New Jersey Department of Environmental Protection
Site Remediation Program

REMEDIAL ACTION WORKPLAN FORM

Date Stamp
(For Department use only)

SECTION A. SITE NAME AND LOCATION

Site Name: Pitt-Consol Chemical Company

List all AKAs: DuPont Pitt-Consol; Pitt Consol Chemical Co.

Street Address: 191 Doremus Avenue

Municipality: Newark (Township, Borough or City)

County: Essex Zip Code: 07105

Program Interest (PI) Number(s): G000002172 Case Tracking Number(s):

Date Remediation Initiated Pursuant to N.J.A.C. 7:26C-2: 03/20/1998

State Plane Coordinates for a central location at the site: Easting: 595856 Northing: 689710

Municipal Block(s) and Lot(s):

Block #	5016	Lot #	1	Block #		Lot #	
Block #	5016	Lot #	1/10	Block #		Lot #	
Block #	5016	Lot #	3	Block #		Lot #	
Block #		Lot #		Block #		Lot #	

SECTION B. SUBMITTAL STATUS

1. Is this submittal a proposal to obtain NJDEP preapproval for using alternative fill in excess of the volume required for a remedial action? ☐ Yes ☒ No

   If "Yes," has notification been provided to:

   - ☐ Each owner of real property and the tenants of those properties, located within 200 feet of the site boundary;
   - ☐ The mayor of each municipality where the site located;
   - ☐ The county designated solid waste coordinator;
   - ☐ The municipal clerk of each municipality in which the site is located; and
   - ☐ The county health department and local health agency.

2. Indicate how the Electronic Data Deliverable (EDD) for this submittal is being provided to the NJDEP:

   ☒ Via Email at srpedd@dep.state.nj.us (attach NJDEP confirmation email)

   ☐ CD (attach to this submittal)

3. Is a Classification Exception Area (CEA) Proposal included with this submission? ☐ Yes ☒ No

4. Complete the following Submittal and Permit Status Table:

	Not Applicable	Included in This Submission	Previously Submitted	Date of Submission	Date of Revised Submission	Date of Document Withdrawal
Public Notification	☐	☐	☒	12/29/2009		
Immediate Environmental Concern Report	☒	☐	☐			
IEC Engineered System Response Action Report	☒	☐	☐			
Vapor Concern Mitigation Report	☒	☐	☐			
LNAPL Interim Remedial Measure Report	☒	☐	☐			
Preliminary Assessment Report	☐	☐	☒	04/15/1998		
Receptor Evaluation	☐	☐	☒	03/01/2011	04/30/2013	
Site Investigation Report	☐	☐	☒	05/26/2000		
Remedial Investigation/Remedial Action Work Plan	☐	☐	☒	06/28/2011	04/30/2013	

Remedial Action Report	☒	☐	☐			
Response Action Outcome	☒	☐	☐			
Alternative Soil Remediation Standard and/or Screening level Application Form	☒	☐	☐			
Case Inventory Document	☐	☒	☐			
Technical Impracticability Determination	☒	☐	☐			
Permit Application – list:	☒	☐	☐			
	☐	☐	☐			
	☐	☐	☐			
	☐	☐	☐			
Radionuclide Remedial Investigation Workplan	☒	☐	☐			
Radionuclide Remedial Investigation Report	☒	☐	☐			
Radionuclide Remedial Action Workplan	☒	☐	☐			
Radionuclide Remedial Action Report	☒	☐	☐			

SECTION C. SITE USE

Current Site Use (check all that apply)

- ☒ Industrial
- ☐ Residential
- ☐ Commercial
- ☐ School or child care
- ☐ Other _____
- ☐ Agricultural
- ☐ Park or recreational use
- ☐ Vacant
- ☐ Government

Intended Future Site Use (check all that apply)

- ☒ Industrial
- ☐ Residential
- ☐ Commercial
- ☐ School or child care
- ☐ Park or recreational use
- ☐ Vacant
- ☐ Government
- ☐ Future site use unknown

SECTION D. CASE TYPE: (check all that apply)

- ☐ Administrative Consent Order (ACO)
- ☐ Brownfield Development Area (BDA)
- ☐ Child Care Facility
- ☐ Chrome Site (Chromate chemical production waste)
- ☐ Coal Gas
- ☐ Due Diligence with RAO
- ☐ Hazardous Discharge Remediation Fund (HDSRF) Grant/Loan
- ☒ ISRA
- ☐ Landfill (SRP subject only)
- ☐ Regulated Underground Storage Tank (UST)
- ☒ Remediation Agreement (RA)
- ☐ School Development Authority (SDA)
- ☐ School facility
- ☐ Spill Act Defense – Government Entity
- ☐ Spill Act Discharge
- ☐ UST Grant/Loan

Federal Case (check all that apply)

☐ **RCRA GPRA 2020** ☐ **CERCLA/NPL** ☐ **USDOD** ☐ **USDOE** ☐ TSCA

☐ Other (explain): _____

SECTION E. PUBLIC FUNDS

Did the remediation utilize public funds? ..... ☐ Yes ☒ No

If "Yes," check applicable: ☐ UST Grant ☐ UST Loan ☐ Brownfield Reimbursement Program ☐ HDSRF Grant ☐ HDSRF Loan ☐ Landfill Reimbursement Program ☐ Spill Fund ☐ Schools Development Authority

SECTION F. SCOPE OF REMEDIAL ACTION WORKPLAN

1. Does the RAW address:
   - ☒ Area(s) of Concern (AOCs) Only
   - ☐ Entire Site (Based on a completed and submitted Preliminary Assessment/Site Investigation)
2. Total number of contaminated AOCs associated with the case: 4
3. Total number of contaminated AOCs addressed in this submittal: 3

SECTION G. GENERAL

1. Does the proposed remedial action require a permit that requires an approval from the NJDEP Site Remediation Program? ☐ Yes ☒ No

   If "Yes," list Permit Type(s)_____

   And if: ☐ Permit Application is attached to this submittal
   ☐ Permit Application submitted to SRP on this date: _____

2. Was a remediation initiated after May 6, 2010, for new construction or a change in the use of the site proposed for the purposes of residential use, use as a licensed child care center or use as a school? ☐ Yes ☒ No

   If "Yes," is an unrestricted use or a presumptive remedy being proposed? ☐ Yes ☐ No

3. Is the proposed remedial action an alternative remedy pursuant to N.J.A.C. 7:26E-5.3? ☐ Yes ☒ No

   If "Yes," specify the section/page(s) of the RAW where the alternative remedy is proposed:

   _____

4. Is any radiological contamination currently present at the AOC/Site? ☐ Yes ☒ No
5. Did any of the site contain Ordnance and Explosives/unexploded ordnance (OE/UXO)? ☐ Yes ☒ No
6. Does the proposed remedial action involve containment of free product? ☒ Yes ☐ No
7. At any time, have any of the following contaminants ever been detected in sediment above the ecological screening levels?

   ☐ Arsenic ☐ Dioxin ☐ Mercury ☐ PCBs ☐ Pesticides ☒ None

8. Have past deficiencies been addressed in this submittal? ☐ Yes ☐ No ☒ N/A
9. Will the proposed remedial action render the property unusable for future redevelopment or for recreational use (N.J.A.C. 7:26C-6.4(b))? ☐ Yes ☒ No
10. Are ground water contaminants from the site discharging to surface water? ☐ Yes ☒ No
11. Are ground water contaminants from the site discharging to an Environmentally Sensitive Natural Resource (ESNR)? ☐ Yes ☒ No
12. If you answered "Yes," to either question 10 or 11, identify the contaminant(s) and concentration(s) in the monitoring well(s) nearest to the surface water body or ESNR in the table below:

Well	Contaminant	Concentration	Well	Contaminant	Concentration

SECTION H. SITE CONDITIONS

1. Has dioxin been detected in any site media? ☐ Yes ☒ No
2. Check each media-type and highest concentration of contamination present above any applicable standards/criteria at the time of remedial investigation:

Soil in ppm	GW = Ground Water in ppb						SW = Surface Water in ppb						Sed = Sediment in ppm				
	Soil ppm	GW ppb	SW ppb	Sed ppm			Soil ppm	GW ppb	SW ppb	Sed ppm			Soil ppm	GW ppb	SW ppb	Sed ppm	
*VOCs	☐	☐	☐	☐	<100		☐	☐	☐	☐	100–1,000		☒	☒	☐	☐	>1,000
*SVOCs	☐	☐	☐	☐	<100		☐	☐	☐	☐	100–1,000		☒	☒	☐	☐	>1,000
*PAHs	☐	☐	☐	☐	<10		☐	☐	☐	☐	10–100		☒	☒	☐	☐	>100
*Metals	☐	☐	☐	☐	<100		☐	☐	☐	☐	100–1,000		☒	☒	☐	☐	>1,000
PCBs	☐	☐	☐	☐	<10		☐	☐	☐	☐	10–100		☐	☐	☐	☐	>100

*Pesticides	☒	☒	☐	☐	<1		☐	☐	☐	☐	1-10		☐	☐	☐	☐	>10
Chromium	☐	☐	☐	☐	<100		☐	☐	☐	☐	100–1,000		☒	☒	☐	☐	>1,000
Mercury	☐	☒	☐	☐	<100		☒	☐	☐	☐	100–1,000		☐	☐	☐	☐	>1,000
Arsenic	☐	☐	☐	☐	<10		☐	☐	☐	☐	10–100		☒	☒	☐	☐	>100
EPH	☐			☐	<1,700		☐			☐	1,700–5,100		☒			☐	>5,100

3. For any contaminant group (*) checked above, identify the contaminant with the highest concentration over its applicable remediation standard and/or screening level:

   Benzene (1), Benzene(2) | Naphthalene (1), Phenol (2) | Naphthalene (1), Naphthalene (2) | Lead (1), Iron (2) | alpha-benzene hexachloride (2)

   (1) and (2) denote the media the contaminant is present in (soil and groundwater, respectively). Each box represents the contaminant group (*) checked above in the order they are listed.

4. Were the laboratory reporting minimum detection limits below applicable remediation standards/ screening levels criteria required for the site? ..... ☐ Yes ☒ No

5. Are any of the following conditions currently present (check all that apply):

Ground water:

- ☒ Contaminated ground water in the overburden aquifer
- ☐ Contaminated ground water in a confined aquifer
- ☐ Contaminated ground water in the bedrock aquifer
- ☒ Contaminated ground water in multiple aquifer units
- ☐ Multiple distinct ground water plumes
- ☒ Contaminated ground water migrating off-site
- ☐ Background ground water contamination
- ☐ Contaminated ground water discharging to surface water or ESNR
- ☒ Residual or free product
- ☐ Radionuclides

Soil:

- ☒ On-site discharge(s) impacting soil off-site
- ☐ Chromate Chemical Production Waste/COPR
- ☐ Munitions and explosives of concern
- ☒ Contaminated soil in the saturated zone
- ☐ Historic pesticide impacts to soil
- ☒ Residual or free product
- ☐ Radionuclides
- ☒ Historic Fill
- ☒ Soil contamination due to naturally occurring background conditions
- ☐ Soil contamination in an ESNR

6. Check each of the following that applies to the primary objective of the remedial action:

☒ Treatment of:	☐ Ground Water	☒ Soil	☐ Sediments	☐ LNAPL	☒ DNAPL	☐ Soil Gas
☐ Removal of:	☐ Ground Water	☐ Soil	☐ Sediments	☐ LNAPL	☐ DNAPL	☐ Soil Gas
☒ Containment/Control of: ..	☐ Ground Water	☒ Soil	☐ Sediments	☐ LNAPL	☒ DNAPL	☐ Soil Gas

With migration pathway(s) to:

- ☐ Indoor Air
- ☐ Surface Water
- ☐ Other
- ☒ Ground Water
- ☐ Sediments or
- ☐ Other ESNRs

With exposure to:

- ☒ Human receptors
- ☒ Offsite impacts
- ☐ Ecological receptor(s) / ESNR

7. Is the remedial action an Interim Remedial Measure that was being implemented at the site? ..... ☐ Yes ☒ No

SECTION I. ALTERNATIVE STANDARD / VARIANCES

Alternative remediation standard

If proposing an alternative remediation standard pursuant to N.J.A.C. 7:26D-7.4, alternate vapor intrusion screening level, or ecological site specific goal check here ☐ and attach the Alternative Soil Remediation Standard and/or Screening Level Application Form as an addendum.

A site-specific screening level was developed for the evaluation of the VI pathway ..... ☐ Yes ☒ No

Variance from regulations

If the Licensed Site Remediation Professional has varied from the Technical Rules, provide the citation(s) from which the remediation varied and the page(s) in the attached document where the rationale for the variance is provided.

N.J.A.C. 7:26E- _____ Page _____

N.J.A.C. 7:26E- _____ Page _____

N.J.A.C. 7:26E- _____ Page _____

SECTION J. APPLICABLE REMEDIATION STANDARDS

1. Were Default Remediation Standards used for all contaminants? ☒ Yes ☐ No
   (If "Yes," check all that apply)
   - ☒ Direct Contact
   - ☒ Impact to Ground Water Soil Screening Levels
   - ☐ Ecological Screening Levels

2. Has compliance averaging been utilized to determine compliance with the Inhalation Pathway? ☐ Yes ☒ No
   If "Yes," check all that apply:

	Compliance Averaging Method Utilized			
Pathway	Arithmetic Mean	95 Percent UCL	Spatially Weighted Average	75 Percent/ 10X Procedure
☐ Ingestion-Dermal Pathway	☐	☐	☐	☐
☐ Inhalation Pathway	☐	☐	☐	☐
☐ Impact to Ground Water Pathway	☐	☐	☐	☐

3. Has a compliance option been utilized to determine compliance with the Impact to Ground Water Pathway? (If "Yes," check all that apply) ☐ Yes ☒ No
   - ☐ Immobile Compounds
   - ☐ Data evaluation for metals and semi-volatiles
   - ☐ Data evaluation for volatile organics derived from discharges of petroleum mixtures

4. Were Alternate Remediation Standards used for the Ingestion/Dermal Pathway? ☐ Yes ☒ No

5. Were Alternate Remediation Standards used for the Inhalation Pathway? ☐ Yes ☒ No

6. Were Site Specific Standards used for the Impact to Ground Water Pathway? ☐ Yes ☒ No
   (If "Yes," check all that apply)
   - ☐ Soil-Water Partitioning Equation ☐ SPLP ☐ Sesoil ☐ Sesoil/AT123D
   - ☐ DAF Modification ☐ Immobile Chemicals List
   - ☐ Soil and Ground Water Analytical Data Evaluation

7. Were Site Specific Ecological Remediation Goals used? ☐ Yes ☒ No

8. What is the ground water classification for this site as per N.J.A.C. 7:9C? (check all that apply)
   - ☐ Class I-A
   - ☐ Class I-PL Pinelands Protection Area
   - ☐ Class I-PL Pinelands Preservation Area
   - ☒ Class II-A
   - ☐ Class III-A
   - ☐ Class III-B

SECTION K. ALTERNATIVE AND CLEAN FILL USE

1. Will alternative fill be used? ☒ Yes ☐ No
2. Will clean fill be used? ☒ Yes ☐ No
3. Will material be sent off-site for use as alternative and/or clean fill? ☐ Yes ☒ No
   If "Yes," specify the section/page in the RAW where it states the SRP site receiving this alternative and/or clean fill: _____
4. Will soil that has been blended due to historically applied pesticides for agricultural purposes be used for alternative and/or clean fill? ☐ Yes ☒ No
5. Specify the section/pages where the Fill Use Plan pursuant to N.J.A.C. 7:26E-5.2(g) can be found:
   Section 5.8.2

SECTION L. REMEDIAL ACTION WORKPLAN INFORMATION

General

1. Are NJDEP-approved permits, other than any permits needing SRP approval, required prior to the implementation of the remedial action? ☒ Yes ☐ No
   If "Yes," please list the type. Air Quality Permitting Program

2. Are land use permits required prior to the implementation of the remedial action? ☐ Yes ☒ No

If "Yes," please list the type. _____

Soils

3. Check each type of remediation being proposed:

☐ No remedial action required ☐ Excavation
☒ Capping/other Engineering Control ☐ Bioremediation
☒ Institutional Control ☐ Soil Vapor Extraction
☐ Chemical Oxidation ☐ Chemical Reduction
☐ Thermal desorption ☐ Soil Washing
☒ Other (specify): STAR Technology

4. Does the proposed remedial action address all saturated zone source material? ☒ Yes ☐ No ☐ N/A

5. If an engineering control is proposed, indicate the receptor(s) each engineering control is intended to protect (check all that apply):

☒ Human ☐ Ecological ☒ Offsite Impacts ☐ No Engineering Control

6. If a restricted use is being proposed, has consent from all involved property owners been obtained? ☒ Yes ☐ No

7. Is the proposed remedial action a presumptive remedy? ☐ Yes ☒ No

Ground Water

8. Check each type of remediation being proposed:

☐ No remedial action required ☐ Containment
☐ Multiple Phase Extraction System ☐ Hydraulic Control
☐ SVE/Air Sparging ☐ Monitored Natural Attenuation
☐ Ozone Sparging ☐ Chemical Oxidation
☐ Pump & Treat ☒ Other (specify): None at this time. Soil RAWP Only.

Ecological

9. Check each type of remediation being proposed:

☐ No remedial action required ☐ Capping
☐ Excavation/Dredging ☒ Other (specify): Not Applicable

Indoor Air

10. Are soil gas concentrations currently >10x SGSLs? ☐ Yes ☒ No

11. Check each type of mitigation being proposed:

☒ No remedial action required ☐ Subsurface Depressurization System
☐ HVAC Positive Pressure ☐ Subsurface ventilation Systems
☐ Soil Vapor Extraction System ☐ Monitoring and Maintenance Schedule
☐ Other (specify): _____

Natural Resource Restoration

12. Will any injured natural resources be restored concurrent with the remedial action? ☐ Yes ☒ No

If "Yes," is the Office of Natural Resources Restoration involved? ☐ Yes ☐ No

SECTION M. PERSON RESPONSIBLE FOR CONDUCTING THE REMEDIATION INFORMATION AND CERTIFICATION

Full Legal Name of the Person Responsible for Conducting the Remediation: E.I du Pont de Nemours & Company

Representative First Name: Michael Representative Last Name: Lukas

Title: Remediation Team manager, DuPont Corporate Remediation Group

Phone Number: (302) 999-3567 Ext: Fax: (302) 999-2497

Mailing Address: Chestnut Run Plaza, Building 715, 4417 Lancaster Pike

City/Town: Wilmington State: DE Zip Code: 19805

Email Address: michael.j.lukas@usa.dupont.com

This certification shall be signed by the person responsible for conducting the remediation who is submitting this notification in accordance with Administrative Requirements for the Remediation of Contaminated Sites rule at N.J.A.C. 7:26C-1.5(a).

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein, including all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, to the best of my knowledge, I believe that the submitted information is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate or incomplete information and that I am committing a crime of the fourth degree if I make a written false statement which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties.

Signature: Michael J. Lukas Date: 6/12/13

Name/Title: MICHAEL J. LUKAS / REMEDIATION TEAM MGR

No changes to contact information since last submittal ☐

SECTION N. LICENSED SITE REMEDIATION PROFESSIONAL INFORMATION AND STATEMENT

LSRP ID Number: 576317

First Name: Scott Last Name: Drew

Phone Number: (609) 493-9077 Ext: Fax: (609) 895-1401

Mailing Address: 7 Graphics Drive, Suite 106

City/Town: Ewing State: New Jersey Zip Code: 08628

Email Address: sdrew@geosyntec.com

This statement shall be signed by the LSRP who is submitting this notification in accordance with SRRA Section 16 d. and Section 30 b.2.

I certify that I am a Licensed Site Remediation Professional authorized pursuant to N.J.S.A. 58:10C to conduct business in New Jersey. As the Licensed Site Remediation Professional of record for this remediation, I:

[SELECT ONE OR BOTH OF THE FOLLOWING AS APPLICABLE]:

☐ *directly oversaw and supervised all of the referenced remediation, and\or*

☒ *personally reviewed and accepted all of the referenced remediation presented herein.*

I believe that the information contained herein, and including all attached documents, is true, accurate and complete.

It is my independent professional judgment and opinion that the remediation conducted at this site, as reflected in this submission to the Department, conforms to, and is consistent with, the remediation requirements in N.J.S.A. 58:10C-14.

My conduct and decisions in this matter were made upon the exercise of reasonable care and diligence, and by applying the knowledge and skill ordinarily exercised by licensed site remediation professionals practicing in good standing, in accordance with N.J.S.A. 58:10C-16, in the State of New Jersey at the time I performed these professional services.

I am aware pursuant to N.J.S.A. 58:10C-17 that for purposely, knowingly or recklessly submitting false statement, representation or certification in any document or information submitted to the board or Department, etc., that there are significant civil, administrative and criminal penalties, including license revocation or suspension, fines and being punished by imprisonment for conviction of a crime of the third degree.

LSRP Signature: Scott R Drew LSRP Date: 06/14/13

LSRP Name/Title: Scott Drew, Associate

Company Name: Geosyntec Consultants, Inc.

No changes to contact information since last submittal ☒

Completed forms should be sent to:

Bureau of Case Assignment & Initial Notice
Site Remediation Program
NJ Department of Environmental Protection
401-05H
PO Box 420
Trenton, NJ 08625-0420

Prepared for

DuPont Corporate Remediation Group
4417 Lancaster Pike
Chestnut Run Plaza, Building 715 – 252
Wilmington, Delaware 19808

ON-SITE SOILS REMEDIAL ACTION WORK PLAN

Pitt-Consol Chemical Co.
191 Doremus Avenue
Newark, New Jersey 07105
SRP-PI # G000002172

Prepared by

Geosyntec consultants

engineers | scientists | innovators

130 Research Lane, Suite 2
Guelph, Ontario N1G 5G3

Project Number TR0388

June 2013

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LIST OF ABBREVIATIONS

%RE	percent of reference emitter
°C	degree Celsius
3D	three-dimensional
AOC	area of concern
AQPP	Air Quality Permitting Program
ARRCS	Administrative Requirements for the Remediation of Contaminated Sites
As	arsenic
bgs	below ground surface
CCS	Columbia Container Services
CEA	Classification Exception Area
CID	Case Inventory Document
CO	carbon monoxide
CO_2	carbon dioxide
COCs	contaminants of concern
CQA	Construction Quality Assurance
CQAPP	Construction Quality Assurance Project Plan
CRG	DuPont Corporate Remediation Group
CSM	Conceptual Site Model
DGI	Data Gap Investigation
DNAPL	dense non-aqueous phase liquid
DuPont	E. I. du Pont de Nemours and Company
EE	Ecological Evaluation
EPH	extractable petroleum hydrocarbons
EVS	Environmental Visualization Systems™
FEMA	Federal Emergency Management Agency
FNA	Former Naphthalene Area
ft	feet
Geosyntec	Geosyntec Consultants, Inc.
GDR	Geotechnical Data Report
GWQS	ground water quality standard
HASP	Health and Safety Plan
HF/NGM	Historic Fill/Native Geologic Material

LIST OF ABBREVIATIONS (CONTINUED)

IGWSRS	Impact to Ground Water Soil Remediation Standards
IGWSSL	Impact to Ground Water Soil Screening Levels
ISS	In Situ Stabilization
ISTD	In Situ Thermal Desorption
ISTS	In Situ Thermal Stabilization
kg	kilograms
kg/day	kilograms per day
LSRP	Licensed Site Remediation Professional
MAPP	Material Acceptance Protocol Plan
msl	mean sea level
NAPL	non-aqueous phase liquid
NEWGIN	Newark Geographic Information Network
NFA	No Further Action
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJGS	New Jersey Geologic Survey
NRDCSRS	Non-Residential Direct Contact Soil Remediation Standards
OFM	Open File Map
P&T	Pump and Treat
PA	Preliminary Assessment
PAHs	polycyclic aromatic hydrocarbons
PAMP	Perimeter Air Monitoring Plan
Pb	lead
PHCs	Petroleum Hydrocarbons
Pitt-Consol	Pitt-Consol Chemical Co.
POC	proof of concept
QAPP	Quality Assurance Project Plan
RAO	Response Action Outcome
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan
RE	Receptor Evaluation
RIPR	Remedial Investigation Progress Report
RIR	Remedial Investigation Report
RO	remedial objective
RSI	Revised Supplemental Investigation

LIST OF ABBREVIATIONS (CONTINUED)

S-ISCO	Surfactant-In Situ Chemical Oxidation
SESC	Soil Erosion and Sediment Control
SI/RI	Site Investigation/Remedial Investigation
SOW	scope of work
SRC	soil remediation criterion
SRP	Site Remediation Program
SRRA	Site Remediation Reform Act
SSP	Steel Sheet Piles
STAR	Self-Sustaining Treatment for Active Remediation
SVOC	semi-volatile organic compound
TarGOST®	Tar-specific Green Optical Screening Tool
TRSR	Technical Requirements for Site Remediation
USGS	United States Geological Survey
VI	vapor intrusion
VOC	volatile organic compound
WMP	Waste Management Plan

Case Inventory Document - Former Pitt-Consol Co. Site [1]

Area(s) of Concern, Receptor and Emergency Response Tracking [2]			*Impacted Media*	*Contaminants of Concern*	*Exposure Route*	*Receptors* [3]		*Current Status/Outcome*
AOC	*Name*	*Description*				*Existing*	*Potential*	
AOC 1	Manufacturing/Storage Area	Consists of approximately 17 acres of the central portion of the Site. Offset from the western boundary by AOC 3 and the southern boundary by AOC 2, and excluding the north east corner of the Site (Administration Area). Defined by historical processes including tank farms (including cresylic acid, oil, tar), former boiler house, former laboratory and warehouses. Former lagoon F is part of this area and was a storage area.	Soil and Groundwater	PAHs, naphthalene, phenolics, PHCs, As, and Pb	Soil (Direct Contact) and Groundwater	None	Passaic River	***1. STATUS/OUTCOME PRIOR TO AOC DEFINITION*** **1983** - Production operations at the Site discontinued. **1985 Phase I, Preliminary Assessment of Environmental Impacts** - Historic aerial photographs reviewed. Seven lagoons (A through G) were identified as having once been present on the entire Site. Lagoons were reportedly used to store production facility by-products and were reportedly closed by being drained and filled. Potential off-Site sources of contamination identified. **1985 Phase II, Preliminary Hydrogeologic Investigation** - Groundwater samples collected and analyzed. In-well NAPL survey performed - no LNAPL detected, DNAPL detected in five shallow wells across the Site. **1987 Supplementary Hydrogeological Study** - Groundwater samples collected and analyzed. **1987 Coal Tar Waste Resource Recovery and Remediation Feasibility Evaluation** - Test pits excavated. Coal tar and sludge samples collected and analyzed. **1987 - 1994 Quarterly Groundwater Monitoring** - NJPDEP groundwater monitoring permit issued in April 1986 - required the collection and analysis of groundwater samples on a quarterly basis. Exceedances of permit limitations were reported for each quarter. **1992 Site Investigation Summary and Report of Findings** - A tidal influence study was conducted, which: (1) confirmed that the shallow hydrologic unit is not tidally influenced; and (2) revealed that the deeper hydrologic unit is tidally influenced on the eastern portion of the Site, but the influence dissipates sharply, and it is not of sufficient magnitude to reverse the direction of groundwater flow. Groundwater samples were collected and analyzed. No NAPLs were detected in any of the wells. VOCs and BNAs were detected in both the shallow and deeper hydrologic units. Detected concentrations of VOCs, phenol and naphthalene were significantly greater in the deeper wells than in the shallow wells, potentially suggesting off-Site sources. Detected concentrations of BNAs (other than naphthalene) were greater in the shallow hydrologic unit. Test pits were dug for the purpose of characterizing the depth and vertical extents of the of the former lagoons. Deposits of crystalline and soft tar were found mixed with and interspersed with soil, rubble, cinders, and brick and wood debris (Historic Fill). Emulsified oil was encountered in some of the test pits. **1998 Preliminary Assessment** - A comprehensive summary of past Site investigation efforts and review of historical operations at the Site was conducted and was the basis for AOC definition at the Site. ***2. STATUS/OUTCOME POST AOC DEFINITION*** **2000 Site Investigation/Remedial Investigation** - Objective was to evaluate the nature and extent of impacts to soil and groundwater which had resulted from on-Site production operations. Soil, groundwater and lagoon characterization samples were collected and analyzed. Off-Site impacts and potential sources were assessed through evaluation of files related to environmental investigations of surrounding properties and through the analysis of soil and groundwater samples collected from around the perimeter of the Site. PAHs and metals detected in several shallow soil samples, and PAHs detected in Meadow Mat samples, at concentrations above RDCSCC criteria. PAHs, BTEX and 2,4 dimethylphenol detected in shallow groundwater and metals, BTEX, 2,4-dimethylphenol, phenol and chlorobenzene detected in deep groundwater in excess of GWQSs. **2002** - CCS (tenant 2002 to present) placed a fabric/plastic geomembrane over the Historic Fill and then placed a crushed gravel layer (between 2 and 5 ft thick) on top. **2005 Revised Supplemental Investigation** - Two of five areas with elevated COCs in soil successfully delineated. Analysis of samples indicate that the deep clay layer is not a source of deeper bedrock aquifer contamination. Off-Site soil sampling revealed no useful information about the potential of an on-Site source of off-Site impacts. Analysis of groundwater samples suggest that both the shallow and deep water bearing units have been impacted by upgradient sources and that COC concentrations in groundwater were trending downward. **2009 Phase I Data Gap Investigation** - Objective was to evaluate the vertical extent of Site-related groundwater impacts. The results revealed that naphthalene has impacted groundwater at one bedrock well location (AOC 2).

Case Inventory Document - Former Pitt-Consol Co. Site [1]

Area(s) of Concern, Receptor and Emergency Response Tracking [2]			*Impacted Media*	*Contaminants of Concern*	*Exposure Route*	*Receptors* [3]		*Current Status/Outcome*
AOC	*Name*	*Description*				*Existing*	*Potential*	
								2011 Receptor Evaluation - Included the assessment of on-Site and surrounding property use, current Site environmental conditions, groundwater use, potential vapor intrusion route, and potential ecological receptors. **2011 Off-Site Investigation** - Report on investigation efforts conducted to further evaluate the down gradient extent of groundwater impacts and to collect data on soil impacts from on-Site and off-Site locations necessary for remedy evaluation and selection. **2011 Supplemental Remedial Investigation Work Plan, 2011 Supplemental Remedial Investigation Addendum #1 Work Plan, 2012 Supplemental Remedial Investigation Addendum #2 Work Plan, Phase II Data Gap Investigation Work Plan Addendum to Investigate LNAPL in MW-105S** - Work Plans were developed to guide investigation activities for the delineation of on-Site soils. Delineation techniques included TarGOST® surveys, test pitting investigations, deep soil boring investigations, installation and sampling of multi-level monitoring wells, and synoptic and long-term groundwater elevation surveys. Investigation of LNAPL in monitoring well MW-105S was also conducted, but determined to be less than 0.01 feet of measurable product, the NJDEP TRSR required thickness to establish remediation practices. **2011 Remedial Investigation Progress Report** - This report presents an outline of activities and investigations conducted in 2011 in the former lagoon areas and other AOCs at the Site. The data from these investigations were compiled with existing data sets to aid in the long term data collection requirements of the CSM. The results of this work were used to evaluate investigative technologies to potentially be applied at the Site and for delineation of on-Site soils. **2012 Remedial Investigation Progress Report** - This report presents an outline of activities and investigations conducted, in the first quarter of 2012, in the former lagoon areas and other AOCs at the Site. The data from these investigations were compiled with existing data sets to aid in the long term data collections requirements of the CSM. The results of this work were used for delineation of on-Site soils. ***3. REDESIGNATION OF AOCs*** **2012 Designation of Pitt-Consol Areas of Concern Technical Memorandum** - A summary of modifications to the designated AOCs for the former Pitt-Consol property based on the delineation of on-Site soils. AOC 1 through 3 were closed and re-defined under AOC 4 through 7 (see below).
AOC 2	Pitch Storage and Tar Tank Farm Area	Consists of approximately 6 acres of the southern portion of the Site. Situated along the southern boundary, offset from the western Site boundary by AOC 3 and extending to the eastern Site boundary. Defined by historical processes including tar tank storage area and former pitch warehouse station.	Soil and Groundwater	PAHs, naphthalene, phenolics, PHCs, VOCs, As, and Pb	Soil (Direct Contact) and Groundwater	None	Passaic River	***1. STATUS/OUTCOME PRIOR TO AOC DEFINITION*** See Section 1 in AOC 1 ***2. STATUS/OUTCOME POST AOC DEFINITION*** See Section 2 in AOC 1 ***3. REDESIGNATION OF AOCs*** See Section 3 in AOC 1
AOC 3	Former Lagoons Area	Consists of approximately 7 acres of the western and northwestern portion of the Site. Situated along the western and north-western Site boundary. Consists of former lagoon areas A, B, C, D, E and G.	Soil and Groundwater	PAHs, naphthalene, phenolics, PHCs, VOCs, As, and Pb	Soil (Direct Contact) and Groundwater	None	Passaic River	***1. STATUS/OUTCOME PRIOR TO AOC DEFINITION*** See Section 1 in AOC 1 ***2. STATUS/OUTCOME POST AOC DEFINITION*** See Section 2 in AOC 1 **2011 STAR Pilot Test Report** - Pilot testing (Phase I and II) of the STAR technology was conducted in the former lagoon area along the westernmost portion of the Site (AOC 3). Post-pilot test soil samples confirmed COC concentration reductions of approximately three to four orders of magnitude as a result of the STAR process. ***3. REDESIGNATION OF AOCs*** See Section 3 in AOC 1

Case Inventory Document - Former Pitt-Consol Co. Site [1]

Area(s) of Concern, Receptor and Emergency Response Tracking [2]			Impacted Media	Contaminants of Concern	Exposure Route	Receptors [3]		Current Status/Outcome
AOC	Name	Description				Existing	Potential	
AOC 4	HF/NGM	11.6 acres (approx.) 414,000 cubic yards (volume approx.); historic fill and native geologic material	Soil	PAHs, naphthalene, phenolics, PHCs, As, and Pb	Soil (Direct Contact) and Groundwater	None	Passaic River	***1. DESIGNATION OF NEW AOCs*** **2012 Designation of Pitt-Consol Areas of Concern Technical Memorandum** - A summary of modifications to the designated AOCs for the former Pitt-Consol property based on the delineation of on-Site soils. AOC 1 through 3 were closed and re-defined under AOC 4 through 7. ***2. STATUS/OUTCOME POST AOC DEFINITION*** **2013 Remedial Action Selection Report** - This Report was prepared to memorialize the selection process, to provide a rationale for remedy selection and begin to develop the implementation approach for treatment of on-Site soils. This Report considers remedies for addressing soils on-Site. Further Site restoration and redevelopment are not evaluated in this memorandum; however, they are considered as part of the evaluation of remedial alternatives. **2013 Additional Data Technical Memo** - An outline of activities and investigations conducted in the second and third quarter of 2012 in the area of the Former Lagoons (A-D) and within the adjacent portion of the Site. The data from these investigations was compiled with existing data sets to aid in the completion of the CSM and delineation of on-Site soils. **2013 Remedial Investigation Report** - This on-Site soils report presents a summary of activities and investigations conducted in 2011 and 2012, based on data gaps identified following a review of available historical data. The intent of this RIR is to document the delineation of, to the degree practical, the horizontal and vertical extent of contamination in the on-Site soils to the applicable remediation standards at the Site pursuant to the N.J.A.C 7:26E-4. **2013 Receptor Evaluation** - Included the assessment of on-Site and surrounding property use, current Site environmental conditions, groundwater use, potential vapor intrusion route, and potential ecological receptors. **2013 STAR Pilot Test Report** - A Phase III pilot test of the STAR technology was conducted in the Former Lagoon C area of the Site. The test was conducted in an area without sheet pile containment and involved: (i) a shallow fill unit test designed to collect additional information regarding process variability and robustness of the technology implementation; and (ii) a deep sand unit test designed to evaluate the potential application of STAR in this deeper sand layer. **2013 Remedial Action Work Plan** - This RAWP outlines the proposed soil remedy implementation plans for on-Site soils, in accordance with the long term ROs set forth for the Site, with the overall goal of the remedial actions to obtain a RAO for AOC 4, 5 and 6.
AOC 5	HF/NGM + Stain + Tar Pieces	18.9 acres (approx.) 221,000 cubic yards (volume approx.); historic fill and native geologic material plus stain and tar pieces	Soil	PAHs, naphthalene, phenolics, PHCs, VOCs, As, and Pb	Soil (Direct Contact) and Groundwater	None	Passaic River	***1. OPENING OF AOC*** See Section 1 in AOC 4 ***2. STATUS/OUTCOME POST AOC DEFINITION*** See Section 2 in AOC 4
AOC 6	HF/NGM + Tar + Viscous Tar	7.3 acres (approx.) 36,000 cubic yards (volume approx.); historic fill and native geologic material plus tar and viscous tar	Soil	PAHs, naphthalene, phenolics, PHCs, VOCs, As, and Pb	Soil (Direct Contact) and Groundwater	None	Passaic River	***1. OPENING OF AOC*** See Section 1 in AOC 4 ***2. STATUS/OUTCOME POST AOC DEFINITION*** See Section 2 in AOC 4

Case Inventory Document - Former Pitt-Consol Co. Site [1]

Area(s) of Concern, Receptor and Emergency Response Tracking [2]			Impacted Media	Contaminants of Concern	Exposure Route	Receptors [3]		Current Status/Outcome
AOC	Name	Description				Existing	Potential	
AOC 7	Site Groundwater	Whole Site	Groundwater	PAHs, naphthalene, phenolics, PHCs, VOCs, As, and Pb	Groundwater	None	Passaic River	***1. OPENING OF AOC*** See Section 1 in AOC 4 ***2. STATUS/OUTCOME POST AOC DEFINITION*** No further activities since re-designation of AOCs.

Notes:

1. Case Inventory Document current as of June 13, 2013.
2. Historical facility operations were used to define the AOCs, but these have not existed on the Site since 1986 at the latest. Some of the AOC boundaries are uncertain and have been approximated.
3. Currently no buildings exist on-Site and no GWSL exceedances within regulated distance to off-Site buildings so no vapor intrusion receptors exist.

AOC - area of concern
As - arsenic
BNAs - base, neutral and acid extractables
BTEX - benzene, toluene, ethyl benzene, xylene
CCS - Columbia Container Services, Inc.
COCs - constituents of concern
CSM - Conceptual Site Model
DNAPL - dense non-aqueous phase liquid
GWSL - Ground Water Screening Levels
GWQSs - New Jersey Class IIA Groundwater Quality Standards
HF/NGM - Historic Fill/Native Geologic Material
LNAPL - light non-aqueous phase liquid
NAPL - non-aqueous phase liquid
NJDEP - New Jersey Department of Environmental Protection
PAHs - polycyclic aromatic hydrocarbons
Pb - lead
PHCs - petroleum hydrocarbons
RAO - Remedial Action Outcome
RAWP - Remedial Action Work Plan
RDCSCC - New Jersey Residential Direct Contact Soil Cleanup Criteria
RO - Remedial Objective
STAR - Self-Sustaining Treatment for Active Remediation
TarGOST® - tar-specific green optical screening tool
TRSR - Technical Requirements for Site Remediation
USTs - underground storage tanks
VOCs - volatile organic compounds

EXECUTIVE SUMMARY

This Remedial Action Work Plan (RAWP) outlines the soil remedy implementation plans for the former Pitt-Consol Chemical Co. (Pitt-Consol) property located at 191 Doremus Avenue in Newark, Essex County, New Jersey (the Site). This RAWP is specifically for on-Site soils, in accordance with the long term remedial objectives (ROs) set forth for the Site, with the overall goal of the remedial actions to obtain a Response Action Outcome (RAO) for the Areas of Concern (AOCs) discussed in this RAWP. A separate RAWP will be prepared associated with Site groundwater remedial action. Geosyntec Consultants, Inc. (Geosyntec) has prepared this RAWP for and on behalf of E. I. du Pont de Nemours and Company (DuPont).

Overall, the remedy consists of the following elements as described in this RAWP:

- Free Product Treatment: Self-sustaining Treatment for Active Remediation (STAR), with a contingency approach of excavation (if required in localized areas). STAR is an innovative new technology based on the principles of smoldering combustion where the contaminants are destroyed as they combust.
- Cap/Final Cover: Integrated into the Site re-development plan.
- Engineering and Institutional Controls: Soil Remediation Permit and Site-wide Deed Notice (institutional controls that will stipulate engineering controls as part of future Site re-development) that will be implemented post remedial actions.

This RAWP also provides a description of the supporting work in preparation for remedial actions (Site preparation including a temporary cover for the STAR working surface area and vapor collection in the areas of STAR implementation and installation of a temporary Impermeable Barrier Wall near property boundaries and existing subsurface utilities to limit propagation of the STAR combustion front to these areas), the permits and notifications necessary to implement remedial actions, the associated construction monitoring and operations plans to execute this work, the methods to evaluate the remedial actions, post-remedial action activities, and the project schedule. DuPont is actively working to finish remedial activities and prepare the Site for re-development.

Following submission of this RAWP, permitting and preparation of a remedial design drawing and specification package will be completed prior to implementation of field activities.

1. INTRODUCTION

This Remedial Action Work Plan (RAWP; the Work Plan) outlines the soil remedy implementation plans for the former Pitt-Consol Chemical Co. (Pitt-Consol) property located at 191 Doremus Avenue in Newark, Essex County, New Jersey (the Site; Figure 1). This Work Plan has been prepared in accordance with the requirements of the New Jersey Department of Environmental Protection (NJDEP) Technical Requirements for Site Remediation (TRSRs or "Tech Regs"), amended 7 May 2012 (New Jersey Administrative Code [N.J.A.C.] 7:26E) (NJDEP, 2012a), for a RAWP (N.J.A.C. 7:26E-5.5). Geosyntec Consultants, Inc. (Geosyntec) has prepared this RAWP for and on behalf of E. I. du Pont de Nemours and Company (DuPont).

Under the New Jersey Site Remediation Reform Act (SRRA; N.J.S.A. 58:10C-1), a Licensed Site Remediation Professional (LSRP) may, with NJDEP approval, assume responsibility for oversight of environmental investigations and cleanups. The LSRP for the Site is Mr. Scott Drew (LSRP # 576317) of Geosyntec.

1.1 Intent of the Remedial Action Work Plan

The intent of the RAWP is to document plans for remediation of on-Site soils so that the long term remedial objectives (ROs) are successfully achieved. These ROs are described in further detail in Section 1.2. This RAWP presents a summary of the remedial action plans for each area of concern (AOC) requiring a remedial action for on-Site soils. These AOCs are described in further detail in Section 3. A separate RAWP will be prepared to address Site groundwater remedial actions.

Included herein is background information related to current Site conditions, former operations, geology, hydrogeology, contaminant distribution and planned re-development at the Site. The AOCs at the Site are defined and the overall remedial action approach for addressing on-Site soils in these AOCs is discussed. Further details on the evaluation of remedial alternatives conducted, the selected treatment technology, details of remedial action plans and how the work will be executed, how the remedy will be evaluated, and what post remedial action activities will be conducted to attain a Response Action Outcome (RAO) for the AOCs discussed in this RAWP, are included in the following sections of this RAWP. A schedule of remedial activities is also provided.

1.2 Remedial Objectives

The goal of the remedial actions for treatment of on-Site soils is to obtain a RAO by the Site LSRP to memorialize the completion of remediation, indicating that in their professional judgment the Site has been remediated in accordance with applicable statues,

regulations, and guidelines, and that the appropriate controls and permits are in place pursuant to N.J.A.C. 7:26E-5.1. This goal will be achieved by meeting the ROs. The ROs for on-Site soils are as follows:

- Protection of human health, safety, and the environment;
- Treatment, removal, or isolation of contamination;
- Treatment or removal of free product;
- Management of direct contact risks; and
- Mitigation of impacts to groundwater.

The implementation of the soil remediation techniques discussed herein will remove, treat, or isolate contamination to:

- Comply with regulatory statutes and applicable permits;
- Minimize disruption to neighboring properties;
- Develop and implement long-term environmental remediation, monitoring, and contingency programs that are compatible with future re-development activities, property sale, leasing, and operations; and
- Not cause a natural resource injury.

1.3 RAWP Submittal

Pursuant to N.J.A.C. 7:26E-5.5(a), this RAWP is being submitted to NJDEP, at least 60 days prior to implementation, for each of the on-Site soil AOC as defined in Section 3 that requires a remedial action.

If requested, a copy of this RAWP will be submitted to the municipal clerk, country health department and local health agency for the municipality and county. Public notification and updates to these entities as well as any property owner or tenant within 200 feet of the Site will also be provided at a minimum of 14 days prior to commencing field activities and will include a summary of the Site conditions, description of the activities that are to take place to remediate the Site, the contact information of the person responsible for conducting the remediation, and the name and number of the LSRP. The notification will be in the form of either written correspondence or the posting of a sign visible to the public at the Site boundary. Government entities will also be provided with a list of the property owner recipients of public notification.

An updated Case Inventory Document (CID) is included at the beginning of this report and an updated Receptor Evaluation (RE) is included in Appendix A of this report.

1.4 Report Organization

The remaining sections of this RAWP present the following:

- Section 2 – an overview of background information about the Site, including Site description and geographic setting, geology and hydrogeology, contaminants of concern (COCs), and property uses for past, present, and planned future re-development;
- Section 3 – a summary of the findings and recommendations from the on-Site soils Remedial Investigation Report (RIR) prepared pursuant to N.J.A.C. 7:26E-4.9, including the identification of each AOC where the remedial action will be implemented, the horizontal and vertical extent of the area to be remediated correlated to the extent of contamination and the volume of contamination to be remediated for on-Site soils;
- Section 4 – a summary of the remedial action approach, including identification of applicable remediation standards and a summary of the remedy evaluation conducted and the technology selected for free product treatment or removal;
- Section 5 – a detailed description of the activities associated with execution of the remedial action plan for the Site;
- Section 6 – a plan to evaluate the effectiveness of the selected remedial action;
- Section 7 – a description of the post remedial action activities including decontamination, deed notices, and reporting;
- Section 8 – a schedule of the planned remedial action activities as well as the pre- and post-remedial action activities, pursuant to the required regulatory timeframe at N.J.A.C. 7:26E-5.8; and
- Section 9 – references.

Interim remedial measures were not previously completed at the Site and are therefore not discussed herein.

2. SITE BACKGROUND AND SETTING

2.1 Site Description and Geographic Setting

The Site is located in an area of prior and current heavy industry use along Doremus Avenue, near to the Port of Newark (Figures 1 and 2). Exit 15E of the New Jersey Turnpike is immediately northwest of the Site. According to information accessed through the Newark Geographic Information Network (NEWGIN), the Site property comprises the parcels designated by the City of Newark, Division of Assessments, as Block 5016, Lots 1 and 3, and Block 5016.01, Lot 10, which together have a combined area of 37.67 acres. Block 5016, Lot 1 and Block 5016.01, Lot 10 form the contiguous portion of the property; Block 5016, Lot 3 is separated from these other parcels by non Pitt-Consol properties in the southeast corner of the Site.

The ground surface of the Site is generally flat, with little topographic relief. The contiguous portions of the Site were previously leased by Columbia Container Services (CCS) for the storage of empty shipping containers but in preparation for remedial activities their lease was not renewed and, as of 2012, the Site is vacant. This area is covered primarily with stone and asphalt, is fenced to the south, west and east of the Site, and contains a wall of shipping containers to the east to limit access to the Site. The separate parcel of the Site is asphalt covered and fenced, and is currently unused.

The Site and surrounding area are zoned "Industrial" (NEWGIN), and the properties adjacent to the Site are used for industrial purposes. Mapped information available through NJDEP's NJ-GeoWeb online Map Viewer indicates that there are no property uses of types frequented by sensitive human receptors (i.e., residences, schools, daycare centers, or parks or other recreational areas) within 1,000 feet (ft) of the Site boundary (NJ-GeoWeb). A map of the Site and surrounding area produced from NJ-GeoWeb is included in the RE, previously submitted to NJDEP in 2011 (Geosyntec, 2011a) and updated as part of the RIR (Appendix A; Geosyntec, 2013d) as required by N.J.A.C. 7:26E-1.12(e).

2.2 Site History and Historical Surrounding Area Property Uses

The areas surrounding what is now the Site were once flood plains and tidal mudflats along the Passaic River. In the late 1800s, the Site and surrounding areas were covered with fill material (Historic Fill) to raise the land and allow for development (CRG, 2000). The Site was reportedly first developed in the late 1800s and from then until May 1983 it was the location of industrial operations which, at various times, produced road tars, phenols, methyl phenols (cresol and cresylic acid) (CRG, 1998). Production operations at the Site were terminated on 23 May 1983, and at that time, an alkylation unit, a natural cresylic

acid plant, a synthetic cresol plant, and several above ground tank and drum storage areas existed at the Site (CRG, 1998). Immediately prior to its shutdown, the Pitt-Consol facility was producing alkylated phenols, primarily cresol (methyl phenol) (CRG, 1998). Work to dismantle the on-Site facilities began in late 1984, and was completed by January 1986 (DuPont, 1995). The Site remained vacant from 1986 until approximately 2002, when CCS began operating a shipping container storage yard on the Site. CCS vacated the Site in early 2012 and the Site is currently vacant in preparation for remediation activities.

According to (CRG, 1998), chemical plants, scrap yards, metal recycling operations, oil terminals, trucking terminals, a power generation plant, and a sewage treatment plant either exist or existed in the past in the area surrounding the Site.

2.3 Local Geology

The Site is underlain by five major unconsolidated units which in turn overlie a reddish brown shale bedrock unit (Brunswick Shale) with an upper weathered surface (CRG, 2000). The unconsolidated units, in ascending order (from deepest to shallowest), as described by the New Jersey Geologic Survey (NJGS) in co-operation with the United States Geological Survey (USGS) in Open File Map (OFM) 42 (NJGS, 1998), are: (1) Rahway Till, a reddish-brown to light reddish-brown glacially derived silty sand to sandy clayey silt unit that is typically less than 20 ft thick in the local Site area; (2) Lake Bottom Deposits composed of predominately gray to reddish-brown silt, clay and fine sand which is well sorted, thinly layered and varved and is up to approximately 50 ft thick at the Site; (3) Alluvium, a medium to coarse dark-brown, gray, reddish-brown sand and silt unit up to 30 ft thick (intermediate water bearing unit); (4) Meadow Mat, a semi-confining organic silt, clay and peat layer with some sand and fine gravel which can be up to 25 ft thick; however, this layer is observed to thin considerably moving from East to West across the Site (in some areas along the Western side of the Site the Meadow Mat is believed to be absent); and (5) Fill, a heterogeneous historic fill unit generally less than 20 ft thick and composed of porous fill materials including sand, gravel, rock, cinders, ash, brick, concrete, wood, slag, metal, glass and trash (shallow water bearing unit). In 2002, after CCS leased the Site, the unconsolidated native materials were covered with a permeable fabric geomembrane, and fill consisting of a layer of crushed stone and gravel, nominally between 2 and 5 ft thick, was placed on the Site.

2.4 Local Hydrogeology

The following is a summary of the local hydrogeology for the Site; a more detailed analysis can be found in the RIR (Geosyntec, 2013d). The ground water table is located in the Fill, generally between zero and six ft mean sea level (msl), or 3 and 9 ft below ground surface (bgs). Horizontal hydraulic gradients calculated based on gauged elevations in July and October 2012 were 0.0065 ft/ft and 0.0034 ft/ft, respectively. Assuming a porosity of 30 percent (%) and hydraulic conductivity of approximately 190 ft/day (CRG, 2008; Golder, 2007; CRG, 2000; CRG, 1998), ground water velocity is estimated to be between 800 and 1,500 ft/year. Ground water flow in the Fill is generally east-northeast. Horizontal hydraulic gradients in the Alluvium calculated based on gauged elevations in July and October 2012 were 0.0013 ft/ft and 0.00096 ft/ft, respectively. Assuming a porosity of 30% and hydraulic conductivity of approximately 50 ft/day (CRG, 2008; CRG, 1998), ground water velocity is estimated to be between 60 and 80 ft/year. The direction of flow during these measured time periods shifted slightly from east-southeast to southeast. The Passaic River, located approximately 600 ft east of Doremus Avenue, is likely the discharge point for Site ground water. However, given the low observed hydraulic gradients and calculated velocities, ground water discharge to the river is considered to be minimal. Horizontal hydraulic gradients calculated based on gauged elevations in the bedrock in July and October 2012 were 0.0026 ft/ft and 0.0031 ft/ft, respectively. The direction of flow ranged from due south to southeast. Vertical gradients between the Fill, Alluvium and bedrock calculated based on gauged elevations during the same time periods are generally downward.

In the Fill, seasonal water level fluctuations are greatest; tides appear to have minimal influence on wells in the fill unit. In the Alluvium, seasonal water level fluctuations are more muted, with wells in the Alluvium showing a minimal response to precipitation events. Tides appear to have a moderate influence on the water levels. In the bedrock, seasonal water level fluctuations are similar to the Alluvium. Response to tides is much more significant and appears to have a moderate influence in this unit. As expected, bedrock wells show very little seasonal change or response to extreme precipitation events.

2.5 Contaminants of Concern for On-Site Soils

The Preliminary Assessment (PA) report (CRG, 1998) identified COCs through a review of the Site history, including process, storage and waste disposal practices, coupled with an evaluation of the soil and ground water analytical data that was available at the time. Identified COCs included volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), phenols, petroleum hydrocarbons (PHCs), arsenic (As), and lead (Pb).

A review of historical operations and data from properties close to the Site show that soil and groundwater at these neighboring lots contain high concentrations of various COCs. Off-site migration from nearby sites could account for the presence of some light organic solvents at the Pitt-Consol Site.

Beneath the surficial stone layer are relatively porous Fill and Alluvium units, described above in Section 2.3, which are believed to allow the downward migration of coal tar dense non-aqueous phase liquid (DNAPL) or free product (as defined in N.J.A.C. 7:26E-1.8). While the Meadow Mat layer limits the downward migration of coal tar DNAPL, in areas where the Meadow Mat unit is very thin or absent (western side of the Site) the coal tar DNAPL has migrated downward into the Alluvium. The thinly layered varved Lake Bottom Deposits were observed to act as a capillary barrier preventing further downward migration of coal tar DNAPL.

2.6 Planned Site Re-Development

It is anticipated that future uses of the Site will be for industrial purposes only; consistent with the current use of this Site and adjacent properties, and that a restricted use RAO will include appropriate institutional and engineering controls to achieve the protection of public health and safety and the environment.

3. INVESTIGATION REPORT SUMMARY

3.1 Historical Investigations

After industrial operations ceased in 1983, a number of studies and environmental investigations were conducted at the Site. The PA Report (CRG, 1998) provided supplemental information about studies and investigations conducted before 1998. Since 1998, several environmental investigations have been performed at the Site. The results of these investigations, which were presented in the following reports, were incorporated into the Site delineation and included in the on-Site Soils RIR (Geosyntec, 2013d):

- 2000 DuPont Corporate Remediation Group (CRG) Site Investigation/Remedial Investigation Report (SI/RI; (CRG, 2000);
- 2005 Revised Supplemental Investigation (RSI) Report (CRG, 2005);
- 2007 Geotechnical Data Report (GDR; Golder, 2007);
- 2009 Phase I Data Gap Investigation (DGI) Report and Phase II DGI Work Plan (CRG, 2009);
- 2011 Off-Site DGI Report (Geosyntec, 2011c);
- 2011 and 2012 Supplemental RI Work Plan and Addendums (Geosyntec, 2011d, 2011e, 2012a);
- 2011 Remedial Investigation Progress Report (RIPR) (Geosyntec, 2012b);
- 2012 RIPR (Geosyntec, 2012c);
- Additional 2012 Remedial Investigation Data Memo (Geosyntec, 2013c); and
- 2013 Updated Receptor Evaluation (Geosyntec, 2013b).

3.2 Summary of the On-Site Soils Remedial Investigation Activities

On-Site soils remedial investigation activities were conducted in 2011 and 2012 following the review of the available historical site data. A three-dimensional (3D) Conceptual Site Model (CSM) was developed in accordance with the NJDEP Site Remediation Program (SRP) document, Technical Guidance for Preparation and Submission of a Conceptual Site Model (Version 1.0, 10 December 2011) from the historical data. The CSM was used to identify gaps in the historical dataset and the subsequent DGI work performed in 2011 and 2012 was conducted to address these data gaps, as outlined below.

- New Jersey Literature Review & Test Pits: Characterize the presence of Historic Fill at the Site.
- Test Pits: The initial delineation of the Site-wide free product distribution, based on the visual observations from the historic boreholes, identified locations for the 2011 DGI test pit investigation. The test pits were used to confirm the historical observations and collect analytical samples from each of the identified free product categories. The 2012 DGI test pit excavations were used to confirm free product types (solid and/or liquid tar in soil) identified during the 2011 test pit excavations, particularly at historic Lagoons that were not previously accessible (Lagoons E, F, G, and the Former Naphthalene Plant, Stills, and Storage Area [FNA]).
- Tar-specific Green Optical Screening Tool (TarGOST®) Survey, Confirmatory Boreholes and Sonic Cores: Additional delineation, to the extent practicable, of the Site wide horizontal and vertical limits of free product (i.e., solid material, semi-solid or non-aqueous phase liquid [NAPL]) using the TarGOST® technology was conducted. The use of the TarGOST® technology was planned as part of the 2011 DGI activities in the area of the Former Lagoons A-D and as a method for delineating the free product distribution at the Site on a relatively dense sampling grid compared to what could be completed with conventional borehole coring in the same timeframe. The investigation was expanded to a Site-wide survey as part of the 2012 DGI. Confirmatory boreholes and sonic cores from the installation of select wells (MW-114S/D and IP-05) were collected near select TarGOST® locations from the 2011 or 2012 surveys to compare the TarGOST® findings against field observations and soil analytical data.
- Soil Borings and Installation of Multi-Channel Monitoring Wells: Further characterization of the subsurface geology at depths below the top of the Meadow Mat and in areas of the Site beyond the boundaries of Former Lagoons A-D as well as to assess the vertical extent of the on-Site soils impact on ground water.

The results of these activities were submitted to the NJDEP in an On-Site Soils RIR (Geosyntec, 2013d) and the findings are summarized below.

- New Jersey Literature Review & Test Pits: The regional maps of historic fill provided by the NJDEP and the NJGS in co-operation with the USGS in OFM 42 (NJGS, 1998) were reviewed and test pits were dug to confirm the historical fill characterization. The results of this information are described further in Section 3.4.

- Test Pits: The types of free product observed in the test pits from 2011 and 2012 were similar to the types observed in the confirmatory borings collected during the 2011 TarGOST® survey and presented in the 2011 RIPR (included as part of the RIR [Geosyntec, 2013d]). This information was used as part of the re-designation of AOC 1, 2, 3, which were replaced with AOC 4, 5 and 6 further described in Sections 3.3 to 3.6.
- TarGOST® Survey: The free product types observed in the confirmatory soil boreholes were similar to the observations made in the test pits. When taking into consideration the off-set between the TarGOST® and sonic soil core locations, a generally good correlation was observed between the NAPL concentration and residual saturation values calculated from the TarGOST® data, the visual observations in the sonic cores, and the extractable petroleum hydrocarbons (EPH) and total Aromatics data from the analysis of soil samples collected from the sonic cores. Therefore, TarGOST® responses (in units of percent of reference emitter [%RE] values) were used as indicators of the free product (representing soils impacted and not impacted by free product) in the on-Site soils. This information was also included in the designation of AOC 4, 5 and 6 described in Section 3.3 to 3.6. The TarGOST® data was incorporated into the 3D CSM using CTech© Environmental Visualization Systems™ (EVS) software, which was used to estimate the volume and location of impacted soil as well as to estimate the mass of free product in the subsurface.
- Soil Borings and Installation of Multi-Channel Monitoring Wells: Following the completion of the soil borings and installation of the multi-channel wells, the lithological data were used to update the CSM geology created from the historic Site borehole data described above. The findings were similar to the historic Site borehole data but provided increased delineation for the deeper lithologic layers below the Meadow Mat. A West-East conceptual cross-section of the Site geology and free product distribution presented in Figure 3 was developed following the addition of the 2011 and 2012 DGI lithological data and contaminant distribution analysis. The cross-section summarizes the findings of the CSM was developed using a 3D EVS model constructed from the Site borehole and TarGOST® information.
- On-Site Soil Analytical Data: The soil analytical data collected by Geosyntec between August 2009 and June 2012 were combined with data collected prior to Geosyntec's involvement in the Site soils investigation (reports listed in Section 3.1) to identify the COCs detected above the Non-Residential Direct Contact Soil Remediation Standards (NRDCSRS). (Of note, analytical data collected prior to remedial investigation activities as part of the pilot test program for the Self-

sustaining Treatment for Active Remediation (STAR) technology [Geosyntec, 2011b] in 2009 and 2010 were included where they represented pre-test conditions.) A total of nineteen (19) compounds including 2-methylnaphthalene, 4-methylphenol, arsenic, benzene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, beryllium, bis(2-ethylhexyl)phthalate, carbazole, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, lead, manganese, mercury, naphthalene and vanadium were found in the on-Site soils above the NRDCSRS criteria.

3.3 Areas of Concern

Three AOCs (AOC 1, 2 and 3) were previously defined for the Site based upon the similarities of the activities, feedstock, products and wastes that occurred or were managed within each area (CRG, 1998). Historical Sanborn Fire Insurance Co. maps, facility maps and aerial photographs were used to identify the three AOCs (CRG, 1998). A former administrative area in the northeast corner of the Site was also marked, but was not designated as an AOC due to historical Site practices. These AOC designations were re-defined in 2012 (Geosyntec, 2012d) to group areas where the nature and extent of impacts are similar, based on the results of on-Site delineation activities discussed in Section 3.2.

The current AOCs for soil and groundwater are summarized in the CID, the table below, and are shown in Figure 4:

AOC	Description	Delineation	Description	Dimensions
4	Historic Fill/Native Geologic Material (HF/NGM)	TarGOST® %RE ≤ 10	Not impacted by Former Site operations	11.6 acres (approx.) 414,000 cubic yards (volume approx.)*
5	HF/NGM + Stain + Tar Pieces	TarGOST® %RE > 10 and ≤ 50	Contains staining or/and hard coal tar pieces from former Site operations	18.9 acres (approx.) 221,000 cubic yards (volume approx.)
6	HF/NGM + Tar + Viscous Tar	TarGOST® %RE > 50 or areas where the TarGOST® probe could not be advanced to depth (Lagoon F)	Contains liquid and viscous tar from former Site operations	7.3 acres (approx.) 36,000 cubic yards (volume approx.)
7	Site Groundwater	To be identified in upcoming groundwater RIR and RAWP	Contamination in groundwater	Whole Site

CY – cubic yards
*Based on soils in the fill

Further details on the RIR findings on each AOC are described in the following sections.

3.4 AOC 4 - Historic Fill/Native Geologic Material

Historic Fill is defined in N.J.A.C. 7:26E-1.8 as "non-indigenous material, deposited to raise the topographic elevation of the Site, which was contaminated prior to emplacement and which includes, without limitation, construction debris, dredge spoils, incinerator residue, demolition debris, fly ash, or non-hazardous solid waste….". The Brownfield and Contaminated Site Remediation Act (N.J.S.A. 58:10B-1) requires the NJDEP provide maps of regions where historic fill exists. Review of these maps show historical fill is present across the entire area of the Site. The depth of the fill is from ground surface to the top of the Meadow Mat layer, ranging from 6 to 15 ft bgs across the Site.

On-Site test pit investigations conducted in 2011 and 2012 confirmed the Fill layer described in Section 2.3 consists of historical debris characterized by the presence of household debris, glass, timber, concrete, asphalt, sand and gravel. AOC 4 is identified by TarGOST® as having a %RE response of equal to or less than 10%RE. An evaluation of the chemical analysis of soil samples collected from the Site was conducted as part of the RIR to identify samples considered to be representative of the historic fill. Remedial actions required for AOC 4 are described in further detail in Section 4.

3.5 AOC 5 - Historic Fill/Native Geologic Material, Stain, and Tar Pieces

AOC 5 exists as an intermediary between AOC 4 and AOC 6. AOC 5 is estimated to occupy 221,000 cubic yards of soil over approximately 18.9 acres at depths extending into the Alluvium. The test pit investigations, confirmatory borings, sonic core borings, and analytical sampling conducted in 2011 and 2012 confirmed AOC 5 consists of the historic fill, described as part of AOC 4, and native geologic material both of which may contain staining or/and hard coal tar pieces due to former Site operations. AOC 5 is identified by TarGOST® as having a %RE response of greater than 10 and less than or equal to 50%RE. Remedial actions required for AOC 5 are described in further detail in Section 4.

3.6 AOC 6 - Historic Fill/Native Geologic Material, Tar, and Viscous Tar

The delineation of AOC 6 within each of the lithological layers is described in the table below:

Lithology	Mean Impacted Soil Volume (cubic yard)	Estimated Mean Free Product Tar Mass (ton)
Fill	27,500	399
Meadow Mat	10,700	172
Alluvium	18,000	354
Total	**56,200**	**925**

The test pit investigations, confirmatory borings, sonic core borings, and analytical sampling conducted in 2011 and 2012 confirmed AOC 6 consisted of the historic fill material described as part of AOC 4, and native geologic material both of which are impacted to heavily impacted with free product (liquid tar/NAPL) from former Site

operations. AOC 6 is identified by TarGOST® as having a %RE response of greater than 50%RE. Remedial actions required for AOC 6 are described in further detail in Section 4.

4. SUMMARY OF REMEDIAL ACTION APPROACH

4.1 Overall Remedial Action Approach

The ROs, as described in Section 1.2 of this RAWP, can be achieved by:

- Implementing a remedy that removes, treats, or isolates contamination that, in so doing, is protective of public health, safety, and the environment;
- Implementing the remedial actions within the applicable regulatory timeframe listed in N.J.A.C. 7:26E-5.8;
- Using any required engineering and institutional controls in conjunction with a remedial action permit, whenever a restricted use remedy or limited restricted use remedy is implemented;
- Implementing a remedy that does not in itself cause an uncontrolled or unpermitted discharge or transfer of contaminants from one medium to another;
- Implementing a remedial action that complies with applicable remediation standards; and
- Implementing remedial actions which shall treat or remove free product and residual product to the extent practicable, or contain free product and residual product when treatment or removal is not practicable.

The on-Site soils remedial approach will be applied to meet the applicable remedial standards as described in Section 4.2 and the approach used for each AOC is discussed in further detail in Section 4.3. Overall, the remedy consists of:

- Free Product Treatment
    - The remedy evaluation conducted, selected treatment technology approach, and the contingency approach (if required in localized areas) are further described in Section 4.4.
    - The use of a temporary Impermeable Barrier Wall in conjunction with the selected treatment technology near property boundaries and existing subsurface utilities is further described in Section 4.5.
- Cap/Final Cover
    - The integration of a Cap/Final Cover into the Site re-development plan is further described in Section 4.6.

- Engineering and Institutional Controls
    - The use of Soil Remediation Permit and Deed Notice (i.e., institutional controls that will stipulate engineering controls as part of future Site re-development) post remedial actions are further described in Section 7.

4.2 Applicable Remediation Standards

The applicable remediation standards developed for the Site are consistent with N.J.A.C. 7:26E-5.5(b)5 to be protective of public health and safety and of the environment. As a Restricted Use Deed Notice will be pursued for the Site, the applicable remediation standards for the on-Site soils include the following:

- The NJDEP NRDCSRS listed in Appendix 1, Table 1B of the N.J.A.C. 7:26D Remediation Standards last updated on May 7, 2012.
- The Default Impact to Ground Water Soil Screening Levels (default IGWSSL) listed in Table 1 of the NJDEP Development of Site-Specific Impact to Ground Water Soil Remediation Standards Using the Soil-Water Partition Equation last revised in December 2008.
- EPH discharges will be addressed pursuant to NJDEP guidance document Protocol for Addressing Extractable Petroleum Hydrocarbons (NJDEP, 2010) for Category 2 discharges using the non-residential exposure scenario.

4.3 Remedial Actions

Pursuant to N.J.A.C. 7:26C-5.5(b)4, a detailed description of the remedial technologies to be used in each AOC are presented in the following sections.

4.3.1 AOC 4 and AOC 5

Pursuant to N.J.A.C. 7:26E-5.4 and N.J.S.A. 58:10B-12h there are no requirements to remove or treat historic fill material (AOC 4) to comply with applicable health risk or environmental standards, provided the required engineering and institutional controls implemented pursuant to N.J.A.C. 7:26C-7 are effective in protecting public health, safety and the environment. The remedial action for soil contamination associated with historic fill materials is the establishment of engineering and institutional controls. If the

engineering and institutional controls are not protective of the public health, safety and the environment, such as in the case of localized high concentrations of heavy metals (lead) in the shallow fill, these materials may be excavated as described in Section 4.4.3.

The impacted materials defined by AOC 5 may also be controlled by the use of appropriate engineering controls in place over these areas (as required based on future Site development), and by developing appropriate institutional controls and deed restrictions. For AOC 4 and AOC 5 a soil cap and final cover as discussed in Section 4.6 would prevent direct exposure to contamination that may remain in place at concentrations above NRDCSRS or Impact to Ground Water Soil Remediation Standards (IGWSRS) provided the conditions outlined in Section 6 (Evaluation of Remedial Actions) for the AOCs are met. The volume of soil to be treated in AOC 4 and AOC 5 are specified in Section 3.3.

4.3.2 AOC 6

Based on the soil descriptions and analytical data presented in the RIR, AOC 6 requires remediation of free product in the soils. AOC 6 contains viscous tar (free product), which is both potentially mobile and a potential source of contaminants to groundwater. The free product in AOC 6 is heterogeneously distributed. Some regions are large in areal extent, such as in and around the former lagoons, and some are smaller, including components of Lagoon F, G, the FNA, and Tank Farm (Figure 2).

The remedial actions presented in Section 5 required for the treatment of AOC 6 are comprised of the following:

- Pre-remedial activities and Site preparation;
- Temporary Impermeable Barrier Wall installation near property boundaries and existing subsurface utilities where the treatment technology is being applied;
- Application of the free product treatment technology within the Fill unit;
- Application of the free product treatment technology within the Alluvium unit;
- Final fill cap and cover; and
- Implementation of a Site-wide deed restriction.

The volume of soil to be treated in AOC 6 in the Fill and the Alluvium are specified in Section 3.6. The AOC 6 impacted soil located in the Meadow Mat cannot be practically treated using the selected treatment technology because of the very low air flows that can only be achieved in the Meadow Mat. Removal of the Meadow Mat layer is not practicable as it is very thin (< 1ft) on the Eastern side of the Site where the majority of the

AOC 6 is located. The Meadow Mat thickens up to approximately 25 ft on the Western side of the Site where smaller pockets of AOC 6 are isolated (the FNA). Therefore, pursuant to N.J.A.C. 7:26E-5.1(e) the remedial actions for AOC 6 in the Fill and the Alluvium will treat and remove the free and residual product to the extent practicable at the Site, while any free and residual product remaining in the Meadow Mat will be contained within the low permeability Meadow Mat zone (due to capillary trapping [Pankow and Cherry, 1996] and limited migration potential due to the low permeability characteristics of the sediments and low solubility of the COCs), as well as controlled with the engineering controls (cap and cover and future engineering controls based on Site re-development) and institutional controls (deed notice and a groundwater classification exception area [CEA]). Details on how these remedial actions will be implemented at the Site are presented in Sections 5.

4.4 Free Product Treatment

4.4.1 Remedial Action Selection Evaluation

A Remedial Action Selection Report (RASR; Appendix B; Geosyntec, 2013a) was prepared prior to this RAWP, although not required as part of the current edition of the TRSR (May 7, 2012), to memorialize the remedial action selection process and to provide a rationale for remedy selection for the free product treatment technology. The process conducted to rank remedial alternatives to address on-Site contamination was as follows:

1) Selection of remedial alternatives suitable for addressing on-Site contamination was made;

2) Selection of criteria used to evaluate the remedial approach was conducted;

3) Ranking of the remedial alternatives to meet performance criteria over the short term (during implementation) and long term (within a 20-30 year timeframe) and comparison of technologies for the top four ranked remedial alternatives was assessed;

4) Comparison of the top four ranked remedial alternatives based on the specific footprint size, location and lithology was performed; and

5) Selection of the remedial alternative(s) based on the nature and distribution of contamination was made.

The following potential remedies were considered:

- STAR;
- In Situ Thermal Desorption (ISTD) or In Situ Thermal Stabilization (ISTS);
- In Situ Stabilization (ISS);
- Surfactant-In Situ Chemical Oxidation (S-ISCO); and
- Excavation & Off-Site Treatment.

Also considered was containment, a combination of hydraulic (Pump and Treat [P&T]) and physical (Impermeable Barrier Wall); bio-venting and air sparging; and No Further Action (NFA); however, these alternatives were not able to meet ROs for on-Site soils and so were not considered suitable alternatives for free product remediation. A description of each of these alternatives can be found in the RASR (Appendix B).

Eleven criteria were used to evaluate the remedial alternatives. Four criteria are based on ROs and seven are from the former NJDEP Remedial Action Selection (RAS) requirements.

The RO criteria include:

- Protection of Human Health, Safety, and the Environment;
- Treatment or Removal of Free Product;
- Management of Direct Contact Risks; and
- Reduction of Impacts to Groundwater.

The NJDEP criteria include:

- Technical Implementability;
- Time Requirements;
- Consistency with Applicable Federal, State and Local Laws and Regulations;
- Impact to Local Community;

- Potential to Impact Natural Resources;
- Sustainability; and
- Cost.

A discussion of how each alternative ranked against the above criteria can be found in the RASR (Appendix B). The best ranked remedy, and therefore the remedy selected for free product treatment, was STAR. STAR generally ranked higher than the other alternatives because of its ability to treat and destroy free product (as opposed to a remedy such as ISS that stabilizes contaminants in place), minimized potential for direct contact (compared to a remedy such as excavation), less potential than some of the alternatives (such as ISTD/ISTS) to mobilize contaminants, sustainability, and cost. Further details on the STAR treatment technology are provided in Section 4.4.2 below.

4.4.2 Selected Treatment Technology

The STAR technology is an innovative technology that has undergone extensive on-Site pilot testing for evaluation as an alternative to traditional soils remedies. STAR is an innovative new technology based on the principles of smoldering combustion where the contaminants are destroyed as they combust. The process is self-sustaining following a short duration, low energy input 'ignition event'. The energy of the reacting contaminants pre-heats and initiates combustion of contaminants in adjacent areas, propagating a combustion front through the contaminated zone, provided that a sufficient flux of oxygen is supplied.

Three phases of pilot testing have been conducted within the former lagoon area of the Site. The first two phases of pilot testing are described in STAR Pilot Test Report (Appendix C; Geosyntec, 2011b) and the third phase of pilot testing is described in the STAR Phase III Pilot Test Report (Appendix D; Geosyntec, 2013e). The Phase I was a proof of concept (POC) study to demonstrate the STAR process below ground surface and beneath the water table. The Phase II test assessed factors governing the ignition protocol and the limitations of the STAR technology with respect to mass destruction rate and combustion front propagation. The Phase III pilot test was designed to evaluate scale-up parameters and to test the application of the technology within the Alluvium.

The Phase I POC test successfully demonstrated the STAR process below ground surface and below the water table for a period of nine days. During the Phase II test, sustained destruction rates in excess of 800 kilograms per day (kg/day) were observed over a four-day period resulting in the destruction of more than 4,500 kilograms (kg) of free product

coal tar. Phase III testing demonstrated the technology twenty-five feet below the water table and resulted in the treatment of a six-foot layer of impacted fine sands to a radial distance of approximately twelve feet. Post-STAR sampling for these phases demonstrated a substantial reduction in coal tar volume within the target treatment zones, with semi-volatile organic compound (SVOC) concentrations reduced (on average) by greater than 99% where combustion was observed or detected.

These three phases of pilot testing demonstrated the suitability of STAR for on-Site soils and contaminants and would be applied within the AOC 6 areas (tar/viscous tar areas) of the Site as follows: a self-sustaining combustion reaction would be initiated by inserting an in-well heating element into a carbon steel well with stainless steel screen placed at the base of the target treatment zone and heating a small volume of the contaminated soils (a few inches around the well). Atmospheric air would then be injected through this well to initiate a combustion reaction and maintain oxygen delivery to the combustion front. Air injection would continue as long as the combustion front continued to propagate away from the point of ignition. Combustion gases would be extracted. The extracted gases would be used to monitor the combustion process and, together with any compounds volatilized by the heat, be treated with an above ground treatment system before discharge to atmosphere. The surface above STAR activities would be sealed with concrete, asphalt, or some other relatively impermeable material to allow for the controlled recovery of combustion gases and volatile emissions.

STAR is very efficient at treating soils containing viscous tar. STAR also requires the delivery of oxygen (air) to the combustion front by injecting atmospheric air near the combustion front. Below the water table, the injected air forms what can be conceptualized as a 'bubble' that encapsulates the combustion front. In regions where the combustion front is sufficiently deep below the groundwater table, the 'bubble' can be maintained. When the groundwater level is too shallow, such as in the Fill unit at the Site, the 'bubble' intersects the unsaturated zone and collapses. This can be addressed by reducing the well spacing so that STAR could be applied using less injection air pressure to reduce the potential for "bubble" collapse.

Although temperatures of over 800 degree Celsius (^{o}C) can be achieved in the subsurface, the width of the combustion front is relatively small (in the order of feet). However, to protect utilities and expansion of the combustion front beyond the Site boundaries, a temporary Impermeable Barrier Wall has been incorporated into the remedial approach as described in further detail in Section 4.5.

4.4.3 Contingency Approach

Excavation and off-Site treatment is a standard remediation practice used when other remedial options are viewed as unfeasible. The act of excavating contaminated areas and relocating the soil to an approved disposal or treatment site is an effective, yet expensive option, which requires the coordination of excavation, transportation and backfill vehicles.

Currently, there are no plans to remediate Site AOCs using excavation; however, excavation is to be considered as a contingency only if STAR treatment within the Fill is deemed unsuccessful or if localized removal of areas with high metals concentration is deemed necessary.

4.5 Temporary Impermeable Barrier Wall

Impermeable barrier walls are physical structures installed in the subsurface that, in application with the STAR free product treatment technology, will be used to temporarily mitigate impacts of the technology on existing subsurface utilities and limit propagation (e.g., off-Site). There were three types of barrier walls considered for this application and they differ mainly in materials and installation methods, but achieve similar results. The three types are as follows:

1) Sheet-Pile Walls – interlocking plates of steel are hammered into the ground;

2) Soil-Bentonite Walls – an excavated trench is backfilled with existing soils that have been mixed with bentonite; and

3) Cement Walls – an excavated trench is backfilled with a cement-bentonite slurry.

For this application, installation is only needed in localized areas of the Site (where STAR is applied near to existing subsurface utilities or the property boundary) into shallow Fill materials. The propagation of heat from the STAR reaction is of short duration so the wall may be removed post remediation. Due to the relative ease of installation and removal, limited waste generation, and that sheet-pile has been previously used during STAR pilot testing, a sheet-pile wall is the preferred temporary barrier wall for this application.

4.6 Cap/Final Cover

A final Site-wide cap will be installed on the Site (above AOC 4, 5 and 6) after the completion of remedial activities so that any residual contaminants remain immobilized and limit contact with future Site occupants. The final cap will be integrated in the Site development plan and include: i) foundations of buildings or structures associated with

future Site use (including engineering controls as stipulated in the deed notice); ii) asphalt areas associated with future Site use (e.g., parking lot areas); and iii) an engineered cap. The cap will be constructed from both an alternative fill subbase and a clean fill final cover. A Material Acceptance Protocol Plan (MAPP), which is further described in Section 5.8.2, will be developed in accordance with NJDEP's Alternative and Clean Fill Guidance (NJDEP, 2011).

5. REMEDIAL ACTION PLAN

The remedial action plan to achieve an RAO for on-Site soils for AOC 4, 5 and 6 is presented in the following sections. The plan for executing remedial actions as described in Section 4 is outlined in in the following sections:

- Section 5.1 (Pre-Remedial Activities and Site Preparation);
- Section 5.2 (Temporary Impermeable Barrier Wall Construction);
- Section 5.3 (STAR Treatment of on-Site soils);
- Section 5.4 (Cap/Final Cover);
- Section 5.5 (Site Restoration Plan and Institutional Controls);
- Section 5.6 (Permits and Notifications);
- Section 5.7 (Construction Quality Assurance Project Plan [CQAPP]); and
- Section 5.8 (Construction Monitoring Plans).

The methods that will be used to evaluate the remedial actions, the activities associated with post-remediation, and the remedial action schedule are outlined in Sections 7, 8 and 9, respectively.

5.1 Pre-Remedial Activities and Site Preparation

The implementation of the STAR technology requires the development of a remedial design drawing and specification package for civil Site preparation and the temporary barrier wall, mechanical and electrical construction of the STAR treatment components, and installation of STAR wells. A remedial design drawing and specification package will be developed separately for the cap/final cover by others in conjunction with the Site re-development plans. The design package will be used during the contracting, procurement, and permitting process to facilitate contractor and equipment/instrumentation selection and communication with permitting agencies, and during construction to facilitate remedy implementation. CQAPP documentation and other construction monitoring and operations plans will be developed to support remedy implementation, as discussed further in Section 5.7 and 5.8. Arrangements will be made with appropriate laboratories for sample analyses and waste disposal.

5.1.1 Mobilization and Site Preparation

Site preparation activities will include establishing new field offices, lavatory facilities, parking spaces for staff and for Site security, staging areas for equipment and materials, construction of new access and egress locations for the Site, and arranging access agreements between separate parcels of the property (if required). On-Site, and nearby off-Site, utilities will be located prior to subsurface field work. The utilities will be located to determine the installation depth and type of materials. If required, construction of a decontamination pad and a wash area will be performed. It is possible that during the remediation process, the geographic location of these facilities may change.

5.1.2 Surveying

A Site-wide topographic survey was completed in March 2013 as part of the remedial investigation activities and the information collected forms the basis of the Site development and preparation work. In addition to the information collected previously, surveys of the Site are expected to be required throughout the Site development, preparation and remediation efforts.

The legal property boundaries of the Site will be surveyed prior to the installation of the temporary barrier wall. The limits of the STAR remediation areas will be surveyed as part of the final record of Site conditions. Additionally, surveying will be completed to delineate the limits of any excavations, as required in the FNA or other areas of the Site.

5.1.3 Earthwork

Site earthwork will generally consist of the removal of any remaining sub-structure demolition, removal of unsuitable surface materials, vegetation removal, minimal Site leveling to construct a relatively level work area and installation of base-rock and a temporary asphalt cover as required for the implementation of the STAR process. Work will be performed in accordance with the approvals granted by the County of Essex and City of Newark.

During the grading and Site preparation effort, unacceptable materials will be identified and removed from the STAR remediation areas. Existing stockpiles of fill material generated during remedial investigations will be leveled and compacted as required to provide an even surface for asphalt paving.

5.1.4 Site Clearing and Demolition

All general debris and vegetation found in the areas where STAR will be implemented will be cleared and properly disposed of off-Site. Existing infrastructure within the work area will be properly removed and disposed of off-Site. Any existing and unused underground utilities within the STAR implementation areas will be decommissioned and removed. Known existing City of Newark water and combination sewer and storm drain lines will be protected during the STAR implementation process.

5.1.5 Fill Materials

It is not expected that imported fill will be required for Site preparation of the remediation areas. Alternative fill materials will be brought on-Site as part of the final Site development plan to raise the overall grade of the Site to meet revised Advisory Base Flood Elevation Map, issued by Federal Emergency Management Agency (FEMA) in January 2013. A separate MAPP will be prepared as required for fill materials prior to delivery to the Site.

If imported fill is required during the Site preparation phase of the project, the fill material will be suitable for Alternative Fill, Common Fill and Select Fill. Fill materials imported to the Site will be tested in accordance with the CQAPP as outlined in Section 5.7.

Alternative Fill will be determined to meet the requirements of the MAPP prior to placement in accordance with the N.J.A.C. 7:26E-5.2 (b) and the NJDEP's Alternative and Clean Fill Guidance for SRP Sites.

5.1.6 Surface Drainage

Surface drainage will be planned to prevent ponding and promote the drainage of surface water away from the work area. It is expected that the current Site water flow pattern will remain unchanged. Currently Site drainage is directed to the interior Site areas. A determination will be made whether application of the City of Newark Stormwater Ordinance 12-1000 will be required with the City's concurrence.

5.1.7 Pavement

The temporary cover for the STAR working surface area and vapor collection in the areas of STAR implementation will consist of asphalt concrete and Class 2 recycled concrete base aggregate subgrade as defined in the State of New Jersey, Department of Transportation "Standard Specifications". Other areas of the Site will not be paved.

5.1.8 Monitoring Well Decommissioning

Several on-Site monitoring wells located in areas where the STAR remedial action is planned to be implemented (AOC 6) will need to be abandoned prior to the remedy implementation as there is a potential for the well structure to be damaged during the STAR remedy. The wells will be decommissioned pursuant to N.J.A.C. 7-9D.

5.2 Temporary Impermeable Barrier Wall Construction

5.2.1 Sheet Pile Installation

Steel Sheet Piles (SSP) will be installed on the Site to limit the extent of STAR propagation off-Site and to subsurface utilities in the vicinity of STAR operations. The SSP will be installed to the lines and grades prescribed in the design documents or to an estimated 10-15 ft bgs. Predrilling may be required to facilitate driving sheet piles to the designated elevations. The SSP will be assembled before driving and then driven as a continuous wall, progressively in stages to keep the piles aligned correctly and minimize the danger of breaking the interlock between sheets. The SSP will be driven to form a tight bulkhead, driven to form a relatively straight line that will be driven vertical within a horizontal tolerance of two percent (2%). A detailed scope of work (SOW) summarizing the execution of the work will be developed and approved prior to contractor mobilization to the Site. Because the propagation of heat from the STAR reaction is of short duration, the wall will be removed post remediation.

5.2.2 Materials and Material Specification Submittals

SSP shall meet the requirements of ASTM A328, (Grade 50). Steel corners, tees, wyes, and crosses shall meet the requirements of ASTM A328 or ASTM A690.

Prior to starting work the selected contractor will provide information from the manufacture that indicates the sheet piling materials meets or exceeds the specification and that the hammer can deliver the required energy. If splices are required during the installation the splice locations shall be reviewed and accepted by the Engineer prior to installation.

5.3 STAR Treatment of On-Site Soils

A description of the STAR treatment system components, implementation strategy, and deployment plan is provided in the STAR Functional Description included in Appendix E of this report.

5.4 Cap/Final Cover

The cap will function as an engineering control to mitigate direct contact or exposure with Site soils that may contain COCs at concentrations greater than the NRDCSRS. The cap will also function as a structural fill to support future Site development (e.g., new building foundations).

The cap subbase will consist of Alternative Fill materials, to raise the elevation of the Site consistent with materials discussed in Section 5.1.5, and a minimum of 12 inches of clean soil material and 6 inches of topsoil and vegetative seeding above the graded base fill layer in areas that will not be paved or overlain by new building foundations. The soil layer will be constructed from certified clean soil from an off-Site supplier. The soil will be placed in lifts and compacted as determined the Site development design. Clean Fill Certification will be provided in the Remedial Action Report (RAR).

Areas that will be paved or are locations for building foundations will have a compacted subbase placed directly on the base fill material prior to construction. Construction of the cap, the subbase and paving, and building foundations will be constructed by others as part of future Site re-development.

5.5 Site Restoration Plan and Institutional Controls

A deed restriction pursuant to N.J.A.C. 7:26C-7.2 will be filed upon completion of soil remedial activities as an institutional control. These controls will limit the type of re-development to those applications that are assumed herein based on the remedial actions selected. This document will stipulate any future development must consider the VI pathway (VI evaluation/mitigation) as required by the Administrative Requirements for the Remediation of Contaminated Sites N.J.A.C. 7:26C, 7 May 2012 (ARRCS; NJDEP, 2012b).

A soil remedial action permit (discussed in Section 7.5) will also be required given the Site remedial action is for restricted use and under this permit, the following are required:

- Modification to the soil remedial action permit will be needed at such time that any alteration, improvement, or disturbance of the engineering control at the Site (for example, the cap) is made;

- Modification to the soil remedial action permit with future development such as construction of buildings and sub-surface utilities and infrastructure will trigger evaluation of the VI pathway (VI evaluation/mitigation); and

- Long-term monitoring of soil, biennial reporting and financial assurance is required of the permittee.

The deed restriction and soil remedial action permit will both function to control the plans for future Site re-development to be consistent with the remedial action plans discussed herein.

5.6 Permits and Notifications

Pursuant to N.J.A.C. 7:26E-5.5(b)8 a list of permits and notifications required for the remedial actions are listed below:

- NJDEP Air Quality Permitting Program (AQPP);
- City of Newark Permits;
- County of Essex Permits;
- Soil Erosion and Sediment Control Permit;
- Well Installation and Abandonment Form; and
- Public Notification.

5.7 Construction Quality Assurance Project Plan

The CQAPP establishes construction quality assurance monitoring and documentation activities that will be implemented during Site preparation activities, construction of the temporary barrier wall, and construction of the STAR treatment system and associated components. The purpose of the CQAPP is to provide a reference and guidance document to the parties involved in the remedial action construction activities and that construction is performed in accordance with the remedial design drawing and specification package.

The CQAPP will include the following elements:

- Scope of work;
- Material requirements;
- Equipment specifications;
- Minimum qualifications for the manufacturer, installer, contractor, construction quality assurance (CQA) personnel, and/or the testing laboratories;

- Material testing required by the manufacturer;
- Construction and installation procedures;
- Equipment testing and certifications required by the manufacturer; and
- Construction/installation monitoring, testing, and record keeping requirements.

The execution of construction activities will require multiple field crews and a competent full-time Site supervisor. The Site supervisor will be experienced in the construction necessitated for the project. Some subsystems of the STAR system as described in Section 5.3 may be constructed off-Site; however CQAPP requirements will still be in place. Record keeping during the construction and installation of the various components of the remedial design will be kept as outlined in the CQAPP.

5.8 Construction Monitoring and Operation Plans

The following plans are intended to be prepared to facilitate control of the construction, operations, and overall implementation of the remedial actions described herein. These controls will be used to comply with applicable local and state regulations governing remedial activities.

5.8.1 Perimeter Air Monitoring Plan

Pursuant to N.J.A.C. 7:26E-5.5(b)7, a Perimeter Air Monitoring Plan (PAMP) will be prepared and implemented during the STAR remedial action. The action plan is designed to monitor and control off-Site excursion of dust, vapor and odors. The PAMP is intended to provide a level of protection for Site workers from potential airborne contaminants, and will present upwind and downwind receptor requirements for the various remedial activities.

5.8.2 Material Acceptance Protocol Plan

Pursuant to N.J.A.C. 7:26E-5.5(b)9, Alternative Fill from an off-Site source may be used as part of the final cap and cover. A MAPP will be developed and submitted for approval to the LSRP prior to bringing any alternative fill on-Site. Alternative Fill Acceptance Criteria (AFAC) will be developed based on the analytical results from samples used to characterize Historic Fill at the Site.

5.8.3 Soil Erosion and Sediment Control Plan

A Soil Erosion and Sediment Control (SESC) Plan will be developed as part of the cap/final cover to address temporary soil erosion control measures and stormwater management during its construction. This plan will be developed by others as part of future Site development.

5.8.4 Health and Safety Plan

A construction and operation Health and Safety Plan (HASP) will be prepared for the remedial actions described herein. The HASP will address the specific activities in this RAWP including:

- Site preparation activities including leveling and asphalt paving for the STAR working surface area and vapor cover;
- Temporary barrier wall installation;
- STAR construction:
    - Well/thermocouple/vapor extraction standpipe installation;
    - Air plant and distribution installation;
    - Heater deployment and use;
    - Air extraction and treatment system installation;
- STAR system operation and monitoring:
    - Shake-down testing;
    - System operation;
    - Demobilization/remobilization; and
- Post-treatment characterization activities.

The HASP will also address potential health and safety issues such as emergency response, flood/hurricane disaster, and establish protocol for pre-field task health and safety assessment and review, tailgate meetings, and post-construction and operation debriefs.

The implementation strategy and deployment plan described in Section 5.3 will require dedicated field crews for each of the operating treatment areas and include: well installation and treatment area set up, STAR operation, well removal and decommissioning. This is in addition to other Site preparation activities and post-treatment characterization activities. Contractor Orientation Handbooks and operator training

sessions will also be developed to facilitate the construction and operation activities at the Site and to provide communication tools to address the health and safety issues associated with the various activities being conducted.

5.8.5 Quality Assurance Project Plan

Quality assurance requirements pursuant to N.J.A.C. 7:26E-2.1 will be followed during the implementation of RAWP activities, including the update of the Quality Assurance Project Plan (QAPP) (N.J.A.C. 7:26E-2.2) prior to the implementation of the remedial activities.

5.8.6 Waste Management Plan

Pursuant to N.J.A.C. 7:26E-5.7(b)11, a Waste Management Plan (WMP) will be developed to address the off-Site disposal of soils resulting from preparation of the Site for a STAR working surface area and vapor cover, sheet pile installation, well/thermocouple installation activities, well abandonment activities, and solid waste that cannot be reused on-Site for grading. The WMP will also address liquid waste from the operation of the STAR system (such as the condensate from the vapor extraction process).

All types and quantities of waste generated by the remedial action will be documented. Copies of manifests or bills of landing will be maintained in the project records for future reference.

5.8.7 STAR Operations Plan

A detailed STAR Operations Plan will be developed to be used as a communication and training tool for operators on the functionality of the STAR system. This plan will be used in conjunction with the HASP and Contractor Orientation Handbook described in Section 5.8.4 for training of field staff.

6. EVALUATION OF REMEDIAL ACTION

Pursuant to N.J.A.C. 7:26E-5.5(b)6, a plan was developed using the NJDEP Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria (NJDEP, 2012c) to evaluate the effectiveness of the remedial actions against applicable requirements of N.J.A.C. 7:26E (Remedial Action).

The same technical guidance was also used to aid with the development of applicable Site remedial action standards. The guidance document outlines methods for evaluating the post-remedial action soils based on the following soil remediation standards:

- Direct contact soil remediation standards (ingestion-dermal and inhalation exposure pathways);
- Impact to ground water exposure pathway soil remediation standards;
- Site-specific standards for irregular contaminants;
- Petroleum hydrocarbon screening levels;
- VI screening levels; and
- Ecological soil screening levels.

In addition to the traditional line of evidence of soil sample collection, analysis and comparison to the standards described above, further lines of evidence to evaluate the effectiveness of the remedial actions will be sought based on the techniques below:

- TarGOST® surveying; and
- Tracking of the subsurface temperature and vapor extraction concentrations during STAR operation.

The plan to evaluate remedial actions based on the standards listed above is described further in Section 6.1 to 6.6. The use of the TarGOST® technology as a method of screening the progress of remedial actions is described in Section 6.7. Methods for tracking the subsurface temperature changes and vapor extraction concentrations and plans to apply this approach are described in detail below in Section 6.8. A combined approach will be used to evaluate remedial actions whereby soil samples will be collected to meet NJDEP's analytical soil sampling requirements, supplemented with a more dense coverage of treatment areas using the TarGOST® method. Using this approach for the evaluation of attainment of remedy completion will lead to safe practice and minimal exposure to prepare the Site for re-development.

6.1 Direct Contact Exposure Standards

Direct contact remediation standards can be found in N.J.A.C. 7:26D Appendix 1, Table 1B. The document outlines the non-residential direct contact limits for both ingestion-dermal and inhalation that are to be achieved for the COCs identified in the AOCs. To determine whether compliance has been achieved and no further action is warranted, methods pursuant to Appendix 4.0 in the NJDEP's Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria (NJDEP, 2012c) will be followed upon completion of the remedial action. Post-remedial samples will be collected per AOC and impact zone, i.e., surface (0-2 ft) and subsurface (>2 ft). A minimum of eight post-remedial samples are required from the zone of impact where the COCs were originally identified in the RIR; however, the number of samples may increase as necessary based on the volume of impacted soil in accordance with NJDEP guidance to sufficiently show treatment of contaminants has been achieved.

6.2 Impact to Ground Water Exposure Standards

Each soil contaminant must also meet the default IGWSSL listed in Table 1 of the NJDEP Development of Site-Specific Impact to Ground Water Soil Remediation Standards Using the Soil-Water Partition Equation (NJDEP, 2008a). These standards are tied to the class designation of the Site, which is Class IIA.

To determine whether compliance has been achieved and no further action is warranted, methods pursuant to Appendix 4.0 in the NJDEP's Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria (NJDEP, 2012c) will be followed upon completion of the remedial actions. Post-remedial samples will be collected per AOC and impact zone, i.e., ground surface to water table and below water table. A minimum of eight post-remedial samples are required from the zone of impact where the COCs were originally identified in the RIR; however, the number of samples may increase as necessary based on the volume of impacted soil in accordance with NJDEP guidance to sufficiently show treatment of contaminants has been achieved.

6.3 Site Specific Standards for Irregular Contaminants

Site-specific remediation standards have not been used; however, they may be developed in the future using the process outlined in N.J.A.C. 7:26D-7 Appendices 5 and 6 for alternative ingestion-dermal and inhalation exposure pathway standards and the NJDEP's Introduction to Site-Specific Impact to Ground Water Soil Remediation Standards Guidance Document (NJDEP, 2008b) for alternative IGWSSLs.

6.4 Petroleum Hydrocarbon Screening Levels

Pursuant NJDEP guidance document Protocol For Addressing Extractable Petroleum Hydrocarbons (NJDEP, 2010), a single-point compliance method for EPH samples will be used to determine whether remediation was achieved following remedial actions. Post-remedial samples will be collected and analyzed following the protocol for Category 2 discharges using the non-residential exposure criteria. Category 2 discharges consist of petroleum hydrocarbon mixtures other than No. 2 fuel oil and/or diesel fuel. Samples will be analyzed using the non-fractionation option of the NJDEP EPH Method Revision 3. The Department provided spreadsheet will be used to calculate the sample-specific, human health-based soil remediation criterion (EPH SRC). Compliance will be determined using the calculated EPH SRC and the residual product/free product limit of 17,000 mg EPH/kg.

6.5 Vapor Intrusion Screening Levels

Currently, there are no buildings within the designated distance of the AOCs that require a VI investigation. Therefore, vapor intrusion screening levels (based on groundwater concentrations) will not be used in the evaluation of the on-Site soils remedial actions.

6.6 Ecological Soil Screening Standards

The Site is located within an area of heavy industry and, according to mapped information review through NJ-GeoWeb, there are no environmentally sensitive natural resources on the Site or on adjacent properties, and no surface water bodies within 200 ft of any Site-associated ground water quality standard (GWQS) exceedances. An Ecological Evaluation (EE), pursuant to N.J.A.C. 7:26E-1.16, has not been conducted for the Site (as discussed in the RE [Appendix A]).

6.7 Screening Measurements – TarGOST® Technology

As an additional line of evidence, a post-remediation TarGOST® investigation will be conducted to evaluate the effectiveness of remedial actions. Since there are no established screening levels for soil data analyzed via the TarGOST® technology, criteria for screening will be developed using statistical methods applied to the pre-treatment TarGOST® data collected by Geosyntec during the 2011 and 2012 DGIs. The criteria for screening for free and residual product will be applied to the post-remedial TarGOST® data to demonstrate the reduction of EPH to target levels.

6.8 Other Methods for Evaluating the Effectiveness of the STAR Technology

The following methods for evaluating the effectiveness of the STAR technology, by the monitoring of subsurface temperature and vapor extraction concentrations, will be attempted as a guide to the progress of STAR operations, and will be assessed through full-scale deployment as to its viability for characterizing the extent of remedial action completed.

Following ignition at each operating well, flow rates and pressures of the injected air will be manipulated in an effort to maintain the smoldering combustion front(s). Propagation of the combustion front(s) will be evaluated in real-time by monitoring subsurface temperatures within the target treatment zone with thermocouples installed between the ignition points. The propagation of the combustion front(s) will be assessed in terms of propagation rate and extent.

In addition, progress of STAR will also be monitored in real-time with carbon dioxide (CO_2) and carbon monoxide (CO) concentration data collected from the vapor collection system(s). These data will be used to confirm that combustion is occurring, and provide an estimate of the mass of contaminants destroyed within the target treatment zone as a function of time based on the carbon mass balance methodology developed during the STAR Phase I and II Pilot Test (Appendix C). This approach is summarized as follows:

$$M_{CoalTar} = \frac{\left[M_{CO_2} \bullet \frac{MW_C}{MW_{CO_2}} + M_{CO} \bullet \frac{MW_C}{MW_{CO}} \right]}{R^C_{Coaltar}}$$

Where:

- $M_{CoalTar}$ is the mass of coal tar destroyed;
- M_{CO_2} is the mass of carbon dioxide measured in the vapor stream (calculated as the product of the carbon dioxide concentration and the vapor phase flow rate);
- M_{CO} is the mass of carbon monoxide measured in the vapor stream (calculated as the product of the carbon monoxide concentration and the vapor phase flow rate);
- MW_C is the molecular weight of carbon;
- MW_{CO_2} is the molecular weight of carbon dioxide;

- MW_{CO} is the molecular weight of carbon monoxide; and
- $R^{C}_{Coaltar}$ is the mass ratio of carbon to the molecular weight of coal tar.

Assuming that the composition of coal tar can be represented as naphthalene ($C_{10}H_8$), the mass of coal tar can be calculated as:

$$M_{CoalTar} = \frac{\left[M_{CO_2} \bullet \frac{MW_C}{MW_{CO_2}} + M_{CO} \bullet \frac{MW_C}{MW_{CO}} \right]}{R^{C}_{Naphthalene}}$$

Where $R^{C}_{Naphthalene}$ is the mass ratio of carbon to the molecular weight of naphthalene and is equal to 0.94:

$$\frac{MW_C \bullet 10}{MW_C \bullet 10 + MW_H \bullet 8} = \frac{120}{120+8} = \frac{120}{128} = 0.94$$

Therefore,

$$M_{CoalTar} = \frac{\left[M_{CO_2} \bullet \frac{12}{36} + M_{CO} \bullet \frac{12}{28} \right]}{0.94}$$

Or

$$M_{CoalTar} = \frac{\left[M_{CO_2} \bullet 0.27 + M_{CO} \bullet 0.42 \right]}{0.94}$$

The exact composition of coal tar at the Site is unknown; therefore, there is an inherent error in this calculation based on the compositional uncertainty. As an estimate for that error, the mass ratio of carbon to naphthalene is compared to the mass ratio of carbon to the range of SVOC compounds comprising the standard EPA Method 8270B. The average mass ratio (carbon to SVOC) is 0.92 with a standard deviation of 0.053 and a 95% confidence interval of 0.11. Therefore, the 95% confidence interval expressed as a percentage of the mass ratio is 11.5%; thus, the assumption of naphthalene as a representative surrogate for coal tar introduces a conservative 11.5% error in the coal tar mass destruction estimate. Alternatively, the mass destroyed estimates can be considered in terms of “naphthalene equivalent” mass.

7. POST-REMEDIAL ACTION ACTIVITIES

7.1 Decontamination

Decontamination procedures will be established for the Site so that any vehicles or equipment that may have been exposed to contaminated soils will be appropriately decontaminated prior to exiting the Site. A zone for decontamination will be established at the start of work and will include steps for the removal of excess soil followed by a high-pressure water rinse.

7.2 STAR Cover and Barrier Wall Removal

A working surface and vapor cover for STAR operations and temporary barrier wall for the protection of subsurface utilities and limiting propagation of STAR off-Site will be installed at the start of the remedial activities as discussed in Section 5.1 and 5.2. This infrastructure will no longer be required post-remediation and is intended to be removed following the completion of STAR operations.

7.3 Deed Notice

Following completion of remedial activities, the draft deed notice will be finalized, signed, and submitted to NJDEP.

7.4 Remedial Action Report

A RAR will be prepared according to N.J.A.C. 7:26E-5.7. The RAR will include certification that the remedial action items were completed in accordance with this RAWP. When completed, this report will be submitted to the Site LSRP for review, approval, and issuance of a RAO.

7.5 Remedial Action Soil Permit

An application for a soil remedial action permit will be submitted to obtain Site closure after completion of the final remedial actions (i.e., cap/final cover). Upon issuance of the permit by the NJDEP, DuPont anticipates receiving a RAO for Site soil from the LSRP.

7.6 Post-Closure Monitoring

7.6.1 Cap Inspection

Site inspections will be performed quarterly for the first two years following construction of the cap/final cover and execution of the institutional and engineering controls and annually thereafter. The purpose of the inspections is to verify that the cap is performing consistently with the design intent and to identify any maintenance needs. The procedure will include inspection and assessment of the following items:

- Cap settlement, subsidence, erosion and displacement;
- Condition of asphalt components;
- Integrity of stormwater controls;
- Condition of the Site security system;
- Disturbance, development, or land-use changes that are inconsistent with the institutional controls; and
- Indications that the remedy is not protective of public health and safety or the environment.

7.6.2 Cap O&M

The cap at the Site is intended to operate for extended periods without significant maintenance. Therefore, maintenance activities will generally be limited to semi-annual mowing of Site vegetation and minor repairs to the cap surface due to erosion, settlement, or subsidence. The vegetation will be inspected, as described above for density, and damage caused by animals, personnel, equipment, or erosion, if any. Areas with insufficient vegetation (defined as having less than 80% coverage or having bare patches larger than one square yard) and areas with undesirable vegetation such as large weeds or woody species will be noted. During inspections, field personnel will also visually assess side slopes for evidence of deformation.

8. SCHEDULE

Based on the implementation of this on-Site Soil RAWP, a schedule of events is presented in Figure 5 pursuant to N.J.A.C. 7:26E-5.8. Remedial construction activities will begin during the 2013 construction season after approval of the permits required for the RAWP activities. The schedule of the remedial actions (pre, during and post) is outlined in Figure 5.

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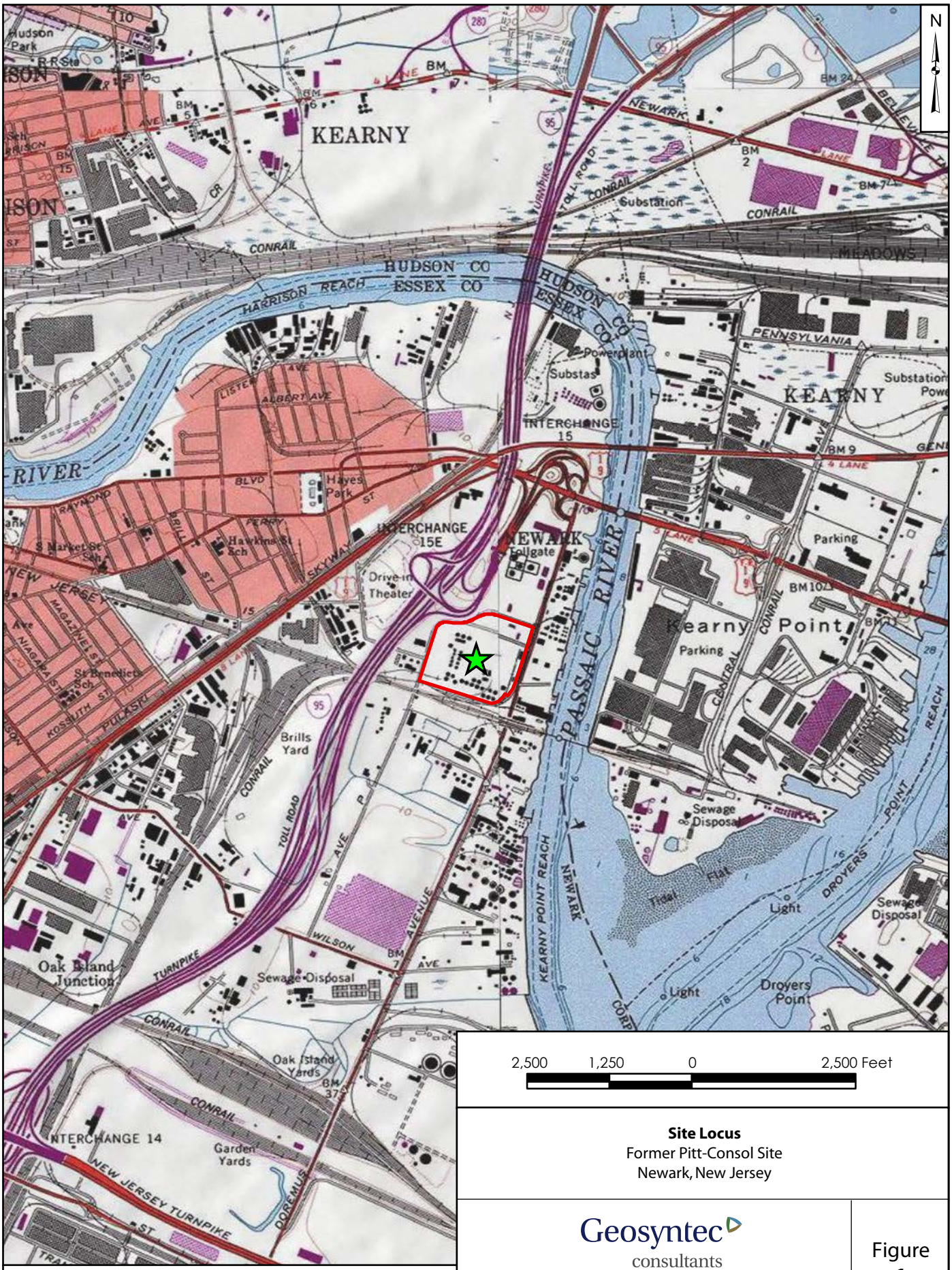
FIGURES



Base Map: USGS Jersey City and Elizabeth Quadrangles (1:24,000)

Site Locus
Former Pitt-Consol Site
Newark, New Jersey

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Figure 1

Site Locus.ai

Path: P:\PRJ1\TR0388-Pitt Consol (Non-STAR)\GIS\Projects\SiteLocus.mxd

Legend

- Well Location
- CMT Well Location
- Site Boundary
- Newark Parcel Boundary (Block/Lot)
- Estimated Sewer Line
- Historic Site Feature
- Former Lagoon

Notes:

1. 2012 aerial photograph courtesy of Microsoft Corporation
CMT - Continuous Multi-Tubing

200 100 0 200 Feet

Site Plan

Former Pitt-Consol Site
Newark, New Jersey

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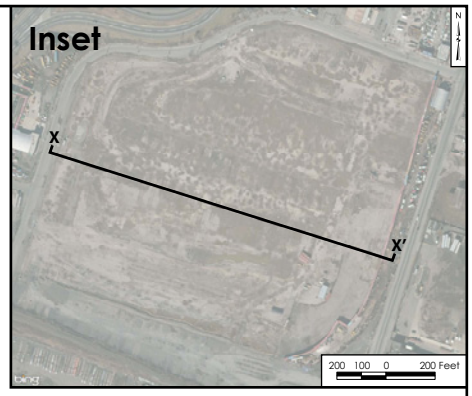
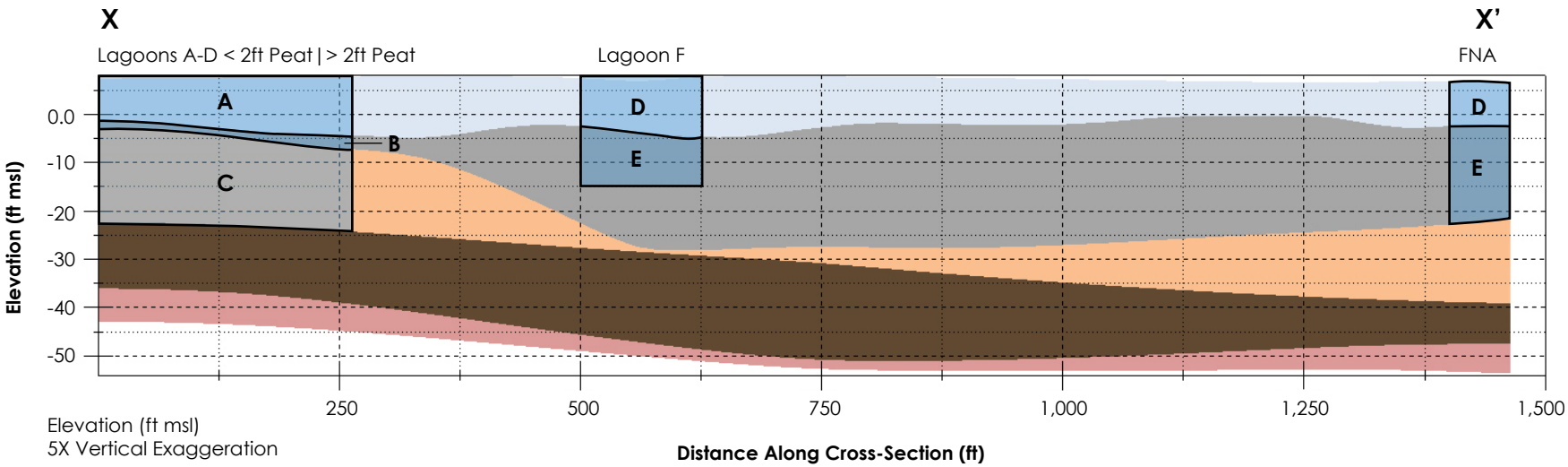
Figure 2

Path: P:\PRJ\Projects\TR0388_DuPont Pitt Consol\Databases and GIS\GIS\TR0388 - Site Features.mxd





Legend

- Historic Fill
- Meadow Mat (Peaty Clay)
- Alluvium (Sand)
- Lake Bottom Deposits (Silt)
- Rahway Till (Clay)
- Bedrock

ft msl - feet mean sea level

Location	Area	Lithology
A	Lagoon Area (Larger Footprint Area)	Historic Fill
B		Meadow Mat
C		Alluvium
D	Lagoon F, G, FNA, Tank Farm (Smaller Footprint/ Remote Area)	Historic Fill
E		Meadow Mat

FNA - Former Naphthalene Area

Conceptual On-Site Soil Contaminant Distribution Along West-East Cross-Section
Former Pitt-Consol Site
Newark, New Jersey

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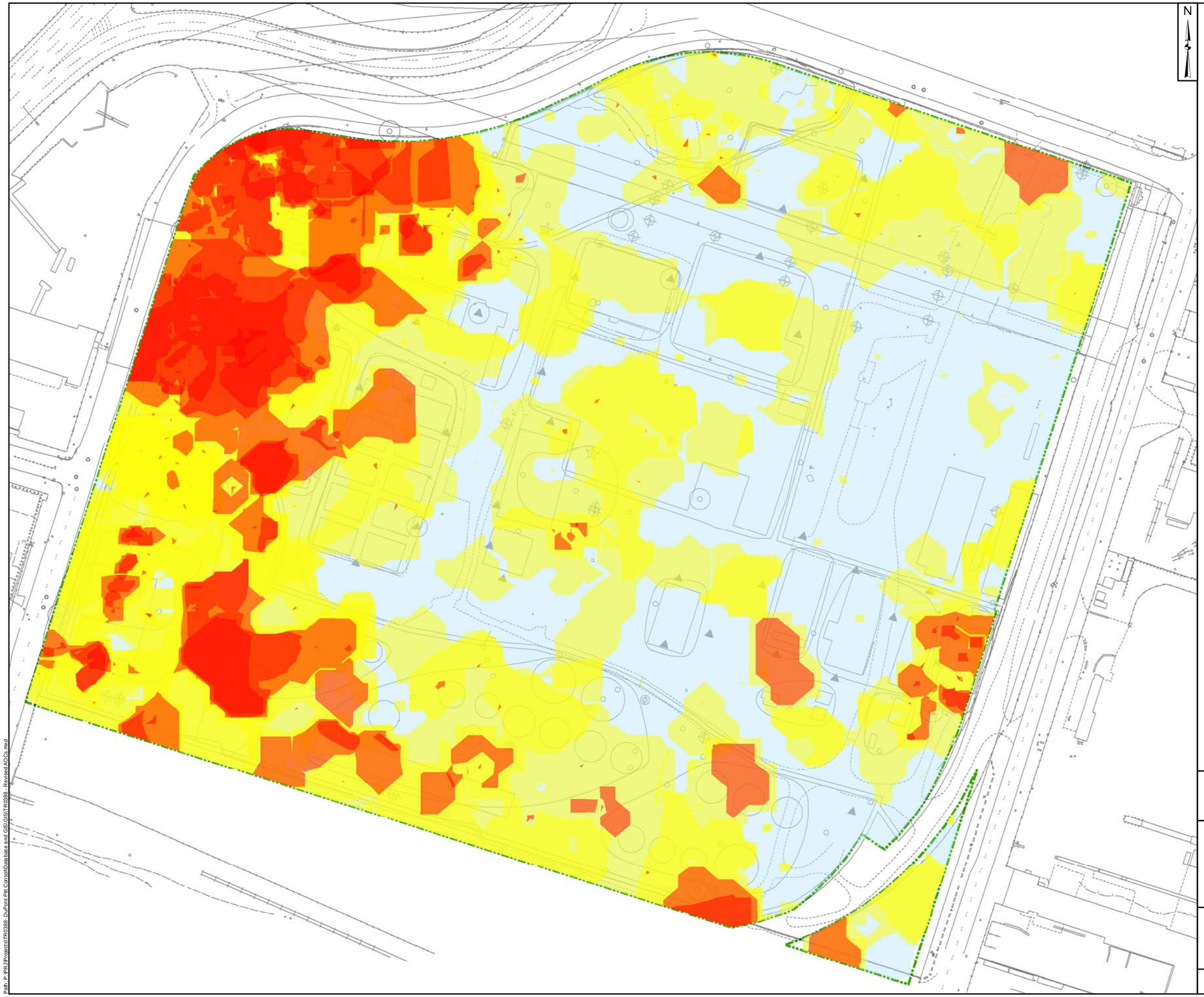
Figure 3

Cross Section_X-X'.ai



Legend

- AOC4 - Historic Fill and Native Geologic Material (%RE ≤ 10)
- AOC 5 - Historic Fill/Native Geologic Material + Stain + Tar Pieces (%RE > 10 and ≤ 50)
- AOC 6 - Historic Fill/Native Geologic Material + Tar + Viscous Tar (%RE > 50)
- Site Boundary
- Historic Site Feature

Notes:

1. AOC delineation based on interpolated TarGOST® data

2. Delineation for all lithologic units are projected in plan view

%RE - percent of reference emitter (TarGOST®)
AOC - Area of Concern
TarGOST® - Tar-specific Green Optical Screening Tool

200 100 0 200 Feet

Areas of Concern

Former Pitt-Consol Site
Newark, New Jersey

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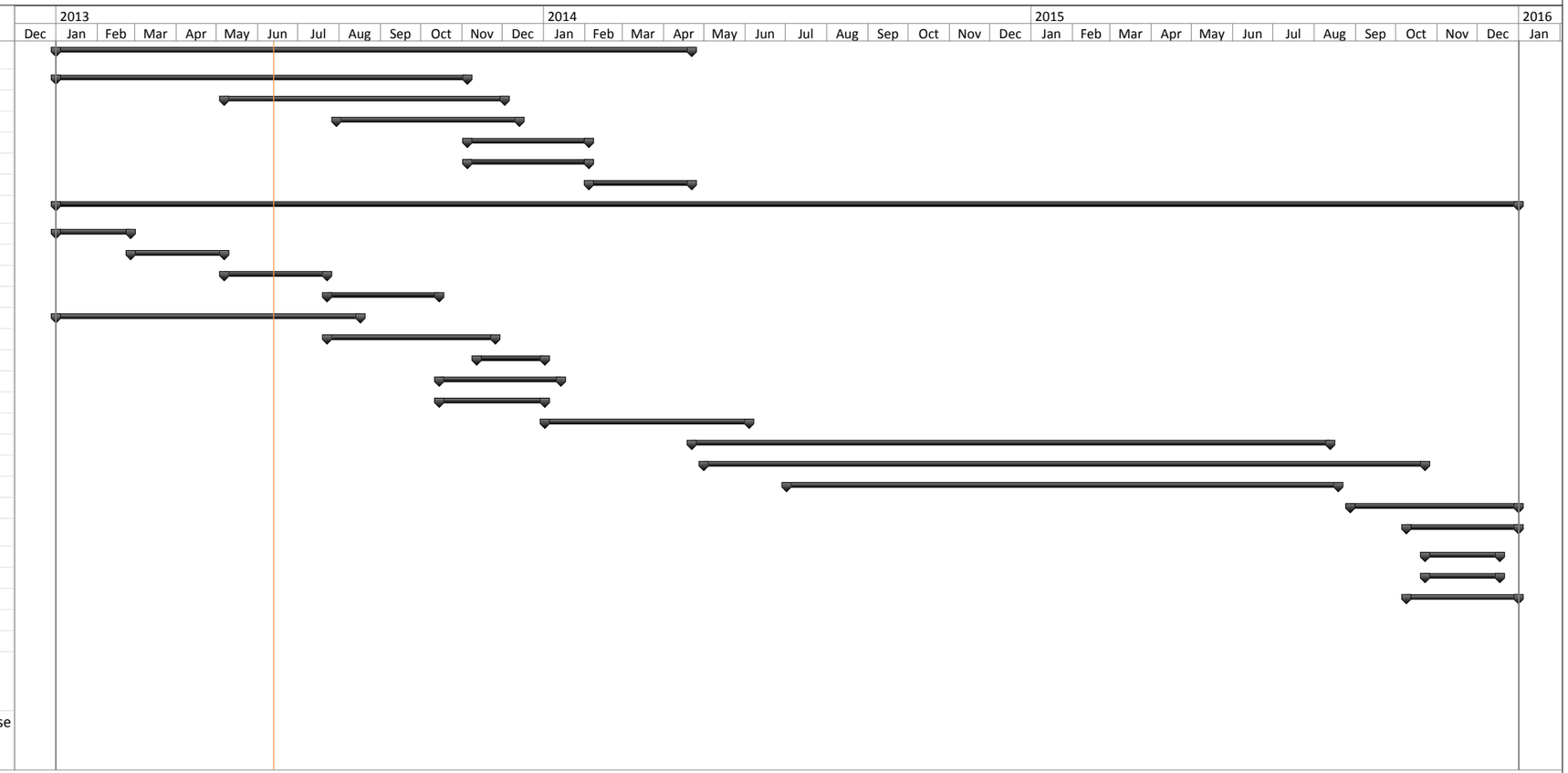
Figure 4

Path: P:\PRJ\Projects\TF0388- DuPont Pitt Consol\Database and GIS\GIS\TF0388 - Revised AOCs.mxd

FIGURE 5: SCHEDULE OF REMEDIAL ACTIONS
Former Pitt-Consol Site, Newark, New Jersey

Geosyntec Consultants

ID	Task Mode	Task Name
1		**Site Preparation**
2		**Design**
21		**Planning**
29		**Permitting**
47		**Contracting (Sheet Pile Wall)**
57		**Contracting (Site Earthwork, Surface Seal)**
67		**Construction**
82		**Remedial Action (STAR)**
83		**Pre-Design**
91		**30% Design**
105		**60% Design**
123		**90% Design**
143		**Pre-Design Field Studies**
162		**Planning**
166		**Permitting**
168		**Contracting (STAR Treatment Systems)**
178		**Procurement**
187		**Construction**
210		**Operation**
221		**Remedy Verification**
245		**Construction & Operations Monitoring**
261		**Decommissioning**
267		**Post-Remedial Action**
268		**Remediation Completion Letter**
272		**Deed Notice**
276		**As-Builts**
280		
281		***Notes:***
282		1. The schedule provided herein does not include tasks associated with the cap/final cover as these will be integrated with the final Site development plans post December 2015.
283		2. A Remedial Action Report (RAR), Remedial Action Soil Permit, and Response Action Outcome (RAO) will be filed for on-Site soils post-completion of the cap/final cover.



Project: TR0388 On-Site Soils Rem
Date: Thu 6/13/13

Task		Summary		External Milestone		Inactive Summary		Manual Summary Rollup		Finish-only	
Split		Project Summary		Inactive Task		Manual Task		Manual Summary		Deadline	
Milestone		External Tasks		Inactive Milestone		Duration-only		Start-only		Progress	

APPENDIX A

RECEPTOR EVALUATION

Prepared for

DuPont Corporate Remediation Group
4417 Lancaster Pike
Chesnut Run Plaza, Building 715
Wilmington, Delaware 19808

RECEPTOR EVALUATION

Pitt-Consol Chemical Co.
191 Doremus Avenue
Newark, New Jersey 07105
SRP-PI G000002172

Prepared by

Geosyntec consultants

engineers | scientists | innovators

7 Graphics Drive, Suite 106
Ewing, New Jersey 08628

Project Number TR0388A

March 2013

Geosyntec consultants

PITT-CONSOL CHEMICAL CO. SITE
RECEPTOR EVALUATION FORM ATTACHMENT

INTRODUCTION AND BACKGROUND

Geosyntec Consultants, Inc. (Geosyntec), on behalf of the DuPont Corporate Remediation Group (CRG), has prepared an updated Receptor Evaluation (RE) for the former Pitt-Consol Chemical Co. (Pitt-Consol) facility property located at 191 Doremus Avenue, Newark City, Essex County, New Jersey (the Site). The Site comprises the land parcels designated on the Newark City Tax Map as Block 5016, Lots 1 and 3, and Block 5016.01, Lot 10. The RE consists of both the RE Form and this RE Attachment, which includes Figures 1 through 4 and Appendices A through E.

The RE was prepared pursuant to, and in accordance with, the requirements of the NJDEP Technical Requirements for Site Remediation (TRSRs), last amended 7 May 2012 (N.J.A.C. 7:26E, specifically N.J.A.C. 7:26E-1.12 through 1.16). This RE Form Attachment has been prepared and included with the RE Form in order to provide information which could not be communicated through the Form or which required further clarification. A copy of the RE Form is included as Appendix A.

In accordance with N.J.A.C. 7:26E-1.12(f)1 and 2, a copy of the RE will be sent to the following local government officials:

Newark City Clerk
Robert Marasco, City Clerk
City of Newark
Newark City Hall
920 Broad Street, Room 306
Newark, New Jersey 07102

Newark City Health Official
Peter J. Dillon, Jr., Director
Division of Environmental Health
Department of Child and Family Wellbeing
City of Newark
110 William Street
Newark, New Jersey 07102

SECTION A. SITE NAME AND LOCATION

The Site is located at 191 Doremus Avenue in an industrial area of Newark near to the Passaic River. Within NJDEP's enterprise data management system, New Jersey Environmental Management System (NJEMS), the Site is referred to variously as Pitt Consol Chemical Co, Pitt Consol Chemical Company, and DuPont Pitt Consol. The NJDEP Site Remediation Program (SRP) identification (ID) numbers for the Site are as follows:

Preferred ID Number: G000002172
Program Interest ID: 099539

A Site Locus map is included as Figure 1 and a Site Plan map is included as Figure 2.

SECTION B. ON SITE AND SURROUNDING PROPERTY USE (N.J.A.C. 7:26E-1.13)

According to mapped information available through NJDEP's NJ-GeoWeb Online Map Viewer, no sensitive populations/uses (as defined in the RE Form and by N.J.A.C. 7:26E-1.13(a)) either use or operate on the Site or on properties within 200 feet of the Site boundary. A map of the Site and surrounding area produced from NJ-GeoWeb is included as Appendix B. The Site is currently not in use and there are no permanent buildings on the Site.

According to the "Land Use Element of the Master Plan for the City of Newark" (adopted 6 December 2004), the anticipated future land use of the Site and properties within 200 feet of the Site boundary is "heavy industrial", which represents no change from current conditions. The Master Plan map of the area around the Site is included as Appendix C.

SECTION D. GROUNDWATER USE (N.J.A.C. 7:26E-1.14)

Since compounds are present in Site groundwater at concentrations which exceed GWQSs, as per N.J.A.C. 7:26E-1.14(a)1, Geosyntec obtained from NJDEP records of all wells which have either been proposed to be installed or have been installed within 1 mile of the Site. These records indicate that there are no potable wells located within 1,000 feet of any Site-associated GWQS exceedences.

As per N.J.A.C. 7:26E-1.14(a)1i and iii, information about the following well types returned in the well search have been entered into the Well Search Spreadsheet: potable wells located within ½ mile, and irrigation and industrial wells, as well as wells with water allocation permits located within 1 mile of the Site-associated GWQS exceedances. A paper copy of the Well Search Spreadsheet is included as Appendix D and the records of relevant wells returned in the well search results are included as Appendix E. The relevant well record locations are depicted on Figure 4.

Figures 3a and 3b depict the piezometric surface contours of groundwater within the shallow (surficial) and deeper water bearing units in the vicinity of the Site, respectively, based on measurements collected in December 2010. Groundwater in the vicinity of the Site flows eastward, towards the Passaic River, and according to a July 2006 (revised February 2009) Phase I Data Gap Investigation Report and Phase II Data Gap Investigation Work Plan prepared by CRG, both the shallow and deeper aquifers apparently discharge to the Passaic River, which is located approximately 650 feet east of the Site.

There are records for 18 industrial wells, and one irrigation well, within 1 mile of the Site (Figure 4). Of these 19 wells, four have been decommissioned, three are located on the other side of the Passaic River, and only three are within 1,000 feet of the Site. No records of any wells with water allocation permits were returned with the well search results. Additionally, no records of potable well types within ½ mile of the Site were returned.

Mapped information available through NJ-GeoWeb indicates that the Site is not located within a Tier 1 or Tier 2 wellhead protection area (WHPA).

SECTION E. VAPOR INTRUSION (N.J.A.C. 7:26E-1.15)

While VOCs have been detected in Site groundwater samples (most recently in September 2012) at concentrations which exceed GWSLs, petroleum-associated VOCs have not been detected above a GWSL at any location within 30 feet of a building, and non-petroleum-associated VOCs have not been detected above a GWSL at any location within 100 feet of a building. Therefore, as per N.J.A.C. 7:26E-1.15(a)1i and ii, these compounds are not considered to pose a VI risk at the Site. Further, DNAPL, which has long been known to exist at the Site, has not been identified in any wells which are within 100 feet of buildings, and therefore, as per N.J.A.C. 7:26E-1.15(a)2, it is not considered to pose a VI risk at the Site.

SECTION F. ECOLOGICAL RECEPTORS (N.J.A.C. 7:26E-1.16)

The Site is located within an area of heavy industry and, according to mapped information review through NJ-GeoWeb, there are no environmentally sensitive natural resources on the Site or on adjacent properties, and no surface water bodies within 200 feet of any Site-associated GWQS exceedances. An Evaluation (EE), pursuant to N.J.A.C. 7:26E-1.16, has not been conducted for the Site.

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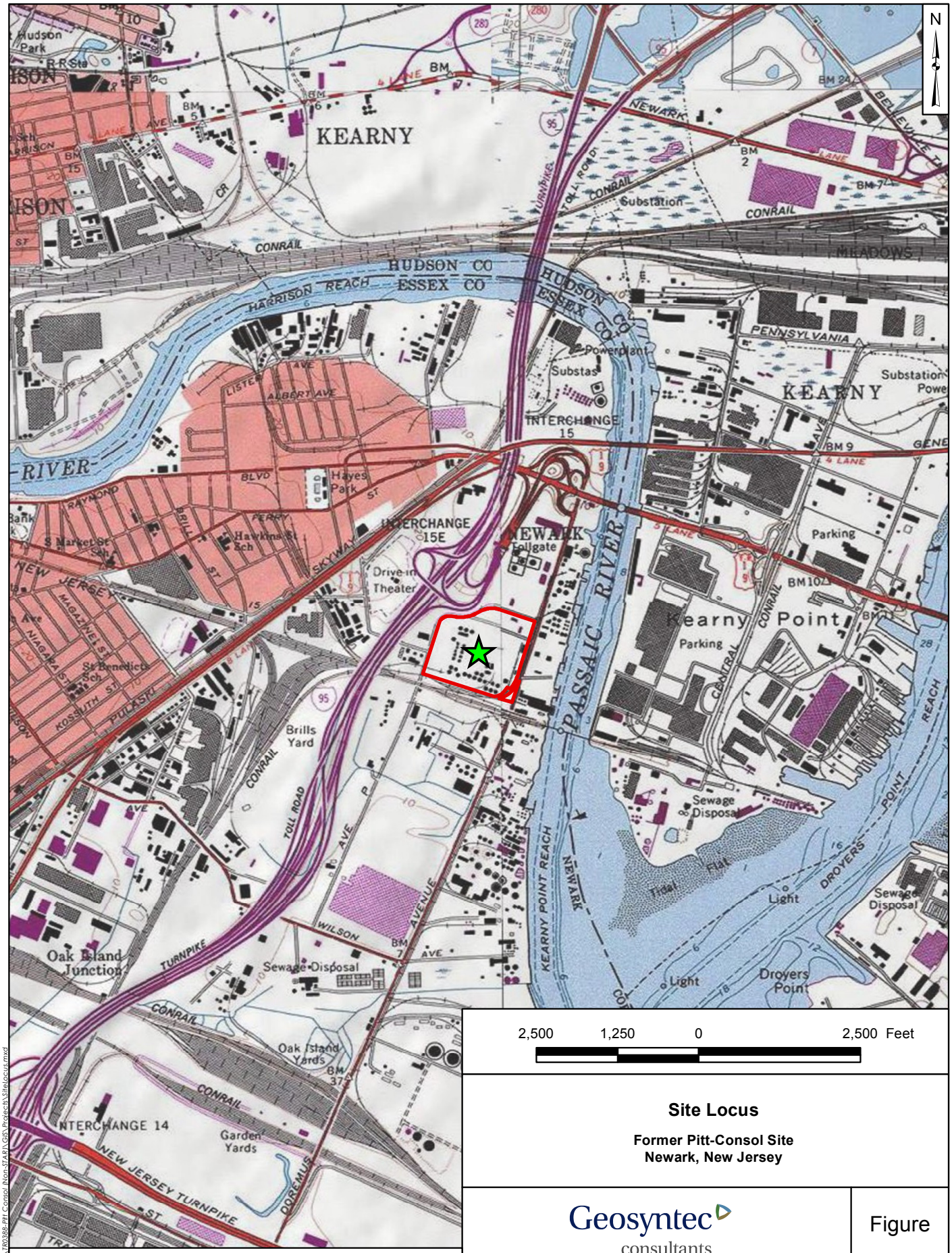
FIGURES



Base Map: USGS Jersey City (1981) and Elizabeth (1995) Quadrangles (1:24,000)

Site Locus

Former Pitt-Consol Site
Newark, New Jersey

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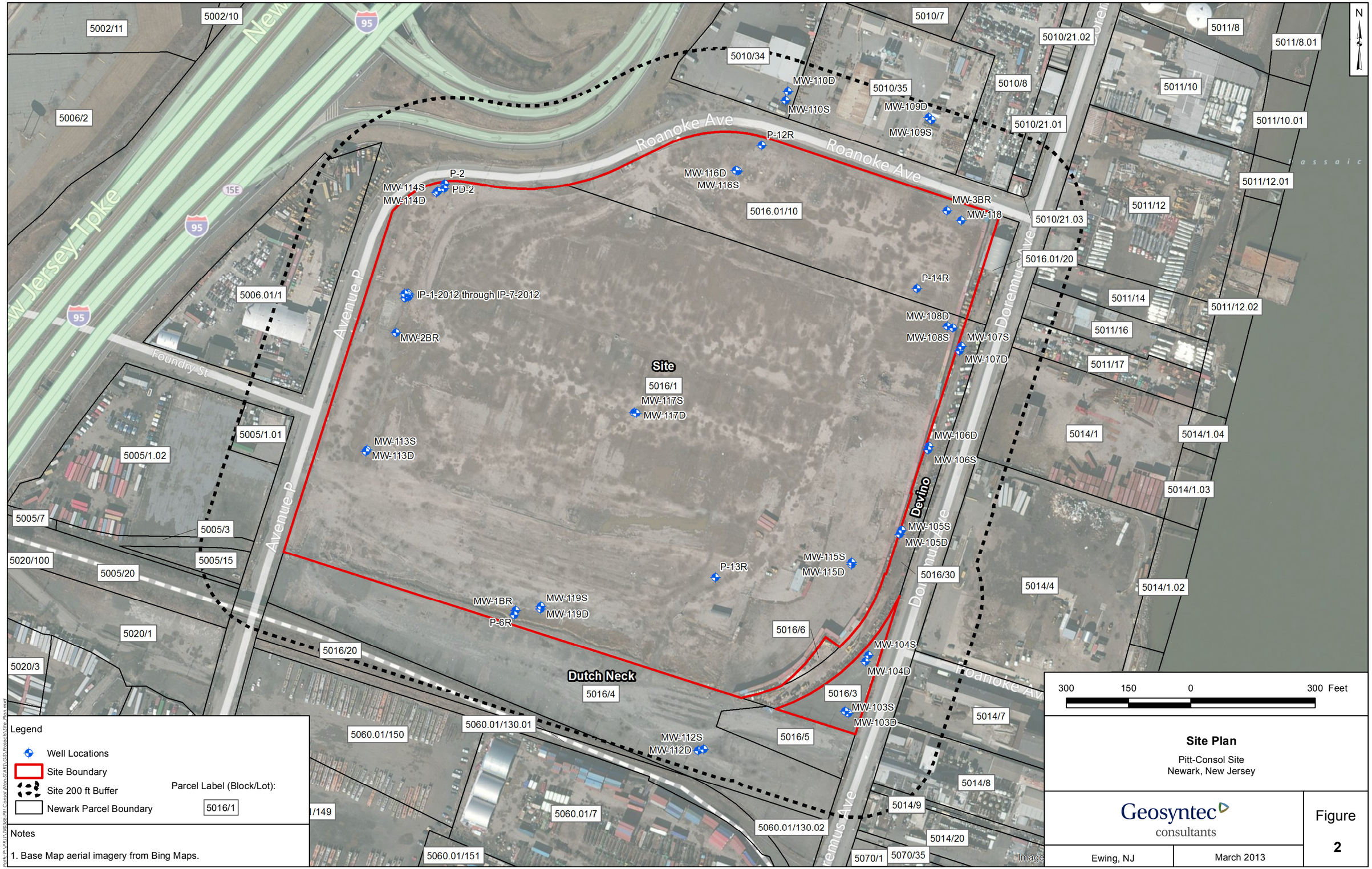
Figure **1**

Path: P:\PBJ\TR0388-PH Consol (Non-STAR)\GIS\Project\SiteLocus.mxd



Legend

- Well Locations
- Site Boundary
- Site 200 ft Buffer
- Newark Parcel Boundary

Parcel Label (Block/Lot): 5016/1

Notes

1. Base Map aerial imagery from Bing Maps.

Site Plan

Pitt-Consol Site
Newark, New Jersey

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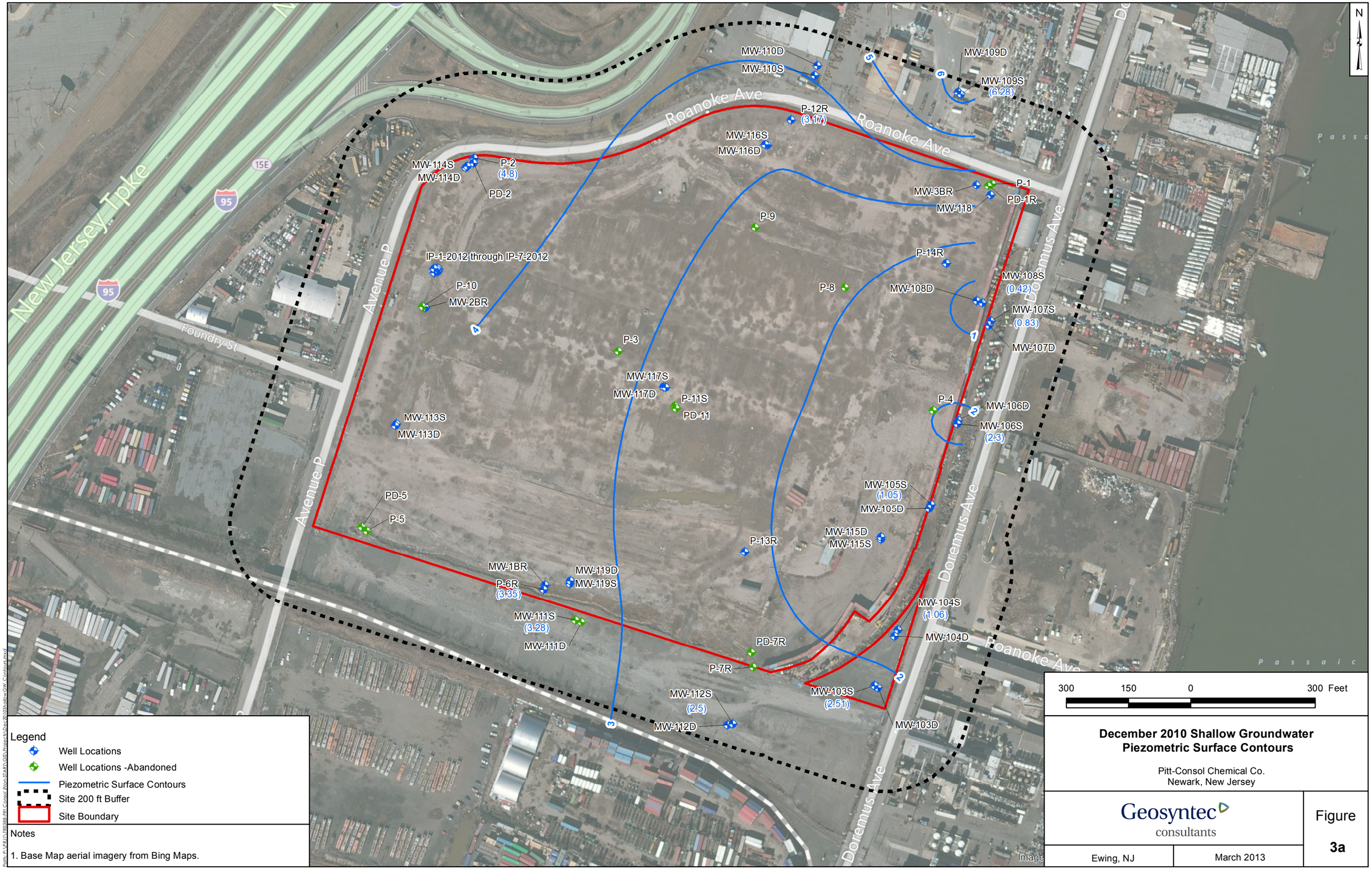
Figure 2

Path: P:\PRJ\TR0388-Pitt Consol (Non-STAR)\GIS\Projects\Site_Plan.mxd



Legend

- Well Locations
- Well Locations -Abandoned
- Piezometric Surface Contours
- Site 200 ft Buffer
- Site Boundary

Notes

1. Base Map aerial imagery from Bing Maps.

300 150 0 300 Feet

December 2010 Shallow Groundwater Piezometric Surface Contours

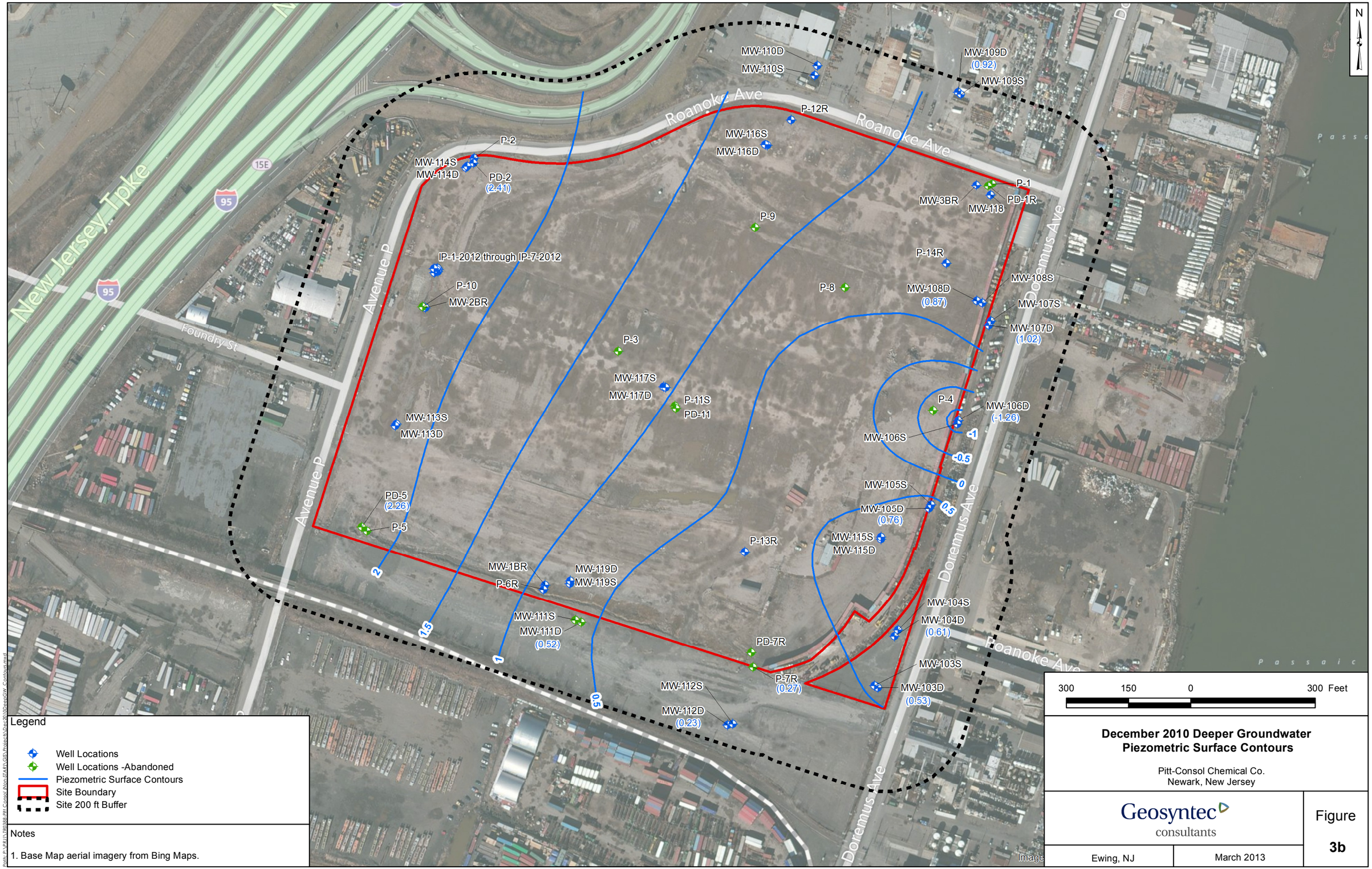
Pitt-Consol Chemical Co.
Newark, New Jersey

Geosyntec consultants

Ewing, NJ | March 2013

Figure 3a

Path: P:\PRJ\LT60388-Pitt Consol (Non-STAR)\GIS\Projects\Dec2010yellowGW_Contours.mxd



December 2010 Deeper Groundwater Piezometric Surface Contours

Pitt-Consol Chemical Co.
Newark, New Jersey

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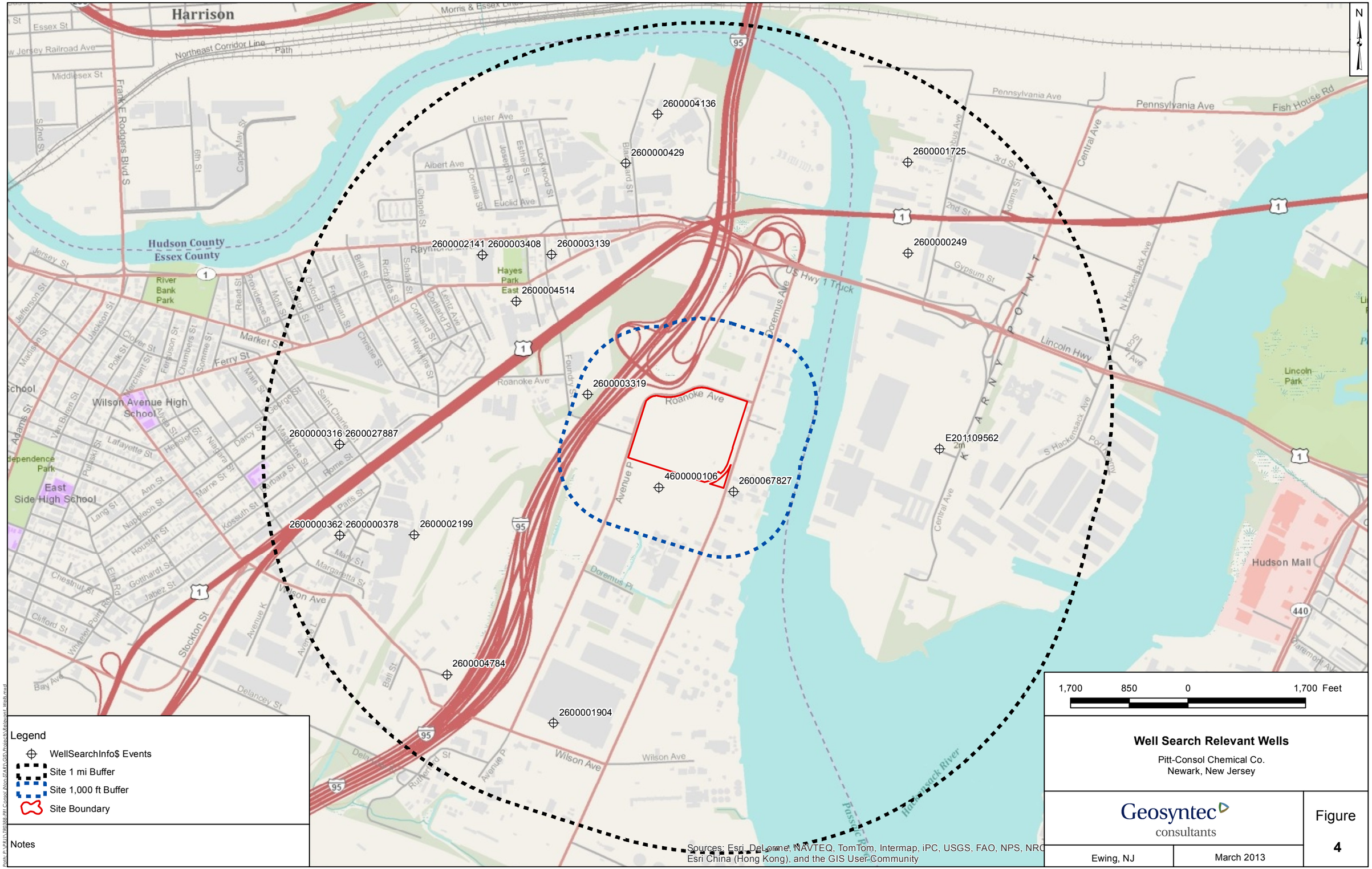
Figure 3b



Legend

- WellSearchInfo$ Events
- Site 1 mi Buffer
- Site 1,000 ft Buffer
- Site Boundary

Notes

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

Well Search Relevant Wells

Pitt-Consol Chemical Co.
Newark, New Jersey

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Ewing, NJ | March 2013

Figure 4

Path: P:\PRJ\LT80388-Pitt Consol Non-STARI\GIS\Projects\Relevant Wells.mxd

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Appendix A

Receptor Evaluation Form

New Jersey Department of Environmental Protection
Site Remediation Program

RECEPTOR EVALUATION (RE) FORM

Date Stamp
(For Department use only)

SECTION A. SITE NAME AND LOCATION

Site Name: Pitt-Consol Chemical Co

List all AKAs: Pitt Consol Chemical Co, Pitt Consol Chemical Company, DuPont Pitt Consol

Street Address: 191 Doremus Avenue

Municipality: Newark City (Township, Borough or City)

County: Essex Zip Code: 07105

Program Interest (PI) Number(s): G000002172 Case Tracking Number(s): _____

Indicate the type of submission:

☐ Initial RE Submission

☒ Updated RE Submission

Indicate the reason for submission of an updated RE form

☐ Submission of an Immediate Environmental Concern (IEC) source control report;
☒ Submission of a Remedial Investigation Report;
☐ Submission of a Remedial Action Report;

Check if included in updated RE

☐ The known concentration or extent of contamination in any medium has increased;
☐ A new AOC has been identified;
☐ A new receptor is identified;
☐ A new exposure pathway has been identified.

SECTION B. ON SITE AND SURROUNDING PROPERTY USE

1. Identify any sensitive populations/uses that are currently on-site or surrounding property usage within 200 feet of the site boundary (check all that apply):

	On-site	Off-site
None of the following	☒	☒
Residences or residential property	☐	☐
Public or Private Schools grades K-12	☐	☐
Child care centers	☐	☐
Public parks, playgrounds or other recreation areas	☐	☐
Other sensitive population use(s) Explain _____	☐	☐

If any of the above applies, attach a list of addresses, facility names, type of use, and a map depicting each location relative to the site.

2. Current site uses (check all that apply):

☐ Industrial ☐ Residential ☐ Commercial ☐ Agricultural
☐ School or child care ☐ Government ☐ Park or recreational use
☒ Vacant ☐ Other: _____

3. Planned future site uses and off-site use within 200 ft of site boundary (check all that apply):

☒ Industrial ☐ Residential ☒ Commercial ☐ Agricultural
☐ School or child care ☐ Government ☐ Park or recreational use
☐ Vacant ☐ Other: _____

Provide a map depicting the location of the proposed changes in land use.

SECTION C. DESCRIPTION OF CONTAMINATION

1. Identify if any of the following exist at the site (check all that apply):
   - ☒ Free product [N.J.A.C. 7:26E-1.8] identified is ☐ LNAPL* or ☒ DNAPL**. Date identified: 12/10/2010
   - ☒ Residual product [N.J.A.C. 7:26E-1.8]
   - ☐ Other high concentration source materials not identified above (e.g., buried drums, containers, unsecured friable asbestos)

     Explain: _____

   * LNAPL – measured thickness of .01 feet or more

   **DNAPL – See US EPA DNAPL Overview

2. Soil Migration Pathway

   Has soil contamination been delineated to the applicable Direct Contact Soil Remediation Standard? ..... ☐ Yes ☒ No

   Are all soils either below the applicable Direct Contact Criteria or under an institutional control (i.e. deed notice)? ..... ☐ Yes ☒ No

3. If this evaluation is submitted with a technical document that includes contaminant summary information, proceed to Section D. Otherwise attach a brief summary of all currently available data and information to be included in the site investigation or remedial investigation report.

SECTION D. GROUND WATER USE

1. Has the requirement for ground water sampling been triggered? ..... ☒ Yes ☐ No ☐ Unknown

   If "No," proceed to Section F. If "Unknown," explain:

   _____

2. Is Ground water contaminated above the Ground Water Remediation Standards [N.J.A.C.7:9C]? ..... ☒ Yes ☐ No ☐ Unknown

   Or ☐ Awaiting laboratory data with the expected due date: _____

   If "Yes," provide the date that the laboratory data was available and confirmed contamination above the Ground Water Remediation Standards. Date: 07/21/2006

   If "Unknown," explain: _____

   If "No," or awaiting laboratory data proceed to Section F.

3. Has ground water contamination been delineated to the applicable Remediation Standard? ..... ☐ Yes ☒ No

4. Has a well search been completed? ..... ☒ Yes ☐ No

   Date of most recent or updated well search: 02/11/2013

   Identify if any of the following conditions exist based on the well search [N.J.A.C.7:26E-1.14(a)] (check all that apply):
   - ☐ Potable wells located within 500 feet from the downgradient edge of the currently known extent of contamination.
   - ☐ Potable well located 250 feet upgradient or 500 feet side gradient of the currently known extent of contamination.
   - ☐ Ground water contamination is located within a Tier 1 wellhead protection area (WHPA).

5. Is a completed Well Search Spreadsheet or historical well search table attached and has an electronic copy of the spreadsheet been submitted to srpgis_wrs@dep.state.nj.us. ..... ☒ Yes ☐ No

   If "No," explain: _____

6. Are any private potable or irrigation wells located within ½ mile of the currently known extent of contamination? ..... ☐ Yes ☒ No

   If "Yes," was a door to door survey completed? ..... ☐ Yes ☐ No

   If survey was not completed explain: _____

7. Has sampling been conducted of ☐ potable well(s) and /or ☐ non-potable use well(s)? ..... ☐ Yes ☐ No

   If "No," provide justification then proceed to Section E.

   _____

8 Has contamination been identified in potable well(s) above Ground Water Remediation Standards that is not suspected to be from the site? (If "Yes," provide justification) ..... ☐ Yes ☐ No

_____

9 Has contamination been identified in potable well(s) that is above the Ground Water Remediation Standards or Federal Drinking Water Standards? ..... ☐ Yes ☐ No

Provide date laboratory data was received: _____

Or ☐ awaiting laboratory data with the expected due date: _____

If "Yes" for potable well contamination **not attributable to background**, follow the IEC Guidance Document at http://www.nj.gov/dep/srp/guidance/index.html#iec for required actions and answer the following:

Has an engineered system response action been completed on all receptors? ..... ☐ Yes ☐ No
Provide a brief narrative description:

Date completed: _____ NJDEP Case Manager: _____

10. Were Non-potable use well(s) sampled and results were above Class II Ground Water Remediation Standards? ..... ☐ Yes ☐ No

Provide date laboratory data was received: _____

Or ☐ awaiting laboratory data with the expected due date: _____

11. Has the ground water use evaluation been completed? ..... ☐ Yes ☐ No

SECTION E. VAPOR INTRUSION (VI)

1. Contaminants present in ground water exceed the Vapor Intrusion Ground Water Screening Levels that trigger a VI evaluation. (see NJDEP Vapor Intrusion Technical Guidance). ... ☒ Yes ☐ No ☐ Unknown

Or ☐ Awaiting laboratory data and the expected due date: _____

Provide the date that the laboratory data was available and confirmed contamination above the Vapor Intrusion Trigger Levels. Date: 02/01/2011

2. Other existing conditions that trigger a VI evaluation. (see NJDEP Vapor Intrusion Technical Guidance)

☐ Wet basement or sump containing free product or ground water containing volatile organics
☐ Methane generating conditions causing oxygen deficient or explosion concern
☐ Other human or safety concern from the VI pathway (i.e. elemental mercury, unsaturated contamination, elevated soil gas or indoor vapor (explain):

If you answered "No," or awaiting laboratory data to Question 1., *and* did not check any boxes in Question 2, proceed to Section F, "Ecological Receptors", otherwise complete the rest of this section.

3. Has ground water contamination been delineated to the applicable Ground Water Vapor Screening Level? ..... ☐ Yes ☒ No

4. Was a site specific screening level, modeling or other alternative approach employed for the VI pathway? ..... ☐ Yes ☒ No

5. Identify and locate on a scaled map any buildings/sensitive populations that exist within the following distances from ground water contamination with concentrations above the Vapor Intrusion Ground Water Screening Levels or specific threats (check all that apply):

☐ 30 feet of petroleum free product or dissolved petroleum hydrocarbon contamination in ground water
☐ 100 feet of any non-petroleum free product or any non-petroleum dissolved volatile organic ground water contamination
☒ No buildings exist within the specified distances

6. The vapor intrusion pathway is a concern at or adjacent to the site (if "No," attach justification) ..... ☐ Yes ☒ No

7. Has soil gas sampling of the building(s) been conducted? ☐ Yes ☐ No ☒ N/A
   If "No," or "N/A," proceed to #10

8. Has indoor air sampling been conducted at the identified building(s)? ☐ Yes ☐ No
   If "No," proceed to #10

9 Has indoor air contamination been identified but not suspected to be from the site?
   (if "Yes," attach justification) ☐ Yes ☐ No

10. Indoor air results were above the NJDEP's Rapid Action Levels. ☐ Yes ☐ No

    Provide the date that the laboratory data was available and confirmed contamination above the Rapid Action Levels. Date: _____

    Or ☐ Awaiting laboratory data with the expected due date: _____

    If "Yes" to #8 above, follow the IEC Guidance Document at http://www.nj.gov/dep/srp/guidance/index.html#iec for required actions.

    The IEC engineering system response for control was implemented for all identified structures ☐ Yes ☐ No

    Date: _____ NJDEP Case Manager: _____

11. Indoor air sampling was conducted and results were above the NJDEP's Indoor Air Screening Levels but at or below the Rapid Action Levels ☐ Yes ☐ No

    Provide the date that the laboratory data was available. Date: _____

    Or ☐ Awaiting laboratory data with the expected due date: _____

    If "Yes" to #10 above, answer the following:

    Has the Vapor Concern (VC) Response Action Form notifying the NJDEP of the exceedances been submitted? ☐ Yes ☐ No
    Date: _____

    Has a plan to mitigate and monitor the exposure been submitted? ☐ Yes ☐ No
    Date: _____

    Has the Mitigation Response Action Report been submitted? ☐ Yes ☐ No
    Date: _____

12. Has the vapor intrusion investigation been completed? ☐ Yes ☐ No
    If "No", is the vapor intrusion investigation stepping out as part of the site investigation or remedial investigation. (If "No," attach justification) ☐ Yes ☐ No

SECTION F. ECOLOGICAL RECEPTORS

1. Has an Ecological Evaluation (EE) has been conducted? [N.J.A.C. 7:26E-1.16] ☐ Yes ☒ No

   Date conducted: _____

2. Do the results of an EE trigger a remedial investigation of ecological receptors? [N.J.A.C. 7:26E-4.8]. ☐ Yes ☐ No

3. Has a remedial investigation of ecological receptors been conducted? ☐ Yes ☐ No

   Date conducted: _____

4. Provide the name(s) of any surface water body on or within 200 feet of the site:

   _____

5. Is free product or residual product located within 100 feet from an ecological receptor? ☐ Yes ☐ No

6. Available data indicate an impact on: ☐ Ecological receptor(s) ☐ Surface water ☐ Sediment

   If this evaluation is submitted with a technical document that includes contaminant summary information, proceed to Section G. Otherwise attach a description of the type of contamination and provide a schedule and a description of all actions to be taken to mitigate exposure

SECTION G. PERSON RESPONSIBLE FOR CONDUCTING THE REMEDIATION INFORMATION AND CERTIFICATION

Full Legal Name of the Person Responsible for Conducting the Remediation: E.I. du Pont de Nemours and Company

Representative First Name: Michael Representative Last Name: Lukas

Title: Remediation Team Manager, DuPont CRG

Phone Number: (302) 999-3567 Ext: Fax: (302) 999-2497

Mailing Address: Chestnut Run Plaza, Building 715, 4417 Lancaster Pike

City/Town: Wilmington State: Delaware Zip Code: 19805

Email Address: michael.j.lukas@usa.dupont.com

This certification shall be signed by the person responsible for conducting the remediation who is submitting this notification in accordance with Administrative Requirements for the Remediation of Contaminated Sites rule at N.J.A.C. 7:26C-1.5(a).

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein, including all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, to the best of my knowledge, I believe that the submitted information is true, accurate and complete. I am aware that there are significant civil penalties for knowingly submitting false, inaccurate or incomplete information and that I am committing a crime of the fourth degree if I make a written false statement which I do not believe to be true. I am also aware that if I knowingly direct or authorize the violation of any statute, I am personally liable for the penalties.

Signature: Michael Lukas Date: 4/30/13

Name/Title: Michael J. Lukas, Remediation Team Manager **No Changes Since Last Submittal** ☐

SECTION H. LICENSED SITE REMEDIATION PROFESSIONAL INFORMATION AND STATEMENT

LSRP ID Number: 576317

First Name: Scott Last Name: Drew

Phone Number: (609) 895-1400 Ext: 9007 Fax: (609) 895-1401

Mailing Address: 7 Graphics Drive, Suite 106

City/Town: Ewing State: New Jersey Zip Code: 08628

Email Address: sdrew@geosyntec.com

This statement shall be signed by the LSRP who is submitting this notification in accordance with SRRA Section 16 d. and Section 30 b.2.

I certify that I am a Licensed Site Remediation Professional authorized pursuant to N.J.S.A. 58:10C to conduct business in New Jersey. As the Licensed Site Remediation Professional of record for this remediation, I:

[SELECT ONE OR BOTH OF THE FOLLOWING AS APPLICABLE]:

☐ *directly oversaw and supervised all of the referenced remediation, and\or*

☒ *personally reviewed and accepted all of the referenced remediation presented herein.*

I believe that the information contained herein, and including all attached documents, is true, accurate and complete.

It is my independent professional judgment and opinion that the remediation conducted at this site, as reflected in this submission to the Department, conforms to, and is consistent with, the remediation requirements in N.J.S.A. 58:10C-14.

My conduct and decisions in this matter were made upon the exercise of reasonable care and diligence, and by applying the knowledge and skill ordinarily exercised by licensed site remediation professionals practicing in good standing, in accordance with N.J.S.A. 58:10C-16, in the State of New Jersey at the time I performed these professional services.

I am aware pursuant to N.J.S.A. 58:10C-17 that for purposely, knowingly or recklessly submitting false statement, representation or certification in any document or information submitted to the board or Department, etc., that there are significant civil, administrative and criminal penalties, including license revocation or suspension, fines and being punished by imprisonment for conviction of a crime of the third degree.

LSRP Signature: Scott R. Drew Date: 04/26/13

LSRP Name/Title: Scott R. Drew **No Changes Since Last Submittal** ☒

Company Name: Geosyntec Consultants, Inc.

Completed forms should be sent to the municipal clerk, designate health department, and:

Bureau of Case Assignment & Initial Notice
Site Remediation Program
NJ Department of Environmental Protection
401-05H
PO Box 420
Trenton, NJ 08625-0420

Geosyntec consultants

Appendix B

NJ-GeoWeb Map

Pitt-Consol Chemical Co.

