REGENESIS®

YOUR EXPERT SOURCE FOR COMPLETE SOIL AND GROUNDWATER REMEDIATION

Chad Northington, PE
Southeast District Manager

Multi-Site Performance Review of Colloidal Liquid Activated Carbon for Groundwater Treatment

Chad Northington, PE – REGENESIS Southeast District Manager

Keith Rice, PG – NOVA Engineering & Environmental Senior Geologist

REGENESIS

2018 FBA Brownfields Conference – Daytona Beach, FL

LARKIN COIL – ATLANTA, GA

Presentation Overview

- Technology Description
- Project Background & Timeline
- Application & Unique Challenges
- Results
- Summary/Q&A

REGENESIS

Research and Development

Remediation Technologies

Remediation Services

Land Science (Vapor Intrusion Mitigation)

1994 ORC® Filter Socks

1995 ORC® Powder/Slurry

1999 HRC®

2000 HRC® Primer

2001 HRC-X®

2002 MRC®

2004 Bio-Dechlor INOCULUM® Plus

2005 ORC Advanced®

2007 3-D Microemulsion®

2008 RegenOx®

2010 Petrocleanze®

2011 ORC Advanced® Pellets

2011 Regenesis Remediation Services™

2012 CRS™

2012 Persulfox®

2014 PlumeStop™ Colloidal Biomatrix

REGENESIS

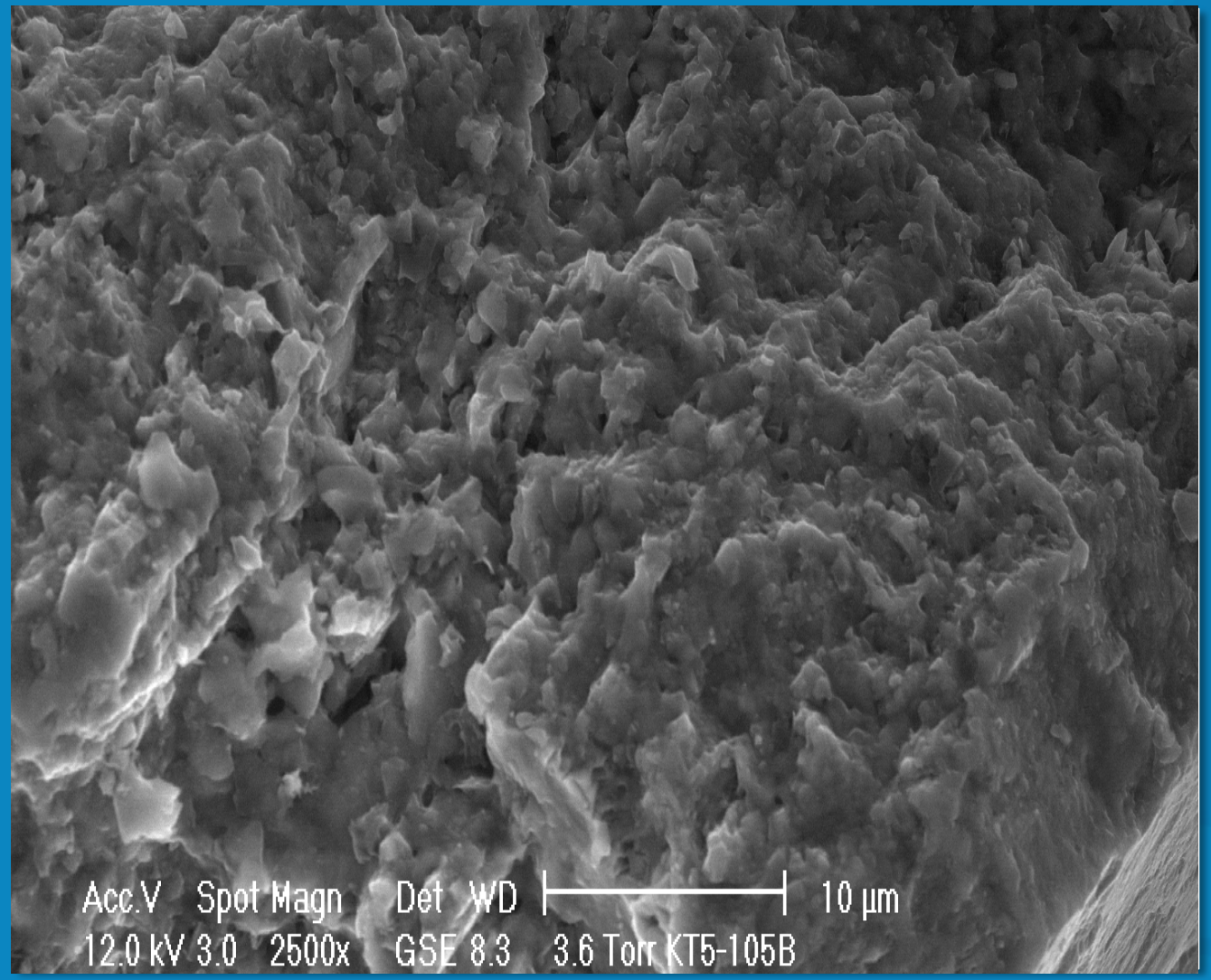
REQUIREMENTS FOR SUCCESSFUL *IN SITU* REMEDIATION

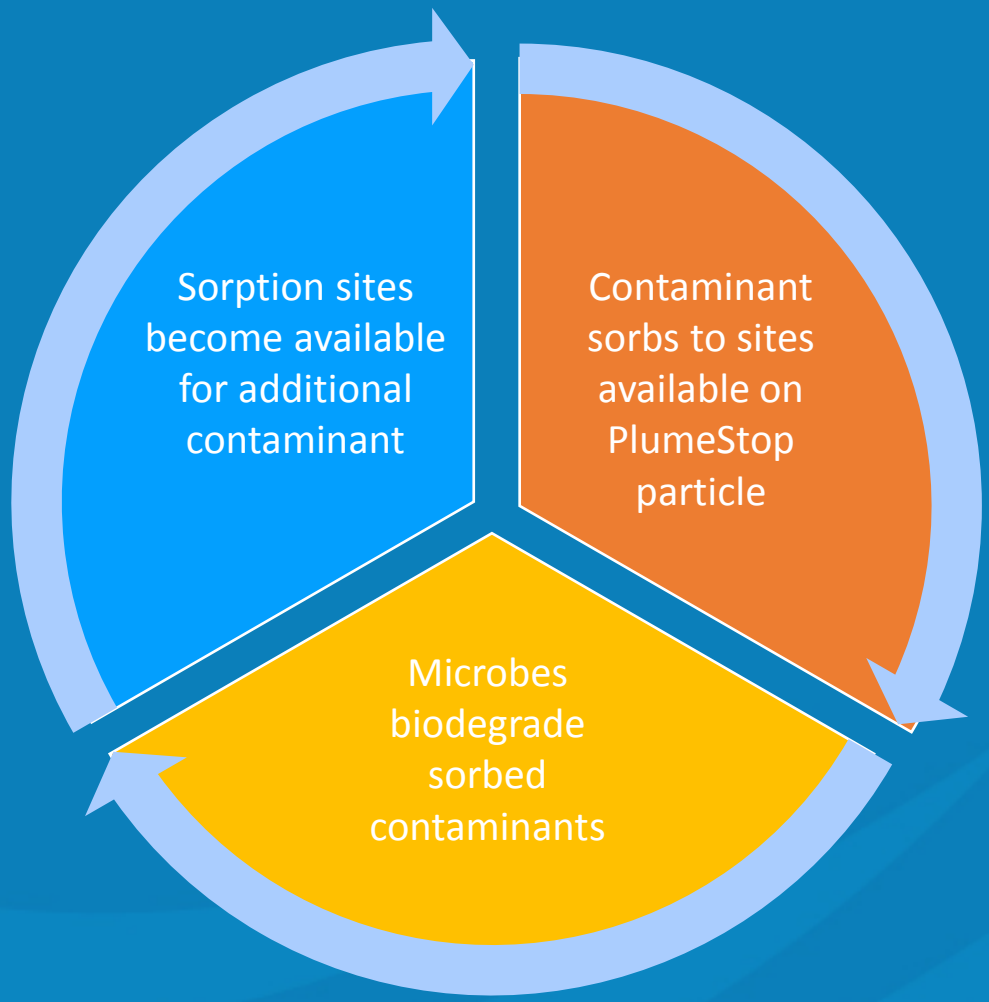
REGENESIS

PLUMESTOP – WHAT IT IS

- Also known as Liquid Activated Carbon™ or Colloidal Activated Carbon
- Colloidal Activated Carbon (1–2 µm)
  - Size of a red blood cell
  - Suspended in water
  - Huge surface area
  - Extremely fast sorption
- Proprietary Anti-Clumping/Distribution Supporting Surface Treatment (Multiple Patents and Additional Patents Pending)
  - Core innovation
  - Enables wide-area, low-pressure distribution through the soil matrix without clogging

