

Subsurface Pre-Treatment using PetroFix

Outline

- **Introduction: Concept of preventative/pre- treatment**
- **PetroFix as a pro-active risk mitigation tool**
- **Product introduction and how it works**
- **Application in preventative scenarios**
- **Case studies**
- **Conclusions with Q&A**

Proactive Remediation

Assess Risk and Act...

Management of Hydrocarbons

- Storage and management of hydrocarbons pose inherent risks
 - **New UST and piping leak**
- Utility corridors are typically the primary transport mechanism from a sub-surface leak
 - **Ongoing secondary source if USTs are removed**
- Management of the risk is focused on preventing surface migration (either off-site or percolation into the subsurface)
 - **Installation of sub surface containment infrastructure often requires updating the entire facility**



Management of Hydrocarbons - Risk

When a leak occurs, **most mass** is found near:

- UST Bedding
- AST Surface
- Service Corridors (pooling of product)
- Fill Point



Preventative, Risk Mitigation Tool



Solutions

Liquid form means easy application by spraying or pouring into tank bedding.

Non-hazardous and compatible with all underground infrastructure.

Can replace the water that would be added to achieve the tank bedding gravel's compaction levels.

Tank basin pre treatment



PetroFix

Product Introduction Treatment Mechanisms

Introduction

- Liquid carbon product which is safe and straightforward to use
- Adaptable to multiple applications
- Provides fast results
- Stops the spread and reduces the risk
- Applied where TPH is at or near solubility limit



Where we cannot help

- × Stopping surface migration
- × Stopping free phase contamination



Ease of use



'Water-like'
PetroFix suspension
requires only gentle
agitation

Safe

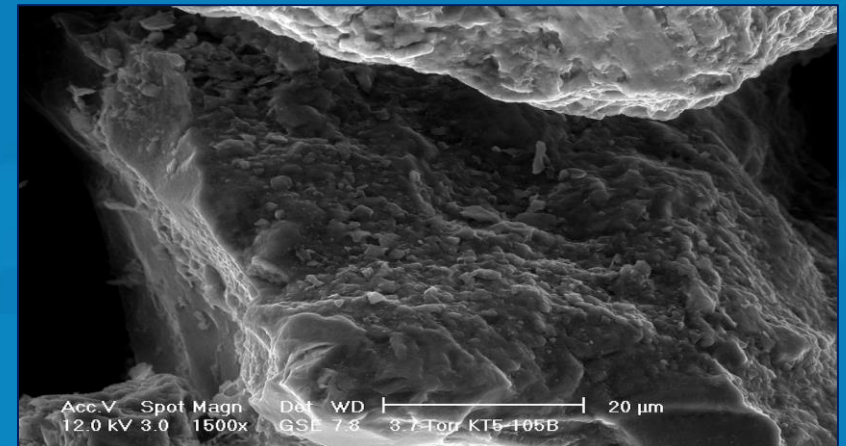
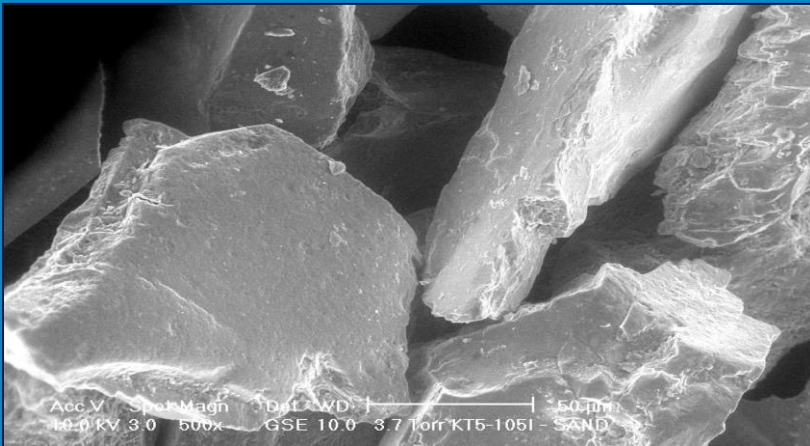
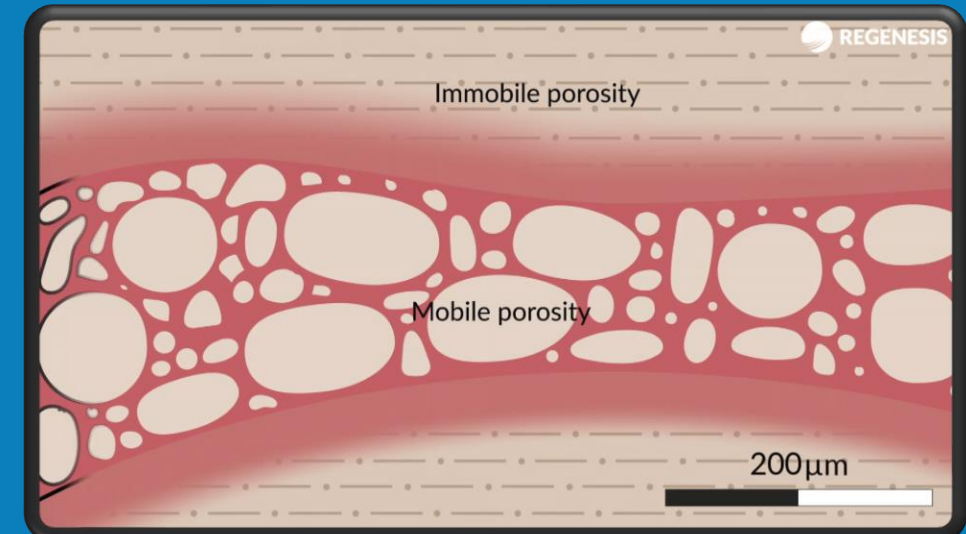
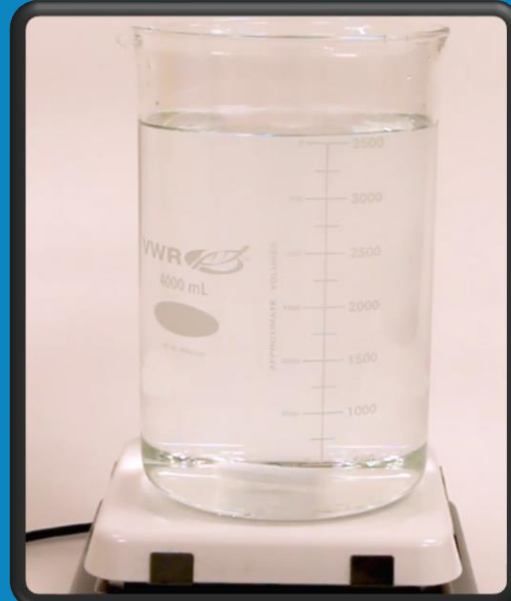


