TETRA TECH

PITT-10-14-016

October 10, 2014

Project Number 02206

Mr. Jeff Dale
BRAC Program Management Office Northeast
4911 South Broad Street
Philadelphia, Pennsylvania 19112-1303

Reference: CLEAN Contract No. N62472-03-D-0057
Contract Task Order 041

Subject: Technical Review Committee (TRC) Meeting Minutes of May 15, 2014
Former Naval Air Warfare Center (NAWC) Warminster, Pennsylvania

Dear Mr. Dale:

Enclosed please find the minutes from the TRC meeting held on May 15, 2014. Copies of the minutes are being sent to the individuals identified on the distribution list.

Please contact me if you have any questions or comments.

Sincerely,

Jeffrey P. Orient
Project Manager
JPO/stc
Enclosure
C: Willie Lin (Navy BRAC PMO)
Kathy Davies (U.S. EPA)
Sarah Kloss (U.S. EPA)
Colin Wade (PADEP)
Mike Penzone (PADEP)
Ron Sloto (USGS)
Dave Fennimore (Earth Data)
Tim Hagy (Warminster Municipal Authority)
Jen Good (H&S)
Pat Schauble (H&S)
Carolyn Scala (Battelle)
Adam Selisker (CRC)
Michelle Rudnick (CRC)
Garth Glenn (Tetra Tech)
CH2MHill RDM
File: 112G02206

FORMER NAVAL AIR WARFARE CENTER (NAWC) WARMINSTER
TECHNICAL REVIEW COMMITTEE (TRC) MEETING MINUTES
MAY 15, 2014 MEETING
REFERENCE: CLEAN CTO NO. 041

1. Meeting Date and Time: May 15, 2014, 9:45 AM to 11:25 AM
2. Location: Warminster Municipal Authority Board Room
3. Attendees: See Attachment 1 (attendance list)
4. Summary of Meeting Discussions: See below.

Administrative Update

Willie Lin, the BRAC Environmental Coordinator (BEC) for the project working out of the Navy's Base Realignment and Closure Program Management Office (BRAC PMO) in Philadelphia, opened the meeting by welcoming the attendees and providing an agenda for the meeting (Attachment 2). This is the third TRC meeting for the former NAWC Warminster following adjournment of the Restoration Advisory Board (RAB). Margaret Pollich (PADEP) indicated that Colin Wade will be replacing here as the new PADEP project manager for the former NAWC Warminster. Sarah Kloss was introduced as the new U.S. EPA Region III project manager, replacing Dennis Orenshaw.

Comments were solicited on the April 10, 2013 TRC meeting minutes (note that the scheduled October 2013 TRC meeting was cancelled due to short-term government funding issues). No comments were offered by those in attendance and the meeting minutes were approved as-is.

Action items from the April 2013 TRC meeting were addressed as meeting agenda topics were brought up for discussion. The action items from the previous TRC meeting are summarized below:

- Mr. Lin is to look into the possibility of adding a community member to replace Mr. Kelly at the TRC meetings.

- Mr. Dale will send WMA some information regarding PFC sampling.
- EPA is to evaluate the new Area C data regarding vapor intrusion.
- The Navy is to provide updates r.e. groundwater extraction, treatment, and source area testing activities.
- PADEP/CRC is to provide an update r.e. the status of the CRC Industries remedial activities. WMA/Earth Data is to provide an update of the municipal wells status.
- The Navy is to update the TRC on the progress of property transfers for the remaining Navy properties along Jacksonville Road and the Shenandoah Woods housing area.
- The Navy is to provide an update on LTM activities (sampling, LUC inspections).

CRC Industries Update

Michelle Rudnick (CRC Industries) provided an update on remedial activities at the facility. The pump and treat system has been up and running since October 2013, pumping from six wells at an aggregate rate of 7.5 gpm. To date, 1.96 million gallons of water have been pumped and treated, with approximately 112 pounds of VOCs removed (mostly PCE and TCE). The semi-annual round of groundwater sampling is

scheduled for next week. Kathy Davies (EPA hydrogeologist) asked what the typical influent concentrations were – Ms. Rudnick indicated that the influent typically has approximately 10-12 mg/l of total VOCs. Ms. Rudnick also indicated that DNAPL monitoring is still being performed – no DNAPL has been observed recently.

WMA 26 Update

Dave Fennimore briefed the meeting attendees on the status of WMA 26. The water supply well is still pumping at its usual rate. Mr. Fennimore handed out a graph showing PCE and TCE concentrations over time, noting that the data does not indicate any change in PCE concentrations since the October 2013 startup of the CRC Industries groundwater extraction/treatment system. There was some general

discussion regarding whether sufficient time had passed to see an effect at WMA 26 from the CRC Industries remedial efforts.

Perfluorinated Compounds (PFCs) Update

Jeff Dale (Navy Remedial Project Manager) provided an update on recent PFC-related activities. The Navy has been sampling for PFCs over the past year, and recently restarted two Area C extraction wells (not needed for PCE plume containment) to enhance PFC-impacted groundwater capture in Area C. A potential PFC source assessment report was prepared by Tetra Tech on behalf of the Navy to identify the

most likely sources for the PFCs at WMA 13; leading candidates include Site 8, former Structure S-1 located near Site 8, Site 4, and Building 134 (currently the Bucks County Emergency Response Facility). The Navy has also tasked Battelle with performing an investigation of PFCs in the area; a Data Quality Objectives (DQO) meeting is scheduled for immediately following the TRC meeting to aid in scoping the investigation. Carolyn Scala (Battelle, Navy contractor) provided a handout (see Attachment 3) summarizing the general path forward for the PFC investigation. The scope of the project will include sampling groundwater for PFCs, a groundwater treatment system evaluation for PFC removal, and a vapor intrusion sampling/assessment for Area C, including Gilda's Club.

Mr. Fennimore asked for an update in the status of PFC sampling in regards to WMA-13 – Mr. Dale indicated that the PFCs are typically below the provisional health advisory levels (slightly above in one round of sampling), continued monitoring is planned, and he reiterated that the Navy is meeting with EPA and PADEP following the TRC meeting to discuss the path forward.

Source Treatment Data Collection and Design Update

Ms. Scala provided an update on Area A soil/rock core testing activities (see handout in Attachment 4). A draft report presenting the results of the rock coring/testing activities was submitted in March 2014. High levels of VOCs were detected in the core boring, drilled between EW-A6 and EW-A7, at depths of 16.5-31.5 and 70.5-76 feet below ground surface. Ms. Davies asked whether there was a lithologic correlation

to the elevated VOCs – Ms. Scala indicated that the VOCs were detected primarily in siltstone versus sandstone.

Ms. Scala then provided an update on the In Situ Chemical Oxidation (ISCO) treatment design (see handout in Attachment 5). The draft design report was submitted in April. Planned ISCO injection activities are targeting the Technical Impracticability (TI) zone, with 4 injection wells planned for installation. A baseline sampling event is scheduled for May (corresponding with the semi-annual round of LTM sampling), with ISCO injections to be performed this summer.

Mr. Fennimore expressed a concern that the design report states that ISCO-related impacts to WMA-26 are not anticipated, and the production well is not scheduled for monitoring as part of the source treatment activities – he pointed out that WMA is on record as being against the ISCO work due to concerns that it might adversely impact WMA-26. Mr. Dale indicated that WMA-26 could be added to the performance monitoring program for the ISCO work, and reiterated that the top Navy priorities were to 1) not impact WMA-26, then 2) not impact the treatment system, then 3) to effectively execute source treatment. Mr. Dale then asked for the recent WMA sampling data for the recent (February 2014) time period over which the extraction system was shut down due to storm damage (some data has been provided but the data set is not complete). Mr. Fennimore asked that the Navy put the request in writing, then they will provide whatever data is requested. Mr. Lin asked whether WMA would be providing written comments on the plan; Mr. Fennimore indicated that they would.