NJ-GeoWeb Map

Map Printed On {2013-02-18 11:03}

0 0.128mi

Environmental Data

Schools

- Public
- Private
- Charter

New Jersey Parcels Data

Water Source Areas

Child Care Centers

Public Community Water Supply Wells

Known Contaminated Sites List

Roads

Major Roads

- Toll Road
- Interstate
- US Highway
- State Highway
- County 500 Series
- County 600 Series

Wetlands (2007)

- WETLANDS

Well Head Protection Areas (Community)

- Tier 1: 2-Year
- Tier 2: 5-Year
- Tier 3: 12-Year

Well Head Protection Areas (Non-Community)

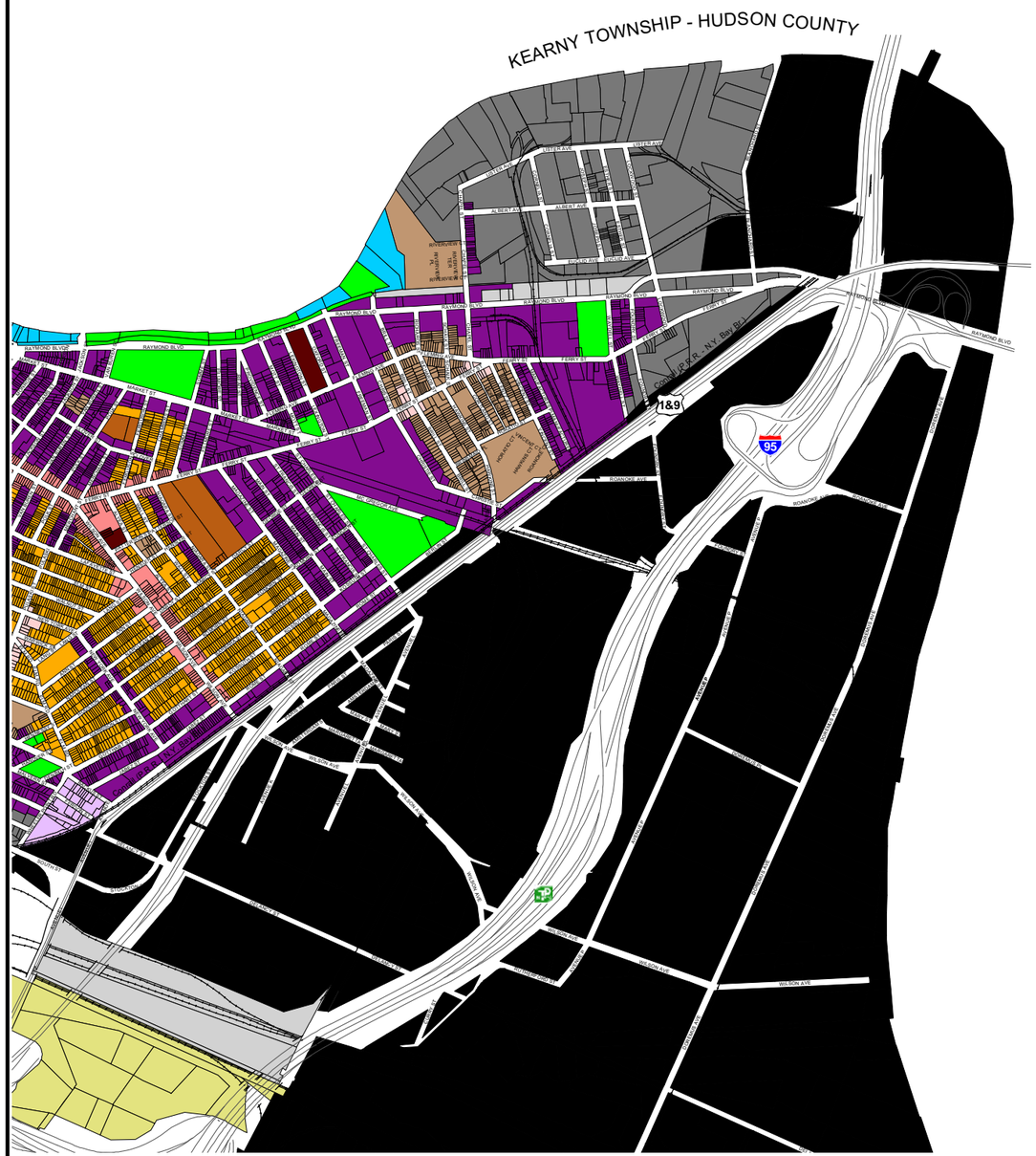
- Tier 1: 2-Year
- Tier 2: 5-Year
- Tier 3: 12-Year

Natural2007

Geosyntec consultants

Appendix C

Newark Master Plan Map



Legend

Residential:

- R-LD Low density detached single-family residential
- R-MD Medium density detached and semi-detached single-&-two-family residential
- R-HD High density detached and attached one-to-three -family and townhouse residential
- R-LM Low-rise multi-family residential
- R-HM High-rise multi-family residential

Commercial:

- C-N Neighborhood commercial
- C-C Community commercial
- C-R Regional commercial
- C-SC Shopping center commercial

Industrial:

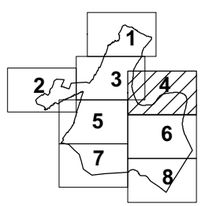
- I-L Light industrial
- I-M Medium industrial
- I-H Heavy industrial

Special Purpose:

- S-M Mixed Use - Residential and Nonresidential
- S-GEM Government, Education and Medical
- S-OR Office research
- S-A Airport support
- S-W Waterfront uses
- S-P Parks and open space
- S-C Cemeteries
- S-D Downtown commercial
- S-T Transitional

Future Land Use Plan
City of Newark
Master Plan

Essex County, New Jersey



Sheet 4 of 8

0 1600 Feet

N

Based on Future Land Use Plan prepared by Phillips Preiss Shapiro Associates, Inc. Planning & Real Estate Consultants

SCHOOR DEPALMA
Engineers and Design Professionals

Date: November 2004

Geosyntec consultants

Appendix D

Well Search Spreadsheet

SITE NAME	Pitt Consol Chemical Co
SITE STREET ADDRESS	191 Doremus Avenue
SITE COUNTY (select)	Essex
SITE MUNICIPALITY (select)	Newark City
PROGRAM INTEREST (PI) ID # :	G000002172
SOURCE COORDINATE X	595800
SOURCE COORDINATE Y	689700
GROUNDWATER FLOW DIRECTION USED (if any)	ESE
WERE APPLICABLE WELL TYPES FOUND? (Yes/No)	Yes
IS THIS SUBMISSION AN UPDATE? (Yes/No)	Yes
AUTHOR (name of company)	Geosyntec Consultants, Inc.
AUTHOR STREET ADDRESS (include town and zip code)	7 Graphics Drive, Suite 106, Ewing, NJ 08628
LSRP LICENSE NUMBER OVERSEEING WORK	576317
LSRP NAME OVERSEEING WORK	Scott R. Drew
PROFESSIONAL WHO PREPARED SUBMISSION	Scott R. Douglas
EMAIL CONTACT	sdouglas@geosyntec.com
PHONE CONTACT	6094939002

Download_Document	Permit_Number	Well_Use	Potentially_Potable	Document	Date (permitted/drilled/sealed)	Physical_Address	County	Municipality	Block	Lot	Location_Method	Easting_X	Northing_Y	Distance_(feet)	Depth (feet)	Capacity (gal/min)	COORD_METHOD	TOP_OPEN_INT	BOT_OPEN_INT	STATIC_LEVEL	STATUS	WELL_SAMPLED?
	2600000249	Industrial	Yes	Permit	2/21/1951		Hudson	Kearny Town			Prop Loc - Hard Copy	599006	692320	4140	250	50						
	2600000316	Industrial	Yes	Permit	8/6/1951		Essex	Newark City			Prop Loc - Hard Copy	590780	689553	5022	400	200						
	2600000362	Industrial	Yes	Record	5/1/1952	AVENUE L	Essex	Newark City			Prop Loc - Hard Copy	590785	688238	5224	500	350						
	2600000378	Industrial	Yes	Permit	10/19/1951		Essex	Newark City			Prop Loc - Hard Copy	590785	688238	5224	600	350						
	2600000429	Industrial	Yes	Record	3/18/1952	60 BLANCHARD STREET	Essex	Newark City			Prop Loc - Hard Copy	594920	693618	4016	400	0				21		
	2600001725	Industrial	Yes	Permit	10/8/1957		Hudson	Kearny Town			Prop Loc - Hard Copy	599000	693636	5073	200	150						
	2600001904	Industrial	Yes	Permit	9/19/1958		Essex	Newark City			Prop Loc - Hard Copy	593877	685518	4603	500	300						
	2600002141	Industrial	Yes	Record	7/12/1960	84 WAYDELL ST	Essex	Newark City			Prop Loc - Hard Copy	592847	692294	3931	500	0				30	Sealed	
	2600002199	Industrial	Yes	Permit	3/16/1960		Essex	Newark City			Prop Loc - Hard Copy	591863	688242	4198	250	65						
	2600003139	Industrial	Yes	Record	6/8/1965	84 FOUNDRY STREET	Essex	Newark City			Prop Loc - Hard Copy	593848	692298	3250	200	0				30	Sealed	
	2600003319	Industrial	Yes	Record	9/8/1965	185 FOUNDRY ST	Essex	Newark City			Prop Loc - Dig Image	594370	690276	1542	400	0				20		
	2600003408	Industrial	Yes	Record	9/22/1965	45-65 MANUFACTURERS PLACE	Essex	Newark City			Prop Loc - Hard Copy	592847	692294	3931	300	0				56	Sealed	
	2600004136	Industrial	Yes	Record	3/8/1968	117 BLANCHARD STREET	Essex	Newark City			Prop Loc - Dig Image	595379	694328	4647	250	0				70	Sealed	
	2600004514	Industrial	Yes	Record	4/12/1973	55 MANUFACTURER'S PLACE	Essex	Newark City			Prop Loc - Dig Image	593338	691621	3173	300	0				35		
	2600004784	Industrial	Yes	Record	3/6/1980	411-443 WILSON AVE	Essex	Newark City	5020	98	Prop Loc - Dig Image	592334	686220	3931	170	0				12		
	2600027887	Industrial	Yes	Record	1/21/1992	46 PARIS STREET	Essex	Newark City	2069	59	Prop Loc - Hard Copy	590780	689553	5022	200	0				15		
	2600067827	Industrial	Yes	Permit	5/7/2003	268 DOREMUS AVE	Essex	Newark City	5014	8.01	Prop Loc - Hard Copy	596480	688869	1074	400	65						
	4600000106	Industrial	Yes	Record	1/2/1930		Essex	Newark City			Prop Loc - Hard Copy	595402	688931	866	250	600						
	E201109562	Irrigation	Yes	Permit	6/20/2011	120 Central Ave	Hudson	Kearny Town	288	10.02	GPS	599464	689488	3670	300	20						

Geosyntec consultants

Appendix E

Relevant Well Search Well Records

Form 99—5M—8-47

File in Triplicate
Sign all copies

14/13

(Do not fill in) Application No. 26-94 ✓

County Essex

Location 26.12.9.9.6

DEPT. OF CONSERVATION RECEIVED FEB 2 1949 DIVISION OF WATER POLICY & SUPPLY

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION
Division of Water Policy and Supply
28 West State Street
Trenton 8, New Jersey

APPLICATION FOR PERMIT TO DRILL WELL

An application must be submitted and permit received before drilling a well 100 feet or more in depth.

print or type

Owner Kolker Chemical Works, Inc. Driller Wm. Stothoff Co., Inc.

Address 80 Lister Avenue Address Lock Box 68

Newark 5, New Jersey Flemington, New Jersey

In compliance with the provisions of Chapter 377, P.L. 1947, application is hereby made for permit to drill a Artesian (type) well in Newark, Essex County, New Jersey (municipality and county)

*Quantity of Water Needed (G.P.M.) 250 **Use of Well Industrial Purposes

Proposed Diameter of Well 10" Proposed Depth of Well 500 Ft.

Method of Drilling to be Used Churn Drill

As a part of this application, and in consideration of the granting of a permit, applicant assumes full responsibility for plugging or sealing said well in a manner satisfactory to the Division, in the event it should become a menace to public health or safety.

Date February 23, 1949

Kolker Chemical Works Inc
A. A. Kolker Pres
Owner's Signature

* Quantities in excess of 100,000 gallons per day may require special application for right to divert water.
** Well used for public and potable purposes will require application and permit for right to divert water.

Location of Well (See other side)

PERMIT TO DRILL WELL

(Not to be filled in by Applicant)

The applicant is hereby granted a permit to drill this well subject to the conditions stipulated on the application and as set forth below.

Samples of Cuttings Required by Department { Yes / No ✓

Special Conditions

PERMIT IS VALID FOR ONE YEAR FROM DATE HEREOF

Permit Required to Divert Water { Yes / No ✓

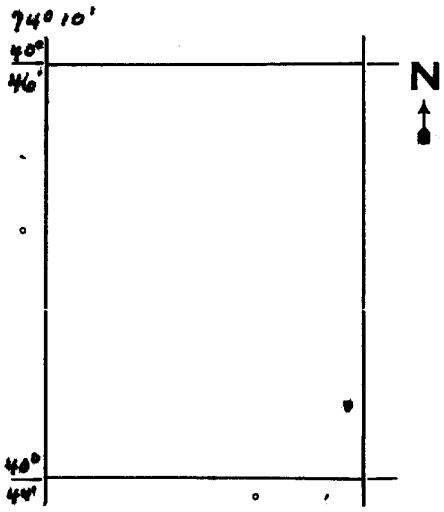
Owner has Permit to Divert Water { Yes / No

Date MAR - 1 49

Chief Engineer

Location of Well

1. Location Overlay for State Topographic Map, Scale 1″ = 1 Mile.



2. Sketch of premises in immediate vicinity showing relation of well to buildings, and distance and relations to nearest public road.

DWR-13SA
1-88

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

PERMIT NO. 26-94
APPLICATION NO.
COUNTY
COORD. 26-12-996

WELL RECORD

1. OWNER Kohler Chemical Works Inc. ADDRESS 80 Lister Ave. - Newark, NJ
   Owner's Well No. 1 SURFACE ELEVATION +8 ± (Above mean sea level) Feet
2. LOCATION 80 Lister Ave. Newark, NJ
3. DATE COMPLETED 4-27-49 DRILLER Wm. Stothoff Co., Inc.
4. DIAMETER: Top 10 inches Bottom 10 inches TOTAL DEPTH 359 Feet
5. CASING: Type Drive Pipe Diameter 10 Inches Length 98'6" Feet
6. SCREEN: Type ____ Size of Opening ____ Diameter ____ Inches Length ____ Feet
   Range in Depth { Top ____ Feet / Bottom ____ Feet } Geologic Formation ____
   Tail Piece: Diameter ____ Inches Length ____ Feet
7. WELL FLOWS NATURALLY ____ Gallons per minute at ____ Feet above surface
   Water rises to ____ Feet above surface
8. RECORD OF TEST: Date 4-26-49 Yield 300 Gallons per minute
   Static water level before pumping 76 Feet below surface
   Pumping level 98 feet below surface after 24 hours pumping
   Drawdown 22 Feet Specific Capacity ____ Gals. per min. per ft. of drawdown
   How pumped Turbine Pump How measured Orifice
   Observed effect on nearby wells ____
9. PERMANENT PUMPING EQUIPMENT:
   Type Turbine Pump Mfrs. Name ____
   Capacity 300 G.P.M. How Driven vertical hollow shaft motor H.P. 30 R.P.M. ____
   Depth of Pump in well 150 Feet Depth of Footpiece in well 160 Feet
   Depth of Air Line in well ____ Feet Type of Meter on Pump ____ Size ____ Inches
10. USED FOR Industrial Purposes AMOUNT { Average ____ Gallons Daily / Maximum ____ Gallons Daily }
11. QUALITY OF WATER ____ Sample: Yes ____ No ____
    Taste none Odor none Color none Temp. ____ °F.
12. LOG See other side Are samples available? ____
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy.)
13. SOURCE OF DATA Well Statement
14. DATA OBTAINED BY H.J. Stothoff Date 5-5-49

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements, etc.)

26-12-996
26-94

Record of well

10" well 359' deep.

Drove 10" pipe to and tight in the rock 98'6" from the surface. Drilled 10" hole on in the rock to 359'

Formation.

0' - 6' fill
6' - 24' river bottom muck
24' - 42' sand & gravel
42' - 67' fine silt
67' - 78' sand & gravel
78' - 87' fine silt
87' - 359' red shale rock

Test on well with turbine pump 180' setting flow 300 GPM 22' drawdown

Static water level 76'

Well drilled March 22-April 27,1949

DEPT. OF CONSERVATION
RECEIVED
MAY 9 - 1949
DIVISION OF WATER POLICY & WELLS

26-12-996

Form 87—5M-1-48

RECEIVED
NOV 1 5 1949
Department of Conservation & Economic Development
Bureau of Water Supply

Additional work on well

DEPARTMENT OF CONSERVATION
Division of Water Policy and Supply

Former Permit No. 26.94
Application No.
County Essex

WELL RECORD

1. OWNER Kelker Chemical Works, Inc. ADDRESS 80 Lister Avenue Newark, N.J.

   Owner's Well No. 1 SURFACE ELEVATION ____ Feet (Above mean sea level)

2. LOCATION 80 Lister Ave. Newark, N.J.

3. DATE COMPLETED Oct 18, 1949 DRILLER Wm. Stothoff Co. Inc.

4. DIAMETER: Top 10" Inches Bottom ____ Inches TOTAL DEPTH 445 Feet

5. CASING: Type See former report Diameter ____ Inches Length ____ Feet

6. SCREEN: Type ____ Size of Opening ____ Diameter ____ Inches Length ____ Feet

   Range in Depth { Top ____ Feet / Bottom ____ Feet } Geologic Formation ____

   Tail piece: Diameter ____ Inches Length ____ Feet

7. WELL FLOWS NATURALLY ____ Gallons per Minute at ____ Feet above surface

   Water rises to ____ Feet above surface

8. RECORD OF TEST: Date Oct 18, 1949 Yield ~~211~~ 122 Gallons per minute

   Static water level before pumping 155 Feet below surface

   Pumping level 187 feet below surface after 24 hours pumping

   Drawdown 32 Feet Specific Capacity ____ Gals. per min. per ft. of drawdown

   How Pumped Turbine pump How measured Orifice

   Observed effect on nearby wells ____

9. PERMANENT PUMPING EQUIPMENT:

   Type Turbine pump Capacity ____ Gallons per minute

   How Driven ____ Horse Power ____ R.P.M. ____

   Depth of pump in well ____ Feet Depth of foot piece in well ____ Feet

10. USED FOR Industrial purposes AMOUNT { Average ____ Gallons Daily / Maximum ____ Gallons Daily }

11. QUALITY OF WATER ____ Sample: Yes ____ No.

    Taste ____ Odor ____ Color ____ Temperature ____ °F

12. LOG See other side (Give details on back of sheet or on separate sheet) Are samples available? no

13. SOURCE OF DATA Well statement

14. DATA OBTAINED BY H.J.Stothoff DATE Nov 5, 1949

(Note:—Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements, etc.)

26.12.996
26-94

Report of work done on well originally drilled
last April, 1949

Depth of well was 359'
Drilled well from 359' to 445' 10" diameter
Test on well with Turbine pump 280' setting
flow 122 GPM 187' drawdown from the surface
Static water level 155'
Note As soon as the ~~xxxxx~~ water was pumped
below 187' pump would get air & gas.
Work done Sept 26-Oct 18, 1949

WELREC 088 0236

Form 89—5M—8-47

File in Triplicate
Sign all copies

DEPT. OF CONSERVATION & DIVISION OF WATER POLICY & SUPPLY
RECEIVED
FEB 20 1951

07/17

(Do not fill in)
Application No. 26-241
County Hudson
Location 26.23.1.2.3

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION
Division of Water Policy and Supply
28 West State Street
Trenton 8, New Jersey

APPLICATION FOR PERMIT TO DRILL WELL

An application must be submitted and permit received before drilling a well 100 feet or more in depth.

print or type

Owner Newark Plaster Co. Driller A.J.Connolly,Inc.

Address Jacobus Ave, Kearny,N.J. Address 100 So 10th St, Newark,N.J.

In compliance with the provisions of Chapter 377, P.L. 1947, application is hereby made for permit to drill a Cased to rock (type) well in Kearny,N.J. Hudson (municipality and county)

*Quantity of Water Needed (G.P.M.) 50 **Use of Well Manufacturing

Proposed Diameter of Well 8 inch Proposed Depth of Well 250 feet

Method of Drilling to be Used Churn

As a part of this application, and in consideration of the granting of a permit, applicant assumes full responsibility for plugging or sealing said well in a manner satisfactory to the Division, in the event it should become a menace to public health or safety.

Date Feb 14th 1951

Newark Plaster Co.
Frederick Tomkins, Pres.
Owner's Signature

* Quantities in excess of 100,000 gallons per day may require special application for right to divert water.
** Well used for public and potable purposes will require application and permit for right to divert water.

Location of Well (See other side)

PERMIT TO DRILL WELL

(Not to be filled in by Applicant)

The applicant is hereby granted a permit to drill this well subject to the conditions stipulated on the application and as set forth below.

Samples of Cuttings Required by Department { Yes / No ✓

Special Conditions

PERMIT IS VALID FOR ONE YEAR FROM DATE HEREOF

Permit Required to Divert Water { Yes / No ✓

Owner has Permit to Divert Water { Yes / No

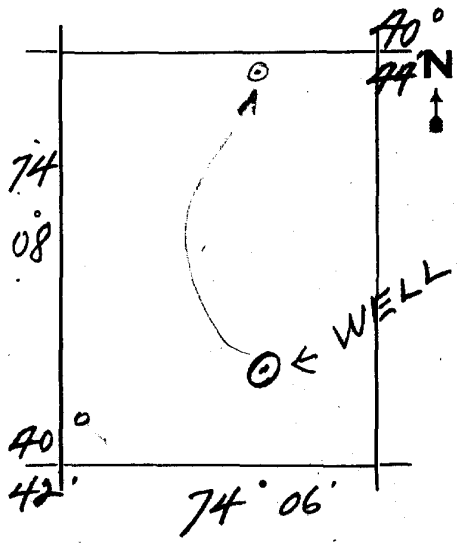
Date FEB 21 1951

R. L. Iaffa
Chief Engineer

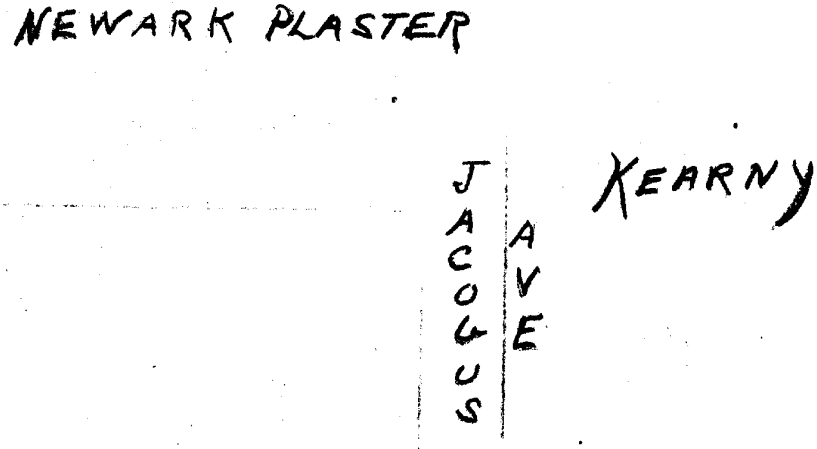
WELPMT 066 0509

Location of Well

1. Location Overlay for State Topographic Map, Scale 1″ = 1 Mile.



2. Sketch of premises in immediate vicinity showing relation of well to buildings, and distance and relations to nearest public road.



Form 99-5M-9-49

File in Triplicate
Sign all copies

14/13

(Do not fill in)
Application No. Z6-316

County

Location 26·22·3·3·7

STATE OF NEW JERSEY

DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
28 WEST STATE STREET
TRENTON 8, N. J.

APPLICATION FOR PERMIT TO DRILL WELL

An application must be submitted and permit received before drilling a well 100 feet or more in depth.

print or type

Owner Devoe and Reynolds, Inc. Driller A.J.Connolly, Inc.

Address Delancy & Rutherford Streets, Newark, N.J. Address 100 So 10th Street, Newark, N.J.

In compliance with the provisions of Chapter 377, P.L. 1947, application is hereby made for permit to drill a Cased (type) well in Newark Essex (municipality and county)

*Quantity of Water Needed (G.P.M.) 200 **Use of Well Process cooling.

Proposed Diameter of Well 10" Proposed Depth of Well 400 ft

Method of Drilling to be Used Cable tool

As a part of this application, and in consideration of the granting of a permit, applicant assumes full responsibility for plugging or sealing said well in a manner satisfactory to the Division, in the event it should become a menace to public health or safety.

Date 7/23/51 Walter K. Lipe Jr. Owner's Signature Plant Manager

* Quantities in excess of 100,000 gallons per day may require special application for right to divert water.
** Well used for public and potable purposes will require application and permit for right to divert water.

Location of Well (See other side)

PERMIT TO DRILL WELL

(Not to be filled in by Applicant)

The applicant is hereby granted a permit to drill this well subject to the conditions stipulated on the application and as set forth below.

WELL PERMIT APPROVED
AUG 6 1951
N. T. Critchlow DIRECTOR
DIV. OF WAT. POLICY & SUPPLY

Samples of Cuttings Required by Department { Yes / No ✓ } *Special Conditions*

Permit Required to Divert Water { Yes / No ✓ }

Owner has Permit to Divert Water { Yes / No }

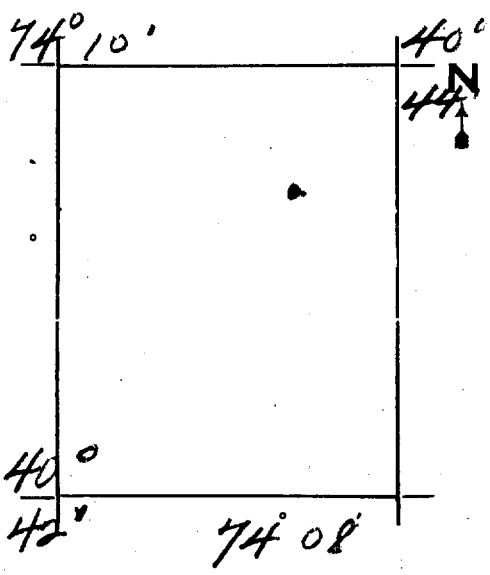
Date AUG 6 1951

Chief Engineer

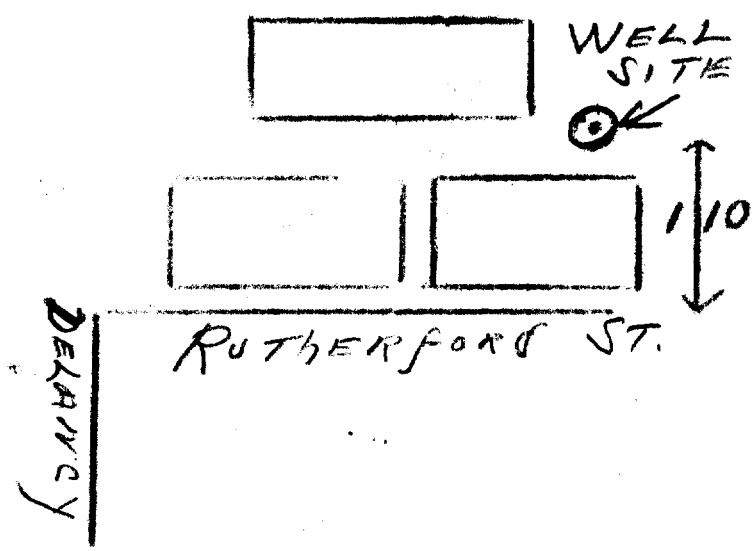
RECEIVED
AUG 3 1951
Department of Conservation
& Economic Development
Geologic & Top. Survey

Location of Well

1. Location Overlay for State Topographic Map, Scale 1" = 1 Mile.



2. Sketch of premises in immediate vicinity showing relation of well to buildings, and distance and relations to nearest public road.



Form 99-5M-9-49

no record

14/13

(Do not fill in) Application No. 26-362

County Essex

Location 26.22.3.6.1

File in Triplicate
Sign all copies

DEPT. CONS. & ECON. DEV. RECEIVED SEP 28 1951 DIVISION OF WATER POLICY & SUPPLY

STATE OF NEW JERSEY

DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
28 WEST STATE STREET
TRENTON 8, N. J.

APPLICATION FOR PERMIT TO DRILL WELL

An application must be submitted and permit received before drilling a well 100 feet or more in depth.

print or type

Owner John Engelhorn & Sons. Driller A.J.Connolly,Inc.

Address 19 Avenue L Address 100 So 10th Street,

Newark,N.J. Newark,N.J.

In compliance with the provisions of Chapter 377, P.L. 1947, application is hereby made for permit to drill a Two Cased to rock wells in Newark,N.J. Essex.

type municipality and county

*Quantity of Water Needed (G.P.M.) 350-400 **Use of Well Washing & cooling.

Proposed Diameter of Wells 14" Proposed Depth of Wells 600 feet.

Method of Drilling to be Used Churn.

As a part of this application, and in consideration of the granting of a permit, applicant assumes full responsibility for plugging or sealing said well in a manner satisfactory to the Division, in the event it should become a menace to public health or safety.

Date September 24th 1951 x Fred Engelhorn

Owner's Signature

* Quantities in excess of 100,000 gallons per day may require special application for right to divert water.

** Well used for public and potable purposes will require application and permit for right to divert water.

Location of Well (See other side)

PERMIT TO DRILL WELL

(Not to be filled in by Applicant)

Rec'd recd 3-21-57

The applicant is hereby granted a permit to drill this well subject to the conditions stipulated on the application and as set forth below.

Samples of Cuttings Required by Department { Yes / No ✓

Permit Required to Divert Water { Yes / No ✓

Owner has Permit to Divert Water { Yes / No

Special Conditions

1. Permit valid for one year from date hereof.
2. Permit covers construction of one well only. Second well at this location is covered by Permit No. 26-378.

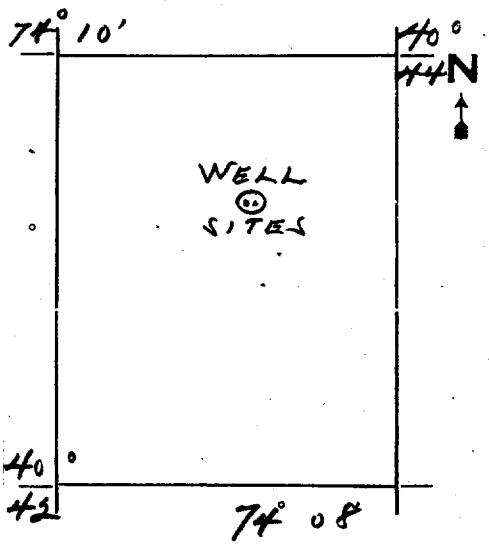
Date OCT 19 '51

Chief Engineer

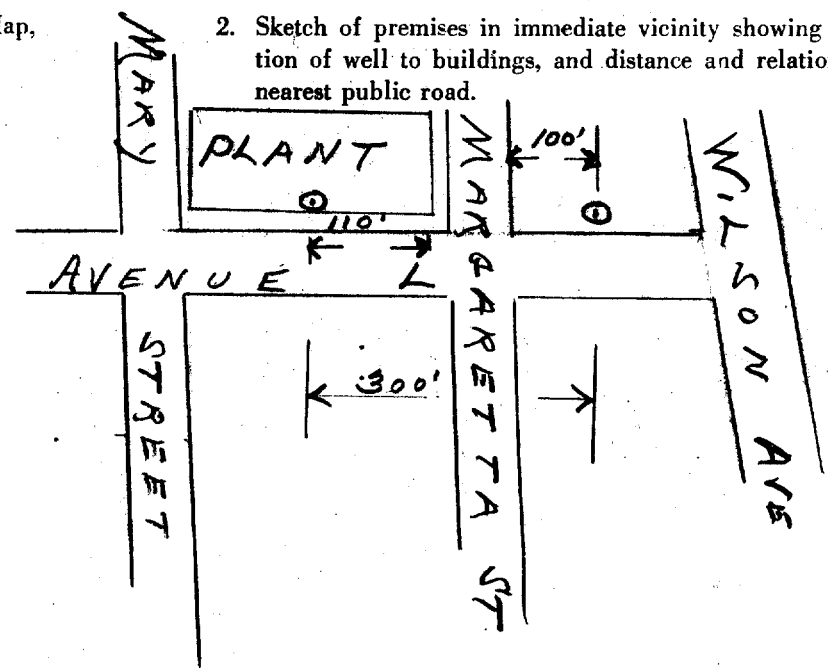
WELPMT 066 0743

Location of Well

1. Location Overlay for State Topographic Map, Scale 1" = 1 Mile.



2. Sketch of premises in immediate vicinity showing relation of well to buildings, and distance and relations to nearest public road.



26-22.361

Form 87

DEPT. CONS & ECON DEV
RECEIVED
MAR 26 1957
DIVISION OF
WATER POLICY & SUPPLY

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT
Division of Water Policy & Supply

WELL RECORD

Permit No 26-362
Application No
County Essex

E

1 OWNER John Engelhorn & Sonx ADDRESS 18 Avenue L, Newark, N. J.

Owner's Well No 1 SURFACE ELEVATION _____ Feet (Above mean sea level)

2 LOCATION Ave L between Margaretta and Mary Streets, Newark

3 DATE COMPLETED May 1952 DRILLER A. J. Connolly, Inc.

4 DIAMETER Top 14 Inches Bottom 10 Inches TOTAL DEPTH ~~Approx.~~ 500 Feet

5 CASING Type Steel Diameter 10 Inches Length 122 Feet

6 SCREEN Type _____ Size of Opening _____ Diameter _____ Inches Length _____ Feet

Range in Depth { Top _____ Feet / Bottom _____ Feet } Geologic Formation _____

Tail piece Diameter _____ Inches Length _____ Feet

7 WELL FLOWS NATURALLY _____ Gallons per Minute at _____ Feet above surface

Water rises to _____ Feet above surface

8 RECORD OF TEST Date May 1952 Yield 450 Gallons per minute

Static water level before pumping _____ Feet below surface

Pumping level 250 feet below surface after 24 hours pumping

Drawdown _____ Feet Specific Capacity _____ Gals per min per ft of drawdown

How Pumped Electric deep well turbine How measured orifice

Observed effect on nearby wells no

9 PERMANENT PUMPING EQUIPMENT

Type Deep Well Turbine Capacity 350 Gallons per minute

How Driven Electric motor Horse Power 50 R P M 1750

Depth of pump in well 250 Feet Depth of Foot piece in well 280 Feet

Depth of Air Line in well 250 Feet Type of Meter on Pump _____

10 USED FOR Cooling AMOUNT { Average _____ Gallons Daily / Maximum _____ Gallons Daily }

became brackish with pumping

11 QUALITY OF WATER Fair Sample Yes _____ No _____

Taste less Odor none Color clear Temperature 56 °F

12 LOG _____ Are samples available? _____
(Give details on back of sheet or on separate sheet)

13 SOURCE OF DATA A. J. Connolly

14 DATA OBTAINED BY A. J. Connolly, Inc. DATE March 21, 1957

(Note Use other side of this sheet for additional information such as log of materials penetrated analysis of the water sketch map sketch of special casing arrangements etc)

Form 99-5M-9-49

File in Triplicate
Sign all copies

14/13 file

(Do not fill in) Application No. 26-378

County Essex

Location 26.22.3.6.1 (same as 26-362)

DEPT. COMM. & ECON. DEV. RECEIVED OCT 18 1951 DIVISION OF WATER POLICY & SUPPLY

STATE OF NEW JERSEY

DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT

DIVISION OF WATER POLICY AND SUPPLY

28 WEST STATE STREET

TRENTON 8, N. J.

APPLICATION FOR PERMIT TO DRILL WELL

An application must be submitted and permit received before drilling a well 100 feet or more in depth.

print or type

Owner John Engelhorn & Sons. Driller A.J.Connolly,Inc.

Address 17-27 Avenue L, Address 100 So 10th Street,

Newark,N.J. Newark,N.J.

In compliance with the provisions of Chapter 377, P.L. 1947, application is hereby made for permit to drill a Cased - rock (type) well in Newark Essex (municipality and county)

*Quantity of Water Needed (G.P.M.) 300-350 **Use of Well Processing & cooling

Proposed Diameter of Well Fourteen (14)inch Proposed Depth of Well 600 ft

Method of Drilling to be Used Cable tool

As a part of this application, and in consideration of the granting of a permit, applicant assumes full responsibility for plugging or sealing said well in a manner satisfactory to the Division, in the event it should become a menace to public health or safety.

Date

Fred Engelhorn
Owner's Signature

* Quantities in excess of 100,000 gallons per day may require special application for right to divert water.

** Well used for public and potable purposes will require application and permit for right to divert water.

Location of Well (See other side)

PERMIT TO DRILL WELL

(Not to be filled in by Applicant)

The applicant is hereby granted a permit to drill this well subject to the conditions stipulated on the application and as set forth below.

Samples of Cuttings Required by Department { Yes / No ✓

Special Conditions

Permit valid for one year from date hereof.

Permit Required to Divert Water { Yes / No ✓

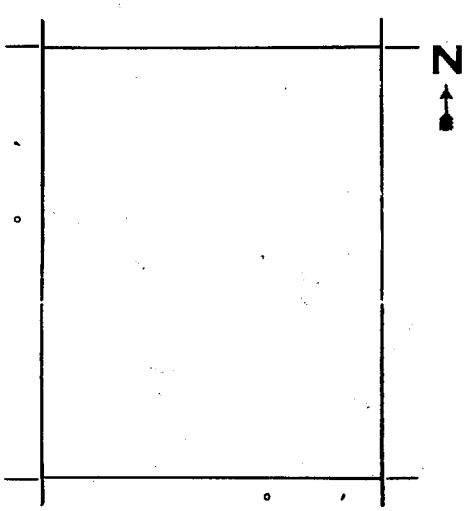
Owner has Permit to Divert Water { Yes / No

Date OCT 19 '51

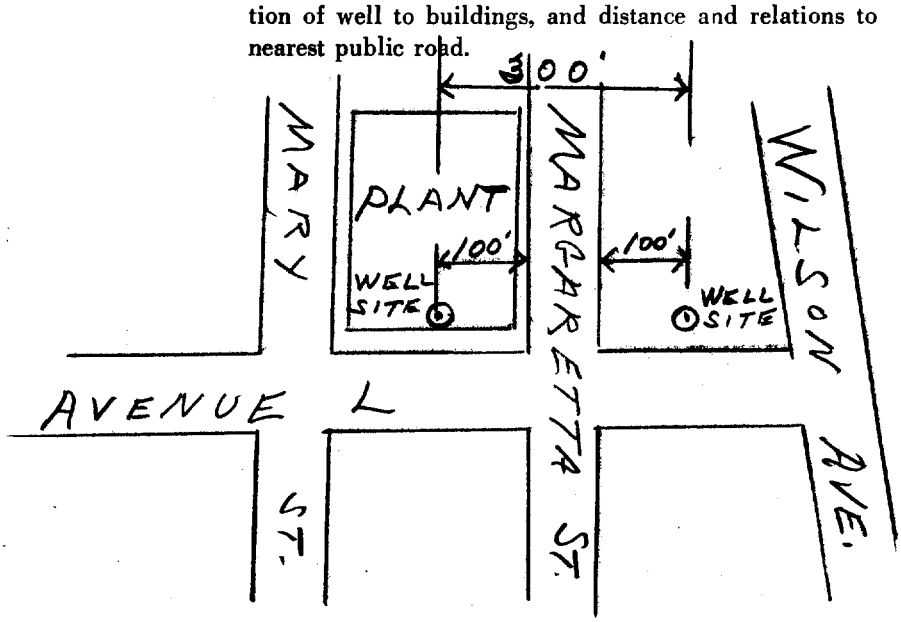
Chief Engineer

Location of Well

1. Location Overlay for State Topographic Map, Scale 1" = 1 Mile.



2. Sketch of premises in immediate vicinity showing relation of well to buildings, and distance and relations to nearest public road.



Form 99 (Rev.) 5M—7-51

(Do not fill in)
Application No. 26-429
County Essex
Location 26.13.7.7.8

Fill in and submit 3 copies
(white, blue, pink)

14/13

DEPT. CONS. & ECON. DEV. RECEIVED DIV. OF WATER POLICY & SUPPLY

Mail to
STATE GEOLOGIST
520 East State Street
Trenton 9, N. J.

STATE OF NEW JERSEY

DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
520 EAST STATE STREET
TRENTON 9, N. J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained **Prior** to the drilling of each well regardless of depth, except a drive-point or hand-dug well. Each application must be accompanied by the legal fee of Three Dollars ($3.00).

(print or type)

Owner ARDEN CHEMICAL Co. Driller GARDEN STATE ART. WELL & PUMP Co.
Address 60 BLANCHARD ST. Address 291 OLIVER ST.
NEWARK N.J. NEWARK 5, N.J.

In compliance with Chapter 377, P. L. 1947, as amended, application is made for a permit to drill a well in NEWARK (municipality) ESSEX (county) Use of Well INDUSTRIAL (domestic, industrial, public supply, test, etc.)

Quantity of Water Needed 90 G.P.M. Diameter of Well EIGHT In.

Proposed Depth of Well 350 Ft. Method of Drilling to be Used CABLE-TOOL (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet Only.

In accepting a permit for this well, the **Owner** agrees to abide by the following **General and Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well will **Not** convey any **Rights,** either expressed or implied, to **Divert Water.**

2. In the event this well is abandoned, the **Owner** will assume full responsibility for plugging or sealing it in a manner satisfactory to the Division, in accordance with the provisions of Chapter 193, Laws of 1951.

3. A permit to drill this well will be valid for one year from date of approval.

Date FEB. 7, 1952 X Bernard R. Epstein
Owner's Signature

(Not to be filled in by Applicant)

SPECIAL CONDITIONS

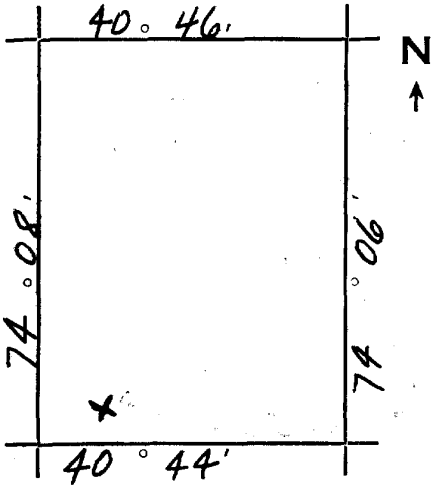
Samples of Cuttings Required by State Geologist { Yes / No ✓

WELL PERMIT APPROVED
FEB 11 1952
N. T. Critchlow
DIRECTOR
DIV. OF WATER POLICY & SUPPLY

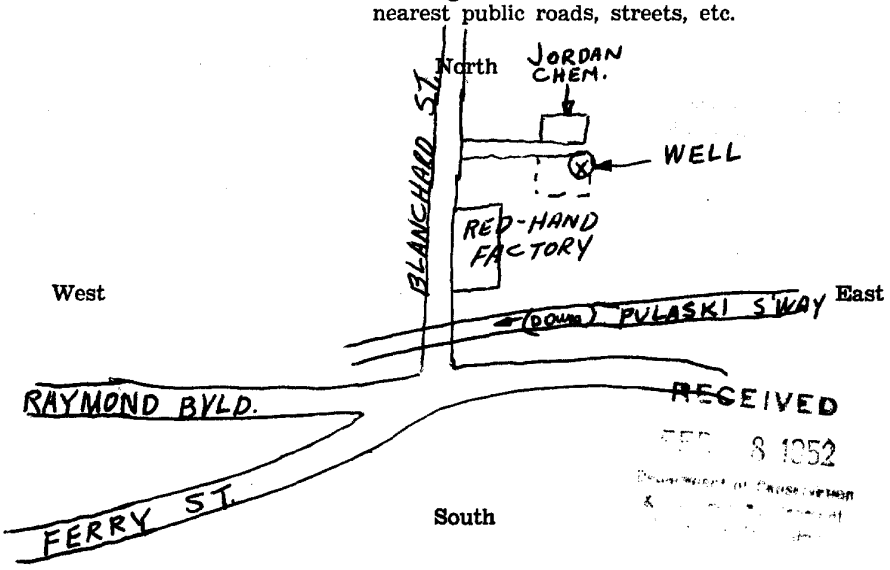
WELPMT 066 0877

LOCATION OF WELL

State Atlas Map No. 26



Draw sketch showing distances and relations of well site to nearest public roads, streets, etc.



RECEIVED
FEB 8 1952

26-13.778

Form 87-5M-8-51

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT
Division of Water Policy & Supply

WELL RECORD

Permit No. 26-429
Application No. _____
County _____

1. OWNER ARDEN CHEMICAL Co. ADDRESS 60 BLANCHARD ST. NWK, N.J.
   Owner's Well No. NO. #1 SURFACE ELEVATION _____ Feet (Above mean sea level)
2. LOCATION ABOVE
3. DATE COMPLETED 3-18-52 DRILLER S. D'ALESSIO GARDEN STATE ART. WELL & PUMP Co.
4. DIAMETER: Top 8 Inches Bottom 8 Inches TOTAL DEPTH 400 Feet
5. CASING: Type DRIVE-PIPE Diameter 8 Inches Length 90 Feet
6. SCREEN: Type NONE Size of Opening _____ Diameter _____ Inches Length _____ Feet
   Range in Depth { Top _____ Feet, Bottom _____ Feet } Geologic Formation _____
   Tail piece. Diameter _____ Inches Length _____ Feet
7. WELL FLOWS NATURALLY — Gallons per Minute at — Feet above surface
   Water rises to — Feet above surface
8. RECORD OF TEST: Date MARCH 19, 1952 Yield 90 Gallons per minute
   Static water level before pumping 21 Feet below surface
   Pumping level 120 feet below surface after 8 hours pumping
   Drawdown 99 Feet Specific Capacity 1.1 Gals. per min. per ft. of drawdown
   How Pumped DEEP WELL TURBINE How measured AIR LINE & GAUGE
   Observed effect on nearby wells NO OBSERVATIONS MADE
9. PERMANENT PUMPING EQUIPMENT: NONE
   Type _____ Capacity _____ Gallons per minute
   How Driven _____ Horse Power _____ R.P.M. _____
   Depth of pump in well _____ Feet Depth of Foot piece in well _____ Feet
   Depth of Air Line in well _____ Feet Type of Meter on Pump _____
10. USED FOR INDUSTRIAL AMOUNT { Average _____ Gallons Daily, Maximum _____ Gallons Daily }
11. QUALITY OF WATER GOOD Sample: Yes _____ No. ✓
    Taste NO Odor NO Color CLEAR Temperature ? °F
12. LOG CLAY MATRIX - SOFT SHALE - RED SHALE Are samples available? YES
    (Give details on back of sheet or on separate sheet)
13. SOURCE OF DATA BAIL
14. DATA OBTAINED BY DRILLER DATE 3/18/52

(Note: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements, etc.)

26·13·7·8·9

07/17

Form 90 (Rev. 4-56)

Application No. 26-1725

Mail to
STATE GEOLOGIST
520 EAST STATE STREET
TRENTON 25, N.J.

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
520 East State Street
Trenton 25, N. J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

DEPT. CONS. & ECON. DEV. RECEIVED OCT 8 - 1957 DIVISION OF WATER POLICY & SUPPLY

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained prior to the drilling of each well regardless of depth, except a drive-point or hand-dug well. Each application must be accompanied by the legal fee of three dollars ($3.00).

(Print or Type)

Owner Jersey Truck Center

Address South Kearny, N.J.

Driller VERONA WELL AND PUMP COMPANY
16 PINE STREET
VERONA, NEW JERSEY

Address

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well in

South Kearny (municipality) Hudson (county)

Use of well Washing trucks & Garage Purposes (domestic, industrial, public supply, test, etc.)

Diameter of Well 8" inches

Proposed Depth of Well 200 Feet

Proposed Capacity of Pump 150 G.P.M.

Method of Drilling cable (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet.

Date Oct. 4th, 1957

Signature of Owner Irving Auerbach

In accepting a permit for this well, the Owner agrees to abide by the following **General** and **Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well conveys no rights, either expressed or implied, to divert water.
2. **If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Division.**
3. In the event this well is abandoned, the Owner will assume full responsibility for plugging or sealing it in the manner satisfactory to the Division, in accordance with provisions of R. S. 58:4A-4.1.
4. A permit to drill this well will be valid for one year from date of approval.

SPECIAL CONDITIONS

WELL PERMIT APPROVED
OCT 8 1957
W. A. Chanklin
CHIEF ENGINEER
DIV. OF WATER POLICY & SUPPLY

☐ Samples of cuttings required every

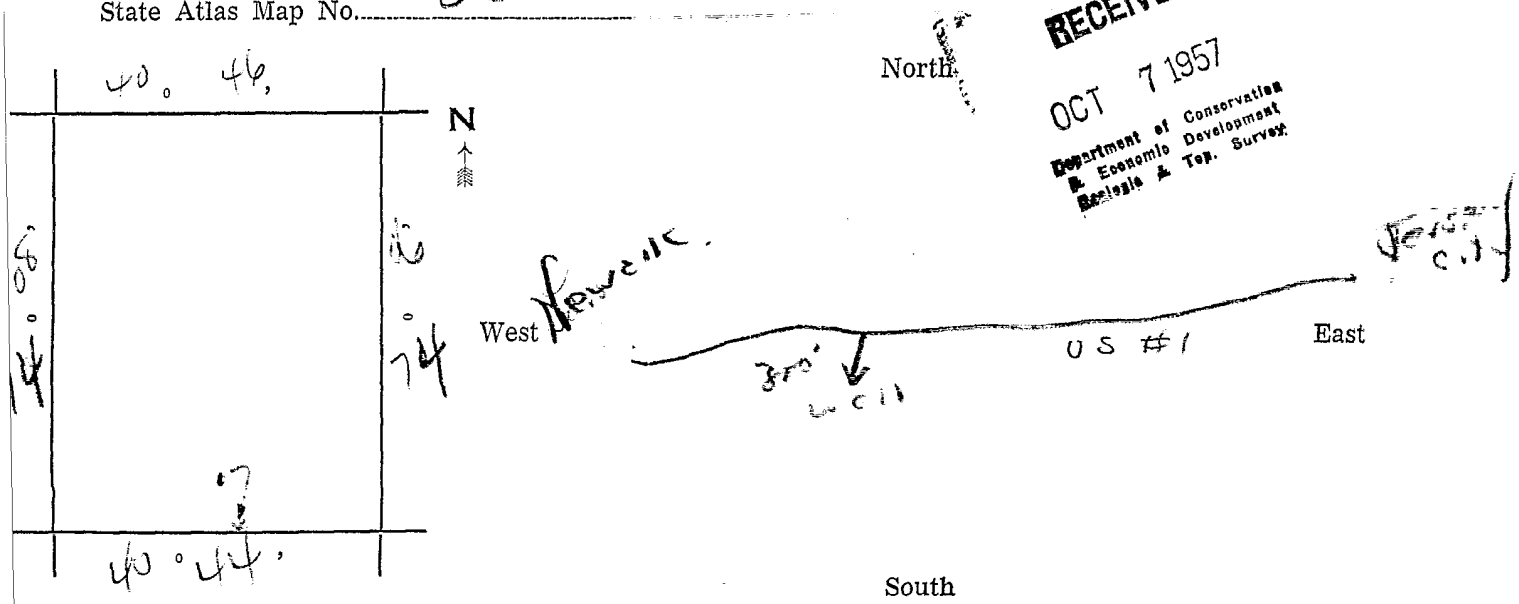
☑ No samples of cuttings required

WELPMT 066 3502

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No. 26



RECEIVED
OCT 7 1957
Department of Conservation & Economic Development Geologic & Top. Survey

Form 99 (Rev.) 4M—

DEPT. CONS. & ECON. DEV.
DIVISION OF
WATER POLICY AND SUPPLY

JAN 27 1958

RECEIVED

14/13

(Do not fill in) Application No. 26-1783 ✓
County .....
Location .....

26. 13. 175

Fill in and submit 3 copies
(white, blue, pink)

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
520 EAST STATE STREET
TRENTON 9, N. J.

Mail to
STATE GEOLOGIST
520 East State Street
Trenton 9, N. J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained **Prior** to the drilling of each well regardless of depth, except a drive-point or hand-dug well. Each application must be accompanied by the legal fee of Three Dollars ($3.00).

(Print or Type)

Owner NEWARK PARAFFINE PAPER CO. Driller PETE CHAFITELLI

Address 70 BLANCHARD ST., NEWARK 5, N.J. Address ~~606 NEW POINT RD.~~ 316 SECOND ST., ELIZABETH, N.J.

In compliance with Chapter 377, P. L. 1947, as amended, application is made for a permit to drill a well in

NEWARK (municipality) ESSEX (county) Use of Well INDUSTRIAL (domestic, industrial, public supply, test, etc.)

Quantity of Water Needed 50 G.P.M. Diameter of Well 8 In.

Proposed Depth of Well 200 Ft. Method of Drilling to be Used CABLE TOOLS (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet Only.

In accepting a permit for this well, the **Owner** agrees to abide by the following **General and Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well will **Not** convey any **Rights,** either expressed or implied, to **Divert Water.**
2. In the event this well is abandoned, the **Owner** will assume full responsibility for plugging or sealing it in the manner satisfactory to the Division, in accordance with the provisions of Chapter 193, Laws of 1951.
3. A permit to drill this well will be valid for one year from date of approval.

Date ..... G. S. Conci
Owner's Signature

(Not to be filled in by Applicant)

SPECIAL CONDITIONS

Samples of Cuttings Required by State Geologist { Yes / No ✓

WELL PERMIT
APPROVED
JAN 28 1958
DEPT. OF CONS. AND ECOM. DEV.
G. R. SHANKLIN
CHIEF ENGINEER
DIV. OF WATER POLICY & SUPPLY

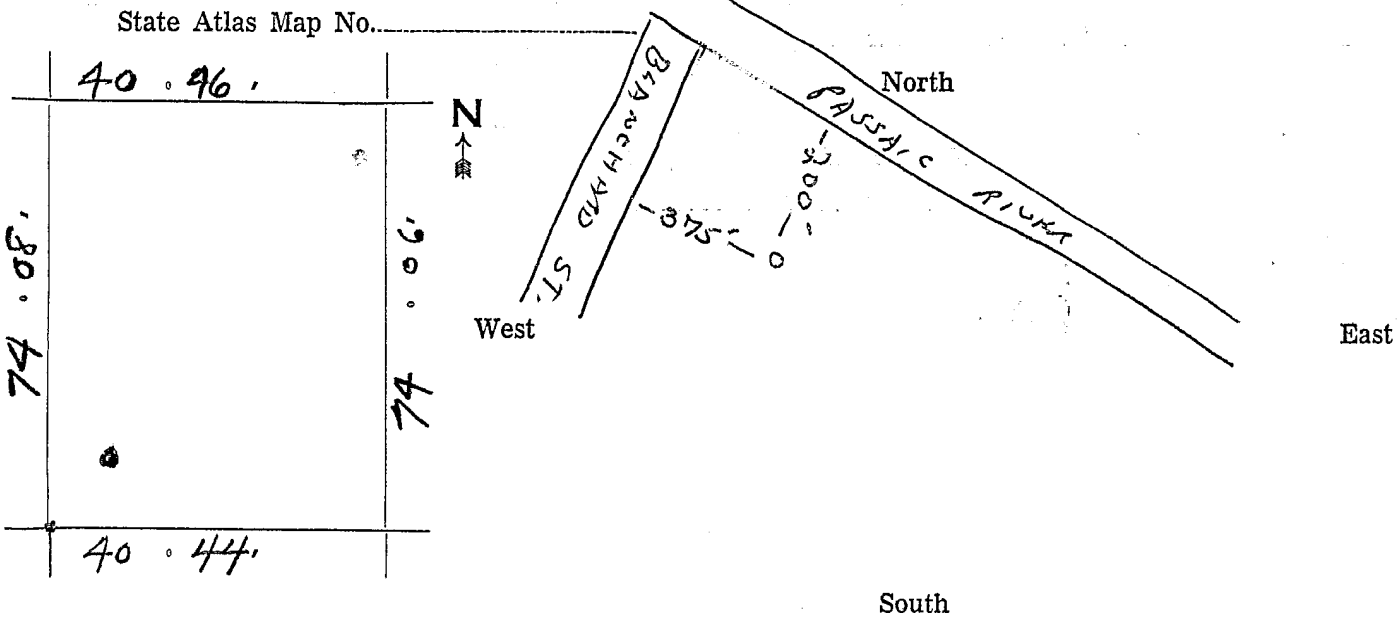
WELPMT 066 3619

RECEIVED
JAN 24 1958
Department of Conservation & Economic Development
Bureau of Top. Survey

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No.



FORM 87-10M

26-13-775

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY & SUPPLY

26-13-775

Permit No. 26-1783
Application No. _____
County _____

WELL RECORD

Red #

1. OWNER NEWARK PARAFFINE CO ADDRESS 70 BLANCHARD ST
Owner's Well No. #1 SURFACE ELEVATION 10 Feet (Above mean sea level)

2. LOCATION 70 BLANCHARD, NEWARK

3. DATE COMPLETED APRIL 10, 1958 DRILLER P. CHAFITELL

4. DIAMETER: top 8 Inches Botton 8 Inches TOTAL DEPTH 503 Feet

5. CASING: Type BLACK STAN. Diameter 8 Inches Length 70 Feet

6. SCREEN: Type — Size of Opening _____ Diameter — Inches Length — Feet
Range { Top — Feet Bottom — Feet } Geologic Formation T.R.B

Tail piece. Diameter — Inches Length — Feet

7. WELL FLOWS NATURALLY — Gallons per Minute at — Feet above surface
Water rises to — Feet above surface

8. RECORD OF TEST: Date APRIL 10, 58 Yield 100 GPM Gallons per minute
Static water level before pumping 26' Feet below surface
Pumping level 160' feet below surface after 3 hours pumping
Drawdown 134' Feet Specific Capacity _____ Gals. per min. per ft. of drawdown
How Pumped SUBMERSIBLE How measured AIR LINE
Observed effect on nearby wells NONE

9. PERMANENT PUMPING EQUIPMENT:
Type SUBMERSIBLE Mfrs. Name MEYERS
Capacity 150 G.P.M. How Driven MOTOR H.P. 15 R.P.M. _____
Depth of Pump in well 200 Feet — Depth of Footpiece in well — Feet
Depth of Air Line in well — Feet — Depth of Meter on Pump —

10. USED FOR INDUSTRIAL AMOUNT Average 800 Gallons Daily
Maximum 900 Gallons Daily

11. QUALITY OF WATER Salty Sample: Yes ____ No. ____
Taste OK Odor NONE Color CLEAR Temp. _____ °F

12. LOG 0-15 CLAY & STONES 15-503 SHALE Are samples available NO
(Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy)

13. SOURCE OF DATA _____

14. DATA OBTAINED BY P. CHAFITELLI Date APRIL 15, 1958

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements etc.)

26-23-1.4.7

Form 99 (Rev. 4-56)

14/13

Application No. 26-1904

Mail to
STATE GEOLOGIST
520 EAST STATE STREET
TRENTON 25, N. J.

DEPT. CONS. & ECON. DEV.
DIVISION OF WATER POLICY AND SUPPLY
SEP 10 1958
RECEIVED

STATE OF NEW JERSEY

DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
520 East State Street
Trenton 25, N. J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained prior to the drilling of each well regardless of depth, except a drive-point or hand-dug well. Each application must be accompanied by the legal fee of three dollars ($3.00).

(Print or Type)

Owner Revere Smelting Co. Driller Garden State Well & Pump Co.

Address Ave. P, Newark, N.J. Address 290 Oliver St., Newark, N.J.

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well in

Newark (municipality) Essex (county) Use of well Industrial (domestic, industrial, public supply, test, etc.)

Diameter of Well ten inches Proposed Depth of Well 500 Feet

Proposed Capacity of Pump 300 G.P.M. Method of Drilling cable-tool (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet.

Date _____ Signature of Owner Edward Parkes

In accepting a permit for this well, the Owner agrees to abide by the following **General** and **Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well conveys no rights, either expressed or implied, to divert water.
2. **If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Division.**
3. In the event this well is abandoned, the Owner will assume full responsibility for plugging or sealing it in the manner satisfactory to the Division, in accordance with provisions of R. S. 58:4A-4.1.
4. A permit to drill this well will be valid for one year from date of approval.

SPECIAL CONDITIONS

☑ Samples of cuttings required every _____

☐ No samples of cuttings required

WELL PERMIT
APPROVED
SEP 15 1958
DEPT. OF CONS. AND ECOM. DEV.
G. R. SHANKLIN
CHIEF ENGINEER
DIV. OF WATER POLICY & SUPPLY

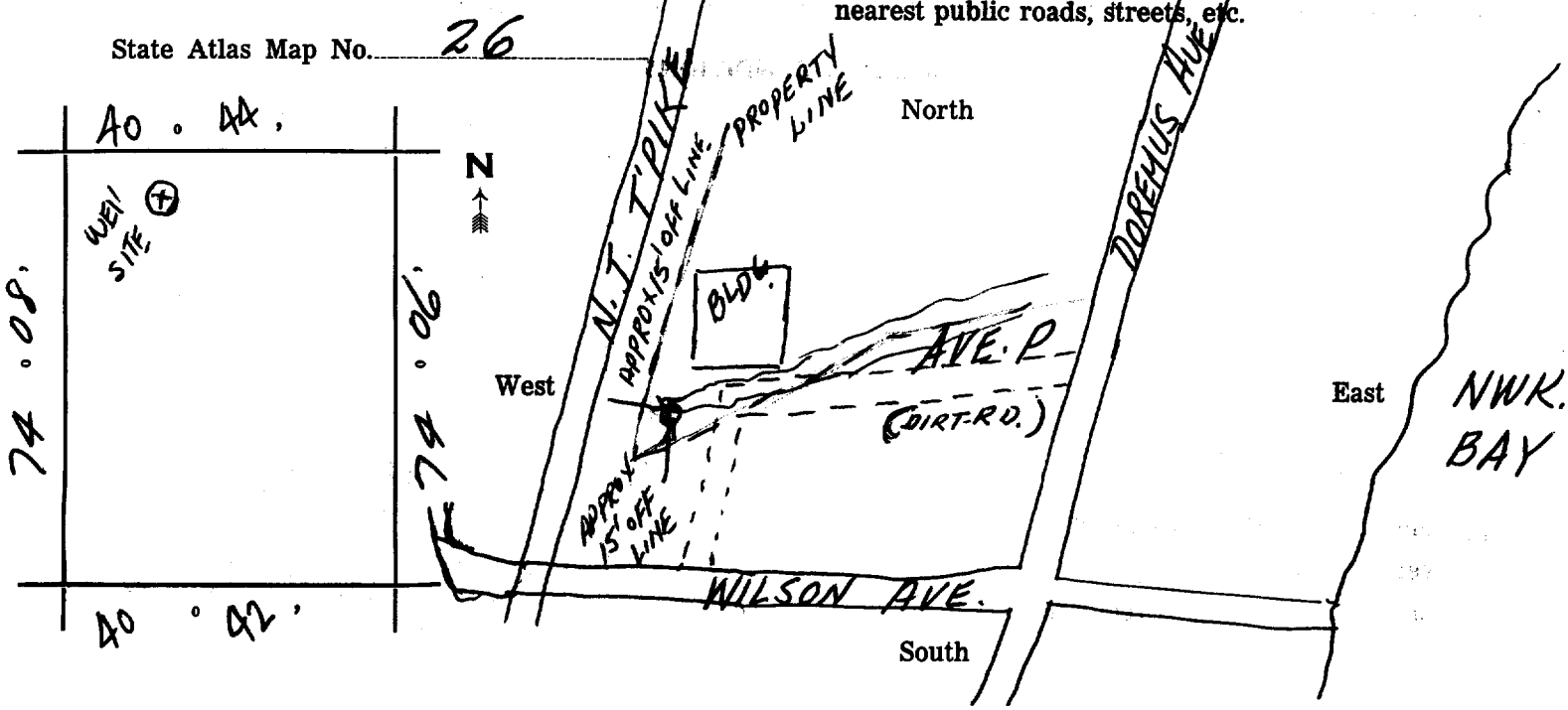
WELPMT 066 3863

RECEIVED
SEP 9 19
Department of Conservation & Economic Development
Geologic & Ind. Survey

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No. 26



26·13·7·7·5 ☐

Form 99 (Rev. 4-56)

14/13

Application No. 26-1940 ✓

Mail to
STATE GEOLOGIST
520 EAST STATE STREET
TRENTON 25, N. J.

DEPT. CONS. & ECON. DEV.
DIVISION OF
WATER POLICY AND SUPPLY
OCT 22 1958
RECEIVED

STATE OF NEW JERSEY

DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
520 East State Street
Trenton 25, N. J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained prior to the drilling of each well regardless of depth, except a drive-point or hand-dug well. Each application must be accompanied by the legal fee of three dollars ($3.00).

(Print or Type)

Owner Eureka Construction Corp. Driller Rinbrand Well Drilling Co Inc

Address 171 Blanchard St Address 14 Waldron Ave

Newark, N. J. Glen Rock N.J.

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well in

Newark (municipality) Essex (county) Use of well Industrial (domestic, industrial, public supply, test, etc.)

Diameter of Well Eight inches Proposed Depth of Well 200 Feet

Proposed Capacity of Pump 200 G.P.M. Method of Drilling Rotary (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet.

Date Signature of Owner Peter J. Capellino - Sec.

To correct Air pollution in a rendering plant.

In accepting a permit for this well, the Owner agrees to abide by the following **General** and **Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well conveys no rights, either expressed or implied, to divert water.
2. **If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Division.**
3. In the event this well is abandoned, the Owner will assume full responsibility for plugging or sealing it in the manner satisfactory to the Division, in accordance with provisions of R. S. 58:4A-4.1.
4. A permit to drill this well will be valid for one year from date of approval.

SPECIAL CONDITIONS

Verified by phone 11/3/58
that Eureka Const. Co.
is owner of rendering plant -
JCW.

WELL PERMIT
APPROVED
NOV 3 1958
DEPT. OF CONS. AND ECOM. DEV.
G. R. SHANKLIN
CHIEF ENGINEER
DIV. OF WATER POLICY & SUPPLY

☐ Samples of cuttings required
every

☑ No samples of cuttings required

WELPMT 066 3934

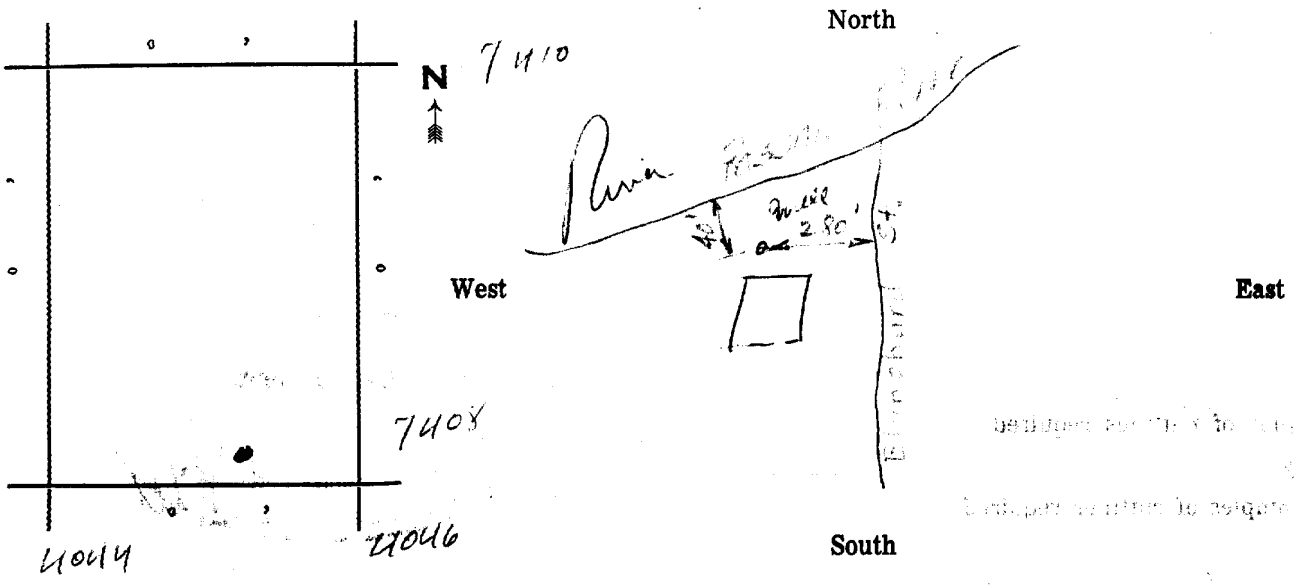
26.12.889

RECEIVED
OCT 2 7 1958
Department of Conservation
& Economic Development
Geologic & Top. Survey

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No. 26



DWR-135A
1-88

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

PERMIT NO. 26-1940
APPLICATION NO. _____
COUNTY Essex
COORD. 26-13-775

WELL RECORD

Red #

1. OWNER Eureka Construction Co. ADDRESS 171 Blanchard St.
   Owner's Well No. One SURFACE ELEVATION 10 (Above mean sea level) Feet
2. LOCATION Newark, NJ - Essex County
3. DATE COMPLETED 1-23-59 DRILLER Andy Hickerson
4. DIAMETER: Top 8 inches Bottom 8 inches TOTAL DEPTH 500 Feet
5. CASING: Type Steel Diameter 8 Inches Length 90 Feet
6. SCREEN: Type _____ Size of Opening _____ Diameter _____ Inches Length _____ Feet
   Range in Depth { Top _____ Feet / Bottom _____ Feet } Geologic Formation _____
   Tail Piece: Diameter _____ Inches Length _____ Feet
7. WELL FLOWS NATURALLY _____ Gallons per minute at _____ Feet above surface
   Water rises to _____ Feet above surface
8. RECORD OF TEST: Date 1-23-59 Yield 75 Gallons per minute
   Static water level before pumping 25 Feet below surface
   Pumping level 250 feet below surface after 18 hours pumping
   Drawdown 225 Feet Specific Capacity _____ Gals. per min. per ft. of drawdown
   How pumped Turbine How measured orifice
   Observed effect on nearby wells none
9. PERMANENT PUMPING EQUIPMENT:
   Type Turbine Mfrs. Name Deming
   Capacity 75 G.P.M. How Driven electric H.P. 15 R.P.M. 1750
   Depth of Pump in well 300 Feet Depth of Footpiece in well 30 Feet
   Depth of Air Line in well no Feet Type of Meter on Pump no Size _____ Inches
10. USED FOR Cooling AMOUNT { Average _____ Gallons Daily / Maximum _____ Gallons Daily }
11. QUALITY OF WATER _____ Sample: Yes X No _____
    Taste no Odor no Color Clear Temp. 54 °F.
12. LOG Clay, sand red rock & shale Are samples available? no
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy.)
13. SOURCE OF DATA Rinbrand Well Drlg. Co., Inc.
14. DATA OBTAINED BY Adam F. Rinbrand Date 2-10-59

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements, etc.)

2b-22·3·3·3·0

Form 99 (Rev. 4-56)

·14/13

Application No. 2d-2141

Mail to
STATE GEOLOGIST
520 EAST STATE STREET
TRENTON 25, N. J.

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
520 East State Street
Trenton 25, N. J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

DEPT. CONS. & ECON. DEV. DIVISION OF WATER POLICY AND SUPPLY RECEIVED NOV 6 1959

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained prior to the drilling of each well regardless of depth, except a drive-point or hand-dug well. Each application must be accompanied by the legal fee of three dollars ($3.00).

(Print or Type)

Owner ABLON FINISHES INC.

Address 84 Waydell Street

Newark, N.J.

Driller FRANK BOTT INC.

Address

Towaco, N.J.

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well in

Newark (municipality) Essex (county)

Use of well Industrial (domestic, industrial, public supply, test, etc.)

Diameter of Well 8 inches

Proposed Depth of Well 400 Feet

Proposed Capacity of Pump 200 G.P.M.

Method of Drilling (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet.

Date 10/16/59

Signature of Owner

In accepting a permit for this well, the Owner agrees to abide by the following **General** and **Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well conveys no rights, either expressed or implied, to divert water.
2. **If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Division.**
3. In the event this well is abandoned, the Owner will assume full responsibility for plugging or sealing it in the manner satisfactory to the Division, in accordance with provisions of R. S. 58:4A-4.1.
4. A permit to drill this well will be valid for one year from date of approval.

SPECIAL CONDITIONS

WELL PERMIT APPROVED NOV 9 1959 DEPT. OF CONS. AND ECON. DEV. G. R. SHANKLIN CHIEF ENGINEER DIV. OF WATER POLICY & SUPPLY

☐ Samples of cuttings required every

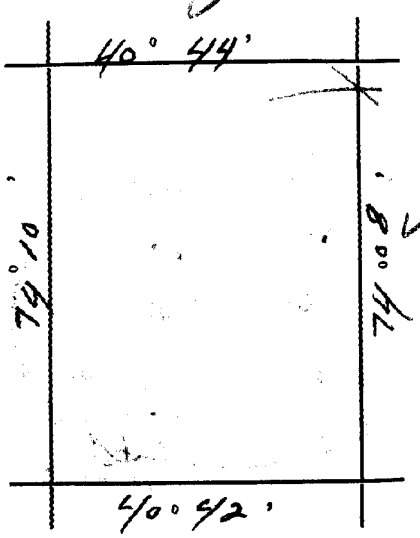
☑ No samples of cuttings required

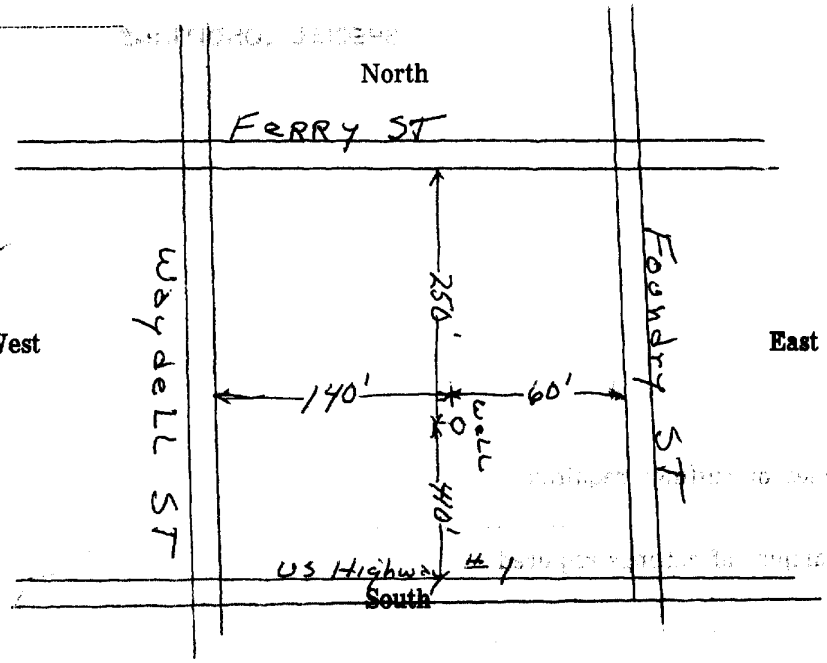
RECEIVED
NOV. 5 1959
~~OCT 23 1959~~
DIVT. OF CONSERVATION &
ECONOMIC DEVELOPMENT
GEOLOGIC & TOP. SURVEY

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No. 26





26-22-333

FORM 87

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY & SUPPLY

Permit No. 26 2141
Application No. _____
County _____

WELL RECORD

1. OWNER Ablon Finishes, Inc ADDRESS 84 Waydell St., Newark, N. J.
   Owner's Well No. 1 SURFACE ELEVATION _____ Feet (Above mean sea level)
2. LOCATION 84 Waydell St., Newark, N. J.
3. DATE COMPLETED 7/12/60 DRILLER Douglas Platt
4. DIAMETER: top 8 Inches Bottom 8 Inches TOTAL DEPTH 500 Feet
5. CASING: Type Steel Diameter 8 Inches Length 86 Feet
6. SCREEN: Type _____ Size of Opening _____ Diameter _____ Inches Length _____ Feet
   Range in Depth { Top _____ Feet / Bottom _____ Feet } Geologic Formation _____
   Tail piece: Diameter _____ Inches Length _____ Feet
7. WELL FLOWS NATURALLY _____ Gallons per Minute at _____ Feet above surface
   Water rises to _____ Feet above surface
8. RECORD OF TEST: Date 7/10/60 Yield 360 Gallons per minute
   Static water level before pumping 30 Feet below surface
   Pumping level 100 feet below surface after 8 hours pumping
   Drawdown 70 Feet Specific Capacity _____ Gals. per min. per ft. of drawdown
   How Pumped Turbine Pump How measured Orifice
   Observed effect on nearby wells none
9. PERMANENT PUMPING EQUIPMENT: not yet installed
   Type _____ Mfrs. Name _____
   Capacity _____ G.P.M. How Driven _____ H.P. _____ R.P.M. _____
   Depth of Pump in well _____ Feet Depth of Footpiece in well _____ Feet
   Depth of Air Line in well _____ Feet Type of Meter on Pump _____ Size _____ Inches
10. USED FOR Industrial AMOUNT { Average _____ Gallons Daily / Maximum _____ Gallons Daily }
11. QUALITY OF WATER good Sample: Yes _____ No. _____
    Taste _____ Odor _____ Color _____ Temp. _____ °F
12. LOG Clay & Dead Sand to 82' then all red rock Are samples available? _____
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy)
13. SOURCE OF DATA _____
14. DATA OBTAINED BY Frank Bott, Inc. Date 8/29/60

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements etc.)

DWR-020
10/92

New Jersey Department of Environmental Protection and Energy
Water Supply Element — Bureau of Water Allocation

WELL ABANDONMENT REPORT

MAIL TO:

Bureau of Water Allocation
CN 426
Trenton, NJ 08625-0426

14
13
STOC

WELL PERMIT # 26-2141
of well sealed

DATE WELL SEALED 10/14/93

PROPERTY OWNER Ablon Finishes, Inc.

ADDRESS 84 Waydell Street, Newark, NJ 07105

WELL LOCATION 84 Waydell Street, Newark, Essex
Street & No., Township, County
1, Lot 20, Block 2392, NJ Grid No. 26:22:333
Well No., Lot & Block No., Longitude & Latitude (N.J. Grid # may be substituted for longitude & latitude)

TYPE OF WELL ABANDONED: Production

REASON FOR ABANDONMENT: No longer in use

WAS A NEW WELL DRILLED? ☐ YES ☒ NO PERMIT # OF NEW WELL: _____

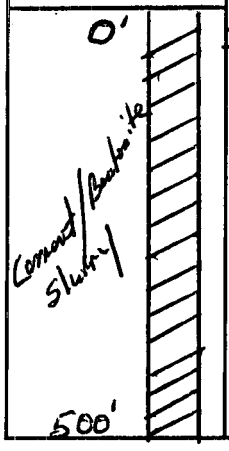
TOTAL DEPTH OF WELL 500'
DIAMETER 8"
CASING LENGTH 86'
SCREEN LENGTH –
NUMBER OF CASINGS 1

MATERIAL USED TO SEAL WELL:

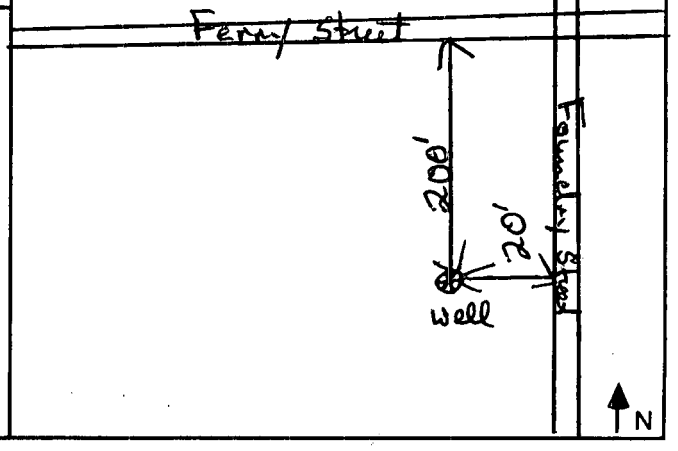
1136 Gallons of Water
13348 Lbs. of Cement
710 Lbs. of Bentonite
_____ Lbs. of Sand/Gravel
(none if well is contaminated)

FORMATION: X Consolidated
_____ Unconsolidated

Cross-section of sealed well



Draw a sketch showing distance and relations of well site to nearest roads, buildings, etc.



To permit adequate grouting, the casing should remain in place, but ungrouted liner pipes or any other obstructions must be removed. Pressure grouting is the only accepted method.

WAS CASING LEFT IN PLACE? ☒ YES ☐ NO CASING MATERIAL: Sch 40 Steel

WERE OTHER OBSTRUCTIONS REMOVED? ☐ YES ☒ NO WHAT WERE THE OBSTRUCTIONS: None Present

I certify that this well was sealed in accordance with N.J.A.C. 7:9-9.1 et seq.

Paul Vrabel/Samuel Stothoff Co., Inc. PO Box 306, Flemington, NJ 08822 — 10/11/93
Name of Person Doing Sealing Work (Print or Type) — Address — Mailing Date

Paul Vrabel
Signature of Person Doing Sealing Work

1545
License #

COPIES: White - Water Allocation Yellow - Owner Pink - Health Dept. Goldenrod - Driller

Form 99 (Rev. 4-56)

14/13

Application No. 26-2199

26.22.362

Mail to
STATE GEOLOGIST
520 EAST STATE STREET
TRENTON 25, N. J.

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
520 East State Street
Trenton 25, N. J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained **prior** to the drilling of each well regardless of depth, except a drive-point or hand-dug well. Each application must be accompanied by the legal fee of three dollars ($3.00).

(Print or Type)

Owner: T. Fiore & Sons
Address: 475-87 Ave P.
Newark N.J.

Driller: Verona Well & Pump Co
Address: 16 Pine St
Verona - NJ -

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well in

Newark - (municipality) Essex (county)

Use of well: Industrial - (domestic, industrial, public supply, test, etc.)

Diameter of Well: 8 inches

Proposed Depth of Well: 250 Feet

Proposed Capacity of Pump: 65 G.P.M.

Method of Drilling: Cable Tool - (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet.

Date: 3/17/60

Signature of Owner: Anthony Fiore

In accepting a permit for this well, the Owner agrees to abide by the following **General** and **Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well conveys no rights, either expressed or implied, to divert water.
2. **If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Division.**
3. In the event this well is abandoned, the Owner will assume full responsibility for plugging or sealing it in the manner satisfactory to the Division, in accordance with provisions of R. S. 58:4A-4.1.
4. A permit to drill this well will be valid for one year from date of approval.

SPECIAL CONDITIONS

WELL PERMIT
APPROVED
MAR 16 1960
G. R. Shanklin
CHIEF ENGINEER & ACTING DIRECTOR
DIV. OF WATER POLICY & SUPPLY

☐ Samples of cuttings required
every

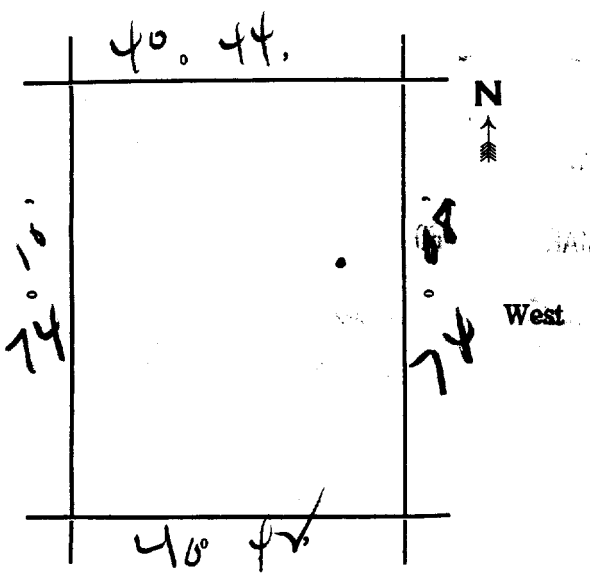
☐ No samples of cuttings required

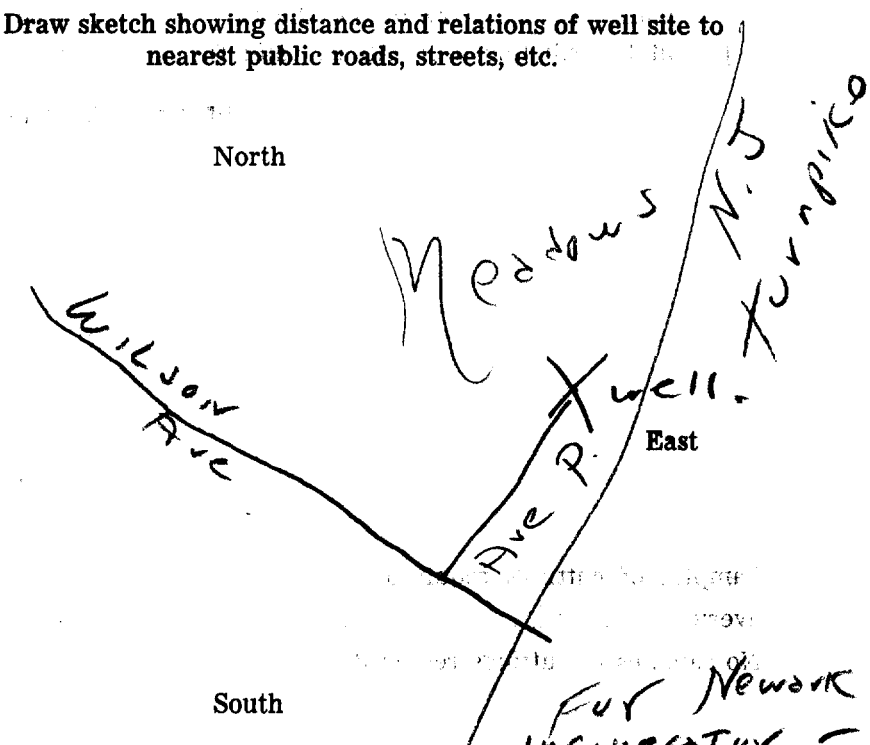
RECEIVED
MAR 16 1967
DEPT. OF CONSERVATION &
ECONOMIC DEVELOPMENT
GEOLOGIC & TOP. SURVEY

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No. 26





26-23-111 ☐

Form 99 (Rev. 4-56) 14/13

Application No. 26-3139

Mail to
STATE GEOLOGIST
P.O. BOX 1889
TRENTON, N.J. 08625

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY

Trenton N. J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained **prior** to the drilling of each well regardless of depth, **except a drive-point or** hand-dug well. Each application must be accompanied by the legal fee of three dollars **($3.00)**.

(Print or Type)

Owner Pfaff & Kowalski

Driller Somerville Well Drilling Co.

Address 84 Kossuth St
Newark NJ.

Address 972 Highway 202
Somerville, New Jersey

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well in

Newark (municipality) Essex (county)

Use of well Industrial (domestic, industrial public supply, test, etc.)

Diameter of Well 6 inches

Proposed Depth of Well 150 Feet

Proposed Capacity of Pump 30 G.P.M.

Method of Drilling Rotary (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet.

Date 6/3/65

Signature of Owner [signature]
Plant Engineer

In accepting a permit for this well, the Owner agrees to abide by the following **General** and **Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well conveys no rights, either expressed or implied, to divert water.
2. **If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Division.**
3. In the event this well is abandoned, the Owner will assume full responsibility for plugging or sealing it in the manner satisfactory to the Division, in accordance with provisions of R. S. 58:4A-4.1.
4. A permit to drill this well will be valid for one year from date of approval.

SPECIAL CONDITIONS

WELL PERMIT
APPROVED
JUN 8 1965
DEPT. OF CONS. AND ECON. DEV.
G. R. SHANKLIN
CHIEF ENGINEER
DIV. OF WATER POLICY & SUPPLY

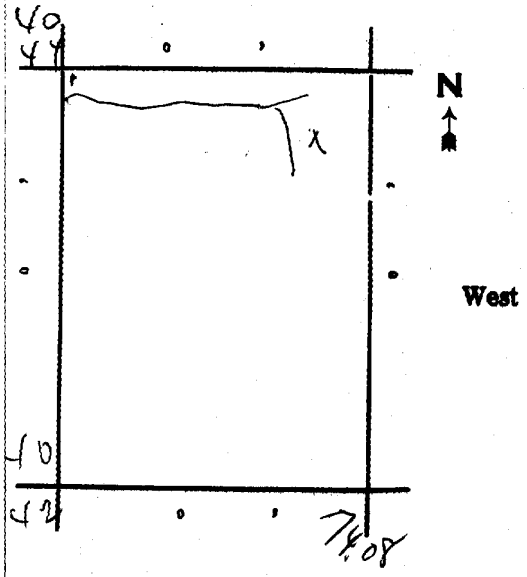
☐ Samples of cuttings required
every

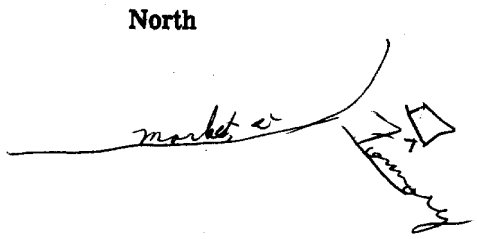
☐ No samples of cuttings required

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No. 26





RECEIVED
JUN 0 12 1984
GEOLOGY & TOPOGRAPHY

well no longer here - 26-23-111 ☐

FORM 87

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY & SUPPLY

Permit No. 26-3139
Application No. _____
County _____

WELL RECORD

1. OWNER Pfaff & Kendall ADDRESS 84 Foundry Street, Newark, N.J.
   Owner's Well No. _____ SURFACE ELEVATION _____ Feet (Above mean sea level)
2. LOCATION Foundry Street, Newark 5, N.J. 26-23-111
3. DATE COMPLETED 6/8/65 DRILLER Somerville Well Drilling Co.
4. DIAMETER: top 6 Inches Bottom 6 Inches TOTAL DEPTH 200 Feet
5. CASING: Type drive Diameter 6 Inches Length 81'6" Feet
6. SCREEN: Type _____ Size of Opening _____ Diameter _____ Inches Length _____ Feet
   Range in Depth { Top _____ Feet / Bottom _____ Feet } Geologic Formation _____
   Tail piece: Diameter _____ Inches Length _____ Feet
7. WELL FLOWS NATURALLY _____ Gallons per Minute at _____ Feet above surface
   Water rises to _____ Feet above surface
8. RECORD OF TEST: Date June 8, 1965 Yield 100 Gallons per minute
   Static water level before pumping 30 Feet below surface
   Pumping level 150 feet below surface after 8 hours pumping
   Drawdown 120 Feet Specific Capacity 2 Gals. per min. per ft. of drawdown
   How Pumped cylinder How measured bucket
   Observed effect on nearby wells none
9. PERMANENT PUMPING EQUIPMENT:
   Type _____ Mfrs. Name _____
   Capacity _____ G.P.M. How Driven _____ H.P. _____ R.P.M. _____
   Depth of Pump in well _____ Feet Depth of Footpiece in well _____ Feet
   Depth of Air Line in well _____ Feet Type of Meter on Pump _____ Size _____ Inches
10. USED FOR Industrial AMOUNT { Average _____ Gallons Daily / Maximum _____ Gallons Daily }
11. QUALITY OF WATER good Sample: Yes _____ No. _____
    Taste none Odor none Color clear Temp. _____ °F
12. LOG shale Are samples available? no
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy)
13. SOURCE OF DATA Somerville Well Drilling Co.
14. DATA OBTAINED BY Same Date 6/17/65

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements etc.)

DWR-020
8/94

New Jersey Department of Environmental Protection
Water Supply Element — Bureau of Water Allocation

WELL ABANDONMENT REPORT

14/13

MAIL TO: **Bureau of Water Allocation**
CN 426
Trenton, NJ 08625-0426

WELL PERMIT # ~~N/A~~ 26-3139
of well sealed

DATE WELL SEALED 3/14/95

PROPERTY OWNER Cooper Industries

ADDRESS 84 Foundry St. Newark

WELL LOCATION 84 Foundry St. Newark, Essex
Street & No., Township, County

N/A — Well No.
Lot 40 Blk-2402 — Lot & Block No.
74°09' 40°43' — Longitude & Latitude
(N.J. Grid # may be substituted for longitude & latitude)

USE OF WELL PRIOR TO ABANDONMENT: Production Water

REASON FOR ABANDONMENT: Not in Use

WAS A NEW WELL DRILLED? ☐ YES ☒ NO PERMIT # OF NEW WELL: _____

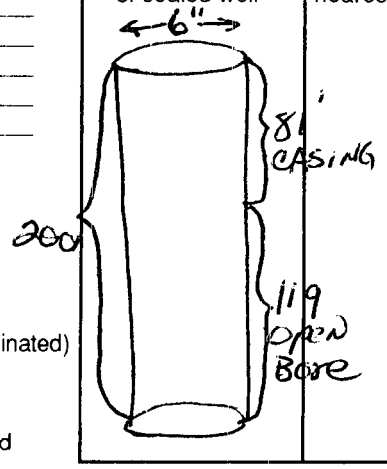
TOTAL DEPTH OF WELL 200'
DIAMETER 6"
CASING LENGTH 81'
SCREEN LENGTH —
NUMBER OF CASINGS 1

MATERIAL USED TO SEAL WELL:

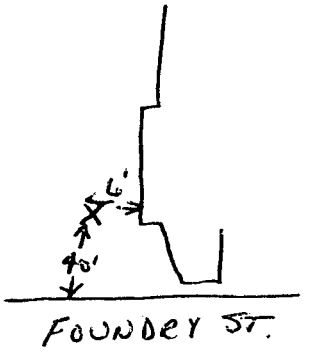
224 Gallons of Water
3760 Lbs. of Cement
— Lbs. of Bentonite
— Lbs. of Sand/Gravel
(none if well is contaminated)

FORMATION: X Consolidated
_____ Unconsolidated

Cross-section of sealed well



Draw a sketch showing distance and relations of well site to nearest roads, buildings, etc.



To permit adequate grouting, the casing should remain in place, but ungrouted liner pipes or any other obstructions must be removed. Pressure grouting is the only accepted method.

WAS CASING LEFT IN PLACE? ☒ YES ☐ NO CASING MATERIAL: Steel

WERE OTHER OBSTRUCTIONS LEFT IN WELL? ☐ YES ☒ NO WHAT WERE THE OBSTRUCTIONS: _____

IF "YES", AUTHORIZATION GRANTED BY _____ (NJDEP Official) ON _____ (Date)

I certify that this well was sealed in accordance with N.J.A.C. 7:9-9.1 et seq.

Paul Thomas — Name of NJ Certified Well Sealer Performing Work (Print or Type)

318 Vanderveer Rd, Bridgewater — Address

3/17/95 — Mailing Date

Paul Thomas — Signature of NJ Certified Well Sealer Performing Work

J1291 — License #

COPIES: White - Water Allocation Yellow - Owner Pink - Health Dept. Goldenrod - Driller

Form 99 (Rev. 4-56)

WELL SEALED 4/16/84

26-13-775

Application No. 26-3293

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY

Mail to
STATE GEOLOGIST
P.O. BOX 1889
TRENTON, N.J. 08625

14/13

Trenton N.J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained **prior** to the drilling of each well regardless of depth, **except a drive-point or** hand-dug well. Each application must be accompanied by the legal fee of three dollars **($3.00)**.

(Print or Type)

Owner FAIRMOUNT CHEMICAL CO INC Driller Somerville Well Drilling Co.

Address 117 BLANCHARD ST Address 972 Highway 202

NEWARK, N.J. Somerville, New Jersey

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well in

Newark (municipality) Essex (county) Use of well Industrial (domestic, industrial public supply, test, etc.)

Diameter of Well 8 inches Proposed Depth of Well 250 Feet

Proposed Capacity of Pump 60 G.P.M. Method of Drilling Rotary (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet.

Date 7/1/65 Signature of Owner Fairmount Chemical Co Inc

William C. Quinn V.P. Engineering

In accepting a permit for this well, the Owner agrees to abide by the following **General** and **Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well conveys no rights, either expressed or implied, to divert water.
2. **If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Division.**
3. In the event this well is abandoned, the Owner will assume full responsibility for plugging or sealing it in the manner satisfactory to the Division, in accordance with provisions of R. S. 58:4A-4.1.
4. A permit to drill this well will be valid for one year from date of approval.

SPECIAL CONDITIONS

WELL PERMIT
APPROVED
JUL 16 1965
DEPT. OF CONS. AND ECON. DEV.
G. R. SHANKLIN
CHIEF ENGINEER
DIV. OF WATER POLICY & SUPPLY

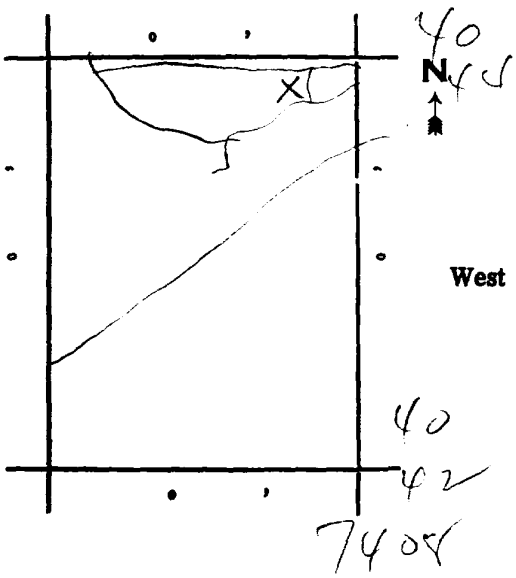
☐ Samples of cuttings required
every .....

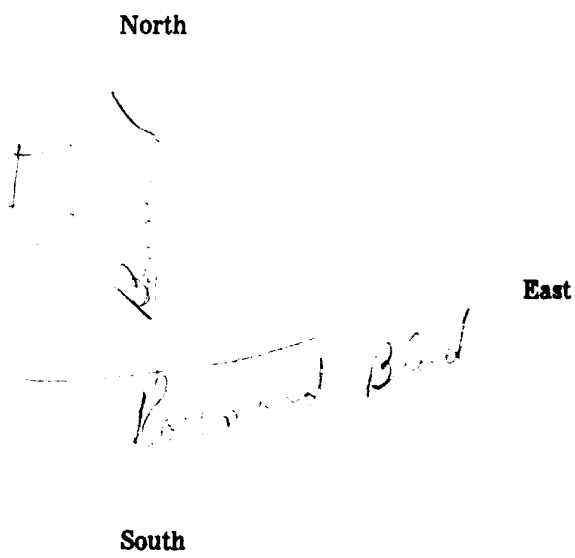
☐ No samples of cuttings required

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No. 26





Scott

FORM 87

26-13-77567
H

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY & SUPPLY

Permit No. 26-3293
Application No. _____
County _____

WELL RECORD

1. OWNER Fairmount Chemical Co., Inc. ADDRESS 117 Blanchard St., Newark, N.J.
   Owner's Well No. _____ SURFACE ELEVATION _____ Feet (Above mean sea level)
2. LOCATION 117 Blanchard St., Newark, Essex County
3. DATE COMPLETED Industrial DRILLER Somerville Well Drilling Co.
4. DIAMETER: top 8 Inches Bottom 8 Inches TOTAL DEPTH 300 Feet
5. CASING: Type LDrive Diameter 8 Inches Length 114 Feet
6. SCREEN: Type _____ Size of Opening _____ Diameter _____ Inches Length _____ Feet
   Range in Depth { Top _____ Feet, Bottom _____ Feet } Geologic Formation _____
   Tail piece: Diameter _____ Inches Length _____ Feet
7. WELL FLOWS NATURALLY _____ Gallons per Minute at _____ Feet above surface
   Water rises to _____ Feet above surface
8. RECORD OF TEST: Date 8/5/65 Yield 300 Gallons per minute
   Static water level before pumping 50 Feet below surface
   Pumping level 200 feet below surface after 8 hours pumping
   Drawdown 150 Feet Specific Capacity 2 Gals. per min. per ft. of drawdown
   How Pumped air How measured weir
   Observed effect on nearby wells none
9. PERMANENT PUMPING EQUIPMENT:
   Type _____ Mfrs. Name _____
   Capacity _____ G.P.M. How Driven _____ H.P. _____ R.P.M. _____
   Depth of Pump in well _____ Feet Depth of Footpiece in well _____ Feet
   Depth of Air Line in well _____ Feet Type of Meter on Pump _____ Size _____ Inches
10. USED FOR Industrial AMOUNT { Average _____ Gallons Daily, Maximum _____ Gallons Daily }
    Mr. Quinn says 1,200 ppm Cl⁻ in 12/67 & doesn't vary much - "Not too corrosive", pH slightly over 7.0
11. QUALITY OF WATER _____ Sample: Yes _____ No. x
    Taste slightly salty? Odor none Color ~~red shale, red~~ clear Temp. around 50 °F
12. LOG 0 - 55' overburden, 55'-300' sandstone Are samples available? no
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy)
13. SOURCE OF DATA Somerville Well Drilling Co.
14. DATA OBTAINED BY Same Date 8/9/65

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements etc.)

185

JCM

Form 99 (Rev. 4-56)

14/13

26-22-333 ☐ ✓

Application No. 26-3319

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY

Mail to
STATE GEOLOGIST
P.O. BOX 1889
TRENTON, N.J. 08625

Trenton N. J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained prior to the drilling of each well regardless of depth, except a drive-point or hand-dug well. Each application must be accompanied by the legal fee of three dollars ($3.00).

(Print or Type)

Owner Arkansas Comapny, Inc. Driller Somerville Well Drilling Co.

Address 185 Foundry Street Address 972 Highway 202

Newark, New Jersey Somerville, N.J.

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well in

Newark (municipality) Essex (county) Use of well Industrial (domestic, industrial public supply, test, etc.)

Diameter of Well 8 inches Proposed Depth of Well 200 Feet

Proposed Capacity of Pump 100 G.P.M. Method of Drilling Rotary (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet.

Date 7/12/65 Signature of Owner Colbert M. Saracco
Vice Pres. Production

In accepting a permit for this well, the Owner agrees to abide by the following **General** and **Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well conveys no rights, either expressed or implied, to divert water.
2. **If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Division.**
3. In the event this well is abandoned, the Owner will assume full responsibility for plugging or sealing it in the manner satisfactory to the Division, in accordance with provisions of R. S. 58:4A-4.1.
4. A permit to drill this well will be valid for one year from date of approval.

SPECIAL CONDITIONS

WELL PERMIT
APPROVED
JUL 23 1965
DEPT. OF CONS. AND ECOM. DEV.
G. R. SHANKLIN
CHIEF ENGINEER
DIV. OF WATER POLICY & SUPPLY

☐ Samples of cuttings required
every

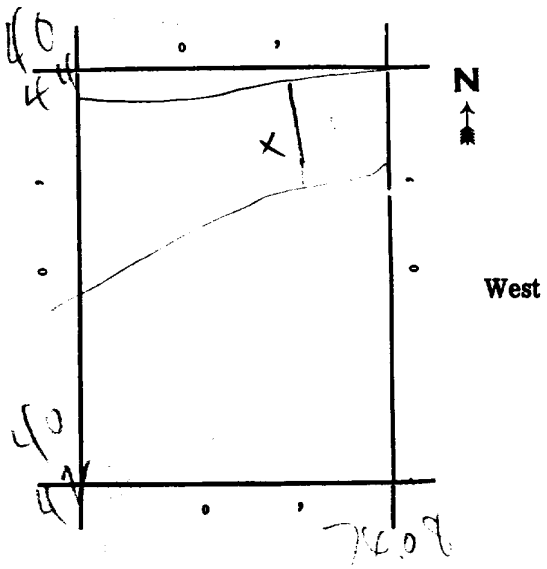
☐ No samples of cuttings required

RECEIVED
21 1:26 AM '6
GEOLOGY
TOPOGRAPHY

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No. 26



~~26-22-333~~ 26 23 114

FORM 87

(12)

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY & SUPPLY

Permit No 26 3319
Application No.
County Essex

WELL RECORD

1 OWNER Arkansas Company, Inc. ADDRESS 185 Foundry St., Newark, N.J.

Owner's Well No _____ SURFACE ELEVATION _____ Feet (Above mean sea level)

2 LOCATION Newark, Essex 185 Foundry St

3 DATE COMPLETED 9/8/65 DRILLER Somerville Well Drilling Co.

4 DIAMETER top 8 Inches Bottom 8 Inches TOTAL DEPTH 400 Feet

5 CASING Type Drive Diameter 8 Inches Length 72'9" Feet

6 SCREEN Type _____ Size of Opening _____ Diameter _____ Inches Length _____ Feet

Range in Depth { Top _____ Feet / Bottom _____ Feet } Geologic Formation _____

Tail piece: Diameter _____ Inches Length _____ Feet

7 WELL FLOWS NATURALLY _____ Gallons per Minute at _____ Feet above surface

Water rises to _____ Feet above surface

8 RECORD OF TEST Date 9/8/65 Yield 65 Gallons per minute

Static water level before pumping 20 Feet below surface

Pumping level 250 feet below surface after 5 8 hours pumping

Drawdown 230 Feet Specific Capacity _____ Gals per min per ft of drawdown

How Pumped air How measured 5 gal. pail

Observed effect on nearby wells none

9 PERMANENT PUMPING EQUIPMENT

Type _____ Mfrs Name _____

Capacity _____ G P M How Driven _____ H P _____ R P M _____

Depth of Pump in well _____ Feet Depth of Footpiece in well _____ Feet

Depth of Air Line in well _____ Feet Type of Meter on Pump _____ Size _____ Inches

10 USED FOR Industrial AMOUNT { Average _____ Gallons Daily / Maximum _____ Gallons Daily }

11 QUALITY OF WATER good Sample Yes _____ No x

Taste none Odor none Color clear Temp _____ °F

12 LOG red shale and red sand stone Are samples available? no
(Give details on back of sheet or on separate sheet If electric log was made please furnish copy)

13 SOURCE OF DATA Somerville Well Drilling Co.

14 DATA OBTAINED BY Same Date 9/14/65

(NOTE Use other side of this sheet for additional information such as log of materials penetrated analysis of the water sketch map sketch of special casing arrangements etc)

Form 99 (Rev. 4-56)

14/13

26-22-333 ☐

Application No. 263408

AUG 12 '65

RECEIVED

Mail to
STATE GEOLOGIST
520 EAST STATE STREET
TRENTON 25, N. J.

STATE OF NEW JERSEY

DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY

Trenton 25, N. J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained **prior** to the drilling of each well regardless of depth, except a **drive-point or** hand-dug well. Each application must be accompanied by the legal fee of three dollars **($3.00).**

(Print or Type)

Owner Ronson Metals Corp. Driller ALGEIER BROS.

Address 45-65 Mfg Place Address 9 Tuttle Ave.
Newark N.J. Hanover, N. J.
Artesian Well Drillers

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well in

Newark (municipality) Essex (county) Use of well Industrial (domestic, industrial, public supply, test, etc.)

Diameter of Well 8" inches Proposed Depth of Well 300 Feet

Proposed Capacity of Pump 100 G.P.M. Method of Drilling Cable Tool (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet.

Date Aug 6-65 Signature of Owner J. S. Hirschhorn
Vice President

In accepting a permit for this well, the Owner agrees to abide by the following **General** and **Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well conveys no rights, either expressed or implied, to divert water.
2. **If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Division.**
3. In the event this well is abandoned, the Owner will assume full responsibility for plugging or sealing it in the manner satisfactory to the Division, in accordance with provisions of R. S. 58:4A-4.1.
4. A permit to drill this well will be valid for one year from date of approval.

SPECIAL CONDITIONS

WELL PERMIT
APPROVED
AUG 13 1965
DEPT. OF CONS. AND ECOM. DEV.
G. R. SHANKLIN
CHIEF ENGINEER
DIV. OF WATER POLICY & SUPPLY

☐ Samples of cuttings required
every

☐ No samples of cuttings required

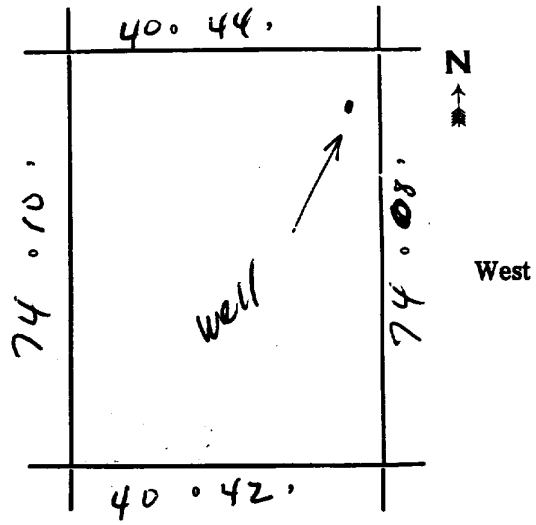
RECEIVED
GEOLOGY
TOPOGRAPHY

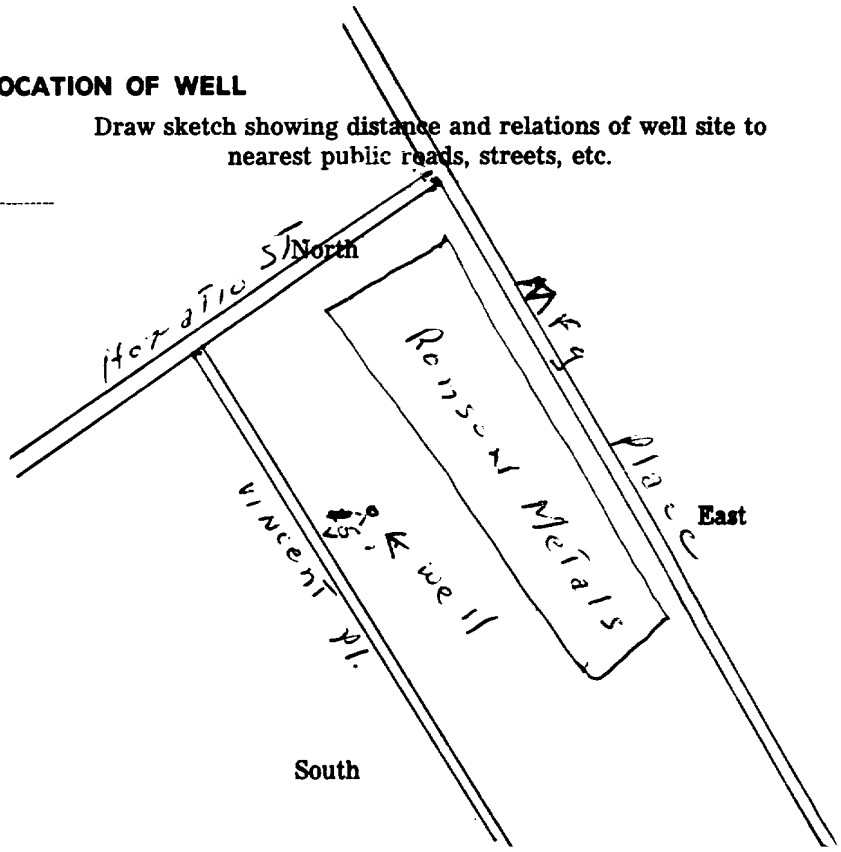
RECEIVED
SEP 23 3 32 PM '94
GEOLOGY
&
TOPOGRAPHY

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No. 26





(11)

FORM 87

26-22-333

ALGEIER BROS.
9 Tuttle Ave.
Hanover, N. J.
Artesian Well Drillers

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY & SUPPLY

Red #

Permit No. 263468
Application No. _____
County Essex

WELL RECORD

1. OWNER Ronson Metals Corp. ADDRESS 45-65 Manufacturers Pl.
   Owner's Well No. _____ SURFACE ELEVATION _____ Feet (Above mean sea level)
2. LOCATION Newark N.J.
3. DATE COMPLETED September-22 DRILLER Algeier Bros
4. DIAMETER: top 8 Inches Bottom 8 Inches TOTAL DEPTH 300 Feet
5. CASING: Type Blk Threaded Diameter 8 Inches Length 80 Feet
6. SCREEN: Type _____ Size of Opening ____ Diameter _____ Inches Length _____ Feet
   Range in Depth { Top _____ Feet / Bottom _____ Feet } Geologic Formation _____
   Tail piece: Diameter _____ Inches Length _____ Feet
7. WELL FLOWS NATURALLY _____ Gallons per Minute at _____ Feet above surface
   Water rises to _____ Feet above surface
8. RECORD OF TEST: Date Sept. 22 Yield 220 Gallons per minute
   Static water level before pumping 56 Feet below surface
   Pumping level 70 feet below surface after 8 hours pumping
   Drawdown 14 Feet Specific Capacity _____ Gals. per min. per ft. of drawdown
   How Pumped Submercible Pump How measured _____
   Observed effect on nearby wells _____
9. PERMANENT PUMPING EQUIPMENT:
   Type Submercible Mfrs. Name Fairbanks + Morse
   Capacity 150 G.P.M. How Driven Elect. H.P. 15 R.P.M. 3450
   Depth of Pump in well 140 Feet Depth of Footpiece in well _____ Feet
   Depth of Air Line in well ____ Feet Type of Meter on Pump _____ Size ____ Inches
10. USED FOR Industrial AMOUNT { Average _____ Gallons Daily / Maximum _____ Gallons Daily }
11. QUALITY OF WATER _____ Sample: Yes ____ No. ____
    Taste _____ Odor None Color Clear Temp. _____ °F
12. LOG _____ Are samples available? _____
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy)
13. SOURCE OF DATA _____
14. DATA OBTAINED BY Conrad Algeier Date Dec 1 1965

Additional information must be kept of materials encountered

WELREC 090 2523

26-22-333
26-3408

0 - 8 ft. fill
8 - 25 fine sand
25 - 50 clay + grit
50 - 75 Dirty sand
75 - 80 - red hard pan
80 - 300 red sand stone

10/7/65
Rec'd

DWR-020
8/97

ENTERED CK

14 X 13 E

26-3408

New Jersey Department of Environmental Protection
Water Supply Element - Bureau of Water Allocation

WELL ABANDONMENT REPORT

MAIL TO **Bureau of Water Allocation**
PO Box 426
Trenton, NJ 08625-0426

WELL PERMIT # ~~7-14-2000~~ of well sealed

DATE WELL SEALED 7-14-2000

PROPERTY OWNER PROMETCOR INC. (FORMERLY RONSON METALS CORP)

ADDRESS CORPORATE Park #3, Campus DR. P.O. Box 6709, Summit NJ

WELL LOCATION 55 MANUFACTURERS PLACE, NEWARK, ESSEX COUNTY
Street & No , Township, County

Well No	Lot No	Block No
	6	2395

USE OF WELL PRIOR TO ABANDONMENT INDUSTRIAL

REASON FOR ABANDONMENT DEMOLITION

WAS A NEW WELL DRILLED? ☐YES ☒NO PERMIT # OF NEW WELL ____

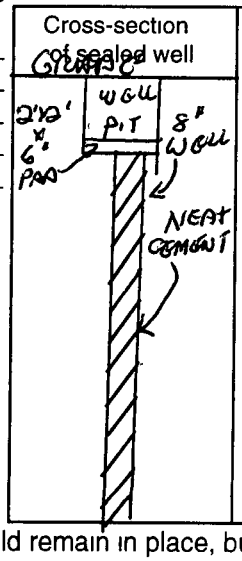
TOTAL DEPTH OF WELL 300'
DIAMETER 8"
CASING LENGTH —
SCREEN LENGTH 0
NUMBER OF CASINGS 1

MATERIAL USED TO DECOMMISSION WELL

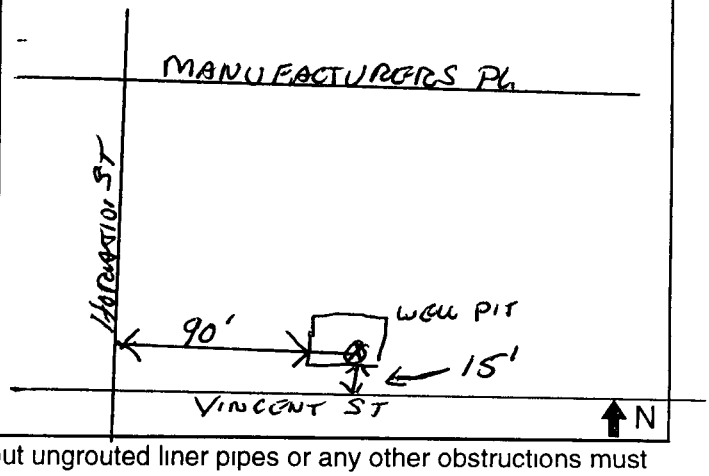
561 Gallons of Water
9,558 Lbs of Cement
0 Lbs of Bentonite
0 Lbs of Sand/Gravel
(none if well is contaminated)

FORMATION X Consolidated
____ Unconsolidated

Cross-section of sealed well



Draw a sketch showing distance and relations of well site to nearest roads, buildings, etc



To permit adequate grouting, the casing should remain in place, but ungrouted liner pipes or any other obstructions must be removed Pressure grouting is the only accepted method

WAS CASING LEFT IN PLACE? ☒ YES ☐ NO CASING MATERIAL 8" BLACK STEEL

WERE OTHER OBSTRUCTIONS LEFT IN WELL? ☐YES ☒NO WHAT WERE THE OBSTRUCTIONS ____

IF "YES", AUTHORIZATION GRANTED BY ____ (NJDEP Official) ON ____ (Date)

Was an alternative decommissioning method used? ☐ YES ☐NO

IF "YES", authorization granted by ____ (NJDEP Official) ON 7-21-2000 (Date)

I certify that this well was sealed in accordance with N J A C 7 9-9 1 et seq

Performing Work (Print or Type) Name of NJ Certified Well Sealer	Address	Mailing Date
RICHARD B BRYAN	P.O. BOX 274 CHESTER, NJ	7-25-2000
	Signature of NJ Certified Well Sealer Performing Work	Registration # 0619M

COPIES *White - Water Allocation* *Yellow - Owner* *Pink - Health Dept* *Goldenrod - Driller*

Form 99 (Rev. 4-56)

14/13 26-13-771 ☐

Application No. 26-4136

STATE OF NEW JERSEY

DEPARTMENT OF CONSERVATION & ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY

Mail to
STATE GEOLOGIST
P.O. BOX 1889
TRENTON, N.J. 08625

Trenton N.J.

Make Checks Payable to
DIVISION OF WATER POLICY & SUPPLY

APPLICATION FOR PERMIT TO DRILL WELL

Permit must be obtained **prior** to the drilling of each well regardless of depth, except a drive-point or hand-dug well. Each application must be accompanied by the legal fee of three dollars ($3.00).

(Print or Type)

Owner: Fairmount Chemical Co.
Address: Blanchard Street, Newark, New Jersey

Driller: Somerville Well Drilling Co.
Address: 972 Highway 202, Somerville Well Drilling Co.

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well in

Newark (municipality) Essex (county)

Use of well: cooling (domestic, industrial public supply, test, etc.)

Diameter of Well: 8 inches

Proposed Depth of Well: 300 Feet

Proposed Capacity of Pump: 60 G.P.M.

Method of Drilling: Rotary (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet.

Date: 8/30/67

Signature of Owner: William C. Quinn
V. P. Engineering, Fairmount Chemical Co.

In accepting a permit for this well, the Owner agrees to abide by the following **General** and **Special Conditions:**

GENERAL CONDITIONS

1. The issuance of a permit to drill this well conveys no rights, either expressed or implied, to divert water.
2. **If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Division.**
3. In the event this well is abandoned, the Owner will assume full responsibility for plugging or sealing it in the manner satisfactory to the Division, in accordance with provisions of R. S. 58:4A-4.1.
4. A permit to drill this well will be valid for one year from date of approval.

SPECIAL CONDITIONS

WELL PERMIT
APPROVED
SEP 7 1967
DEPT. OF CONS. AND ECON. DEV.
G. R. SHA[illegible]
DIV. OF WATER POLICY & SUPPLY

☐ Samples of cuttings required every _____

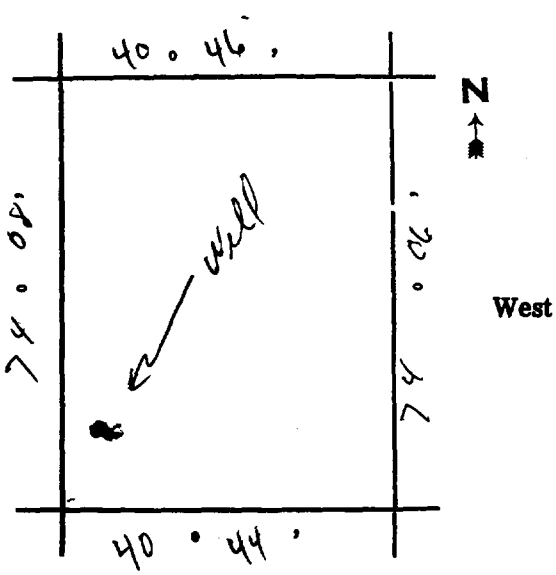
☐ No samples of cuttings required

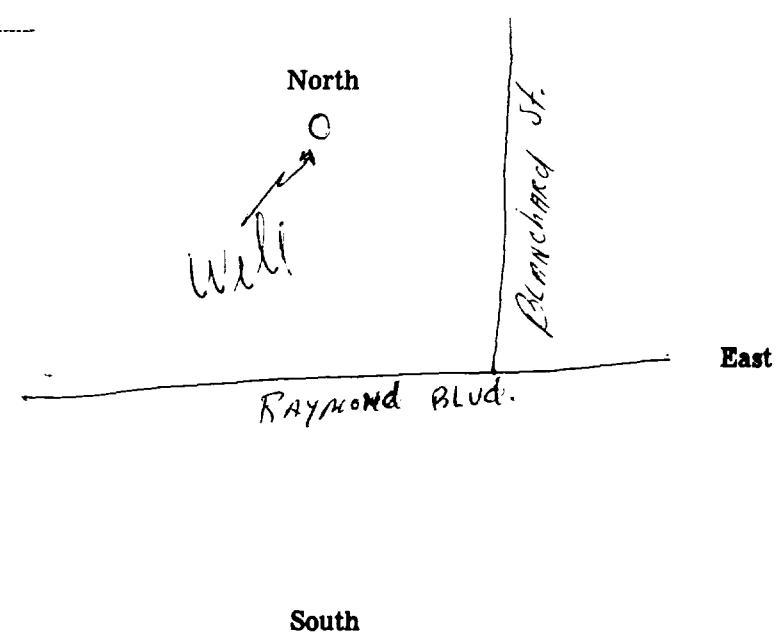
RECEIVED
SEP 6 3 33 PM '67
GEOLOGY
&
TOPOGRAPHY

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No. 26





26-13-775 ☐

FORM 87

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY & SUPPLY

Permit No 26-4136
Application No.
County ESSEX

WELL RECORD

1 OWNER Fairmount Chemical Co. ADDRESS 117 Blanchard Street, Newark, N.J.

Owner's Well No SURFACE ELEVATION Feet (Above mean sea level)

2 LOCATION 117 BLANCHARD ST, NEWARK ~~Newark, Essex County~~

3 DATE COMPLETED 9/18/68 DRILLER ~~Somerville Well Drilling Co.~~

4 DIAMETER top 12 Inches Bottom 8 Inches TOTAL DEPTH 250 Feet

5 CASING Type ~~Drive~~ Diameter 8" Inches Length 74 Feet

6 SCREEN Type Size of Opening Diameter Inches Length Feet

Range in Depth { Top Feet / Bottom Feet } Geologic Formation

Tail piece Diameter Inches Length Feet

7 WELL FLOWS NATURALLY Gallons per Minute at Feet above surface

Water rises to Feet above surface

8 RECORD OF TEST Date 9/18/67 Yield 200 Gallons per minute

Static water level before pumping 70 Feet below surface

Pumping level 210 feet below surface after hours pumping

Drawdown 140 Feet Specific Capacity 2 Gals per min per ft of drawdown

How Pumped air test How measured

Observed effect on nearby wells ~~none~~

9 PERMANENT PUMPING EQUIPMENT

Type Mfrs Name

Capacity G P M How Driven H P R P M

Depth of Pum in well Feet Depth of Footpiece in well Feet

Depth of Air Line in well Feet Type of Meter on Pump Size Inches

10 USED FOR ~~cooling~~ AMOUNT { Average Gallons Daily / Maximum Gallons Daily }

11 QUALITY OF WATER good Sample Yes No xx

Taste none Odor none Color clear Temp °F

12 LOG ~~argillite~~ Are samples available? ~~no~~
(Give details on back of sheet or on separate sheet If electric log was made please furnish copy)

13 SOURCE OF DATA Somerville Well Drilling Co.

14 DATA OBTAINED BY Same Date 3/8/68

(NOTE Use other side of this sheet for additional information such as log of materials penetrated analysis of the water sketch map sketch of special casing arrangements etc)

26-3293
26-4136

HYDRO GROUP

LAYNE WELL & PUMP DIVISION

April 23, 1984

E

Department of Environmental Protection
Division of Water Resources
P O Box 2809
Trenton, N J 08625

Re Fairmount Chemical
Newark, N J
Well Abandonment

Gentlemen

Please be advised that during the week of April 16, 1984 two water wells were sealed in accordance with NJSA58 4A-4, sub-chapter 9

These wells are located on the property known as 117 Blanchard Street Newark, N J

Respectfully submitted,

HYDRO GROUP, INC.

John A Headley, Jr.
License #1149

JAH sg
Encl

~~26-3293~~
26-4136 ?

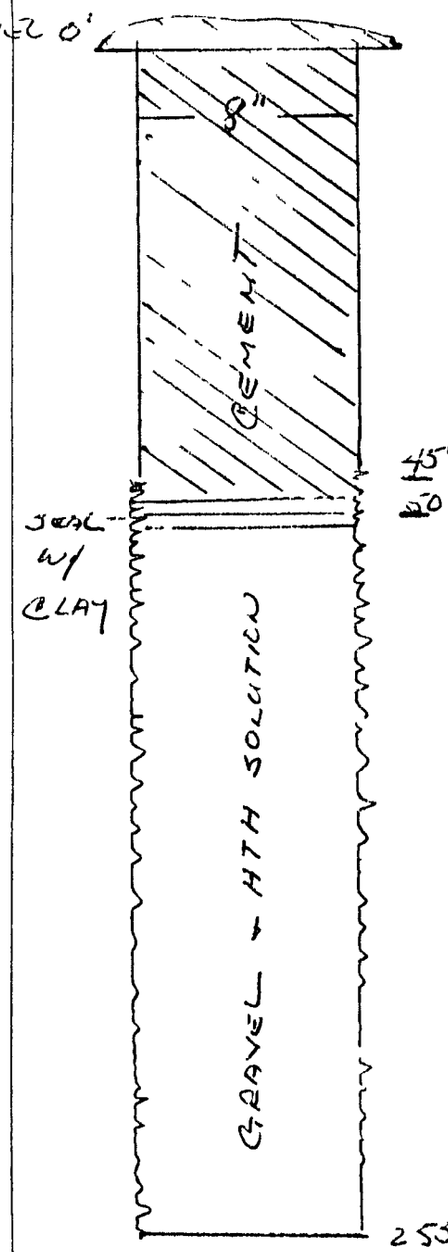
LAYNE-NEW YORK CO., INC
1250 WEST ELIZABETH AVE., LINDEN, N J

DRILLERS REPORT

JOB No 594702 DRILLER R GOMEZ CUSTOMER WELL No 1
CUSTOMER FAIRMOUNT CHEMICAL LAYNE WELL No 1
WELL LOCATION NEWARK, N J STATE PERMIT No

FORMATION | SKETCH OF SETTING | REMARKS

ABANDON WELL #1



PIPE SET
DIA WALL LGTH MATL T & C (OR) WELDED

ELEV GL

PIPE LEFT IN PLACE
DIA WALL LGTH MATL T & C (OR) WELDED

SCREEN:
Nom Size I D Lgth Opng
Mfg Type Metal Ga No
Set In Formation
Well Undereamed To Diameter

MISCELLANEOUS
R & L Back Off Cut Off Packer Type

CONE
Dia Top Dia Bott Lgth Mtl

PLUG
Dia Lgth Mtl

GRAVEL **CLAY**
Amt Bags Pwdr Reg
Size Bags Layneite B 3

CEMENT **SEAL**
Bags Used Clay 1 BAG Cement 1 CU. YDS.
Yds Concrete Lgth 50

METHOD OF DRILLING
☐ Std Rot ☐ Rev Rot ☐ Cable Tool ☐ Air Rot
☐ Other

MEASUREMENTS
Ground Elev Above Sea Level
Depth Of Well After Plug 255' } From { ☐ Grd Lev ☐ Top Of ___ Casing ☐ Orig Grd Lev
Depth To Gravel Wall

MISCELLANEOUS
Date Work Started 4/12/84 Date First Pumped
Did Well Clear Up How Soon
Was Sand Pumped How Long
How Long Agitated How Long Pumped
Chem Used To Develop Sample Taken

PRELIMINARY TEST DATA
Static Level 12' 6" Date 4/12/84 Water Temp
Capacity GPM With Pumping Level

SKETCH OF LOCATION

R A Gomez
SIGNATURE OF DRILLER

2M 1 68WP

26-22-Se 14 Mr. No ✓

Form 39 (Rev. 6-70)

14/13

Application No. 26-4514

STATE OF NEW JERSEY

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
TRENTON, N. J.

Mail to
STATE GEOLOGIST
P.O. BOX 1889
TRENTON, N.J. 08625

Make Checks Payable to:
BUREAU OF GEOLOGY & TOPOGRAPHY

APPLICATION FOR PERMIT TO DRILL WELL

Application must be accompanied by a legal fee of five dollars ($5.00).

(Print or Type)

Owner Ronson Metals Corp. Driller Wm. Stothoff Co. Inc.

Address 55 Manufacturers Place Address P.O. Box 68

~~Newark, N.J.~~ Flemington, N.J. 08822

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well in

lot # block # Newark (municipality) Essex (county)

Use of well ~~Industrial - Diffussion~~ (semi-public, domestic, industrial, public supply, test, etc.)

Diameter of Well 8" inches Proposed Depth of Well 300' Feet

Proposed Capacity of Pump 150 Diffussion G.P.M. Method of Drilling Rotary (cable-tool, rotary, jet, etc.)

Show Location on Back of this Sheet.

Date March 27, 1973 Signature of Owner Edward Klein
Plant Mgr. Ronson Metals Corp

1. The issuance of a permit to drill this well conveys no rights, either expressed or implied, to divert water.
2. **If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Division.**
3. In the event this well is abandoned, the Owner will assume full responsibility for plugging or sealing it in the manner satsifactory to the Division, in accordance with provisions of R. S. 58:4A-4.1.
4. A permit to drill this well will be valid for one year from date of approval.
5. If this well is to be used for domestic or semi-public supply it must be constructed in accordance with provisions of "Standards for the Construction of Water Supply Systems for Realty Improvements (Revised 1966)" and be approved by the local Board of Health.

All water introduced into this well must be from a source approved by the Bureau of Potable Water.

This space for Approval Stamp

WELL PERMIT
APPROVED
APR 6 1973
DEPT. OF ENVIRO MENTA PROT.
Div of Water Resources
CHARLES M. PIKE
DIRECTOR

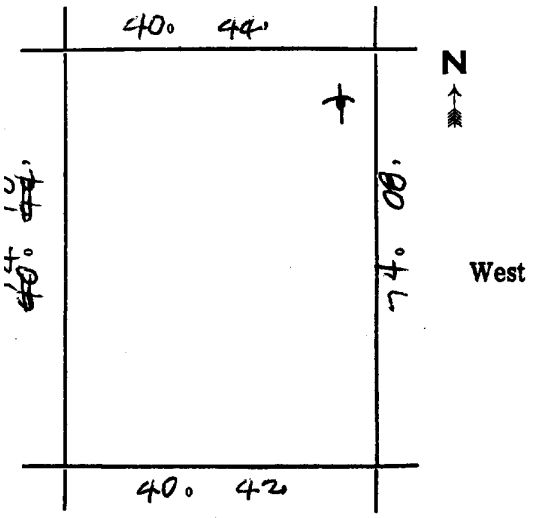
☐ Samples of cuttings required
every

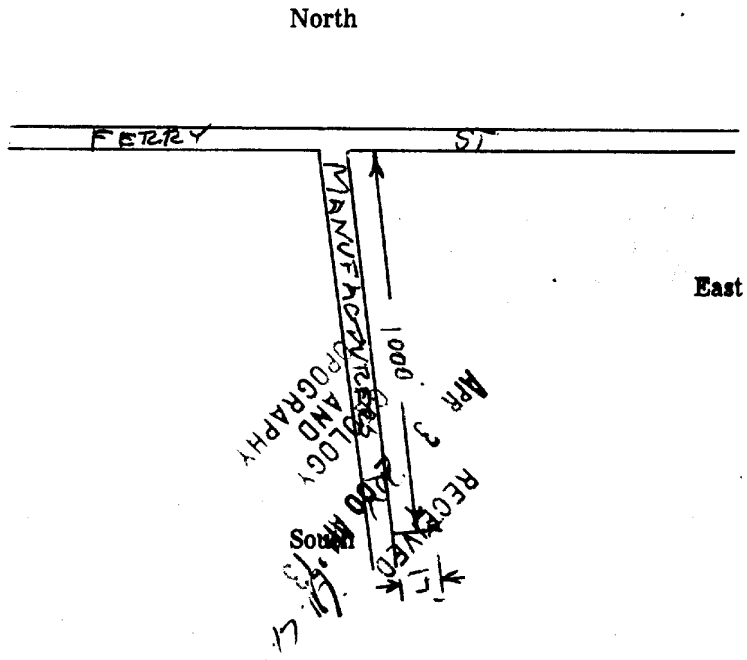
☐ No samples of cuttings required

LOCATION OF WELL

Draw sketch showing distance and relations of well site to nearest public roads, streets, etc.

State Atlas Map No. 26





FORM 87

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

26-22-333

WELL RECORD

Permit No. 26-4514
Application No. _____
County _____

1. OWNER Ronson Metals Corp. ADDRESS 55 Manufacturers Pl.Newark, N.J.
   Owner's Well No. _____ SURFACE ELEVATION _____ Feet (Above mean sea level)
2. LOCATION Newark, Essex County, N. J.
3. DATE COMPLETED April 12, 1973 DRILLER Wm. Stothoff Co., Inc.
4. DIAMETER: top 8 Inches Bottom 8 Inches TOTAL DEPTH 300 Feet
5. CASING: Type Steel Pipe Diameter 8 Inches Length 88 Feet
6. SCREEN: Type _____ Size of Opening ____ Diameter _____ Inches Length _____ Feet
   Range in Depth { Top _____ Feet / Bottom _____ Feet } Geologic Formation RG
   Tail piece: Diameter _____ Inches Length _____ Feet
7. WELL FLOWS NATURALLY _____ Gallons per Minute at _____ Feet above surface
   Water rises to _____ Feet above surface
8. RECORD OF TEST: Date 4-12-73 Yield 150 Gallons per minute
   Static water level before pumping 35 Feet below surface
   Pumping level _____ feet below surface after _____ hours pumping
   Drawdown _____ Feet Specific Capacity _____ Gals. per min. per ft. of drawdown
   How Pumped Air How measured Weir
   Observed effect on nearby wells None
9. PERMANENT PUMPING EQUIPMENT:
   Type _____ Mfrs. Name _____
   Capacity _____ G.P.M. How Driven _____ H.P. _____ R.P.M. _____
   Depth of Pump in well _____ Feet Depth of Footpiece in well _____ Feet
   Depth of Air Line in well _____ Feet Type of Meter on Pump _____ Size ____ Inches
10. USED FOR Industrial AMOUNT { Average _____ Gallons Daily / Maximum _____ Gallons Daily }
11. QUALITY OF WATER Unknown Sample: Yes ____ No. X
    Taste _____ Odor _____ Color _____ Temp. _____ °F
12. LOG 0-82 Sand & Gravel 82-300 Red shale Are samples available? No
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy)
13. SOURCE OF DATA Wm. Stothoff Co., Inc.
14. DATA OBTAINED BY " " " " Date May 7, 1973

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements etc.)

Mail to
STATE GEOLOGIST
P.O. BOX 1390
TRENTON, N.J. 08625

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
OFFICE OF THE COMMISSIONER
TRENTON, N.J.

26·22·333

14
13

Permit No. 26-4784

PERMIT TO DRILL WELL **VALID ONLY AFTER APPROVAL BY THE D.E.P.**

Owner Scientific Chemical Co.
Address 411 Wilson St.
Newark, N.J.

Driller Ernest S. Richardson
Address 7 Fourth Street
Wood Ridge, N.J.

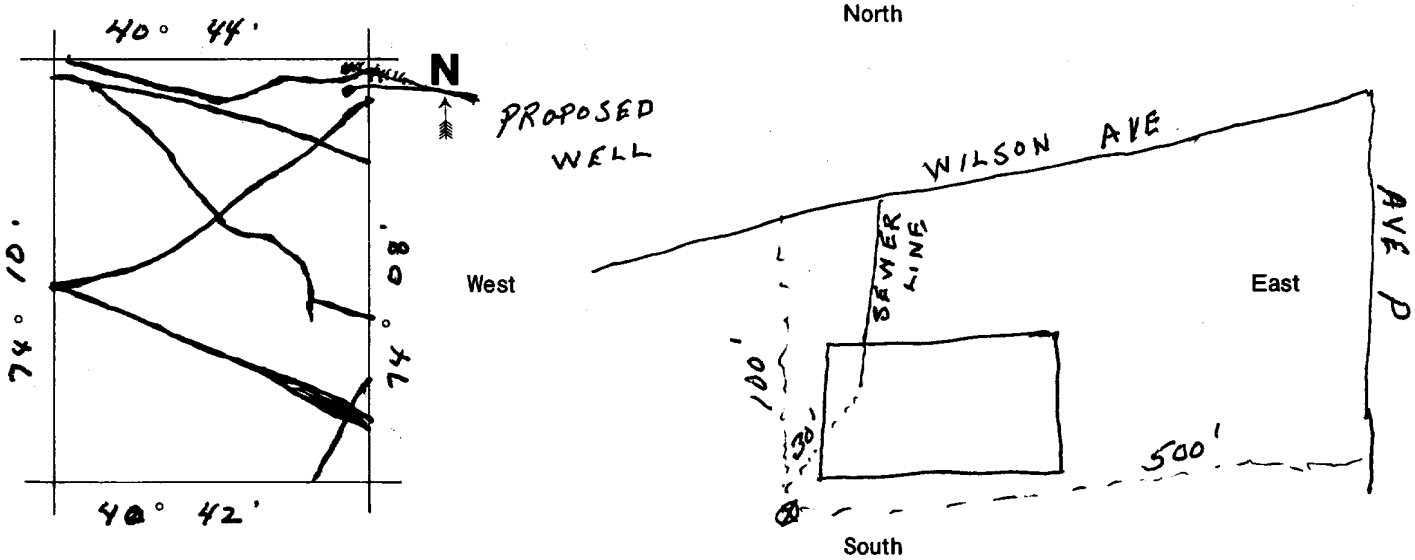
diameter of well	proposed depth of well	proposed capacity of pump
6 inches	200 feet	60 G.P.M.
	method of drilling: cable (cable-tool, rotary, jet, etc.)	use of well: industrial (semi-public, domestic, industrial, public-supply, test, etc.)

LOCATION OF WELL

lot #	block #	municipality	county
98	5020	Newark	Essex

State Atlas Map No. 26

Draw sketch showing distance and relations of well site to nearest public roads, streets, septic systems, etc.



SEE REVERSE SIDE for IMPORTANT PROVISIONS AND REGULATIONS pertaining to this permit. APPROVAL of this permit is made SUBJECT TO acceptance of and compliance with the following ADDITIONAL CONDITIONS:

- ☐ Permit issued in accordance with provisions of letter of transmittal dated _____.
- ☐ It is necessary that Geophysical Logs of this well be made by the Division of Water Resources. The owner shall require the driller to notify the Division by PHONE (609-292-2232) when drilling is completed. Permanent pumping equipment SHALL NOT be installed until such logs are made.
- ☐ Samples of cuttings required every _____ feet.
- ☐ _____

This space for Approval Stamp

WELL PERMIT
APPROVED
MAY 14 1979
DEPT. ENV. PROTECTION
OFF. OF THE COMM.
KEMBLE WIDMER
STATE GEOLOGIST

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well as described above.

Date _____ Signature of Owner Mary Barnes

BUREAU OF GEOLOGY COPY

WELPMT 067 3779

~~26-22-335~~

FORM 87

5/14/79 26 22 365

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Permit No. 26-4784

Application No. _____

County ESSEX

WELL RECORD

1 OWNER Scientific Chemical Co. ADDRESS 411 Wilson St., Newark, N.J.

Owner's Well No 1 SURFACE ELEVATION 22 Feet (Above mean sea level)

2 LOCATION same 411-443 Wilson Avenue Newark

3 DATE COMPLETED Mar. 6, 1980 DRILLER Ernest S. Richardson

4 DIAMETER top 6 inches Bottom 6 inches TOTAL DEPTH 170 Feet

5 CASING Type steel-drive Diameter 6 inches Length 51 Feet

6 SCREEN Type ----- Size of Opening ___ Diameter ___ inches Length ___ Feet

Range in Depth { Top ___ Feet / Bottom ___ Feet } Geologic Formation ___

Tail piece Diameter ___ inches Length ___ Feet

7 WELL FLOWS NATURALLY ----- Gallons per Minute at ___ Feet above surface

Water rises to ___ Feet above surface

8 RECORD OF TEST Date Mar. 3, 1980 Yield 70 Gallons per minute

Static water level before pumping 12 Feet below surface

Pumping level 70 feet below surface after 3 hours pumping

Drawdown 58 Feet Specific Capacity ___ Gals per min per ft of drawdown

How Pumped submersible pump How measured barrel

Observed effect on nearby wells none

9 PERMANENT PUMPING EQUIPMENT

Type submersible Mfrs Name Red Jacket

Capacity 60 G P M How Driven electric H P 5 R P M 3450

Depth of Pump in well 126 Feet Depth of Footpiece in well ----- feet

Depth of Air Line in well --- Feet Type of Meter on Pump ___ Size ___ Inches

10 USED FOR cooling AMOUNT { Average 36,000 Gallons Daily / Maximum 45,000 Gallons Daily }

11 QUALITY OF WATER good Sample Yes ___ No ___

Taste none Odor none Color clear Temp 54 °F

12 LOG ___ Are samples available? ___

(Give d ta l ba k of he t o n eparat sh t If electric log was made please furn sh copy)

13 SOURCE OF DATA top of well

14 DATA OBTAINED BY Ernest S. Richardson Date Mar. 3, 1980

(NOTE Use other side of this sheet to additional info nation such as log of materials penetrated analysis of the wa e sket h map ake h of spe ial cas g arrangements etc)

26 22 365

~~26-22-333~~

26-4784

0'-----5'-------stony fill
5'-----38'-------grey clay
38'-----50'-------red hardpan
50'-------105'-------red shale
105'-------170'-------red sandstone

Mail to
Water Allocation
CN-029
Trenton, N. J. 08625

0002

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
TRENTON, N. J.

NO

26·13·775
Redtt
Permit No. 26-4947

PERMIT TO DRILL WELL **VALID ONLY AFTER APPROVAL BY THE D.E.P.**

Owner NEWARK BOXBOARD CO
Address 17 BLANCHARD STREET
NEWARK, NEW JERSEY

Driller RINDBRAND WELL DRILLING INC
Address 14 WALDRON AVE
GLEN ROCK N.J. 07452

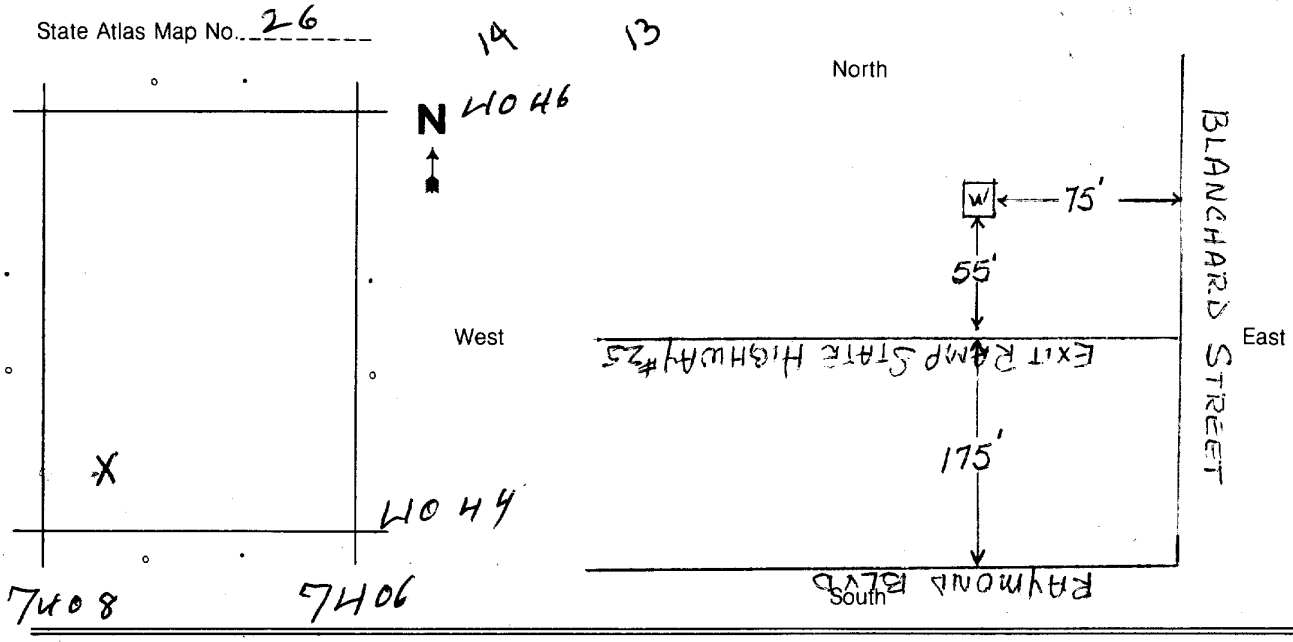
diameter of well	proposed depth of well	proposed capacity of pump
10 inches	300 feet	300 G.P.M.
	method of drilling: ROTARY (cable-tool, rotary, jet, etc.)	use of well: INDUSTRIAL (semi-public, domestic, industrial, public-supply, test, etc.)

LOCATION OF WELL

lot #	block #	municipality	county
80	2412	NEWARK	ESSEX

State Atlas Map No. 26

Draw sketch showing distance and relations of well site to nearest public roads, streets, septic systems, etc.



SEE REVERSE SIDE for IMPORTANT PROVISIONS AND REGULATIONS pertaining to this permit. APPROVAL of this permit is made SUBJECT TO acceptance of and compliance with the following ADDITIONAL CONDITIONS:

- ☐ Permit issued in accordance with provisions of letter of transmittal dated _____.
- ☐ It is necessary that Geophysical Logs of this well be made by the Division of Water Resources. The owner shall require the driller to notify the Division by PHONE (609-292-2232) when drilling is completed. Permanent pumping equipment SHALL NOT be installed until such logs are made.
- ☐ Samples of cuttings required every _____ feet.
- ☐ _____

This space for Approval Stamp

WELL PERMIT
APPROVED
JAN 22 1981
DEPT. ENV. PROTECTION
DIV. OF WATER RESOURCES
WATER ALLOCATION

In compliance with R. S. 58:4A-14, application is made for a permit to drill a well as described above.

Date 1/12/81 Signature of Owner [signature] V.P. & GEN MGR

WATER ALLOCATION COPY

DWR-13SA
:-82

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

PERMIT NO. 26-4947
APPLICATION NO.
COUNTY Essex
COORD. 26-13-775

Sealed

WELL RECORD

1. OWNER Newark Box Board Co. ADDRESS 17 Blanchard Street
   Owner's Well No. One SURFACE ELEVATION 25 (Above mean sea level) Feet
2. LOCATION Newark, NJ - Essex County
3. DATE COMPLETED 12-1-81 DRILLER Rinbrand Well Drlg. Co Inc
4. DIAMETER: Top 10 inches Bottom 10 inches TOTAL DEPTH 400 Feet
5. CASING: Type Steel Diameter 10 Inches Length 90 Feet
6. SCREEN: Type no Size of Opening ____ Diameter ____ Inches Length ____ Feet
   Range in Depth { Top ____ Feet / Bottom ____ Feet } Geologic Formation ____
   Tail Piece: Diameter ____ Inches Length ____ Feet
7. WELL FLOWS NATURALLY no Gallons per minute at ____ Feet above surface
   Water rises to ____ Feet above surface
8. RECORD OF TEST: Date 11-3-81 Yield 105 Gallons per minute
   Static water level before pumping 21' Feet below surface
   Pumping level 200 feet below surface after 8 hours pumping
   Drawdown 179 Feet Specific Capacity ____ Gals. per min. per ft. of drawdown
   How pumped Turbine How measured orific
   Observed effect on nearby wells none
9. PERMANENT PUMPING EQUIPMENT:
   Type ____ Mfrs. Name owner to supply
   Capacity ____ G.P.M. How Driven ____ H.P. ____ R.P.M. ____
   Depth of Pump in well ____ Feet Depth of Footpiece in well ____ Feet
   Depth of Air Line in well ____ Feet Type of Meter on Pump ____ Size ____ Inches
10. USED FOR Industrial AMOUNT { Average ____ Gallons Daily / Maximum ____ Gallons Daily }
    Note: installed a liner 140 ft. with rubber packer
11. QUALITY OF WATER ____ Sample: Yes X No ____
    Taste Salty Odor no Color clear Temp. 56 °F.
12. LOG 72 silt clay, 328 red shale sandstone Are samples available? no
    (Give details on back of sheet or on separate sheet. If electric log was made, please furnish copy.)
13. SOURCE OF DATA Rinbrand Well Drlg Co Inc
14. DATA OBTAINED BY Adam F. Rinbrand Date 12-10-81

(NOTE: Use other side of this sheet for additional information such as log of materials penetrated, analysis of the water, sketch map, sketch of special casing arrangements, etc.)

Tel. 652-4274

26-13775

Established 1919

26-4947

RINBRAND WELL DRILLING CO., Inc.

14 Waldron Avenue Glen Rock, N. J.

Well No. R-1 Date November 6, 1981

For whom Newark Box Board

Well Located at Newark, N.J.

Time	Pumping Level	Air Press.	Inches Weir, Orifice or Meter	G.P.M.	Time	Pumping Level	Air Press.	Inches Weir, Orifice or Meter	G.P.M.
9:00 AM									
10:00			16"	159					
10:30	180'		12	138					
11:00	200'		9	119					
11:00	200'		7	105					
11:30	200		7	105					
12:00	200		7	105					
12:30	200		7	105					
1:00	200		7	105					
1:30	200		7	105					
2:00	200		7	105					
2:30	200		7	105					
3:00	200		7	105					
3:30	200		7	105					
4:00	200		7	105					

[illegible] Parts per million of salt

Description of pump used

Type Turbine Deisel

Stages 12

Size 8"

Discharge 4"

Depth of Setting 200 ft

3 inch Orifice on 4 Pipe

Depth Air Line 200

Air Pressure When Not Pumping 21#

Static Level 21

Well Size 10 x 8

Total Depth 403 ft

Sgd: Witness for Purchaser

Sgd: Kryn Rinbrand
For Rinbrand Well Drilling Co., Inc.

26.13.775

26-4947

EDWARD R. GRICH, INC.
Sanitary Chemists
12 INDUSTRIAL ROAD
PEQUANNOCK, NEW JERSEY 07440
AREA CODE 201
694-5677

LABORATORY ANALYSIS
PLANT START-UPS
STREAM POLLUTION
WATER SUPPLY

LABORATORY INVESTIGATIONS
LICENSED PLANT SUPERVISION
TECHNICAL REPORTS
RESEARCH AND DEVELOPMENT

November 9, 1981

Mr. Adam F. Rinbrand, Sr.
Rinbrand Well Drilling Company, Inc.
14 Waldron Avenue
Glen Rock, New Jersey 07452

Dear Mr. Rinbrand:

Re: Newark Box Board Company
Newark, New Jersey

Contained herein are the results of the chloride analysis performed on the well water samples drawn by Crin Rinbrand on Friday; November 6, 1981 and delivered to this office on Friday; November 6, 1981 and Monday; November 9, 1981.

The water was drawn from the new boiler house well.

The chloride concentrations were as follows:

TIME	DATE	CHLORIDES, PPM AS Cl^-
9:00 A.M.	Friday; November 6, 1981	2715
4:00 P.M.	Friday; November 6, 1981	2760

Respectfully submitted;

EDWARD R. GRICH, INC.

per Edward R. Grich

EDWARD R. GRICH

ERG:jc

26-13-775

26-4947

ARTESIAN WELL & EQUIPMENT CO., Inc.

ROCHELLE PARK
NEW JERSEY
07662

Area Code 201
845-7080

WATER
COMPLETE SYSTEMS FOR
MUNICIPAL, INDUSTRIAL & PRIVATE SUPPLY

January 13, 1983

State of New Jersey
Department of Environmental Protection
Division of Water Resources
P. O. Box CN 029
Trenton, New Jersey 08625

Attention: Mr. Dennis C. Schwab

Re: Newark Box Board Company

Gentlemen:

On January 10, 1983, we sealed a 10" diameter well located on the property of the referenced company on Blanchard Street. This well was drilled by Rinbrand Well Drilling Company some time in 1982.

We sealed this well as if it was a single cased well by introducing grout into it from a depth of 243 feet, where it was bridged, to the surface.

If there are any questions, please call the undersigned.

Very truly yours,

ARTESIAN WELL & EQUIPMENT CO., INC.

Graham B. Every

Graham B. Every

GBE:ecw

cc: Harold DeGroat
Newark Box Board Co.

We reserve the right to correct stenographic errors and omissions. Quotations subject to change without notice.
All agreements and contracts contingent upon strikes, accidents and other delays unavoidable and beyond our control.

DWR-133
(7/90)

SERIAL # 47834

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
TRENTON, N.J.

14

Permit No. 2427887

Mail to

Water Allocation
CN 029
Trenton, N.J. 08625

PERMIT TO DRILL WELL

VALID ONLY AFTER APPROVAL BY THE D.E.P.

COORD #: 24.22.3, 37

Owner American Ready Mix
Address 46 Paris Ave.
Newark NJ

Name of Facility CEMENT Plant
Address Same as above

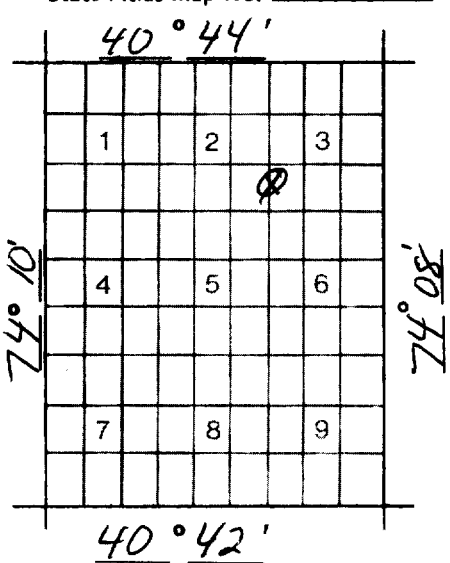
Driller Samuel Stothoff Co., Inc.
Address PO Box 306 HWY 31
Flemington NJ 08822

Diameter of Well	6 Inches	Proposed Depth of Well	250 Feet
Proposed Capacity of Pump	50 GPM	Method of Drilling (cable-tool, rotary, etc.)	Rotary
Use of Well (See Reverse)	Industrial		
Drinking Water Supply?	yes (see #6 on reverse)		no ✓

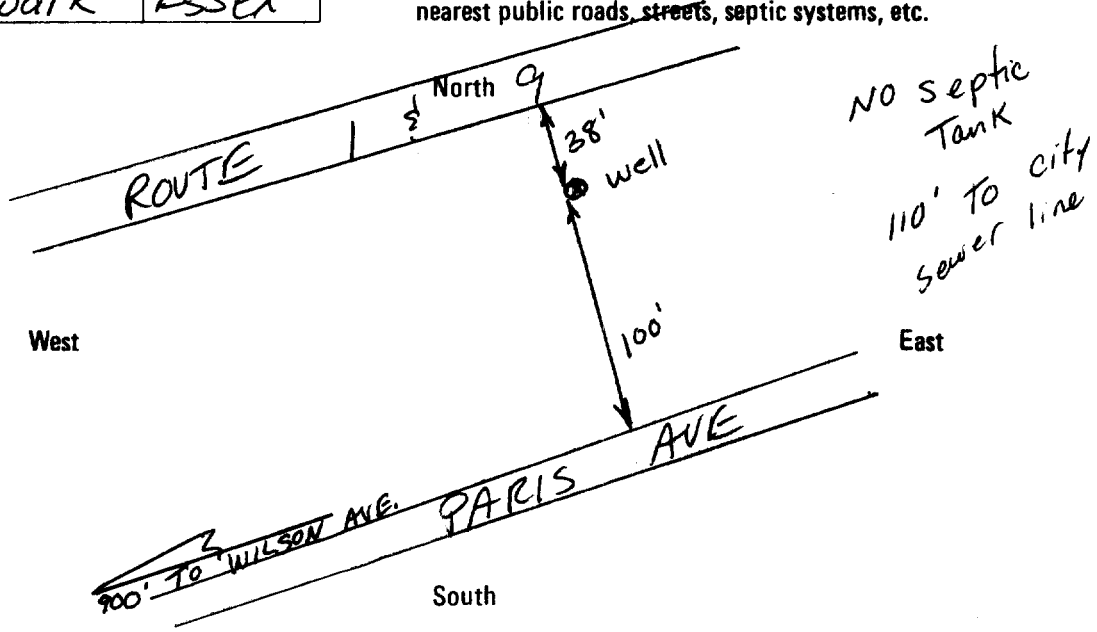
LOCATION OF WELL

Lot #	Block#	Municipality	County
59	2069	Newark	Essex

State Atlas Map No. 26



Draw sketch showing distance and relations of well site to nearest public roads, streets, septic systems, etc.



SEE REVERSE SIDE FOR IMPORTANT PROVISIONS AND REGULATIONS PERTAINING TO THIS PERMIT. APPROVAL OF THIS PERMIT IS MADE SUBJECT TO ACCEPTANCE OF AND COMPLIANCE WITH THE FOLLOWING ADDITIONAL CONDITIONS.

- ☐ **DOMESTIC/PUBLIC NON-COMMUNITY** Water Supply Wells shall comply with N.J.A.C. 7:10-12.1 et. seq.
- ☐ **PUBLIC COMMUNITY** Water Supply Wells shall obtain construction and operation permits from the Bureau of Safe Drinking Water in accordance with N.J.A.C. 7:10-11.1et. seq.
- ☐ **DOMESTIC IRRIGATION SUPPLY** - No piping from the well for which the permit applies shall enter any building.
- ☐ **HEAT PUMP WELLS** - Wells must be a minimum of 50 feet apart and the water must be returned to the same aquifer as the production well. A two hour pump test must be performed on the return well at a rate of 1½ times the estimated return flow of water.
- ☒ **INDUSTRIAL SUPPLY** - A physical connection control permit shall be obtained pursuant to the provisions of N.J.A.C. 7:10-10.1 et. seq.
- ☐ **REPLACEMENT WELL** - Existing well must be sealed by a certified New Jersey licensed well driller upon abandonment.
- ☐ IRRIGATION PURPOSES ONLY ☐ TEST PURPOSES ONLY
- ☐ PINELANDS - Well must be drilled and cased to a minimum depth of 100' unless the provisions of N.J.A.C. 7:50-6.84(a)4.v. are met.
- ☐ GEOPHYSICAL LOGS of this well must be made. Permanent pumping equipment *SHALL NOT* be installed until such logs are made.
- ☐ SAMPLES of cuttings required every _____ feet or change in material.
- ☐ MINIMUM distance requirements as per N.J.A.C. 7:10-12.13 have not been met - see attached additional condition(s).
- ☐ _____

This Space for Approval Stamp

WELL PERMIT APPROVED
Dept. of Environmental Protection
Water Resources/Water Allocation

DEC 12 1991

In compliance with N.J.S.A. 58:4A-14, application is made for a permit to drill a well as described above.

Date Nov. 4, 1991

Signature of Driller Richard H Stothoff License No. 1085

Signature of Owner Jon Tolul

COPIES: Water Allocation — White Health Dept. — Yellow Owner — Blue Driller — White

WELPMT 070 2142

DWR-138
8/91

New Jersey Department of Environmental Protection and Energy
Bureau of Water Allocation

WELL RECORD

Well Permit No. 26 - 27887
Atlas Sheet Coordinates ~~26 · 22 · 337~~
26 · 22 · 329

OWNER IDENTIFICATION - Owner ~~AMERICAN READY MIX~~
Address ~~46 PARIS AVE.~~
City ~~NEWARK~~ State ~~NJ~~ Zip Code

WELL LOCATION - If not the same owner please give address. Owner's Well No. 1
Address Same as above 46 Paris Street
County Essex Municipality ~~NEWARK CITY~~ Lot No. ~~59~~ Block No. ~~2089~~

WELL USE Withdrawl Status Not in use

WATER USE Industrial Average - gals. daily Maximum - gals. daily

WELL CONSTRUCTION Date well completed 1 / 21 / 92
BOREHOLE DIMENSIONS Depths: Total 200 ft. Finished 200 ft.
Diameter: Top 10 in. Bottom 6 in.
Land Surface Elevation at well - ft. Elevation was determined using
Casing Height (stick-up) above land surface 1.5 ft.

	DEPTH TO TOP (FT.)	LENGTH (FT.)	DIAMETER (IN.)	TYPE AND MATERIAL *Screens Note Slot Size(s)*
Casing 1		40	10	Sch 40 Steel
Casing 2		111.5	6	Sch 40 Steel w/ harden drive shoe
Casing 3				
Screen 1				
Screen 2				
Tail Piece				
Gravel Pack				
Grout	-	-		-
Grouting Method	-			

WELL FLOWS NATURALLY - gals. per min. at ft. above the land surface.
Water rises to ft. above the land surface.

RECORD OF TEST Test Date 1 / 21 / 92
Static water-level before pumping 15 ft. below land surface. Water level 100 ft. below land surface after 1 hrs. of pumping.
Water level was measured using M-Scope Drawdown 85 ft.
Discharge rate measured using Weir Discharge Rate 50+ gals. per min.
Well was pumped using Air Lift Specific Capacity gals. per min. per ft. of drawdown
Observed effects on nearby wells None
Water Quality (taste, odor, color, etc.) Fair Possible salt water intrusion

PERMANENT PUMPING EQUIPMENT Installed by - Pump Type
Mfrs. Name Model
CAPACITY: Pump delivers GPM at PSI pressure.
POWER: HP at RPM Power Source
DEPTHS: Pump ft. Footpiece ft. Airline ft.
FLOW METER: Model installed on in. diameter pipe.

CONTRACTOR - Name of Drilling Contractor ~~SAMUEL STOTHOFF CO., INC.~~
Address P.O. Box 306
City Flemington State NJ Zip Code 08822
Name of Driller Dennis Wene License No. 0931

Signature of Contractor [signature] Date 3 / 2 / 92

COPIES White - DEPE Canary - Driller Pink - Owner Goldenrod - Health Dept

Form DWR 138
11/85

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

WELL RECORD

Well Permit No 26 - 27887

26 22 329 ~~26 22 339~~

Driller Please use the space below for the log description Note water bearing zones or geological formation

Are samples available? ☐ Yes ☒ No

Drilling Method Air Rotary - Drill & Drive

Type of Rig Reichdrill 650

Aquifer/Geo Fm Brunswick

DEP USE ONLY

Storet Hydrogeo Code _____

USGS Hydrogeo Code _____

Depth to Bedrock _____ ft

Bedrock Lith Code _____

Bedrock Fm Code _____

Completed by _____

Date ____ / ____ / ____

LOG

			Thick	Lith	Fm
0'	- 90'	Sand			
90'	- 200'	Red shale			

GWPI No ____ _____

NJPDES No _____ ____

Latitude ____ ° ____ ____

Longitude ____ ° ____ ____

Lat Long Accuracy ☐ 1 ☐ 5 ☐ 10 ☐ 20

USGS Quadrangle _____

Drainage Basin Code _____

County/Municipality Code _____

OTHER FILES ☐ Lithologic Log ☐ Samples Available ☐ Aquifer Test ☐ Water Level Data
☐ Geophysical Logs ☐ Water Chemistry ☐ Pollution Case

Checked by _____

Date ____ / ____ / ____

DWR-133
2/99

MAIL TO
NJDEP
BUREAU OF WATER ALLOCATION
PO BOX 426
TRENTON, NJ 08625-0426

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
TRENTON, NJ

Permit No 2600067827

PERMIT TO DRILL WELL

VALID ONLY AFTER APPROVAL BY THE D E P

COORD # 26 . 23 . 1 19

Property Owner Elan Inc.
Address 268 Doremus Ave.
Newark, NJ 07105

Driller Wm Slothoff Co Inc
Address PO Box 68
Flemington NJ 08822

Name of Facility Elan Inc
Address 268 Doremus Ave
Newark, NJ 07105

Diameter of Well	8 Inches	Proposed Depth of Well	400 Feet
Proposed Capacity of Pump	65 GPM	Method of Drilling (Cable tool, Rotary, etc.)	Air Rotary
Use of Well (See Reverse)	Industrial Supply		
Drinking Water Supply?	yes (see #6 on reverse)		no

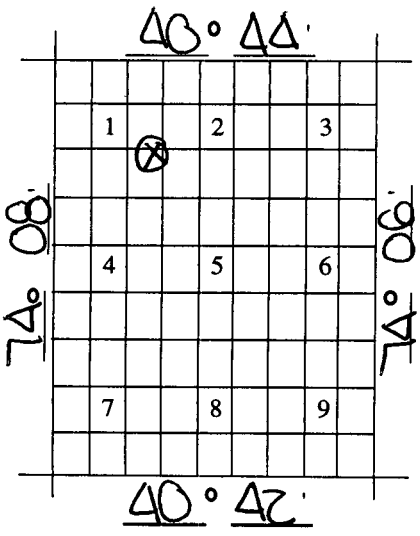
LOCATION OF WELL

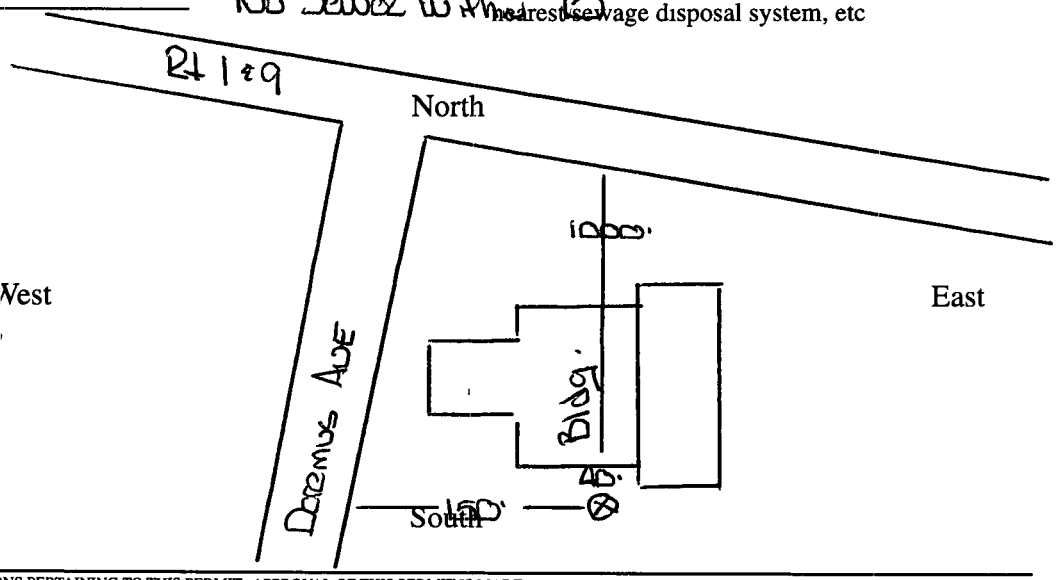
Lot #	Block #	Municipality	County
8.01	501A	City of Newark	Essex

State Atlas Map No. 26

Draw sketch showing distance and location of well site to nearest public roads, streets, components of the nearest sewage disposal system, etc

No Sewer within 15'





SEE REVERSE SIDE FOR IMPORTANT PROVISIONS AND REGULATIONS PERTAINING TO THIS PERMIT APPROVAL OF THIS PERMIT IS MADE SUBJECT TO ACCEPTANCE OF AND COMPLIANCE WITH THE FOLLOWING ADDITIONAL CONDITIONS

- ☐ **DOMESTIC/PUBLIC NON COMMUNITY/NON PUBI IC** Water Supply Wells shall comply with N J A C 7 10 12 1 et seq
- ☐ **PUBLIC COMMUNITY Water Supply** Wells shall obtain construction and operation permits from the Bureau of Safe Drinking Water in accordance with N J A C 7 10 11 1 et seq
- ☐ **CLOSED LOOP GEOTHERMAL** see attached conditions
- ☐ **OPEN LOOP GEOTHERMAL HEAT PUMP WELLS** Wells must be a minimum of 50 feet apart and the water must be returned to the same aquifer as the production well
- ☒ **INDUSTRIAL SUPPLY** A physical connection control permit shall be obtained pursuant to the provisions of N J A C 7 10 10 1 et seq
- ☐ **IRRIGATION SUPPLY** A physical connection control permit may be required pursuant to the provisions of N J A C 7 10 10 1 et seq
- ☐ **REPLACEMENT WELL** Existing well must be sealed by a certified New Jersey licensed well driller upon abandonment
- ☐ IRRIGATION PURPOSES ONLY ☐ TEST PURPOSES ONLY
- ☐ PINELANDS Well must be drilled and cased to a minimum depth of 100 unless the provisions of N J A C 7 50 6 84 (a)4 v are met
- ☐ MINIMUM distance requirements as per N J A C 7 10-12 12 have not been met see attached condition(s)
- ☐ The well shall be equipped with a totalizing flow meter per N J A C 7 19 2 et seq
- ☐

This Space for Approval Stamp

WELL PERMIT APPROVED
NJDEP
MAY 7 2003
BUREAU OF WATER ALLOCATION

In compliance with N.J S.A 58 4A 14, application is made for a permit to drill a well as described above.