Non-hazardous
Activated Carbon

Remediation Process – Step 1

Sorption

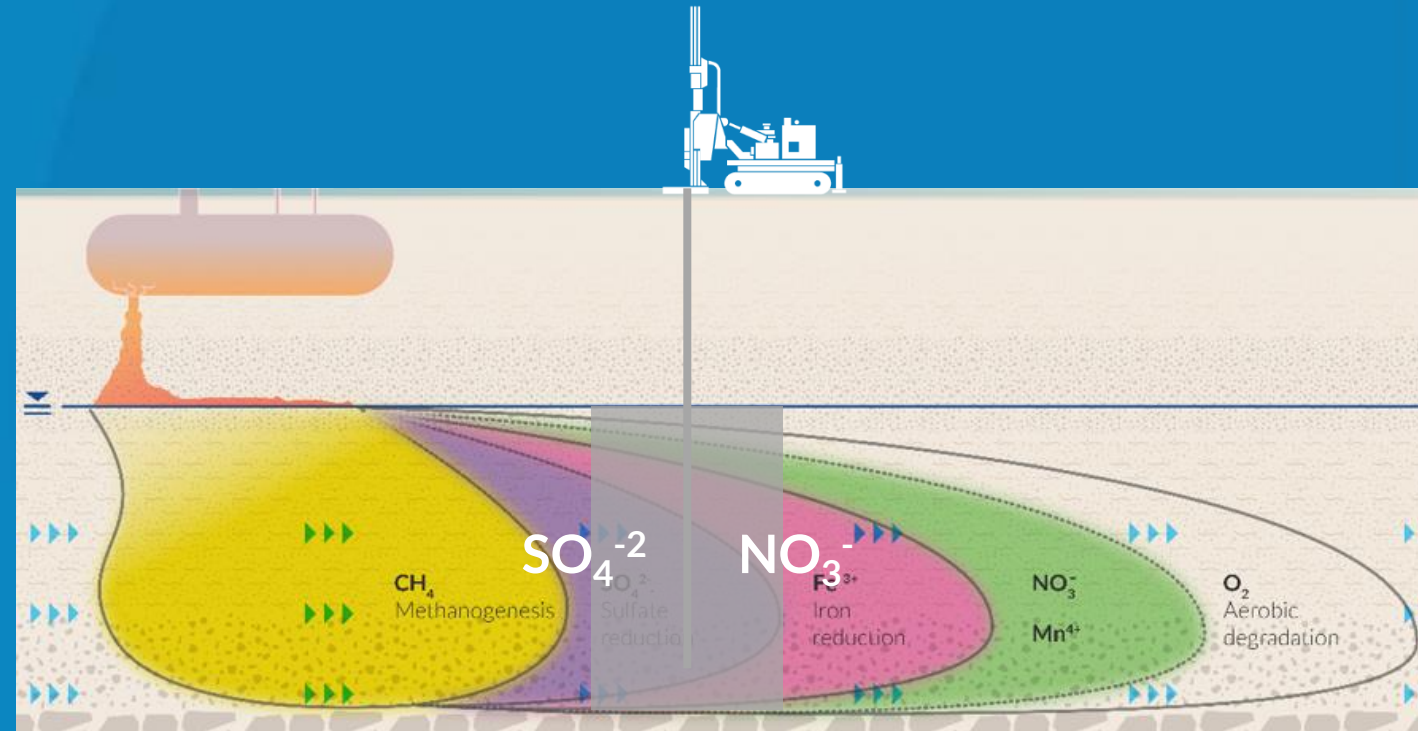
- PetroFix creates a sub-surface filter
- Rapidly removes dissolved contamination from the groundwater