Ms. Davies expressed a concern regarding the nearby stream – some monitoring of the stream should be included in the plan. She also did not concur with a statement in the

design report that no gas will be generated by the sodium persulfate. Ms. Scala indicated that it will be clarified in the report that gas generation will be minimal in comparison to using peroxide. Ms. Davies also asked why sulfate is not being monitored – Mr. Dale pointed out that persulfate is being monitored, however Ms. Davies felt that sulfate monitoring would be useful for looking at TDS changes. Mr. Tim Hagy (WMA) expressed a concern that the water authority has a permit limit for TDS of 500 mg/l and is currently at about 400 mg/l. Mr. Hagy then asked whether there is an MCL for sulfate – Mr. Dale indicated that there is only a secondary MCL based on taste/odor. Mr. Hagy also expressed a concern

about potential impacts to a nearby commercial well (Aztec Machinery Company); Ms. Davies indicated that this well has not been impacted by the site or site-related activities in the past.

Mr. Hagy asked whether ISCO has been used at other sites for source remediation – several meeting attendees affirmed its past use for this type of application. Mr. Fennimore asked whether other oxidants besides sodium persulfate had been considered – Ms. Scala stated that they had, and sodium persulfate was selected as the best option due to its limited gas generation and limited persistence in the environment. Ms. Davies asked how persulfate monitoring would be done – Mr. Dale stated that field test kits would be used. Ms. Davies suggested adding either location HN-14 or HN-16 to the monitoring program as they are downgradient from the source area.

Groundwater Extraction, Treatment, and Monitoring Update

Jen Good (H&S Environmental, Navy contractor) provided an update on groundwater extraction, treatment, and monitoring activities (see handout in Attachment 6).

The spring round of LTM sampling is scheduled for next week. Ms. Davies asked whether Area D wells were above the MCL – Ms. Good stated that a couple wells have been slightly above MCLs for the past 2 years, but all of the extraction wells remain below MCLs (~2-3 ug/l). Some notable points covered include:

- The treatment plant operated at an average rate of 102 gpm in April, with most flow coming from Area A and the remainder from Area C. Flows have increased recently with EW-C16 and EW-C17 being brought back online.
- Minor extraction system shutdowns over the past 6 months were due to the rock coring work and a storm-related electrical power outage.
- VOC removal via pumping totaled approximately 8.95 lbs in April, with 8.29 lbs of TCE the primary VOC removed. Almost all the mass removal was from Area A wells.
- VOC recovery rates have stabilized and have been at similar levels for ~5 years.

- Area C wells were sampled for PFCs in January 2014; the highest concentrations were PFOA at 2.6 ug/l and PFOS at 16 ug/l, both in well OB-11. PADEP has been notified r.e. PFCs in the treatment plant influent.
- A pH adjustment pilot study to improve the removal efficiency of Cr^{+6} is ongoing.
- The Fall 2013 round of groundwater sampling was performed in November, with a report due out in May 2014, and the Spring 2014 round of sampling is scheduled for May.
- TCE concentrations in Area D continue to be close to or below the MCL, with all extraction well concentrations below 3 ug/l. Pumping is no longer being performed, but monitoring will continue for now.
- The 2013 annual land use control inspections were performed in November 2013, with no issues of note identified. A report is scheduled for May.

Navy Housing Transfer Update

Mr. Lin informed the TRC that the housing units along Jacksonville Road have been transferred to a Bucks County group. The Shenandoah Woods housing units are still owned by the Navy. Ms. Kloss asked whether Findings of Suitability to Transfer (FOSTs) had been completed for the housing units – Mr. Lin indicated that they have been completed; the work was performed through the Willow Grove Installation Restoration team.

Miscellaneous Topics and Issues – Action Items

Some additional discussion focused around the PFCs issue. Mr. Fennimore asked if additional monitoring will be done to determine whether the recent increase in pumping in Area C is having a positive effect on PFCs at WMA-13. Mr. Dale affirmed that the Navy is planning on continuing to sample WMA-13 every other quarter, and will also sample Area C wells to see if the restart of EW-C16 and EW-C17 changes anything. Mr. Lin suggested that either the Navy or WMA sample WMA-13 in May – Mr. Hagy indicated that WMA is planning to sample on May 20. Mr. Fennimore suggested splitting some samples between WMA and the Navy; Mr. Dale concurred. Ms. Davies asked if EPA could get copies of the WMA sampling results; Mr. Hagy said they'd provide them.

Mr. Lin updated the TRC on the search for a replacement community representative for Norm Kelly – none has been found to date. Ms. Davies suggested approaching Ivyland

Boro, as Mr. Kelly was the mayor of Ivyland at one point. Mr. Hagy also volunteered to check internally (within Warminster Township) for any interest.

Action Items that will be carried through to the next TRC meeting include:

- Mr. Lin will continue to look into the possibility of adding a community member to replace Mr. Kelly at the TRC meetings.
- Mr. Dale will send a written request to WMA for information regarding WMA-26 sampling; WMA will provide the requested information.
- The Navy is to provide an update on groundwater extraction, treatment, and source area testing/treatment activities.
- The Navy will provide an update on PFC investigation activities.
- PADEP/CRC is to provide an update regarding the status of the CRC Industries remedial activities.
- WMA/Earth Data is to provide an update of the municipal wells status.
- The Navy is to update the TRC on the progress of property transfers for the remaining Navy properties along Jacksonville Road and the Shenandoah Woods housing area.
- The Navy is to provide an update on LTM activities (sampling, LUC inspections).

Next Meeting Date

The next TRC meeting date was confirmed for October 16, 2014 (note that it is on a Thursday) at 9:30 AM in the WMA Board Room. The meeting was adjourned at approximately 11:25 AM.

FORMER NAVAL AIR WARFARE CENTER WARMINSTER

Technical Review Committee (TRC) Meeting Minutes

ATTACHMENT 1
ATTENDANCE LIST

NAWC WARMINSTER
TECHNICAL REVIEW COMMITTEE (TRC) MEETING
DATE: May 15, 2014

NAME	AFFILIATION	PHONE	EMAIL
JEFF ORIENT	TETRA TECH/NAVY	412-921-8778	jeff.orient@tetratech.com
Ron Sloto	U.S. Geological Survey	610-321-6072	raslotoe@USGS.GOV
Jeff Dale	U.S. Navy	215-897-4914	jeffrey.m.dale@navy.mil
Kathy Davies	USEPA Reg 3	215-814-3315	davies.kathy@epa.gov
Sarah Kloss	USEPA Reg 3	215-814-3379	kloss.sarah@epa.gov
WILLIE LIN	NAVY BRAC PMO	215-897-4904	WILLIE.LIN@NAVY.MIL
MARGARET POLLICH	PADEP	484-250-5731	mpollich@PA.GOV
Jen Good	H+S Environmental	508-366-7442	jgood@hsenv.com
Carolyn Scala	Battelle	215-504-5003	scalac@battelle.org
michelle Rudnick	CRC Industries	215-442-6224	mrudnick@crcindustries.com
Tim Cherry	PA DEP	484-250-5728	tcherry@pa.gov
Tavi Michini	PADEP intern	267-446-0163	omichini@pa.gov
Russell Sirabian	Battelle	914-682-2179	sirabianr@battelle.org
Dave Fennie	EOA	610 524 9966	dfennie@eoa4data.com
Timothy Hagey	WTMA	215 675 3301	timh@warminsterauthority.com

