

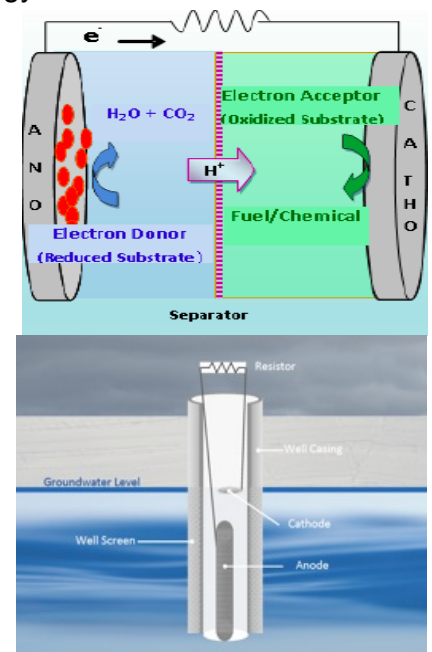
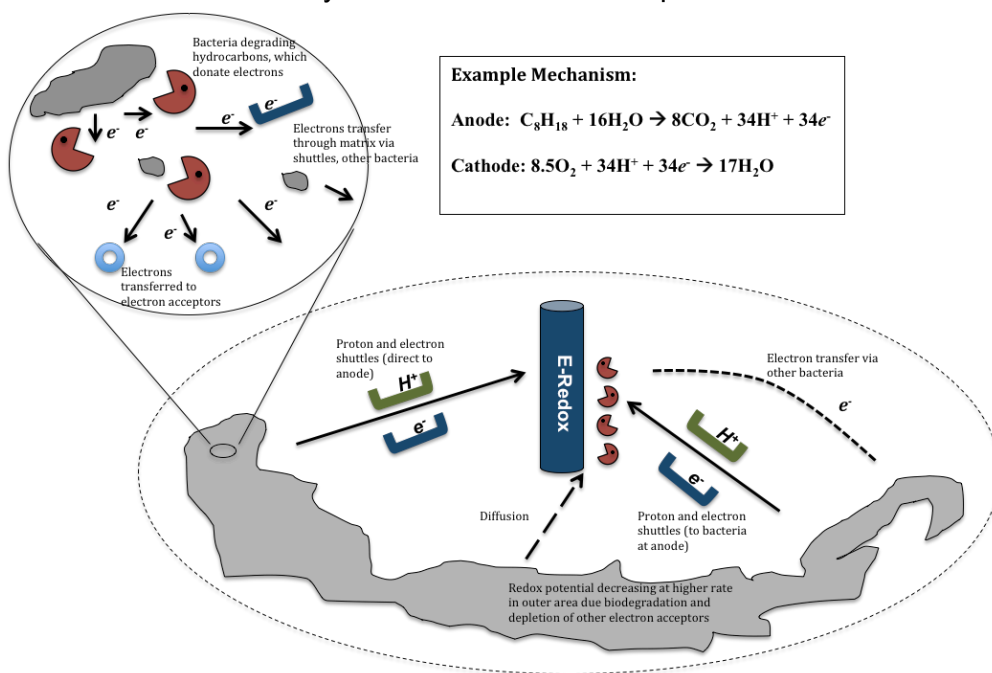
E-Redox-O: Bio-oxidation Enhancement

E-Redox-O is a patented technology developed by Advanced Environmental Technologies, LLC (AET, Fort Collins, CO). Field applications of **E-Redox-O** have demonstrated the sustainability and cost-effectiveness of this technology in enhancing the degradation of a number of recalcitrant contaminants in saturated matrices, such as groundwater and sediments.

Counterintuitive to contemporary technologies that deliver electron acceptors to impacted matrices and are restricted by matrix permeability, **E-Redox-O** technology “pulls” the electrons toward the perpetual and thermodynamically favorable electron acceptor of oxygen at no energy cost:

- The anode (in contact with the contaminated matrix) and the established biofilm at the anode-matrix interface serve as a solid and highly conductive electron collector and interim electron acceptor for electrons released from biodegradation.
- Constituents including certain microbes, humic materials, metal compounds, and soil particles shuttle the electrons in the matrix towards the **E-Redox-O** device, which establishes a redox gradient. Electrons eventually reach the cathode-ambient air interface of the device and are consumed by oxygen, completing the electron transfer path. Electricity is generated in the **E-Redox-O** circuit during the electron transfer. Meanwhile, protons migrate through the matrix towards the cathode.

In summary, the **E-Redox-O** system stimulates biological oxidation of contaminants by expediting electron transfer from the biodegradation process, “pulling” electrons to ambient O₂ as the terminal electron acceptor, competing with microorganisms for extracellular electrons thus accelerating metabolic rates, and maintaining low electron density and H₂ levels in the matrix to eliminate potential product feedback and inhibitory influences. The whole process consumes zero energy!