Remediation Process – Step 2

Optimised biological degradation of the sorbed contamination

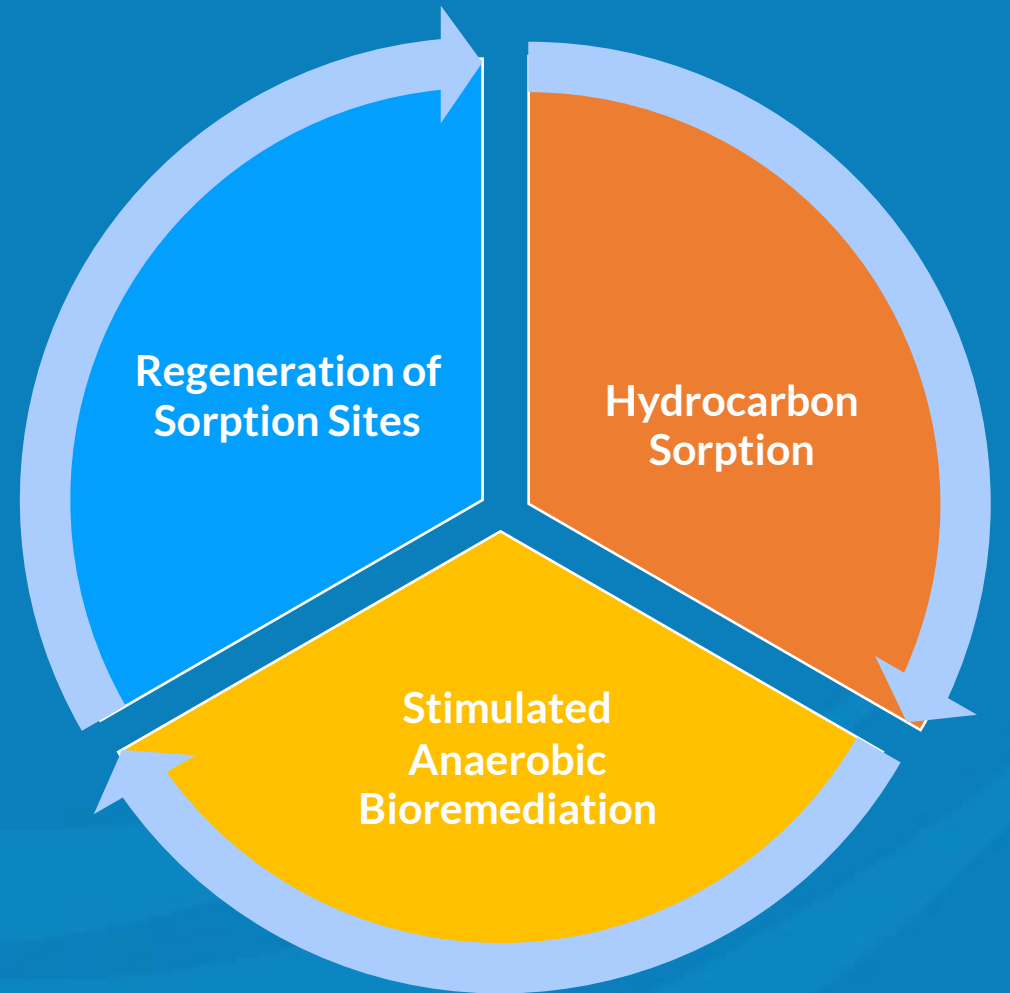
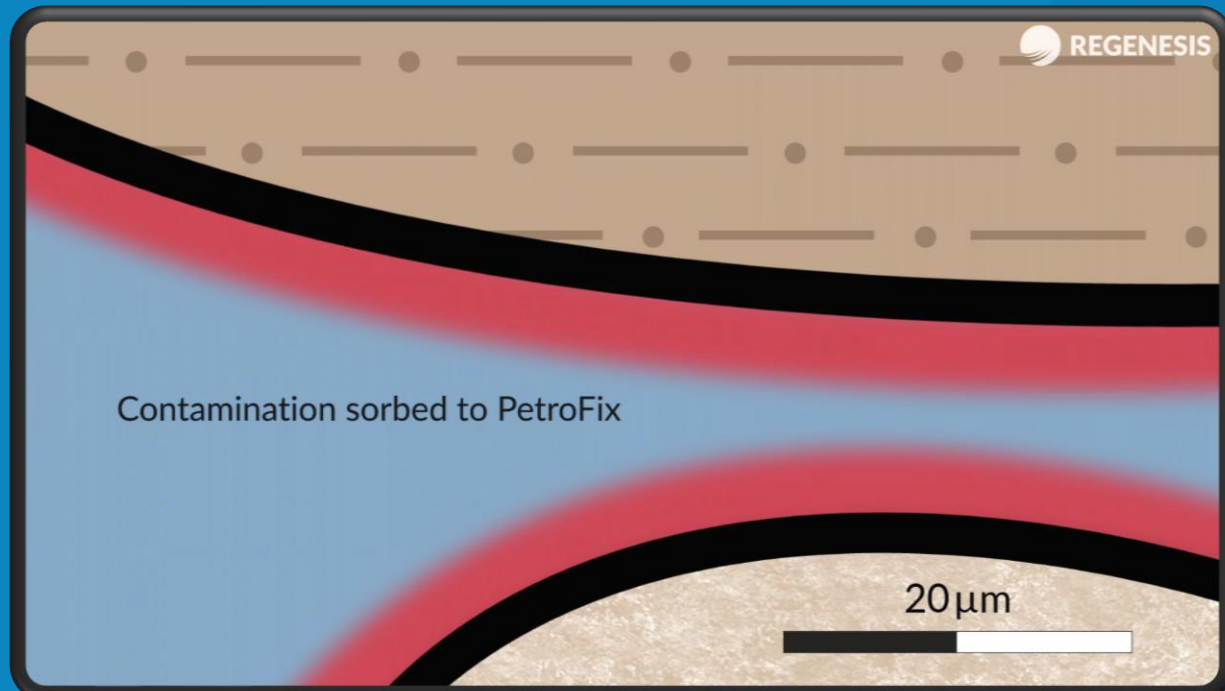
- Anaerobic oxidation
 - matches groundwater conditions in an oil spill
- Kick-starts biological degradation
 - sulphate and
 - nitrate electron acceptor
- Large effective biomass
- Maintained by naturally occurring nutrients in the groundwater



