THE NEW ROI

Return on Investigation from Smart Characterization Methods

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December 2, 2015

FRTR General Meeting
Site Characterization for Effective Remediation
Agenda

• Health and Safety Moment

• Return on Investigation
  • Exit Ramp Strategies
  • Smart Characterization
  • Flux-Based CSMs
Health and Safety Innovation

Zipliner

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Zipliner

FEATURES

- Operates with drill tooling similar to standard liners.
- Designed to fit with AMS Power-Probe and the Geoprobe Systems direct push technologies.
- The ZipTool is the safest opening tool for soil sampling sleeves.
- Similar durability as standard liners.
The ROI of Smart Characterization
90% of relative flux in 10% of cross-section

Return on Investigation
Client avoided spending > $5M on slurry wall
Return on Investigation

Client avoided spending $4 - $5M on active LNAPL recovery
Return on Investigation

No active remediation required
Return on Investigation Approach

Value proposition

The New ROI

Align remedy with business strategy

Outcome certainty

Least cost

Flux-Based Conceptual Site Model

Smart Characterization

Exit Ramp Strategies
The New ROI

Current Trajectory

Total $$

Time
The New ROI

Current Trajectory

Optimized OpEx

Year 30 projected cost savings

ROI pay back period

CapEx for Smart Characterization

Time

Year 30

Total $$
The New ROI

Current Trajectory

Optimized OpEx

Best Outcome

Year 30 projected cost savings

ROI pay back period

CapEx for source treatment or alternate strategy

Total $$

Time

Year 30

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Return on Investigation Approach

The New ROI

Exit Ramp Strategies

Align remedy with business strategy

Outcome certainty

Least cost

Flux-Based Conceptual Site Model

Smart Characterization

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Background

Diffuse VOC plume

Characterized with monitoring wells

20 years of P&T
The Problem

Mass Removal

Total $$

Time

Sand

Clay

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The New ROI

Current Trajectory

Smart characterization
- Find mass that moves
- Focus remedy

Balanced approach:
- Align remedy with business objectives
- Achieve *return on investigation*

Time

Total $$
The New ROI

- Optimize P&T performance
- Flatten OpEx trajectory
- Potential to reduce duration
- Use Exit Ramps to ensure business solution

Current Trajectory

Optimized OpEx

CapEx for Smart Characterization

Total $$

Time
The New ROI

- Optimize remedy performance
- Align with business objectives
- Limit CapEx to ensure ROI
- Select alternative strategy or management based on payback period

Current Trajectory

Optimized OpEx

Best Outcome

CapEx for source treatment

Total $$

Time

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Return on Investigation Approach

The New ROI
Align remedy with business strategy
Outcome certainty
Least cost

Exit Ramp Strategies

Flux-Based Conceptual Site Model
Smart Characterization

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Exit Ramp 1 – Can P&T be optimized?

$50K investment

Goal:
- Optimize P&T
- Reduce OpEx
- Reduce duration & increase mass removal
Exit Ramp 1
Result: Flux transect

- Plume is concentrated
- Pumping can be optimized
- Change cost and performance curve

Why is plume concentrated?
Return on Investigation Approach

The New ROI

- Align remedy with business strategy
- Outcome certainty
- Least cost

Exit Ramp Strategies

Flux-Based Conceptual Site Model

Next Generation Smart Characterization

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Stratigraphic Flux

Find the flux

Relative permeability

0.1 1.0 10 100

> 90% of flow is in coarse sand zone

Sand

Clay

Fine Sand

Coarse Sand

Interbedded sand & silt

Clay
Stratigraphic Flux

Find the flux

HPT
Relative permeability

0.1 1.0 10 100

Fine Sand

Coarse Sand

Interbedded sand & silt

Clay

>90% of flux is in coarse sand zone
Exit Ramp 2 - OpEx Optimization

- Consider ROI payback on CapEx
- Verify plume geometry
Focus pumping on flux...
Optimize OpEx, enhance mass recovery with less flow
The New ROI – Flux-Based CSM

- Optimize P&T performance
- Flatten OpEx trajectory
- Potential to reduce duration

Current Trajectory

Optimized OpEx

Total $$

CapEx for Smart Characterization

Time
Outcome Certainty

Duration of P&T or opportunity for optimized remedy depends on source.
Calibrating ROI Expectations

• Remedy decisions dependent on more than least total cost

• Align the remedy to meet expectations that match your business needs in short- and long-term
The New ROI

- What ROI is required to optimize remedy?
- Select payback period to determine if source characterization & remedy aligns with business objective
Flux-Based Source Evaluation

- Mass distribution relative to transport and storage zones dictate technologies, endpoint, and cost

Is Smart source characterization worth the effort?
Flux-based source evaluation – Transport zone

>90% of flux in coarse sand zone

Limited mass in difficult to treat storage zone

Size is key cost factor
The New ROI - Outcome

Certainty

Current Trajectory

Optimized OpEx

Best Outcome

• Benefit of source evaluation
  • Evaluate payback period for CapEx of Smart Characterization and source treatment
  • Business decision to proceed

CapEx for source treatment

Total $$$

Time
Flux-based source evaluation – storage zone source

Treatment approach is key cost factor

>90% of flux in coarse sand zone

Significant mass in difficult to treat storage zone

Interbedded sand & silt
The New ROI - Outcome Trajectory

Certainty

- Benefit of source characterization
  - CapEX of source treatment exceeds reasonable payback
- Optimize P&T performance
  - Flatten OpEx trajectory
  - Potential to reduce duration

Current Trajectory

Source Treatment

Optimized OpEx

CapEx for source treatment

Total $$

Time
For new sites, do it right the first time:

CONVENTIONAL V/S. SMART CHARACTERIZATION

Investigation
- **Years** of effort
- **Dozens** of reports & work plans

Remediation
- Long-term, ineffective remedy
- Poor outcome certainty

Investigation
- **Weeks** of effort using real-time methods
- **ONE** report & work plan

Remediation
- Focused, cost-effective remedy
- Outcome certainty with opportunity to match business objectives
Return on Investigation Approach

The New ROI

- Align remedy with business strategy
- Outcome certainty
- Least cost

Exit Ramp Strategies

Value proposition

Flux-Based Conceptual Site Model

Smart Characterization

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Questions?
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