

## BOS 100® Remediation at a Former Dry Cleaning Operation Charlotte, North Carolina



**Period – June 2007 – February 2010**

**Project Value - \$735,000**

### Background Information

A former dry cleaning facility located at in North Carolina was in operation from 1979 to 2002. Site Investigations over the years has documented that site soil and groundwater is impacted with chlorinated constituents (primarily tetrachloroethene (PCE) and its degradation products) resulting from releases from the historical dry cleaning operations. The primary area of concern is approximately 25,000 square feet.

Saporlite is the primary site stratigraphy to a depth of approximately 50 feet below ground surface (bgs). The depth to groundwater varies across the site from depths of approximately 10 to 25 feet bgs. Shallow monitoring wells indicate that PCE concentrations ranged from 6,800 ug/L to 37,000 ug/L in the area of the former dry cleaning operations in the shallow groundwater (to a depth of approximately 50' bgs). Substantially, lower levels of TCE, and to an even lesser extent cis-1, 2-DCE, have also been detected in a few of the shallow monitoring wells. PCE was detected in the down gradient bedrock wells at concentrations ranging from 47 to 880 µg/L. ***However, the bedrock impacts were not part of the injection effort scope.***

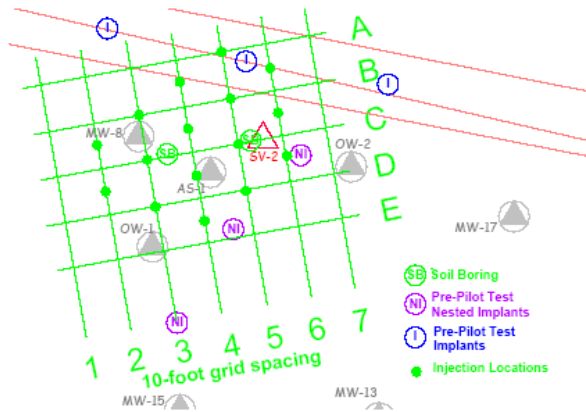
Soil samples were collected in and around the location of the former dry cleaning operations. Chlorinated VOC compounds, primarily PCE, were detected in the soil beneath the dry cleaning room at concentrations above applicable cleanup standards. The highest PCE concentration (21,020 mg/kg) was detected near a floor trench. Soil excavation activities were conducted in an attempt to remove PCE-impacted soil from the dry cleaning area. However, due to physical constraints associated with excavating inside a building, some impacted soil remained at the site.

### Description of Remedial Effort

The work consisted of three phases: BOS 100® Pilot Test performed in 2007, Phase I Full Scale Injections performed in 2008 and Phase II Full Scale Injections performed in February 2010.

**Pilot Test in 2007:**

AST was tasked with perform a pilot test to evaluate the use of BOS 100® to remediated the shallow groundwater (11' to 41' bgs) in a 1,460 sf area of the site. Since this is an industrial setting the established onsite groundwater remedial goal for PCE is 0.5 mg/L. The following provides the results (in ug/L) from this pilot test:



**Pilot Injection Plan**

Project Data							
Well/Implant Locations	Analytes	Well Data Before	Well Data 1 day	Well Data 2 weeks	Well Data 4 weeks	Well Data 6 weeks	Well Data 8 weeks
MW-8	PCE VC	5222 (50) ND (50)	12 (0.5) ND (0.5)	61 (0.5) ND (0.5)	12 (0.5) ND (0.5)	40 (0.5) ND (0.5)	64 (0.5) ND (0.5)
MW-AS-1	PCE VC	317 (5) ND (0.5)	2.5 (0.5) ND (0.5)	29 (0.5) ND (0.5)	15 (0.5) ND (0.5)	72 (0.5) ND (0.5)	15 (0.5) ND (0.5)
I-15	PCE VC	6285 (50) ND (50)	35 (0.5) ND (0.5)	1.5 (0.5) ND (0.5)	1.2 (0.5) ND (0.5)	1.5 (0.5) ND (0.5)	No sample