Date 04.29 03 Signature of Driller [signature] Registration No M-1

Signature of Property Owner for Jerome Schaff By RHS

COPIES Water Allocation White Health Dept - Yellow Owner Blue Driller White

New Jersey State Department of Environmental Protection
Bureau of Water Systems and Well Permitting
PO BOX 420 Trenton, NJ 08625-0420 Tel: 609-984-6831

Well Permit Number
E201109562

WELL PERMIT

The New Jersey Department of Environmental Protection grants this permit in accordance with your application, attachments accompanying same application, and applicable laws and regulations. This permit is also subject to further conditions and stipulations enumerated in the supporting documents which are agreed to by the permittee upon acceptance of the permit

Certifying Driller: CHRIS BIAMONTE, JOURNEYMAN LICENSE # 0022210

Permit Issued to: BRYAN DRILLING CO INC

Company Address: BOX 274 RT 24 CHESTER, NJ 07930

PROPERTY OWNER

Name: EMILLIO GUARINO

Organization: RTC PROPERTIES, INC.

Address: 100 Central Ave Suite 630

City: Kearny Town State: New Jersey Zip Code: 07032

PROPOSED WELL LOCATION

Facility Name: RTC PROPERTIES, INC.

Address: 120 Central Ave Put thru as is per Chris Biamonte

County: Hudson Municipality: Kearny Town Lot: 10.02 Block: 288

Easting (X): 599464 Northing (Y): 689488
Coordinate System: NJ State Plane (NAD83) - USFEET

Local ID: 1

SITE CHARACTERISTICS

Distance to Nearest Building Sewer:	31 to 50 ft
Distance to Nearest Road:	> 250 ft
Distance to Nearest Wooden Structure:	51 to 100 ft

PROPOSED CONSTRUCTION

WELL USE: IRRIGATION

Other Use(s):

Diameter (in.): 6

Regulatory Program Requiring Wells/Borings:

Depth (ft.): 300

Case ID Number:

Pump Capacity (gpm): 20

Deviation Requested: N

Drilling Method: Air Rotary

Attachments:

SPECIFIC CONDITIONS/REQUIREMENTS

Approval Date: June 20, 2011
Expiration Date: June 19, 2012

Approved by the authority of:
Bob Martin
Commissioner

John Fields, Acting Bureau Chief
Bureau of Water Systems and Well Permitting

WELL PERMIT

DEVIATION INFORMATION	
Purpose:	
Unusual Conditions:	
Reason for Deviation:	
Proposed Well Construction	

GENERAL CONDITIONS/REQUIREMENTS
A copy of this permit shall be kept at the worksite / on the property and shall be exhibited upon request. [N.J.A.C. 7:9D-1]
A well record must be submitted by the well driller to the Bureau of Water Systems and Well Permitting. Unless prior written approval is obtained from the Bureau of Water Systems and Well Permitting the well record shall be submitted electronically through the New Jersey Department of Environmental Protection's Regulatory Services Portal Submit Well Record: within ninety (90) days after the well is completed.[N.J.A.C. 7:9D-1]
All well drilling/pump installation activities shall comply with N.J.A.C. 7:9D-1 et seq. [N.J.A.C. 7:9D-1]
For this permit to remain valid, the well approved in this permit shall be constructed within one year of the effective date of the permit. [N.J.A.C. 7:9D-1]
If the pump capacity applied for is less than 70 gpm, no subsequent increase to 70 gpm or more shall be made without prior approval of the Bureau of Water Systems and Well Permitting. [N.J.A.C. 7:9D-1]
If the use of the well is to be changed a well permit for the proposed use of the well shall be submitted for review and approval. [N.J.A.C. 7:9D-1]
If you or a future property owner intend to redesignate this well as a Category 1 well (domestic, non-public, community water supply or public non-community water supply wells), the well must be constructed as a Category 1 well per the Well Construction and Abandonment Regulations at N.J.A.C. 7:0D-1.1 et seq. In addition, if the current or future property owner intends to have this well redesignated as a community water supply well, the well must be constructed by a Master well driller, which would include having a Master well driller on-site at all times during construction of the well, as specified in the Well Construction and Abandonment Regulations. Otherwise, the New Jersey Department of Environmental Protection will not allow the well to be redesignated, and a new well would have to be installed. [N.J.A.C. 7:9D-1.7((a))1i]
In accepting this permit the Property Owner and Driller agree to abide by the following terms and conditions [N.J.A.C. 7:9D-1]
In the event that this well is not constructed the well driller shall notify the Bureau of Water Systems and Well Permitting of the permit cancellation. Unless prior written approval is obtained from the Bureau of Water Systems and Well Permitting the Cancellation notification shall be submitted electronically through the New Jersey Department of Environmental Protection's Regulatory Services Portal Submit Well Permit Cancellation : by the expiration date of this permit.[N.J.A.C. 7:9D-1]
In the event this well is abandoned, the Owner or Well driller shall assume full responsibility for having the well decommissioned in a manner satisfactory to the New Jersey Department of Environmental Protection in accordance with the provisions of N.J.A.C. 7:9D-1 et seq. [N.J.A.C. 7:9D-1]
The granting of this permit shall not be construed in any way to affect the title or ownership of property, and shall not make the New Jersey Department of Environmental Protection or the State a party in any suit or question of ownership of property. [N.J.A.C. 7:9D-1]
The issuance of this permit shall not be deemed to affect in any way action by the New Jersey Department of Environmental Protection on any future application. [N.J.A.C. 7:9D-1]
This permit conveys no rights, either expressed, or implied to divert water. [N.J.A.C. 7:9D-1]
This permit does not waive the obtaining of Federal or other State or local Government consent when necessary. This permit is not valid and no work shall be undertaken until such time as all other required approvals and permits have been obtained. [N.J.A.C. 7:9D-1]
This permit is NONTRANSFERABLE [N.J.A.C. 7:9D]
This well shall not be used for the supply of potable / drinking water. [N.J.A.C. 7:9D-1]

APPENDIX B

REMEDIAL ACTION SELECTION REPORT

Geosyntec consultants

engineers | scientists | innovators

REMEDIAL ACTION SELECTION REPORT (RASR)

Pitt-Consol Chemical Co.
191 Doremus Avenue
Newark, New Jersey 07105
SRP-PI # G000002172

Prepared for

DuPont Corporate Remediation Group
4417 Lancaster Pike
Chestnut Run Plaza, Building 715 - 252
Wilmington, Delaware 19808

Prepared by

Geosyntec Consultants, Inc.
130 Research Lane, Suite 2
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Project Number TR0388

22 February 2013

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LIST OF ABBREVIATIONS

˚C	degrees Celsius
%RE	percent reference emitter
AOCs	Areas of Concern
As	arsenic
bgs	below ground surface
CCS	Columbia Container Services
COC	Constituent of Concern
CRG	Corporate Remediation Group
CSM	Conceptual Site Model
DNAPL	dense non-aqueous phase liquid
DuPont	E. I. du Pont de Nemours and Company
EPH	Extractable petroleum hydrocarbon
ERH	electrical resistive heating
FNA	Former Naphthalene Area
ft	feet
GAC	granular activated carbon
Geosyntec	Geosyntec Consultants, Inc.
HF/NGM	Historic Fill/Native Geological Material
IGWSRS	impact to groundwater soil remediation standard
ISS	In Situ Stabilization
ISTD	In Situ Thermal Desorption
ISTS	In Situ Thermal Stabilization
kg	kilograms
kg/day	kilograms per day
LSRP	Licensed Site Remediation Professional
NFA	No Further Action
N.J.A.C.	New Jersey Administrative Code
NAPL	non-aqueous phase liquid
NJDEP	New Jersey Department of Environmental Protection
NRDCSRS	non-residential direct contact soil remediation standard
P&T	pump and treat
PA	Preliminary Assessment
PAHs	polycyclic aromatic hydrocarbons
Pb	lead
PHCs	petroleum hydrocarbons
Pitt-Consol	Pitt-Consol Chemical Company

LIST OF ABBREVIATIONS (CONT'D)

POC	proof of concept
RAO	Remedial Action Order
RAS	Remedial Action Selection
RASR	Remedial Action Selection Report
RAWP	Remedial Action Work Plan
RIPR	Remedial Investigation Progress Report
RIR	Remedial Investigation Report
S-ISCO	Surfactant-In Situ Chemical Oxidation
STAR	Self-sustaining Treatment for Active Remediation
SVE	Soil Vapor Extraction
SVOC	semi-volatile organic compound
TarGOST®	Tar-specific Green Optical Screening Tool
TCH	Thermal Conductive Heating
TCLP	toxicity characteristic leaching procedure
Tech Regs	Technical Requirements for Site Remediation
TRSRs	Technical Requirements for Site Remediation
VOCs	volatile organic compounds

1. INTRODUCTION

Geosyntec Consultants, Inc. (Geosyntec), at the request of E. I. du Pont de Nemours and Company (DuPont) Corporate Remediation Group (CRG), has prepared this report summarizing the Remedial Action Selection (RAS) evaluation of remedial alternatives for the former Pitt-Consol Chemical Company (Pitt-Consol) property located at 191 Doremus Avenue in Newark, Essex County, New Jersey 07105 (the Site). A Site Locus map is provided in Figure 1. This document has been prepared in advance of the preparation of a soils-only Remedial Action Work Plan (RAWP) report to be prepared in accordance with the requirements of the New Jersey Department of Environmental Protection (NJDEP) Technical Requirements for Site Remediation (TRSRs or "Tech Regs"), amended 7 May 2012 (New Jersey Administrative Code [N.J.A.C.] 7:26E).

1.1 Remedial Action Selection Evaluation

The current edition (May 7, 2012) of the NJDEP TRSR does not include the section on RAS that was found in previous versions of the TRSRs and therefore no formal preparation of a RAS report is required. However, this Remedial Action Selection Report (RASR) has been prepared to memorialize the selection process, to provide a rationale for remedy selection and begin to develop the RAWP for on-Site soils. This RASR considers remedies for addressing soils on-Site. A RAS process may be conducted at a later date for on-Site groundwater in conjunction with regulatory submittals for a Remedial Investigation Report (RIR) and a RAWP for on-Site groundwater. Further Site restoration and redevelopment are also not evaluated in this report; however they are considered as part of the evaluation of remedial alternatives.

The process used to rank remedial alternatives to address on-Site contamination was as follows:

1) Selection of remedial alternatives suitable for addressing on-Site contamination was made;

2) Selection of criteria used to evaluate the remedial approach was conducted;

3) Ranking of the remedial alternatives to meet performance criteria over the short term (during implementation) and long term (within a 20-30 year timeframe) and comparison of technologies for the top four ranked remedial alternatives was assessed;

4) Comparison of the top four ranked remedial alternatives based on the specific footprint size, location and lithology was performed; and

5) Selection of the remedial alternative(s) based on the nature and distribution of contamination was made.

1.2 RASR Organization

The remaining sections of this RASR present the following:

- Section 2: Background – provides a general Site description and discussion of the Site geology and hydrogeology, the nature and distribution of contamination, and remedial objectives;
- Section 3: Remedial Alternatives – describes how each remedial alternative would be applied and a discussion of the suitability of the technology for the Site;
- Section 4: Evaluation Criteria – describes the criteria used to rank the remedial alternatives;
- Section 5: Remedial Alternative Rankings – compares the top four ranked remedial alternatives;
- Section 6: Remedy Application by Footprint Size, Location and Lithology of the impacted soils – compares the specific application of the top four ranked remedial alternative based on the contaminated area, location and lithology;
- Section 7: Selected Remedies – describes the rational for selection of remedial alternative(s) and an overview of their conceptualized implementation;
- Section 8: Other Full-Scale Design Consideration – describes other components of the design and implementation of the remedial alternative selected for on-Site soils; and
- Section 9: References – provides a list of resources referenced throughout this report.

2. BACKGROUND

2.1 Site Description

The Site is located in an area of past and current heavy industrial use along the Passaic River, near to the Port of Newark (Figure 1). The Site is a former road tar, cresols, phenols, and cresylic acid production facility. According to CRG (1998), chemical plants, scrap yards, metal recycling operations, oil terminals, trucking terminals, a power generation plant, and a sewage treatment plant all either exist or existed in the past in the area surrounding the Site.

The ground surface of the Site is generally flat with little topographic relief, and is covered primarily with stone and asphalt. A Site Plan is provided in Figure 2. The former Site tenant, Columbia Container Services (CCS) used the property for the storage of empty shipping containers but in preparation for remedial activities their lease was not renewed and, as of 2012, the Site is vacant.

It is anticipated that future uses of the Site will be for industrial purposes only and that a restricted use remedial action with appropriate institutional and engineering controls will be appropriate for the protection of public health and safety and the environment.

2.2 Geology and Hydrogeology

The Site is underlain by five major unconsolidated units, which in turn overlie a reddish brown shale bedrock unit (Brunswick Shale) with an upper weathered surface (CRG, 2000). The unconsolidated units, in ascending order (from deepest to shallowest), are: (1) Rahway Till, a glacially derived silt and clay confining unit; (2) lake-bottom deposits composed of predominately silt (deep confining layer) (NJDEP, 1998); (3) a medium to coarse sand unit (deep water bearing unit); (4) a semi-confining organic clay and peat layer (Meadow Mat layer); and (5) a heterogeneous historic fill unit (shallow water bearing unit) (CRG, 2000). The unconsolidated native materials were covered with a geotextile membrane. The current Site conditions consist of a layer of crushed stone and gravel nominally between 2 and 5 feet (ft) thick installed above the geotextile across the entire area of the Site. Further Site geology detail is provided in the 2012 Remedial Investigation Progress Report (RIPR) (Geosyntec, 2012a).

The groundwater table at and around the Site has ranged from approximately 3 and 8 ft below ground surface (bgs), and there is a downward flow gradient between the shallow and deep water bearing units. Groundwater in both the shallow and deep hydrologic units flows roughly eastward across the Site, Figure 3. The Passaic River, located

approximately 600 ft east of Doremus Avenue, is the likely discharge point for Site groundwater, Figure 2. However, given the low horizontal hydraulic gradients observed on-Site, discharge is likely to be minimal. Further Site geology detail is provided in the 2012 RIPR (Geosyntec, 2012a).

2.3 Nature and Distribution of Contamination

After industrial operations ceased in 1983, a number of studies and environmental investigations were conducted at the Site. The Preliminary Assessment (PA) report (CRG, 1998) identified constituents of concern (COCs) through a review of the Site history, including process, storage and waste disposal practices, coupled with an evaluation of the soil and groundwater analytical data that was available at the time. Identified COCs included volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), phenols, petroleum hydrocarbons (PHCs), arsenic (As), and lead (Pb).

On-Site investigations were conducted in 2011 and 2012 to further understand contaminant distribution and establish Site zones according to lithology, contaminant type and location. These investigations were used to facilitate assessment of remedial approaches, and delineate impacts to soil (Geosyntec, 2011a and 2012a). In combination with historical data, these data were compiled in a Conceptual Site Model (CSM).

The original areas of concern (AOCs), designated by the location of previous Site activities, were redefined by tar classification (the type and distribution of the tar at the Site). The results of the remedial investigation delineation are presented in Figures 4 and 5, and are based on a Tar-specific Green Optical Screening Tool (TarGOST®) survey with 552 probe locations comprising 280,383 unique x-y-z data points. The on-Site soils RI Report (Geosyntec, 2013b) includes a detailed analysis comparing analytical soil and groundwater concentrations at specific depth intervals to the corresponding response from the TarGOST® survey. This study correlated extractable petroleum hydrocarbon (EPH) concentrations and the percent of reference emitter (%RE). TarGOST® probe readings that were below 10% reference emitter (RE) were interpreted to be associated with historic fill and native geologic material. Readings between 10 and 50% RE were interpreted to have tar stain and tar pieces. Readings above 50% were interpreted to contain tar and viscous tar. Further detail is provided in the on-Site soils RI Report (Geosyntec, 2013b).

Based on the updated CSM the AOCs were revised as described in the *Designation of Pitt-Consol Site Areas of Concern* Memorandum (Geosyntec, 2012b). The table below and Figures 4 and 5 describe and show the new AOCs classifications.

AOC	Description	Delineation	Dimensions
4	Historic Fill/Native Geologic Material (HF/NGM)	TarGOST® %RE ≤ 10	11.6 acres (approx.) 414,000 cubic yards (volume approx.)*
5	HF/NGM + Stain + Tar Pieces	TarGOST® %RE > 10 and ≤ 50	18.9 acres (approx.) 221,000 cubic yards (volume approx.)
6	HF/NGM + Tar + Viscous Tar	TarGOST® %RE > 50 or areas where the TarGOST® probe could not be advanced to depth (Lagoon F)	7.3 acres (approx.) 36,000 cubic yards (volume approx.)
7	Site Groundwater	To be identified in upcoming groundwater RIR and RAWP	Whole Site

HF/NGM – Historic Fill/Native Geological Material
*Based on soils in the Historic Fill not in AOC 5 or 6

The impacted materials defined by AOC 4 and 5 can be controlled by the use of appropriate engineering control in place (i.e., soil cap) over these areas, developing appropriate institutional controls and deed restrictions. These actions restrict exposure to contamination that may remain in place at concentrations above appropriate non-residential direct contact soil remediation standards (NRDCSRS) or impact to groundwater soil remediation standards (IGWSRS).

Based on the soil categories and AOC designations, AOC 6 requires active remediation of soils. AOC 6 contains viscous tar, which is both potentially mobile and a potential source of contaminants to groundwater. The viscous tar in AOC 6 is heterogeneously distributed. Some regions are large in areal extent, such as in and around the former lagoons, and some are small, such as more remote areas of the Site including components of Lagoon F, G, the Former Naphthalene Area (FNA), and Tank Farm (See Figures 2, 4, and 5).

2.4 Remedial Objectives

The remedial objectives for the Site are to be protective of public health, safety, and the environment. Once these objectives are met a Licensed Site Remediation Professional (LSRP) is authorized to issue an Remedial Action Order (RAO) to memorialize the completion of remediation, indicating that in their professional judgment the Site has been remediated in accordance with all applicable statues, regulations, and guidelines, and that the appropriate controls and permits are in place. General remedial goals are:

- Protection of Human Health, Safety, and the Environment;
- Treatment or Removal of Free (liquid phase) Product;
- Management of Direct Contact Risks; and
- Reduction of Impacts to Groundwater.

These objectives have been incorporated into the evaluation criteria of the RAS process as described in Section 4, Evaluation Criteria.

3. REMEDIAL ALTERNATIVES

This section describes the potential remedial alternatives for addressing on-Site soils contamination, their suitability given Site conditions, and how each remedy might be implemented. The following nine potential remedies were considered:

- Self-sustaining Treatment for Active Remediation (STAR);
- In Situ Thermal Desorption (ISTD) or In Situ Thermal Stabilization (ISTS);
- In Situ Stabilization (ISS);
- Containment – Combination of Hydraulic (Pump and Treat [P&T]) and Physical (Impermeable Barrier Wall);
- Surfactant-In Situ Chemical Oxidation (S-ISCO);
- Bio-Venting & Air Sparging;
- Excavation & Off-Site Treatment; and
- No Further Action (NFA).

3.1 STAR

STAR is an innovative new technology based on the principles of smoldering combustion where the contaminants are destroyed as they combust. The process is self-sustaining following a short duration, low energy input 'ignition event'. The energy of the reacting contaminants pre-heats and initiates combustion of contaminants in adjacent areas, propagating a combustion front through the contaminated zone, provided that a sufficient flux of oxygen is supplied.

Three phases of pilot testing have been conducted within the former lagoon area of the Site. The first two phases of pilot testing are described in STAR Pilot Test Report (Geosyntec, 2011b) and the third phase of pilot testing is described in the STAR Phase III Pilot Test Report (Geosyntec, 2013c). The Phase I was a proof of concept (POC) study to demonstrate the STAR process below ground surface and beneath the water table. The Phase II test assessed factors governing the ignition protocol and the limitations of the STAR technology with respect to mass destruction rate and

combustion front propagation. The Phase III pilot test was designed to evaluate scale-up parameters and to test the application of the technology within the deep sand unit.

The Phase I POC test successfully demonstrated the STAR process below ground surface and below the water table for a period of nine days. During the Phase II test, sustained destruction rates in excess of 800 kilograms per day (kg/day) were observed over a four-day period resulting in the destruction of more than 4,500 kilograms (kg) of coal tar. Phase III testing demonstrated the technology twenty-five feet below the water table and resulted in the treatment of a six-foot layer of impacted fine sands to a radial distance of approximately twelve feet. Post-STAR sampling for all phases demonstrated a substantial reduction in coal tar volume within the target treatment zones, with semi-volatile organic compound (SVOC) concentrations reduced (on average) by greater than 99% where combustion was observed or detected.

These three phases of pilot testing demonstrated the suitability of STAR for Site soils and contaminants and would be applied within the tar/viscous tar areas of the Site as follows: a self-sustaining combustion reaction would be initiated by inserting an in-well heating element into a carbon steel well with stainless steel screen placed at the base of the target treatment zone and heating a small volume of the contaminated soils (a few inches around the well). Atmospheric air would then be injected through this well to initiate a combustion reaction and maintain oxygen delivery to the combustion front. Air injection would continue as long as the combustion front continued to propagate away from the point of ignition. Combustion gases would be extracted. The extracted gases would be used to monitor the combustion process and, together with any compounds volatilized by the heat, be treated using granular activated carbon (GAC) before discharge to atmosphere. The surface above STAR activities would be sealed with concrete, asphalt, or some other relatively impermeable material to allow for the controlled recovery of combustion gases and volatile emissions.

STAR is most efficient in areas with large areas of viscous tar contamination. STAR also requires the delivery of oxygen to the combustion front by injecting atmospheric air near the combustion front. Below the water table, the injected air forms what can be conceptualized as a ‘bubble’ that encapsulates the combustion front. In regions where the combustion front is sufficiently deep below the groundwater table, the ‘bubble’ can be maintained. When the groundwater level is too shallow the ‘bubble’ intersects the unsaturated zone and collapses.

A number of implementation options have been considered for areas where the combustion front is not deep enough below the water table. The treatment area could be dewatered for STAR implementation under unsaturated conditions or flooded to increase the water pressure above the “bubble”. Alternatively, the well spacing could

be reduced (i.e. increased well placement density) so that STAR could be applied using less injection air pressure to reduce the potential for "bubble" collapse. A physical barrier may be required for the dewatering and flooding options but not the reduced well spacing option. These modifications to the implementation strategy are not anticipated to be required for the deep sand unit based on pilot testing, but may be required for STAR in the fill materials.

A result of STAR is heating the sub-surface. This heat may reduce the viscosity of non-aqueous phase liquid (NAPL) contamination; thus increasing the potential for mobilization of NAPL during operation. However, pilot testing has shown that the heating zone is small and localized relative to the volume of active combustion; thus the potential for mobilization is low. In addition, STAR will be implemented using an "outward-in" approach so that if any mobilization occurs, mobile NAPL will be driven from areas undergoing treatment to areas that are about to be treated. Furthermore, in areas where NAPL is present adjacent to Site boundaries (Figure 5), thermocouples will be installed to measure and provide real-time temperature information on the heat applied to further mitigate off-Site impacts. Post remediation confirmatory testing using TarGOST® will also be conducted to assess the possible migration of free product.

3.2 ISTD/ISTS

ISTD is the process of removing hydrophobic contamination from the sub-surface by increasing temperatures causing the contamination to become volatilized (i.e. desorbed). The volatilized contamination is then captured through extraction wells.

When contamination is below the water table, lower molecular weight contaminants (i.e. benzene) can be removed by electrical resistive heating (ERH). In ERH the sub-surface is heated by passing an electrical current through the groundwater. The resistivity to current flow is transformed into heat energy, and the contamination is more readily desorbed, solubilized and volatilized. ERH can reach maximum temperature around 100 degrees Celsius (˚C).

For higher molecular weight compounds (i.e., PAHs) heating the subsurface using electrical resistivity of water cannot achieve sufficient temperatures for complete and expedient removal. Thermal conductive heating (TCH), which can reach temperatures of around 300˚C, is needed. The higher temperatures more readily desorb and volatilize the higher weight compounds. To enable ISTD-TCH, the treatment zone must be dewatered otherwise the target temperatures cannot be achieved.

ISTD-TCH is potentially suitable for the Site because it can remove dense-NAPL (DNAPL). It would be applied in areas with tar/viscous tar. Dewatering wells would be installed to maintain unsaturated conditions in the treatment zone. An impermeable barrier wall could be installed to restrict ground water inflow. Heater wells would need to be installed. Extraction wells would be installed, and a soil vapor extraction (SVE) approach would collect the volatilized contaminants and treat them via GAC or a thermal oxidizer system. A significant and reliable source of electricity is essential to maintain sub-surface temperatures and vapor collection. If electrical power is lost during active remediation, heated tar, which is now less viscous, and liberated vapors may migrate. Similar to STAR, ISTD is most effective in areas with larger extents of contamination.

A variant of ISTD that can be applied at the Site is ISTS. Here the subsurface is heated to just below 100˚C. The solubility of lighter more volatile components increase, and increased volatilization occurs. The mobilized lighter component is then captured by soil gas and groundwater extraction wells and treated before discharge. This process removes the more mobile contaminants from the tar/viscous tar leaving a solid remainder that does not pose the same mobility concerns of a tar/viscous tar.

3.3 ISS

ISS is a method to contain contamination in a zone of low hydraulic conductivity. Soils in the target treatment area are mixed with cement or bentonite. Treatment area soils then have a much lower hydraulic conductivity, greatly reducing the potential for the contamination to migrate advectively. The soils can be mixed either in situ or ex situ. In situ mixing often uses augers to combine the stabilizing agent and soil. Ex situ mixing temporarily excavates the soil, mixes it with the stabilizing agent in a soil mixing rig, and then re-places the soil with stabilization agent in the recently excavated zone. Air controls for VOC and odor emission are also required.

With ISS soil bulking occurs. The excess soil would have to be disposed of off-Site at a suitable landfill dependent upon toxicity characteristic leaching procedure (TCLP) results. Further, odor/vapor control measures (i.e. spraying with vapor reducing foams) would be needed when applying ISS to mitigate the potential for contaminants (i.e. VOCs and some SVOCs) to volatilize. After stabilization is complete, the footprint of the treated zone would then be covered with a capping material, typically clay.

ISS is potentially suitable for the Site because it can be implemented to depths required, and it is capable of addressing the contamination in a zone of low hydraulic

conductivity where advective transport is not possible. For the Site, the ISS remedy would potentially be comprised of mixing impacted Site soils ex situ with bentonite. Soil would be excavated and mixed in a soil mixing rig with bentonite. Then, the resulting soil-bentonite mixture would be placed back into the target treatment area. Once stabilization is complete, an engineered cap would be placed above the treated soils.

This remedial alternative assumes that all tar/viscous tar (and metals) is encapsulated. This encapsulation changes groundwater gradients and flow paths. These changes should not have negative consequences to the stabilized contamination since the tar/viscous tar is encapsulated. Over long time periods, contamination will diffuse out of the stabilized soil; however, compared to advection, diffusion is a slow process.

Two possibilities exist that can compromise the ability of ISS to sequester contamination. First, tar/viscous tar may still exist as free product because the mixing may be heterogeneous and some contamination may not be stabilized. Second, over long time periods, the deterioration of the stabilization followed by the re-release of the contaminant is a possibility.

3.4 Containment – Hydraulic and Physical

If containment is applied as a remedy at the Site, it would be applied as a combination of both hydraulic and physical containment. The following subsections describe the respective components of the containment approach.

3.4.1 Hydraulic Containment – P&T

Hydraulic containment creates groundwater gradients that control groundwater flow to prevent aqueous contamination from migrating off-Site. A basic hydraulic containment system is comprised of an extraction and injection well connected by piping. Water is moved from the extraction to injection well by a pump. Over large areas, or hydrogeologically more complex areas, sets of pumps and extraction and injection wells can be used to create the desired groundwater flow field. Hydraulic containment can also be coupled with a treatment system to remove contaminants in extracted water before injecting the water. Using this method, the contamination that is soluble can slowly be removed from the sub-surface; however, insoluble components would remain and only be removed over a very lengthy period of time.

Hydraulic Containment is potentially suitable for the Site because it can prevent the off-Site migration of contamination, and slowly remove contaminant mass. For the Site groundwater extraction would be performed on-Site and at the Site boundary. Extraction in these locations would be expected to capture the contaminant mass originating from on-Site. Extracted water would be treated by an on-Site treatment system using GAC. Extraction and injection wells, plus the supporting above ground infrastructure (treatment system, piping, pumps, etc.,) would need to be installed.

It is assumed that hydraulic containment would flush the more transmissive zones over time while the lower permeability zones would retain mass, but over the long term a net contaminant mass diffusion and desorption from low permeability zones would achieve remedial objectives.

3.4.2 Physical Containment – Impermeable Barrier Wall

An impermeable barrier wall is a physical structure installed in the subsurface to reduce and/or re-direct groundwater flow. Flow through these barriers is minimal. At many sites, barrier walls have received regulatory acceptance given that they contain contamination. There are four types of barrier walls. They differ mainly in materials and installation methods, but achieve the same results. The four types are as follows:

1) Sheet-Pile Wall – interlocking plates of steel are hammered into the ground;

2) Soil-Bentonite Wall – an excavated trench is backfilled with existing soils that have been mixed with bentonite;

3) Cement-Bentonite Wall – an excavated trench is backfilled with a cement-bentonite slurry; and

4) Jet Grouted Wall – using a specialized drill rig, overlapping cement columns are installed by jetting out most of the native material, while simultaneously combining any remaining native material with cement.

Impermeable barrier walls are potentially suitable for the Site because they greatly reduce possible off-Site migration of NAPL or contaminated groundwater. For the Site, an impermeable barrier wall would be installed at selected down gradient and upgradient boundaries of the Site, reducing flow across these boundaries. Either a sheet-pile wall, a soil-bentonite wall, a cement-bentonite wall, or a jet-grouted wall would be installed. The sheet-pile wall would be mechanically driven to the desired depth. The bentonite or cement wall would be constructed by digging a trench to the

desired depth and filling the trench with either a bentonite-soil mixture or a cement-bentonite mixture. During trenching, the trench would be filled with a viscous bentonite fluid to maintain stability.

There are two potential limitations to barrier walls. First, contaminated groundwater may flow through possible imperfections in the wall. Second, because the wall alters groundwater gradients and flow paths, contaminated groundwater may be deflected either vertically or horizontally away from and then around the wall.

Of the four walls, a soil-bentonite wall is the most cost effective, meets project requirements, and is an environmentally sustainable wall to install, particularly for long duration walls at the scale of installation as would be required at this Site. For short term duration walls (for example, as used for the temporary protection of utilities) that would be removed following the completion of remediation, sheet pile walls are a cost effective alternative. Additional information on the sustainable metrics used to evaluate the four wall types is presented in the Sustainability Evaluation of Remedial Alternatives Report (Geosyntec, 2013a).

3.5 S-ISCO

S-ISCO is a method to destroy contaminant mass in situ. An oxidant (i.e., persulfate) is injected into the subsurface to react with the contaminant mass present in the aqueous phase. When the contaminant is sparingly soluble a surfactant is injected with the oxidant. The surfactant solubilizes hydrophobic contaminants, making them more available for reaction with the oxidant.

S-ISCO is potentially suitable for the Site because the viscous coal tar can be solubilized by surfactants and then be destroyed by an oxidant. If implemented, treatability testing would be performed to determine the appropriate oxidant and surfactant, and determine the appropriate dosing levels. The surfactant would be injected in concert with the oxidant via direct push injection points, or permanent injection wells. Because the amount of mass needing treatment is large, multiple injections of oxidant would be needed.

One of the largest limitations to S-ISCO is uncertainty about whether the oxidant will be effectively delivered to low permeability zones and heavily contaminated NAPL zones where transmissivity is limited; otherwise not all contamination will be treated by S-ISCO. The treatability of the contaminants in the subsurface is dependent on the fluid/fluid contact in a heterogeneous, high saturation, multi-phase environment. In

addition, oxidant is spent on natural/background organics. Multiple injections are likely necessary and significant performance uncertainty exists.

3.6 Bio-Venting & Air Sparging

Bio-Venting and Air Sparging is a process to enhance aerobic degradation of lower molecular weight hydrocarbons by delivery of oxygen and nutrients. In the unsaturated zone (Bio-Venting), atmospheric air is pumped into the subsurface to stimulate aerobic degradation; nutrients may also be delivered. In the saturated zone, nutrients are injected (i.e., nitrates, phosphates, etc.,) and atmospheric air is sparged into the sub-surface. Bio-Venting and Air Sparging degrades lighter weight organic compounds (i.e., benzene) more readily than higher molecular weight hydrocarbons (i.e., PAHs) that are less water soluble, and more difficult to degrade.

This technology is potentially suitable for the Site because in the case of viscous coal tar, bio-venting and sparging depletes the more mobile and soluble components, leaving the heavier, less soluble, and difficult to degrade components behind as remainders. This remainder component represents a much lower environmental risk than the original viscous coal tar.

Bio-venting and sparging would be used to stimulate aerobic biodegradation of components of viscous tar at the Site. Injection points would be drilled to deliver oxygen and nutrients to support microbes capable of aerobically degrading the viscous tar. Regular sparging events would be needed in the saturated zones to deliver oxygen (atmospheric air) as it is consumed by degradation of the tar. Bio-venting would be operated continuously to resupply oxygen to the unsaturated zone, and nutrients added periodically via injection points. This remedy is a slow process for higher weight molecular compounds. The degradation of lower weight compounds would be limited by their diffusion out of the viscous coal tar. Given the significant amount of mass present and the high molecular weight, this remedy would take on the order of many years to decades to achieve remedial objectives.

3.7 Excavation & Off-Site Treatment

Excavation and off-Site Treatment is a combination method that involves the physical extraction of contaminated soil from its original location, and performance of off-Site treatment to destroy the contamination before disposal or reuse. Non-contaminated excavated material is stock-piled on-Site for future backfill material. During

excavation, shoring would be used to enable excavation of deeper contamination with minimal use of sloping. Sloping necessitates a larger volume of soil to be excavated. Excavated areas would need to be continually de-watered to allow machinery to operate and enhance geotechnical stability. The water collected during de-watering would be treated using GAC before discharge. Characterization sampling would be performed to confirm excavation bottom and side-walls meet remedial objectives. Following the completion of excavation and confirmatory sampling, backfilling of the excavated area with non-contaminated Site soils and imported materials would be required.

Off-Site treatment is an ex situ method to remove the contamination. Some form of thermal treatment is typically employed. Heat can be applied to desorb the contamination, or higher temperatures can be used to combust the contaminants.

Excavation and off-Site treatment is potentially suitable for the Site because the technology approach successfully identifies, removes, and treats the contamination. If implemented, the excavation remedy would remove the viscous tar. The excavated soils would be thermally treated off-Site at a treatment and disposal facility. Excavation areas would need dewatering and the collected water would need treating before discharge. Excavation at the Site would be logistically complicated to perform because of depth of contamination, anticipated dewatering rates, and footprint requirements at the Site for stock piling clean and contaminated soil. This remedial alternative remains technically challenging with potential health and safety issues associated with transportation of waste, vehicle related injuries, etc., and relatively low sustainability ranking during implementation due to generation of carbon dioxide, etc.

For full scale excavation of the Site, on-Site treatment was not considered a viable remedial approach because it would be even more logistically complicated to perform at the Site due to required space needs.

3.8 NFA

NFA assumes no remedial action is taken with the exception of institutional controls and monitoring. For the fill, sand, and silt lithologies NFA is not considered compliant with the Tech. Regs., which require the removal, treatment, or containment of free product (N.J.A.C, 7:26E-5.1). Further discussion on application of NFA in the Meadow Mat is discussed in more detail in Section 6.3.2.

4. EVALUATION CRITERIA

Eleven criteria were used to evaluate the remedial alternatives. Four criteria are based on Remedial Objectives, and seven are from the former NJDEP RAS requirements.

The remedial objectives criteria include:

- Protection of Human Health, Safety, and the Environment;
- Treatment or Removal of Free Product;
- Management of Direct Contact Risks; and
- Reduction of Impacts to Groundwater.

The NJDEP criteria include:

- Technical Implementability;
- Time Requirements;
- Consistency with Applicable Federal, State and Local Laws and Regulations;
- Impact to Local Community;
- Potential to Impact Natural Resources;
- Sustainability; and
- Cost.

Table 1 presents the ranking of each criterion for each remedial alternative. Each criterion was ranked a 1, 2, or 3 as defined in the following:

- 1 means the remedy ranks well for the evaluation criteria;
- 2 means the remedy ranks neutrally in the evaluation criteria; and
- 3 means the remedy ranks poorly for the evaluation criteria.

The scores of the Remedial Objective and the NJDEP Criteria were summed separately to assess the technology by each set of criteria, and then summed as a total score. The following sub-sections describe each evaluation criteria.

4.1 Protection of Human Health, Safety, and the Environment

This criterion judges the overall ability of a remedy to reduce the negative impacts of contamination. Remedies achieving this result received a score of 1. Remedies that cannot achieve this result received a score of 3.

4.2 Treatment or Removal of Free Product

This criterion judges the remedy's ability to remove, destroy, or isolate contaminant mass. Remedies achieving this result received a score of 1. Remedies that cannot achieve this result received a score of 3.

4.3 Management of Direct Contact Risks

This criterion judges the remedy's ability to reduce direct contact of contamination by humans and organisms. Remedies that more completely remove, destroy, or isolate the contaminant mass at or near surface received a score of 1. Remedies that cannot achieve this result received a score of 3.

4.4 Reduction of Impacts to Groundwater

This criterion judges the remedy's ability to stop mass transfer from non-aqueous phases to groundwater. Remedies that more completely stop mass transfer received a score of 1. Remedies that make no impact on reducing current and future mass transfer received a score of 3.

4.5 Implementability

This criterion judges each remedy's:

- Engineering and scientific feasibility;
- Availability of services and resources required for implementation; and
- Uncertainties associated with the construction, operation, and performance.

Remedies received a lower score (i.e., 1) if they can be implemented with standard equipment, required resources are readily available, and the uncertainties for construction, operation and performance are understood. Similarly a higher ranking (i.e., 3) was assigned if the remedy is more difficult to construct and operate.

4.6 Time Requirements

This criterion judges the length of time to achieve a RAO, based on experience with previous sites. Remedies received a lower score (i.e., 1) if the remedy can result in an RAO within 1 year of implementation, an intermediate score (i.e., 2) if the RAO is achieved in 2 years of implementation, and high score (i.e., 3) if the RAO is achieved in 3 years or more.

4.7 Consistency with Applicable Federal, State and Local Laws and Regulations

This criterion judges a remedy's compliance with local, state and federal laws as they apply to soils contamination on-Site and associated remedial activities. A lower score (i.e., a 1) indicates the remedy meets most applicable laws and a higher score (i.e., 3) indicates the remedy meets fewer applicable laws.

4.8 Ability to Minimize Potential Impact to the Local Community

This criterion judges potential impacts to local community in the short and long-term, including increased construction traffic, noise from remedial operations, dust generation, and detours. A lower score (i.e., a 1) indicates minimal impacts to the community and a higher score (i.e., a 3) indicates significant impacts to the community.

4.9 Potential to Impact Natural Resources

This criterion judges the potential for negative impacts to natural resources, including groundwater, surface water, and the sediment benthic habitat. Remedies that prevent impacts received a ranking of 1; remedies that did not prevent impacts received a ranking of 3.

4.10 Sustainability

This criterion judges the sustainability of the remedies. More sustainable remedies were given a lower score (i.e., 1 versus 3). More sustainable remedies use less energy during installation and operation, require less manufactured material (e.g., steel or chemical amendments), use natural processes, facilitate beneficial use of the treated area, permanently destroy/stabilize/remove contaminants, and have a more neutral water balance. The sustainability scores assigned are derived from and consistent with the rankings of the remedies in the Sustainability Report (Geosyntec, 2013a).

4.11 Cost

This criterion judges the potential cost for implementing and operating the remedy based on previous experience and Site characteristics. Remedies that have high costs received a score of 3. Remedies with lowest costs received a score of 1.

5. REMEDIAL ALTERNATIVE RANKINGS

The results of the evaluation are displayed in Table 1. Table 2 provides the rationale and assumptions for the rankings. This section compares the best ranked remedy in Table 1 against the next three ranked remedies. In Table 1 STAR is ranked the best remedy. STAR received an overall ranking of 24 followed by ISTD/ISTS at 29, Excavation & Off-Site Treatment at 33, and ISS at 34. Generally rankings summed on the basis of NJDEP Criteria or Remedial Objectives, or all criteria (Total) correlate well with each other (see Table 1).

5.1 Comparison of STAR vs. ISTD/ISTS

STAR ranks more favorably than ISTD/ISTS for three main reasons: (1) Potential for mobilization of contaminants; (2) Sustainability; and (3) Cost.

STAR is less likely to mobilize contamination than ISTD/ISTS. During ISTD/ISTS, the amount of heat present in the subsurface at any given time is more widely distributed than STAR. If there is a power outage during ISTD/ISTS, a larger amount of mobilized vapors and less viscous tar can migrate. During STAR the heat is confined to the small volume of soil adjacent to and within the combustion front, resulting in less possibly mobilized contamination. ISTD/ISTS also leaves some contaminants in place (low temperature application), which is not as beneficial a technology application as STAR which more completely thermally destructs constituents.

Any form of ISTD (i.e. TCH, ISTS) uses more electricity than STAR, making it less sustainable and cost effective compared to STAR. ISTD/ISTS must continue to supply heat to the sub-surface to volatilize the contamination. During STAR, heat is only supplied at the beginning to initiate the combustion front. All subsequent heat to continue the combustion front comes from the energy released by the exothermic combustion of the contaminants. See the Sustainability Report (Geosyntec, 2013a) for more details.

Although ISTD/ISTS is an established technology with proven/predictable results as a function of temperature and time, the benefits of the innovative technology of STAR and the positive results of the pilot test are seen to outweigh this.

5.2 Comparison of STAR vs. ISS

STAR ranks more favorably than ISS for three main reasons: (1) Destruction of Contamination; (2) Sustainability; and (3) Cost.

STAR completely destroys the tar/viscous tar present in the subsurface. ISS binds the tar/viscous tar in an impermeable matrix (cement or bentonite). Tar/viscous tar may still exist as free product because the mixing may be heterogeneous and some contamination may not be stabilized. This negatively impacts ISS when ranking for Consistency with Federal, State and Local Laws and Impact to Natural Resources. In addition, the application of ISS also changes the geotechnical characteristics of the Site, which is a consideration for future use of the Site.

ISS is less sustainable than STAR because of the significant amount of machinery and fuel needed to mix the soil and stabilizing agent. If cement is used as the stabilizing agent instead of bentonite, ISS is even less sustainable because of the energy expended and carbon dioxide emitted to produce and transport cement. See the Sustainability Report (Geosyntec, 2013a) for more details.

The cost of mixing the soil and adding the stabilizing agent (bentonite or cement) is greater than STAR where vapor extraction and injection wells need to be installed and heat only applied at the beginning of the process.

Similar to the STAR vs. ISTD/ISTS comparison, ISS is also an established technology; however, the benefits of STAR and the positive results of the pilot test are seen to outweigh this.

5.3 Comparison of STAR vs. Excavation & Off-Site Treatment

STAR ranks more favorably than Excavation & Off-Site Treatment for the following reasons: (1) Management of Direct Contact Risks; (2) Complexity; (3) Sustainability; and (4) Cost.

During Excavation and off-Site Treatment, the possibility of contact with contamination is relatively high for workers. In addition, implementing the remedy will be difficult because of the logistical complexity of excavating to the desired depth and managing stockpiling of clean and contaminated excavated soils. Some of this may be mitigated by staging the implementation approach.

The high-energy use during excavation, dewatering, trucking, etc., and off-Site treatment of contaminated soil will make Excavation & Off-Site Treatment much less

sustainable than STAR. See the Sustainability Report (Geosyntec, 2013a) for more details.

The cost for heavy construction associated with Excavation & Off-Site Treatment is greater than STAR where vapor extraction and injection wells need to be installed, heat applied at the beginning of the process, and the surface sealed with a thin layer of asphalt.

While Excavation and Off-Site Treatment is a generally accepted remedial option with more certainty of treatment, the management of direct contact risks, complexity, sustainability and cost of this option make STAR a more preferred remedial approach.

6. REMEDY APPLICATION BY FOOTPRINT SIZE AND LITHOLOGY

The top four remedies presented in the previous section are compared against each other in Table 3 for their implementability and anticipated remedial success within the different footprint size, location, and lithology in which the COCs reside. The regions and lithology over which the remedies would be applied are shown in plan view in Figures 4 and 5 and profile view in Figure 6.

6.1 Footprint Size

STAR is both suitable in larger footprint areas (where dedicated power drops and equipment may reside) and smaller footprint areas (where a mobile system can be deployed). If required, ISTD/ISTS or ISS may be considered for remediation in large and small footprint areas. In small footprint areas Excavation & Off-Site Treatment and NFA (based on groundwater modeling) may also be considered along with ISTD/ISTS and ISS.

6.2 Lithology

6.2.1 Historic Fill

STAR is the preferred remedy to treat contamination at the Site. STAR requires the delivery of oxygen to the combustion front by injecting atmospheric air near the combustion front. Through pilot test experience, it is believed that the injected air forms what can be conceptualized as a ‘bubble’ of air encapsulating the combustion front and surrounded by groundwater. In regions where the combustion front is sufficiently deep below the groundwater table, the ‘bubble’ can be maintained.

A number of implementation options have been considered for the Historic Fill where the combustion front is not deep enough below the water table. The treatment area could be dewatered for STAR implementation under unsaturated conditions or flooded to increase the water pressure above the “bubble”. Alternatively, the well spacing could be reduced so that STAR could be applied using less injection air pressure to reduce the potential for “bubble” collapse. A physical barrier may be required for the dewatering and flooding options but not the reduced well spacing option.

If clean-up objectives are not achieved by STAR in the historic fill, other alternative technologies that can be used to treat contamination are ISTD/ISTS, Excavation & Off-

Site Treatment, or ISS. In smaller footprint areas NFA (based on supporting groundwater modeling) may also be considered.

6.2.2 Meadow Mat

The Meadow Mat is a lithological zone characterized by low permeability soil and with high natural organic matter. In this environment, the organic COCs will be strongly sorbed, and contaminant transport/flux will be dominated by diffusion. Diffusion is a slow process, and thus may bind contaminants similar to application of an ISS technology. The back diffusion of COCs from the Meadow Mat may be minimal and can therefore be left in place. Any COC mass that diffuses into the groundwater should therefore be less than the assimilative biodegradation capacity of the groundwater. This is also the preferred remedial approach as the Meadow Mat serves as a semi-confining layer and use of remedial approaches that may impact that role should be minimized (e.g., excavation). If a more aggressive remedial alternative is required, ISTD/ISTS or ISS are alternative technologies that can be implemented in this lithology.

6.2.3 Sand/Silt

Contamination in the Sand/Silt lithological zones has only been found to reside in the larger footprint areas of the Site (See Figure 4, Alluvium and Lake Bottom Deposits). STAR is the preferred remedy to treat contamination, and through pilot testing, has been shown to be effective within this unit. If clean-up objectives are not achieved, ISTD/ISTS or ISS may be alternative technologies in this region. As a polishing technology, bio-venting and sparging may be a suitable remedy.

7. SELECTED REMEDIES

The nature of contamination at the Site necessitates a mixed approach to remediation. Consideration for the area and lithological zone of the contamination must be made when selecting the appropriate remedial technology. Generally, the following approach is selected for implementation at the Site for the treatment of on-Site soils:

- Application of STAR to treat tar/viscous tar contamination in the Historic Fill and Sand/Silt lithological zone of the Site;
- If required based on STAR performance, application of Excavation & Off-Site Treatment, ISTD/ISTS, or ISS in the Historic Fill lithologic zone where free product is present for remediation in large footprint areas (and additional NFA [based on groundwater modeling] in smaller footprint areas);
- If required based on STAR performance, application of ISTD/ISTS, or ISS in the Sand/Silt lithologies where free product is present;
- Application of bio-venting and sparging in the Sand/Silt lithological zone of the Site as a polishing technology will be considered if required; and
- Application of NFA for residual compounds present in the Meadow Mat lithological zone of the Site; provided that groundwater evaluations (i.e., modeling, sampling and analysis) after on-site soil treatment is complete confirm natural attenuation is adequate.

The rankings presented in this RASR and the remedies selected are based on our current knowledge of the Site, current Site conditions, and our professional judgment. The Site is large and complex. Possible new information may necessitate an adjustment in the rankings presented, technologies selected, and implementation of selected technologies.

8. OTHER FULL-SCALE DESIGN CONSIDERATIONS

As part of the full-scale design and implementation of the remedial alternative selected, a number of other associated activities will be required for remediation of on-Site soils, and may include:

- Site preparation (clearing, demolition, re-grading, surface drainage/storm water management, and paving), which will be designed to maintain the cap/final cover of the Site;
- Localized utility protection, both along the Site boundaries and on the property where the remedy is applied (consideration for abandonment of shallow utilities, bringing above ground where required, localized sheet pile wall that may be removed post treatment, replacement of wood posts with alternative materials, etc.)
- Service installation (electrical supply installation);
- Preparation of necessary permits, notifications, etc.; and
- Completion of institutional controls (deed notice and soil remediation permit).

A consideration for implementation of the selected remedial alternative (i.e., STAR), particularly where contamination resides along Site boundaries, has been the installation of an impermeable barrier wall. A barrier wall will mitigate the migration of off-Site NAPL into treated on-Site areas; however, the potential for NAPL migration in this manner is not well understood. Confirmatory testing post-STAR activities may be conducted to better understand the likelihood of this scenario, and a wall may be installed post-soils treatment if NAPL migration to the Site is observed. The need for a Site boundary barrier wall does not appear to be required based on remedial objectives; however, a shallow (i.e., the fill layer) barrier wall locally to STAR operations may be required based on design plan review by local regulatory agencies or as assessed during detailed design. These shallow walls could be removed post-STAR operation.

Plans for full-scale implementation will be covered in more detail in the upcoming RAWP currently being prepared.

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TABLES

TABLE 1
RANKING OF REMEDIAL ALTERNATIVES
Former Pitt-Consol Site, Newark, New Jersey

			Remedial Alternatives															
			STAR		ISTD/ISTS		ISS		P&T + Wall		S-ISCO		BV&Sparging		Excavation		NFA	
		Term in Which the Result is Anticipated	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long
Evaluation Criteria	Remedial Objectives	Protective of Health, Safety, and Environment	1	1	1	1	1	2	1	2	2	2	2	2	1	1	3	3
		Treatment/Removal of Free Product	1	1	2	1	1	2	3	3	2	2	2	2	1	1	3	3
		Management of Direct Contact Risks	1	1	1	1	2	1	2	2	2	2	2	2	3	1	3	3
		Reduction of Impacts to Groundwater	1	1	1	1	1	2	1	1	2	2	2	2	1	1	3	3
	NJDEP Criteria	Technical Implementability	2	1	2	1	2	2	1	2	2	2	2	2	3	1	1	1
		Time Requirements	1	1	1	1	1	1	3	3	3	2	3	3	1	1	3	3
		Consistency with Federal, State and Local Laws	1	1	1	1	2	2	2	2	1	3	2	2	1	1	3	3
		Impact to Local Community	1	1	1	1	1	1	2	1	1	1	1	1	3	1	1	1
		Impact to Natural Resources	1	1	2	1	2	2	1	1	3	3	2	1	2	1	3	3
		Sustainability	1	1	3	1	2	1	1	1	3	2	1	3	3	1	1	1
		Cost	2	1	3	1	2	1	2	2	3	2	1	1	3	1	1	2
		Subtotal Remedial Objectives	8		9		12		15		16		16		10		24	
		Subtotal NJDEP Criteria	16		20		22		24		31		25		23		27	
		TOTAL	**24**		**29**		**34**		**39**		**47**		**41**		**33**		**51**	

3	Alternative ranks poorly for the evaluation criteria
2	Alternative ranks neutrally for the evaluation criteria
1	Alternative ranks well for the evaluation criteria
	Gradient for Subtotals and Total based upon the following:

Subtotal Remedial Objectives = 8 to 24
Subtotal of NJDEP Criteria = 16 to 31
Total = 24 to 51

Remedial Alternatives	
Descriptor	**Full Name**
STAR	Self-sustaining Treatment for Active Remediation
ISTD/ISTS	In Situ Thermal Desorption / In Situ Thermal Stabilization
ISS	In Situ Stabilization
P&T + Wall	Hydraulic Containment - Pump & Treat & Physical Containment - Impermeable Barrier Wall
S-ISCO	Surfactant - In Situ Chemical Oxidation
BV&Sparging	Bio-Venting & Air Sparging
Excavation	Excavation & Off-Site Treatment
NFA	No Further Action

Acronyms
NJDEP - New Jersey Department of Environmental Protection

TABLE 2
ASSUMPTIONS FOR RANKING OF REMEDIAL ALTERNATIVES
Former Pitt-Consol Site, Newark, New Jersey

			STAR	In Situ Thermal Desorption / In Situ Thermal Stabilization	In Situ Stabilization	Hydraulic Containment - Pump & Treat with Physical Containment - Barrier Wall
Evaluation Criteria	Remedial Objectives	Protective of Health, Safety, and Environment	• Short-term and Long-term: low, remedy destruction of tar/viscous tar, remedy activities are not relatively hazardous.	• Short-term and Long-term: low, remedy destruction of tar/viscous tar, remedy activities are not relatively hazardous.	• Short-term: low, remedy isolates viscous tar. • Long-term: moderate, slight chance remedy may not meet objectives.	• Short-term and Long-term: low, remedy contains contaminated groundwater on-Site. • Long-term: moderate, contaminated groundwater may leak through, or transport around, wall.
		Treatment/Removal of Free Product	• Short-term and Long-term: low, remedy destruction of tar/viscous tar.	• Short-term: moderate, remedy destruction of tar/viscous tar, but tar and vapor may migrate during power failures. Long-term: low, remedy destruction of tar/viscous tar.	• Short-term: low, remedy isolates viscous tar. • Long-term: moderate, slight chance remedy may not meet objectives.	• Short-term and Long-term: high, pump and treat system slowly removes tar/viscous tar through the treatment system.
		Management of Direct Contact Risks	• Short-term and Long-term: low, remedy destruction of tar/viscous tar, remedy activities involve minimal direct contact with contaminants.	• Short-term and Long-term: low, remedy destruction of tar/viscous tar, remedy activities involve minimal direct contact with contaminants.	• Short-term: moderate, mixing brings tar/viscous tar to surface before isolation by stabilization agent. • Long-term: low, remedy isolates viscous tar and places a capping layer over top.	• Short-term and Long-term: moderate, remedy does not address direct contact risks.
		Reduction of Impacts to Groundwater	• Short-term and Long-term: low, remedy destruction of tar/viscous tar.	• Short-term and Long-term: low, remedy destruction of tar/viscous tar.	• Short-term: low, remedy isolates viscous tar. • Long-term: moderate, slight chance remedy may not meet objectives.	• Short-term and Long-term: low, remedy prevents contaminated groundwater from leaving the Site, via capture and impediment of flow leaving the Site.
	NJDEP Criteria	Technical Implementability	• Short-term: moderate, technology is demonstrated at pilot scales, requires moderate amount of infrastructure and equipment. • Long-term: low, no long term elements to this remedy.	• Short-term: moderate, technology is demonstrated, but requires moderate amount of infrastructure and equipment. • Long-term: low, no long term elements to this remedy.	• Short-term: moderate, large and deep volume of soil needs remediation. • Long-term: moderate, long term monitoring may be required.	• Short-term: low, pump and treat is easy to implement; barrier wall installation is standard. • Long-term: moderate, long term monitoring, operation, and maintenance and replacement. Infrastructure constrains future development.
		Time Requirements	• Short- and Long-term: low, this remedy can be implemented within one year.	• Short- and Long-term: low, this remedy can be implemented within one year.	• Short- and Long-term: low, this remedy can be implemented within one year.	• Short- and Long-term: high, pump and treat will take on the order of decades to significantly reduce contaminant concentrations to below regulatory standards.
		Consistency with Federal, State, and Local Laws	• Short- and Long-term: low, once implemented tar/viscous tar destroyed.	• Short- and Long-term: low, once implemented tar/viscous tar destroyed.	• Short- and Long-term: moderate, remedy stops off-Site contaminant migration; however, does not reduce contaminant mass in situ.	• Short- and Long-term: moderate, remedy physically separates on-Site tar/viscous tar from off-Site properties. Residual tar/viscous tar will remain in low permeability zones.
		Impact to Local Community	• Short-term: low, remediation activities take place on-Site. Relatively low impacts from transportation/shipping to/from the Site. • Long-term: low, remedial activities are complete	• Short-term: low, remediation activities take place on-Site. Relatively low impacts from transportation/shipping to/from the Site. • Long-term: low, remedial activities are complete	• Short-term: low, remedy implemented on-Site. • Long-term: low, remedial activities are complete.	• Short-term: moderate, installation of wall will be noisy and involve truck traffic. • Long-term: low, remedy is passive.
		Impact to Natural Resources	• Short-term: low, remediation occurs on-Site, and is unlikely to mobilize contaminants, and combustion vapors are collected and treated. • Long-term: low, the tar/viscous tar is destroyed.	• Short-term: moderate, power outages during remediation can result in off-Site migration of heated, less viscous tar and contaminant vapors. • Long-term: low, the tar/viscous tar is destroyed.	• Short-term and Long-term: moderate, viscous tar leaching is not anticipated, but still possible.	• Short- and Long-term: low, however a pump failure will allow migration of contaminant. Assumed mechanical failures will be fixed in a matter of days to re-establish the capture zone and barrier wall provides additional time for system repair.
		Sustainability	• Short-term: low, minimal heavy equipment, fuel, and energy used during remediation compared to other remedies. • Long-term: low, no further remediation activities are needed.	• Short-term: high, heavy equipment and large amounts of energy are used during remediation. • Long-term: low, no further remediation activities are needed.	• Short-term: moderate, requires equipment and injection of manufactured material (concrete). • Long-term: low, remedy is passive.	• Short- and Long-term: low, less heavy equipment, fuel, and steel or concrete used during construction compared to other remedies. • Long-term: low, pumping only requires a low extraction rate.
		Cost	• Short-term: moderate, relative to other remedies. • Long-term: low, no further remediation activities are needed.	• Short-term: high, significant electricity usage. • Long-term: low, no further remediation activities are needed.	• Short-term: moderate, heavy construction and addition of stabilizing agents. • Long-term: low, minimal O&M.	• Short-term: moderate, relative to other remedies. • Long-term: moderate, active pumping will have long term O&M costs.

TABLE 2
ASSUMPTIONS FOR RANKING OF REMEDIAL ALTERNATIVES
Former Pitt-Consol Site, Newark, New Jersey

			Surfactant - In Situ Chemical Oxidation	Bio-Venting & Sparging	Excavation & Off-Site Treatment	No Further Action
Evaluation Criteria	Remedial Objectives	Protective of Health, Safety, and Environment	• Short-term: moderate, remedy degrades tar/viscous tar, but presents a hazard to ecological and worker health. • Long-term: moderate, untreated viscous tar will be present in low permeability zones after oxidant is exhausted.	• Short-term & Long-term: moderate, remedy will only slowly degrade the high weight tar/viscous tar compounds, leaving them available for off-Site migration.	• Short-term and Long-term: low, remedy removes tar/viscous tar.	• Short-term & Long-term: high, remedy does not remove contaminant or stop contaminant migration.
		Treatment/Removal of Free Product	• Short-term and Long-term: moderate, oxidant will destroy tar/viscous tar it contacts, but may not be adequately delivered to all zones, and will become exhausted over longer time periods.	• Short-term & Long-term: moderate, the remedy will be very slow to degrade all free product. Further adequate delivery of oxygen to viscous tar is uncertain.	• Short-term and Long-term: low, remedy removes tar/viscous tar.	• Short-term & Long-term: high, remedy does not remove or treat contaminant.
		Management of Direct Contact Risks	• Short-term and Long-term: moderate, oxidant will destroy viscous tar it contacts, but may not be adequately delivered to all zones, and will become exhausted over longer time periods.	• Short-term & Long-term: moderate, the remedy will be very slow to degrade all free product.	• Short-term: high, during excavation and off-Site treatment possibility of contact with contamination is relatively high for workers. • Long-term: low, remedy removes tar/viscous tar	• Short-term & Long-term: high, remedy does not remove or treat contaminant.
		Reduction of Impacts to Groundwater	• Short-term: moderate, oxidant will destroy aqueous contaminants, but may present a hazard to environmental receptors. • Long-term: moderate, oxidant may not have consumed all viscous tar.	• Short-term & Long-term: moderate, the remedy will be very slow to degrade all free product. Further adequate delivery of oxygen to viscous tar is uncertain.	• Short-term: low, water removed during excavation is treated. • Long-term: low, remedy removes tar/viscous tar.	• Short-term & Long-term: high, remedy does not remove or treat contaminant.
	NJDEP Criteria	Technical Implementability	• Short-term: moderate, multiple injection points to reduce uncertainty of S-ISCO delivery. Oxidant migration to off-Site properties needs to be prevented. • Long-term: moderate, multiple injections likely required.	• Short-term: moderate-low, multiple injection points required, to reduce uncertainty about oxygen delivery. • Long-term: moderate, on-going sparging and presence of injection points will constrain future development.	• Short-term: high, though a standard technology, excavating and off-Site treatment will be difficult because of depth of contamination and space limitations on-Site. • Long-term: low, no long term elements to this remedy.	• Short- and Long-term: low, only monitoring.
		Time Requirements	• Short-term: high, multiple injections spanning more than 3 years will likely be needed. • Long-term: moderate, repeat injections may be required as contaminant diffuses out of low permeability zones.	• Short-term and Long-term: high, degradation of high molecular weight organic compounds takes a significant time period.	• Short- and Long-term: low, remedy can be implemented in under one year.	• Short- and Long-term: high, monitoring will continue into perpetuity.
		Consistency with Federal, State, and Local Laws	• Short-term: low, remedy destroys solubilized tar/viscous tar. • Long-term: high, remedy may fail as oxidant is depleted or redistributed by diffusion and desorption.	• Short-term and Long-term: moderate, alternative takes a long time to destroy tar/viscous tar.	• Short- and Long-term: low, removes contaminant mass and eliminates potential for COC migration.	• Short- and Long-term: high, potential for COC migration off-Site is not mitigated.
		Impact to Local Community	• Short-term: low, activities will be limited to the Site. • Long-term: low, few long term activities are expected.	• Short-term and Long-term: low, activities will be limited to the Site, and decline over time.	• Short-term: high, remedy increases heavy equipment traffic on local streets. • Long-term: low, no long term elements to this remedy.	• Short- and Long-term: low, no activities aside from monitoring occur.
		Impact to Natural Resources	• Short-term: high, if oxidant migrates off-Site or to surface waters it could cause fish kills and other issues. • Long-term: high, after oxidant exhaustion, tar desorption may occur and migrate to off-Site properties.	• Short-term: moderate, degradation is slow for high molecular weight compounds and they may still migrate off Site without containment measures. • Long-term: low, remedy will destroy tar/viscous tar.	• Short-term: moderate, dewatering alters groundwater flow patterns. • Long-term: low, remedy removes and treats tar/viscous tar.	• Short- and Long-term: high, off-Site migration of contaminants possible.
		Sustainability	• Short-term: high, much energy required for oxidant production. Also, shipping and equipment necessary to inject oxidant. • Long-term: moderate, multiple injections may be necessary.	• Short-term: low, biologically based remedy needing minimal construction compared to other remedies. • Long-term: high, long term energy consumption for air injection and soil vapor extraction.	• Short-term: high, high-energy use during excavation, dewatering, trucking, etc., and off-Site treatment of contaminated soil. • Long-term: low, no further remediation activities are needed.	• Short- and Long-term: low, minimal technology implementation and therefore minimal energy usage and waste generation.
		Cost	• Short-term: high, cost for oxidant. • Long-term: moderate, multiple on-going injections may be necessary.	• Short-term and Long-term: low, drilling of wells is common and relatively simple, sparging of air is less energy intensive than pumping water.	• Short-term: high, heavy construction, depth of contamination, dewatering and on-Site treatment costs. • Long-term: low, no further remediation activities are needed.	• Short- term: low, only costs are for monitoring. • Long-term: moderate, monitoring costs will be a recurring expense into perpetuity.

Acronyms COC - Contaminant of Concern
O&M - Operation and Maintenance
NJDEP - New Jersey Department of Environmental Protection
STAR - Self-sustaining Treatment for Active Remediation

TABLE 3
REFINED REMEDIAL OPTIONS BY CONTAMINANT LOCATION
Former Pitt-Consol Site, Newark, New Jersey

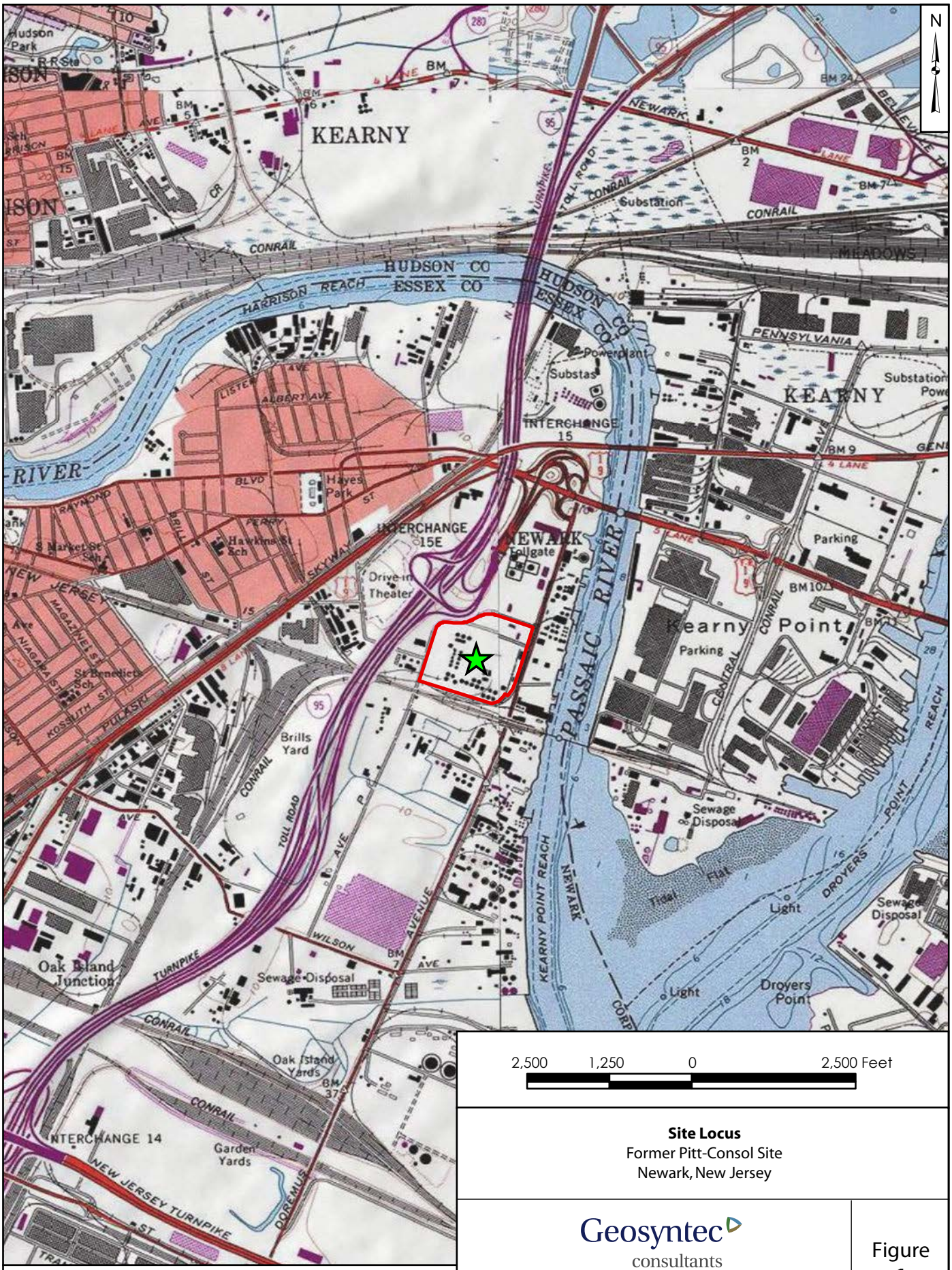
Lithology (from surface to depth)	Considered Remedial Options				Selected Remedial Options
	STAR	ISTD/ISTS	ISS	Excavation & Off-Site Treatment	
Larger Footprint Areas					
Historic Fill	1	2	2	2	STAR (ISTD/ISTS, ISS, and Excavation and Off-Site Treatment are retained as back-up alternatives if required.)
Meadow Mat	--	--	--	--	No Further Action (Active remedies herein difficult to apply in Meadow Mat. Meadow Mat hydrogeological characteristics more suitable medium for this approach.)
Sand/Silt	1	2	2	3	STAR (ISTD/ISTS or ISS retained as back-up alternatives if required.)
Smaller Footprint Areas & More Remote Areas					
Historic Fill	1	2	2	2	STAR (ISTD/ISTS, ISS, Excavation & Off-Site Treatment, or NFA retained as back-up alternatives if required/appropriate.)
Meadow Mat	--	--	--	--	No Further Action (Active remedies herein difficult to apply in Meadow Mat. Meadow Mat hydrogeological characteristics more suitable medium for this approach.)
Sand/Silt	--	--	--	--	NA - Contamination has not been discovered in the sand and silt in the smaller foot print and more remote areas.

Legend

3	Alternative ranks least implementable for the location of contaminants
2	Alternative ranks neutrally for the location of contaminants
1	Alternative ranks most implementable for the location of contaminants
--	Active remediation is not needed in this location.

ISS - In Situ Stabilization
ISTD/ISTS - In Situ Thermal Desorption / In Situ Thermal Stabilization
NA - Not Applicable
NFA - No Further Action
STAR - Self-sustaining Treatment for Active Remediation

FIGURES



Base Map: USGS Jersey City and Elizabeth Quadrangles (1:24,000)

Site Locus
Former Pitt-Consol Site
Newark, New Jersey

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Figure 1

Site Locus.ai

Path: P:\PRJ1\TR0388-Pitt Consol (Non-STAR)\GIS\Projects\SiteLocus.mxd

Legend

- Well Location
- CMT Well
- Newark Parcel Boundary (lot/block)
- Site Boundary
- Estimated Sewer Line
- Historic Site Feature
- Former Lagoon

Notes:

1. 2012 aerial photograph courtesy of Microsoft Corporation

CMT - Continuous Multi-Channel Tubing

200 100 0 200 Feet

Site Plan

Former Pitt-Consol Site
Newark, New Jersey

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Figure 2

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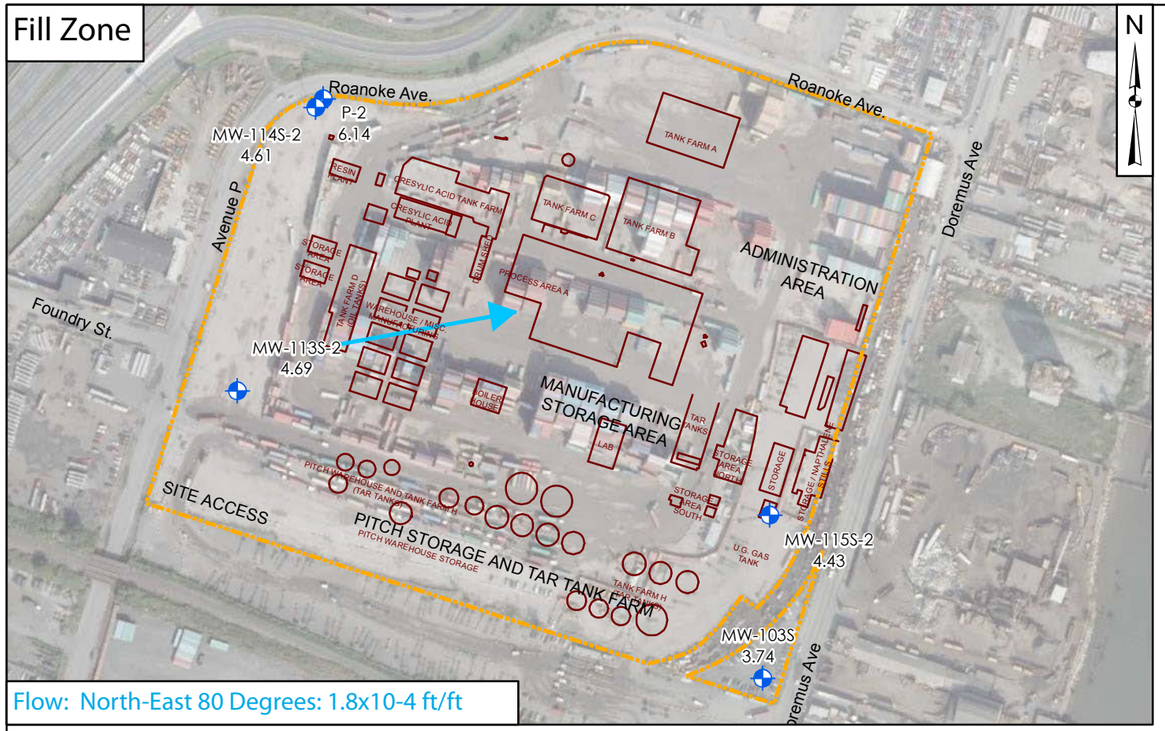

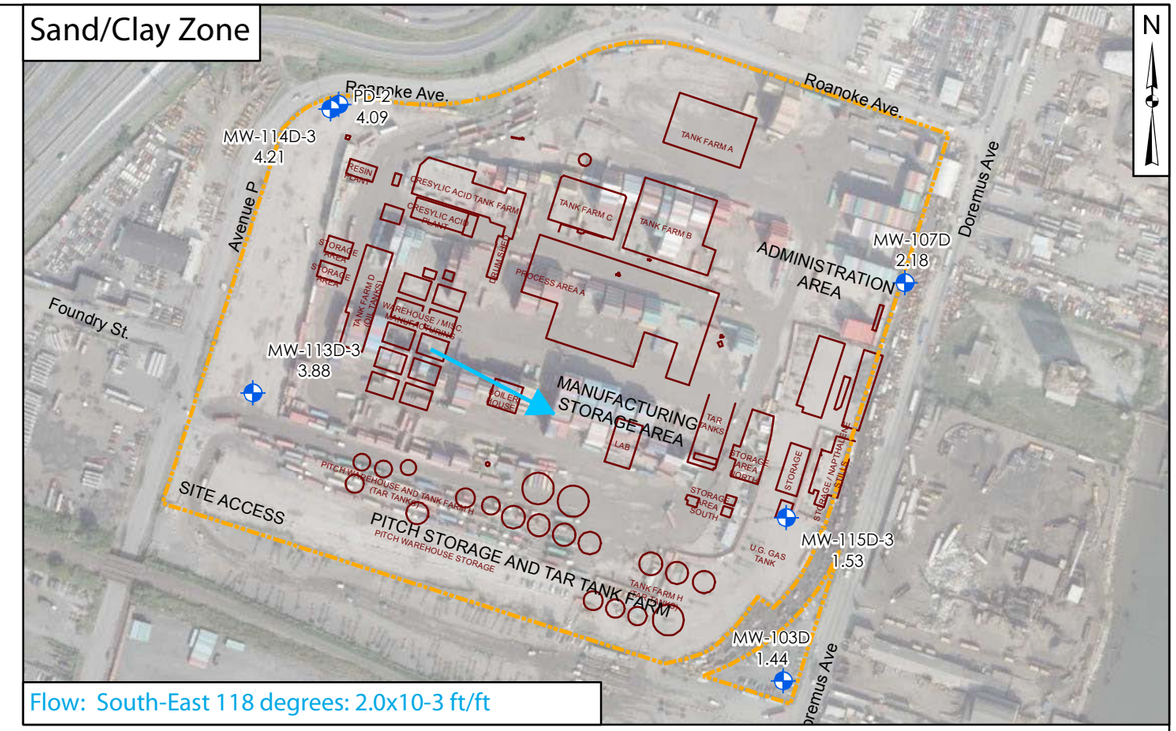

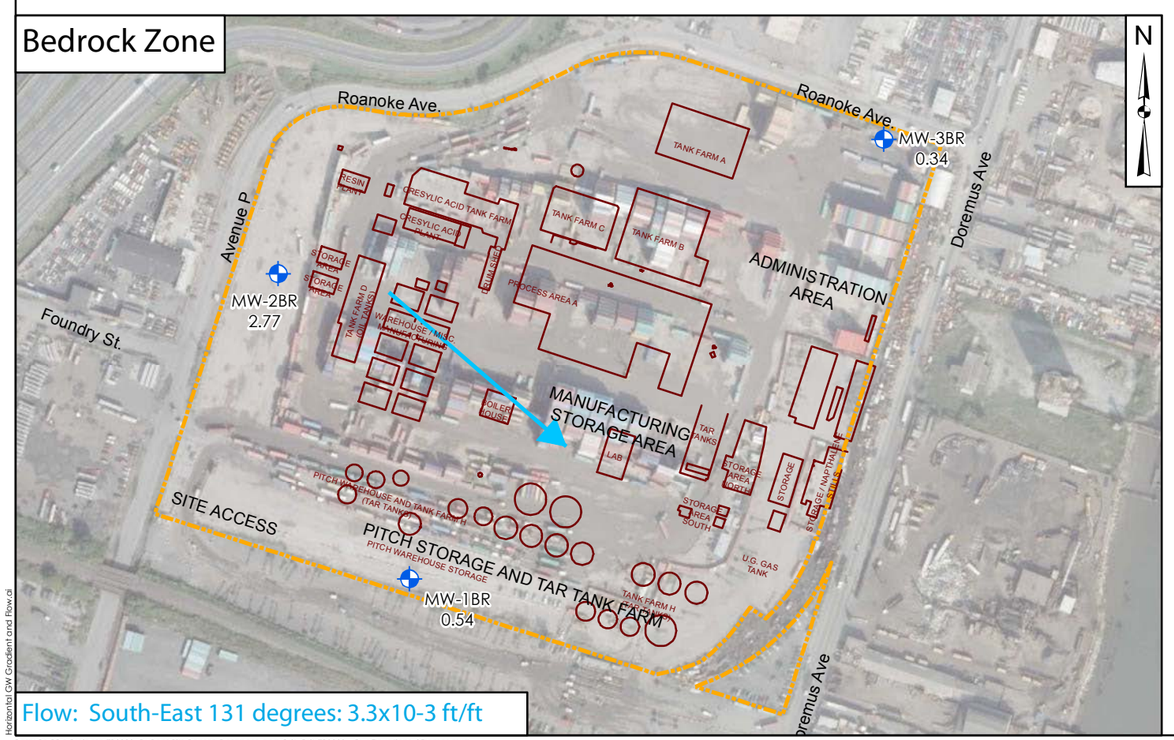

Legend

- Groundwater Elevation (ftmsl)
- Groundwater Flow Direction
- Site Boundary
- Historical Feature

Flow: North-East 80 Degrees: 1.8x10-4 ft/ft

Flow Direction

Hydraulic Gradient

Notes:

1. MW-113S-2, MW-114S-2, and MW-115S-2 were used to calculate groundwater flow direction and gradient in the fill zone.
2. MW-113D-3, MW-114D-3, MW-115D-3, and PD-2 were used to calculate groundwater flow direction and gradient in the sand/clay zone.
3. MW-1BR, MW-2BR, and MW-3BR were used to calculate groundwater flow direction and gradient in the bedrock zone.
4. Location of Columbia Container shipping vessels are approximate and may be different from what is shown.
5. 2010 aerial photograph courtesy of Mircosoft Corporation.

CCS - Columbia Container Services

ftmsl - feet mean sea level

300 150 0 300 Feet

Horizontal Groundwater Gradient and Flow Direction
Former Pitt-Consol Site
Newark, New Jersey

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Figure 3

Horizontal GW Gradient and Flow.ai

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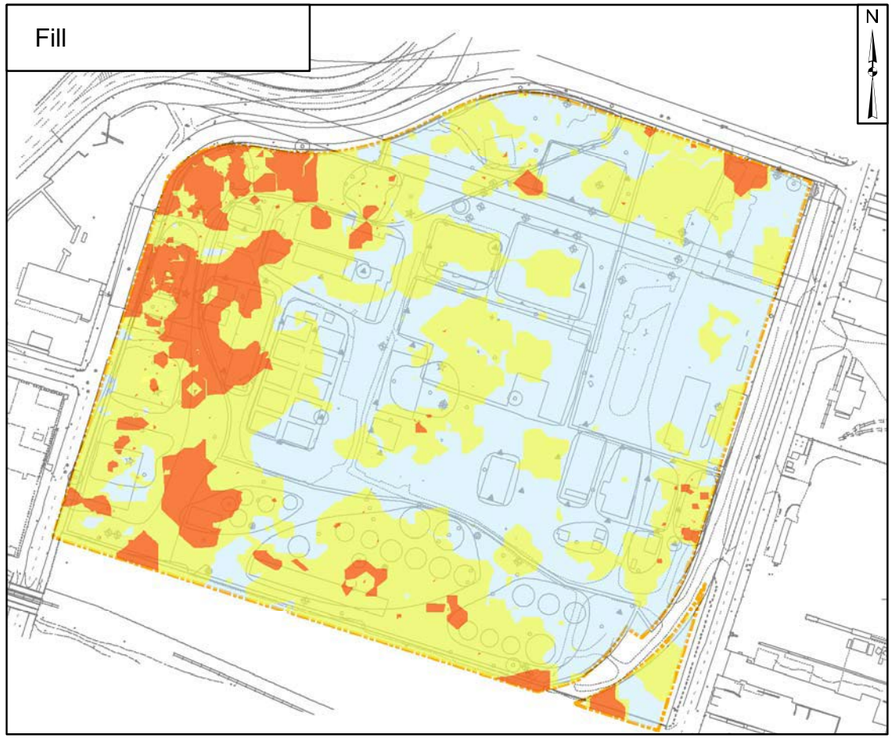

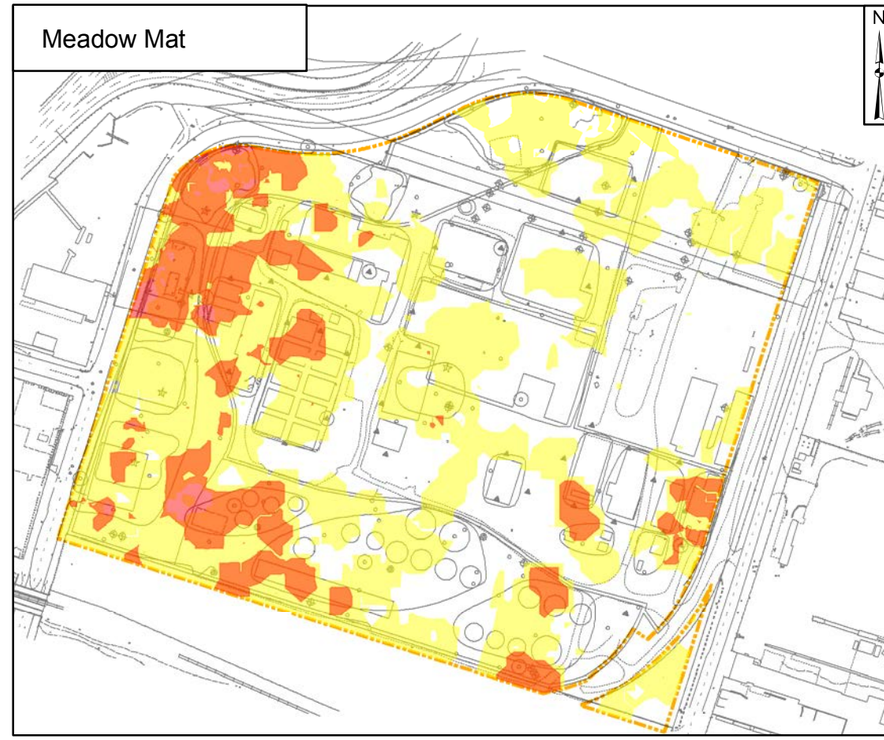

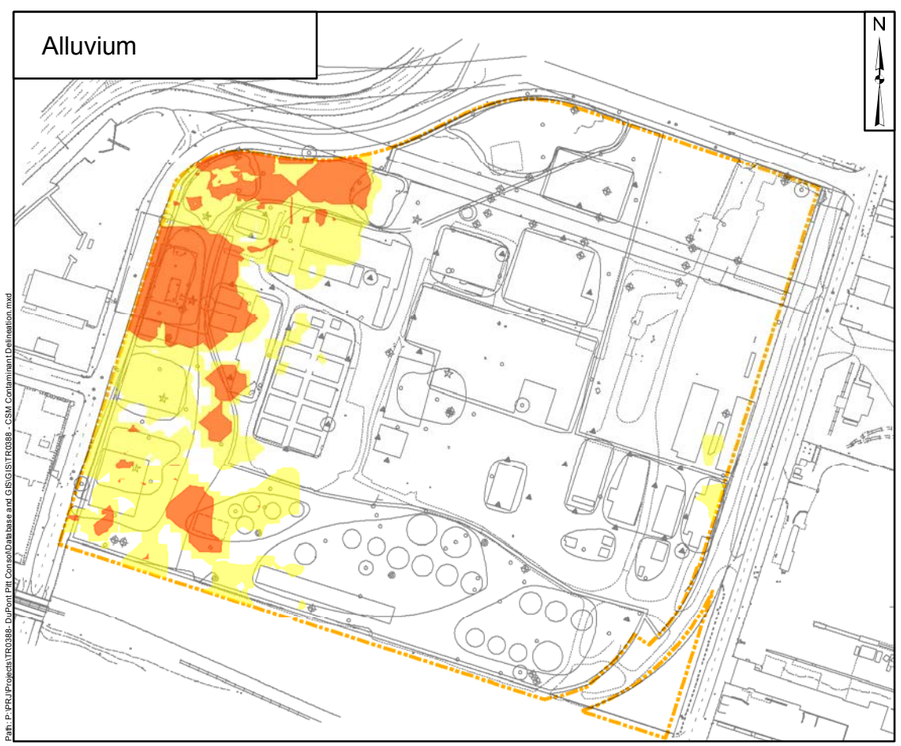

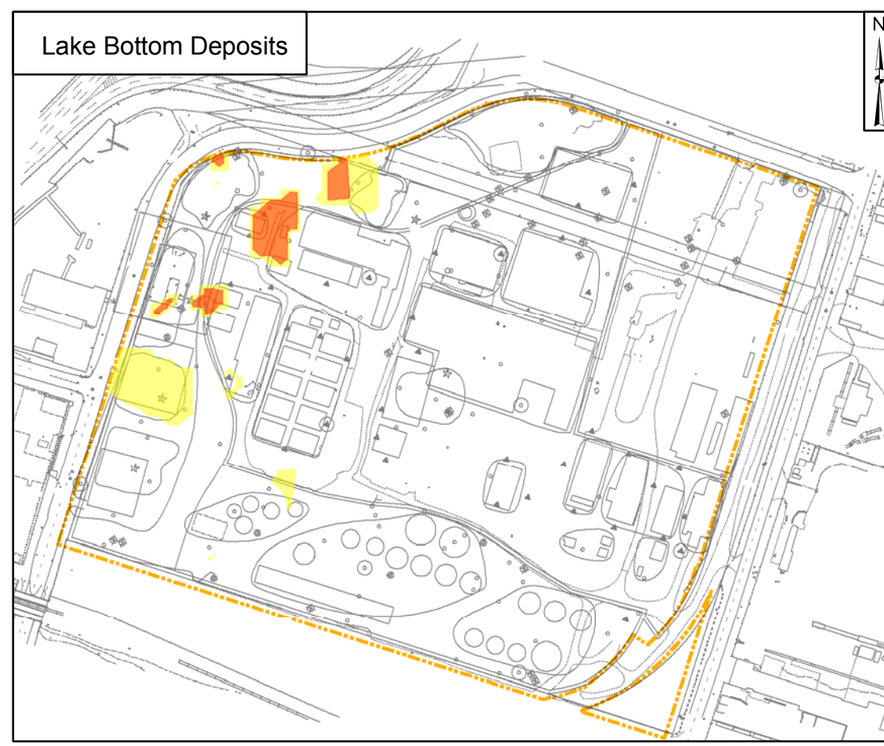

Legend

- Historic Fill and Native Geologic Material (%RE ≤ 10)
- Historic Fill/Native Geologic Material + Stain + Tar Pieces (%RE > 10 and ≤ 50)
- Historic Fill/Native Geologic Material + Tar + Viscous Tar (%RE > 50)
- Site Boundary
- Historic Site Feature

Notes:

1. CSM delineation based on interpolated TarGOST® data

2. Approximate top of lithology depths starting from ground surface are as follows:

Lithology	Depth
Fill (Below Geomembrane)	2 - 4 ft bgs
Meadow Mat	10 – 20 ft bgs
Alluvium	12 – 35 ft bgs
Lake Bottom Deposits	30 – 50 ft bgs
Rahway Till	30 - 70 ft bgs

3. Delineation for lithologic unit are projected in plan view

%RE - percent of reference emitter (TarGOST®)
CSM - Conceptual Site Model
ft bgs - feet below ground surface
TarGOST® - Tar-specific Green Optical Screening Tool

400 200 0 400 Feet

Conceptual Site Model Contaminant Delineation

Former Pitt-Consol Site
Newark, New Jersey

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Figure 4

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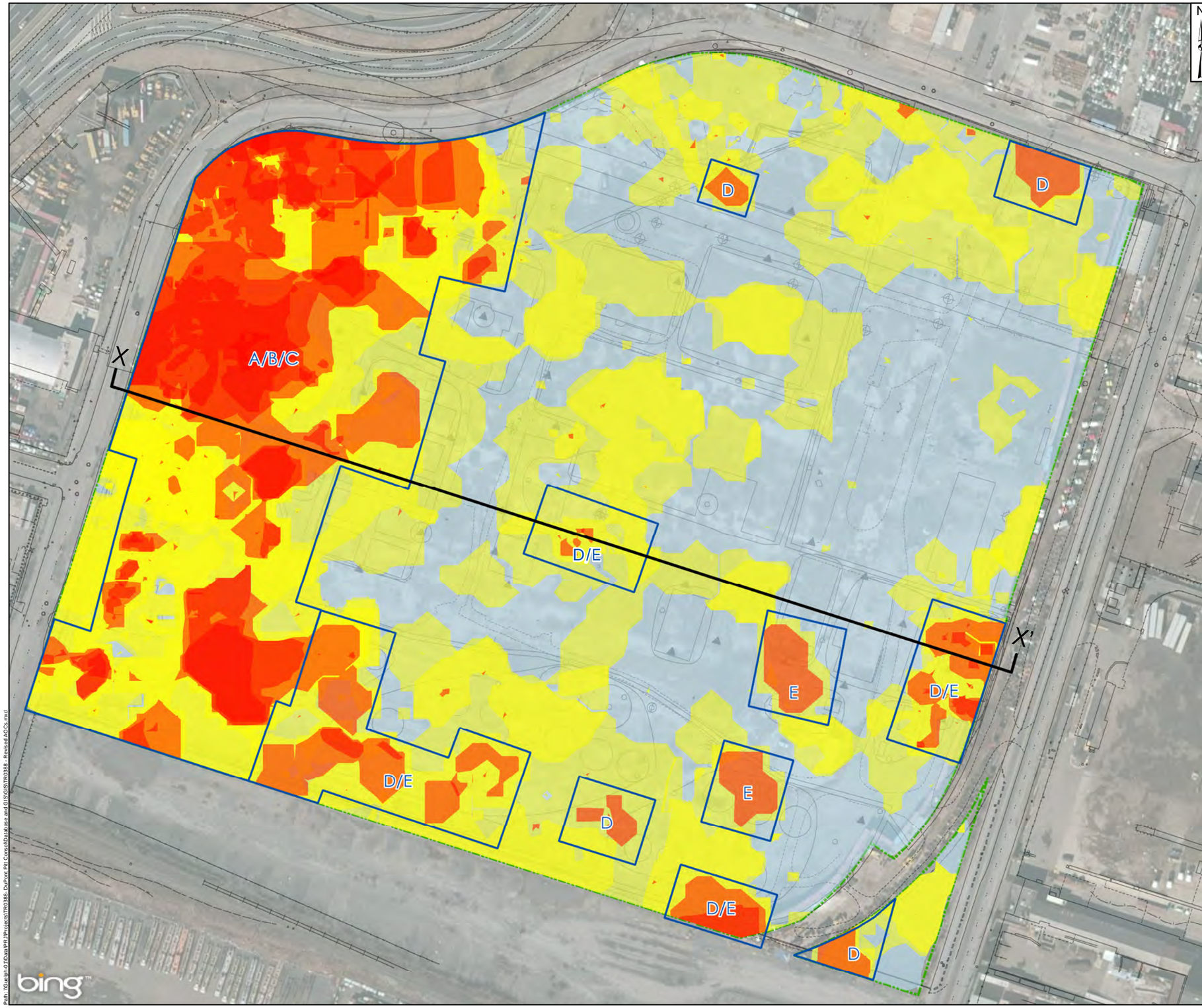

Legend

- AOC4 - Historic Fill and Native Geologic Material (%RE ≤ 10)
- AOC 5 - Historic Fill/Native Geologic Material + Stain + Tar Pieces (%RE > 10 and ≤ 50)
- AOC 6 - Historic Fill/Native Geologic Material + Tar + Viscous Tar (%RE > 50)
- Site Boundary
- Treatment Option Area
- Historic Site Feature

Location	Area	Lithology
A	Lagoon Area (Larger Footprint Area)	Historic Fill
B		Meadow Mat
C		Sand/Silt
D	Lagoon F, G, FNA, Tank Farm (Smaller Footprint/Remote Area)	Historic Fill
E		Meadow Mat

Notes:

1. AOC delineation based on interpolated TarGOST® data

2. Delineation for all lithologic units are projected in plan view

%RE - percent of reference emitter (TarGOST®)
AOC - Area of Concern
FNA - Former Naphthalene Area
TarGOST® - Tar-specific Green Optical Screening Tool

200 100 0 200 Feet

Remedial Action Areas - Plan View

Former Pitt-Consol Site
Newark, New Jersey

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Figure 5

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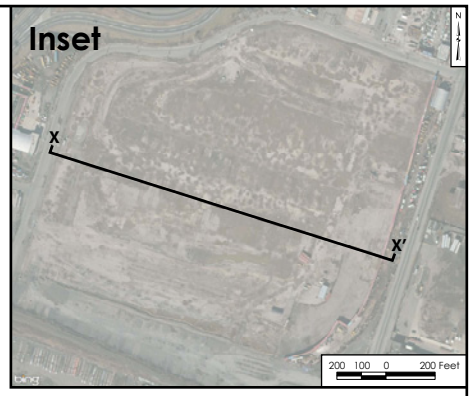

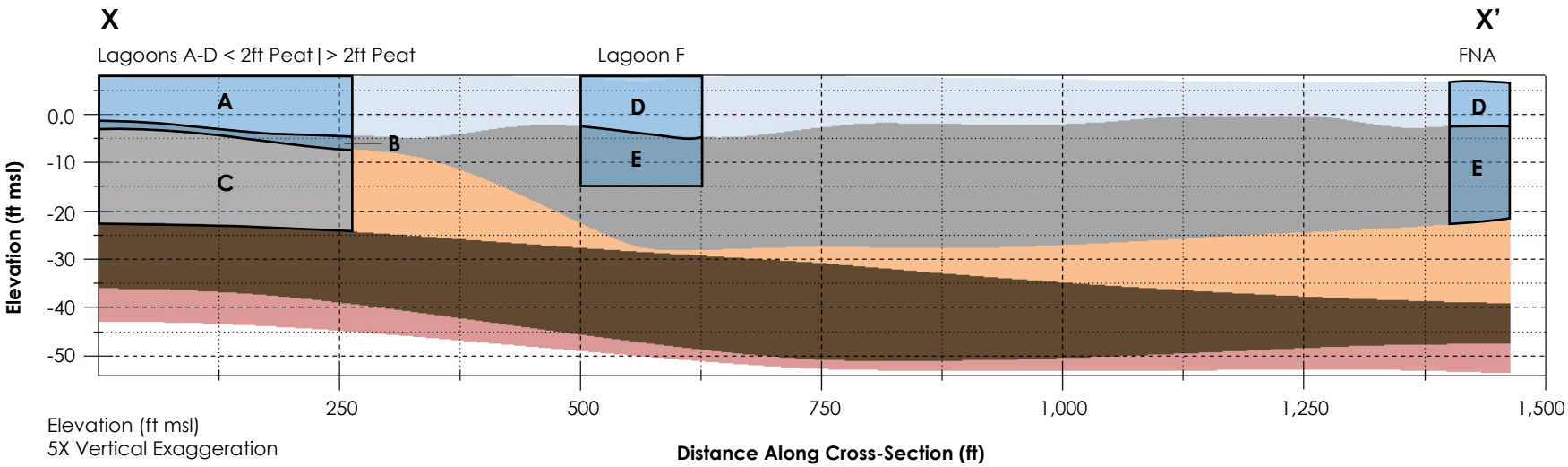

Legend

- Historic Fill
- Meadow Mat (Peaty Clay)
- Alluvium (Sand)
- Lake Bottom Deposits (Silt)
- Rahway Till (Clay)
- Bedrock

ft msl - feet mean sea level

Location	Area	Lithology
A	Lagoon Area (Larger Footprint Area)	Historic Fill
B		Meadow Mat
C		Alluvium
D	Lagoon F, G, FNA, Tank Farm (Smaller Footprint/ Remote Area)	Historic Fill
E		Meadow Mat

FNA - Former Naphthalene Area

Remedial Action Areas Profile View
Former Pitt-Consol Site
Newark, New Jersey

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Figure 6

Cross Section_X-X'.ai

APPENDIX C

STAR PILOT TEST REPORT (PHASE I AND II)

Prepared for

DuPont Corporate Remediation Group
Barley Mill Plaza 19 – 2164
4417 Lancaster Pike
Wilmington, DE, 19805

Self-sustaining Treatment for Active Remediation (STAR) Pilot Test Report

DuPont Pitt Consol Site, Newark, New Jersey

Prepared by

Geosyntec consultants

engineers | scientists | innovators

Guelph. Ontario N1G 5G3

Project Number TR0341C

22 June 2011

EXECUTIVE SUMMARY

A pilot test of the Self-Sustaining Treatment for Active Remediation (STAR) technology was conducted to treat coal tar-impacted soils at the Former Pitt Consol Site in Essex County at 191 Doremus Avenue, Newark, New Jersey (the Site). The STAR technology is based on the principles of smoldering combustion where the contaminants are the source of fuel. The process is self-sustaining following a short duration, low energy input 'ignition event'; such that the energy of the contaminants is used to pre-heat and combust the contaminants, provided a sufficient flux of oxygen is supplied to the combustion front.

The pilot test was conducted in two Phases: 1) a Phase I Proof-of-Concept pilot test designed to demonstrate the technology under Site conditions; and 2) a Phase II pilot test to elucidate cost, design, and performance uncertainties for the implementation of STAR as a Site-wide remediation strategy. The pilot test was conducted in the former Lagoon C area of the Site along the western Site perimeter. The pilot test area (PTA) was approximately 60 feet (ft) long, 20 ft wide and 10 ft deep, and was surrounded by sealed sheet pile. Groundwater was present approximately 3 feet below ground surface (bgs).

The Phase I Proof of Concept (POC) pilot study successfully demonstrated the STAR process. Self-sustaining smoldering combustion was achieved below ground surface and beneath the water table for approximately 9 days, resulting in the destruction of approximately 200 kg (greater than 400 lbs) of coal tar. However, the volume of coal tar within the PTA – and the mobility of the coal tar present – limited the propagation of the combustion front.

The Phase II test assessed factors governing the ignition protocol and the limitations of the STAR technology with respect to mass destruction rate and combustion front propagation. During the Phase II test, sustained destruction rates in excess of 800 kg/day were observed over a four-day period resulting in the destruction of more than 4,500 kg of coal tar. Propagation rates during Phase II were estimated to be on the order of 5 feet per day, with propagation distances between 10 and 30 feet from the ignition / air injection point.

Post-pilot samples demonstrated a substantial reduction in coal tar volume within the PTA, with SVOC concentrations reduced (on average) by greater than 99% in zones where combustion was observed or detected. Concentrations of the volatile constituents of coal tar were detected in the vapor phase, but the majority of coal tar mass was destroyed in situ (i.e., through combustion as opposed to volatilization). Approximately 160 kg of coal tar was destroyed in situ for every kilogram of total volatiles discharged to ground surface during the most vigorous period of combustion.

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LIST OF ABBREVIATIONS

^{o}C	degrees Celsius
ASE	Accelerated Solvent Extraction
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylene
CCS	Columbia Container Services
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/s	centimeters per second
CO	carbon monoxide
CO_2	carbon dioxide
CRG	Corporate Remediation Group
DRO	Diesel Range Organics
DuPont	DuPont Corporate Remediation Group
EIPT	Environmental Improvement Pilot Test
EPA	Environmental Protection Agency
ft	feet
FTIR	Fourier Transform Infrared
Geosyntec	Geosyntec Consultants
GRO	Gasoline Range Organics
kg/hr	kilograms per hour
mg/kg	milligrams per kilogram
mm	millimeters
NAPL	Non-Aqueous Phase Liquid
NJDEP	New Jersey Department of Environmental Protection
POC	Proof of Concept
ppmv	parts per million by volume
PTA	Pilot Test Area
STAR	Self-sustaining Treatment for Active Remediation
SVOC	Semi-Volatile Organic Compound
TPH	Total Petroleum Hydrocarbons
US	United States
VOC	Volatile Organic Compound

1. INTRODUCTION

This report has been prepared by Geosyntec Consultants (Geosyntec) on behalf of DuPont Corporate Remediation Group (DuPont) to present the results of a pilot test to support the design for potential application of the Self-Sustaining Treatment for Active Remediation (STAR) technology to treat coal tar-impacted soils at the Former Pitt Consol Site in Essex County at 191 Doremus Avenue, Newark, New Jersey (the Site). The STAR technology is being evaluated as an alternative to traditional remedies for coal tar-impacted soils including excavation and disposal.

In accordance with the Guidance in Conducting Remedial Investigations and Feasibility Studies Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, Oct 1988), the purpose of the pilot test was to provide information to assess the performance of the STAR technology at the Site with the objectives of 1) providing sufficient data to allow treatment alternatives to be fully developed and evaluated during the detailed analysis and to support the remedial design of a selected alternative, and 2) reducing the cost and performance uncertainties for treatment alternatives to acceptable levels so that a remedy can be selected.

The scope of the pilot test included: 1) collection of samples and instrumentation of the pilot test area (PTA) for STAR performance evaluation; 2) installation of ignition / air injection wells to initiate and maintain the STAR process; 3) installation of vapor control equipment; 4) operation and monitoring of the pilot system; and 5) collection and analysis of data to evaluate the technology as a potential Site remedy.

The remaining sections of this Work Plan present the following:

- Section 2 – an overview of background information about the Site;
- Section 3 – a description of the STAR technology, and the purpose, objectives and general scope of the pilot test;
- Section 4 – the scope of work and deviations from the STAR Pilot Test Work Plan (Work Plan; Geosyntec, 2009);
- Section 5 – the results and discussion of the pilot test; and,
- Section 6 – references.

2. BACKGROUND

2.1 Site Description and Geographic Setting

The Site is located at 191 Doremus Avenue in Newark City, Essex County, New Jersey. Site Location and Site Layout maps are included as Figures 1 and 2, respectively. The ground surface of the Site is generally flat and covered primarily with stone and asphalt. There is little topographic relief over the Site, generally less than 3 feet (ft), with topographic highs on the northern side of the property, and the topographic low on the southeast corner of the property.

The Site is bordered to the north and northwest by Roanoke Avenue, to the west by Avenue P, to the south by the Dutch Neck Land Company (i.e., "Nimco property") and to the east by Anthony Devino (i.e., "Devino Brothers property") and Doremus Avenue.

2.2 Local Geology

The Site is underlain by four major unconsolidated units which in turn overlie a reddish brown shale bedrock unit (Brunswick Shale) with an upper weathered surface (Geosyntec, 2011). The unconsolidated units, in ascending order (from deepest to shallowest), are: (1) a glacially derived silty clay confining unit (deep confining layer); (2) a medium to coarse sand unit (deep water bearing unit); (3) a semi-confining organic clay and peat layer (meadow mat layer); and (4) a heterogeneous fill unit (shallow water bearing unit). An approximately 2 ft thick crushed gravel cap underlain by a geo membrane installed by Columbia Container Services (CCS) covers the historic fill layer. The bedrock and the four unconsolidated layers are described below.

2.2.1 Bedrock

Bedrock beneath the Site has been encountered at depths of between 48 to 79 ft below ground surface (bgs). The upper 7 to 10 ft of the bedrock has been found to be heavily weathered, with competent bedrock beneath.

2.2.2 Deep Confining Layer

The deep confining layer, which overlies the bedrock, is composed of silty clay and is approximately 20 ft thick. The current geologic description is based on sparse borehole data which limits prediction of the depth, thickness and lateral extent of the clay across the site.

2.2.3 Deep Water Bearing Unit

The deep water bearing unit consists of medium to coarse sand and is approximately 8 to 20 ft thick beneath the central and eastern parts of the Site, but thickens to the west, where it may interfinger with the Meadow Mat layer.

2.2.4 Meadow Mat Layer

The peaty-clay marsh deposits which form the semi-confining Meadow Mat layer are approximately 26 ft thick in the central and eastern portions of the Site, but thin to 2 ft or less along the westernmost portion of the Site. Where present, it is thought that the Meadow Mat may limit the downward vertical migration of contaminants to deeper soils. Borehole data for the Meadow Mat below Lagoon F indicates that non-aqueous phase liquids (NAPLs) have invaded this peaty clay unit to between 4 and 7 feet below the base of the fill. Soil investigation logs indicate that the Meadow Mat layer is absent in some locations, which may result from either the installation, or restoration, of the historic lagoons on the westernmost portion of the Site.

2.2.5 Fill Layer/Shallow Water Bearing Unit

The fill layer (shallow water bearing unit), which extends over the entire Site, varies in thickness from 2 to 18 ft. The fill reportedly consists of silty clay, sand, gravel, cinders, brick, and concrete and wood debris. This unit may represent non-indigenous materials, termed Historic Fill, that were imported to aid the redevelopment of approximately 60 acres of the Newark Salt Marsh. The Brownfield and Contaminated Site Remediation Act (NJSA 58:10B-1) requires the New Jersey Department of Environmental Protection (NJDEP) to map areas of Historic Fill over 5 acres in size. The Pitt Consol Site was identified by the New Jersey Geological Survey as an area of Historic Fill. Other materials, including coal-like and tar-like materials, have been found in the fill layer, primarily on the western portion of the Site. An oily, creosote-like staining has been observed in the fill layer throughout much of the northern portion of the Site. The coal-like, tar-like, and creosote-like materials are most often associated with the former lagoon and tank farm areas along the western and southern property boundaries, respectively.

2.3 Site History

The areas surrounding what is now the Site were once flood plains and tidal mudflats (Meadow Mat) along the Passaic River. In the late 1800s, the Site and surrounding areas were covered with fill material (Historic Fill) to raise the land and allow for development (Corporate Remediation Group [CRG], 2000). The Site itself was reportedly first developed in the late 1800s, and from then until May 1983 it was the location of industrial operations which, at various times produced road tars, phenols, cresol (methyl phenol), and cresylic acid (CRG, 1998).

Manufacturing operations at the Site were terminated on 23 May 1983, and at that time an alkylation unit, a natural acid plant, a synthetic cresol plant, and several above ground tank and drum storage areas existed at the Site (CRG, 1998). The Site was subsequently decommissioned, and by January 1986 the production facilities had been razed and removed from the property (CRG, 1998).

3. PURPOSE AND OBJECTIVES OF PILOT TEST

3.1 Self-sustaining Treatment for Active Remediation (STAR)

3.1.1 Overview of STAR Process

Combustion is the exothermic oxidation of a carbon-based compound (i.e., fuel) to primarily carbon dioxide (CO_2), water, and energy. The combustibility of NAPLs is a characteristic that has been successfully exploited through the *ex situ* incineration of NAPLs and contaminated soil (e.g., Howell *et al.*, 1996); however, incineration is achieved primarily via flaming combustion which is an energy inefficient process (i.e., high heat losses), requiring the continuous addition of fuel and, often, supplemental energy.

Smoldering combustion, by contrast, is the exothermic oxidation of a condensed phase (i.e., solid or liquid) occurring on the fuel surface (Ohlemiller, 1985). Smoldering is limited by the rate of oxygen-transport to the fuel's surface, resulting in a slower and lower temperature reaction than flaming. Importantly, smoldering can be self-sustaining (i.e., no energy input required after ignition) when the fuel is (or is embedded in) a porous medium. Self-sustaining smoldering occurs because the solid acts as an energy sink and then feeds that energy back into the un-burnt fuel, creating a very energy efficient reaction (Howell *et al.*, 1996). Solid porous fuels such as polyurethane foam (Torero and Fernandez-Pello, 1996), cellulose (Ohlemiller, 1985), and charcoal are typical media that exhibit self-sustained smoldering.

Studies have demonstrated that the rate of propagation of the combustion front and net heat generated are affected by the velocity (magnitude and direction) of air flow, pore diameter of the medium, and the fraction of porosity occupied by fuel, air and non-reacting materials (DeSoete, 1966). Smoldering reactions can leave a carbon-based residue (oxygen limited reactions) or can result in complete combustion of the fuel (fuel limited reactions) (Schultz *et al.* 1995). The former is common in combustible porous media where the char minimizes heat losses and enables the reaction to propagate. The latter is common when the fuel is combined with an inert porous media that provides the required insulation even in the fuel's absence. While most research focuses on smoldering of solid fuels, there are several examples of combustion of a liquid fuel embedded in a porous matrix. Lagging fires occur inside porous insulating materials soaked in oils and other self-igniting liquids (Drysdale, 1998). To enhance oil recovery, combustion fronts are initiated in petroleum reservoirs to drive oil towards extraction points (Greaves *et al*., 2000). However, the smoldering of liquids as a remediation technique is entirely novel (Switzer *et al.*, 2009).

NAPL smoldering is different from existing thermal remediation techniques. *In situ* thermal remediation requires the continuous input of energy in order to primarily volatilize and, in some cases, thermally degrade (pyrolize) and mobilize (via viscosity reductions) the organic phase. All of these processes are endothermic and remediation continues as long as externally-supplied energy input is sustained throughout the NAPL-occupied porous medium. In contrast, NAPL

smoldering has the potential to create a combustion front that: (i) initiates at a single location with the NAPL-occupied porous medium; (ii) initiates with a one-time, short duration energy input; (iii) propagates through the NAPL-occupied medium in a self-sustained manner; and (iv) destroys the NAPL wherever the front passes. NAPL smoldering is different from *in situ* combustion for enhanced oil recovery in that the latter is designed to generate heat and pressure that will mobilize the entrapped oil towards recovery wells. NAPL smoldering, in contrast, may benefit from avoiding the recovery (and thus treatment) of NAPL and/or water.

3.1.2 Site-Specific Bench-Scale STAR Treatability Study

Methods

Preliminary STAR evaluation testing (bench-scale treatability study) was carried out in a quartz glass column 138 millimeters (mm) in diameter and 275 mm in height. Soil recovered from the bottom of the historic fill unit in the vicinity of P-6r was extruded directly (i.e., without homogenization or dewatering) into the apparatus in a 150 mm layer, followed by a 30 mm layer of clean sand. The combustion front was tracked in space and time with fifteen thermocouples inserted into the contaminated sand pack along the column central axis and spaced at 10 mm intervals above the igniter. Injected air flux was set to a constant value of 4.25 centimeters per second (cm/s). Continuous exit gas analysis was performed using a Fourier Transform Infrared (FTIR) system to monitor for the presence of combustion products as well as to identify key emission gases.

A heating element or igniter located at the bottom of the column was initiated for a short period until the ignition temperature (400 degrees Celsius [ºC]) was achieved in the immediate vicinity of the igniter. Air injection was started when the ignition temperature was observed and was maintained until the end of the experiment. When the onset of smoldering combustion was confirmed, the igniter was turned off for the rest of the experiment. The experiment was allowed to proceed until it self-terminated following the complete destruction of the NAPL.

Pre-treatment and post-treatment chemical analysis of the samples was conducted to assess contaminant destruction. Equally spaced subsamples of the treated soil were extracted with a mixture of dichloromethane and acetone by accelerated solvent extraction (ASE). The analytical method was based on a suite of United States Environmental Protection Agency (US EPA) methods in SW-846 with an acetone:dichloromethane ratio of 1:1. The samples were analyzed for total extractable petroleum hydrocarbons (TPH) by a gas chromatograph equipped with flame ionization detector by CLARRC laboratory analytical services; an independent entity located on University of Edinburgh campus.

Results

Successful, self-sustaining smoldering combustion behavior for the material was confirmed. Pre- and post-STAR treatment TPH results are presented in Table 1. Initial concentrations

ranged from 2,010 milligams per kilograms (mg/kg) to 23,400 mg/kg on a dry weight basis (depending on the sub-sample) and post-STAR concentrations ranged from 90 to 140 mg/kg. In addition, no visible contamination remained on the STAR treated soils (Figure 3).

Table 2 presents an analysis of compounds recovered from the test in the vapor phase. Water, CO_2, and carbon monoxide (CO) are the dominant combustion products with low levels [average concentration less than 5 parts per million by volume (ppmv)] of hexane, xylene, benzene, nitrogen dioxide, sulfur dioxide, naphthalene, carbonyl sulfide and ammonia.

The test demonstrated the viability of STAR for Site soils and contaminants over a range of moisture contents (initial soil moisture sub-samples ranged from 0.09 to 0.79 grams of water per gram of soil). In addition, the results (in particular the vapor phase concentrations) enabled the design of a pilot test of the technology. Unlike most other remediation processes, STAR is least efficient at the laboratory scale and most efficient at the field scale because heat losses to the environment decrease with increasing scale. Scale-up will depend on soil-specific properties, including soil type, contaminant concentration and moisture content.

3.2 STAR Pilot Test Objectives

3.2.1 Overview

The purpose of the pilot test was to demonstrate the viability of STAR and evaluate the performance of the technology in an *in situ* field setting at the Pitt-Consol Site. The PTA was conducted within an area that was 60 ft by 20 ft, surrounded by sheet piling, and under water saturated conditions to a depth of 10 ft bgs (Geosyntec, 2009). An overview of the PTA is shown in Figure 4.

The STAR pilot testing evaluation was carried out in two phases: 1) Phase I POC testing; and 2) Phase II Testing. The pilot tests consisted of continuous temperature monitoring (via thermocouples), combustion monitoring (via air-phase CO_2 and CO monitoring), volatile organic compounds (VOC) monitoring, and the collection of baseline and post-STAR soil samples (for chemical analysis).

3.2.2 Phase I POC Testing

The objectives of the Phase I POC test were to assess the ignition protocol, assess the system requirements for sustaining the smoldering combustion reaction, and to evaluate the rate of smoldering front propagation. This test was carried out through the initiation of a smoldering combustion front at a single location within the PTA and monitoring the smoldering front progression through thermocouples, and rate and mass of coal tar destruction through the collection and analysis of combustion gas data (i.e., CO_2 and CO).

3.2.3 Phase II Testing

The objectives of the Phase II test were to apply the lessons learned during the Phase I POC test and initiate and maintain the smoldering combustion front(s) within the PTA. Multiple ignition events and air injection points were used to evaluate the:

1. ignition protocol sensitivity to well construction and subsurface heterogeneity;
2. smoldering front propagation distance and rates;
3. coal tar mass destruction rates;
4. fraction of contaminant mass destroyed in situ (versus that collected and treated in the vapor phase); and
5. treatment efficiency of STAR with respect to contaminant constituents in soil within the combustion zone.

4. PILOT TEST WORK PLAN

4.1 Summary of Phase I Scope of Work

The Phase I POC pilot test scope of work is presented in the Work Plan (Geosyntec, 2009). This work plan describes the design basis and process flow, and details the procedures and methodologies for:

1. site preparation;
2. air injection / ignition well installation;
3. instrumentation;
4. ignition;
5. air injection;
6. vapor collection and treatment;
7. performance monitoring; and
8. baseline and post-pilot characterization.

The Work Plan was closely followed during the Phase I POC pilot test with the exception of tasks that were deferred to Phase II (e.g., post-pilot characterization). Deviations from the Work Plan, including changes to equipment, operation, and sampling for Phase II testing are noted in Section 4.2.

4.2 Modifications to Work Plan

A number of changes were made to the set-up, operation, and monitoring of the Phase II pilot test system following the conclusion of the Phase I POC test as highlighted in Table 3 and Figure 5. In addition, the naming convention for the ignition / air injection wells was changed to reflect the change of pre-heating methodology. In Phase I, heaters were installed in the backfill of two wells (IG-1 and IG-2), and the remaining wells were identified as air injection wells (AI-1 through AI-7). However, a portable heating element was used in Phase II so that all wells within the PTA could be used as both ignition and air injection wells; thus, the well names were changed to IP-1 through IP-9 to reflect this change. The following table identifies the well name changes:

Phase I Well Name	Phase II Well Name
IG-1	IP-1
AI-1	IP-2
AI-2	IP-3
AI-3	IP-4
AI-4	IP-5
AI-5	IP-6
AI-6	IP-7
AI-7	IP-8
IG-2	IP-9

4.3 Air Permit Monitoring

NJDEP required an Environmental Improvement Pilot Test (EIPT) permit for the discharged vapor stream resulting from the STAR pilot tests. Table 4 presents a summary of the permit requirements. For both Phase I (EIP090001, Facility ID: 08627) and Phase II (EIP100001; Facility ID: 08627), the permit regulated the equipment to be used, the vapor treatment protocol, and the permissible discharge levels of CO and benzene.

5. RESULTS AND DISCUSSION

5.1 Pre-STAR Characterization

Pre-STAR characterization or ‘baseline’ samples were collected from one or more depth intervals at 9 locations within the Lagoon C area of the Site (Figure 6). A total of 14 soil samples were collected to aid in selecting the PTA location and to serve as a baseline for comparison with post-STAR sampling results. These samples were analyzed by a licensed analytical laboratory for semi-volatile organic compounds (SVOCs) according to EPA Method 8270B and TPH (F1 to F4 and BTEX) according to EPA Method 8015B.

Table 5 presents the results of the baseline sampling. The highest concentration area was selected for the pilot test. This area encompassed samples collected from PTC-S-1, PTC-S-2, PTC-S-9 and PTC-S-10. The test pit for the collection of soils from the pre-pilot drum testing was located immediately adjacent to, and on the east side of, the selected pilot test area (Figure 6). The elevated concentrations of SVOCs and TPH for diesel range organic (DRO) compounds indicate the presence of NAPL at these locations. Visual observations of the test pit and of core retrieved from these locations confirm the presence of free-phase organic liquids (coal tars) at mobile saturations.

Soil samples collected at a depth of 6.0 to 7.0 ft and 9.0 to 10.0 ft at PTC-9 showed TPH for gasoline range organics (GRO) concentrations ranging from approximately 46,000 mg/kg to approximately 190,000 mg/kg, naphthalene concentrations ranging from 10,000 mg/kg to 49,000 mg/kg, and anthracene concentrations ranging from 4,400 mg/kg to 29,000 mg/kg. These samples were taken from within the primary Phase II combustion zone and were used as the baseline concentration to which the concentrations of the post-treatment samples were compared (see Section 5.4).

5.2 Phase I POC Testing

5.2.1 Qualitative Assessment of Ignition Event

Figure 7 presents thermocouple data collected from TC-34-8.5 and TC-33-8.5, the thermocouple located within the backfill of ignition well IP-9 and the thermocouple located approximately 10 inches from the IP-9 well screen, respectively (see Figure 4).

The temperature profile at TC-34-8.5 showed the slow ramping up of temperatures from ambient (18 ºC) at T = -24 hours (Note: T = time relative to the initiation of smoldering combustion at T = 0 hours) to 100 ºC at T = -8.5 hours as water was vaporized in the immediate vicinity of the ignition well. Following removal of water in this area, a more rapid increase in temperature to approximately 900 ºC (the target ignition temperature) took place. 900 ºC was selected as a conservative target ignition temperature to ensure an adequate volume of soil reached the 'true' ignition temperature around the ignition well, which was anticipated to be approximately 400 ºC. When 900 ºC was reached (T = 0 hours), air flow was initiated and the temperature immediately spiked to 1343 ºC, indicating ignition at IP-9.

The temperature profile at TC-33-8.5 showed a rapid jump in temperature from ambient (18 ºC) to approximately 111 ºC, corresponding to the ignition event at IP-9. This was followed by a secondary jump in temperature to approximately 160 ºC at T = 7 hours, likely as a result of combustion front propagation in the vicinity of IP-9.

Elevated temperatures at these locations above ambient levels were maintained throughout the Phase I POC test (9 days). The heating element at IP-9 was turned off at T = 12 hours after

which the remainder of the Phase 1 test demonstrated self-sustained smoldering combustion (i.e., combustion maintained without the use of an external energy source).

The ignition event, and continued combustion was confirmed through the detection of combustion gases in the collected vapor stream (CO_2 and CO) at concentrations above background levels. These gases were absent from the collected vapor stream prior to the initiation of air flow, and rose to 0.3% for CO_2 and more than 5000 ppmv for CO following the temperature spike observed at TC-34-8.5 at T = 0 hours. CO_2 and CO concentrations remained above ambient levels, varying between 0.1% and 3.3% for CO_2 and 26 and >5000 ppmv for CO for the duration of the Phase I test (9 days), confirming that the ignition event resulted in the formation of a self-sustained smoldering combustion front that was maintained through the addition of air for a period of 9 days.

5.2.2 Combustion Front Propagation

While a localized temperature of 1343 ºC was observed in the immediate vicinity of IP-9, indicating the absence of liquid water from this area, temperatures largely remained ambient throughout the rest of the PTA as these thermocouples were located beneath and remained beneath the water table throughout the test. This lack of temperature change suggests significant propagation of the smoldering combustion front did not occur during this test, with the exception of the rapid combustion event that occurred on Day 5 (see Figure 8) that resulted in temperatures above ambient (i.e., up to 30 ºC) up to 15 feet south of IP-9.

It is hypothesized that the expansion of the combustion front was matched by the influx of mobile coal tar to IP-9 such that a constant supply of fuel was provided to the combustion front and propagation along the path of the fuel source was not possible. This could have been overcome (i.e., propagation could have been observed) if additional air flux was provided to the combustion front (as a result of the correlation between air flux and propagation velocity; Pironi *et al*, 2011). However, the flux of air was limited by the size of the equipment available during the Phase I test, and this hypothesis could not be tested. The reduction of air flux observed on Day 3 (see Figure 8), and the corresponding decrease in coal tar mass destruction rate (see Section 5.2.3) suggests that an increase in air flux would have resulted in an increase in mass destruction rate, and therefore allow the propagation rate to overcome the rate of influx of surrounding mobile coal tar.

5.2.3 Quantitative Assessment of STAR Performance

The mass of coal tar destroyed by the STAR process can be estimated using a carbon mass balance approach and the concentrations of combustion gases CO_2 and CO in the collected vapor stream as follows:

$$M_{CoalTar} = \frac{\left[M_{CO_2} \bullet \frac{MW_C}{MW_{CO_2}} + M_{CO} \bullet \frac{MW_C}{MW_{CO}} \right]}{R^C_{Coaltar}}$$

Where:

- $M_{CoalTar}$ is the mass of coal tar destroyed;
- M_{CO_2} is the mass of carbon dioxide measured in the vapor stream (calculated as the product of the carbon dioxide concentration and the vapor phase flow rate);
- M_{CO} is the mass of carbon monoxide measured in the vapor stream (calculated as the product of the carbon monoxide concentration and the vapor phase flow rate);
- MW_C is the molecular weight of carbon;
- MW_{CO_2} is the molecular weight of carbon dioxide;
- MW_{CO} is the molecular weight of carbon monoxide; and
- $R^C_{Coaltar}$ is the mass ratio of carbon to the molecular weight of coal tar.

Assuming that the composition of coal tar can be represented as naphthalene ($C_{10}H_8$), the mass of coal tar can be calculated as:

$$M_{CoalTar} = \frac{\left[M_{CO_2} \bullet \frac{MW_C}{MW_{CO_2}} + M_{CO} \bullet \frac{MW_C}{MW_{CO}} \right]}{R^C_{Naphthalene}}$$

Where $R^C_{Naphthalene}$ is the mass ratio of carbon to the molecular weight of naphthalene and is equal to 0.94:

$$\frac{MW_C \bullet 10}{MW_C \bullet 10 + MW_H \bullet 8} = \frac{120}{120+8} = \frac{120}{128} = 0.94$$

Therefore,

$$M_{CoalTar} = \frac{\left[M_{CO_2} \bullet \frac{12}{36} + M_{CO} \bullet \frac{12}{28} \right]}{0.94}$$

Or

$$M_{CoalTar} = \frac{\left\lfloor M_{CO_2} \bullet 0.27 + M_{CO} \bullet 0.42 \right\rfloor}{0.94}$$

The exact composition of coal tar at the Site is unknown; therefore, there is likely to be a significant amount of error in this calculation. As an estimate for that error, the mass ratio of carbon to naphthalene is compared to the mass ratio of carbon to the range of SVOC compounds comprising the standard EPA Method 8270B. The average mass ratio (carbon to SVOC) is 0.92 with a standard deviation of 0.053 and a 95% confidence interval of 0.11. Therefore, the 95% confidence interval expressed as a percentage of the mass ratio is 11.5%. It was assumed that the assumption of naphthalene as a representative surrogate for coal tar introduces a conservative 11.5% error in the coal tar mass destruction estimate. This error (11.5%) is reflected in all figures herein presenting an estimate of cumulative mass of coal tar mass destroyed.

Figure 8 presents an estimate of the coal tar mass destruction rate and cumulative mass of coal tar destroyed during the Phase I POC pilot test. This mass estimate neglects any coal tar mass that may have been recovered in the vapor collection system via volatilization or as an aerosol (i.e., mass that was not combusted but still removed from the subsurface).

Early on in the Phase I POC test (i.e., T < 3.7 days), the rate of coal tar destruction was relatively steady at approximately 2 kilograms per hour (kg/hr). However, at T = 3.7 days the main blower failed and was replaced by an auxiliary blower with only 25% the capacity of the main blower. As a result, CO_2 and CO production dropped and the coal tar destruction rate reduced to less than 0.5 kg/hr. The main blower was returned to full operation at T = 4 days and as a result, the mass destruction rate increased to earlier levels (approximately 6 kg/hr) by T = 5.8 days. The influence of air flow rate to mass destruction rate noted here suggests that higher flow rates would result in an increase in mass destruction rate, and potentially combustion front propagation (see Section 5.2.2)

At T = 5.8 days, the rate of CO_2 and CO production increased significantly, resulting in destruction rates of approximately 7 kg of coal tar per hour. This event was accompanied by temperature increases at thermocouples more than 15 feet distant from IP-9 (e.g., TC-27-8, and TC-25-8), signifying a rapid, vigorous smolder of coal tar, likely following a preferential smolder path. However, following this event the temperatures at thermocouples in the vicinity of IP-9 decreased, as did CO_2 and CO production and coal tar mass destruction. It is hypothesized that this event drew the combustion front away from IP-9 to be smothered by inflowing, unheated coal tar. This could have quenched the combustion front and removed it from the air injection point, thereby stifling the reaction and preventing its recovery.

The Phase I POC test was terminated at T = 9 days because the mass destruction rates were too low to warrant continued operation. It is estimated that approximately 200 kg of coal tar (+/- 11.5%) was destroyed during this time.

Table 6 presents benzene, toluene, ethylbenzene, xylene (BTEX) and SVOC constituents in vapors collected during the Phase I POC Pilot Test. As expected, the high volatility constituents of coal tar were observed in the collected vapors. Compounds detected include benzene, toluene, ethylbenzene, xylenes, and naphthalene during all sampling events and acenaphthene on one occasion (SVE Influent 23 October 2009). These data were used in the design of the Phase II vapor collection and treatment system.

5.3 Phase II Testing

5.3.1 Qualitative Assessment of Ignition Events

Figure 9 presents coal tar mass destruction rates (kg/hr) as a function of time for four Phase II ignition events. The coal tar mass destruction rate was estimated from combustion gas data collected in the vapor collection and treatment system as per the method outlined in Section 5.2.3. Data are shown for ignition events at IP-1, IP-9 / IP-5, IP-6 and IP-8 during the month of August 2010. The peak rate of mass destruction ranges from approximately 3 kg/hr at IP-6 to approximately 42 kg/hr at IP-5. The range of peak destruction rates is a function of numerous interrelated and complex parameters and includes:

- Subsurface heterogeneity;
- Pre-heat duration;
- Pre-heat temperature (i.e., heater output temperature); and
- Pre-heat injected air flow rate.

The ignition events at IP-1 and IP-9 / IP-5 were terminated prematurely due to compressor failures (IP-1) and a leak through the sealant between two sheet piling sections that resulted in incomplete capture of vapors by the vapor containment system (IP-9 / IP-5). However, these ignition events were characterized by rapid destruction rates and high and increasing combustion gas concentrations, suggesting that the peak destruction rate had not yet been attained when the unscheduled terminations occurred. The ignition events at IP-6 and IP-8, however, were characterized by an initial rapid destruction rate followed by diminishing combustion gas levels because small variations in the ignition protocol (pre-heating duration, temperature, air flow rates, etc) resulted in an insufficient critical mass of heat required to initiate a strong combustion reaction following ignition. In contrast, self-ignition occurred at IP-5 as evident by the observation of temperature increases prior to increasing the flow rate. Self-ignition is the only assurance that the critical mass of heat energy in the system is present at the time of ignition.

Self-ignition, rapid destruction rates, and high and increasing combustion gas concentrations were also characteristic of the second ignition event at IP-5 that took place in November 2010. The combustion front resulting from this ignition event was allowed to continue (i.e., air was

supplied to maintain the reaction) until the process self-terminated, as is discussed in detail in Sections 5.3.2 and 5.3.3.

5.3.2 Combustion Front Propagation

Figure 10 shows the peak temperatures attained at various locations and depths within the PTA during the Phase II pilot test. This figure illustrates that the majority of elevated temperatures are clustered around the ignition points (IP-1 through IP-9) and in the south / southeastern quarter of the PTA near IP-1.

Combustion temperatures greater than 600 ^{o}C were observed adjacent to IP-1, IP-2, IP-3, IP-4, IP-5, IP-6, and IP-8. The combustion temperatures attained at IP-1, IP-5, IP-6, and IP-8 were anticipated because ignition was attempted at these locations. Ignition was not attempted at IP-7 and therefore the peak temperature at this location remained less than 200 ^{o}C. Ignition was initiated at IP-9 and was maintained for more than 48 hours (as evidenced through the measurement of combustion gas concentrations), yet the thermocouples adjacent to this well showed peak temperatures of less than 400 ^{o}C (i.e., below confirmed combustion temperatures). This suggests that temperatures below confirmed ignition temperatures, but elevated above ambient temperatures, are indicative of combustion in the immediate vicinity of the measurement point. It also illustrates the short transfer distances of combustion heat within a saturated porous medium.

Combustion temperatures at IP-2 and IP-3 are not related to ignition events at these wells. These temperatures were associated with the ignition of IP-5 on 11 November 2010 and the subsequent propagation of the combustion front along a preferential combustion / air flow pathway to the south (see Section 5.4.1). The combustion temperatures surrounding IP-1 are also related to the ignition event at IP-5. Although not observable in Figure 10, the live output of thermocouple data showed the combustion front propagate from IP-5 to IP-1 (past IP-3 and IP-2), then spread to the south and east towards the sheet pile walls defining the boundaries of the PTA. The propagation distance from IP-1 to the sheet pile walls is approximately 12 feet, and the duration of the propagation over this distance was approximately 50 hours. Therefore, the propagation velocity of the combustion front was approximately 5 feet per day, which is consistent with propagation rates observed in laboratory studies of the STAR technology (Pironi *et al*, 2011). The propagation front radiating outwards from IP-1 covered the entire vertical distance of contaminated materials within the PTA (4 to 5 feet of thickness) as evidenced by the concurrent temperature spikes observed at all depth intervals within the TC7 and TC4 thermocouple bundles. This finding was confirmed with visual evidence of the treatment zone thickness as presented in Section 5.4.1.

The combustion front initiated at IP-5 travelled to the south then expanded, and ultimately terminated when the combustion front reached the sheet pile walls (i.e., the fuel source was exhausted). Although combustion temperatures were observed to the west of IP-1 at TC11, the

direction of propagation was dictated by the existence of a preferential combustion / air flow pathway that extended to the south and east of IP-1 (see Section 5.4.1).

5.3.3 Quantitative Assessment of STAR Performance

Figure 11 presents the estimated coal tar mass destruction rate and cumulative mass of coal tar destroyed during the Phase I POC and Phase II pilot test according to the methods described in Section 5.2.3. This mass estimate neglects any coal tar mass that may have been recovered in the vapor collection system via volatilization or as an aerosol (i.e., mass that was not combusted but still removed from the subsurface).

T = 0 days corresponds to the ignition event at IP-9 on 9 November 2010, and the cumulative mass of coal tar destroyed at T = 0 is the summation of coal tar destroyed during the Phase I POC pilot test and the ignition testing events depicted in Figure 9 (cumulative coal tar mass destroyed at T = 0 days was approximately 860 kg).

Early on in the Phase II pilot test (i.e., T < 3 days), coal tar destruction was a result of combustion in the vicinity of IP-9 only. Destruction rates were on the order of 2 to 3 kg/hr which are comparable to destruction rates observed for this ignition point during the Phase I POC test. At T = 3 days, ignition was achieved at IP-5 and the mass destruction rate immediately increased to levels in excess of 40 kg/hr (greater than 900 kilograms per day). After a brief decline in combustion gas production, destruction rates between 25 and 45 kg/hr were sustained between T = 4 days and T = 7 days. During this time period the combustion front propagated from IP-1 to the south and east towards the sheet pile walls as described in Section 5.3.2. By T = 7 days the combustion front had approached the sheet pile wall and the coal tar mass destruction rate decreased. By T = 8 days, the destruction rate was less than 10 kg/hr and decreased further to 1 to 2 kg/hr before the combustion front was ultimately exhausted (due to lack of fuel) at T = 11 days.

The greatest period of cumulative mass destroyed corresponds to the period of combustion front propagation in the vicinity of IP-1. The total mass of coal tar destroyed during the Phase I POC test and the Phase II test was approximately 4,588 kg.

Table 7 presents BTEX and SVOC constituents in vapors collected during the Phase II Pilot Test. The list of SVOC analytes presented in Table 7 is expanded from that presented as Table 6 for the Phase I POC test. Similar to the Phase I POC results, the high volatility constituents of coal tar were observed in the collected vapors. Compounds detected include benzene, toluene, ethylbenzene, xylenes, and naphthalene as in Phase I, but additional constituents (1,2,4-trimethylbenzene, 1,2-dichloroethane, 1,3,5-trimethylbenzene, 1,3-butadiene, 2-butanone, 4-ethyltoluene, bromomethane, carbon disulfide, chlorobenzene, chlorodifluouromethane, chloroform, chloromethane, cumene, dichlorodifluoromethane, heptane, hexane, octane, pentane, styrene, and trichlorofluoromethane) were also detected as a result of the expanded list of

analytes. Emitted vapors (i.e., 'stack samples') indicated compliance with the EIPT permit for the pilot test.

The vapor phase sample on 15 November 2010 (SP-01) was used to estimate the amount of vapor generated per kilogram of coal tar destroyed in situ. This sample corresponds to the period of vigorous coal tar destruction related to the propagation of the combustion front in the vicinity of IP-1 as described above. The ratio of total volatile mass extracted in the vapor phase to the mass of coal tar destroyed during this time period was 1:160; thus, for every 160 kilograms of coal tar destroyed, only 1 kilogram of volatile mass is discharged to ground surface. Following carbon treatment (as estimated from the stack discharge sample SP-06 collected on 15 November 2010), more than 11,000 kg of coal tar would be destroyed in situ for every kilogram of total volatile compounds emitted through the vapor collection and treatment system.

5.4 Post-STAR Characterization

5.4.1 Visual Assessment of Post-STAR Soil Quality

Figure 12 shows a plan view of the PTA indicating the locations of soil cores collected in December 2010 following the completion of the Phase II pilot test. In total, 19 soil cores were collected within the PTA with the greatest number of samples collected in the south eastern quarter. A total of 41 soil samples were collected from the soil cores for chemical analysis.

Figures 13a and 13b present photographic comparisons of soils within the PTA both before and after the STAR pilot tests. Figure 13a compares soil cores PTC-S-9 (pre pilot test) and SC-1 (post pilot test) collected immediately to the east of IP-1. The photograph of PTC-S-9 shows that the core barrels were dripping with black, viscous coal tar and the soils were highly saturated with contaminants. The post pilot tests soils show no signs of visible contamination. The recovery of these cores was poor, either as a result of soil drying (due to combustion) or due to the presence of large bricks within the fill material (see below). However, it is clear that the soils underwent substantial coal tar removal as a result of the STAR pilot test.

Figure 13b shows a similar comparison of soils in the vicinity of IP-9. During the installation of IP-9, coal tar bubbled to the surface through the well boring. After the pilot tests the soils were largely coal tar-free as was observed for the southern portion of the PTA. Although combustion temperatures were not directly observed in the vicinity of IP-9 through thermocouple data (see Section 5.3.2), the drastic change in the quality of the soils in this area indicates that substantial mass destruction as a result of smoldering combustion did indeed take place. The photograph shows an area of coal tar-impacted soils from a depth of approximately 9 ft bgs. The well screen at IP-9 was set to 9 ft bgs, indicating that there was good lateral burning, but not downward burning (i.e., burning below the target treatment zone), at IP-9.

Portions of the PTA were excavated in April 2011 (almost 4 months after completion of the testing). A trench was dug in the vicinity of IP-9 and another to the south and east of IP-1. The

exposed test pit showed depressed, but recovering water levels relative to those expected outside the PTA. In addition, excavation at IP-1 identified an extensive area of the fill unit occupied by whole bricks. It is hypothesized that it is this predominantly brick area that constituted the preferential combustion / air flow path discussed in Section 5.3.2. The large pore spaces between the brick would be expected to contain the largest volumes of coal tar per volume of subsurface material and allow for the ready and rapid delivery of air through the subsurface.

5.4.2 Analytical Assessment of Post-STAR Soil Quality

Table 8 presents analytical results for soils collected within the PTA at the conclusion of the pilot tests for the depth intervals specified in the table and at the locations indicated on Figure 12. Collected samples were categorized as follows:

- Four samples were located within the Confirmed Combustion Zone (confirmed through thermocouples data showing peak temperatures in excess of 600 ^{o}C);
- Four samples were located within the High Temperature Zone (thermocouple temperatures between 200 ^{o}C and 600 ^{o}C),
- 14 samples were located within the Unconfirmed Combustion Zone according to visual inspection of core logs (but not confirmed through elevated temperatures recorded at thermocouples); and
- one was located within the Elevated Temperature Zone (thermocouple temperatures between 50 ^{o}C and 200 ^{o}C).

Analytical results for these samples were compared to pre-pilot soils concentrations and NJDEP soil remediation standards in Table 9 for compounds detected during the pre-pilot characterization. The pre-pilot soils concentrations used for this comparison were taken from the two samples collected from PTC-S-9 (see Table 5), as these samples were located within the primary area of combustion during the Phase II pilot test and represent the most authentic 'before' concentrations. As seen in Table 9, the analytical results confirm the substantial reductions in contaminant concentrations observed during core inspections, with concentration reductions ranging from 98.57% to 99.98% for the four zones of combustion presented. Even the Elevated Temperature Zone and the High Temperature Zone (where combustion temperatures were not observed during the test) showed an average concentration reduction greater than 99% versus pre-pilot levels. This suggests that the thermocouple monitoring network could not detect direct combustion at all locations within the PTA. As observed during the tests, temperature differences of hundreds of degrees Celsius were observed between thermocouples separated by just one foot, which suggests that elevated temperatures (i.e., temperatures > 50 ^{o}C above ambient conditions) may be indicative of smoldering combustion in the vicinity of the thermocouple.

18 samples were collected outside the Confirmed Combustion Zone, the High Temperature Zone, the Unconfirmed Combustion Zone, and the Elevated Temperature Zone (data not presented in Table 9). These samples showed some reductions in contaminant concentrations, likely due to the mobilization of coal tar from these areas to combustion zones and the volatilization of high volatility compounds from the coal tar. Two of these samples were located beneath the well screen depth of the air injection wells, and therefore were not targeted for treatment. The remaining 16 samples were collected from soil cores outside the limits of the propagating combustion front, and could not be treated with the existing PTA air injection wells due to the presence of the preferential air flow path dictating the propagation direction as discussed in Section 5.4.1.

5.5 Summary and Conclusions

Self-sustaining smoldering combustion was achieved below ground surface and beneath the water table. During the Phase I POC test, self-sustaining smoldering combustion was maintained for approximately 9 days, resulting in the destruction of approximately 200 kg (greater than 400 lbs) of coal tar. However, the volume of coal tar within the PTA – and the mobility of the coal tar present – limited the propagation of the combustion front. It was hypothesized that the propagation front limitation resulted from a balance between the flux of the mobile coal tar towards, and the rate of expansion outwards of, the combustion front. It was anticipated that by increasing the air injection rate, the increased air pressure and oxygen flux to the combustion front would counteract the mobility of the coal tar and allow for more rapid combustion and outwards propagation.

The Phase II pilot test assessed the impact of increased and more controlled air delivery, as well as evaluated an improved pre-heating system for smoldering ignition. In addition, there was an increase in the data collection density, along with the ability to initiate combustion at more than one location. These changes allowed for an evaluation of the factors governing the ignition protocol and to assess the limitations of the STAR technology with respect to mass destruction rate and combustion front propagation. During the Phase II test, sustained destruction rates in excess of 800 kg/day were observed over a four-day period resulting in the destruction of more than 4,500 kg of coal tar. Propagation rates during Phase II were estimated to be on the order of 5 feet per day, with propagation distances between 10 and 30 feet from the ignition / air injection point.

Post-pilot samples demonstrated a substantial reduction in coal tar volume within the PTA, with SVOC concentrations reduced (on average) by greater than 99% in zones where combustion was observed or detected. Concentrations of the volatile constituents of coal tar were detected in the vapor phase, but the majority of coal tar mass was destroyed in situ (i.e., through combustion as opposed to volatilization). Approximately 160 kg of coal tar was destroyed in situ for every kilogram of total volatiles discharged to ground surface during the most vigorous period of combustion.

6. REFERENCES

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TABLE 1
CHEMICAL ANALYSIS OF SOILS FROM STAR TREATABILITY STUDY

Sample[1]	TPH Concentration (mg/kg)	
	Minimum	Maximum
Initial (wet)	630	12,600
Initial (dry)	2,010	23,400
Final (dry)	90	140

Notes:
TPH - Total Petroleum Hydrocarbons (C10 to C40)
mg/kg - milligrams per kilogram
[1]Samples were received wet (0.09 to 0.79 grams of water per gram of soil) but STAR performance was evaluated on a dry weight basis as all moisture is removed from the sample during combustion

TABLE 2
FTIR ANALYSIS OF COLLECTED VAPORS DURING THE STAR TREATABILITY STUDY

Constituent	Vapor Concentration (ppmv)	
	Maximum	Average
Water (vapor)	13,300	7,520
Carbon dioxide	2,400	980
Carbon monoxide	580	110
Methane	19	2.9
Hexane[1]	13	3.7
Xylenes[1]	9	2.7
Benzene[1]	9	4.7
Nitrogen dioxide[1]	8	1.9
Sulfur dioxide[1]	7	2.8
Naphthalene[1]	5	2.3
Carbonyl sulfide[1]	4	0.1
Ammonia[1]	2	1.6

Notes:
FTIR - Fourier Transform Infrared
ppmv - parts per million by volume
[1]Some overlap between constituents exists in the FTIR spectrum; thus concentrations of these samples may be biased high

TABLE 3
MODIFICATIONS FROM THE WORK PLAN FOR THE PHASE II PILOT TEST
Former Pitt Consol Site, Newark, New Jersey

Modification	Phase I	Phase II
Power Supply		
Equipment and instrumentation power source	100 kW diesel generator	Two 400 AMP 480V electrical services
Preheating/Ignition		
Ignition Locations	IG 1 (IP-1) and IG-2 (IP-9)	IP-1 through IP-9
Preheating Method	6 inch diameter, 1 foot long coil, 3.8kW electrical resistance heater buried directly in borehole surrounding well screens of IG-1 and IG-2	2 inch diameter, 4 foot long, 4.1 kW electrical resistance heater. Installed and sealed inside any PTA well for ignition. Removable and reusable for multiple ignitions
Air Injection		
Equipment	15 HP positive displacement blower with additional 5 HP positive displacement blower for backup	Two 200HP, 600 cfm compressors (primary and secondary) with 1000 gallon equalization tank
Max Flow (cfm)	200	600
Max Pressure (psi)	14	100
Manifold	Two leg manifold with flexible hose connection to be switched from well to well during operation	Nine leg manifold allowing for simultaneous operation of all wells
Measurement	Handheld anemometer for total flow through manifold	Dedicated venturi flow meters on each manifold leg with corresponding pressure gauge
Flow Control	Manual throttling of blower pressure, or adjustable blow off air with ball valve	Dedicated pressure regulator and fine adjustment gate valve on each manifold leg
Vapor Collection System		
Vapor Cap	4 Inch lean concrete layer	Existing lean concrete layer with additional 6 inch reinforced concrete layer to withstand increased injection pressure
Extraction Piping	Two 4 inch slotted PVC pipes buried in gravel layer connected to single 4 inch PVC collection header piped to knock out tank and carbon.	Two 12 inch diameter "chimneys" keyed into gravel layer on east and west sides of the cell. Chimney connected to 18 inch galvanized steel extraction ducting to knockout tanks and carbon.
Sheet Pile Ducting	None	Galvanized steel ducting covering sheet pile perimeter
Extraction Blower	10 HP Regenerative Blower	Two 100 HP Extraction Blowers (primary and secondary
Max Flow (cfm)	200	12500
Max Vacuum (Inches H_2O)	40	26
Measurement	Manually via anemometer	Automatically via pitot tube and pressure transducer connected to PLC, Checked manually via anemometer twice daily at minimum
Mist Treatment	None	Mist accumulators consisting of expansion chamber and series of coalescing plates connected inline to each of the extraction chimneys
Moisture Knockout	One 60 gallon knockout tank	Two 20,000 gallon knockout tanks connected in parallel
Carbon Vessel Size	Two 500 pound vessels connected in series	Two 10,000 pound vessels connected in series
Stack Height	Approximately 10 ft	40 ft
Monitoring		
Subsurface Temperature Monitoring (# of thermocouples)	86	170
Gravel Layer Temperature Monitoring (# of thermocouples)	2	6
Effluent Temperature Monitoring (# of thermocouples)	2 Thermocouples connected to data logger	4 Thermocouples connected to PLC system with safety shutdowns
Combustion Gas (CO, CO_2, O_2) Monitoring	Manual collection of extraction vapors via tedlar bag and lung box on an hourly basis. Analysis via landfill gas hand held meter	Automatic continuous emission extraction via heated umbilical line with continuous monitoring using dedicated CO, O_2, and CO_2 analyzers in climate controlled shed. Live readout and logging of data to site computer.
VOC Screening	Manual collection of extraction vapors via tedlar bag and lung box on an hourly basis. Analysis via PID	Manual collection of extraction vapors via tedlar bag and lung box on a twice daily basis. Analysis via PID
Vacuum Propagation Monitoring	None	Four manual vacuum gauges installed into gravel layer and four manual vacuum gauges installed into sheet pile ducting. Readings collected manually at a minimum of twice daily
Process Equipment Monitoring/ Safety Alarms	System operated manually. Operator on Site 24 hours	System run via PLC. Air injection and extraction equipped with redundancies (back up compressor and blower) to operate in the event of primary failure. PLC to shut down system under various operational failures and alert operator via auto phone and email for all alarms. Operator on site daily.
Analytical Sample Collection		
Benzene	Daily during operation via summa canister	Once per week via summa canister at Stack sampling port
VOCs	Daily during operation via summa canister	Variable; measured at SVE influent, carbon vessel midpoint, and stack
SVOCs	Daily during operation via sorbent tube	Variable; collected via summa canister

Notes:
kW - kilowatts
V - volts
cfm - cubic feet per minute
psi - pounds per square inch
HP - horsepower
CO - carbon monoxide
CO_2 - carbon dioxide
O_2 - oxygen
VOC - volatile organic compound
SVOC - semi-volatile organic compound
PLC - Process Logic Controller
PID - Photoionization detector
SVE - soil vapor extraction
H_2O - water
ft - feet

TABLE 4
SUMMARY OF PERMIT REQUIREMENTS FROM THE NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
Former Pitt Consol Site, Newark, New Jersey

Reference Number	Applicable Requirement	Notes
Phase I Environmental Improvement Pilot Test (EIPT) Permit - Permit Activity Number: EIP090001; Facility ID: 08627		
1	The EIPT Permit is valid for 90 days only	Condition met; System operated for 9 days during Phase I
2	All equipment must be functioning properly and in accordance with the permit	Condition met
3	The equipment must not cause any air contamination that will be injurious to human health and the environment except in areas over which the owner or operator has exclusive use or occupency	Condition met
4	The EIPT permit pertains to emissions of air contaminant only	Condition met
5	The operator shall retain copies of design specifications for each piece of equipment included in the permit	Condition met
6	Document construction of pilot test area and equipment	Condition met
7	Hours of operation <=720 hours for diesel enginer / elctrical generator (100kW)	Condition met
8	At all times during the experiment, an air pollution control system consisting of two 500-pound carbon absorbers shall be connected in series to treat exhaust from the soil vapor extraction blower	Condition met
9	Air injection rate shall be limited to 100 ACFM, and if increased above this level, it shall be done in a well controlled manner and reasons must be documented	Condition met
10	Extraction flowrate <= 100 CFM, increased only if air input rate increases	Condition met
11	Lead / lag carbon vessels will be changed if breakthrough concentration (50 ppmv measured as isobutylene) is exceeded at the point between the two carbon beds	Condition met; Breakthrough concentration not encountered
12	Carbon monoxide <= 0.09 lb/hr at stack, monitored hourly and recorded	Condition met; Peak carbon monoxide concentration measured at stack = 5000 ppmv, CO discharge = 2.25 kg/hr at stack; therefore, stack height increased during test, continuous CO monitoring implemented and stack modeled and re-designed for Phase II
13	Benzene <= 0.01 lb/hr at stack, monitored hourly and recorded	Condition met; Peak benzene concentration measured at stack = 22 $\mu g/m^3$ (see Table 5), benzene discharge = 1.3×10^{-5} lb/hr at Stack
14	Records must be kept of electrical heat input, air injection rate, vapor extraction rate, run time, emission testing performed, etc.	Condition met
15	There shall be no visible emissions (opacity testing) except for a period of not longer that 3 minutes in any consecutive thirty minute period	Condition met
16	The experiment shall be terminated when: 1) any fugitive emissions are observed on ground surface for more than 5 minutes; 2) health and safety concerns warrant; and 3) completion of the test based on temperature and CO2 concentrations	Condition met; No fugitive emissions observed for more than 5 minutes; no health and safety concers warranted termination; test terminated upon completion
Phase II Environmental Improvement Pilot Test (EIPT) Permit - Permit Activity Number: EIP100001; Facility ID: 08627		
1	The EIPT Permit is valid for 90 days only	Condition met; System operated for 17 days used during Phase II
2	All equipment must be functioning properly and in accordance with the permit	Condition met
3	The equipment must not cause any air contamination that will be injurious to human health and the environment except in areas over which the owner or operator has exclusive use or occupency	Condition met
4	The EIPT permit pertains to emissions of air contaminant only	Condition met
5	The operator shall retain copies of design specifications for each piece of equipment included in the permit	Condition met
6	Document construction of pilot test area and equipment	Condition met
7	At all times during the experiment, an air pollution control system consisting of two 10,000-pound carbon absorbers shall be connected in series to treat exhaust from the soil vapor extraction blower, with vapors emitted through a 40-foot stack	Condition met
8	Extraction flowrate <= 12,500 CFM, increased only if air input rate increases	Condition met
9	If, based on TO-15 analytical results, total VOCs (TVOCs) exceed 0.5 pounds per hour or toxic substances (TXS) exceeds 0.1 pounds per hour between the carbon beds, the lag / lead carbon beds will be exchanged and the lag unit will be replaced; if, based on TO-15 analytical results, TVOCs exceed 0.5 pounds per hour or TXS exceeds 0.1 pounds per hour at ths Stack, operation of the system will cease.	Condition met; Breakthrough concentration not encountered between carbon beds; Peak TVOC concentration measured at stack = 202.7 µg/m3 (see Table 6), TVOC discharge = 0.0068 lb/hr at Stack
10	Carbon monoxide <= 10 ppm at field monitoring locations, 4 points, 90 degrees apart, 500 feet away from stack	Condition met; No exceedences detected at any of the monitoring locations
11	Benzene <= 0.01 lb/hr at stack	Condition met; Peak benzene concentration measured at stack = 9.9 $\mu g/m^3$ (see Table 6), benzene discharge = 3×10^{-4} lb/hr at Stack
12	Records must be kept of electrical heat input, air injection rate, vapor extraction rate, run time, emission testing performed, etc.	Condition met
13	There shall be no visible emissions (opacity testing) except for a period of not longer that 3 minutes in any consecutive thirty minute period	Condition met
14	The experiment shall be terminated when: 1) any fugitive emissions are observed on ground surface for more than 5 minutes; 2) health and safety concerns warrant; and 3) completion of the test based on temperature and CO2 concentrations	Condition met; No fugitive emissions observed for more than 5 minutes; no health and safety concers warranted termination; test terminated upon completion

TABLE 5
PRE-PILOTSOIL CONCENTRATIONS
Former Pitt Consol Site, Newark New Jersey

Location	PTC-S-1	PTC-S-2	PTC-S-3	PTC-S-4	PTC-S-4	PTC-S-5	PTC-S-5	PTC-S-6	PTC-S-6	PTC-S-7	PTC-S-7	PTC-S-8	PTC-S-9	PTC-S-9	PTC-S-TESTPIT
Depth Interval (ft bgs)	8.0-8.5	8.0-8.5	8.0-8.5	6.5-7.0	8.5-9.0	6.6-7.0	9.0-10.0	6.5-7.0	9.0-10.0	6.0-7.0	9.0-10.0	9.0-10.0	6.0-7.0	9.0-10.0	8.0
Sample Date	18-Aug-09	18-Aug-09	18-Aug-09	18-Aug-09	18-Aug-09	19-Aug-09	19-Aug-09	19-Aug-09	19-Aug-09	19-Aug-09	19-Aug-09	19-Aug-09	19-Aug-09	19-Aug-09	19-Aug-09
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte															
1,2,4-Trichlorobenzene	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
1,2-Dichlorobenzene	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
1,3-Dichlorobenzene	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
1,4-Dichlorobenzene	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
2,2-Oxybis(1-Chloropropane)	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
2,4,5-Trichlorophenol	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
2,4,6-Trichlorophenol	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
2,4-Dichlorophenol	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
2,4-Dimethylphenol	**51 J**	62 U	**35**	**540**	**63**	**72**	**650**	62 U	**310**	**2.4 J**	**590**	63 U	**1,000**	**270**	**98**
2,4-Dinitrophenol	720 U	740 U	370 U	950 U	710 U	720 U	1,400 U	740 U	990 U	24 U	1,600 U	750 U	1,100 U	770 U	850 U
2,4-Dinitrotoluene	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
2,6-Dinitrotoluene	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
2-Chloronaphthalene	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
2-Chlorophenol	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
2-Methylnaphthalene	**310**	**250**	**610**	**3,400**	**550**	**620**	**2,400**	**280**	**2,500**	**22**	**2,500**	**82**	**13,000**	**2,800**	**1,200**
2-Methylphenol	**66**	62 U	**16 J**	**390**	**47 J**	**66**	**770**	62 U	82 U	**1.4 J**	**890**	63 U	**700**	**250**	**52 J**
2-Nitroaniline	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
2-Nitrophenol	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
3,3-Dichlorobenzidine	120 U	120 U	62 U	160 U	120 U	120 U	230 U	120 U	160 U	4.0 U	260 U	130 U	180 U	130 U	140 U
3-Nitroaniline	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
4,6-Dinitro-2-methylphenol	180 U	180 U	93 U	240 U	180 U	180 U	350 U	190 U	250 U	6.1 U	390 U	190 U	270 U	190 U	210 U
4-Bromophenyl-phenylether	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
4-Chloro-3-methylphenol	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
4-Chloroaniline	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
4-Chlorophenyl-phenylether	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
4-Methylphenol	**110**	**34 J**	**24 J**	**580**	**70**	**120**	**1,600**	**26 J**	**550**	**4.9 J**	**1,600**	63 U	**860**	**330**	**70 J**
4-Nitroaniline	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
4-Nitrophenol	180 U	180 U	93 U	240 U	180 U	180 U	350 U	190 U	250 U	6.1 UJ	390 U	190 U	270 U	190 U	210 U
Acenaphthene	**180**	**130**	**350**	**1,800**	**300**	**350**	**1,300**	**170**	**1,500**	**21**	**1,500**	**54 J**	**6,400**	**1,500**	**630**
Acenaphthylene	**13 J**	**18 J**	**35**	**230**	**30 J**	**52 J**	**54 J**	**13 J**	**180**	**3.1**	**110 J**	63 U	**470**	**120**	**60 J**
Anthracene	**550**	**140**	**900**	**4,400**	**780**	**430**	**1,200**	**360**	**2,100**	**27**	**810**	**65**	**29,000**	**4,400**	**2,700**
Benzene	**3.5 J**	**2.0 J**	**21 J**	**65 J**	**4.0 J**	**7.4 J**	**16 J**	**3.2 J**	**15 J**	**0.089**	**18 J**	**0.77 J**	**36 J**	**36**	**15 J**
Benzo(a)anthracene	**46 J**	**42 J**	**63**	**460**	**63**	**130**	**400**	**44 J**	**370**	**16**	**370**	**16 J**	**1,200**	**350**	**160**
Benzo(a)pyrene	**31 J**	**29 J**	**39**	**300**	**43 J**	**87**	**280**	**22 J**	**240**	**14**	**230**	63 U	**780**	**230**	**100**
Benzo(b)fluoranthene	**42 J**	**35 J**	**50**	**310**	**53 J**	**110**	**340**	**32 J**	**280**	**17**	**300**	63 U	**980**	**300**	**120**
Benzo(g,h,i)perylene	**17 J**	**16 J**	**18 J**	**150**	**23 J**	**47 J**	**140**	**14 J**	**120**	**8.7**	**120 J**	63 U	**390**	**120**	**52 J**
Benzo(k)fluoranthene	**14 J**	**14 J**	**17 J**	**150**	**19 J**	**43 J**	**150**	**15 J**	**120**	**6.8 J**	**120 J**	63 U	**360**	**120**	**47 J**
bis(2-Chloroethoxy) methane	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
bis(2-Chloroethyl) ether	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
bis(2-Ethylhexyl) phthalate	120 U	120 U	62 U	160 U	120 U	120 U	230 U	120 U	160 U	4.0 U	260 U	130 U	180 U	130 U	140 U
Butylbenzylphthalate	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
Carbazole	**200**	**47 J**	**390**	**1,800**	**290**	**190**	**560**	**140**	**860**	**8.6**	**440**	**23 J**	**12,000**	**1,500**	**1,100**
Chrysene	**47 J**	**41 J**	**68**	**470**	**72**	**110**	**370**	**52 J**	**360**	**18**	**320**	**16 J**	**1,400**	**340**	**170**
Dibenzo(a,h)anthracene	60 U	62 U	31 U	**35 J**	59 U	60 U	**38 J**	62 U	**26 J**	**1.7 J**	**32 J**	63 U	**91**	**28 J**	**14 J**
Dibenzofuran	**170**	**110**	**320**	**1,800**	**270**	**340**	**1,200**	**180**	**1,400**	**19**	**1,200**	**47 J**	**6,400**	**1,300**	**630**
Diethylphthalate	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
Dimethylphthalate	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
Di-n-butylphthalate	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
Di-n-octylphthalate	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	**2.0 R**	130 U	63 U	89 U	64 U	71 U
Ethyl benzene	**8.1 J**	**2.3 J**	**31 J**	**66 J**	**6.8 J**	**17 J**	**16 J**	**8.6 J**	**12 J**	**0.17 J**	**20 J**	**2.8 J**	**34 J**	**45**	**23 J**
Fluoranthene	**200**	**150**	**310**	**1,800**	**300**	**500**	**1,500**	**230**	**1,700**	**65**	**1,600**	**61 J**	**6,000**	**1,500**	**670**
Fluorene	**210**	**140**	**400**	**2,100**	**340**	**400**	**1,300**	**180**	**1,500**	**21**	**1,400**	**56 J**	**8,600**	**1,700**	**840**
Hexachlorobenzene	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
Hexachlorobutadiene	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
Hexachlorocyclopentadiene	180 U	180 U	93 U	240 U	180 U	180 U	350 U	190 U	250 U	**6.1 R**	390 U	190 U	270 U	190 U	210 U
Hexachloroethane	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
Indeno(1,2,3-cd)pyrene	**14 J**	**13 J**	**17 J**	**130**	**18 J**	**43 J**	**140**	62 U	**99**	**7.4**	**110 J**	63 U	**330**	**110**	**42 J**
Isophorone	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
Naphthalene	**1,100**	**850**	**2,000**	**14,000**	**2,000**	**2,000**	**14,000**	**1,100**	**10,000**	**70**	**8,100**	**310**	**49,000**	**10,000**	**4,300**
Nitrobenzene	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
N-Nitroso-di-n-propylamine	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
N-Nitrosodiphenylamine	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	2.0 U	130 U	63 U	89 U	64 U	71 U
Pentachlorophenol	180 U	180 U	93 U	240 U	180 U	180 U	350 U	190 U	250 U	**6.1 R**	390 U	190 U	270 U	190 U	210 U
Phenanthrene	**480**	**350**	**740**	**4,700**	**770**	**1,200**	**3,100**	**580**	**4,300**	**85**	**3,100**	**150**	**18,000**	**3,700**	**1,600**
Phenol	60 U	62 U	31 U	79 U	59 U	60 U	120 U	62 U	82 U	**2.4**	130 U	63 U	89 U	64 U	71 U
Pyrene	**140**	**110**	**220**	**1,400**	**210**	**350**	**1,100**	**150**	**1,200**	**44**	**1,100**	**46 J**	**4,100**	**1,000**	**480**
Toluene	**18 J**	**7.7**	**100 J**	**250 J**	**18 J**	**38 J**	**52 J**	**17 J**	**39 J**	**0.35**	**63 J**	**5.0 J**	**120 J**	**140**	**66 J**
Xylenes (total)	**47 J**	**16**	**220 J**	**470 J**	**42 J**	**95 J**	**86 J**	**48 J**	**63 J**	**0.88**	**110 J**	**17 J**	**190 J**	**260**	**140 J**
API Diesel Range Organics	**3,400 J**	**2,600 J**	**6,800 J**	**45,000 J**	**12,000 J**	**3,800 J**	**97,000 J**	**1,500 J**	**40,000 J**	**2,900 J**	**69,000 J**	**13,000 J**	**46,000 J**	**190,000 J**	**35,000 J**
TPH-GRO soil C6-C10	**290 J**	**120 J**	**850 J**	**1,100 J**	**63 J**	**330 J**	**640 J**	**250 J**	**430 J**	**8.1 J**	**560 J**	**97 J**	**1,400 J**	**1,200 J**	**360 J**

Notes:
mg/kg - milligrams per kilogram
ft bgs - feet below ground surface
U - Analyte not detected above quantitation limit
J - estimated concentration
R - result rejected
Bold values indicated detections

TABLE 6
PHASE I PILOT TEST VOLATILE COMPOUND CONCENTRATIONS IN THE VAPOR PHASE
Former Pitt Consol Site, Newark, New Jersey

Location	SVE Influent	SVE Influent	SVE Influent	SVE Influent	SVE Influent	SVE Influent	SVE Influent	SVE Influent	SVE Influent
Sample ID	INF-01-GS	INF-02-GG	SVOC-INF-F-01	INF-03-GG	SVOC-INF-F-02	INF-04-GG	SVOC-INF-F-03	INF-05-GG	SVOC-INF-F-04
Sample Date	16-Oct-09	17-Oct-09	17-Oct-09	18-Oct-09	18-Oct-09	19-Oct-09	19-Oct-09	20-Oct-09	20-Oct-09
Units	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Analyte	--	--	--	--	--	--	--	--	--
Acenaphthene	--	--	85 U	--	90 U	--	220 U	--	82 U
Acenaphthylene	--	--	85 U	--	90 U	--	220 U	--	82 U
Anthracene	--	--	85 U	--	90 U	--	220 U	--	82 U
Benzene	**25,900**	**4,200**	--	**38,300**	--	**57,500**	--	**29,100**	--
Benzo(a)anthracene	--	--	85 U	--	90 U	--	220 U	--	82 U
Benzo(a)pyrene	--	--	85 U	--	90 U	--	220 U	--	82 U
Benzo(b)fluoranthene	--	--	85 U	--	90 U	--	220 U	--	82 U
Benzo(g,h,i)perylene	--	--	85 U	--	90 U	--	220 U	--	82 U
Benzo(k)fluoranthene	--	--	85 U	--	90 U	--	220 U	--	82 U
Chrysene	--	--	85 U	--	90 U	--	220 U	--	82 U
Dibenzo(a,h)anthracene	--	--	85 U	--	90 U	--	220 U	--	82 U
Ethyl benzene	**1,800**	90 U	--	**3,300**	--	**5,200**	--	**5,200**	--
Fluoranthene	--	--	85 U	--	90 U	--	220 U	--	82 U
Fluorene	--	--	85 U	--	90 U	--	220 U	--	82 U
Indeno(1,2,3-cd)pyrene	--	--	85 U	--	90 U	--	220 U	--	82 U
m&p-Xylenes	**4,800**	90 U	--	**9,100**	--	**13,500**	--	**12,200**	--
Naphthalene	--	--	**1000000**	--	**1700000**	--	**830000**	--	**430000**
o-Xylene	**1,400**	90 U	--	**2,600**	--	**3,400 J**	--	**3,900**	--
Phenanthrene	--	--	85 U	--	90 U	--	220 U	--	82 U
Pyrene	--	--	85 U	--	90 U	--	220 U	--	82 U
Toluene	**16,200**	**410**	--	**28,600**	--	**49,000**	--	**31,700**	--

TABLE 6
PHASE I PILOT TEST VOLATILE COMPOUND CONCENTRATIONS IN THE VAPOR PHASE
Former Pitt Consol Site, Newark, New Jersey

Location	SVE Influent	SVE Influent	SVE Influent	SVE Influent	Stack	Stack	Stack	Stack	Stack
Sample ID	INF-06-GG	INF-07-GG	SVOC-INF-F-05	INF-08-MW/JS/RS	STACK-01-GS	STACK-02-GG	SVOC-STACK-01	STACK-03-GG	SVOC-STACK-02
Sample Date	21-Oct-09	23-Oct-09	23-Oct-09	25-Oct-09	16-Oct-09	17-Oct-09	17-Oct-09	18-Oct-09	18-Oct-09
Units	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Analyte	--	--	--	--	--	--	--	--	--
Acenaphthene	--	--	**22000**	--	--	--	92 U	--	86 U
Acenaphthylene	--	--	89 U	--	--	--	92 U	--	86 U
Anthracene	--	--	89 U	--	--	--	92 U	--	86 U
Benzene	**20,100**	**10,900**	--	**5,400**	**22**	**5**	--	**4**	--
Benzo(a)anthracene	--	--	89 U	--	--	--	92 U	--	86 U
Benzo(a)pyrene	--	--	89 U	--	--	--	92 U	--	86 U
Benzo(b)fluoranthene	--	--	89 U	--	--	--	92 U	--	86 U
Benzo(g,h,i)perylene	--	--	89 U	--	--	--	92 U	--	86 U
Benzo(k)fluoranthene	--	--	89 U	--	--	--	92 U	--	86 U
Chrysene	--	--	89 U	--	--	--	92 U	--	86 U
Dibenzo(a,h)anthracene	--	--	89 U	--	--	--	92 U	--	86 U
Ethyl benzene	**5,200**	**3,300**	--	**1,400**	4 U	**4 J**	--	4 U	--
Fluoranthene	--	--	89 U	--	--	--	92 U	--	86 U
Fluorene	--	--	89 U	--	--	--	92 U	--	86 U
Indeno(1,2,3-cd)pyrene	--	--	89 U	--	--	--	92 U	--	86 U
m&p-Xylenes	**13,500**	**7,800**	--	**4,000**	4 U	**3 J**	--	4 U	--
Naphthalene	--	--	**1600000**	--	--	--	92 U	--	86 U
o-Xylene	**4,800**	**3,000**	--	**1,600**	4 U	**1 J**	--	4 U	--
Phenanthrene	--	--	89 U	--	--	--	92 U	--	86 U
Pyrene	--	--	89 U	--	--	--	92 U	--	86 U
Toluene	**26,800**	**13,900**	--	**7,500**	4 U	**9**	--	4 U	--