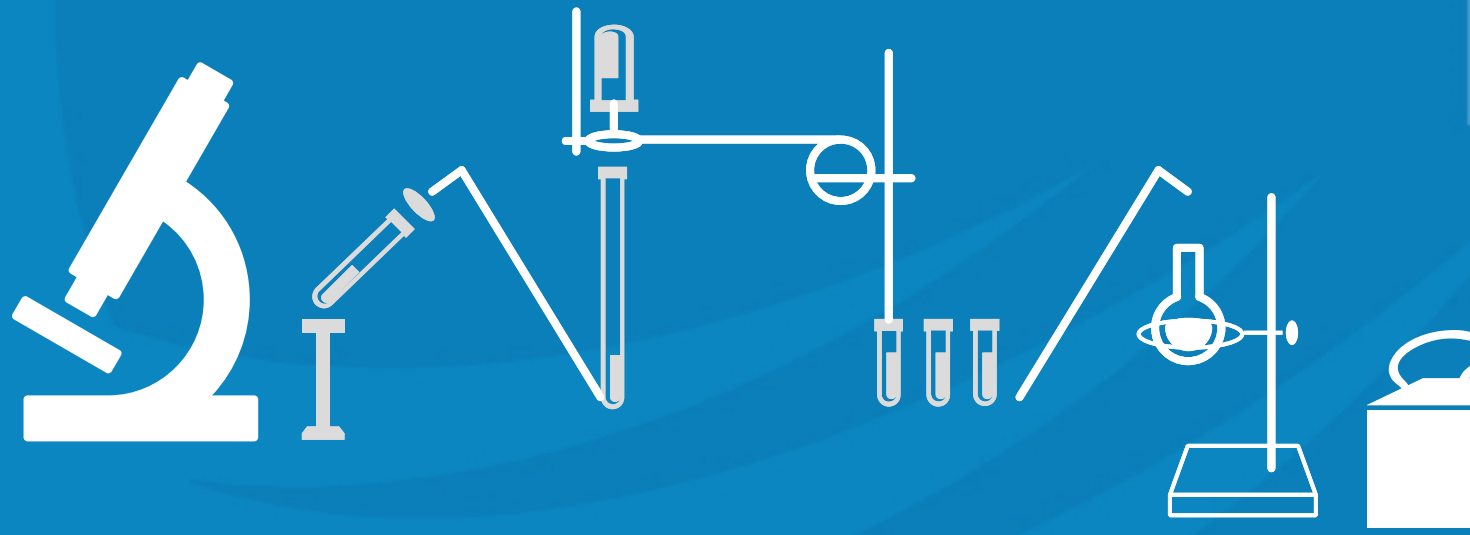
PlumeStop Mode of Action





REGENESIS®

TRANSPORT:
Colloidal AC



REGENESIS®

Subsurface Distribution

Colloidal Activated Carbon (cAC)

Powdered Activated Carbon (PAC)

- 1” diameter glass columns
- Sandy soil with 11% silt/clay
- Gravity feed

REGENESIS®

Colloidal Activated Carbon (cAC)

Carbon Type	Particle Size (micrometers)
Granular Activated Carbon	400-1000
Powdered Activated Carbon	50-250
Micron-Scale Activated Carbon	1-2

Powdered Activated Carbon (PAC)

Grain Size	Pore Throat Diameter (micrometers)
Medium Sand	8-50
Fine Sand	5-20
Silt	3-8

