OPTIMA: A Web-Based Tool for Performance-Based Optimization of Groundwater Pump-and-Treat Systems

Xuehang Song[1], Inci Demirkanli[1], Frank Lopez[1], Christian Johnson[1], Mikaela Corney[1], Paul Tran[1], Kaitlyn He[1], Xiaoliang He[1], Rockhold Mark[1], Marinko Karanovic[2], Matt Tonkin[2], Delphine Appriou, and Rob Mackley[1]
[1]Pacific Northwest National Laboratory [2] S.S. Papadopulos and Associates Inc.

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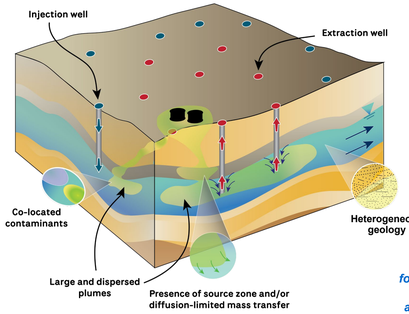
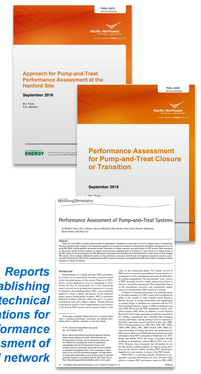
Why Consider Performance-Based Optimization Approaches for P&T Systems?

- **Pump-and-treat (P&T) systems**: Common technology for contaminated groundwater aquifer treatment and/or hydraulic containment
- **Challenge:** Performance diminishes over time due to factors depicted below, resulting in longer-than-planned remedy duration





Reports establishing technical foundations for performance assessment of P&T well network

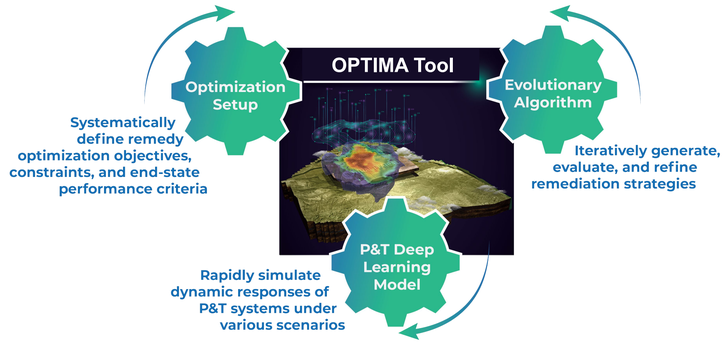
- **Performance-based P&T optimization** focuses on dynamic management of well network to maintain effectiveness and efficiency throughout remedy lifetime, relying on:
  - Continuous/iterative performance monitoring & evaluations
  - Computational optimization assessments
- Web-based tools can support development of P&T optimization strategies

Actionable Outcomes & Next Steps

- Near-real-time optimization based on user-defined objectives and constraints
- Supports remedy optimization decisions with transparent trade-off insights
- Web-based tools in active development: will make interpretation of complex data easier
- Exportable maps/schedules/data for QA records and stakeholder review

P&T Optimization Screening with OPTIMA

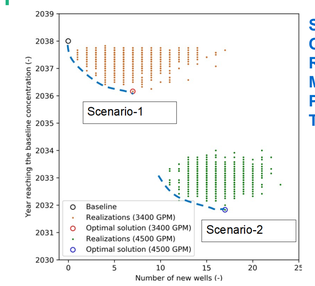
- **OPTIMA (O**ptimization for **P**ump-and-**T**reat **I**mplementations: **M**anagement & **A**ssessment**)** tool allows development of end-state-driven, performance-based optimization scenarios
- **Application of OPTIMA to Hanford 200W P&T system**



Optimization Objectives	Target CoC/Parameter	End-State Performance Criteria
Maximize mass recovery	Carbon tetrachloride	UCL 95 concentration < Cleanup level
Minimize pumping timeframe	Carbon tetrachloride	UCL 95 concentration < Cleanup level
Minimize plume area	Technetium-99	Plume area
Maintain pumping volume	Groundwater drawdown	Maintain P&T network efficiency