Anaerobic core

Remediation Process – Step 3

Regeneration



Lab Scale Studies Pre Treatment

Bench Scale Tests

- The treated column was dosed with 29.4g of a 50% PetroFix solution applied to the top of the column, representative of a recommended field dose.
- The columns were fed tap water for 24hrs under gravity flow from top to bottom to emulate a natural flux of water.
- Through the top few layers of soil and ongoing 'spills' of neat diesel slugs were added at regular intervals to each column.
- No PetroFix eluted from the bottom of the column.



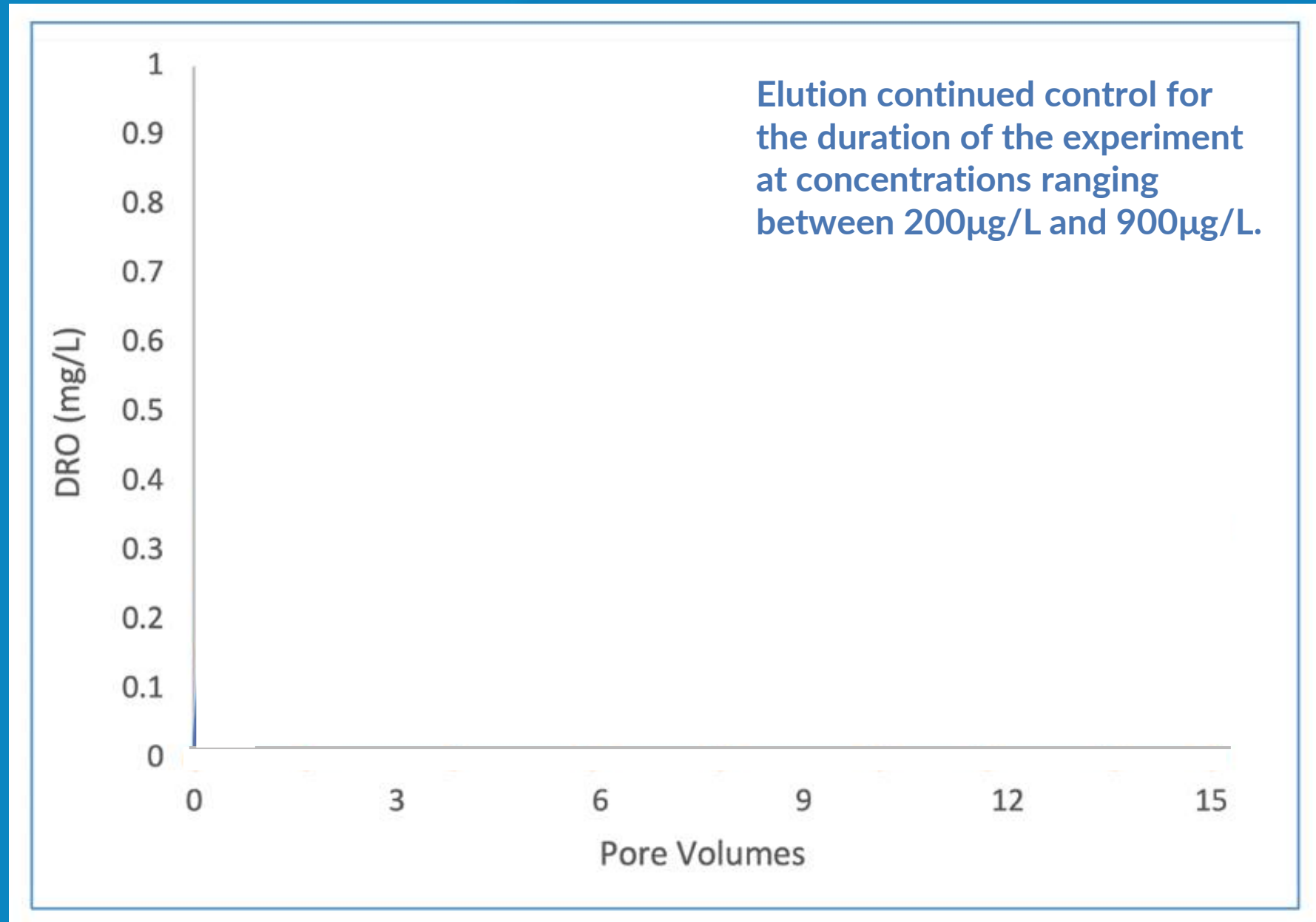
Fig 6. The control (left) and PetroFix-treated (right) columns used in the study to demonstrate the ability of PetroFix to capture small diesel spills.

Bench Test Results

Total mass of 2.6g diesel added to each column.

Diesel quickly migrated through the control column and eluted within the first pore volume.

PetroFix-treated column had **no detectable** (< 50µg/L) **levels of DRO** eluting from the column for 15 pore volumes.



Case Studies

Petrofix coating of pipeline, Germany

Background

- A new underground pipeline was required to be installed across a chemical plant in southwestern Germany across TPH contaminated soil and groundwater.

Remedial Strategy

- Limited impacted soils and groundwater removed via excavation and dewatering



Petrofix coating of pipeline, Germany

Risk – Rebound

- Residual contamination represented a secondary
- Contamination rebound into the groundwater and excavated area.
- Impacting clean backfill around the pipeline

Risk – Mobilisation

- Granular pipe-bedding material creates conduit through which re-contaminated groundwater could spread further across and potentially beyond the site.