TABLE 6
PHASE I PILOT TEST VOLATILE COMPOUND CONCENTRATIONS IN THE VAPOR PHASE
Former Pitt Consol Site, Newark, New Jersey

Location	Stack	Stack	Stack	Stack	Stack	Stack	Stack	Stack	Stack
Sample ID	STACK-04-GG	SVOC-STACK-03	STACK-05-GG	SVOC-STACK-04	STACK-06-GG	SVOC-STACK-05	STACK-07-GG	SVOC-STACK-06	STACK-08-MW/JS/RS
Sample Date	19-Oct-09	19-Oct-09	20-Oct-09	20-Oct-09	21-Oct-09	22-Oct-09	23-Oct-09	24-Oct-09	25-Oct-09
Units	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Analyte	--	--	--	--	--	--	--	--	--
Acenaphthene	--	87 U	--	78 U	--	75 U	--	76 U	--
Acenaphthylene	--	87 U	--	78 U	--	75 U	--	76 U	--
Anthracene	--	87 U	--	78 U	--	75 U	--	76 U	--
Benzene	**6**	--	**5**	--	**4**	--	**1 J**	--	**4**
Benzo(a)anthracene	--	87 U	--	78 U	--	75 U	--	76 U	--
Benzo(a)pyrene	--	87 U	--	78 U	--	75 U	--	76 U	--
Benzo(b)fluoranthene	--	87 U	--	78 U	--	75 U	--	76 U	--
Benzo(g,h,i)perylene	--	87 U	--	78 U	--	75 U	--	76 U	--
Benzo(k)fluoranthene	--	87 U	--	78 U	--	75 U	--	76 U	--
Chrysene	--	87 U	--	78 U	--	75 U	--	76 U	--
Dibenzo(a,h)anthracene	--	87 U	--	78 U	--	75 U	--	76 U	--
Ethyl benzene	**10**	--	4 U	--	4 U	--	4 U	--	**1 J**
Fluoranthene	--	87 U	--	78 U	--	75 U	--	76 U	--
Fluorene	--	87 U	--	78 U	--	75 U	--	76 U	--
Indeno(1,2,3-cd)pyrene	--	87 U	--	78 U	--	75 U	--	76 U	--
m&p-Xylenes	**22**	--	4 U	--	4 U	--	4 U	--	**3 J**
Naphthalene	--	87 U	--	78 U	--	75 U	--	76 U	--
o-Xylene	**12**	--	4 U	--	4 U	--	4 U	--	**1 J**
Phenanthrene	--	87 U	--	78 U	--	75 U	--	76 U	--
Pyrene	--	87 U	--	78 U	--	75 U	--	76 U	--
Toluene	**6**	--	**2 J**	--	**1 U**	--	4 U	--	**2 J**

Notes:
µg/m^3 - micrograms per cubic meter
U - Analyte not detected above quantitation limit
J - estimated concentration
SVE - soil vapor extraction system
Bold values indicate detections
-- analyte not measured

TABLE 7
PHASE II PILOT TEST VOLATILE COMPOUND CONCENTRATIONS IN THE VAPOR PHASE
Former Pitt Consol Site, Newark, New Jersey

Location	SVE Influent	SVE Influent	SVE Influent	SVE Influent	SVE Influent	SVE Influent	SVE Influent	SVE Influent	Carbon Midpoint
Sample Name	SP-01	SP-01	SP-01	SP-01	SP-01	SP-01	SP-01	SP-04	SP-05
Sample Date	12-Aug-10	23-Aug-10	09-Nov-10	15-Nov-10	22-Nov-10	29-Nov-10	06-Dec-10	15-Nov-10	15-Nov-10
Units	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Analyte									
1,1,1,2-Tetrachloroethane	690 U	140 U	69 U	690 U	6.9 U	210 U	69 U	69 U	6.9 U
1,1,1-Trichloroethane	550 U	110 U	55 U	550 U	5.5 U	160 U	55 U	55 U	5.5 U
1,1,2,2-Tetrachloroethane	690 U	140 U	69 U	690 U	6.9 U	210 U	69 U	69 U	6.9 U
1,1,2-Trichloroethane	550 U	110 U	55 U	550 U	5.5 U	160 U	55 U	55 U	5.5 U
1,1-Dichloroethane	400 U	81 U	40 U	400 U	4 U	120 U	40 U	40 U	4 U
1,1-Dichloroethene	400 U	79 U	40 U	400 U	4 U	120 U	40 U	40 U	4 U
1,2,3-Trichloropropane	600 U	120 U	60 U	600 U	6 U	180 U	60 U	60 U	6 U
1,2,4-Trimethylbenzene	**2400**	**1800**	**1600**	**1600**	**200**	**470**	**990**	**280**	4.9 U
1,2-Dibromoethane	770 U	150 U	77 U	770 U	7.7 U	230 U	77 U	77 U	7.7 U
1,2-Dichlorobenzene	600 U	120 U	60 U	600 U	6 U	180 U	60 U	60 U	6 U
1,2-Dichloroethane	400 U	81 U	**66**	400 U	4 U	120 U	**150**	40 U	4 U
1,2-Dichloropropane	460 U	92 U	46 U	460 U	4.6 U	140 U	46 U	46 U	4.6 U
1,3,5-Trimethylbenzene	**1300**	**810**	**910**	**760**	**100**	**230**	**480**	**110**	4.9 U
1,3-Butadiene	**4300**	**53 J**	**51**	**900**	4.4 U	**160**	**570**	**150**	**160**
1,3-Dichlorobenzene	600 U	120 U	60 U	600 U	6 U	180 U	60 U	60 U	6 U
1,4-Dichlorobenzene	600 U	120 U	60 U	600 U	6 U	180 U	60 U	60 U	6 U
2-Butanone (MEK)	**1500**	**120**	**57 J**	**1100**	**12**	180 U	**260**	**150**	**57**
2-Hexanone	820 U	160 U	82 U	820 U	8.2 U	250 U	82 U	82 U	**18**
3-Chloropropene	310 U	63 U	31 U	310 U	3.1 U	94 U	31 U	31 U	3.1 U
4-Ethyltoluene	**750**	**420**	**870**	**440 J**	**50**	**120 J**	**270**	**66**	4.9 U
4-Methyl-2-pentanone	820 U	160 U	82 U	820 U	8.2 U	250 U	82 U	82 U	8.2 U
Benzene	**19000**	**1700**	**2200**	**25000**	**110**	**830**	**6900**	**4000**	**170**
Bromobenzene	640 U	130 U	64 U	640 U	6.4 U	190 U	64 U	64 U	6.4 U
Bromodichloromethane	670 U	130 U	67 U	670 U	6.7 U	200 U	67 U	67 U	6.7 U
Bromoform	1000 U	210 U	100 U	1000 U	10 U	310 U	100 U	100 U	10 U
Bromomethane	390 U	78 U	39 U	390 U	3.9 U	120 U	**9.9 J**	**8 J**	**3.1 J**
Carbon disulfide	**2300**	**110**	**160**	**1000**	**5.1**	**90 J**	**600**	**86**	**78**
Carbon tetrachloride	630 U	130 U	63 U	630 U	6.3 U	190 U	63 U	63 U	6.3 U
Chlorobenzene	460 U	**24 J**	**28 J**	**160 J**	**2.1 J**	140 U	**49**	**20 J**	**1.8 J**
Chlorodifluoromethane	**430**	71 U	35 U	350 U	**2 J**	110 U	35 U	35 U	3.5 U
Chloroethane	260 U	53 U	26 U	260 U	2.6 U	79 U	26 U	26 U	**4.1**
Chloroform	490 U	98 U	49 U	490 U	**1.4 J**	150 U	49 U	49 U	4.9 U
Chloromethane	**720**	**34 J**	21 U	**810**	**2 J**	**44 J**	**150**	**130**	2.1 U
cis-1,2-Dichloroethene	400 U	79 U	40 U	400 U	4 U	120 U	40 U	40 U	4 U
cis-1,3-Dichloropropene	450 U	91 U	45 U	450 U	4.5 U	140 U	45 U	45 U	4.5 U
Cumene	**340 J**	**120**	**530**	**200 J**	**16**	**41 J**	**120**	**29 J**	4.9 U
Dibromochloromethane	850 U	170 U	85 U	850 U	8.5 U	260 U	85 U	85 U	8.5 U
Dibromomethane	710 U	140 U	71 U	710 U	7.1 U	210 U	71 U	71 U	7.1 U
Dichlorodifluoromethane	490 U	99 U	49 U	490 U	**4.1 J**	150 U	49 U	49 U	**2.3 J**
Dichlorofluoromethane	420 U	84 U	42 U	420 U	4.2 U	130 U	42 U	42 U	4.2 U
Ethyl benzene	**3800**	**1100**	**1500**	**2300**	**110**	**330**	**2500**	**280**	**2 J**
Freon-113	1500 U	310 U	150 U	1500 U	15 U	460 U	150 U	150 U	15 U
Freon-114	700 U	140 U	70 U	700 U	7 U	210 U	70 U	70 U	7 U
Heptane	**220 J**	**25 J**	**49**	**1400**	**2.3 J**	120 U	**68**	**170**	**1.6 J**
Hexachloroethane	970 U	190 U	97 U	970 U	9.7 U	290 U	97 U	97 U	9.7 U
Hexane	**500**	**25 J**	**55**	**1500**	**3.3 J**	**24 J**	**74**	**210**	**9.1**
Isooctane	470 U	93 U	47 U	470 U	4.7 U	140 U	47 U	47 U	4.7 U
m&p-Xylenes	**11000**	**2100**	**5700**	**5300**	**390**	**1400**	**8600**	**660**	**3.7 J**
Methyl-tert-Butyl Ether (MTBE)	360 U	72 U	36 U	360 U	3.6 U	110 U	36 U	36 U	3.6 U
Naphthalene	**1900**	**3500**	**330**	**31000**	**3700**	**1800**	**1100**	**2000**	**5.2 J**
Octane	**180 J**	**34 J**	**120**	**1100**	**2.3 J**	140 U	**65**	**130**	4.7 U
o-Xylene	**4100**	**1400**	**2300**	**2300**	**160**	**560**	**3300**	**320**	**1.9 J**
Pentane	**560**	**34 J**	**47**	**2100**	**1.4 J**	**34 J**	**110**	**320**	**26**
Styrene	**2800**	**540**	**850**	**1700**	**29**	**140**	**1400**	**230**	4.3 U
Tetrachloroethene	680 U	140 U	68 U	680 U	6.8 U	200 U	68 U	68 U	6.8 U
Toluene	**15000**	**3800**	**5400**	**7400**	**280**	**1200**	**7500**	**1700**	**26**
trans-1,2-Dichloroethene	400 U	79 U	40 U	400 U	4 U	120 U	40 U	40 U	4 U
trans-1,3-Dichloropropene	450 U	91 U	45 U	450 U	4.5 U	140 U	45 U	45 U	4.5 U
Trichloroethene	540 U	110 U	54 U	540 U	5.4 U	160 U	54 U	54 U	5.4 U
Trichlorofluoromethane	560 U	110 U	56 U	560 U	**4.3 J**	170 U	56 U	56 U	**5.2 J**
Vinyl chloride	260 U	51 U	26 U	260 U	2.6 U	77 U	26 U	26 U	2.6 U

TABLE 7
PHASE II PILOT TEST VOLATILE COMPOUND CONCENTRATIONS IN THE VAPOR PHASE
Former Pitt Consol Site, Newark, New Jersey

Location	Stack	Stack	Stack	Stack	Stack	Stack	Stack
Sample Name	SP-06	SP-06	SP-06	SP-06	SP-06	SP-06	SP-06
Sample Date	12-Aug-10	23-Aug-10	09-Nov-10	15-Nov-10	22-Nov-10	29-Nov-10	06-Dec-10
Units	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Analyte							
1,1,1,2-Tetrachloroethane	2 U	6.9 U	6.9 U	6.9 U	6.9 U	6.9 U	6.9 U
1,1,1-Trichloroethane	2 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U
1,1,2,2-Tetrachloroethane	2 U	6.9 U	6.9 U	6.9 U	6.9 U	6.9 U	6.9 U
1,1,2-Trichloroethane	2 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U	5.5 U
1,1-Dichloroethane	2 U	4 U	4 U	4 U	4 U	4 U	4 U
1,1-Dichloroethene	2 U	4 U	4 U	4 U	4 U	4 U	4 U
1,2,3-Trichloropropane	2 U	6 U	6 U	6 U	6 U	6 U	6 U
1,2,4-Trimethylbenzene	**0.99 J**	**3.7 J**	**1.6 J**	**2.2 J**	**2.6 J**	4.9 U	4.9 U
1,2-Dibromoethane	2 U	7.7 U	7.7 U	7.7 U	7.7 U	7.7 U	7.7 U
1,2-Dichlorobenzene	2 U	6 U	6 U	6 U	**1.7 J**	6 U	6 U
1,2-Dichloroethane	2 U	4 U	4 U	4 U	4 U	4 U	4 U
1,2-Dichloropropane	2 U	4.6 U	4.6 U	4.6 U	4.6 U	4.6 U	4.6 U
1,3,5-Trimethylbenzene	**0.43 J**	**1 J**	4.9 U	4.9 U	**2.1 J**	4.9 U	4.9 U
1,3-Butadiene	4 U	4.4 U	4.4 U	**7.2**	**33**	**4.7**	4.4 U
1,3-Dichlorobenzene	2 U	6 U	6 U	6 U	**1.6 J**	6 U	6 U
1,4-Dichlorobenzene	2 U	6 U	6 U	6 U	**2 J**	6 U	6 U
2-Butanone (MEK)	**7.6**	**150**	**4.9 J**	**19**	**28**	**8.2**	**7.3**
2-Hexanone	**1.1 J**	**39**	8.2 U	**3.1 J**	**6.9 J**	8.2 U	8.2 U
3-Chloropropene	2 U	**0.95 J**	3.1 U	3.1 U	3.1 U	3.1 U	3.1 U
4-Ethyltoluene	2 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U
4-Methyl-2-pentanone	4 U	8.2 U	8.2 U	8.2 U	8.2 U	8.2 U	8.2 U
Benzene	**4.4**	**6.9**	**1.1 J**	**9.9**	**3.7**	**1.6 J**	**3.2 J**
Bromobenzene	2 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U
Bromodichloromethane	2 U	6.7 U	6.7 U	6.7 U	6.7 U	6.7 U	6.7 U
Bromoform	2 U	10 U	10 U	10 U	10 U	10 U	10 U
Bromomethane	2 U	3.9 U	3.9 U	**1.7 J**	3.9 U	3.9 U	3.9 U
Carbon disulfide	**1.1 J**	**96**	**0.65 J**	**3.8**	**16**	**2 J**	**0.75 J**
Carbon tetrachloride	2 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U	6.3 U
Chlorobenzene	2 U	4.6 U	4.6 U	4.6 U	4.6 U	4.6 U	4.6 U
Chlorodifluoromethane	**0.75 J**	**1.8 J**	**1 J**	3.5 U	**1.7 J**	**1.8 J**	**0.81 J**
Chloroethane	2 U	**0.6 J**	2.6 U	**2.1 J**	**1.8 J**	2.6 U	2.6 U
Chloroform	2 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U	4.9 U
Chloromethane	**6.6**	**7.2**	**4.1**	**120**	2.1 U	**5.1**	**1.6 J**
cis-1,2-Dichloroethene	2 U	4 U	4 U	4 U	**1.3 J**	4 U	4 U
cis-1,3-Dichloropropene	2 U	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U
Cumene	2 U	**5.8**	4.9 U	**8**	**7.4**	**3.8 J**	**1.2 J**
Dibromochloromethane	2 U	8.5 U	8.5 U	8.5 U	8.5 U	8.5 U	8.5 U
Dibromomethane	2 U	7.1 U	7.1 U	7.1 U	7.1 U	7.1 U	7.1 U
Dichlorodifluoromethane	**0.51 J**	**3 J**	**3.7 J**	**4.4 J**	**4.2 J**	**2.9 J**	**2.6 J**
Dichlorofluoromethane	2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U	4.2 U
Ethyl benzene	**2.8**	**1.9 J**	**2.1 J**	**0.96 J**	**6.4**	4.3 U	**1 J**
Freon-113	4 U	15 U	15 U	15 U	15 U	15 U	15 U
Freon-114	2 U	7 U	7 U	7 U	7 U	7 U	7 U
Heptane	2 U	**4 J**	4.1 U	4.1 U	4.1 U	4.1 U	4.1 U
Hexachloroethane	2 U	9.7 U	9.7 U	9.7 U	9.7 U	9.7 U	9.7 U
Hexane	**0.49 J**	**3.8**	3.5 U	3.5 U	**0.8 J**	3.5 U	3.5 U
Isooctane	2 U	4.7 U	4.7 U	4.7 U	4.7 U	4.7 U	4.7 U
m&p-Xylenes	**11**	**4.5**	**5.6**	**3.1 J**	**18**	**0.91 J**	**2.5 J**
Methyl-tert-Butyl Ether (MTBE)	2 U	3.6 U	**1.6 J**	3.6 U	3.6 U	3.6 U	3.6 U
Naphthalene	**15**	**170**	**3.6 J**	**31**	**21**	**2.7 J**	**3.8 J**
Octane	**0.44 J**	**3.1 J**	4.7 U	4.7 U	**2.6 J**	4.7 U	**1.2 J**
o-Xylene	**5.9**	**2.6 J**	**2.5 J**	**3 J**	**17**	**1.2 J**	**1.5 J**
Pentane	2 U	**6**	**0.72 J**	**1.4 J**	**1.2 J**	**1 J**	**0.69 J**
Styrene	**0.94 J**	**0.96 J**	4.3 U	4.3 U	4.3 U	4.3 U	4.3 U
Tetrachloroethene	2 U	**13**	6.8 U	6.8 U	6.8 U	6.8 U	6.8 U
Toluene	**6.3**	**7.2**	**2.3 J**	**3.8**	**5.3**	**1.1 J**	**6.3**
trans-1,2-Dichloroethene	2 U	4 U	4 U	4 U	4 U	4 U	4 U
trans-1,3-Dichloropropene	2 U	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U	4.5 U
Trichloroethene	2 U	5.4 U	5.4 U	5.4 U	**1.3 J**	5.4 U	5.4 U
Trichlorofluoromethane	2 U	5.6 U	5.6 U	5.6 U	**2.4 J**	**1.2 J**	**1.2 J**
Vinyl chloride	2 U	2.6 U	2.6 U	**1.8 J**	2.6 U	2.6 U	2.6 U

Notes:
µg/m^3 - micrograms per cubic meter
U - Analyte not detected above quantitation limit
J - estimated concentration
Bold values indicate detections

TABLE 8
POST-PILOT SOIL CONCENTRATIONS
Former Pitt Consol Site, Newark, New Jersey

Location	SC-1	SC-1	SC-1	SC-2	SC-2	SC-3	SC-3
Depth Interval (ft bgs)	2.8-3.8	3.8-4.2	8.7-9.3	3-4.2	7.9-8.4	2.9-4.1	7.5-8.6
Sample Date	16-Dec-10	16-Dec-10	16-Dec-10	16-Dec-10	16-Dec-10	16-Dec-10	16-Dec-10
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte							
1,2,4-Trichlorobenzene	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
1,2-Dichlorobenzene	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
1,3-Dichlorobenzene	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
1,4-Dichlorobenzene	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
2,2-Oxybis(1-Chloropropane)	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
2,4,5-Trichlorophenol	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
2,4,6-Trichlorophenol	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
2,4-Dichlorophenol	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
2,4-Dimethylphenol	**1.7**	1.8 U	**1.2 J**	0.19 U	2.0 U	1.9 U	2.1 U
2,4-Dinitrophenol	21 U	22 U	24 U	2.2 U	24 U	23 U	25 U
2,4-Dinitrotoluene	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
2,6-Dinitrotoluene	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
2-Chloronaphthalene	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
2-Chlorophenol	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
2-Methylnaphthalene	**46**	**18**	**7.0**	**1.1**	**1.9 J**	1.9 U	**1.0 J**
2-Methylphenol	**1.7 J**	1.8 U	**2.2**	0.19 U	**0.85 J**	1.9 U	**1.3 J**
2-Nitroaniline	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
2-Nitrophenol	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
3,3-Dichlorobenzidine	3.4 U	3.6 U	4.1 U	0.37 U	4.0 U	3.8 U	4.2 U
3-Nitroaniline	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
4,6-Dinitro-2-methylphenol	5.2 U	5.4 U	6.1 U	0.56 U	6.1 U	5.8 U	6.3 U
4-Bromophenyl-phenylether	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
4-Chloro-3-methylphenol	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
4-Chloroaniline	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
4-Chlorophenyl-phenylether	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
4-Methylphenol	**2.5**	1.8 U	**2.4**	**0.078 J**	**1.1 J**	1.9 U	**2.2**
4-Nitroaniline	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
4-Nitrophenol	5.2 U	5.4 U	6.1 U	0.56 U	6.1 U	5.8 U	6.3 U
Acenaphthene	**26**	**7.7**	**9.2**	**1.5**	**5.4**	1.9 U	**5.6**
Acenaphthylene	**4.1**	**1.0 J**	**0.99 J**	**0.14 J**	**0.51 J**	1.9 U	**0.58 J**
Anthracene	**37**	**8.5**	**15**	**1.8**	**9.5**	**0.39 J**	**8.7**
Benzene	0.26 U	**0.0010 J**	0.30 U	**0.017**	0.0060 U	0.0060 U	0.33 U
Benzo(a)anthracene	**8.0**	**2.7**	**2.9**	**0.25**	**2.7**	1.9 U	**4.1**
Benzo(a)pyrene	**3.2**	**1.7 J**	**1.4 J**	**0.068 J**	**1.5 J**	1.9 U	**2.0 J**
Benzo(b)fluoranthene	**5.9**	**3.2**	**2.9**	**0.12 J**	**2.0 J**	1.9 U	**3.6**
Benzo(g,h,i)perylene	**1.8**	**1.3 J**	**1.3 J**	0.19 U	**0.65 J**	1.9 U	**1.1 J**
Benzo(k)fluoranthene	**2.2**	**1.1 J**	**0.98 J**	**0.054 J**	**0.83 J**	1.9 U	**1.5 J**
bis(2-Chloroethoxy) methane	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
bis(2-Chloroethyl) ether	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
bis(2-Ethylhexyl) phthalate	3.4 U	3.6 U	4.1 U	0.37 U	4.0 U	3.8 U	4.2 U
Butylbenzylphthalate	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
Carbazole	**10**	**1.9**	**3.8**	**0.22**	**1.4 J**	1.9 U	**2.0 J**
Chrysene	**8.8**	**3.3**	**3.9**	**0.25**	**2.8**	1.9 U	**4.7**
Dibenzo(a,h)anthracene	**0.46 J**	**0.38 J**	**0.41 J**	0.19 U	2.0 U	1.9 U	2.1 U
Dibenzofuran	**33**	**9.9**	**12**	**1.7**	**5.0**	1.9 U	**5.3**
Diethylphthalate	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
Dimethylphthalate	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
Di-n-butylphthalate	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
Di-n-octylphthalate	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
Ethyl benzene	0.26 U	**0.0030 J**	0.30 U	0.0060 U	**0.0020 J**	0.0060 U	0.33 U
Fluoranthene	**39**	**13**	**15**	**1.4**	**12**	**0.70 J**	**16**
Fluorene	**22**	**5.5**	**11**	**1.5**	**6.6**	1.9 U	**6.5**
Hexachlorobenzene	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
Hexachlorobutadiene	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
Hexachlorocyclopentadiene	5.2 U	5.4 U	6.1 U	0.56 U	6.1 U	5.8 U	6.3 U
Hexachloroethane	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
Indeno(1,2,3-cd)pyrene	**1.6 J**	**1.1 J**	**1.2 J**	0.19 U	**0.62 J**	1.9 U	**1.0 J**
Isophorone	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
Naphthalene	**110**	**39**	**15**	**3.2**	**1.9 J**	**0.60 J**	**2.0 J**
Nitrobenzene	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
N-Nitroso-di-n-propylamine	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
N-Nitrosodiphenylamine/Diphenylamine	1.7 U	1.8 U	2.0 U	0.19 U	2.0 U	1.9 U	2.1 U
Pentachlorophenol	5.2 U	5.4 U	6.1 U	0.56 U	6.1 U	5.8 U	6.3 U
Phenanthrene	**95**	**24**	**34**	**3.7**	**18**	**1.2 J**	**22**
Phenol	**1.9**	1.8 U	**2.8**	**0.075 J**	**1.5 J**	**0.53 J**	**2.4**
Pyrene	**33**	**9.1**	**9.9**	**1.0**	**8.6**	**0.50 J**	**11**
Toluene	**0.12 J**	**0.0070**	0.30 U	**0.0050 J**	**0.037**	**0.0020 J**	0.33 U
TPH-DRO soil C10-C28	**1,700**	**420**	**150**	**16**	**130**	**15**	**120**
TPH-GRO soil C6-C10	**3.0 J**	11 U	12 U	**0.40 J**	13 U	12 U	13 U
Xylenes (total)	**0.17 J**	**0.018**	0.30 U	0.0060 U	**0.011**	0.0060 U	0.33 U

TABLE 8
POST-PILOT SOIL CONCENTRATIONS
Former Pitt Consol Site, Newark, New Jersey

Location	SC-4	SC-4	SC-5	SC-5	SC-5	SC-6	SC-6
Depth Interval (ft bgs)	2.6-4	7.6-8.3	2.3-3.1	6.9-7.5	8-9	3-4	8-9
Sample Date	16-Dec-10	16-Dec-10	16-Dec-10	16-Dec-10	16-Dec-10	16-Dec-10	16-Dec-10
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte							
1,2,4-Trichlorobenzene	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
1,2-Dichlorobenzene	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
1,3-Dichlorobenzene	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
1,4-Dichlorobenzene	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
2,2-Oxybis(1-Chloropropane)	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
2,4,5-Trichlorophenol	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
2,4,6-Trichlorophenol	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
2,4-Dichlorophenol	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
2,4-Dimethylphenol	1.9 U	**1.4 J**	0.19 U	**0.087 J**	**14**	2.0 U	**160**
2,4-Dinitrophenol	23 U	24 U	2.3 U	2.4 U	22 U	24 U	120 U
2,4-Dinitrotoluene	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
2,6-Dinitrotoluene	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
2-Chloronaphthalene	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
2-Chlorophenol	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
2-Methylnaphthalene	**26**	**20**	**0.27**	**0.39**	**220**	**3.2**	**1,400**
2-Methylphenol	1.9 U	2.0 U	0.19 U	**0.18 J**	**11**	2.0 U	**120**
2-Nitroaniline	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
2-Nitrophenol	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
3,3-Dichlorobenzidine	3.8 U	3.9 U	0.38 U	0.40 U	3.7 U	4.1 U	20 U
3-Nitroaniline	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
4,6-Dinitro-2-methylphenol	5.7 U	5.9 U	0.57 U	0.60 U	5.6 U	6.1 U	30 U
4-Bromophenyl-phenylether	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
4-Chloro-3-methylphenol	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
4-Chloroaniline	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
4-Chlorophenyl-phenylether	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
4-Methylphenol	**0.93 J**	**3.7**	0.19 U	**0.30**	**16**	2.0 U	**240**
4-Nitroaniline	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
4-Nitrophenol	5.7 U	5.9 U	0.57 U	0.60 U	**4.2 J**	6.1 U	30 U
Acenaphthene	**8.6**	**52**	**0.63**	**0.36**	**150**	**7.8**	**970**
Acenaphthylene	**3.9**	**11**	**0.062 J**	**0.047 J**	**11**	**1.3 J**	**100**
Anthracene	**7.2**	**470**	**1.4**	**1.0**	**200**	**7.3**	**1,500**
Benzene	1.1 U	**0.032 J**	0.0060 U	**0.0010 J**	**5.9**	**0.0020 J**	**0.12 J**
Benzo(a)anthracene	**17**	**210**	**0.20**	**0.23**	**83**	**4.9**	**420**
Benzo(a)pyrene	**14**	**110**	**0.10 J**	**0.17 J**	**54**	**3.4**	**250**
Benzo(b)fluoranthene	**17**	**170**	**0.15 J**	**0.21**	**68**	**4.0**	**320**
Benzo(g,h,i)perylene	**9.3**	**60**	**0.047 J**	**0.10 J**	**27**	**1.9 J**	**130**
Benzo(k)fluoranthene	**7.0**	**39**	**0.054 J**	**0.086 J**	**25**	**1.7 J**	**130**
bis(2-Chloroethoxy) methane	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
bis(2-Chloroethyl) ether	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
bis(2-Ethylhexyl) phthalate	3.8 U	3.9 U	0.38 U	0.40 U	3.7 U	**1.8 J**	20 U
Butylbenzylphthalate	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	**93**	9.9 U
Carbazole	**2.2**	**84**	**0.20**	**0.31**	**85**	**1.4 J**	**570**
Chrysene	**17**	**220**	**0.19**	**0.26**	**77**	**5.6**	**370**
Dibenzo(a,h)anthracene	**2.5**	**21**	0.19 U	0.20 U	**7.7**	**0.58 J**	**30**
Dibenzofuran	**9.0**	**60**	**0.59**	**0.37**	**130**	**4.4**	**890**
Diethylphthalate	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
Dimethylphthalate	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
Di-n-butylphthalate	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
Di-n-octylphthalate	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
Ethyl benzene	1.1 U	0.30 U	0.0060 U	0.0060 U	**12**	0.0060 U	**0.95**
Fluoranthene	**31**	**730**	**0.92**	**0.82**	**280**	**20**	**1,400**
Fluorene	**6.3**	**33**	**0.84**	**0.43**	**160**	**4.5**	**1,100**
Hexachlorobenzene	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
Hexachlorobutadiene	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
Hexachlorocyclopentadiene	5.7 U	5.9 U	0.57 U	0.60 U	5.6 U	6.1 U	30 U
Hexachloroethane	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
Indeno(1,2,3-cd)pyrene	**8.0**	**56**	**0.042 J**	**0.089 J**	**25**	**1.6 J**	**110**
Isophorone	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
Naphthalene	**120**	**22**	**0.82**	**1.3**	**690**	**4.0**	**5,200**
Nitrobenzene	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
N-Nitroso-di-n-propylamine	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
N-Nitrosodiphenylamine/Diphenylamine	1.9 U	2.0 U	0.19 U	0.20 U	1.9 U	2.0 U	9.9 U
Pentachlorophenol	5.7 U	5.9 U	0.57 U	0.60 U	5.6 U	6.1 U	30 U
Phenanthrene	**24**	**890**	**2.1**	**1.1**	**500**	**16**	**2,900**
Phenol	**0.49 J**	**0.71 J**	**0.070 J**	**0.31**	**17**	2.0 U	**150**
Pyrene	**41**	**550**	**0.78**	**0.83**	**220**	**22**	**1,400**
Toluene	1.1 U	**0.14 J**	**0.017**	**0.012**	**26**	**0.0090**	**1.3**
TPH-DRO soil C10-C28	**120 J**	**2,700**	**23**	**16**	**5,900**	**240**	**14,000**
TPH-GRO soil C6-C10	**3.4 J**	12 U	11 U	**3.5 J**	**330**	12 U	**100**
Xylenes (total)	1.1 U	0.30 U	**0.0010 J**	**0.0020 J**	**70**	0.0060 U	**5.9**

TABLE 8
POST-PILOT SOIL CONCENTRATIONS
Former Pitt Consol Site, Newark, New Jersey

Location	SC-7	SC-7	SC-7	SC-8	SC-8	SC-9	SC-9
Depth Interval (ft bgs)	3-4.1	7.1-8	8-9	3-4.1	8.2-9.2	3.6-4.1	7-7.8
Sample Date	16-Dec-10	16-Dec-10	16-Dec-10	16-Dec-10	16-Dec-10	17-Dec-10	17-Dec-10
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte							
1,2,4-Trichlorobenzene	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
1,2-Dichlorobenzene	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
1,3-Dichlorobenzene	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
1,4-Dichlorobenzene	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
2,2-Oxybis(1-Chloropropane)	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
2,4,5-Trichlorophenol	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
2,4,6-Trichlorophenol	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
2,4-Dichlorophenol	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
2,4-Dimethylphenol	**0.96 J**	**1.6 J**	**6.4**	1.8 U	**2.3**	**0.90 J**	2.2 U
2,4-Dinitrophenol	22 U	25 U	3.5 U	22 U	2.5 U	22 U	27 U
2,4-Dinitrotoluene	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
2,6-Dinitrotoluene	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
2-Chloronaphthalene	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
2-Chlorophenol	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
2-Methylnaphthalene	**23**	**35**	**13**	**27**	**50**	**5.8**	**17**
2-Methylphenol	1.8 U	**1.5 J**	**9.8**	1.8 U	**3.5**	1.9 U	2.2 U
2-Nitroaniline	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
2-Nitrophenol	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
3,3-Dichlorobenzidine	3.7 U	4.1 U	0.59 U	3.6 U	0.41 U	3.7 U	4.4 U
3-Nitroaniline	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
4,6-Dinitro-2-methylphenol	5.5 U	6.2 U	0.88 U	5.4 U	0.62 U	5.6 U	6.6 U
4-Bromophenyl-phenylether	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
4-Chloro-3-methylphenol	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
4-Chloroaniline	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
4-Chlorophenyl-phenylether	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
4-Methylphenol	**0.81 J**	**2.6**	**9.4**	**0.87 J**	**4.3**	**1.3 J**	2.2 U
4-Nitroaniline	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
4-Nitrophenol	5.5 U	6.2 U	0.88 U	5.4 U	0.62 U	5.6 U	6.6 U
Acenaphthene	**23**	**31**	**17**	**14**	**43**	**33**	**32**
Acenaphthylene	**7.2**	**3.7**	**1.7**	**2.9**	**3.6**	**3.3**	**3.2**
Anthracene	**27**	**310**	**29**	**11**	**87**	**39**	**87**
Benzene	**0.043 J**	**0.086 J**	**20**	0.29 U	**0.40 J**	0.28 U	0.32 U
Benzo(a)anthracene	**31**	**41**	**7.1**	**7.1**	**14**	**7.1**	**14**
Benzo(a)pyrene	**25**	**12**	**3.9**	**4.5**	**5.5**	**3.3**	**5.4**
Benzo(b)fluoranthene	**27**	**22**	**5.6**	**5.9**	**8.3**	**9.3**	**11**
Benzo(g,h,i)perylene	**16**	**5.3**	**2.0**	**2.7**	**3.0**	**3.3**	**2.6**
Benzo(k)fluoranthene	**11**	**10**	**2.3**	**2.8**	**3.7**	**2.8**	**3.7**
bis(2-Chloroethoxy) methane	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
bis(2-Chloroethyl) ether	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
bis(2-Ethylhexyl) phthalate	**1.2 J**	4.1 U	0.59 U	3.6 U	0.41 U	3.7 U	4.4 U
Butylbenzylphthalate	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
Carbazole	**2.3**	**81**	**6.9**	**3.5**	**21**	**8.4**	**13**
Chrysene	**31**	**46**	**6.7**	**7.6**	**16**	**9.3**	**14**
Dibenzo(a,h)anthracene	**4.2**	**2.0 J**	**0.52**	**0.73 J**	**0.98**	**0.94 J**	**0.83 J**
Dibenzofuran	**18**	**47**	**18**	**15**	**46**	**39**	**40**
Diethylphthalate	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
Dimethylphthalate	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
Di-n-butylphthalate	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
Di-n-octylphthalate	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
Ethyl benzene	**0.071 J**	0.30 U	**25**	0.29 U	**1.5**	0.28 U	0.32 U
Fluoranthene	**58**	**270**	**29**	**21**	**73**	**38**	**74**
Fluorene	**13**	**40**	**20**	**9.8**	**51**	**33**	**42**
Hexachlorobenzene	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
Hexachlorobutadiene	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
Hexachlorocyclopentadiene	5.5 U	6.2 U	0.88 U	5.4 U	0.62 U	5.6 U	6.6 U
Hexachloroethane	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
Indeno(1,2,3-cd)pyrene	**13**	**4.7**	**1.8**	**2.4**	**2.8**	**2.8**	**2.4**
Isophorone	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
Naphthalene	**17**	**58**	**26**	**74**	**87**	**13**	**14**
Nitrobenzene	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
N-Nitroso-di-n-propylamine	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
N-Nitrosodiphenylamine/Diphenylamine	1.8 U	2.1 U	0.29 U	1.8 U	0.21 U	1.9 U	2.2 U
Pentachlorophenol	5.5 U	6.2 U	0.88 U	5.4 U	0.62 U	5.6 U	6.6 U
Phenanthrene	**87**	**450**	**61**	**33**	**150**	**100**	**150**
Phenol	1.8 U	**2.4**	**12**	**0.64 J**	**4.9**	**0.92 J**	2.2 U
Pyrene	**96**	**170**	**20**	**23**	**48**	**26**	**47**
Toluene	**0.18 J**	**0.24 J**	**63**	**0.071 J**	**2.7**	**0.081 J**	0.32 U
TPH-DRO soil C10-C28	**2,800**	**1,900**	**52,000**	**350**	**17,000**	**230**	**620**
TPH-GRO soil C6-C10	**3.0 J**	12 U	**610**	**4.2 J**	**130**	**3.1 J**	13 U
Xylenes (total)	**0.45**	**0.25 J**	**140**	**0.23 J**	**9.0**	**0.11 J**	**0.088 J**

TABLE 8
POST-PILOT SOIL CONCENTRATIONS
Former Pitt Consol Site, Newark, New Jersey

Location	SC-9	SC-10	SC-10	SC-11	SC-11	SC-12	SC-12
Depth Interval (ft bgs)	8-8.8	2.8-3.8	7.3-8.3	3.2-4.1	8-8.9	2.9-3.8	8-9
Sample Date	17-Dec-10	17-Dec-10	17-Dec-10	17-Dec-10	17-Dec-10	17-Dec-10	17-Dec-10
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte							
1,2,4-Trichlorobenzene	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
1,2-Dichlorobenzene	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
1,3-Dichlorobenzene	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
1,4-Dichlorobenzene	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
2,2-Oxybis(1-Chloropropane)	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
2,4,5-Trichlorophenol	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
2,4,6-Trichlorophenol	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
2,4-Dichlorophenol	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
2,4-Dimethylphenol	**310**	1.9 U	**1.2 J**	1.7 U	**7.0**	2.0 U	**1.1**
2,4-Dinitrophenol	120 U	23 U	23 U	20 U	26 U	24 U	2.3 U
2,4-Dinitrotoluene	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
2,6-Dinitrotoluene	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
2-Chloronaphthalene	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
2-Chlorophenol	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
2-Methylnaphthalene	**240**	1.9 U	**19**	**3.0**	**56**	**2.8**	**18**
2-Methylphenol	**380**	1.9 U	1.9 U	1.7 U	**8.5**	2.0 U	**2.7**
2-Nitroaniline	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
2-Nitrophenol	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
3,3-Dichlorobenzidine	20 U	3.9 U	3.8 U	3.4 U	4.3 U	4.1 U	0.39 U
3-Nitroaniline	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
4,6-Dinitro-2-methylphenol	30 U	5.8 U	5.8 U	5.1 U	6.5 U	6.1 U	0.58 U
4-Bromophenyl-phenylether	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
4-Chloro-3-methylphenol	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
4-Chloroaniline	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
4-Chlorophenyl-phenylether	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
4-Methylphenol	**1,200**	1.9 U	1.9 U	1.7 U	**18**	2.0 U	**4.0**
4-Nitroaniline	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
4-Nitrophenol	30 U	5.8 U	5.8 U	5.1 U	6.5 U	6.1 U	0.58 U
Acenaphthene	**350**	**1.3 J**	**39**	**0.79 J**	**50**	**0.88 J**	**10**
Acenaphthylene	**18**	**2.2**	**2.5**	1.7 U	**4.0**	**1.8 J**	**0.71**
Anthracene	**930**	**6.8**	**140**	**0.80 J**	**110**	**3.0**	**14**
Benzene	**0.10 J**	**0.0040 J**	**0.065 J**	0.25 U	0.65 U	0.62 U	0.28 U
Benzo(a)anthracene	**1,600**	**23**	**15**	**1.0 J**	**27**	**9.3**	**3.2**
Benzo(a)pyrene	**1,400**	**18**	**10**	**0.46 J**	**14**	**7.9**	**1.8**
Benzo(b)fluoranthene	**1,600**	**23**	**15**	**3.2**	**21**	**10**	**2.2**
Benzo(g,h,i)perylene	**680**	**13**	**6.1**	**0.39 J**	**8.7**	**5.3**	**0.93**
Benzo(k)fluoranthene	**700**	**9.5**	**5.6**	**0.50 J**	**7.1**	**4.4**	**1.0**
bis(2-Chloroethoxy) methane	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
bis(2-Chloroethyl) ether	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
bis(2-Ethylhexyl) phthalate	20 U	3.9 U	3.8 U	3.4 U	4.3 U	4.1 U	**0.096 J**
Butylbenzylphthalate	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
Carbazole	**600**	**1.7 J**	**25**	1.7 U	**32**	**1.6 J**	**3.4**
Chrysene	**1,500**	**19**	**15**	**1.5 J**	**29**	**8.8**	**3.2**
Dibenzo(a,h)anthracene	**200**	**3.7**	**1.8 J**	1.7 U	**2.6**	**1.7 J**	**0.25**
Dibenzofuran	**310**	**0.73 J**	**50**	**0.73 J**	**77**	**0.61 J**	**9.3**
Diethylphthalate	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
Dimethylphthalate	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
Di-n-butylphthalate	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
Di-n-octylphthalate	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
Ethyl benzene	0.29 U	**0.0010 J**	**0.11 J**	0.25 U	0.65 U	0.62 U	0.28 U
Fluoranthene	**3,200**	**46**	**52**	**3.6**	**140**	**20**	**13**
Fluorene	**450**	**1.7 J**	**51**	**0.47 J**	**65**	**0.98 J**	**11**
Hexachlorobenzene	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
Hexachlorobutadiene	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
Hexachlorocyclopentadiene	30 U	5.8 U	5.8 U	5.1 U	6.5 U	6.1 U	0.58 U
Hexachloroethane	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
Indeno(1,2,3-cd)pyrene	**730**	**11**	**6.0**	1.7 U	**7.1**	**4.9**	**0.86**
Isophorone	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
Naphthalene	**690**	**0.92 J**	**25**	**14**	**130**	**21**	**35**
Nitrobenzene	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
N-Nitroso-di-n-propylamine	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
N-Nitrosodiphenylamine/Diphenylamine	10 U	1.9 U	1.9 U	1.7 U	2.2 U	2.0 U	0.19 U
Pentachlorophenol	30 U	5.8 U	5.8 U	5.1 U	6.5 U	6.1 U	0.58 U
Phenanthrene	**2,500**	**18**	**150**	**3.4**	**260**	**8.2**	**28**
Phenol	**1,100**	**0.51 J**	**0.55 J**	1.7 U	**11**	2.0 U	**4.3**
Pyrene	**2,400**	**42**	**35**	**2.3**	**93**	**18**	**9.7**
Toluene	**0.085 J**	**0.0060**	**0.15 J**	0.25 U	**0.14 J**	0.62 U	0.28 U
TPH-DRO soil C10-C28	**29,000**	**2,000**	**22,000**	**160**	**6,700**	**630**	**220**
TPH-GRO soil C6-C10	12 U	11 U	**7.8 J**	10 U	**3.3 J**	**2.7 J**	12 U
Xylenes (total)	0.29 U	**0.0060**	**0.46**	**0.10 J**	**0.26 J**	0.62 U	**0.077 J**

TABLE 8
POST-PILOT SOIL CONCENTRATIONS
Former Pitt Consol Site, Newark, New Jersey

Location	SC-13	SC-13	SC-14	SC-14	SC-15	SC-15	SC-17
Depth Interval (ft bgs)	3.3-4.1	8-8.9	3.3-4.1	8-9	3-4.1	8-9	3.3-4.1
Sample Date	17-Dec-10	17-Dec-10	17-Dec-10	17-Dec-10	17-Dec-10	17-Dec-10	17-Dec-10
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte							
1,2,4-Trichlorobenzene	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
1,2-Dichlorobenzene	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
1,3-Dichlorobenzene	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
1,4-Dichlorobenzene	2.0 U	**0.39**	1.9 U	1.9 U	0.18 U	20 U	2.0 U
2,2-Oxybis(1-Chloropropane)	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
2,4,5-Trichlorophenol	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
2,4,6-Trichlorophenol	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
2,4-Dichlorophenol	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
2,4-Dimethylphenol	2.0 U	**1.4**	1.9 U	1.9 U	0.18 U	**260**	2.0 U
2,4-Dinitrophenol	24 U	2.3 U	23 U	23 U	2.2 U	240 U	24 U
2,4-Dinitrotoluene	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
2,6-Dinitrotoluene	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
2-Chloronaphthalene	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
2-Chlorophenol	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
2-Methylnaphthalene	**0.70 J**	**13**	1.9 U	**270**	**0.81**	**1,300**	2.0 U
2-Methylphenol	2.0 U	**6.5**	1.9 U	1.9 U	0.18 U	**350**	2.0 U
2-Nitroaniline	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
2-Nitrophenol	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
3,3-Dichlorobenzidine	3.9 U	0.39 U	3.8 U	3.9 U	0.36 U	39 U	4.0 U
3-Nitroaniline	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
4,6-Dinitro-2-methylphenol	5.9 U	0.58 U	5.7 U	5.8 U	0.54 U	59 U	6.0 U
4-Bromophenyl-phenylether	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
4-Chloro-3-methylphenol	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
4-Chloroaniline	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
4-Chlorophenyl-phenylether	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
4-Methylphenol	2.0 U	**11**	1.9 U	1.9 U	**0.079 J**	**640**	2.0 U
4-Nitroaniline	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
4-Nitrophenol	5.9 U	0.58 U	5.7 U	5.8 U	0.54 U	59 U	6.0 U
Acenaphthene	**1.2 J**	**0.89**	**1.2 J**	**130**	**0.88**	**720**	2.0 U
Acenaphthylene	**7.9**	**0.18 J**	**3.1**	**8.8**	**0.085 J**	**140**	**1.3 J**
Anthracene	**6.1**	**1.3**	**4.9**	**410**	**1.4**	**2,200**	**2.1**
Benzene	**0.0010 J**	**0.21 J**	**0.0030 J**	**0.047 J**	**0.0020 J**	**0.38 J**	**0.0040 J**
Benzo(a)anthracene	**20**	**0.88**	**14**	**26**	**0.82**	**1,100**	**7.2**
Benzo(a)pyrene	**22**	**0.61**	**12**	**16**	**0.43**	**780**	**5.5**
Benzo(b)fluoranthene	**23**	**0.87**	**16**	**16**	**0.79**	**1,100**	**7.8**
Benzo(g,h,i)perylene	**18**	**0.35**	**7.8**	**7.6**	**0.36**	**410**	**3.4**
Benzo(k)fluoranthene	**7.7**	**0.32**	**7.0**	**8.6**	**0.31**	**380**	**3.3**
bis(2-Chloroethoxy) methane	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
bis(2-Chloroethyl) ether	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
bis(2-Ethylhexyl) phthalate	3.9 U	0.39 U	3.8 U	3.9 U	0.36 U	39 U	4.0 U
Butylbenzylphthalate	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
Carbazole	**1.6 J**	**0.54**	**1.9 J**	**150**	**0.30**	**890**	**0.78 J**
Chrysene	**19**	**0.84**	**15**	**26**	**0.98**	**1,000**	**7.2**
Dibenzo(a,h)anthracene	**5.3**	**0.12 J**	**2.4**	**2.3**	**0.11 J**	**120**	**1.0 J**
Dibenzofuran	**0.67 J**	**0.77**	**0.64 J**	**130**	**1.1**	**710**	2.0 U
Diethylphthalate	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
Dimethylphthalate	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
Di-n-butylphthalate	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
Di-n-octylphthalate	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
Ethyl benzene	0.0060 U	**0.14 J**	0.0050 U	**0.46**	**0.0010 J**	**1.4 J**	0.0060 U
Fluoranthene	**30**	**2.3**	**29**	**150**	**2.1**	**2,600**	**13**
Fluorene	**1.2 J**	**1.1**	**1.3 J**	**160**	**0.89**	**940**	**0.61 J**
Hexachlorobenzene	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
Hexachlorobutadiene	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
Hexachlorocyclopentadiene	5.9 U	0.58 U	5.7 U	5.8 U	0.54 U	59 U	6.0 U
Hexachloroethane	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
Indeno(1,2,3-cd)pyrene	**14**	**0.32**	**6.8**	**6.8**	**0.29**	**410**	**3.1**
Isophorone	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
Naphthalene	**2.1**	**200**	**2.8**	**1,100**	**1.9**	**5,600**	**0.63 J**
Nitrobenzene	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
N-Nitroso-di-n-propylamine	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
N-Nitrosodiphenylamine/Diphenylamine	2.0 U	0.19 U	1.9 U	1.9 U	0.18 U	20 U	2.0 U
Pentachlorophenol	5.9 U	0.58 U	5.7 U	5.8 U	0.54 U	59 U	6.0 U
Phenanthrene	**12**	**3.3**	**18**	**370**	**2.8**	**3,300**	**6.5**
Phenol	2.0 U	**20**	**0.59 J**	**0.43 J**	**0.20**	**400**	2.0 U
Pyrene	**37**	**1.9**	**31**	**97**	**1.5**	**1,900**	**15**
Toluene	**0.0050 J**	**0.39**	**0.0060**	**0.62**	**0.0030 J**	**2.3 J**	**0.0060**
TPH-DRO soil C10-C28	**2,800**	**470**	**1,700**	**160**	**620**	**16,000**	**6,900**
TPH-GRO soil C6-C10	11 U	**6.5 J**	11 U	**6.0 J**	11 U	**92**	12 U
Xylenes (total)	0.0060 U	**0.89**	0.0050 U	**3.2**	**0.0050 J**	**9.0**	0.0060 U

TABLE 8
POST-PILOT SOIL CONCENTRATIONS
Former Pitt Consol Site, Newark, New Jersey

Location	SC-17	SC-18	SC-18	SC-19	SC-19	SC-19
Depth Interval (ft bgs)	7-8	3.3-4.1	7-8	2.8-3.4	3.4-4.1	8-9
Sample Date	17-Dec-10	17-Dec-10	17-Dec-10	17-Dec-10	17-Dec-10	17-Dec-10
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Analyte						
1,2,4-Trichlorobenzene	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
1,2-Dichlorobenzene	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
1,3-Dichlorobenzene	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
1,4-Dichlorobenzene	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
2,2-Oxybis(1-Chloropropane)	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
2,4,5-Trichlorophenol	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
2,4,6-Trichlorophenol	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
2,4-Dichlorophenol	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
2,4-Dimethylphenol	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	**0.12 J**
2,4-Dinitrophenol	2.2 U	2.4 U	23 U	23 U	2.2 U	2.4 U
2,4-Dinitrotoluene	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
2,6-Dinitrotoluene	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
2-Chloronaphthalene	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
2-Chlorophenol	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
2-Methylnaphthalene	**0.048 J**	0.20 U	**0.46 J**	**0.57 J**	0.19 U	**1.4**
2-Methylphenol	**0.094 J**	0.20 U	**3.3**	1.9 U	0.19 U	**0.084 J**
2-Nitroaniline	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
2-Nitrophenol	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
3,3-Dichlorobenzidine	0.37 U	0.40 U	3.8 U	3.8 U	0.37 U	0.40 U
3-Nitroaniline	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
4,6-Dinitro-2-methylphenol	0.55 U	0.59 U	5.7 U	5.7 U	0.56 U	0.59 U
4-Bromophenyl-phenylether	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
4-Chloro-3-methylphenol	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
4-Chloroaniline	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
4-Chlorophenyl-phenylether	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
4-Methylphenol	**0.15 J**	0.20 U	**5.7**	1.9 U	0.19 U	**0.14 J**
4-Nitroaniline	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
4-Nitrophenol	0.55 U	0.59 U	5.7 U	5.7 U	0.56 U	0.59 U
Acenaphthene	**0.14 J**	0.20 U	**0.54 J**	**0.56 J**	**0.048 J**	**1.4**
Acenaphthylene	**0.041 J**	0.20 U	1.9 U	**2.7**	**0.15 J**	**0.085 J**
Anthracene	**0.29**	**0.13 J**	**1.6 J**	**2.6**	**0.21**	**0.32**
Benzene	0.0060 U	0.0060 U	**0.0050 J**	0.0060 U	**0.0010 J**	**0.041 J**
Benzo(a)anthracene	**0.33**	**0.20**	**2.3**	**8.5**	**0.56**	**0.39**
Benzo(a)pyrene	**0.24**	**0.11 J**	**2.1**	**7.7**	**0.77**	**0.35**
Benzo(b)fluoranthene	**0.49**	**0.39**	**4.3**	**11**	**0.94**	**0.48**
Benzo(g,h,i)perylene	**0.13 J**	**0.099 J**	**1.4 J**	**6.2**	**0.60**	**0.24**
Benzo(k)fluoranthene	**0.13 J**	**0.055 J**	**0.72 J**	**3.3**	**0.37**	**0.16 J**
bis(2-Chloroethoxy) methane	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
bis(2-Chloroethyl) ether	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
bis(2-Ethylhexyl) phthalate	0.37 U	0.40 U	3.8 U	3.8 U	0.37 U	**0.14 J**
Butylbenzylphthalate	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
Carbazole	**0.14 J**	**0.078 J**	**1.9 J**	**0.85 J**	**0.093 J**	**0.42**
Chrysene	**0.33**	**0.19 J**	**2.5**	**8.3**	**0.61**	**0.44**
Dibenzo(a,h)anthracene	**0.041 J**	0.20 U	**0.42 J**	**1.8 J**	**0.17 J**	**0.062 J**
Dibenzofuran	**0.16 J**	**0.044 J**	**0.53 J**	**0.40 J**	**0.040 J**	**0.57**
Diethylphthalate	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
Dimethylphthalate	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
Di-n-butylphthalate	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
Di-n-octylphthalate	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
Ethyl benzene	0.0060 U	0.0060 U	0.0060 U	0.0060 U	**0.0020 J**	0.28 U
Fluoranthene	**0.78**	**0.39**	**4.5**	**15**	**0.97**	**0.96**
Fluorene	**0.25**	**0.045 J**	**0.85 J**	**0.60 J**	**0.056 J**	**0.60**
Hexachlorobenzene	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
Hexachlorobutadiene	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
Hexachlorocyclopentadiene	0.55 U	0.59 U	5.7 U	5.7 U	0.56 U	0.59 U
Hexachloroethane	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
Indeno(1,2,3-cd)pyrene	**0.13 J**	**0.079 J**	**1.0 J**	**5.3**	**0.56**	**0.21**
Isophorone	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
Naphthalene	**0.10 J**	**0.16 J**	**2.3**	**2.0**	**0.11 J**	**6.2**
Nitrobenzene	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
N-Nitroso-di-n-propylamine	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
N-Nitrosodiphenylamine/Diphenylamine	0.18 U	0.20 U	1.9 U	1.9 U	0.19 U	0.20 U
Pentachlorophenol	0.55 U	0.59 U	5.7 U	5.7 U	0.56 U	0.59 U
Phenanthrene	**0.74**	**0.30**	**3.6**	**6.2**	**0.48**	**0.77**
Phenol	**0.16 J**	0.20 U	**7.0**	1.9 U	0.19 U	0.20 U
Pyrene	**0.63**	**0.32**	**4.3**	**16**	**1.0**	**0.82**
Toluene	**0.0020 J**	**0.0070**	**0.0040 J**	**0.0020 J**	**0.0070**	**0.064 J**
TPH-DRO soil C10-C28	**27**	**530**	**120**	**350**	**17**	**190**
TPH-GRO soil C6-C10	11 U	12 U	**2.3**	11 U	**0.40 J**	**3.5 J**
Xylenes (total)	0.0060 U	0.0060 U	**0.0030 J**	0.0060 U	**0.0060**	0.28 U

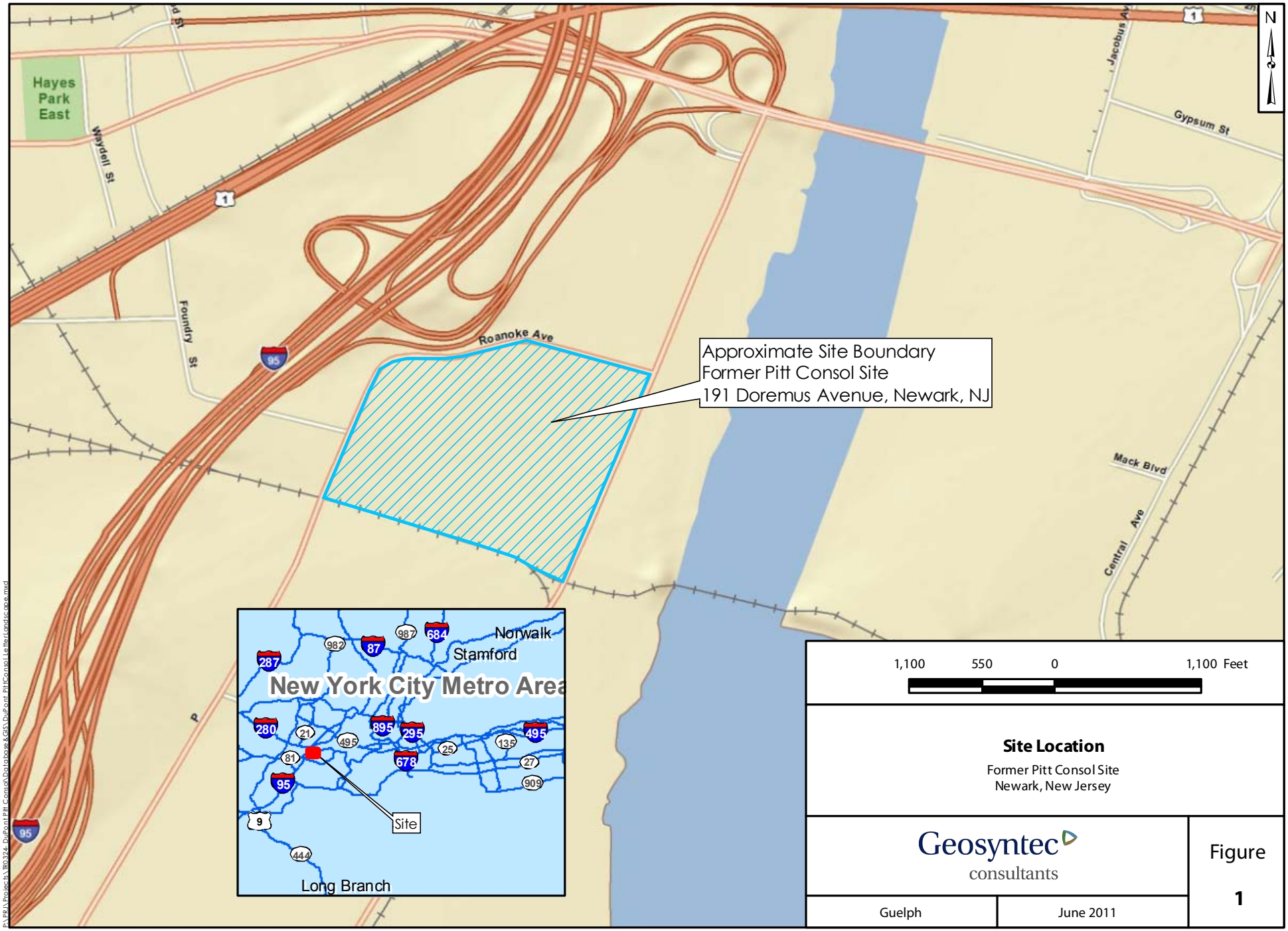
Notes:
mg/kg - milligrams per kilogram
ft bgs - feet below ground surface
U - Analyte not detected above quantitation limit
J - estimated concentration
Bold values indicated detections

TABLE 9
COMPARISON OF PRE- AND POST-PLIOT CONCENTRATIONS OF CONTAMINANTS IN SOILS WITHIN SPECIFIC TEMPERATURE ZONES
Former Pitt Consol Site, Newark, New Jersey

Analyte	Average Concentration (mg/kg)					Percent Reduction in Concentration			
	Before STAR Treatment (N=2)	Confirmed Combustion Zone T > 600 °C (N=4)	High Temperature Zone T > 200 °C (N=4)	Unconfirmed Combustion Zone[1] (N=14)	Elevated Temperature T > 50 °C (N=1)	Confirmed Combustion Zone T > 600 °C (N=4)	High Temperature Zone T > 200 °C (N=4)	Unconfirmed Combustion Zone[1] (N=14)	Elevated Temperature T > 50 °C (N=1)
2,4-Dimethylphenol	635	1	0	1	0	99.81%	99.98%	99.79%	100.00%
2-Methylnaphthalene	7,900	10	72	13	0	99.87%	99.08%	99.83%	100.00%
2-Methylphenol	475	3	1	2	0	99.36%	99.85%	99.64%	99.98%
4-Methylphenol	595	5	1	2	0	99.22%	99.80%	99.71%	99.97%
Acenaphthene	3,950	6	42	11	0	99.84%	98.93%	99.72%	100.00%
Acenaphthylene	295	1	3	3	0	99.80%	98.93%	98.89%	99.99%
Anthracene	16,700	10	127	42	0	99.94%	99.24%	99.75%	100.00%
Benzene	36	0	0	0	0	99.42%	99.88%	99.98%	100.00%
Benzo(a)anthracene	775	2	11	25	0	99.69%	98.56%	96.75%	99.96%
Benzo(a)pyrene	505	1	6	16	0	99.74%	98.82%	96.86%	99.95%
Benzo(b)fluoranthene	640	2	8	23	0	99.69%	98.79%	96.43%	99.92%
Benzo(g,h,i)perylene	255	1	3	11	0	99.68%	98.87%	95.75%	99.95%
Benzo(k)fluoranthene	240	1	3	7	0	99.67%	98.55%	97.19%	99.95%
Carbazole	6,750	2	41	9	0	99.97%	99.39%	99.87%	100.00%
Chrysene	870	3	11	26	0	99.69%	98.70%	97.02%	99.96%
Dibenzo(a,h)anthracene	60	0	1	3	0	99.56%	98.21%	94.21%	99.93%
Dibenzofuran	3,850	7	44	14	0	99.82%	98.86%	99.63%	100.00%
Ethylbenzene	40	0	0	0	0	99.82%	98.84%	99.99%	100.00%
Fluoranthene	3,750	11	60	72	1	99.72%	98.39%	98.08%	99.98%
Fluorene	5,150	7	52	9	0	99.86%	98.98%	99.83%	100.00%
Indeno(1,2,3-cd)pyrene	220	1	3	10	0	99.66%	98.82%	95.64%	99.94%
Naphthalene	29,500	63	281	24	0	99.79%	99.05%	99.92%	100.00%
Phenanthrene	10,850	21	136	86	1	99.81%	98.75%	99.21%	99.99%
Pyrene	2,550	8	39	59	1	99.70%	98.47%	97.70%	99.98%
Toluene	130	0	0	0	0	99.84%	99.74%	99.98%	100.00%
Xylenes (total)	225	0	2	0	0	99.86%	99.27%	99.97%	100.00%
TPH-DRO soil C10-C28*	118,000	243	273	1,400	27	99.79%	99.77%	98.81%	99.98%
TPH-GRO soil C6-C10	1,300	7	5	2	0	99.50%	99.63%	99.83%	100.00%
Average Concentration Reduction		99.72%	99.08%	98.57%	99.98%	99.72%	99.08%	98.57%	99.98%

Notes:

[1]Combustion assumed based on appearance of soil cores but not confirmed through thermocouple data
mg/kg - milligrams per kilogram
NA - not applicable
*Criteria based on Protocol for Addressing Extractable Petroleum Hydrocarbon (EPH) Contamination
°C - degrees Celsius
T - temperature
N - number of samples
TC - thermocouple



Site Location

Former Pitt Consol Site
Newark, New Jersey

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Figure 1

Site Plan
Former Pitt Consol Site
Newark, New Jersey

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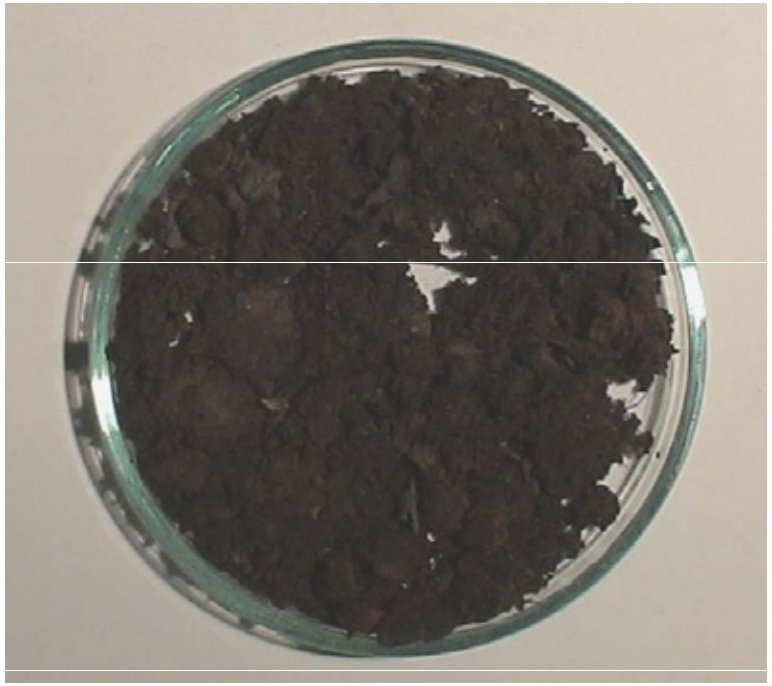
Figure 2



Soil Sample Prior to STAR Treatment

Soil Sample Post STAR Treatment

Results of Bench-Scale STAR Treatability Study
Former Pitt-Consol Site
Newark, New Jersey

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Figure **3**

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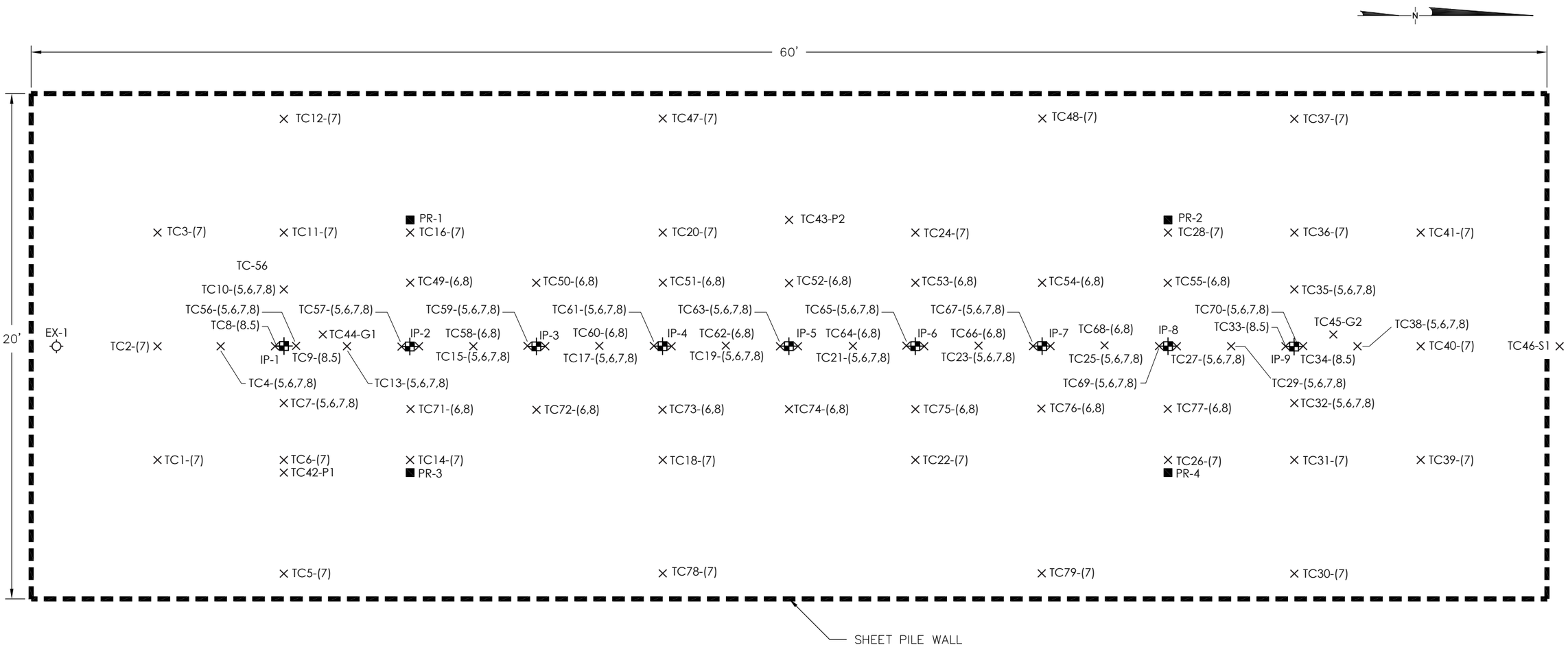

Legend

- STAR Pilot Test Area
- Ignition/Air Injection Well
- Thermocouple Probe
- Groundwater Extraction Well
- Pressure Relief Point
- () Depth of Thermocouple Probe (ft)

Notes

1. Depth to peat is 9' bgs.
2. Air injection intervals are 8-9 ft bgs.

Pilot Test Area (PTA) Schematic
Former Pitt Consol Site
Newark, New Jersey

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Figure **4**

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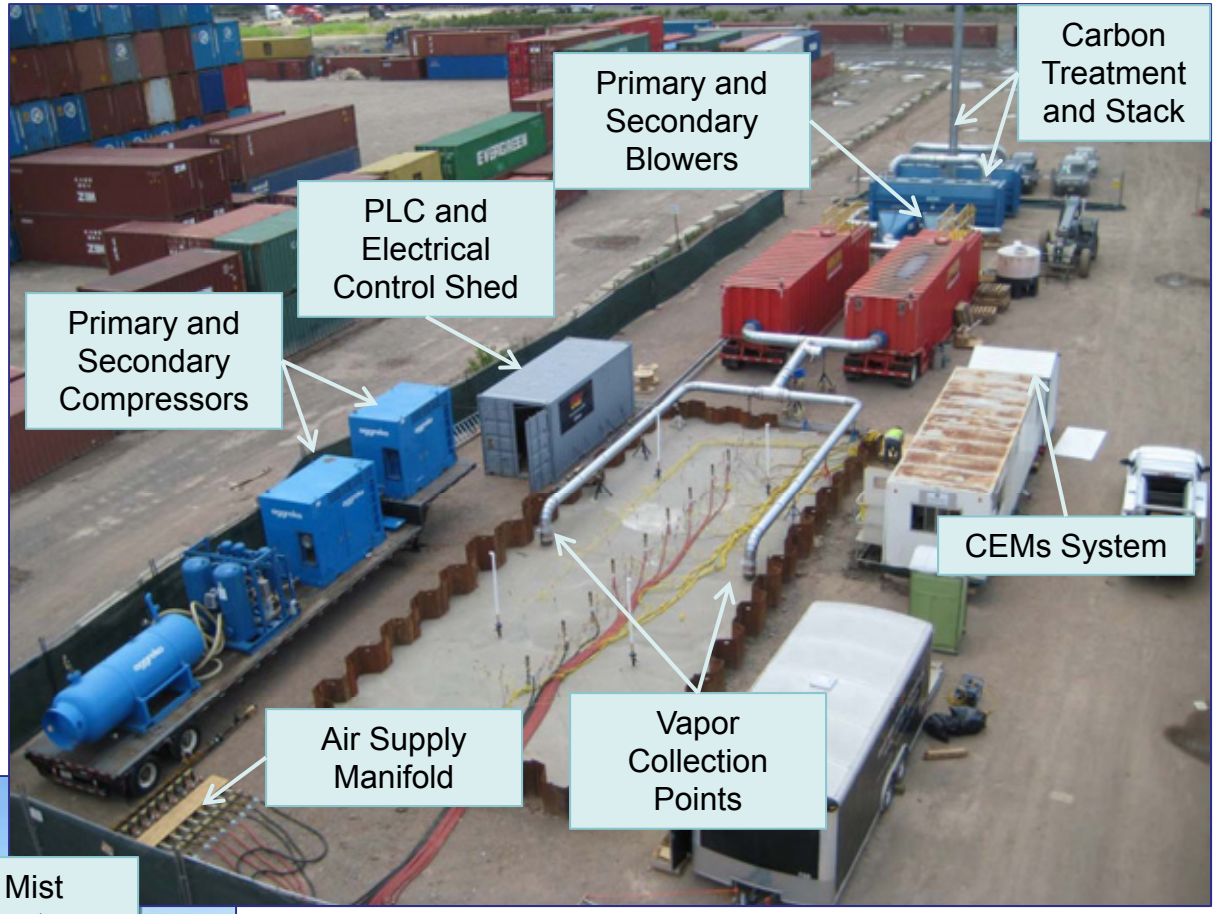

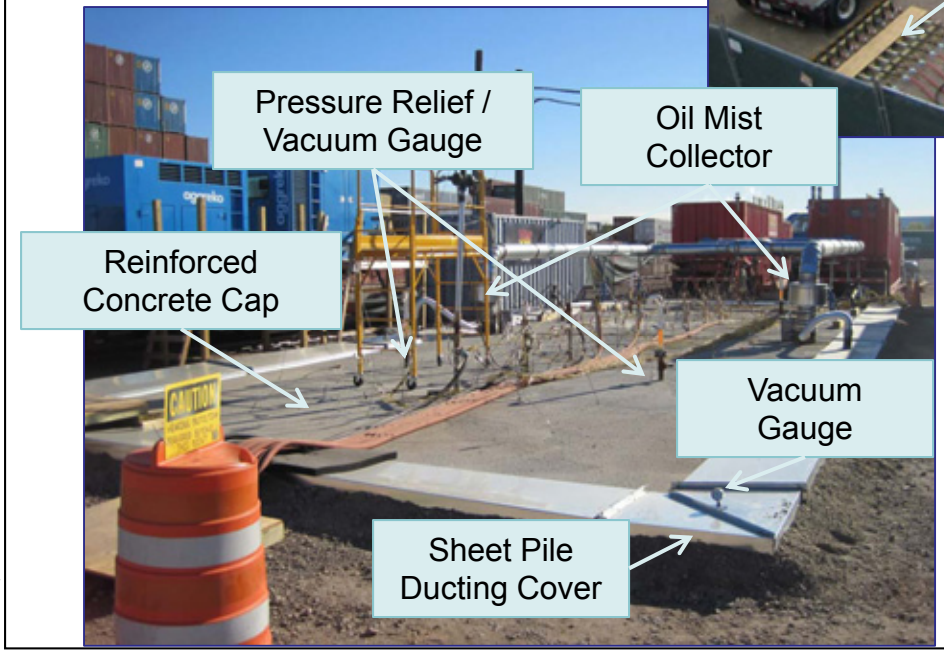

Modifications to the Pilot Test Area (PTA)
Former Pitt-Consol Site
Newark, New Jersey

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Figure **5**

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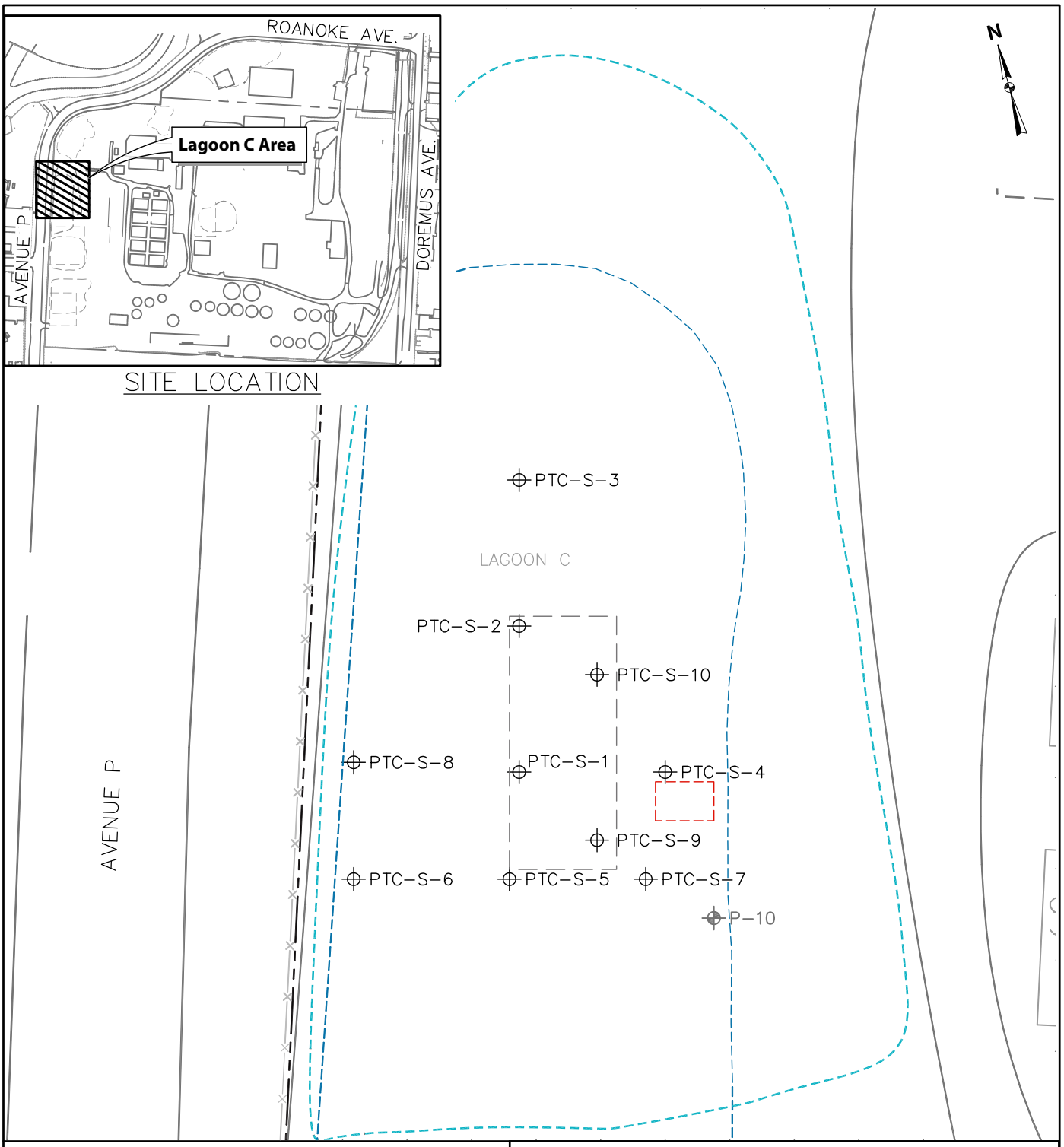

Legend

- Property Boundary
- Previous Lagoon Area-Based on 1985 W-CC Report
- Actual Lagoon Area-Based on Air Photo Reinterpretation
- Existing Fence
- PTA Area (Sheet Pile Wall)
- Test Pit
- Sampling Location
- Existing Monitoring Well

30 15 0 30 Feet

Pre-Pilot Soil Borings / Sample Locations
Former Pitt Consol Site
Newark, New Jersey

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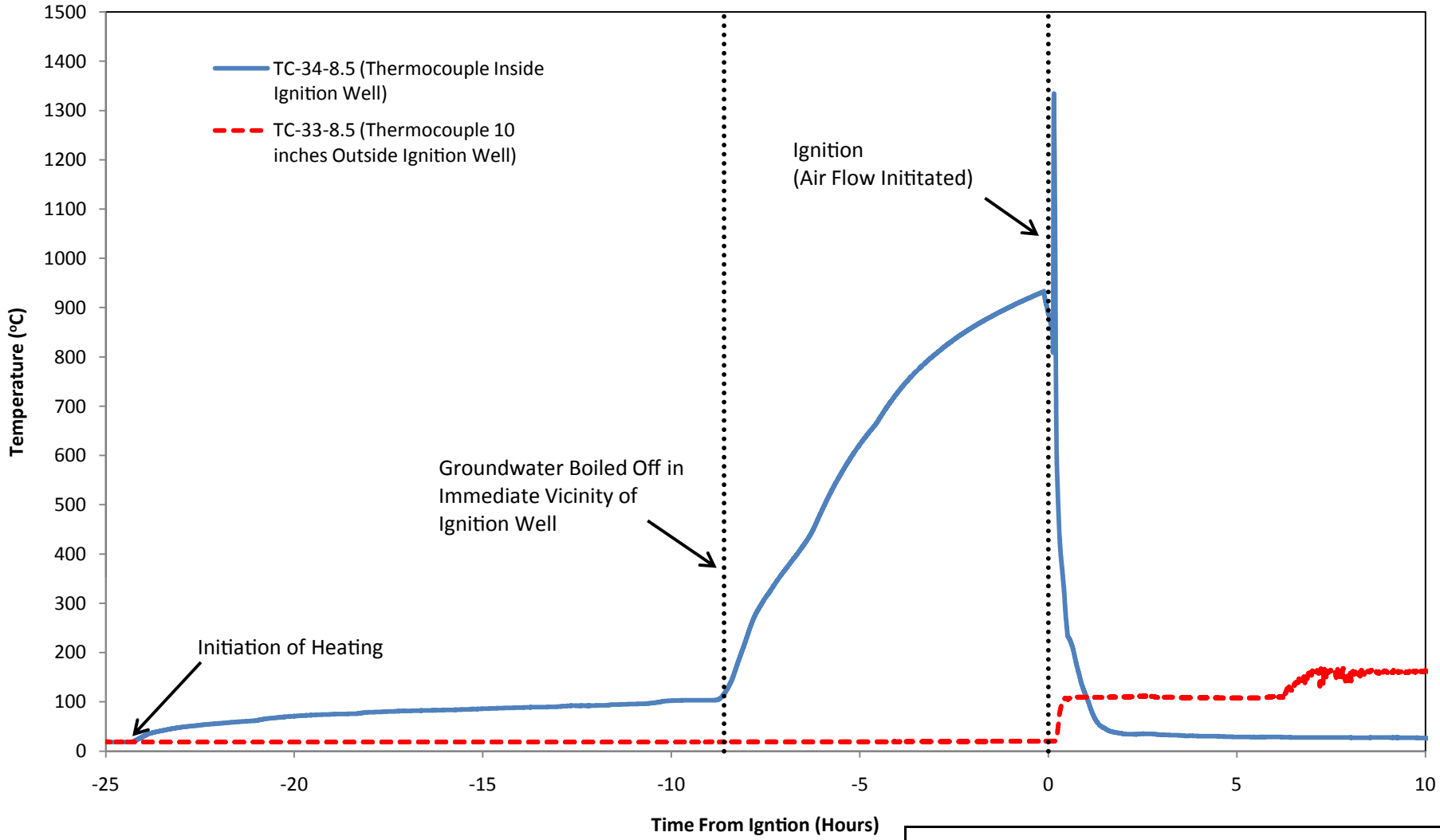
Figure **6**

Pre-Characterization Sampling Locations.ai



Thermocouple Response During Phase I Ignition Event

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Figure **7**

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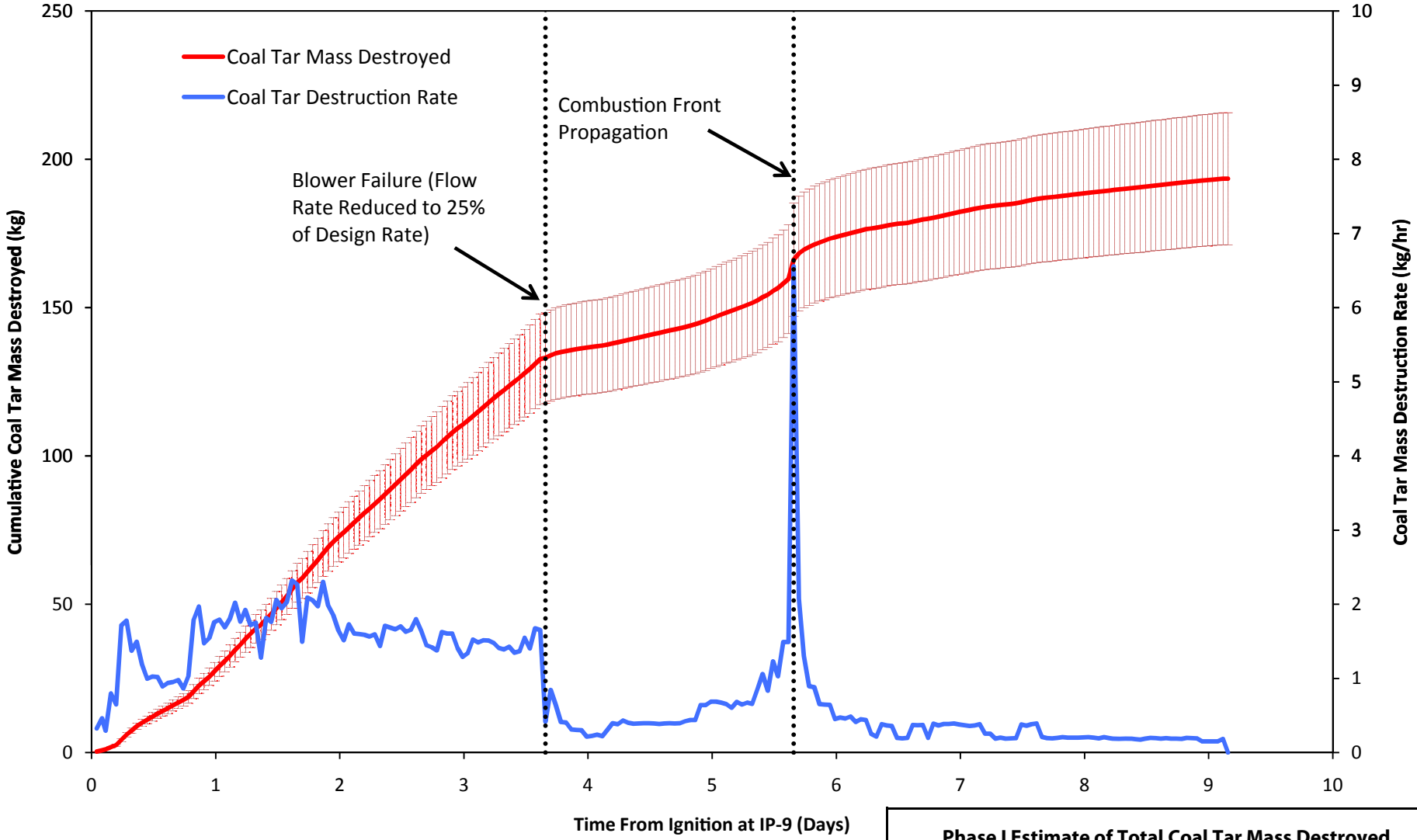

Notes:
Error bars represent 11.5% uncertainty in cumulative mass estimate
Mass of coal tar destroyed based on carbon mass balance using collected combustion gas concentrations

Phase I Estimate of Total Coal Tar Mass Destroyed
Former Pitt Consol Site
Newark, New Jersey

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Figure **8**

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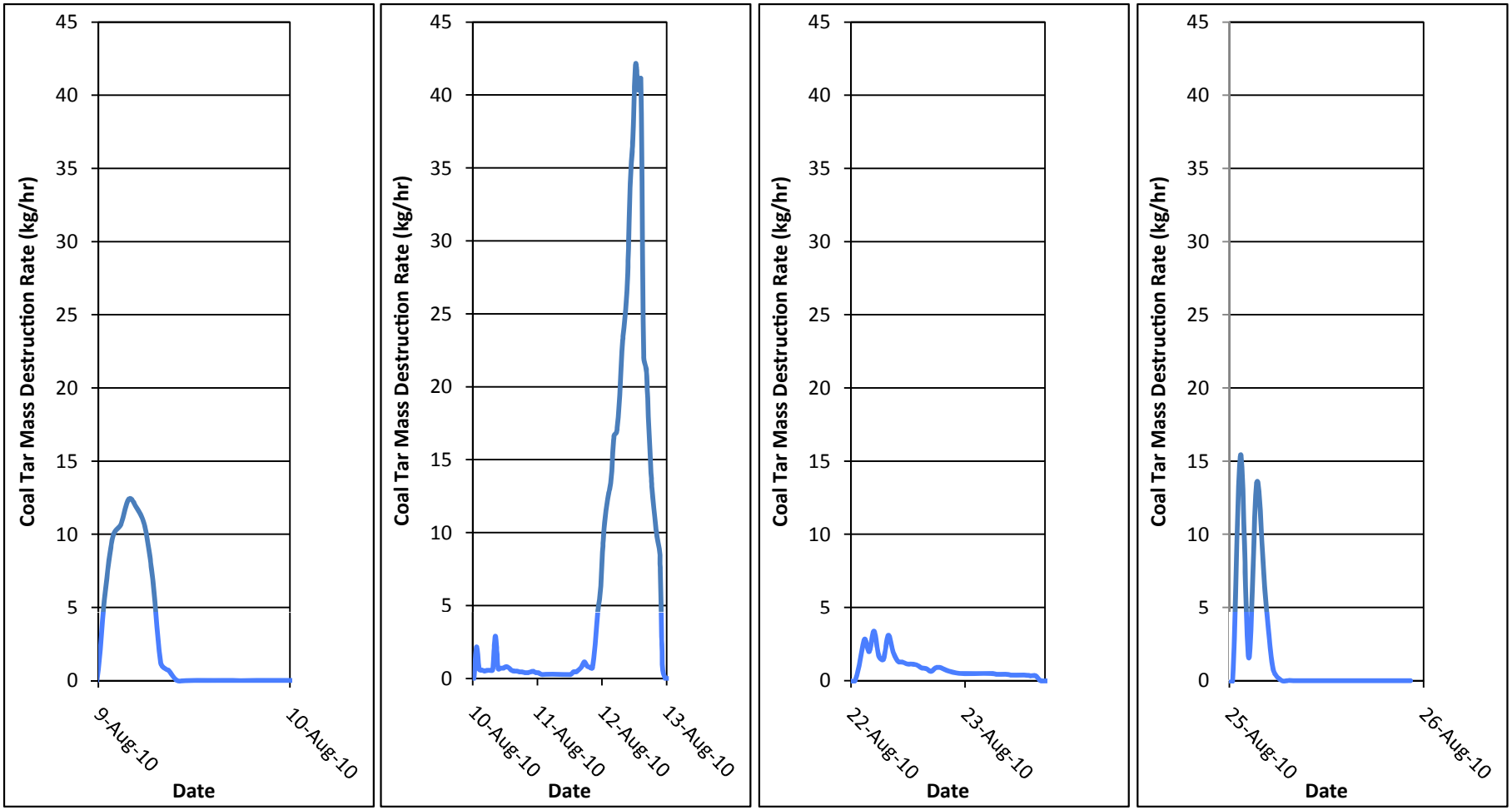

IP-1 Ignition Test

IP-9 / IP-5 Ignition Test

IP-6 Ignition Test

IP-8 Ignition Test

Qualitative Assessment of Ignition Events
Former Pitt Consol Site
Newark, New Jersey

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Figure **9**

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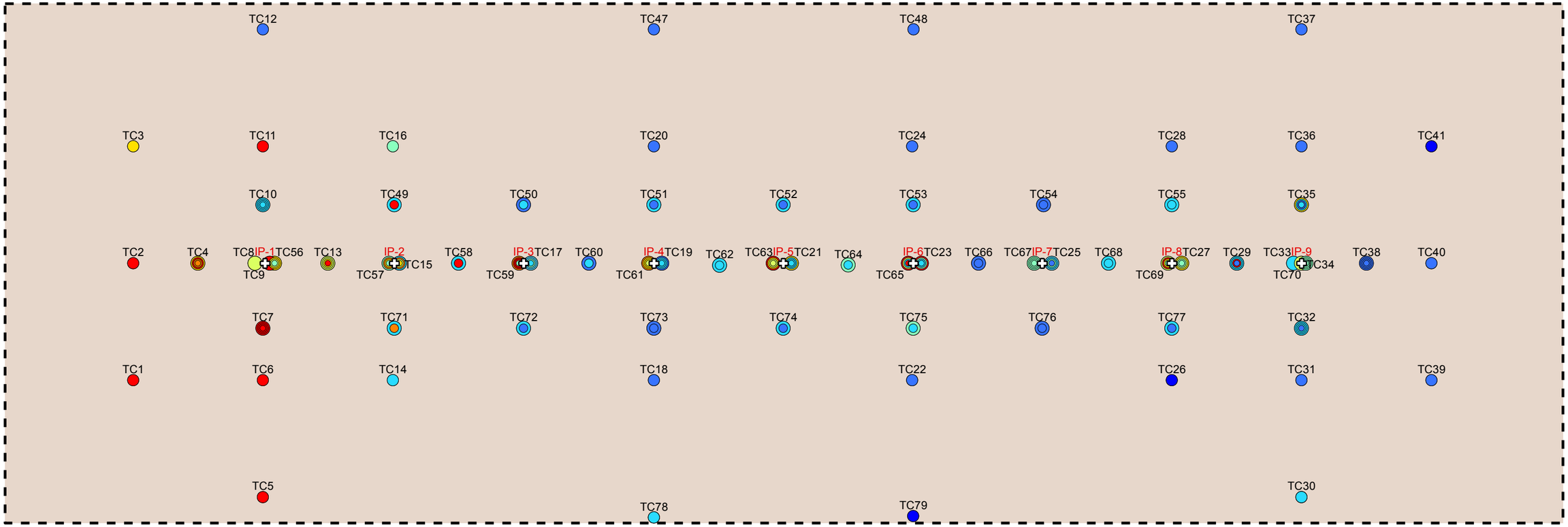

Maximum Temperature (˚C)

- ≤ 25
- > 25 to 50
- > 50 to 100
- > 100 to 200
- > 200 to 400
- > 400 to 600
- > 600 to 800
- > 800

Thermocouple Depth (ft)

- 5
- 6
- 7
- 8 to 8.5

Ignition Well

Pilot Test Area

0 5 10 Feet

Phase II Peak Temperatures within the Pilot Test Area (PTA)
Former Pitt Consol Site
Newark, New Jersey

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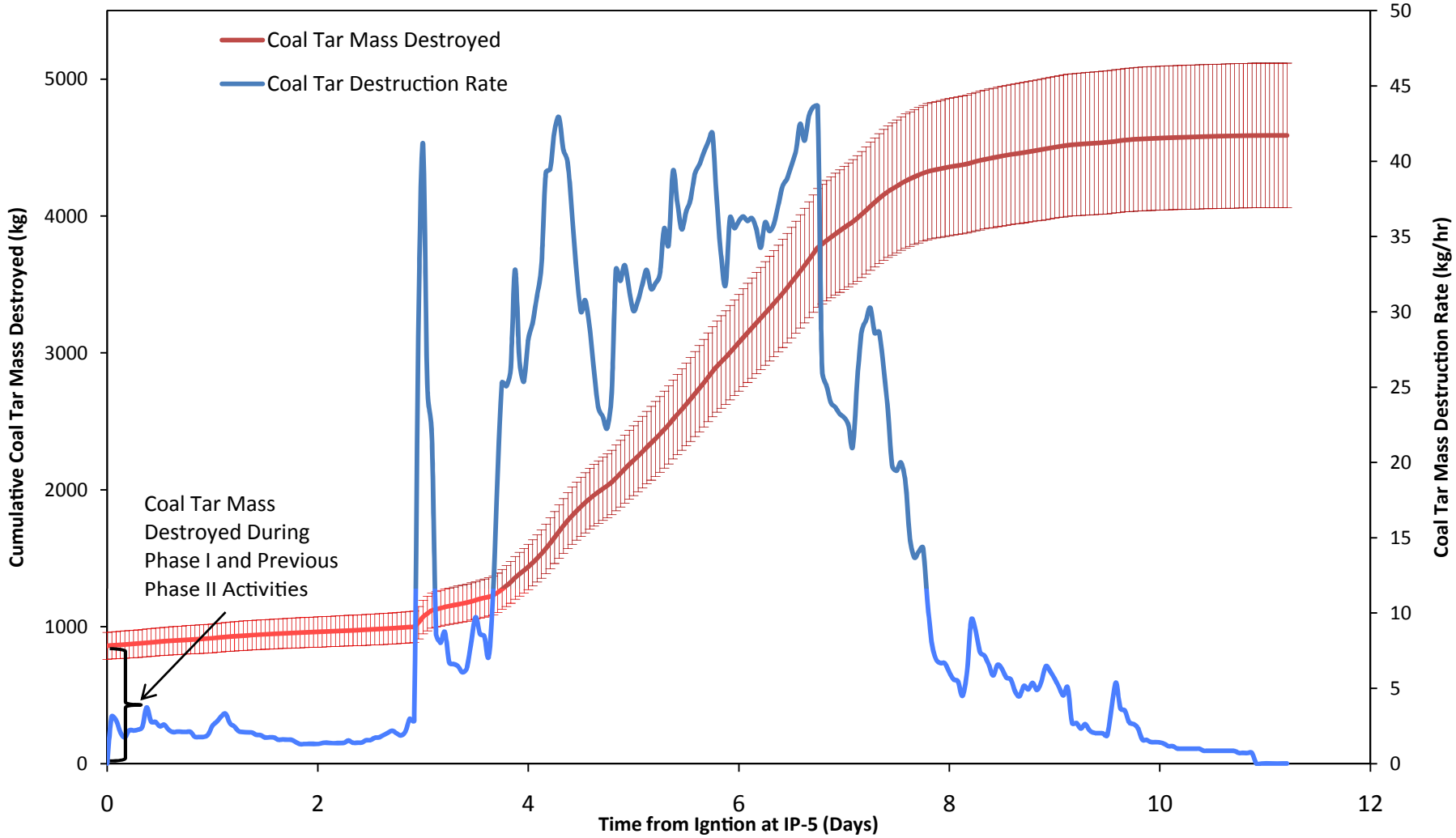
Figure **10**

Phase II Peak Temperatures.dwg



Notes:
Error bars represent 11.5% uncertainty in cumulative mass estimate
Mass of coal tar destroyed based on carbon mass balance using collected combustion gas concentrations

Phase II Estimate of Total Coal Tar Mass Destroyed
Former Pitt Consol Site
Newark, New Jersey

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Figure **11**

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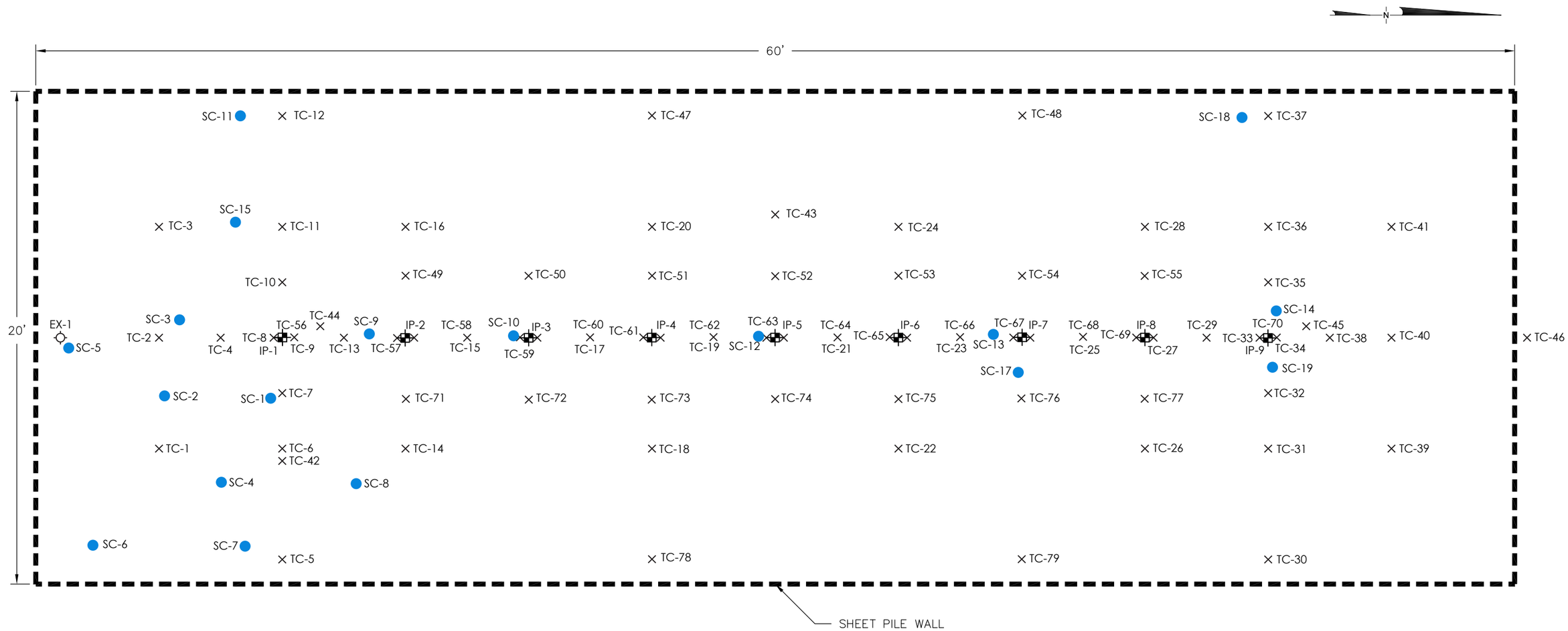

Legend

- STAR Pilot Test Area
- Ignition/Air Injection Well
- Thermocouple Probe
- Groundwater Extraction Well
- Post-Pilot Soil Core

Notes

1. Depth to peat is 9' bgs.
2. Air injection intervals are 8-9 ft bgs.

Post-Pilot Soil Sampling Locations
Former Pitt Consol Site
Newark, New Jersey

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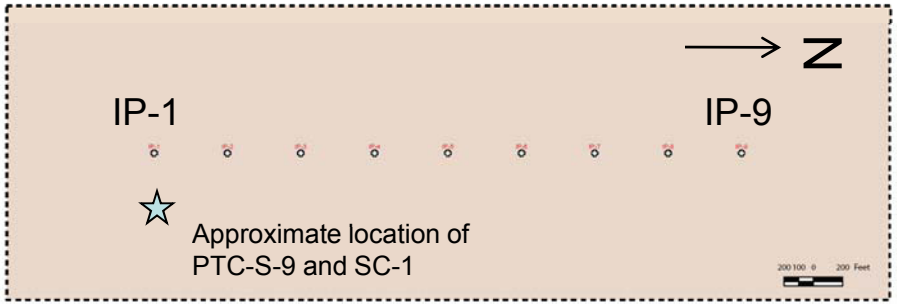
Figure **12**

Layers: 100 03 **Filename:** Thermocouple Layout.dgn

Before
(PTC-S-9)

After
(SC-1)



Qualitative Comparison of Pre- and Post-Pilot Soils – South End of PTA

Former Pitt-Consol Site, Newark, New Jersey

Geosyntec consultants

Figure **13a**

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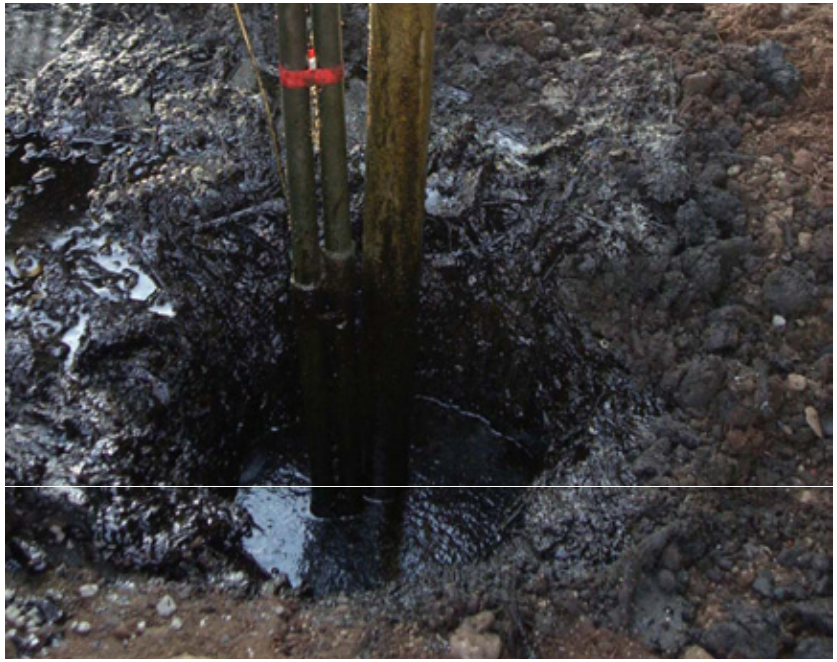
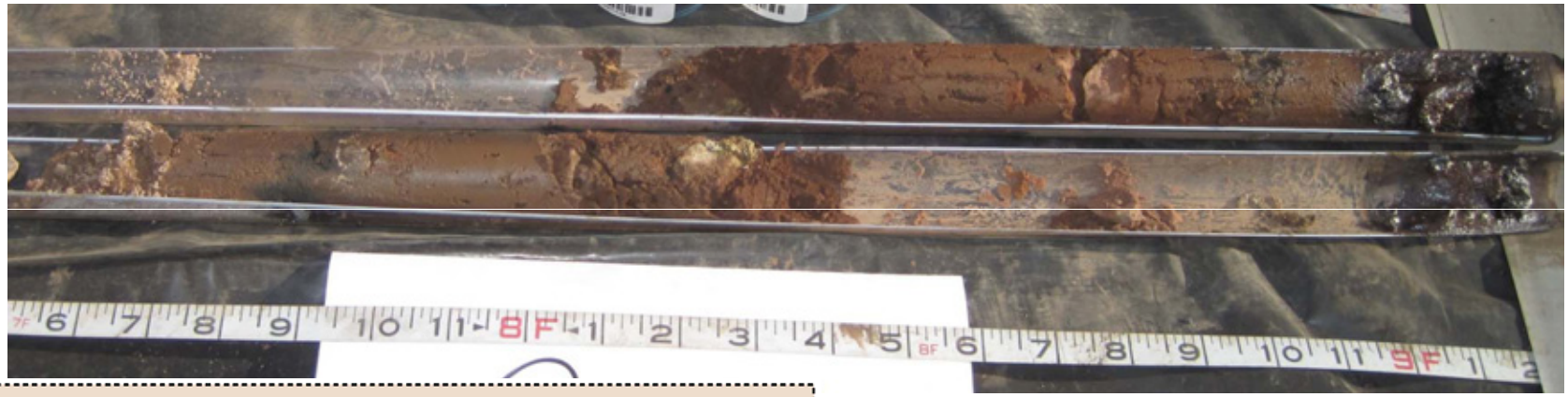
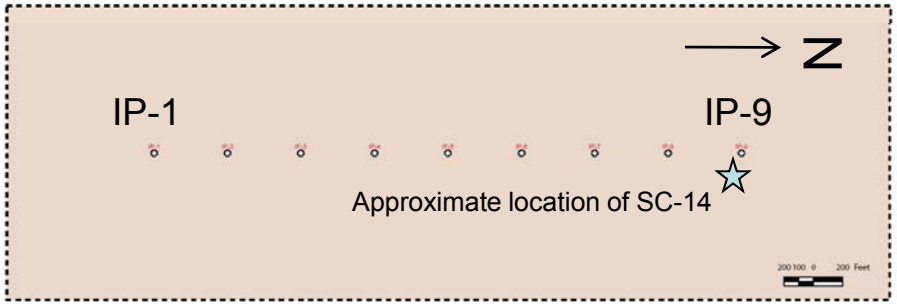


Before
(Installation
of IP-9)

After
(SC-14)





Qualitative Comparison of Pre- and Post-Pilot Soils – North End of PTA

Former Pitt-Consol Site, Newark, New Jersey

Geosyntec consultants

Figure **13b**

Guelph | June 2011

internal info: path, date revised, author

APPENDIX D

STAR PHASE III PILOT TEST REPORT

Prepared for

DuPont Corporate Remediation Group
4417 Lancaster Pike
Chestnut Run Plaza, Building 715 – 252
Wilmington, Delaware 19808

Self-sustaining Treatment for Active Remediation (STAR) Phase III Pilot Test Report

Pitt-Consol Chemical Co.
191 Doremus Avenue
Newark, New Jersey 07105
SPR-PI# G000002172

Prepared by

Geosyntec consultants

engineers | scientists | innovators

130 Research Lane, Suite 2
Guelph, Ontario N1G 5G3

Project Number TR0341D

May 6, 2013

EXECUTIVE SUMMARY

A Phase III pilot test of the Self-sustaining Treatment for Active Remediation (STAR) technology was conducted in the Former Lagoon C area of the Pitt-Consol Chemical Company (Pitt-Consol) property located at 191 Doremus Avenue in Newark, Essex County, New Jersey 07105 (the Site). The test was conducted in an area without sheet pile containment and involved: (i) a shallow fill unit test designed to collect additional information regarding process variability and robustness of the technology implementation; and (ii) a deep sand unit test designed to evaluate the potential application of STAR in this deeper sand layer.

Numerous combustion reactions were initiated within the shallow fill unit during the pilot test, including an ignition event at IP-2, which resulted in the destruction of 750 kilograms (kg) (approximately 1650 pounds [lbs]) of coal tar. However, additional attempts to initiate and maintain combustion reactions within the shallow fill unit (i.e., IP-3, IP-6, and IP-7) demonstrated that STAR application near the water table can result in abrupt pressure changes due to the migration of groundwater in response to pressurized air injection. These abrupt pressure changes can disrupt the smoldering process and terminate the smoldering reaction; thus, the proximity of the water table to the smoldering front within the shallow fill unit necessitates a low pressure / flow rate, close-well-spacing implementation strategy for STAR application within this unit.

An Electrical Resistive Tomography (ERT) survey was conducted during the shallow fill unit test to monitor the combustion reaction. Numerical modeling suggested that surface ERT is likely suitable for monitoring STAR operation; however, no conclusive evidence of subsurface changes were seen with the available ERT data collected during the shallow fill unit pilot test as a result of the limited size/placement/timing of the combustion events and the planned boundaries of the ERT study.

The deep sand unit combustion test resulted in the destruction of 900 kg to 1900 kg of coal tar within a six-foot treatment horizon to a radial distance of approximately 12 feet (ft). Propagation was near uniform in the four-directions of thermocouple monitoring and proceeded at a rate of approximately two feet per day (ft/day). Post-pilot soil characterization data demonstrated significant coal tar destruction with average total aromatic, total aliphatic, and total BTEX/VOC percent concentration reductions in soils on the order of 98.6%, 99.7% and 100.0%, respectively.

The pilot test objectives were met; namely, sufficient data was collected to design a full-scale application of the STAR technology at the Site. This work demonstrates that the STAR technology is suitable for the Site and that sufficient information has been collected to demonstrate how it can be applied to meet the New Jersey Technical Requirements for Site Remediation (TRSR; NJDEP, 2012). Numerous configurations for the implementation of the technology have been identified, which will be evaluated in a forthcoming Remedial Action Work Plan (RAWP).

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Appendix B Daily Operator Field Forms
Appendix C ERT Report
Appendix D TarGOST® Profiles

LIST OF ABBREVIATIONS

^{o}C	degrees Celsius
%	percent
%RE	percent response emitter
As	arsenic
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylene
CCS	Columbia Container Services
CEMs	Continuous Emissions Monitoring system
CO	carbon monoxide
CO_2	carbon dioxide
COC	contaminants of concern
DGI	Data Gaps Investigation
DNAPL	Dense Non-Aqueous Phase Liquid
DuPont	E. I. du Pont de Nemours and Company
EIPT	Environmental Improvement Pilot Test
EPA	Environmental Protection Agency
EPH	Extractable Petroleum Hydrocarbons
ERT	Electrical Resistive Tomography
ft	feet
Geosyntec	Geosyntec Consultants
kg	kilograms
kg/hr	kilograms per hour
kW	kilowatts
lbs	pounds
mg/kg	milligrams per kilogram
msl	mean sea level
NAPL	Non-Aqueous Phase Liquid
NEWGIN	Newark Geographical Information Network
NJDEP	New Jersey Department of Environmental Protection
NJGS	New Jersey Geologic Survey
OFM	Open File Map

LIST OF ABBREVIATIONS (CONTINUED)

PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbons
Pb	lead
PHC	petroleum hydrocarbons
Pitt-Consol	Pitt-Consol Chemical Company
POC	Proof of Concept
Ppmv	parts per million by volume
PTA	Pilot Test Area
RAWP	Remedial Action Work Plan
RIR	Remedial Investigation Report
RE	Receptor Evaluation
scfm	standard cubic feet per minute
STAR	Self-sustaining Treatment for Active Remediation
SVE	soil vapor extraction
SVOC	Semi-Volatile Organic Compound
TarGOST®	tar-specific green optical screening tool
TRSR	Technical Requirements for Site Remediation
USGS	United States Geological Survey
VOC	Volatile Organic Compound

1 INTRODUCTION

This report has been prepared by Geosyntec Consultants (Geosyntec) on behalf of E. I. du Pont de Nemours and Company (DuPont) to present the results of the phase III pilot test to support the design for potential application of the Self-sustaining Treatment for Active Remediation (STAR) technology to treat coal tar-impacted soils at the former Pitt-Consol Chemical Company (Pitt-Consol) property located at 191 Doremus Avenue in Newark, Essex County, New Jersey 07105 (the Site).

The purpose of the pilot test was to provide information to assess the performance of the STAR technology at the Site with the objectives of 1) providing sufficient data to allow treatment alternatives to be fully developed and evaluated during the detailed analysis and to support the remedial design of a selected alternative, and 2) reducing the cost and performance uncertainties for treatment alternatives to acceptable levels so that a remedy can be selected.

The scope of the pilot test included: 1) collection of samples and instrumentation of the pilot test area (PTA) for STAR performance evaluation; 2) installation of ignition / air injection wells to initiate and maintain the STAR process; 3) installation of vapor control equipment; 4) operation and monitoring of STAR pilot tests in both the shallow fill unit and deeper sand unit; and 5) collection and analysis of data to evaluate the technology as a potential Site remedy.

The remaining sections of this Work Plan present the following:

- Section 2 – an overview of background information about the Site;
- Section 3 – a description of the STAR technology and the purpose, objectives and general scope of the phase III pilot test;
- Section 4 – the scope of work and deviations from the STAR Phase III Pilot Test Work Plan (Work Plan; Geosyntec, 2012a);
- Section 5 – the results and discussion of the pilot test;
- Section 6 – implications and strategy for full scale implementation of the STAR technology;
- Section 7 – summary and conclusions of the pilot test; and
- Section 8 – references.

2 BACKGROUND

2.1 Site Description and Geographic Setting

The Site is located in an area of past and current heavy industry use along the Passaic River, near to the Port of Newark (Figures 1 and 2). Exit 15E of the New Jersey Turnpike is immediately northwest of the Site. According to information accessed through the Newark Geographic Information Network (NEWGIN), the Site property comprises the parcels designated by the City of Newark, Division of Assessments, as Block 5016, Lots 1 and 3, and Block 5016.01, Lot 10, which together have a combined area of 37.67 acres. Block 5016, Lot 1 and Block 5016.01, Lot 10 form the contiguous portion of the property; Block 5016, Lot 3 is separate from these other parcels by non Pitt-Consol properties in the southeast corner of the Site.

The ground surface of the Site is generally flat, with little topographic relief. The contiguous portions of the Site were previously leased by Columbia Container Services (CCS) for the storage of empty shipping containers but in preparation for remedial activities their lease was not renewed and, as of 2012, the Site is vacant. This area is covered primarily with stone and asphalt, is fenced to the south, west and east of the Site, and contains a wall of shipping containers to the east to limit access to the Site. The separate parcel of the Site is asphalt covered and fenced, and is currently unused.

The Site and surrounding area are zoned "Industrial" (NEWGIN), and the properties adjacent to the Site are used for industrial purposes. Mapped information available through the New Jersey Department of Environmental Protection (NJDEP) NJ-GeoWeb online Map Viewer indicates that there are no property uses of types frequented by sensitive human receptors (i.e., residences, schools, daycare centers, or parks or other recreational areas) within 1,000 feet (ft) of the Site boundary (NJ-GeoWeb). A map of the Site and surrounding area produced from NJ-GeoWeb is included in the Receptor Evaluation (RE), previously submitted to NJDEP in 2011 (Geosyntec, 2011a) and updated as part of the Remedial Investigation Report (RIR; Geosyntec, 2013). The Site and all adjacent properties are used for industrial purposes.

2.2 Site History and Surrounding Area Property Uses

The areas surrounding what is now the Site were once flood plains and tidal mudflats along the Passaic River. In the late 1800s, the Site and surrounding areas were covered with fill material (Historic Fill) to raise the land and allow for development (CRG, 2000). The Site was reportedly first developed in the late 1800s and from then until May 1983 it was the location of industrial operations which, at various times, produced road tars, phenols, methyl phenols (cresol and cresylic acid) (CRG, 1998). Production operations at the Site were terminated on 23 May 1983, and at that time, an alkylation unit, a natural cresylic acid plant, a synthetic cresol plant, and several above ground tank and drum storage areas existed at the Site (CRG, 1998). Immediately prior to its shutdown, the Pitt-Consol facility was producing alkylated phenols, primarily cresol (methyl phenol) (CRG, 1998). Work to dismantle the on-Site facilities began in late 1984, and

was completed by January 1986 (DuPont, 1995). The Site remained vacant from 1986 until approximately 2002, when CCS began operating a shipping container storage yard on the Site. CCS vacated the Site in early 2012 and the Site is currently vacant to allow Site access for delineation and to prepare for remediation activities.

According to (CRG, 1998), chemical plants, scrap yards, metal recycling operations, oil terminals, trucking terminals, a power generation plant, and a sewage treatment plant all either exist or existed in the past in the area surrounding the Site.

2.3 Local Geology

The Site is underlain by five major unconsolidated units which in turn overlie a reddish brown shale bedrock unit (Brunswick Shale) with an upper weathered surface (CRG, 2000). The unconsolidated units, in ascending order (from deepest to shallowest), as described by the New Jersey Geologic Survey (NJGS) in co-operation with the United States Geological Survey (USGS) in Open File Map (OFM) 42 (NJGS, 1998), are: (1) Rahway Till, a reddish-brown to light reddish-brown glacially derived silty sand to sandy clayey silt unit that is typically less than 20 ft thick in the local Site area; (2) Lake Bottom Deposits composed of predominately gray to reddish-brown silt, clay and fine sand which is well sorted, thinly layered and varved and is up to approximately 50 ft thick at the Site; (3) Alluvium, a medium to coarse dark-brown, gray, reddish-brown sand and silt unit up to 30 ft thick (intermediate water bearing unit); (4) Meadow Mat, a semi-confining organic silt, clay and peat layer with some sand and fine gravel which can be up to 25 ft thick; however, this layer is observed to thin considerably moving from East to West across the Site (in some areas along the Western side of the Site the Meadow Mat is believed to be absent); and (5) Fill, a heterogeneous historic fill unit generally less than 20 ft thick and composed of porous fill materials including sand, gravel, rock, cinders, ash, brick, concrete, wood, slag, metal, glass and trash (shallow water bearing unit). In 2002, after CCS leased the Site the unconsolidated native materials were covered with a permeable fabric geomembrane and fill consisting of a layer of crushed stone and gravel, nominally between 2 and 5 ft thick, was placed on the Site.

2.4 Local Hydrogeology

The following is a summary of the local hydrogeology for the Site; a more detailed analysis can be found in the RIR (Geosyntec, 2013). The ground water table is located in the Fill, generally between zero and six feet mean sea level (ft msl), or 3 and 9 ft below ground surface (bgs). Horizontal hydraulic gradients calculated based on gauged elevations in July and October 2012 were 0.0065 ft/ft and 0.0034 ft/ft, respectively. Assuming a porosity of 30 percent (%) and hydraulic conductivity of approximately 190 ft/day (CRG, 2008; Golder, 2007; CRG, 2000; CRG, 1998), ground water velocity is estimated to be between 800 and 1,500 ft/year. Ground water flow in the Fill is generally east-northeast. Horizontal hydraulic gradients in the Alluvium calculated based on gauged elevations in July and October 2012 were 0.0013 ft/ft and 0.00096 ft/ft, respectively. Assuming a porosity of 30% and hydraulic conductivity of approximately 50

ft/day (CRG, 2008; CRG, 1998), ground water velocity is estimated to be between 60 and 80 ft/year. The direction of flow during these measured time periods shifted slightly from east-southeast to southeast. The Passaic River, located approximately 600 ft east of Doremus Avenue, is likely the discharge point for Site ground water. However, given the low observed hydraulic gradients and calculated velocities, ground water discharge to the river is considered to be minimal. Horizontal hydraulic gradients calculated based on gauged elevations in the bedrock in July and October 2012 were 0.0026 ft/ft and 0.0031 ft/ft, respectively. The direction of flow ranged from due south to southeast. Vertical gradients between the Fill, Alluvium and bedrock calculated based on gauged elevations during the same time periods are generally downward.

In the Fill, seasonal water level fluctuations are greatest; tides appear to have minimal influence on wells in the fill unit. In the Alluvium, seasonal water level fluctuations are more muted, with wells in the Alluvium showing a minimal response to precipitation events. Tides appear to have a moderate influence on the water levels. In the bedrock, seasonal water level fluctuations are similar to the Alluvium. Response to tides is much more significant and appears to have a moderate influence in this unit. As expected, bedrock wells show very little seasonal change or response to extreme precipitation events.

2.5 Contaminants of Concern for On-Site Soils

The Preliminary Assessment (PA) report (CRG, 1998) identified contaminants of concern (COCs) through a review of the Site history, including process, storage and waste disposal practices, coupled with an evaluation of the soil and ground water analytical data that was available at the time. Identified COCs included volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), phenols, petroleum hydrocarbons (PHCs), arsenic (As), and lead (Pb).

A large proportion of hard pitch and waste heavy ends found at the Site are likely attributable to the use of thermal processing, as used by Butterworth-Judson and Reilly Tar companies while operating at the Site. It is reasonable to conclude that the vast majority of the coal tar and its associated residuals are associated with the exclusive use of thermal processing pre-1955. In addition, light organic solvents (benzene, phenols, cresols, short chain liquid hydrocarbons) may be attributed to the use of these materials after Pitt-Consol started operating at the Site. However, given that these compounds could also be produced during thermal processing, they may be associated with past operating practices.

Reviewing the historical operations on properties close to the Site show the neighboring lots also contain high concentrations of various COCs. Nearby sites could be accountable for light organic solvents due to their mobility and prevalence on multiple adjacent sites.

Beneath the surficial stone layer are relatively porous Fill and Alluvium units, described above in Section 2.3, which are believed to allow the downward migration of coal tar dense non-aqueous phase liquid (DNAPL) or free product (pursuant to NJAC 7:26E-1.8). While the Meadow Mat

layer limit the downward migration of coal tar DNAPL, in areas where the Meadow Mat unit is very thin or absent (western side of the Site) the coal tar DNAPL is free to migrate downward into the Alluvium. The thinly layered varved Lake Bottom Deposits were observed to act as a capillary barrier preventing further downward migration of coal tar DNAPL.

3 STAR TECHNOLOGY, DEVELOPMENT AND PILOT TEST OBJECTIVES

3.1 STAR Technology

Combustion is the exothermic oxidation of a carbon-based compound (i.e., fuel) to primarily carbon dioxide (CO_2), carbon monoxide (CO), water, and energy. The combustibility of Non Aqueous Phase Liquids (NAPLs) is a characteristic that has been successfully exploited through the *ex situ* incineration of NAPLs and contaminated soil (e.g., Howell *et al.*, 1996); however, incineration is achieved primarily via flaming combustion which is an energy inefficient process (i.e., high heat losses), requiring the continuous addition of fuel and, often, supplemental energy.

Smoldering combustion, by contrast, is the exothermic oxidation of a condensed phase (i.e., solid or liquid) occurring on the fuel surface (Ohlemiller, 1985). Smoldering is limited by the rate of oxygen-transport to the fuel's surface, resulting in a slower and lower temperature reaction than flaming. Importantly, smoldering can be self-sustaining (i.e., no energy input required after ignition) when the fuel is (or is embedded in) a porous medium. Self-sustaining smoldering occurs because the solid acts as an energy sink and then feeds that energy back into the un-burnt fuel, creating a very energy efficient reaction (Howell *et al.*, 1996). Solid porous fuels such as polyurethane foam (Torero and Fernandez-Pello, 1996), cellulose (Ohlemiller, 1985), and charcoal are typical media that exhibit self-sustained smoldering.

Studies have demonstrated that the rate of propagation of the combustion front and net heat generated are affected by the velocity (magnitude and direction) of air flow, pore diameter of the medium, and the fraction of porosity occupied by fuel, air and non-reacting materials (DeSoete, 1966). Smoldering reactions can leave a carbon-based residue (oxygen limited reactions) or can result in complete combustion of the fuel (fuel limited reactions) (Schultz *et al.* 1995). The former is common in combustible porous media where the char minimizes heat losses and enables the reaction to propagate. The latter is common when the fuel is combined with an inert porous media that provides the required insulation even in the fuel's absence. While most research focuses on smoldering of solid fuels, there are several examples of combustion of a liquid fuel embedded in a porous matrix. Lagging fires occur inside porous insulating materials soaked in oils and other self-igniting liquids (Drysdale, 1998). To enhance oil recovery, combustion fronts are initiated in petroleum reservoirs to drive oil towards extraction points (Greaves *et al*., 2000). However, the smoldering of liquids as a remediation technique is entirely novel (Switzer *et al.*, 2009).

STAR is different from existing thermal remediation techniques. *In situ* thermal remediation requires the continuous input of energy in order to primarily volatilize and, in some cases, thermally degrade (pyrolize) and mobilize (via viscosity reductions) the organic phase. All of these processes are endothermic and remediation continues as long as externally-supplied energy input is sustained throughout the NAPL-occupied porous medium. In contrast, STAR has the potential to create a combustion front that: (i) initiates with a short duration energy input; (ii) propagates through the NAPL-occupied medium in a self-sustained manner; and (iii) destroys the

NAPL wherever the front passes. STAR is different from *in situ* combustion for enhanced oil recovery in that the latter is designed to generate heat and pressure that will mobilize the entrapped oil towards recovery wells. In contrast the benefit of STAR is avoiding the recovery (and thus treatment) of NAPL and/or water.

3.2 Phase I and II STAR Pilot Studies

An initial pilot test of the STAR technology was conducted within the shallow fill unit of the Site (Geosyntec, 2011b). The pilot test was conducted in two phases: 1) a Phase I Proof of Concept (POC) pilot test designed to demonstrate the technology under Site conditions (October 2009); and 2) a Phase II pilot test to elucidate cost, design, and performance uncertainties for the implementation of STAR as a Site-wide remediation strategy (August through November 2010). The pilot test was conducted in the former Lagoon C area of the Site along the western Site perimeter (Figure 2). The PTA was approximately 60 ft long, 20 ft wide and 10 ft deep, and was surrounded by sealed sheet pile. Groundwater was present approximately 3 ft bgs.

The Phase I POC pilot study successfully demonstrated the STAR process. Self-sustaining smoldering combustion was achieved below ground surface and beneath the water table for approximately 9 days, resulting in the destruction of approximately 200 kilograms (kg) (greater than 400 pounds [lbs]) of coal tar. However, the volume of coal tar within the PTA – and the mobility of the coal tar present – limited the propagation of the combustion front.

The Phase II test assessed factors governing the ignition protocol and the limitations of the STAR technology with respect to mass destruction rate and combustion front propagation. During the Phase II test, sustained destruction rates in excess of 800 kg/day were observed over a four-day period resulting in the destruction of more than 4,500 kg of coal tar. Propagation rates during Phase II were estimated to be on the order of 5 feet per day, with propagation distances between 10 and 30 feet from the ignition / air injection point.

Post-pilot samples demonstrated a substantial reduction in coal tar volume within the PTA, with semi-volatile organic compound (SVOC) concentrations reduced (on average) by greater than 99% in zones where combustion was observed or detected. Concentrations of the volatile constituents of coal tar were detected in the vapor phase, but the majority of coal tar mass was destroyed in situ (i.e., through combustion as opposed to volatilization). Approximately 160 kg of coal tar was destroyed in situ for every kilogram of total volatiles discharged to ground surface during the most vigorous period of combustion.

Further details regarding the initial pilot test are presented in the STAR Pilot Test Report (Geosyntec, 2011b). This report concluded that additional on-Site testing was needed prior to full-scale STAR design and implementation at the Site.

3.3 Phase III STAR Pilot Study Objectives

The Phase I and Phase II pilot tests (Geosyntec, 2011b) indicated that the ignition quality, in situ coal tar mass destruction rates, vapor mass loading rates, vapor mist content, and vapor temperatures exhibited variability during testing as a function of both time and ignition location. In addition, the combustion front propagation observed in the Phase II pilot test was influenced by preferential flow pathways, which could potentially affect the application or suitability of the technology. Furthermore, the previous pilot testing was implemented under conditions that are not anticipated to exist during full-scale operation (i.e., the PTA was contained within sheet pile walls). Therefore, the Phase III pilot test was conducted in an area without sheet pile containment and was designed to collect additional information regarding process variability and robustness.

The 2011 and 2012 Data Gaps Investigations (DGIs; Geosyntec, 2012c and 2012d) conducted at the Site revealed that coal tar contamination exists within the alluvial sand layer (beneath the Meadow Mat underlying the shallow fill unit) to depths of up to approximately 35 ft bgs within Lagoons C and D. The preliminary data collected during the DGIs indicated that the contaminant concentration and geology in alluvial sand layer would support application of the STAR technology. The Phase III pilot test was designed to evaluate the potential application of STAR in this deeper alluvium layer (hereinafter referred to as the "Deep Sand Unit Test").

The objectives of the Phase III pilot test were to evaluate:

1. Scale-up issues, process variability, and process controllability within the fill unit (shallow combustion test); and

2. Implementation considerations of the STAR technology within the deep sand unit beneath the former lagoon areas (deep air sparge and deep sand unit combustion testing).

The Phase III STAR pilot test was carried out as two distinct tests: 1) Shallow fill unit combustion test; and 2) Deep sand unit test. Figures 3 and 4 present the layout of ignition points, thermocouples and characterization locations for the shallow fill unit and deep sand unit tests respectively. Each of the pilot tests consisted of continuous temperature monitoring using thermocouples, monitoring the combustion process by measuring the concentrations of CO_2, CO, and VOCs in the extracted air phase, the collection of soil samples for chemical analysis, and conducting a tar-specific green optical screening tool (TarGOST®) survey before and after STAR was applied. The shallow fill unit pilot test also included the evaluation of time lapse electrical resistance tomography (ERT) as a tool for: a) the characterization of subsurface contamination; b) temperature tracking of STAR combustion fronts; and c) STAR treatment effectiveness. The deep sand unit test included an air sparge/tracer test to evaluate vapor migration and capture from this deeper geologic unit by the surface soil vapor extraction (SVE) system.

4 PILOT TEST WORK PLAN

4.1 Summary of Phase III Scope of Work

The Phase III pilot test scope of work is presented in the STAR Phase III Pilot Test Work Plan (the Work Plan, Appendix A, [Geosyntec, 2012a]). This work plan describes the design basis, process flow, and details the procedures and methodologies for:

1. site preparation;
2. ignition point installation;
3. instrumentation;
4. shallow fill unit STAR test;
5. deep air sparge/tracer test;
6. deep sand unit combustion test;
7. vapor collection and treatment;
8. performance monitoring; and
9. baseline and post-pilot characterization.

The Work Plan was closely followed during the Phase III pilot test. Any minor deviations from the Work Plan, including changes to equipment, operation, and sampling for Phase III testing are noted in Section 4.2.

4.2 Modifications to Work Plan

The following modifications were made to the Work Plan during the course of pilot test implementation:

1. In-line air heaters were added to the shallow fill ignition well heads (IP-1, IP-2, IP-3, IP-4, IP-6, and IP-7) to preheat injection air; thus increasing the temperature of the air entering the formation to reduce ignition time.
2. Additional ignition points IP-6 and IP-7 were installed in the shallow fill unit for confirmation testing following the initial round of shallow fill unit trials.
3. Post pilot TarGOST® activities were postponed due to hurricane Sandy.
4. Two types of in-well heaters were utilized for the shallow fill unit pilot test. Initial testing was performed using 9 kilowatt (kW) heaters and subsequent testing was performed using 15kW heaters as discussed in Section 5.2.2.

The thermocouple labels include nominal depths from excavated ground surface (during pilot test area preparation activities); however, all depth information within this report has been corrected to original ground surface (i.e., ground surface at the time of the DGI investigation and prior to site preparation excavation or concrete cap placement).

4.3 Air Permit Monitoring

NJDEP required an Environmental Improvement Pilot Test (EIPT) permit for the discharged vapor stream resulting from the STAR pilot tests. Table 1 presents a summary of the permit requirements; data and observations related to permit compliance are provided in the daily field forms (Appendix B). The permit regulated the equipment to be used, the vapor treatment protocol, and the permissible discharge levels. All permit requirements were met during the pilot test.

5 RESULTS AND DISCUSSION

5.1 Pre-Pilot Characterization

The Phase III PTA was selected based on TarGOST® survey data, laboratory VOC, SVOC, and extractable petroleum hydrocarbons (EPH) analysis of soil samples, and visual inspection of soil cores collected during the 2011 and 2012 DGIs (Geosyntec, 2012c and 2012d). The results of the TarGOST® survey showed a good correlation between TarGOST® signal response (percent reference emitter [% RE]) to EPH concentrations in soil and a % RE value of 50 was found to be indicative of the presence of free product (coal tar). This correlation is further described in the RIR (Geosyntec, 2013). Figures 3 and 4 present the locations of pre-pilot characterization samples in the shallow fill unit and deep sand unit tests respectively. The five TarGOST® survey locations indicating the presence of free product in the former Lagoon C area (adjacent to the Phase I and II PTA) were chosen to site the Phase III PTA. Four of these locations (at the four corners of the vapor cap) characterized the shallow fill unit only (TGB-D22, TGB-D21, TGB-C22, TGB-C21) while the fifth TarGOST® probe was co-located with IP-5 and was advanced to a total depth of 35 ft bgs (LCC-C5) (see Geosyntec, 2012c and 2012d).

During construction and instrumentation activities, soil samples were collected to confirm the selection of the PTA and provide pre-pilot characterization ('baseline') samples for comparison with post-pilot sampling results to evaluate STAR treatment efficiency during the test. A total of 61 pre-pilot samples (32 from the shallow fill unit and 29 from the deeper sand unit) were collected from multiple depth intervals at 14 locations within the PTA (each of the ignition pint locations IP-1 through IP-5 and thermocouple locations TC-8, TC-15, TC-23, TC-31, TC-38, TC-51, TC-52, TC-66 and TC-72; see Figures 3 and 4). These samples were analyzed by a licensed analytical laboratory for SVOCs according to Environmental Protection Agency (EPA) Method 8270B and for EPH (F1 to F4 and benzene, toluene, ethylbenzene, and xylene [BTEX]) according to NJDEP Extractable Petroleum Hydrocarbons Method, Version 3 (2010).

A total of 46 of the 61 pre-pilot characterization samples analyzed had EPH concentrations above 5,000 milligrams per kilograms (mg/kg), which were assumed to be indicative of the presence of free product for the purposes of this pilot test (see Tables 2a and 2b for shallow fill unit and deep sand unit analytical data, respectively). Of the remaining 15 samples with EPH concentrations below 5,000 mg/kg, 11 of these were from depths below 26.7 ft bgs and below the bottom of the IP-5 well screen and outside its influence (Table 2b). The greatest presence of free product in the shallow fill unit was observed in the two to three foot interval immediately above the Meadow Mat layer (Table 2a).

Following construction and instrumentation activities, the PTA was further characterized through an ERT survey. The results of the ERT survey are presented in Appendix C, and while the ERT survey confirmed the stratigraphic sequence at the Site, the geophysical methodology was unable to differentiate zones of free product from background (i.e., uncontaminated) materials.

5.2 Shallow Fill Unit Combustion Test

The shallow fill unit test commenced following completion of shakedown testing, which consisted of: 1) compressor / blower "bumping"; 2) SVE system leak testing; 3) vapor collection cap vacuum propagation evaluation; 4) heater control panel testing and heater "bumping"; and 5) alarm / set point testing.

5.2.1 Operational Periods

The shallow fill unit combustion test was conducted in three operational periods: 1) "IP-2 Premature Ignition" from 14 to 17 August 2012; 2) "Ignition Testing at IP-1, IP-3, and IP-4" from 21 to 27 August 2012 and 19 to 28 September 2012; and, 3) "IP-6 and IP-7 Combustion" from 18 to 20 October 2012. Each of the operational periods is described in the following sections.

5.2.2 Assessment of Shallow Fill Unit Ignition Events

<u>IP-2 Premature Ignition</u>

During shakedown activities (testing of SVE system, setup of the Continuous Emissions Monitoring [CEMs] system, testing heater controls, etc.), the in-well heaters were installed to their target depths and a low (approximately 5 standard cubic feet per minute [scfm]) flow rate of air was applied to each of the wells in order to evacuate fluids and keep the heater elements dry. In addition, each heater was briefly cycled on (less than 20 minutes) to a low set point to ensure the heater and controller were functioning properly (i.e., 'bump' testing). During these shakedown activities, thermocouple data collection and operation of the CEMs system was intermittent. Two days following the heater 'bump tests', elevated thermocouple readings in the vicinity of IP-2 as well as elevated combustion gas concentrations from the CEMs system were observed. Shakedown activities were not yet complete at this time and the air flow to the shallow wells was shut off to terminate the combustion event. Subsequent review of the CEMs and thermocouple data indicate that the ignition and combustion event originated at IP-2 following the very brief 'bump testing' and that the combustion reaction propagated over the course of 48 to 60 hours through approximately one quarter of the PTA (in the vicinity of IP-2). The SVE system was operating continuously throughout this period and no uncontrolled air emissions resulted from the premature ignition event.

Figure 5 shows the maximum temperatures measured in thermocouples in the vicinity of IP-2 during the premature burn. Several thermocouples to the north, east and south achieved maximum temperatures in excess of 1200 degrees Celsius (°C, i.e. in excess of the design rating of the thermocouples), resulting in the permanent loss of signal from these TC locations. Using the coal tar mass destroyed estimation methods developed in the initial STAR Pilot Test Report (Geosyntec 2011b), and using a linear interpolation between gaps in combustion gas data

collected during the premature burn, it is estimated that approximately 750 kg (approximately 1650 lbs) of coal tar was destroyed during this combustion event. The estimated radius of influence for this burn was approximately six to eight feet; however, the reaction was terminated prior to reaching its maximum lateral extent.

Ignition Testing at IP-1, IP-3, and IP-4

The premature burn destroyed a significant mass of coal tar in the vicinity of IP-2 and the entire south eastern quadrant of the PTA. As a result, no further ignition attempts were made at IP-2 during the shallow fill unit combustion test.

Ignition testing was performed at the remaining three ignition wells (IP-1, IP-3, and IP-4) from 21 to 27 August 2012, and 19 to 28 September 2012. The ignition event at IP-3 on 26 and 27 August 2012 was the most successful event during this period. Ignition was observed at IP-3 following approximately 8 hours of preheating and was characterized by a sharp spike in CO concentration to above 3,000 parts per million by volume (ppmv), and corresponding spikes in temperature at thermocouples TC-44 (1 ft east of IP-3) and TC-42 (3 ft east of IP-3) at a depth of 9.2 ft bgs to above 500° C. Several other thermocouples in the vicinity of IP-3 showed spikes in temperature ranging from 50 to 100° C indicating that the combustion reaction was nearby. Sustained, elevated combustion gas concentrations (CO concentrations greater than 2500 ppmv) were observed for a period of approximately 10 hours after ignition followed by a sharp decline to ambient levels over the course of a few minutes. No equipment failures or changes in the process were observed during this time. Additional attempts at IP-3 and attempts at IP-1 and IP-4 were able to achieve ignition but were generally short lived and limited to short distances around each air injection / ignition well. Modified in-well heaters (15kW versus 9kW) and in-line air heaters (see Section 4.2) were installed to provide sufficient heating, and soil coring / sampling following the completion of the deep combustion test at IP-5 confirmed the presence of adequate concentrations of coal tar within the shallow fill unit. Additional shallow combustion wells IP-6 and IP-7 were installed to confirm well screen size and placement were optimal. The results of these tests are presented below.

IP-6 and IP-7 Combustion

Two additional ignition points (IP-6 and IP-7) were installed in the shallow fill unit to investigate and characterize the propagation limitations observed during the Ignition Testing at IP-1, IP-3, and IP-4 described above. The IP-6 and IP-7 wells were completed with a shorter screen interval (6 inches versus 12 inches for IP-1 through IP-4) to allow for more targeted injection of preheating air. Soil cores collected during well installation confirmed the presence of adequate coal tar at the screen interval depth. In addition, these ignition wells used the 15kW in-well heaters and the in-line air heaters described in Section 4.2 to provide sufficient heating for ignition.

Ignition was successfully achieved at both IP-6 and IP-7 on 18 and 20 October 2012, respectively; however, the behavior of the ignition events were similar to those at IP-3 and can be described by the following series of events (see Figures 6 and 7):

1. Ignition within one hour of initiating preheating, characterized by spikes in temperature at adjacent thermocouples and increased combustion gas concentrations;
2. A steady rise in combustion gas concentrations over a period of several hours indicating a growing combustion front;
3. Observed propagation of combustion temperatures radially out from the wells. During the IP-6 ignition event, temperatures of 439 ° C were observed at thermocouple TC-35-75, approximately 5 ft away, and during the IP-7 ignition event, temperatures of 997 ° C were observed at thermocouple TC-44-75, approximately 6 ft away.
4. Following several hours of combustion, a near instantaneous loss of combustion gases and elevated temperatures was observed. During the IP-7 ignition event, for example, temperatures at thermocouple TC-44-75 dropped from above 700 ° C to below 100° Cover a two minute period and CO concentrations shortly after this time dropped from a concentration of above 1000 ppmv to 50ppmv over a 2 minute period.

The phenomenon observed in the shallow fill unit ignition events is consistent with air flow behavior commonly observed in air sparging which is characterized by three stages: 1) transient growth; 2) collapse; and, 3) steady state (Lundegard, 1996). During the transient growth stage, air saturation around the injection point (i.e. sparging radius of influence) increases both laterally and vertically as air displaces water around the well screen. This continues until such a time that a zone of increased air saturation reaches the water table which provides a preferential pathway for injected air and a loss of air pressure at depth. The consequence of this loss of air pressure is a ‘collapse’ of the groundwater around the sparge well and a narrowing of the effective radius of influence towards a steady state flow pattern (with a smaller radius of influence than was initially achieved during transient growth) is achieved. The transient growth phase can last from hours to years depending on the relative depths of the well screen and water table, soil properties, air injection rate and pressure and anisotropy in the subsurface (Lundegard, 1996). A longer / larger transient growth phase is favored for deeper well screens installed in natural aquifer materials with a large vertical/horizontal permeability anisotropy ratio such as the deep sand unit at the Site.

The ignition events at IP-6 and IP-7 were similar to the ignition event at IP-3 and analysis of the thermocouple and combustion gas data presented in Figures 6 and 7, respectively, suggest that the growth followed by rapid termination of the combustion reaction is analogous to the transient growth and collapse stages observed in air sparging.

Section 6 presents an approach for STAR implementation within the shallow fill unit that considers the repeatable and predictable nature of these stages of air flow behavior.

5.2.3 ERT Survey Results

Appendix C presents the ERT modeling and field study report completed by the University of Western Ontario. It is evident from the modeling work that potential changes associated with a STAR combustion event could be successfully mapped by ERT. The scale of a STAR event that could be observed by ERT will be dependent on a number of factors including: site heterogeneity (both geologic and contaminant distribution heterogeneity), site specific ERT 'noise', depth below water table, thickness of treated zone, level of dewatering, the lateral offset of the treated zone to the event, and the resistivity of the contaminant.

The field survey suggests that while the ERT data was affected by random noise and artifacts, the data provided very repeatable and acceptable resistivity cross-sections. Thus, surface ERT is likely to be compatible with STAR installations; however, no conclusive evidence of subsurface changes was seen in the available ERT data collected during the shallow fill unit pilot test. This is not an indication of a lack of combustion activity or that ERT is not suited to tracking STAR; rather, it reveals only that the limited size/placement/timing of the combustion events monitored (IP-6 combustion event and only sporadic data from the premature ignition event) occurred outside the planned boundaries for this ERT study. The available evidence suggests potential for ERT to track STAR in the near subsurface using surface arrays. In addition, there is potential for tracking temperature changes with ERT as well as mapping deeper remediation with borehole-to-borehole and/or borehole-to-surface arrays.

5.3 Deep Sand Unit Test

5.3.1 Operational Periods

The deep sand unit test consisted of an air sparge/tracer test and a combustion test on ignition point IP-5 and was performed between 29 August and 5 August 2012 and 1 and 10 October 2012, respectively. Each of the operational periods is described in the following sections.

5.3.2 Deep Sand Unit Air Sparge/Tracer Test

The deep sand unit air sparge/tracer test was undertaken to evaluate the influence of the Meadow Mat on the migration of combustion gases and volatile compounds from the deep sand unit to ground surface. The test involved the injection of a helium tracer through IP-5 using the STAR process equipment and flow rates used in the deep combustion test.

Helium was detected within the SVE system during the tracer test (see Table 3 and Appendix A), confirming that the Meadow Mat is either not laterally continuous in this area of the Site, or is not a significant barrier to vapor migration (and, thus, confirming that combustion gases can be used to monitor combustion within the deep sand unit and that vapor treatment and capture at ground surface is necessary). However, interpretation of the results is complicated by the presence of methane in the subsurface, which has the potential to return a false positive for

helium within the sensor apparatus. The potential for false positives as a result of methane presence was confirmed in the field by a response when passing methane calibration gas through the helium detector. Furthermore, the presence of methane at the Site was verified by an independent methane gas analyzer. Thus, both helium concentrations (via helium detector) and methane concentrations (via methane gas analyzer) were recorded throughout the tracer test to separate the overlapping responses within the helium detector.

Helium (and methane) readings were collected from the SVE system, ignition/air injection wells IP-1 through IP-4, and the soil vapor monitoring probes and are presented in Table 3 (laboratory analytical data) and Appendix A (field screening data). For wells IP-2, IP-3, and IP-4, the relative response of both the helium and methane detectors was similar, indicating that the amount of helium present at the sampling times was minimal. The relative responses of the detectors at IP-1 varied with time; however, the most significant variation is due to a low methane reading 20 hours after the start of the tracer test and significantly after the cessation of helium injection.

Examination of the pressure response data from wells IP-1 through IP-4 does not indicate a build-up of pressure due to the deep injection activities. Such a build-up would indicate that the Meadow Mat layer acts as a confining or semi-confining layer. No “blow-outs” (air discharge from previously saturated wells) occurred during the testing, which would have been indicated by rapid helium breakthrough in the vicinity of the monitored wells. Therefore, based on these two observations, it is likely that the Meadow Mat is not present across the entire test area, or is not acting as a confining or semi-confining unit at this location, and that helium was transported to the shallow regions, likely in isolated areas through preferential pathways. These pathways may or may not have intersected the shallow IP wells.

5.3.3 Deep Sand Unit Combustion Test

Figure 8 presents the well screen thermocouple and combustion gas data observed during the ignition event of the deep sand unit combustion test. The ignition event at IP-5 was achieved using a 9kW in-well heater (with an in-line air heater) and an injection air flow rate of approximately 10-15 scfm. A slow rise in CO concentrations was observed following approximately 1.5 hours of preheating indicating the on-set of combustion. Once combustion was confirmed through rising subsurface temperatures and steady or climbing combustion gas concentrations, the in-well heater was shut off such that subsequent combustion continued in a self-sustaining manner. Combustion continued for a period of six days and involved the systematic increase in air injection flow rate and pressure to increase / maintain combustion gas concentrations and propagate the combustion front to the extent of the thermocouple monitoring network (12 ft radius from IP-5). The test was terminated when gas concentrations in the vapor collection system reached ambient levels and no further increasing temperatures were observed in the thermocouple network.

Throughout the test, the combustion front travelled in a near uniform, radial pattern and was consistently approximately 6 feet thick as evidenced by combustion temperatures observed in thermocouples from 20.5 to 26.7 ft bgs (Note: the pattern and uniformity of the propagation was evidenced through arrival times at thermocouples observed during operation). The next shallower thermocouple depth, located at 16.7 ft bgs, showed only very modest increases above baseline temperatures and was generally not considered to have been affected by the combustion front. This vertical limit on the thickness of the combustion front was anticipated based on the LCC-C5 TarGOST® profile (Geosyntec 2012d), which shows a gap in the %RE factors indicating coal tar free product along this horizon. These results are discussed in detail in Sections 5.3.4 and 5.3.5 below.

5.3.4 Combustion Front Propagation

The thermocouple monitoring network consisted of concentric 'rings' of multilevel thermocouples bundles located at the four points of the compass at radial distances of 1, 2, 5 and 12 feet from IP-5 (Figure 4). Figure 9a presents the maximum temperature achieved (at any depth in the thermocouple bundle) over the course of the deep sand unit combustion test. Figures 9b through 9g present the maximum temperature achieved at each location in the thermocouple network at depth specific intervals (12, 15, 19, 21, 23, and 25 ft nominal depths corresponding to 13.7, 16.7, 20.7, 22.7, 24.7, and 26.7 ft actual depths below original ground surface, respectively) over the course of the deep sand unit combustion test. Figures 10a and 10b present the maximum thermocouple temperatures at each thermocouple along north-south and east-west cross sections, respectively. Temperatures in excess of 400° C, displayed as red symbols in the figures, are considered indicative of direct contact with the combustion front. Temperatures between 200° C and 400° C, displayed as orange symbols, are considered to be adjacent (i.e. two to three inches) to the combustion front. Temperatures between 50° C and 200° C, displayed as green symbols, are considered to be in the vicinity (i.e. 12 to 18 inches) of the combustion front. Temperatures between 25° C and 50° C, displayed as light blue symbols, indicate the nearby occurrence of combustion or high temperature combustion gases, and temperatures below 25° C, displayed as dark blue, are considered to be unaffected by the combustion front.

Ignition was achieved at the IP-5 well screen (25.7 to 26.7 ft bgs) following only about 1.5 hours of preheating (Figure 8). Combustion temperatures (greater than 400° C) were observed at the 1- and 2-foot thermocouple rings within 12 hours of ignition at depths from 20.7 to 26.7 ft bgs. Temperatures between 50° C and 200° C were observed at the 5-foot thermocouple ring within 24 hours of ignition and increased to combustion temperatures (greater than 400° C) throughout the majority of the 20.7 to 26.7 ft bgs depth interval within 72 hours (3 days) of ignition. Between days 4 and 6 of the test (96 to 144 hours following ignition), temperatures at the 1-, 2-, and 5- foot thermocouple rings were decreasing, yet combustion gas concentrations remained elevated, indicating that the combustion front had migrated past the 5-foot ring and was approaching the 12-foot ring. On day 6 of the test (144 hours after ignition), the combustion

front was observed at the 12 foot thermocouple ring at TC71-21 which reached a maximum temperature of 429° C. Between days 6 and 8 of the test all thermocouples between the 19 and 25 foot depths within the 12 foot thermocouple ring were observed to be at least moderately affected by the combustion front (temperatures greater than 25° C) indicating that the radius of influence of the combustion front in the deep well combustion test was about 10 to 12 ft. The propagation velocity of the combustion front was calculated to be approximately 2 ft/day (12 feet in 6 days).

The propagation of the combustion front was uniform as evidenced by the near simultaneous arrival of peak temperature in all four lateral directions of thermocouple monitoring. This is in contrast to the shallow fill unit combustion propagation observed during the Phase II 'Significant Burn' and the Phase III burn at IP-2 which showed uneven propagation highly influenced by subsurface geologic features (e.g., brick layers). This suggests that the deep sand unit is geologically 'homogeneous' relative to the shallow fill with respect to the smoldering combustion process and that combustion propagation within this unit should be more predictable during future STAR implementation activities. The propagation within the deep sand unit test is also consistent with the air sparging behavior described in Section 5.2.2; that is, a long period of transient growth brought about by the depth of the well screen and the anisotropy of the natural sand unit being targeted (i.e., the collapse phase associated with air sparge behavior was not encountered during the deep combustion test).

5.3.5 Quantitative Assessment of STAR Performance

Figure 11 presents the estimated free product (coal tar) mass destruction rate and cumulative mass of free product destroyed during the deep sand unit pilot test according to the methods described in the STAR Pilot Test Report (Geosyntec 2011b). This mass estimate neglects any mass that may have been recovered in the vapor collection system via volatilization or as an aerosol (i.e., mass that was not combusted but still removed from the subsurface).

T = 0 days corresponds to the ignition event at IP-5 on 1 October 2012. Free product mass destruction rates increased gradually from ignition through Day 3 with a maximum destruction rate of about 7 kilograms per hour (kg/hr). After Day 3, coal tar destruction rates decreased to a rate of 3 kg/hr on Day 8 (see Figure 11). The cumulative mass destroyed during this time period is estimated to be about 860 kg.

The mass destroyed estimate uses the CO and CO_2 raw data collected from the CEMs system in its calculations. The method is detailed in the STAR Pilot Test Report (Geosyntec 2011b) and is highly influenced by the CO_2 concentration term. Vapors analyzed for CO_2 by the CEMs system originate at the combustion front and travel through 19 to 25 ft of soil and groundwater to reach ground surface and the SVE system. CO_2 can dissolve and be transformed to carboxylic acid when bubbling through groundwater and concentrations reaching ground surface in the vapor phase are likely to have undergone significant attenuation. This attenuation is considered

insignificant during shallow testing where the combustion front is close to ground surface and overlain by minimal groundwater, but it may be significant for the deep sand combustion test.

The dissolution and transformation potential of CO is expected to be much less than that anticipated for CO_2; therefore, a CO_2 attenuation factor for the deep test can be estimated assuming conservative CO transport and the CO_2:CO ratios measured during the shallow Phase II STAR pilot test. A comparison of CO_2:CO ratios for the Phase II 'significant burn' test (shallow fill unit) versus the ratios measured during the Phase III deep sand combustion test is presented in Table 4.

Based on the average CO_2:CO ratios above, a CO_2 'correction factor' of 2.3 was applied to CO_2 concentrations input into the mass destroyed calculation. Using the corrected CO_2 concentrations, the peak mass destruction rate observed during the deep sand unit combustion test was 14.6 kg/hr and the cumulative mass destroyed was 1858 kg.

Assuming that: 1) the combustion front passed entirely though a cylinder of material of 10 ft in diameter and 6 ft high (consistent with thermocouple data); 2) the porosity of the deep sand unit is 0.35; and 3) the coal tar free product has a unit density of 1 kg/L, then the estimated mass destroyed using the original, and 'corrected' methods described above would correspond to initial free product saturations of 4 and 8.5%, respectively within the treatment zone. These saturations are consistent with pre-characterization TarGOST® data and EVS modeling of the Site to date.

Table 5 presents BTEX and VOC constituents in vapors collected during the Deep Sand Unit Pilot Test. Similar to the previous pilot testing results, the high volatility constituents of coal tar were observed in the collected vapors. Compounds detected include benzene, toluene, ethylbenzene, and xylenes, 1,2,4-trimethylbenzene, 1,2-dichloroethane, 1,3,5-trimethylbenzene, 1,3-butadiene, 4-ethyltoluene, acetone, chloromethane, cyclohexane, heptane, hexane, octane, pentane, and styrene. Emitted vapors (i.e., 'stack samples') indicated compliance with the EIPT permit for the pilot test.

The vapor phase samples collected from SP-101 (pre-treatment) on 3 October 2012 and 5 October 2012 correspond to the period of deep sand combustion. Using the SVE system extraction rate of 1500 scfm and by extrapolating the results of these two samples over the course of the deep sand combustion period, the estimated mass of volatile compounds emitted as vapors and captured by the SVE system during the deep sand combustion test is approximately 28.3 kg. Therefore, the ratio of mass of volatiles emitted to mass destroyed via combustion ranges from approximately 1:30 to 1:66 for the two estimates of the mass destroyed, respectively, that was presented above. The Phase II 'significant burn' test resulted in a mass emitted to mass destroyed ratio of 1:161; therefore, the Phase III deep sand test showed a greater volatile mass loading relative to the mass of coal tar destroyed. This is likely attributed to the increased depth of the test and the passage of injected air / combustion gases through the free

product that was above the treatment zone as well as more than 20 feet of coal tar-impacted groundwater. In essence, the air injection will act as an air sparging system of the deep sand, Meadow Mat, and shallow fill units and strip out any volatiles above the deep sand test area. The increase in volatile mass loading would also be exacerbated by differences in coal tar composition between the deep sand and the shallow fill if the composition of coal tar free product in the deep sand unit contains a greater proportion of 'light' hydrocarbons.

5.4 Post-STAR Characterization

Post-characterization of the pilot test was performed in two mobilizations. Soil cores were collected from the pilot test areas on October 12 to 14, 2012 and TarGOST borings and additional soil cores were collected January 22 and 23, 2013.

5.4.1 Shallow Fill Unit

Figure 3 shows the locations of soil cores collected following the completion of the shallow fill unit combustion test. In total, 10 TarGOST® profiles and 13 soil cores were collected within the PTA from the shallow fill unit with the greatest number of samples collected within the thermocouple monitoring network of IP-2. The post characterization program was intended to characterize the results of the premature ignition event during the shallow fill combustion test. A total of 34 soil samples were collected from the soil cores from the shallow fill unit for chemical analysis.

Analytical Assessment of Post-STAR Soil Quality

Table 6a presents analytical results for soils collected from the shallow fill unit at the conclusion of the pilot test for the depth intervals specified in the table and at the locations indicated on Figure 3. In total, 34 samples were collected for laboratory analysis from within the shallow fill unit. None of the samples collected from the shallow fill unit were determined to be definitively within STAR treatment zones; therefore, no significant concentration reductions resulting from STAR operation can be inferred from the data.

TarGOST® profiles from the 10 shallow fill unit locations indicated on Figure 3 are presented in Appendix D in addition to TarGOST® profiles of the pre-characterization locations TGB-D22, TGB-D21, TGB-C22, TGB-C21 (originally presented in the 2011 DGI report [Geosyntec 2012c]). Inspection of the pre- and post-characterization TarGOST® profiles does not identify any significant effects of STAR treatment in the shallow fill unit.

5.4.2 Deep Sand Unit

Figure 4 show the locations of soil cores and TarGOST® profiles collected following the completion of the deep sand unit combustion test. In total, 9 soil cores and 4 TarGOST® profiles were collected within the PTA with the greatest number of samples collected within the

thermocouple monitoring network of IP-5. A total of 27 soil samples were collected from the soil cores from the deep sand unit for chemical analysis.

Visual Assessment of Post-STAR Soil Quality

Figures 12a, 12b and, 12c, present photographic comparisons of soils collected from the deep sand unit within the PTA both 'before' and 'after' the deep sand unit combustion test. In all three figures, the pre-pilot photograph was taken of the IP-5 core at three different depth intervals corresponding to the zone of treatment. Figure 12a compares the IP-5 core with the B-4-2012 core at a depth of 23 to 25 ft bgs collected adjacent to TC-75 (see inset plan view map in Figure); whereas Figures 12b and 12c compare IP-5 photographs with the B-6-2012 core at 24 to 25 ft bgs and the B-7-2012 core at 24 to 25 ft bgs collected adjacent to TC-78 and IP-5 / TC-68, respectively. In each case, the 'Before' photographs show core barrels containing black, viscous coal tar and sand impacted with free product. The 'After' photographs show no signs of visible contamination and no free product. These results are consistent throughout the various cores across the six-foot treatment thickness and are similar in appearance to those collected following the Phase I and II pilot tests.

Analytical Assessment of Post-STAR Soil Quality

Table 6b presents analytical results for soils collected from the deep sand unit at the conclusion of the pilot test for the depth intervals specified in the table and at the locations indicated on Figure 4. In total, 27 samples were collected from the deep sand unit for laboratory analysis including 14 samples within the deep sand treatment zone corresponding to 20.7 to 26.7 ft bgs and within 12 feet of IP-5.

Analytical results for the 14 treatment zone samples were compared to the eight (8) pre-pilot soils concentrations in Table 2 that correspond to the same depth interval (seven samples collected from IP-5 and one sample collected from TC-72-2012). In summary, coal tar concentrations were reduced from an average total EPH concentration of 18,462 mg/kg (N=8) to an average concentration of 442 mg/kg (N=14) within the deep sand treatment zone as illustrated in Table 7.

TarGOST® profiles from the 4 deep sand unit locations indicated on Figure 4 are presented in Appendix D in addition to TarGOST® profile of the pre-characterization location LCC-C5 (originally presented in the 2011 DGI report [Geosyntec 2012c]). Inspection of the pre- and post-characterization TarGOST® profiles show significant changes in the %RE values within the STAR treatment zone corresponding to 20.7 to 26.7 ft bgs with all %RE values within this interval reducing to less than 50%RE in the post-characterization TarGOST® profiles.

6 FULL SCALE IMPLEMENTATION

Pilot testing has demonstrated that STAR can be successfully applied for the removal of free product both above and below the water table. Reaction propagation is most effective during the transient growth stage associated with air injection; however, Phase III pilot testing at the Site has demonstrated that the transient growth phase in the shallow fill unit can be on the order of only a few hours, and that the 'collapse' stage results in the migration of groundwater can disrupt the smoldering process and terminate the smoldering reaction.

STAR will be implemented within the shallow fill unit using low pressure air injection and close well spacing to maximize the transient growth stage and mitigate the impacts of 'collapse'. The shallow pilot test observed combustion front propagation of approximately five feet prior to water table break through and the collapse of the combustion front. Therefore, a close well spacing on the order of ten feet would allow for overlapping reaction propagation from wells within the transient growth stage prior to collapse.

The transient growth stage in the deep sand unit lasts significantly longer than in the shallow fill unit allowing much greater propagation of the combustion reaction. Therefore, STAR will be implemented as tested within the deep treatment horizon without modification (i.e., "standard" STAR will be applied).

7 SUMMARY AND CONCLUSIONS

The Phase III pilot test was conducted in an area without sheet pile containment and involved a shallow fill unit test designed to collect additional information regarding process variability and robustness and a deep sand unit test designed to evaluate the potential application of STAR in this deeper sand layer.

The shallow fill unit combustion test demonstrated that STAR application near the water table has a relatively short transient growth phase followed by a collapse, which can disrupt the smoldering process and terminate the smoldering reaction; thus, the proximity of the water table within the shallow fill unit necessitates a low pressure / flow rate, close-well-spacing implementation strategy for STAR application within this unit.

The deep sand unit combustion test resulted in the destruction of approximately 900 kg to 1900 kg of coal tar within a six-foot treatment horizon to a radial distance of approximately 12 feet. Propagation was near uniform in the four-directions of thermocouple monitoring and proceeded at a rate of approximately two feet per day. Post-pilot soil characterization data demonstrated significant coal tar destruction with average total aromatic, total aliphatic, and total BTEX/VOC percent concentration reductions in soils on the order of 98.6%, 99.7% and 100.0%, respectively.

The pilot test objectives were met; namely, sufficient data was collected to design a full-scale application of the STAR technology at the Site. This work demonstrates that the STAR technology is suitable for the Site and that sufficient information has been collected to demonstrate how it can be applied to meet the New Jersey Technical Requirements for Site Remediation (TRSR; NJDEP, 2012). Numerous configurations for the implementation of the technology have been identified which will be evaluated in a forthcoming Remedial Action Work Plan (RAWP).