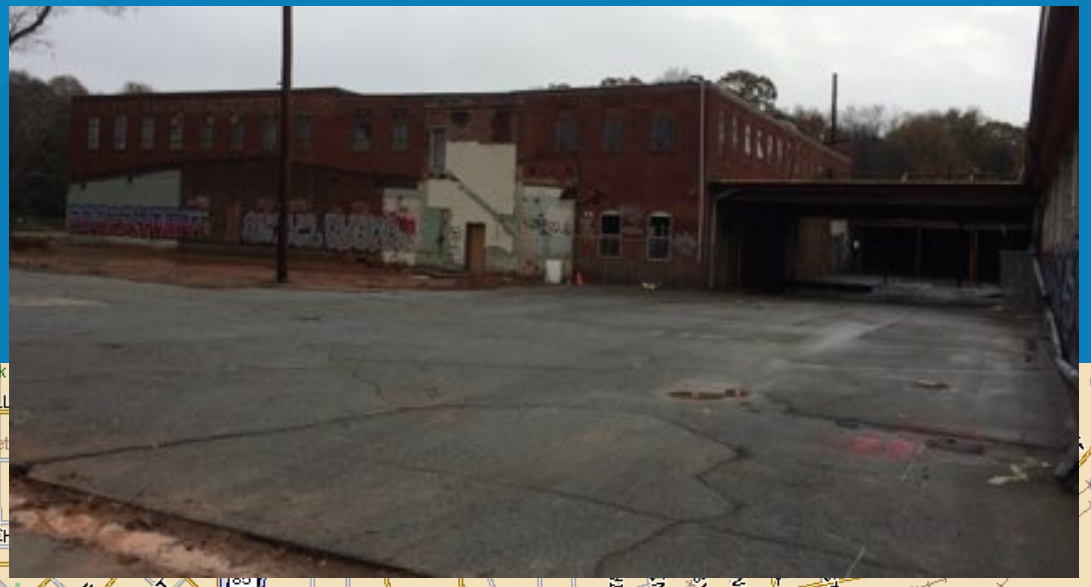
REGENESIS®

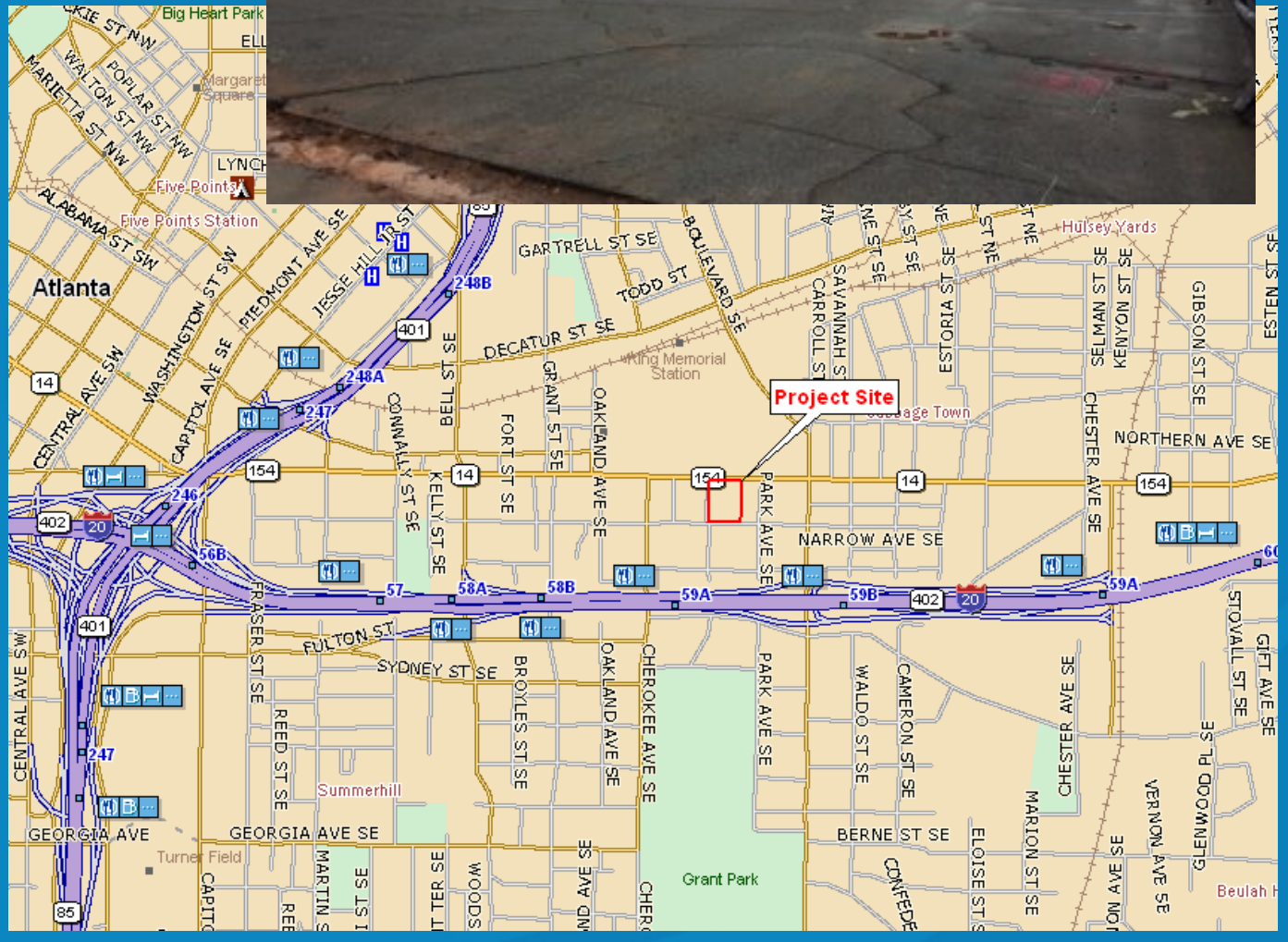
Time Lapse = 12 minutes

LARKIN COIL – ATLANTA, GA

Project Background

- Former Refrigeration Equipment Manufacturing Facility
  - Approx. 1920 – 1988
  - Bend & weld metal tubing (coils)
  - 1 TCE UST and 3 TCE degreaser pits on property
- Operations led to TCE contamination
  - Groundwater Contamination
    - TCE concentrations ranged from 100 to 460,000 µg/L