FORMER NAVAL AIR WARFARE CENTER WARMINSTER

Technical Review Committee (TRC) Meeting Minutes

ATTACHMENT 2
MEETING AGENDA

AGENDA
FORMER NAWC WARMINSTER
Technical Review Committee (TRC) Meeting

Date: 15 May 2014
Time: 9:30 AM
Location: WMA Board Room, 415 Gibson Ave., Warminster, PA

- **Administrative Update**
  - Minutes of the last meeting (10 April 2013)
  - Review action items **(see below)**
  - Sarah Kloss introduction – new EPA Remedial Project Manager
  - Colin Wade– new PADEP Project Manager

- **Off-Site Investigations**
  - PADEP update on CRC Chemicals

- **WMA Update**
  - Status of Well #26

- **Perfluorinated Compounds (PFC) Update**
  - Area C Investigation
  - Area A, C and D sampling and analysis
  - Groundwater extraction wells EW-C16 & EW-C17

- **Source Treatment Data Collection and Design Update**
  - Results of Soil/Rock Core Testing at Area A
  - Draft ISCO Source Treatment Design for Area A

- **Groundwater Extraction and Treatment Update**
  - Plant operating status
  - VOC removal evaluation
  - PFC analytical results/Permit notifications
  - pH pilot update

- **Monitoring Activities Update**
  - Fall 2013 LTM results summary
  - Plans for Spring 2014 performance monitoring

- **Finalization of Pending LTM/LUC Reports**
  - Spring 2013 draft LTM report distributed 3/14/2014
  - Fall 2013 draft LTM report status
  - 2013 LUC Inspection Report status

- **Navy Housing Transfer Update**
  - Status of property transfer activities along Jacksonville Road and Shenandoah Woods

- **Miscellaneous Topics and Issues – Action Items**
  - Area C vapor intrusion evaluation

Time and Location of Next Meeting: Date TBD, October 2014, WMA Board Room

- **Action Items**

The following action items have been identified as a result of the April 2013 meeting:

- Mr. Lin will look into the possibility of adding a community member to replace Mr. Kelly at the TRC meetings.
- Mr. Dale will send WMA some information regarding PFC sampling.
- EPA is to evaluate the new Area C data regarding vapor intrusion.
- The Navy is to provide an update on groundwater extraction, treatment, and source area testing activities.
- PADEP/CRC is to provide an update regarding the status of the CRC Industries remedial activities.
- WMA/Earth Data is to provide an update of the municipal wells status.
- The Navy is to update the TRC on the progress of property transfers for the remaining Navy properties along Jacksonville Road and the Shenandoah Woods housing area.
- The Navy is to provide an update on LTM activities (sampling, LUC inspections).

Directions to the WMA Board Room:

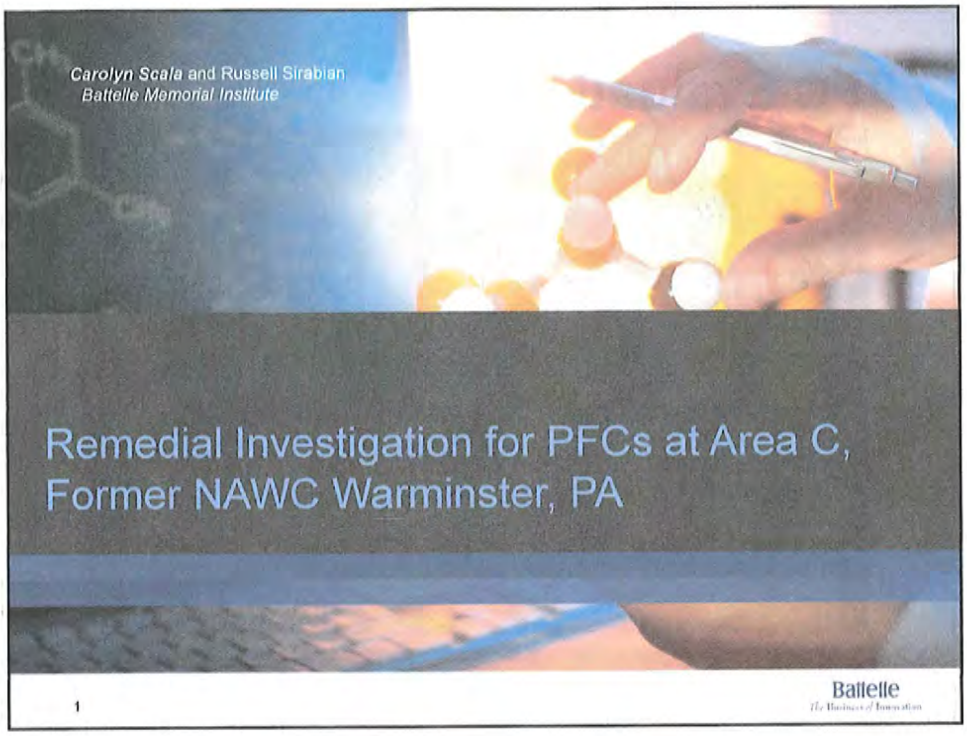
From the former NAWC - Proceed to the intersection of Street and Jacksonville Rd. Turn west (right) onto Street Rd. Continue west to York Rd. Turn south (left) onto York Rd. Continue to Henry Ave. Turn west (right) onto Henry Ave. Follow directions as above to the WMA building.

From County Line Rd - Instead of turning north (right) onto Jacksonville, continue west on County Line to York Rd. Turn north (right) onto York Rd. Continue to Henry Ave. Turn west (left) onto Henry Ave. Continue to Gibson Ave. Turn right into the parking lot shared by the Warminster Township and WMA. The WMA building in located towards the rear.

FORMER NAVAL AIR WARFARE CENTER WARMINSTER

Technical Review Committee (TRC) Meeting Minutes

ATTACHMENT 3
BATTELLE PFCs PRESENTATION



Task Objectives

- Delineate the extent of PFCs at Area C
  - Focus on PFOA and PFOS
- Evaluate the potential for vapor intrusion at Area C
- Project DQO meeting held after TRC meeting

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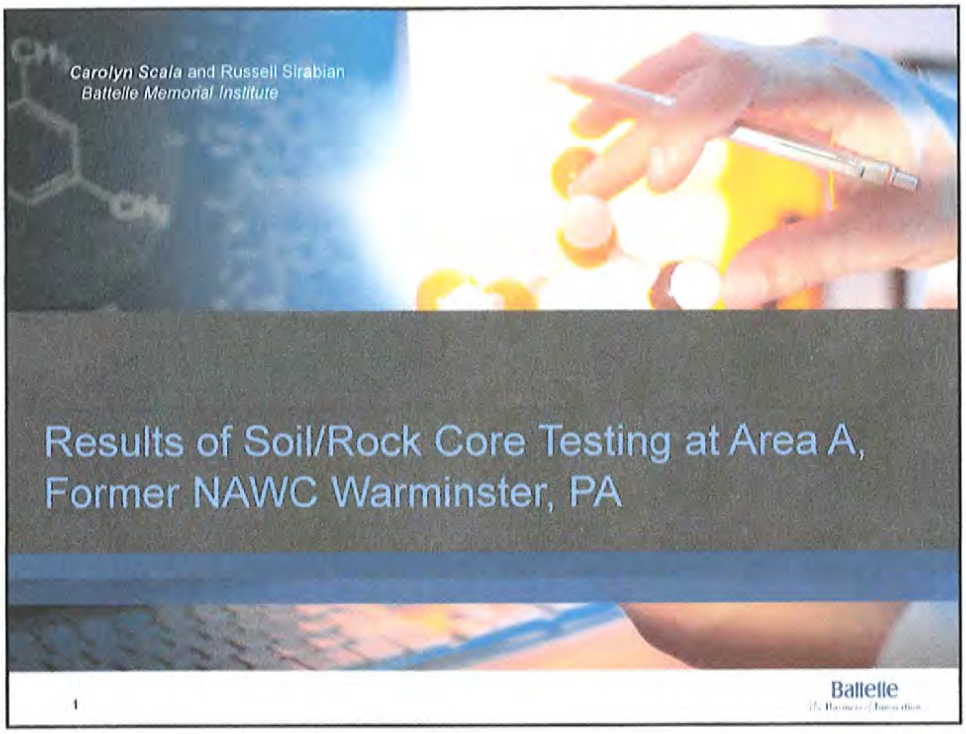
Area C VI Evaluation