**Full Scale Injections Phase I in 2008 and Phase II in 2010:**

Based on the Pilot Test results, a remedial design was prepared for the installation of 35,300 pounds BOS 100®. In July 2008, AST mobilized to the site and installed ~29,000 pounds of BOS100® in 164 direct push injection points as part of the Phase I injection effort. These injections were within the shallow aquifer, 17 to 53' bgs. The BOS 100® loadings varied from 5 lbs. to 25 lbs. per injection depending of the saturated soil and groundwater concentrations in a specific area. These injection locations are identified on the attached figure.

Based on progress monitoring during the Phase I injection effort, it was determined to delay the injection of the final 6,300 lbs and to continue monitoring the site groundwater in order to determine if injection loadings should be adjusted. After approximately 1 year of monitoring, injection loadings were adjusted to target specific areas (just east of excavation area, near MW-13, MW-16 and MW-14).

In February 2010, AST remobilized to the site to install the 6,300 lbs of BOS 100® as part of the Phase II injection effort. These injections were within the shallow aquifer, 14' to 43' bgs. The BOS 100® loadings varied from 7.5 lbs. to 25 lbs. per injection depending of the saturated soil and groundwater concentrations in a specific area.

Also, the attached figure identifies the Phase II injection points installed. Additionally, charted data is provided showing PCE concentrations in groundwater over time relative to each of the full scale injection events. As an example, the area around MW-13 had the some of the highest pre-treat concentrations. As demonstrated in the MW-13 charted data, PCE concentrations were reduced by over 98% using the BOS 100® remedial approach.

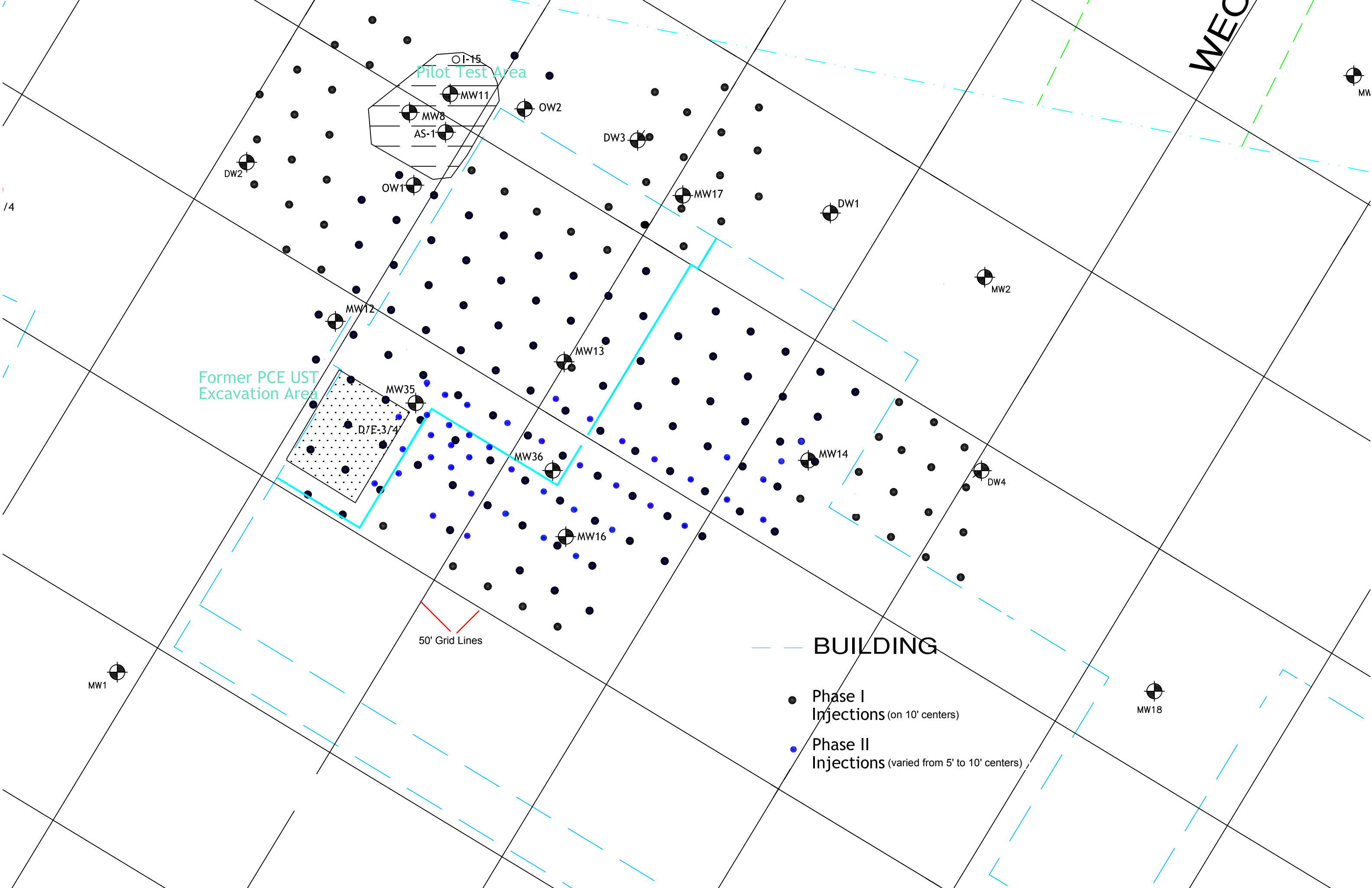
The table provided below, summarizes the pre- and post full scale PCE concentrations in key monitoring wells at the site:

**Full Scale Injection Results Summary**

Well ID	Analytes	Pre-Inject (~1 month prior to Full Scale Injections) (mg/L)	Post Phase I Injection (~1.25 years) (mg/L)	Post Phase II Injections (~1 month) (mg/L)	Reduction Of PCE
MW-12	PCE VC	0.412 <0.01	0.25 <0.0005	Not Sampled	39.3% (this area was on the periphery of the full scale injection areas & was already below cleanup goals)
MW-13	PCE VC	17 <0.1	0.722 <0.01	0.33 <0.0005	98%
MW-14	PCE VC	7.6 <0.001	5.84 <0.01	1.7 <0.0005	77%
MW-16	PCE VC	15.6 <0.02	6.39 <0.01	0.18 <0.0005	98.8%
MW-17	PCE VC	1.51 <0.002	0.0062 <0.0005	0.0046 <0.0005	99.7%
MW-36**	PCE VC	5.97** <0.001	0.25 <0.0005	0.28 <0.0005	95.3%

\*\*MW-36 was installed just post of the Phase I injection effort (the 1<sup>st</sup> Sample collect September 2008).

Monitoring of the site groundwater is ongoing.



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WEG

Former PCE UST  
Excavation Area

Pilot Test Area

BUILDING

50' Grid Lines

- Phase I Injections (on 10' centers)
- Phase II Injections (varied from 5' to 10' centers)