REGENESIS

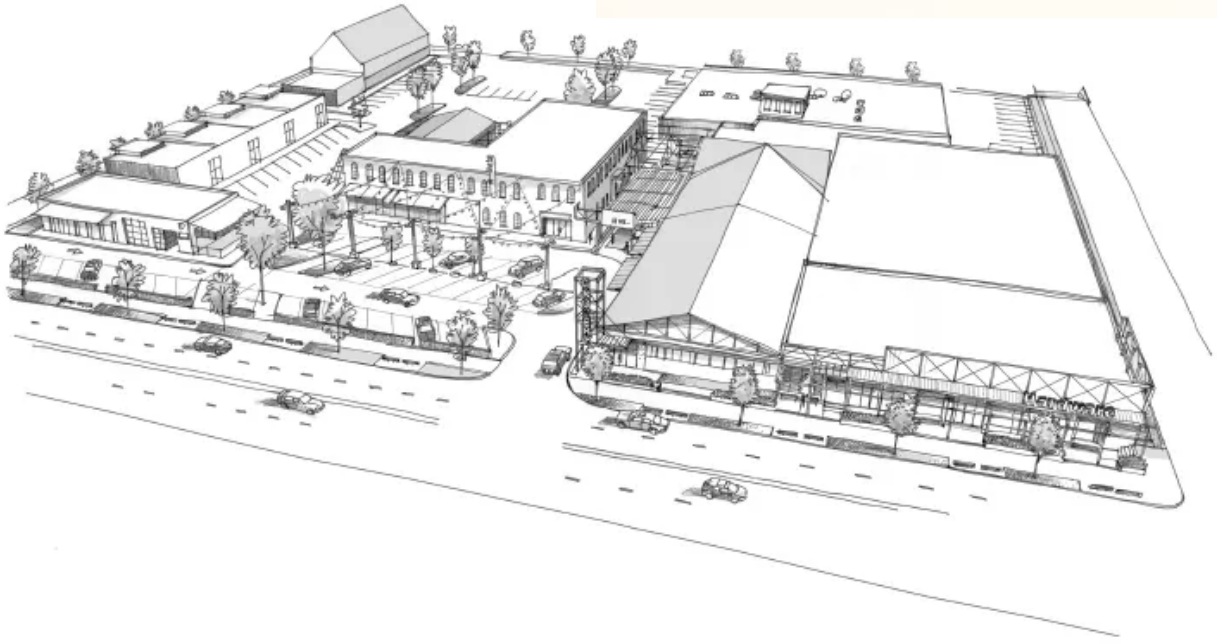
LARKIN COIL – ATLANTA, GA

Project Background

- Prospective Purchaser saw opportunity for mixed-use development
  - Track record for unique developments in Atlanta
- Prospective Purchaser (Paces Properties) going through GA Brownfield Program
  - PPCAP included remediation

PACES PROPERTIES

NOVA
PROFESSIONAL | PRACTICAL | PROVEN



REGENESIS

PROJECT TIMELINE

REGENESIS®

TIMELINE

2015
Preliminary Remedial Efforts
- Pilot studies, SVE, ISCO & Enhanced Fluid Recovery events

Fall 2015
NOVA Engineering and Environmental takes on role as environmental consultant

December 2016
Design development
- Completion of turnkey cost and proposal

January 2017
Event #1
- ISCO in source and mid-plume areas

April 2017
Event #2
- Combination ISCO/sorption/bio in source and mid-plume areas

August 2017
Event #3
- Downgradient sorption/bio barrier installation at property boundary in deep zone