- Collect air samples for analysis of CVOCs
  - Air samples collected from basements of selected buildings in vicinity of Area C CVOC plume (e.g., Gilda's Club)
  - Water samples from adjacent sumps also will be collected if possible
- Include VI evaluation in Area C RI report

PFC

ATTACHMENT 4
BATTELLE AREA A SOIL/ROCK CORE TESTING PRESENTATION



Outline

- Approach Utilized
  - Sample collection, preservation, and analysis
- Results summary
- Results Interpretation
  - Distribution of contaminants in hydrogeologic unit B and overburden unsaturated zone soil,
  - Distribution adjacent to identified fractures and within the matrix
- Use of results
  - Optimize the design of the ISCO bench-scale testing and field-scale source treatment

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Soil/Rock Coring Activities

- Borehole installation
  - RC-01 completed between EW-A6 and EW-A7; work performed by H&S
  - 5-in diameter surface casing grouted into bedrock at 15.5 ft bgs
  - 4-in diameter open hole completion from 15.5 to 72 ft bgs
- Soil/rock core sample collection
  - Unconsolidated samples collected at 6 and 10 ft bgs
  - Weathered bedrock samples collected at 10.5 and 14 ft bgs
  - 1.55-ft long cores collected from 15.5 to 17 ft bgs
  - 5-ft long cores collected from 17 to 76 ft bgs

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Soil/Rock Core Sample Screening/Selection

- All soil/rock cores field screened with a PID
- If elevated PID reading or staining was observed, a rock core sample was collected from that depth and one each from above and below
- Collected at least 1 rock core sample from each 5-ft core
- Collected 2 soil, 2 weathered bedrock & 35 rock core samples
- 4 samples collected for analysis of physical parameters

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Soil/Rock Core Sample preparation/preservation/analysis

- Utilized modified sample preparation/preservation procedure utilizing input from USGS and Stone Environmental, Inc.
- Samples analyzed for VOCs using Microwave Assisted Extraction (MAE) using GC/dual EDC detectors

Soil/Rock Coring Results

- Unsaturated zone (static/non-pumping conditions)
  - TCE slightly exceeded RSL in soil & weathered bedrock samples
  - No other COCs exceeded RSL
- Two hot spot intervals present in siltstone units
  - 16.5 to 31.5 ft bgs: Unsaturated during GWETS operation
  - 70.5 to 76 ft bgs: Continuously saturated
- Intervals of elevated soil/rock core concentrations are relatively consistent that of dissolved chemical concentrations

Soil/Rock Coring Results (cont.)

- Elevated dissolved TCE and CCl_4 at 30 and 70 ft bgs but rock core concentrations in this interval are relatively low
  - May be the result of upward migration of TCE and CCl_4 due to upward vertical gradient
- Equivalent porewater concentrations are generally lower than measured groundwater concentrations,
  - Exception of a highly elevated TCE and PCE equivalent concentration at 73 ft bgs

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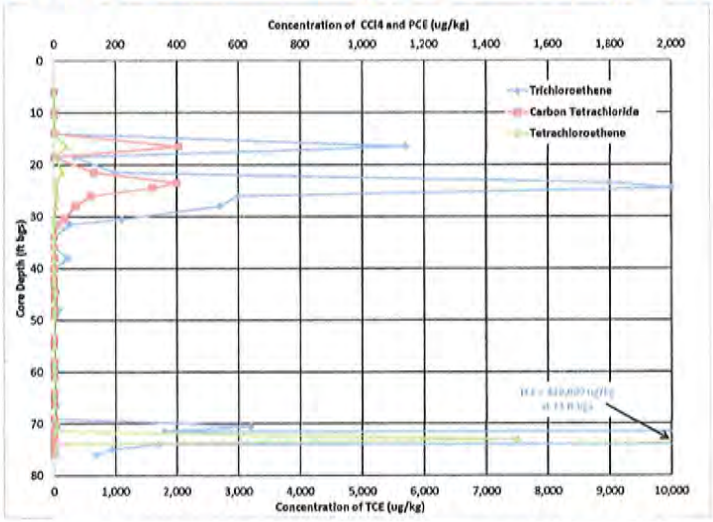
Soil/Rock Coring Results (cont.)



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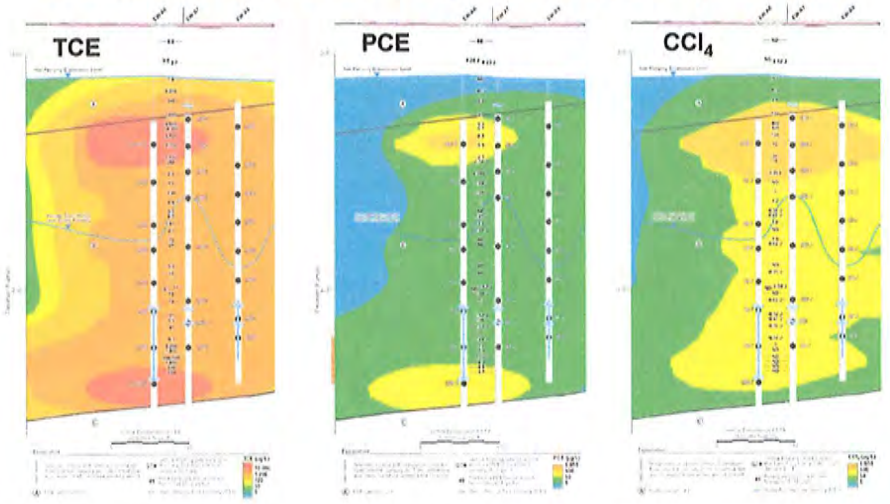
Soil/Rock Coring Results (cont.)