MW1

MW18

MW

MW2

DW2

OW1

OW2

DW3

MW17

DW1

MW12

MW13

MW35

D7E-3/4

MW36

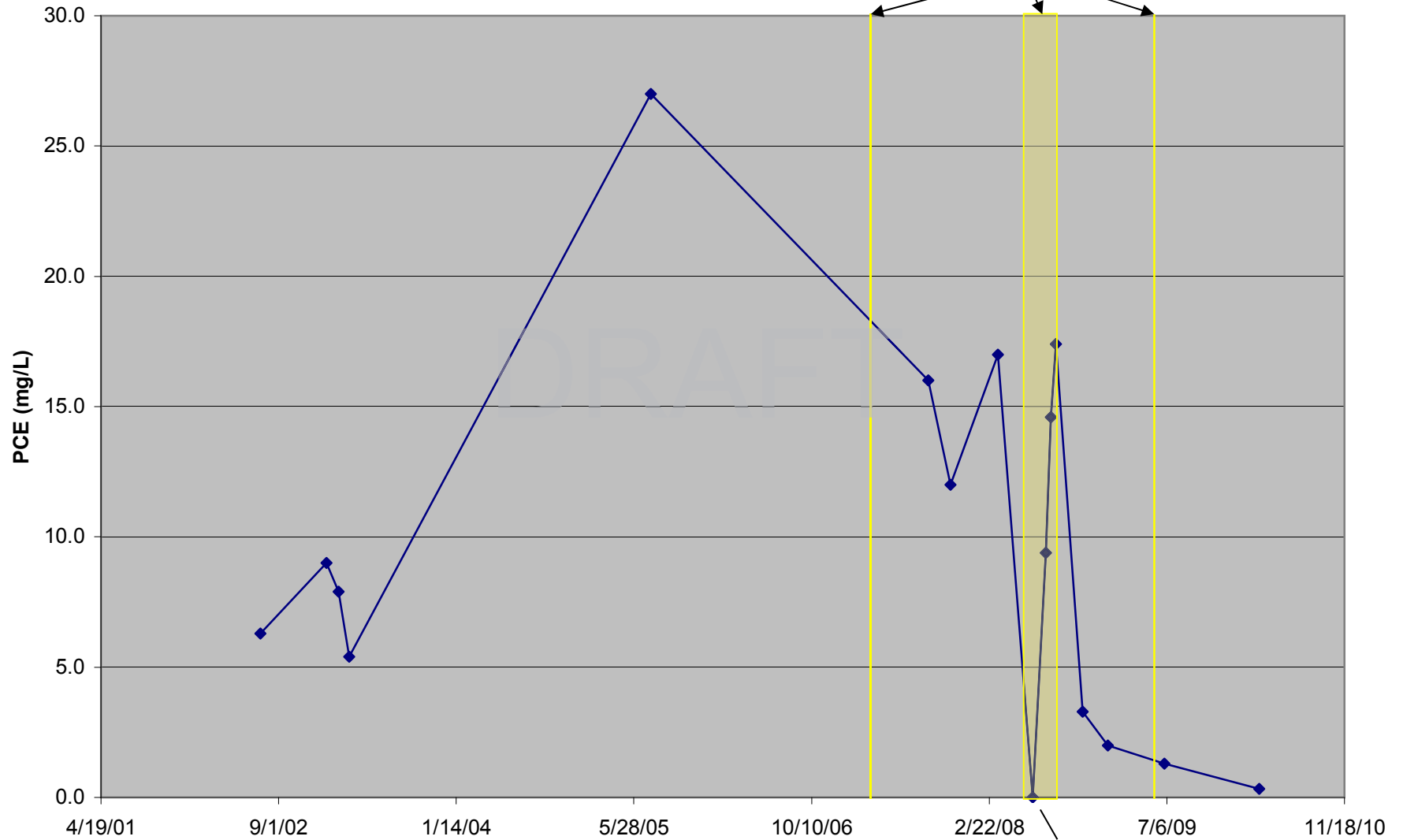
MW16

MW14

DW4

# MW-13

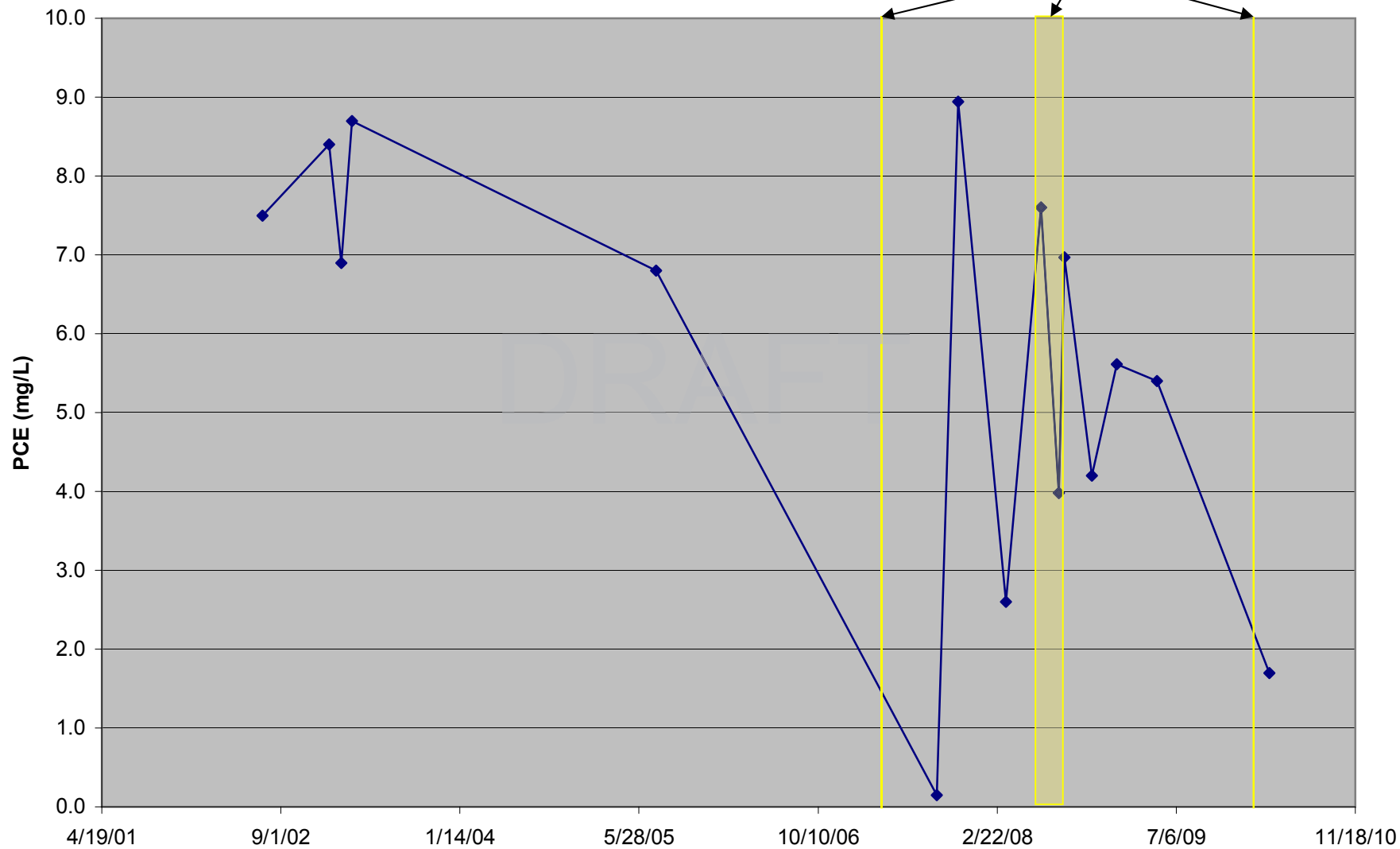
BOS-100 Injection Events



This data point is an anomaly. It was below detection limits (BDL) and is believed to be a field sample collection error