PERSULF Ox Catalyzed Persulfate

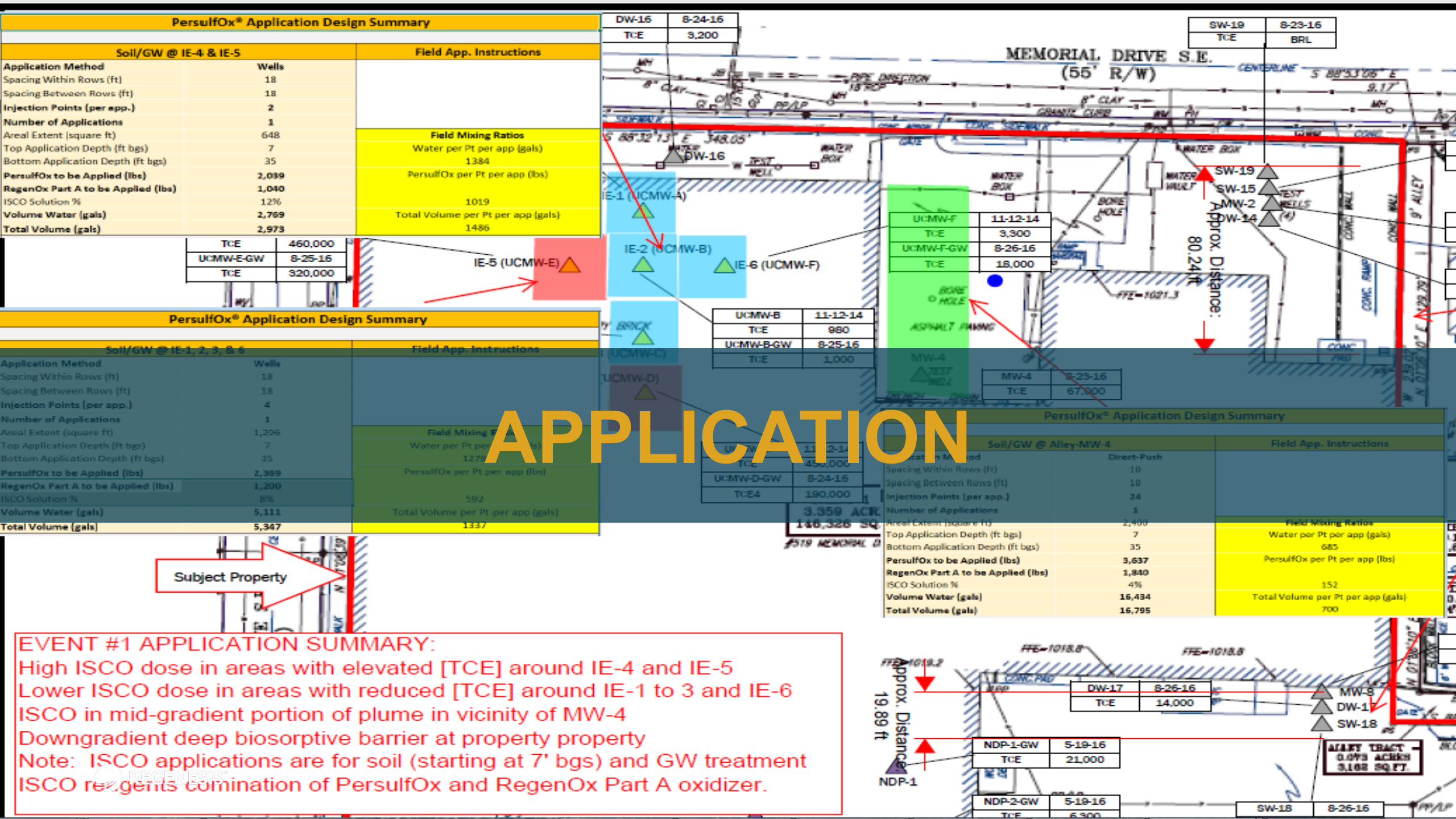
REGEN Ox

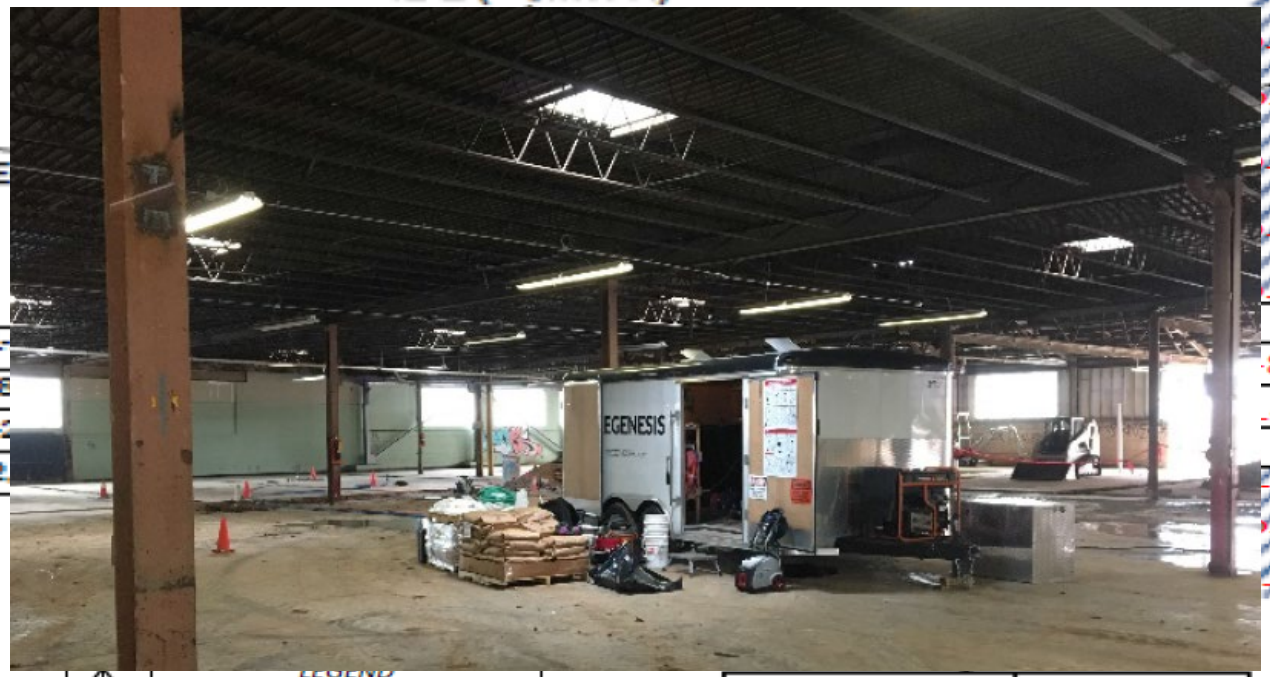
PLUME STOP Liquid Activated Carbon

BDI PLUS BIO-DECHLOR INOCULUM

HRC HYDROGEN RELEASE COMPOUND

REGENESIS®


PersulfOx® Application Design Summary
Soil/GW @ IE-4 & IE-5
Field App. Instructions
Application Method
Wells
Spacing Within Rows (ft)
18
Spacing Between Rows (ft)
18
Injection Points (per app.)
2
Number of Applications
1
Areal Extent (square ft)
648
Top Application Depth (ft bgs)
7
Bottom Application Depth (ft bgs)
35
PersulfOx to be Applied (lbs)
2,039
RegenOx Part A to be Applied (lbs)
1,040
ISCO Solution %
12%
Volume Water (gals)
2,769
Total Volume (gals)
2,973
Field Mixing Ratios
Water per Pt per app (gals)
1384
PersulfOx per Pt per app (lbs)
1019
Total Volume per Pt per app (gals)
1486
DW-16
8-24-16
TCE
3,200
SW-19
8-23-16
TCE
BRL
MEMORIAL DRIVE S.E.
(55' R/W)
TCE
460,000
UCMW-E-GW
8-25-16
TCE
320,000
IE-1 (UCMW-A)
IE-2 (UCMW-B)
IE-5 (UCMW-E)
IE-6 (UCMW-F)
UCMW-F
11-12-14
TCE
3,300
UCMW-F-GW
8-26-16
TCE
18,000
SW-19
SW-15
MW-2
DW-14
Approx. Distance: 80.24 ft
UCMW-B
11-12-14
TCE
980
UCMW-B-GW
8-25-16
TCE
1,000
MW-4
8-23-16
TCE
67,000
PersulfOx® Application Design Summary
Soil/GW @ IE-1, 2, 3, & 6
Field App. Instructions
Application Method
Wells
Spacing Within Rows (ft)
18
Spacing Between Rows (ft)
18
Injection Points (per app.)
4
Number of Applications
1
Areal Extent (square ft)
1,296
Top Application Depth (ft bgs)
7
Bottom Application Depth (ft bgs)
35
PersulfOx to be Applied (lbs)
2,369
RegenOx Part A to be Applied (lbs)
1,200
ISCO Solution %
8%
Volume Water (gals)
5,111