*CoC: Contaminants of Concern

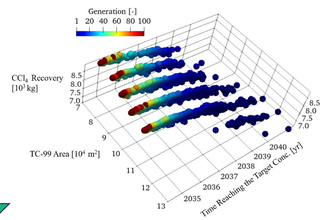
Single-Objective
Contaminant
End-State Performance Criteria



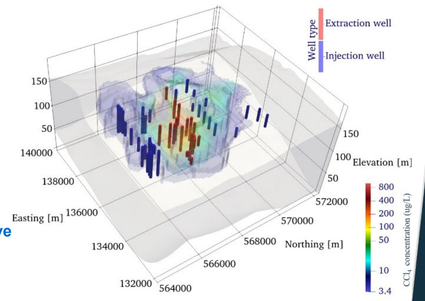
Single-Objective Optimization Results for Minimizing Pumping Timeframe

Optimization Complexity

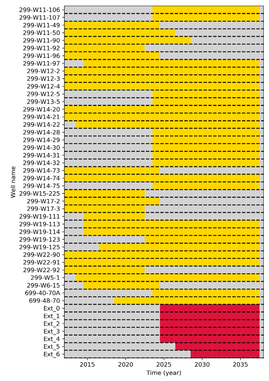
Multi-Objective
Contaminant
End-State Performance Criteria



Multi-Objective Optimization Results for Mass Recovery, Plume Area, and Time to Reach Target Concentration



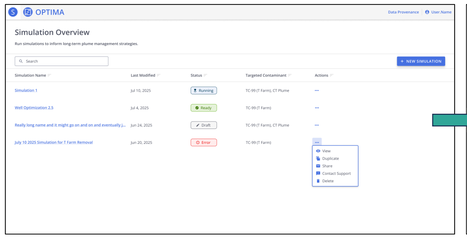
3D-Model Domain and Well Field



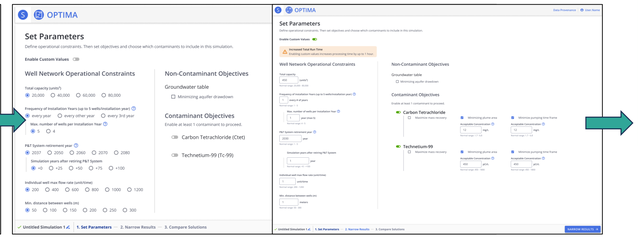
Well operational timeline showing existing (yellow) and proposed (red) wells.

OPTIMA Web-Based User Interface

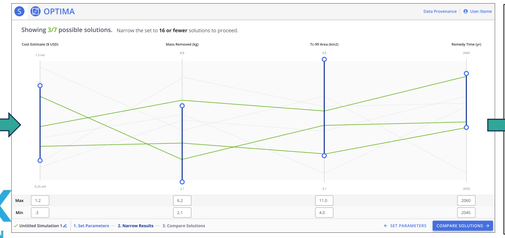
- Integrated decision-support environment combining surrogate model-driven optimization, visualization, and export in one browser workspace
- User-guided workflow: define objectives and constraints → generate candidate designs → filter and compare solutions → export results



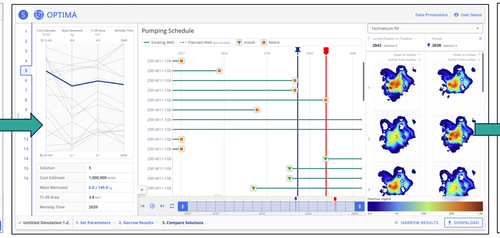
Simulation Management Dashboard



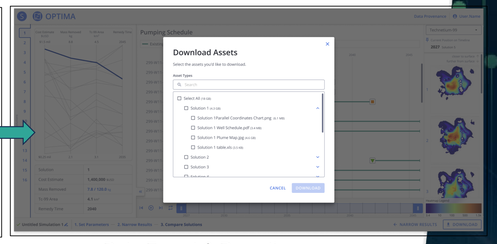
Scenario Setup Wizard



Result Filtering & Trade-Off Analysis



Compare Solutions Interface



Data Export & Reporting

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