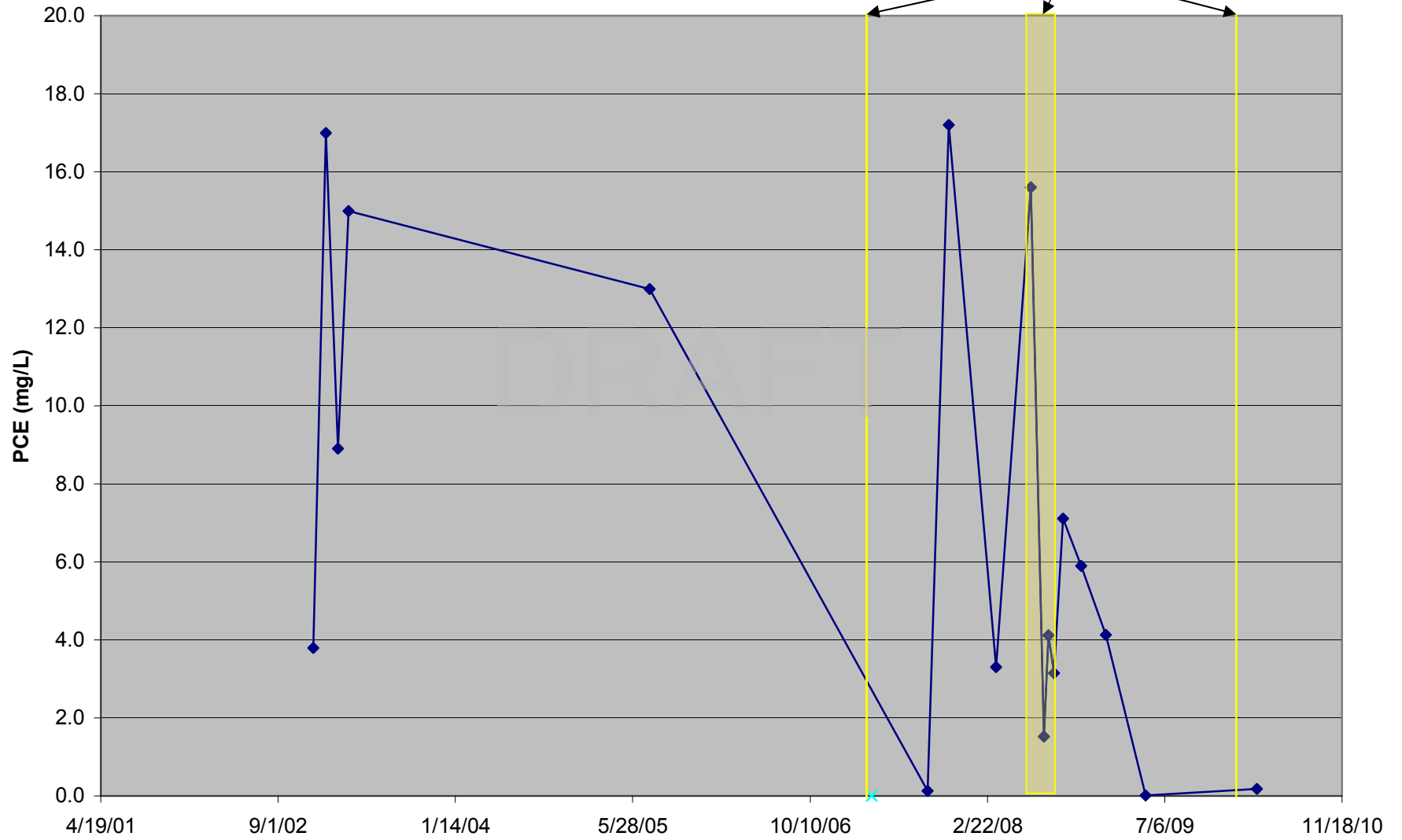
**MW-14**

BOS-100 Injection  
Events