Total Volume (gals)
5,347
Field Mixing Ratios
Water per Pt per app (gals)
1278
PersulfOx per Pt per app (lbs)
592
Total Volume per Pt per app (gals)
1337
UCMW-D
11-12-14
TCE
450,000
UCMW-D-GW
8-24-16
TCE4
190,000
3.359 ACRE
146,326 SQ
519 MEMORIAL D
APPLICATION
PersulfOx® Application Design Summary
Soil/GW @ Alley-MW-4
Field App. Instructions
Direct-Push
Spacing Within Rows (ft)
10
Spacing Between Rows (ft)
10
Injection Points (per app.)
24
Number of Applications
1
Top Application Depth (ft bgs)
7
Bottom Application Depth (ft bgs)
35
PersulfOx to be Applied (lbs)
3,637
RegenOx Part A to be Applied (lbs)
1,840
ISCO Solution %
4%
Volume Water (gals)
16,434
Total Volume (gals)
16,795
Field Mixing Ratios
Water per Pt per app (gals)
685
PersulfOx per Pt per app (lbs)
152
Total Volume per Pt per app (gals)
700
Subject Property
EVENT #1 APPLICATION SUMMARY:
High ISCO dose in areas with elevated [TCE] around IE-4 and IE-5
Lower ISCO dose in areas with reduced [TCE] around IE-1 to 3 and IE-6
ISCO in mid-gradient portion of plume in vicinity of MW-4
Downgradient deep biosorptive barrier at property property
Note: ISCO applications are for soil (starting at 7' bgs) and GW treatment
ISCO reagents comination of PersulfOx and RegenOx Part A oxidizer.
FFE=1018.8
FFE=1019.2
Approx. Distance 19.89 ft
NDP-1
DW-17
8-26-16
TCE
14,000
MW-8
DW-17
SW-18
NDP-1-GW
5-19-16
TCE
21,000
NDP-2-GW
5-19-16
SW-18
8-26-16
ALLEY TRACT
0.073 ACRES
3,182 SQ FT



UCMW-D	11-12-14
TCE	450,000
UCMW-D-GW	8-24-16
TCE4	190,000

Prepared By: *WJM*	**Figure 1 – Injection Locations Map** **Larkin Coil** **519 Memorial Drive** **Atlanta, GA**
Date Prepared: *January 2017*	