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TABLES

TABLE 1
SUMMARY OF PERMIT REQUIREMENTS FROM THE NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION
Former Pitt Consol Site, Newark, New Jersey

Phase III Environmental Improvement Pilot Test (EIPT) Permit - Permit Activity Number: EIP120001; Facility ID: 08627		
Reference Number	**Applicable Requirement**	**Notes**
CD1 Activated Carbon Adsorption Vessel		
1	The permittee shall maintain records of carbon unit operations	Condition met; Measurements of carbon influent and effluent concentrations, temperatures, pressures, and flow rates recorded during Phase 3 operation
OS Summary		
1	The EIPT Permit is valid for 90 days only	Condition met; System operated for 14 days during Phase 3
2	The EIPT permit pertains to emissions of air contaminant only	Condition met
3	Applicant shall comply with all terms and conditions of any Administrative Consent Order	Condition met
4	Upon completion of the Environmental Improvement Pilot Test, the equipment involved shall cease operation, or shall return to operating under conditions of the existing permit, if any	Condition met
5	The equipment must not cause any air contamination that will be injurious to human health and the environment except in areas over which the owner or operator has exclusive use or occupency	Condition met
6	Records must be kept of run time, emission testing performed, etc.	Condition met
7	There shall be no visible emissions (opacity testing) except for a period of not longer that 3 minutes in any consecutive thirty minute period	Condition met
8	<= 1 Billable Compliance Inspections over life of Operating Certificate	Condition met

TABLE 2a
PRE-PILOT SOIL CONCENTRATIONS - SHALLOW FILL UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	IP-1-2012	IP-1-2012	IP-1-2012	IP-2-2012	IP-2-2012	IP-2-2012	IP-3-2012	IP-3-2012
Date Sampled	01-Jun-12	01-Jun-12	01-Jun-12	05-Jun-12	05-Jun-12	05-Jun-12	05-Jun-12	05-Jun-12
Depth Interval (ft bgs)	4.2-4.7	7.2-7.7	8.7-9.2	4.69-5.19	7.19-7.69	8.19-8.69	3.81-4.31	4.31-4.81
STAR Treatment Zone	N	N	N	N	N	N	N	N
Duplicate	--	--	--	--	--	--	--	--
Volatile Organic Compounds (mg/kg)								
1,1,1-Trichloroethane	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	--	--	--	--	--	--	--	--
1,2-Dibromoethane	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--	--	--	--
2-Butanone (MEK)	--	--	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--	--	--
Acetone	--	--	--	--	--	--	--	--
Benzene	--	--	--	--	--	--	--	--
Bromochloromethane	--	--	--	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--	--	--	--
Bromoform	--	--	--	--	--	--	--	--
Carbon disulfide	--	--	--	--	--	--	--	--
Carbon tetrachloride	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	--	--	--	--	--	--
Chloroethane	--	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--	--
Chloromethane	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--
Dibromochloromethane	--	--	--	--	--	--	--	--
Dichloromethane (Methylene chloride)	--	--	--	--	--	--	--	--
Ethyl benzene	--	--	--	--	--	--	--	--
Methyl Bromide	--	--	--	--	--	--	--	--
Methyl isobutyl ketone	--	--	--	--	--	--	--	--
Styrene	--	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--
Vinyl chloride	--	--	--	--	--	--	--	--
Xylenes (unspecified)	--	--	--	--	--	--	--	--
Semi-Volatile Organic Compounds(mg/kg)								
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	--	--	--	--	--	--	--	--
2,4-Dichlorophenol	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	--	--	--	--	--	--	--	--
2,4-Dinitrotoluene	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	--	--	--	--	--	--	--	--
2-Chloronaphthalene	--	--	--	--	--	--	--	--
2-Chlorophenol	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--	--
2-Methylphenol	--	--	--	--	--	--	--	--
2-Nitroaniline	--	--	--	--	--	--	--	--
2-Nitrophenol	--	--	--	--	--	--	--	--
3,3-Dichlorobenzidine	--	--	--	--	--	--	--	--
3-Nitroaniline	--	--	--	--	--	--	--	--
4,6-Dinitro-2-methylphenol	--	--	--	--	--	--	--	--
4-Bromophenyl-phenylether	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	--	--	--	--	--	--	--	--
4-Chloroaniline	--	--	--	--	--	--	--	--
4-Chlorophenyl-phenylether	--	--	--	--	--	--	--	--
4-Methylphenol	--	--	--	--	--	--	--	--
4-Nitroaniline	--	--	--	--	--	--	--	--
4-Nitrophenol	--	--	--	--	--	--	--	--
Acenaphthene	--	--	--	--	--	--	--	--
Acenaphthylene	--	--	--	--	--	--	--	--
Anthracene	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	--	--	--	--	--	--	--	--
Bis(2-Chloro-1-methylethyl)Ether	--	--	--	--	--	--	--	--
bis(2-Chloroethoxy) methane	--	--	--	--	--	--	--	--
bis(2-Chloroethyl) ether	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	--	--	--	--	--	--	--	--
Butylbenzylphthalate	--	--	--	--	--	--	--	--
Carbazole	--	--	--	--	--	--	--	--
Chrysene	--	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	--	--	--	--	--	--	--	--
Dibenzofuran	--	--	--	--	--	--	--	--
Diethylphthalate	--	--	--	--	--	--	--	--
Dimethylphthalate	--	--	--	--	--	--	--	--
Di-n-butylphthalate	--	--	--	--	--	--	--	--
Di-n-octylphthalate	--	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	--	--	--	--
Fluorene	--	--	--	--	--	--	--	--
Hexachlorobenzene	--	--	--	--	--	--	--	--
Hexachlorobutadiene	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	--	--	--	--	--	--	--	--
Hexachloroethane	--	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--	--	--
Isophorone	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--	--
Nitrobenzene	--	--	--	--	--	--	--	--
N-Nitroso-di-n-propylamine	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine/Diphenylamine	--	--	--	--	--	--	--	--
Pentachlorophenol	--	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--
Polychlorinated naphthalene-2	--	--	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--	--	--
Extractable Petroleum Hydrocarbons (mg/kg)								
C10-C12 AROMATICS	**1,300 J**	**3,000 J**	**160**	**2,000 J**	**2,200 J**	**770 J**	**940 J**	**1,600 J**
C12-C16 ALIPHATICS	**1,000**	**5,300**	**2,800**	**15,000**	**6,700**	**11,000**	**3,100**	**6,100**
C12-C16 AROMATICS	**1,400**	**2,200**	**3,200**	**2,900**	**2,700**	**1,400**	**1,000 J**	**2,000**
C16-C21 ALIPHATICS	**930**	**1,400**	**840**	**8,000**	**1,400**	**4,700**	**4,000**	**3,300**
C16-C21 AROMATICS	**2,700**	**6,200**	**2,400**	**5,700**	**5,700**	**5,100**	**3,300**	**6,100**
C21-C36 AROMATIC	**1,900**	**2,600**	**1,100**	**3,900**	**3,100**	**2,900**	**3,900**	**3,700**
C21-C40 ALIPHATICS	**2,700**	**1,200**	**970**	**13,000**	**1,100**	**2,300**	**8,600**	**7,000**
C9-C12 ALIPHATICS	**970**	**7,300**	**4,200**	**8,600**	**6,000**	**2,700**	**1,300**	**4,100**
TOTAL ALIPHATICS	**5,600**	**15,000**	**8,800**	**45,000**	**15,000**	**21,000**	**17,000**	**20,000**
TOTAL AROMATICS	**7,300**	**14,000**	**6,900**	**14,000**	**14,000**	**10,000**	**9,200**	**13,000**
TOTAL EPH	**13,000**	**29,000**	**16,000**	**59,000**	**29,000**	**31,000**	**26,000**	**34,000**

TABLE 2a
PRE-PILOT SOIL CONCENTRATIONS - SHALLOW FILL UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	IP-3-2012	IP-3-2012	IP-4-2012	IP-4-2012	IP-4-2012	IP-5-2012	IP-5-2012
Date Sampled	05-Jun-12	05-Jun-12	05-Jun-12	05-Jun-12	05-Jun-12	31-May-12	31-May-12
Depth Interval (ft bgs)	7.81-8.31	7.81-8.31	4.32-4.72	7.82-8.32	8.32-8.82	6.65-7.15	7.65-8.15
STAR Treatment Zone	N	N	N	N	N	N	N
Duplicate	--	Duplicate	--	--	--	--	--
Volatile Organic Compounds (mg/kg)							
1,1,1-Trichloroethane	--	--	--	--	--	0.15 U	0.12 U
1,1,2,2-Tetrachloroethane	--	--	--	--	--	0.15 U	0.12 U
1,1,2-Trichloroethane	--	--	--	--	--	0.15 U	0.12 U
1,1-Dichloroethane	--	--	--	--	--	0.15 U	0.12 U
1,1-Dichloroethene	--	--	--	--	--	0.15 U	0.12 U
1,2-Dibromo-3-chloropropane	--	--	--	--	--	0.3 U	0.24 U
1,2-Dibromoethane	--	--	--	--	--	0.15 U	0.12 U
1,2-Dichlorobenzene	--	--	--	--	--	0.15 U	0.12 U
1,2-Dichloroethane	--	--	--	--	--	0.15 U	0.12 U
1,2-Dichloropropane	--	--	--	--	--	0.15 U	0.12 U
1,3-Dichlorobenzene	--	--	--	--	--	0.15 U	0.12 U
1,4-Dichlorobenzene	--	--	--	--	--	0.15 U	0.12 U
2-Butanone (MEK)	--	--	--	--	--	0.6 U	0.48 U
2-Hexanone	--	--	--	--	--	0.45 U	0.36 U
Acetone	--	--	--	--	--	1.1 U	0.84 U
Benzene	--	--	--	--	--	**7.9**	**2.4**
Bromochloromethane	--	--	--	--	--	0.15 U	0.12 U
Bromodichloromethane	--	--	--	--	--	0.15 U	0.12 U
Bromoform	--	--	--	--	--	0.15 U	0.12 U
Carbon disulfide	--	--	--	--	--	0.15 U	0.12 U
Carbon tetrachloride	--	--	--	--	--	0.15 U	0.12 U
Chlorobenzene	--	--	--	--	--	**0.22 J**	**0.12 J**
Chloroethane	--	--	--	--	--	0.3 U	0.24 U
Chloroform	--	--	--	--	--	0.15 U	0.12 U
Chloromethane	--	--	--	--	--	0.3 U	0.24 U
cis-1,2-Dichloroethene	--	--	--	--	--	0.15 U	0.12 U
cis-1,3-Dichloropropene	--	--	--	--	--	0.15 U	0.12 U
Dibromochloromethane	--	--	--	--	--	0.15 U	0.12 U
Dichloromethane (Methylene chloride)	--	--	--	--	--	0.3 U	0.24 U
Ethyl benzene	--	--	--	--	--	**20**	**9.7**
Methyl Bromide	--	--	--	--	--	0.3 U	0.24 U
Methyl isobutyl ketone	--	--	--	--	--	0.45 U	0.36 U
Styrene	--	--	--	--	--	0.15 U	0.12 U
Tetrachloroethene	--	--	--	--	--	0.15 U	0.12 U
Toluene	--	--	--	--	--	**40**	**19**
trans-1,2-Dichloroethene	--	--	--	--	--	0.15 U	0.12 U
trans-1,3-Dichloropropene	--	--	--	--	--	0.15 U	0.12 U
Trichloroethene	--	--	--	--	--	0.15 U	0.12 U
Vinyl chloride	--	--	--	--	--	0.15 U	0.12 U
Xylenes (unspecified)	--	--	--	--	--	**120**	**61**
Semi-Volatile Organic Compounds(mg/kg)							
1,2,4-Trichlorobenzene	--	--	--	--	--	0.44 U	0.43 U
2,4,5-Trichlorophenol	--	--	--	--	--	0.44 U	0.43 U
2,4,6-Trichlorophenol	--	--	--	--	--	0.44 U	0.43 U
2,4-Dichlorophenol	--	--	--	--	--	0.44 U	0.43 U
2,4-Dimethylphenol	--	--	--	--	--	**20**	**20**
2,4-Dinitrophenol	--	--	--	--	--	7.8 U	7.8 U
2,4-Dinitrotoluene	--	--	--	--	--	1.7 U	1.7 U
2,6-Dinitrotoluene	--	--	--	--	--	0.44 U	0.43 U
2-Chloronaphthalene	--	--	--	--	--	--	--
2-Chlorophenol	--	--	--	--	--	0.44 U	0.43 U
2-Methylnaphthalene	--	--	--	--	--	**680**	**490**
2-Methylphenol	--	--	--	--	--	**14**	**14**
2-Nitroaniline	--	--	--	--	--	0.44 U	0.43 U
2-Nitrophenol	--	--	--	--	--	0.44 U	0.43 U
3,3-Dichlorobenzidine	--	--	--	--	--	2.6 U	2.6 U
3-Nitroaniline	--	--	--	--	--	1.7 U	1.7 U
4,6-Dinitro-2-methylphenol	--	--	--	--	--	4.4 U	4.3 U
4-Bromophenyl-phenylether	--	--	--	--	--	0.44 U	0.43 U
4-Chloro-3-methylphenol	--	--	--	--	--	0.44 U	0.43 U
4-Chloroaniline	--	--	--	--	--	0.44 U	0.43 U
4-Chlorophenyl-phenylether	--	--	--	--	--	0.44 U	0.43 U
4-Methylphenol	--	--	--	--	--	**23**	**20**
4-Nitroaniline	--	--	--	--	--	1.7 U	1.7 U
4-Nitrophenol	--	--	--	--	--	4.4 U	4.3 U
Acenaphthene	--	--	--	--	--	**380**	**270**
Acenaphthylene	--	--	--	--	--	**34**	**27**
Anthracene	--	--	--	--	--	**330**	**200**
Benzo(a)anthracene	--	--	--	--	--	**81**	**49**
Benzo(a)pyrene	--	--	--	--	--	**45**	**28**
Benzo(b)fluoranthene	--	--	--	--	--	**50**	**29**
Benzo(g,h,i)perylene	--	--	--	--	--	**22**	**13**
Benzo(k)fluoranthene	--	--	--	--	--	**21**	**15**
Bis(2-Chloro-1-methylethyl)Ether	--	--	--	--	--	0.44 U	0.43 U
bis(2-Chloroethoxy) methane	--	--	--	--	--	0.44 U	0.43 U
bis(2-Chloroethyl) ether	--	--	--	--	--	0.44 U	0.43 U
bis(2-Ethylhexyl) phthalate	--	--	--	--	--	1.7 U	1.7 U
Butylbenzylphthalate	--	--	--	--	--	1.7 U	1.7 U
Carbazole	--	--	--	--	--	**150**	**94**
Chrysene	--	--	--	--	--	**68**	**44**
Dibenzo(a,h)anthracene	--	--	--	--	--	**6.8**	**3.8**
Dibenzofuran	--	--	--	--	--	**320**	**230**
Diethylphthalate	--	--	--	--	--	1.7 U	1.7 U
Dimethylphthalate	--	--	--	--	--	1.7 U	1.7 U
Di-n-butylphthalate	--	--	--	--	--	1.7 U	1.7 U
Di-n-octylphthalate	--	--	--	--	--	1.7 U	1.7 U
Fluoranthene	--	--	--	--	--	**350**	**250**
Fluorene	--	--	--	--	--	**380**	**270**
Hexachlorobenzene	--	--	--	--	--	0.087 U	0.086 U
Hexachlorobutadiene	--	--	--	--	--	0.44 U	0.43 U
Hexachlorocyclopentadiene	--	--	--	--	--	4.4 U	4.3 U
Hexachloroethane	--	--	--	--	--	0.87 U	0.86 U
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	**19**	**12**
Isophorone	--	--	--	--	--	0.44 U	0.43 U
Naphthalene	--	--	--	--	--	**2,700**	**2,100**
Nitrobenzene	--	--	--	--	--	0.44 U	0.43 U
N-Nitroso-di-n-propylamine	--	--	--	--	--	0.44 U	0.43 U
N-Nitrosodiphenylamine/Diphenylamine	--	--	--	--	--	0.44 U	0.43 U
Pentachlorophenol	--	--	--	--	--	0.87 U	0.86 U
Phenanthrene	--	--	--	--	--	**810**	**590**
Phenol	--	--	--	--	--	**21**	**14**
Polychlorinated naphthalene-2	--	--	--	--	--	0.18 U	0.18 U
Pyrene	--	--	--	--	--	**230**	**160**
Extractable Petroleum Hydrocarbons (mg/kg)							
C10-C12 AROMATICS	**890 J**	**1,200 J**	88 U	**2,600 J**	**1,600 J**	**1,700 J**	**270 J**
C12-C16 ALIPHATICS	**9,300**	**5,400**	**840**	**5,600**	**5,000**	**2,300**	**1,600**
C12-C16 AROMATICS	**1,100**	**1,500**	**360**	**2,800**	**1,700**	**1,300**	**3,900**
C16-C21 ALIPHATICS	**4,800**	**3,900**	**1,600**	**1,700**	**1,300**	**1,300**	**500**
C16-C21 AROMATICS	**3,000**	**2,800**	**1,300**	**5,300**	**3,700**	**2,500**	**3,500**
C21-C36 AROMATIC	**2,300**	**1,200**	**570**	**2,400**	**1,600**	**1,400**	**1,900**
C21-C40 ALIPHATICS	**10,000**	**9,700**	**1,900**	**2,200**	**1,300**	**2,400**	**470**
C9-C12 ALIPHATICS	**5,100**	**3,800**	**92**	**4,900**	**3,900**	**2,700**	**2,200**
TOTAL ALIPHATICS	**29,000**	**23,000**	**4,400**	**14,000**	**12,000**	**8,700**	**4,700**
TOTAL AROMATICS	**7,300**	**6,700**	**2,300**	**13,000**	**8,700**	**6,800**	**9,600**
TOTAL EPH	**37,000**	**29,000**	**6,700**	**28,000**	**20,000**	**16,000**	**14,000**

TABLE 2a
PRE-PILOT SOIL CONCENTRATIONS - SHALLOW FILL UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012	TC-15-2012	TC-15-2012
Date Sampled	31-May-12	31-May-12	31-May-12	31-May-12	31-May-12	12-Jun-12	12-Jun-12
Depth Interval (ft bgs)	8.65-9.15	11.35-11.85	12.65-13.15	13.65-14.15	13.65-14.15	4.17-4.67	7.17-7.67
STAR Treatment Zone	N	N	N	N	N	N	N
Duplicate	--	--	--	--	Duplicate	--	--
Volatile Organic Compounds (mg/kg)							
1,1,1-Trichloroethane	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
1,1,2,2-Tetrachloroethane	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
1,1,2-Trichloroethane	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
1,1-Dichloroethane	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
1,1-Dichloroethene	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
1,2-Dibromo-3-chloropropane	0.31 U	0.24 U	0.2 U	0.23 U	0.21 U	--	--
1,2-Dibromoethane	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
1,2-Dichlorobenzene	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
1,2-Dichloroethane	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
1,2-Dichloropropane	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
1,3-Dichlorobenzene	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
1,4-Dichlorobenzene	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
2-Butanone (MEK)	0.61 U	0.47 U	0.39 U	0.47 U	0.43 U	--	--
2-Hexanone	0.46 U	0.35 U	0.29 U	0.35 U	0.32 U	--	--
Acetone	1.1 U	0.83 U	0.68 U	0.82 U	0.75 U	--	--
Benzene	**4.5**	**0.29 J**	**13**	**0.74**	**2.8**	--	--
Bromochloromethane	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Bromodichloromethane	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Bromoform	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Carbon disulfide	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Carbon tetrachloride	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Chlorobenzene	**0.23 J**	0.12 U	**0.25 J**	0.12 U	0.11 U	--	--
Chloroethane	0.31 U	0.24 U	0.2 U	0.23 U	0.21 U	--	--
Chloroform	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Chloromethane	0.31 U	0.24 U	0.2 U	0.23 U	0.21 U	--	--
cis-1,2-Dichloroethene	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
cis-1,3-Dichloropropene	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Dibromochloromethane	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Dichloromethane (Methylene chloride)	0.31 U	0.24 U	0.2 U	0.23 U	0.21 U	--	--
Ethyl benzene	**19**	**0.47 J**	**21**	**0.91**	**4**	--	--
Methyl Bromide	0.31 U	0.24 U	0.2 U	0.23 U	0.21 U	--	--
Methyl isobutyl ketone	0.46 U	0.35 U	0.29 U	0.35 U	0.32 U	--	--
Styrene	**12**	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Tetrachloroethene	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Toluene	**36**	**1.1**	**48**	**2.2**	**10**	--	--
trans-1,2-Dichloroethene	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
trans-1,3-Dichloropropene	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Trichloroethene	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Vinyl chloride	0.15 U	0.12 U	0.098 U	0.12 U	0.11 U	--	--
Xylenes (unspecified)	**120**	**2.8**	**110**	**5.5**	**23**	--	--
Semi-Volatile Organic Compounds(mg/kg)							
1,2,4-Trichlorobenzene	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
2,4,5-Trichlorophenol	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
2,4,6-Trichlorophenol	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
2,4-Dichlorophenol	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
2,4-Dimethylphenol	**36**	**7.6**	**93**	**24**	**21**	--	--
2,4-Dinitrophenol	7.4 U	0.38 U	3.6 U	3.5 U	3.6 U	--	--
2,4-Dinitrotoluene	1.6 U	0.083 U	0.8 U	0.79 U	0.79 U	--	--
2,6-Dinitrotoluene	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
2-Chloronaphthalene	--	--	--	--	--	--	--
2-Chlorophenol	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
2-Methylnaphthalene	**1,100**	**30**	**1,100**	**180**	**160**	--	--
2-Methylphenol	**16**	**8.7**	**48**	**14**	**12**	--	--
2-Nitroaniline	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
2-Nitrophenol	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
3,3-Dichlorobenzidine	2.5 U	0.13 U	1.2 U	1.2 U	1.2 U	--	--
3-Nitroaniline	1.6 U	0.083 U	0.8 U	0.79 U	0.79 U	--	--
4,6-Dinitro-2-methylphenol	4.1 U	0.21 U	2 U	2 U	2 U	--	--
4-Bromophenyl-phenylether	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
4-Chloro-3-methylphenol	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
4-Chloroaniline	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
4-Chlorophenyl-phenylether	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
4-Methylphenol	**22**	**13**	**52**	**17**	**15**	--	--
4-Nitroaniline	1.6 U	0.083 U	0.8 U	0.79 U	0.79 U	--	--
4-Nitrophenol	4.1 U	0.21 U	2 U	2 U	2 U	--	--
Acenaphthene	**570**	**19**	**580**	**100**	**90**	--	--
Acenaphthylene	**48**	**0.83**	**27**	**6.4**	**5.8**	--	--
Anthracene	**550**	**19**	**250**	**44**	**42**	--	--
Benzo(a)anthracene	**110**	**3.6**	**100**	**19**	**17**	--	--
Benzo(a)pyrene	**53**	**1.8**	**52**	**9.5**	**8.7**	--	--
Benzo(b)fluoranthene	**63**	**2.2**	**59**	**11**	**11**	--	--
Benzo(g,h,i)perylene	**25**	**0.82**	**24**	**4.3**	**3.9**	--	--
Benzo(k)fluoranthene	**24**	**0.71**	**24**	**4.3**	**3.7**	--	--
Bis(2-Chloro-1-methylethyl)Ether	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
bis(2-Chloroethoxy) methane	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
bis(2-Chloroethyl) ether	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
bis(2-Ethylhexyl) phthalate	1.6 U	0.083 U	0.8 U	0.79 U	0.79 U	--	--
Butylbenzylphthalate	1.6 U	0.083 U	0.8 U	0.79 U	0.79 U	--	--
Carbazole	**230**	**10**	**120**	**23**	**20**	--	--
Chrysene	**82**	**2.7**	**90**	**14**	**13**	--	--
Dibenzo(a,h)anthracene	**7.4**	**0.23**	**7.3**	**1.2**	**1.2**	--	--
Dibenzofuran	**490**	**17**	**430**	**83**	**74**	--	--
Diethylphthalate	1.6 U	0.083 U	0.8 U	0.79 U	0.79 U	--	--
Dimethylphthalate	1.6 U	0.083 U	0.8 U	0.79 U	0.79 U	--	--
Di-n-butylphthalate	1.6 U	0.083 U	0.8 U	0.79 U	0.79 U	--	--
Di-n-octylphthalate	1.6 U	0.083 U	0.8 U	0.79 U	0.79 U	--	--
Fluoranthene	**500**	**18**	**470**	**91**	**81**	--	--
Fluorene	**580**	**20**	**550**	**97**	**85**	--	--
Hexachlorobenzene	0.082 U	0.004 U	0.04 U	0.039 U	0.039 U	--	--
Hexachlorobutadiene	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
Hexachlorocyclopentadiene	4.1 U	0.21 U	2 U	2 U	2 U	--	--
Hexachloroethane	0.82 U	0.042 U	0.4 U	0.39 U	0.39 U	--	--
Indeno(1,2,3-cd)pyrene	**23**	**0.72**	**22**	**3.8**	**3.6**	--	--
Isophorone	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
Naphthalene	**4,200**	**100**	**3,800**	**690**	**600**	--	--
Nitrobenzene	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
N-Nitroso-di-n-propylamine	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
N-Nitrosodiphenylamine/Diphenylamine	0.41 U	0.021 U	0.2 U	0.2 U	0.2 U	--	--
Pentachlorophenol	0.82 U	0.042 U	0.4 U	0.39 U	0.39 U	--	--
Phenanthrene	**1,300**	**43**	**1,200**	**220**	**190**	--	--
Phenol	**13**	**17**	**42**	**19**	**16**	--	--
Polychlorinated naphthalene-2	0.17 U	0.009 U	0.084 U	0.083 U	0.083 U	--	--
Pyrene	**330**	**12**	**320**	**60**	**55**	--	--
Extractable Petroleum Hydrocarbons (mg/kg)							
C10-C12 AROMATICS	**3,400 J**	**84 J**	**650 J**	**600 J**	**560 J**	**2,200**	**4,900**
C12-C16 ALIPHATICS	**2,100**	**8.1 J**	**2,300**	**450**	**450**	**5,700**	**11,000**
C12-C16 AROMATICS	**2,600**	**98**	**9,000**	**530**	**500**	**3,100**	**4,000**
C16-C21 ALIPHATICS	**440**	**6.5 J**	**800**	**270**	**260**	**6,000**	**9,300**
C16-C21 AROMATICS	**5,500**	**220**	**7,000**	**870**	**830**	**5,700**	**6,800**
C21-C36 AROMATIC	**2,600**	**110**	**3,700**	**450**	**430**	**4,100**	**3,800**
C21-C40 ALIPHATICS	**280**	**6.1 J**	**760**	**400**	**410**	**17,000**	**23,000**
C9-C12 ALIPHATICS	**3,200**	**4.1 J**	**2,700**	**340**	**330**	**3,600**	**5,100**
TOTAL ALIPHATICS	**6,100**	**25**	**6,600**	**1,500**	**1,400**	**32,000**	**49,000**
TOTAL AROMATICS	**14,000**	**520**	**20,000**	**2,500**	**2,300**	**15,000**	**19,000**
TOTAL EPH	**20,000**	**540**	**27,000**	**3,900**	**3,800**	**47,000**	**68,000**

TABLE 2a
PRE-PILOT SOIL CONCENTRATIONS - SHALLOW FILL UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	TC-23-2012	TC-23-2012	TC-31-2012	TC-31-2012	TC-38-2012	TC-38-2012	TC-51-2012
Date Sampled	13-Jun-12	13-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	12-Jun-12	15-Jun-12
Depth Interval (ft bgs)	7.17-7.67	7.67-8.17	3.67-4.17	8.17-8.67	3.67-4.17	7.67-8.17	7.17-7.67
STAR Treatment Zone	N	N	N	N	N	N	N
Duplicate	--	--	--	--	--	--	--
Volatile Organic Compounds (mg/kg)							
1,1,1-Trichloroethane	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	--	--	--	--	--	--	--
1,2-Dibromoethane	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--	--	--
2-Butanone (MEK)	--	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--	--
Acetone	--	--	--	--	--	--	--
Benzene	--	--	--	--	--	--	--
Bromochloromethane	--	--	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--	--	--
Bromoform	--	--	--	--	--	--	--
Carbon disulfide	--	--	--	--	--	--	--
Carbon tetrachloride	--	--	--	--	--	--	--
Chlorobenzene	--	--	--	--	--	--	--
Chloroethane	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--
Chloromethane	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--
Dibromochloromethane	--	--	--	--	--	--	--
Dichloromethane (Methylene chloride)	--	--	--	--	--	--	--
Ethyl benzene	--	--	--	--	--	--	--
Methyl Bromide	--	--	--	--	--	--	--
Methyl isobutyl ketone	--	--	--	--	--	--	--
Styrene	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--
Vinyl chloride	--	--	--	--	--	--	--
Xylenes (unspecified)	--	--	--	--	--	--	--
Semi-Volatile Organic Compounds(mg/kg)							
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	--	--	--	--	--	--	--
2,4-Dichlorophenol	--	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--
2,4-Dinitrophenol	--	--	--	--	--	--	--
2,4-Dinitrotoluene	--	--	--	--	--	--	--
2,6-Dinitrotoluene	--	--	--	--	--	--	--
2-Chloronaphthalene	--	--	--	--	--	--	--
2-Chlorophenol	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	--
2-Methylphenol	--	--	--	--	--	--	--
2-Nitroaniline	--	--	--	--	--	--	--
2-Nitrophenol	--	--	--	--	--	--	--
3,3-Dichlorobenzidine	--	--	--	--	--	--	--
3-Nitroaniline	--	--	--	--	--	--	--
4,6-Dinitro-2-methylphenol	--	--	--	--	--	--	--
4-Bromophenyl-phenylether	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	--	--	--	--	--	--	--
4-Chloroaniline	--	--	--	--	--	--	--
4-Chlorophenyl-phenylether	--	--	--	--	--	--	--
4-Methylphenol	--	--	--	--	--	--	--
4-Nitroaniline	--	--	--	--	--	--	--
4-Nitrophenol	--	--	--	--	--	--	--
Acenaphthene	--	--	--	--	--	--	--
Acenaphthylene	--	--	--	--	--	--	--
Anthracene	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	--	--	--	--	--	--	--
Benzo(k)fluoranthene	--	--	--	--	--	--	--
Bis(2-Chloro-1-methylethyl)Ether	--	--	--	--	--	--	--
bis(2-Chloroethoxy) methane	--	--	--	--	--	--	--
bis(2-Chloroethyl) ether	--	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	--	--	--	--	--	--	--
Butylbenzylphthalate	--	--	--	--	--	--	--
Carbazole	--	--	--	--	--	--	--
Chrysene	--	--	--	--	--	--	--
Dibenzo(a,h)anthracene	--	--	--	--	--	--	--
Dibenzofuran	--	--	--	--	--	--	--
Diethylphthalate	--	--	--	--	--	--	--
Dimethylphthalate	--	--	--	--	--	--	--
Di-n-butylphthalate	--	--	--	--	--	--	--
Di-n-octylphthalate	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	--	--	--
Fluorene	--	--	--	--	--	--	--
Hexachlorobenzene	--	--	--	--	--	--	--
Hexachlorobutadiene	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	--	--	--	--	--	--	--
Hexachloroethane	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--	--
Isophorone	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	--	--
Nitrobenzene	--	--	--	--	--	--	--
N-Nitroso-di-n-propylamine	--	--	--	--	--	--	--
N-Nitrosodiphenylamine/Diphenylamine	--	--	--	--	--	--	--
Pentachlorophenol	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--
Polychlorinated naphthalene-2	--	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--	--
Extractable Petroleum Hydrocarbons (mg/kg)							
C10-C12 AROMATICS	**3,700**	**2,600**	**1,900**	**5,600**	**1,100**	**7,200**	**2,200**
C12-C16 ALIPHATICS	**11,000**	**19,000**	**9,700**	**10,000**	**2,800**	**17,000**	**4,000**
C12-C16 AROMATICS	**3,900**	**32,000**	**3,100**	**3,900**	**2,000**	**5,800**	**2,000**
C16-C21 ALIPHATICS	**7,300**	**4,800**	**7,900**	**3,900**	**4,200**	**14,000**	**2,000**
C16-C21 AROMATICS	**8,700**	**26,000**	**6,700**	**6,200**	**6,500**	**9,600**	**4,900**
C21-C36 AROMATIC	**4,300**	**15,000**	**4,600**	**3,300**	**5,600**	**5,200**	**3,700**
C21-C40 ALIPHATICS	**13,000**	**7,600**	**23,000**	**7,100**	**14,000**	**30,000**	**5,300**
C9-C12 ALIPHATICS	**12,000**	**26,000**	**6,800**	**13,000**	**1,000**	**11,000**	**4,400**
TOTAL ALIPHATICS	**43,000**	**58,000**	**48,000**	**35,000**	**22,000**	**71,000**	**16,000**
TOTAL AROMATICS	**21,000**	**75,000**	**16,000**	**19,000**	**15,000**	**28,000**	**13,000**
TOTAL EPH	**64,000**	**130,000**	**64,000**	**54,000**	**37,000**	**99,000**	**28,000**

TABLE 2a
PRE-PILOT SOIL CONCENTRATIONS - SHALLOW FILL UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	TC-51-2012	TC-52-2012	TC-52-2012	TC-8-2012	TC-8-2012
Date Sampled	15-Jun-12	15-Jun-12	15-Jun-12	15-Jun-12	15-Jun-12
Depth Interval (ft bgs)	8.67-9.17	7.17-7.67	8.17-8.67	4.17-4.67	8.17-8.67
STAR Treatment Zone	N	N	N	N	N
Duplicate	--	--	--	--	--
Volatile Organic Compounds (mg/kg)					
1,1,1-Trichloroethane	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--
1,2-Dibromo-3-chloropropane	--	--	--	--	--
1,2-Dibromoethane	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--
2-Butanone (MEK)	--	--	--	--	--
2-Hexanone	--	--	--	--	--
Acetone	--	--	--	--	--
Benzene	--	--	--	--	--
Bromochloromethane	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--
Bromoform	--	--	--	--	--
Carbon disulfide	--	--	--	--	--
Carbon tetrachloride	--	--	--	--	--
Chlorobenzene	--	--	--	--	--
Chloroethane	--	--	--	--	--
Chloroform	--	--	--	--	--
Chloromethane	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--
Dibromochloromethane	--	--	--	--	--
Dichloromethane (Methylene chloride)	--	--	--	--	--
Ethyl benzene	--	--	--	--	--
Methyl Bromide	--	--	--	--	--
Methyl isobutyl ketone	--	--	--	--	--
Styrene	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--
Toluene	--	--	--	--	--
trans-1,2-Dichloroethene	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	--	--
Trichloroethene	--	--	--	--	--
Vinyl chloride	--	--	--	--	--
Xylenes (unspecified)	--	--	--	--	--
Semi-Volatile Organic Compounds(mg/kg)					
1,2,4-Trichlorobenzene	--	--	--	--	--
2,4,5-Trichlorophenol	--	--	--	--	--
2,4,6-Trichlorophenol	--	--	--	--	--
2,4-Dichlorophenol	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--
2,4-Dinitrophenol	--	--	--	--	--
2,4-Dinitrotoluene	--	--	--	--	--
2,6-Dinitrotoluene	--	--	--	--	--
2-Chloronaphthalene	--	--	--	--	--
2-Chlorophenol	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--
2-Methylphenol	--	--	--	--	--
2-Nitroaniline	--	--	--	--	--
2-Nitrophenol	--	--	--	--	--
3,3-Dichlorobenzidine	--	--	--	--	--
3-Nitroaniline	--	--	--	--	--
4,6-Dinitro-2-methylphenol	--	--	--	--	--
4-Bromophenyl-phenylether	--	--	--	--	--
4-Chloro-3-methylphenol	--	--	--	--	--
4-Chloroaniline	--	--	--	--	--
4-Chlorophenyl-phenylether	--	--	--	--	--
4-Methylphenol	--	--	--	--	--
4-Nitroaniline	--	--	--	--	--
4-Nitrophenol	--	--	--	--	--
Acenaphthene	--	--	--	--	--
Acenaphthylene	--	--	--	--	--
Anthracene	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--
Benzo(a)pyrene	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--
Benzo(g,h,i)perylene	--	--	--	--	--
Benzo(k)fluoranthene	--	--	--	--	--
Bis(2-Chloro-1-methylethyl)Ether	--	--	--	--	--
bis(2-Chloroethoxy) methane	--	--	--	--	--
bis(2-Chloroethyl) ether	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	--	--	--	--	--
Butylbenzylphthalate	--	--	--	--	--
Carbazole	--	--	--	--	--
Chrysene	--	--	--	--	--
Dibenzo(a,h)anthracene	--	--	--	--	--
Dibenzofuran	--	--	--	--	--
Diethylphthalate	--	--	--	--	--
Dimethylphthalate	--	--	--	--	--
Di-n-butylphthalate	--	--	--	--	--
Di-n-octylphthalate	--	--	--	--	--
Fluoranthene	--	--	--	--	--
Fluorene	--	--	--	--	--
Hexachlorobenzene	--	--	--	--	--
Hexachlorobutadiene	--	--	--	--	--
Hexachlorocyclopentadiene	--	--	--	--	--
Hexachloroethane	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	--	--
Isophorone	--	--	--	--	--
Naphthalene	--	--	--	--	--
Nitrobenzene	--	--	--	--	--
N-Nitroso-di-n-propylamine	--	--	--	--	--
N-Nitrosodiphenylamine/Diphenylamine	--	--	--	--	--
Pentachlorophenol	--	--	--	--	--
Phenanthrene	--	--	--	--	--
Phenol	--	--	--	--	--
Polychlorinated naphthalene-2	--	--	--	--	--
Pyrene	--	--	--	--	--
Extractable Petroleum Hydrocarbons (mg/kg)					
C10-C12 AROMATICS	**5,100**	**2,300**	**2,500**	**1,100**	**1,700**
C12-C16 ALIPHATICS	**11,000**	**11,000**	**4,100**	**6,300**	**5,800**
C12-C16 AROMATICS	**4,600**	**2,100**	**2,000**	**1,400**	**1,600**
C16-C21 ALIPHATICS	**1,700**	**3,000**	**1,000**	**2,400**	**1,900**
C16-C21 AROMATICS	**10,000**	**5,700**	**4,000**	**3,800**	**4,200**
C21-C36 AROMATIC	**5,800**	**3,800**	**2,500**	**3,400**	**3,100**
C21-C40 ALIPHATICS	**2,300**	**5,400**	**1,600**	**5,800**	**3,600**
C9-C12 ALIPHATICS	**15,000**	**14,000**	**5,300**	**6,200**	**6,600**
TOTAL ALIPHATICS	**30,000**	**33,000**	**12,000**	**21,000**	**18,000**
TOTAL AROMATICS	**26,000**	**14,000**	**11,000**	**9,700**	**11,000**
TOTAL EPH	**56,000**	**47,000**	**23,000**	**30,000**	**28,000**

Notes:
mg/kg - milligrams per kilogram
ft bgs - feet below ground surface
U - Analyte not detected above quantitation l
J - estimated concentration
R - rejected result
Bold values indicated detections

TABLE 2b
PRE-PILOT SOIL CONCENTRATIONS - DEEP SAND UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012
Date Sampled	31-May-12	31-May-12	31-May-12	31-May-12	01-Jun-12	01-Jun-12	01-Jun-12
Depth Interval (ft bgs)	14.65-15.15	15.35-15.85	16.65-17.15	17.65-18.15	21.65-22.15	22.65-23.15	23.65-24.15
STAR Treatment Zone	N	N	N	N	Y	Y	Y
Duplicate	--	--	--	--	--	--	--
Volatile Organic Compounds (mg/kg)							
1,1,1-Trichloroethane	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
1,1,2,2-Tetrachloroethane	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
1,1,2-Trichloroethane	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
1,1-Dichloroethane	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
1,1-Dichloroethene	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
1,2-Dibromo-3-chloropropane	0.24 U	0.25 U	0.26 U	0.21 U	120 U	110 U	23 U
1,2-Dibromoethane	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
1,2-Dichlorobenzene	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
1,2-Dichloroethane	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
1,2-Dichloropropane	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
1,3-Dichlorobenzene	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
1,4-Dichlorobenzene	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
2-Butanone (MEK)	0.48 U	0.49 U	0.51 U	0.42 U	250 U	220 U	47 U
2-Hexanone	0.36 U	0.37 U	0.38 U	0.31 U	190 U	170 U	35 U
Acetone	0.84 U	0.87 U	0.89 U	0.73 U	430 U	390 U	82 U
Benzene	**16**	**4.1**	**5.3**	**2.7**	31 U	28 U	**6.4 J**
Bromochloromethane	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Bromodichloromethane	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Bromoform	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Carbon disulfide	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Carbon tetrachloride	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Chlorobenzene	**0.36 J**	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Chloroethane	0.24 U	0.25 U	0.26 U	0.21 U	120 U	110 U	23 U
Chloroform	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Chloromethane	0.24 U	0.25 U	0.26 U	0.21 U	120 U	110 U	23 U
cis-1,2-Dichloroethene	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
cis-1,3-Dichloropropene	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Dibromochloromethane	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Dichloromethane (Methylene chloride)	0.24 U	0.25 U	0.26 U	0.21 U	120 U	110 U	23 U
Ethyl benzene	**30**	**7.5**	**8.2**	**4.4**	62 U	56 U	**22 J**
Methyl Bromide	0.24 U	0.25 U	0.26 U	0.21 U	120 U	110 U	23 U
Methyl isobutyl ketone	0.36 U	0.37 U	0.38 U	0.31 U	190 U	170 U	35 U
Styrene	0.12 U	0.12 U	**2.3**	**1.5**	62 U	56 U	12 U
Tetrachloroethene	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Toluene	**60**	**17**	**21**	**11**	62 U	56 U	**38 J**
trans-1,2-Dichloroethene	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
trans-1,3-Dichloropropene	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Trichloroethene	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Vinyl chloride	0.12 U	0.12 U	0.13 U	0.1 U	62 U	56 U	12 U
Xylenes (unspecified)	**160**	**45**	**47**	**25**	62 U	56 U	**89**
Semi-Volatile Organic Compounds(mg/kg)							
1,2,4-Trichlorobenzene	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
2,4,5-Trichlorophenol	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
2,4,6-Trichlorophenol	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
2,4-Dichlorophenol	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
2,4-Dimethylphenol	**16**	**12**	**25**	**7.7**	**5.8**	**3.5**	0.21 U
2,4-Dinitrophenol	3.5 U	3.6 U	3.9 U	3.6 U	3.8 U	3.6 U	3.7 U
2,4-Dinitrotoluene	0.78 U	0.81 U	0.86 U	0.8 U	0.84 U	0.8 U	0.83 U
2,6-Dinitrotoluene	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
2-Chloronaphthalene	--	--	--	--	--	--	--
2-Chlorophenol	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
2-Methylnaphthalene	**390**	**360**	**480**	**180**	**150**	**170**	**1,100**
2-Methylphenol	**4.1**	**3**	**4.5**	**1.5**	**2.1**	**1.6**	**1.4**
2-Nitroaniline	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
2-Nitrophenol	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
3,3-Dichlorobenzidine	1.2 U	1.2 U	1.3 U	1.2 U	1.3 U	1.2 U	1.2 U
3-Nitroaniline	0.78 U	0.81 U	0.86 U	0.8 U	0.84 U	0.8 U	0.83 U
4,6-Dinitro-2-methylphenol	2 U	2 U	2.2 U	2 U	2.1 U	2 U	2.1 U
4-Bromophenyl-phenylether	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
4-Chloro-3-methylphenol	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
4-Chloroaniline	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
4-Chlorophenyl-phenylether	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
4-Methylphenol	**4.3**	**3.3**	**4.9**	**1.7**	**2.6**	**1.9**	0.21 U
4-Nitroaniline	0.78 U	0.81 U	0.86 U	0.8 U	0.84 U	0.8 U	0.83 U
4-Nitrophenol	2 U	2 U	2.2 U	2 U	2.1 U	2 U	2.1 U
Acenaphthene	**210**	**200**	**250**	**91**	**75**	**82**	**550**
Acenaphthylene	**13**	**13**	**25**	**11**	**9**	**8**	**28**
Anthracene	**110**	**95**	**130**	**50**	**47**	**45**	**260**
Benzo(a)anthracene	**42**	**39**	**57**	**21**	**20**	**17**	**120**
Benzo(a)pyrene	**21**	**19**	**30**	**12**	**11**	**9.5**	**35**
Benzo(b)fluoranthene	**23**	**23**	**32**	**13**	**11**	**9.9**	**38**
Benzo(g,h,i)perylene	**9.6**	**8.8**	**14**	**5.3**	**5.1**	**4.4**	**16**
Benzo(k)fluoranthene	**12**	**8.4**	**14**	**4.6**	**5.9**	**5.1**	**16**
Bis(2-Chloro-1-methylethyl)Ether	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
bis(2-Chloroethoxy) methane	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
bis(2-Chloroethyl) ether	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
bis(2-Ethylhexyl) phthalate	0.78 U	0.81 U	0.86 U	0.8 U	0.84 U	0.8 U	0.83 U
Butylbenzylphthalate	0.78 U	0.81 U	0.86 U	0.8 U	0.84 U	0.8 U	0.83 U
Carbazole	**47**	**42**	**55**	**21**	**19**	**18**	**98**
Chrysene	**33**	**28**	**42**	**16**	**15**	**15**	**110**
Dibenzo(a,h)anthracene	**2.1 J**	**2.6**	**4.1**	**1.6**	**1.3**	**1**	**3.6**
Dibenzofuran	**180**	**160**	**210**	**75**	**60**	**66**	**430**
Diethylphthalate	0.78 U	0.81 U	0.86 U	0.8 U	0.84 U	0.8 U	0.83 U
Dimethylphthalate	0.78 U	0.81 U	0.86 U	0.8 U	0.84 U	0.8 U	0.83 U
Di-n-butylphthalate	0.78 U	0.81 U	0.86 U	0.8 U	0.84 U	0.8 U	0.83 U
Di-n-octylphthalate	0.78 U	0.81 U	0.86 U	0.8 U	0.84 U	0.8 U	0.83 U
Fluoranthene	**190**	**180**	**250**	**94**	**76**	**83**	**550**
Fluorene	**200**	**190**	**250**	**90**	**73**	**79**	**520**
Hexachlorobenzene	0.039 U	0.04 U	0.043 U	0.04 U	0.042 U	0.04 U	0.042 U
Hexachlorobutadiene	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
Hexachlorocyclopentadiene	2 U	2 U	2.2 U	2 U	2.1 U	2 U	2.1 U
Hexachloroethane	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.42 U
Indeno(1,2,3-cd)pyrene	**8.8**	**8.1**	**13**	**4.7**	**4.4**	**3.7**	**15**
Isophorone	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
Naphthalene	**1,400**	**1,300**	**1,700**	**610**	**480**	**560**	**3,600**
Nitrobenzene	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
N-Nitroso-di-n-propylamine	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
N-Nitrosodiphenylamine/Diphenylamine	0.2 U	0.2 U	0.22 U	0.2 U	0.21 U	0.2 U	0.21 U
Pentachlorophenol	0.39 U	0.4 U	0.43 U	0.4 U	0.42 U	0.4 U	0.42 U
Phenanthrene	**450**	**420**	**630**	**210**	**170**	**190**	**1,200**
Phenol	**4.6**	**4.1**	**3.4**	**1.1**	**2.8**	**2**	0.21 U
Polychlorinated naphthalene-2	0.082 U	0.085 U	0.091 U	0.084 U	0.088 U	0.084 U	0.087 U
Pyrene	**130**	**120**	**170**	**63**	**52**	**57**	**380**
Extractable Petroleum Hydrocarbons (mg/kg)							
C10-C12 AROMATICS	**1,700 J**	**880 J**	**1,100 J**	**830 J**	**1,100 J**	**45 J**	**2,200 J**
C12-C16 ALIPHATICS	**2,100**	**2,300**	**3,000**	**1,500**	**2,000**	**140**	**2,000**
C12-C16 AROMATICS	**1,300**	**780**	**970**	**630**	**850**	**1,000**	**2,000**
C16-C21 ALIPHATICS	**830**	**1,100**	**1,200**	**890**	**950**	**100**	**450**
C16-C21 AROMATICS	**2,300**	**1,400**	**1,900**	**1,000**	**1,300**	**770**	**3,700**
C21-C36 AROMATIC	**1,100**	**650**	**1,100**	**570**	**660**	**440**	**2,000**
C21-C40 ALIPHATICS	**940**	**1,700**	**1,500**	**1,200**	**1,200**	**150**	**120**
C9-C12 ALIPHATICS	**2,800**	**2,200**	**3,000**	**1,500**	**2,300**	**110**	**2,500**
TOTAL ALIPHATICS	**6,700**	**7,400**	**8,700**	**5,200**	**6,500**	**490**	**5,100**
TOTAL AROMATICS	**6,500**	**3,800**	**5,100**	**3,100**	**4,000**	**2,200**	**10,000**
TOTAL EPH	**13,000**	**11,000**	**14,000**	**8,200**	**11,000**	**2,700**	**15,000**

TABLE 2b
PRE-PILOT SOIL CONCENTRATIONS - DEEP SAND UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012
Date Sampled	01-Jun-12	01-Jun-12	01-Jun-12	01-Jun-12	01-Jun-12	01-Jun-12	01-Jun-12
Depth Interval (ft bgs)	24.35-24.75	26.65-27.15	27.65-28.15	28.65-29.15	29.65-30.15	30.65-31.15	31.65-32.15
STAR Treatment Zone	Y	Y	Y	Y	N	N	N
Duplicate	--	--	--	--	--	--	--
Volatile Organic Compounds (mg/kg)							
1,1,1-Trichloroethane	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
1,1,2,2-Tetrachloroethane	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
1,1,2-Trichloroethane	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
1,1-Dichloroethane	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
1,1-Dichloroethene	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
1,2-Dibromo-3-chloropropane	26 U	12 U	110 U	23 U	0.12 U	0.24 U	0.12 U
1,2-Dibromoethane	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
1,2-Dichlorobenzene	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
1,2-Dichloroethane	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
1,2-Dichloropropane	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
1,3-Dichlorobenzene	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
1,4-Dichlorobenzene	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
2-Butanone (MEK)	53 U	23 U	230 U	46 U	0.24 U	0.48 U	0.23 U
2-Hexanone	40 U	17 U	170 U	35 U	0.18 U	0.36 U	0.17 U
Acetone	92 U	41 U	400 U	81 U	0.42 U	0.84 U	0.4 U
Benzene	**25 J**	**3.7 J**	**90 J**	**18 J**	**0.26 J**	**0.18 J**	**0.056 J**
Bromochloromethane	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Bromodichloromethane	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Bromoform	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Carbon disulfide	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Carbon tetrachloride	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Chlorobenzene	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Chloroethane	26 U	12 U	110 U	23 U	0.12 U	0.24 U	0.12 U
Chloroform	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Chloromethane	26 U	12 U	110 U	23 U	0.12 U	0.24 U	0.12 U
cis-1,2-Dichloroethene	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
cis-1,3-Dichloropropene	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Dibromochloromethane	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Dichloromethane (Methylene chloride)	26 U	12 U	110 U	23 U	0.12 U	0.24 U	0.12 U
Ethyl benzene	**36 J**	5.8 U	**93 J**	**24 J**	0.061 U	**0.21 J**	0.058 U
Methyl Bromide	26 U	12 U	110 U	23 U	0.12 U	0.24 U	0.12 U
Methyl isobutyl ketone	40 U	17 U	170 U	35 U	0.18 U	0.36 U	0.17 U
Styrene	13 U	5.8 U	**59 J**	**18 J**	0.061 U	0.12 U	0.058 U
Tetrachloroethene	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Toluene	**79**	**10 J**	**230 J**	**59**	**0.15 J**	**0.35 J**	**0.075 J**
trans-1,2-Dichloroethene	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
trans-1,3-Dichloropropene	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Trichloroethene	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Vinyl chloride	13 U	5.8 U	57 U	12 U	0.061 U	0.12 U	0.058 U
Xylenes (unspecified)	**180**	**24 J**	**490**	**140**	**0.077 J**	**0.9**	**0.12 J**
Semi-Volatile Organic Compounds(mg/kg)							
1,2,4-Trichlorobenzene	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
2,4,5-Trichlorophenol	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
2,4,6-Trichlorophenol	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
2,4-Dichlorophenol	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
2,4-Dimethylphenol	**6**	**14**	**26**	**43**	**3.3**	**0.11**	**0.35**
2,4-Dinitrophenol	3.8 U	3.6 U	3.5 U	3.7 U	1.8 U	0.36 U	0.36 U
2,4-Dinitrotoluene	0.84 U	0.79 U	0.78 U	0.82 U	0.41 U	0.08 U	0.08 U
2,6-Dinitrotoluene	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
2-Chloronaphthalene	--	--	--	--	--	--	--
2-Chlorophenol	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
2-Methylnaphthalene	**1,200**	**290**	**4,100**	**680**	**46**	**1**	**11**
2-Methylphenol	**5.8**	**4.6**	**6.9**	**11**	**1.7**	**0.044**	**0.14**
2-Nitroaniline	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
2-Nitrophenol	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
3,3-Dichlorobenzidine	1.3 U	1.2 U	1.2 U	1.2 U	0.61 U	0.12 U	0.12 U
3-Nitroaniline	0.84 U	0.79 U	0.78 U	0.82 U	0.41 U	0.08 U	0.08 U
4,6-Dinitro-2-methylphenol	2.1 U	2 U	2 U	2.1 U	1 U	0.2 U	0.2 U
4-Bromophenyl-phenylether	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
4-Chloro-3-methylphenol	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
4-Chloroaniline	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
4-Chlorophenyl-phenylether	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
4-Methylphenol	**7.9**	**7.3**	**11**	**13**	**1.5**	**0.073**	**0.28**
4-Nitroaniline	0.84 U	0.79 U	0.78 U	0.82 U	0.41 U	0.08 U	0.08 U
4-Nitrophenol	2.1 U	2 U	2 U	2.1 U	1 U	0.2 U	0.2 U
Acenaphthene	**640**	**150**	**1,900**	**330**	**23**	**1.1**	**7.6**
Acenaphthylene	**25**	**14**	**23**	**41**	**3**	**0.14**	**0.75**
Anthracene	**290**	**77**	**980**	**160**	**12**	**0.76**	**4.3**
Benzo(a)anthracene	**130**	**30**	**440**	**78**	**5.5**	**0.37**	**1.8**
Benzo(a)pyrene	**33**	**17**	**26**	**46**	**3.3**	**0.22**	**1.1**
Benzo(b)fluoranthene	**39**	**18**	**28**	**46**	**3.5**	**0.24**	**1.2**
Benzo(g,h,i)perylene	**15**	**7.9**	**12**	**22**	**1.6**	**0.11**	**0.47**
Benzo(k)fluoranthene	**15**	**10**	**14**	**22**	**1.7**	**0.1**	**0.46**
Bis(2-Chloro-1-methylethyl)Ether	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
bis(2-Chloroethoxy) methane	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
bis(2-Chloroethyl) ether	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
bis(2-Ethylhexyl) phthalate	0.84 U	0.79 U	0.78 U	0.82 U	0.41 U	0.08 U	0.08 U
Butylbenzylphthalate	0.84 U	0.79 U	0.78 U	0.82 U	0.41 U	0.08 U	0.08 U
Carbazole	**120**	**30**	**44**	**62**	**5.2**	**0.35**	**1.7**
Chrysene	**120**	**26**	**38**	**72**	**4.6**	**0.29**	**1.4**
Dibenzo(a,h)anthracene	**3.8**	**1.9**	**2.9**	**5.7**	**0.43**	**0.025**	**0.12**
Dibenzofuran	**510**	**120**	**1,500**	**250**	**19**	**0.96**	**6.1**
Diethylphthalate	0.84 U	0.79 U	0.78 U	0.82 U	0.41 U	0.08 U	0.08 U
Dimethylphthalate	0.84 U	0.79 U	0.78 U	0.82 U	0.41 U	0.08 U	0.08 U
Di-n-butylphthalate	0.84 U	0.79 U	0.78 U	0.82 U	0.41 U	0.08 U	0.08 U
Di-n-octylphthalate	0.84 U	0.79 U	0.78 U	0.82 U	0.41 U	0.08 U	0.08 U
Fluoranthene	**610**	**140**	**1,900**	**330**	**22**	**1.5**	**8.7**
Fluorene	**600**	**140**	**1,800**	**300**	**22**	**1.3**	**7.8**
Hexachlorobenzene	0.042 U	0.04 U	0.039 U	0.041 U	0.02 U	0.004 U	0.004 U
Hexachlorobutadiene	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
Hexachlorocyclopentadiene	2.1 U	2 U	2 U	2.1 U	1 U	0.2 U	0.2 U
Hexachloroethane	0.42 U	0.4 U	0.39 U	0.41 U	0.2 U	0.04 U	0.04 U
Indeno(1,2,3-cd)pyrene	**14**	**7.2**	**11**	**21**	**1.4**	**0.088**	**0.43**
Isophorone	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
Naphthalene	**4,100**	**930**	**13,000**	**2,000**	**110**	**1.3**	**19**
Nitrobenzene	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
N-Nitroso-di-n-propylamine	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
N-Nitrosodiphenylamine/Diphenylamine	0.21 U	0.2 U	0.2 U	0.21 U	0.1 U	0.02 U	0.02 U
Pentachlorophenol	0.42 U	0.4 U	0.39 U	0.41 U	0.2 U	0.04 U	0.04 U
Phenanthrene	**1,400**	**320**	**4,200**	**710**	**58**	**3.5**	**18**
Phenol	**2.3**	**2.8**	**3.3**	**3.5**	0.1 U	0.02 U	0.02 U
Polychlorinated naphthalene-2	0.088 U	0.083 U	0.082 U	0.086 U	0.043 U	0.008 U	0.008 U
Pyrene	**420**	**98**	**1,300**	**230**	**17**	**1.2**	**6**
Extractable Petroleum Hydrocarbons (mg/kg)							
C10-C12 AROMATICS	**2,500 J**	**1,200 J**	**3,500 J**	**240 J**	**210 J**	3.6 U	**11 J**
C12-C16 ALIPHATICS	**3,300**	**1,800**	**8,500**	**3,100**	**59**	3.6 U	3.4 U
C12-C16 AROMATICS	**2,200**	**1,100**	**2,900**	**4,000**	**220**	3.6 U	**22**
C16-C21 ALIPHATICS	**780**	**1,100**	**3,300**	**1,100**	**31**	3.6 U	3.4 U
C16-C21 AROMATICS	**5,000**	**1,700**	**11,000**	**3,100**	**360**	**11 J**	**56**
C21-C36 AROMATIC	**2,600**	**800**	**9,100**	**1,700**	**200**	**5.6 J**	**30**
C21-C40 ALIPHATICS	**490**	**1,600**	**530 J**	**860**	**11 J**	3.6 U	3.4 U
C9-C12 ALIPHATICS	**4,200**	**1,200**	**9,300**	**3,300**	**44**	3.6 U	3.4 U
TOTAL ALIPHATICS	**8,800**	**5,700**	**22,000**	**8,300**	**150**	3.6 U	3.4 U
TOTAL AROMATICS	**12,000**	**4,800**	**27,000**	**9,100**	**1,000**	**17**	**120**
TOTAL EPH	**21,000**	**11,000**	**48,000**	**17,000**	**1,100**	**17**	**120**

TABLE 2b
PRE-PILOT SOIL CONCENTRATIONS - DEEP SAND UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012	IP-5-2012
Date Sampled	01-Jun-12	01-Jun-12	01-Jun-12	01-Jun-12	01-Jun-12	01-Jun-12	01-Jun-12
Depth Interval (ft bgs)	32.65-33.15	32.65-33.15	33.65-34.15	34.65-35.15	35.65-36.15	36.65-37.15	37.65-38.15
STAR Treatment Zone	N	N	N	N	N	N	N
Duplicate	--	Duplicate	--	--	--	--	--
Volatile Organic Compounds (mg/kg)							
1,1,1-Trichloroethane	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
1,1,2,2-Tetrachloroethane	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
1,1,2-Trichloroethane	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
1,1-Dichloroethane	**0.006**	0.058 U	**0.005 J**	0.12 U	**0.01**	0.053 U	**0.006**
1,1-Dichloroethene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
1,2-Dibromo-3-chloropropane	0.002 U	0.12 U	0.002 U	0.23 U	0.002 U	0.11 U	0.002 U
1,2-Dibromoethane	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
1,2-Dichlorobenzene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
1,2-Dichloroethane	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	**0.007**
1,2-Dichloropropane	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
1,3-Dichlorobenzene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
1,4-Dichlorobenzene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
2-Butanone (MEK)	0.005 U	0.23 U	0.004 U	0.47 U	0.005 U	0.21 U	0.005 U
2-Hexanone	0.004 U	0.17 U	0.003 U	0.35 U	0.004 U	0.16 U	0.003 U
Acetone	**0.014 J**	0.41 U	**0.009 J**	0.82 U	**0.018 J**	0.37 U	**0.055**
Benzene	**0.037**	**0.092 J**	**0.029**	0.058 U	**0.084**	**0.16 J**	**0.31**
Bromochloromethane	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Bromodichloromethane	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Bromoform	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Carbon disulfide	**0.001 J**	0.058 U	0.001 U	0.12 U	**0.002 J**	0.053 U	**0.001 J**
Carbon tetrachloride	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Chlorobenzene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Chloroethane	0.002 U	0.12 U	0.002 U	0.23 U	0.002 U	0.11 U	0.002 U
Chloroform	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Chloromethane	0.002 U	0.12 U	0.002 U	0.23 U	0.002 U	0.11 U	0.002 U
cis-1,2-Dichloroethene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
cis-1,3-Dichloropropene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Dibromochloromethane	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Dichloromethane (Methylene chloride)	0.002 U	0.12 U	0.002 U	0.23 U	0.002 U	0.11 U	0.002 U
Ethyl benzene	**0.008**	0.058 U	**0.005 J**	0.12 U	**0.022**	**0.07 J**	**0.032**
Methyl Bromide	0.002 U	0.12 U	0.002 U	0.23 U	0.002 U	0.11 U	0.002 U
Methyl isobutyl ketone	0.004 U	0.17 U	0.003 U	0.35 U	0.004 U	0.16 U	0.003 U
Styrene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	**0.009**
Tetrachloroethene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Toluene	**0.019**	**0.12 J**	**0.009**	0.12 U	**0.035**	**0.16 J**	**0.18**
trans-1,2-Dichloroethene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
trans-1,3-Dichloropropene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Trichloroethene	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Vinyl chloride	0.001 U	0.058 U	0.001 U	0.12 U	0.001 U	0.053 U	0.001 U
Xylenes (unspecified)	**0.023**	0.058 U	**0.01**	**0.22 J**	**0.051**	**0.26 J**	**0.11**
Semi-Volatile Organic Compounds(mg/kg)							
1,2,4-Trichlorobenzene	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
2,4,5-Trichlorophenol	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
2,4,6-Trichlorophenol	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
2,4-Dichlorophenol	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
2,4-Dimethylphenol	**0.22**	**0.26**	**0.15**	**0.26**	**0.25**	**2.2**	**3.8**
2,4-Dinitrophenol	0.36 U	0.36 U	0.36 U	0.36 U	0.37 U	0.36 U	0.36 U
2,4-Dinitrotoluene	0.08 U	0.08 U	0.079 U	0.079 U	0.083 U	0.079 U	0.081 U
2,6-Dinitrotoluene	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
2-Chloronaphthalene	--	--	--	--	--	--	--
2-Chlorophenol	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	**0.022 J**	0.02 U
2-Methylnaphthalene	**2.9**	**3.3**	**1.2**	**4.9 J**	**0.087**	**0.57**	**0.2**
2-Methylphenol	**0.068**	**0.082**	**0.04 J**	**0.041**	**0.36**	**5.2**	**8.8**
2-Nitroaniline	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
2-Nitrophenol	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
3,3-Dichlorobenzidine	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
3-Nitroaniline	0.08 U	0.08 U	0.079 U	0.079 U	0.083 U	0.079 U	0.081 U
4,6-Dinitro-2-methylphenol	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U	0.2 U	0.2 U
4-Bromophenyl-phenylether	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
4-Chloro-3-methylphenol	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
4-Chloroaniline	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
4-Chlorophenyl-phenylether	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
4-Methylphenol	**0.098**	**0.13**	**0.054**	0.02 U	0.021 U	**8.5**	**15**
4-Nitroaniline	0.08 U	0.08 U	0.079 U	0.079 U	0.083 U	0.079 U	0.081 U
4-Nitrophenol	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U	0.2 U	0.2 U
Acenaphthene	**2.9**	**3.2**	**1.5**	**4.3 J**	**0.14**	**0.84**	**0.35**
Acenaphthylene	**0.32**	**0.35**	**0.18**	**0.51**	**0.021**	**0.097**	**0.054**
Anthracene	**2**	**2**	**1.2**	**3 J**	**0.096**	**0.7**	**0.36**
Benzo(a)anthracene	**0.84**	**0.89**	**0.55**	**1.3**	**0.054**	**0.32**	**0.16**
Benzo(a)pyrene	**0.52**	**0.51**	**0.32**	**0.82**	**0.035**	**0.19**	**0.1**
Benzo(b)fluoranthene	**0.58**	**0.57**	**0.36**	**0.92**	**0.033**	**0.22**	**0.12**
Benzo(g,h,i)perylene	**0.24**	**0.25**	**0.15**	**0.38**	**0.019 J**	**0.09**	**0.054**
Benzo(k)fluoranthene	**0.25**	**0.24**	**0.15**	**0.39**	**0.018 J**	**0.086**	**0.044**
Bis(2-Chloro-1-methylethyl)Ether	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
bis(2-Chloroethoxy) methane	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
bis(2-Chloroethyl) ether	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
bis(2-Ethylhexyl) phthalate	0.08 U	0.08 U	0.079 U	0.079 U	0.083 U	0.079 U	0.081 U
Butylbenzylphthalate	0.08 U	0.08 U	0.079 U	0.079 U	0.083 U	0.079 U	0.081 U
Carbazole	**0.75**	**0.76**	**0.48**	**1.2**	**0.12**	**0.35**	**0.22**
Chrysene	**0.67**	**0.69**	**0.44**	**1.1**	**0.044**	**0.25**	**0.15**
Dibenzo(a,h)anthracene	**0.057**	**0.054**	**0.033**	**0.086**	0.004 U	**0.02**	**0.014 J**
Dibenzofuran	**2.4**	**2.6**	**1.3**	**4 J**	**0.099**	**0.74**	**0.32**
Diethylphthalate	0.08 U	0.08 U	0.079 U	0.079 U	0.083 U	0.079 U	0.081 U
Dimethylphthalate	0.08 U	0.08 U	0.079 U	0.079 U	0.083 U	0.079 U	0.081 U
Di-n-butylphthalate	0.08 U	0.08 U	0.079 U	0.079 U	0.083 U	0.079 U	0.081 U
Di-n-octylphthalate	0.08 U	0.08 U	0.079 U	0.079 U	0.083 U	0.079 U	0.081 U
Fluoranthene	**3.5**	**3.7**	**2.4**	**5.9 J**	**0.22**	**1.4**	**0.8**
Fluorene	**3.1**	**3.3**	**1.8**	**4.7 J**	**0.13**	**1**	**0.48**
Hexachlorobenzene	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U
Hexachlorobutadiene	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
Hexachlorocyclopentadiene	0.2 U	0.2 U	0.2 U	0.2 UR	0.21 U	0.2 U	0.2 U
Hexachloroethane	0.04 U	0.04 U	0.04 U	0.04 U	0.041 U	0.04 U	0.04 U
Indeno(1,2,3-cd)pyrene	**0.22**	**0.22**	**0.14**	**0.35**	**0.017 J**	**0.083**	**0.045**
Isophorone	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
Naphthalene	**3.3**	**3.8**	**1.2**	**5.5 J**	**0.23**	**1.1**	**0.66**
Nitrobenzene	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
N-Nitroso-di-n-propylamine	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
N-Nitrosodiphenylamine/Diphenylamine	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	0.02 U	0.02 U
Pentachlorophenol	0.04 U	0.04 U	0.04 U	0.04 U	0.041 U	0.04 U	0.04 U
Phenanthrene	**8.9**	**9**	**5.8**	**12**	**0.43**	**3**	**1.7**
Phenol	0.02 U	0.02 U	0.02 U	0.02 U	0.021 U	**20**	**35**
Polychlorinated naphthalene-2	0.008 U	0.008 U	0.008 U	0.008 U	0.009 U	0.008 U	0.008 U
Pyrene	**2.8**	**2.8**	**1.8**	**4.3 J**	**0.18**	**1**	**0.6**
Extractable Petroleum Hydrocarbons (mg/kg)							
C10-C12 AROMATICS	3.5 U	**3.7 J**	3.5 U	3.5 U	**5.7 J**	3.5 U	3.6 U
C12-C16 ALIPHATICS	3.5 U	3.6 U	3.5 U	3.5 U	3.6 U	3.5 U	3.6 U
C12-C16 AROMATICS	**8.7 J**	**11 J**	**3.6 J**	**8.8 J**	3.6 U	3.5 U	3.6 U
C16-C21 ALIPHATICS	3.5 U	3.6 U	3.5 U	3.5 U	3.6 U	3.5 U	3.6 U
C16-C21 AROMATICS	**33**	**40**	**23**	**36 J**	**12 J**	**12**	**6.7 J**
C21-C36 AROMATIC	**15**	**21**	**12 J**	**19**	3.6 U	**3.9 J**	3.6 U
C21-C40 ALIPHATICS	3.5 U	3.6 U	3.5 U	3.5 U	3.6 U	3.5 U	3.6 U
C9-C12 ALIPHATICS	3.5 U	3.6 U	3.5 U	3.5 U	3.6 U	3.5 U	3.6 U
TOTAL ALIPHATICS	3.5 U	3.6 U	3.5 U	3.5 U	3.6 U	3.5 U	3.6 U
TOTAL AROMATICS	**57**	**76**	**39**	**63**	**18**	**16**	**6.7 J**
TOTAL EPH	**57**	**76**	**39**	**63**	**18**	**16**	**6.7 J**

TABLE 2b
PRE-PILOT SOIL CONCENTRATIONS - DEEP SAND UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	IP-5-2012	TC-66-2012	TC-66-2012	TC-66-2012
Date Sampled	01-Jun-12	13-Jun-12	13-Jun-12	13-Jun-12
Depth Interval (ft bgs)	38.65-39.15	17.17-17.67	17.17-17.67	22.67-23.17
STAR Treatment Zone	N	N	N	N
Duplicate	--	--	Duplicate	--
Volatile Organic Compounds (mg/kg)				
1,1,1-Trichloroethane	0.001 U	--	--	--
1,1,2,2-Tetrachloroethane	0.001 U	--	--	--
1,1,2-Trichloroethane	0.001 U	--	--	--
1,1-Dichloroethane	**0.004 J**	--	--	--
1,1-Dichloroethene	0.001 U	--	--	--
1,2-Dibromo-3-chloropropane	0.002 U	--	--	--
1,2-Dibromoethane	0.001 U	--	--	--
1,2-Dichlorobenzene	0.001 U	--	--	--
1,2-Dichloroethane	0.001 U	--	--	--
1,2-Dichloropropane	0.001 U	--	--	--
1,3-Dichlorobenzene	0.001 U	--	--	--
1,4-Dichlorobenzene	0.001 U	--	--	--
2-Butanone (MEK)	**0.018**	--	--	--
2-Hexanone	0.003 U	--	--	--
Acetone	**0.074**	--	--	--
Benzene	**0.31**	--	--	--
Bromochloromethane	0.001 U	--	--	--
Bromodichloromethane	0.001 U	--	--	--
Bromoform	0.001 U	--	--	--
Carbon disulfide	0.001 U	--	--	--
Carbon tetrachloride	0.001 U	--	--	--
Chlorobenzene	0.001 U	--	--	--
Chloroethane	0.002 U	--	--	--
Chloroform	0.001 U	--	--	--
Chloromethane	0.002 U	--	--	--
cis-1,2-Dichloroethene	0.001 U	--	--	--
cis-1,3-Dichloropropene	0.001 U	--	--	--
Dibromochloromethane	0.001 U	--	--	--
Dichloromethane (Methylene chloride)	0.002 U	--	--	--
Ethyl benzene	**0.028**	--	--	--
Methyl Bromide	0.002 U	--	--	--
Methyl isobutyl ketone	0.003 U	--	--	--
Styrene	**0.009**	--	--	--
Tetrachloroethene	0.001 U	--	--	--
Toluene	**0.18**	--	--	--
trans-1,2-Dichloroethene	0.001 U	--	--	--
trans-1,3-Dichloropropene	0.001 U	--	--	--
Trichloroethene	0.001 U	--	--	--
Vinyl chloride	0.001 U	--	--	--
Xylenes (unspecified)	**0.098**	--	--	--
Semi-Volatile Organic Compounds(mg/kg)				
1,2,4-Trichlorobenzene	0.02 U	--	--	--
2,4,5-Trichlorophenol	0.02 U	--	--	--
2,4,6-Trichlorophenol	0.02 U	--	--	--
2,4-Dichlorophenol	0.02 U	--	--	--
2,4-Dimethylphenol	**4.6**	--	--	--
2,4-Dinitrophenol	0.36 U	--	--	--
2,4-Dinitrotoluene	0.081 U	--	--	--
2,6-Dinitrotoluene	0.02 U	--	--	--
2-Chloronaphthalene	--	--	--	--
2-Chlorophenol	0.02 U	--	--	--
2-Methylnaphthalene	**0.17**	--	--	--
2-Methylphenol	**11**	--	--	--
2-Nitroaniline	0.02 U	--	--	--
2-Nitrophenol	0.02 U	--	--	--
3,3-Dichlorobenzidine	0.12 U	--	--	--
3-Nitroaniline	0.081 U	--	--	--
4,6-Dinitro-2-methylphenol	0.2 U	--	--	--
4-Bromophenyl-phenylether	0.02 U	--	--	--
4-Chloro-3-methylphenol	0.02 U	--	--	--
4-Chloroaniline	0.02 U	--	--	--
4-Chlorophenyl-phenylether	0.02 U	--	--	--
4-Methylphenol	**20**	--	--	--
4-Nitroaniline	0.081 U	--	--	--
4-Nitrophenol	0.2 U	--	--	--
Acenaphthene	**0.27**	--	--	--
Acenaphthylene	**0.036**	--	--	--
Anthracene	**0.26**	--	--	--
Benzo(a)anthracene	**0.12**	--	--	--
Benzo(a)pyrene	**0.071**	--	--	--
Benzo(b)fluoranthene	**0.087**	--	--	--
Benzo(g,h,i)perylene	**0.036**	--	--	--
Benzo(k)fluoranthene	**0.03**	--	--	--
Bis(2-Chloro-1-methylethyl)Ether	0.02 U	--	--	--
bis(2-Chloroethoxy) methane	0.02 U	--	--	--
bis(2-Chloroethyl) ether	0.02 U	--	--	--
bis(2-Ethylhexyl) phthalate	0.081 U	--	--	--
Butylbenzylphthalate	0.081 U	--	--	--
Carbazole	**0.16**	--	--	--
Chrysene	**0.098**	--	--	--
Dibenzo(a,h)anthracene	**0.01 J**	--	--	--
Dibenzofuran	**0.25**	--	--	--
Diethylphthalate	0.081 U	--	--	--
Dimethylphthalate	0.081 U	--	--	--
Di-n-butylphthalate	0.081 U	--	--	--
Di-n-octylphthalate	0.081 U	--	--	--
Fluoranthene	**0.55**	--	--	--
Fluorene	**0.36**	--	--	--
Hexachlorobenzene	0.004 U	--	--	--
Hexachlorobutadiene	0.02 U	--	--	--
Hexachlorocyclopentadiene	0.2 U	--	--	--
Hexachloroethane	0.04 U	--	--	--
Indeno(1,2,3-cd)pyrene	**0.031**	--	--	--
Isophorone	0.02 U	--	--	--
Naphthalene	**0.54**	--	--	--
Nitrobenzene	0.02 U	--	--	--
N-Nitroso-di-n-propylamine	0.02 U	--	--	--
N-Nitrosodiphenylamine/Diphenylamine	0.02 U	--	--	--
Pentachlorophenol	0.04 U	--	--	--
Phenanthrene	**1.2**	--	--	--
Phenol	**48**	--	--	--
Polychlorinated naphthalene-2	0.008 U	--	--	--
Pyrene	**0.41**	--	--	--
Extractable Petroleum Hydrocarbons (mg/kg)				
C10-C12 AROMATICS	3.6 U	**4,700**	**2,600**	**1,100**
C12-C16 ALIPHATICS	3.6 U	**18,000**	**9,200**	**730**
C12-C16 AROMATICS	3.6 U	**4,400**	**3,100**	**1,000**
C16-C21 ALIPHATICS	3.6 U	**7,200**	**2,700**	**550**
C16-C21 AROMATICS	**11 J**	**13,000**	**12,000**	**1,700**
C21-C36 AROMATIC	3.6 U	**12,000**	**10,000**	**1,100**
C21-C40 ALIPHATICS	3.6 U	**2,500**	**690 J**	**1,500**
C9-C12 ALIPHATICS	3.6 U	**18,000**	**9,500**	**430**
TOTAL ALIPHATICS	3.6 U	**46,000**	**22,000**	**3,200**
TOTAL AROMATICS	**11 J**	**34,000**	**28,000**	**4,900**
TOTAL EPH	**11 J**	**80,000**	**50,000**	**8,100**

TABLE 2b
PRE-PILOT SOIL CONCENTRATIONS - DEEP SAND UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	TC-72-2012	TC-72-2012
Date Sampled	13-Jun-12	13-Jun-12
Depth Interval (ft bgs)	18.67-19.17	24.17-24.67
STAR Treatment Zone	N	Y
Duplicate	--	--
Volatile Organic Compounds (mg/kg)		
1,1,1-Trichloroethane	--	--
1,1,2,2-Tetrachloroethane	--	--
1,1,2-Trichloroethane	--	--
1,1-Dichloroethane	--	--
1,1-Dichloroethene	--	--
1,2-Dibromo-3-chloropropane	--	--
1,2-Dibromoethane	--	--
1,2-Dichlorobenzene	--	--
1,2-Dichloroethane	--	--
1,2-Dichloropropane	--	--
1,3-Dichlorobenzene	--	--
1,4-Dichlorobenzene	--	--
2-Butanone (MEK)	--	--
2-Hexanone	--	--
Acetone	--	--
Benzene	--	--
Bromochloromethane	--	--
Bromodichloromethane	--	--
Bromoform	--	--
Carbon disulfide	--	--
Carbon tetrachloride	--	--
Chlorobenzene	--	--
Chloroethane	--	--
Chloroform	--	--
Chloromethane	--	--
cis-1,2-Dichloroethene	--	--
cis-1,3-Dichloropropene	--	--
Dibromochloromethane	--	--
Dichloromethane (Methylene chloride)	--	--
Ethyl benzene	--	--
Methyl Bromide	--	--
Methyl isobutyl ketone	--	--
Styrene	--	--
Tetrachloroethene	--	--
Toluene	--	--
trans-1,2-Dichloroethene	--	--
trans-1,3-Dichloropropene	--	--
Trichloroethene	--	--
Vinyl chloride	--	--
Xylenes (unspecified)	--	--
Semi-Volatile Organic Compounds(mg/kg)		
1,2,4-Trichlorobenzene	--	--
2,4,5-Trichlorophenol	--	--
2,4,6-Trichlorophenol	--	--
2,4-Dichlorophenol	--	--
2,4-Dimethylphenol	--	--
2,4-Dinitrophenol	--	--
2,4-Dinitrotoluene	--	--
2,6-Dinitrotoluene	--	--
2-Chloronaphthalene	--	--
2-Chlorophenol	--	--
2-Methylnaphthalene	--	--
2-Methylphenol	--	--
2-Nitroaniline	--	--
2-Nitrophenol	--	--
3,3-Dichlorobenzidine	--	--
3-Nitroaniline	--	--
4,6-Dinitro-2-methylphenol	--	--
4-Bromophenyl-phenylether	--	--
4-Chloro-3-methylphenol	--	--
4-Chloroaniline	--	--
4-Chlorophenyl-phenylether	--	--
4-Methylphenol	--	--
4-Nitroaniline	--	--
4-Nitrophenol	--	--
Acenaphthene	--	--
Acenaphthylene	--	--
Anthracene	--	--
Benzo(a)anthracene	--	--
Benzo(a)pyrene	--	--
Benzo(b)fluoranthene	--	--
Benzo(g,h,i)perylene	--	--
Benzo(k)fluoranthene	--	--
Bis(2-Chloro-1-methylethyl)Ether	--	--
bis(2-Chloroethoxy) methane	--	--
bis(2-Chloroethyl) ether	--	--
bis(2-Ethylhexyl) phthalate	--	--
Butylbenzylphthalate	--	--
Carbazole	--	--
Chrysene	--	--
Dibenzo(a,h)anthracene	--	--
Dibenzofuran	--	--
Diethylphthalate	--	--
Dimethylphthalate	--	--
Di-n-butylphthalate	--	--
Di-n-octylphthalate	--	--
Fluoranthene	--	--
Fluorene	--	--
Hexachlorobenzene	--	--
Hexachlorobutadiene	--	--
Hexachlorocyclopentadiene	--	--
Hexachloroethane	--	--
Indeno(1,2,3-cd)pyrene	--	--
Isophorone	--	--
Naphthalene	--	--
Nitrobenzene	--	--
N-Nitroso-di-n-propylamine	--	--
N-Nitrosodiphenylamine/Diphenylamine	--	--
Pentachlorophenol	--	--
Phenanthrene	--	--
Phenol	--	--
Polychlorinated naphthalene-2	--	--
Pyrene	--	--
Extractable Petroleum Hydrocarbons (mg/kg)		
C10-C12 AROMATICS	**3,800**	**1,900**
C12-C16 ALIPHATICS	**15,000**	**4,200**
C12-C16 AROMATICS	**3,000**	**2,000**
C16-C21 ALIPHATICS	**6,300**	**2,000**
C16-C21 AROMATICS	**9,000**	**3,000**
C21-C36 AROMATIC	**8,500**	**1,800**
C21-C40 ALIPHATICS	**1,600**	**3,200**
C9-C12 ALIPHATICS	**18,000**	**3,900**
TOTAL ALIPHATICS	**41,000**	**13,000**
TOTAL AROMATICS	**24,000**	**8,700**
TOTAL EPH	**65,000**	**22,000**

Notes:
mg/kg - milligrams per kilogram
ft bgs - feet below ground surface
U - Analyte not detected above quantitation limit
J - estimated concentration
R - rejected result
Bold values indicated detections

TABLE 3
DEEP SAND UNIT AIR SPARGE TRACER TEST HELIUM CONCENTRATIONS IN THE VAPOR PHASE
Former Pitt Consol Site, Newark, New Jersey

Program	HELIUM TRACER TEST 8/12				
Location	Helium Injection Point	IP-2-2012	IP-4-2012	SP-01	VAPMP-1
Date Sampled	30-Aug-12	31-Aug-12	31-Aug-12	31-Aug-12	31-Aug-12
Helium (% v/v)	**0.32**	**0.61**	0.27 U	0.26 U	0.27 U

Notes:
µg/m3 - micrograms per cubic meter
U - Analyte not detected above quantitation limit
Bold values indicate detections

TABLE 4
COMPARISON OF CO2:CO RATIOS BETWEEN THE PHASE II 'SIGNIFICANT BURN' AND THE PHASE III DEEP SAND UNIT COMBUSTION TEST
Former Pitt Consol Site, Newark, New Jersey

	CO_2:CO Ratio	
	Phase II 'Significant Burn'	**Phase III Deep Sand Unit Combustion Test**
Minimum	4.9	3.7
Maximum	32.8	12.4
Average	15.5	6.6

TABLE 5
PHASE III PILOT TEST VOLATILE COMPOUND CONCENTRATIONS IN VAPOR PHASE
Former Pitt Consol Site, Newark, New Jersey

Program	TR0341D AIR SAMPLING 10/12			
Location	SP-01	SP-01	Stack	Stack
Date Sampled	03-Oct-12	05-Oct-12	03-Oct-12	05-Oct-12
Volatile Organic Compound (µg/m3)				
1,1,1-Trichloroethane	5 U	7 U	0.1 U	0.1 U
1,1,2,2-Tetrachloroethane	4 U	5 U	0.08 U	0.08 U
1,1,2-Trichloroethane	4 U	6 U	0.09 U	0.09 U
1,1-Dichloroethane	5 U	6 U	0.09 U	0.09 U
1,1-Dichloroethene	17 U	22 U	0.3 U	0.3 U
1,2,4-Trichlorobenzene	11 U	14 U	0.2 U	0.2 U
1,2,4-Trimethylbenzene	**1,500**	**2,100**	0.1 U	0.1 U
1,2-Dibromoethane	5 U	7 U	0.1 U	0.1 U
1,2-Dichlorobenzene	8 U	10 U	0.2 U	0.2 U
1,2-Dichloroethane	4 U	5 U	0.07 U	0.07 U
1,2-Dichloropropane	5 U	7 U	0.1 U	0.1 U
1,3,5-Trimethylbenzene	**770**	**1,100**	0.09 U	0.09 U
1,3-Butadiene	**25**	3 U	**92**	**110**
1,3-Dichlorobenzene	6 U	7 U	0.1 U	0.1 U
1,4-Dichlorobenzene	5 U	7 U	0.1 U	0.1 U
1,4-Dioxane	13 U	16 U	0.30 U	0.30 U
2-Butanone (MEK)	4 U	5 U	**4**	**5**
2-Chlorotoluene	3 U	4 U	0.07 U	0.07 U
3-Chloropropene	7 U	9 U	0.1 U	0.1 U
4-Ethyltoluene	**470**	**680**	0.07 U	0.07 U
Acetone	**1,700**	**840**	**27**	**41**
Benzene	**8,700**	**10,000**	0.06 U	0.06 U
Bromodichloromethane	4 U	5 U	0.08 U	0.08 U
Bromoethene	4 U	5 U	0.08 U	0.08 U
Bromoform	4 U	5 U	0.07 U	0.07 U
Carbon disulfide	3 U	4 U	**78**	**71**
Carbon tetrachloride	4 U	5 U	0.08 U	0.08 U
Chlorobenzene	3 U	4 U	**1**	**1**
Chloroethane	4 U	6 U	0.09 U	**5**
Chloroform	6 U	7 U	0.1 U	0.1 U
Chloromethane	**64**	**67**	**38**	**72**
cis-1,2-Dichloroethene	17 U	21 U	0.3 U	0.3 U
cis-1,3-Dichloropropene	3 U	4 U	0.06 U	0.06 U
Cyclohexane	**180**	**160**	0.07 U	0.07 U
Dibromochloromethane	5 U	6 U	0.09 U	0.09 U
Dichlorodifluoromethane	5 U	6 U	**4**	**3**
Dichloromethane (Methylene chloride)	4 U	5 U	0.08 U	0.08 U
Ethyl benzene	**2,200**	**3,300**	0.07 U	0.07 U
Freon-113	8 U	10 U	0.2 U	0.2 U
Freon-114	7 U	9 U	0.1 U	0.1 U
Heptane	**200**	**250**	0.07 U	0.07 U
Hexachlorobutadiene	15 U	20 U	0.3 U	0.3 U
Isooctane	3 U	4 U	0.07 U	0.07 U
Isopropanol	9 U	12 U	0.2 U	0.2 U
m&p-Xylenes	**7,400**	**11,000**	0.1 U	0.1 U
Methyl Bromide	5 U	7 U	0.1 U	0.1 U
Methyl isobutyl ketone	7 U	9 U	0.1 U	0.1 U
Methyl methacrylate	3 U	4 U	0.07 U	0.07 U
Methyl-tert-Butyl Ether (MTBE)	3 U	3 U	0.05 U	0.05 U
n-Hexane	**200**	**210**	0.07 U	0.07 U
o-Xylene	**2,300**	**3,500**	0.07 U	0.07 U
Styrene	**94**	3 U	0.05 U	0.05 U
Tert-Butyl Alcohol (TBA)	6 U	8 U	0.1 U	0.1 U
Tetrachloroethene	5 U	6 U	0.1 U	0.1 U
Tetrahydrofuran	4 U	5 U	0.09 U	0.09 U
Toluene	**17,000**	**19,000**	**0.9**	**0.8**
trans-1,2-Dichloroethene	5 U	6 U	0.09 U	0.09 U
trans-1,3-Dichloropropene	3 U	4 U	0.07 U	0.07 U
Trichloroethene	2 U	3 U	0.05 U	0.05 U
Trichlorofluoromethane	6 U	7 U	0.1 U	0.1 U
Vinyl chloride	1 U	1 U	0.02 U	**2**

Notes:
µg/m3 - micrograms per cubic meter
U - Analyte not detected above quantitation limit
Bold values indicate detections

TABLE 6a
POST-PILOT SOIL CONCENTRATIONS - SHALLOW FILL UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	B-1-2012	B-1-2012	B-2-2012	B-2-2012	B-3-2012	B-3-2012	B-4-2012	B-4-2012
Date Sampled	12-Oct-12	12-Oct-12	12-Oct-12	12-Oct-12	14-Oct-12	14-Oct-12	12-Oct-12	12-Oct-12
Depth Interval (ft bgs)	5.84-6.34	13.84-14.34	5.84-6.34	13.34-13.84	6.34-6.84	12.84-13.34	5.84-6.34	12.84-13.34
STAR Treatment Zone	N	N	N	N	N	N	N	N
Duplicate	--	--	--	--	--	--	--	--
Volatile Organic Compounds (mg/kg)								
1,1,1-Trichloroethane	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	--	--	--	--	--	--	--	--
1,2-Dibromoethane	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--	--	--	--
2-Butanone (MEK)	--	--	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--	--	--
Acetone	--	--	--	--	--	--	--	--
Benzene	--	--	--	--	--	--	--	--
Bromochloromethane	--	--	--	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--	--	--	--
Bromoform	--	--	--	--	--	--	--	--
Carbon disulfide	--	--	--	--	--	--	--	--
Carbon tetrachloride	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	--	--	--	--	--	--
Chloroethane	--	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--	--
Chloromethane	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--
Dibromochloromethane	--	--	--	--	--	--	--	--
Dichloromethane (Methylene chloride)	--	--	--	--	--	--	--	--
Ethyl benzene	--	--	--	--	--	--	--	--
Methyl Bromide	--	--	--	--	--	--	--	--
Methyl isobutyl ketone	--	--	--	--	--	--	--	--
Styrene	--	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--
Vinyl chloride	--	--	--	--	--	--	--	--
Xylenes (unspecified)	--	--	--	--	--	--	--	--
Semi-Volatile Organic Compounds (mg/kg)								
1,2,4-Trichlorobenzene	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
2,4,5-Trichlorophenol	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
2,4,6-Trichlorophenol	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
2,4-Dichlorophenol	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
2,4-Dimethylphenol	**23**	**45**	**7.4**	**3.7**	**29**	**65**	**59**	**34**
2,4-Dinitrophenol	3.6 U	3.5 U	3.9 U	3.5 U	13 U	6.6 U	22 U	3.5 U
2,4-Dinitrotoluene	0.8 U	0.77 U	0.87 U	0.77 U	2.8 U	1.5 U	4.9 U	0.78 U
2,6-Dinitrotoluene	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
2-Chloronaphthalene	0.083 U	0.081 U	0.091 U	0.081 U	0.29 U	0.15 U	0.52 U	0.082 U
2-Chlorophenol	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
2-Methylnaphthalene	**390**	**680**	**290**	**94**	**410**	**920**	**2,100**	**460**
2-Methylphenol	**9.8**	**18**	**6**	**2.1**	**18**	**24**	**28**	**15**
2-Nitroaniline	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
2-Nitrophenol	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
3,3-Dichlorobenzidine	1.2 U	1.2 U	1.3 U	1.2 U	4.2 U	2.2 U	7.4 U	1.2 U
3-Nitroaniline	0.8 U	0.77 U	0.87 U	0.77 U	2.8 U	1.5 U	4.9 U	0.78 U
4,6-Dinitro-2-methylphenol	2 U	1.9 U	2.2 U	1.9 U	7 U	3.6 U	12 U	1.9 U
4-Bromophenyl-phenylether	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
4-Chloro-3-methylphenol	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
4-Chloroaniline	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
4-Chlorophenyl-phenylether	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
4-Methylphenol	**13**	**17**	**10**	**0.23 J**	**27**	**26**	**42**	**17**
4-Nitroaniline	0.8 U	0.77 U	0.87 U	0.77 U	2.8 U	1.5 U	4.9 U	0.78 U
4-Nitrophenol	2 U	1.9 U	2.2 U	1.9 U	7 U	3.6 U	12 U	1.9 U
Acenaphthene	**210**	**320**	**200**	**50**	**270**	**470**	**1,000**	**210**
Acenaphthylene	**16**	**18**	**16**	**3.7**	**21**	**24**	**64**	**11**
Anthracene	**1,200**	**190**	**310**	**26**	**250**	**240**	**4,500**	**100**
Benzo(a)anthracene	**41**	**58**	**69**	**10**	**47**	**75**	**200**	**35**
Benzo(a)pyrene	**25**	**32**	**46**	**6.6**	**26**	**44**	**110**	**18**
Benzo(b)fluoranthene	**30**	**38**	**49**	**7.3**	**36**	**56**	**130**	**20**
Benzo(g,h,i)perylene	**13**	**15**	**25**	**3.3**	**12**	**20**	**56**	**8.7**
Benzo(k)fluoranthene	**11**	**16**	**23**	**3**	**15**	**23**	**67**	**11**
Bis(2-Chloro-1-methylethyl)Ether	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
bis(2-Chloroethoxy) methane	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
bis(2-Chloroethyl) ether	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
bis(2-Ethylhexyl) phthalate	0.8 U	0.77 U	**1.9 J**	0.77 U	2.8 U	1.5 U	4.9 U	0.78 U
Butylbenzylphthalate	0.8 U	0.77 U	0.87 U	0.77 U	2.8 U	1.5 U	4.9 U	0.78 U
Carbazole	**390**	**85**	**110**	**11**	**130**	**110**	**1,500**	**41**
Chrysene	**42**	**52**	**70**	**9.3**	**41**	**63**	**190**	**31**
Dibenzo(a,h)anthracene	**3.8**	**4.6**	**6**	**0.98**	**3.4**	**5.1**	**17**	**2.5**
Dibenzofuran	**230**	**270**	**180**	**40**	**250**	**380**	**1,000**	**180**
Diethylphthalate	0.8 U	0.77 U	0.87 U	0.77 U	2.8 U	1.5 U	4.9 U	0.78 U
Dimethylphthalate	0.8 U	0.77 U	0.87 U	0.77 U	2.8 U	1.5 U	4.9 U	0.78 U
Di-n-butylphthalate	0.8 U	0.77 U	0.87 U	0.77 U	2.8 U	1.5 U	4.9 U	0.78 U
Di-n-octylphthalate	0.8 U	0.77 U	0.87 U	0.77 U	2.8 U	1.5 U	4.9 U	0.78 U
Fluoranthene	**220**	**290**	**300**	**44**	**300**	**420**	**950**	**190**
Fluorene	**290**	**310**	**230**	**50**	**300**	**460**	**1,400**	**180**
Hexachlorobenzene	0.04 U	0.038 U	0.043 U	0.038 U	0.14 U	0.073 U	0.25 U	0.039 U
Hexachlorobutadiene	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
Hexachlorocyclopentadiene	2 U	1.9 U	2.2 U	1.9 U	7 U	3.6 U	12 U	1.9 U
Hexachloroethane	0.4 U	0.38 U	0.43 U	0.38 U	1.4 U	0.73 U	2.5 U	0.39 U
Indeno(1,2,3-cd)pyrene	**11**	**13**	**22**	**2.8**	**11**	**18**	**49**	**7.8**
Isophorone	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
Naphthalene	**1,300**	**2,500**	**840**	**310**	**1,100**	**3,200**	**8,100**	**1,400**
Nitrobenzene	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
N-Nitroso-di-n-propylamine	0.2 U	0.19 U	0.22 U	0.19 U	0.7 U	0.36 U	1.2 U	0.19 U
N-Nitrosodiphenylamine/Diphenylamine	0.2 U	0.19 U	0.22 U	0.19 U	**4.6**	**8.3**	1.2 U	0.19 U
Pentachlorophenol	0.4 U	0.38 U	0.43 U	0.38 U	1.4 U	0.73 U	2.5 U	0.39 U
Phenanthrene	**680**	**840**	**700**	**120**	**700**	**1,100**	**2,500**	**540**
Phenol	**6**	**11**	**9.5**	**1.1**	**16**	**18**	**32**	**16**
Polychlorinated naphthalene-2	--	--	--	--	--	--	--	--
Pyrene	**150**	**200**	**210**	**33**	**180**	**270**	**650**	**130**
Extractable Petroleum Hydrocarbons (mg/kg)								
C10-C12 AROMATICS	**620**	**1,500**	**910**	**530**	**2,100 J**	**1,700 J**	**2,700**	**1,100**
C12-C16 ALIPHATICS	**3,400**	**3,100**	**2,600**	**500**	**3,600**	**4,200**	**8,700**	**2,300**
C12-C16 AROMATICS	**710**	**1,400**	**1,100**	**480**	**2,000**	**1,700**	**2,600**	**1,100**
C16-C21 ALIPHATICS	**1,200**	**660**	**1,800**	**350**	**1,100**	**750**	**2,900**	**700**
C16-C21 AROMATICS	**2,900**	**3,500**	**7,500**	**960**	**4,800**	**4,100**	**14,000**	**2,300**
C21-C36 AROMATIC	**930**	**1,300**	**4,100**	**460**	**1,800**	**1,200**	**5,700**	**1,000**
C21-C40 ALIPHATICS	**2,100**	**550**	**4,000**	**570**	**1,200**	**370**	**1,500**	**920**
C9-C12 ALIPHATICS	**3,200**	**3,900**	**1,700**	**370**	**4,500**	**5,600**	**11,000**	**2,600**
TOTAL ALIPHATICS	**9,800**	**8,200**	**10,000**	**1,800**	**10,000**	**11,000**	**24,000**	**6,500**
TOTAL AROMATICS	**5,100**	**7,700**	**14,000**	**2,400**	**11,000**	**8,700**	**25,000**	**5,500**
TOTAL EPH	**15,000**	**16,000**	**24,000**	**4,200**	**21,000**	**20,000**	**48,000**	**12,000**

TABLE 6a
POST-PILOT SOIL CONCENTRATIONS - SHALLOW FILL UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	B-5-2012	B-5-2012	B-6-2012	B-6-2012	B-7-2012	B-7-2012	B-8-2012
Date Sampled	12-Oct-12	12-Oct-12	14-Oct-12	14-Oct-12	14-Oct-12	14-Oct-12	14-Oct-12
Depth Interval (ft bgs)	6.34-6.84	13.34-13.84	6.84-7.34	12.34-12.84	6.84-7.34	12.84-13.34	7.14-7.64
STAR Treatment Zone	N	N	N	N	N	N	N
Duplicate	--	--	--	--	--	--	--
Volatile Organic Compounds (mg/kg)							
1,1,1-Trichloroethane	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
1,1,2,2-Tetrachloroethane	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
1,1,2-Trichloroethane	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
1,1-Dichloroethane	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
1,1-Dichloroethene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
1,2-Dibromo-3-chloropropane	--	--	1.6 U	1 U	1.5 U	1.2 U	--
1,2-Dibromoethane	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
1,2-Dichlorobenzene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
1,2-Dichloroethane	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
1,2-Dichloropropane	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
1,3-Dichlorobenzene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
1,4-Dichlorobenzene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
2-Butanone (MEK)	--	--	3.1 U	2 U	2.9 U	2.4 U	--
2-Hexanone	--	--	2.3 U	1.5 U	2.2 U	1.8 U	--
Acetone	--	--	5.4 U	3.5 U	5.2 U	4.2 U	--
Benzene	--	--	**5.3**	**7.7**	**8.3**	**1.5 J**	--
Bromochloromethane	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Bromodichloromethane	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Bromoform	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Carbon disulfide	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Carbon tetrachloride	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Chlorobenzene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Chloroethane	--	--	1.6 U	1 U	1.5 U	1.2 U	--
Chloroform	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Chloromethane	--	--	1.6 U	1 U	1.5 U	1.2 U	--
cis-1,2-Dichloroethene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
cis-1,3-Dichloropropene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Dibromochloromethane	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Dichloromethane (Methylene chloride)	--	--	1.6 U	1 U	1.5 U	1.2 U	--
Ethyl benzene	--	--	**20**	**14**	**19**	**37**	--
Methyl Bromide	--	--	1.6 U	1 U	1.5 U	1.2 U	--
Methyl isobutyl ketone	--	--	2.3 U	1.5 U	2.2 U	1.8 U	--
Styrene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Tetrachloroethene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Toluene	--	--	**36**	**33**	**42**	**51**	--
trans-1,2-Dichloroethene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
trans-1,3-Dichloropropene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Trichloroethene	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Vinyl chloride	--	--	0.78 U	0.5 U	0.74 U	0.6 U	--
Xylenes (unspecified)	--	--	**120**	**81**	**120**	**190**	--
Semi-Volatile Organic Compounds (mg/kg)							
1,2,4-Trichlorobenzene	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
2,4,5-Trichlorophenol	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
2,4,6-Trichlorophenol	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
2,4-Dichlorophenol	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
2,4-Dimethylphenol	**12**	**8.1**	**79**	**40**	**65**	**63**	**41**
2,4-Dinitrophenol	21 U	1.7 U	26 U	7 U	54 U	6.7 U	25 U
2,4-Dinitrotoluene	4.6 U	0.39 U	5.8 U	1.6 U	12 U	1.5 U	5.5 U
2,6-Dinitrotoluene	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
2-Chloronaphthalene	0.48 U	0.041 U	0.61 U	0.16 U	1.3 U	0.16 U	0.58 U
2-Chlorophenol	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
2-Methylnaphthalene	**510**	**44**	**3,400**	**460**	**3,600**	**930**	**1,900**
2-Methylphenol	**11**	**4.3**	**31**	**18**	**28**	**41**	**29**
2-Nitroaniline	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
2-Nitrophenol	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
3,3-Dichlorobenzidine	6.9 U	0.58 U	8.8 U	2.3 U	18 U	2.2 U	8.3 U
3-Nitroaniline	4.6 U	0.39 U	5.8 U	1.6 U	12 U	1.5 U	5.5 U
4,6-Dinitro-2-methylphenol	11 U	0.97 U	15 U	3.9 U	30 U	3.7 U	14 U
4-Bromophenyl-phenylether	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
4-Chloro-3-methylphenol	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
4-Chloroaniline	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
4-Chlorophenyl-phenylether	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
4-Methylphenol	**17**	**5.4**	**46**	**20**	**51**	**47**	**68**
4-Nitroaniline	4.6 U	**1**	5.8 U	1.6 U	12 U	1.5 U	5.5 U
4-Nitrophenol	11 U	0.97 U	15 U	3.9 U	30 U	3.7 U	14 U
Acenaphthene	**270**	**28**	**1,900**	**260**	**2,000**	**530**	**1,000**
Acenaphthylene	**20**	**1.7**	**110**	**13**	**150**	**27**	**81**
Anthracene	**250**	**15**	**6,700**	**120**	**3,400**	**220**	**2,200**
Benzo(a)anthracene	**57**	**5.4**	**320**	**44**	**380**	**86**	**180**
Benzo(a)pyrene	**34**	**3.1**	**190**	**21**	**230**	**47**	**110**
Benzo(b)fluoranthene	**42**	**3.7**	**230**	**28**	**290**	**64**	**150**
Benzo(g,h,i)perylene	**16**	**1.4**	**77**	**8.3**	**100**	**19**	**51**
Benzo(k)fluoranthene	**17**	**1.4**	**110**	**12**	**110**	**22**	**53**
Bis(2-Chloro-1-methylethyl)Ether	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
bis(2-Chloroethoxy) methane	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
bis(2-Chloroethyl) ether	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
bis(2-Ethylhexyl) phthalate	4.6 U	0.39 U	5.8 U	1.6 U	12 U	1.5 U	5.5 U
Butylbenzylphthalate	4.6 U	0.39 U	5.8 U	1.6 U	12 U	1.5 U	5.5 U
Carbazole	**110**	**8.8**	**2,200**	**61**	**1,300**	**100**	**830**
Chrysene	**56**	**4.9**	**290**	**37**	**360**	**71**	**170**
Dibenzo(a,h)anthracene	**5**	**0.41**	**24**	**2.6**	**30**	**4.9**	**12**
Dibenzofuran	**230**	**25**	**1,700**	**220**	**1,700**	**430**	**970**
Diethylphthalate	4.6 U	0.39 U	5.8 U	1.6 U	12 U	1.5 U	5.5 U
Dimethylphthalate	4.6 U	0.39 U	5.8 U	1.6 U	12 U	1.5 U	5.5 U
Di-n-butylphthalate	4.6 U	0.39 U	5.8 U	1.6 U	12 U	1.5 U	5.5 U
Di-n-octylphthalate	4.6 U	0.39 U	5.8 U	1.6 U	12 U	1.5 U	5.5 U
Fluoranthene	**260**	**28**	**1,600**	**220**	**1,900**	**460**	**990**
Fluorene	**270**	**28**	**2,300**	**250**	**2,200**	**510**	**1,200**
Hexachlorobenzene	0.23 U	0.019 U	0.29 U	0.078 U	0.6 U	0.074 U	0.28 U
Hexachlorobutadiene	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
Hexachlorocyclopentadiene	11 U	0.97 U	15 U	3.9 U	30 U	3.7 U	14 U
Hexachloroethane	2.3 U	0.19 U	2.9 U	0.78 U	6 U	0.74 U	2.8 U
Indeno(1,2,3-cd)pyrene	**14**	**1.3**	**70**	**7.7**	**91**	**17**	**47**
Isophorone	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
Naphthalene	**1,600**	**130**	**12,000**	**1,600**	**12,000**	**3,200**	**6,500**
Nitrobenzene	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
N-Nitroso-di-n-propylamine	1.1 U	0.097 U	1.5 U	0.39 U	3 U	0.37 U	1.4 U
N-Nitrosodiphenylamine/Diphenylamine	1.1 U	0.097 U	**39**	**3.9**	**36**	**8**	1.4 U
Pentachlorophenol	2.3 U	0.19 U	2.9 U	0.78 U	6 U	0.74 U	2.8 U
Phenanthrene	**670**	**69**	**4,600**	**540**	**4,700**	**1,100**	**2,500**
Phenol	**18**	**8.2**	**33**	**16**	**30**	**33**	**52**
Polychlorinated naphthalene-2	--	--	--	--	--	--	--
Pyrene	**190**	**19**	**1,100**	**150**	**1,200**	**290**	**620**
Extractable Petroleum Hydrocarbons (mg/kg)							
C10-C12 AROMATICS	**1,400**	**130**	**1,600 J**	**1,200 J**	**2,500 J**	**1,600 J**	**2,800 J**
C12-C16 ALIPHATICS	**4,400**	**140**	**10,000**	**1,700**	**5,800**	**13,000**	**6,100**
C12-C16 AROMATICS	**1,500**	**160**	**1,700**	**1,200**	**2,500**	**1,700**	**2,800**
C16-C21 ALIPHATICS	**1,400**	**39**	**3,400**	**310**	**2,300**	**2,800**	**1,300**
C16-C21 AROMATICS	**5,300**	**380**	**14,000**	**3,000**	**15,000**	**5,000**	**12,000**
C21-C36 AROMATIC	**2,200**	**160**	**5,000**	**1,100**	**7,700**	**2,000**	**4,700**
C21-C40 ALIPHATICS	**2,500**	**39**	**1,100**	**260**	**1,100 J**	**2,700**	**460 J**
C9-C12 ALIPHATICS	**5,100**	**130**	**12,000**	**2,300**	**7,000**	**16,000**	**7,600**
TOTAL ALIPHATICS	**13,000**	**350**	**27,000**	**4,600**	**16,000**	**34,000**	**16,000**
TOTAL AROMATICS	**10,000**	**840**	**22,000**	**6,400**	**28,000**	**10,000**	**23,000**
TOTAL EPH	**24,000**	**1,200**	**49,000**	**11,000**	**44,000**	**44,000**	**38,000**

TABLE 6a
POST-PILOT SOIL CONCENTRATIONS - SHALLOW FILL UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	B-8-2012	B-09-2013	B-09-2013	B-10-2013	B-11-2013
Date Sampled	14-Oct-12	23-Jan-13	23-Jan-13	23-Jan-13	23-Jan-13
Depth Interval (ft bgs)	12.34-12.84	9.34-10.34	9.34-10.34	5.34-6.34	9.34-10.34
STAR Treatment Zone	N	N	N	N	N
Duplicate	--	--	Duplicate	--	--
Volatile Organic Compounds (mg/kg)					
1,1,1-Trichloroethane	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--
1,2-Dibromo-3-chloropropane	--	--	--	--	--
1,2-Dibromoethane	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--
2-Butanone (MEK)	--	--	--	--	--
2-Hexanone	--	--	--	--	--
Acetone	--	--	--	--	--
Benzene	--	--	--	--	--
Bromochloromethane	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--
Bromoform	--	--	--	--	--
Carbon disulfide	--	--	--	--	--
Carbon tetrachloride	--	--	--	--	--
Chlorobenzene	--	--	--	--	--
Chloroethane	--	--	--	--	--
Chloroform	--	--	--	--	--
Chloromethane	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--
Dibromochloromethane	--	--	--	--	--
Dichloromethane (Methylene chloride)	--	--	--	--	--
Ethyl benzene	--	--	--	--	--
Methyl Bromide	--	--	--	--	--
Methyl isobutyl ketone	--	--	--	--	--
Styrene	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--
Toluene	--	--	--	--	--
trans-1,2-Dichloroethene	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	--	--
Trichloroethene	--	--	--	--	--
Vinyl chloride	--	--	--	--	--
Xylenes (unspecified)	--	--	--	--	--
Semi-Volatile Organic Compounds (mg/kg)					
1,2,4-Trichlorobenzene	0.4 U	--	--	--	--
2,4,5-Trichlorophenol	0.4 U	--	--	--	--
2,4,6-Trichlorophenol	0.4 U	--	--	--	--
2,4-Dichlorophenol	0.4 U	--	--	--	--
2,4-Dimethylphenol	**94**	--	--	--	--
2,4-Dinitrophenol	7.2 U	--	--	--	--
2,4-Dinitrotoluene	1.6 U	--	--	--	--
2,6-Dinitrotoluene	0.4 U	--	--	--	--
2-Chloronaphthalene	0.17 U	--	--	--	--
2-Chlorophenol	0.4 U	--	--	--	--
2-Methylnaphthalene	**790**	--	--	--	--
2-Methylphenol	**80**	--	--	--	--
2-Nitroaniline	0.4 U	--	--	--	--
2-Nitrophenol	0.4 U	--	--	--	--
3,3-Dichlorobenzidine	2.4 U	--	--	--	--
3-Nitroaniline	1.6 U	--	--	--	--
4,6-Dinitro-2-methylphenol	4 U	--	--	--	--
4-Bromophenyl-phenylether	0.4 U	--	--	--	--
4-Chloro-3-methylphenol	0.4 U	--	--	--	--
4-Chloroaniline	0.4 U	--	--	--	--
4-Chlorophenyl-phenylether	0.4 U	--	--	--	--
4-Methylphenol	**99**	--	--	--	--
4-Nitroaniline	1.6 U	--	--	--	--
4-Nitrophenol	4 U	--	--	--	--
Acenaphthene	**460**	--	--	--	--
Acenaphthylene	**16**	--	--	--	--
Anthracene	**220**	--	--	--	--
Benzo(a)anthracene	**68**	--	--	--	--
Benzo(a)pyrene	**40**	--	--	--	--
Benzo(b)fluoranthene	**52**	--	--	--	--
Benzo(g,h,i)perylene	**17**	--	--	--	--
Benzo(k)fluoranthene	**19**	--	--	--	--
Bis(2-Chloro-1-methylethyl)Ether	0.4 U	--	--	--	--
bis(2-Chloroethoxy) methane	0.4 U	--	--	--	--
bis(2-Chloroethyl) ether	0.4 U	--	--	--	--
bis(2-Ethylhexyl) phthalate	1.6 U	--	--	--	--
Butylbenzylphthalate	**2.1 J**	--	--	--	--
Carbazole	**100**	--	--	--	--
Chrysene	**55**	--	--	--	--
Dibenzo(a,h)anthracene	**5**	--	--	--	--
Dibenzofuran	**380**	--	--	--	--
Diethylphthalate	1.6 U	--	--	--	--
Dimethylphthalate	1.6 U	--	--	--	--
Di-n-butylphthalate	1.6 U	--	--	--	--
Di-n-octylphthalate	1.6 U	--	--	--	--
Fluoranthene	**400**	--	--	--	--
Fluorene	**450**	--	--	--	--
Hexachlorobenzene	0.08 U	--	--	--	--
Hexachlorobutadiene	0.4 U	--	--	--	--
Hexachlorocyclopentadiene	4 U	--	--	--	--
Hexachloroethane	0.8 U	--	--	--	--
Indeno(1,2,3-cd)pyrene	**16**	--	--	--	--
Isophorone	0.4 U	--	--	--	--
Naphthalene	**3,000**	--	--	--	--
Nitrobenzene	0.4 U	--	--	--	--
N-Nitroso-di-n-propylamine	0.4 U	--	--	--	--
N-Nitrosodiphenylamine/Diphenylamine	**7.2**	--	--	--	--
Pentachlorophenol	0.8 U	--	--	--	--
Phenanthrene	**1,000**	--	--	--	--
Phenol	**95**	--	--	--	--
Polychlorinated naphthalene-2	--	--	--	--	--
Pyrene	**250**	--	--	--	--
Extractable Petroleum Hydrocarbons (mg/kg)					
C10-C12 AROMATICS	**1,400 J**	**4,000**	**440**	**5.7 J**	**59 J**
C12-C16 ALIPHATICS	**2,600**	**13,000 J**	**1,700 J**	**6.3 J**	**720 J**
C12-C16 AROMATICS	**1,300**	**3,800**	**850**	**19**	**380**
C16-C21 ALIPHATICS	**470**	**5,300**	**600**	4.4 U	**590**
C16-C21 AROMATICS	**3,600**	**12,000**	**3,400**	**100**	**2,100**
C21-C36 AROMATIC	**1,400**	**5,700**	**1,400**	**21**	**1,400**
C21-C40 ALIPHATICS	**230**	**3,800**	**680**	4.4 U	**1,500**
C9-C12 ALIPHATICS	**3,800**	**13,000 J**	**1,100 J**	4.4 U	**120 J**
TOTAL ALIPHATICS	**7,100**	**35,000**	**4,100**	**6.3 J**	**2,900**
TOTAL AROMATICS	**7,700**	**25,000**	**6,000**	**150**	**3,900**
TOTAL EPH	**15,000**	**61,000**	**10,000**	**150**	**6,900**

TABLE 6a
POST-PILOT SOIL CONCENTRATIONS - SHALLOW FILL UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	B-12-2013	B-13-2013
Date Sampled	22-Jan-13	22-Jan-13
Depth Interval (ft bgs)	7.34-8.34	7.34-8.34
STAR Treatment Zone	N	N
Duplicate	--	--
Volatile Organic Compounds (mg/kg)		
1,1,1-Trichloroethane	--	--
1,1,2,2-Tetrachloroethane	--	--
1,1,2-Trichloroethane	--	--
1,1-Dichloroethane	--	--
1,1-Dichloroethene	--	--
1,2-Dibromo-3-chloropropane	--	--
1,2-Dibromoethane	--	--
1,2-Dichlorobenzene	--	--
1,2-Dichloroethane	--	--
1,2-Dichloropropane	--	--
1,3-Dichlorobenzene	--	--
1,4-Dichlorobenzene	--	--
2-Butanone (MEK)	--	--
2-Hexanone	--	--
Acetone	--	--
Benzene	--	--
Bromochloromethane	--	--
Bromodichloromethane	--	--
Bromoform	--	--
Carbon disulfide	--	--
Carbon tetrachloride	--	--
Chlorobenzene	--	--
Chloroethane	--	--
Chloroform	--	--
Chloromethane	--	--
cis-1,2-Dichloroethene	--	--
cis-1,3-Dichloropropene	--	--
Dibromochloromethane	--	--
Dichloromethane (Methylene chloride)	--	--
Ethyl benzene	--	--
Methyl Bromide	--	--
Methyl isobutyl ketone	--	--
Styrene	--	--
Tetrachloroethene	--	--
Toluene	--	--
trans-1,2-Dichloroethene	--	--
trans-1,3-Dichloropropene	--	--
Trichloroethene	--	--
Vinyl chloride	--	--
Xylenes (unspecified)	--	--
Semi-Volatile Organic Compounds (mg/kg)		
1,2,4-Trichlorobenzene	--	--
2,4,5-Trichlorophenol	--	--
2,4,6-Trichlorophenol	--	--
2,4-Dichlorophenol	--	--
2,4-Dimethylphenol	--	--
2,4-Dinitrophenol	--	--
2,4-Dinitrotoluene	--	--
2,6-Dinitrotoluene	--	--
2-Chloronaphthalene	--	--
2-Chlorophenol	--	--
2-Methylnaphthalene	--	--
2-Methylphenol	--	--
2-Nitroaniline	--	--
2-Nitrophenol	--	--
3,3-Dichlorobenzidine	--	--
3-Nitroaniline	--	--
4,6-Dinitro-2-methylphenol	--	--
4-Bromophenyl-phenylether	--	--
4-Chloro-3-methylphenol	--	--
4-Chloroaniline	--	--
4-Chlorophenyl-phenylether	--	--
4-Methylphenol	--	--
4-Nitroaniline	--	--
4-Nitrophenol	--	--
Acenaphthene	--	--
Acenaphthylene	--	--
Anthracene	--	--
Benzo(a)anthracene	--	--
Benzo(a)pyrene	--	--
Benzo(b)fluoranthene	--	--
Benzo(g,h,i)perylene	--	--
Benzo(k)fluoranthene	--	--
Bis(2-Chloro-1-methylethyl)Ether	--	--
bis(2-Chloroethoxy) methane	--	--
bis(2-Chloroethyl) ether	--	--
bis(2-Ethylhexyl) phthalate	--	--
Butylbenzylphthalate	--	--
Carbazole	--	--
Chrysene	--	--
Dibenzo(a,h)anthracene	--	--
Dibenzofuran	--	--
Diethylphthalate	--	--
Dimethylphthalate	--	--
Di-n-butylphthalate	--	--
Di-n-octylphthalate	--	--
Fluoranthene	--	--
Fluorene	--	--
Hexachlorobenzene	--	--
Hexachlorobutadiene	--	--
Hexachlorocyclopentadiene	--	--
Hexachloroethane	--	--
Indeno(1,2,3-cd)pyrene	--	--
Isophorone	--	--
Naphthalene	--	--
Nitrobenzene	--	--
N-Nitroso-di-n-propylamine	--	--
N-Nitrosodiphenylamine/Diphenylamine	--	--
Pentachlorophenol	--	--
Phenanthrene	--	--
Phenol	--	--
Polychlorinated naphthalene-2	--	--
Pyrene	--	--
Extractable Petroleum Hydrocarbons (mg/kg)		
C10-C12 AROMATICS	**1,100**	**21 J**
C12-C16 ALIPHATICS	**17,000 J**	**220 J**
C12-C16 AROMATICS	**1,500**	**20 J**
C16-C21 ALIPHATICS	**6,700**	**1,000**
C16-C21 AROMATICS	**5,100**	**580**
C21-C36 AROMATIC	**2,600**	**590**
C21-C40 ALIPHATICS	**10,000**	**1,100**
C9-C12 ALIPHATICS	**14,000 J**	**99 J**
TOTAL ALIPHATICS	**47,000**	**2,400**
TOTAL AROMATICS	**10,000**	**1,200**
TOTAL EPH	**58,000**	**3,600**

Notes:
mg/kg - milligrams per kilogram
ft bgs - feet below ground surface
U - analyte not detected above quantitation limit
J - estimated concentration
Bold values indicate detections

TABLE 6b
POST-PILOT SOIL CONCENTRATIONS - DEEP SAND UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	B-1-2012	B-1-2012	B-2-2012	B-2-2012	B-3-2012	B-3-2012	B-4-2012	B-4-2012
Date Sampled	12-Oct-12	12-Oct-12	12-Oct-12	12-Oct-12	14-Oct-12	14-Oct-12	12-Oct-12	12-Oct-12
Depth Interval (ft bgs)	18.84-19.34	22.14-22.64	20.84-21.34	22.14-22.64	20.34-20.84	21.84-22.34	22.84-23.34	23.84-24.34
STAR Treatment Zone	N	N	Y	Y	Y	Y	Y	Y
Duplicate	--	--	--	--	--	--	--	--
Volatile Organic Compounds (mg/kg)								
1,1,1-Trichloroethane	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--
1,2-Dibromo-3-chloropropane	--	--	--	--	--	--	--	--
1,2-Dibromoethane	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--	--	--	--
2-Butanone (MEK)	--	--	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--	--	--
Acetone	--	--	--	--	--	--	--	--
Benzene	--	--	--	--	--	--	--	--
Bromochloromethane	--	--	--	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--	--	--	--
Bromoform	--	--	--	--	--	--	--	--
Carbon disulfide	--	--	--	--	--	--	--	--
Carbon tetrachloride	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	--	--	--	--	--	--
Chloroethane	--	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--	--
Chloromethane	--	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--
Dibromochloromethane	--	--	--	--	--	--	--	--
Dichloromethane (Methylene chloride)	--	--	--	--	--	--	--	--
Ethyl benzene	--	--	--	--	--	--	--	--
Methyl Bromide	--	--	--	--	--	--	--	--
Methyl isobutyl ketone	--	--	--	--	--	--	--	--
Styrene	--	--	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--
Vinyl chloride	--	--	--	--	--	--	--	--
Xylenes (unspecified)	--	--	--	--	--	--	--	--
Semi-Volatile Organic Compounds (mg/kg)								
1,2,4-Trichlorobenzene	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
2,4,5-Trichlorophenol	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
2,4,6-Trichlorophenol	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
2,4-Dichlorophenol	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
2,4-Dimethylphenol	**2.2**	**6.6**	**0.32**	0.017 U	0.02 U	0.19 U	**0.061**	0.017 U
2,4-Dinitrophenol	3.1 U	3 U	1.7 U	0.3 U	0.35 U	3.5 U	0.3 U	0.3 U
2,4-Dinitrotoluene	0.69 U	0.67 U	0.38 U	0.067 U	0.079 U	0.77 U	0.066 U	0.066 U
2,6-Dinitrotoluene	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
2-Chloronaphthalene	0.073 U	0.07 U	0.039 U	0.007 U	0.008 U	0.081 U	0.007 U	0.007 U
2-Chlorophenol	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
2-Methylnaphthalene	**73**	**280**	**5.9**	**0.5**	**0.15**	**71**	**6.2**	**0.49**
2-Methylphenol	**0.38**	**1.4**	**0.2**	**0.017 J**	**0.021 J**	**0.57**	**0.024 J**	0.017 U
2-Nitroaniline	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
2-Nitrophenol	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
3,3-Dichlorobenzidine	1 U	1 U	0.56 U	0.1 U	0.12 U	1.2 U	0.1 U	0.099 U
3-Nitroaniline	0.69 U	0.67 U	0.38 U	0.067 U	0.079 U	0.77 U	0.066 U	0.066 U
4,6-Dinitro-2-methylphenol	1.7 U	1.7 U	0.94 U	0.17 U	0.2 U	1.9 U	0.17 U	0.17 U
4-Bromophenyl-phenylether	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
4-Chloro-3-methylphenol	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
4-Chloroaniline	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
4-Chlorophenyl-phenylether	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
4-Methylphenol	**0.28 J**	**3**	**0.27**	**0.031 J**	0.02 U	**1.2**	**0.025 J**	0.017 U
4-Nitroaniline	0.69 U	0.67 U	0.38 U	0.067 U	0.079 U	0.77 U	0.066 U	0.066 U
4-Nitrophenol	1.7 U	1.7 U	0.94 U	0.17 U	0.2 U	1.9 U	0.17 U	0.17 U
Acenaphthene	**60**	**98**	**5.5**	**0.53**	**0.28**	**40**	**2.3**	**0.12**
Acenaphthylene	**6**	**7.7**	**0.77**	**0.072**	**0.039**	**3.2**	**0.16**	**0.015 J**
Anthracene	**38**	**47**	**7.9**	**0.76**	**0.7**	**21**	**1**	**0.07**
Benzo(a)anthracene	**13**	**22**	**3**	**0.25**	**0.16**	**9.1**	**0.52**	**0.036**
Benzo(a)pyrene	**8.1**	**12**	**1.7**	**0.15**	**0.091**	**5.1**	**0.31**	**0.015 J**
Benzo(b)fluoranthene	**9.4**	**16**	**2.4**	**0.22**	**0.13**	**5.8**	**0.39**	**0.027**
Benzo(g,h,i)perylene	**3.9**	**6.1**	**1.1**	**0.086**	**0.037**	**2.2**	**0.15**	**0.007 J**
Benzo(k)fluoranthene	**3.7**	**5.8**	**0.88**	**0.073**	**0.049**	**2.6**	**0.14**	**0.009 J**
Bis(2-Chloro-1-methylethyl)Ether	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
bis(2-Chloroethoxy) methane	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
bis(2-Chloroethyl) ether	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
bis(2-Ethylhexyl) phthalate	0.69 U	0.67 U	0.38 U	0.067 U	0.079 U	0.77 U	0.066 U	0.066 U
Butylbenzylphthalate	0.69 U	0.67 U	0.38 U	0.067 U	0.079 U	0.77 U	0.066 U	0.066 U
Carbazole	**18**	**15**	**3.3**	**0.31**	**1**	**10**	**0.45**	**0.036**
Chrysene	**13**	**20**	**3.1**	**0.26**	**0.14**	**7.3**	**0.51**	**0.049**
Dibenzo(a,h)anthracene	**1.1**	**1.8**	**0.3**	**0.028**	**0.013 J**	**0.68**	**0.045**	0.003 U
Dibenzofuran	**52**	**84**	**7.3**	**0.7**	**0.46**	**33**	**2.2**	**0.21**
Diethylphthalate	0.69 U	0.67 U	0.38 U	0.067 U	0.079 U	0.77 U	0.066 U	0.066 U
Dimethylphthalate	0.69 U	0.67 U	0.38 U	0.067 U	0.079 U	0.77 U	0.066 U	0.066 U
Di-n-butylphthalate	0.69 U	0.67 U	0.38 U	0.067 U	0.079 U	0.77 U	0.066 U	0.066 U
Di-n-octylphthalate	0.69 U	0.67 U	0.38 U	0.067 U	0.079 U	0.77 U	0.066 U	0.066 U
Fluoranthene	**62**	**100**	**15**	**1.3**	**0.69**	**36**	**3.1**	**0.28**
Fluorene	**60**	**90**	**9.2**	**0.87**	**0.59**	**39**	**2.5**	**0.22**
Hexachlorobenzene	0.035 U	0.033 U	0.019 U	0.003 U	0.004 U	0.039 U	0.003 U	0.003 U
Hexachlorobutadiene	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
Hexachlorocyclopentadiene	1.7 U	1.7 U	0.94 U	0.17 U	0.2 U	1.9 U	0.17 U	0.17 U
Hexachloroethane	0.35 U	0.33 U	0.19 U	0.034 U	0.039 U	0.39 U	0.033 U	0.033 U
Indeno(1,2,3-cd)pyrene	**3.3**	**5.2**	**0.89**	**0.071**	**0.033**	**2**	**0.13**	**0.008 J**
Isophorone	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
Naphthalene	**190**	**890**	**9.9**	**0.95**	**0.38**	**160**	**17**	**1.8**
Nitrobenzene	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
N-Nitroso-di-n-propylamine	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
N-Nitrosodiphenylamine/Diphenylamine	0.17 U	0.17 U	0.094 U	0.017 U	0.02 U	0.19 U	0.017 U	0.017 U
Pentachlorophenol	0.35 U	0.33 U	0.19 U	0.034 U	0.039 U	0.39 U	0.033 U	0.033 U
Phenanthrene	**150**	**240**	**33**	**2.8**	**1.7**	**98**	**7.3**	**0.65**
Phenol	0.17 U	**0.94**	**0.26**	**0.037**	**0.024 J**	**1**	0.017 U	0.017 U
Polychlorinated naphthalene-2	--	--	--	--	--	--	--	--
Pyrene	**44**	**73**	**10**	**0.89**	**0.52**	**28**	**1.9**	**0.18**
Extractable Petroleum Hydrocarbons (mg/kg)								
C10-C12 AROMATICS	**69**	**5,100**	**20**	3 U	3.5 U	**160 J**	**16**	3 U
C12-C16 ALIPHATICS	**30**	**7,700**	**10 J**	3 U	3.5 U	**120**	**3.8 J**	3 U
C12-C16 AROMATICS	**160**	**5,600**	**41**	3 U	3.5 U	**230**	**17**	3 U
C16-C21 ALIPHATICS	**42**	**1,600**	**8.3 J**	3 U	3.5 U	**50**	2.9 U	3 U
C16-C21 AROMATICS	**430**	**9,700**	**200**	**12**	**11 J**	**510**	**35**	3 U
C21-C36 AROMATIC	**180**	**3,900**	**100**	**3.6 J**	3.5 U	**200**	**10**	3 U
C21-C40 ALIPHATICS	**41**	**1,400**	**13**	3 U	3.5 U	**52**	2.9 U	3 U
C9-C12 ALIPHATICS	**3.1 J**	**6,900**	**5.7 J**	3 U	3.5 U	**64**	**4.3 J**	3 U
TOTAL ALIPHATICS	**120**	**18,000**	**37**	3 U	3.5 U	**290**	**8.1 J**	3 U
TOTAL AROMATICS	**830**	**24,000**	**370**	**16**	**11 J**	**1,100**	**78**	3 U
TOTAL EPH	**950**	**42,000**	**400**	**16**	**11 J**	**1,400**	**86**	3 U

TABLE 6b
POST-PILOT SOIL CONCENTRATIONS - DEEP SAND UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	B-5-2012	B-5-2012	B-6-2012	B-6-2012	B-7-2012	B-7-2012	B-8-2012
Date Sampled	12-Oct-12	12-Oct-12	14-Oct-12	14-Oct-12	14-Oct-12	14-Oct-12	14-Oct-12
Depth Interval (ft bgs)	20.34-20.84	22.34-22.84	20.34-20.84	23.84-24.34	22.34-22.84	23.84-24.34	21.84-22.34
STAR Treatment Zone	Y	Y	Y	Y	Y	Y	N
Duplicate	--	--	--	--	--	--	--
Volatile Organic Compounds (mg/kg)							
1,1,1-Trichloroethane	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
1,1,2,2-Tetrachloroethane	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
1,1,2-Trichloroethane	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
1,1-Dichloroethane	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
1,1-Dichloroethene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
1,2-Dibromo-3-chloropropane	--	--	0.11 U	0.002 U	0.002 U	0.002 U	1.1 U
1,2-Dibromoethane	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
1,2-Dichlorobenzene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
1,2-Dichloroethane	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
1,2-Dichloropropane	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
1,3-Dichlorobenzene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
1,4-Dichlorobenzene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
2-Butanone (MEK)	--	--	0.23 U	**0.005 J**	**0.1**	**0.006 J**	2.1 U
2-Hexanone	--	--	0.17 U	**0.004 J**	**0.013**	**0.013**	1.6 U
Acetone	--	--	0.4 U	**0.024**	**0.67**	**0.017 J**	3.7 U
Benzene	--	--	0.029 U	**0.001 J**	**0.04**	**0.004 J**	0.27 U
Bromochloromethane	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Bromodichloromethane	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Bromoform	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Carbon disulfide	--	--	0.057 U	0.001 U	**0.003 J**	0.001 U	0.53 U
Carbon tetrachloride	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Chlorobenzene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Chloroethane	--	--	0.11 U	0.002 U	0.002 U	0.002 U	1.1 U
Chloroform	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Chloromethane	--	--	0.11 U	0.002 U	0.002 U	0.002 U	1.1 U
cis-1,2-Dichloroethene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
cis-1,3-Dichloropropene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Dibromochloromethane	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Dichloromethane (Methylene chloride)	--	--	0.11 U	0.002 U	0.002 U	0.002 U	1.1 U
Ethyl benzene	--	--	0.057 U	0.001 U	**0.002 J**	**0.002 J**	0.53 U
Methyl Bromide	--	--	0.11 U	0.002 U	0.002 U	0.002 U	1.1 U
Methyl isobutyl ketone	--	--	0.17 U	0.004 U	0.003 U	0.004 U	1.6 U
Styrene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Tetrachloroethene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Toluene	--	--	**0.092 J**	**0.002 J**	**0.037**	**0.005 J**	0.53 U
trans-1,2-Dichloroethene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
trans-1,3-Dichloropropene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Trichloroethene	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Vinyl chloride	--	--	0.057 U	0.001 U	0.001 U	0.001 U	0.53 U
Xylenes (unspecified)	--	--	**0.32**	**0.004 J**	**0.022**	**0.009**	**4.3**
Semi-Volatile Organic Compounds (mg/kg)							
1,2,4-Trichlorobenzene	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
2,4,5-Trichlorophenol	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
2,4,6-Trichlorophenol	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
2,4-Dichlorophenol	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
2,4-Dimethylphenol	**0.2**	0.017 U	0.02 U	**1.4**	**0.12**	**0.08**	**6.3**
2,4-Dinitrophenol	0.35 U	0.31 U	0.36 U	0.35 U	0.35 U	0.37 U	3.5 U
2,4-Dinitrotoluene	0.078 U	0.068 U	0.08 U	0.078 U	0.078 U	0.082 U	0.78 U
2,6-Dinitrotoluene	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
2-Chloronaphthalene	0.008 U	0.007 U	0.008 U	0.008 U	0.008 U	0.009 U	0.081 U
2-Chlorophenol	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
2-Methylnaphthalene	**2.6**	**0.092**	**0.23**	**0.056**	**0.96**	**0.1**	**330**
2-Methylphenol	**0.13**	0.017 U	**0.22**	**1.7**	**0.12**	**0.51**	**2.1**
2-Nitroaniline	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
2-Nitrophenol	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
3,3-Dichlorobenzidine	0.12 U	0.1 U	0.12 U	0.12 U	0.12 U	0.12 U	1.2 U
3-Nitroaniline	0.078 U	0.068 U	0.08 U	0.078 U	0.078 U	0.082 U	0.78 U
4,6-Dinitro-2-methylphenol	0.19 U	0.17 U	0.2 U	0.2 U	0.2 U	0.2 U	1.9 U
4-Bromophenyl-phenylether	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
4-Chloro-3-methylphenol	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
4-Chloroaniline	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
4-Chlorophenyl-phenylether	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
4-Methylphenol	**0.21**	**0.043**	**0.11**	**2.3**	**0.088**	**0.53**	**0.74**
4-Nitroaniline	0.078 U	0.068 U	0.08 U	0.078 U	0.078 U	0.082 U	0.78 U
4-Nitrophenol	0.19 U	0.17 U	0.2 U	0.2 U	0.2 U	0.2 U	1.9 U
Acenaphthene	**2.7**	**0.11**	**2.9**	**0.084**	**0.69**	**0.09**	**170**
Acenaphthylene	**0.22**	**0.024**	**0.21**	**0.029**	**0.099**	**0.043**	**18**
Anthracene	**3**	**0.17**	**3.9**	**0.23**	**0.65**	**0.29**	**92**
Benzo(a)anthracene	**0.71**	**0.06**	**0.94**	**0.057**	**0.2**	**0.046**	**36**
Benzo(a)pyrene	**0.46**	**0.037**	**0.54**	**0.031**	**0.11**	**0.023**	**21**
Benzo(b)fluoranthene	**0.55**	**0.05**	**0.71**	**0.039**	**0.16**	**0.026**	**24**
Benzo(g,h,i)perylene	**0.23**	**0.02**	**0.26**	**0.017 J**	**0.055**	**0.012 J**	**9.9**
Benzo(k)fluoranthene	**0.21**	**0.016 J**	**0.24**	**0.017 J**	**0.048**	**0.017 J**	**10**
Bis(2-Chloro-1-methylethyl)Ether	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
bis(2-Chloroethoxy) methane	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
bis(2-Chloroethyl) ether	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
bis(2-Ethylhexyl) phthalate	0.078 U	0.068 U	0.08 U	0.078 U	0.078 U	0.082 U	0.78 U
Butylbenzylphthalate	0.078 U	0.068 U	0.08 U	0.078 U	0.078 U	0.082 U	0.78 U
Carbazole	**1.4**	**0.083**	**0.85**	0.02 U	**0.3**	**0.1**	**38**
Chrysene	**0.67**	**0.06**	**0.84**	**0.057**	**0.18**	**0.041**	**30**
Dibenzo(a,h)anthracene	**0.06**	**0.006 J**	**0.08**	0.004 U	**0.018 J**	**0.006 J**	**3**
Dibenzofuran	**2.5**	**0.18**	**2.5**	**0.099**	**2.1**	**0.1**	**200**
Diethylphthalate	0.078 U	0.068 U	0.08 U	0.078 U	0.078 U	0.082 U	0.78 U
Dimethylphthalate	0.078 U	0.068 U	0.08 U	0.078 U	0.078 U	0.082 U	0.78 U
Di-n-butylphthalate	0.078 U	0.068 U	0.08 U	0.078 U	0.078 U	0.082 U	0.78 U
Di-n-octylphthalate	0.078 U	0.068 U	0.08 U	0.078 U	0.078 U	0.082 U	0.78 U
Fluoranthene	**3.4**	**0.3**	**4.4**	**0.26**	**4.2**	**0.19**	**170**
Fluorene	**3.1**	**0.21**	**4.1**	**0.16**	**0.87**	**0.13**	**170**
Hexachlorobenzene	0.004 U	0.003 U	0.004 U	0.004 U	0.004 U	0.004 U	0.039 U
Hexachlorobutadiene	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
Hexachlorocyclopentadiene	0.19 U	0.17 U	0.2 U	0.2 U	0.2 U	0.2 U	1.9 U
Hexachloroethane	0.039 U	0.034 U	0.04 U	0.039 U	0.039 U	0.041 U	0.39 U
Indeno(1,2,3-cd)pyrene	**0.19**	**0.017 J**	**0.23**	**0.015 J**	**0.053**	**0.009 J**	**8.9**
Isophorone	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
Naphthalene	**2.4**	**1.1**	**0.64**	**0.11**	**2.3**	**0.24**	**1,000**
Nitrobenzene	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
N-Nitroso-di-n-propylamine	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	0.19 U
N-Nitrosodiphenylamine/Diphenylamine	0.019 U	0.017 U	0.02 U	0.02 U	0.02 U	0.02 U	**3.1**
Pentachlorophenol	0.039 U	0.034 U	0.04 U	0.039 U	0.039 U	0.041 U	0.39 U
Phenanthrene	**8.2**	**0.71**	**11**	**0.54**	**4.3**	**0.37**	**480**
Phenol	**0.18**	**0.13**	0.02 U	**1.1**	**0.18**	**0.86**	**0.7**
Polychlorinated naphthalene-2	--	--	--	--	--	--	--
Pyrene	**2.7**	**0.23**	**3.1**	**0.19**	**0.68**	**0.14**	**120**
Extractable Petroleum Hydrocarbons (mg/kg)							
C10-C12 AROMATICS	3.5 U	3 U	**5.6 J**	3.4 U	3.4 U	3.6 U	**960 J**
C12-C16 ALIPHATICS	**5.9 J**	3 U	3.5 U	3.4 U	3.4 U	3.6 U	**2,600**
C12-C16 AROMATICS	**11 J**	3 U	**15**	3.4 U	3.4 U	3.6 U	**1,000**
C16-C21 ALIPHATICS	3.5 U	3 U	3.5 U	3.4 U	3.4 U	3.6 U	**660**
C16-C21 AROMATICS	**45**	3 U	**54**	3.4 U	**17**	3.6 U	**2,500**
C21-C36 AROMATIC	**14**	3 U	**21**	3.4 U	3.4 U	3.6 U	**1,000**
C21-C40 ALIPHATICS	3.5 U	3 U	3.5 U	3.4 U	3.4 U	3.6 U	**490**
C9-C12 ALIPHATICS	3.5 U	3 U	3.5 U	3.4 U	3.4 U	3.6 U	**3,100**
TOTAL ALIPHATICS	**5.9 J**	3 U	3.5 U	3.4 U	3.4 U	3.6 U	**6,800**
TOTAL AROMATICS	**70**	3 U	**95**	3.4 U	**17**	3.6 U	**5,500**
TOTAL EPH	**76**	3 U	**95**	3.4 U	**17**	3.6 U	**12,000**

TABLE 6b
POST-PILOT SOIL CONCENTRATIONS - DEEP SAND UNIT
Former Pitt Consol Site, Newark, New Jersey

Location	B-8-2012	B-12-2013	B-12-2013
Date Sampled	14-Oct-12	22-Jan-13	22-Jan-13
Depth Interval (ft bgs)	24.84-25.34	19.34-20.34	24.34-25.34
STAR Treatment Zone	Y	N	Y
Duplicate	--	--	--
Volatile Organic Compounds (mg/kg)			
1,1,1-Trichloroethane	0.001 U	--	--
1,1,2,2-Tetrachloroethane	0.001 U	--	--
1,1,2-Trichloroethane	0.001 U	--	--
1,1-Dichloroethane	0.001 U	--	--
1,1-Dichloroethene	0.001 U	--	--
1,2-Dibromo-3-chloropropane	0.002 U	--	--
1,2-Dibromoethane	0.001 U	--	--
1,2-Dichlorobenzene	0.001 U	--	--
1,2-Dichloroethane	0.001 U	--	--
1,2-Dichloropropane	0.001 U	--	--
1,3-Dichlorobenzene	0.001 U	--	--
1,4-Dichlorobenzene	0.001 U	--	--
2-Butanone (MEK)	**0.24**	--	--
2-Hexanone	0.004 U	--	--
Acetone	**0.37**	--	--
Benzene	**0.002 J**	--	--
Bromochloromethane	0.001 U	--	--
Bromodichloromethane	0.001 U	--	--
Bromoform	0.001 U	--	--
Carbon disulfide	0.001 U	--	--
Carbon tetrachloride	0.001 U	--	--
Chlorobenzene	0.001 U	--	--
Chloroethane	0.002 U	--	--
Chloroform	0.001 U	--	--
Chloromethane	0.002 U	--	--
cis-1,2-Dichloroethene	0.001 U	--	--
cis-1,3-Dichloropropene	0.001 U	--	--
Dibromochloromethane	0.001 U	--	--
Dichloromethane (Methylene chloride)	0.002 U	--	--
Ethyl benzene	0.001 U	--	--
Methyl Bromide	0.002 U	--	--
Methyl isobutyl ketone	0.004 U	--	--
Styrene	0.001 U	--	--
Tetrachloroethene	0.001 U	--	--
Toluene	**0.002 J**	--	--
trans-1,2-Dichloroethene	0.001 U	--	--
trans-1,3-Dichloropropene	0.001 U	--	--
Trichloroethene	0.001 U	--	--
Vinyl chloride	0.001 U	--	--
Xylenes (unspecified)	**0.004 J**	--	--
Semi-Volatile Organic Compounds (mg/kg)			
1,2,4-Trichlorobenzene	0.043 U	--	--
2,4,5-Trichlorophenol	0.043 U	--	--
2,4,6-Trichlorophenol	0.043 U	--	--
2,4-Dichlorophenol	0.043 U	--	--
2,4-Dimethylphenol	**0.059 J**	--	--
2,4-Dinitrophenol	0.77 U	--	--
2,4-Dinitrotoluene	0.17 U	--	--
2,6-Dinitrotoluene	0.043 U	--	--
2-Chloronaphthalene	0.018 U	--	--
2-Chlorophenol	0.043 U	--	--
2-Methylnaphthalene	**0.04 J**	--	--
2-Methylphenol	**0.47**	--	--
2-Nitroaniline	0.043 U	--	--
2-Nitrophenol	0.043 U	--	--
3,3-Dichlorobenzidine	0.26 U	--	--
3-Nitroaniline	0.17 U	--	--
4,6-Dinitro-2-methylphenol	0.43 U	--	--
4-Bromophenyl-phenylether	0.043 U	--	--
4-Chloro-3-methylphenol	0.043 U	--	--
4-Chloroaniline	0.043 U	--	--
4-Chlorophenyl-phenylether	0.043 U	--	--
4-Methylphenol	**0.81**	--	--
4-Nitroaniline	0.17 U	--	--
4-Nitrophenol	0.43 U	--	--
Acenaphthene	**0.064**	--	--
Acenaphthylene	**0.046**	--	--
Anthracene	**0.21**	--	--
Benzo(a)anthracene	**0.081**	--	--
Benzo(a)pyrene	**0.05**	--	--
Benzo(b)fluoranthene	**0.059**	--	--
Benzo(g,h,i)perylene	**0.023 J**	--	--
Benzo(k)fluoranthene	**0.026 J**	--	--
Bis(2-Chloro-1-methylethyl)Ether	0.043 U	--	--
bis(2-Chloroethoxy) methane	0.043 U	--	--
bis(2-Chloroethyl) ether	0.043 U	--	--
bis(2-Ethylhexyl) phthalate	0.17 U	--	--
Butylbenzylphthalate	0.17 U	--	--
Carbazole	**0.1**	--	--
Chrysene	**0.071**	--	--
Dibenzo(a,h)anthracene	0.009 U	--	--
Dibenzofuran	**0.14**	--	--
Diethylphthalate	0.17 U	--	--
Dimethylphthalate	0.17 U	--	--
Di-n-butylphthalate	0.17 U	--	--
Di-n-octylphthalate	0.17 U	--	--
Fluoranthene	**0.39**	--	--
Fluorene	**0.16**	--	--
Hexachlorobenzene	0.009 U	--	--
Hexachlorobutadiene	0.043 U	--	--
Hexachlorocyclopentadiene	0.43 U	--	--
Hexachloroethane	0.086 U	--	--
Indeno(1,2,3-cd)pyrene	**0.021 J**	--	--
Isophorone	0.043 U	--	--
Naphthalene	**0.059**	--	--
Nitrobenzene	0.043 U	--	--
N-Nitroso-di-n-propylamine	0.043 U	--	--
N-Nitrosodiphenylamine/Diphenylamine	0.043 U	--	--
Pentachlorophenol	0.086 U	--	--
Phenanthrene	**0.72**	--	--
Phenol	**0.95**	--	--
Polychlorinated naphthalene-2	--	--	--
Pyrene	**0.24**	--	--
Extractable Petroleum Hydrocarbons (mg/kg)			
C10-C12 AROMATICS	3.3 U	**78**	**210**
C12-C16 ALIPHATICS	3.3 U	**150 J**	**690 J**
C12-C16 AROMATICS	3.3 U	**130**	**300**
C16-C21 ALIPHATICS	3.3 U	**39**	**480**
C16-C21 AROMATICS	3.3 U	**360**	**1,100**
C21-C36 AROMATIC	3.3 U	**150**	**300**
C21-C40 ALIPHATICS	3.3 U	**29**	**340**
C9-C12 ALIPHATICS	3.3 U	**120 J**	**580 J**
TOTAL ALIPHATICS	3.3 U	**340**	**2,100**
TOTAL AROMATICS	3.3 U	**720**	**2,000**
TOTAL EPH	3.3 U	**1,100**	**4,100**

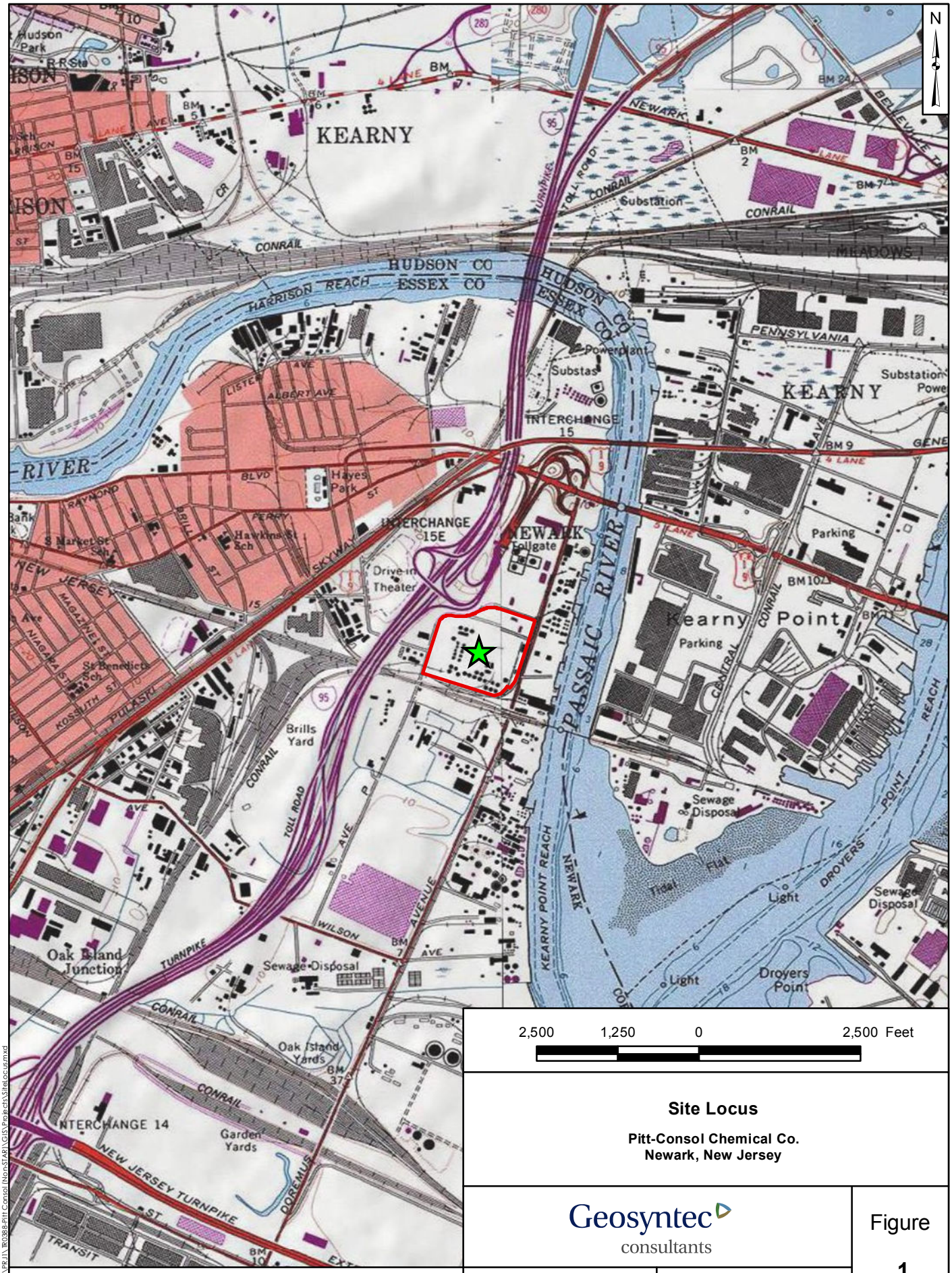
Notes:
mg/kg - milligrams per kilogram
ft bgs - feet below ground surface
U - analyte not detected above quantitation limit
J - estimated concentration
Bold values indicate detections

TABLE 7
SUMMARY OF SOIL CONCENTRASTION REDUCTIONS IN DEEP SAND UNIT TREATMENT AREA
Former Pitt Consol Site, Newark, New Jersey

Compound Group	Concentration Reduction (%) in Soil*
Total Aromatics	97.30%
Total Aliphatics	99.04%
Total BTEX/VOCs	99.95%

Notes:
*Percent reduction of average concentrations from 8 'Before' samples and 14 'After' samples corresponding to the deep sand unit treatment zone
BTEX - benzene, toluene, ethylbenzenem xylenes
VOCs - volatile organic compounds

FIGURES



2,500 1,250 0 2,500 Feet

Site Locus

Pitt-Consol Chemical Co.
Newark, New Jersey

Geosyntec consultants

Figure 1

Base Map: USGS Jersey City and Elizabeth Quadrangles (1:24,000)

Ewing, NJ

May 2013

Path: P:\PRJ\TR0388-PH Consol (NonSTAR)\GIS\Projects\SiteLocus.mxd

Legend

- Well Location
- CMT Well
- Site Boundary
- Newark Parcel Boundary (lot/block)
- Pilot Test Area
- Estimated Sewer Line
- Historic Site Feature
- Former Lagoon

Notes:

1. 2012 aerial photograph courtesy of Mircosoft Corporation
2. CMT - Continuous Multi-Channel Tubing

200 100 0 200 Feet

Site Plan
Former Pitt Consol Site, Newark, NJ

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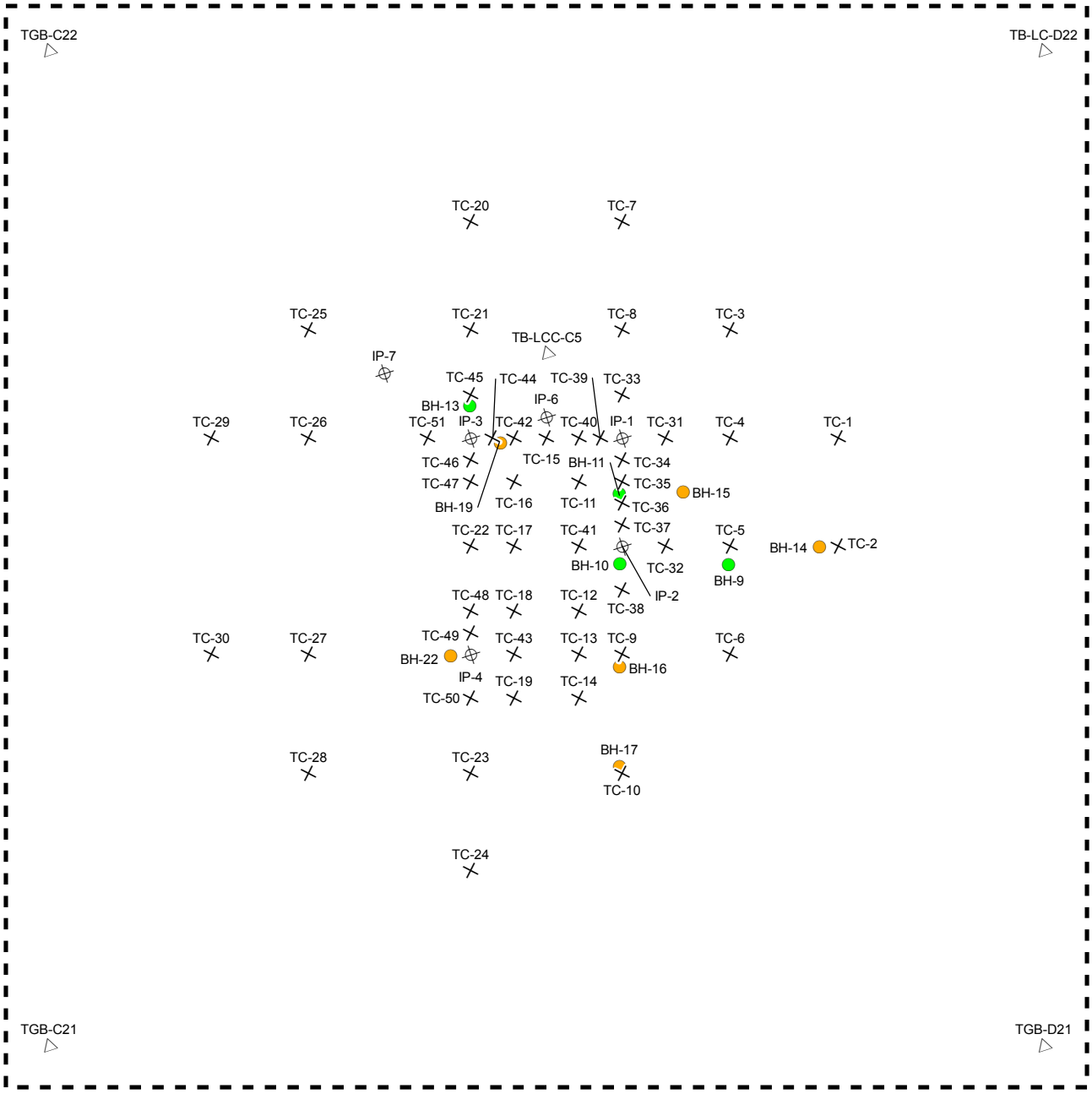
Figure **2**

Site Plan.cal

Path: P:\PRJ\Projects\TR0388- DuPont Pitt Consol\Database and GIS\GIS\fig2,3,6_sitefeatures.mxd



7.5 0 7.5 15 Feet

Legend

- Ignition Point
- Thermocouple
- Pre-Pilot TARGOST Location
- Post-Pilot Co-Located Borehole and TARGOST Location
- Post-Pilot TARGOST Location
- Concrete Work Platform

Pilot Test Area (PTA) Schematic
Shallow Fill Unit

Former Pitt-Consol Site, Newark, New Jersey

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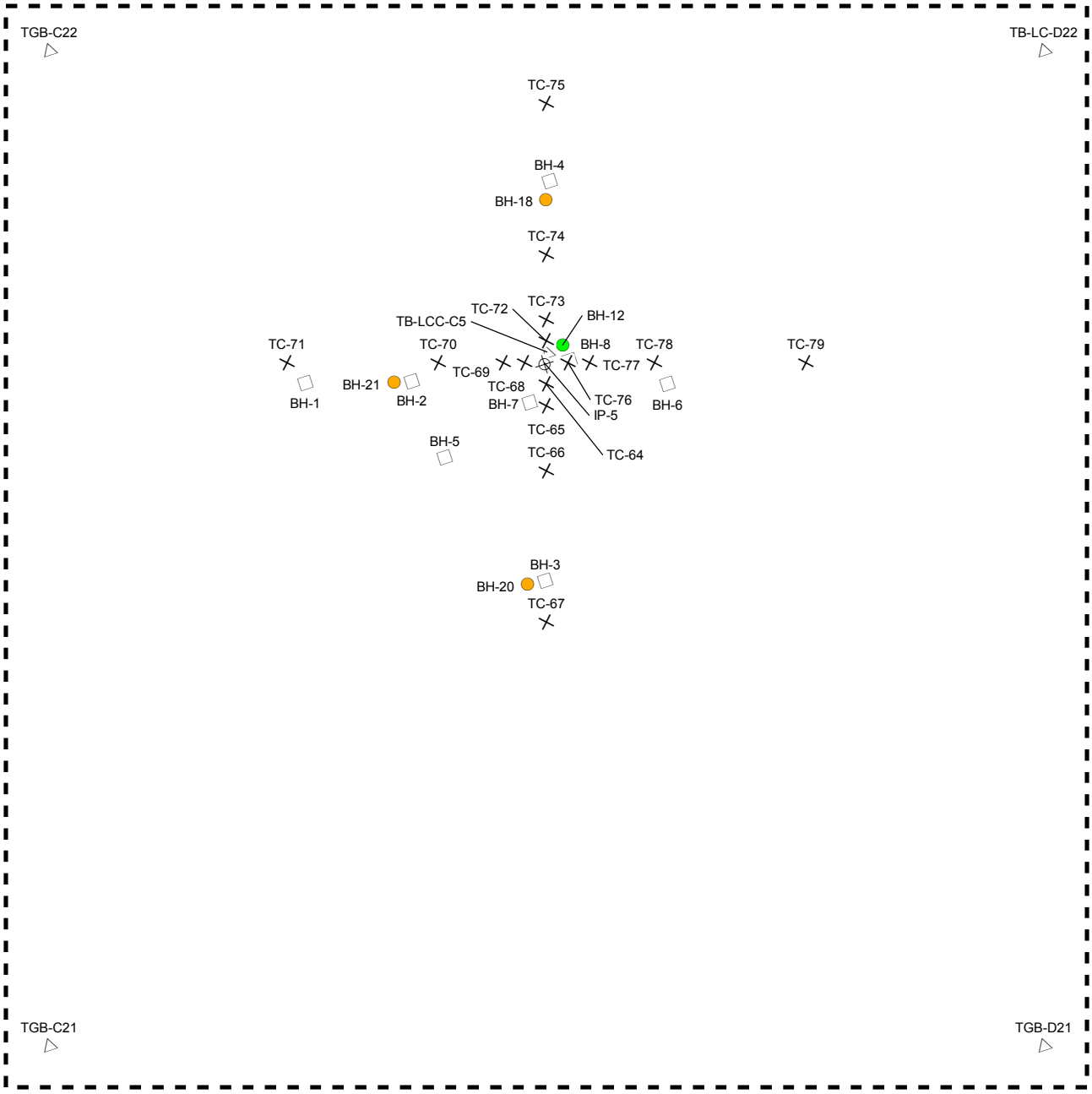
Figure 3

Path: \\Guelph-01\data\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Max Temperature Map (portrait).mxd



Legend

- Ignition Point
- Thermocouple
- Pre-Pilot TARGOST Location
- Post Pilot Borehole Location
- Post-Pilot Co-Located Borehole and TARGOST Location
- Post-Pilot TARGOST Location
- Concrete Work Platform

7.5 0 7.5 15 Feet

Pilot Test Area (PTA) Schematic
Deep Sand Unit

Former Pitt-Consol Site, Newark, New Jersey

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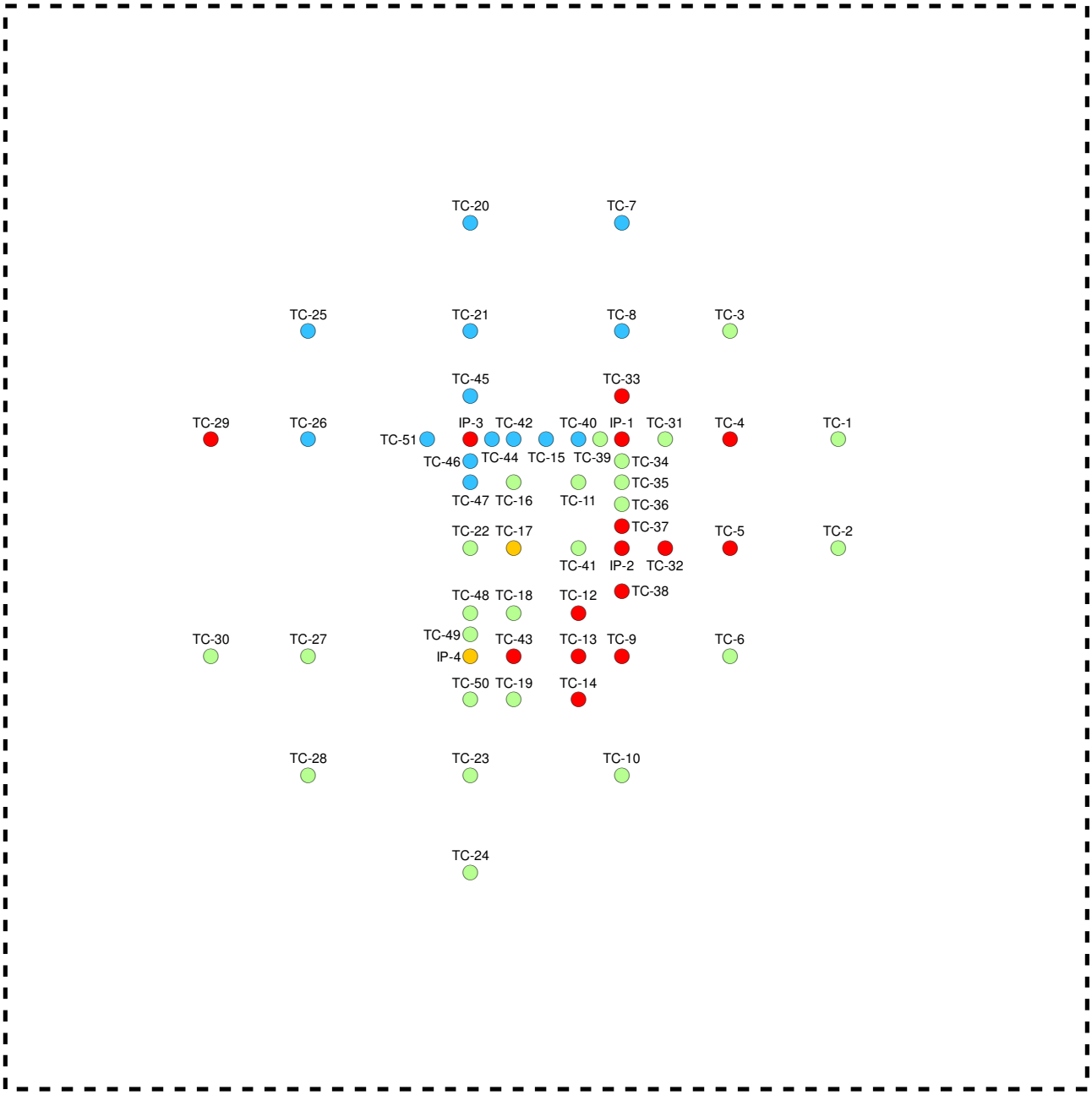
Figure 4

Path: \\Guelph-01\data\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Max Temperature Map (portrait).mxd



7.5 0 7.5 15 Feet

Legend

Maximum Temperature (°C)

- ≤ 25
- > 25 – 50
- > 50 – 200
- > 200 – 400
- > 400

Concrete Work Platform

Peak Temperatures:
IP-2 Premature Ignition Event

Former Pitt-Consol Site, Newark, New Jersey

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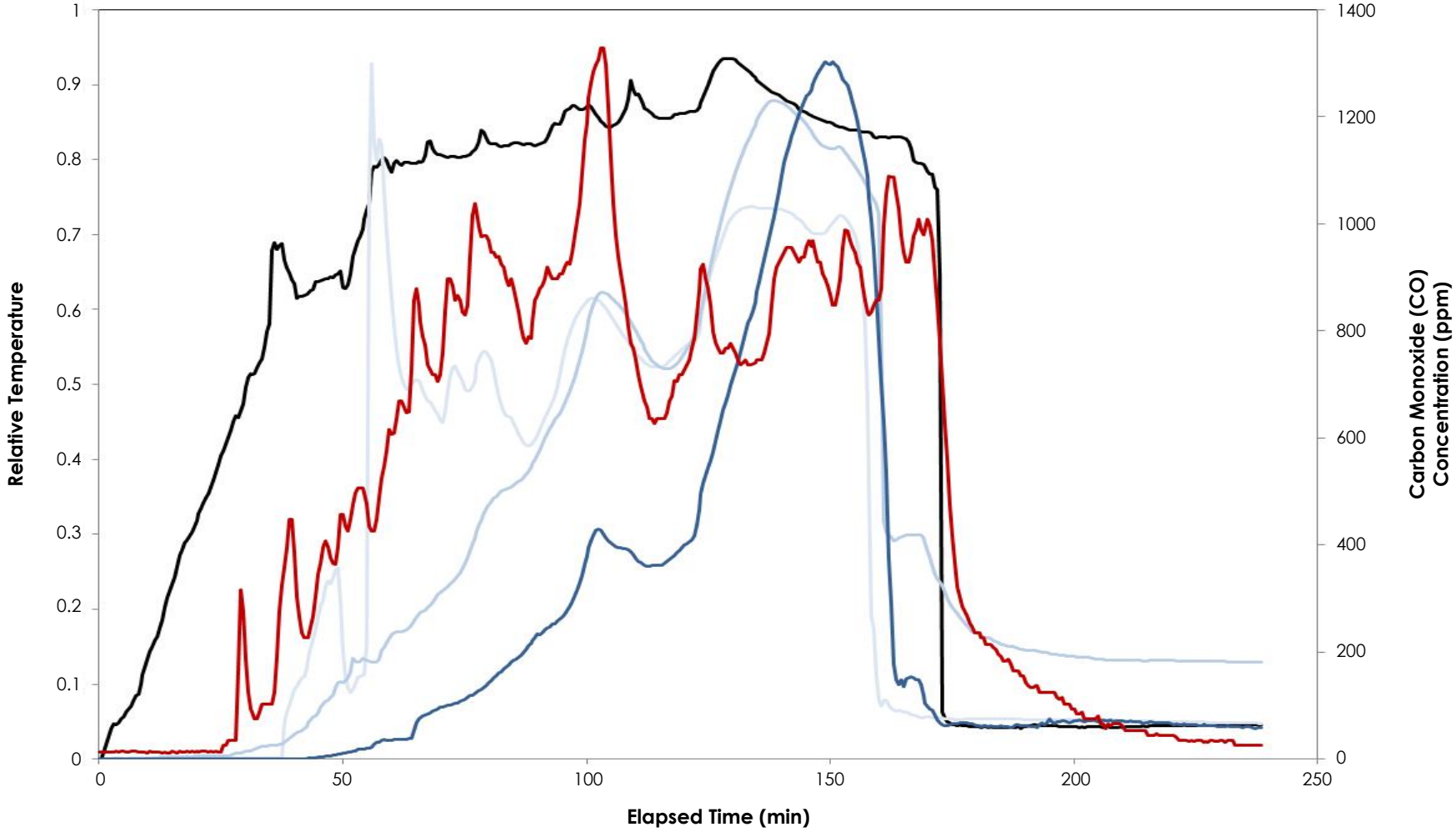
May 2013

Figure

5

Path: P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Map_Temperature Map (portrait).mxdM



Location	CO	TC-IP6-B	TC-15-75	TC-42-75	TC-35-75
Symbol					
Distance from Igniton	--	0	1 ft	1.75 ft	5 ft
Maximum Value	1328 ppm	527°C	412°C	239°C	439°C

IP6 Ignition/Abrupt Pressure Change Event
Former Pitt Consol Site, Newark, NJ

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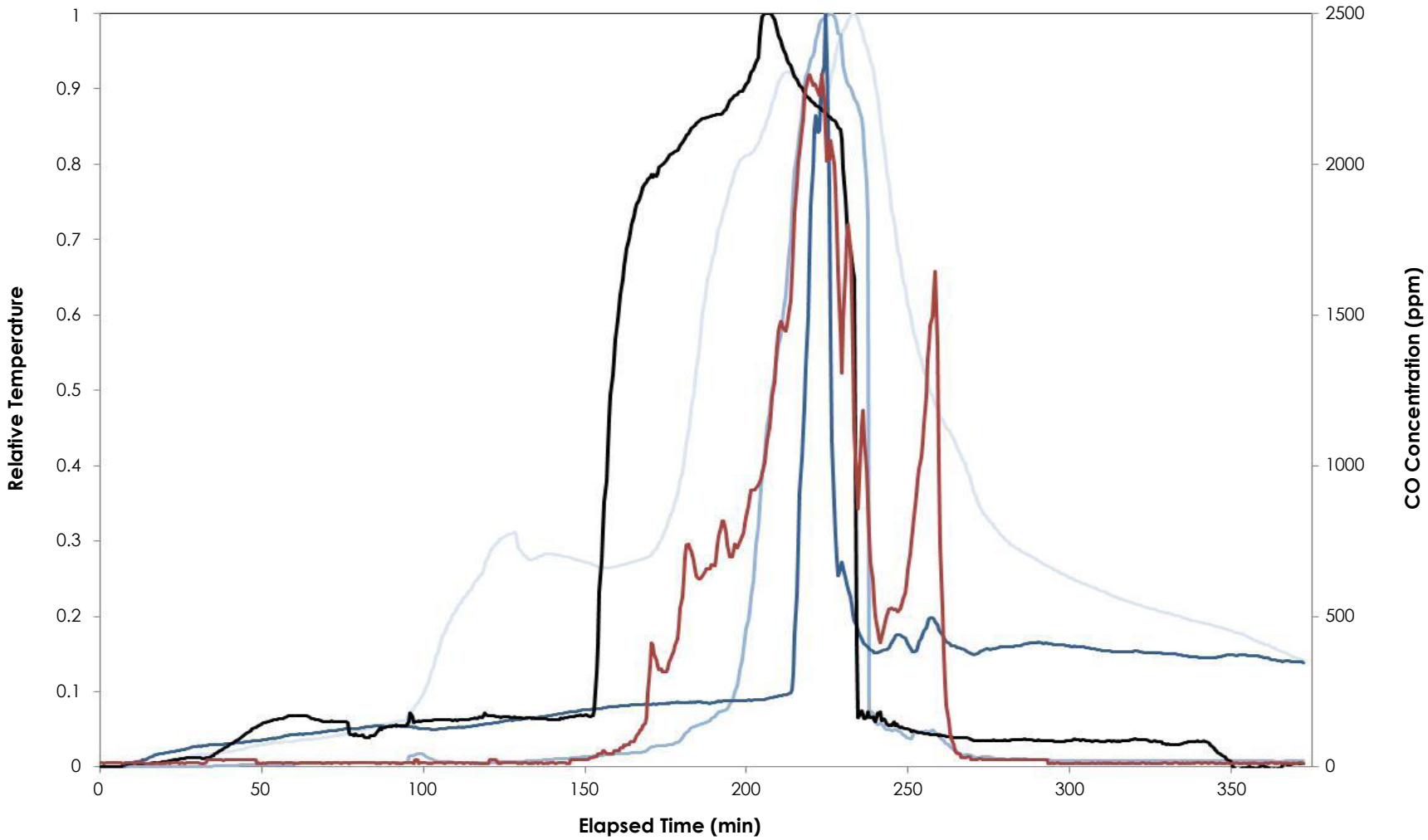
Figure **6**