Applications

- Organic contaminants
 - Examples: Petroleum hydrocarbons such as BTEX
- Stand-alone technology for treating a variety of contaminants *in situ* and *ex situ* applications
- Integration with other remediation technologies to achieve significant enhancement

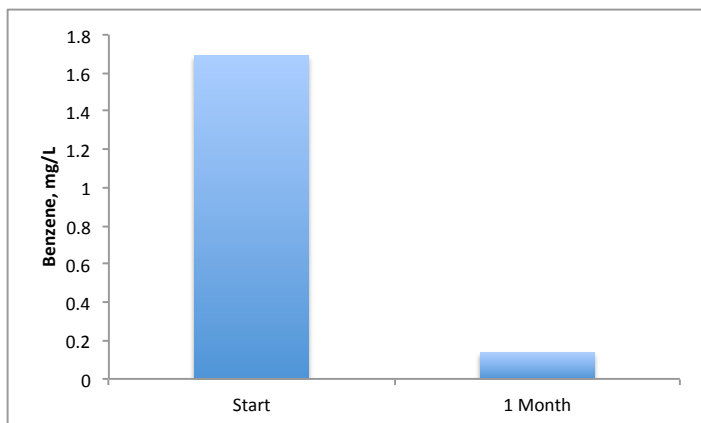


Advantages

- Implementable in a wide-range of matrices, including low permeable zones
- Requires zero energy input and generates electricity
- Effective as stand-alone treatment
- Synergistic to other remediation technologies (e.g., electron acceptor amendments, injections of carbon)

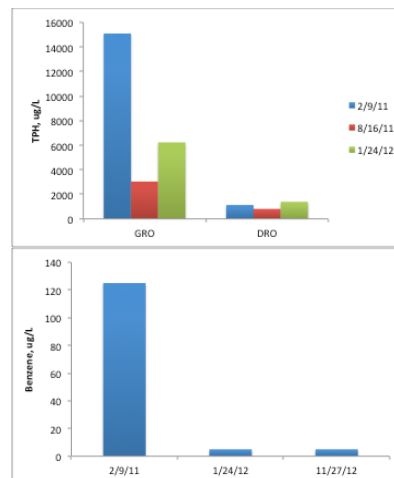
CASE STUDY 1: Former Petroleum Bulk Plant, CO

The E-Redox-O technology was installed at a former petroleum bulk plant site located in Lafayette, Colorado, where the primary groundwater contaminant of concern was benzene. The E-Redox-O technology used existing groundwater wells. Voltage production indicated organics degradation was occurring. One month after installation, the benzene concentration decreased by 92% within a radius of 15 ft from the E-Redox-O unit.



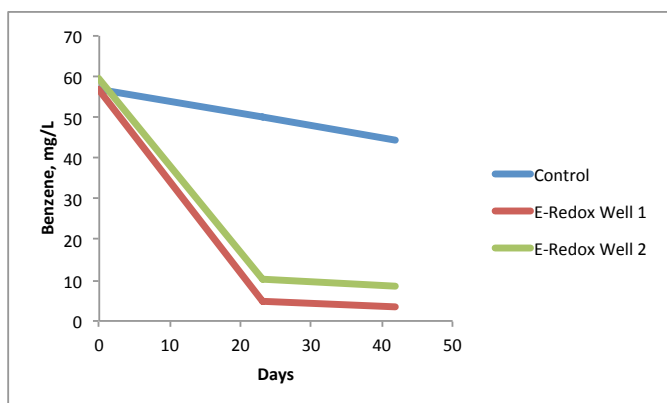
CASE STUDY 2: Leaking UST Site, SD

An E-Redox-O unit was installed at a former gas station in South Dakota, where leaking underground storage tank impacted the groundwater with petroleum hydrocarbons (free product was present at approximately 3 ft thick in two monitoring wells). After less than one year since the installation of the E-Redox unit, over 60% of the GRO-TPH was degraded, while over 90% of the benzene was degraded. Voltage production was observed indicating biodegradation.



CASE STUDY 3: Leaking UST Site, CO

E-Redox-O units were installed in two existing groundwater wells for treating benzene and other petroleum constituents at a fueling station in Denver, Colorado. The benzene concentrations decreased by 80 to 92% within the first 4 weeks of installation of E-Redox-O devices, while no more than 30% of the benzene was biodegraded in the control without E-Redox-O (Figure 4). Meanwhile, voltage production was observed, indicating biodegradation.



About Us

Advanced Environmental Technologies, LLC (AET) is a technology innovator and implementer, specializing in sustainable treatment solutions for wastewater, contaminated soils, groundwater, and sediments. Our patented and patent-pending technologies focus on remediation of a variety of recalcitrant contaminants, wastewater treatment, and low-value compounds to energy conversion. We provide both technologies and specialized services to project owners and engineering companies by offering innovative and sustainable solutions for environmental remediation, wastewater treatment, and bioenergy.



Advanced Environmental Technologies, LLC
4025 Automation Way, Suite F4
Fort Collins, CO 80525, USA
Tel: +1-970-449-9711
E-mail: info@aetecs.com
URL: www.aetecs.com