REGENESIS
REMEDIATION SERVICES

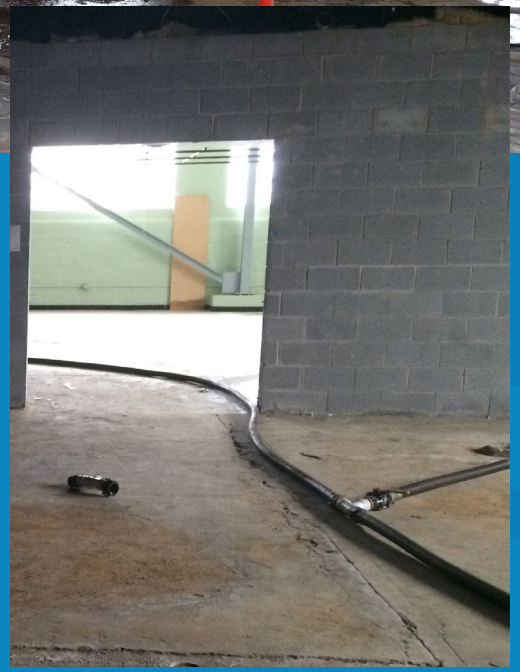
Memorial Dr SE
Park Ave SE
Park Ave SE
519 Memorial
Drive Southeast
Radiator
IW-20
IW-19
IW-18
IW-17
IW-16
IW-15
IW-14
IW-13
IW-12
IW-11
IW-10
IW-9
IW-8
IW-7
IW-6
IW-5
IW-4
IW-3
IW-2
IW-1

LARKIN COIL – ATLANTA, GA

Unique Challenges: Application

REGENESIS

- Who put that wall there?
- Who put that in the well?
- Who moved my reagent?



PROJECT STATS

TOTAL VOLUME (GAL) = 56,057

Location	PersulfOx (lbs)	RegenOx (lbs)	PlumeStop (lbs)	HRC (lbs)	BDI (liters)
Source	6281	2880	1600	-	-
Mid-plume	3637	1840	1200	270	18
Downgradient	-	-	12000	2610	27

REAGENTS

PLUME STOP® Liquid Activated Carbon

BDI PLUS BIO-DECHLOR INOCULUM

HRC® HYDROGEN RELEASE COMPOUND

HRC® PRIMER HYDROGEN RELEASE COMPOUND

HRC-X® EXTENDED HYDROGEN RELEASE COMPOUND

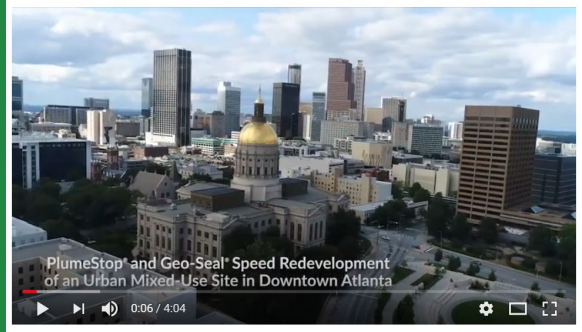
REGEN Ox® Chemical Oxidant Part A

PERSULF Ox® Catalyzed Persulfate

PARTNERSHIP

REGENESIS®

PlumeStop® and Geo-Seal® Speed Redevelopment of an Urban Mixed-Use Site in Downtown Atlanta



PlumeStop® and Geo-Seal® Speed Redevelopment of an Urban Mixed-Use Site in Downtown Atlanta

Keith Rice, Senior Professional Geologist, NOVA Engineering and Environmental

Author: Dane Menke **Date:** December 12, 2017

Ask Keith Rice, Senior Professional Geologist, about his role at NOVA Engineering and Environmental, LLC (NOVA) and you will likely get a range of responsibilities typically handled by several geologists. As one who wears two "hats," Senior Professional Geologist and Senior Technical Professional, Rice's duties encompass many key areas within today's expanding environmental industry. "My responsibilities are wide-ranging", says Rice. "They include, but are not limited to, soil and groundwater assessment, *in situ* and *ex situ* soil/groundwater remediation design and implementation, vapor intrusion mitigation system design and implementation, managing Brownfield sites, real estate due diligence assessments, such as writing and reviewing Phase I and Phase II Environmental Site Assessments, project management , and growing client relationships."

LARKIN COIL – ATLANTA, GA

Post-Application Results

Location	Baseline Concentration (ppb)	Final Concentration (ppb)	# of Events	% Reduction	Application Method	Injection Rate Range (gpm)	Maximum Injection Pressure (psi)	Maximum Injection Depth (ft bgs)
Source #1	190,000	85	1	99.96	IW/DPI	2-8	55	35
Source #2	320,000	75,000	1	77	IW/DPI	2-8	55	35
Mid-plume	67,000	350	2	99	DPI	1-6	35	35
Downgradient	610	NS	1	NA	IW	1-3	21	100
* Notes: IW = injection well; DPI = direct push injection								

SUCCESSFUL IN SITU REMEDIATION

What it takes in the world of Brownfield sites …

"Design plus implementation capabilities set REGENESIS apart…" - Keith Rice, NOVA

"Simplified what could have been a very difficult process" - Pat Wilson, Paces Properties

"Speed and willingness to work with schedule…" - Keith Rice, NOVA

REGENESIS®

QUESTIONS?

Chad Northington, PE
Southeast District Manager
cnorthington@regenesis.com
864-884-4346

REGENESIS