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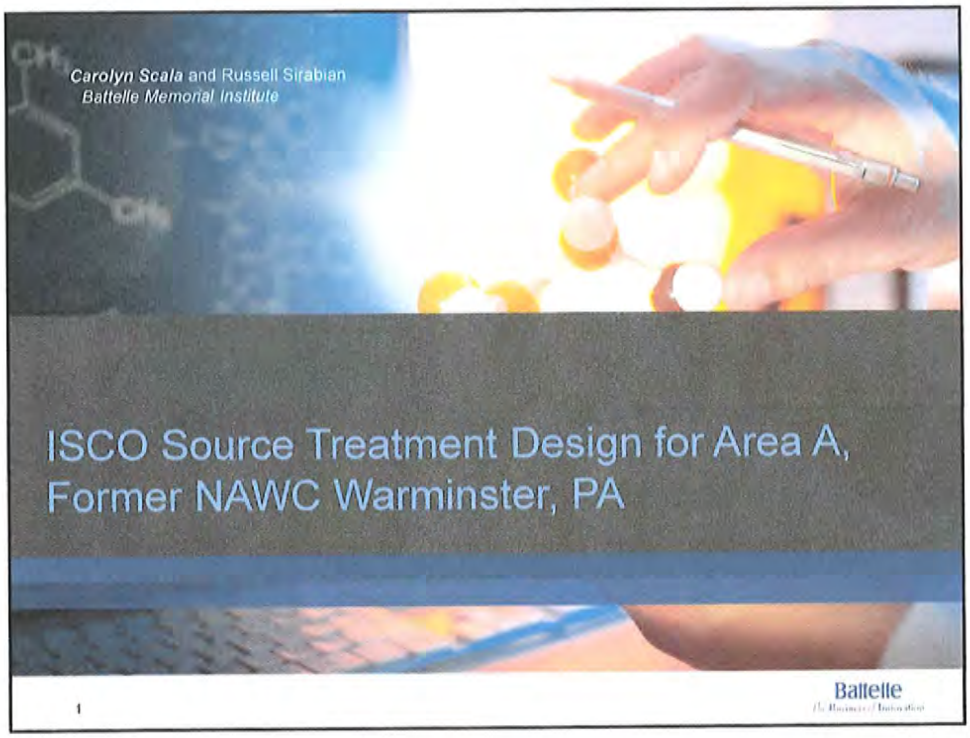
Technical Review Committee (TRC) Meeting Minutes

ATTACHMENT 5
BATTELLE ISCO SOURCE TREATMENT PRESENTATION



Source Area Investigations

- Well profiling investigation
  - Determine vertical borehole flow, identify water-bearing zones, and perform vertical chemical concentration profiling in study area wells
- Rock coring investigation
  - Understand the distribution of contaminants within the rock matrix in both the saturated and unsaturated zones
- ISCO bench-scale treatability study
  - Identify an appropriate oxidant and dosage necessary to treat site chemicals and understand its impact on site geochemistry

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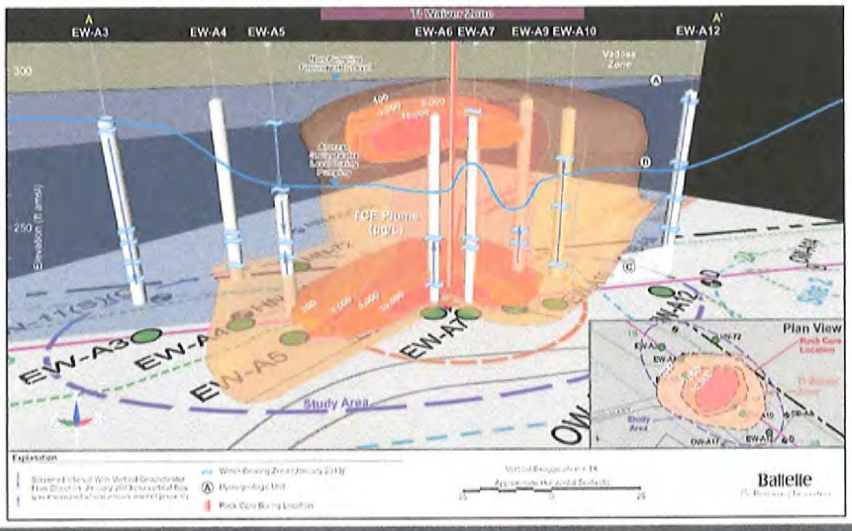
Study Area Results - TCE



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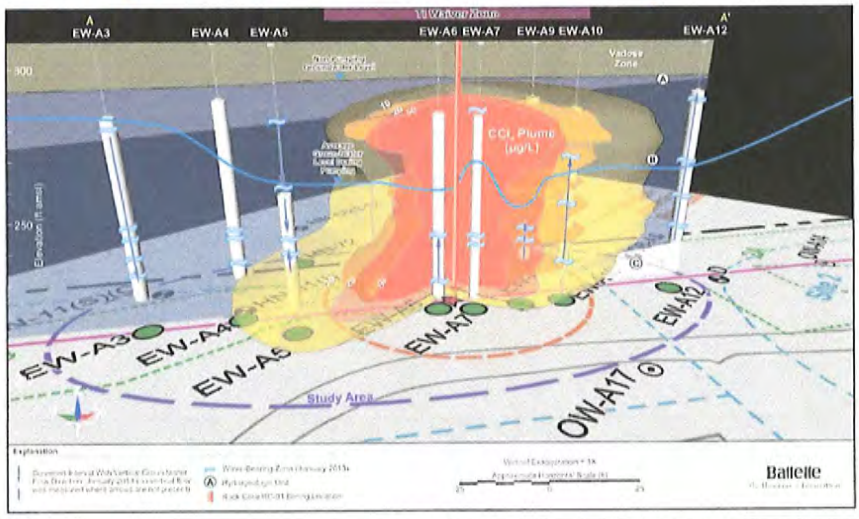
Study Area Results – CCl_4



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ISCO Source Treatment Objectives

- Evaluate efficacy of in situ applications of ISCO within the TI waiver zone
- Provide a design basis for ISCO application in TI waiver zone
  - Determine the frequency of injections,
  - Evaluate well spacing,
  - Optimize dosage and injection rates
- Perform monitoring to ensure effectiveness and minimize impacts GWETS and downgradient supply wells.
- Determine impacts to the aquifer geochemistry

ISCO Design

- **Bench scale testing recommended alkaline-activated persulfate for the source treatment**
  - Effectively treated the chlorinated ethenes as well as CCl_4.
  - Does not generate gas or heat during application.
  - Demonstrated to be relatively stable under expected site conditions, persisting for more than 14 days in the bench test reactors.
  - Mass of persulfate required to treat the TI area will not be prohibitively high.
  - Alkaline activated persulfate concentrations decreased more rapidly than unactivated persulfate and is less likely to be present for a prolonged period of time.

ISCO Design – Target Treatment Zone

- Treat TCE plume at dissolved concentrations >5,000 µg/L
- Target treatment area - 3,800 ft^2
- Vertical treatment interval of 65 ft (15 ft bgs to 80 ft bgs)
  - Based on results of recent well profiling and rock coring investigations
  - In hydrogeologic unit B to the base of the siltstone/mudstone unit
- Treatment volume of roughly 247,000 ft^3 within the TTZ
- Target high concentration vertical intervals based on the results of the recent study area investigations

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ISCO Design – Injection Dosing

- Persulfate concentration between 50 g/L and 100 g/L
- Volumes based on 3,800 ft^2 and 65-ft-thick vertical interval
  - 100 g/L sodium persulfate in 12,900 gal of amended solution; or
  - 50 g/L sodium persulfate in 25,800 gal of amended solution
- The first ISCO application will inject up to 11,020 lb of persulfate and up to 16,100 lb of 25% NaOH solution
  - Oxidant volume/mass in second application will be optimized
- Injection over a period of 8 days
  - 6 days - treat each injection well at different injection intervals
  - 2 days – preferentially target the shallow (15 to 26 ft bgs) and deep zone (69 to 80 ft bgs) around EW-6 and EW-7

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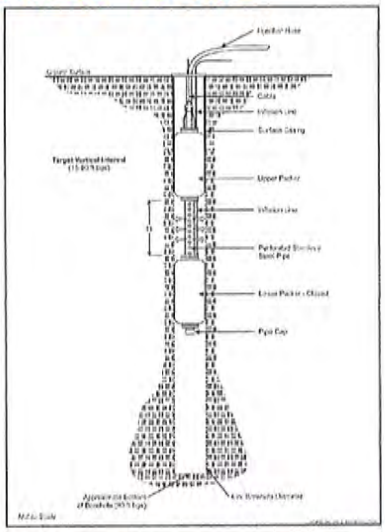
ISCO Design – Injection Wells