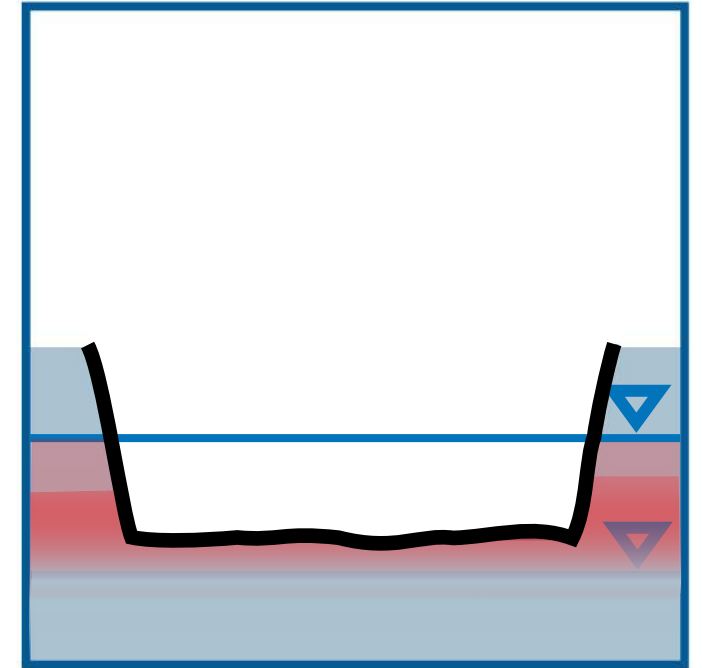
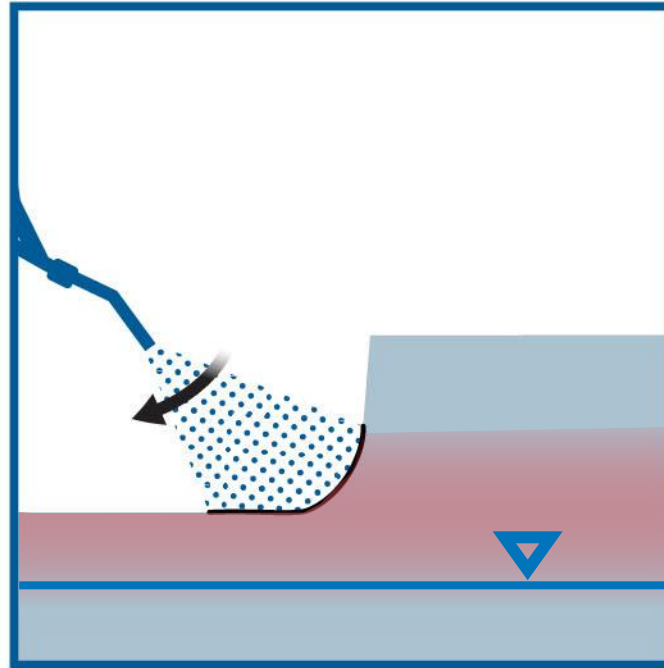
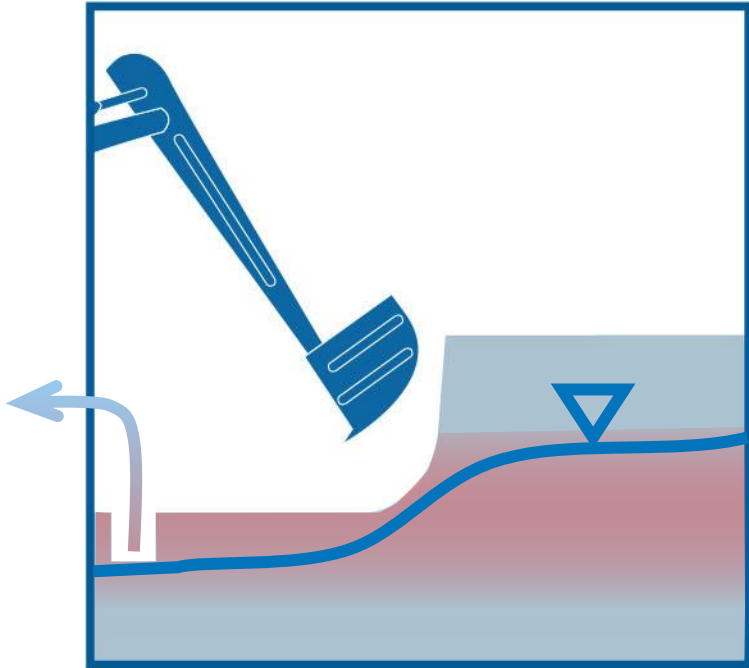


Risk mitigation – Topical PetroFix Application

- Topical application of PetroFix® onto the excavation base and sides
- Prevent contamination of the granular backfill
- Stops the infiltration and spread of contaminated groundwater in the pipe-bedding.