IP6 Ignition Abrupt Pressure Change.ai

P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Pilot Studies\Pilot Test Report\Phase III\Figures\Excel Figures\[IP6 cork pop.xlsx]FIGURE



Location	CO	TC-IP7-C	TC-45-75	TC-44-75	TC-42-75
Symbol					
Distance from Igniton	--	0	4.25 ft	6.25 ft	7 ft
Maximum Value	2298 ppm	593°C	86°C	997°C	79°C

IP7 Ignition/Abrupt Pressure Change Event
Former Pitt Consol Site, Newark, NJ

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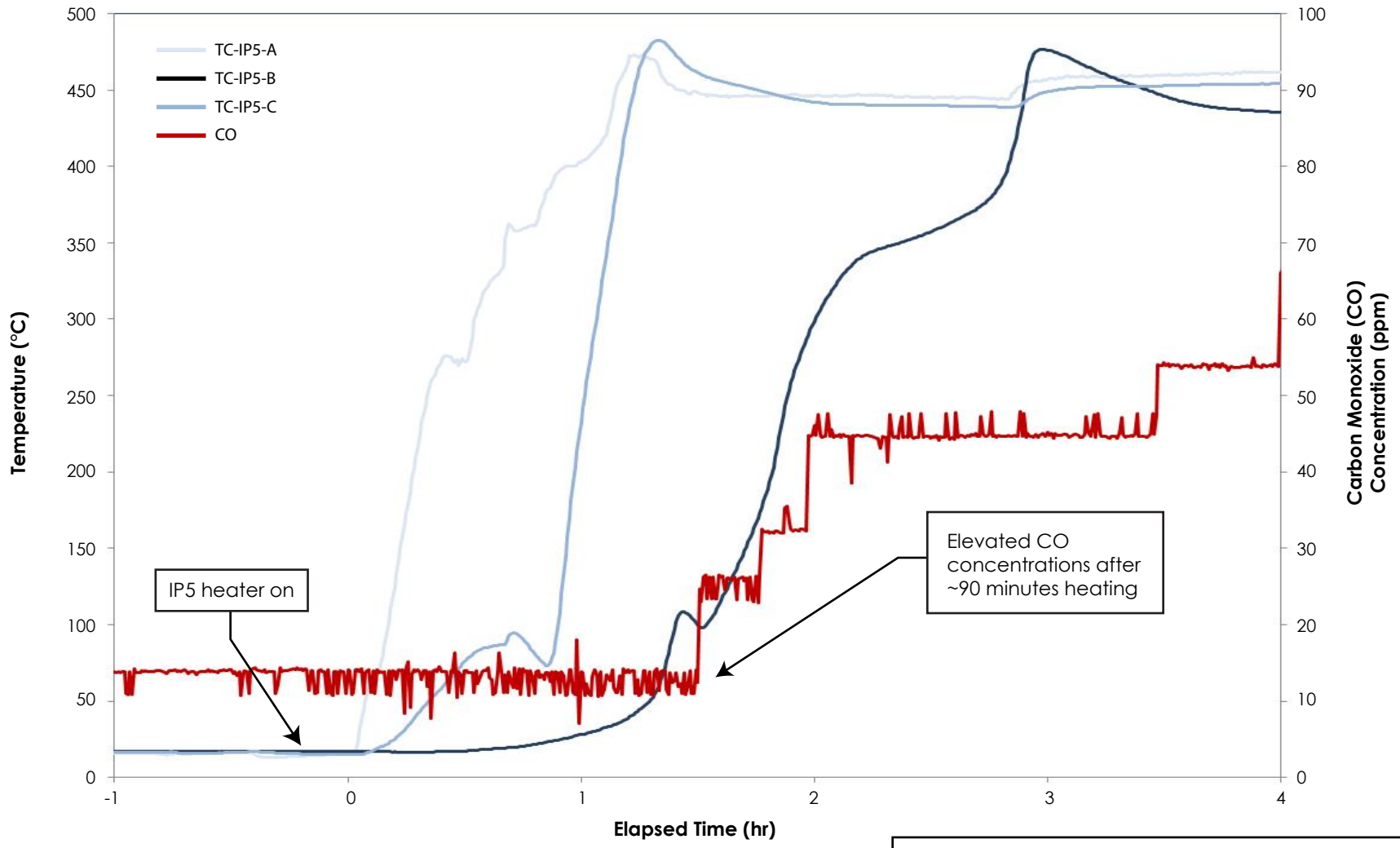
Figure 7

IP7 Ignition_Abrupt Pressure Change.ai

P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Pilot Studies\Pilot Test Report\Phase III\Figures\source files\[IP7 Cork Pop.xlsx]StarPlot



IP5 Ignition
Former Pitt Consol Site, Newark, NJ

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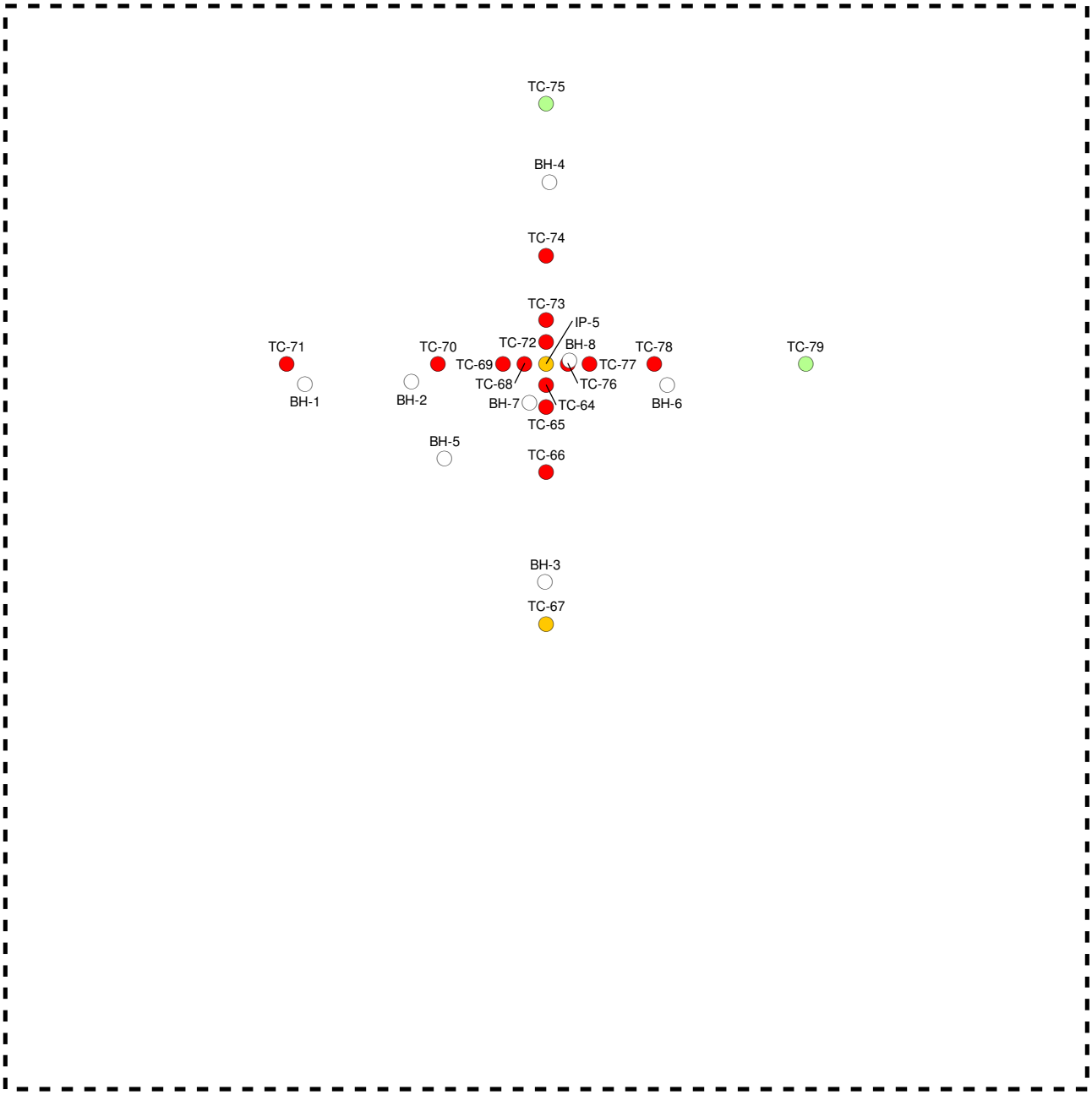
Figure **8**

IP5 Ignition.ai

P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Pilot Studies\Pilot Test Report\Phase III\Figures\Excel Figures\[IP5 Ignition.xlsx]FIGURE



7.5 0 7.5 15 Feet

Legend

Maximum Temperature (°C)

- ≤ 25
- > 25 – 50
- > 50 – 200
- > 200 – 400
- > 400

Concrete Work Platform

Peak Temperatures - Deep Sand Unit Combustion Test: All Depths

Former Pitt-Consol Site, Newark, New Jersey

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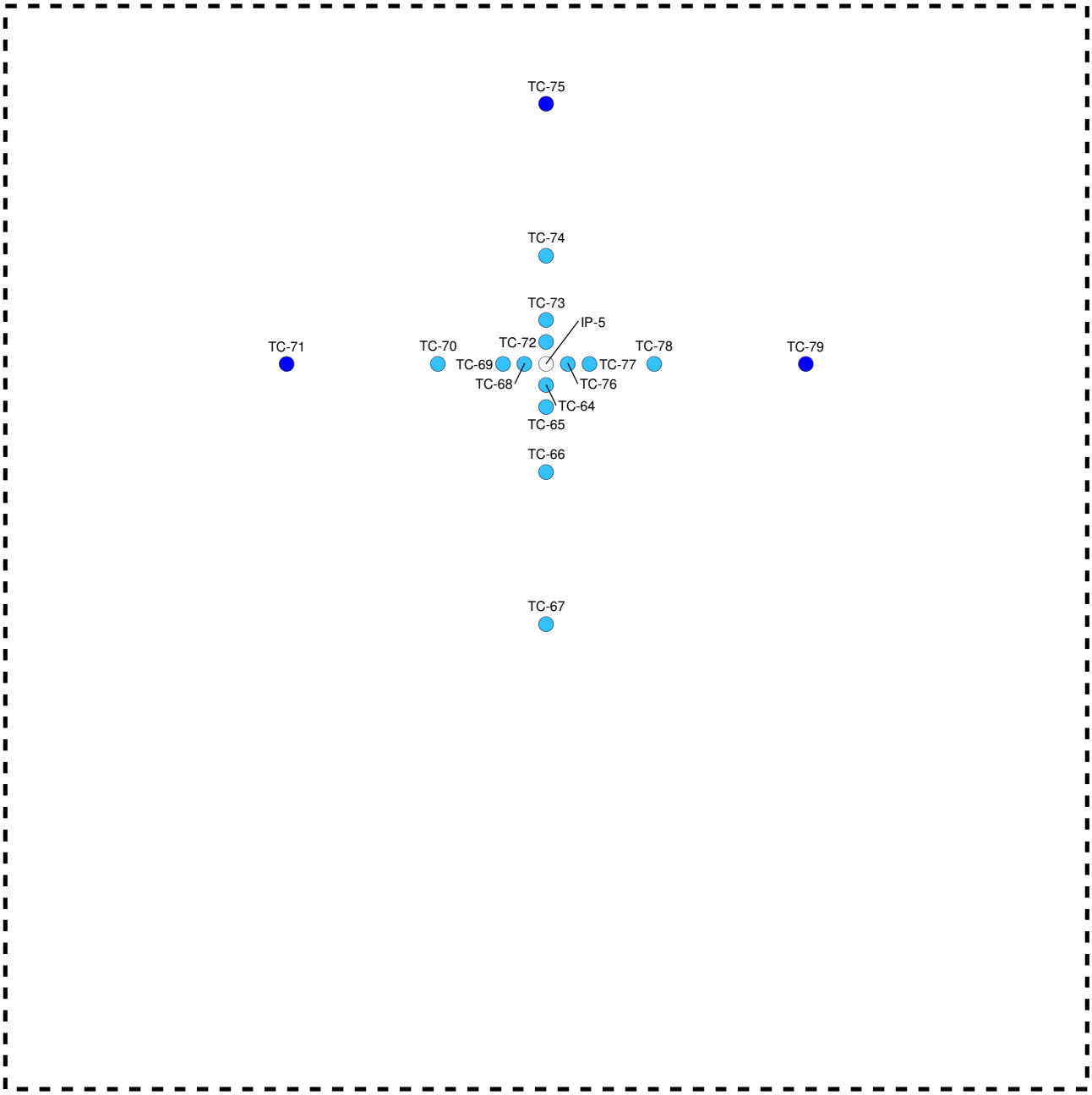
May 2013

Figure **9a**

Path: P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Max_Temperature Map (portrait).mxd



7.5 0 7.5 15 Feet

Legend

Maximum Temperature (°C)

- ≤ 25
- > 25 – 50
- > 50 – 200
- > 200 – 400
- > 400

Concrete Work Platform

Notes

ftbgs - Feet below ground surface
Peak Temperatures measured by nominal 12 foot thermocouples

Peak Temperatures - Deep Sand Unit Combustion Test: 13.7 ft bgs

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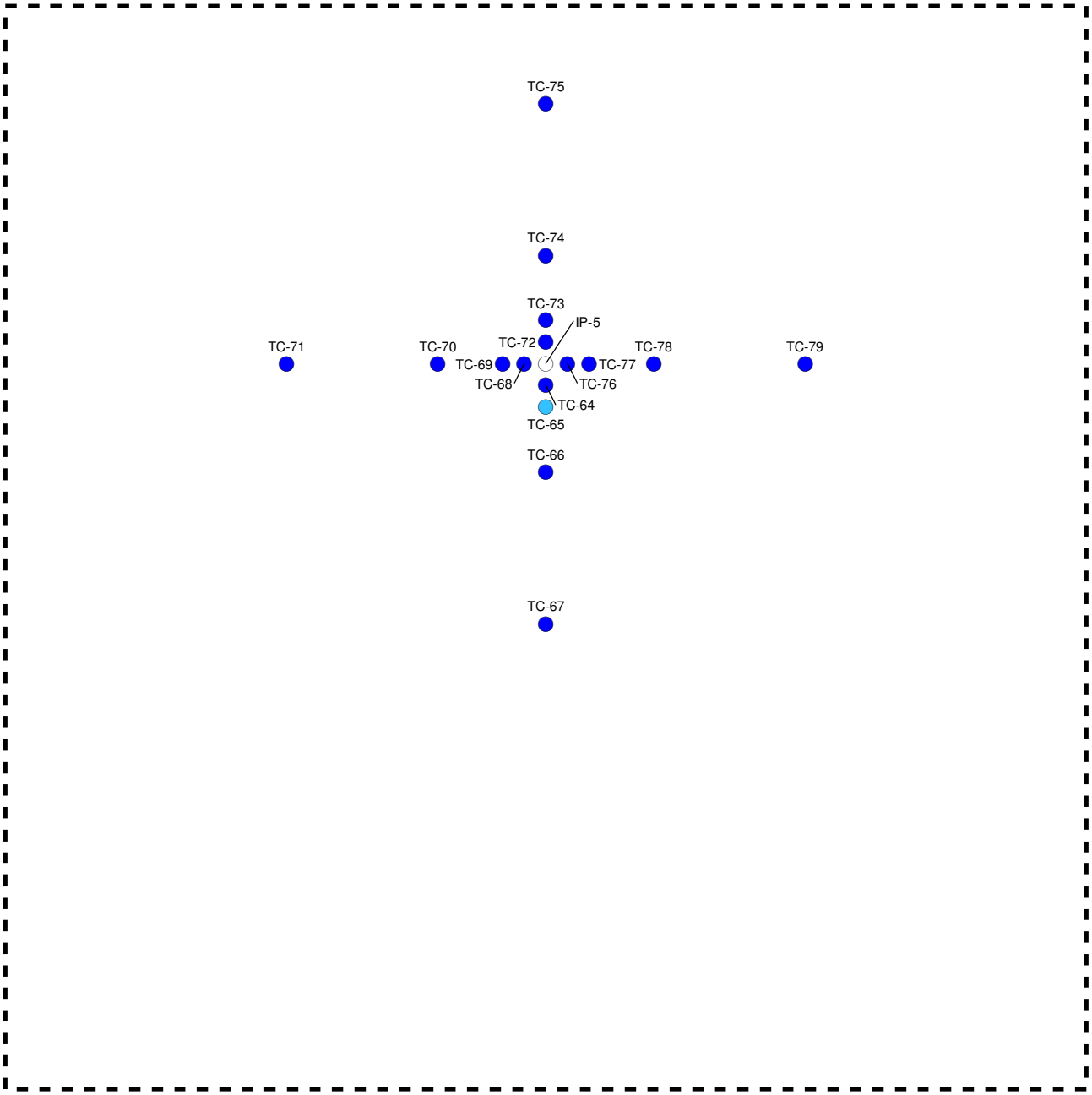
May 2013

Figure **9b**

Path: P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Max_Temperature Map (portrait).mxd



7.5 0 7.5 15 Feet

Legend

Maximum Temperature (°C)

- ≤ 25
- > 25 – 50
- > 50 – 200
- > 200 – 400
- > 400

Concrete Work Platform

Notes

ftbgs - Feet below ground surface
Peak Temperatures measured by nominal 15 foot thermocouples

Peak Temperatures - Deep Sand Unit Combustion Test: 16.7 ft bgs

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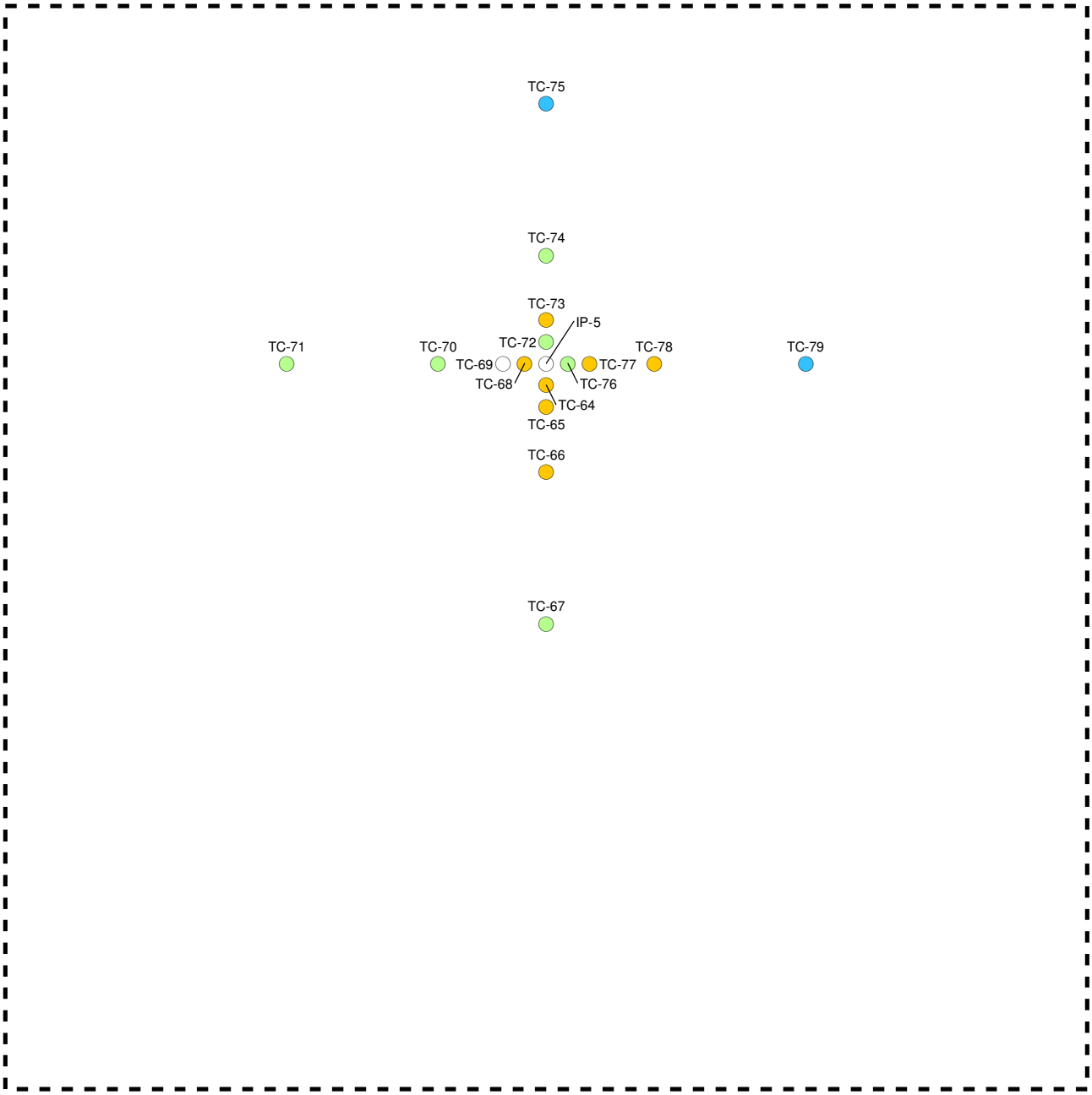
Figure **9c**

Path: P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Max_Temperature Map (portrait).mxd



7.5 0 7.5 15 Feet

Legend

Maximum Temperature (°C)

- ≤ 25
- > 25 – 50
- > 50 – 200
- > 200 – 400
- > 400

Concrete Work Platform

Notes

ftbgs - Feet below ground surface
Peak Temperatures measured by nominal 19 foot thermocouples

Peak Temperatures - Deep Sand Unit Combustion Test: 20.7 ft bgs

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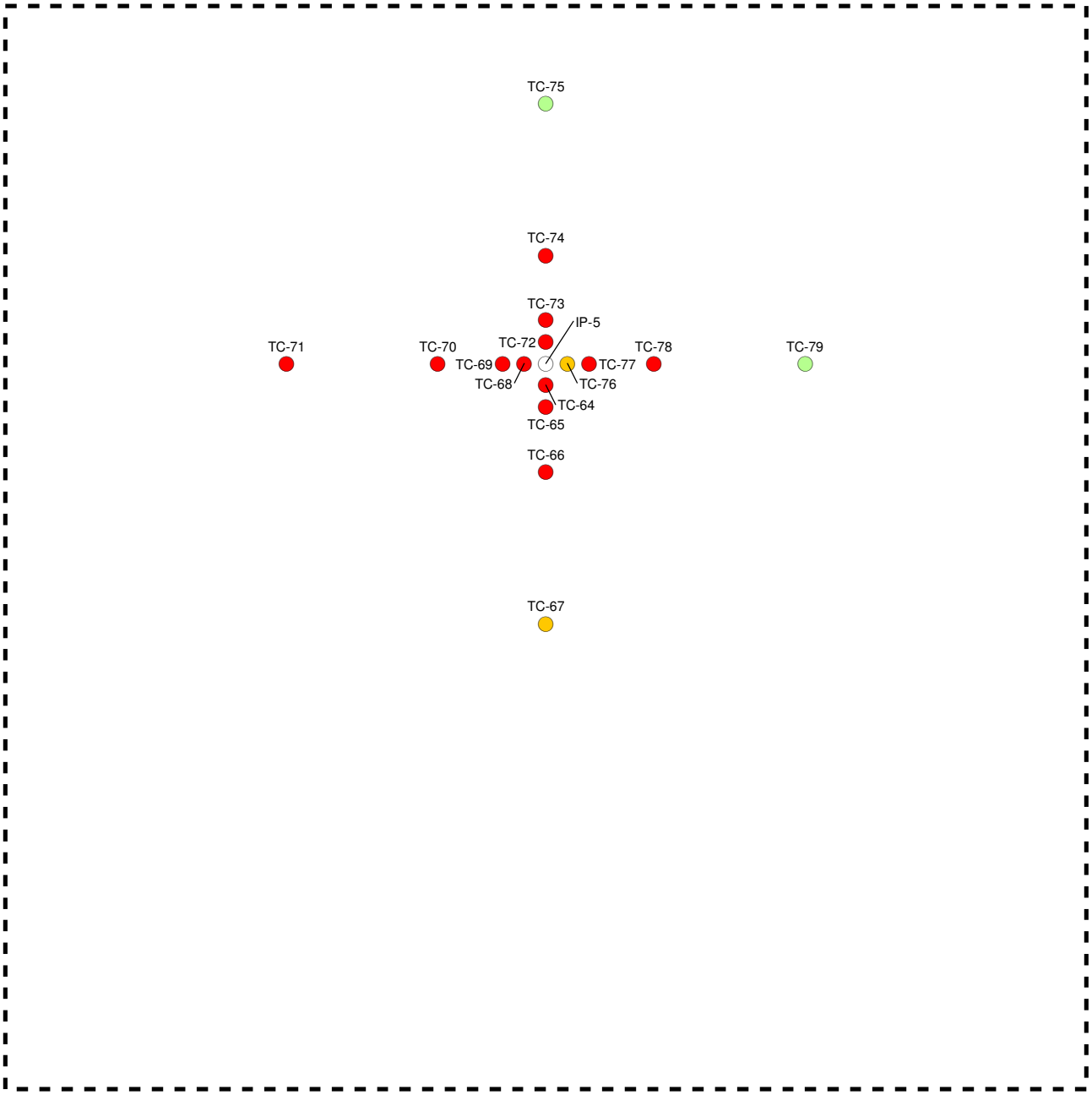
Figure **9d**

Path: P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Max_Temperature Map (portrait).mxd



7.5 0 7.5 15 Feet

Legend

Maximum Temperature (°C)

- ≤ 25
- > 25 – 50
- > 50 – 200
- > 200 – 400
- > 400

Concrete Work Platform

Notes

ftbgs - Feet below ground surface
Peak Temperatures measured by nominal 21 foot thermocouples

Peak Temperatures - Deep Sand Unit Combustion Test: 22.7 ft bgs

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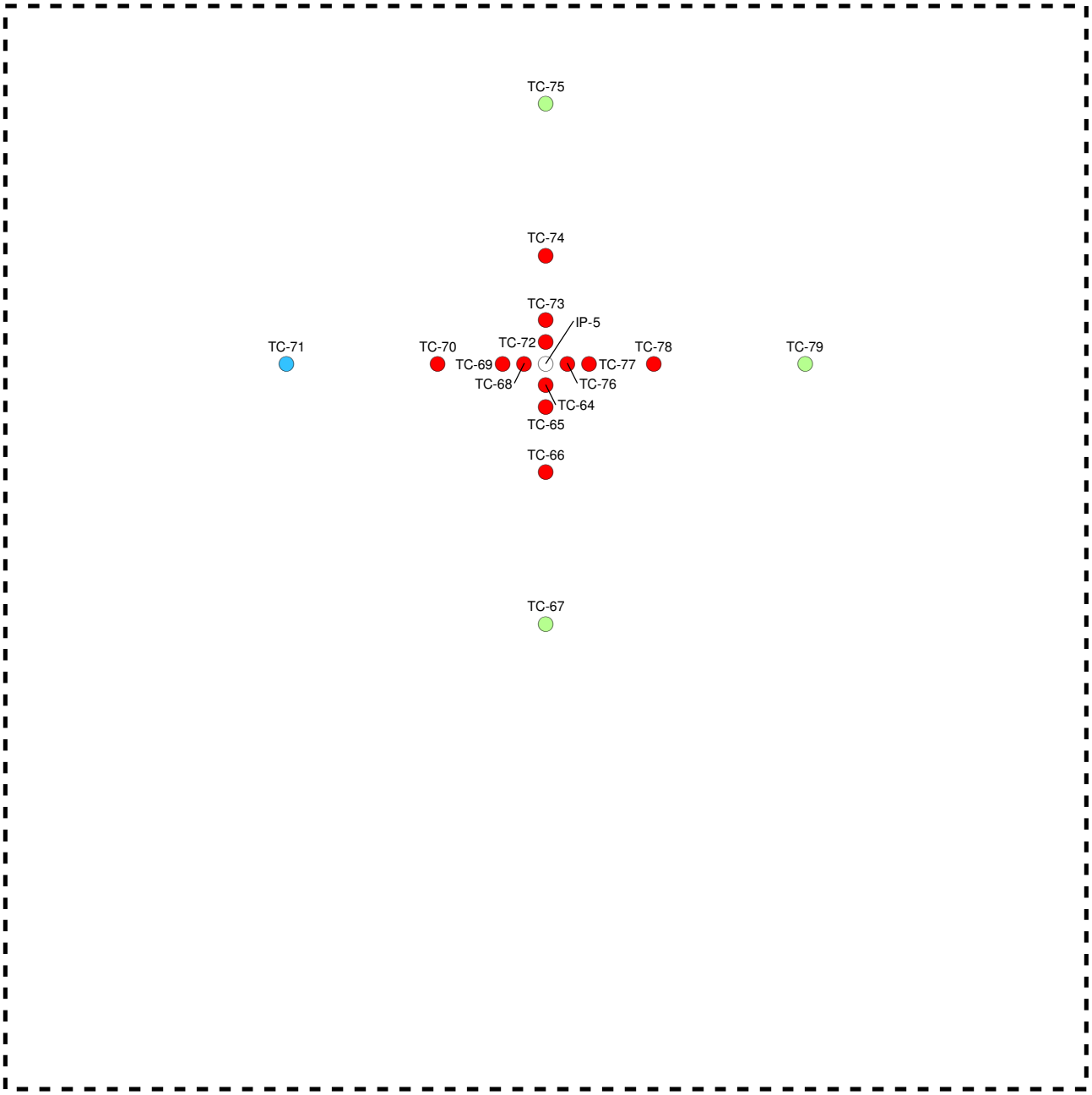
Figure **9e**

Path: P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Max_Temperature Map (portrait).mxd



7.5 0 7.5 15 Feet

Legend

Maximum Temperature (°C)

- ≤ 25
- > 25 – 50
- > 50 – 200
- > 200 – 400
- > 400

Concrete Work Platform

Notes

ftbgs - Feet below ground surface
Peak Temperatures measured by nominal 23 foot thermocouples

Peak Temperatures - Deep Sand Unit Combustion Test: 24.7 ft bgs

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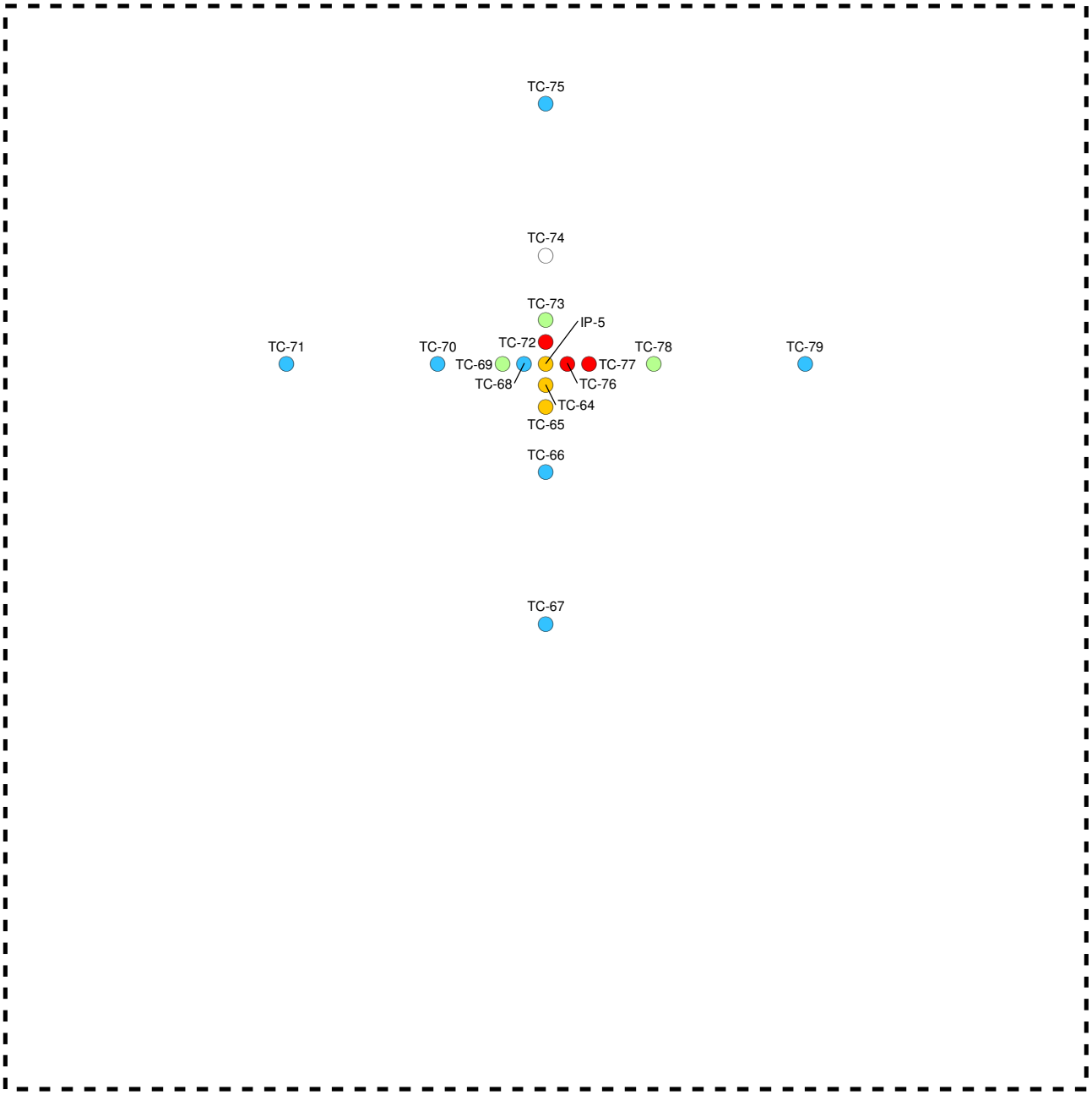
May 2013

Figure **9f**

Path: P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Max_Temperature Map (portrait).mxd



7.5 0 7.5 15 Feet

Legend

Maximum Temperature (°C)

- ≤ 25
- > 25 – 50
- > 50 – 200
- > 200 – 400
- > 400

Concrete Work Platform

Notes

ftbgs - Feet below ground surface
Peak Temperatures measured by nominal 25 foot thermocouples

Peak Temperatures - Deep Sand Unit Combustion Test: 26.7 ft bgs

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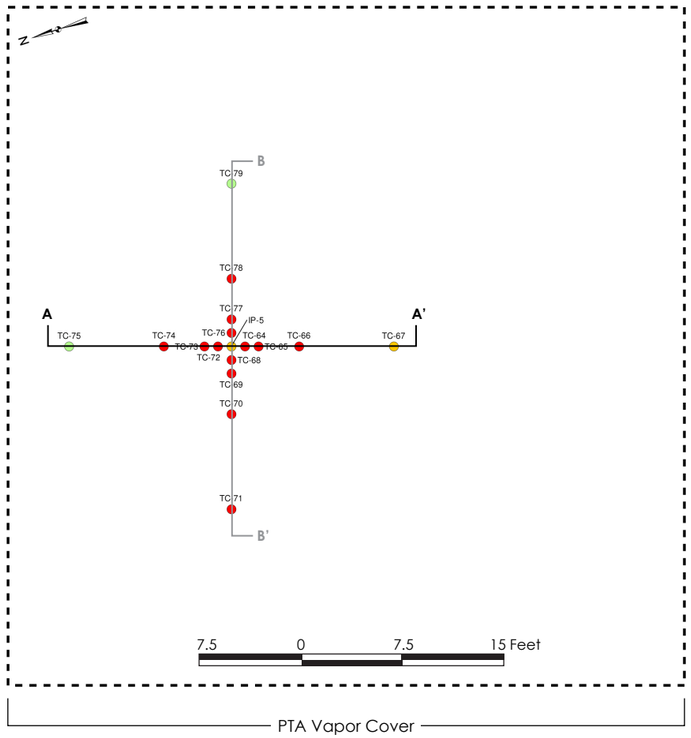
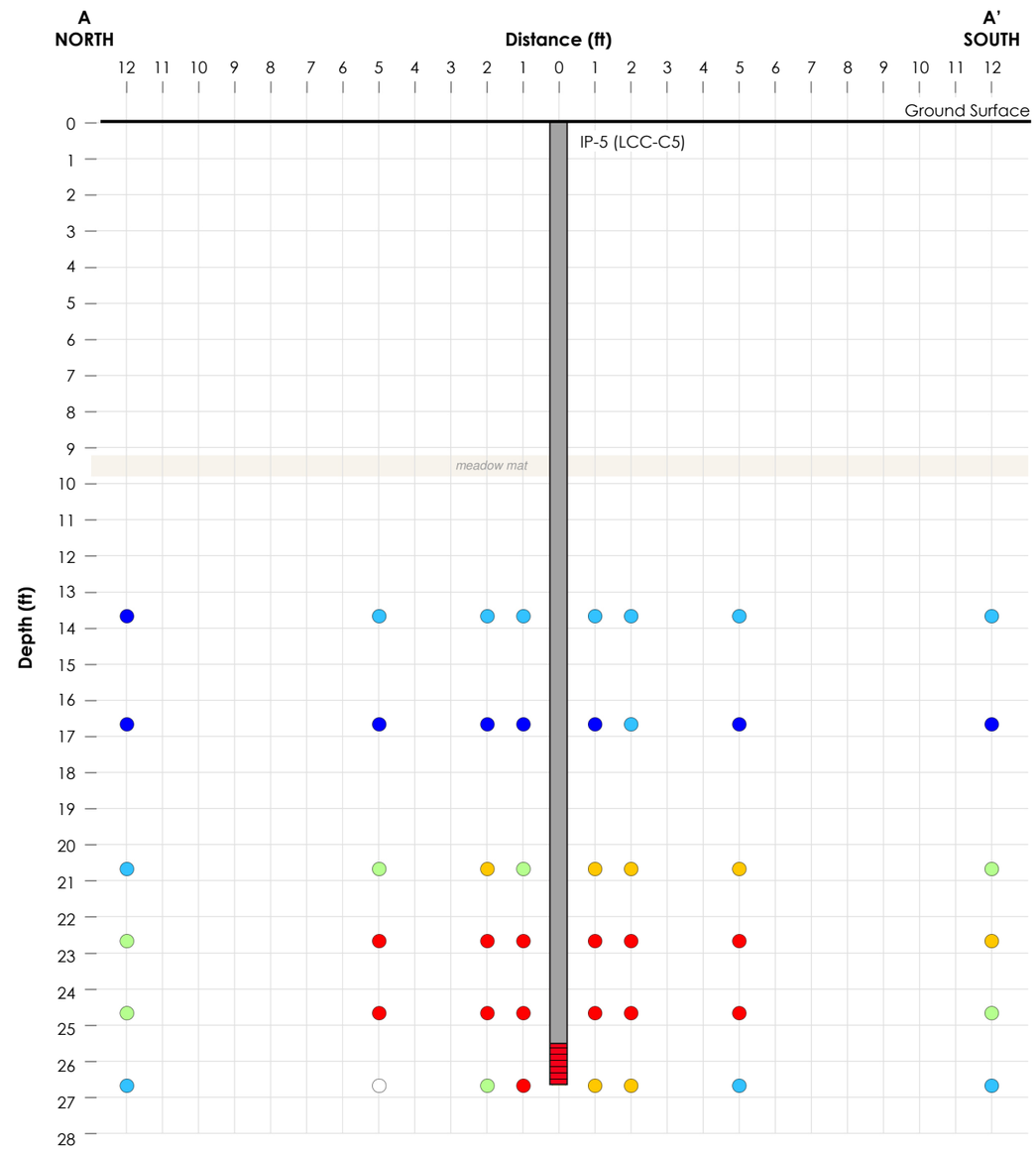
Figure **9g**

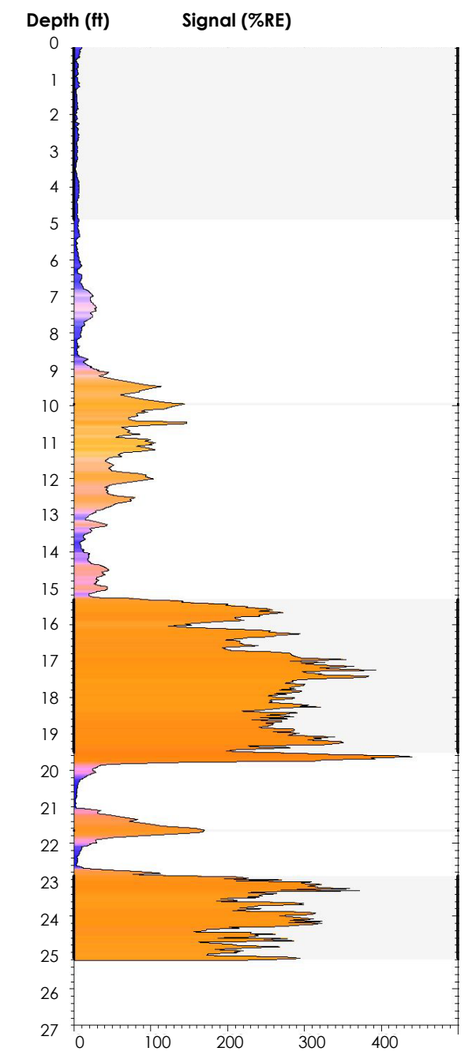
Path: P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Max_Temperature Map (portrait).mxd

PLAN VIEW





PRE-PILOT TARGOST PROFILE
LCC-C5 (IP-5)



Legend

Maximum Temperature (°C)

- ≤ 25
- > 25 – 50
- > 50 – 200
- > 200 – 400
- > 400

Notes

Temperature displayed is maximum measured during time period
Temperature of "0" indicates thermocouple probe not functioning

Peak Temperatures - Deep Sand Unit
Combustion Test:
North/South Cross Section
Former Pitt-Consol Site, Newark, New Jersey

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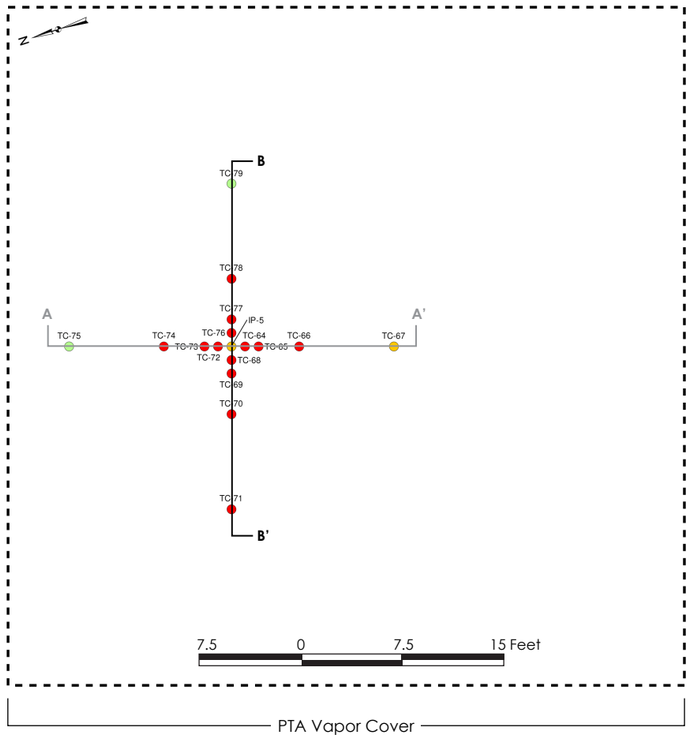
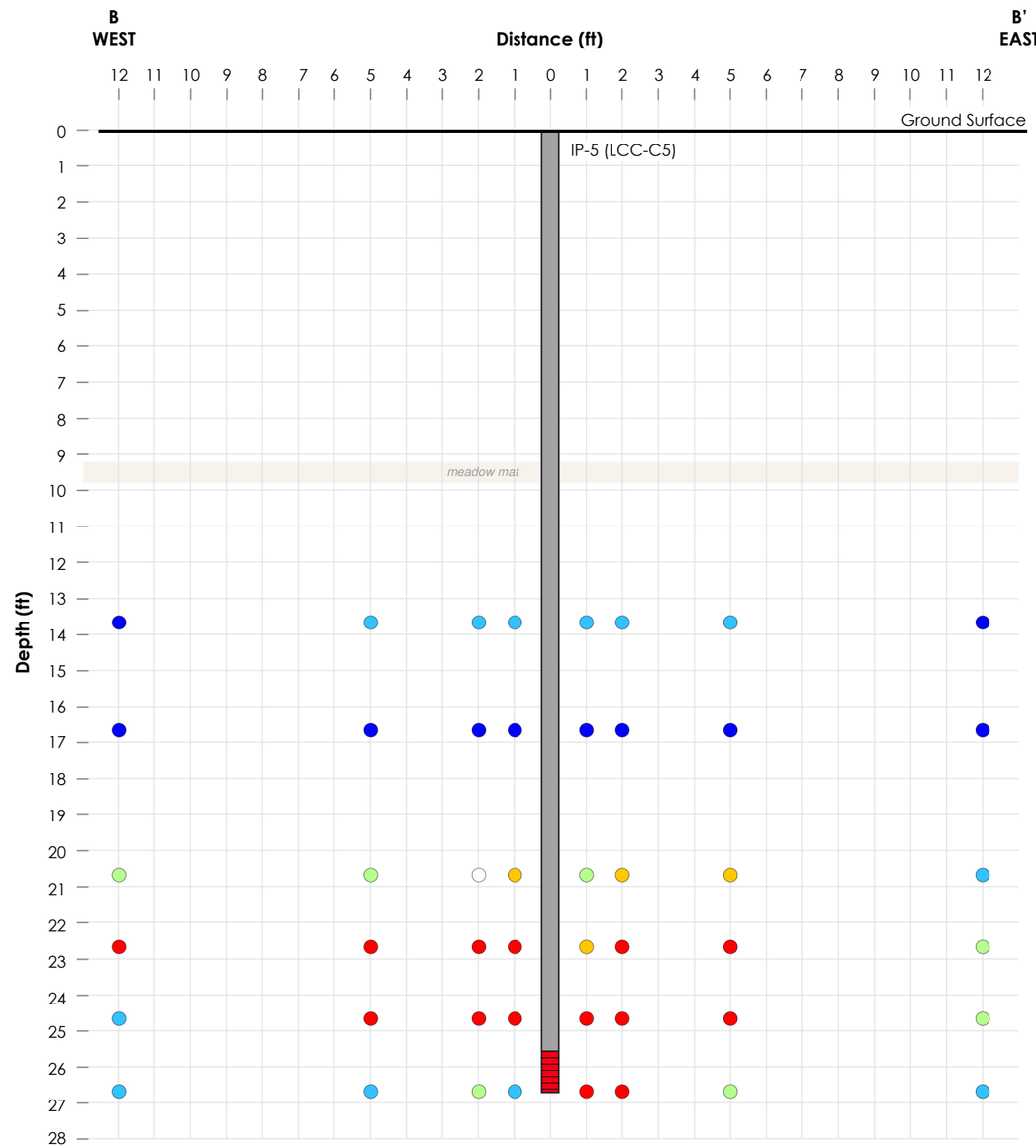
Figure **10a**

Peak Temps - Deep Sand NS Cross Section.ai

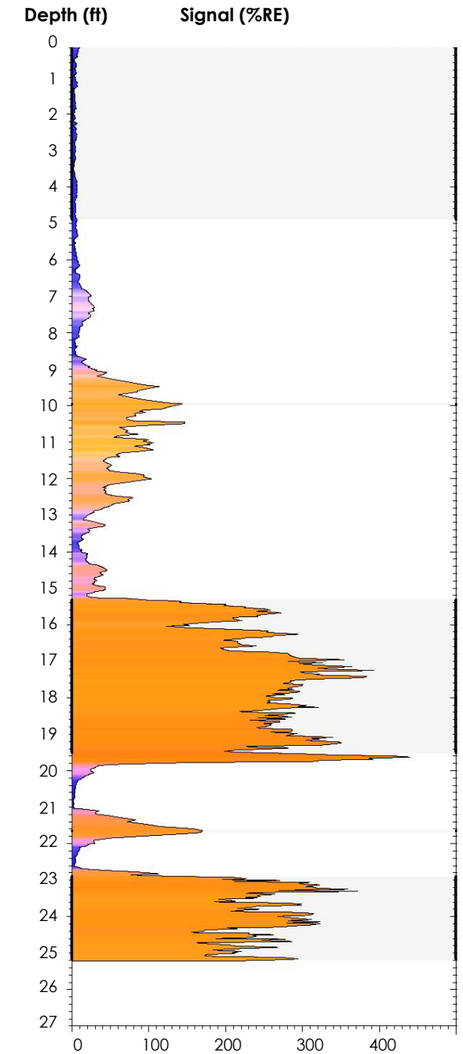
Path: P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Max Temperatures Map (XS-Section).mxd

PLAN VIEW





PRE-PILOT TARGOST PROFILE
LCC-C5 (IP-5)



Legend

Maximum Temperature (°C)

- ≤ 25
- > 25 – 50
- > 50 – 200
- > 200 – 400
- > 400

Notes

Temperature displayed is maximum measured during time period

Temperature of "0" indicates thermocouple probe not functioning

Peak Temperatures - Deep Sand Unit
Combustion Test:
East/West Cross Section
Former Pitt-Consol Site, Newark, New Jersey

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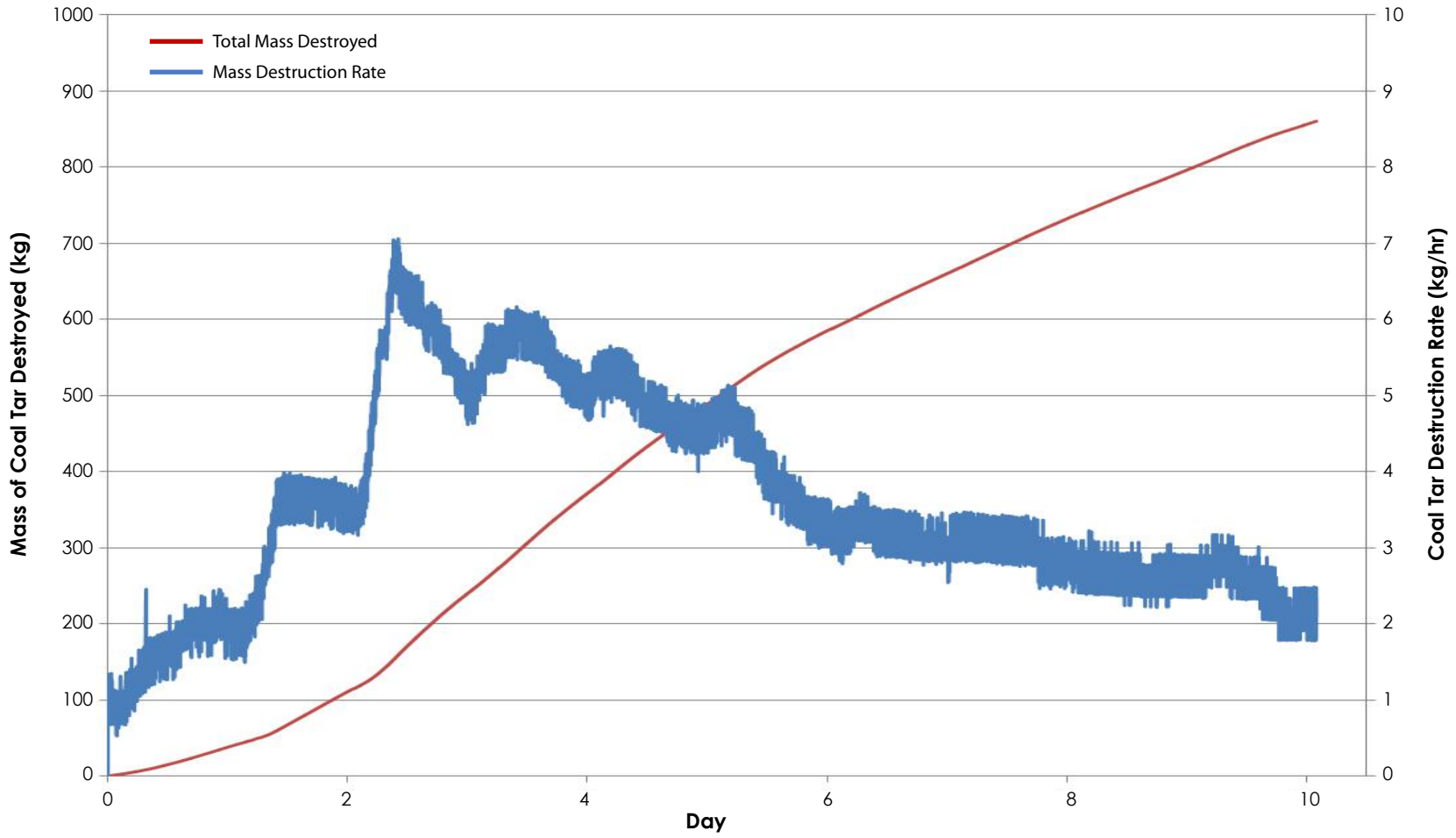
Figure **10b**

Peak Temps - Deep Sand_EW Cross Section.ai

Path: P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Database&GIS\GIS\Max Temperatures Map (XS-Section).mxd



Mass Destroyed - Deep Sand Unit
Combustion Test (Raw Data)
Former Pitt Consol Site, Newark, NJ

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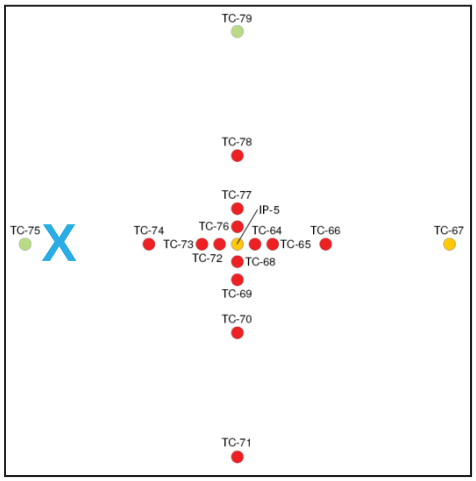
Figure **11**

Mass Destroyed_Deep Sand.ai

P:\PRJ\Projects\TR0341 - STAR Pitt Consol\Pilot Studies\Pilot Test Report\Phase III\Figures\Excel Figures\[Mass Removed Estimate - 2012_10_09.xlsx]Fig 19

'Before'
(IP-5
25-26 ft bgs)

'After'
(B-4-2012
23-25 ft bgs)



Notes:
ft bgs = feet below ground surface
X = approximate location of post-pilot ('After') soil sample; pre-pilot ('Before') soil samples collected from IP-5 at center-point of thermocouple array

Qualitative Comparison of Pre- and Post-Pilot Soils
Post-Pilot Boring B-4
Former Pitt-Consol Site, Newark, New Jersey

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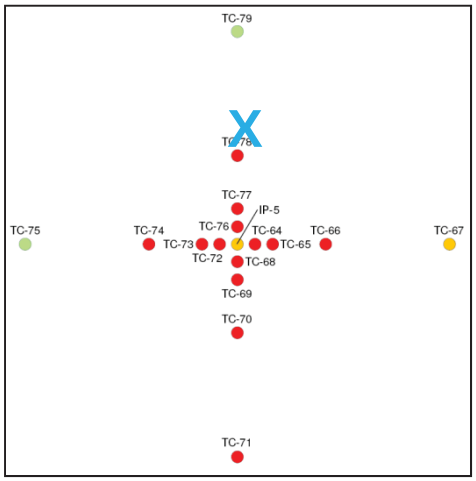
Figure **12a**

Guelph | May 2013

internal info: path, date revised, author

'Before'
(IP-5
26-28 ft bgs)

'After'
(B-6-2012
24-25 ft bgs)



Notes:
ft bgs = feet below ground surface
X = approximate location of post-pilot ('After') soil sample; pre-pilot ('Before') soil samples collected from IP-5 at center-point of thermocouple array

Qualitative Comparison of Pre- and Post-Pilot Soils
Post-Pilot Boring B-6
Former Pitt-Consol Site, Newark, New Jersey

Geosyntec consultants

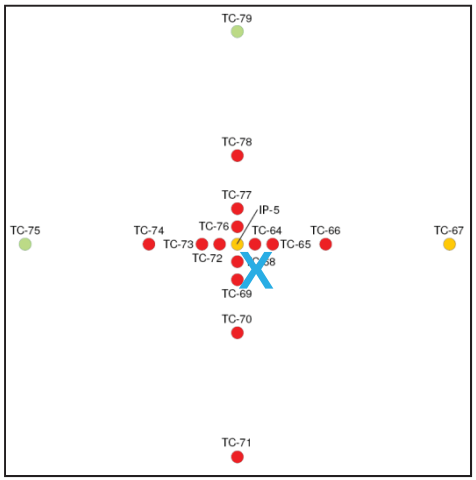
Figure **12b**

Guelph | May 2013

internal info: path, date revised, author

'Before'
(IP-5
28-30 ft bgs)

'After'
(B-7-2012
24-25 ft bgs)



Notes:
ft bgs = feet below ground surface
X = approximate location of post-pilot ('After') soil sample; pre-pilot ('Before') soil samples collected from IP-5 at center-point of thermocouple array

Qualitative Comparison of Pre- and Post-Pilot Soils
Post-Pilot Boring B-7
Former Pitt-Consol Site, Newark, New Jersey

Geosyntec consultants

Figure **12c**

Guelph | May 2013

internal info: path, date revised, author

APPENDIX A

Self-sustaining Treatment for Active Remediation (STAR)
Phase III Work Plan

Prepared for

DuPont Corporate Remediation Group
4417 Lancaster Pike
Chestnut Run Plaza, Building 715 – 252
Wilmington, Delaware 19808

Self-Sustaining Treatment for Active Remediation (STAR) Phase III Pilot Test Work Plan

DuPont Pitt-Consol Site, Newark, New Jersey

Prepared by

Geosyntec consultants

engineers | scientists | innovators

130 Research Lane, Suite 2

Guelph. Ontario N1G 5G3

Project Number TR0341C

May 25, 2012

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Appendix E Standard Operating Procedures (SOPs)

LIST OF ABBREVIATIONS

CEMS	continuous emissions monitoring system
CO	carbon monoxide
CO_2	carbon dioxide
DGI	Data Gaps Investigation
DPT	direct push technique
DuPont	DuPont Corporate Remediation Group
EIPT	Environmental Improvement Pilot Test (permit)
EPA	Environmental Protection Agency
EPH	extractable petroleum hydrocarbon
ERT	electrical resistive tomography
ft	feet (foot)
ft bgs	feet below ground surface
FTP	file transfer protocol
GAC	granular activated carbon
Geosyntec	Geosyntec Consultants
HASP	Health and Safety Plan
kg	kilogram
lb	pound
NAPL	Non-aqueous phase liquid
NJDEP	New Jersey Department of Environmental Protection
PAH	polycyclic aromatic hydrocarbon
PID	photoionization detector
PLC	programmable logic controller
PPE	personal protective equipment
ppm	parts per million
psi	pounds per square inch gauge
PTA	pilot test area
ROI	radius of influence
scfm	standard cubic feet per minute
SOP	standard operating procedure
STAR	Self-Sustaining Treatment for Active Remediation
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
TarGOST	Tar-specific Green Optical Screening Tool
THA	Task Hazard Analysis
TPH	total petroleum hydrocarbon
TXS	toxic substances
VOC	volatile organic compound

1. INTRODUCTION

1.1 Purpose and Scope of Work Plan

This pilot test work plan has been prepared by Geosyntec Consultants (Geosyntec) on behalf of DuPont Corporate Remediation Group (DuPont) to present plans for the next phase of pilot testing (Phase III Pilot Test) to support the design and potential application of the Self-Sustaining Treatment for Active Remediation (STAR) technology to treat coal tar-impacted soils at the Former Pitt-Consol Site in Essex County at 191 Doremus Avenue, Newark, New Jersey (the Site). The STAR technology is being evaluated as an alternative to traditional remedies for coal tar-impacted soils including excavation and disposal. This evaluation is being conducted in accordance with the Site Project Plan for the STAR technology, which is a "living" document outlining the evaluation process and the "Go / No-Go" decision points.

Two phases of pilot testing of the STAR technology have been completed at the Site since August 2009 and are summarized in the STAR Pilot Test Report (Geosyntec, 2011). Pilot testing to date has been completed within a 20 foot (ft) by 60 ft pilot test area (PTA) contained within a sheet pile boundary in the former Lagoon C area on the western portion of the Site. The first phase of pilot testing verified that the process was feasible in situ and below the water table within the shallow fill unit. The second phase of testing refined the ignition protocol and succeeded in propagating a combustion front through the PTA while destroying approximately 4,500 kilograms (kg) of coal tar within the shallow fill unit over the course of the test.

Further pilot testing is required to collect additional data to evaluate the applicability of, and to develop the full-scale design and cost for, the STAR technology. The previous pilot tests (Geosyntec, 2011) indicated that the ignition quality, in situ coal tar mass destruction rates, vapor mass loading rates, vapor mist content, and vapor temperatures exhibited variability during testing as a function of both time and ignition location. In addition, the combustion front propagation observed in the Phase II pilot test was influenced by preferential flow pathways, which could potentially limit the effectiveness of the technology. Furthermore, the Phase II pilot test was implemented under conditions that are not anticipated to exist during full-scale operation (i.e., the PTA was contained within sheet piles walls). Therefore, the Phase III pilot test will be conducted in an area without sheet pile containment, and has been designed to collect additional information regarding process variability and to evaluate the controllability of STAR to target specific areas between ignition points.

During the recent 2012 Data Gaps Investigation (DGI) at the Site, it was revealed that coal tar contamination exists within the sand layer (beneath the shallow fill unit and underlying peaty material [meadow mat]) to depths of up to 35 feet below ground surface (ft bgs) within Lagoons C and D. Based on preliminary data collected during the DGI, the contaminant levels and geology in these areas may be amenable to treatment via the STAR technology. Thus, the Phase III pilot test will also evaluate the potential of the STAR technology in this deeper sand layer.

The objectives of the Phase III Pilot Test are to evaluate:

1. Scale-up issues, process variability, and process controllability within the fill unit (shallow combustion test); and
2. Implementation considerations of the STAR technology within the sand layer beneath the former lagoon areas (deep air sparge and deep combustion testing).

The scope of the Phase III pilot test includes:

1. Instrumentation of the PTA for STAR performance evaluation;
2. Installation of ignition/air injection wells to initiate the STAR process;
3. Installation of air injection and vapor control equipment; and
4. Initiation of pilot testing activities to address the objectives listed above, consisting of a:
    a. Shallow combustion test;
    b. Deep air sparge test; and
    c. Deep combustion test.

The Phase III pilot test will be conducted for a performance period of up to 42 days, and will include up to 21 days of combustion testing within the shallow fill unit and up to 21 days of testing (7 days air sparge testing; 14 days combustion testing) within the deep sand layer beneath the meadow mat. The performance period includes all efforts to initiate and maintain smoldering reaction(s) within the PTA (i.e., active operation) but does not include site preparation, mobilization, installation, sampling, demobilization, or performance evaluation activities.

1.2 Work Plan Organization

The remaining sections of this work plan present the following:

- Section 2 – the pilot test design basis and process flow details;
- Section 3 – the procedures and methodologies for conducting the pilot test;
- Section 4 – references.

This work plan is accompanied by a detailed project design drawing package (Appendix A). Text within this work plan will refer to details by drawing number where appropriate.

2. STAR PHASE III PILOT TEST DESIGN BASIS AND PROCESS FLOW

2.1 Selection of Pilot Test Location

The pilot test will be conducted in Lagoon C (Drawing C01), centered on boring TB-LCC-C5 from the 2012 Tar-specific Green Optical Screening Tool (TarGOST) survey. The PTA location was selected based on the results of the TarGOST logs, soils analytical data, and visual inspections of boring logs collected during the 2012 DGI and was chosen due to its similarity with the previous PTA (with respect to the thickness of geologic units, the extent and distribution of coal tar impacts, etc.) and proximity to the existing power drop electrical poles. In addition, this area has been identified as having coal tar impacts within the sand unit beneath the meadow mat.

2.2 Site Preparation, Instrumentation & Pre-Pilot Characterization

The PTA is approximately 50 ft by 50 ft and is defined by the footprint of the concrete work platform (Drawing C02). However, a total area of approximately 300 ft by 100 ft will be required to encompass the 50 ft by 50 ft PTA and all associated process equipment. The surficial compacted fill layer inside the PTA will be removed down to and including the existing geomembrane (approximately 1-2 ft bgs). The PTA will then be instrumented as follows:

1. Five ignition/air injection wells (IP-1 through IP-5) will be installed in the approximate center of the PTA. Wells IP-1 through IP1-4 will be installed to the top of the meadow mat layer at a depth of approximately 10 ft below the excavated ground surface (to be determined during well installation) and will be positioned in an uneven grid designed to evaluate STAR propagation and inter-well effects at a variety of distances within the shallow fill unit (Drawing C02). Well IP-5 will be installed to a depth of approximately 25 ft below the excavated ground surface (to be determined during well installation). The wells will be constructed of 2-inch diameter carbon steel wells with a one-foot stainless steel wire wrap (0.1 slot) screen. Thermocouple probes will be installed within each well borehole as described in Section 3.3.

2. Multi-level thermocouple probes will be installed to monitor combustion front propagation (Drawings C06 and M03 to M06). The highest density of probes will be located around the ignition wells.

3. Pre-pilot soil samples will be collected from each of the ignition / air injection well cores as well as from borings advanced to install thermocouples TC-8, TC-15, TC-23, TC-31, TC-38, TC-51, TC-52, TC-66, and TC-72 (up to 2 soil samples will be collected from each boring; see Drawings M04 and M06) during well and thermocouple probe installation. Soil samples collected during installation of thermocouple probes will be submitted for laboratory analysis of extractable petroleum hydrocarbons (EPHs). During

drilling of wells IP-1 through IP-4, up to three soil samples will be collected from each borehole (up to a total of 12 samples) and samples will be submitted for laboratory analysis of EPHs. During installation of well IP-5, continuous soil cores will be collected to a depth of approximately 45 feet below the excavated ground surface (or until the Rahway Till layer has been visually confirmed by Geosyntec), and samples will be submitted for laboratory analysis of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and EPHs. Following collection of soil cores, the borehole will be grouted following New Jersey Department of Environmental Protection (NJDEP) regulations to a final depth of approximately 25 feet below excavated ground surface in preparation for installation of the IP-5 well.

4. Electrical resistive tomography (ERT) electrodes will be installed within the PTA (Drawing M07) for use in conducting a time-lapse ERT survey to aid in monitoring combustion front propagation and identifying treated areas for the STAR technology.

5. A 2-inch layer of clean crushed stone (clear stone) will be backfilled within the PTA to create a base for the vapor extraction piping (Drawing C03).

6. Four horizontal perforated pipes for the collection of vapors will be laid on the clear stone within the PTA and connected to the vapor extraction (SVE) system (Drawings C02, C03 and M09).

7. An additional 6 inches (minimum) of clear stone will be placed within the PTA to cover the vapor collection piping. The clear stone will then be covered with a layer of plastic sheeting (Drawing C03).

8. Vacuum monitoring probes will be installed at five locations within the clear stone (Drawings C05 and M03) to monitor vacuum propagation of the vapor collection system and 11 thermocouple probes (TC-53-G through TC-63-G) will be placed in the clear stone (Drawings C06 and M05) to monitor vapor temperatures.

9. A 50 ft by 50 ft by 4-inch thick (minimum) concrete work platform will be formed around the ignition wells and thermocouple probes (Drawings C02 and C03).

10. The perimeter of the concrete work platform will be sealed to ground surface to close the system for the purposes of vapor collection (Drawing C03).

11. Four soil vapor monitoring probes will be installed around the outside of the PTA to monitor vacuum propagation from the vapor collection system and to screen for the presence of combustion gases outside of the PTA during system operation (Drawings C05 and M03). Additional soil vapor monitoring probes may be added within the PTA for use in collection of air samples during the deep air sparge test (see Section 2.5).

The Phase III PTA will not be contained within a sheet pile boundary; however, the concrete cover and vacuum coverage of the vapor collection system has been designed to cover an area larger than the anticipated combustion zone to capture vapors.

Once the PTA has been instrumented, the air injection and SVE systems will be installed. The air injection system will consist of two electric air compressors (one will serve as the primary air compressor and the other will serve as a back-up air compressor), a desiccant air dryer, an equalization tank, and associated interconnecting piping, manifolds, pressure regulating and relief valves, ball and gate valves, and pressure and temperature indicators and transmitters as per Drawings D02 and M08. The vapor collection system will consist of a vapor mist accumulator, a continuous emissions monitoring system (CEMS), a cyclonic moisture / temperature knock-out tank (knock-out tank), two condensate transfer pumps, a condensate holding tank, two vapor extraction blowers (one will serve as the primary blower and the other will serve as a back-up blower), two vapor-phase vertical flow through carbon units, a discharge stack, and associated interconnecting piping/ductwork, manifolds, pressure relief valves, gate/knife valves, sample ports, and flow, pressure and temperature indicators and transmitters as per Drawings D03 and M09. To the extent practicable, existing equipment from the Phase II pilot test will be reused during the Phase III pilot testing (e.g. ducting, piping, instrumentation, electrical control, etc.). The air injection and SVE systems will be designed so that they can be operated continuously for the duration of the pilot test (e.g. with ability to perform system maintenance as required without disrupting operation). The existing electrical enclosure will also be moved from its current location at the Site (near the PTA of the Phase II pilot test) to a suitable location near the Phase III PTA. Power will be connected to the electrical enclosure from the existing Service #1 and #2 power drop electrical poles (Drawing C01). Electrical connections will then be made between the electrical enclosure and all power-requiring equipment for the pilot test.

2.3 Preliminary ERT Testing

A time-lapse ERT survey will be conducted by a representative from the University of Western Ontario during the pilot test to evaluate the methodology for monitoring combustion front propagation and identifying treated areas for the STAR technology. The number and close proximity of thermocouple probes within the PTA have the potential to interfere with the ERT measurements. Therefore, an initial test of the ERT system will be conducted after installation and connection of the thermocouples probes and ERT electrodes and installation of the clear stone layer (but prior to placement of the plastic sheeting and concrete work platform). ERT readings will be taken along each of the two survey lines to determine the level of interference and confirm the data can be successfully inverted. In addition, this test will help determine if the ERT survey process causes interference with thermocouple readings. If the ERT system functions as required without interference, then the time-lapse ERT survey will be conducted during the pilot test.

2.4 Shallow Combustion Test

2.4.1 Ignition System

Preheating and ignition time was identified as a cost-driving variable requiring further investigation in the Site Project Plan. Similar to the Phase II pilot test, STAR ignition for Phase III will be based on a convective heating process employing portable, in-well heaters. However, during the Phase III test, two types of heaters will be available to initiate the process: 1) electrical resistive heaters similar to those used in Phase II; and 2) new in-well cartridge heaters designed to supply more power to reduce the preheating and ignition time. The Phase II heaters will be used as back-up should the cartridge heater units fail under field conditions; however, the cartridge heaters will be the primary means of STAR ignition as above ground testing has shown that they allow for the injection of higher temperature air at a higher flow rate, and should reduce the pre-heating and ignition time.

2.4.2 Combustion Test Startup

Each of the four shallow ignition/air injection wells (IP-1 through IP-4) will be fitted with a down-well heater. Ignition at the four points will be initiated simultaneously. Interactions between the various combustion fronts will be monitored with subsurface thermocouples and ERT electrodes and through the analysis of combustion gas (carbon dioxide, carbon monoxide and oxygen) concentrations in collected vapors.

The procedure for system startup and STAR ignition in the PTA is consistent with the procedures employed during the Phase II pilot test and is detailed below:

1. Start the CEMS and data logging system.

2. Begin the ERT survey.

3. Start the air injection and SVE systems via the main control panel.

4. Install the down-well heaters in the four shallow ignition/air injection wells and seal them using the blow out preventer compression valves on the well heads (see Drawing M01).

5. Apply a low flow of injected air into each ignition/air injection well to evacuate the well of fluids.

6. Connect the down-well heaters to the heater control panel and turn on to drive off residual groundwater in the immediate vicinity of the ignition/air injection wells and heat the non-aqueous phase liquid (NAPL) in the target treatment zone to the target ignition temperature. Air flow will be adjusted during this time to maximize the skin temperature

of the heater while minimizing the on/off toggling of the heating element about the element's safe operating temperature set point.

7. The temperature in the ignition/air injection well boreholes will be monitored by the thermocouples in real time using a data logger with live display. Once the target ignition temperature is attained for each well, air flow into that well will be increased to the target air flow rate. [Note: the air injection rate / air temperature achievable with the cartridge heaters may be sufficient for spontaneous smoldering ignition without air flow manipulation; therefore increasing the air flow rate following attainment of the target ignition temperatures within the target treatment zone may not be required.]

8. Ignition will be confirmed through a temperature spike observed by thermocouples and through the observation of increased carbon dioxide / carbon monoxide (CO_2 / CO) emissions in the vapor collection system.

9. Monitoring of the thermocouple and combustion gas data will continue throughout the combustion test operation (Section 2.4.3).

2.4.3 STAR Operation and Monitoring

Following ignition, the flow rates and pressures of the injected air will be manipulated in an effort to maintain the smoldering combustion front(s) at each of the four shallow ignition/air injection wells for as long as possible within the 21-day shallow combustion test performance period. The propagation of the combustion front(s) will be evaluated in real-time using thermocouple data collected with a data logger fitted with live display and using data collected from the ERT survey. The propagation of the combustion front(s) will be assessed:

1. Radially away from a given ignition well to evaluate the anticipated single well radius of influence (ROI); and

2. Between ignition wells (shallow pilot test only) to evaluate inter-well interferences.

Progress of STAR will also be monitored in real-time with CO_2 and CO concentration data collected from the vapor collection system. These data will be used to indicate that combustion is occurring, and provide an estimate of the mass of contaminants destroyed within the PTA as a function of time.

Once ignition is complete and combustion is stable, the system is designed to be operated for periods unmanned (e.g. overnight) with operator visits for data collection and system maintenance performed daily. Daily operator tasks are discussed in Section 3.10.

2.4.4 Vapor Collection

Vapors will be collected from the PTA using the SVE system connected to the vapor collection pipes at a flow rate that is greater than the maximum air injection flow rate. The larger capacity of the vapor collection system (versus that of the air injection system) is designed to induce vacuum beyond the immediate PTA and draw in vapors that may travel beyond the PTA perimeter. Collected vapors will be passed through an oil mist separator and a moisture knock-out system then treated through vapor phase granular activated carbon (GAC) units in lead-lag configuration for removal of any VOCs. Influent and effluent vapors to the GAC will be screened daily for VOCs using a photoionization detector (PID) and collected periodically for confirmatory laboratory analysis and permit compliance. CO_2, CO, and O_2 emissions will be monitored and recorded in real time within the vapor treatment system via the CEMS. CO_2, CO and O_2 emissions data will be logged via a data logging unit and transferred to a database. Fluids accumulated from the oil mist and knock-out processes will be conveyed via automated transfer pumps to a storage tank for processing/disposal.

2.4.5 STAR Termination

Any initiated combustion fronts will be maintained through the manipulation of injected air for as long as possible during the 21-day performance period. However, pilot operation may be terminated pre-maturely (i.e., before the end of the performance period) according to any of the following early termination triggers:

- As directed by DuPont or local authorities;
- Vandalism resulting in damage to equipment;
- Health and safety concerns that cannot be mitigated in a safe and timely fashion without shut-down of the pilot test;
- Fugitive emissions or noise issues that result in un-safe conditions or neighbor complaints that cannot be contained / mitigated without termination of the pilot test;
- Propagation of the combustion front(s) to the limit of the thermocouple monitoring network;
- Complete treatment of soils within the PTA;
- Combustion around the ignition wells followed by unanticipated extinction of the combustion front(s) as a result of subsurface conditions that prevent the re-ignition of subsurface materials;
- Unanticipated failure of all ignition elements;

- Weather conditions that make continued operation un-safe;
- Unanticipated failure of power supply; and
- Unanticipated equipment failure / shutdown.

The STAR implementation field and support crew will conduct the evaluation of these termination triggers and assess whether termination of the pilot test is required.

2.5 Deep Air Sparge Test

Upon completion of the shallow test, a deep air sparge test will be conducted. It is believed that STAR implementation in the sand layer may be complicated by the presence of the meadow mat above the treatment zone which could impede the ability (or the necessity) of collecting combustion gases and volatile emissions from the STAR process. A simple air injection/tracer test into the sand layer below the meadow mat using process equipment, flow rates, etc. that will be used for the deep combustion test within this aquifer will allow for a preliminary evaluation of this potential issue.

The deep air sparge test will consist of injecting air containing a tracer (helium gas) into IP-5 via an injection port on the IP-5 injection piping, and collecting samples from the SVE system, ignition/air injection wells IP-1 through IP-4 (the wellheads will be fitted with sample ports to facilitate sample collection), and the soil vapor monitoring probes. The injection flow rate and pressure cannot be determined a priori but are likely to be in the range of 5-20 standard cubic feet per minute (scfm) and 10-18 pounds per square inch gauge (psig), respectively. Helium will be added to the injected air at a concentration of approximately 5-10% by volume for a period of up to 6 hours (to be determined in the field). The helium canister will be connected to the IP-5 air injection piping. The line connecting the helium canister to the IP-5 injection piping will be fitted with a flow meter, pressure gauge, and needle valve. A small vacuum will also be applied to the PTA using the SVE system (air flow of the SVE system will be a minimum of 5x the air injection rate). After the tracer addition period has elapsed, air injection will continue for up to 7 days or until helium is no longer detected in samples collected from the SVE system. Wells IP-1 through IP-4 will also be equipped with level loggers (e.g. In-Situ Level TROLL or equivalent) for use in assessing subsurface pressures during the test. Air samples will be collected from the SVE system, wellheads, and the soil vapor monitoring probes throughout the test period, and samples will be analyzed for helium on-site using a field helium detector (e.g., Marks model 9821 or equivalent). Confirmatory samples may also be collected and submitted for laboratory analysis.

Results of the deep air sparge test will be used to establish achievable flow rates and required pressures for the deep combustion test and to assess whether combustion gases and volatile emissions generated by the STAR process in the sand layer may eventually daylight to surface. If helium is detected in samples collected from the vapor monitoring probes and/or SVE system,

helium concentration data will be used to estimate potential combustion gas concentrations and volatile emissions in any vapors that may be collected during the deep combustion test. If helium is not detected in the vapor monitoring probes or SVE system samples, additional deep air sparge testing may be performed at higher flow rates and/or pressures before initiating the deep combustion test. Regardless of whether or not helium is detected during the air sparge test, full vapor capture, treatment, and monitoring for volatile emissions and combustion gases (CO, CO_2 and O_2) will occur throughout the deep combustion test (see Section 2.6) to further evaluate the influence of the meadow mat on the transport of generated vapors.

2.6 Deep Combustion Test

Upon completion of the air sparge test, a deep ignition/air injection well (IP-5) will be fitted with a down-well heater and ignition will be initiated. Propagation of the combustion front will be monitored with subsurface thermocouples. To the extent practicable, evaluation of the STAR technology within the deep sand aquifer unit will also be assessed using the ERT electrodes and through the analysis of combustion gas concentrations in any vapors that may be collected. The procedure for STAR ignition in the deep sand aquifer unit will be the same as that used for the shallow combustion test (see Section 2.4) with the exception that only one deep ignition/air injection well will be used. Operation will proceed as described for the shallow combustion test; however, the performance period for the deep combustion test is 14 days.

As described in Section 2.5 above, vapor collection using the SVE system will occur throughout the deep combustion test regardless of the results of the deep air sparge test. If volatile emissions and combustion gases are transported to ground surface, progress of STAR will be monitored in real-time with CO_2 and CO concentration data collected from the vapor collection system. However, if combustion gases cannot be collected, the evaluation of system performance and the estimate of the mass of contaminants destroyed within the deep sand unit will rely of thermocouple data and soils concentrations data only.

As for the shallow combustion test, once ignition is complete and combustion is stable, the system is designed to be operated for periods unmanned (e.g. overnight) with operator visits for data collection and system maintenance performed daily. The early termination triggers listed for the shallow combustion test apply for the deep combustion test as well.

2.7 Post-Pilot Characterization

Post-pilot characterization samples will be collected within the PTA immediately following the termination of the pilot test (provided a sufficient cool-down period has passed). This sampling will include the collection of soil cores via direct push, and may include test pitting and additional TarGOST surveying if warranted based on performance monitoring data collected during the combustion tests. Post characterization samples will be collected for laboratory analysis of EPHs.

These data will be compared with data collected during the recent TarGOST survey in the Lagoon C area and with samples collected from the PTA during the ignition/air injection well and thermocouple probe installations to evaluate the performance of the technology with respect to reduction of contaminant concentrations in soils within the target treatment zones. Locations of the post-STAR samples will be selected based on the data collected during the pilot test.

3. PROCEDURES AND METHODOLOGY

The following presents the field procedures and analytical methods for the STAR Phase III Pilot Test. Standard operating procedures (SOPs) are provided in Appendix E.

3.1 Site Preparation

Site preparation involves the excavation of the surficial gravel cap and removal of the underlying geo-membrane within the PTA. An approximately 50 ft by 50 ft PTA will be staked out in the selected location. The surficial gravel layer will be removed from the staked out PTA area and stock-piled on Site using a backhoe or equivalent earth excavator to allow for the removal of the underlying geo-membrane and installation of the PTA instrumentation (see below). It is anticipated that the water table lies beneath the geo-membrane and that de-watering will not be required during excavation of the PTA.

3.2 Ignition/Air Injection Well Installation

3.2.1 Borehole Drilling and Soil Sampling

Sonic drilling techniques will be used for ignition/air injection well installations. Soil samples will be collected during drilling from each boring using acetate core barrels. Up to 3 soil samples will be collected from wells IP-1 through IP-4. Well IP-5 should be located immediately adjacent to former TarGOST location TB-LCC-C5. During installation of well IP-5, continuous soil cores will be collected to a depth of approximately 45 feet below the excavated ground surface (or until the Rahway Till layer has been visually confirmed by Geosyntec). Following collection of soil cores, the borehole will be grouted following NJDEP regulations to a final depth of approximately 25 feet below excavated ground surface in preparation for installation of the IP-5 well. Soil samples will be sub-sampled and screened using a PID. Samples from well IP-5 will be recovered at 1 ft intervals and submitted for laboratory analysis of VOCs, SVOCs and EPHs. Samples from wells IP-1 through IP-4 will be submitted for laboratory analysis of EPHs. Table 2 lists the sample containers, preservatives, and analytical methods.

3.2.2 Well Screen and Pipe

The ignition/air injection wells (IP-1 through IP-5) will be constructed of 2-inch diameter carbon steel pipe with a 2-inch diameter stainless steel wire wrap screen (Drawing C04). The screen slot size will be 0.1 slot. The screened interval of the shallow fill unit wells (IP-1 through IP-4) will extend from approximately 9 to 10 ft below the excavated PTA ground surface (assuming the surface of the meadow mat is located at 10 ft beneath the excavated PTA ground surface). The screened interval of the deep sand aquifer unit well (IP-5) will extend from approximately 24 to 25 ft below the excavated PTA ground surface.

3.2.3 Ignition/Air Injection Well Thermocouples

Thermocouple probes will be installed within each well borehole for temperature monitoring. Three thermocouple probes will be installed within each borehole for wells IP-1 through IP-4 (for a total of 12 thermocouple probes). Four thermocouple probes will be installed within the borehole for well IP-5. Thermocouple probes will be attached to the well screens and installed with the well backfill materials as the Sonic casing is removed. The thermocouples are described in detail in Section 3.3.

3.2.4 Well Annulus Materials

Prior to placing the well components and thermocouples into the borehole, a direct measurement of the borehole depth will be made using a clean weighted measuring tape.

Following placement of the well components and thermocouples, from the bottom up, the borehole annulus will be backfilled with (Drawing C04):

- A filter pack consisting of at least 95% crushed silica gravel that is washed and contaminant free and contains less than 1% water-soluble material, placed to a height of 2 inches above the top of the screen.

- A layer of fine gravel bentonite (e.g., HolePlug™) placed to a depth of 3 ft beneath the excavated PTA ground surface. This layer will be installed on top of the filter pack to isolate the well screen.

- Bentonite-cement grout. The grout will be installed to the excavated PTA ground surface.

All materials will be installed using a rigid side-discharge tremie pipe. The elevation of the top of each backfill material will be measured in the borehole annulus at the time of emplacement by either plumbing with a weighted tape or by tapping with accurately measured tremie pipe and recorded on the well construction log.

The grout will be pumped using a grout pump through the tremie pipe, which will be placed 6 inches above the top of the bentonite seal and slowly withdrawn as the grout is pumped. Pumping will continue until undiluted grout (i.e., the weight of the exiting grout is equal to the injected grout) exits the annulus at the surface. Additional grout will be added to the borehole after at least 12 hours to compensate for settling. Both the initial grout volume and volume added subsequently will be recorded.

3.2.5 Well and Surface Completion

All ignition/air injection wells will extend approximately 3 ft in length above the surface of the excavated PTA. A concrete work platform will be installed across the entire excavated area (see Section 3.6), thus no surface vault or pad is required for the wells. The entire PTA and area containing process equipment will be protected by a temporary construction fence throughout the course of the pilot test.

3.2.6 Well Development

No well development will be conducted; however, water level monitoring will be conducted to ensure that the wells are sufficiently connected with the shallow fill and deep sand aquifer units. Should groundwater and/or NAPL be restricted from flowing into the well, some limited, short duration and low flow rate pumping may be conducted to free the gravel backfill and adjacent geologic unit of drilling fluids and particulate matter.

3.3 Pilot Test Instrumentation

Thermocouple probes will be installed within the PTA at the locations shown in Drawings M03 to M06. The shallow and deep multi-level probes will be installed via a direct push technique (DPT) rig whereby:

- The direct push rod is installed to the target depth;
- The thermocouple probe is installed within the rod; and
- The rod is extracted from the borehole, leaving the thermocouple in place within the target geologic unit.

The multi-level thermocouple probes will be instrumented such that temperatures are measured at the depths depicted in Drawing C06. Thermocouple probes will also be installed within the clear stone layer as depicted in Drawing C06. The probes will be protected by an Inconel™ sheath extending the entire length of the probe. The portion of probe exiting the top of the clear stone layer (once installed) will be bent as needed in order to maintain an unobstructed work area around the ignition/air injection wells once the concrete work platform is constructed (see

Section 3.6). Following installation of the concrete work platform, the thermocouple probes will be connected to a multi-channel data logger (Agilent Multifunction with live display and operator interface via laptop computer) with all conduits located above the surface of the concrete platform.

Thermocouples will also be installed within each well borehole. Thermocouple probes will be attached to the well screens using steel clamps installed with the well backfill materials as the Sonic casing is removed. Thermocouple designations and target depths will be as follows:

- TC-80-IP-1: thermocouple attached to IP-1 well screen and located approximately 1 inch below top of screen.
- TC-81-IP-1: thermocouple attached to IP-1 well screen and located approximately 1 inch below top of screen.
- TC-82-IP-1: thermocouple installed within IP-1 filter pack (against borehole wall) and located approximately 1 inch below top of screen elevation.
- TC-83-IP-2: thermocouple attached to IP-2 well screen and located approximately 1 inch below top of screen.
- TC-84-IP-2: thermocouple attached to IP-2 well screen and located approximately 4 inches below top of screen.
- TC-85-IP-2: thermocouple installed within IP-2 filter pack (against borehole wall) and located approximately 1 inch below top of screen elevation.
- TC-86-IP-3: thermocouple attached to IP-3 well screen and located approximately 1 inch below top of screen.
- TC-87-IP-3: thermocouple attached to IP-3 well screen and located approximately 7 inches below top of screen.
- TC-88-IP-3: thermocouple installed within IP-3 filter pack (against borehole wall) and located approximately 1 inch below top of screen elevation.
- TC-89-IP-4: thermocouple attached to IP-4 well screen and located approximately 1 inch below top of screen.
- TC-90-IP-4: thermocouple attached to IP-4 well screen and located approximately 11 inches below top of screen.
- TC-91-IP-4: thermocouple installed within IP-4 filter pack (against borehole wall) and located approximately 1 inch below top of screen elevation.

- TC-92-IP-5: thermocouple attached to IP-5 well screen and located approximately 1 inch below top of screen.
- TC-93-IP-5: thermocouple attached to IP-5 well screen and located approximately 8 inches below top of screen.
- TC-94-IP-5: thermocouple installed within IP-5 filter pack (against borehole wall) and located approximately 1 inch below top of screen elevation.
- TC-95-IP-5: thermocouple installed within IP-5 filter pack (against borehole wall) and located approximately 1 inch below top of screen elevation.

ERT electrodes will be installed within the PTA for use in conducting a time-lapse ERT survey to aid in monitoring combustion front propagation and identifying treated areas for the STAR technology. Two parallel survey lines will be established within the test area (Drawing M07). An electrode spacing of 3'-3" (1 meter) will be used along each line covering a horizontal distance of approximately 100 ft (30 meters), giving a total of 31 electrodes for each line. Due to the nature of the STAR test design, the electrodes and associated cables will need to be buried within the clear stone layer; therefore, permanent installation of electrodes and cables are needed and they will be deemed disposable after the survey. The electrodes are approximately 16 inches in length and will be hammered into the excavated ground surface along each survey line. If needed, pilot holes may be drilled into the excavated ground surface to facilitate installation. The cables that will connect the electrodes to the Syscal Pro resistivity meter will exist as a strapped bundle of 31 individual cables with each individual cable 'splitting off' and connecting to each electrode along the line (i.e., 31 cables bundled at the first electrode with 1 cable remaining at the last electrode). The electrodes will be designed with a 'bolt and nut' connection to the cables to ensure a permanent connection.

Four soil vapor monitoring probes will be installed using direct push technology outside of the PTA. Probe installation locations are provided in Drawing C02. The direct push casings and expendable tips will be advanced to approximately 3 ft bgs and then backfilled with 2-inches of clean sand prior to the installation of the probe assemblies. Installation specifications are provided in Drawing C05.

3.4 Clear Stone Layer and Vapor Collection Piping

Following installation of the wells, thermocouples and ERT electrodes, the PTA area will be backfilled with a minimum of 2 inches of ¾-inch clean crushed stone (clear stone) to lay a base on which to install the four 4-inch horizontal perforated carbon steel pipes for the collection of vapors (Drawings C02 and C03). The vapor collection piping will transition from perforated pipe to solid pipe immediately before exiting the concrete work platform (once installed) on one end of the PTA, and will then be combined in a manifold for connection to the vapor extraction

system (Drawing M09). After placement of the vapor collection pipes, the PTA will be backfilled with an additional 6 inches (minimum) of clear stone to cover the pipes and create a base for the concrete work platform. Thermocouples will also be installed directly into the clear stone as discussed in Section 3.3.

Vacuum monitoring probes will be installed within the clear stone as per Drawing C05, and will be positioned at locations shown in Drawing M03.

3.5 Ignition/Air Injection Wellheads and Collars

Ignition/air injection well head parts and equipment will be installed as per Drawing M01. Each of the five ignition/air injection wells will also be fitted with a carbon steel color/restraint plate to anchor the wells within the concrete platform (Drawing C04 and M01).

3.6 Concrete Platform

A 50 ft by 50 ft concrete work platform will be installed around the ignition/air injection wells and thermocouples (Drawings C02 and C03). The work platform shall be a minimum of 4 inches in thickness and will be constructed of 3000 pounds per square inch (psig), heat-resistant concrete reinforced by a welded wire mesh. Prior to placement of the concrete and mesh wire grid, plastic sheeting will be placed on top of the clear stone layer within the PTA in order to prevent concrete from penetrating and plugging the clear stone layer. Following curing of the concrete, a weather resistant sealant (GeoCell 3300 or equivalent) will be placed around penetrations through the concrete (e.g., ignition wells, thermocouples, vapor collection piping, etc.). The perimeter of the concrete platform (where the concrete contacts the existing ground surface) will also be sealed using a bentonite slurry.

As needed, cable trays will be installed to allow for placement of air lines, thermocouple wires and electrical cables for the in-well heaters. A minimum width of 30 inches will be maintained free of obstruction (e.g. cable trays) as a walkway between the wells and the outside of the PTA.

3.7 Air Injection System

The air injection system will consist of two electric air compressors (C-201 and C-202; one will serve as the primary air compressor and the other will serve as a back-up air compressor), each rated at approximately 900 scfm and 100 psig, a desiccant air dryer (AD-203), a 1000 gallon equalization tank (T-701), and associated interconnecting piping, manifolds, pressure regulating and relief valves, ball and gate valves, pressure and temperature indicators and transmitters, and air flow indicators as per Drawings D02 and M08. The compressors will be interfaced with the programmable logic controller (PLC) system such that during system startup and operation only one compressor (i.e., the primary compressor, C-201) starts and runs with the secondary compressor (C-202) starting automatically in the event of a failure of the primary compressor

(e.g. mechanical/electrical failure). The primary compressor shall be automatically shut down prior to the activation of the secondary compressor such that only one compressor at a time can be energized. The switching procedure from primary to secondary compressor shall be completed within a timeframe that will prevent a loss in air flow or pressure in the injection manifold, and thus provided uninterrupted system operation (e.g., switching within a maximum of 20 seconds following indication of failure of the primary compressor). The PLC system will also log the alarm condition in its user accessible memory, activate the external alarm beacon on the electrical enclosure, and dial-out the alarm condition to the system operator to notify them of the primary compressor failure. A summary of alarm conditions is provided in Table 1.

3.8 Vapor Collection System

The vapor collection system will consist of (see Drawing D03):

- A 10-inch diameter vapor mist accumulator;
- A CEMS unit;
- One cyclonic moisture/temperature knock-out tank (knock-out tank; T-702) prior to the inlet of the vapor extraction blowers, two condensate transfer pumps (P-201 and P-202 [with secondary containment]) and one minimum 500 gallon tank (T-705) for collection of discharged water;
- One primary vapor extraction blower (B-214) and one secondary (e.g., backup) vapor extraction blower (B-215) each capable of producing a minimum of 2500 scfm at 60-inches of water static pressure and equipped with inlet particulate filters;
- two maximum 6000-pound (lb) vapor-phase vertical flow through GAC units (T-703 and T-704) in lead-lag configuration for vapor emissions treatment;
- A minimum 35 ft tall 8-inch diameter discharge stack (S-216) that will route the treated vapors from the outlet of the vapor phase carbon units for discharge to the atmosphere; and
- Associated interconnecting piping/ductwork, perforated vapor collection pipes, manifolds, pressure relief valves, gate/knife valves, sample ports, and flow, pressure and temperature indicators and transmitters connections as per Drawings D03 and M09.

The blowers will be interfaced with the PLC system installed such that during system startup the PLC system only allows the primary (B-214) to start and run during system operation, but that in the event B-214 shuts down due to mechanical/electrical failure, the secondary blower (B-215) starts immediately to prevent a loss in air flow or vacuum in the SVE system and thus provide uninterrupted system operation (Table 1). The PLC system will also log the alarm condition in

its user accessible memory, activate the external alarm beacon on the electrical enclosure, and dial-out the alarm condition to the system operator to notify them of the primary blower failure. A summary of alarm conditions is provided in Table 1. The PLC system will also be programmed such that an operator can manually switch between operation of either the primary or secondary blower (but both blowers cannot operate at the same time), without interrupting system operation (i.e., instantaneous switching of blowers), to allow for change-out of the blower filters and maintenance if necessary.

3.9 System Startup & Ignition

The STAR ignition process is described in Section 2.4. A schematic of the down-well heaters and a heater deployment detail are provided in Drawing M01.

3.10 STAR Operation and Monitoring

Once ignition is complete and combustion is stable, the system is designed to be operated unmanned overnight with operator visits for data collection and system maintenance performed daily. Daily operator tasks will include the following items, which are documented in the Operator Daily Checklist (Appendix B):

1. Perform daily health and safety meeting outside of fenced area.
    a. Monitor CO and VOCs in air space outside PTA while approaching PTA using QRae and PID (operator to bring instruments on and offsite).
    b. Discuss day's tasks and conduct Task Hazard Analyses (THAs) as needed (Appendix C).
2. Observe exterior beacon alarm light before entering PTA.
    a. If beacon light is not on, proceed with caution into PTA and perform general inspection.
    b. If beacon light is on, notify Project Manager (Gavin Grant). Measure CO and VOC concentrations in ambient air to determine they are less than 10 parts per million (ppm). Proceed with caution and review the alarm conditions to determine the problem.
3. Download data logger, PLC system and ERT system data to laptop computer and upload data to Geosyntec file transfer protocol (FTP) site. Review previous night's data.
4. Perform regular workspace measurements of CO and VOC concentrations using the QRae and PID and document measurements in the Daily Operator Checklist (Appendix

B; record at least 4 readings of CO and VOC concentrations each day). Note: the operator should have the QRae and PID meters on his/her-self at all times while on-site and the meters should be continuously operating. The Office Trailer and CEMs enclosure are equipped with household CO alarms that will continuously monitor CO levels in these enclosures and sound an alarm in the event of elevated CO levels. The operator should check for proper operation of these alarms on a daily basis (i.e., using the test feature on the CO alarms).

5. Collect manual recordings of local system readouts.
6. Perform equipment inspections.
7. Perform PTA inspection (e.g. concrete seals and integrity).
8. Check/sample vapor monitoring probes.
9. Check and plot temperatures of clear stone layer and shallow thermocouples to monitor any changes in exhaust gas temperatures.
10. Review user input alarm set points.
11. Check and calibrate CEMS unit as required.
12. Check blower pressure differential.
13. Check GAC unit pressures.
14. Check liquid levels in knock-out tank and mist accumulator and record approximate volumes.
15. Collect screening samples and perform observational and record keeping requirement of permit as describer in Section 3.11.
16. Collect analytical samples as required in Section 3.15.
17. Update inventory of field supplies and sampling media and make orders with suppliers as required.
18. Communicate with Geosyntec Project Manager (Gavin Grant).
19. Perform general Site maintenance and housekeeping.

3.11 Permit Compliance

The Phase III pilot test will be operating under a NJDEP Environmental Improvement Pilot Test (EIPT) permit. Geosyntec will apply for and obtain an EIPT permit on DuPont's behalf prior to system startup and ignition. Based on the conditions of the EIPT permits obtained during the Phase II pilot test (Permit Activity Numbers EIP100001 and EIP10002), it is envisioned that the operator will be required to collect the following data under the activities as described below:

1. Monitor the performance of the air control system twice daily.

    a. Collection of screening samples (tedlar bags) from between the carbon vessels (SP-03 in Drawing D03) to assess contaminant breakthrough.

    b. Screening samples with a PID

    c. If between carbon sample shows PID concentrations in excess of 50 parts per million by volume as isobutylene, collection of a summa canister sample from between the carbon vessels and prior to discharge from the stack. Both samples will be submitted to the laboratory with a 24-hour turn-around time.

    d. Assessment of laboratory results to determine if total VOCs exceed 0.5 pounds per hour or toxic substances (TXS) exceeds 0.1 pounds per hour between the carbon beds, at which point the lead carbon vessel shall be isolated (i.e., vapors will be routed directly from the blower to the lag carbon vessel) to allow for carbon change out. Once carbon change out has been completed, vapors will once again be routed through both vessels (as during normal system operation).

    e. Documenting and maintaining all sampling records and results.

2. Monitor discharge flow rate.

    a. Permit requires hourly collection. FIT-201 in Drawing D03 will continuously record and log flow rate into a database.

    b. Operator to check daily the operation of FIT-201 to ensure data quality.

3. Monitor the VOC mass flow rate emitted by system twice daily.

    a. Collection of screening samples (tedlar bags) from stack (SP-05 in Drawing D03).

    b. Screening samples with a PID.

    c. Notification of project manager if PID readings indicate concentrations in excess of permitted mass flow rate of 0.5 lbs per day of total VOCs.

   d. Documenting and maintaining all sampling records and results.

4. Monitor the benzene mass flow rate emitted by system once initially, and then once per week.

   a. Collection of Summa canister samples from stack (SP-05 in Drawing D03) to assess contaminant breakthrough.

   b. Submittal of sample for analysis of benzene using United States Environmental Protection Agency (EPA) Method TO-15 on 24 hour turnaround time for initial sample.

   c. Confirmation that concentrations do not exceed mass flow rate for benzene of 0.01 lbs per hour.

   d. Documenting and maintaining all sampling records and results.

5. Monitor ground level carbon monoxide levels once per day.

   a. Collection of CO measurements using a QRae CO detector or equivalent from four points, 90 degrees apart and 500 ft away from the stack.

   b. Notification of project manager if concentrations at monitored locations are in excess of 10 ppm_v.

6. Document and maintain all sampling records and results.

7. Monitor stack opacity daily.

   a. Perform a 30 minute opacity test daily.

   b. Notification of project manager if stack produces visual emissions for 3 continuous minutes within the 30 minute period.

   c. Documenting and maintaining all sampling records and results.

3.12 Pilot Test Termination

The pilot test will be terminated under the conditions listed in Section 2.4.5. The STAR implementation field and support crew will conduct the evaluation of these termination triggers and assess whether termination of the pilot test is required. Termination of the pilot test will consist of shutting down the supply of air to the PTA and shutting down the SVE system. Air supply to the wells should be shut down by: a) manually closing all ball and globe valves to ignition points on the air injection manifold, and b) shutting down the compressor via the main

control panel. The SVE should be shut down by: a) shutting down the blower via the main control panel, and b) manually closing all isolation valves on the SVE piping manifold.

3.13 Baseline and Post-STAR Characterization

Baseline and post-STAR characterization will consist of a series of soil samples collected during ignition/air injection well and thermocouple installation activities and immediately following the termination of the pilot (provided a sufficient cool-down period has passed). Soil samples will be sub-sampled and screened using a PID. Samples will also be submitted for laboratory analysis of VOCs, SVOCs and EPHs as discussed in Sections 2.2 and 3.2.1. Table 2 lists the sample containers, preservatives, and analytical methods. Post-STAR characterization may also include a TarGOST survey.

3.14 Deep Air Sparge Test Monitoring

Monitoring during the deep air sparge test will consist of collecting air samples from the air injection and SVE systems, wells IP-1 through IP-4, and from the soil vapor monitoring probes. Air samples from the air injection and SVE systems will be collected via sample ports (ball valves) located on the IP-5 injection line and the SVE piping (sample port SP-01). The frequency of sample collection will be determined from detailed modeling. Samples will be analyzed for helium on-site using a field helium detector (e.g., Marks model 9821 or equivalent). Confirmatory samples may also be collected and submitted for laboratory analysis. Wells IP-1 through IP-4 will be equipped with level loggers (e.g. In-Situ Level TROLL or equivalent) for use in assessing subsurface pressures during the test. Continuous measurements of injection air temperature and pressure will be made using the existing injection line temperature and pressure transmitters (TIT-101 and PIT-101). Regular measurements of air injection flow rate will also be made using FI-106.

3.15 Combustion Performance Monitoring

Performance monitoring and assessment of the combustion tests will be conducted over the course of a 21-day performance period for the shallow combustion test and a 14-day performance period for the deep combustion test. The performance monitoring periods will include all efforts to ignite and maintain smoldering combustion reaction(s) within the PTA. Following the initial performance monitoring periods for each geologic unit, the data will be evaluated and the test period may be extended as necessary at the discretion of DuPont. Any extension in the duration of the pilot test would likely be to obtain additional data to be used in the design of a full-scale STAR remedy.

3.15.1 Combustion Tracking

The progress of the combustion front(s) will be tracked using the network of thermocouples and ERT electrodes installed in the PTA. This information will be used to determine how quickly the combustion front is progressing. Thermocouple data will be collected on a multi-channel data logger (Agilent Multifunction unit) with live display and operator interface via a laptop computer. ERT data will be collected on a Syscal Pro resistivity meter.

In addition to thermocouple and ERT data, real-time CO_2 / CO emissions in the vapor phase will be analyzed at the vapor extraction manifold via the CEMS unit. These data will aid in determining the initiation of combustion and will be used to estimate time-variable combustion rate.

3.15.2 Vapor Sampling

Vapor samples will be collected from sample ports located within the SVE system piping and ducting (Drawings D03 and M09) using tedlar bags and screened for VOCs using a PID. Samples will also be collected on sorbent tubes for polycyclic aromatic hydrocarbon (PAH) analysis by EPA Method TO-13A and in Summa canisters for total petroleum hydrocarbon (TPH) analysis by EPA Methods TO-15 and 25 (modified). Table 2 lists the sample containers, preservatives, and analytical methods. Samples will be collected for the duration of the pilot test to: a) evaluate the composition and concentrations of constituents in the vapor phase resulting from STAR operation; and b) to evaluate the performance of the vapor treatment system.

In addition, vapors will be analyzed between the carbon units and downstream of the carbon units in the vapor treatment system with a PID twice daily. These data will be used to evaluate the possibility of contaminant ‘break-through’ and allow for the replacement or augmentation of the vapor treatment system during operation as necessary.

3.16 Data Evaluation and Reporting

The data obtained from the pilot test (chemistry data, thermocouple temperatures, ERT data, system operating conditions such as air flow rates, etc.) will be tabulated, reviewed, and interpreted to estimate the extent of coal tar destruction in the PTA. The rate of combustion front propagation (and thus mass destruction via STAR) will be determined based on the thermocouple, ERT, and CO_2 / CO emissions data. To the extent possible, a carbon mass balance will be conducted to verify these results and the relative fractions of coal tar treatment via smoldering combustion versus volatilization and capture in the vapor collection and treatment system. Factors affecting STAR performance such as water content, air flow rate, and ignition/air injection well spacing will be identified during the pilot test. Geosyntec will prepare a STAR Phase III Pilot Test Report containing detailed study methods, all data generated during the study, and an assessment of the data, conclusions, and recommendations.

3.17 Equipment Cleaning

All drilling and sampling equipment will be free of contamination, including the drill rig, Sonic casings, DPT rods, samplers, tools, water tank, dosing tanks, pumps and any other auxiliary equipment. Drilling and non-disposable sampling equipment will be cleaned prior to initiating drilling or sampling at each location. All equipment will be cleaned prior to leaving the Site. Equipment cleaning will be performed in a designated area on Site in such a manner as to allow collection of the wash water.

3.18 Permitting

An EIPT is required by NJDEP to conduct the pilot test. The purpose of the permit is to derive the data required for a pre-construction permit should the program move to full scale. In addition, well permits will be required for the ignition/air injection wells.

3.19 Health and Safety

Appendix D contains the Site-specific Health and Safety Plan (HASP). All Site personnel will be required to follow this plan during implementation of this Work Plan. All tasks will be performed using Level D personal protective equipment (PPE) with the exception of the tasks involving the measurement, sampling, collection or general handling of NAPL (if required), which will require Level C PPE.

3.20 Waste Management

All drill cuttings, drilling fluids, groundwater generated during well development and well decommissioning, SVE system recovered fluids, and decontamination residuals generated during equipment cleaning will be stored in labeled containers in a designated storage area for subsequent proper disposal by DuPont in accordance with applicable regulations. All non-hazardous trash associated with system installation and operation (i.e., general trash such as supply packaging, etc.) will be removed from the site and properly disposed of by the drilling or construction subcontractor.

4. REFERENCES

Geosyntec Consultants. 2011. Self-Sustaining Treatment for Active Remediation (STAR) Pilot Test Report. DuPont Pitt Consol Site, Newark, New Jersey. June 22, 2011.

APPENDIX A

DRAWING PACKAGE

IN SITU SELF SUSTAINING TREATMENT FOR ACTIVE REMEDIATION
SCALE UP PILOT TEST
100% DESIGN DRAWINGS
FOR CONSTRUCTION

FORMER PITT CONSOL SITE
NEWARK, NEW JERSEY

VICINITY MAP

LIST OF DRAWINGS		
DRAWING NUMBER	DRAWING NUMBER	DRAWING TITLE
GENERAL		
G01	01	TITLE SHEET
CIVIL		
C01	02	PILOT TEST AREA (PTA) LOCATION
C02	03	PILOT TEST AREA SCHEMATIC
C03	04	PILOT TEST AREA CROSS SECTIONS
C04	05	PILOT TEST AREA INJECTION WELL DETAILS
C05	06	PILOT TEST AREA MONITORING PROBE DETAILS
C06	07	PILOT TEST AREA THERMOCOUPLE PROBE DETAILS
PROCESS		
D01	08	PROCESS FLOW DIAGRAM
D02	09	PIPING AND INSTRUMENTATION DIAGRAM – AIR INJECTION
D03	10	PIPING AND INSTRUMENTATION DIAGRAM – VAPOR EXTRACTION
MECHANICAL		
M01	11	HEATER DEPLOYMENT AND WELL HEAD DETAILS
M02	12	CONTINUOUS EMISSIONS MONITORING SYSTEM DETAILS
M03	13	IGNITION WELL AND THERMOCOUPLE PROBE LAYOUT
M04	14	SHALLOW MULTI–LEVEL THERMOCOUPLE PROBE LOCATIONS
M05	15	SINGLE THERMOCOUPLE PROBE LOCATION (CLEAR STONE)
M06	16	DEEP MULTI–LEVEL THERMOCOUPLE PROBE LOCATIONS
M07	17	ERT ELECTRODE LOCATIONS
M08	18	INJECTION WELL MANIFOLD DETAILS
M09	19	EXTRACTION MANIFOLD DETAILS
ELECTRICAL		
E01	20	SINGLE LINE DIAGRAM ELECTRICAL
E02	21	WIRING DIAGRAM ELECTRICAL
E10	22	PRIMARY BLOWER B–214 – MOTOR SCHEMATIC
E11	23	PRIMARY BLOWER B–215 – MOTOR SCHEMATIC
E12	24	TRANSFER PUMP P–201 – MOTOR SCHEMATIC
E13	25	PLC CABINET – SCHEMATIC DIAGRAM SHEET 1 OF 6
E14	26	PLC CABINET – SCHEMATIC DIAGRAM SHEET 2 OF 6
E15	27	PLC CABINET – SCHEMATIC DIAGRAM SHEET 3 OF 6
E16	28	PLC CABINET – SCHEMATIC DIAGRAM SHEET 4 OF 6
E17	29	PLC CABINET – SCHEMATIC DIAGRAM SHEET 5 OF 6
E18	30	PLC CABINET – SCHEMATIC DIAGRAM SHEET 6 OF 6

LOCATION MAP

PREPARED BY:

Geosyntec consultants

130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519–822–2230

100% DESIGN DRAWINGS
FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: TITLE SHEET

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE
NEWARK, NEW JERSEY

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SIGNATURE

DATE

DESIGN BY:	GS	DATE:	JULY 12, 2012
DRAWN BY:	JFH	PROJECT NO.:	TR0341D
CHECKED BY:	GS	FILE:	TR0341–G01.dwg
DRAWING NO.:	G01	SHEET NO.:	01 OF 30

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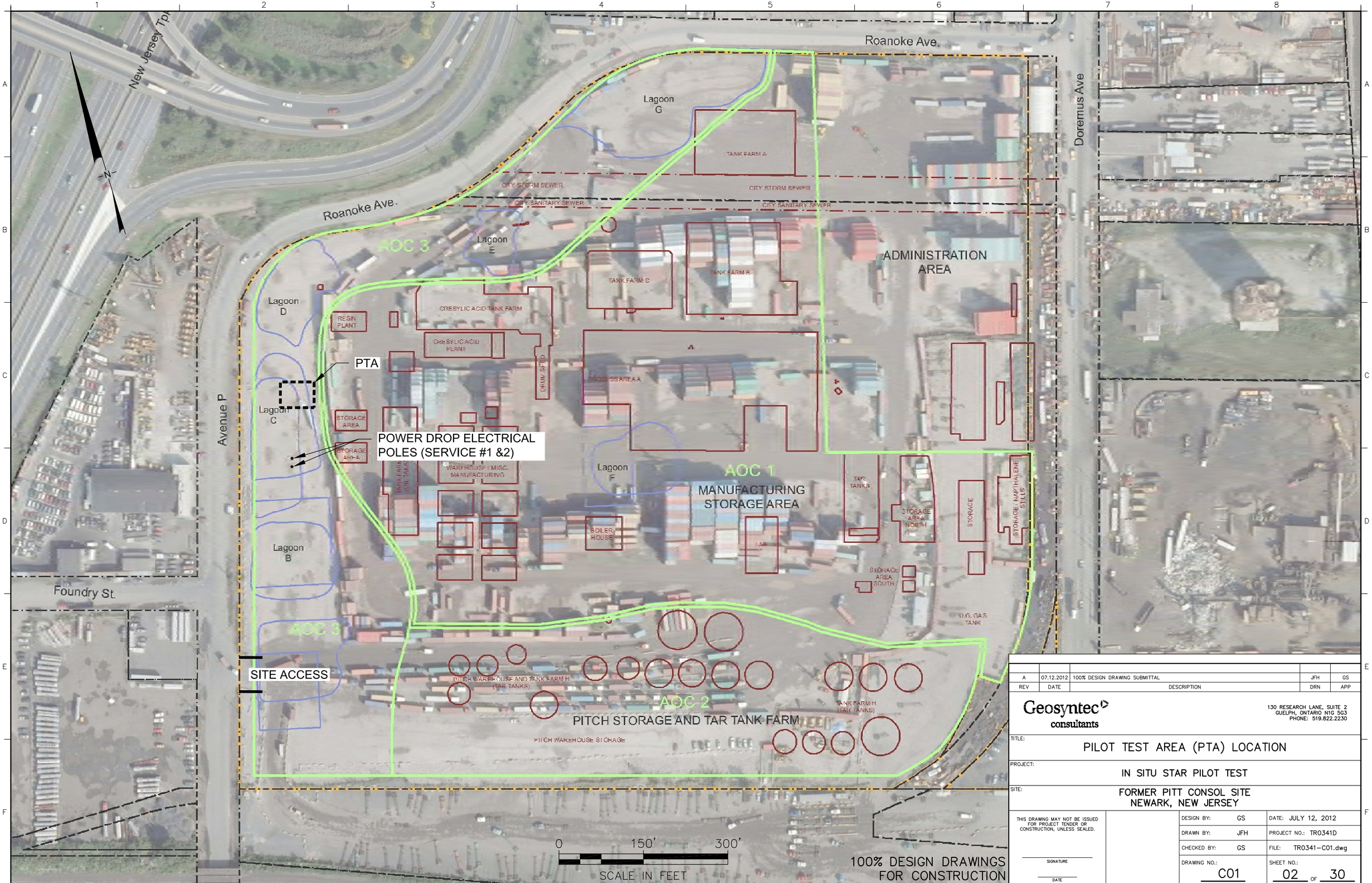

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130 RESEARCH LANE, SUITE 2
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TITLE: PILOT TEST AREA (PTA) LOCATION

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE
NEWARK, NEW JERSEY

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DESIGN BY:	GS	DATE:	JULY 12, 2012
DRAWN BY:	JFH	PROJECT NO.:	TR0341D
CHECKED BY:	GS	FILE:	TR0341-C01.dwg
DRAWING NO.:	C01	SHEET NO.:	02 OF 30

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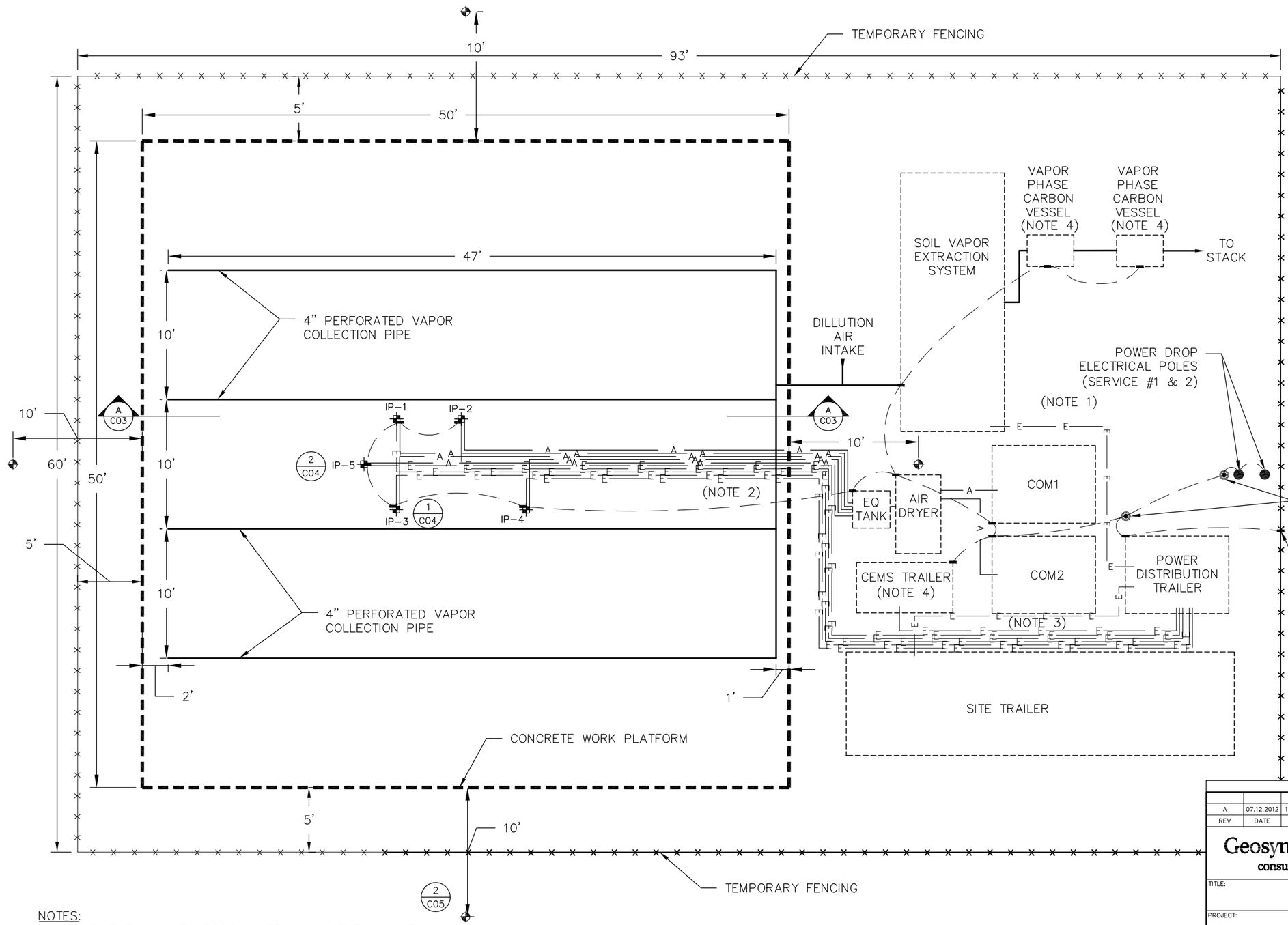

LEGEND

	CONCRETE WORK PLATFORM
	AIR EXTRACTION LINE
A	AIR INJECTION LINE
E	ELECTRICAL POWER
	EQUIPMENT LOCATION
	TEMPORARY FENCE
	#4 AWG GROUNDING WIRE
	GROUND POINT TO EQUIPMENT
	IGNITION WELL
COM1	COMPRESSOR 1
COM2	COMPRESSOR 2
	VAPOR MONITORING PROBE
CEMS	CONTINUOUS EMISSIONS MONITORING SYSTEM

NOTES:
1. EQUIPMENT LAYOUT APPROXIMATE AND NOT TO SCALE.
2. CABLE TRAYS SHALL BE INSTALLED TO RUN AIR LINES, HEATER, AND THERMOCOUPLE WIRES.
3. ELECTRICAL CONNECTIONS BETWEEN ELECTRICAL ENCLOSURE AND EQUIPMENT TO BE BURIED OR RUN IN CABLE TRAYS. ALL CABLE TRAYS TO BE BONDED TO GROUNDING SYSTEM.
4. CEMS TRAILER AND VAPOR PHASE CARBON VESSELS TO BE SUPPLIED BY GEOSYNTEC CONSULTANTS.

1 / C02 PLAN VIEW
PILOT TEST AREA
NOT TO SCALE

100% DESIGN DRAWINGS FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

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130 RESEARCH LANE, SUITE 2
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TITLE: PILOT TEST AREA SCHEMATIC

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE NEWARK, NEW JERSEY

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DATE

DESIGN BY:	GS	DATE:	JULY 12, 2012
DRAWN BY:	JFH	PROJECT NO.:	TR0341D
CHECKED BY:	GS	FILE:	TR0341-C02.dwg
DRAWING NO.:	C02	SHEET NO.:	03 OF 30

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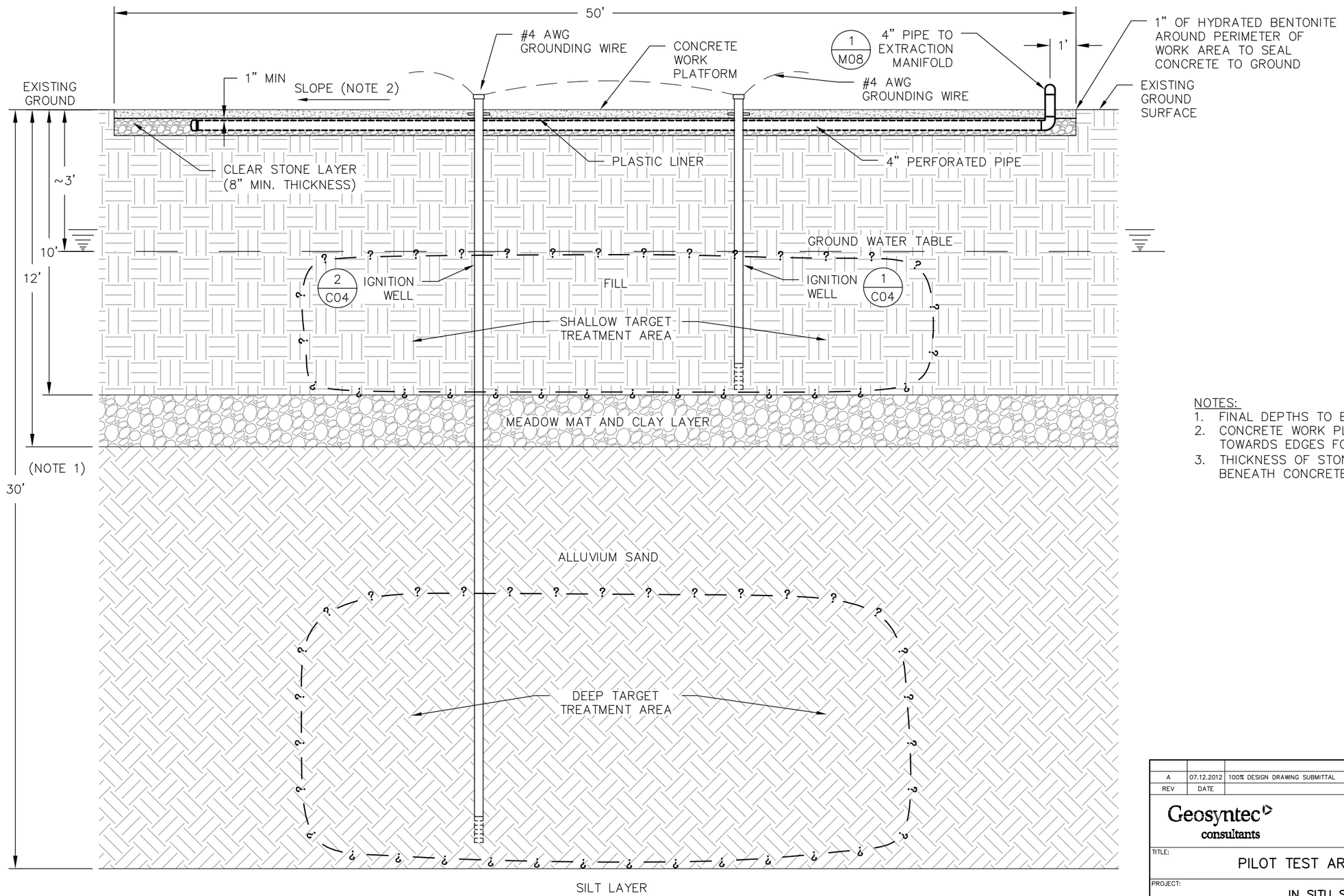

NOTES:
1. FINAL DEPTHS TO BE CONFIRMED.
2. CONCRETE WORK PLATFORM TO BE SLOPED TOWARDS EDGES FOR SURFACE DRAINAGE.
3. THICKNESS OF STONE LAYER TO BE MIN. 8" BENEATH CONCRETE WORK PLATFORM.

A / C03 SECTION VIEW
PILOT TEST AREA
NOT TO SCALE

100% DESIGN DRAWINGS FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
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TITLE: PILOT TEST AREA CROSS SECTIONS

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE
NEWARK, NEW JERSEY

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

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DATE

DESIGN BY:	GS	DATE:	JULY 12, 2012
DRAWN BY:	JFH	PROJECT NO.:	TR0341D
CHECKED BY:	GS	FILE:	TR0341-C02.dwg
DRAWING NO.:	C03	SHEET NO.:	04 OF 30

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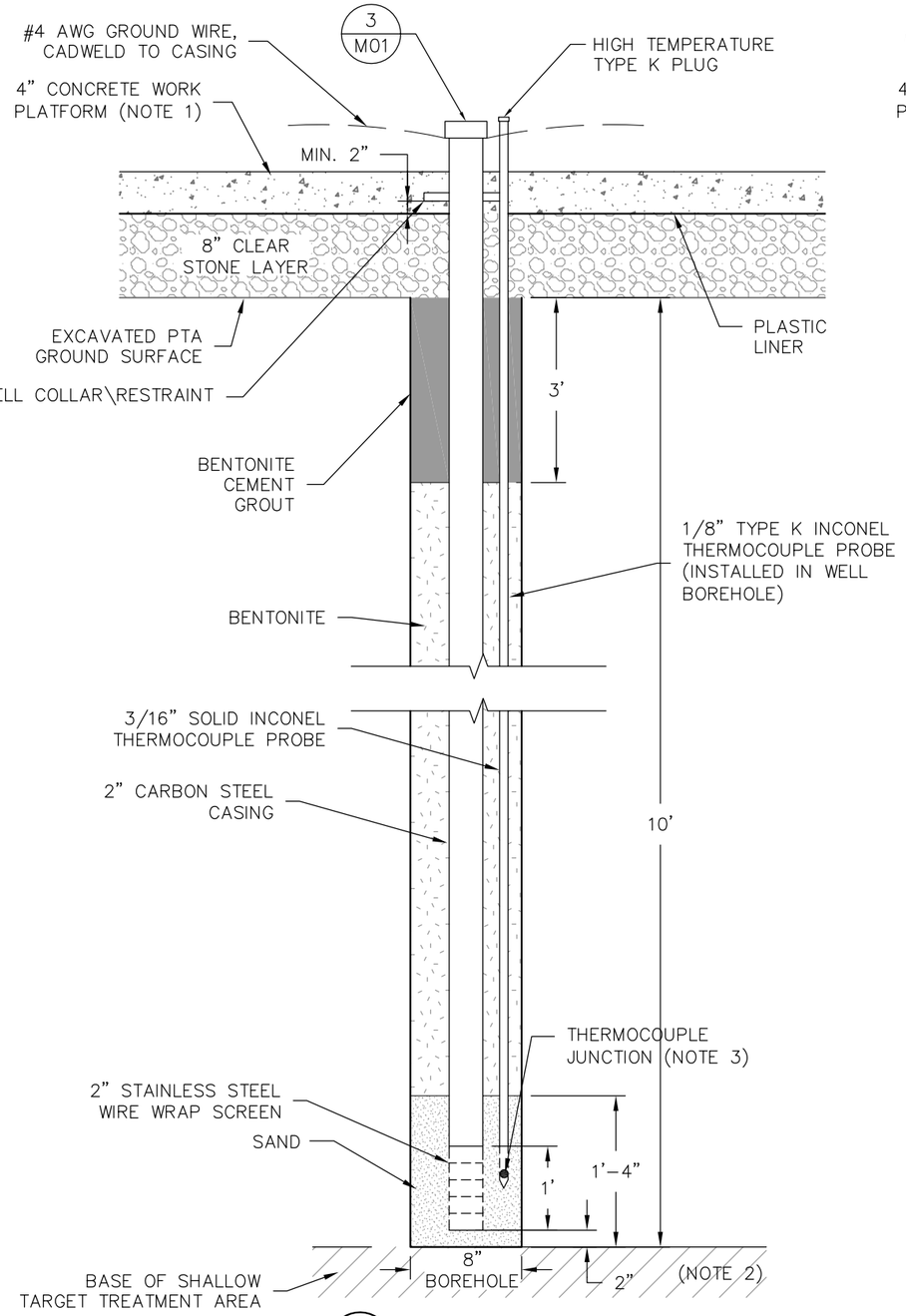
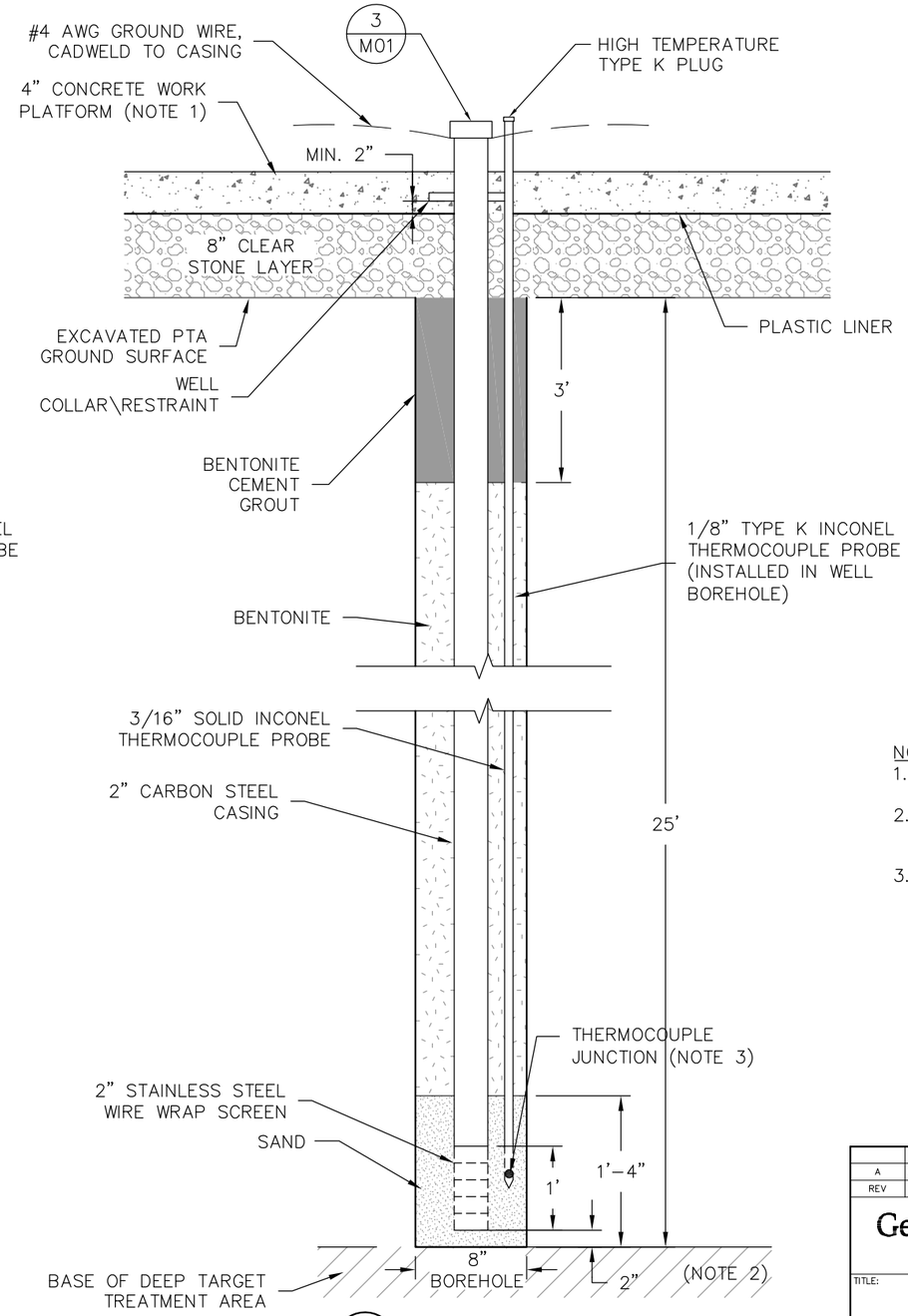


1 C04 DETAIL
IGNITION/AIR INJECTION WELL
IP-1 – IP-4
NOT TO SCALE



2 C04 DETAIL
IGNITION/AIR INJECTION WELL
IP-5
NOT TO SCALE

NOTES:
1. CONCRETE TO CONSIST OF 4" OF 3000 PSI CONCRETE REINFORCED BY A 6X6 WELDED WIRE MESH.
2. FINAL DEPTHS ARE APPROXIMATE AND ARE TO BE CONFIRMED FOLLOWING PRE-CONSTRUCTION INVESTIGATION.
3. ALL THERMOCOUPLE PROBES AND WIRING PROVIDED BY GEOSYNTEC CONSULTANTS.

100% DESIGN DRAWINGS FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: PILOT TEST AREA IGNITION WELL DETAILS

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE NEWARK, NEW JERSEY

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DRAWN BY:	JFH	PROJECT NO.:	TR0341D
CHECKED BY:	GS	FILE:	TR0341-C04.dwg
DRAWING NO.:	C04	SHEET NO.:	05 OF 30

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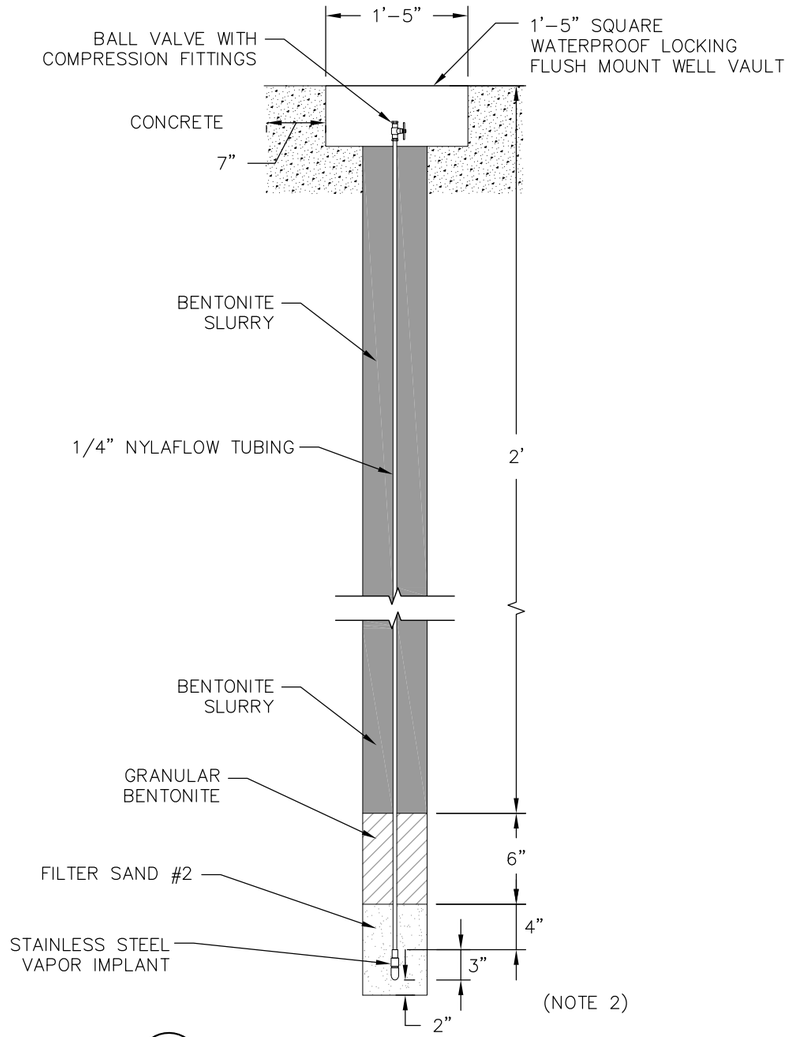
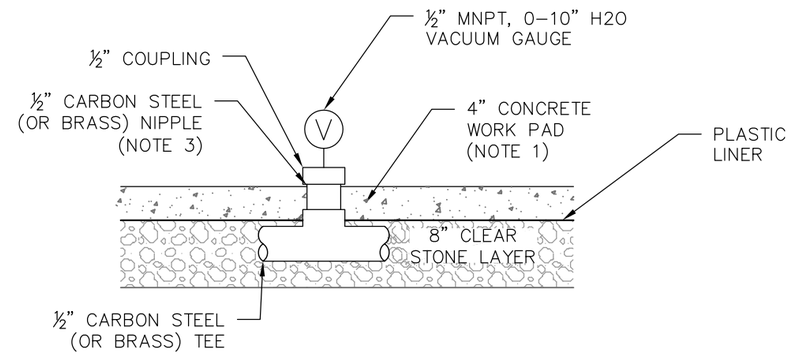


1 / C05 DETAIL
SOIL VAPOR MONITORING PROBE
NOT TO SCALE



2 / C05 DETAIL
VACUUM MONITORING PROBE
NOT TO SCALE

NOTES:
1. CONCRETE TO CONSIST OF 4" OF 3000 PSI CONCRETE REINFORCED BY A 6X6 WELDED WIRE MESH.
2. FINAL DEPTHS ARE APPROXIMATE AND TO BE CONFIRMED FOLLOWING PRE-CONSTRUCTION INVESTIGATION.
3. PENETRATION OF CONCRETE WORK PAD TO BE SEALED TO PROBE WITH HIGH TEMPERATURE CAULKING, MIN. 200°C TEMPERATURE RESISTANCE.

100% DESIGN DRAWINGS FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: PILOT TEST AREA MONITORING PROBE DETAILS

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE NEWARK, NEW JERSEY

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DRAWN BY:	JFH	PROJECT NO.:	TR0341D
CHECKED BY:	GS	FILE:	TR0341-C04.dwg
DRAWING NO.:	C05	SHEET NO.:	06 OF 30

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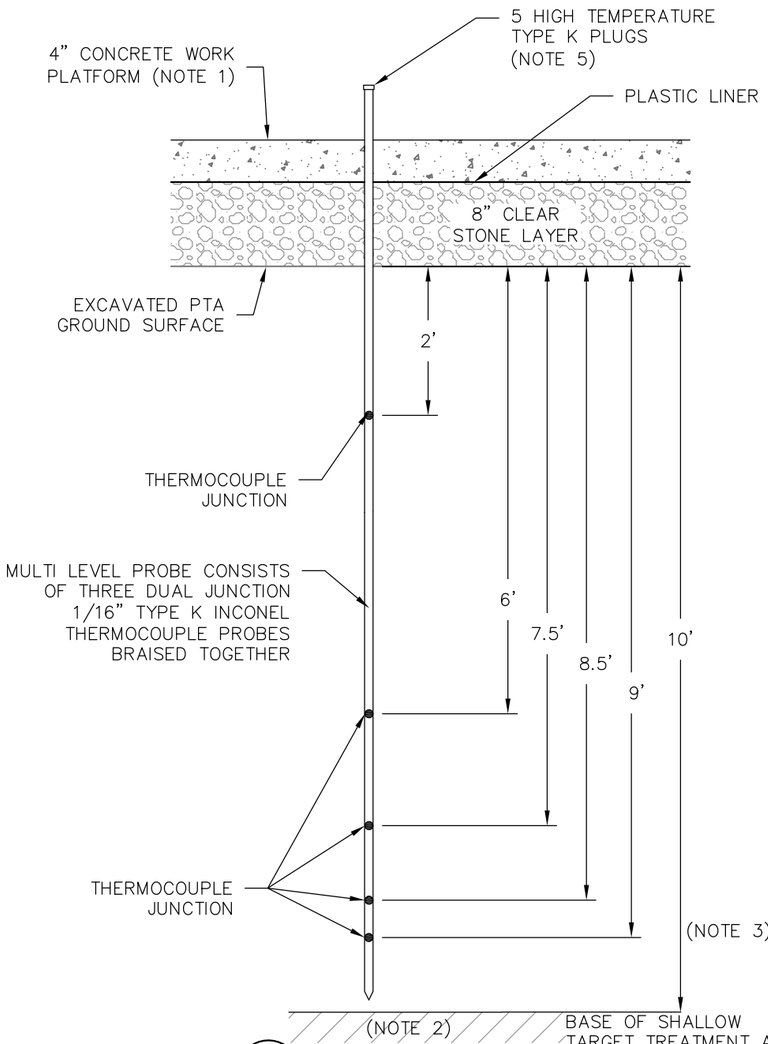
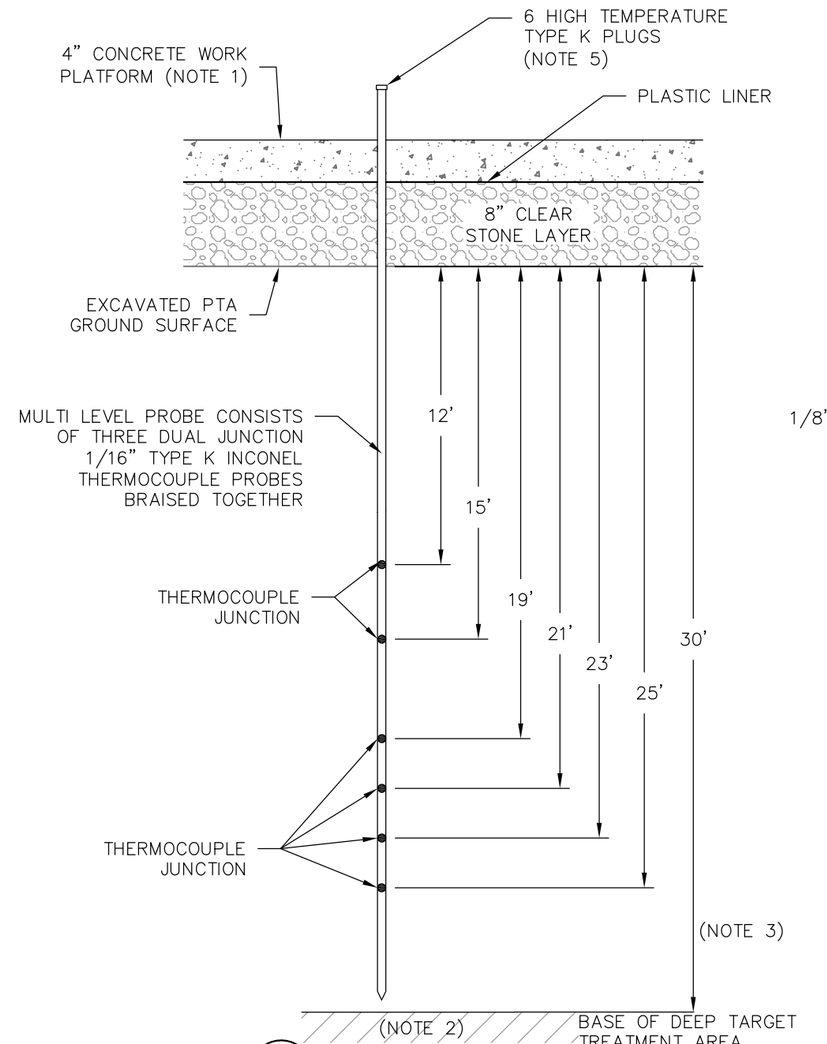
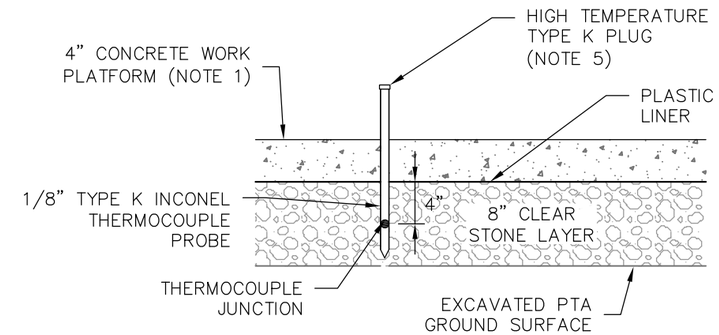


1 C06 DETAIL
SHALLOW MULTI-LEVEL THERMOCOUPLE PROBE
NOT TO SCALE
(NOTE 4)



2 C06 DETAIL
DEEP MULTI-LEVEL THERMOCOUPLE PROBE
NOT TO SCALE
(NOTE 4)



3 C06 DETAIL
SINGLE THERMOCOUPLE PROBE (CLEAR STONE)
NOT TO SCALE
(NOTE 4)

NOTES:
1. CONCRETE TO CONSIST OF 4" OF 3000 PSI CONCRETE REINFORCED BY A 6X6 WELDED WIRE MESH.
2. THERMOCOUPLES TO BE INSTALLED THROUGH DRILL RODS BY DIRECT PUSH OR EQUIVALENT SMALL DIAMETER BORING. IF BORING REMAINS OPEN AFTER PROBE PLACEMENT, ENSURE PROBE TIP IS COVERED WITH 0.2' OF CLEAN SAND, AND BACKFILL BORING ANNULUS WITH THICK MIXTURE OF POWDERED BENTONITE AND CEMENT.
3. FINAL DEPTHS ARE APPROXIMATE AND TO BE CONFIRMED FOLLOWING PRE-CONSTRUCTION INVESTIGATION.
4. ALL THERMOCOUPLE PROBES AND WIRING PROVIDED BY GEOSYNTEC CONSULTANTS.
5. PENETRATION OF CONCRETE WORK PAD TO BE SEALED TO PROBE WITH HIGH TEMPERATURE CAULKING, MIN. 200°C TEMPERATURE RESISTANCE.

100% DESIGN DRAWINGS FOR CONSTRUCTION

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A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: PILOT TEST AREA THERMOCOUPLE PROBE DETAILS

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE NEWARK, NEW JERSEY

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DRAWN BY: JFH	PROJECT NO.: TR0341D		
CHECKED BY: GS	FILE: TR0341-C04.dwg		
DRAWING NO.: C06	SHEET NO.: 07 OF 30		

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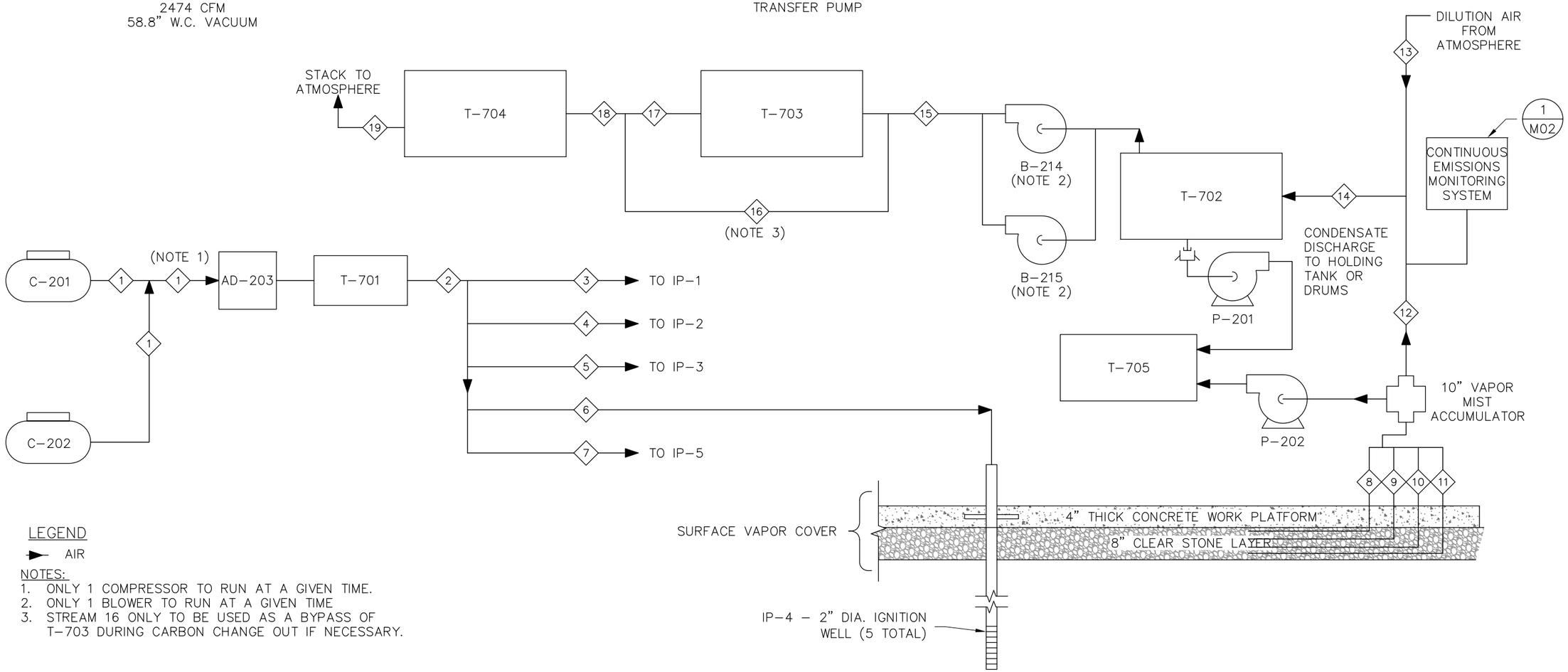
AD-203	B-214	C-201	C-202	P-201	T-701	T-702	T-703	T-704	T-705
DESICCANT AIR DRYER 1327 CFM	2474 CFM 58.8" W.C. VACUUM	PRIMARY AIR COMPRESSOR 970 CFM (INLET) ELECTRIC 100 PSI	BACK-UP AIR COMPRESSOR 970 CFM (INLET) ELECTRIC 100 PSI	TRANSFER PUMP 10 GPM	400 GALLON EQUALIZATION TANK	MOISTURE/TEMPERATURE KNOCK OUT TANK	VAPOR PHASE CARBON UNIT MAX 5000 LB	VAPOR PHASE CARBON UNIT MAX 5000 LB	MIN. 500 GALLON TANK
	B-215 2474 CFM 58.8" W.C. VACUUM			P-202 TRANSFER PUMP					



LEGEND

→ AIR

NOTES:
1. ONLY 1 COMPRESSOR TO RUN AT A GIVEN TIME.
2. ONLY 1 BLOWER TO RUN AT A GIVEN TIME
3. STREAM 16 ONLY TO BE USED AS A BYPASS OF T-703 DURING CARBON CHANGE OUT IF NECESSARY.

STREAM INFORMATION

STREAM NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MAX OP FLOW (ACFM)	123	123	65	65	65	65	65	357	357	357	357	1430	1161	2552	2341	2341	2341	2341	2341
MAX TEMP, (°C)	40	40	40	40	40	40	40	100	100	100	100	100	30	60	60	60	60	60	60
MAX GAUGE PRESSURE, (PSIG)	100	100	40	40	40	40	40	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	1	1	1	1	1
ATMOSPHERIC PRESSURE, (PSI)	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
TOTAL PRESSURE, (PSI)	114.7	114.7	54.7	54.7	54.7	54.7	54.7	14.4	14.4	14.4	14.4	14.4	14.4	14.4	15.7	15.7	15.7	15.7	15.7
MAX STANDARD FLOW, (SCFM)	900	900	225	225	225	225	225	275	275	275	275	1100	1100	2200	2200	2200	2200	2200	2200
PIPE DIAMETER (IN)	3	3	1.25	1.25	1.25	1.25	1.25	4	4	4	4	10	6	10	10	10	10	10	8
PIPE MATERIAL	Carbon Steel	Carbon Steel	Carbon Steel/ Rubber Air Hose	Carbon Steel/ Rubber Air Hose	Carbon Steel/ Rubber Air Hose	Carbon Steel/ Rubber Air Hose	Carbon Steel/ Rubber Air Hose	Perforated carbon steel	Perforated carbon steel	Perforated carbon steel	Perforated carbon steel	Carbon Steel or Galvenized Ducting	Carbon Steel or Galvenized Ducting	Carbon Steel or Galvenized Ducting	Carbon Steel or Galvenized Ducting	Carbon Steel or Galvenized Ducting or Schedule 80 PVC	Carbon Steel or Galvenized Ducting or Schedule 80 PVC	Carbon Steel or Galvenized Ducting or Schedule 80 PVC	Carbon Steel or Galvenized Ducting or Schedule 80 PVC

100% DESIGN DRAWINGS FOR CONSTRUCTION

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Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: PROCESS FLOW DIAGRAM

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE NEWARK, NEW JERSEY

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

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DESIGN BY:	GS	DATE:	JULY 12, 2012
DRAWN BY:	JFH	PROJECT NO.:	TR0341D
CHECKED BY:	GS	FILE:	TR0341-D01.dwg
DRAWING NO.:	D01	SHEET NO.:	08 OF 30

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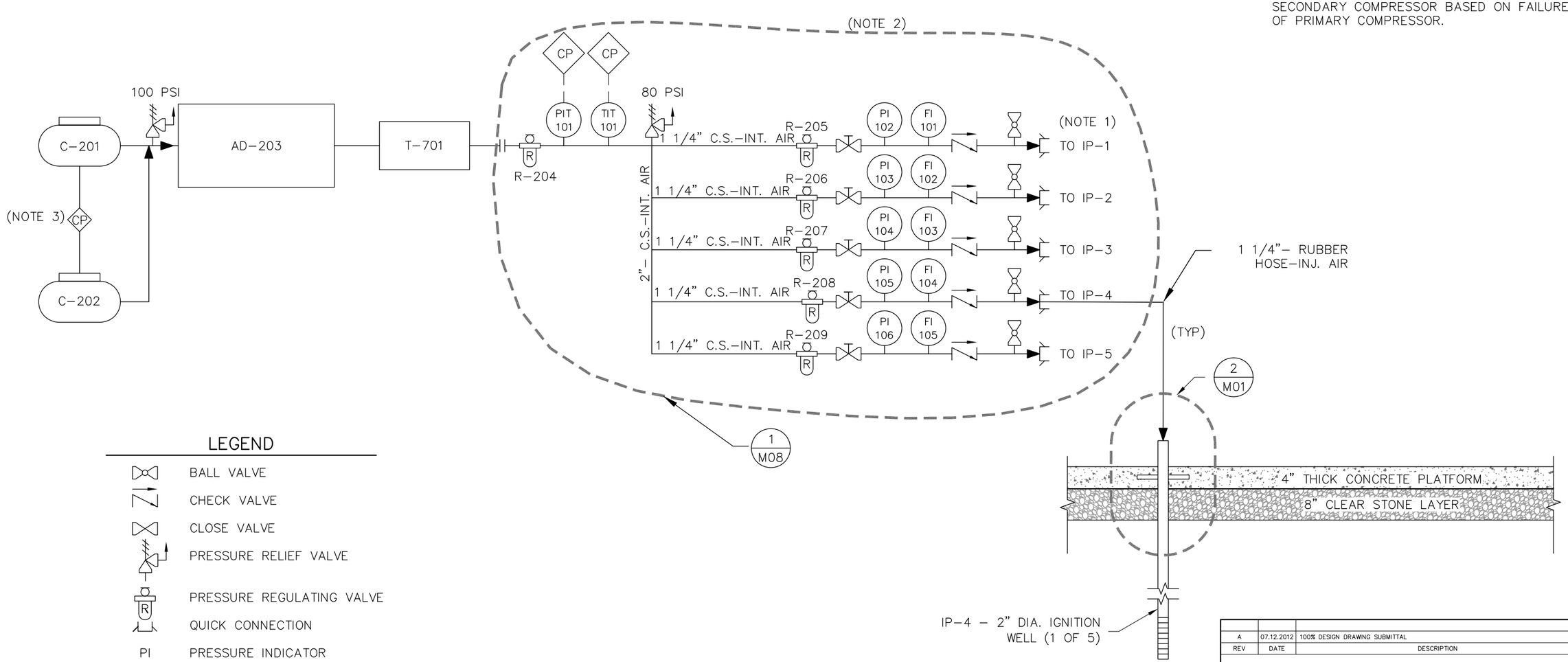
T–701
400 GALLON
EQUALIZATION TANK

R–204 TO R–208
AIR REGULATOR

AD–203
1327 CFM
DESICCANT AIR DRYER

NOTES:

1. ALL HOSE CONNECTIONS COMPLETED AT MANIFOLD AND WELL HEAD WITH QUICK CONNECT CLAW FITTINGS AND WHIP CHECKS.
2. DETAILED INJECTION MANIFOLD AND PARTS LISTS PROVIDED ON SHEET M08.
3. COMPRESSOR CONTROL PANEL ACTIVATES SECONDARY COMPRESSOR BASED ON FAILURE OF PRIMARY COMPRESSOR.



LEGEND

	BALL VALVE
	CHECK VALVE
	CLOSE VALVE
	PRESSURE RELIEF VALVE
	PRESSURE REGULATING VALVE
	QUICK CONNECTION
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATING TRANSMITTER
FI	FLOW INDICATOR
FIT	FLOW INDICATING TRANSMITTER
CP	CONTROL PANEL
	AIR
	DIESEL
	TIE POINT

C–201
PRIMARY AIR COMPRESSOR
970 CFM (INLET) AT 100 PSI
ELECTRIC

C–202
BACK–UP AIR COMPRESSOR
970 CFM (INLET) AT 100 PSI
ELECTRIC

100% DESIGN DRAWINGS
FOR CONSTRUCTION

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A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: PIPING AND INSTRUMENTATION DIAGRAM
AIR INJECTION

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE
NEWARK, NEW JERSEY

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

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DRAWING NO.:	D02	SHEET NO.:	09 OF 30

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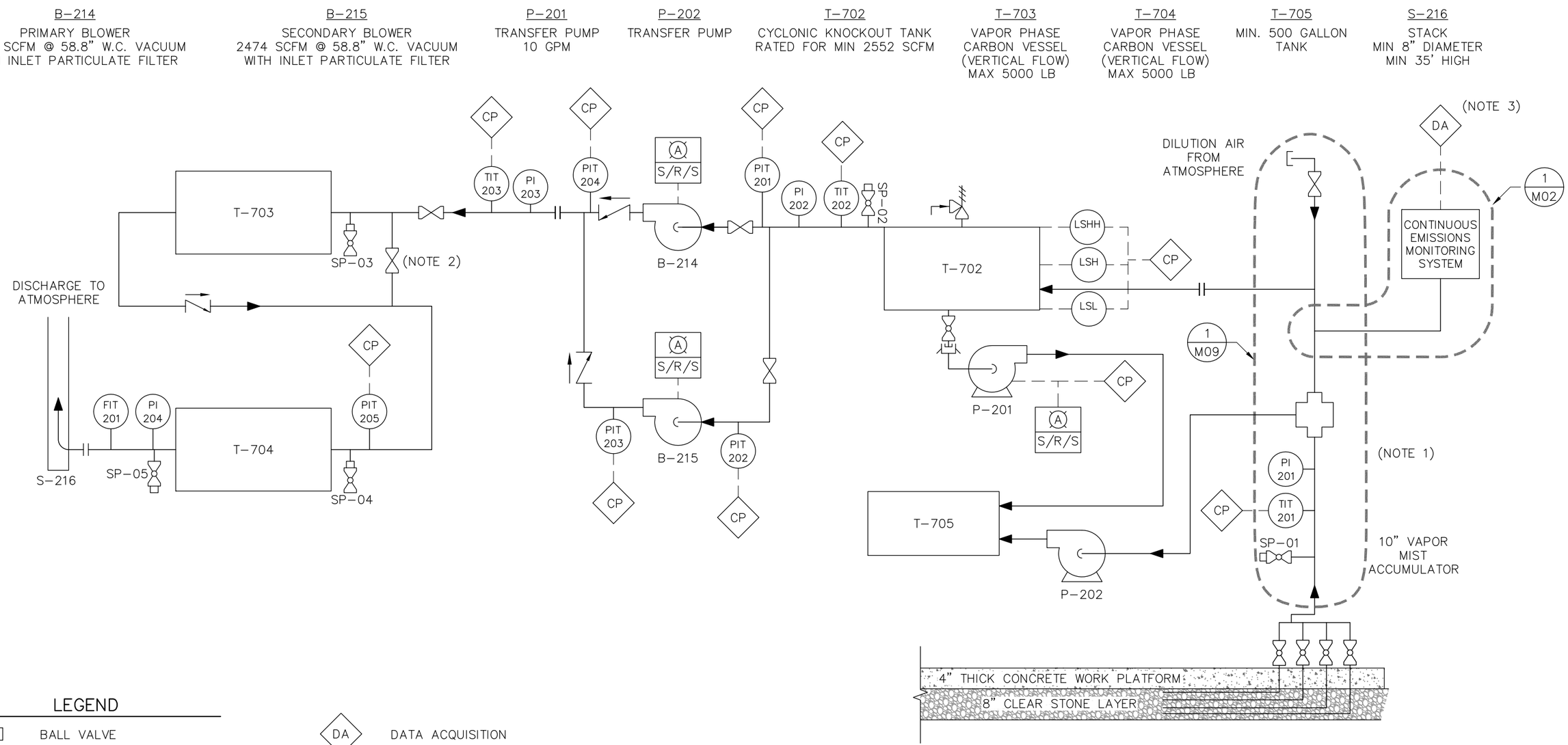

LEGEND

	BALL VALVE
	SEALED GATE/KNIFE VALVE
	CHECK VALVE
	VACUUM RELIEF VALVE
	SAMPLE PORT
	QUICK CONNECTION
FIT	FLOW INDICATING TRANSMITTER
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATING TRANSMITTER
TIT	TEMPERATURE INDICATING TRANSMITTER
DA	DATA ACQUISITION
LSHH	LEVEL SENSOR HIGH HIGH
LSH	LEVEL SENSOR HIGH
LSL	LEVEL SENSOR LOW
CP	CONTROL PANEL
	TIE POINT
A / S/R/S	LOCAL PUSH-TO-TRY LIGHT WITH STOP-RUN-START HANDSTATION

NOTES:
1. DETAILED EXTRACTION MANIFOLD AND PARTS LIST PROVIDED ON DRAWING M09.
2. STREAM 16 ONLY TO BE USED AS A BYPASS OF T-703 DURING CARBON CHANGE OUT IF NECESSARY.
3. DATA ACQUISITION SYSTEM PROVIDED BY GEOSYNTEC CONSULTANTS.

100% DESIGN DRAWINGS
FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: PIPING AND INSTRUMENTATION DIAGRAM
VAPOR EXTRACTION

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE
NEWARK, NEW JERSEY

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DRAWING NO.:	D03	SHEET NO.:	10 OF 30

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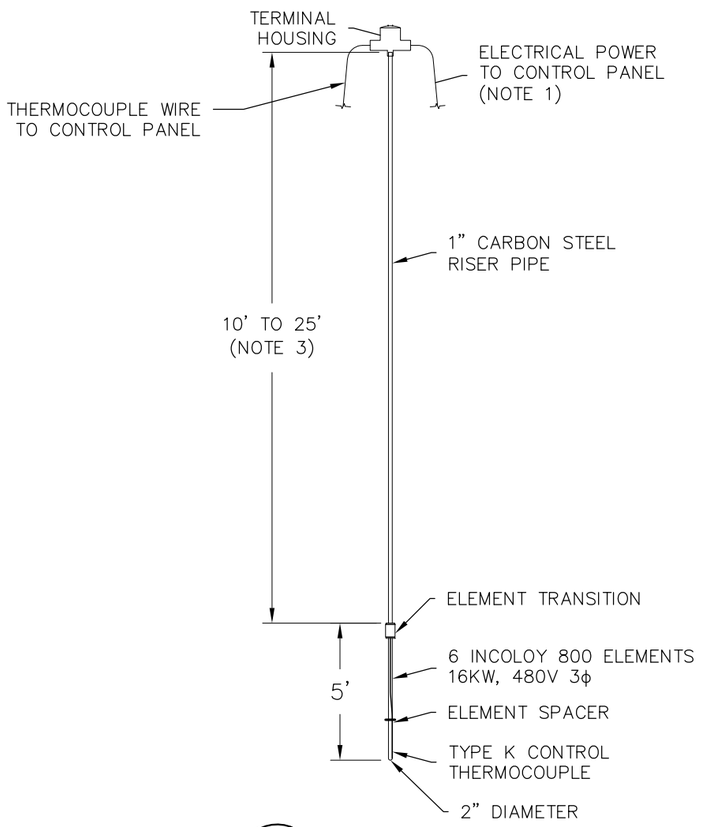
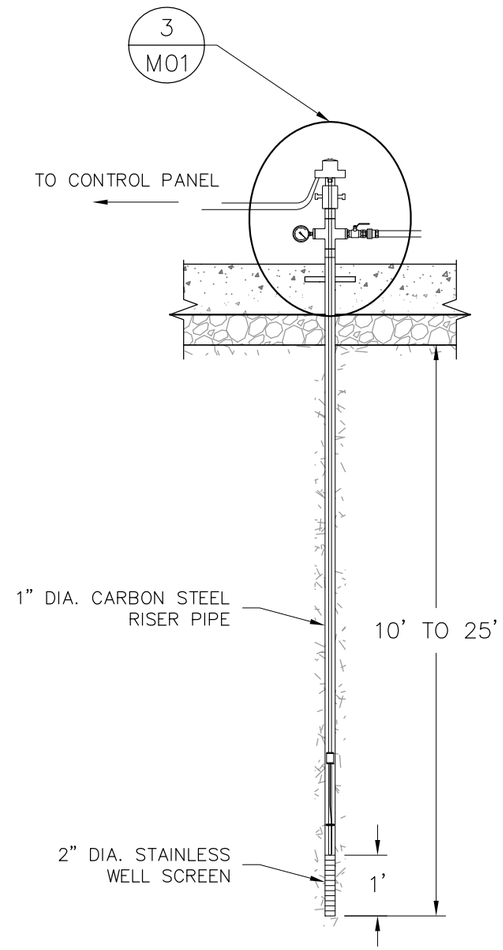
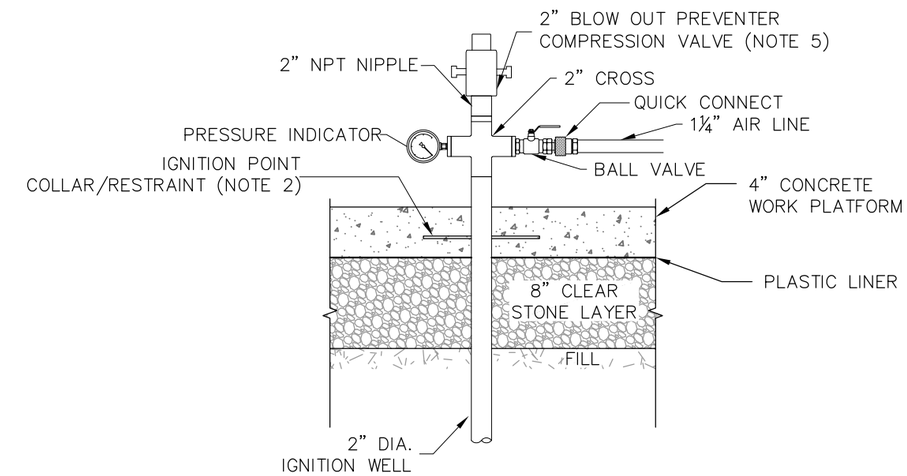


1 / M01 DETAIL
HEATER ASSEMBLY
NOT TO SCALE
(NOTE 4)



2 / M01 DETAIL
HEATER DEPLOYMENT
NOT TO SCALE
(NOTE 4)



3 / M01 DETAIL
WELLHEAD DETAIL
NOT TO SCALE

NOTES:

1. HEAVY DUTY CORD WITH CGB CORD GRIPS WITH WIRE BASKET STRAIN RELIEF.
2. WELL RESTRAINT SHALL BE 1/4" CARBON STEEL PLATE APPROXIMATELY 1 ft X 1 ft WITH 2" DIAMETER HOLE IN CENTER, INSERTED OVER WELL AND WELDED IN PLACE.
3. LENGTH OF 1" CARBON STEEL RISER PIPE SUBJECT TO CHANGE.
4. HEATER ASSEMBLY TO BE PROVIDED BY GEOSYNTEC CONSULTANTS.
5. BLOW OUT PREVENTER COMPRESSION VALVE TO BE PROVIDED BY GEOSYNTEC CONSULTANTS.

