazil and therefore reduce the contaminant concentrations to risk based levels, established by local state legislation. The treatment volume consisted of a saturated source zone extending to 16 m below grade surface (bgs). Part of the target treatment area was inside a production building where people constantly work around several machines that are located directly on top of the heating area. While cooperative and accommodating, the owners of the ongoing manufacturing business necessitated specific restrictions to protect operations which included: (1) no interruption to free movement of equipment or materials. (2) ensuring that operation of remediation system equipment did not affect operations, equipment, and personnel, (3) no potential health or safety issues to workers including vapor migration, and (4) no adverse effects to the integrity of the security at the facility.

**Approach/Activities.** The project goal was to reduce PCE concentrations in soil and water by 99% using ERH. The treatment area measured approximately 787 square meters (m<sup>2</sup>), with a targeted treatment depth starting at 2 mbgs and extending to 16 mbgs. The resulting treatment volume was approximately 11,800 cubic meters (m<sup>3</sup>). Forty-five electrodes with co-located vapor recovery wells were installed in the treatment area. Electrodes located within the production area of the industrial site were completed below grade in order to reduce impact to the owner's ongoing operations. These electrodes were installed during planned downtime by the owner. Some electrodes were installed above grade with piping and cabling running along the ground surface back to the equipment compound located outside of the industrial area. Subsurface temperatures were measured at nine monitoring points, each containing eleven thermocouples spaced vertically through the heated volume beginning at 2.4 mbgs. One 1200kW power control unit was used to apply power to the ground. Because of continued worker access, voltage surveys were conducted daily throughout operation of the ERH system to ensure safety.

**Results/Lessons Learned.** Commission of the ERH system was performed while the factory was in operation. Also during operation of the ERH system a subway line was drilled that passes by the site. Voltage measurements were taken during drilling to ensure the safety of the workers. Electrodes in the production area that were installed below grade minimized the impact to ongoing operations of the facility. Daily voltage monitoring measurements were taken during ERH operations to ensure no voltage hazards as site conditions changed. Constant and open communication with the facility owner was important during construction and commission to avoid unnecessary risk to personnel safety and scheduling conflicts.