- Four new IWs
  - 4-in diameter; 5-in surface casing
  - Open hole completion
- Vertical target interval 15 to 80 ft bgs
- Installed to base of siltstone/mudstone unit
- Pneumatic packers used to perform the injection of the oxidant into specific vertical interval



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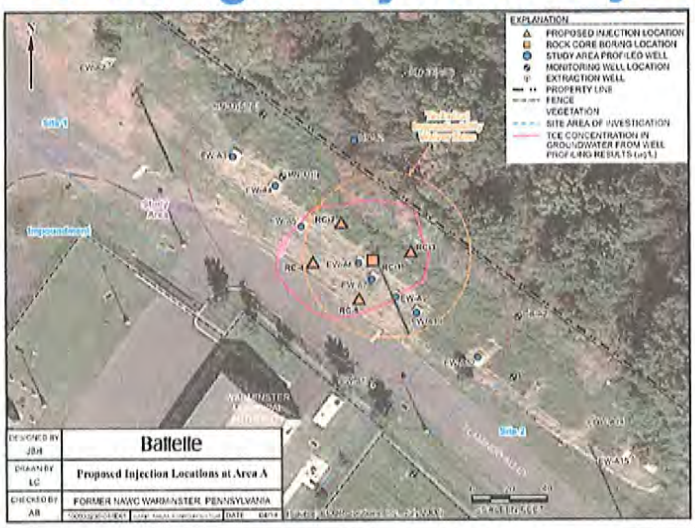
ISCO Design – System Layout



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ISCO Design – Equipment

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Design Contingencies - GWETS

- Elevated concentrations of persulfate may be detrimental to the GWETS extraction well pumps and the GWETS
- Extraction wells monitored periodically after the injection event for residual persulfate concentration
- Persulfate concentration in extraction wells <5 g/L, wells will be reactivated according to the proposed schedule
- Extracted water from Area C or from unaffected Area A EWs is blended at influent

Week of Reactivation	Extraction Well
Week 4	EW-A1, EW-A11, EW-A19, EW-A8
Week 5	EW-A2 , EW-A3, EW-A4 , EW-A15
Week 6	EW-A5, EW-A12
Week 7/8	EW-A6, EW-A7, EW-A9, EW-A10

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Design Contingencies - Metals

- Results of the bench-scale tests suggest it is not likely that elevated concentrations of metals will persist in the groundwater
- The existing hexavalent chromium removal process will remove some dissolved chromium if present
- GWETS influent water will be collected and monitored for metals after the ISCO source treatment injections
- Area C extraction water or water from unaffected Area A extraction wells will be blended with Area A influent to further reduce metals concentrations

Design Contingencies – GW Surfacing

- Surfacing of groundwater less prevalent when applying ISCO using sodium persulfate compared to hydrogen peroxide
- Extraction and injection wells and surrounding areas will be monitored for any type of surfacing
- Injection rates and pressures will be reduced and monitored to mitigate the surfacing.
  - In case of surfacing, absorbent pads and booms will be used to contain the surfaced fluids
- All extraction well heads will be sealed during ISCO application and will be opened only after slowly bleeding any pressure from the well

Process Monitoring

- Monitored parameters include:
  - Pressure at each injection well and injection interval
  - Total volume of fluid introduced into each injection well and injection interval
  - Injection flowrates
  - Temperature of the injection fluid
  - Volume of water and mass of sodium persulfate and sodium hydroxide injected daily
  - Concentration of persulfate injected
  - Concentration of persulfate in GWETS influent and groundwater monitoring wells
  - Groundwater levels in TTZ

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Performance Monitoring

- Pre-ISCO baseline collected during the May 2014 annual performance monitoring event
- Pre-ISCO baseline and post-ISCO data to include groundwater sampling information from 9 study area wells
- Post-ISCO samples analyzed at Week 4 and Week 12
- All samples analyzed for VOCs and metals (total and hexavalent chromium, arsenic, and iron)
  - Baseline concentration of chromium necessary to determine the potential to oxidize and mobilize chromium at the site.
- GWETS influent groundwater samples collected monthly before/after ISCO injections when GWETS is operational

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Monitoring Schedule

Purpose	Well/Sample ID	Monitoring Timeframe	Analysis
Pre-ISCO baseline monitoring	HN11(I), HN-72, EW-A5, EW-A6, EW-A7, EW-A9, EW-A10, EW-A12, OW-A17	Annual performance monitoring event	General groundwater quality, oxidant, groundwater level. VOCs, metals (hexavalent chromium, iron, and arsenic), total dissolved solids (TDS), total suspended solids (TSS)
	GWETS influent	Monthly	
Process monitoring	HN11(I), HN-72, EW-A5, EW-A6, EW-A7, EW-A9, EW-A10, EW-A12, OW-A17	During injection; daily	General groundwater quality, oxidant, groundwater level
Post-ISCO monitoring	HN11(I), HN-72, EW-A5, EW-A6, EW-A7, EW-A9, EW-A10, EW-A12, OW-A17	Week 4 and week 12	General groundwater quality, oxidant, groundwater level. VOCs, metals (hexavalent chromium, iron, and arsenic), TDS, TSS
	GWETS influent	Monthly	

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FORMER NAVAL AIR WARFARE CENTER WARMINSTER

Technical Review Committee (TRC) Meeting Minutes

ATTACHMENT 6
H & S GROUNDWATER EXTRACTION/TREATMENT/LTM/LUC PRESENTATION

Technical Review Committee Meeting

NAVFAC

NAWC Warminster
15 May 2014

Presented by

H&S

Presentation Agenda

- Treatment Plant Operation
  - Plant Operating Status
  - VOC Removal Evaluation
  - PFC Analytical Results / Permit Notifications
  - pH Adjustment System Pilot Update
- LTM Activities Update
  - Fall 2013 LTM Results Summary
  - Plans for Spring 2014 Performance Monitoring
- Finalization of Pending LTM/LUC Reports
  - Spring 2013 LTM
  - Fall 2013 LTM
  - 2013 LUC Inspection Report

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GWTP Operation

- Average flowrates for April 2014:
  - 65.6 gpm from Area A
  - 36.4 gpm from Area C
  - 0.0 gpm from Area D
  - 102.0 gpm overall
- Area C -- Extraction wells EW-C16 and EW-C17 brought on-line on 1/13/14. Currently operate ~5.5gpm each, accounting for increased total influent flowrate.
- 832,039,437 gallons treated through April 2014.