100% DESIGN DRAWINGS FOR CONSTRUCTION

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A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: HEATER DEPLOYMENT AND WELL HEAD DETAILS

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE NEWARK, NEW JERSEY

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

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DRAWN BY:	JFH	PROJECT NO.:	TR0341D
CHECKED BY:	GS	FILE:	TR0341-M01.dwg
DRAWING NO.:	M01	SHEET NO.:	11 OF 30

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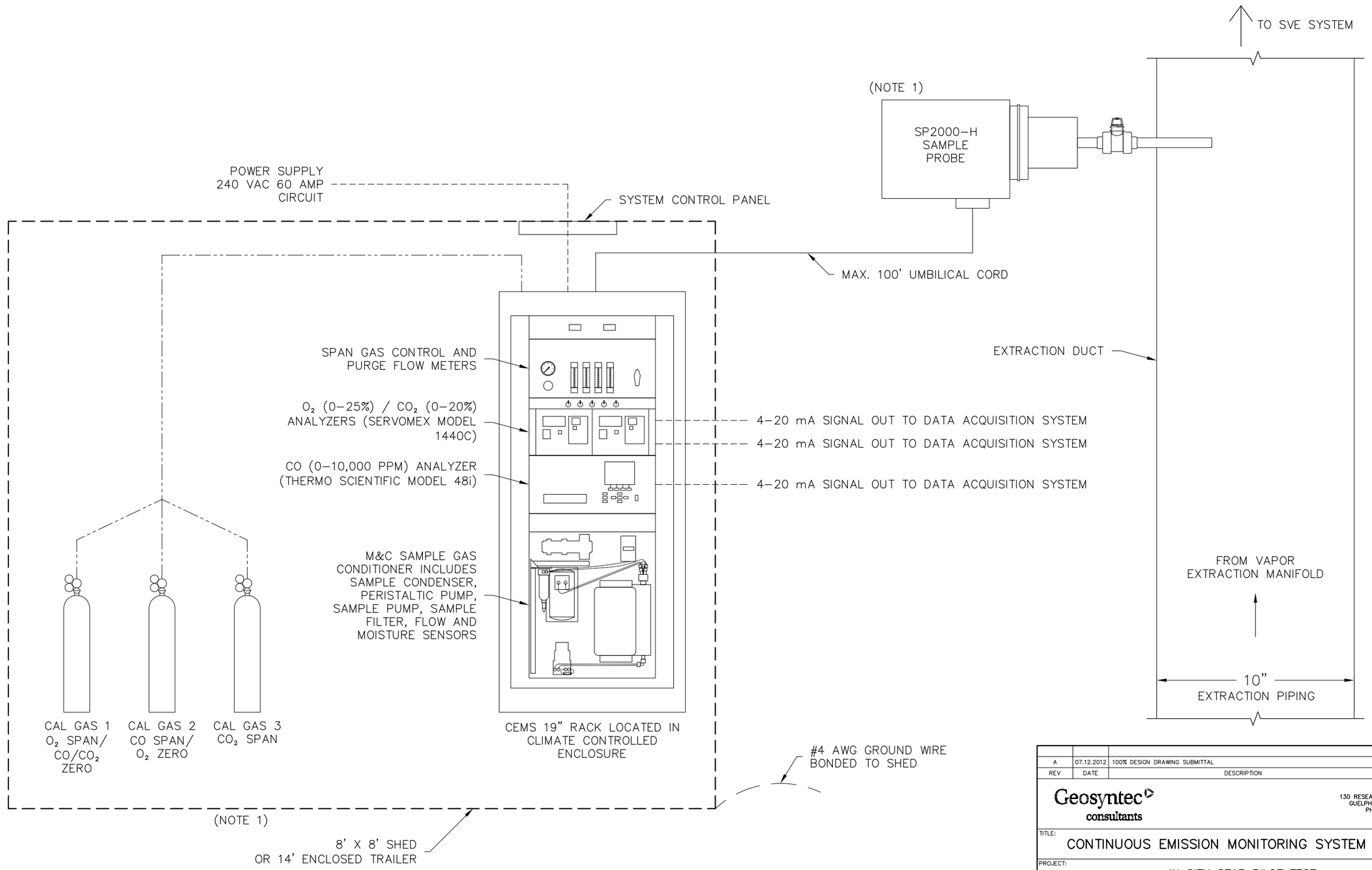

1 / M02 DETAIL
EMISSION MONITORING SYSTEM

NOTES:

1. CEMS SHED/TRAILER, UMBILICAL CORD, AND SAMPLE PROBE TO BE PROVIDED BY GEOSYNTEC CONSULTANTS.

100% DESIGN DRAWINGS FOR CONSTRUCTION

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A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: CONTINUOUS EMISSION MONITORING SYSTEM DETAIL

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE NEWARK, NEW JERSEY

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DRAWING NO.:	M02	SHEET NO.:	12 OF 30

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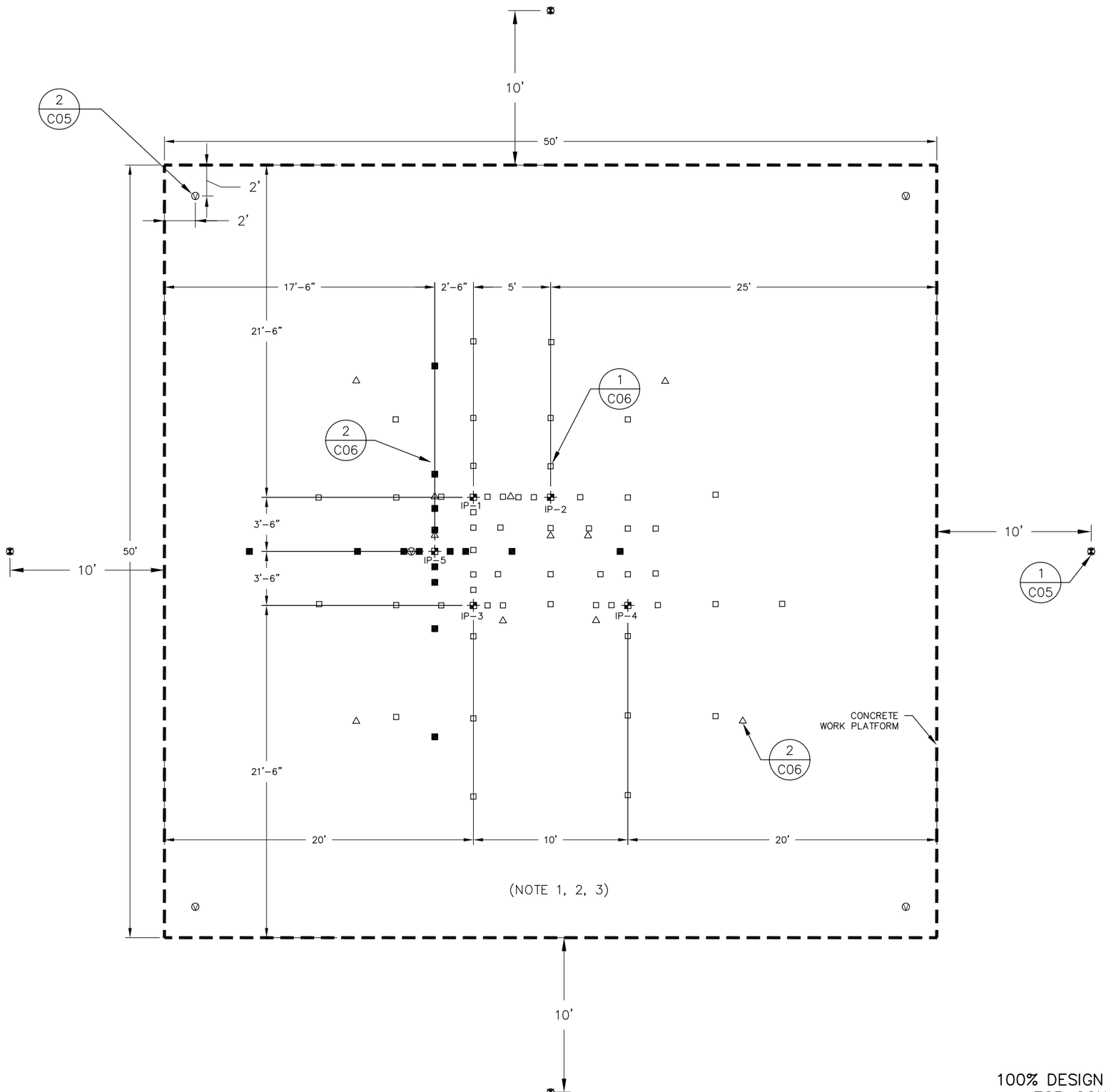

LEGEND

- CONCRETE WORK PLATFORM
- IGNITION WELL
- VAPOR MONITORING PROBE
- SINGLE THERMOCOUPLE PROBE (LOCATED IN CLEAR STONE)
- SHALLOW MULTI-LEVEL THERMOCOUPLE PROBE
- DEEP MULTI-LEVEL THERMOCOUPLE PROBE
- CLEAR STONE LAYER VACUUM MONITORING PROBE (0-10" H2O)

NOTES:

1. TABLE OF DIMENSIONS FOR THE THERMOCOUPLE INSTALLATION PROVIDED ON DRAWINGS M04, M05, AND M06.
2. ALL THERMOCOUPLES TO BE INSTALLED BEFORE INSTALLATION OF CONCRETE PAD.
3. ALL THERMOCOUPLE PROBES AND WIRING SUPPLIED BY GEOSYNTEC CONSULTANTS.

100% DESIGN DRAWINGS
FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants

130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: IGNITION WELL AND THERMOCOUPLE LAYOUT

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE
NEWARK, NEW JERSEY

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CHECKED BY:	GS	FILE:	TR0341-M03.dwg
DRAWING NO.:	M03	SHEET NO.:	13 OF 30

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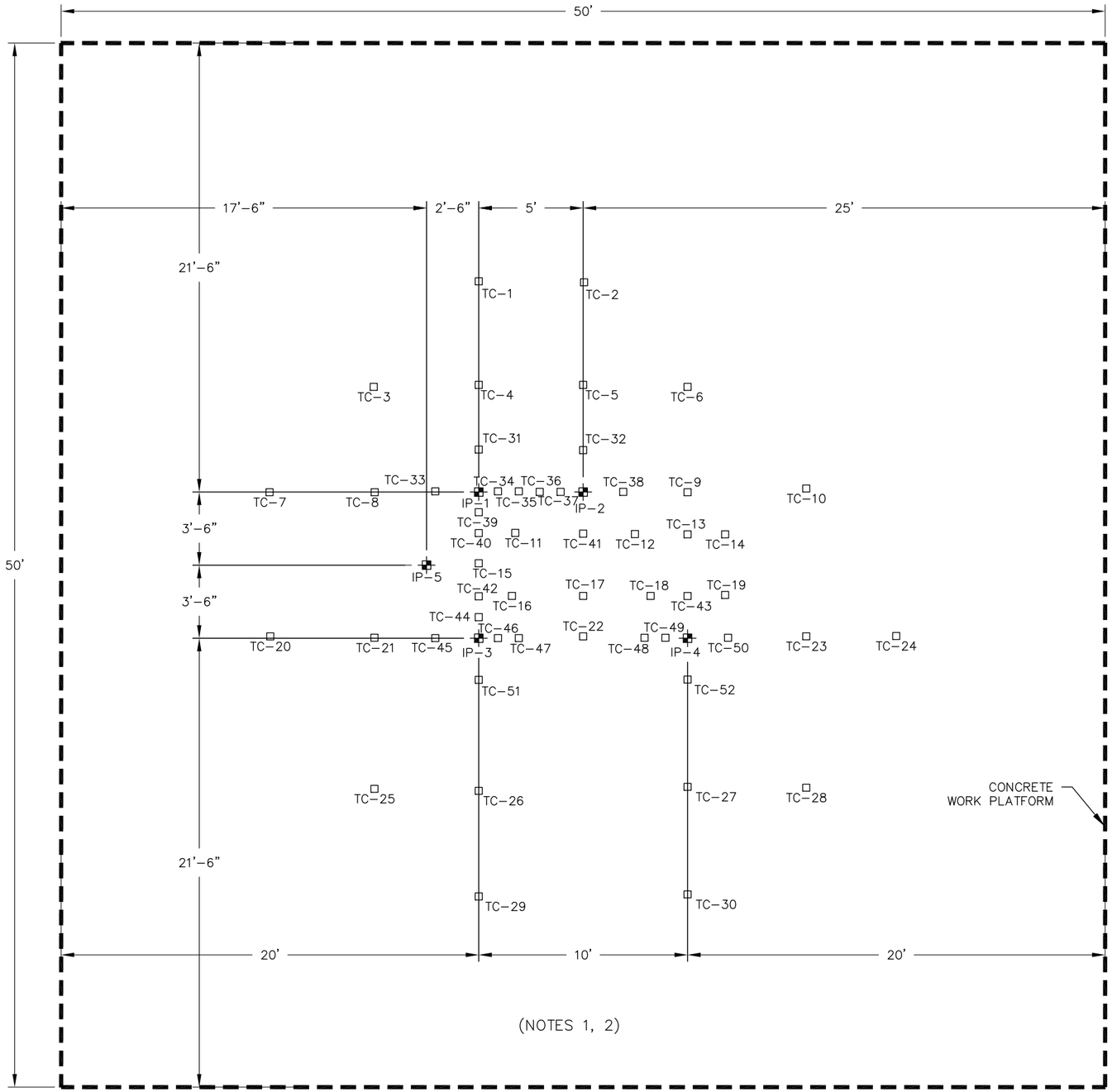

LEGEND

- CONCRETE WORK PLATFORM
- IGNITION WELL
- SHALLOW MULTI-LEVEL THERMOCOUPLE PROBE

SHALLOW MULTI-LEVEL THERMOCOUPLE PROBE LOCATIONS			
		Distance (feet) From Ignition Point	
Thermocouple ID	Reference Point	North	East
TC-1	IP-1	10	0
TC-2	IP-2	10	0
TC-3	IP-1	5	-5
TC-4	IP-1	5	0
TC-5	IP-2	5	0
TC-6	IP-2	5	5
TC-7	IP-1	0	-10
TC-8	IP-1	0	-5
TC-9	IP-2	0	5
TC-10	IP-2	0	10.5
TC-11	IP-1	-2	2
TC-12	IP-2	-2	3
TC-13	IP-2	-2	5
TC-14	IP-2	-2	7
TC-15	IP-5	0	2.5
TC-16	IP-3	2	2
TC-17	IP-3	2	5
TC-18	IP-4	2	-2
TC-19	IP-4	2	2
TC-20	IP-3	0	-10
TC-21	IP-3	0	-5
TC-22	IP-3	0	5
TC-23	IP-4	0	5.5
TC-24	IP-4	0	10
TC-25	IP-3	-7.5	-5
TC-26	IP-3	-7.5	0

SHALLOW MULTI-LEVEL THERMOCOUPLE PROBE LOCATIONS			
		Distance (feet) From Ignition Point	
Thermocouple ID	Reference Point	North	East
TC-27	IP-4	-7.5	0
TC-28	IP-4	-7.5	5.5
TC-29	IP-3	-12	0
TC-30	IP-4	-12	0
TC-31	IP-1	2	0
TC-32	IP-2	2	0
TC-33	IP-1	0	-2
TC-34	IP-1	0	1
TC-35	IP-1	0	2
TC-36	IP-2	0	-2
TC-37	IP-2	0	-1
TC-38	IP-2	0	2
TC-39	IP-1	-1	0
TC-40	IP-1	-2	0
TC-41	IP-2	-2	0
TC-42	IP-3	2	0
TC-43	IP-4	2	0
TC-44	IP-3	1	0
TC-45	IP-3	0	-2
TC-46	IP-3	0	1
TC-47	IP-3	0	2
TC-48	IP-4	0	-2
TC-49	IP-4	0	-1
TC-50	IP-4	0	2
TC-51	IP-3	-2	0
TC-52	IP-4	-2	0

NOTE:
EACH MULTI-LEVEL THERMOCOUPLE TO HAVE THERMOCOUPLE JUNCTION LOCATIONS AT 2', 6', 7.5', 8.5', AND 9'.

THERMOCOUPLE ID

EXAMPLE: TC-31

NOTES:
1. ALL THERMOCOUPLES TO BE INSTALLED BEFORE INSTALLATION OF CONCRETE PAD.
2. ALL THERMOCOUPLE PROBES AND WIRING PROVIDED BY GEOSYNTEC CONSULTANTS.

1 / M04 DETAIL
SHALLOW MULTI-LEVEL THERMOCOUPLE PROBE LOCATIONS

100% DESIGN DRAWINGS FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: SHALLOW MULTI-LEVEL THERMOCOUPLE PROBE LOCATIONS

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE
NEWARK, NEW JERSEY

THIS DRAWING MAY NOT BE ISSUED FOR PROJECT TENDER OR CONSTRUCTION, UNLESS SEALED.

SIGNATURE

DATE

DESIGN BY:	GS	DATE:	JULY 12, 2012
DRAWN BY:	JFH	PROJECT NO.:	TR0341D
CHECKED BY:	GS	FILE:	TR0341-M03.dwg
DRAWING NO.:	M04	SHEET NO.:	14 OF 30

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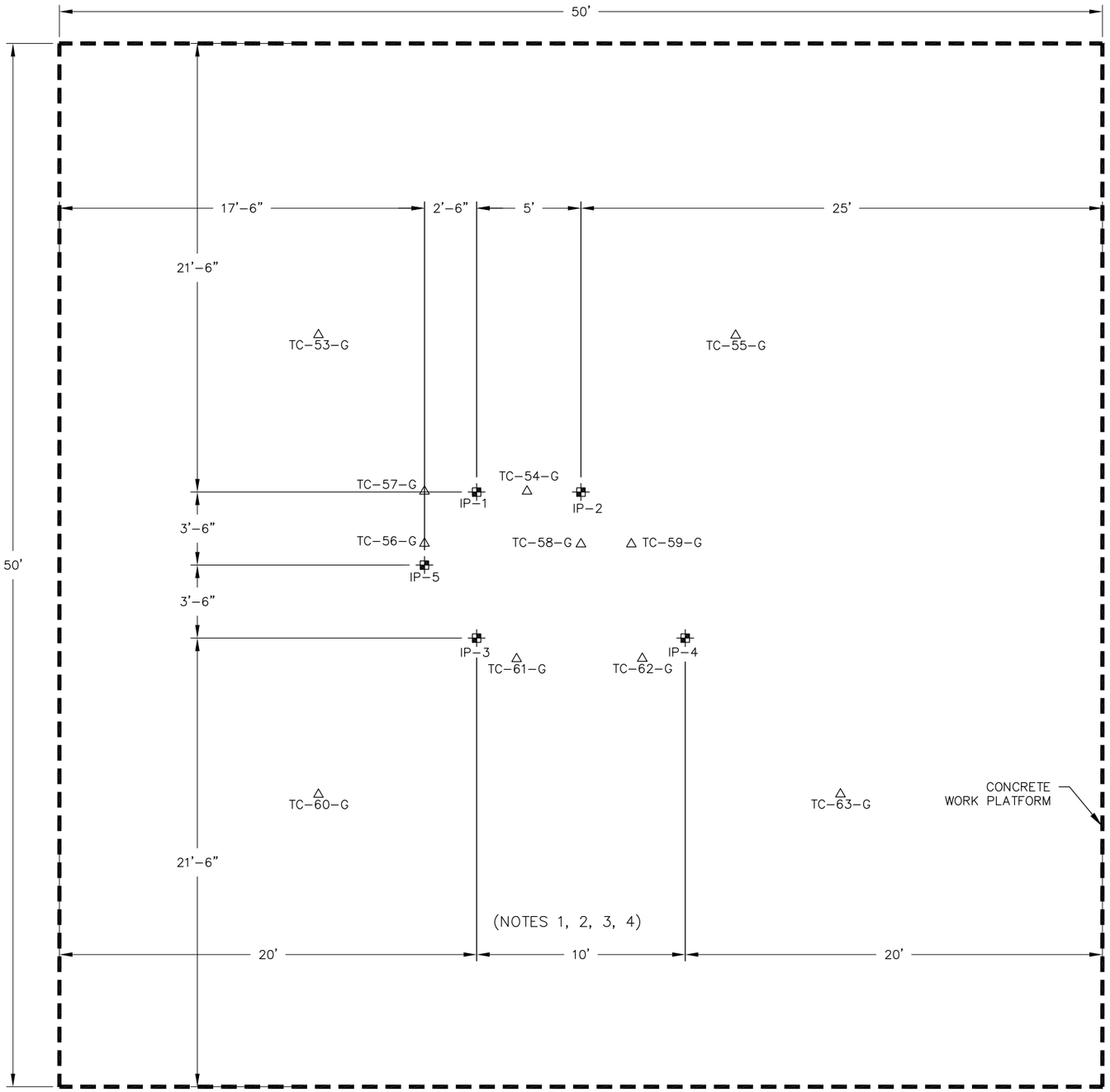

LEGEND

- CONCRETE WORK PLATFORM
- IGNITION WELL
- △ SINGLE THERMOCOUPLE PROBE (LOCATED IN CLEAR STONE)

SINGLE THERMOCOUPLE PROBE LOCATIONS (CLEAR STONE)			
		Distance (feet) From Ignition Point	
Thermocouple ID	Reference Point	North	East
TC-53-G	IP-1	8	-8
TC-54-G	IP-1	0	2.5
TC-55-G	IP-2	8	8
TC-56-G	IP-1	-2.5	-2.5
TC-57-G	IP-1	0	-2.5
TC-58-G	IP-2	-2.5	0
TC-59-G	IP-2	-2.5	3
TC-60-G	IP-3	-8	-8
TC-61-G	IP-3	-1	2
TC-62-G	IP-4	-1	-2
TC-63-G	IP-4	-8	8

NOTE:
EACH CLEAR STONE THERMOCOUPLE TO HAVE THERMOCOUPLE JUNCTION LOCATED IN CLEAR STONE/GRAVEL LAYER

THERMOCOUPLE ID

EXAMPLE: TC-58-G

JUNCTION DEPTH(CLEAR STONE/GRAVEL)

NOTES:
1. ALL THERMOCOUPLES TO BE INSTALLED BEFORE INSTALLATION OF CONCRETE PAD.
2. ALL THERMOCOUPLE PROBES AND WIRING PROVIDED BY GEOSYNTEC CONSULTANTS.

1 / M05 DETAIL
SINGLE THERMOCOUPLE PROBE LOCATIONS (CLEAR STONE)

100% DESIGN DRAWINGS FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: SINGLE THERMOCOUPLE PROBE LOCATIONS (CLEAR STONE)

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE NEWARK, NEW JERSEY

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SIGNATURE

DATE

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CHECKED BY:	GS	FILE:	TR0341-M03.dwg
DRAWING NO.:	M05	SHEET NO.:	15 OF 30

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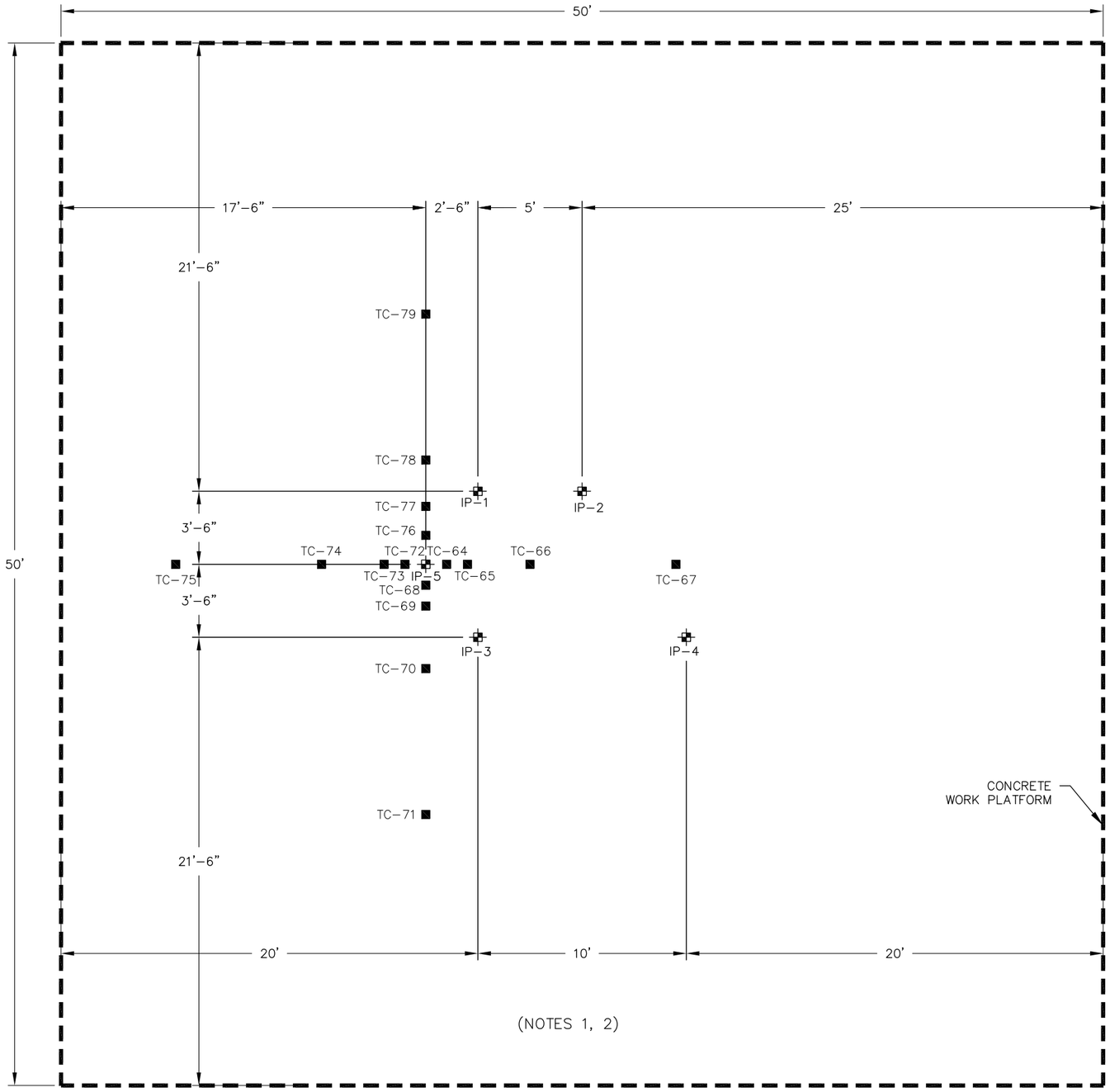

LEGEND

- CONCRETE WORK PLATFORM
- IGNITION WELL
- DEEP MULTI-LEVEL THERMOCOUPLE PROBE

DEEP MULTI-LEVEL THERMOCOUPLE PROBE LOCATIONS

		Distance (feet) From Ignition Point	
Thermocouple ID	Reference Point	North	East
TC-64	IP-5	0	1
TC-65	IP-5	0	2
TC-66	IP-5	0	5
TC-67	IP-5	0	12
TC-68	IP-5	-1	0
TC-69	IP-5	-2	0
TC-70	IP-5	-5	0
TC-71	IP-5	-12	0
TC-72	IP-5	0	-1
TC-73	IP-5	0	-2
TC-74	IP-5	0	-5
TC-75	IP-5	0	-12
TC-76	IP-5	1	0
TC-77	IP-5	2	0
TC-78	IP-5	5	0
TC-79	IP-5	12	0

NOTES:
1. ALL THERMOCOUPLES TO BE INSTALLED BEFORE INSTALLATION OF CONCRETE PAD.
2. ALL THERMOCOUPLE PROBES AND WIRING PROVIDED BY GEOSYNTEC CONSULTANTS.

1 / M06 DETAIL
DEEP MULTI-LEVEL THERMOCOUPLE PROBE LOCATIONS

NOTE:
EACH MULTI-LEVEL THERMOCOUPLE TO HAVE THERMOCOUPLE JUNCTION LOCATIONS AT 12', 15', 19', 21', 23', AND 25'.

THERMOCOUPLE ID

EXAMPLE: TC-31

100% DESIGN DRAWINGS FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: DEEP MULTI-LEVEL THERMOCOUPLE PROBE LOCATIONS

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE
NEWARK, NEW JERSEY

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DRAWING NO.:	M06	SHEET NO.:	16 OF 30

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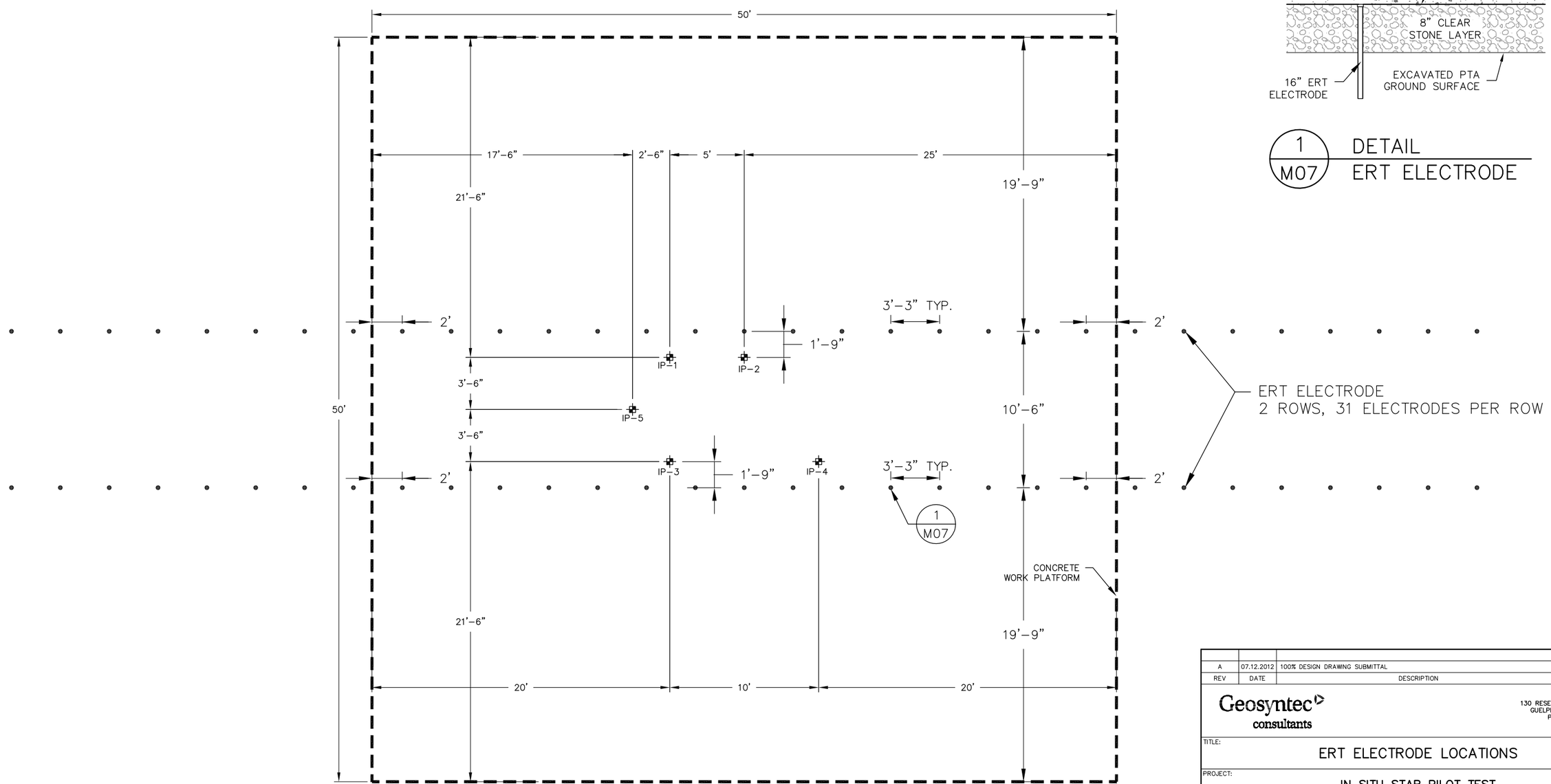
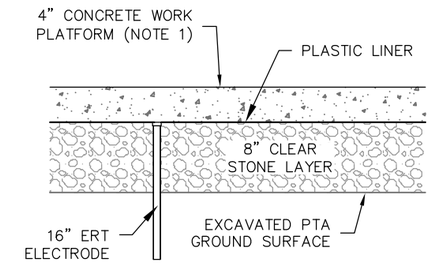
LEGEND

- CONCRETE WORK PLATFORM
- IGNITION WELL
- ERT ELECTRODE





1 / M07 DETAIL
ERT ELECTRODE

NOTES:

1. CONCRETE TO CONSIST OF 4" OF 3000 PSI CONCRETE REINFORCED BY A 6X6 WELDED WIRE MESH.
2. ALL ERT ELECTRODES TO BE INSTALLED BEFORE INSTALLATION OF CONCRETE PAD.
3. ALL ERT ELECTRODES AND WIRING PROVIDED BY GEOSYNTEC CONSULTANTS.

100% DESIGN DRAWINGS
FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: ERT ELECTRODE LOCATIONS

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE
NEWARK, NEW JERSEY

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DRAWING NO.:	M07	SHEET NO.:	17 OF 30

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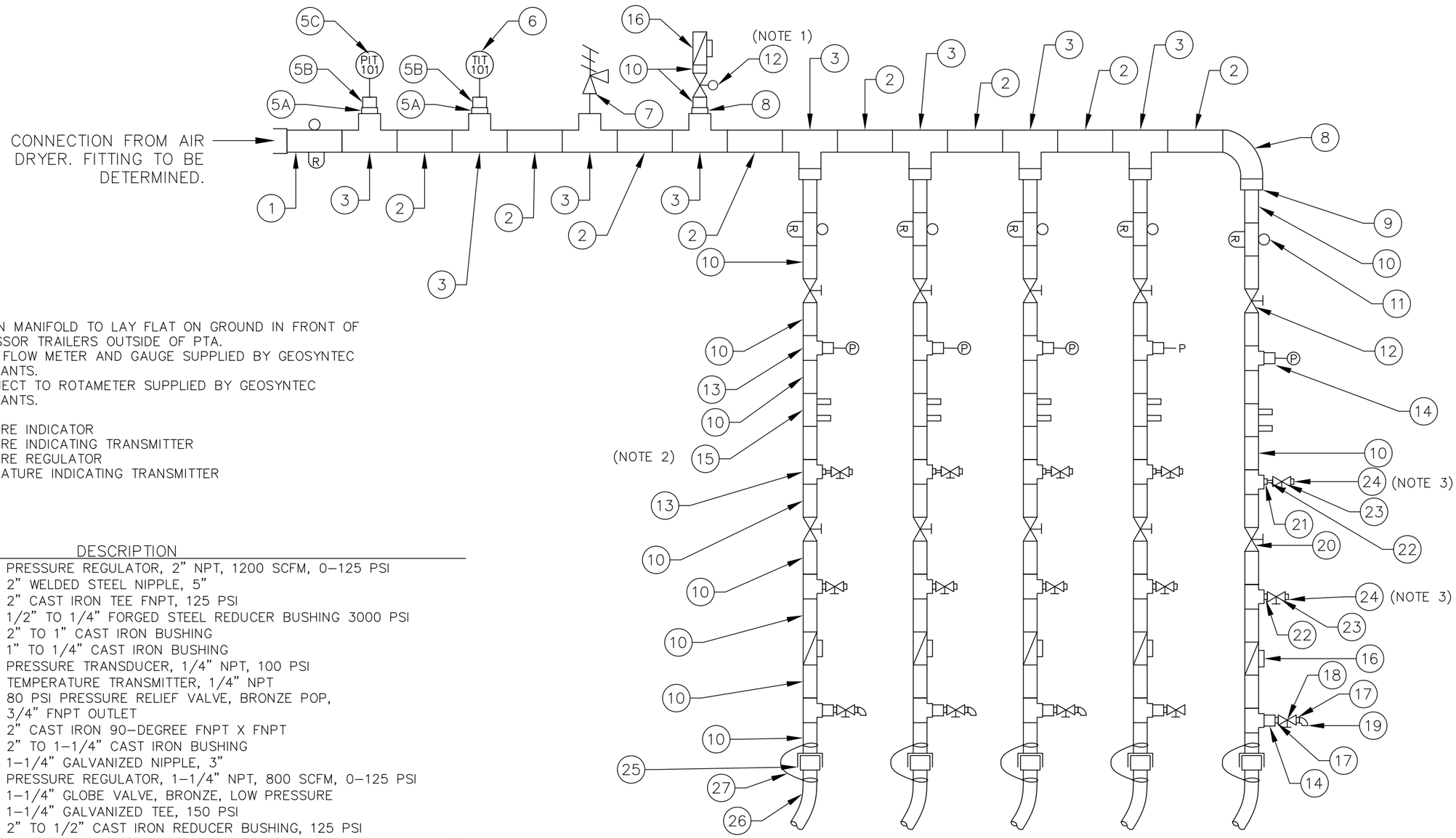

NOTES:
1. INJECTION MANIFOLD TO LAY FLAT ON GROUND IN FRONT OF COMPRESSOR TRAILERS OUTSIDE OF PTA.
2. VENTURI FLOW METER AND GAUGE SUPPLIED BY GEOSYNTEC CONSULTANTS.
3. TO CONNECT TO ROTAMETER SUPPLIED BY GEOSYNTEC CONSULTANTS.

PI PRESSURE INDICATOR
PIT PRESSURE INDICATING TRANSMITTER
R PRESSURE REGULATOR
TIT TEMPERATURE INDICATING TRANSMITTER

ITEM	DESCRIPTION
1	PRESSURE REGULATOR, 2" NPT, 1200 SCFM, 0–125 PSI
2	2" WELDED STEEL NIPPLE, 5"
3	2" CAST IRON TEE FNPT, 125 PSI
4	1/2" TO 1/4" FORGED STEEL REDUCER BUSHING 3000 PSI
5A	2" TO 1" CAST IRON BUSHING
5B	1" TO 1/4" CAST IRON BUSHING
5C	PRESSURE TRANSDUCER, 1/4" NPT, 100 PSI
6	TEMPERATURE TRANSMITTER, 1/4" NPT
7	80 PSI PRESSURE RELIEF VALVE, BRONZE POP, 3/4" FNPT OUTLET
8	2" CAST IRON 90–DEGREE FNPT X FNPT
9	2" TO 1–1/4" CAST IRON BUSHING
10	1–1/4" GALVANIZED NIPPLE, 3"
11	PRESSURE REGULATOR, 1–1/4" NPT, 800 SCFM, 0–125 PSI
12	1–1/4" GLOBE VALVE, BRONZE, LOW PRESSURE
13	1–1/4" GALVANIZED TEE, 150 PSI
14	2" TO 1/2" CAST IRON REDUCER BUSHING, 125 PSI
15	1–1/4" VENTURI (TO BE SUPPLIED BY GEOSYNTEC CONSULTANTS)
16	CHECK VALVE, 1–1/4", BRONZE, 300 PSI, FNPT
17	1/2" WELDED STEEL NIPPLE, 1–1/2"
18	1/2" BRASS BALL VALVE FNPT
19	1/2" FORGED STEEL 90 DEGREE ELBOW FNPT
20	BRASS BALL VALVE, 1–1/4" FNPT
21	1–1/4" TO 1/2" IRON REDUCER BUSHING
22	STEEL PIPE NIPPLE 1/2"
23	1/2" BRASS BALL VALVE FNPT
24	BRASS AIR HOSE PLUG, 1/2" FNPT MALE, 1/2 COUPLING SIZE
25	QUICK CONNECT TWIST CLAW, 1–1/4" FNPT PIPE, 110 PSI
26	AIR HOSE WITH TWIST CLAW FITTINGS BOTH ENDS, 100', 1–1/4", 150 PSI
27	WHIP CHECK

1 / M08 DETAIL
INJECTION MANIFOLD HEADER
NOT TO SCALE

100% DESIGN DRAWINGS FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: INJECTION MANIFOLD DETAILS

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE NEWARK, NEW JERSEY

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DRAWING NO.:	M08	SHEET NO.:	18 OF 30

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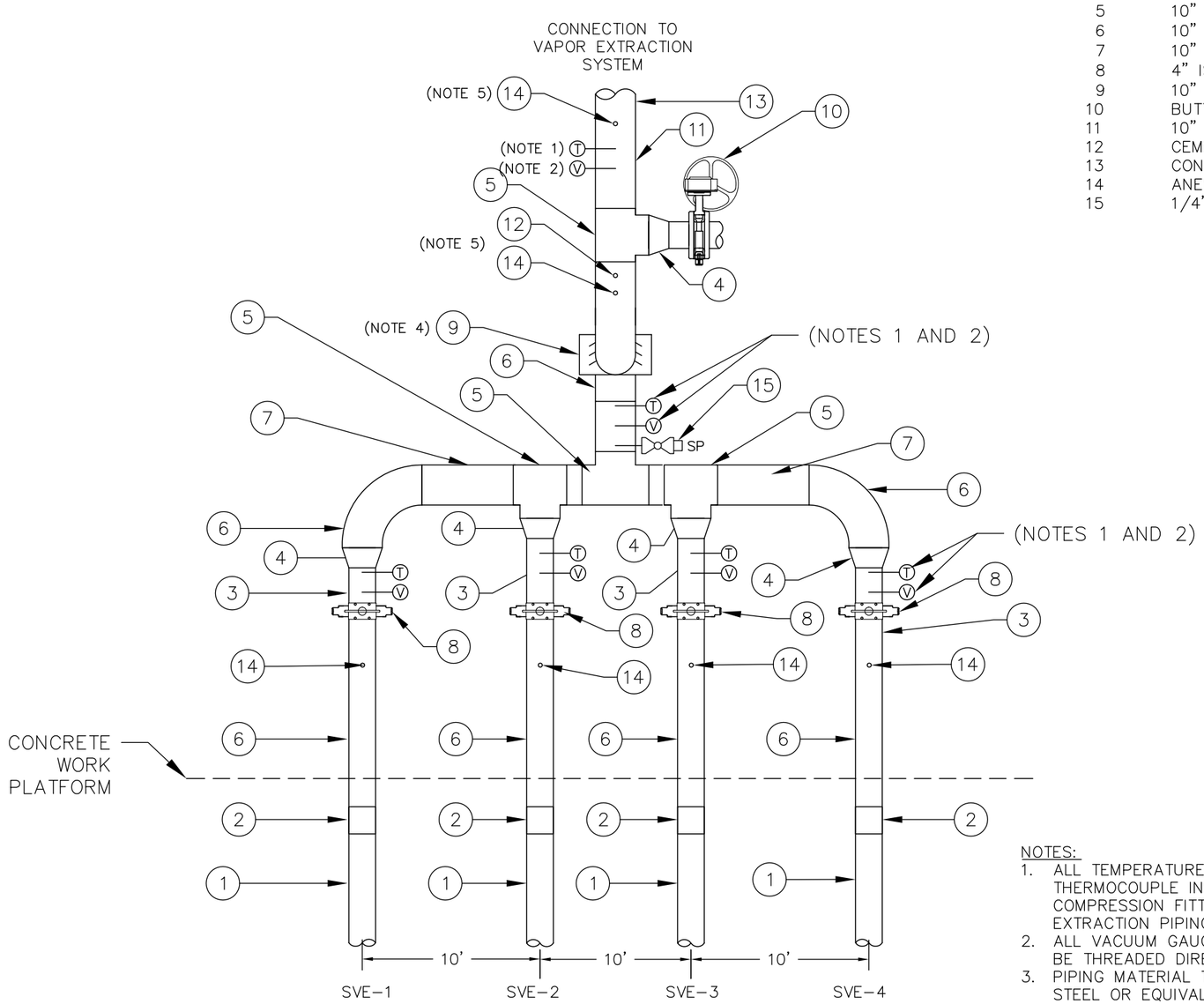
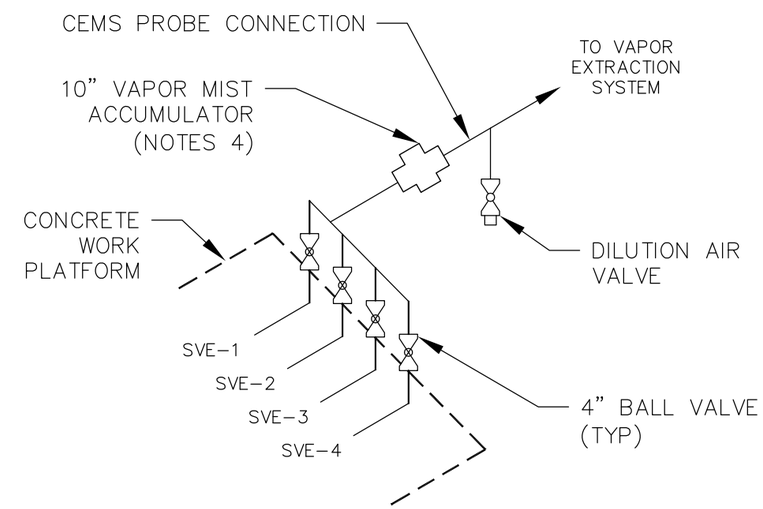
ITEM	DESCRIPTION
1	4" PERFORATED PIPE
2	TRANSITION COUPLING
3	4" NIPPLE
4	10" X 6" REDUCING BUSHING
5	10" X 10" TEE
6	10" ELBOW
7	10" PIPE
8	4" ISOLATION VALVE (BALL OR BUTTERFLY)
9	10" VAPOR MIST ACCUMULATOR – PROVIDED BY GEOSYNTEC CONSULTANTS
10	BUTTERFLY VALVE
11	10" PIPE
12	CEMS SAMPLE PORT
13	CONNECTION TO SVE SYSTEM (TBD)
14	ANEMOMETER ACCESS PORT
15	1/4" BALL VALVE THREADED DIRECTLY INTO EXTRACTION PIPING.

NOTE:
ALL PIPE DIAMETERS TO BE DETERMINED.



1 / M09 DETAIL
EXTRACTION MANIFOLD HEADER
NOT TO SCALE



2 / M09 ISOMETRIC VIEW
EXTRACTION MANIFOLD HEADER
NOT TO SCALE

T TEMPERATURE INDICATOR
V VACUUM INDICATOR

NOTES:
1. ALL TEMPERATURE GAUGES TO CONSIST OF TYPE K THERMOCOUPLE INSTALLED INTO CENTER OF PIPE THROUGH COMPRESSION FITTING THREADED DIRECTLY INTO EXTRACTION PIPING.
2. ALL VACUUM GAUGES TO BE 0–50 INCHES OF WATER AND BE THREADED DIRECTLY INTO EXTRACTION PIPING.
3. PIPING MATERIAL TO BE GALVANIZED STEEL, CARBON STEEL OR EQUIVALENT MATERIAL RESISTANT TO TEMPERATURES OF 100°C.
4. VAPOR MIST ACCUMULATOR PROVIDED BY GEOSYNTEC CONSULTANTS.
5. CEMS SAMPLE PORT AND ANEMOMETER ACCESS PORT TO BE LOCATED A MINIMUM OF 5 PIPE DIAMETERS UPSTREAM/ DOWNSTREAM OF DILUTION AIR VALVE.

100% DESIGN DRAWINGS FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRN	APP
A	07.12.2012	100% DESIGN DRAWING SUBMITTAL	JFH	GS

Geosyntec consultants
130 RESEARCH LANE, SUITE 2
GUELPH, ONTARIO N1G 5G3
PHONE: 519.822.2230

TITLE: EXTRACTION MANIFOLD DETAILS

PROJECT: IN SITU STAR PILOT TEST

SITE: FORMER PITT CONSOL SITE
NEWARK, NEW JERSEY

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DRAWN BY:	JFH	PROJECT NO.:	TR0341D
CHECKED BY:	GS	FILE:	TR0341–M08.dwg
DRAWING NO.:	M09	SHEET NO.:	19 OF 30

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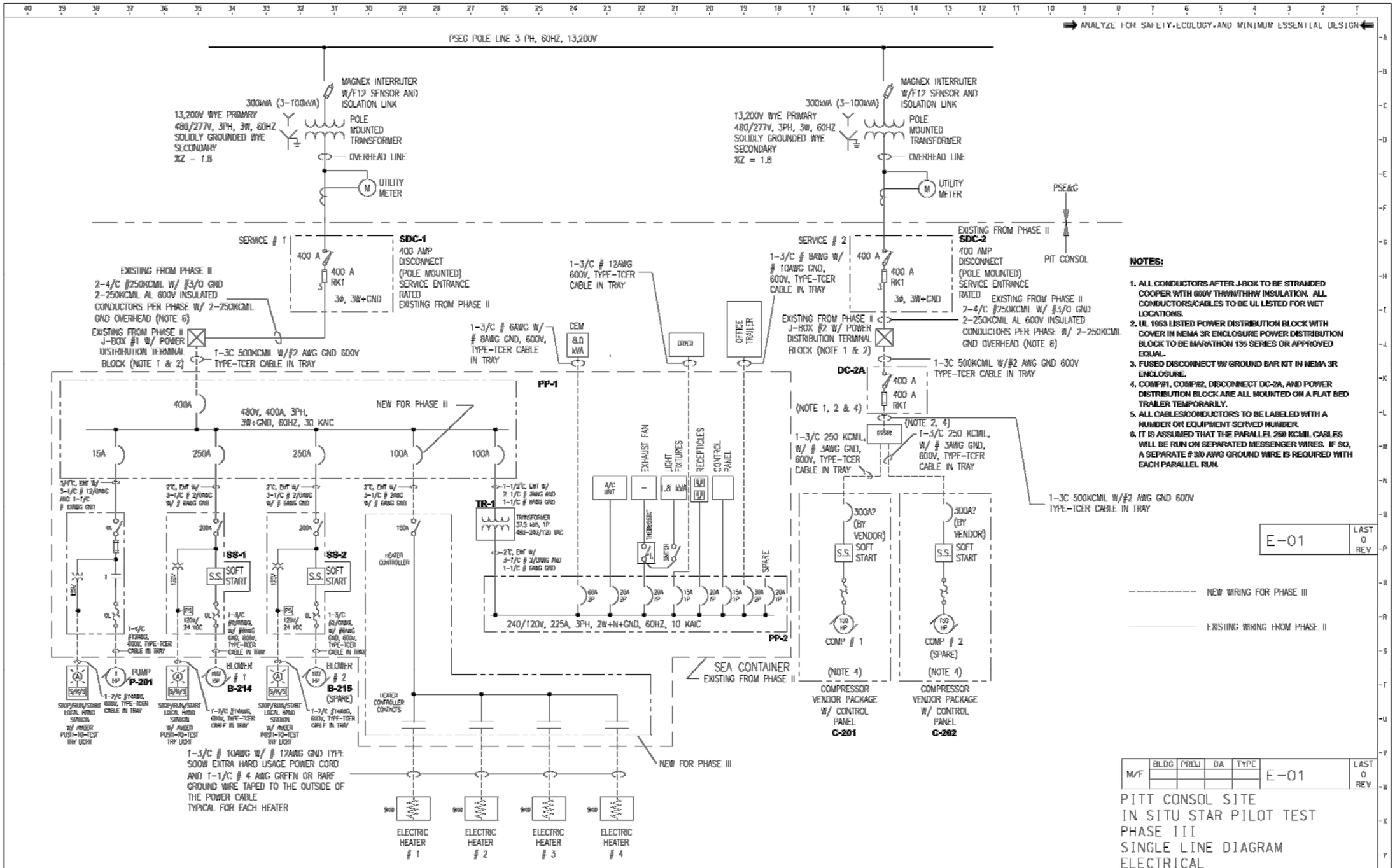

NOTES:

1. ALL CONDUCTORS AFTER J-BOX TO BE STRANDED COOPER WITH 600V THWN/THHW INSULATION. ALL CONDUCTORS/CABLES TO BE UL LISTED FOR WET LOCATIONS.
2. UL 1953 LISTED POWER DISTRIBUTION BLOCK WITH COVER IN NEMA 3R ENCLOSURE POWER DISTRIBUTION BLOCK TO BE MARATHON 135 SERIES OR APPROVED EQUAL.
3. FUSED DISCONNECT W/ GROUND BAR KIT IN NEMA 3R ENCLOSURE.
4. COMP#1, COMP#2, DISCONNECT DC-2A, AND POWER DISTRIBUTION BLOCK ARE ALL MOUNTED ON A FLAT BED TRAILER TEMPORARILY.
5. ALL CABLES/CONDUCTORS TO BE LABELED WITH A NUMBER OR EQUIPMENT SERVED NUMBER.
6. IT IS ASSUMED THAT THE PARALLEL 250 KCMIL CABLES WILL BE RUN ON SEPARATED MESSENGER WIRES. IF SO, A SEPARATE # 3/0 AWG GROUND WIRE IS REQUIRED WITH EACH PARALLEL RUN.

PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE

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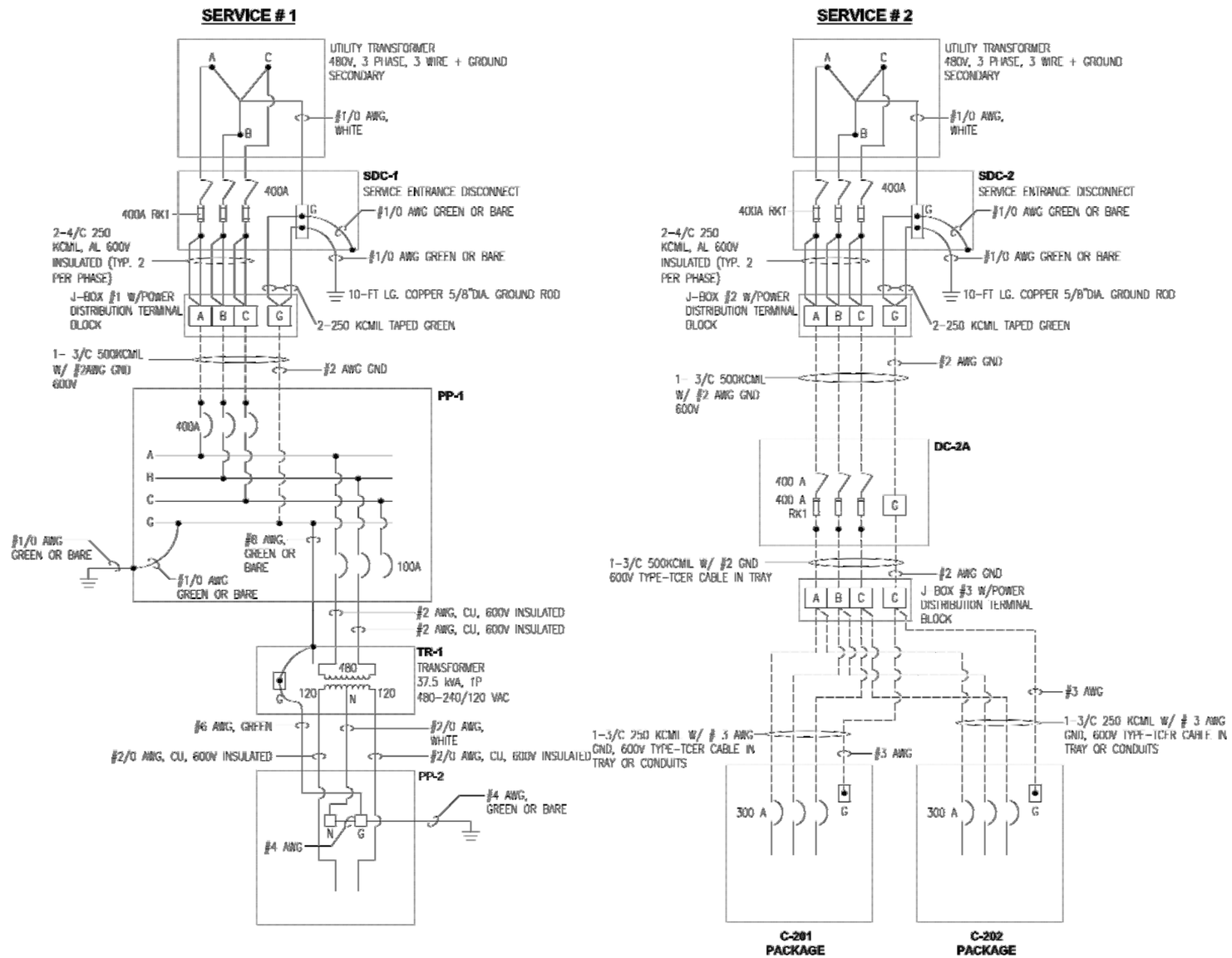
INTERGRAPH COMPUTER DRAWING PLOTTED

PROJECT
SCALE NONE DATE
CHECKED
RELEASE
APPROVED
APPROVED

E.I.DU PONT DE NEMOURS & CO.,INC.
WILMINGTON, DELAWARE
ENGINEERING DEPARTMENT
E-01

A. HARMON 04/10/12

ANALYZE FOR SAFETY,ECOLOGY,AND MINIMUM ESSENTIAL DESIGN



E-02 | LAST REV

NEW WIRING FOR PHASE III

EXISTING WIRING FROM PHASE II

M/F	BLDG	PROJ	DA	TYPE	E-02	LAST REV

PITT CONSOL SITE
IN SITU STAR PILOT TEST
PHASE III
WIRING DIAGRAM
ELECTRICAL

PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE

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PROJECT
SCALE NONE DATE
CHECKED
RELEASE FOR PRODUCTION
APPROVED
APPROVED

E.I.DU PONT DE NEMOURS & CO.,INC.
WILMINGTON, DELAWARE
ENGINEERING DEPARTMENT
E-02

SHEET NO.: 21 OF 30

A. HARMON 04/10/12

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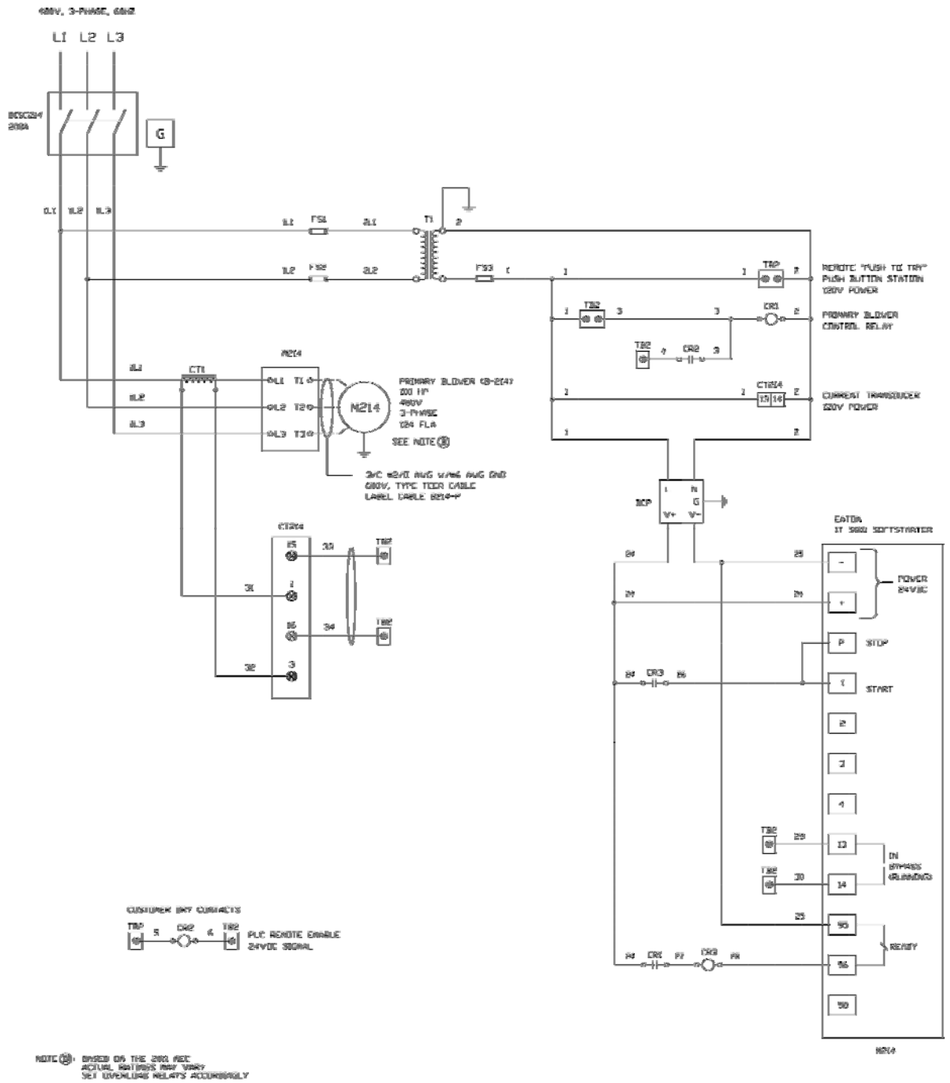
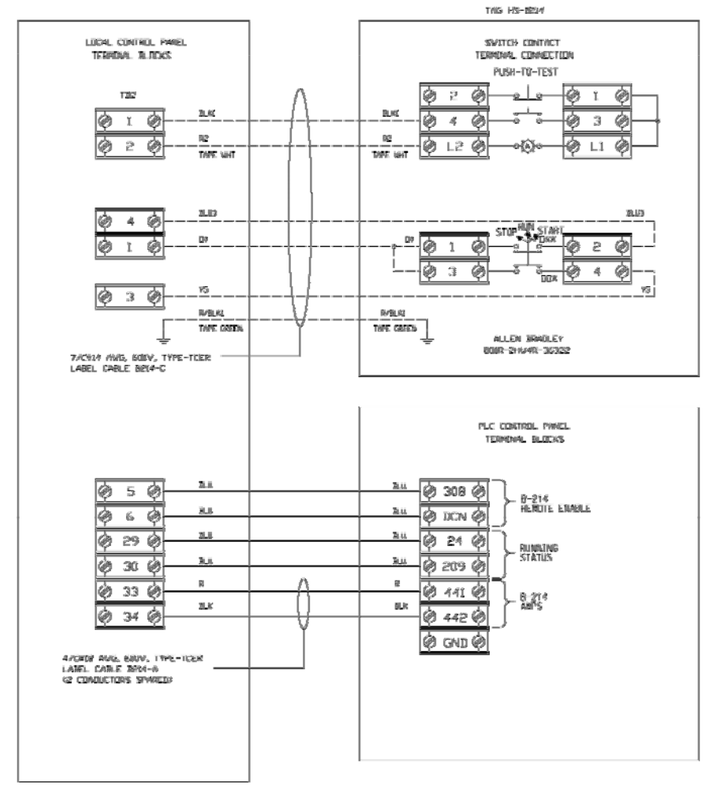


NOTE (8): BASED ON THE 2001 NEC ACTUAL RATINGS MAY VARY SET OVERLOAD RELAYS ACCORDINGLY



E-10 | LAST 0 REV

NEW WIRING FOR PHASE II

EXISTING WIRING FROM PHASE I

M/F	BLDG	PROJ	DA	TYPE	E-10	LAST 0 REV

PITT CONSOL SITE
IN SITU STAR PILOT TEST
PRIMARY BLOWER B-214
MOTOR SCHEMATIC
ELECTRICAL

PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE

STANDARDS | REFERENCE DRAWINGS

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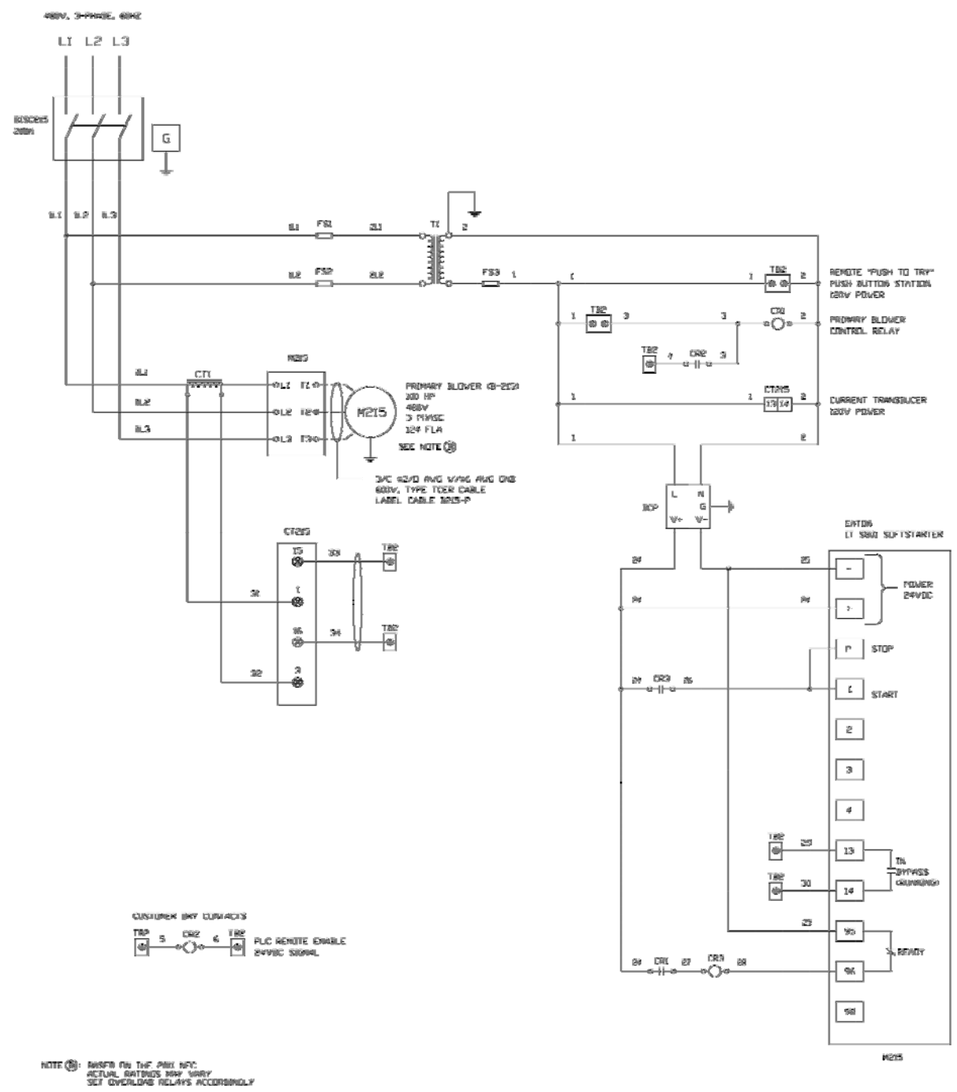
INTERGRAPH COMPUTER DRAWING PLOTTED

PROJECT
SCALE NONE DATE
CHECKED
RELEASED FOR PRODUCTION DESIGN
APPROVED DESIGN ENGINEER
APPROVED CONTROL ENGINEER

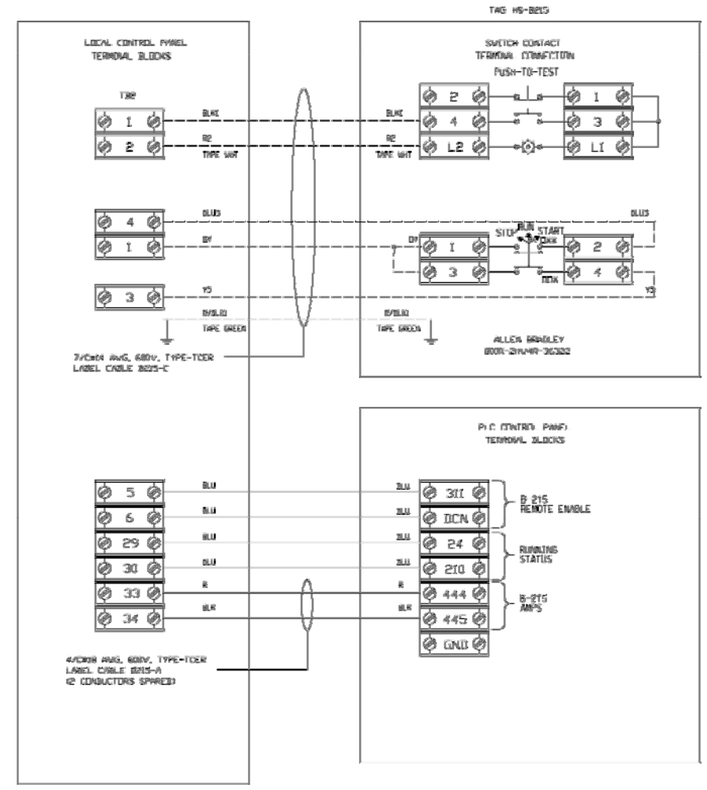
E.I.DU PONT DE NEMOURS & CO., INC.
WILMINGTON, DELAWARE
ENGINEERING DEPARTMENT
E-10

A. HARMON 04/10/72

ANALYZE FOR SAFETY, ECOLOGY, AND MINIMUM ESSENTIAL DESIGN



NOTE (8): AWARE ON THE FAN NFC
ACTUAL RATINGS MAY VARY
SET OVERLOAD RELAYS ACCORDINGLY



NEW WIRING FOR PHASE III

EXISTING WIRING FROM PHASE I

E-11	LAST 0 REV

M/F	BLDG	PROJ	DA	TYPE	E-11	LAST 0 REV

PITT CONSOL SITE
IN SITU STAR PILOT TEST
PRIMARY BLOWER B-215
MOTOR SCHEMATIC
ELECTRICAL

PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE

STANDARDS | REFERENCE DRAWINGS

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INTERGRAPH COMPUTER DRAWING PLOTTED

PROJECT
SCALE NONE DATE
CHECKED
PUBL. RELEASE FOR PRODUCTION REVIEW
APPROVED
DESIGN RELEASE
APPROVED
CONSTR. RELEASE

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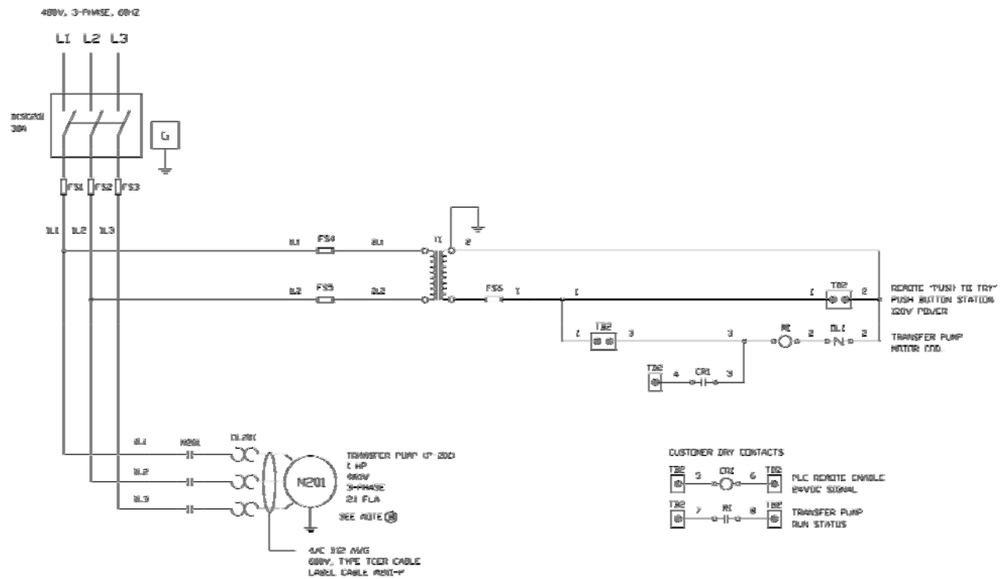
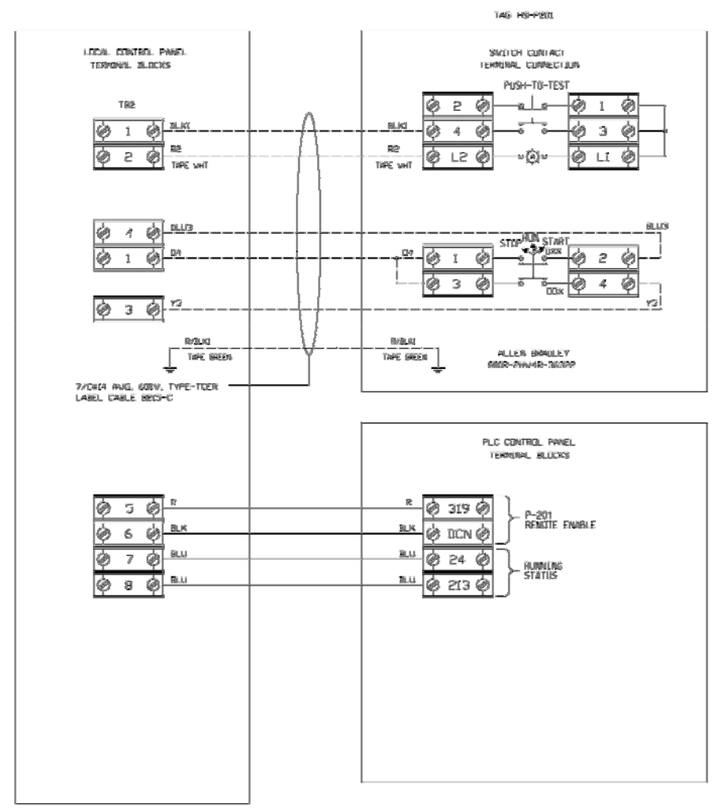
WILMINGTON, DELAWARE
ENGINEERING DEPARTMENT
F-11

A. HARMON 04/10/12

ANALYZE FOR SAFETY, ECOLOGY, AND MINIMUM ESSENTIAL DESIGN





NOTE (8): BASED ON THE 2001 NEC
ACTUAL RATINGS MAY VARY
SET OVERLOAD RELAYS ACCORDINGLY

E-12 | LAST 0 REV

——— NEW WIRING FOR PHASE III
——— EXISTING WIRING FROM PHASE II

M/F	BLDG	PROJ	DA	TYPE		
				61	E-12	LAST 0 REV

PITT CONSOL SITE
IN SITU STAR PILOT TEST
TRANSFER PUMP P-201
MOTOR SCHEMATIC
ELECTRICAL

PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE

STANDARDS		REFERENCE DRAWINGS			
		E-01	E-13	E-18	
		E-02	E-14		
		E-03	E-15		
		P-10	P-16		
		E-11	E-17		

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INTERGRAPH COMPUTER DRAWING PLOTTED

PROJECT
SCALE NONE DATE
CHECKED A. HARMON 04/20/12
RELEASED FOR PRODUCTION
DESIGN
APPROVED M. SCARBOROUGH 04/20/12
DESIGN RELEASE S. THOMAS 04/20/12
APPROVED M. SCARBOROUGH 04/20/12
CONSTR. RELEASE S. THOMAS 04/20/12

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E-12

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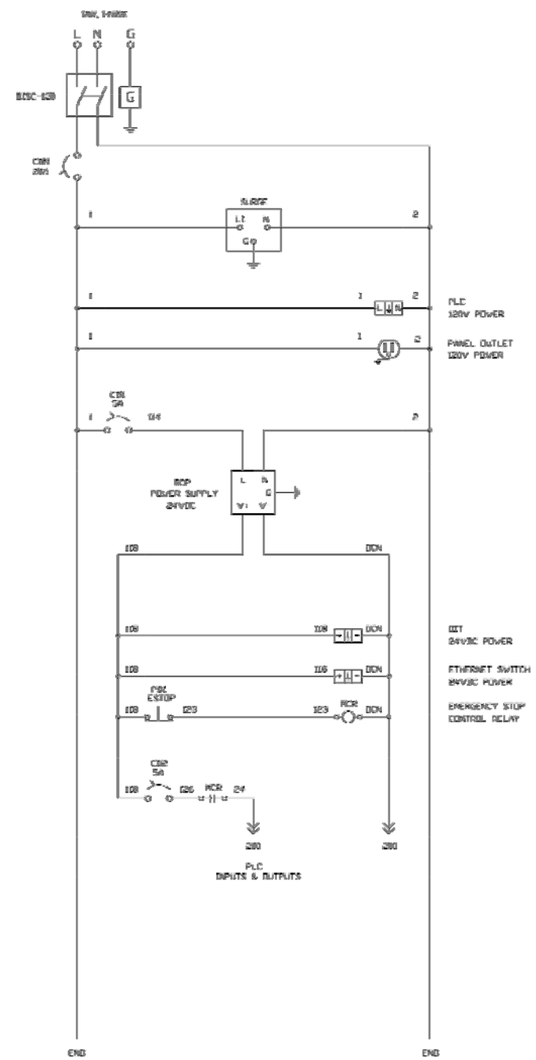
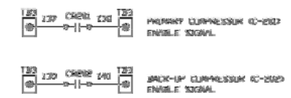
A. HARMON 04/23/12

ANALYZE FOR SAFETY,ECOLOGY,AND MINIMUM ESSENTIAL DESIGN



ULSOBA LISTED



E-13 | LAST 0 REV

NEW WIRING FOR PHASE III

EXISTING WIRING FROM PHASE II

M/F	BLDG	PROJ	DA	TYPE	E-13	LAST 0 REV

PITT CONSOL SITE
IN SITU STAR PILOT TEST
PLC CABINET
SCHEMATIC DIAGRAM SHT 1 OF 6
ELECTRICAL

PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE

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INTERGRAPH COMPUTER DRAWING PLOTTED

PROJECT
SCALE NONE DATE
CHECKED
HELD BACK FOR CONSTRUCTION DIVISION
APPROVED DESIGN RELEASE
APPROVED CONSTR. RELEASE

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E-13

A. HARMON 06/10/12

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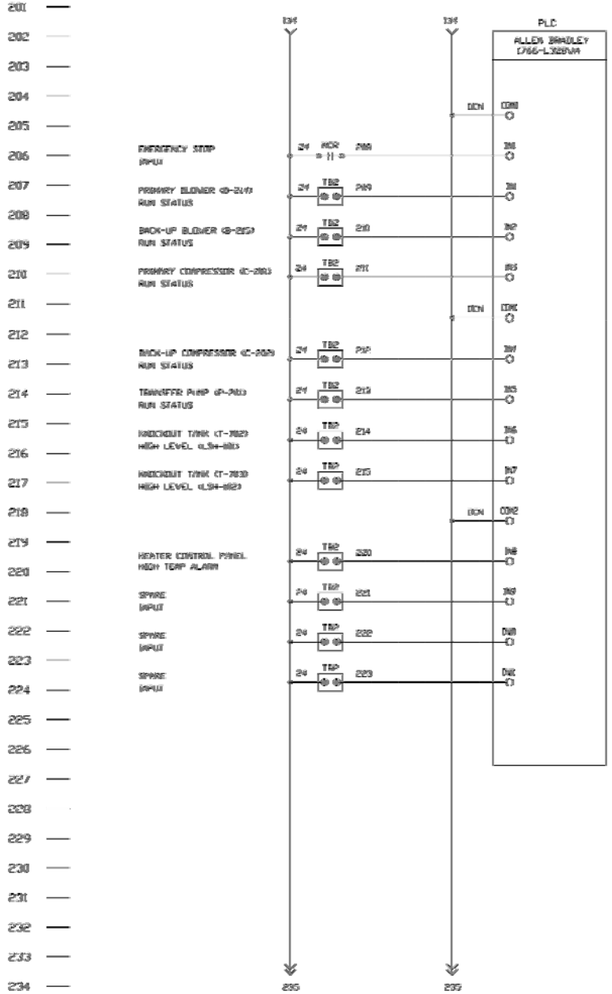

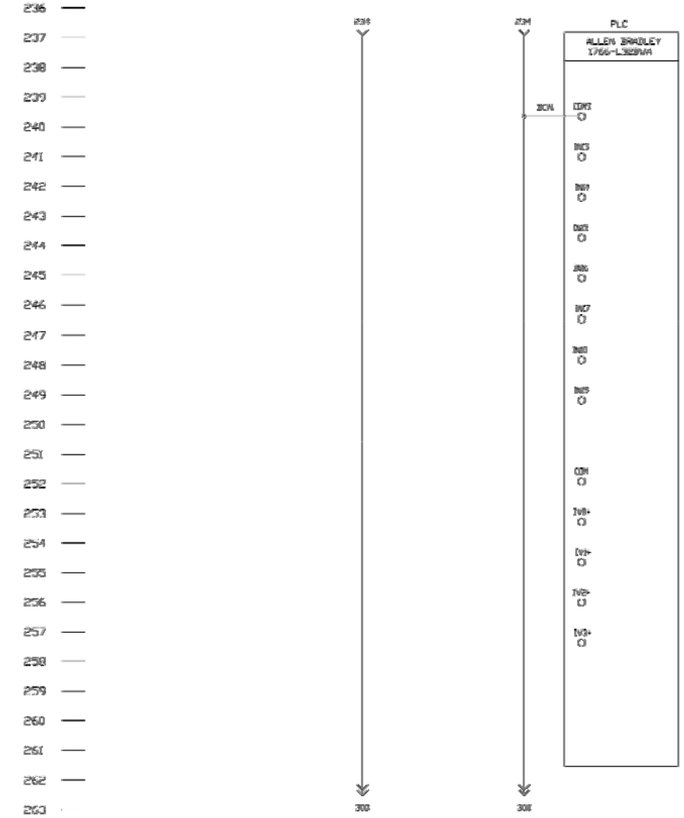

E-14 | LAST REV

NEW WIRING FOR PHASE III

EXISTING WIRING FROM PHASE II

UL508A LISTED

M/F	BLDG	PROJ	DA	TYPE	F-14	LAST REV

PITT CONSOL SITE
IN SITU STAR PILOT TEST
PLC CABINET
SCHEMATIC DIAGRAM SHT 2 OF 6
ELECTRICAL

PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	STANDARDS	REFERENCE DRAWINGS

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INTERGRAPH COMPUTER DRAWING PLOTTED

PROJECT
SCALE NONE DATE
CHECKED
APPT. PROJ. MGR. FOR PRODUCTION DESIGN
APPROVED
DESIGN RELEASE
APPROVED
CONSTR. RELEASE

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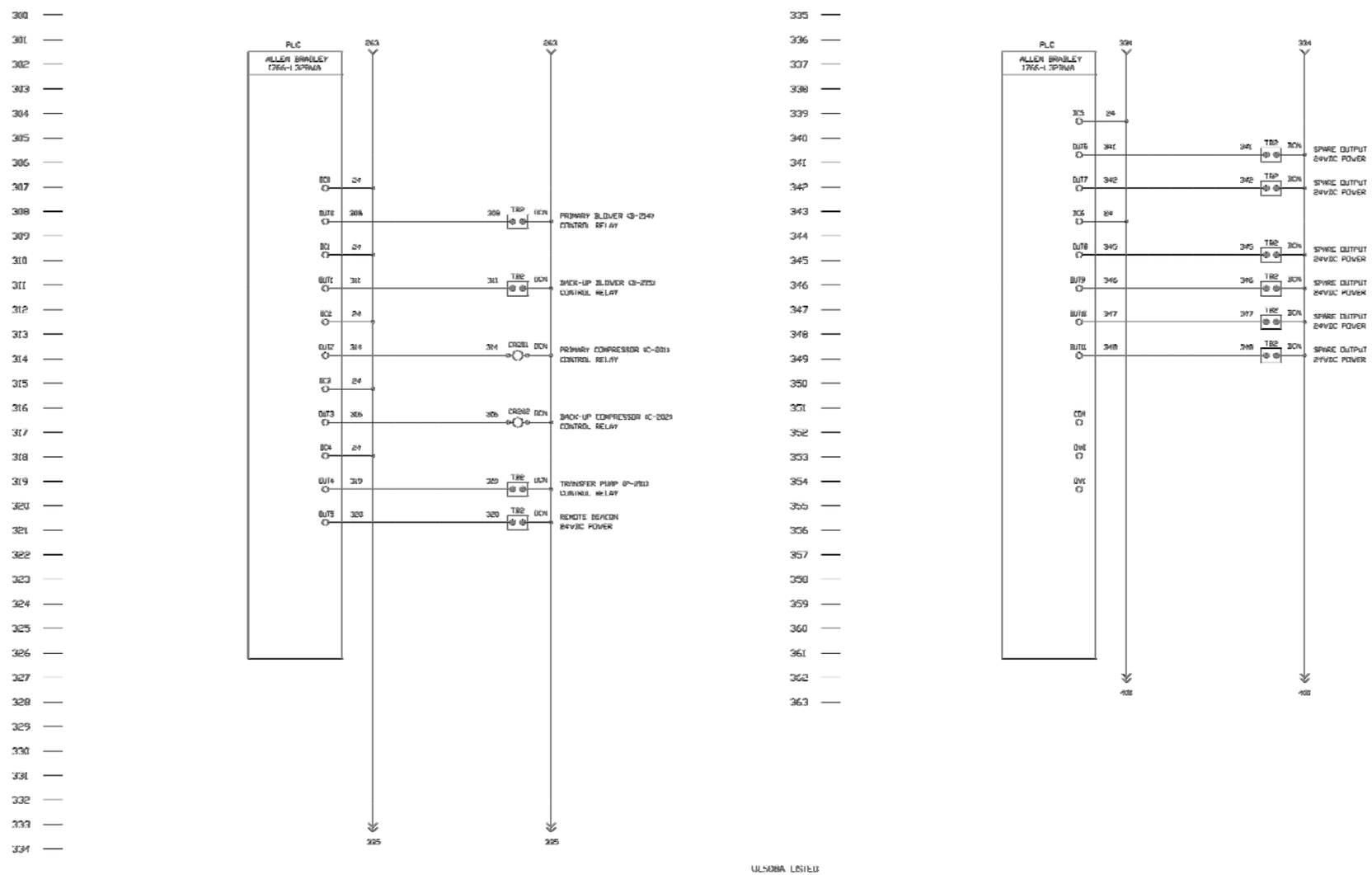
E-14

A. HARMON 04/10/12

ANALYZE FOR SAFETY, ECOLOGY, AND MINIMUM ESSENTIAL DESIGN



E-15 | LAST 0 REV

UL508A LISTED

M/F	BLDG	PROJ	DA	TYPE	E-15	LAST 0 REV

PITT CONSOL SITE
IN SITU STAR PILOT TEST
PLC CABINET
SCHEMATIC DIAGRAM SHT 3 OF 6
ELECTRICAL

PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE

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INTERGRAPH COMPUTER DRAWING PLOTTED

PROJECT
SCALE NONE DATE
CHECKED
RELEASE FOR PRODUCTION
DESIGN
APPROVED
DESIGN ENGINEER
APPROVED
CONSTR. ENGINEER

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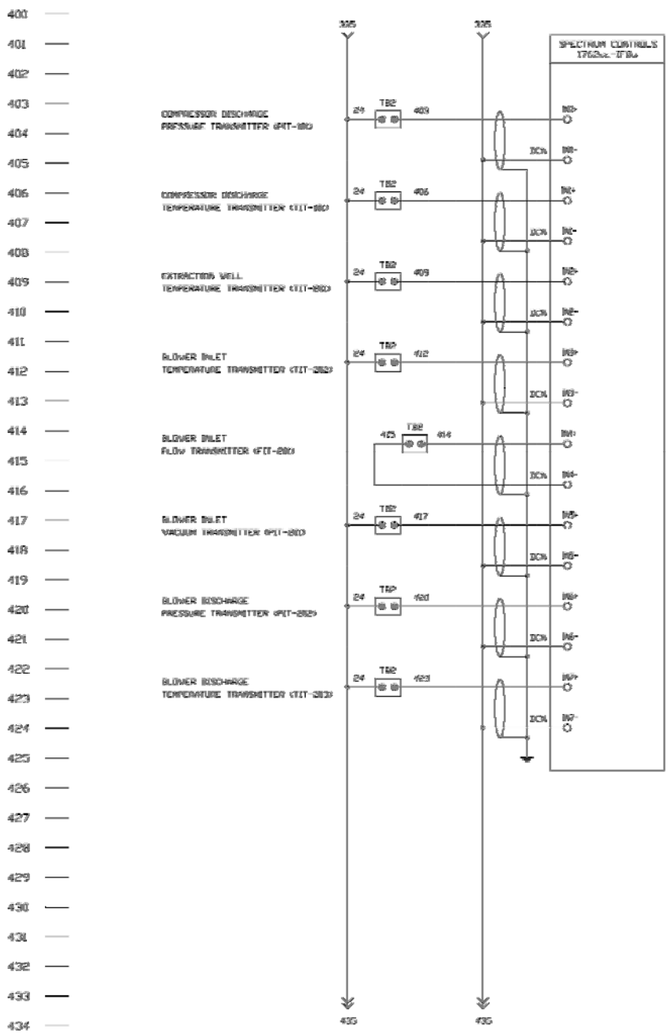
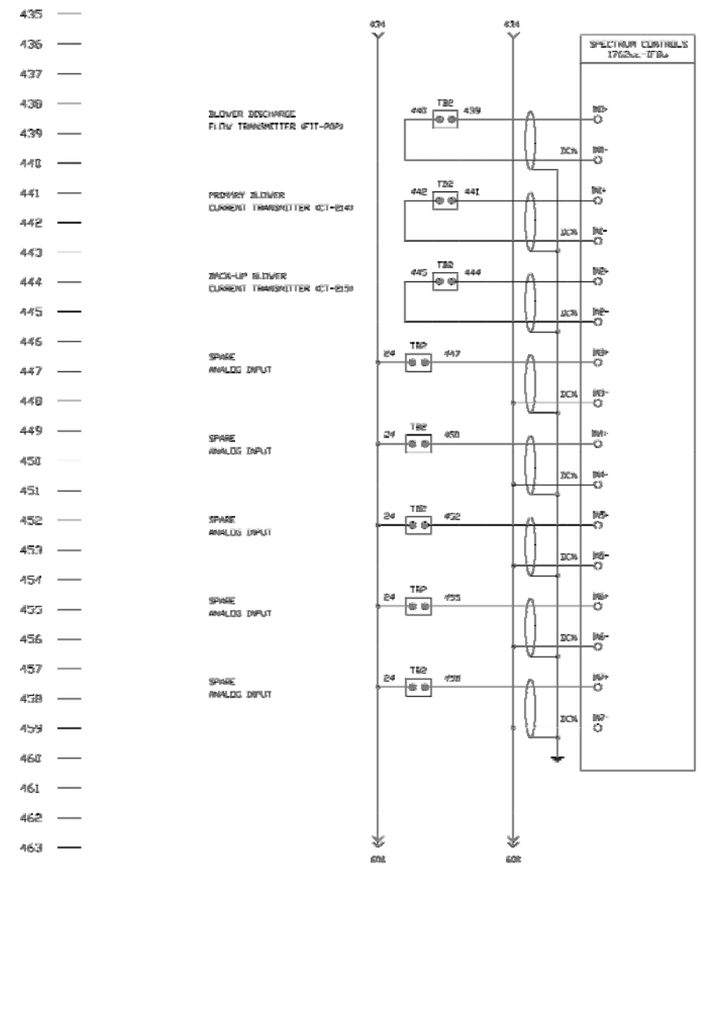
SHEET NO.: 27 OF 30

A. HARMON 94/10/12

ANALYZE FOR SAFETY,ECOLOGY,AND MINIMUM ESSENTIAL DESIGN





NEW WIRING FOR PHASE II

EXISTING WIRING FROM PHASE I

ULSOBA LISTED

M/F	BLDG	PROJ	UA	TYPE	E-16	LAST 0 REV

PITT CONSOL SITE
IN SITU STAR PILOT TEST
PLC CABINET
SCHEMATIC DIAGRAM SHT 4 OF 6
ELECTRICAL

PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE

STANDARDS	REFERENCE DRAWINGS

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DESIGN RELEASE
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A. HAMMON 04/10/12

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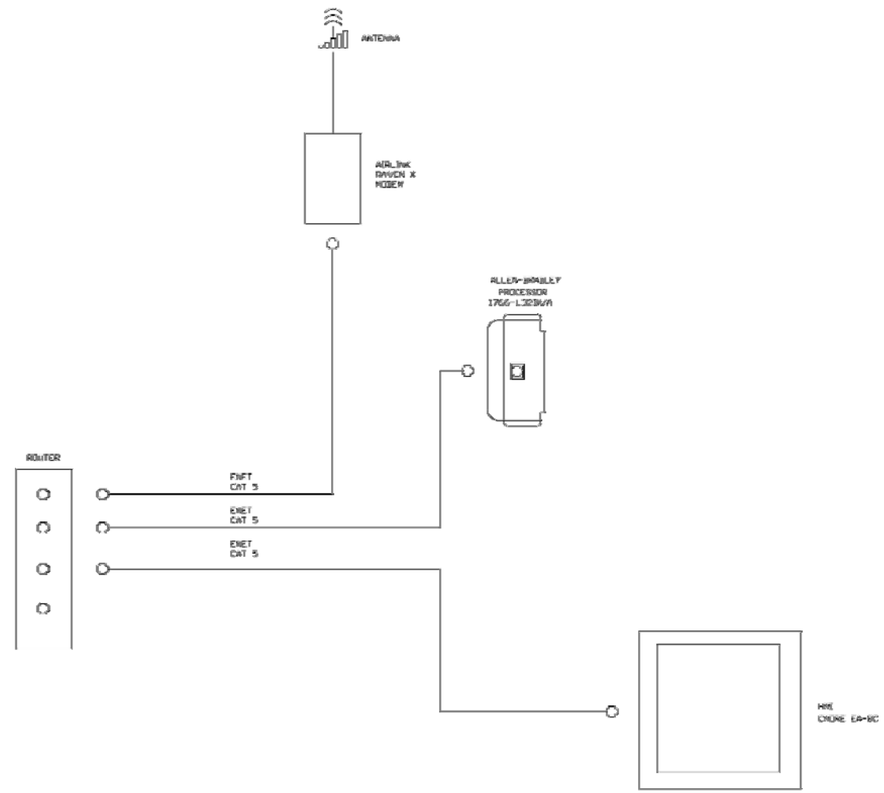

E-17 | LAST 0 REV

NEW WIRING FOR PHASE II

EXISTING WIRING FROM PHASE I

UL508A LISTED

M/F	BLDG	PROJ	DA	TYPE	E-17	LAST 0 REV

PITT CONSOL SITE
IN SITU STAR PILOT TEST
PLC CABINET
SCHEMATIC DIAGRAM SHT 5 OF 6
ELECTRICAL

PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE

STANDARDS	REFERENCE DRAWINGS

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INTERGRAPH COMPUTER DRAWING PLOTTED

PROJECT
SCALE NONE DATE
CHECKED
RELEASE FOR PRODUCTION
DESIGN
APPROVED
DESIGN RELEASE
APPROVED
CONSTR. RELEASE

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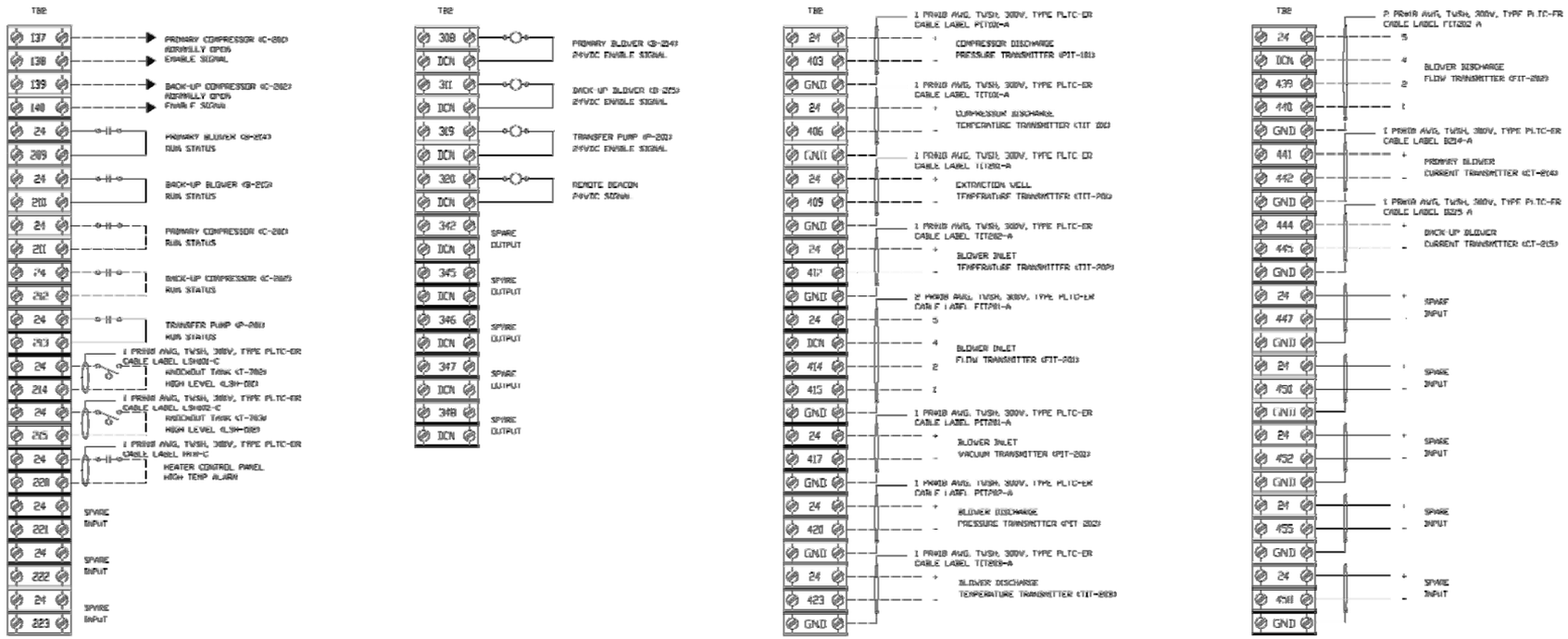
E-17

A. HARMON 06/10/12

ANALYZE FOR SAFETY, ECOLOGY, AND MINIMUM ESSENTIAL DESIGN



E-18 | LAST 0 REV

NEW WIRING FOR PHASE III

EXISTING WIRING FROM PHASE I

M/F	BLDG	PROJ	DA	TYPE	E-18	LAST 0 REV

PITT CONSOL SITE
IN SITU STAR PILOT TEST
PLC CABINET
SCHEMATIC DIAGRAM SHT 6 OF 6
ELECTRICAL

PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE	PROJ	NO	REVISION	RVSD	CHKD	APPD	DATE

STANDARDS | REFERENCE DRAWINGS

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INTENGRAPH COMPUTER DRAWING PLOTTED

PROJECT
SCALE NONE DATE
CHECKED
RELEASE FOR CONSTRUCTION DIVISION
APPROVED
DIVISION RELEASE
APPROVED
CONSTR. RELEASE

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ENGINEERING DEPARTMENT
E-18

SHEET NO.: 30 OF 30

A. HARMON 04/10/12

APPENDIX B

OPERATOR DAILY CHECKLIST

Daily Operator Checklist
Pitt Consol, Newark, New Jersey

Date: _____ List of expected visitors or subcontractors:

Site Operator: _____ _____

Time Onsite: _____ Time Off Site _____ _____

Weather: _____ _____

Status of exterior Beacon prior to entering PTA: on / off _____

Carbon Monoxide of air space at PTA gate: CO% _____

Completed Tailgate meeting: Y / NA _____

Security Briefing notes: _____

Wind Direction: _____

THERMOCOUPLE DATALOGGER

Download and backup Transducer data to external hard drive: complete

Complete daily upload to FTP site:

Copy of Active File Name: _____ Time of upload: _____

Have any Input Names (TC IDs) Changed? Y / N (notified R.Roff of change? (Y / N)

ADDITIONAL SYSTEM CHECKS

Local System Readout: Complete / Incomplete (see separate sheet)

Perform Equipment Inspections: Complete / Incomplete (see separate sheet)

Daily Screening and Sampling: Complete / Incomplete (Separate Sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702): Check Y/N

Pumped out: Y/N, Volume: _____

Condensate Holding Tank (T-705): Check Y/N

Pumped out: Y/N, Volume: _____

Mist Accumulator Condensate Tote: Check Y/N

Pumped out: Y/N, Volume: _____

PTA INSPECTION

Concrete Integrity: _____

Exhaust Gas Temperatures changing?: _____

PTA Effluent Alarm Set Point of TIT-201 = _____Alarm Set Point Modified: N/Y to _____

Carbon Influent Alarm Set Point of TIT-203 = _____Alarm Set Point Modified: N/Y to _____

Completed Daily Summary Email: Y / N

Notes: _____

_____

_____

_____

Date: _____

Site Operator: _____

CALIBRATION

PID daily calibration:

model and serial number: _____

Fresh Air scan, reading: _____

100 ppm isobutylene, reading:

Qrae/Vrae Calibration: Span Gas target =

Serail #						
	Fresh Air	Span Gas	Fresh Air	Span Gas	Fresh Air	Span Gas
CO						
O_2						

GEM2000 Plus Calibration:

model and serial number

	Zero Span (%)	Calibration Span (%)	Span Target %	Calibration Comments:
CO_2				
O_2				
CH_4				
CO				

MORNING SCREENING

Carbon Monoxide Screening (CO%):

	CO%	Time
Location 1 (N)		
Location 2 (E)		
Location 3 (S)		
Location 4 (W)		

SVE Influent Concentrations (SP-01):

CO_2%		Time: _____
O_2%		
CO%		

Carbon Breakthrough Testing (PID Screening) (ppm):

Influent (SP-03)		Time:	
Carbon Midpoint (SP-04)		Time:	
Stack Effluent (SP-05)		Time:	

Vapor Monitoring Probe Screening

	PID (ppm)	CO2%	O2%	CO%	Time:
VMP-1					
VMP-2					
VMP-3					
VMP-4					

AFTERNOON SCREENING

Carbon Monoxide Screening (CO%):

	CO%	Time
Location 1 (N)		
Location 2 (E)		
Location 3 (S)		
Location 4 (W)		

SVE Influent Concentrations (SP-01):

CO_2%		Time: _____
O_2%		
CO%		

Carbon Breakthrough Testing (PID Screening) (ppm):

Influent (SP-03)		Time:	
Carbon Midpoint (SP-04)		Time:	
Stack Effluent (SP-05)		Time:	

Vapor Monitoring Probe Screening

	PID (ppm)	CO2%	O2%	CO%	Time:
VMP-1					
VMP-2					
VMP-3					
VMP-4					

Is midpoint (SP-04) sample greater than 50 ppm? Y / N If > 50 ppm, re-confirm: _____ ppm Mid Point and Effluent Summa Canister Samples (24 hr Rush TAT) Collected? Y / N / NA	Is midpoint (SP-04) sample greater than 50 ppm? Y / N If > 50 ppm, re-confirm: _____ ppm Mid Point and Effluent Summa Canister Samples (24 hr Rush TAT) Collected? Y / N / NA
OPACITY TESTING	
Observation Point: Stack / Other _____ System Running: Y/N Start of Test: _____ End of Test: _____ (30 minute period) 3 minutes of consecutive emissions? Y / N Description of corrective action (if required):	Observation Point: Stack / Other _____ System Running: Y/N Start of Test: _____ End of Test: _____ (30 minute period) 3 minutes of consecutive emissions? Y / N Description of corrective action (if required):
SAMPLE COLLECTION	
Analytical (Summa) Sample Required today (every other day)? Y / N SVE Influent Sample from SP-03 (INF-##-Initials) Sample ID: _____ Time: _____ Initial Vac (" Hg) _____ Final Vac (" Hg) _____ Canister ID: Flow Controller ID:	
Stack Sample from SP-05 (STACK-##-Initials) Sample ID: _____ Time: _____ Initial Vac (" Hg) _____ Final Vac (" Hg) _____ Canister ID: _____ Flow Controller ID: _____ Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11) Y / N	

Notes:

Date:

Site Operator: barometric pressure 29.9 in. Hg

Tag ID	Location/Description	Value	Units	Time
R-204	influent main line pressure regulating valuve		psi	
R-205	IP-1 regulating valve pressure		psi	
R-206	IP-2 regulating valve pressure		psi	
R-207	IP-3 regulating valve pressure		psi	
R-208	IP-4 regulating valve pressure		psi	
R-209	IP-5 regulating valve pressure		psi	

Ignition Well Flow rate calculation Time:

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines					Time
IP-1	on / off	FI 101 (DP psi)		PI 102	
IP-2	on / off	FI 102 (DP psi)		PI 103	
IP-3	on / off	FI 103 (DP psi)		PI 104	
IP-4	on / off	FI 104 (DP psi)		PI 105	
IP-5	on / off	FI 105 (DP psi)		PI 106	

PLC READOUTS		Value	Units	Time
TIT 101	air injection temperature indicator		°F	
PIT 101	compressor discharge pressure		psi	
TIT 201	PTA effluent temperature indicator		°F	
TIT 202	pre-blower influent temperature		°F	
PIT 201	blower B-214 inlet vacuum		in. H_2O	
PIT 202	blower B-215 inlet vacuum		in. H_2O	
PIT 203	blower B-215 outlet pressure		psi	
PIT 204	blower B-214 outlet pressure		psi	
TIT 203	carbon influent temperature		°F	
PIT 205	carbon mid-point pressure		psi	
FIT 201	discharge flow to stack		scfm	
IP-1 PI	ignition point pressure		psi	
IP-2 PI	ignition point pressure		psi	
IP-3 PI	ignition point pressure		psi	
IP-4 PI	ignition point pressure		psi	
IP-5 PI	ignition point pressure		psi	
VMP-1	vacuum monitoring probe 1		in. H_2O	
VMP-2	vacuum monitoring probe 2		in. H_2O	
VMP-3	vacuum monitoring probe 3		in. H_2O	
VMP-4	vacuum monitoring probe 4		in. H_2O	
VMP-5	vacuum monitoring probe 5		in. H_2O	
PI 201	PTA effluent vacuum		in. H_2O	
PI 202	pre-blower influent vacuum		in. H_2O	
PI 203	carbon influent pressure		in. H_2O	
PI 204	post carbon pressure		in. H_2O	

CEMS		Time:
CO%	_____	
CO_2%	_____	
O_2%	_____	

Air Space Monitoring (throughout the day)

Time	Location	PID (ppm)	CO (ppm)
	trailer		
	PTA		
	carbon units		
	blowers		

Comments: _____

Date:
Site Operator:

CEMS System Checks		
☐	A/C unit is running and temp is ~70F in enclosure	
☐	Liquid Alarm Light and Flow Alarm Light is Green	
☐	confirm probe heater controller temp is 250F +/- 10F if temp is approaching or above 300F need to call CEMS immediately	
☐	confirm umbilical heater controller temp is 250 +/- 10F	
	Sample Flow Rate (L/min)	
	Excess Flow (L/min)	
☐	calibration check complete	CO_2% =
		CO% =
		O_2% =
	CO Regulator = _____ psi, cylinder = _____ psi	
	CO_2/O_2 Regulator = _____ psi, cylinder = _____ psi	

Air Injection/SVE System Checks			
C-201	Primary Air Compressor	motors are not generating excessive noise	☐
		no visible oil leaks	☐
C-202	Secondary Air Compressor	motors are not generating excessive noise	☐
		no visible oil leaks	☐
T-701	Equalization Tank	Check for condensate and drain as needed	☐
B-214	Primary Blower	motors are not generating excessive noise	☐
B-215	Secondary Blower	motors are not generating excessive noise	☐
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		☐
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		☐

Comments:_____

APPENDIX C

TASK HAZARD ANALYSIS (THA) DOCUMENTS

Geosyntec consultants

PRE-WORK THA

THA Title:		**Date:**	
Project Name:		**Client Name:**	
Project Number:		**Client Project Manager:**	
Project Location:		**Geosyntec Project Manager:**	
Scope of Work Summary:			

Work Steps	**Process or Activity**	**Hazards**	**Hazard Control**
1)			

Min. Personal Protective Equipment (PPE):	

Individuals Must Sign the last page of this THA after review.

HAZARD		**HAZARD CONTROLS (check all that apply and comment as required)**
WALKING/WORKING SURFACES (EHS 210, 501)		
☐	☐ Uneven terrain ☐ Slippery surfaces	☐ Walkways are cleared of equipment, vegetation, excavated material, tools and debris ☐ Pits and floor openings are covered or otherwise guarded ☐ Work areas are illuminated adequately; field operations are not conducted before sunrise or after sunset unless adequate lighting is provided. ☐ Spills are cleaned up promptly ☐ Salt applied to icy areas, snow cleared from walkways
☐	LADDERS / STAIRS ☐ Extension Ladders ☐ Step Ladders ☐ Fixed Ladders ☐ Stairs	☐ Employees trained in safe ladder use at safety meeting ☐ Extension ladders are properly footed, secured at top, and setup at proper angle ☐ Stepladders are set on level ground or properly shimmed with spreaders locked. ☐ Stairs have proper rise over run and stairs >4 steps or 4' have guardrails. ☐ Ladders/Stairs Comments: ☐ Never use a step ladder as a straight ladder. All straight ladders shall be extended three rungs past leading edge. Never use metal ladders while working with electricity.
☐	MANLIFT used to reach work ☐ Scissor Lift	☐ Operators are sufficiently trained, experienced and qualified. ☐ Equipment is inspected after mobilization and is in good condition.

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PRE-WORK THA

	HAZARD	HAZARD CONTROLS (check all that apply and comment as required)
	☐ Extensible Boom ☐ Articulated Boom ☐ vertical Lift ("Genie")	☐ Harness & Lanyard worn whenever operating the lift (scissor lifts may be excepted) ☐ Overhead and surface obstructions are reviewed with operators prior to use. **Manlift Comments:**
EXCAVATIONS / TRENCHING/UNDERGROUND HAZARDS (EHS 402)		
☐	☐ Max Depth ≥ 20' ☐ Max Depth ≥ 5' ☐ Max Depth <5' with potential cave-in hazard ☐ Potential permit-required confined space at depth ≥ 4' ☐ Underground utilities ☐ Structures/foundations ☐ Falls into excavations	☐ Sloping & shoring for excavations ≥20' are approved by a professional engineer ☐ Sloping & shoring for excavations ≥5' when persons are exposed to cave-in. (specify below) ☐ Sloping & shoring for shallow (<5') excavations with cave-in hazard (specify below) ☐ Excavations ≥ 4' are classified as a non-permit confined space ☐ Excavations ≥ 4' are classified as Alternate Entry or Permit-Required (see confined space) ☐ Underground utilities have been identified and marked. ☐ Local "dig safe" organization has been notified for utility locations in public areas or rights of way. Number: _____ Date: _____ ☐ Hand digging within 3' of utility locations. ☐ Excavations are protected by perimeter fencing (not barricade tape): (☐ rigid fence - chain link or wood, safety fence 6' from edge.) **Excavation Comments:**
CONFINED SPACES (EHS 118)		
☐	☐ No Serious Hazards ☐ Toxic atmosphere ☐ carbon monoxide ☐ hydrogen sulfide ☐ ☐ Flammable atmosphere ☐ Low oxygen ☐ Combustible dust ☐ Other Serious Hazard:	☐ Confined space is altered so that it is no longer a confined space. (describe below) ☐ Confined space is downgraded to a non-permit confined space. (identify which spaces below) ☐ Alternate Entry is used. (Identify which space qualify for confined space entry below) ☐ Full permit-required confined space entry is used due to presence of serious hazards. ☐ Rescue team has been notified (☐ Paid FD ☐ Volunteer FD ☐ Plant Rescue) Rescue Team:_____ Phone Number: _____ ☐ All entrants and attendants for Alternate Entry and Permit-Required Entry have confined space entry training. **Confined Space Comments:**
BOAT OPERATIONS/WORKING ON or NEAR WATER and ICE (EHS 306)		
☐	☐ Drowning ☐ Hypothermia	☐ Only qualified employees are operating the boat ☐ Coast Guard-approved Personal Flotation Device (PFD), sized and adjusted to the wearer, is worn by all when involved in boat operations. ☐ A float plan is completed prior to leaving dock. ☐ Emergency equipment like ring buoy, flares and fire extinguishers are present **Boat, water operations Comments:**
DRILLING (EHS 403)		
☐	☐ Struck By, Run-Over, Caught In Between (pinch points), Roll Over, Fluid Leaks ☐ Underground utilities, aboveground ☐ Spills	☐Contractor has been prequalified ☐Contractor inspected the drill rig ☐ High visibility vests, hard hats are being worn near the equipment ☐ Operators and helpers will maintain a safe distance to moving parts. All those working near moving or rotating parts will secure loose hair, clothing, and equipment. ☐ Drill rigs will only be moved with masts lowered. Masts will be erected with outriggers fully extended when equipped with outriggers. ☐ Max. safe slope for rig will be followed ☐ Spinning parts of the rig are guarded when possible, no loose clothing being worn near the rig ☐ Local "dig safe" organization has been notified for utility locations in public areas or rights of way. Number: _____ Date: _____ ☐ IDW is being managed as per regulations ☐ Area is surveyed for overhead utilities ☐ Hearing protection is used when working near the rig ☐ Spill equipment is available for fuel and hydraulic fluid leaks. Spill Kit Located: _____ **Drilling operations Comments:**
HEAVY EQUIPMENT [other than cranes] (EHS 504)		
☐	☐ Max. safe slope for each vehicle will be followed Struck By, Run-Over, Caught In Between (pinch points), Roll Over, Fluid Leaks ☐ Bulldozer ☐ Excavator	☐ Qualified persons operate all heavy equipment. (certificate is required for forklift and lull operators) ☐ Equipment will be inspected upon mobilization ☐ All leaks or defective safety equipment will be repaired before use. ☐ Operators will be reminded of seatbelt use by: _____ ☐ Eye contact with the operator is made prior to approaching near equipment or swing radius ☐ High visibility vests are required ☐ Max. safe slope for each vehicle will be followed

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PRE-WORK THA

	HAZARD	HAZARD CONTROLS (check all that apply and comment as required)
	☐ Front Loader ☐ mini Skid Steer (bobcat) ☐ mini Excavator ☐ Dump Truck ☐ Drill/Boring Rig ☐ Lull / Material Handler ☐ Forklift ☐ Manlift - specify type(s) ☐ Land Clearing loader	☐ Counterweight swing radius will be barricaded. ☐ Rigging directly to the forks of a lull, forklift, or front loader equipped forks is prohibited. Crane hook attachments will be used (specify):_____ ☐ Spill equipment is available for fuel and hydraulic fluid leaks. Spill Located:_____
ENVIRONMENTAL HAZARDS (NON CHEMICAL) (EHS 124, 125, 127)		
☐	☐ Heat Stress ☐ Cold Stress ☐ Insects, spiders, ticks ☐ Wild animals ☐ Mold, fungi ☐ Poisonous plants ☐ Hazardous noise	☐ Heat/Cold stress are monitored in accordance with Geosyntec procedures EHS 124 & EHS 125 ☐ Fluids are provided to prevent worker dehydration ☐ Types and injury potential of snakes, insects, spiders are reviewed with workers ☐ Insect repellant is used, PPE is used to protect against sting/bite injuries. ☐ All potentially poisonous plants such as poison ivy, poison oak, poison sumac are identified, long sleeve shirt or Tyvek is worn or a barrier cream is used when near these plants ☐ Hearing protection is used when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period) **Environmental Hazards Comments:**
POWER TOOLS, HAND TOOLS, and EXTENSION CORDS (EHS 121)		
☐	Eye injury, hand/arm cuts, electrical shock, strains, foot injuries, dust ☐ Grinders ☐ Needle Gun ☐ Chop saw ☐ Chain saw ☐ Trimmer ☐ concrete/asphalt saw	☐ All tools and electrical cords will be inspected upon mobilization by: _____ ☐ All tools and electrical cords in-use will be inspected daily by: _____ ☐ Grinder speeds will not exceed grinding wheel ratings. ☐ Water or wet cutting performed to control dust ☐ Respirators used to prevent exposure to dust (respirator type:_____) ☐ Thorough utility survey conducted prior to any concrete cutting, coring ☐ Face shield <u>and</u> safety glasses used (required for all grinders, jackhammers, chain saws, etc) ☐ Kevlar chaps and jacket (required for all chainsaw work) ☐ Hearing protection required for which tools or areas: _____ _____ ☐ All extension cords are in good condition with no cuts through outer insulation, ground plugs are present, and no "vinyl tape" repairs. **Tool & Cord Comments:**
MANUAL MATERIAL HANDLING / MATERIAL STORAGE / HOUSEKEEPING (EHS 401)		
☐	Back or shoulder strain, struck by falling objects, trips and falls, incompatible materials (fire or explosion) ☐ hvy manual lifting (>30 lbs) ☐ chemical storage ☐ compressed gas storage ☐ Tall storage greater than 2 pallets stacked. ☐ Material & equipment laydown areas ☐ Debris removal	☐ Mechanical lifting equipment used to reduce manual material handling: (☐ Forklift/Lull ☐ Heavy Equipment ☐ chainfall ☐ _____) ☐ Manual lifting more than 50 lbs by a single person will be avoided. ☐ Good manual lifting techniques will be reviewed prior to site work. ☐ Incompatible chemicals will be separated by 20' ☐ Secondary containment will be provided for the following chemicals: _____ ☐ Safety equipment will be located near chemical storage. ☐ Spill Kit ☐ Emergency Shower ☐ Eyewash ☐ Drench Hose ☐ Splash PPE ☐ Flammable gases and oxygen will be separated by 20'. ☐ All compressed gas cylinders will be transported vertically and secured upright. ☐ Equipment and materials will not be stored on site ☐ Debris will be moved daily and placed in designated areas. **Material Handling & Housekeeping Comments:**
TRAFFIC & SIDEWALK OBSTRUCTION (EHS 517)		
☐	☐ Vehicle accidents ☐ Pedestrians struck by vehicles or heavy equipment ☐ Pedestrians falls ☐ Pedestrian struck-by falling objects	☐ DOT signal devices will be used to re-route vehicles around excavations or busy site entrances/exits that affect road traffic. ☐ Flaggers will be used and have DOT Flagger Training ☐ Pedestrian traffic will be safely routed around or over excavations. ☐ Pedestrian traffic will be safely routed around or under overhead work. **Traffic & Sidewalk Comments:**
HAZARDOUS WASTE SITE WORK (EHS 108, 112, 301)		
☐	☐ exposure to hazardous vapors or dust, contact with	☐ Site workers with a potential for contact with contaminated materials will have OSHA 40-hour training, current 8-hour refresher, and medical exam.

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PRE-WORK THA

HAZARD		HAZARD CONTROLS (check all that apply and comment as required)
	contaminated materials, fire, and explosion. Contaminants of Concern and hazardous chemicals include: ☐ volatile organic compounds (describe:_____ _____) ☐ semivolatile organic cmpds (describe:_____ _____) ☐ metal dusts (describe:_____ _____) ☐ PCBs ☐ caustic (NaOH) ☐ Acid (H_2SO_4, HCl) ☐ Other hazardous waste site hazards are covered elsewhere in the HASP)	☐ No intrusive work activities or areas are anticipated with current scope of work. Intrusive work activities include: _____ _____ The perimeter of intrusive work areas are identified by:_____ Decontamination of personnel or equipment is <u>not</u> anticipated with the current scope of work. ☐ Decontamination of personnel and small tools will be conducted as follows: _____ ☐ Decontamination of heavy equipment will be conducted as follows: _____ ☐ Heavy equipment leaving the site will be inspected by_____ ☐ Work area monitoring is not anticipated with the current scope of work. ☐ Work Area Air Monitoring as follows for (dust, VOCs, etc) **OR** see attached. _____ _____ Level C Tyvek, boot covers, nitrile gloves, half or full face respirator with _____ cartridges changed daily _____ _____ Level B Same as above except supplied air respirator _____ _____ STOP work, contact EHS Department ☐ Community Air Monitoring is not anticipated with the current scope of work. ☐ Community Air Monitoring is required per the attached document. **Comments/Other:**

EMERGENCY RESPONSE **(911 Service is Available ☐ Yes ☐ No)**

Emergency Medical Treatment - Hospital Name: Hospital Address:		**Number:**	
Non-Emergency Med. Treatment - Clinic Name: Occupational Clinic Address:		**Number:**	
Fire Department Name		**Number:**	
Spill Response:		**Number:**	
Client Representative Name::		**Office Number:**	
		Cell Number:	
Geosyntec **Project Manager** Name:		**Office Number:**	
		Cell Number:	
Geosyntec **Corporate H&S** Name:		**Office Number:**	
		Cell Number:	

Emergency Response Comments:

Date:	
Project Name:	
THA Title:	
Subcontractor Name:	
Geosyntec Representative (reviewed by):	
Subcontractor Foreman/Supervisor Signature (authorize):	
Crew Signatures (acknowledge):	
Print Name	**Signature**

PLEASE RETURN A COPY OF THIS SIGNED PAGE TO GEOSYNTEC PROJECT MGR., SUPERINTENDENT UPON REVIEW AND ACKOWLEDGMENT BY THE CREW MEMBERS. ALL NEW CREW MEMBERS SHALL BE ORIENTATED THE SAME AND A SUBMITTAL OF A NEW SIGN IN SHEET SHALL BE COMPLETED.

APPENDIX D

SITE-SPECIFIC HEALTH AND SAFETY PLAN (HASP)

DuPont Corporate Remediation Group
4417 Lancaster Pike
Chestnut Run Plaza, Building 715 - 252
Wilmington, DE, 19808

HEALTH AND SAFETY PLAN

SELF-SUSTAINING TREATMENT FOR ACTIVE REMEDIATION (STAR) PILOT TEST DUPONT PITT-CONSOL SITE

Newark, New Jersey

Prepared by

Geosyntec consultants

engineers | scientists | innovators

130 Research Lane, Suite 2
Guelph, ON N1G 5G3

Project Number: TR0341

May 15, 2012

Geosyntec consultants

Instructions for Injury Response

If SERIOUS and/or LIFE THREATENING

Seek immediate medical attention at the hospital/facility that provides emergency care shown on **FIGURE 1A**.

- **Once the emergency situation has stabilized, follow the "Instructions for Incident Reporting" included in this HASP.**

If NON-Life Threatening

Manager/Supervisor calls the EHS Department at **(804) 349-8067 (Dale Prokopchak)** or **(404) 435-4722 (Ersin Yalcin)** to discuss appropriate medical attention (even if he/she thinks medical attention is not required). If professional care is needed, seek medical attention at the URGENT CARE facility shown on **FIGURE 1B**.

- **Present the medical care provider with the TEAR-OUT FORMS *("Instructions to Medical Provider"* and *"Physical Status for Return to Work")* included in this HASP.**
- **Follow the *"Instructions for Incident Reporting"* included in this HASP within one hour.**

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FIGURE 1A

ROUTE TO HOSPITAL

St. James Hospital **Distance: 5.2km/ 7 minutes**
(973)-589-1300
155 Jefferson Street
Newark, New Jersey 07105

Written Directions to Hospital from Site:

Depart Doremus Avenue.

Take ramp right for Raymond Blvd;

bear left, then turn right onto US-19 south;

bear right onto Raymond Blvd;

bear left onto Jefferson Street, St. James Hospital is on the right.

FIGURE 1B

ROUTE TO FAMILY HEALTH CLINIC

Metropolitan Family Health Clinic **Distance: 6.6km/ 11 minutes**
(201) 478-5800
935 Garfield Avenue
Jersey City, New Jersey

Written Directions to Urgent Care Facility from Site:

Depart Doremus Avenue;

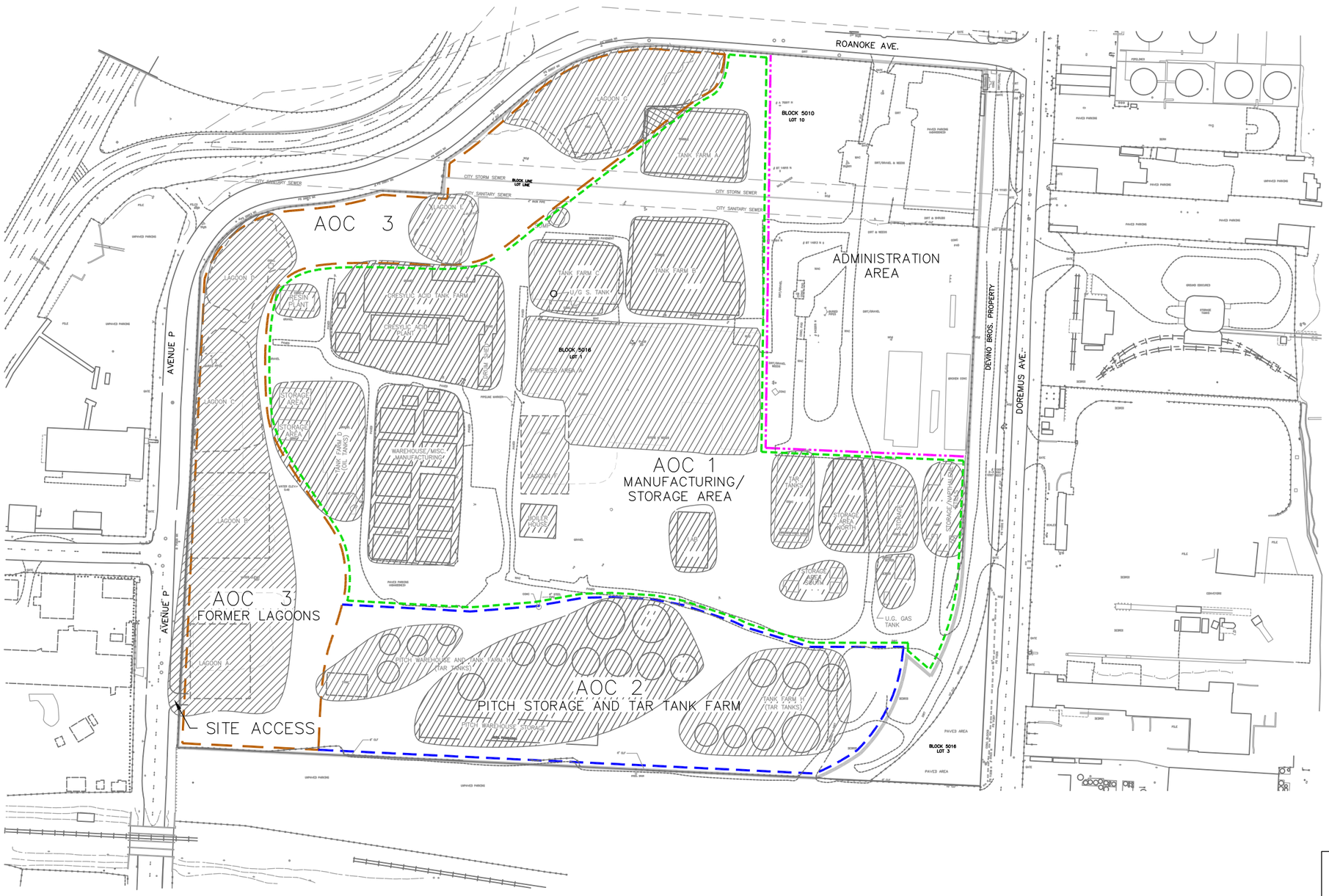
take ramp left and follow signs for US-1 Truck North;

keep straight onto US-19;

keep straight onto Communipaw Avenue;

turn right onto Garfield Avenue;

arrive at 935 Garfield Avenue



LEGEND

PREVIOUS LAGOON AREA–BASED ON 1985 W–CC REPORT

ACTUAL LAGOON AREA–BASED ON AIR PHOTO REINTERPRETATION

AOC BOUNDARY LINES

AOC 1

AOC 2

AOC 3

ADMINISTRATION AREA

200 100 0 200 Feet

Site Layout

Former Pitt Consol Site
Newark, New Jersey

Geosyntec consultants

Guelph | August 2009

Figure **2**

P:\PRJ\Projects\TR0341 - STAR Pitt Consol\AutoCAD\TR0341 F01.dwg

EMERGENCY RESPONSE PROCEDURES

- The Site Health and Safety Officer (SHSO), or designated alternate, should be immediately notified via the on-site communication system. The SHSO assumes control of the emergency response.

- If applicable, the SHSO must immediately notify off-site emergency responders (i.e., fire department, hospital, police department, etc.) and must inform the response team of the nature and location of the emergency on site.

- If applicable, the SHSO calls for evacuation of the site. Site workers should move to their respective refuge stations using the evacuation routes provided on the Site Map (Figure 2).

- For small fires, flames should be extinguished using the fire extinguisher. Large fires should be handled by the local fire department.

- If a worker is injured, the procedures presented in "Instructions for Injury Response", located in the front of this HASP, must be implemented immediately.

- After an incident has stabilized, the procedures presented in "Instructions for Incident Reporting", located in the front of this HASP, must be followed.

EMERGENCY RESPONSE CONTACT INFORMATION

Contact	***Telephone Numbers***		***Date of Pre-Emergency Notification (if required)***
	Office	***Alternate (Type)***	
Fire Department	911		
Police Department	911		
Hospital - St. James Hospital	(973)-589-1300		
Metropolitan Family Health Clinic	(201) 478-5800		
Director of Environment, Health & Safety – *Dale Prokopchak*	(804) 332-6376	Cell (804) 349-8067	
Project Manager - Gavin Grant	(519) 822-2230 Ext. 247	Cell (519) 400-4967	
Environmental, Health & Safety Coordinator - Danielle Rowlands	(519) 822-2230 Ext. 300	Cell (519) 827-1773	
Principal- or Associate-in-Charge - David Major	(519) 822-2230 Ext. 232	Cell (519) 241-8810	
- Michaye McMaster	(519) 822-2230 Ext. 229	Cell (519) 654-6904	
Office Manager - Karan Dixon	(519) 822-2230 Ext. 249		
Utility Emergencies	811		
Field Manager/Site Health & Safety Officer - Mark Watling	(519) 822-2230 Ext. 316	Cell (905) 315-0197	
DuPont Project Manager – John Vidumsky	(302) 999-2850	(610) 291-1123	
DuPont Contact: Brian Ambrose	(302) 999-2518	(302) 528-6553	

Dear Medical Provider:

On behalf of Geosyntec Consultants/MMI Engineering, you are authorized to evaluate and treat the above Geosyntec/MMI employee today for an alleged work-related injury or illness.

Employee Name: _____
Alleged Injury: _____
Date of Alleged Injury: _____
Date of Medical Evaluation: _____

Geosyntec/MMI strives to reduce OSHA recordables; therefore, ***please do not prescribe or dispense prescription medications if OTC medications or non-prescription strength can be used*.** It is our primary interest to ensure this employee returns to work full duty. If a full duty release is not possible, Geosyntec/MMI may be able to find light duty for the **employee**; ***unless it is unavoidable, please do not prescribe lost time.*** We would appreciate it if you would complete the attached form "Physical Status for Return to Work", or a similar form, to assist us in evaluating this employee's work capabilities.

- Please fax a copy of all medical paperwork and "Physical Status for Return to Work Form" to Dale Prokopchak at (804) 332-6732.
- Invoices and supporting medical records should be mailed to:

  Gail Hapeman
  Human Resources Department
  Geosyntec Consultants
  5901 Broken Sound Parkway, NW, Suite 300
  Boca Raton, FL 33487
  Phone: 561.922.1002
  Fax: 561.922.1101

Thank you for your assistance.

Very truly yours,

Dale Prokopchak, CIH, CSP
Director of Environmental Health and Safety

Geosyntec consultants

PHYSICAL STATUS FOR RETURN TO WORK
PLEASE FAX COMPLETED FORM TO DALE PROKOPCHAK AT (804) 332-6732

Employee Name _____ Date of Injury/Illness _____

TO BE COMPLETED BY TREATING PHYSICIAN

Diagnosis _____

I saw and treated this patient on (date) _____ and:

__ Release the patient to full duty with no limitations on (date) _____

__ Patient may return to work with the following limitation on (date) _____ and may work an 8 hr. shift unless specified otherwise.

LIFTING CAPACITY

__ Occasional lifting (10 lbs. max.) and lifting and carrying occasionally. Walking and standing occasionally.

__ Occasional lifting (20 lbs. max.). Significant walking, standing; or sitting with pushing and pulling with arms or legs.

__ Occasional lifting (50 lbs. max.) with frequent lifting and/or carrying up to 25 pounds.

OTHER ACTIVITIES

		SINGLE DURATION					IN AN 8 HOUR DAY PATIENT MAY DO				
LIMITATION	NO LIMITATION	< 1/2 hr	1/2-1 hr	1-2 hr	2-4 hr	4-6 hr	1/2-1 hr	1-2 hr	2-4 hr	4-6 hr	6-8 hr
SIT											
STAND											
WALK											
USE RIGHT HAND											
USE LEFT HAND											

	NO LIMITATION	FREQUENTLY (31%-60%)	OCCASIONALLY (1%.-30%)	NEVER
BEND				
SQUAT				
CLIMB				
REACH OVERHEAD		WEIGHT LIMIT	WEIGHT LIMIT	
REACH SHOULDER		WEIGHT LIMIT	WEIGHT LIMIT	
PUSHING/PULLING		WEIGHT LIMIT	WEIGHT LIMIT	

Other instructions or limitations:

_____

_____

Estimated length of time of modified duty: _____

__ These restrictions are in effect until (date) _____ or until patient is reevaluated on (date) _____

__ Patient is totally incapacitated at this time. Patient will be reevaluated on (date) _____

Physician Signature _____ Date _____

ADDITIONAL NOTES:

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Instructions for Incident Reporting

Once an emergency situation has been stabilized, or within one hour of a non-emergency incident:

- Manager/Supervisor contacts Gail Hapeman in Human Resources, Office: (561) 922-1002, Mobile: (561) 789-6830, with additional details of the incident.

- Within 24 hours, the Manager/Supervisor completes a draft of the "Manager's Report of Incident", located in this HASP and on the EHS website, and sends to Gail Hapeman at (561) 922-1101.

- Manager/Supervisor forwards the finalized paperwork within 48 hours to both EHS (dprokopchak@geosyntec.com); fax (804) 332-6732 and HR (ghapeman@geosyntec.com); fax (561) 922-1101 for review, documentation, and implementation into our case management program.

- Contractors are responsible for compliance with their internal safety procedures regarding Incident Reporting. Geosyntec will document the Contractor's incident in their Project Logbook.

- In the event of a vehicle accident that does not involve injuries, please follow the procedures outlined in EHS 105—Driver Safety.

Contact Information

Dale Prokopchak: office: 804.332.6376 | cell: 804.349.8067 | fax: 804.332.6732 | dprokopchak@geosyntec.com
Ersin Yalcin: office: 678.202.9552 | cell: 404.435.4722 | fax: 678.202.9501 | eyalcin@geosyntec.com
Gail Hapeman: office: 561.922.1002 | fax: 561.922.1101 | ghapeman@geosyntec.com

DRIVER'S REPORT OF ACCIDENT – PAGE 1

Select & Zoom

Driver's Report of Accident

Do not argue at the scene of the accident. Be courteous and show your license willingly.

Your Vehicle

Name of Driver _____

Odometer Reading _____

Vehicle I.D. No. _____

License Plate No. _____ State _____

Place of Accident _____

_____

City/State _____

Direction of Travel _____

Speed _____

Other Vehicle

Name of Driver _____

Address _____

_____

Phone No. _____

Driver's License No. _____

License Plate No. _____ State _____

Vehicle I.D. Number _____

Year/Model _____

Owner of Vehicle _____

Address of Owner _____

_____

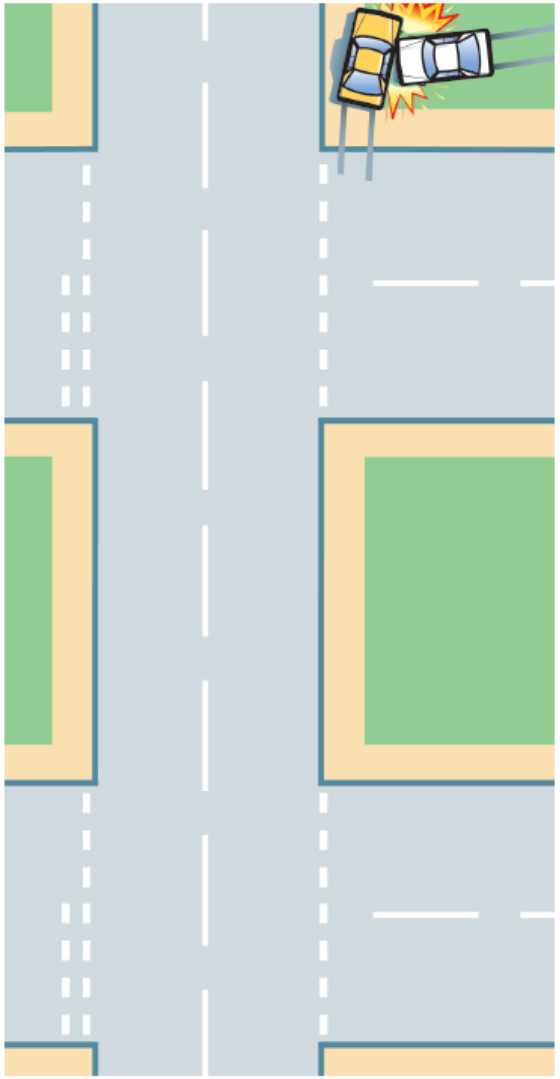
Insured by _____

Direction of Travel _____

Approximate Speed _____

Diagram of Accident

Using the diagram below, show exact relationship of roadways and vehicles at the time of the accident. (Indicate North) Show measurements if possible (identify your vehicle as #1, other vehicles as #2, #3, etc.)



What to do in Case of a **Vehicle Accident**

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DRIVER'S REPORT OF ACCIDENT – PAGE 2

Here is What to do

1. Take precautions necessary to protect the scene of the accident from further accidents.
2. Call police immediately, if someone is injured, request medical assistance. In case of fire, request fire department.
3. If there are any injuries, follow the requirements of the injury, illness, near miss procedure
4. Be courteous. Answer police questions. Give identifying information to the other party involved, but make no comments about assuming responsibility
5. Complete this ACCIDENT REPORT FORM. You will need this information later for state and insurance reports.
6. Report the accident to your immediate supervisor and office manager as quickly as possible. The Office Manager will send the completed form to Natasha Pinkerton of Human Resources: phone (561) 922-1003; fax (561) 922-1101. Human Resources will contact our insurance carrier Marsh: fax (954) 838-3700. If the vehicle accident results in a Geosyntec employee being injured and requiring medical attention, Human Resources will notify both appropriate personnel within their Department and the EHS Department.
7. Take photographs of the damage if it is safe to do so.
8. Do not leave the scene of the accident, until police have arrived or you're being transported by rescue.

Description of Accident

Date _____ Time _____ ○am ○pm

Road Condition _____

Time of Day (check one) ○ Daylight ○ Dawn/Dusk ○ Night

Weather Condition (check one) ○ Foggy ○ Cloudy ○ Clear

Road Surface (check one) ○ Wet ○ Damp ○ Dry

Description _____

Driver's Signature _____

Employer Geosyntec Consultants

Branch Location _____

Branch Phone Number _____

Witnesses

1. Name _____
   Address _____
   Phone _____
2. Name _____
   Address _____
   Phone _____

Police Investigation

Name of Officer _____

Report Number _____

Name of Police Agency _____

Was Summons Issued ○ Yes ○ No

Injured Persons

1. Name _____ DOB: _____
   Address _____
   Nature of Injury _____
2. Name _____ DOB: _____
   Address _____
   Nature of Injury _____

Damage to Property

1. Owner _____
   Address _____
   Damaged _____
   Property _____
   Extent of Damage _____
2. Owner _____
   Address _____
   Damaged _____
   Property _____
   Extent of Damage _____

MANAGER'S REPORT OF INCIDENT

1. Seek immediate medical attention if the injury/illness is serious and/or life threatening.
2. Employee must report all incidents and near misses to their supervisor **immediately**
3. Supervisor must immediately notify the EHS Department at **(804) 349-8067 or (404) 435-4722** with details of the incident, and discuss appropriate medical care for non life threatening injury/illness.

EMPLOYEE INFORMATION

Name: _____ Position: _____

Department #: _____ Employee #: _____ Phone #: _____

Supervisor Name: _____

FACTS OF INCIDENT

☐ Injury ☐ Illness ☐ General Liability ☐ Near Miss Date and Time of Incident: _____

Date and Time Accident Reported: _____ To Whom: _____

Where did the incident occur (location name and street address)? _____

City: _____ State/Province_____ Zip/Postal Code: _____

County _____ Country: _____

What was the employee doing when the incident occurred? Name the tools, equipment or material the employee was handling and what he was doing with them. _____

_____

_____

Explain how the incident occurred. List events leading up to incident, what happened, how it happened and name objects and how they were involved (use a separate sheet if necessary). _____

_____

_____

NATURE OF INCIDENT

Describe incident and indicate body part affected if injury (e.g. cut on middle left finger). _____

_____

_____

Name object or substance that injured the employee._____

_____

Has any prior, related injury to affected area of body occurred while employed at Geosyntec/MMI? ☐ Yes ☐ No

MEDICAL ATTENTION GIVEN (check all that apply)

☐ First Aid given by _____ Date/Time _____ Phone _____

☐ Doctor's Name _____ Date/Time _____ Phone _____

Address _____

☐ Hospital Name _____ Date/Time _____ Phone _____

Address _____

☐ Released ☐ Admitted Length of Stay: _____

Did the employee go to an Emergency Room? ☐ Yes ☐ No

EMPLOYEE'S DESCRIPTION OF THE INCIDENT (IN OWN WORDS)

Describe incident and indicate body part affected (e.g. cut on middle left finger) and what you were doing when the incident occurred (be specific) _____

_____

_____

_____

Explain how the incident occurred. List events leading up to incident, what happened, how it happened and name objects and how they were involved (use a separate sheet if necessary). _____

_____

_____

_____

Employee's Signature _____ **Date**_____

ADDITIONAL INFORMATION (TO BE COMPLETED BY THE MANAGER)

Witnesses

Name: _____ Phone: _____

Name: _____ Phone: _____

What do you believe could be done to help prevent incidents of this type (be specific)? _____

_____

_____

_____

Any additional Comments _____

_____

_____

_____

Manager's Signature _____ **Date**_____ **Phone #:** _____

HR/EHS

OSHA Recordable?: ☐ Yes ☐ No ☐ Pending WC? ☐ Yes ☐ No

Days away from work: _____ Days of restricted work activity: _____ Date returned to work _____

HR Manager's Signature _____ **Date**_____

Comments: _____

EHS Manager's Signature _____ **Date**_____

Comments: _____

Manager must complete this form within 24 Hours of the incident and fax a copy of this report to Human Resources at (561) 922-1011 and EHS at (804) 332-6732

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Appendix C: Hazard Analysis and Hazard Mitigators
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1. SIGNATURES

1.1 Preparers and Reviewers

This HASP, which must be maintained on site when field work is being performed, addresses the health and safety hazards of each phase of site operation, including the procedures and equipment required for worker protection. Only the Site Health and Safety Officer (SHSO) can change or amend this document, in agreement with the Environmental Health and Safety Coordinator (EHSC), and Project Manager. The SHSO must initial any change made to the HASP at the relevant section. Major amendments (e.g., changes in personal protective equipment, addition of tasks, etc.) must be documented in Section 3 and in Appendix A. This HASP must be reviewed and amended on an annual basis for projects lasting more than one year.

Prepared by:	Paul Nicholson	Date
Reviewed by:	Danielle Rowlands, EHSC	Date
Approved by:	Gavin Grant, Project Manager	Date
Approved by: (as needed)	David Major, Principal- or Associate-in-Charge	Date

Copy Cover Sheet to: EHSC

This HASP has been given to the following subcontractor(s) in accordance with the Occupational Safety and Health Administration (OSHA) HAZWOPER Standard, per Chapter 29 of Code of Federal Regulations (CFR), Subsection 1910.120.

Subcontractor: _____ Representative: _____ Date: _____

Subcontractor: _____ Representative: _____ Date: _____

Subcontractor: _____ Representative: _____ Date: _____

1.2 Site Workers

A pre-entry briefing conducted by the SHSO must be held prior to initiating the field work of this project. All sections of this HASP must be reviewed during this briefing. Any worker not in attendance at the initial meeting must be trained by the SHSO on the information covered in the pre-entry briefing. Tailgate meetings must be held at the beginning of each day by the SHSO to discuss important health and safety issues concerning tasks to be performed during that shift. Topics discussed in the tailgate meetings must be documented in a daily field log. Weekly site health and safety audits must be performed and documented by the SHSO for projects lasting more than one week. After reading the HASP and attending a pre-entry briefing, Geosyntec employees must sign the following acknowledgment statement.

"I have read, understand, and agree with the information set forth in this HASP. I have also attended a pre-entry briefing. I agree to perform my work in accordance with this HASP."

Signature	Printed Name	Date

2. DISCLAIMER

This HASP was prepared in accordance with Geosyntec Consultants' Health and Safety Procedures for use by Geosyntec project staff. This plan complies with Geosyntec internal review procedures. Geosyntec does not endorse the use of this HASP by others. This document and its contents should not be used by firms other than Geosyntec or by persons other than Geosyntec employees without a thorough peer review by their health and safety managers. Should the work outlined in this HASP be executed by contractors other than Geosyntec, the HASP should be modified and reviewed to comply with such company's corporate health and safety procedures. In the event that a contractor other than Geosyntec executes this work, the contractor should complete independent analyses of hazards and mitigation measures, and should update all HASP tables, text, figures, and appendices prior to commencing work. Geosyntec assumes no responsibility for the accuracy, content, or health and safety of non-Geosyntec personnel during the implementation of the work in this HASP by other parties.

3. HASP AMENDMENTS

Over the course of this project, it is possible that the project-specific details and working conditions will change. This HASP shall be reviewed and amended as necessary to effectively describe the changing working conditions and to mitigate the potential health and safety issues that may arise during the project. Amendments to the HASP should be briefly described in the following spaces provided. The full text of the amendments should be provided in Appendix A.

AMENDMENT 1:

Date: October 23, 2009 Project Manager: _____ EHSC:
Brief description of amendment:

- Updated air monitoring to include current on-site monitoring of carbon monoxide within staff trailer, SVE trailer and during sampling activities

AMENDMENT 2:

Date: April 1, 2010 Project Manager: _____ EHSC:
Brief description of amendment:

- Removed task 2 "Pilot Test Operation" and added additional tasks related to Phase 2 activities, including, modifications to the pilot test area, heater setup, startup and equipment testing, and daily operations. Also added Appendix H:

Unexpected Occurrence Report associated with the shock and spark incident on October 19, 2009.

AMENDMENT 3:

Date: June, 2010 Project Manager: _____ EHSC:
Brief description of amendment:

- Added use of ground fault circuit interrupter (GFCI), and the use of an electrical hazard mitigator and updated Table 2. Changed Appendix H to "Electrical Control Plan" to include PPE for electrical work, Lockout/Tag out information on select equipment and included Unexpected Occurrence Report. Added Lockout/Tag out hazard mitigator to App C.

AMENDMENT 4:

Date: May 15, 2012 Project Manager: _____ EHSC:
Brief description of amendment:

- Updated emergency contact form and route to hospital figure, revised Tasks 1 and 2 include details associated with installation and instrumentation of the pilot test area and installation of the STAR process equipment for the Phase III pilot testing.

4. SITE/TASK DESCRIPTION

The following is a brief description of the site, including information as to the location, approximate size, previous usage, and current usage. A description of the tasks to be performed is also presented.

- Site Location: 191 Doremus Avenue
- Approximate Size of Site: 37 acres
- Previous Site Usage: Manufacturing Facility
- Current Site Usage: Columbia Container Services
- Description of Surrounding Property/Population:

North	Roanoke Avenue	East	Devino Brothers Metal Recycling
South	Nimco Shredding Company	West	Ashland Chemical Company

- Summary of previous site investigations (if available/applicable):

The Pitt-Consol Site has been an industrial Site from the late 1800s. From the late 1800s until 1983, the facility manufactured road tar, cresols, phenols, and cresylic acid. In 1983, all manufacturing at the Pitt-Consol Site was discontinued. Dismantling of all production facilities was completed by January 1986. Currently, the Site is used for container storage. Numerous subsurface investigations have been performed at the Site that have identified extensive contamination in shallow soil at several locations on Site. A coal tar-like DNAPL has been identified in the intended vicinity of the pilot test area at a depth of 5 to 10 feet below ground surface.

The Site is underlain by four major unconsolidated units which in turn overlie a reddish brown shale bedrock unit (Brunswick Shale) at approximately 65 to 70 feet below ground surface. Unconsolidated units in ascending order (from bedrock to ground surface), consist of a glacially derived silty clay confining unit; a fine to coarse water bearing sand unit (referred to as the deep water bearing unit); a semi-confining silty organic clay and peat layer; a heterogeneous, unconsolidated, water bearing fill unit (target unit of pilot test); and a geo-membrane and crushed gravel cap. Groundwater is often encountered within the first foot below ground surface. Both water bearing units discharge to the Passaic River to the east.

- Task Descriptions:

Task 1: Drilling/ Well Installation/ Sampling

Task 1 involves the preparation and initial instrumentation of the pilot test area. This task will include excavation activities and drilling activities for the purpose of collecting baseline soil samples, and to install pilot test air injection and ignition wells, thermocouple probes, and soil vapor monitoring probes. A backhoe will be used to remove the fill material to and including the existing geomembrane (approximately 1-2 feet below ground surface). Drilling activities will be completed using sonic and direct push drilling techniques. Hazards associated with this task include potential encounters with sub surface utilities, working around heavy equipment (backhoe and drill rigs), potential contact with highly contaminated (DNAPL saturated) soils and subsequent vapors, slips, trips and falls, and potential contact with stored energy.

Task 2: Pilot Test Area Construction and Installation of STAR Process Equipment

Task 2 involves construction of the pilot test area and installation of the STAR process equipment. This task will include installation electrical resistive tomography electrodes, a clear stone layer, and vapor collection piping, installation of wellheads and collars, construction of a concrete platform, and installation and instrumentation of the air injection and soil vapor extraction systems (e.g., air compressors, air injection piping, blowers, knock-out tank, blowers, carbon vessels, ducting, etc.). Hazards associated with this task include potential encounters with sub surface utilities, working around heavy equipment (drill rigs, crane for moving large equipment and installing stack), potential contact with highly contaminated (DNAPL saturated) soils and subsequent vapors, slips, trips and falls, and potential contact with stored energy.

Task 3: Heater Testing

Task 3 involves the testing of the down-hole well heaters. The heaters will be briefly tested above ground to ensure proper operation and then will be installed into the ignition wells for the start of the test. Hazards associated with this task include potential to encounter hot surfaces, energized systems, and potential contact with highly contaminated (DNAPL saturated) soils and subsequent vapors, slips, trips and falls, and potential contact with stored energy.

Task 4: Startup and Equipment Testing

Task 4 involves equipment and air flow testing including the baseline flow testing of the onsite equipment. Hazards associated with this task include potential to encounter hot surfaces, energized systems, potential contact with contaminated discharge gases, slips, trips and falls, and potential contact with stored energy.

Task 5: Daily Operation

Task 5 involves the daily maintenance and operation of the system. Once ignition has occurred vapors will be collected by the extraction system. This task includes the collection of samples for permit compliance and system monitoring, personal air montirong, calibration of system components, reviewing recorded data and the ongoing operation of system components. Following completion of the pilot test, soil samples will be collected for the purpose of evaluating the performace of the technology. This task will include drilling activities for the purpose of collecting post-pilot soil samples. Hazards include the potential to encounter hot surfaces, energized systems, and potential contact with contaminated discharge gases, compressed gases, slips, trips and falls, potential contact with stored energy, potential encounters with sub surface utilities, working around heavy equipment (drill rigs), and potential contact with highly contaminated (DNAPL saturated) soils and subsequent vapors.y

5. KEY PERSONNEL AND HEALTH AND SAFETY RESPONSIBILITIES

Table 1 lists project personnel and their responsibilities in regard to health and safety concerns on this project.

6. WORKER TRAINING

Table 2 presents the training and medical monitoring that project personnel have received in accordance with the company Environmental, Health, and Safety (EH&S) Training Program. Pre-entry briefings and daily tailgate meetings shall also be conducted to facilitate site-specific training.

7. MAPS AND SITE CONTROL

7.1 Routes to Hospital and Urgent Care Facility

A hospital and an urgent care facility near the site have been identified. Figure 1A presents the route to the hospital, for emergency care. Figure 1B presents the route to an urgent care facility, for non-emergency care. Both figures also include the facility name, phone number, and written directions from the site. The figures are included at the front of this HASP.

7.2 Site Map

A site map is presented on Figure 2, located inside the cover of this HASP. The site map is intended to show the location of the work zone(s), to provide on-site orientation, and to delineate evacuation routes. Changes may be made to the site map by the SHSO based on changing site conditions. The site map should be accessible in the work area.

7.3 Buddy System

The buddy system is required for all tasks. The buddy system includes maintaining regular contact with onsite Geosyntec personnel, clients, and/or contractors to periodically check on the condition of site workers. In situations when only one employee is performing field work, on-site personnel must have appropriate communication devices on his/her persons at all times and shall maintain contact with off-site personnel. The field worker must communicate with off-site personnel, at a minimum, of three times daily: (1) upon arriving at the site; (2) midway through the work day; and (3) upon departing from site.

7.4 Controlled Work Zones

APPLIES TO TASK: ☒① ☒② ☒③ ☒④ ☒⑤ ☐⑥ ☐⑦ ☐⑧ ☐ Not Applicable

Three controlled work zones, including an Exclusion Zone, a Contaminant Reduction Zone (CRZ), and a Support Zone, are required for the task(s) indicated above. The Exclusion Zone is defined as the area on site where contamination is suspected and tasks are to be performed. For the Pilot test the exclusion zone will include the concrete work platform (pilot test area) and the process equipment area. The CRZ is defined as the area where equipment and workers are to be decontaminated as they leave the Exclusion Zone. The Support Zone is defined as the command area and may serve as a staging and storage area for supplies and will consist of the personnel trailer. The location and extent of the work zones may be modified as necessary as site investigation information becomes available. All areas will be within the security fence area that surrounds the pilot test area and equipment.

The boundaries of the Exclusion Zone, CRZ, and Support Zone or the Work Zone shall be marked using the following methods:

☒ Warning tape ☐ Traffic cones
☒ Signs ☒ Fence
☐ Other: _____

7.5 Site Access

Access to the site must be controlled using the following method:

☐ Sign in/Sign out log ☐ Guard
☐ Identification badges ☒ Check in with SHSO
☐ Other: _____

7.6 Visitors

Visitors to the site may need to be continually escorted for safety purposes. Geosyntec employees must not be allowed into the CRZ or Exclusion Zone or the Work Zone until they have received the proper personal protective equipment (PPE) and they have read, understand, and meet the requirements outlined in this HASP. Other visitors under Geosyntec's direction (subcontractors, etc.) may review this HASP for site familiarity, but they are ultimately responsible for their own health and safety (see disclaimer in Section 1).

7.7 Safe Work Practices

General Safe Work Practices that must be implemented during work activities at this site are listed in Table 3.

7.8 Inspections

For projects with field components lasting longer than one week, the SHSO must conduct periodic health and safety inspections. The inspections must be documented using the Health & Safety Inspection Checklist, presented in Appendix B. The Health & Safety Inspection Checklist records should be kept on file at the project site.

The requirement for periodic inspections is:

☐ Not Applicable
☐ Applicable, and the frequency shall be:
- ☒ Weekly
- ☐ Bi-Weekly
- ☐ Monthly

8. HAZARD ANALYSIS AND MITIGATORS

Site specific hazards have been identified through a hazard analysis. Hazard analysis included a review of chemical, physical, and biological hazards. The analysis also identified health and safety hazard mitigators needed to protect workers, which are presented in Appendix C.

8.1 Chemical Hazards

Potential exposure pathways to chemical health hazard agents include inhalation, dermal exposure, and/or ingestion. To effectively manage risk to exposure, constituents of concern (COCs) have been identified. Potential exposure to these COCs will be mitigated through engineering, administrative, and/or PPE controls. The COCs are documented and/or suspected materials present based on previous operations/activities. The identified COCs for this project are listed in Appendix D with appropriate hazard information, including signs of exposure. Hazard Mitigators, which include control measures and methods to minimize exposure, are presented in Appendix C. Also, airborne levels of COCs may be estimated or measured to evaluate levels of PPE that will be required for individual tasks. The type(s) of air monitoring to be performed are discussed in Section 9.

8.2 Physical Hazards

Physical hazards due to the tasks to be performed (e.g., electrocution and hot surfaces, etc.) and due to the site setting and condition (e.g., slips, trips, or falls due to rocky terrain, etc.) were analyzed. Hazard mitigators for each physical hazard identified are presented in Appendix C. These hazard mitigators must be implemented for each task in which they are applicable, as summarized in the table in Appendix C.

The electrical components of the Pilot test equipment operate at higher than normal voltage (up to 480 V). Therefore, additional information about electrical systems has been added to the electrical and portable hand tools hazard mitigators. In addition, a lockout/ tag out system will be implemented.

To further address the electrical components of this project, and Electrical Control Plan has been added as Appendix H. This plan identifies how to lockout/ tag out specific equipment as part of the pilot test operation and includes a table on PPE requirements for the energized systems involved.

Two hazard mitigators have been added to this HASP specifically related to this project. Telelift forklift use has been added as this equipment will be used to lift equipment and install the stack for the air treatment system. A hazard mitigator has also been added to address the potential for personnel to come into contact with hot surfaces and use of the heating element.

8.3 Biological Hazards

Biological hazards (e.g., allergic reactions to poisonous plants or insects indigenous to the area, etc.) associated with tasks to be performed were analyzed. Hazard mitigators for each biological hazard identified are presented in Appendix C. These hazard mitigators must be implemented for each task in which they are applicable, as summarized in the table in Appendix C.

9. AIR MONITORING

APPLIES TO TASK: ☒① ☒② ☒③ ☒④ ☒⑤ ☐⑥ ☐⑦ ☐⑧ ☐ Not Applicable

Air monitoring will be performed to evaluate airborne exposure levels associated with the COCs on site within the breathing zone of site workers. Hazardous conditions may include concentrations that may cause acute or chronic illness, potential oxygen deficient environments, or potential explosive environments. Air monitoring may also be performed to evaluate the adequacy of engineering, administrative, and/or PPE controls.

Air monitoring may be "real-time" (e.g., the instrument provides immediate results at the project), using multi-gas meters, photoionization detectors (PIDs), or colorimetric tubes. "Non-real-time" monitoring may also be performed by collecting samples and forwarding to a laboratory for analysis and quantification.

The type(s) of air monitoring equipment required to evaluate COCs is outlined in Appendix E. Monitoring equipment must be calibrated based on the manufacturer's requirements. Calibration results and air monitoring measurements must be documented. Based on the results noted and site activities or scope of work changes, the frequency of air monitoring may be adjusted on site by the SHSO with the consent of the Project Manager and communication with the EHSC.

10. PERSONAL PROTECTIVE EQUIPMENT

The levels of PPE required for each task are presented in Appendix F in addition to PPE required for energized systems in Appendix H. Required equipment and types of protective clothing materials, as well as an indication of the initial level of protection to be utilized, are listed. The level of protection may be upgraded or downgraded by the SHSO according to mitigation measures required in Appendix C or according to action guidelines provided in Appendix E. The PPE levels that are implemented must be documented in a daily field log.

If respirators are worn, workers must abide by the company's Respiratory Protection Program in accordance with 29 CFR §1910.134. Table 2 provides a record of the last fit test for each site worker that may be required to wear a respirator. Fit tests are valid for a period of one year. Persons with facial hair that may interfere with the respirator seal may not wear respirators.

11. DECONTAMINATION

The SHSO and Project Manager will determine the type and level of decontamination procedures for both personnel and equipment based on evaluation of specific work activities in the controlled work zones. In an emergency, the primary concern is to prevent the loss of life or serious injury to personnel. Medical treatment will take precedence over decontamination in the event of a life threatening and/or serious injury/illness. Personnel will perform decontamination in designated and identified areas upon leaving "hot zones" where the potential exists for exposure to hazardous chemical, biological, or environmental conditions.

Decontamination of personnel in Level D (modified) will consist of closure and disposal of coveralls, disposable boots, and gloves, (if applicable).

Decontamination of personnel in Level C, if applicable, will consist, at a minimum, of:

- Removal and cleaning/disposal of boot covers, coveralls, and outer gloves;
- Removal, cleaning, and storage of respiratory protection;
- Washing of boots or other non-disposable PPE (e.g., hard hat, safety glasses/goggles, etc.) suspected of being contaminated using a soap solution followed by a water rinse; and
- Removal and disposal of inner gloves.

Wash solutions and PPE may require disposal at a licensed waste facility. Hand tools and sampling equipment shall be decontaminated as needed by washing in decontamination basins with appropriate solutions, or, if possible, by dry decontamination.

12. EMERGENCY PREPAREDNESS AND RESPONSE

A table presenting a list of contacts and telephone numbers for the applicable local off-site emergency responders is provided inside the front cover of this HASP (after figures). If the nature of the site work and COCs requires that off-site responders be notified before work begins on this project, the date that the pre-notification was made is presented in the table.

The following emergency response equipment is required for this project:

☒ First Aid Kit
☒ Fire Extinguisher (Type ABC)
☐ Eyewash bottle
☐ Other: _____

In the event of an injury to an employee, the Instructions for Injury Response, located in the front of this HASP, must be implemented immediately. 'Tear-out' forms are located after the Instructions for Injury Response. If professional medical attention is required, these forms must be provided to the medical provider at the time the medical attention is administered. Injury reporting is required per the procedures presented on the Instructions for Incident Reporting, also located in the front of this HASP.

In the event that an emergency develops, the procedures delineated in the Emergency Response Procedures, located in the front of this HASP, are to be followed immediately.

(Note that an emergency does not necessarily include an injury.) After the emergency is resolved, post-incident reporting is required per the procedures presented on the Instructions for Incident Reporting, also located in the front of this HASP.

13. CONFINED SPACE ENTRY

☐ APPLICABLE ☒ NOT APPLICABLE

The task(s) for this project involve confined-space entry. Workers must abide by the company's Confined Space Entry Program [29 CFR §1910.120(j)].

14. SPILL CONTAINMENT

☒ APPLICABLE ☐ NOT APPLICABLE

The task(s) for this project involve handling of drums and/or containers that contain stored chemicals and/or wastes associated with sampling, excavation, transportation, etc. Workers must implement the hazard mitigating procedures for drum/container handling presented in Appendix C.

15. CHEMICAL HAZARD COMMUNICATION LABELING

☒ APPLICABLE ☐ NOT APPLICABLE

The following procedures must be followed for chemicals brought onto the site by Geosyntec personnel (i.e., decontamination solution, sampling preservatives, KB-1 solution, sodium permanganate, etc.) while performing the tasks of this project:

- Labels on primary chemical containers must not be defaced.
- Chemical containers must be stored in appropriate storage containers.
- Secondary containers and storage cabinets must be correctly and clearly labeled using the Hazardous Materials Identification System (HMIS).
- Chemicals incompatible with each other must not be stored together.
- Workers must receive training on the chemical hazards.
- Material Safety Data Sheets (MSDSs) for the chemical must be added to Appendix G.

When chemicals are used on site, workers must abide by Geosyntec's Hazard Communication Program.

Table 1

Key Personnel and Health & Safety Responsibilities

Principal-in-Charge or Associate-in-Charge David Major/Michaye McMaster	***Project Manager (PM)*** Gavin Grant	***Site Health & Safety Officer (SHSO)*** Mark Watling	***Project Personnel*** Refer to Table 2	***Environmental, Health & Safety Coordinator (EHSC)*** Danielle Rowlands
• Approve this HASP and amendments, if any. • Verify that elements of this HASP are implemented.	• Approve this HASP and amendments, if any. • Monitor the field logbooks for health and safety work practices employed. • Coordinate with SHSO so that emergency response procedures are implemented. • Verify that corrective actions are implemented. • Verify and document that personnel receive this plan and are aware of its provisions and potential hazards associated with site operations, and that they are instructed in safe work practices and familiar with emergency response procedures. • Provide for appropriate monitoring, personal protective equipment, and decontamination materials.	• Prepare and implement project HASP and amendments, if any, and report to the Project Manager for action if any deviations from the anticipated conditions exist and authorize the cessation of work if necessary. • Verify that site personnel meet the training and medical requirements. • Conduct pre-entry briefing and daily tailgate safety meetings. • Verify that all monitoring equipment and personal protective equipment is operating correctly according to manufacturer's instructions and such equipment is utilized by on-site personnel. Calibrate or verify calibration of all monitoring equipment and record results. • Verify that decontamination procedures are being implemented. • Implement site emergency response and follow-up procedures. • Notify the EHSC in the event an emergency occurs. • Perform weekly inspections.	• Provide verification of required health and safety training and medical surveillance prior to arriving at the site. • Notify the SHSO of any special medical conditions (e.g., allergies). • Attend pre-entry briefings and daily tailgate safety meetings. • Immediately report any accidents and/or unsafe conditions to the SHSO. • Be familiar with and abide by the HASP. • Be ultimately responsible for his or her own safety.	• Review and audit HASP and amendments. • Maintain a copy of the cover sheet of each completed HASP. • Notify Director of Environment, Health & Safety in the event an emergency occurs. • Assist with the implementation of the corporate health and safety program. • Consult on health and safety issues.

Geosyntec consultants

Geosyntec Consultants Inc.,

5/23/2012 5:08 PM

Table 2

Training / Medical Surveillance / Respirator Fit Test Records

	Employee name	Category	Initial 40 Hour	Initial 24 Hour	Annual 8 Hour Refresher	8 Hour Supervisor	CPR	First Aid	Medical Surveillance	Annual Respirator Fit Test	Other
	BINGHAM, WILLIAM	I	6/15/1990		11/11/2011	5/15/1997	1/30/2012	1/30/2012	11/4/2011		12/21/2011
	BRISMAN, JARED				5/2/2012						
	DOUGLAS, SCOTT	I	12/11/2008		5/2/2012				3/25/2009		
	GRANT, GAVIN	IV	1/19/2006		2/1/2012	7/9/2001	7/16/2008	1/26/2001			
	HYATT, RUSSELL		2/26/2011		5/2/2012						
	JO, LUANA	II	4/14/2008		2/1/2012		11/3/2010	11/3/2010	1/10/2011		
	LIEFL, DAVID	II	5/9/2008		2/1/2012		10/4/2011	10/4/2011	4/28/2008		
	MAJOR, DAVID	IV	1/27/2000		4/9/2001		6/20/2002	6/20/2002			
	MRAW, MATTHEW		10/28/2011		5/2/2012		6/3/2011	6/3/2011			
	PROBASCO, PAUL		9/13/2002		5/2/2012				7/15/2010		
	SCHOLES, GRANT	II	11/14/2003		2/1/2012	2/5/2004	11/3/2010	11/3/2010	1/23/2012	8/11/2009	
	WATLING, MARK	II	11/25/2004		2/1/2012	1/26/2005	7/22/2008	7/9/2007	2/23/2011	8/11/2009	12/5/2011

Footnotes:

1 CPR Refresher: every year; First Aid Refresher: every three years.

2 Annual Medical Surveillance for EH&S Category I, Biannual Medical Surveillance for EH&S Categories II & III.

3 For EH&S Categories I & II Only.

4 Could Include task-specific training, project-specific training, or project-specific medial surveillance.

Table 3

General Safe Work Practices

- Minimize contact with impacted materials. Do not place equipment on the ground. Do not sit or kneel on potentially contaminated surfaces.
- Smoking, eating, or drinking after entering the work zone and before decontamination is not allowed. Employees who are suspected of being under the influence of illegal drugs or alcohol will be removed from the site. Workers taking prescribed medication that may cause drowsiness shall not operate heavy equipment and are prohibited from performing tasks where Level C or B personal protective equipment is required.
- Practice good housekeeping. Keep everything orderly and out of potentially harmful situations.
- Use of contact lenses may not be allowed under certain hazardous working conditions.
- The following conditions must be observed when operating a motor vehicle.
  - Wearing of seat belts is mandatory
  - The use of headlights is mandatory during periods of rain, fog, or other adverse weather conditions
  - A backup warning system or use of vehicle horn is mandatory when the vehicle is engaged in a backward motion
  - All posted traffic signs and directions from flagmen must be observed
  - Equipment and/or samples transported in vehicles must be secured from movement
  - The use of vehicles acquired by Geosyntec by non-Geosyntec personnel is prohibited
- In an unknown situation, always assume the worst reasonable conditions
- Be observant of your immediate surroundings and the surroundings of others. It is a team effort to notice and warn of dangerous situations. Withdrawal from a hazardous situation to reassess procedures is the preferred course of action.
- Conflicting situations may arise concerning safety requirements and working conditions. These must be addressed and resolved rapidly by the SHSO and PM to relieve any motivations or pressures to circumvent established safety policies.
- Unauthorized breaches of specified safety protocol must not be allowed. Workers unwilling or unable to comply with the established procedures must be discharged.

