Field Pilot Studies for In Situ Stabilization (ISS) of Hydrocarbon Contaminated Sediment in Kendall Bay, Sydney, NSW, Australia

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VENTIA
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22 MGP Projects
6 Sediments Projects
JEMENA
(Project Principal)

A $10.5b Business
c.1.6m customers

NSW gas distribution network
Victorian electricity distribution network

Gas pipelines across eastern and northern Australia

Also gas hubs, transmission, storage and water recycling
SITE
SETTING

Kendall Bay
Sydney CBD
Breakfast Point
OVERVIEW OF REMEDY

Southern Remediation Area
PROJECT PERFORMANCE CRITERIA

CHEMICAL PERFORMANCE

> 90% reduction in cumulative mass release compared to existing conditions

PHYSICAL PERFORMANCE

- Unconfined Compressive Strength (UCS)
- Shallow ISS Raft – 1 MPa (145 psi)
- Deep ISS Columns – 2 MPa (290 psi)
- Hydraulic Conductivity < 1x10^-5 cm/sec
TRIAL OVERVIEW

**PHASE 1**  Bench-Scale Laboratory Study

**PHASE 2**  Clean Field Trial

**PHASE 3**  Contaminated Field Trial
PHASE 1

PHYSICAL TESTING

• Grout Marsh Funnel Viscosity
• Unconfined Compressive Strength (UCS)
  • 3, 7 and 28-day standard curing
  • 2 and 7-day accelerated curing
• Hydraulic Conductivity

CHEMICAL TESTING

• LEAF 1316 (untreated sediment)
• LEAF 1315M (ISS Monolith)

LABORATORY TRIAL
Overall tested 78 mix designs as part of the treatability study:
LABORATORY TRIAL

Conclusions

Phase 1 conclusions were:

Moisture identified as driving factor.

No treatment enhancers required.

Mixture for field trial confirmed as:

ISS Raft: 300 to 350 kg/m³ marine cement (1 MPa)

ISS columns: 375 to 425 kg/m³ marine cement (2 MPa)
Two phase pilot study was performed in the Southern Remediation area to assess ISS performance, constructability and productivity.
PHASE 2

CLEAN SEDIMENT TRIAL
PHASE 3

ENVIRONMENTAL CONTROLS
PHASE 3

CONTAMINATED SEDIMENT TRIAL
MASS SOIL MIXING

RAFT SLAB MIXING TOOL
DEEP SOIL MIXING

COLUMN MIXING TOOL
SAMPLING TOOLS

Mechanical Wet Grab Sampler

PVC Sampler

Russian-D Sampler
RESULTS
WEIGHT OF EVIDENCE APPROACH

INDICATORS OF SUCCESSFUL ISS APPLICATION

- Increased pH
- Increase temperature
- Moisture content
RESULTS
WEIGHT OF EVIDENCE APPROACH

Before ISS Treatment

After ISS Treatment
LABORATORY RESULTS
Leaching Phase 3 Raft

More than 90% reduction in leaching (~2 orders of magnitude)
KEY LESSONS LEARNT

Plant, equipment & environmental controls appropriate.

Validation sampling - proved to be a challenging task.

Strength gain exceeded expectations.

Movement & positioning of barges challenging.

Design & sequencing requires careful consideration.

Stakeholder engagement - community & regulator key focus.
CONCLUSION

EPA ACCREDITED AUDITOR TRIAL REPORT CONCLUDED

“Trial demonstrated practicality and applicability of ISS remedy to Kendall Bay. Works should progress to full-scale remediation”.