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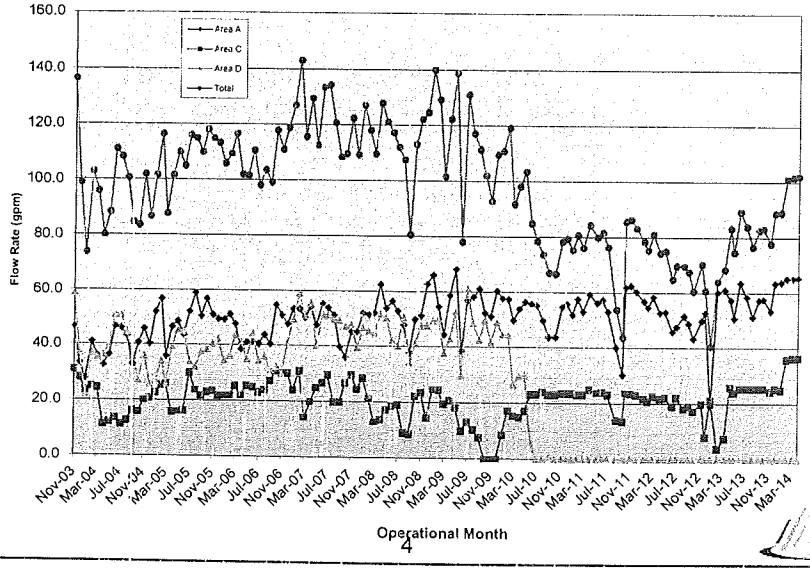
Groundwater Treatment Plant Recovery Flow Rates



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GWTP Operation

- Recent operational and maintenance activities (since previous meeting in April 2013):
  - 4/26/13 – Replaced motor on EW-A11.
  - 5/16/13 – Replaced auxiliary contact on motor starters for EW-A1 and EW-A12.
  - 5/20/13 – Replaced pH meter sensor for pH adjustment system.
  - 8/22/13 – Replaced motor starter coil for EW-A19.
  - 9/9/13 – Replaced motor starter coil for EW-A4.
  - 9/12/13 – Replaced motor on EW-A13.
  - 11/7/13 – Resin changeout performed.

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GWTP Operation

- 11/14/13 – Repaired EW-A5 high water level probe.
- 11/19-11/21/13 – Area A rock coring performed. Area A EWs off-line during each day and reactivated each night.
- 11/25/13 – Repaired EW-A13 water level probe.
- 12/9/13 – EW-A6 level probe issue corrected.
- 1/6 – 1/9/14 – Area C sampling event performed.
- 1/9/14 - Flow totalizers replaced on EW-C17 and EW-C19.
- 1/13/14 - Extraction wells EW-C16 and EW-C17 brought on-line. Flowrates increased throughout month to current flowrate of ~5.5 gpm each.
- 2/5/14 - Power outage due to storm. System restarted once power restored.

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VOC Mass Removal

- Cumulative dissolved-phase VOC recovery through April 2014 reporting period:
  - Trichloroethene (TCE) – 4,798.0 pounds (8.29 lbs in 4/14)
  - Tetrachloroethene (PCE) – 149.2 pounds (0.45 lbs in 4/14)
  - Carbon Tetrachloride (CCl_4) – 162.7 pounds (0.21 lbs in 4/14)
- Majority of VOC recovery is from Area A (8.28 lbs TCE, 0.35 lbs PCE, and 0.21 lbs CCl_4 in 4/14), with remainder of PCE recovery from Area C (0.11 lbs in 4/14).
- No recovery from Area D, as Area D extraction system is no longer in operation.

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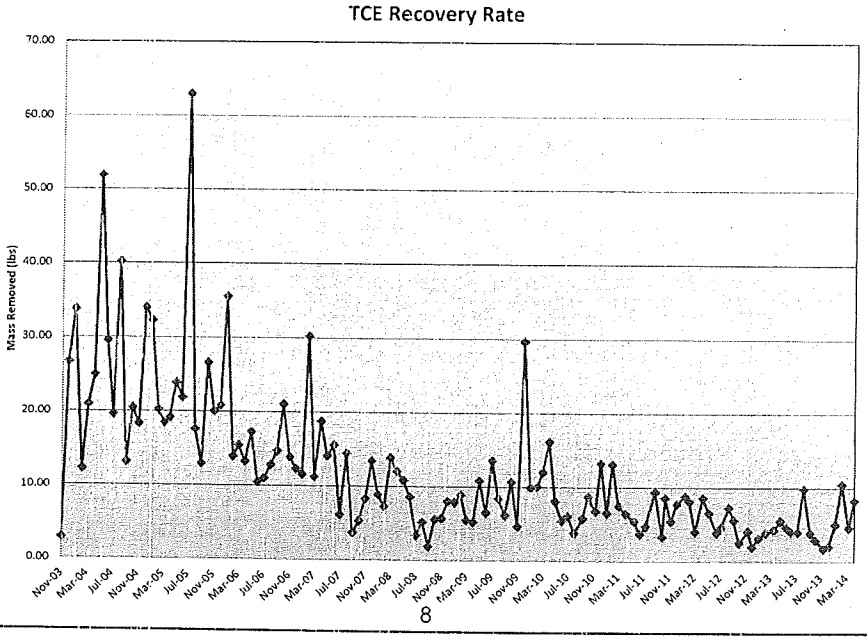

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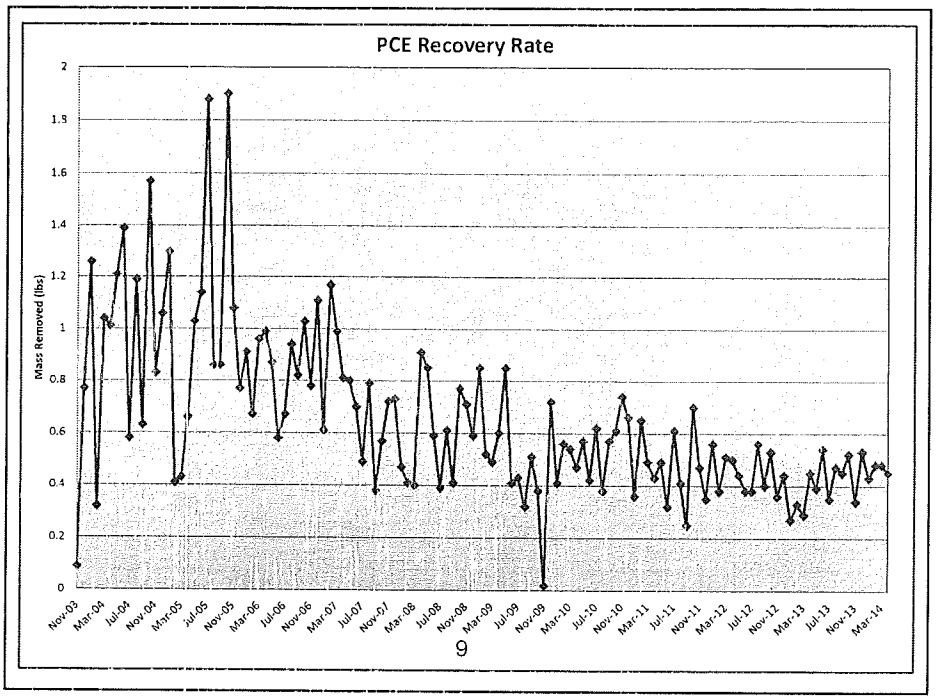
PCE Recovery Rate
Mass Removed (lbs)
2
1.8
1.6
1.4
1.2
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0.8
0.6
0.4
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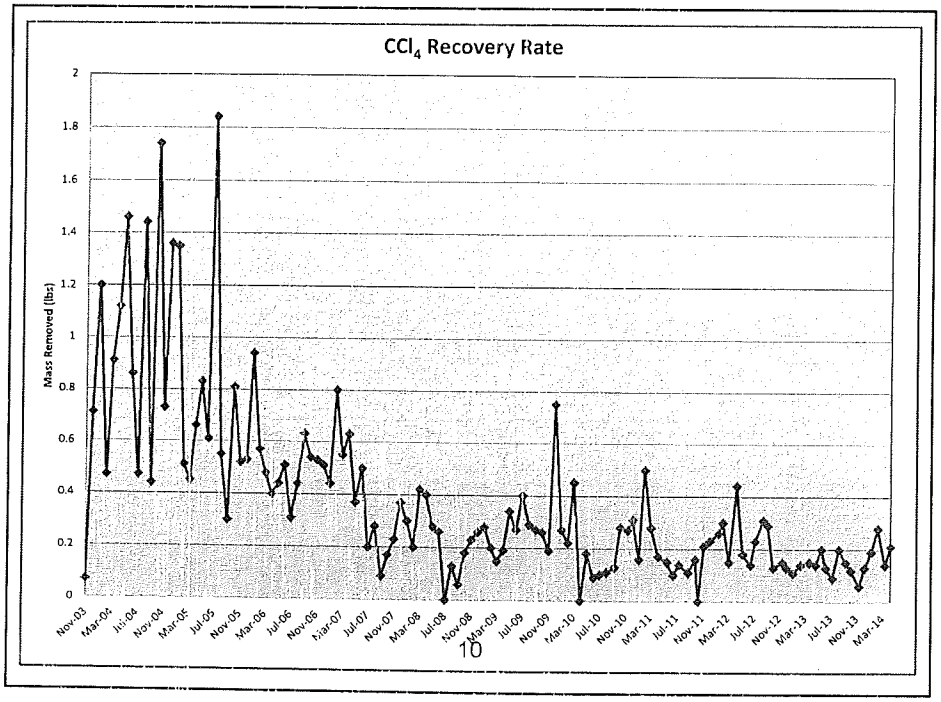
CCl4 Recovery Rate
Mass Removed (lbs)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Nov-03
Mar-04
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PFC Analytical Results / Permit Notifications

