ThermaCycle™

Adaptive Low to Mid Temperature In-Situ Thermal Remediation

ThermaCycle™ is ERG's next-generation platform for low- to mid-temperature in situ thermal remediation — a closed-loop, recirculating groundwater heating system engineered to adapt dynamically to subsurface conditions, and employ the full range of low to mid temperature (<70°C) remediation mechanisms under on a single unified equipment platform. ThermaCycle™ allows flowrate, temperature, and amendment delivery to adapt with changing conditions so that the dominant contaminant-removal pathways evolve alongside the remedial trajectory.

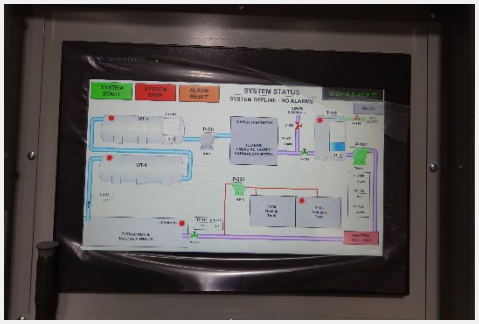
A Dynamic, Multi-Mechanism Approach

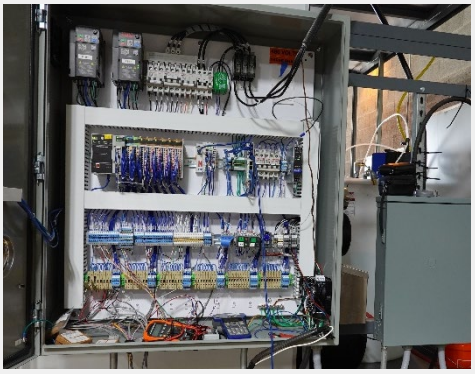
ThermaCycle™ operates intentionally below volatilization and boiling thresholds, maintaining average subsurface temperatures between 90 and 150 °F. Injection temperatures ranging from 100 to 180 °F allow operators to tune the system toward the most effective removal mechanisms:

- Around 95 °F, microbial communities experience rapid metabolic growth, increasing electron-acceptor demand and driving heat-enhanced biodegradation.
- Between 95 and 150 °F, hydrolysis half-life reactions of susceptible chlorinated VOCs—such as 1,1,1-TCA, carbon tetrachloride, 1,1-DCA, and 1,1,2,2-TeCA are accelerated —driving >90% reductions over months to a few years as half-lives shorten by one to two orders of magnitude.
- At elevated temperatures, contaminant viscosity and interfacial tension drop sharply, while solubility increases, and contaminant desorption, mobilization, and extraction is optimized .
- For NAPL zones, higher-temperature and higher-flow configurations support thermal enhanced free product mobilization, which can be further strengthened via surfactants, co-solvents, or substrate blends.

Because all heat and amendments are delivered through the same closed-loop architecture, these mechanisms can be prioritized, blended, or sequenced as remediation progresses — without redesigning the system.

Platform Architecture and Control





Each ThermaCycle™ skid arrives fully piped, wired, and factory-tested inside a rugged 8.5 × 12 ft all-metal enclosure. The system is driven by Allen-Bradley PLCs, delivering real-time telemetry, remote HMI access, automated alarm states, and continuous data logging.

Operators can shift operation between 5 and 40 gpm, and from modest 30–40 °F heating boosts for heat-enhanced bioremediation to aggressive 105 °F temperature lifts for hydrolysis or DNAPL mobilization. Inline dosing ports, multiple amendment and chemical dosing tanks, tied to rugged chemical metering pumps and a static mixing valve - allow seamless introduction of substrates, augmentation cultures, surfactants, co-solvents, oxidants, reductants, or nutrients — treating the system as a true multi-modal platform rather than a single-mechanism technology.

This flexible architecture makes ThermaCycle™ uniquely capable of responding to subsurface feedback, allowing heat and chemistry to be adjusted in real time as contaminant concentrations, geochemical conditions, and hydraulic behavior evolve.

A Platform Built for Combined Remedy Strategies

ThermaCycle™ delivers predictable hydraulic capture, efficient contaminant recovery, and data-rich performance across complex stratigraphy, reducing cleanup durations to roughly 3 months–3 years while operating at far lower energy demand than high-temperature TCH systems. Its closed-loop, amendment-ready architecture integrates seamlessly with chemical and biological injection technologies, allowing the platform to function as either a standalone remedy or the backbone of a combined approach. By transitioning smoothly between hydrolysis-driven, bio-augmented, and surfactant/co-solvent-assisted NAPL recovery phases, ThermaCycle™ acts as a flexible thermal engine engineered to maximize every available low- to mid-temperature removal mechanism within one unified system.