Preventing recontamination



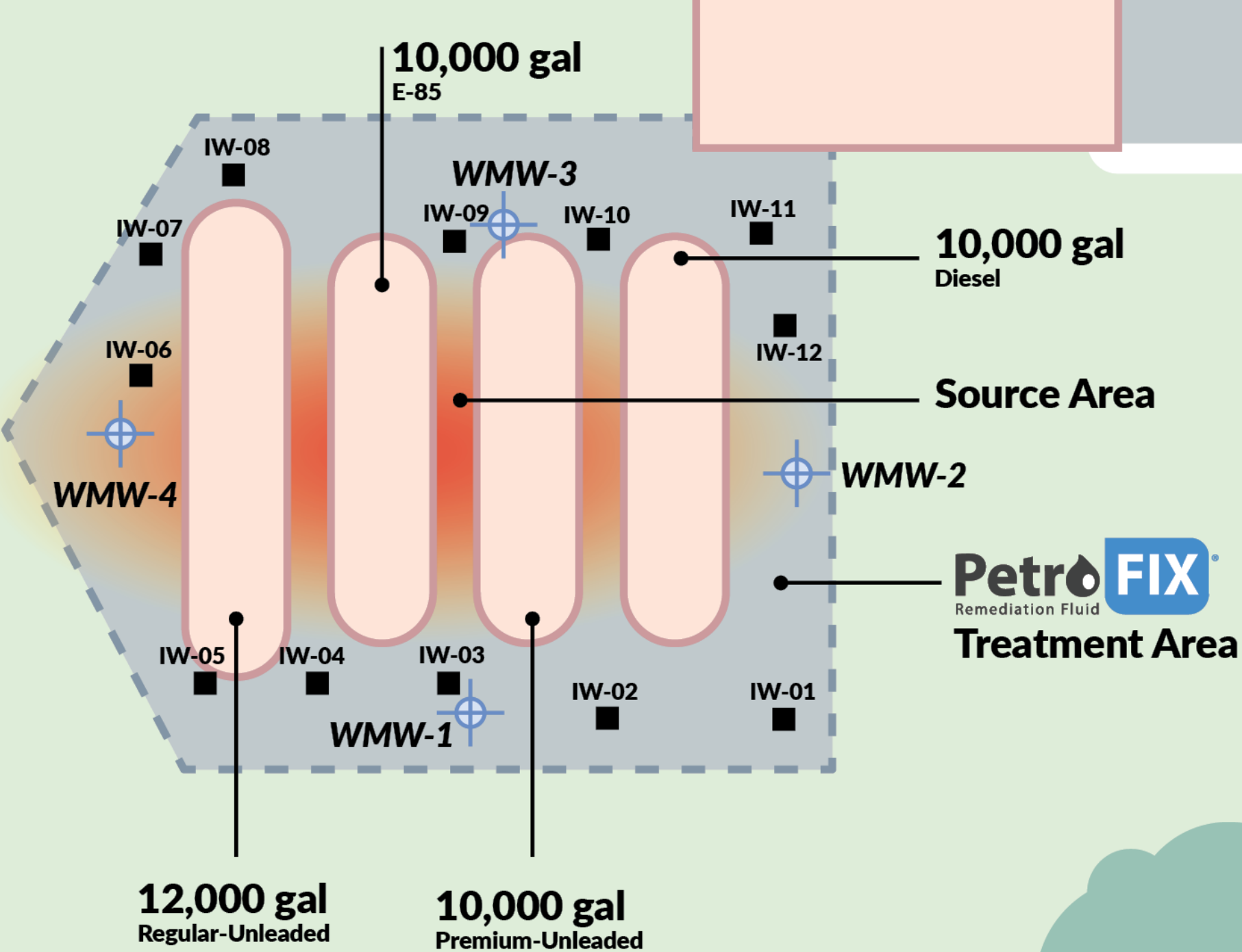
PETROFIX APPLIED TO ACTIVE UST BASIN

CASE STUDY:

Innovative tank basin flooding method fully treats gasoline contaminants at active petrol filling station

Tank Basin Details

- Max BTEX concentration: 6,557 µg/L
- 3x 37,000L tanks.
- 1x 45,000L tank.
- Contaminants within tank basin and in surrounding soils (clay/sand, weathered bedrock)



PetroFix Application

- Pilot test conducted July 2020 with 180 kg PetroFix and roughly 17,000L water.
- Full-Scale application conducted September 2020 with 2,000 Kg PetroFix and roughly 17,000 gallons water
- Volumes limited out of fear of floating the tanks, but distribution was excellent
- Treatment area of ~280m²



Results

Before PetroFix Treatment – March 2020

Mon. Well	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	TVPH
WMW-1	216 µg/L	2 µg/L	2,150 µg/L	69 µg/L	112 µg/L	10,800 µg/L
WMW-2	15 µg/L	<1 µg/L	50 µg/L	10 µg/L	1 µg/L	820 µg/L
WMW-3	185 µg/L	770 µg/L	828 µg/L	4,770 µg/L	<5 µg/L	30,500 µg/L
WMW-4	6 µg/L	<1 µg/L	3 µg/L	2 µg/L	15 µg/L	990 µg/L