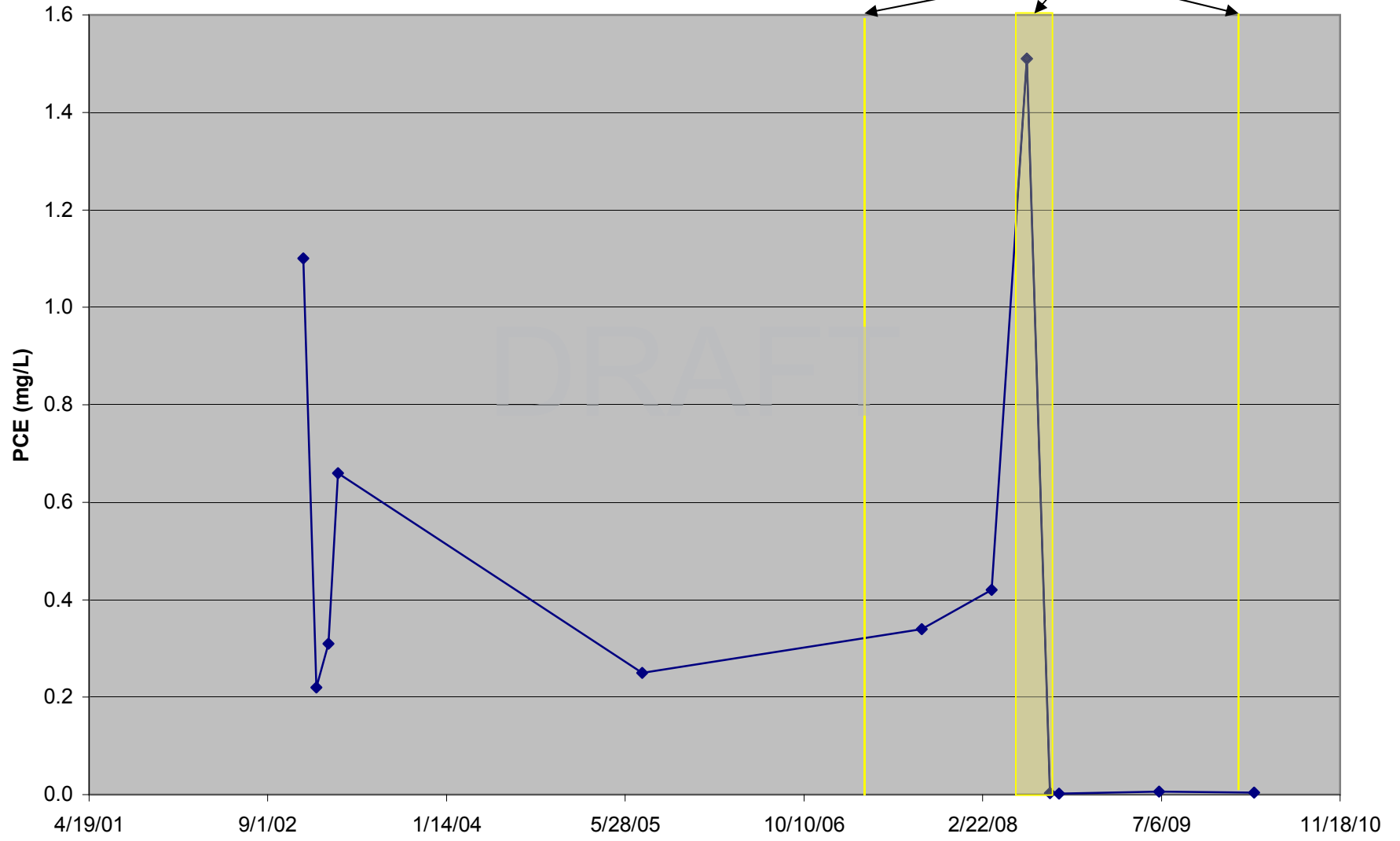
# MW-16

BOS-100 Injection Events



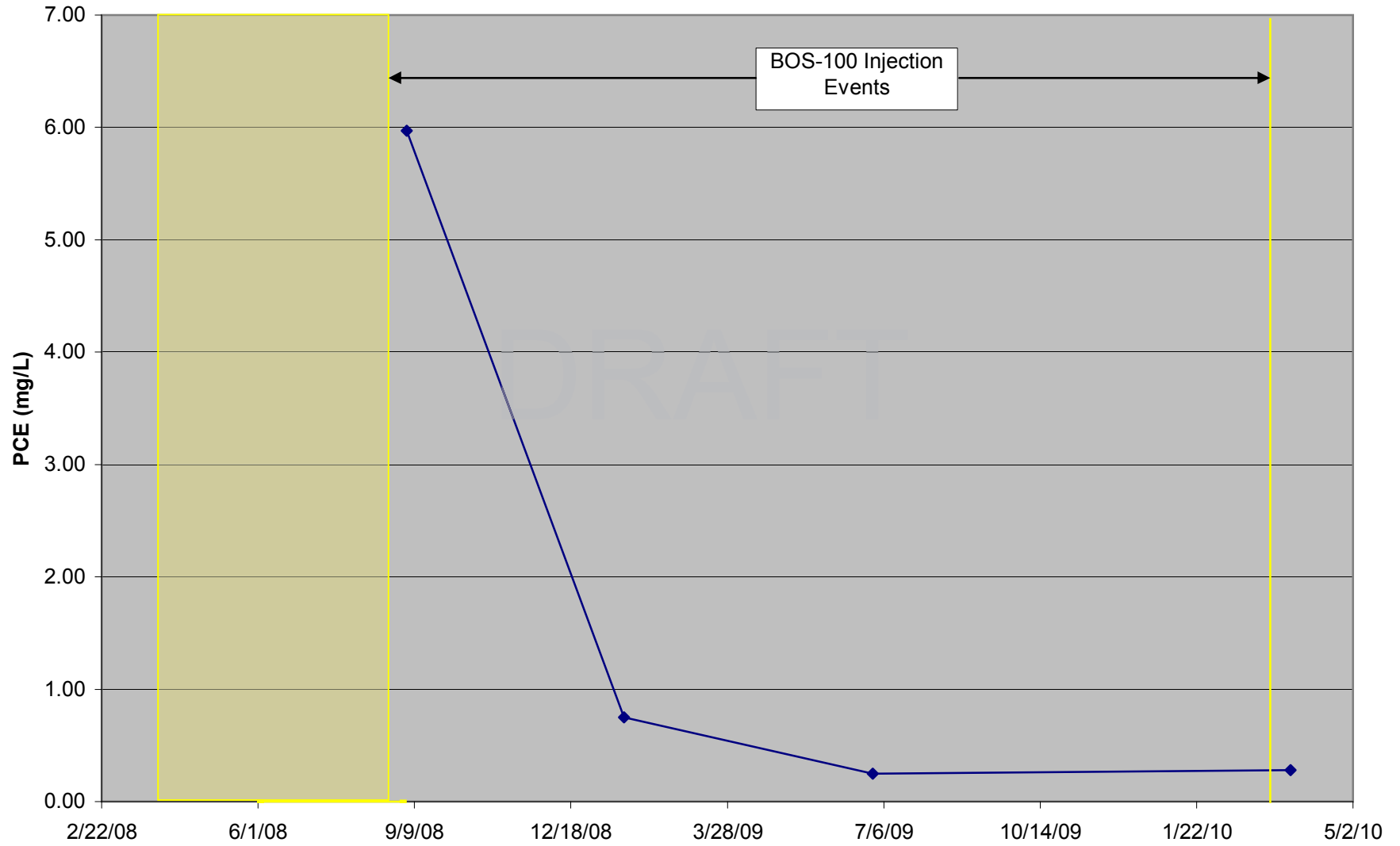
MW-17

BOS-100 Injection  
Events





# MW-36



AS-1

BOS-100 Injection Events

