OVERVIEW

Induction Heating for Difficult Ground

Inductive-Thermal Dynamic Stripping Process (IT-DSP™) is VIYA's induction-heating technology for in-situ and ex-situ thermal remediation. Each heater assembly heats a steel casing directly through electromagnetic induction, independent of the surrounding soil's own electrical or thermal properties. This allows IT-DSP™ to reach and sustain the temperatures required for high-boiling-point contaminants, including PFAS, PAHs, PCBs, mercury, and petroleum hydrocarbons, in formations where other thermal methods have limited effectiveness.

DESIGN BASIS: NUMERICAL MODELING

IT-DSP™ system designs are finalized using numerical simulation to determine key design and operational parameters, including heater locations, sizes, and depths; power requirements (average and peak); extraction well locations, sizes, and screened intervals; vapor and liquid extraction rates; total energy budget; and expected rates of temperature increase.

The model couples the electrical heat output at each heater to standard multiphase flow and heat transfer equations for porous media, accounting for latent heat during phase change. Simplified assumptions are applied to reduce computing time without compromising accuracy.

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- Vapor and liquid extraction rates;
- Total energy budget; and expected rates of temperature increase.

The numerical model calculates how heat from each heater moves through the soil and groundwater over time, including the extra energy needed to convert water to vapor. Simplified assumptions are used to keep computing time reasonable without sacrificing accuracy.

HOW HEATING IS GENERATED

Alternating current from a surface induction control inverter (ICI) drives the IT-DSP™ heater, generating a changing magnetic field. That field induces current directly in the steel casing, and resistance in the casing converts the induced current to heat the casing itself becomes the heat source.

WHERE IT-DSP™ EXCELS

One Technology Across the Boiling-Point Range

VIYA matches the heating method to the contaminant. Lighter compounds such as VOCs, chlorinated solvents, and BTEX are typically addressed around a 100°C target with steam-enhanced extraction (SEE) or electrical resistance heating (ERH). Heavier, non-volatile contaminants require the higher temperatures that IT-DSP™, VIYA's thermal conductive heating (TCH) technology, is built to reach.

Contaminant	Boiling point	Typical method
VOCs	50 to 250°C (122 to 482°F)	SEE / ERH / TCH
BTEX and chlorinated VOCs	~100°C (~212°F) target	SEE / ERH / TCH
Total petroleum hydrocarbons	200 to 360°C (392 to 680°F)	TCH
Polycyclic aromatic hydrocarbons (PAHs)	218 to 496°C (424 to 925°F)	TCH
Polychlorinated biphenyls (PCBs)	275 to 375°C (527 to 707°F)	TCH
Mercury	357°C (675°F)	TCH
PFAS	110 to 343°C (230 to 649°F)	TCH

PROJECT DURATION & MONITORING

Tracking Heating to Completion

A typical IT-DSP™ heating program runs approximately six months to bring the treatment zone to target temperature for contaminant recovery. Temperature data from each temperature sensor feeds into a web-based monitoring platform, where project engineers track subsurface temperatures in real time and use temperature and mass-removal data to determine when the treatment zone has reached target temperature and when heating operations are complete.

PFAS BENCH TESTING

Characterizing Thermal Treatment for PFAS

PFAS boil across a wide range and can form hazardous by-products when heated, so VIYA has run bench-scale IT-DSP™ tests to characterize thermal treatment. In VIYA's own bench cell, a 1.5 yd³ (1.14 m³) volume was spiked to roughly 6,000 µg/kg total PFAS, including PFOA, PFHpA, PFBA, PFHxA, PFPeA, and PFOS, and heated with a single IT-DSP™ heater and a vapor-extraction well. The test targeted 662°F (350°C) and ran 22 days, averaging 672.6°F (355.9°C) and peaking at 1,065.2°F (574°C), at about 4.25 kW (5.7 hp) average power (6 kW / 8.0 hp peak).

To date, the work has found no detectable degradation by-products (e.g., hydrofluoric acid or Freon-type compounds); quantifying where the remaining PFAS mass goes is the current focus. This work is bench-scale and ongoing, not a finished field result.

IT-DSP™ IN THE FIELD

Bench to Full Scale

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IT-DSP™ has been applied at ex-situ pilot and in-situ full-scale projects.

FIELD-PROVEN RESULTS: IT-DSP™ CASE STUDIES

Location	Target temperature	Contaminants	Outcome	Year
Porto Torres, Italy	100°C / 212°F	TPH, CVOCs	~5,200 lbs removed	202-2021
Camaçari, Bahia, Brazil	260°C+ / 500°F+ (peak 375°C / 707°F)	Chlorobenzenes, chloroanilines, BTEX, pesticides	~344 kg removed (ex situ, both batches)	2020–2021
Norrköping, Sweden	800°C / 1,472 300°F (pipe wall)	PAHs, benzene, NAPL	>1,300 lbs removed	2020-2021
Teckomatorp, Sweden	300°C / 572°F	Chlorophenols, chlorocresols, Phenoxy alkanoic acids	~159 lbs removed	2021
Gimo, Sweden	91°C / 196°F	TCE, 1,2-DCE, TPH	181 lbs removed; 99.8% TCE reduction	2022
Huntsville, Alabama, USA	90°C+ / 194°F+ (peak 104°C / 220°F)	TCE, PCE, VOCs	75,123 lbs removed *(Combined technology project outcome)*	2025

IT-DSP™ In-situ Full-scale IT-DSP™ project Teckomatorp, Sweden.

IT-DSP™ Ex-situ Pilot Project Camaçari, Bahia, Brazil