Coloring indicates concentrations above Tier 1 Risk Based Screening levels

TVPH Value Represents Total Volatile Petroleum Hydrocarbons

Results

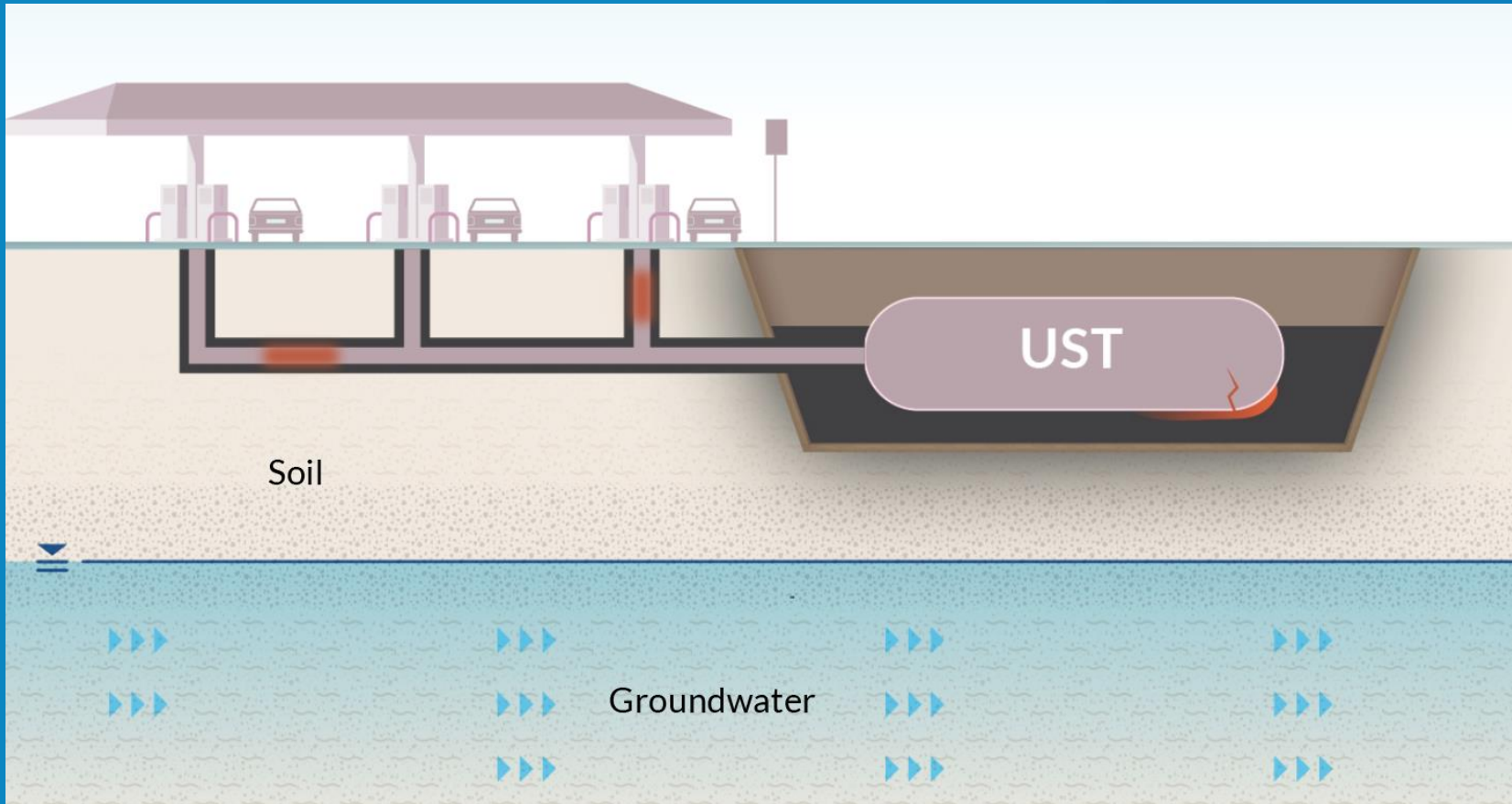
After PetroFix Treatment – March 2020

Mon. Well	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	TVPH
WMW-1	<1 µg/L	<1 µg/L	18 µg/L	60 µg/L	<1 µg/L	700 µg/L
WMW-2	<1 µg/L	<1 µg/L	<1 µg/L	<1 µg/L	<1 µg/L	<500 µg/L
WMW-3	<1 µg/L	<1 µg/L	<1 µg/L	<1 µg/L	<1 µg/L	<500 µg/L
WMW-4	1 µg/L	<1 µg/L	<1 µg/L	<1 µg/L	1 µg/L	<500 µg/L

All concentrations are below
Tier 1 Risk Based Screening Levels

TVPH Value Represents Total Volatile Petroleum
Hydrocarbons

Pre Treatment Conclusion



- Liquid application - easily sprayed into base of excavation and/or utility pipe bedding
- Non-hazardous - does not degrade underground infrastructure
- Can be co-mixed with water and added to tank bedding
- Once in-situ, sorption will last for decades
- Reduces reactive remedial costs
- Excellent distribution in situ

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