- Sampled various Area C monitoring and extraction wells on 1/6-1/9/14:
  - EW-C16, EW-C17, HN-24S, HN-25S, HN-25I, OB-11, OB-13, R-9:
    - PFOA concentrations ranged from 0.64 ug/L (HN-25S) – 2.6 ug/L (OB-11).
    - PFOS concentrations ranged from 0.69 ug/L (R-9) – 16 J ug/L (OB-11).
  - Also collected samples from Area A influent, Area C influent, treated effluent, and WMA-13.

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PFC Analytical Results / Permit Notifications

- Notified PADEP in December 2013 of presence of PFOA and PFOS in influent stream.
- Collected samples of Area A influent, Area C influent, and treated effluent in Jan 2014 for baseline.
- Activated EW-C16 and EW-C17 on 1/13/14.
- Will begin monitoring and reporting Area A influent, Area C influent, lead carbon effluent, and treated effluent on a monthly basis in May 2014.
- Sampling of Area A and Area D extraction wells to be performed in conjunction with Spring (May) 2014 LTM event.
- Sampling of Area A, Area C, and Area D extraction wells to be performed in conjunction with Fall (November) 2014 LTM event.

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pH Adjustment Pilot System Update

- Background:
  - Objective: To improve the removal efficiency of Cr+6 from the Area A process stream using the existing ion exchange treatment system.
  - Adjusts pH to ~6.0 to increase the capacity of the resin.
- Obtained concurrence from PADEP and EPA for implementation of pH adjustment system pilot study.
- Pilot testing begun in April 2013. Weekly to bi-weekly samples of resin influent and effluent collected to determine life cycle of resin using pH adjustment.

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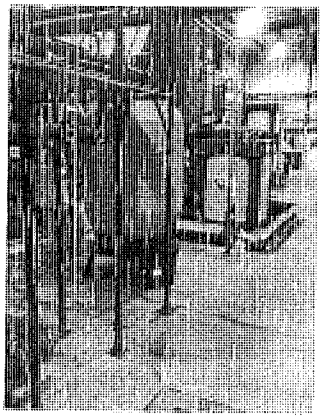
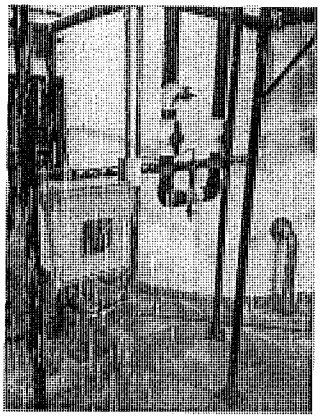
pH Adjustment Pilot System Update



Overall view



pH meter/controller, sample ports

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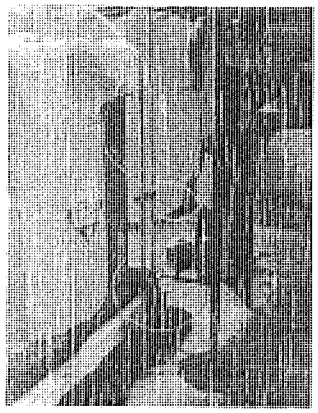
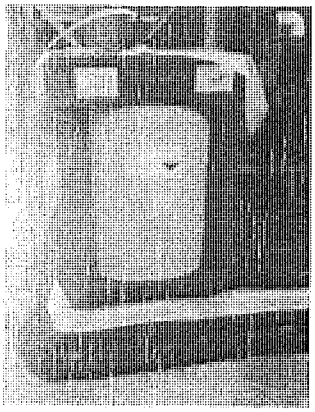
pH Adjustment Pilot System Update



HCl metering pump, PPE



HCl, secondary containment

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pH Adjustment Pilot System Update

- Run #1:
  - Operated for 162 days before full breakthrough was realized.
  - Average resin influent concentration of Cr+6 of 9.5 ug/L.
  - Average HCl usage of 6.0 gpd to maintain pH of 6.0.
  - Resin was changed out 11/7/13.
- Run #2:
  - Currently 189 days into Run #2, have not yet realized full breakthrough.
  - Average resin influent concentration of Cr+6 of 7.6 ug/L.
  - Average HCl usage of 7.1 gpd to maintain pH of 6.0.

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pH Adjustment Pilot System Update

- Analyzed individual Area A extraction wells in November 2013 for Cr+6:
  - Results ranged from non-detect (MDL of 1.9 ug/L) in eight EWs to 25 ug/L at inactive EW-A15.
  - Highest concentration in active EW was 12 ug/L at EW-A19, below the effluent permit limit of 14 ug/L.
- Path forward:
  - Continue to operate pH adjustment system during upcoming Area A well installations / ISCO.
  - Collect another round of samples from Area A EWs.
  - Evaluate whether continued operation of the pH adjustment system is needed.

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LTM Activities Update

- Fall 2013 LTM Results Summary:
  - Groundwater sampling event performed in November 2013 (11/11/13 – 11/14/13):
    - Area A – 24 wells sampled, GW elevations from 66 wells.
    - Area C – 11 wells sampled, GW elevations from 25 wells.
    - Area D – 13 wells sampled (4 additional wells: HN-57S, HN-58I, HN-74I, OW-D10 that are usually only sampled annually), GW elevations from 37 wells.
  - Draft LTM Report to be submitted May 2014.

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LTM Activities Update

- Spring 2014 groundwater sampling event scheduled for May 2014 (5/19-5/23/14)
  - Routine LTM :
    - Area A – sample 45 wells, GW elevations from 66 wells.
    - Area C – sample 12 wells, GW elevations from 25 wells.
    - Area D – sample 16 wells, GW elevations from 37 wells.
  - Additional sampling planned:
    - PFOA/PFOS samples from Area A and Area D extraction wells.
    - Additional metals (total and dissolved Fe, total Cr, dissolved Cr+6, dissolved As, and dissolved Mn) samples from Area A for pre-ISCO data.

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Finalization of Pending LTM/LUC Reports

- Spring 2013 LTM Report
  - Draft submitted to TEG 3/14/14.
  - No comments received to date.
- Fall 2013 LTM Report
  - To be submitted to TEG in May 2014.
- Fall 2013 LUC Inspection Report
  - No issues/ deficiencies observed during inspection.
  - To be submitted to TEG in May 2014.

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