Appendix A

HASP Amendments

Discuss details of amendments to this HASP here. Include amendment number, date, and details of amendments.

October 23, 2009 amendments were made to update the on-site air monitoring to include the monitoring of carbon monoxide within the staff trailer, SVE trailer and during sampling activities

April 1 2010 amendments were made to include updated tasks associated with the Phase 2 operation of the STAR system. Operation of the system was separated into individual components to identify hazards associated with the operation of the heating element, ignition and start up of the system and the daily operation of the system. Site contacts were updated to include Parsons and DuPont Health and Safety representatives and MSDS sheets were updated. In addition, the previous incident report of a site employee receiving a shock while exchanging and air hose during the Phase 1 pilot test was added as an attachment.

June, 2010 amendment:
added use of GFCI, and the use of to electrical hazard mitigator and updated Table 2. Changed Appendix H to “Electrical Control Plan” to include PPE for electrical work, Lockout/Tag out information and included Unexpected Occurrence Report. Added Lockout/Tag out hazard mitigator to App C.

May 2012 amendment:
HASP was updated to include details associated with the Phase III pilot test. Task 1 was revised to include excavation and drilling activities. Task 2 was revised to include construction of the pilot test area and installation of the STAR process equipment. Updated emergency contact form and route to hospital figure.

Geosyntec consultants

Appendix B

Health & Safety Inspection Checklist

Project: _____ Date: _____

Inspected by: _____

Category	***Observations/Corrective Actions (N/A, if Not Applicable)***
Pre-entry briefing records are current	
Tailgate meeting records are current	
Training/medical surveillance/respiratory protection records are current	
Site map is posted	
Buddy system is implemented	
Work zones are identified	
Site access is controlled	
Visitors are being escorted	
On-site/off-site communications are in working order	
Safe work practices are being implemented	
Any additional hazards incurred?	
Air monitoring equipment is in working condition	
Air monitoring records are being recorded in field logbook	
Air monitoring calibration records are being recorded in field logbook	
PPE storage area is neat and organized	
Standard operating procedures are being implemented	
Housekeeping at decontamination zone is appropriate	
Decontamination procedures are being implemented	
Emergency response equipment is in working condition	
Route to hospital is posted	
Confined space entry program is being implemented	
Spill containment equipment is available	
Chemical inventory is up to date	
Material safety data sheets are available	
Primary and secondary containers are properly labeled	
Housekeeping at the chemical storage area is appropriate	

Appendix C

Hazard Analysis and Hazard Mitigators

TASKS	
① Drilling/ Well Installation/ Sampling	⑤ Daily Operation
② Pilot Test Area Construction and Installation of STAR Process Equipment	⑥
③ Heater Testing	⑦
④ Startup and Equipment Testing	⑧

TASK #	①	②	③	④	⑤	⑥	⑦	⑧
I. Chemical Hazards								
Fire	X	X	X	X	X			
Permanganate Handling								
Reactivity	X	X	X	X	X			
Skin absorption	X	X	X	X	X			
II. Physical Hazards								
Bioaugmentation Culture Handling								
Boating								
Chainsaw								
Cold Stress								
Compressed Gas Cylinder	X	X		X	X			
Downhole Logging	X				X			
Drilling (including Indoor)	X				X			
Drum and Container Handling	X				X			
Electrocution	X	X	X	X	X			
Excavation/Trenching	X							
Eye Injury	X	X	X	X	X			
Fall Protection		X						
Flash Flood								
Hand/Foot Injury	X	X	X	X	X			
Heat Stress	X	X	X	X	X			
Heavy Equipment	X	X			X			

TASK #	①	②	③	④	⑤	⑥	⑦	⑧
Hot Surfaces			X		X			
Knives / Blades	X	X		X	X			
Lifting Heavy Loads	X	X	X	X	X			
Lockout/Tagout		X	X	X	X			
Loud Noise	X	X		X	X			
Nuclear Gauge Radiation Exposure								
Portable Power/Hand Tool	X	X	X	X	X			
Slips, Trips, and Falls	X	X	X	X	X			
Thoroughfares								
Telelift Forklift		X						
Urban Environments								
Utility Protection	X	X			X			
Welding and Cutting	X	X			X			
Other:								
III. Biological Hazards								
Allergic Reaction to Poisonous Plants								
Alligators								
Dogs								
Stinging Insects / Vermin / Snakes	X	X	X	X	X			
Medical Waste								
Mountain Lions								
Other:								

An X in a box indicates that the listed hazard is applicable to the respective task. The appropriate Hazard Mitigators are presented in this Appendix.

FIRE

- Know fire prevention procedures, fire-fighting techniques and essential precautions to prevent injury.
- Do not stop to get anything out of a building or area if evacuation is required. JUST GET OUT - and assemble in the predetermined evacuation assembly points.
- There are 3 elements to starting a fire: a fuel source, an oxygen source and a point of ignition.
- Know how and when to use different types of fire extinguishers.
- Keep all fire extinguishers in workable condition and accessible at all times. Access to or visibility of extinguishers shall not be obstructed.
- Control static electricity (e.g., ground equipment)
- Remove only the minimum required supply of paints, solvents, or other flammables from storage. At no time shall the quantity removed exceed one day's working supply.
- Do not allow combustible products of rubbish, waste or other residues to accumulate. Oil soaked rags and material subject to spontaneous combustion shall only be stored in non-combustible containers with self-closing lids.
- Do not store gasoline, flammable solvents, and liquids inside a building unless the structure has been approved for flammable storage containers. Only OSHA-approved storage cabinets shall be used for all flammable liquids, paints or solvents.
- Flammable liquids shall be stored in locations that will not interfere with evacuation of the area in case of a fire.
- Do not permit smoking, striking of matches, or other sources of ignition outside of designated "SMOKING" areas.
- Discard cigarette butts, matches or other similar materials in non-combustible containers.

-

REACTIVITY

- Be aware of the chemical properties (e.g., air reactive, water reactive) of the constituents of concern at the site.
- Be aware of incompatibilities between contaminants of concern at the site.
- Be aware of incompatibilities between chemicals that you bring onto the job site (e.g., decontamination solutions, sample preservatives, etc.) and the chemicals of concern at the site.
- Do not store incompatible chemicals together.
- Be aware of the reactivity of chemicals with storage containers, hoses, gloves etc.
- Make sure your spill containment and fire fighting materials are compatible with your chemicals of concern and chemicals stored on site.
- Be aware of first aid treatments required if exposed to chemicals of concern at the site or chemicals brought to the site.
- Use segregation techniques when performing drum handling activities.

SKIN ABSORPTION

- Be aware of chemicals of concern that can directly injure (corrode, burn, dehydrate) the skin or that can be absorbed into the bloodstream and subsequently transported to other organs from dust, liquid or vapor sources.
- Know that skin absorption is enhanced by abrasions, cuts, heat, and moisture.
- Do not wear contact lenses in contaminated atmospheres (since they may trap chemicals against the eye surface). The eye is particularly vulnerable because airborne chemicals can dissolve in its moist surface and be carried to the rest of the body through the bloodstream (capillaries are very close to the surface of the eye).
- Keep hands away from face.
- Minimize contact with liquid and solid chemicals.
- Wear protective clothing (e.g., suits and gloves) as specified by the Site Specific Health and Safety Plan.

COMPRESSED GAS CYLINDER

- Keep cylinder valve caps screwed on at all times when regulators and gauges are not attached to the cylinder and when the cylinder is being moved.
- Do not use force to remove valve cap if stuck.
- Protect cylinders from cuts and abrasions.
- Use extreme care not to drop cylinders.
- Secure cylinders in an upright position using chains or other approved restraints.
- Do not use cylinders for rollers or support.
- Do not tamper with cylinder valves or safety devices.
- Do not lift cylinders using the protective valve caps.
- Do not substitute oxygen for compressed air.
- Store all oxygen cylinders at least 20 feet from all fuel gas cylinders and gasoline or diesel storage tanks.
- Keep cylinders away from exposure to open flame.
- Do not use oil or grease on oxygen cylinders or regulator connections to avoid an explosion.
- All cylinders must be labeled and indicate when they have been emptied.
- Check all valves and fittings on a cylinder for leaks with each use. If leakage is found, place a tag on the cylinder indicting the defect, and report it to the SHSO.
- Leak test all connections using soap solution where possible.
- Be certain that the second stage of the regulator is closed, after attaching the regulator to the cylinder, but before opening the cylinder valve.
- Stand to one side of the regulator gauge while you slowly open the cylinder valve 1/4 of a turn.
- Keep wrench on the valve stem of an acetylene cylinder when in use.
- Close the cylinder valve and bleed the pressure off hoses on cylinders when not in use.
- Use a cylinder cart to transport cylinders distances greater than 2 feet.

DOWNHOLE LOGGING

- All members of the drilling crew shall be trained in the safety features and procedures to be utilized during operation, inspection, and maintenance of the equipment.
- Set up equipment on stable ground. Cribbing (a system of timbers, arranged in a rectangular pattern, used to support and distribute the weight of the equipment) shall be used when necessary.
- Potentially unsafe shafts SHALL NOT be entered.
- A cage with a solid plate on top shall always be used when downhole logging. Wear hard hats, steel-toed boots, and eye protection at all times in case of falling debris.
- Be sure equipment (including the cage and lights) are in good working condition and the hoist line is free of rust/wear before lowering the downhole logger.
- The boring is a confined space. The Geosyntec Confined Space Entry Program must be followed strictly.
- Prior to entry into a shaft, air monitoring shall be conducted to ensure that the shaft does not contain dangerous air contamination or an oxygen deficiency. This monitoring shall continue for the duration of the logging.
- Be sure the air line is operational before beginning downhole logging work (if required). If supplied air is used it must be certified for breathing use purposes.
- The downhole logger shall wear a full safety harness at all times when performing logging activities and shall be tethered directly to the hoist line, separate from the cage.
- A 12-inch to 18-inch diameter steel cone-shaped headguard/deflector will be attached to the hoist cable above the harness.
- Workers will be in continuous verbal contact with the downhole logger to provide surveillance of his/her conditions while logging is carried out. Any sign of changes in verbal communication of the logger, he/she will immediately be lifted to the surface.
- All wells, shafts, caissons, etc shall be barricaded or securely covered when not in use.
- Surface personnel should keep back from the mouth of the boring to prevent rocks and other debris from falling into the hole.
- Monitor weather conditions. Operations shall cease during electrical storms or when electrical storms are imminent.

DRILLING (Including Indoor)

- All members of the drilling crews shall be trained in the standard operating safety features and procedures to be utilized during operation, inspection, and maintenance of the equipment.
- Wear hard hats, steel toed boots, hearing protection and safety glasses at all times when performing drilling operations.
- Conduct a survey, prior to bringing drilling equipment to the job site, to identify overhead electrical hazards, potential subsurface hazards, and terrain hazard. Once on site, before drilling equipment is moved, the travel route shall again be visually surveyed for overhead and terrain hazards. Document possible hazards and communicate them to the drilling crew.
- Use only drilling equipment equipped with two easily-accessible emergency shutdown devices, one for the operator and one for the helper. Shutdown devices should be tested at the beginning of each day.
- Do not transport drilling equipment with the mast in the upward position.
- Extend outriggers per the manufacturer's specifications.
- Monitor weather conditions. Operations shall cease during electrical storms or when electrical storms are imminent.
- Wearing of loose clothing (e.g., open shirts, hooded sweatshirts, etc) is not permitted.
- When appropriate use auger guides on hard surfaces.
- Verbally alert employees and visually ensure employees are clear from dangerous parts of equipment prior to starting or engaging equipment.
- Channel the discharge of drilling fluids away from the work area to prevent the ponding of water.
- Use hoists only for their designed intent. Hoists shall not be loaded beyond their rated capacity. Steps shall be taken to prevent two-blocking of hoists (the condition when the lower load block or hook assembly comes in contact with the upper load block, or when the load block comes in contact with the boom tip). Follow the equipment manufacturer's procedures if ropes become caught in, or objects are pulled into a cathead.
- Do not run or rotate drill rods through rod slipping devices. No more than 5 feet of drill rod column shall be hoisted above the top of the drill mast. Drill rod tool joints shall not be made up, tightened, or loosened while the rod column is supported by a rod slipping device.
- Control dust using dust suppression techniques.
- Clean augers, drill casing, or drill rod only when the rotating mechanism is in neutral and the pipe is stationary is stopped.

- Cap and flag open boreholes; open excavations shall be barricaded.
- Keep all hand tools used during drilling operations clean and in good working condition.
- Check fire extinguishers and notify all onsite personnel to their whereabouts.
- Check cables for frays and hydraulic hoses for leaks daily.
- In situations where ambient water level may be above top of well screen, during well construction, ensure that well casing is vented to prevent air pressure build-up in blank casing above screen.

Indoor Drilling

- Conduct a survey, prior to bringing drilling equipment to the job site, to identify ceiling height, overhead hazards, potential subsurface hazards, terrain hazard, and building stability particularly during drilling activities. Identify sources of ventilation (including open doorways for cross ventilation and fans to assist in air flow). Once on site, before drilling equipment is moved, the travel route shall again be visually surveyed for overhead and terrain hazards and avenues of ventilation will be opened or turned on.
- Notify and/or evacuate all building occupants prior to start of drilling activities.
- All drilling rig exhaust will be redirected outdoors by tubing. The perimeter of the outdoor exhaust area shall be roped off a suitable distance to allow proper ventilation of exhaust.
- Monitor ambient oxygen percentage and carbon monoxide concentrations in the work zone, as well as entire indoor area, to prevent low oxygen or high carbon monoxide environments. Operations shall cease and the building will be evacuated if levels become dangerous.

DRUM AND CONTAINER HANDLING

- Only trained personnel should open drums containing unknown materials.
- Bulging drums or containers are an indication of pressure build-up. Open all drums or bungs extremely slowly to determine the presence of vapors or pressure inside the drum. If the possibility of fire or explosion exists, a protective shield should be used and/or remote opening devices. Employees not directly involved with opening a container shall be kept a safe distance away.
- Use only drums and containers that meet the appropriate DOT, OSHA, and EPA regulations.
- Utilize drum/container handling equipment whenever possible. The equipment should have a sufficiently rated load capacity and should be able to operate smoothly on the available surface.
- Label and identify drums and containers when moved to the staging areas to safely identify and classify their contents. Segregate incompatible drums.
- Inspect the integrity of the drum container before moving. Any drum or container lacking integrity shall be placed within an over pack container.
- Staging areas require adequate escape routes. Staging area should provide secondary containment for all moved drums.
- Employees must be warned of the potential hazards associated with the contents of containers or drums prior to moving said containers or drums.
- Organize site operation to minimize the amount of drum or container movement. Have a clear view of the available pathway when moving drums. If needed, an additional person should be available to provide guidance.
- Never stand on drums or containers.
- Use non-sparking tools and appropriate grounding and bonding equipment.
- Appropriate fire extinguishing equipment must be onsite at all times during drum handling.
- Spill control equipment shall be onsite in areas where spills ruptures or leaks may occur.

ELECTROCUTION

- Install adequate warning signs and barriers (in plain sight) in all areas where hazardous electrical facilities exist.
- Use only heavy duty electrical cords that are not subjected to excessive bending, stretching, or kicking. All cords and wires shall be frequently inspected for signs of defects. Damaged or frayed electrical wires, cords, and plugs shall be immediately replaced by a qualified electrician or other properly trained personnel.
- all 120VAC receptacles that are outdoors and all 120VAC receptacles that can have extension cords plug into them for electric hand tools require GFCI protection.
- Equip all portable extension cords with a non-conducting plug and/or another socket shell. All electrical cords shall be equipped with three-blade grounding type plugs. The use of extension cords with built in GFCI protection is highly recommended.
- Do not permit overloading of electrical circuits at anytime. The replacement of fuses or circuit breakers with makeshift materials or over-capacity fuses is strictly prohibited.
- A minimum clearance of 20 feet (radius) will be maintained between heavy equipment (i.e., drill rig) and any overhead power lines, regardless of voltage.
- Before subsurface work, a utilities search for underground lines will occur and will be documented (if within 3 feet of marked underground utility, hand digging is required).
- Installation and maintenance of electrical facilities or equipment must only be performed by qualified and properly authorized personnel or electrical subcontractors. Apprentice personnel permitted to work on electrical equipment shall be under the supervision of a fully qualified electrician.
- Follow the company Lock-out/Tag-out procedures when applicable. Electrical equipment and lines shall always be considered “energized” until proven “de-energized”. Before beginning work, each electrical circuit shall be inspected, tested, and where possible, isolated from the power source. Working on energized circuits is not allowed unless all other possible means of "de-energized" trouble shooting has been performed. Before any terminal or conductor is touched, the absence of voltage is required to be verified with a single purpose contact type voltage tester.
- Non-contact voltage tests are not acceptable to perform an absence of voltage test.
- Extreme care shall be exercised as wires designed to operate at ground potential may become energized by faulty or inadequate connections.
- Do not wear rings, watches or metallic objects that could act as conductors when working with electrical circuits.
- Do not use metal ladders and un-insulated tools while working with electrical circuits and equipment.

- Protect electrical wires with suitable protective conduits or devices where they are exposed to possible damage.
- Connect grounding devices to a ground before contacting any conductor of a circuit. When grounding devices are removed, they shall be disconnected from the circuit before being disconnected from ground.
- The type of circuit shall determine the type of protective equipment required. Rubber gloves, sleeves, blankets, mats, and insulated platforms shall be used as required. Questions regarding PPE should be directed to the SHSO.
- Inspect all insulated protective equipment continuously for defects or damages. Any defective equipment shall be replaced before using.
- Establish and enforce testing schedules for insulation qualities for protective equipment. All users shall verify that equipment has been satisfactorily tested prior to use.
- Electricians shall be familiar with the National Electrical Code; state and local electric codes; OSHA standards, including 29 CFR 1926, Subpart K; and applicable sections of the National Fire Protection Association Codes.
- When working on energized circuits of 440 volts or higher, at least one qualified electrician and one other employee shall be present.
- Use only NEC approved grounding equipment as a ground for electrical equipment. Metal frames on electricity-powered equipment, electrical facilities, and transmission equipment shall be connected to the grounding system. Alternative grounding systems complying with applicable electrical codes may be used for temporary portable equipment.

EXCAVATION/TRENCHING

Prior to Excavation

- Confirm that an OSHA competent person is available. An OSHA competent person is someone with enough training to identify soil types and other excavation hazards and authority to take prompt corrective actions.
- Check for the presence of underground and aboveground utilities before conducting any intrusive work. Support, protect or remove utility lines as appropriate.
- Implement the Geosyntec Confined Space Entry Program if employees are to enter excavations or trenches of 4 feet deep or deeper (regardless of width).
- Remove or brace trees, boulders, etc., adjacent to the work area that could fall into the work area before intrusive begins.
- Underpin all nearby existing structures to ensure their stability before excavating below the level of the base of the footing of any foundation or retaining wall.

During Excavation

- Wear hard hats, safety boots and reflective vests.
- Use flagmen or warning devices for all mobile equipment using reverse and forward motion
- Adequately slope or shore all sides of excavations/trenches 5 feet or more in depth (depending on local regulations) before allowing anyone to enter them (see below).
- Store and retain all equipment/material and excavated soil/rock/waste (spoil(s)) at least 2 feet or more from the edge of the excavation/trench.
- Use diversion ditches or dikes to prevent water from entering an excavation, and to provide adequate drainage of the area adjacent to the excavation. Prevent water from accumulating in an excavation.
- Install substantial stop logs or barricades when mobile equipment is used or allowed adjacent to excavations.
- Provide a walkway or bridge with standard guardrails where employees or equipment are required or permitted to cross over excavations.
- Ladders used for ingress/egress should extend a minimum of 3’ above ground surface, be secured, and be located so as to require no more than 25 feet of lateral travel for workers in the trench or excavation.
- Avoid standing on top of trench/excavation while personnel are below, in the trench.
- Examine all excavation work areas and faces for unsafe conditions at least at the beginning of each shift and especially after blasting, a rain, a freeze or a thaw. If unsafe conditions are found, all work in that immediate area shall cease until the necessary

- If it is necessary to place or operate trucks, materials or other heavy objects on a level above and near an excavation, pile, shore, and/or brace sides of excavations to resist the extra pressure due to such superimposed loads.

Shoring an Excavation

- Place cross braces or trench jacks in a true horizontal position, space vertically and secure to prevent sliding, falling or kick-outs.
- Use portable trench boxes or sliding trench shields, if needed, in place of a shoring system or sloping.
- Support systems shall be planned and designed by a qualified professional engineer when the excavation is in excess of 20 feet in depth, adjacent to structures or improvement, or subject to vibration or ground water.
- Removal and backfilling of trench supports must slowly progress together from the bottom of the trench. Jacks or braces shall be released slowly and in unstable soil, ropes shall be used to pull out the jacks or braces from above after employees have cleared the trench.
- Stability of an excavation left open for a long period of time(i.e. more than a few days) should be evaluated by a professional engineer to assess if slopes, bracing measures, etc. need to be modified.
- Start backfilling trench before removing braces in case of Type C soils.
- Put up barricades – flagging tape, fencing to prevent falls into the excavation.
- Cover or secure trench/excavation if left open overnight.

Sloping an excavation

- Excavate to at least the OSHA minimum required angle ratio according to soil classification identified except for areas where solid rock allows for line drilling or pre-splitting.
- Flatten the angle of repose when an excavation has water conditions, silty materials, loose boulders, and areas where erosion, deep frost action and slide planes appear.

Soil Classification	Soil Classification Description	OSHA Minimum Requirements For Side Slopes
Soil Type A	Most stable: clay, silty clay and hardpan (resists penetration)	.75:1 (for one foot vertical rise, the trench wall must be cut back ¾’)
Soil Type B	Medium stability: silt, sandy loam, medium clay and unstable dry rock	1:1 (each step has an equal horizontal and vertical rise; only cohesive Type B soils may be benched)
Soil Type C	Least stable: gravel, loamy sand, soft clay, submerged soil or dense, heavy unstable rock	1.5:1 (trench wall must be cut back 1-1/2’ for 1’ vertical rise; type C soil is not benched)

EYE INJURY

- Wear appropriate eye protection according to the task at hand.

HAZARD	TYPE OF PROTECTION
Impact	Safety glasses with side shield or vented safety goggles
Heat (Sparks)	Vented safety goggles or safety glasses with a face shield
Chemical	Hooded vented safety goggles or full-face respirator (if mild chemicals then safety glasses with side shield is acceptable)
Light Radiation	Tinted/reflective safety glasses or tinted/reflective face shield
Dust	Hooded vented safety goggles

- Apply anti-fog product to lens not previously treated.
- Minimize the amount of vapor or particulate matter generated, if possible.
- Avoid touching the face and eyes.
- Flush eyes with water for at least 15 minutes if chemicals do get into the eyes. If condition persists, seek medical attention.
- If dust or foreign objects are in your eyes, do not rub your eyes.
- If an object becomes embedded in the eye, do not attempt to remove. Lightly bandage your eyes, or both eyes, if possible and immediately seek medical attention.
- Do not wear contact lenses if chemical or dust hazard is present (e.g. decontamination or preservation chemicals used during sampling).
- Provide on-site training to workers before tasks at hand.
- If visitors enter area, stop work until they are properly protected.

FALL PROTECTION

Each worksite and all activities shall be evaluated prior to the start of the job to identify the hazards of falling from any elevation. Site specific fall protection programs shall identify the areas/activities requiring fall protection, the manner in which fall protection will be accomplished, a listing of qualified individuals for fall protection and a roster of personnel authorized to utilize specific fall protection equipment. As part of this evaluation, all applicable requirements of 29 CFR 1926 Subpart M shall be addressed.

- All Geosyntec employees and contracted employees on walking/working surfaces 6 feet or more above the immediate lower level shall be protected from falling by a guardrail system, safety net system, or personal fall-arrest system 100% of the time. This includes working near edges of excavations and trenches and wells and caissons greater than 20" in diameter.

- All elevated work, regardless of the height, shall incorporate job planning to anticipate and mitigate the consequences of a fall. Job planning should include rescue after a fall.

- First consideration shall be given to the elimination of fall hazards. If a fall hazard cannot be practically eliminated, second consideration shall be implementing effective permanent or temporary means of fall prevention.

- Before using any equipment, pipelines, or trusses for elevated work, it must be determined by the project manager if they are suitable for climbing or walking. Not all pipelines, trusses, and hanger systems are designed to support individuals doing elevated work.

- Weather must be a safety consideration whenever outdoor elevated work is to be done. The weather hazard must be addressed prior to and during the work.

- When fall protection is required, a personal fall arrest system must be utilized that complies with 29 CFR 1926.502(d) (full body harness with a fall arrest system)
- Look where you walk to make certain your pathway is clear of hazards.
- Practice safe walking skills.
- Scaffolds/ladders: Both require pre-use inspection for integrity, with particular attention given to scaffold planking (secure and strong), levelness of erection, avoidance of power lines, and bolted pipe connections.

HAND/FOOT INJURY

- Wear protective gloves as required in the Health and Safety Plan. Gloves should be chosen to suit the work being performed (e.g., chemical resistant gloves will be worn when handling chemicals or sampling for suspected chemicals).
- Steel-toed/steel-shanked safety boots must be worn whenever working around heavy objects (or as required by the HASP). Insulated and/or waterproof boots may also be warranted depending on weather conditions. Boots should be inspected periodically for signs of wear (e.g., cracks in rubber or along soles) and replaced as required.
- Durable footwear which provides adequate ankle support should be worn when working in rugged terrain.
- Use proper lifting techniques to avoid dropping heavy loads on hands and feet (refer to lifting heavy loads hazard mitigator)
- Be aware of moving machinery and heavy equipment in the work area and tuck away any loose clothing.

HEAT STRESS

Prevention:

- Drink plenty of hydrating fluids, such as Gatorade® or water. In high heat, a minimum of one gallon per day should be consumed. Fluid should be consumed frequently. Don't wait until thirsty.
- Provide cooling devices, when necessary, to aid natural body heat exchange during prolonged work or severe heat exposure. Devices include field showers, hose-down areas, shade umbrellas/tents, wide-brim hats, and cooling jackets, vests, or suits.
- If amenable to work conditions, wear light-colored, loose fitting, "breathable" clothing.
- Avoid prolonged periods of exposure. Take breaks as necessary. Higher heat exposure requires more frequent breaks.
- Be able to recognize the signs, symptoms and how to treat for heat stress. Signs, symptoms and treatment are listed below.

Signs and Symptoms:

- Mild heat stress - Decreased energy, slight loss of appetite, nausea, lightheadedness.
- Moderate heat stress - heavy sweating, thirst, faintness, headache, confusion.
- Severe heat stress (heat stroke) - Throbbing headache, confusion, irritability, rapid heartbeat, difficulty breathing, dry skin (no sweating), vomiting, diarrhea.

Treatment:

- Mild and Moderate heat stress - Take to cool place, drink cool (not cold) fluids, remove excess clothing, rest.
- Severe heat stress - Call 911 for an ambulance and get to a cool place, remove excess clothing and rest.
- Adjust work and rest schedules as needed. Establish a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts of workers.
- Provide shelter or shaded areas (77ºF is best) to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels to ensure that the cardiovascular system functions adequately. Daily fluid intake must equal the approximate amount of water lost in sweat. Workers are encouraged to drink more than the amount required to satisfy thirst (recommend water and sport drinks, not coffee or soda), because thirst is not an adequate indicator of adequate salt and fluid replacement.
- Remove impermeable protective garments during rest periods.
- Do not assign other tasks to personnel during rest periods.

HEAVY EQUIPMENT

Working around Heavy Equipment

- Yield to heavy equipment.
- Listen for warning signals on heavy equipment.
- Perform a visual inspection and walk around parked heavy equipment before moving to assure that equipment is in good condition and that there are no personnel on the ground that could be injured or objects that could be damaged by vehicle movement.
- Wear hearing protection if required.
- Wear traffic vests for increased visibility.
- Maintain eye contact with the heavy equipment operator when working near equipment.
- Be aware of changes in sound of equipment which may indicate a change in direction.

Heavy Equipment Operators

- Use hand rails and footholds when mounting and dismounting equipment,
- Brakes, steering, clutches and controls shall be tested.
- Pay attention to workers on the ground who may be in the path and provide warning prior to moving the equipment.
- Permit no one to ride on, or in, heavy equipment. This includes any portion of a backhoe, bulldozer, forklift or the back of a pickup truck, except in locations specifically designed for passenger use and approved by the SHSO.
- Keep haulage vehicles under positive control at all times while operating. Vehicles shall be kept in gear when descending grades.
- Do not use heavy equipment on slopes with steepness exceeding 3H:1V unless operations are consistent with manufacturer's recommendations (if the Owner's Manual is not with the equipment or does not specify slope operating procedures, see the SHSO).
- Operate equipment with booms, blades, buckets, beds, etc., lowered or in a stable position while on slopes. Safety cables tethered to appropriate anchors shall be used for equipment working on steep slopes, where appropriate.
- Suspend in slings or support by hoists or jacks heavy equipment in need of repair. The equipment must also be blocked or cribbed before working underneath.
- Shut off motors, do not allow smoking, and use proper dispensing equipment when refueling gasoline-operated equipment to prevent fire hazards.
- Lower hydraulic systems (e.g., blades, etc.) to the ground, set brakes, and shut down equipment if malfunction occurs.
- Use rollover protection and seat belts.

Hot Surfaces

Appropriate measures will be taken to protect on-site workers from potential contact with hot surfaces.

- Hot surfaces may potentially exist on ducts which remove vapors from the pilot test area and during the removal of the heating element from each ignition well;

- The extraction point for vapors from the pilot test area may have air temperatures upto 480°F (250°C). In addition, air discharge from the moisture knock out tanks prior to inlet to the activated carbon units may have temperatures up to 140°F (60°C). These areas will be cordoned off from access and sign posted to protect workers from incidental contact. Access to these areas will require heat resistant gloves rated to 500°F (260°C and all surfaces will be measured using a laser thermometer prior to contact.

- Required PPE maybe reduce to a standard leather glove by the SHSO once the surface temperature has be confirmed to be below 120°F (49°C), however changes in system temperature may occur, therefore surface temperatures should be routinely monitored while working in these restricted areas.

Heater element removal

- Lock out/Tag out procedures must be followed prior to deploying or removing the heater element in an ignition well.

- Refer to heater element lockout/tag out procedure.

- Prior to personnel coming in contact with the heating element and associated installation and removal equipment the temperature of each surface will be measured using an laser temperature sensor;

- The laser temperature sensor should be operated according to manufacturer's instructions and should be measured from a distance sufficient to obtain an accurate reading of the specific surface of interest.

- Heater removal shall be conducted by two or more people. Each person shall wear heat resistant gloves rated to 500°F (260°C) in addition to a face shield and goggles. Note that air flow to the well will continue and some leakage of injected air out of the open seal may occur.

- One person will use the laser to check the temperature of the surface of the heater riser pipe. The seal on the hydraulic lubricator valve will be opened and a second person will begin to manually lift riser up a full arms length above the assembly.

- Actuate lubricator valve with hydraulic hand pump and use the laser to measure the surface temperature of the newly exposed portion of riser pipe. If the surface temperature is below 250°F (121°C), then this process can be repeated until the heater element is situated within the lubricator chamber. Riser pipe should not be hot, however great care should be taken, and if temperatures above 250°F (121°C) are measured, then the riser pipe will be left to cool before another section of riser pipe is removed.

- Actuate the hydraulic seal using the hand pump to prevent further air leakage. Close both of the full port ball valves on the well head and lubricator assembly to seal the heater inside the lubricator chamber. Once the heater is within the lubricator chamber, the surface temperature of the assembly should be monitored with the laser thermometer. Once the assembly has cooled to below 250°F (121°C), then the assembly can be transported to another ignition well.

- Required PPE maybe reduce to a standard leather glove by the SHSO once the surface temperature has be confirmed to be below 120°F (49°C). This will enable more dexterity for the movement of the lubricator chamber to the next ignition well.

KNIVES / BLADES

- Always wear proper protective equipment. This should include:

  - heavy-duty leather gloves,

  - steel-toed boots with non-slip soles, and

  - hardhat and eye protection.

- Check the work area and make sure that:

  - the ground is free of obstacles such as rocks, stumps, holes, and wet or otherwise slippery conditions.

  - you can get a firm footing on the ground.

- Route cords, hoses, and cables supplying power to portable power tools to prevent tripping hazards.
- Protect tools from corrosion damage.
- Keep tools free of accumulated dirt and unnecessary oil or grease.
- Worn, damaged or dull blades should be sharpened or replaced as necessary.

LIFTING HEAVY LOADS

- Proper lifting techniques include:
  - *Feet* - Feet should be parted, with one foot alongside the object being lifted and one behind. Feet should be comfortably spread to give greater stability. The rear foot should be in position for the upward thrust of the lift.
  - *Back* - Use the sit-down position and keep the back straight, but remember that "straight" does not mean "vertical". A straight back keeps the spine, back muscles, and organs of the body in correct alignment. It minimizes the compression of the abdomen that can cause a hernia.
  - *Arms and Elbows* - The load should be drawn close to the body, and the arms and elbows should be tucked in. When the arms are held away from the body, they lose much of their strength and power. Keeping the arms tucked in also helps keep body weight centered.
  - *Palm* - The palm grip is one of the most important elements of lifting. The fingers and the hand are extended around the object to be lifted. Use the full palm; fingers alone have very little power.
  - *Chin* - Tuck in the chin so the neck and head continue the straight back line. Keep the spine straight and firm.
  - *Body Weight* - Position the body so its weight is centered over the feet. This provides a more powerful line of thrust and assures better balance. Start the lift with a thrust of the rear foot. Shift hand positions so the object can be boosted after knees are bent. Straighten knees as object is lifted or shifted to the shoulders. To change direction, lift the object to a carrying position, and turn the entire body, including the feet. Do not twist your body. In repetitive work, both the person and the material should be positioned so that the worker will not have to twist his body when moving the material. If the object is too heavy to be handled by one person, get help.

- Limit continuous lifting of weights to 50 pounds or the maximum allowed by the client whichever is less. Lifts of heavier weights are permitted on an interim basis. Help shall be obtained for lifting of loads greater than 50 pounds or the maximum allowed by the client whichever is less. Mechanical equipment should be used on heavy materials when possible. If mechanical assistance is not available, adequate manpower to maintain the 50-pound limit per employee will be required.
- Do not lift more weight than can be handled comfortably, regardless of load weight. If necessary, help should be requested to lift a load so that the lifting is comfortable.
- Use drum dollies when moving drums or barrels.

- Inspect objects for grease or slippery substances before they are lifted to ensure that the object will not slip.
- Do not carry long, bulky or heavy objects without first verifying that the way is clear and that vision is unobstructed. This ensures that other persons or objects will not be struck by the load.
- Do not carry loads that cannot be seen over or around.
- Exercise caution when lifting above the chest level.
- Make sure workers are physically suited for the job before assigning jobs requiring heavy and/or frequent lifting. A person's lifting ability is not necessarily indicated by his height or weight.
- Before lifting an object, consideration should be given to how the object will be set down without pinching or crushing hands or fingers. For example, to place an object on a bench or table, the object should be set on the edge and pushed far enough onto the support so it will not fall. The object can then be released gradually as it is set down, and pushed in place with the hands and body from in front of the object.
- When two or more people are handling the same object, one should "call the signals". All the persons on the lift should know who this person is and should warn him if anyone in the crew is about to relax his grip.

LOCKOUT/TAGOUT

- Use of lockout/tagout procedures is mandatory when performing maintenance, repair or other service-related activities on any machine or equipment where unexpected startup or release of stored energy could cause injury to employees.
- Types of stored energy to lockout and/or tagout include:
  - Mechanical energy
  - Electrical energy
  - Hydraulic energy
  - Pressurized liquids and gases
  - Chemical energy
  - Pneumatic energy
  - Thermal energy
- The following are examples of Geosyntec possible energy sources:
  - Pressure washers
  - SVE (Soil Vapor Extraction)
  - Landfill gas blower/flare station
  - Generators
  - Pug Mill
  - Pump and Treat System
- Prevent potentially injurious situations by using padlocks (lockout), warning tags (tagout) on disconnect switches, circuit breakers, valve handles, or any other energy-isolating mechanism that is in the off or closed position.
- Padlocks and tags must be durable, not easily removed, must not deteriorate in inclement conditions, and must be a standardized color, shape and size that is easily recognized by your employees.
- Be aware of the most frequent causes of fatal accidents and take action to prevent them from occurring:
  - Failure to stop equipment
  - Failure to disconnect from the power source
  - Failure to dissipate residual energy
  - Accidental restarting of equipment
  - Failure to clear work areas before reactivation
- Develop an Energy Control Program to identify and implement specific procedures in writing. Utilize the following checklist as a step-by-step guideline.
  1. Prepare for shutdown
  2. Shut down the equipment
  3. Isolate the equipment
  4. Apply lockout/tagout devices to:

- Circuit breakers
- Fuses
- Plugs
- Air Compressor
- Wall Switches
- Ball valves
- Gate valves
- Pug Mill

5. Control stored energy.
   - Relieve, disconnect or restrain any residual hazardous energy that could be present.
   - Check that all moving parts have stopped turning.
   - Relieve trapped pressure.
   - Blank pipe flanges.
   - Install ground wires to discharge electrical capacitors.
   - Block or support elevated equipment.
6. Verify isolation of equipment.
   - Warn employees
   - Test
   - Press "start" and return "off"
   - Verify isolation

- Conduct annual inspections of your Energy Control Program and authorized employees.
- Ensure that each authorized employee is protected by his or her own personal lockout/tagout device. No employee may affix the personal lockout/tagout device of another employee. Each employee is responsible for removing his or her own lockout tagout device. Have the tags signed by the employee and turned in.
- Inform all employees whenever locks and/or tags are about to be affixed to machinery or removed from it. Conduct a head count to be sure that affected employees are clear from the area during such procedures.
- Verify that authorized employees have been instructed in proper lockout/tagout procedures and are trained in the following:
  - Recognition of hazardous energy
  - Type and magnitude of energy found in the workplace
  - The means and methods of isolating and/or controlling energy
  - The means of verification of effective energy control, and the purpose of the procedures to be used.
- Re-train, as needed; i.e., when there is a change in employee job assignments, when a new hazard is introduced due to a change in machines, equipment or processes, when

there is a change in the energy control procedures, or when periodic inspections reveal inadequacies in company procedure, etc.

- The 3 restart steps of lockout/tagout
    - Verify personnel affected during the lockout tagout/tagout.
    - Notify all personnel affected
    - Remove lock and tag

LOUD NOISE

- Wear hearing protection in areas with constant or loud noise.
- Know the effects of noise, including:
  - Workers being startled, annoyed, or distracted.
  - Physical damage to the ear, pain, and temporary and/or permanent hearing loss.
  - Communication interference that may increase potential hazards due to the inability to warn of danger and proper safety precautions to be taken.
- Implement the company Hearing Conservation Program when noise exposures equal or exceed an 8-hour, time-weighted average (TWA) sound level of 85 decibels on the A-weighed scale (dB).
- Utilize feasible administrative or engineering controls if workers are subjected to noise exceeding an 8-hour TWA sound level of 90 dB.

PORTABLE POWER/HAND TOOL

- Read instruction manual for the safe operation of any portable power tool.
- Route cords, hoses, and cables to prevent tripping hazards or contact with equipment.
- Avoid abusing the power supply lines of portable equipment. Excessive scraping, kicking, stretching, and exposure to grease and oils will damage lines or cause them to fail prematurely, and possibly injure the operator or fellow workers.
- Inspect cords, hoses, and cables for wear or deterioration.
- Do not use electrically powered tools near flammable materials or explosive atmosphere, unless they are of the explosion-proof type meeting the National Electrical Code for potentially explosive work areas. Employees operating the equipment should be aware of sparks and or metal fragments when using this equipment.
- Ground-check portable electric power tools with metal cases initially and quarterly. At no time will electrical power equipment be operated without proper grounding. All electrical cords and cables, including extension cords, shall include a third wire ground.
- All portable power / hand tools shall only be plugged into a GFCI protected extension cord.
- It is recommended that the GFCI circuit be tested daily to confirm it is still functional.
- Prohibit operations of electric tools in wet or damp areas.
- Size cords adequately for length and the electrical demand of the tool. Otherwise, they may cause a fire hazard.
- Limit use of tools to the purpose for which the tool is intended (e.g., wrenches will not be used as hammers). Defective tools (e.g., with mushroomed heads or split or defective handles) shall not be used.
- Keep tools free of accumulated dirt and unnecessary oil or grease. Moving and adjustable parts shall be lubricated frequently to prevent wear and misalignment.
- Replace or repair damaged or worn tools promptly. Temporary or makeshift repairs are prohibited. At the discretion of the supervisor, discard all tools that cannot be repaired safely. Supervisors shall decide when to discard a tool.
- Store tools in suitable boxes or containers. Loose tools shall not be stored on ledges or where they might fall. Tools shall be picked up when a job is completed and not be allowed to accumulate in the work area. Store all tools in a safe place.
- Do not use conducting (i.e., metal) tools around electrical facilities. Insulated tools, approved for electrical work, shall be tested frequently for proper insulation.
- Select the correct size and type of wrench for each job. Wrench handles shall not be extended with a pipe or cheater because the jaws will spread.

- Repair mushroomed punch, drift and chisel heads. Mushroomed heads represent crystallized metal that will break and fly off when struck.
- Wear eye protection at all times.

SLIPS, TRIPS, AND FALLS

- Wear the proper foot wear and clothing for the task at hand.
- Pay attention to the work environment and become aware of all equipment and vehicles active onsite and use caution when moving about.
- Use caution when walking on sloped areas (especially geosynthetics), particularly when moisture is present. Use caution when walking on soft or uneven surfaces; e.g., marsh areas. Watch for icy conditions in cold weather.
- Follow the established designated safe paths for travel and keep these areas free from debris. Avoid steep or slippery slopes and paths near operation vehicles and equipment.
- Follow good housekeeping procedures. Never assume that someone else will clean up a spill or put away an object.
- Remove or clearly mark objects that pose tripping hazards.
- Prevent water accumulation where practicable.
- Cables and/or wiring should be taped down, when possible. Locate cables and/or wiring out of the commonly used areas.
- Mark or repair any opening or hole in the floor.
- Carry objects in a manner that allows you to see in the area you are moving in. Do not carry objects that are too large or bulky. Do not carry more weight than you can balance and keep stable. Understand that PPE can reduce or limit your field of vision and mobility.
- Use the proper ladder for the task at hand and do not exceed the recommended height. Do not use the top two rungs of a ladder. Ensure a flat and stable footing for the placement of a ladder. Utilize the buddy system to help secure the ladder. When working over 6 ft., utilize fall prevention measures. Obey height and weight guidelines and/or rules.
- Use the handrail when using stairs. Be aware of stairway blockages.
- If conditions even slightly resemble an unsafe environment, do not make any assumptions that the integrity of a workplace is intact.
- Never jump over or into a trench or excavation.
- Walk, do not run.
- Maintain proper lighting so obstacles are clearly visible

Telelifter Forklift

Working with telelifter forklift

- Make sure vehicle is operated by a trained individual.
- Truck should be parked on as level of a surface as possible.
- Check the crane for proper support pin placements and that the crane unit is secured properly.
- Ensure equipment inspection has been completed prior to operation.
- Maintain eye contact with the crane operator when working near equipment.
- Be aware of changes in sound of equipment which may indicate a change in direction or fatigue with equipment.
- Hand signals may be needed to communicate with crane operator in areas with loud noise.
- Do not stand beneath load and ensure area surrounding equipment is clear of personnel

Lifting Loads with telelifter forklift

- Respect the load capabilities of the unit at all times. Ensure crane rating is sufficient for the distance of the crane to the load.
- Make sure the load is secured correctly to the crane using appropriate equipment.
- Make sure the load that will be lifted in not secured, bolted down, or attached in anyway before lifting.
- Equipment used to secure load to the truck crane should be properly rated for the load being lifted.
- Know the weight of the load being lifted, and make sure it falls under the maximum lift load of the crane.
- Do not put any part of body under the crane boom or lifted loads at any time.
- Load lifting should be as close to vertical (plumb) as possible. Be aware of swinging loads once lifted.
- Lift and drop load at a safe rate of speed.
- When rotating the load, make sure that the pathway way is clear of equipment and personnel.
- Do not stand between crane cable and truck at any time.

UTILITY PROTECTION

The occurrence of above and below-ground utilities should be anticipated at every site. The traditional method of using existing "as built" plans and maps (if available) and probing in the field (i.e., "hunt and hope") is not sufficient to provide adequate assurance that utilities are not impacted during site activities. Geosyntec developed this Utility Protection Hazard Mitigator to implement prior to conducting intrusive site activities (i.e., drilling, well installation, trenching, excavation, hand auguring, etc.). The objective of the Utility Protection Hazard Mitigator is to describe the process necessary to investigate, and to the extent practical, identify utilities in work areas for the purpose of avoiding the utilities, protecting utilities and site personnel, and mitigating impacts to site operations.

Approximate location of subsurface installation means a strip of land not more than 24-inches on either side of the exterior surface of the subsurface installation.

Excavation means any operation in which earth, rock, or other material in the ground is moved, removed, or otherwise displaced by means of tools, equipment, or explosives in any of the following ways: grading, trenching, digging, ditching, drilling, auguring, tunneling, scraping, cable or pipe plowing and driving, or any other way.

High priority subsurface installation means high-pressure natural gas pipelines with normal operating pressures greater than 415 kPa gauge (60 psig) or greater than six inches nominal pipe diameter, petroleum pipelines, pressurized sewage pipelines, high-voltage electric supply lines, conductors, or cables that have a potential to ground of greater than or equal to 60 kilovolt (kV), or hazardous materials pipelines that are potentially hazardous to workers or the public if damaged.

The Mitigator process is summarized below:

- Identify the location of the planned intrusive activities.
- Mark the planned work area with white water based marking paint. If work area is not visible from the street either because of obstruction or distance, provide distance from street to work area (i.e., 150 feet north).
- Contact DigAlert or dial 811 (nationwide) to identify utilities in your work area. http://www.digalert.org/ (811) provides a link to the local state operated "Call-Before-You-Dig" service.
- Review existing utility maps with facility personnel and determine the approximate numbers and types of utilities within the project area. This is inclusive of below-ground utilities that may be encountered during intrusive operations as well as overhead utilities that may be encountered during operations (i.e., drilling mast and overhead power lines).
- Most "Call-Before-You-Dig" services will only mark below-ground utilities leading to the site utility meter. With the exception of high priority utilities (as defined above), utilities present after passing through the site meter may be left without adequate inspection. In such cases, the use of a private utility location firm may be prudent to ensure thorough identification of utilities.
- Retain the services of a private utility locating company that can identify metallic utilities and anomalies in the vicinity of the work area. Private utility location firms use a variety of location techniques. The suspected types of utilities should be discussed

with the private utility location firm to ensure that proper techniques are used. Improper techniques may result in missed or improperly identified utilities.

- DigAlert must be called at least 48 hours prior to the start of work to complete a utility inspection. (For example, if you notify DigAlert on Tuesday at 9:43 a.m. no work can begin until Thursday at 9:43 a.m.)
- Record the inspection confirmation number. Confirm that the inspection was conducted prior to the start of work. The inspection confirmation number is critical in the event that an unmarked utility is encountered, or if a utility identified during the inspection request did not mark the site for the presence or absence of the utility (no-show). If a no-show occurs with it may be possible that the utility operator sent a facsimile care of the project manager (identified during utility inspection request) indicating that there are no conflicts in the planned work area. However, if there is any question, contact DigAlert immediately and request that the missing utility please call to confirm presence or absence of utility in work area or schedule a meeting time at the site.
- After below-ground utilities are identified, the utilities should be marked. The most common marking method is paint or pin flags. The following marking colors are generally widely accepted to demarcate specific types of utilities, but should be confirmed.

RED	ELECTRIC
YELLOW	GAS, OIL, STEAM
ORANGE	COMMUNICATIONS
BLUE	POTABLE WATER
PURPLE	RECLAIMED WATER
GREEN	SEWER / DRAINAGE
PINK	SURVEY MARKS
WHITE	PROPOSED EXCAVATION

- Above-ground utilities should be visually identified. Warning signs may be placed in work areas to remind workers of the above-ground utilities. Other techniques such as shielding or utility relocation may be necessary to make the work safe. Proper set back and approach distances must be maintained at all times.
- Be observant of above-ground features at a site that may be indicative of an underground utility line. An example of this would be noticing two fire hydrants and noting that there is likely a buried water line between them, sings of trenching activities, asphalt or concrete patches, or linear depressions in the ground surface.
- Following the completion of the utility marking, the work area should be inspected by all members of the project team (client, engineer, and contractor) to inspect and discuss the finding. Adjustments to site operations, if necessary, should be discussed and agreed

upon by the project team prior to initiation of site work. If possible, work areas should be re-located away from utilities.

- If conditions allow, consider using vacuum excavation.
- Depending on the proximity of utilities to the work area, low impact soil removal techniques (potholing) may be necessary to either confirm the presence of utilities or to provide protection of utilities before invasive activities. In such cases, hand excavation, hand auguring, vacuum excavation, water jet removal, or other low impact removal techniques may be necessary to a depth of 3 to 5 feet (or other depth as determined by project-specific conditions). In cases where a high priority utility is located within 10 feet of the work area, documentation from the utility owner must be obtained allowing potholing before any work can be conducted. If the utility is not found after potholing is conducted, contact DigAlert and the utility owner immediately to request additional information as to the location of the utility. It is necessary to conduct potholing activities before any work can be conducted in the vicinity (within 10 feet) of the high priority utility.
- If utility location markings are lost, damaged, or faded, a new utility location survey should be conducted to replace the missing or damaged markings. Please note that some municipalities require that all utility markings be removed after work is completed. Black spray paint may be used to cover up utility markings in the street but must be removed from sidewalks.
- In all cases, State, local, utility-specific requirements, facility-specific controls, permits, and operations should be considered and incorporated into the Utility Protection Hazard Mitigator.
- Utility protection should be addressed during each tailgate or job briefing in order to reinforce below-ground utility location and the avoidance of above-ground utilities.

WELDING AND CUTTING

- Reduce exposure to all welding emissions using engineering controls (ventilation) and safe work practices.
- All persons who weld or cut must be properly trained. Associated hazards include:
  - Thermal
  - Chemical fumes
  - Physical injury
  - Volatile combination of heat and gas
  - Radiation from unfiltered ultraviolet light
  - Electrical circuit
  - Gas leakage
  - Excessive noise
  - Poisoning
- Preventative fire measures include use of a welding blanket, removal or covering of flammable materials, and working a safe distance from flammable materials.
- Wear hearing protection, as required.
- Ensure that there is adequate lighting in the work area.
- Utilize the proper protective clothing and equipment (PPE), including:
  - Shield or helmet with filtered lens
  - Fire-resistant gloves
  - Leather apron
  - Overalls
  - Boots
  - Leather spats
  - Felt skullcap or beret
  - Hand shields
- Read the MSDS sheets for all hazardous substances with which you may come into contact prior to starting work.
- Never cut off the tops of drums that have contained flammable liquids or gases. Vapors left inside the drum may explode! If a drum that has held toxic or flammable substances must be cut, it should be filled with water, or thoroughly cleaned of such substances by a specialist cleaning company, then ventilated and tested.
- Do not apply heat to drums that have held chemicals because it may cause them to produce poisonous gas.
- Never weld or grind near an empty drum. A single spark inside an empty drum can trigger an explosion. Keep torches, flames and sparks away from grinding and welding equipment.
- Under no circumstances should fittings of oxyacetylene equipment be allowed to become contaminated with grease or oil, which can ignite in the presence of pure oxygen.
- Have flashback arrestors fitted to all oxyacetylene equipment to overcome the danger of flashback.
- Store oxygen and gas separately. Store acetylene cylinders upright to prevent explosion. Always chain stored cylinders.

STINGING INSECTS / VERMIN / SNAKES

- Be able to recognize stinging insects/vermin/snakes indigenous to the site location and habitats. Learn the indigenous dangerous species (e.g., spiders, snakes, ticks) prior to entering the field and know the first aid treatments.
- Venomous snakes swim on top of the water, non-venomous snakes swim with only their heads above water.
- Advise the SHSO if you have allergies to any insects prior to engaging in any field activities.
- Include the following preventative measures as necessary: wear light-colored clothing, keep clothing buttoned, tuck pant legs into socks, keep shirt tails tucked in, boots, hoods, netting, gloves, masks, insect repellants or other personal protection.
- Snake bite kits are commercially available and should be carried by field personnel when working where venomous snakes exist. In the case of a snake bite, keep the patient calm, restrict activity and immobilize the bite area (do not elevate), and immediately obtain medical attention.
- Report any bites or stings to the SHSO and seek medical attention immediately.
- Be aware of potential hive/nest locations, which may include culverts, drainage pipes, junk piles, or dense shrubbery.
- Advise the SHSO if you are allergic to stinging insects prior to engaging in any field activities.
- Include the following controls:
  - Do not agitate stinging insects or disrupt their hive/nest.
  - Wear light-colored clothes.
  - Avoid wearing perfumes, hair spray, or scented lotions in the wilderness.
- If attacked:
  - <u>Do not</u> scream or wave arms.
  - Cover your face with your hands.
  - Run for shelter in a building or vehicle. Do not seek shelter in water.
  - Remove stingers as quickly as possible to lessen the amount of venom entering the body. Remove the stinger by raking your fingernail across it. Don't pinch or pull the stinger out. Put ice on the sting to reduce the swelling.

Report any stings to the SHSO and seek first aid or emergency medical care immediately if stung several times.

Appendix D

Constituents of Concern (COCs)

Constituent[1]	*Medium*[2]	*Maximum Concentration*[3]
CO	Air	110
Benzene	Air	4.7

Footnotes:

1 Constituents that are included on this list have either been detected at the site at concentrations that may cause potential dermal, ingestion, or inhalation hazards, or the constituent is suspected to potentially be present at elevated concentrations but no analytical data are available.

2 Type of medium (i.e. soil, water, sludge, etc.).

3 Maximum concentration previously detected for the constituent based on historic data (if available). Liquid concentrations are presented in micrograms of constituent per liter of solution (ug/L). Solids concentrations are presented in milligrams of constituent per kilogram of soil (mg/kg). Soil gas and/or vapor concentrations are reported in parts per million by volume (ppm_v).

COC FACT SHEET - BENZENE

CAS Number:71-43-2	**Molecular Weight: 78.1**	**Color: Colorless to Lt. Yellow**	**Ionization Potential (eV): 9.24**	**Vapor Density (Air=1):2.7**
Synonyms: Benzol; Phenyl hydride	**Physical State: Liquid**	**Odor: Aromatic**	**Henry's Constant: 0.23**	**Vapor Pressure: 75 (mmHg@20C)**

Fire Hazard	**Reactivity Hazard**	**Health Hazard**
NFPA rating: 3 **HMIS rating: 3**	**NFPA rating: 0** **HMIS rating: 0**	**NFPA rating: 2** **HMIS rating: 3**

Flash Point(°F): 12
LEL(%): 1.2 UEL(%): 7.8

Fire Extinguishing Media:
☒ Dry Chemical ☒ Foam
☐ Water Spray ☒ CO_2

Fire Extinguisher:
☐ Class A ☐ Class B
☐ Class C ☐ Class D
☒ Class A/B/C

DOT: ☒Flammable Liquid
☐Combustible Liquid

Incompatibilities: Strong oxidizers; many fluorides & perchlorates; nitric acid

DOT: ☐ Oxidizer
☐ Water Reactive

Odor Threshold (ppm): 34-114

IDLH (ppm): 500

Source	TWA (ppm)	STEL (ppm)	C (ppm)
OSHA PELs	1*	5*	NA
ACGIH TLVs	.5	2.5	NA

* Table Z-2 for exclusions in 29CFR 1910, 1028

Signs/Symptoms of Acute Exposure: Irritation of eyes, skin, nose, & respiratory system; giddiness; headache; nausea; staggered gait

DOT: ☐ Poison

Carcinogenic:
OSHA: ☒ Yes ☐ Not listed

IARC: ☒ Group 1 ☐ Group 2A
☐ Group 2B ☐ Group 3
☐ Group 4 ☐ Not listed

NTP: ☒ Known ☐ Anticipated
☐ Process ☐ Not listed

ACGIH: ☒ A1 ☐ A2
☐ A3 ☐ A4
☐ A5 ☐ Not listed

Skin Absorbable: ☒ Yes ☐ No
Skin Corrosive: ☐ Yes ☒ No

DOT: ☐ Corrosive

Air Monitoring

Type	Brand/Model No.	Calibration Method/Media
☒ Explosimeter	GasTech GX-82	Methane
☒ PID	MiniRAE	Isobutylene
☒ FID	Foxboro OVA 128	Methane
☒ Colorometric Tubes	Drager/6728561(0.5-10ppm)	Check pump for leaks
☐ Chemical Monitor ☐ Dust Monitor		
☒ Collection Medium/Sampling Pump	Gilian Pump/NIOSH#1500	Calibrate pump w/ media

Protective Clothing

Glove Type/Brand (Breakthrough >2 hrs unless noted):
☒Viton/North ☐Viton/Best ☒Silvershield/North ☒4H/Safety
☐Neoprene/Mapa ☐Neoprene/Ans.Ed. ☐Neoprene/BestUltraflex ☐ Neoprene/BestNeo.
☐PVC/Ans.Ed. ☐PVC/BestHustler ☒Nitrile/LabSafe.(27min) ☐Nitrile/Ans.Ed.
☒Butyl/North (31min) ☐PVA/Ans.Ed. ☐Other

Suit Type (Breakthrough >1hr unless noted): ☐Tyvek ☐ Tyvek QC ☐Tyvek/Saranex ☒Tychem7500 (49min) ☒Tychem 9400 ☐Tychem 10,000 ☐Other

Respiratory Protection

☒Air Purifying ☐Air Supplied Only | Maximum Use Concentration (ppm): Half mask: 10 Full face: 50

Notes: Poor warning but OSHA allows Air Purifying Respirators
Prepared by: Sherry Hall Date: 16 January 1997, Rev. 24 January 2002

BOC GASES

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: CARBON MONOXIDE

1. Chemical Product and Company Identification

BOC Gases,
Division of
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974

TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER:
CHEMTREC (800) 424-9300

BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6

TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER:
(905) 501-0802
EMERGENCY RESPONSE PLAN NO: 20101

PRODUCT NAME: CARBON MONOXIDE
CHEMICAL NAME: Carbon Monoxide
COMMON NAMES/SYNONYMS: Carbonic Oxide, Exhaust Gas, Flue Gas
TDG (Canada) CLASSIFICATION: 2.3 (2.1)
WHMIS CLASSIFICATION: A, D1A, D2A, D2B, B1

PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 6/7/96

2. Composition, Information on Ingredients

INGREDIENT	% VOLUME	PEL-OSHA[1]	TLV-ACGIH[2]	LD_{50} or LC_{50} Route/Species
Carbon Monoxide FORMULA: CO CAS: 630-08-0 RTECS #: FG3500000	100.0	50 ppm TWA	25 ppm TWA	LC_{50} 1807 ppm/4H (rat)

[1] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[2] As stated in the ACGIH 1994-95 Threshold Limit Values for Chemical Substances and Physical Agents

3. Hazards Identification

EMERGENCY OVERVIEW

Inhaled Carbon Monoxide binds to the blood hemoglobin, greatly reducing the red blood cell's ability to transport oxygen to body tissues. Effects may include headaches, dizziness, convulsions, loss of consciousness and death. Extremely flammable gas.

ROUTE OF ENTRY:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
No	No	No	Yes	No

HEALTH EFFECTS:

Exposure Limits	Irritant	Sensitization
Yes	No	No
Teratogen	Reproductive Hazard	Mutagen
Yes	Yes	Yes
Synergistic Effects None Reported		

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS:
None reported.

SKIN EFFECTS:
None reported.

INGESTION EFFECTS:
None reported.

INHALATION EFFECTS:
Inhaled carbon monoxide binds with blood hemoglobin to form carboxyhemoglobin. Carboxyhemoglobin can not take part in normal oxygen transport, greatly reducing the blood's ability to transport oxygen. Depending on levels and duration of exposure, symptoms may include headache, dizziness, heart palpitations, weakness, confusion, nausea, and even convulsions, eventual unconsciousness and death.

Some experimental evidence indicating teratogenic and reproductive effects.

NFPA HAZARD CODES	HMIS HAZARD CODES	RATINGS SYSTEM
Health: 2	Health: 2	0 = No Hazard
Flammability: 4	Flammability: 4	1 = Slight Hazard
Reactivity: 0	Reactivity: 0	2 = Moderate Hazard
		3 = Serious Hazard
		4 = Severe Hazard

4. First Aid Measures

EYES:
None required.

SKIN EFFECTS:
None required.

INGESTION:
None required.

INGESTION EFFECTS:
None required.

INHALATION:
Conscious persons should be assisted to an uncontaminated area and be treated with supplemental oxygen. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area and be given artificial respiration and oxygen at the same time. The administering of the oxygen at an elevated pressure (up to 2 to 2.5 atmospheres) has shown to be beneficial as has treatment in a hyperbaric chamber. The physician should be informed that the patient has inhaled toxic quantities of carbon monoxide. PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO CARBON MONOXIDE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS AND BE COGNIZANT OF EXTREME FIRE AND EXPLOSION HAZARD.

5. Fire Fighting Measures

Conditions of Flammability: Flammable gas		
Flash point: Not Available	Method: Not Applicable	Autoignition: Temperature: 116 ^{o}F (639 ^{o}C)
LEL(%): 12.5	UEL(%): 74.0	
Hazardous combustion products: None		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: Not Available		

FIRE AND EXPLOSION HAZARDS:
Having almost the same density as air, it will not diffuse by rising as with some lighter flammable gases such as hydrogen or natural gas (methane). Flammable in air over a very wide range. It reacts violently with oxygen difluoride and barium peroxide.

EXTINGUISHING MEDIA:
Water, dry chemical, carbon dioxide.

FIRE FIGHTING INSTRUCTIONS:
If possible, stop flow of gas; use water spray to cool surrounding containers.

6. Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Electrical Classification:
Class 1, Group C

Earth-ground and bond all lines and equipment associated with the carbon monoxide system. Electrical equipment should be non sparking or explosion proof.

Carbon Monoxide can be handled in all commonly used metals up to approximately 500 psig (3450 kPa). Above that pressure it forms toxic and corrosive carbonyl compounds with some metals. Carbon steels, aluminum alloys, copper and copper alloys, low carbon stainless steels and nickel-based alloys such as Hastelloy A, B & C are recommended for higher pressure applications.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated areas away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130°F (54°C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time. Post "NO SMOKING OR OPEN FLAMES" signs in the storage area or use area. There should be no sources of ignition in the storage area or use area.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the system.

ENGINEERING CONTROLS:
Hood with forced ventilation. Use local exhaust to prevent accumulation above the exposure limit. Use general mechanical ventilation in accordance with electrical codes.

8. Exposure Controls, Personal Protection

EXPOSURE LIMITS[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Carbon Monoxide FORMULA: CO CAS: 630-08-0 RTECS #: FG3500000	100.0	50 ppm TWA	25 ppm TWA	LC_{50} 1807 ppm/4H (rat)

[1] Refer to individual state of provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 1994-1995 Threshold Limit Values for Chemical Substances and Physical Agents.

EYE/FACE PROTECTION:
Safety goggles or glasses.

SKIN PROTECTION:
Any material protective gloves.

RESPIRATORY PROTECTION:
Positive pressure air line with full-face mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

OTHER/GENERAL PROTECTION:
Safety shoes.

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: >220.4	psia
Vapor density (Air = 1)	: Not Available	
Evaporation point	: Not Available	
Boiling point	: -312.7	^{o}F
	: -191.5	^{o}C
Freezing point	: -337.1	^{o}F
	: -205.1	^{o}C
pH	: Not Available	
Specific gravity	: 0.96	
Oil/water partition coefficient	: Not Available	
Solubility (H20)	: Very slight	
Odor threshold	: Not Applicable	
Odor and appearance	: Odorless; colorless gas	

10. Stability and Reactivity

STABILITY:
Stable

INCOMPATIBLE MATERIALS:
Oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon dioxide

HAZARDOUS POLYMERIZATION:
Will not occur.

11. Toxicological Information

REPRODUCTIVE:
Inhalation of 150 ppm carbon monoxide for 24 hours by pregnant rats produced cardiovascular and behavioral defects in offspring. Toxic effects to fertility were observed in female rats exposed to 1 mg/m^3 for 24 hours. Similar effects observed in other mammalian species.

MUTAGENIC:
Genetic changes observed in mammalian cell assay systems at exposures of 1500 to 2500 ppm for 10 minutes.

OTHER:
Degenerative changes to the brain in rats chronically exposed to 30 mg/m^3.

12. Ecological Information

No data given.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Carbon Monoxide	Carbon Monoxide
HAZARD CLASS:	2.3	2.3 (2.1)
IDENTIFICATION NUMBER:	UN 1016	UN 1016
SHIPPING LABEL:	POISON GAS, FLAMMABLE GAS	POISON GAS, FLAMMABLE GAS

Additional Marking Requirement: "Inhalation Hazard"
Additional Shipping Paper Description Requirement: "Poison-Inhalation Hazard, Zone D"

15. Regulatory Information

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:
Acute Health Hazard
Chronic Health Hazard
Fire Hazard
Sudden Release of Pressure Hazard

16. Other Information

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES:
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

Geosyntec consultants

Appendix E

Air Monitoring Equipment, Frequency of Readings, and Action Guidelines per Task

Applies to Task: ☒ ① ☒ ② ☐ ③ ☒ ④ ☒ ⑤ ☐ ⑥ ☐ ⑦ ☐ ⑧

☐ *Explosimeter*

Brand/Model No.: _____

Monitoring Frequency:____

Source Reading (% LEL)	Action
1 to 10	Continue with caution.
Greater than 10	Stop work. Evacuate the area. If upon return, if concentration still exceeds 10% LEL, ventilate until concentration is back to <10% LEL.

Note: _____

☐ *Oxygen Meter*

Brand/Model No.: _____

Monitoring Frequency: hourly during operation in task 2 only

Reading (%)	Action
Less than 19.5	Stop work. Evacuate the area.
19.5 to 23.5	Continue to work with caution.
Greater than 23.5	Stop work. Evacuate the area.

Note: _____

☒ *Photoionization Detector*

Brand/Model No.: Mini Rae 2000 _____

Monitoring Frequency: continuous during sampling activities, periodic within staff trailer,

Breathing Zone Reading (ppm)	Action
0 to1 (above background)	Level D PPE
01 to 25	Level C PPE
Greater than 25	Stop work. Evacuate the area. If upon return, levels still exceed 25, stop work and implement engineering controls.

Note:_____

☐ *Flame Ionization Detector*

Brand/Model No.: _____

Monitoring Frequency:hourly during operation and drilling

Breathing Zone Reading (ppm)	Action
_____ to _____	Level D PPE
_____ to _____	Level C PPE
Greater than _____	Stop work. Evacuate the area. If upon return, levels still exceed ____, stop work and implement engineering controls.

Note: _____

☒ *Chemical Detector Tube*

Brand/Model No.: Drager – Benzene
Carbon Monoxide -#6733051

Monitoring Frequency: if PID is sustained greater than 0.5 in breathing space. For CO test if area monitoring exceeds 10 ppm

Breathing Zone Reading (ppm)	Action
0 to 1 (for benzene above background)	Level D PPE
Greater than 1	Stop work. Evacuate the area. If upon return, levels still exceed 0.5, stop work and implement engineering controls.

Note: for carbon monoxide, stop work if greater than 25 ppm

☒ *Other*

Brand/Model No.: QRae for breathing zone measurements during sampling and staff trailer, Household CO alarm for staff trailer

Monitoring Frequency: continuous during sampling activities, periodic within staff trailer,

Breathing Zone Reading	Action
0 to 25	Level D PPE
Greater than 25	Stop work. Evacuate the area. If upon return, levels still exceed 25, stop work and implement engineering controls. Fans or move upwind.

Note: if staff trailer CO alarm goes off, evacuate trailer and stay upwind of treatment system discharge, until safe to return

Appendix F

Personal Protective Equipment per Task (PPE for Energized Systems is provided in Appendix H)

	Task ①	Task ②	Task ③	Task ④	Task ⑤	Task ⑥	Task ⑦	Task ⑧
Potential PPE Level per Task:	☒ D ☐ C	☒ D ☒ C	☒ D ☐ C	☒ D ☐ C	☒ D ☐ C	☐ D ☐ C	☐ D ☐ C	☐ D ☐ C

Modified Level D*		***Level C****	
Equipment	***Material/Type***	***Equipment***	***Material/Type***
☒ Protective clothing	Tyvex, Nomex, as applicable	☒ Full-face air-purifying respirator/ supplied air	Supplied air required
☒ Outer gloves	Leather and nitrile as applicable	☐ Half-mask air-purifying respirator	Cartridge Type:
☒ Outer boots		☒ Protective clothing	Tyvec Suit
☒ Hard hat**		☒ Outer gloves	
☒ Safety glasses**		☐ Inner gloves	
☒ Hard-toed boots**		☐ Outer boots	
☒ Hearing protection**		☒ Hard hat**	
☒ Other: Insulated Gloves**	Rated for 500°F, or category 0 for electrical work	☒ Safety glasses**	
☒ Other: Face Shield**		☒ Hard-toed boots**	
☒ Other: Goggles**		☒ Hearing protection**	
		☐ Other:	

* If checked, indicates initial level of PPE. Other completed columns indicate information to upgrade/downgrade.

** Optional as applicable

Appendix G

Material Safety Data Sheets

Included in HASP	*Chemical*
☐	Acetone
☒	Alconox
☐	Ammonia
☒	Bentonite
☒	Carbon dioxide calibration gas
☒	Carbon monoxide calibration gas
☒	Diesel Fuel Oil No. 2-D
☐	Hydrochloric Acid
☐	Hydrogen
☒	Isobutylene Calibration Gas
☐	Isopropyl Alcohol
☐	KB-1
☐	Methane Calibration Gas
☒	Oxygen calibration gas
☐	Permanganate
☒	Portland Cement
☐	Sulfuric Acid
☐	Other: _____

MATERIAL SAFETY DATA SHEET
29 CFR 1910.1200 OSHA Hazard
Communication Rule Format
Chem-Tel 24 Hour Emergency # 1-800-255-3924

MINE SAFETY APPLIANCES COMPANY
P.O. Box 426
Pittsburgh, PA 15230
PHONE (412) 967-3000

This product contains oxygen and nitrogen, substances subject to the Pennsylvania Worker and Community Right-To-Know Act.

PRODUCT IDENTITY

LABEL IDENTITY - MSA P/N 10028028 Calibration Check Gas, Air, 20.8% Oxygen, Balance Nitrogen

CHEMICAL NAME - Oxygen, Nitrogen Mixture

ADDITIONAL IDENTITIES - MSA P/N 10028028 Calibration Gas

FORMULA - O_2 in N_2

APPLICABLE CHEMICAL CONTENTS

	%	TWA
Oxygen (CAS 7782-44-7)	20.8	None
Nitrogen (CAS 7727-37-9)	Balance	None

NOTE: Gas Under Pressure, 1000 PSIG at 70°F, Approx. 100 Liters Gas at Atmospheric Pressure

PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR - Colorless, odorless gas

BOILING POINT - N/A

SPECIFIC GRAVITY (H_2O = 1) - N/A

VAPOR PRESSURE - N/A

PERCENT VOLATILE BY VOLUME - N/A

VAPOR DENSITY (AIR = 1) - 1

SOLUBILITY IN WATER - Oxygen - 3.2 cm^3/100 ml (25°C)
Nitrogen - 2.3 cm^3/100 ml (0°C)

N/A - Not Applicable

PHYSICAL HAZARD INFORMATION

PHYSICAL HAZARD - Compressed gas, 1000 PSIG at 70°F

CONDITIONS OR MATERIALS TO AVOID - None

FLASH POINT - N/A LEL - N/A UEL - N/A

EXTINGUISHING MEDIA - This calibration gas mixture is not flammable

SPECIAL FIRE FIGHTING PROCEDURES - See next item

UNUSUAL FIRE AND EXPLOSION HAZARDS - Gas under pressure, 1000 PSIG at 70°F. Do not exceed 120°F.

HEALTH HAZARDS

HEALTH HAZARDS - None

SIGNS AND SYMPTOMS OF EXPOSURE - N/A

PRIMARY ROUTES OF ENTRY - Inhalation

TARGET ORGANS - N/A

MEDICAL CONDITIONS GENERALLY RECOGNIZED AS BEING AGGRAVATED BY EXPOSURE - N/A

EXPOSURE LIMITS - N/A

CARCINOGENICITY DATA - NIOSH RTECS, OSHA, NTP or IARC does not list component gases.

EMERGENCY AND FIRST AID PROCEDURES - None

SAFE HANDLING AND USE

HYGIENIC PRACTICES - None

PROTECTIVE MEASURES DURING REPAIR AND MAINTENANCE OF CONTAMINATED EQUIPMENT - N/A

PROCEDURES FOR SPILL OR LEAK CLEANUP - None

WASTE DISPOSAL - Do not puncture or incinerate cylinder. Before discarding cylinder, slowly release contents to a safe exhaust. Dispose of cylinder in accordance with local, state, and federal regulations.

STORAGE - Store in a cool, dry, well-ventilated area. Do not exceed 120°F.

CONTROL MEASURES

PERSONAL PROTECTIVE EQUIPMENT - None

ENGINEERING CONTROLS - None

WORK PRACTICES - Follow the calibration procedure detailed in the MSA instruction manual provided with the instrument under calibration.

DATE OF PREPARATION - Rev. 4, May 2009

WARNING: This is a hazardous chemical product. By following the directions and warnings provided with this product, the hazards associated with the use of this product can be greatly reduced but never entirely eliminated. Mine Safety Appliances Company makes no warranties, expressed or implied, with respect to this product and EXPRESSLY DISCLAIMS THE WARRANTY OF MERCHANTABILITY AND ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE. Users assume all risks in handling, using or storing this product.

AIR LIQUIDE™

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas: Oxygen 0-23.5%; Isobutylene, 0.0005-0.9%

SYNONYMS: Not Applicable
CHEMICAL FAMILY NAME: Not Applicable
FORMULA: Not Applicable
Document Number: 50054

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

PRODUCT USE:	Calibration of Monitoring and Research Equipment
SUPPLIER/MANUFACTURER'S NAME:	AIR LIQUIDE AMERICA CORPORATION
ADDRESS:	821 Chesapeake Drive Cambridge, MD 21613
EMERGENCY PHONE:	CHEMTREC: 1-800-424-9300
BUSINESS PHONE:	1-410-228-6400
General MSDS Information	1-713/868-0440
Fax on Demand:	1-800/231-1366

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	
Oxygen	7782-44-7	0 - 23.5%	There are no specific exposure limits for Oxygen.					
Isobutylene	115-11-7	0.0005 - 0.9%	There are no specific exposure limits for Isobutylene.					
Nitrogen	7727-37-9	Balance	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					

NE = Not Established. C = Ceiling Limit. See Section 16 for Definitions of Terms Used.

NOTE : All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is a colorless, odorless gas. Releases of this product may produce oxygen-deficient atmospheres (especially in confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated. Isobutylene, a component of this gas mixture, may cause drowsiness and other central nervous system effects in high concentrations; however, due to its low concentration in this gas mixture, this is unlikely to occur.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this product is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this product, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. The chief health hazard associated with this gas mixture is when this product contains less than 19.5% Oxygen and is released in a small, poorly-ventilated area (i.e. an enclosed or confined space). Under this circumstance, an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN	OBSERVED EFFECT
12-16% Oxygen:	Breathing and pulse rate increase, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea, vomiting, collapse, or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.

HAZARDOUS MATERIAL INFORMATION SYSTEM

HEALTH	(BLUE)	1
FLAMMABILITY	(RED)	0
REACTIVITY	(YELLOW)	0
PROTECTIVE EQUIPMENT		B

EYES	RESPIRATORY	HANDS	BODY
See Section 8			

For routine industrial applications

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:

ACUTE: Due to the small size of the individual cylinder of this product, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. The most significant hazard associated with this gas mixture when it contains less than 19.5% oxygen is the potential for exposure to oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, unconsciousness, and death. The skin of a victim of over-exposure may have a blue color. Additionally, Isobutylene, a component of this gas mixture, may cause drowsiness or central nervous system effects in high concentrations; however, due to its low concentration in this gas mixture, this is unlikely to occur.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to this gas mixture.

TARGET ORGANS: Respiratory system.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn.

No unusual health effects are anticipated after exposure to this product, due to the small cylinder size. If any adverse symptom develops after over-exposure to this product, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

4. FIRST-AID MEASURES (Continued)

Victim(s) who experience any adverse effect after over-exposure to this product must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

5. FIRE-FIGHTING MEASURES

FLASH POINT, (method): Not applicable.

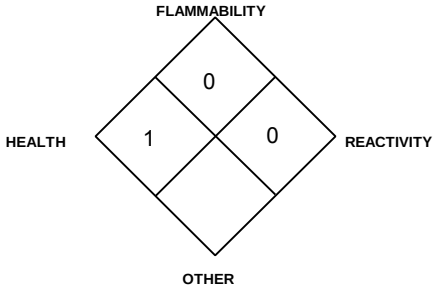
AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):
Lower (LEL): Not applicable.
Upper (UEL): Not applicable.

FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

NFPA RATING



Explosion Sensitivity to Mechanical Impact: Not sensitive.
Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this product presents significantly less risk of an oxygen deficient environment and other safety hazards than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen. Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.

If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue, especially if work is done in a poorly-ventilated area; exposures to fatal concentrations of this product could occur without any significant warning symptoms, due to oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify cylinders containing this gas mixture. If there is a malfunction or another type of operational problem, contact nearest distributor immediately.

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C; 70°F). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage.

Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. **WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.**

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this product in well-ventilated areas. If this product is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of oxygen.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if oxygen levels are below 19.5% or unknown during emergency response to a release of this product. If respiratory protection is required for emergency response to this product, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards.

EYE PROTECTION: Safety glasses.

HAND PROTECTION: No special protection is needed under normal circumstances of use.

BODY PROTECTION: No special protection is needed under normal circumstances of use.

9. PHYSICAL and CHEMICAL PROPERTIES

Unless otherwise specified, the following information is for Nitrogen, the main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.072 lbs/ ft^3 (1.153 kg/m^3)

BOILING POINT: -195.8°C (-320.4 °F)

FREEZING/MELTING POINT @ 10 psig -210°C (-345.8°F)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906

pH: Not applicable.

SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023

MOLECULAR WEIGHT: 28.01

EVAPORATION RATE (nBuAc = 1): Not applicable.

EXPANSION RATIO: Not applicable.

ODOR THRESHOLD: Not applicable.

SPECIFIC VOLUME (ft^3/lb): 13.8

VAPOR PRESSURE @ 70°F (21.1°C) psig: Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is for this gas mixture.

APPEARANCE AND COLOR: This product is a colorless, odorless gas.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no unusual warning properties associated with a release of this product.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: The thermal decomposition products of Isobutylene include carbon oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in Nitrogen (the main component of this product). Lithium reacts slowly with Nitrogen at ambient temperatures. A component of this product (Isobutylene) are also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen difluoride, and nitrogen trifluoride).

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this product:

NITROGEN: There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

ISOBUTYLENE:
LC_{50} (inhalation, rat) = 620,000 mg/kg/4 hours
LC_{50} (inhalation, mouse) = 415,000 mg/kg

11. TOXICOLOGICAL INFORMATION (Continued)

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: Not applicable.

SENSITIZATION TO THE PRODUCT: This gas mixture is not known to cause sensitization in humans.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this product and its components on the human reproductive system.

Mutagenicity: No mutagenicity effects have been described for this gas mixture.
Embryotoxcity: No embryotoxic effects have been described for this gas mixture.
Teratogenicity: No teratogenicity effects have been described for this gas mixture.
Reproductive Toxicity: No reproductive toxicity effects have been described for gas mixture.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions may be aggravated by over-exposure to the components of this product.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary; treat symptoms; eliminate exposure.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for the components of this gas mixture.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The components of this gas mixture occur naturally in the atmosphere. The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this product.

OXYGEN: Water Solubility = 1 volume Oxygen/32 volumes water at 20°C. Log K_{ow} = -0.65
NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C. 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this product's effects on plant and animal life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this product's effects on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (Nitrogen, Oxygen)
HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1956
PACKING GROUP: Not applicable.
DOT LABEL(S) REQUIRED: Non-Flammable Gas
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 126

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

14. TRANSPORTATION INFORMATION (Continued)

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

SARA REPORTING REQUIREMENTS: This product is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPONENT	SARA 302	SARA 304	SARA 313
Oxygen	NO	NO	NO
Nitrogen	NO	NO	NO
Isobutylene	NO	NO	NO

SARA THRESHOLD PLANNING QUANTITY: Not applicable.

TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

OTHER U.S. FEDERAL REGULATIONS:

- No component of this product is subject to the requirements of CFR 29 1910.1000 (under the 1989 PELs).
- Isobutylene is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 pounds.
- The regulations of the Process Safety Management of Highly Hazardous Chemicals are not applicable (29 CFR 1910.119).
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR Part 82).
- Nitrogen and Oxygen are not listed as Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Isobutylene is listed under this regulation in Table 3 as Regulated Substances (Flammable Substances), in quantities of 10,000 lbs (4,553 kg) or greater.

OTHER CANADIAN REGULATIONS: This gas mixture is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations.

STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: No.
California - Permissible Exposure Limits for Chemical Contaminants: Nitrogen.
Florida - Substance List: Oxygen, Isobutylene.
Illinois - Toxic Substance List: No.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List: Oxygen, Isobutylene.
Michigan - Critical Materials Register: No.
Minnesota - List of Hazardous Substances: No.
Missouri - Employer Information/Toxic Substance List: No.
New Jersey - Right to Know Hazardous Substance List: Oxygen, Nitrogen, Isobutylene.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.
Pennsylvania - Hazardous Substance List: Oxygen, Nitrogen, Isobutylene.
Rhode Island - Hazardous Substance List: Oxygen, Nitrogen.
Texas - Hazardous Substance List: No.
West Virginia - Hazardous Substance List: No.
Wisconsin - Toxic and Hazardous Substances: : No.

CALIFORNIA PROPOSITION 65: No component of this product is on the California Proposition 65 lists.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. Air Liquide America will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

P-1 *"Safe Handling of Compressed Gases in Containers"*
AV-1 *"Safe Handling and Storage of Compressed Gases"*
"Handbook of Compressed Gases"

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

Fax on Demand: 1-800/231-1366

AIR LIQUIDE™

This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this product. To the best of Air Liquide America Corporation's knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this product is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.

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Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Diesel fuel oil no. 2-D
Chemical Formula: Unspecified or variable
CAS Number: 68334-30-5
Synonyms: automotive diesel oil; diesel fuel; diesel oil (medium); diesel oil no. 2; diesel oil (petroleum); diesel oils; diesel test fuel; fuels, diesel; no. 2 diesel oil; olej napeldowy III (Polish)
Derivation: Fuel oil may be a distilled fraction of petroleum, a residuum from refinery operations, a crude petroleum or a blend of two or more of these.
General Use: This medium viscosity residual fuel oil has both light and heavy grades, and is used in furnaces and boilers of utility and industrial power plants, ships, locomotives, and metallurgical operations.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Diesel fuel oil no. 2-D, ca 100% vol; diesel fuels consist primarily of aliphatic (64% vol), aromatic (35% vol), and olefinic (1-2% vol) hydrocarbons.
Trace Impurities: May contain sulfur (< 0.5), benzene (<100 ppm), and additives such as sulfurized esters.

OSHA PEL
As petroleum distillates
8-hr TWA: 500 ppm (2000 mg/m^3)

ACGIH TLV
As diesel fuel
Notice of impending change (1997):
TWA: 100 mg/m^3, *Skin*

NIOSH REL
As petroleum distillates
10-hr TWA: 350 mg/m^3
Ceiling (15 min): 1800 mg/m^3

IDLH Level
As petroleum distillates
1,100 ppm

DFG (Germany) MAK
None established

Section 3 - Hazards Identification

ANSI Signal Word: Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Diesel fuel oil no. 2-D is a brown, slightly viscous liquid with a kerosene-like odor. It is irritating to the skin and respiratory tract. Inhalation of mist or vapor may result in headache, nausea, vomiting, diarrhea, central nervous system (CNS) depression, tachycardia (rapid heart beat), cyanosis (blue coloration of skin due to oxygen deficiency), pulmonary edema (fluid in the lungs), and liver or kidney injury. Diesel fuel oil no. 2-D is an environmental hazard when spilled. When exposed to heat or flame, this flammable liquid is a fire hazard. When heated to decomposition, diesel fuel oil no. 2-D will emit acrid smoke and irritating vapors.

Wilson Risk Scale
R 1
I 2
S 2*
K 2
*Skin absorption

HMIS
H 1*
F 2
R 0
PPE†
*Chronic effects
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin contact/absorption
Target Organs: Skin, CNS, cardiovascular system (CVS), respiratory system, liver, kidneys
Acute Effects
Inhalation: Euphoria, respiratory irritation, cardiac dysrhythmia, increased respiration rates, cyanosis, pulmonary edema, hemoptysis (spitting up blood from the respiratory tract), respiratory arrest, renal (kidney) and liver injury, and CNS toxicity can result from inhalation of diesel fuel oil no. 2-D mist or vapor.
Eye: Contact may result in irritation.
Skin: Contact may cause irritation, systemic effects (see Inhalation), and block the sebaceous (oil) glands, resulting in a rash of acne-like pimples and spots, usually on the arms and legs.
Ingestion: Gastrointestinal irritation, vomiting, diarrhea, and in severe cases, CNS depression progressing to coma and death and other systemic effects (see Inhalation) can result. Aspiration can result in transient CNS depression or excitement, hypoxia, infection, pneumatocele (abnormal cavities in lungs) formation, and chronic lung dysfunction.
Carcinogenicity: IARC lists occupational exposure in petroleum refining as Group 2A (Probable human carcinogen) and distillate light (diesel) fuels as Group 3 (Not classifiable as to carcinogenicity to humans). ACGIH lists a notice of impending change for diesel fuels as TLV-A3 (Animal carcinogen). NTP and OSHA do not list diesel fuel oil no. 2-D as a carcinogen.

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Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Prolonged or repeated skin contact causes dermatitis and possible systemic toxicity. Prolonged or repeated inhalation can cause CNS and peripheral nervous system damage.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain and/or irritation develops.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water followed by washing the exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Have the *conscious and alert* person drink 1 to 2 glasses of water. Contact a poison control center. Because of aspiration risk, *do not* induce vomiting unless the poison control center advises otherwise.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Gastric lavage is contraindicated due to aspiration risk. Instead, consider administration of charcoal or milk. If ingestion amount is large, gastric emptying in the alert patient can be accomplished through administration of Syrup of Ipecac. Treat overexposure symptomatically and supportively.

Section 5 - Fire-Fighting Measures

Flash Point: 100.4 °F (38 °C)

Flash Point Method: CC

Autoignition Temperature: 351-624 °F (177-329 °C)

LEL: 1.3% v/v

UEL: 75% v/v

Flammability Classification: OSHA Class II Combustible Liquid

Extinguishing Media: Use dry chemical, carbon dioxide, foam, low velocity water fog or spray. Use a smothering technique to extinguish fire. Water may be ineffective in putting out a fire involving diesel fuel oil no. 2-D, and a solid water stream may spread the flames; however, a water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources.

Unusual Fire or Explosion Hazards: Vapor or mist can form explosive mixtures in air. In still air, the heavier-than-air vapors of diesel fuel oil no. 2-D from a large source may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers may explode in heat of fire.

Hazardous Combustion Products: Heating diesel fuel oil no. 2-D to decomposition can produce acrid smoke and irritating vapors.

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Ground all equipment used when handling this product. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A fire fighting foam may be used to suppress vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material.

Small Spills: Absorb diesel fuel oil no. 2-D with vermiculite, earth, sand or similar material.

Large Spills

Containment: For large spills, consider downwind evacuation of at least 1000 ft (300 m). Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.

Cleanup: Ground all equipment. Use non-sparking tools. Spills can be absorbed with materials such as peat, activated carbon, polyurethane foam, or straw. Sinking agents, gelling agents, dispersants, and mechanical systems can also be use to treat oil spills.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor or mist inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves (or use barrier cream), and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers.

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Storage Requirements: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Periodically inspect stored materials. Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.106) for Class II Combustible Liquid.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Enclose operations and/or provide local exhaust ventilation appropriately designed for flammable mist and vapor at the site of chemical release. Where possible, transfer diesel fuel oil no. 2-D from drums or other storage containers directly to process containers. Minimize sources of ignition in surrounding low-lying areas.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), use an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets. Wear protective eyeglasses, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance and Odor: Brown, slightly viscous; kerosene-like odor
Odor Threshold: 0.7 ppm
Vapor Pressure: < 0.1 mm Hg at 68 °F (20 °C)
Vapor Density (Air=1): > 6
Formula Weight: N/A

Specific Gravity (H_2O=1, at 4 °C): < 0.86
Water Solubility: Insoluble
Boiling Point: 340-676 °F (171-358 °C)
Freezing Point: -29.2 °F (-34 °C)
Viscosity: 1.9-4.1 centistoke at 104 °F (40 °C)
Surface Tension: 23-32 dynes/cm at 68 °F (20 °C)

Section 10 - Stability and Reactivity

Stability: Diesel fuel oil no. 2-D is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Include strong oxidizing agents.

Conditions to Avoid: Exposure to heat and ignition sources.

Hazardous Decomposition Products: Thermal oxidative decomposition of diesel fuel oil no. 2-D can produce low molecular weight hydrocarbons, hydrocarbon derivatives, carbon oxides (CO_x), and sulfur oxides (SO_x).

Section 11- Toxicological Information

Toxicity Data:*

Acute Oral Effects:
Rat, oral, LD_{50}: 7500 mg/kg

Acute Dermal Effects:
Rabbit, skin, LD: > 5 mL/kg

Skin Effects:
Rabbit, skin, standard Draize test: 500 µL/24 hr, resulted in severe reaction.

Other Multiple Dose Toxicity Data:
Rat, inhalation: 2 g/m^3/6 hr/3 weeks, intermittently, resulted in changes in blood erythrocyte (RBC) count, and focal fibrosis (pneumonoconiosis) and other changes in the lung, thorax or respiration.
Rat, inhalation: 400 µg/m^3/16 hr/2.5 years, intermittently, caused other changes in the blood, and biochemical effects - transaminases.
Rabbit, skin: 80 mL/kg/12 days, continuously, resulted in other changes in the liver, kidney, ureter, and bladder, and death.

* See NIOSH, *RTECS* (HZ1800000), for additional toxicity data.

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Section 12 - Ecological Information

Ecotoxicity: Juvenile American shad, salt water TLm: 204 mg/L/24 hr; mallard duck, LD_{50}=20 mg/kg.

Environmental Fate: Diesel fuel oil no. 2-D will evaporate from water or soil. In surface water, it may partition from the water column to suspended sediments.

Environmental Degradation: Biodegradation may occur in soil and water.

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Diesel fuel
Shipping Symbols: D
Hazard Class: 3
ID No.: NA1993
Packing Group: III
Label: None
Special Provisions (172.102): B1

Packaging Authorizations
a) Exceptions: 173.150
b) Non-bulk Packaging: 173.203
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 60 L
b) Cargo Aircraft Only: 220 L

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: –

Section 15 - Regulatory Information

EPA Regulations:

Classified as RCRA Hazardous Waste (40 CFR 261.21): Characteristic of Ignitability
RCRA Hazardous Waste Number: D001
Listed as a CERCLA Hazardous Substance (40 CFR 302.4), Unlisted Hazardous Waste, Characteristic of Ignitability per RCRA Sec. 3001
CERCLA Final Reportable Quantity (RQ): 100 lb (45.4 kg)
SARA Toxic Chemical (40 CFR 372.65): Not listed
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A, as petroleum distillates)

Section 16 - Other Information

References: 73, 103, 136, 190, 209, 222, 230, 231

Prepared By..... HM Spliethoff, MS
Industrial Hygiene Review..... PA Roy, MPH, CIH
Medical Review ..... T Thoburn, MD, MPH

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CAS # 68334-30-5

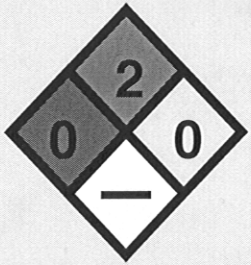
Warning! 1 3

Flammable

Diesel Fuel Oil No. 2-D

diesel fuel

Brown, slightly viscous liquid; kerosene-like odor. Irritating to eyes/skin/respiratory tract. Also Causes: increased respiration rate, rapid heart beat, cyanosis; GI irritation, vomiting, diarrhea, CNS depression. Chronic Effects: dermatitis. Flammable.



Target Organs

3 9 10

Skin, Respiratory System, Nervous System, Liver, Kidneys, Cardio-vascular

Personal Protective Equipment

8

Goggles, Gloves, Apron

Check to see is respirator required

Emergency Procedures

First Aid

4

Inhalation: Remove to fresh air and support breathing as needed. Eyes/Skin: Remove contaminated clothing. Flush eyes with plenty of water. Thoroughly wash skin with soap and water. Ingestion: Do not induce vomiting. Consult physician.

Fire

5

Flammable. Can form explosive mixtures in the air. Use water as fog, dry chemical, or carbon dioxide. Do not use water spray as it may scatter fire.

Spills & Leaks

6

Notify safety personnel, isolate and ventilate area, deny entry, stay upwind. Shut off ignition sources. Absorb with inert material, such as sand or vermiculite. Cleanup crew should protect against exposure.

Consult **MSDS 0470** for more information

Material Safety Data Sheet

Airgas

Nonflammable Gas Mixture: Carbon Monoxide 0.0001-12.5% / Nitrogen 87.5-99%

Section 1. Chemical product and company identification

Product name : Nonflammable Gas Mixture: Carbon Monoxide 0.0001-12.5% / Nitrogen 87.5-99%

Supplier : AIRGAS INC., on behalf of its subsidiaries
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Product use : Synthetic/Analytical chemistry.

MSDS # : 002027

Date of Preparation/Revision : **1/22/2009.**

In case of emergency : 1-866-734-3438

Section 2. Hazards identification

Physical state : Gas.

Emergency overview : WARNING!

HARMFUL IF INHALED.
CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CONTENTS UNDER PRESSURE.

Do not puncture or incinerate container. Avoid breathing gas. Contains material that may cause target organ damage, based on animal data. Use only with adequate ventilation. Keep container closed.

Contact with rapidly expanding gases can cause frostbite.

Target organs : Contains material which may cause damage to the following organs: blood, lungs, cardiovascular system, central nervous system (CNS).

Routes of entry : Inhalation

Potential acute health effects

Eyes : Contact with rapidly expanding gas may cause burns or frostbite.

Skin : Contact with rapidly expanding gas may cause burns or frostbite.

Inhalation : Toxic by inhalation.

Ingestion : Ingestion is not a normal route of exposure for gases

Potential chronic health effects : **CARCINOGENIC EFFECTS**: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.

Medical conditions aggravated by over-exposure : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (section 11)

Section 3. Composition, Information on Ingredients

Name	CAS number	% Volume	Exposure limits
Nitrogen	7727-37-9	87.5 - 99	Oxygen Depletion [Asphyxiant]
Carbon Monoxide	630-08-0	0.0001 - 12.5	**ACGIH TLV (United States, 1/2008).** TWA: 29 mg/m³ 8 hour(s). TWA: 25 ppm 8 hour(s). **NIOSH REL (United States, 6/2008).** CEIL: 229 mg/m³ CEIL: 200 ppm TWA: 40 mg/m³ 10 hour(s). TWA: 35 ppm 10 hour(s).

Nonflammable Gas Mixture: Carbon Monoxide 0.0001-12.5% / Nitrogen 87.5-99%

OSHA PEL (United States, 11/2006).
TWA: 55 mg/m³ 8 hour(s).
TWA: 50 ppm 8 hour(s).
OSHA PEL 1989 (United States, 3/1989).
CEIL: 229 mg/m³
CEIL: 200 ppm
TWA: 40 mg/m³ 8 hour(s).
TWA: 35 ppm 8 hour(s).

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training.If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus.It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : As this product is a gas, refer to the inhalation section.

Section 5. Fire fighting measures

Flammability of the product : Non-flammable.

Auto-ignition temperature : Lowest known value: 608.89°C (1128°F) (carbon monoxide).

Flammable limits : Greatest known range: Lower: 12.5% Upper: 74.2% (carbon monoxide)

Products of combustion : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
nitrogen oxides

Fire-fighting media and instructions : Use an extinguishing agent suitable for the surrounding fire.

Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up : Immediately contact emergency personnel. Stop leak if without risk. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

Handling : Use only with adequate ventilation. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Keep container closed. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Storage : Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Personal protection

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory : Use a properly fitted, air supplied respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

Hands : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Personal protection in case of a large spill : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. Full chemical-resistant suit and self-contained breathing apparatus should be worn only by trained and authorized persons.

Product name

nitrogen	Oxygen Depletion [Asphyxiant]
carbon monoxide	**ACGIH TLV (United States, 1/2008).** TWA: 29 mg/m³ 8 hour(s). TWA: 25 ppm 8 hour(s). **NIOSH REL (United States, 6/2008).** CEIL: 229 mg/m³ CEIL: 200 ppm TWA: 40 mg/m³ 10 hour(s). TWA: 35 ppm 10 hour(s). **OSHA PEL (United States, 11/2006).** TWA: 55 mg/m³ 8 hour(s). TWA: 50 ppm 8 hour(s). **OSHA PEL 1989 (United States, 3/1989).** CEIL: 229 mg/m³ CEIL: 200 ppm TWA: 40 mg/m³ 8 hour(s). TWA: 35 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Nonflammable Gas Mixture: Carbon Monoxide 0.0001-12.5% / Nitrogen 87.5-99%

Section 9. Physical and chemical properties

Melting/freezing point : -198.9°C (-326°F) This is based on data for the following ingredient: carbon monoxide. Weighted average: -208.76°C (-343.8°F)

Critical temperature : Lowest known value: -146.9°C (-232.4°F) (nitrogen).

Vapor pressure Not available.

Vapor density : Highest known value: 0.97 (Air = 1) (carbon monoxide). Weighted average: 0.97 (Air = 1)

Gas Density (lb/ft ^{3}) : Weighted average: 0.07

Section 10. Stability and reactivity

Stability and reactivity : The product is stable.

Incompatibility with various substances : No incompatible product according to our database.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Product/ingredient name	Result	Species	Dose	Exposure
carbon monoxide	TDLo Intraperitoneal	Rat	35 mL/kg	-
	LC50 Inhalation Vapor	Rat	13500 mg/m3	15 minutes
	LC50 Inhalation Vapor	Rat	1900 mg/m3	4 hours
	LC50 Inhalation Gas.	Rat	3760 ppm	1 hours
	LC50 Inhalation Gas.	Mouse	2444 ppm	4 hours
	LC50 Inhalation Gas.	Rat	6600 ppm	30 minutes
	LC50 Inhalation Gas.	Rat	1807 ppm	4 hours

Chronic effects on humans : Contains material which may cause damage to the following organs: blood, lungs, cardiovascular system, central nervous system (CNS).

Other toxic effects on humans : No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects : No known significant effects or critical hazards.

Mutagenic effects : No known significant effects or critical hazards.

Reproduction toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Products of degradation : Products of degradation: carbon oxides (CO, CO_2), nitrogen oxides (NO, NO_2 etc.).

Environmental fate : Not available.

Environmental hazards : No known significant effects or critical hazards.

Toxicity to the environment : Not available.

Nonflammable Gas Mixture: Carbon Monoxide 0.0001-12.5% / Nitrogen 87.5-99%

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation.Return cylinders with residual product to Airgas, Inc.Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1956	COMPRESSED GAS, N.O.S.	2.2	Not applicable (gas).		-
TDG Classification	UN1956	COMPRESSED GAS, N.O.S.	2.2	Not applicable (gas).		**Explosive Limit and Limited Quantity Index** 0.125 **Passenger Carrying Road or Rail Index** 75
Mexico Classification	UN1956	COMPRESSED GAS, N.O.S.	2.2	Not applicable (gas).		-

Section 15. Regulatory information

United States

U.S. Federal regulations : **United States inventory (TSCA 8b):** All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: nitrogen; carbon monoxide
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: nitrogen: Sudden release of pressure; carbon monoxide: Fire hazard, Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 accidental release prevention: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

State regulations : **Connecticut Carcinogen Reporting:** None of the components are listed.
Connecticut Hazardous Material Survey: None of the components are listed.
Florida substances: None of the components are listed.
Illinois Chemical Safety Act: None of the components are listed.
Illinois Toxic Substances Disclosure to Employee Act: None of the components are listed.
Louisiana Reporting: None of the components are listed.
Louisiana Spill: None of the components are listed.
Massachusetts Spill: None of the components are listed.
Massachusetts Substances: The following components are listed: NITROGEN; CARBON MONOXIDE
Michigan Critical Material: None of the components are listed.
Minnesota Hazardous Substances: None of the components are listed.
New Jersey Hazardous Substances: The following components are listed: NITROGEN

(COMPRESSED OR LIQUIFIED); CARBON MONOXIDE
New Jersey Spill: None of the components are listed.
New Jersey Toxic Catastrophe Prevention Act: None of the components are listed.
New York Acutely Hazardous Substances: None of the components are listed.
New York Toxic Chemical Release Reporting: None of the components are listed.
Pennsylvania RTK Hazardous Substances: The following components are listed: NITROGEN; CARBON MONOXIDE
Rhode Island Hazardous Substances: None of the components are listed.

California Prop. 65 : **WARNING:** This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
Carbon Monoxide	No.	Yes.	No.	No.

Canada

WHMIS (Canada) : Class A: Compressed gas.
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class D-2A: Material causing other toxic effects (Very toxic).

CEPA Toxic substances: None of the components are listed.
Canadian ARET: None of the components are listed.
Canadian NPRI: The following components are listed: Carbon monoxide
Alberta Designated Substances: None of the components are listed.
Ontario Designated Substances: None of the components are listed.
Quebec Designated Substances: None of the components are listed.

Section 16. Other information

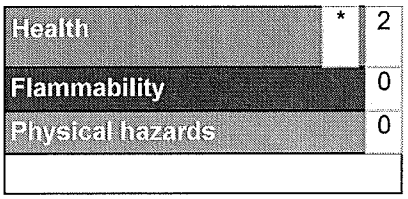
United States

Label requirements : HARMFUL IF INHALED.
CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CONTENTS UNDER PRESSURE.

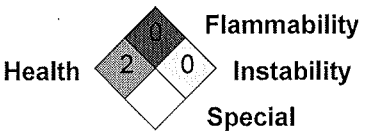
Canada

Label requirements : Class A: Compressed gas.
Class D-1A: Material causing immediate and serious toxic effects (Very toxic).
Class D-2A: Material causing other toxic effects (Very toxic).

Hazardous Material Information System (U.S.A.) :



National Fire Protection Association (U.S.A.) :



Notice to reader

Nonflammable Gas Mixture: Carbon Monoxide 0.0001-12.5% / Nitrogen 87.5-99%

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Material Safety Data Sheet

Nonflammable Gas Mixture: Carbon Dioxide / Nitrogen / Oxygen

Section 1. Chemical product and company identification

Product name	: Nonflammable Gas Mixture: Carbon Dioxide / Nitrogen / Oxygen
Supplier	: AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Product use	: Synthetic/Analytical chemistry.
MSDS #	: 005093
Date of Preparation/Revision	: **10/21/2009.**
In case of emergency	: 1-866-734-3438

Section 2. Hazards identification

Physical state : Gas.

WARNING!

MAY CAUSE RESPIRATORY TRACT, EYE AND SKIN IRRITATION.
CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CONTENTS UNDER PRESSURE.

Do not puncture or incinerate container. Avoid contact with eyes, skin and clothing. Contains material that may cause target organ damage, based on animal data. Wash thoroughly after handling. Keep container closed. Avoid breathing gas. Use with adequate ventilation.

Contact with rapidly expanding gases can cause frostbite.

Target organs : Contains material which may cause damage to the following organs: lungs, cardiovascular system, skin, eyes, central nervous system (CNS).

Routes of entry : Inhalation Dermal Eyes

Potential acute health effects

Eyes	: Moderately irritating to eyes. Contact with rapidly expanding gas may cause burns or frostbite.
Skin	: Moderately irritating to the skin. Contact with rapidly expanding gas may cause burns or frostbite.
Inhalation	: Moderately irritating to the respiratory system.
Ingestion	: Ingestion is not a normal route of exposure for gases
Potential chronic health effects	: **CARCINOGENIC EFFECTS**: Not available. **MUTAGENIC EFFECTS**: Not available. **TERATOGENIC EFFECTS**: Not available.
Medical conditions aggravated by over-exposure	: Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (section 11)

Section 3. Composition, Information on Ingredients

Name	CAS number	% Volume	Exposure limits

Nonflammable Gas Mixture: Carbon Dioxide / Nitrogen / Oxygen			
Nitrogen	7727-37-9	55.5 - 99	Oxygen Depletion [Asphyxiant]
Carbon Dioxide	124-38-9	0.1 - 25	**ACGIH TLV (United States, 1/2009).** STEL: 54000 mg/m³ 15 minute(s). STEL: 30000 ppm 15 minute(s). TWA: 9000 mg/m³ 8 hour(s). TWA: 5000 ppm 8 hour(s). **NIOSH REL (United States, 6/2008).** STEL: 54000 mg/m³ 15 minute(s). STEL: 30000 ppm 15 minute(s). TWA: 9000 mg/m³ 10 hour(s). TWA: 5000 ppm 10 hour(s). **OSHA PEL (United States, 11/2006).** TWA: 9000 mg/m³ 8 hour(s). TWA: 5000 ppm 8 hour(s). **OSHA PEL 1989 (United States, 3/1989).** STEL: 54000 mg/m³ 15 minute(s). STEL: 30000 ppm 15 minute(s). TWA: 18000 mg/m³ 8 hour(s). TWA: 10000 ppm 8 hour(s).
Oxygen	7782-44-7	0.1 - 19.5	

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training.If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus.It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

Flammability of the product : Non-flammable.

Products of combustion : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
nitrogen oxides

Fire-fighting media and instructions : Use an extinguishing agent suitable for the surrounding fire.

Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up : Immediately contact emergency personnel. Stop leak if without risk. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

Handling : Wash thoroughly after handling. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Keep container closed. Avoid contact with skin and clothing. Use with adequate ventilation. Avoid contact with eyes. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Storage : Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Personal protection

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

Hands : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Personal protection in case of a large spill : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. Full chemical-resistant suit and self-contained breathing apparatus should be worn only by trained and authorized persons.

Product name

Nitrogen	Oxygen Depletion [Asphyxiant]
Carbon dioxide	**ACGIH TLV (United States, 1/2009).** STEL: 54000 mg/m³ 15 minute(s). STEL: 30000 ppm 15 minute(s). TWA: 9000 mg/m³ 8 hour(s). TWA: 5000 ppm 8 hour(s). **NIOSH REL (United States, 6/2008).** STEL: 54000 mg/m³ 15 minute(s). STEL: 30000 ppm 15 minute(s). TWA: 9000 mg/m³ 10 hour(s). TWA: 5000 ppm 10 hour(s). **OSHA PEL (United States, 11/2006).** TWA: 9000 mg/m³ 8 hour(s). TWA: 5000 ppm 8 hour(s). **OSHA PEL 1989 (United States, 3/1989).** STEL: 54000 mg/m³ 15 minute(s).

STEL: 30000 ppm 15 minute(s).
TWA: 18000 mg/m³ 8 hour(s).
TWA: 10000 ppm 8 hour(s).

Oxygen

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Melting/freezing point : -210°C (-346°F) This is based on data for the following ingredient: Nitrogen. Weighted average: -211.42°C (-348.6°F)

Critical temperature : Lowest known value: -146.9°C (-232.4°F) (Nitrogen).

Vapor density : Highest known value: 1.53 (Air = 1) (Carbon dioxide). Weighted average: 1.08 (Air = 1)

Gas Density (lb/ft ^{3}) : Weighted average: 0.09

Section 10. Stability and reactivity

Stability and reactivity : The product is stable.

Incompatibility with various substances : Not considered to be reactive according to our database.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Product/ingredient name	Result	Species	Dose	Exposure
Carbon dioxide	LC50 Inhalation Gas.	Rat	470000 ppm	30 minutes

Chronic effects on humans : Contains material which may cause damage to the following organs: lungs, cardiovascular system, skin, eyes, central nervous system (CNS).

Other toxic effects on humans : No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects : No known significant effects or critical hazards.

Mutagenic effects : No known significant effects or critical hazards.

Reproduction toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Products of degradation : Products of degradation: carbon oxides (CO, CO_2), nitrogen oxides (NO, NO_2 etc.).

Environmental fate : Not available.

Environmental hazards : No known significant effects or critical hazards.

Toxicity to the environment : Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation.Return cylinders with residual product to Airgas, Inc.Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1956	COMPRESSED GAS, N.O.S.	2.2	Not applicable (gas).		-
TDG Classification	UN1956	COMPRESSED GAS, N.O.S.	2.2	Not applicable (gas).		**Explosive Limit and Limited Quantity Index** 0.125 **Passenger Carrying Road or Rail Index** 75
Mexico Classification	UN1956	COMPRESSED GAS, N.O.S.	2.2	Not applicable (gas).		-

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Section 15. Regulatory information

United States

U.S. Federal regulations : **United States inventory (TSCA 8b):** All components are listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: Oxygen; Nitrogen; Carbon dioxide
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Oxygen: Fire hazard, Sudden release of pressure, Delayed (chronic) health hazard; Nitrogen: Sudden release of pressure; Carbon dioxide : Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 accidental release prevention: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

State regulations : **Connecticut Carcinogen Reporting:** None of the components are listed.
Connecticut Hazardous Material Survey: None of the components are listed.
Florida substances: None of the components are listed.
Illinois Chemical Safety Act: None of the components are listed.
Illinois Toxic Substances Disclosure to Employee Act: None of the components are listed.
Louisiana Reporting: None of the components are listed.
Louisiana Spill: None of the components are listed.
Massachusetts Spill: None of the components are listed.
Massachusetts Substances: The following components are listed: CARBON DIOXIDE; NITROGEN; OXYGEN (LIQUID)
Michigan Critical Material: None of the components are listed.
Minnesota Hazardous Substances: None of the components are listed.
New Jersey Hazardous Substances: The following components are listed: CARBON DIOXIDE; NITROGEN (COMPRESSED OR LIQUIFIED); OXYGEN

New Jersey Spill: None of the components are listed.
New Jersey Toxic Catastrophe Prevention Act: None of the components are listed.
New York Acutely Hazardous Substances: None of the components are listed.
New York Toxic Chemical Release Reporting: None of the components are listed.
Pennsylvania RTK Hazardous Substances: The following components are listed: CARBON DIOXIDE; NITROGEN; OXYGEN
Rhode Island Hazardous Substances: None of the components are listed.

Canada

WHMIS (Canada) : Class A: Compressed gas.

CEPA Toxic substances: The following components are listed: Carbon dioxide
Canadian ARET: None of the components are listed.
Canadian NPRI: None of the components are listed.
Alberta Designated Substances: None of the components are listed.
Ontario Designated Substances: None of the components are listed.
Quebec Designated Substances: None of the components are listed.

Section 16. Other information

United States

Label requirements : MAY CAUSE RESPIRATORY TRACT, EYE AND SKIN IRRITATION.
CONTAINS MATERIAL THAT MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CONTENTS UNDER PRESSURE.

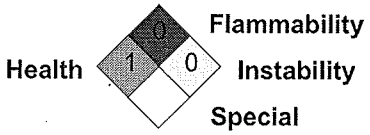
Canada

Label requirements : Class A: Compressed gas.

Hazardous Material Information System (U.S.A.) :

Health	*	1
Flammability		0
Physical hazards		0

National Fire Protection Association (U.S.A.) :



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

International Chemical Safety Cards

BENTONITE

ICSC: 0384

BENTONITE
Wilkinite

CAS # 1302-78-9
RTECS # CT9450000
ICSC # 0384

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST!	
• **INHALATION**		Avoid inhalation of fine dust and mist.	
• **SKIN**		Protective gloves.	
• **EYES**		Safety spectacles.	
• **INGESTION**			

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting (extra personal protection: P1 filter respirator for inert particles).		

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0384

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

BENTONITE

ICSC: 0384

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** ODOURLESS GRANULES OR POWDER IN VARIABLE COLOUR. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** The substance is a weak base in suspension in water. **OCCUPATIONAL EXPOSURE LIMITS (OELs):** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of dust. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** The substance may have effects on the lungs , resulting in silicosis due to the presence of crystalline silica (see ICSC # 0808).
PHYSICAL PROPERTIES	Relative density (water = 1): 2.5	Solubility in water: none
ENVIRONMENTAL DATA		

NOTES

Bentonites are aluminate silicate and can contain crystalline silica. The content varies widely from less than 1% to about 24%.

ADDITIONAL INFORMATION

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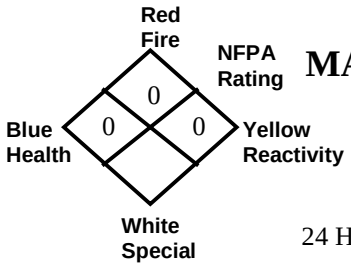
Alconox ®



MATERIAL SAFETY DATA SHEET

Alconox, Inc.
30 Glenn Street. Suite 309
White Plains, NY 10603

24 Hour Emergency Number – Chem-Tel (800) 255-3924

I. IDENTIFICATION

Product Name (as appears on label)	ALCONOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 1999
Chemical Family:	Anionic Powdered Detergent
Manufacturer Catalog Numbers for sizes	1104, 1125, 1150, 1101, 1103 and 1112

II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Melting Point:	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.

IV. FIRE AND EXPLOSION DATA

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO_2, foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. REACTIVITY DATA

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO_2 on burning

VI. HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VIII. CONTROL MEASURES

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	No special practices required

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Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2000-07

Portland Cement
MSDS 718
POR5000

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Portland Cement **CAS Number:** 65997-15-1
Chemical Formula: Unspecified or Variable
Synonyms: CEMENT; HYDRAULIC CEMENT; PORTLAND CEMENT; PORTLAND CEMENT SILICATE
General Use: Hydraulic binder used for mixing concrete, concrete masonry, mortars and grouts; also soil stabilization.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
portland cement	65997-15-1	varies

OSHA PEL
TWA: 15 mg/m^3; total dust.

NIOSH REL
No data found.

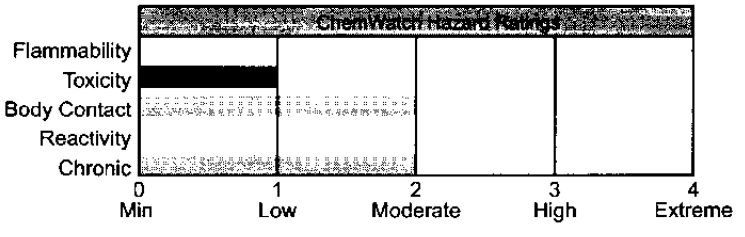
DFG (Germany) MAK
TWA: 5 mg/m^3.

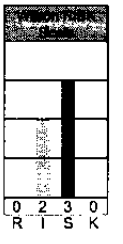
OSHA PEL Vacated 1989 Limits
TWA: 10 mg/m^3; total. Other Values: respirable mg/m^3; 5.

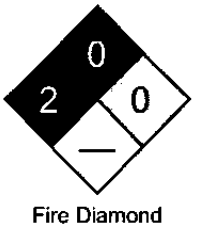
IDLH Level
5000 mg/m^3.

ACGIH TLV
TWA: 10 mg/m^3.

Section 3 - Hazards Identification







Fire Diamond

ANSI Signal Word
Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Gray powder; odorless. Irritating to eyes/skin/respiratory tract. Also causes (on contact with wet cement): corneal edema, dermatitis, cracked skin. Chronic: bronchitis, dermatitis.

Potential Health Effects

Primary Entry Routes: inhalation, ingestion, skin contact
Target Organs: respiratory system, skin, eyes
Acute Effects

Inhalation: Generated dust may be highly discomforting if inhaled and may even cause in some cases, sensitization. Respiratory sensitization may result in allergic/asthma like responses; from coughing and minor breathing difficulties to bronchitis with wheezing, gasping.
Effects on lungs are significantly enhanced in the presence of respirable particles.

Eye: The solid/dust is highly discomforting, may be abrasive to the eyes and capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

Skin: The dust is extremely discomforting to the skin and is capable of causing skin reactions which may lead to dermatitis.

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Handling wet cement can cause dermatitis. Cement when wet is quite alkaline and this alkali action on the skin contributes strongly to cement contact dermatitis since it may cause drying and defatting of the skin which is followed by hardening, cracking, lesions developing, possible infections of lesions and penetration by soluble salts. Cement contact dermatitis (CCD) may occur when contact shows an allergic response, which may progress to sensitization. Sensitization is due to soluble chromates (chromate compounds) present in trace amounts in some cements, cement products. Soluble chromates readily penetrate intact skin.

Cement dermatitis can be characterized by fissures, eczematous rash, dystrophic nails, and dry skin; acute contact with highly alkaline mixtures may cause localized necrosis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The material is harmful if swallowed.

The dust is discomforting to the gastrointestinal tract.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Cement eczema may be due to chromium in feed stocks or contamination from materials of construction. Sensitization to chromium may be the leading cause of nickel and cobalt sensitivity and the high alkalinity of cement is an important factor in cement dermatoses.

Repeated, prolonged severe inhalation exposure may cause pulmonary edema and rarely, pulmonary fibrosis. Workers may also suffer from dust-induced bronchitis with chronic bronchitis reported in 17% of a group occupationally exposed to high dust levels.

Data suggests that occupational exposure to Portland cement dust may lead to a higher incidence of chronic respiratory symptoms and a reduction of ventilatory capacity.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Encourage patient to blow nose to ensure clear breathing passages.

Ask patient to rinse mouth with water but to not drink water.

Seek immediate medical attention.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically as for strong alkaline material.

Section 5 - Fire-Fighting Measures

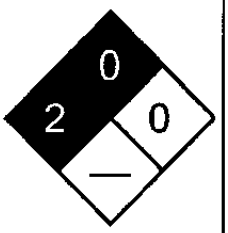
Flash Point: Noncombustible

Autoignition Temperature: Not applicable

LEL: Not applicable

UEL: Not applicable

Extinguishing Media: If small amounts are involved in a fire, there is no restriction on the type of extinguisher. Otherwise, use LARGE AMOUNTS of water to absorb heat generated.



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Noncombustible.

Not considered to be a significant fire risk; however, containers may burn.

Decomposes on heating and produces toxic fumes of caustic compounds.

Fire Incompatibility: No known incompatibility with normal range of industrial materials.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves for fire only. Prevent, by any means available, spillage from entering drains or waterways.

Use fire fighting procedures suitable for surrounding area.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.

Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.

Wear protective clothing, gloves, safety glasses and dust respirator.

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Use dry clean-up procedures and avoid generating dust.
Vacuum up or sweep up. Place in clean drum then flush area with water.
Large Spills: Clear area of personnel and move upwind.
Use dry clean-up procedures. Avoid generating dust.
If inhalation risk of exposure exists, wear NIOSH-approved dust respirator.
Collect recoverable product into labeled containers for recycling.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing dust. Limit all unnecessary personal contact.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Atmosphere should be checked against exposure standards to ensure safe working conditions are maintained.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Always wash hands with soap and water after handling.
Use good occupational work practices.
Observe manufacturer's storing and handling recommendations.
Recommended Storage Methods: Packaging as recommended by manufacturer.
Check that containers are clearly labeled.
Metal pail or Paper bag with sealed plastic liner.
Multi-ply woven plastic or paper bag with sealed plastic liner.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area.
If exposure to workplace dust is not controlled, respiratory protection is required; wear NIOSH-approved dust respirator.
General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved dust respirator.
Correct fit is essential to obtain adequate protection.
Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Barrier cream and Wear chemical protective gloves, eg. PVC.
Wear safety footwear or safety gumboots, eg. Rubber.
Respiratory Protection:
Exposure Range >5 to 50 mg/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >50 to 500 mg/m^3: Air Purifying, Negative Pressure, Full Face
Exposure Range >500 to <5000 mg/m^3: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range 5000 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: dust/mist filter (use P100 or consult supervisor for appropriate dust/mist filter)
Other: Overalls. Eyewash unit. Ensure there is ready access to a safety shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Finely divided grey to off-white colored powder with no odor. Hardens after reaction with water. A finely ground mixture of cement clinker and gypsum, surface area 300-500 m2/kg (Blaine Method).

Physical State: Divided solid
Vapor Pressure (kPa): Not applicable
Vapor Density (Air=1): Not applicable
Formula Weight: Not applicable.
Specific Gravity (H_2O=1, at 4 °C): 3.0-3.2
Water Solubility: Insoluble
Evaporation Rate: Not applicable
pH: alkaline
Boiling Point Range: No data found.
Freezing/Melting Point Range: > 1200 °C (2192 °F)
Decomposition Temperature (°C): Not applicable

Section 10 - Stability and Reactivity

Stability/Polymerization: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Segregate from strong oxidizers and strong acids.

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Section 11 - Toxicological Information

No relevant toxicological data found at time of research.

See NIOSH, *RTECS* VV 8770000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible or consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Bury residue in an authorized landfill.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: NONE
Hazard Class: None
ID No.: None
Packing Group: None
Label: No class label assigned

Additional Shipping Information:

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Research Date: .....1999-11 **Review Date:** 2000-07

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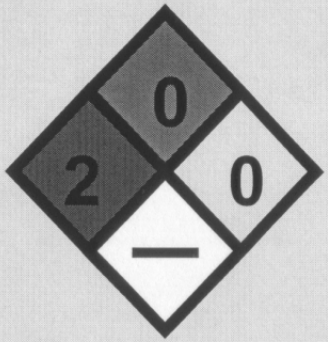
CAS # 65997-15-1 **Caution** 1 3

Portland Cement

hydraulic cement; portland cement silicate

Gray powder; odorless. Irritating to eyes/skin/respiratory tract. Also Causes (on contact with wet cement): corneal edema, skin burns, dermal necrosis, first/second/third degree burns, esophagus/stomach burns. Chronic: bronchitis, dermatitis.



Target Organs

3 9 10

Eyes

Skin

Respiratory System

Personal Protective Equipment

8

Goggles

Gloves

Apron

is respirator required?

Emergency Procedures

First Aid

4

Inhalation: Remove to fresh air and support breathing. Eyes/Skin: Flush with flooding amounts of water. Thoroughly wash skin with soap and water. Ingestion: Do not induce vomiting. Contact physician immediately.

Fire

5

Noncombustible. Use agent suitable for surrounding fire.

Spills & Leaks

6

Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. DO NOT SWEEP! Carefully scoop up or vacuum (with a HEPA filter). Cleanup crew should protect against exposure.

Consult MSDS 0718 for more information

Appendix H

Electrical Control Plan

The following information is intended to provide specific instructions with respect to the Lockout /tag out of energized systems and appropriate PPE to wear during different activities involving energized systems. The Electrical Control Plan provides:

- Table for required PPE for energized systems;
- Lockout/Tag out procedures for Compressors, blowers and knockout tank pump;
- Lockout/Tag out procedures for the Heater Element; and
- Unexpected Occurrence Report.

Geosyntec employees will be familiar the locations of emergency stop buttons on each piece of equipment.

Geosyntec employees will not operate the pole mounted transformers or two service disconnects (SDC-1 and SDC-2) for any reason.

Geosyntec staff will be familiar with lockout/ tag out procedures for the compressors (C-201 and C-202), blowers (B-214 and B-215) and the knockout tank pump (P201) for the purposes of providing "stand-by" emergency response to subcontractors who will conduct maintenance on this equipment.

Geosyntec staff will be required to lockout/ tag out the heating element as part of the ignition process, therefore this procedure is discussed below.

Lockout/Tag Out Procedures for the Heater Element.

1. Identify the electrical load to be locked out. Panels are labeled showing which components they operate.
2. Identify required PPE on Table below. PPE for heater element lockout will include:
   a. non-melting fabrics (wool, cotton) with long sleeve shirt, pants;
   b. Safety glasses; and
   c. Dry-leather gloves or voltage rated gloves

3. Turn the disconnect lever to the off position. Pull pin on the bottom of the handle and apply personal lock and tag.
4. Unplug heater element at twist lock attachment and unplug thermocouple connections.
5. Absence of voltage test is not required for the heater element once the disconnect switch is off and the element is unplugged.
6. Even if the heater element has been de-energized, surface temperatures may still be elevated. Always, check the riser pipe and lubricator assembly surfaces with a laser thermometer and where appropriate heat resistant gloves, safety glasses and face shield prior to touching the heater element setup.

Lockout/Tag Out Procedures for Compressors (C-201 and C-202), Blowers (B-214 and B215) and pump (P-201). Geosyntec will be familiar with the following process and will discuss functions of the "stand-by" responsibility with the subcontractor completing the work, prior to assuming such a role.

1. Identify the electrical load to be locked out.
2. Identify required PPE on Table below.
3. Identify the lock out location based on the single line diagram. There are two lockout locations for the blowers and pump consisting of a disconnect switch on the panel with a lock out location and the circuit breaker panel.
4. Go to the local hand station for the specific electrical load to be locked out.
5. Push the AMBER 'PUSH TO TRY' light. The light should energize. This confirms that there is control power available to the motor starter.
6. Wearing the appropriate electrical PPE (see table below), turn the starter disconnect to the OFF position. This removes 480V and 120V control power. Apply appropriate lock and tag as required by site lockout / tagout procedure.
7. Go to the local hand station for that specific electrical load.

8. Push the AMBER 'PUSH TO TRY' light. The light should NOT energize. This confirms that the electrical load has been locked out.

9. The system is safely locked out from the energy associated with this electrical load.

10. If the motor needs to be disconnected electrically or wires need to touched for determination or testing, an Absence of Voltage test must be performed on all electrical connections.

Absence of voltage test, after locking out a piece of equipment.

11. All circuits shall be considered energized until proven otherwise.

12. Use a single purpose voltage tester.

13. Test the voltage tester in a known operating 120V outlet to confirm the tester is functional.

14. Wearing the appropriate PPE for the arc flash exposure level and voltage rated gloves, test all termination phase to phase and/or phase to ground for voltage. After all checks have been made, re-test the voltage tester in a known operating 120V outlet to confirm that the test is still functional.

PITT CONSOL STAR PILOT PPE TABLE

Rev. 0

14-Jun-10

Equipment	Cleared for Geosyntec Staff Operation (Yes/ No)	Flash Protection Category[1]	Maximum Calculated Arc Flash Energy at Equipment (cal/cm^2)	PPE Rating cal / cm^2	Clothing Layer Requirements	Head Protection Requirements	Hand Protection Requirements
13.2kV Pole Mounted Transformers with Integral Interrupter / Switch	NO	N/A	N/A	N/A	PSE&G responsibility.	PSE&G responsibility.	PSE&G responsibility.
480V Service Entrance #1 and #2 fused disconnects (SDC-1 and SDC-2) *	NO	1	4	8	FR Suit rated 8 cal/cm^2 with just wool or cotton underwear or full wool or cotton street clothes	Safety glasses, ear plugs, hard hat, and face-shield 8 cal/cm^2	Voltage-rated gloves with leather protector
480V Equipment Downstream of the Fused Service Entrance Disconnects (All circuit breakers in PP-1, DC-2A, C-201 / C-202 Control Panels, B-214 DS / B-215 DS, and P-201 DS)	YES	0	1.2	1.2	Non-melting fabrics (wool, cotton) with long sleeve shirt, pants	Safety glasses	Dry leather gloves or Voltage-rated gloves if required by task
208V, 120V receptacles and light switches in office and shop environments	YES	0	N/A	N/A	No PPE required	Not required	Not required
208V or 120VAC circuit breaker panels (i.e. Receptacle and Lighting Panel Boards - PP-2)	YES	0	1.2	1.2	Non-melting fabrics (wool, cotton) with long sleeve shirt, pants	Safety glasses	Dry leather gloves or Voltage-rated gloves if required by task

* Try not to operate the Service Entrance Disconnects Frequently. The primary protection of the PSE&G transformers is questionable.

[1] - National Fire Protection Association (NFPA) 70 E: Standard for Electrical Safety in the Workplace

cal/cm^2 - calories per square centimeter

FR - fire resistant

APPENDIX H:
CRG UNEXPECTED OCCURRENCE REPORT

REPORT NO: UO-01-

TITLE: Electrical Shock

LOCATION: Pitt Consol Newark, NJ

DATE / TIME: 10/19/09 12:30

DESCRIPTION: During the reconnect of the air hose to the fitting, the operator felt a shock and saw a spark.

KEY LEARNINGS:

Engineering design review of electrical, mechanical should be performed by DuPont for all technologies used for DuPont projects.

Though the cause for the electrical short can not be verified because of the field set up, the shock would not have occurred had the entire system been grounded.
.
.

SUMMARY OF INVESTIGATION: A pilot program is being conducted at the Pitt Consol site using an in-situ smouldering combustion technology. The pilot involves a small plot of ground, 60ft by 20ft which is isolated from the rest of the site by sheet piling. The surface of the pilot test cell is covered with a 6-inch layer of low strength concrete. The sheet piles are keyed into an organic clay layer at a depth of approximately 12 feet below ground surface.

The pilot began on 10/15 and requires a 24/7 operation which is supported by several teams to cover all shifts.

Within the sheet pile area is a series of nine stainless steel 2-inch diameter air injection wells, two of which are equipped with heating elements to bring the subsurface materials to the ignition temperature (800 degrees C) prior to injection of air to initiate and sustain smouldering combustion. The heating coils surround the 18-inch stainless steel well screens at the bottom of the boreholes. The boreholes are grouted from the top of the well screens to the ground surface. The air is delivered to the air injection wells via a hose from a 180 cfm blower, powered by a large type diesel generator. Power to the system is delivered by a generator 460 volts 3 phase , transformed down using a Variac to 240 volts.

The generator was grounded and bonded to the sheet pile. The conduit in which the heater was installed was not bonded to the ground sheet pile, nor was it bonded to the ground conductor in the SO cord supplying power to the heater.

On 10/19 the operator involved in the incident came on shift at 12:00am. During his shift he collects data on a hourly basis and ensure proper operations of the system.

At about 6:00 am it was determined that the air hose to the air injection well needed to be changed out due to signs of wear and possible cracking . It was decided to wait until the next shift (2nd shift and daylight) so that the change out process could be evaluated and a dry run conducted prior to the actual removal.

Subsequent to the change out dry run, Gavin Grant was stationed on the blower. The blower would remain running during the hose change-out, but the air diverted away from the injection well. Bill and Grant Scholes were station at the well head.

At about 12:30 Grant disconnected the old air hose and as he was reconnecting the new hose and closing the cam fitting he felt a slight shock and saw a spark.

At the time, Grant thought the shock and spark was due to static build up in the line but mention the event to Gavin. Grant was wearing a rubber type glove boots with voltage resistant soles. However the PPE was not designed for the purpose of electrical protection.

Grant departed the site at approximately 1:00 pm and upon further reflection of the incident called back to the site to discuss with Gavin. After the discussion Gavin then locked out the electrical panel which powered the heater and contacted the electrician.

The heater element was still operating at 240v.

At 1:30pm the electrician arrived on -site and determined that the air injection well casing housing the heating element was energized. Using a Fluke multimeter, he was able to measure 50 volts from the well casing to the concrete surface up to 2 feet away from the casing. After the heater was locked out the voltage readings dropped to zero when measured at the well casing.

The team also noted a change in current of the heater during the Sat/Sun shift on 10/18. The first well heater used on the project failed as well so the second heater was put in service.

There has not been any static electricity build up detected in the hose in the past .

The same heater has been tested in a lab set up in Scotland without any issues, however the leads from the heater were located outside of a drum of soil used in the test.
·

Key Factors:

Physical: Can not be determined

·System 1: The entire system of well casings and conduits were not bonded/grounded to the sheet piling

Physical , Human & System 2 : separate conduits used for the two heater leads

.
.

RECOMMENDATIONS/responsibility:

S1 Communicate to contractor the need to keep heater locked out

Responsibility: J Vidumsky Timing: 10/21/09 complete

S1 Project director to conduct design review of system by DuPont Engineering resources prior to next phase of the project.

Responsibility: J Vidumsky Timing: ???

·P/H/S2 Inform Contractor of National electrical code requirement to have both heater leads in the same conduit to prevent, AC induction.

Responsibility: J Vidumsky Timing: 10/27/09 complete

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PRE-WORK THA

THA Title:		**Date:**	
Project Name:		**Client Name:**	
Project Number:		**Client Project Manager:**	
Project Location:		**Geosyntec Project Manager:**	
Scope of Work Summary:			

Work Steps	**Process or Activity**	**Hazards**	**Hazard Control**
1)			

Min. Personal Protective Equipment (PPE):	

Individuals Must Sign a Separate the last page of this THA after review.

	HAZARD	**HAZARD CONTROLS (check all that apply and comment as required)**
WALKING/WORKING SURFACES (EHS 210, 501)		
☐	☐ Uneven terrain ☐ Slippery surfaces	☐ Walkways are cleared of equipment, vegetation, excavated material, tools and debris ☐ Pits and floor openings are covered or otherwise guarded ☐ Work areas are illuminated adequately; field operations are not conducted before sunrise or after sunset unless adequate lighting is provided. ☐ Spills are cleaned up promptly ☐ Salt applied to icy areas, snow cleared from walkways
☐	LADDERS / STAIRS ☐ Extension Ladders ☐ Step Ladders ☐ Fixed Ladders ☐ Stairs	☐ Employees trained in safe ladder use at safety meeting ☐ Extension ladders are properly footed, secured at top, and setup at proper angle ☐ Stepladders are set on level ground or properly shimmed with spreaders locked. ☐ Stairs have proper rise over run and stairs >4 steps or 4' have guardrails. ☐ Ladders/Stairs Comments: ☐ Never use a step ladder as a straight ladder. All straight ladders shall be extended three rungs past leading edge. Never use metal ladders while working with electricity.
☐	MANLIFT used to reach work ☐ Scissor Lift ☐ Extensible Boom ☐ Articulated Boom ☐ vertical Lift ("Genie")	☐ Operators are sufficiently trained, experienced and qualified. ☐ Equipment is inspected after mobilization and is in good condition. ☐ Harness & Lanyard worn whenever operating the lift (scissor lifts may be excepted) ☐ Overhead and surface obstructions are reviewed with operators prior to use. **Manlift Comments:**
EXCAVATIONS / TRENCHING/UNDERGROUND HAZARDS (EHS 402)		
☐	☐ Max Depth ≥ 20' ☐ Max Depth ≥ 5' ☐ Max Depth <5' with potential cave-in hazard ☐ Potential permit-required confined space at depth ≥ 4' ☐ Underground utilities ☐ Structures/foundations ☐ Falls into excavations	☐ Sloping & shoring for excavations ≥20' are approved by a professional engineer ☐ Sloping & shoring for excavations ≥5' when persons are exposed to cave-in. (specify below) ☐ Sloping & shoring for shallow (<5') excavations with cave-in hazard (specify below) ☐ Excavations ≥ 4' are classified as a non-permit confined space ☐ Excavations ≥ 4' are classified as Alternate Entry or Permit-Required (see confined space) ☐ Underground utilities have been identified and marked. ☐ Local "dig safe" organization has been notified for utility locations in public areas or rights of way. Number: _____ Date: _____ ☐ Hand digging within 3' of utility locations. ☐ Excavations are protected by perimeter fencing (not barricade tape): (☐ rigid fence - chain link or wood, safety fence 6' from edge.)

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PRE-WORK THA

HAZARD		HAZARD CONTROLS (check all that apply and comment as required)
		Excavation Comments:
CONFINED SPACES (EHS 118)		
☐	☐ No Serious Hazards ☐ Toxic atmosphere ☐ carbon monoxide ☐ hydrogen sulfide ☐ ☐ Flammable atmosphere ☐ Low oxygen ☐ Combustible dust ☐ Other Serious Hazard:	☐ Confined space is altered so that it is no longer a confined space. (describe below) ☐ Confined space is downgraded to a non-permit confined space. (identify which spaces below) ☐ Alternate Entry is used. (Identify which space qualify for confined space entry below) ☐ Full permit-required confined space entry is used due to presence of serious hazards. ☐ Rescue team has been notified (☐ Paid FD ☐ Volunteer FD ☐ Plant Rescue) Rescue Team:_____ Phone Number: _____ ☐ All entrants and attendants for Alternate Entry and Permit-Required Entry have confined space entry training. **Confined Space Comments:**
ELECTRICAL SYSTEMS (EHS 121, 119, 304)		
☐	☐ No Serious Hazards ☐ Energized systems ☐ electrical equip. ☐ portable elec. equip. ☐ Steam equip. ☐ thermal equip. ☐ natural gas equip. ☐ pneumatic equip. ☐ chemical equip. ☐ gravity, spring equip. ☐ other_____ ☐ Overhead power lines ☐ Other Serious Hazard:	☐ Only qualified personnel shall perform electrical wiring or connections. ☐ voltage is less than or equal to 240 V. ☐ LO/TO procedures have been implemented (EHS 119) ☐ LO/TO verification Checklist complete (EHS 119) ☐ equipment specific LO/TO procedure required. ☐ PPE required for specific task. Facesheild, gloves, FR clothing, cotton clothing (describe below) ☐ Ground Fault Circuit Interrupter (GFCI) devices will be used ☐ Overhead power lines work with EHS 304. Minimum safe working distance = _____ ☐ Components are grounded and bonded. **Electrical systems Comments:**
HEAVY EQUIPMENT (other than cranes)		
☐	Struck By, Run-Over, Caught In Between (pinch points), Roll Over, Fluid Leaks ☐ Bulldozer ☐ Excavator ☐ Front Loader ☐ mini Skid Steer (bobcat) ☐ mini Excavator ☐ Dump Truck ☐ Drill/Boring Rig ☐ Lull / Material Handler ☐ Forklift ☐ Manlift - specify type(s) ☐ Land Clearing loader	☐ Qualified persons operate all heavy equipment. (certificate is required for forklift and lull operators) ☐ Equipment will be inspected upon mobilization ☐ All leaks or defective safety equipment will be repaired before use. ☐ Operators will be reminded of seatbelt use by: _____ ☐ Eye contact with the operator is made prior to approaching near equipment or swing radius ☐ High visibility vests are required ☐ Max. safe slope for each vehicle will be followed ☐ Counterweight swing radius will be barricaded. ☐ Operators and helpers will maintain a safe distance to moving parts. All those working near moving or rotating parts will secure loose hair, clothing, and equipment. ☐ Drill rigs will only be moved with masts lowered. Masts will be erected with outriggers fully extended when equipped with outriggers. ☐ Rigging directly to the forks of a lull, forklift, or front loader equipped forks is prohibited. Crane hook attachments will be used (specify):_____ Spill equipment is available for fuel and hydraulic fluid leaks. Spill Kit in Vehicle_____
ENVIRONMENTAL HAZARDS (NON CHEMICAL) (EHS 124, 125, 127)		
☐	☐ Heat Stress ☐ Cold Stress ☐ Insects, spiders, ticks ☐ Wild animals ☐ Mold, fungi ☐ Poisonous plants ☐ Hazardous noise	☐ Heat/Cold stress are monitored in accordance with Geosyntec procedures EHS 124 & EHS 125 ☐ Fluids are provided to prevent worker dehydration ☐ Types and injury potential of snakes, insects, spiders are reviewed with workers ☐ Insect repellant is used, PPE is used to protect against sting/bite injuries. ☐ All potentially poisonous plants such as poison ivy, poison oak, poison sumac are identified, long sleeve shirt or Tyvek is worn or a barrier cream is used when near these plants ☐ Hearing protection is used when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period)
POWER TOOLS, HAND TOOLS, and EXTENSION CORDS (EHS 121)		
☐	Eye injury, hand/arm cuts, electrical shock, strains, foot injuries, dust ☐ Grinders ☐ Needle Gun ☐ Chop saw ☐ Chain saw	☐ All tools and electrical cords will be inspected upon mobilization by: _____ ☐ All tools and electrical cords in-use will be inspected daily by: _____ ☐ Grinder speeds will not exceed grinding wheel ratings. ☐ Water or wet cutting performed to control dust ☐ Respirators used to prevent exposure to dust (respirator type:_____) ☐ Through utility survey conducted prior to any concrete cutting, coring ☐ Face shield and safety glasses used (required for all grinders, jackhammers, chain saws, etc)

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PRE-WORK THA

	HAZARD	HAZARD CONTROLS (check all that apply and comment as required)
	☐ Trimmer ☐ concrete/asphalt saw	☐ Kevlar chaps and jacket (required for all chainsaw work) ☐ Hearing protection required for which tools or areas: _____ _____ ☐ All extension are in good condition with no cuts through outer insulation, ground plugs are present, and no "vinyl tape" repairs. (Only 12 gauge extension cords may be repaired.) **Tool & Cord Comments:**
MANUAL MATERIAL HANDLING / MATERIAL STORAGE / HOUSEKEEPING (EHS 401)		
☐	Back or shoulder strain, struck by falling objects, trips and falls, incompatible materials (fire or explosion) ☐ hvy manual lifting (>30 lbs) ☐ chemical storage ☐ compressed gas storage ☐ Tall storage greater than 2 pallets stacked. ☐ Material & equipment laydown areas ☐ Debris removal	☐ Mechanical lifting equipment used to reduce manual material handling: (☐ Forklift/Lull ☐ Heavy Equipment ☐ chainfall ☐ _____) ☐ Manual lifting more than 50 lbs by a single person will be avoided. ☐ Good manual lifting techniques will be reviewed prior to site work. ☐ Incompatible chemicals will be separated by 20' ☐ Secondary containment will be provided for the following chemicals: _____ ☐ Safety equipment will be located near chemical storage. ☐ Spill Kit ☐ Emergency Shower ☐ Eyewash ☐ Drench Hose ☐ Splash PPE ☐ Flammable gases and oxygen will be separated by 20'. ☐ All compressed gas cylinders will be transported vertically and secured upright. ☐ Equipment and materials will not be stored on site ☐ Debris will be moved daily and placed in designated mulch pile areas. **Material Handling & Housekeeping Comments:**
TRAFFIC & SIDEWALK OBSTRUCTION (EHS 517)		
☐	☐ Vehicle accidents ☐ Pedestrians struck by vehicles or heavy equipment ☐ Pedestrians falls ☐ Pedestrian struck-by falling objects	☐ DOT signal devices will be used to re-route vehicles around excavations or busy site entrances/exits that affect road traffic. ☐ Flaggers will be used and have DOT Flagger Training ☐ Pedestrian traffic will be safely routed around or over excavations. ☐ Pedestrian traffic will be safely routed around or under overhead work. **Traffic & Sidewalk Comments:**
HAZARDOUS WASTE SITE WORK (EHS 108, 112)		
☐	☐ exposure to hazardous vapors or dust, contact with contaminated materials, fire, and explosion. Contaminants of Concern and hazardous chemicals include: ☐ volatile organic compounds (describe:_____ _____) ☐ semivolatile organic cmpds (describe:_____ _____) ☐ metal dusts (describe:_____ _____) ☐ PCBs ☐ caustic (NaOH) ☐ Acid (H_2SO_4, HCl) ☐ Other hazardous waste site hazards are covered elsewhere in the HASP)	☐ Site workers with a potential for contact with contaminated materials will have OSHA 40-hour training, current 8-hour refresher, and medical exam. ☐ No intrusive work activities or areas are anticipated with current scope of work. Intrusive work activities include: _____ _____ The perimeter of intrusive work areas are identified by:_____ Decontamination of personnel or equipment is not anticipated with the current scope of work. ☐ Decontamination of personnel and small tools will be conducted as follows: _Spay decon for removal of site materials, soapy water, potable water rinse_ ☐ Decontamination of heavy equipment will be conducted as follows: Spay decon for removal of site materials, soapy water, potable water rinse ☐ Heavy equipment leaving the site will be inspected by_____ ☐ Work area monitoring is not anticipated with the current scope of work. ☐ Work Area Air Monitoring as follows for (dust, VOCs, etc) **OR** see attached. _____ _____ Level C Tyvek, boot covers, nitrile gloves, half or full face respirator with _____ cartridges changed daily _____ _____ Level B Same as above except supplied air respirator _____ _____ STOP work, contact EHS Department ☐ Community Air Monitoring is not anticipated with the current scope of work. ☐ Community Air Monitoring is required per the attached document. **Comments/Other:**

EMERGENCY RESPONSE **(911 Service is Available ☐ Yes ☐ No)**

Emergency Medical Treatment - Hospital Name: Hospital Address:		**Number:**	
Non-Emergency Med. Treatment - Clinic Name: Occupational Clinic Address:		**Number:**	
Fire Department Name		**Number:**	
Spill Response:		**Number:**	

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PRE-WORK THA

HAZARD	HAZARD CONTROLS (check all that apply and comment as required)		
Client Representative Name::		**Office Number:**	
		Cell Number:	
Geosyntec **Project Manager** Name:		**Office Number:**	
		Cell Number:	
Geosyntec **Corporate H&S** Name:		**Office Number:**	
		Cell Number:	
Emergency Response Comments:			

Date:	
Project Name:	
THA Title:	
Subcontractor Name:	
Geosyntec Representative (reviewed by):	
Subcontractor Foreman/Supervisor Signature (authorize):	
Crew Signatures (acknowledge):	
Print Name	**Signature**

PLEASE RETURN A COPY OF THIS SIGNED PAGE TO GEOSYNTEC PROJECT MGR., SUPERINTENDENT UPON REVIEW AND ACKOWLEDGMENT BY THE CREW MEMBERS. ALL NEW CREW MEMBERS SHALL BE ORIENTATED THE SAME AND A SUBMITTAL OF A NEW SIGN IN SHEET SHALL BE COMPLETED.

APPENDIX E

STANDARD OPERATING PROCEDURES (SOPs)

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STANDARD OPERATING PROCEDURE

STAR PHASE III PILOT TEST AREA EXCAVATION

Prepared by: ___Dave Liefl_____ Date:___05/23/2012_____

Reviewed by: _____Mark Watling_____ Date:__05/25/2012____

Approved by: _____ Date:_____

SOP No. X

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1.1 Overview

This Standard Operating Procedure (SOP) was prepared to direct field personnel in the excavation of the Pilot Test Area (PTA) in preparation for the construction and installation of the Self Sustaining Treatment for Active Remediation (STAR) Phase III pilot test system and its auxiliary components.

This SOP will be implemented in accordance with the following governing documents:

- STAR Phase III Work Plan (where applicable), which provides an overview of the STAR Phase III Pilot Design, experimental procedure, and the overall goals and scope of work;
- Health and Safety Plan (HASP), which identifies all physical, chemical, and biological hazards relevant to each field task and provides hazard mitigators to address these hazards;

1.2 Objectives

PTA excavation objectives include; (i) removal of surficial compacted fill layer down to the existing geomembrane; (ii) removal and containerization of geomembrane; (iii) preparation of excavated subsurface for the installation of in-situ STAR system components.

The PTA is approximately 50 ft by 50 ft and is defined by the footprint of the concrete work platform (Drawing C02). The PTA excavation is centered on boring TB-LCC-C5 from the 2012 Tar-specific Green Optical Screening Tool (TarGOST) survey. The PTA location was selected based on the results of the TarGOST logs, soils analytical data, and visual inspections of boring logs collected during the 2012 DGI and was chosen due to its similarity with the previous PTA (with respect to the thickness of geologic units, the extent and distribution of coal tar impacts, etc.) and proximity to the existing power drop electrical poles.

1.3 Equipment

A backhoe, operated by Summit, will be used to complete the PTA excavation activities at the Pitt Consol site in Newark, New Jersey. The following list of equipment includes the necessary items to be used by field personnel during PTA excavation. Subcontractor personnel typically provide and operate all excavation and steam and/or pressure cleaning equipment. Site-specific conditions may warrant the use of additional or deletion of items from this list.

- Backhoe Excavator
- Personal Protective Equipment (PPE) and air monitoring equipment as required by the HASP;

- camera;
- field log book and forms as specified in other SOPs;
- STAR Construction Drawing Package

1.4 Decontamination

Decontamination practices are to include an Alconox wash with water, and if required steam and/or pressure cleaning will be available. Decontamination will occur before excavation machinery is to be shipped offsite. All decontamination activities will take place on a decontamination pad to be constructed by Summit before work begins.

1.5 Procedures

The following procedures should be used during the excavation of the PTA area. Procedures may vary depending on the objectives, equipment used, and contaminants present at the site. Site-specific conditions may warrant the use of stringent air monitoring, PPE and potentially substantial access constraints. These are defined in the HASP.

1. Mark out PTA excavation area with marking paint and stakes visible from the operators cab aboard the backhoe. Remove excess debris and miscellaneous garbage from the area and containerize or dispose of as required.

2. Mark out area where excavated soils are to be stockpiled. This location should be in proximity of the PTA, however not in a location that will interfere with the installation of the remaining STAR system components. The transportation route between the PTA and the designated stockpile location should also be marked with traffic cones to ensure personnel restrain from entering the area.

3. Excavate the PTA to the depth of the geotextile membrane (approximately 1-2 ft bgs). Clean excavated fill material are to be transferred to the stockpile zone, while any contaminated materials that are unearthed above the geotextile membrane are to be containerized in labeled 55-gallon drums. The geotextile membrane is also to be containerized in labeled drums. Once sealed, the labeled drums are to be transferred out of the PTA excavation area, to the drum staging location present onsite.

4. After the removal of the geomembrane, the excavated subsurface is to be leveled to the extent practicable with the excavation equipment available onsite.

5. A ramp is to be excavated prior to completion along one of the PTA side walls to allow access of tracked vehicles required later in the construction process.

1.6 Documentation and Transmittal

Daily field forms, including but not limited to; Daily Field Summary, Geosyntec Tailgate Safety Form, DuPont DSR Form, and Meter Calibration Form, should be completed each day by the Geosyntec representative.

All drums are to be labeled prior to filling with contaminated soils or PPE. A drum inventory in to be completed at the end of each day, and finalized prior to demobilization. This information is to be transferred to URS Corporation, who will arrange for the disposal of contaminated materials through a licensed waste hauler.

Photographs are to be taken periodically throughout the course of the excavation to document the subsurface conditions for future analysis.

Fieldwork Schedule

Mobilization Date – Tuesday May 29th 2012

Demobilization Date – Tuesday June 26th 2012

1.7 Waste Generation

Waste generated as a part of the PTA excavation is to be drummed and stored onsite in a designated drum staging area until a pick up by a licensed waste hauler can be arranged through URS Corporation. Contaminated soils and PPE are to be separated prior to containerization and all drums must be labeled before they are filled.

* * * * *

REFERENCES

STANDARD OPERATING PROCEDURE

SONIC DRILLING AND LOGGING – STAR PHASE III

Prepared by: _Dave Liefl_____ Date:__May 23, 2012_____

Reviewed by: _Mark Watling_____ Date:___May 30, 2012_____

Approved by:_____ Date:_____

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STANDARD OPERATING PROCEDURE NO. X
SONIC DRILLING AND LOGGING – STAR PHASE III

1. INTRODUCTION

1.1 Overview

This Standard Operating Procedure (SOP) was prepared to direct field personnel in the methods for conducting sonic drilling technology logging and soil sampling activities.

This SOP will be implemented in accordance with the following governing documents:

- STAR Phase III Work Plan (where applicable), which provides an overview of the STAR Phase III Pilot Design, experimental procedure, and the overall goals and scope of work;
- Health and Safety Plan (HASP), which identifies all physical, chemical, and biological hazards relevant to each field task and provides hazard mitigators to address these hazards;
- Quality Assurance Project Plan (QAPP), which is written to establish protocols necessary to ensure that the data generated are of a quality sufficient to ensure that valid conclusions are drawn from the site characterization;
- NJDEP Technical Requirements for Site Remediation and Field Sampling Procedures Manual.
- Soil Core Sampling SOP Document

1.2 Objectives

The objectives of sonic drilling, logging and soil sampling are to characterize soils and collect subsurface soil samples at depth-discrete intervals which will provide baseline data for the upcoming STAR Phase 3 Pilot test, and to install the pilot test ignition/air injection wells.

1.3 Scope of Work

The proposed work consists of the installation of (5) five wells within the excavated PTA. IP-1 through IP-4 are to be drilled using an 8-inch Sonic drilling equipment to a depth of approximately 10-feet below excavated ground surface (bgs.). Sonic casing will be advanced with 4-inch acetate core barrels to provide suitable materials for analytical sampling and lithographic descriptions. Up to three soil samples are to be collected from IP-1 through IP-4 (up to a total of 12 samples) and will be submitted for laboratory analysis of EPHs. IP-1 through IP-4 are to be constructed of 2-inch carbon steel casing with a 1-foot stainless steel wire wrap screen (0.1 inch opening) installed at depth after the completion of sampling and lithographic activities. Thermocouple probes will be installed within each well borehole as described in the Work Plan. Backfill materials are to be added to the borehole as Sonic casing is removed. The well casings are to each extend a minimum of 3-feet above the excavated surface upon completion. A concrete pad will be installed by others across the entire excavated area following drilling activities, so no surface vault or pad is required for the wells.

IP-5 is to be drilled to a depth of approximately 45-feet bgs or until the Rahway Till layer has been visually confirmed by a Geosyntec representative. Sonic casings are to be advanced with 4-inch acetate core barrels to provide suitable materials for analytical sampling and lithographic descriptions. Soil samples are to be collected every foot to the drilled depth and submitted for laboratory analysis of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and EPHs. The borehole is to be grouted following NJDEP regulations to a final depth of 25-feet bgs in preparation for the installation of the IP-5 well casing. Two inch carbon steel well casing with a 1-foot stainless steel wire wrap screen (0.1 inch openingst) is to be installed after a suitable waiting period has elapsed to allow the grout to set. Thermocouple probes will be installed within the well borehole as described in the Work Plan. The well casing is to each extend a minimum of 3-feet above the excavated surface upon completion. A concrete pad will be installed by others across the entire excavated area following drilling activities, so no surface vault or pad is required for the wells.

2. EQUIPMENT

A sonic drill rig will be used to conduct subsurface soil boring, sampling and well installation activities in preparation for the STAR Phase 3 Pilot Test at the Pitt Consol site in Newark, New Jersey. Using a sonic drill rig, borings are advanced by driving an outer stainless steel casing at a depth increment of 5 feet, which is then followed by advancement of the inner steel sampling casing. The inner steel casing is retrieved while the outer steel casing remains in the borehole. The soils within the inner steel sample casing are collected within a 4-inch acetate core barrel liner that is extracted hydraulically and transferred to core barrel boxes. The inner steel sampling casing is subsequently decontaminated with Alconox and water, and if necessary, a steam cleaner prior to being used to collect the next soil core. The following materials should be available, as required, during the subsurface soil logging and sampling:

- equipment necessary for soil logging (see SOP 210);
- Personal Protective Equipment (PPE) and air monitoring equipment as required by the HASP;
- decontamination equipment per the QAPP and workplan;
- tape measure;
- photoionization detector (PID);
- camera;
- field log book and forms as specified in other SOPs;
- electrical resistivity equipment;
- stainless steel spoons and aluminum pans for soil homogenizing (non-VOC soil samples only); and
- laboratory-supplied bottleware.

3. PROCEDURES

The following procedures will be employed to conduct subsurface soil logging and collect subsurface soil samples:

1. Ensure that all drilling sites are safe by carrying out appropriate subsurface utility clearance.
2. Don the appropriate PPE and begin air monitoring as specified in the HASP.
3. Set-up an equipment cleaning station, and decontaminate reusable equipment as described in the QAPP. Use new, clean, disposable materials when decontamination is not appropriate.
4. Drive the sonic outer casing and inner steel sampling tools to the appropriate sampling depth interval.
5. When the desired depth for the collection of a subsurface soil sample is reached, retrieve the inner steel casing and remove the soil core in the acetate liner. For the 0 to 5-ft depth interval with relatively high gravel content, extrude soils into a plastic liner bag in place of the acetate liner. Transfer the soil core in the acetate liner or plastic core bag to a table for logging.
6. Cut open the acetate liner in a length-wise direction using a vibratory cutting saw (supplied by Contractor).
7. Photograph the core, with the borehole ID, depth interval and orientation of the core indicated on a sheet of paper placed next to the core.
8. Conduct the PID screening of the core at 6 inch depth intervals. Starting from a depth of 3 inches below the top of the recovered soils (mid-point of each 6-inch depth interval), make a small (<0.5 inch dia) impression into the soils on one side of the core utilizing a dedicated, plastic spoon. Insert the tip of the PID into the impression, and record the stabilized PID reading. Continue down-core collecting PID readings every 6 inches. Note any background moisture effects during the PID screening.
9. Complete the lithologic logging of the core following the Unified Soil Classification System. The soil characteristics to record include recovery, color, texture, density, mineral content (including presence of peat), presence of any NAPL and moisture content. A Munsell color chart is to be used to describe soil color as part of the lithologic logging. Details of the soil classification procedures are provided in SOP 210 (Soil Classification).

10. Communicate the observations of the PID screening and lithologic logging to the project manager/senior geologist. Determine the sample depth intervals based upon visual logging and PID results. For IP-1 through IP-4, up to three samples for a total of 12 are to be collected. Samples are to be collected every foot from IP-5, for a total of approximately 45 samples, as specified in the Work Plan.
11. Collect soil sample(s) for VOC analysis at the targeted depth interval(s). Soils will be sampled at each depth interval on the side of the core that was not disturbed during the PID screening and lithologic logging.
12. For the SVOC, and EPH soil analyses, transfer the remaining soil from the undisturbed, targeted depth interval to a dedicated, aluminum pan using a decontaminated stainless steel spoon. Homogenize soils in the aluminum pan with the stainless steel spoon, and then transfer soils to the appropriate laboratory-supplied bottleware. No NAPL samples are planned to be collected.
13. Decontaminate non-disposable equipment or tools that may have come into contact with subsurface soil (refer to Work Plan or QAPP).
14. Discard all disposable equipment used during sampling activities in a designated location.

Prior to placing the well components and thermocouples into the borehole, a direct measurement of the borehole depth will be made using a clean weighted measuring tape.

Following placement of the well components and thermocouples, from the bottom up, the borehole annulus will be backfilled with (refer to Drawing C04 in the Work Plan):

- A filter pack consisting of at least 95% crushed silica gravel that is washed and contaminant free and contains less than 1% water-soluble material, placed to a height of 2 inches above the top of the screen.
- A layer of fine gravel bentonite (e.g., HolePlug™) placed to a depth of 3 ft beneath the excavated PTA ground surface. This layer will be installed on top of the filter pack to isolate the well screen.

- Bentonite-cement grout. The grout will be installed to the excavated PTA ground surface.

All materials will be installed using a rigid side-discharge tremie pipe. The elevation of the top of each backfill material will be measured in the borehole annulus at the time of emplacement by either plumbing with a weighted tape or by tapping with accurately measured tremie pipe and recorded on the well construction log.

The grout will be pumped using a grout pump through the tremie pipe, which will be placed 6 inches above the top of the bentonite seal and slowly withdrawn as the grout is pumped. Pumping will continue until undiluted grout (i.e., the weight of the exiting grout is equal to the injected grout) exits the annulus at the surface. Additional grout will be added to the borehole after at least 12 hours to compensate for settling. Both the initial grout volume and volume added subsequently will be recorded.

STANDARD OPERATING PROCEDURE

SOIL CORE SAMPLING – STAR Phase III

Prepared by:_____Dave Liefl_____ Date:___05/25/2012____

Reviewed by:__Mark Watling_____ Date:__05/28/2012 _____

Approved by:_____ Date:_____

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STANDARD OPERATING PROCEDURE NO. X
SOIL CORE SAMPLING – STAR Phase III

INTRODUCTION

Overview

This standard operating procedure (SOP) describes the protocol to be followed for the collection of soil samples for chemical analyses during borehole drilling and logging, and direct push drilling and logging activities being conducted during the installation of STAR Phase III system components.

Soil samples collected will be submitted for chemical composition laboratory analysis of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and extractable petroleum hydrocarbons (EPH). Borehole samples from injection wells IP-1 through IP-4 will be submitted for EPH analysis. Three samples from each injection well are to be collected for a maximum of 12 samples. Borehole samples from IP-5 will be submitted for VOC, SVOC and EPH analysis. IP-5 is to be sampled every foot to a depth of approximately 45-feet bgs or until the Rahway Till layer has been visually confirmed by a Geosyntec representative.

Samples collected from thermocouple injection locations TC-8, TC-15, TC-23, TC-31, TC-38, TC-51, TC-52, TC-66, and TC-72 will be submitted for EPH analysis. Up to two samples are to be collected from each for a total of 18 submittals.

This SOP will be implemented in accordance with the following governing documents:

- STAR Phase III Work Plan (where applicable), which provides an overview of the STAR Phase III Pilot Design, experimental procedure, and the overall goals and scope of work;
- Health and Safety Plan (HASP), which identifies all physical, chemical, and biological hazards relevant to each field task and provides hazard mitigators to address these hazards;
- Quality Assurance Project Plan (QAPP), which is written to establish protocols necessary to ensure that the data generated are of a quality sufficient to ensure that valid conclusions are drawn from the site characterization;

- NJDEP Technical Requirements for Site Remediation and Field Sampling Procedures Manual.
- STAR Phase III Sonic Drilling and Logging SOP Document

Objectives

The objective of soil core sampling is to characterize soils and collect subsurface soil samples at depth-discrete intervals. Data from the laboratory analysis will be used to determine pre-investigation subsurface conditions prior to the operation of the STAR In-Situ remediation system.

Equipment List and Supplies

The following materials should be available, as required, during the subsurface soil sampling:

- Stainless Steel Spoons – small
- Stainless Steel Spoons – large
- Personal Protective Equipment (PPE), as required by HASP
- Encore Samplers
- Whiteboard and dry erase marker
- Tape measure/reel
- Acetate Liner Cutting Tool (Supplied by Drilling Contractor)
- Ziploc Bags
- Alconox®, Liquinox®, or other non-phosphate concentrated laboratory-grade detergent
- Scrub brush
- Five gallon bucket
- Photoionization detector (PID) for air monitoring, as required by HASP
- Distilled water
- Pump sprayer or pint squeeze bottles
- Garbage bags
- Camera
- Black Berry Playbook/Field Journal
- equipment necessary for soil logging (see SOP 210)
- Ice (for sample coolers)
- Cooler

Laboratory Bottleware

Table 1 - Sample Bottleware Type by Analysis

Analysis	Method	Matrix	Bottleware	Preservative
TCL Volatiles (VOC)	8260B + TIC	Soil	4 x 5 gm Encore	Cool, 4 °C +/- 2 °C
TCL Semi volatiles (SVOC)	8270C + TIC	Soil	125 ml glass, wide mouth	Cool, 4 °C +/- 2 °C
Moisture	D2216	Soil	125 ml glass, wide mouth	Cool, 4 °C +/- 2 °C
NJDEP EPH	NJDEP rev 3	Soil	125 ml glass, wide mouth	Cool, 4 °C +/- 2 °C

VOC – 10/92 SOW List
SVOC – OLM03.1 List

Sample ID Nomenclature

Table 2 - Sampling ID Nomenclature

Sample Type	Nomenclature	Example	Sample ID
IP Soil	PTC-S-IP-#-2012-(#.#-#.#)	IP-1 Depth: 12.5-13.0 ft. bgs.	PTC-S-IP-1-2012-(12.5-13.0)
TC Soil	PTC-S-TC-##-2012-(#.#-#.#)		PTC-S-TC-23-2012-(12.5-13.0)
MS	PTC-S-IP-# 2012-(#.#-#.#)MS		
MSD	PTC-S-IP-# 2012-(#.#-#.#)MSD		
Eq. Blank	PTC-K-EQBLK-#		
Trip Blank	PTC-K-TBLK-#		

Sample Destination and Laboratory Addresses

All samples are to be sent to Lancaster Laboratories;

Lancaster Laboratories
2425 New Holland Pike
Lancaster, PA 17601
717-656-2300

The Guelph FedEx Account is provided if samples must be shipped. (Guelph FedEx Account #232786035).

PROCEDURE

1. Determine suitable location for the collection of soil sample(s).
2. Gather required bottleware and labels for the sample(s) to be collected.
3. Prepare labels with; Sample ID, Time, Date, Company, and Sampler's name.
4. Ready/clean sampling tools to be used to collect soil and transfer into bottleware.
5. Conduct soil sampling with appropriate PPE in a suitable location away from the open test pit.
6. Place sample in cooler with cap facing up. Secure with packing materials if required.
7. Cover samples with ice in preparation for transportation to the laboratory.
8. Clean sampling equipment and dispose of used PPE and materials in labeled drum.

DECONTAMINATION

Care will be taken to prevent cross-contamination between samples. PPE such as nitrile gloves should be replaced before beginning to sample and between sample locations. Additionally, all sample preparation materials should be decontaminated between sample locations. Care should be taken when walking in the vicinity of the work area. Contaminated soil can become logged in the soles of boots and transported without knowledge.

A clean bucket of water mixed with Alconox® or Liquinox® will be used to decontaminate sampling equipment used to collect the sample. Rinsing will follow in a clean bucket filled with fresh water.

DOCUMENTATION

Chain of Custody

Photos of the COC's must be taken prior to sample pick up and forwarded to Dave Liefl (Guelph) for sample tracking. The Blackberry handset or Playbook may be used for this purpose.

SCHEDULE

Fieldwork Schedule

Field Mobilization Date – Tuesday May 29th 2012

Estimated Demobilization Date – Tuesday June 6th 2012

Bottleware Delivery Schedule

Initial Sample Bottleware Delivery: Tuesday May 29th 2012

Final Sample Bottleware Delivery: TBD

Sample Pick Up Schedule

Thursday May 29th 2012 – AM Pick Up

Friday June 1st 2012 – PM Pick Up

Remaining sample pick up dates have not been determined and will be based upon field progress.

STANDARD OPERATING PROCEDURE

MULTI-LEVEL THERMOCOUPLE AND SOIL VAPOR PROBE INSTALLATION – STAR PAHSE III

Prepared by:_Dave Liefl_____ Date:__June 1st, 2012_____

Reviewed by:_____Mark Watling_____ Date:____June 4, 2012_____

Approved by:_____ Date:_____

SOP No. X

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STANDARD OPERATING PROCEDURE NO. X
MULTI-LEVEL THERMOCOUPLE AND SOIL VAPOR PROBE INSTALLATION – STAR Phase III

1. INTRODUCTION

1.1 Overview

This Standard Operating Procedure (SOP) was prepared to direct field personnel in the installation of multi-level thermocouple and soil vapor probe components as a part of the STAR Phase III system construction.

This SOP will be implemented in accordance with the following governing documents:

- STAR Phase III Work Plan (where applicable), which provides an overview of the STAR Phase III Pilot Design, experimental procedure, and the overall goals and scope of work;
- Health and Safety Plan (HASP), which identifies all physical, chemical, and biological hazards relevant to each field task and provides hazard mitigators to address these hazards;
- Quality Assurance Project Plan (QAPP), which is written to establish protocols necessary to ensure that the data generated are of a quality sufficient to ensure that valid conclusions are drawn from the site characterization;
- NJDEP Technical Requirements for Site Remediation and Field Sampling Procedures Manual.
- Sonic Drilling and Logging – STAR Phase III SOP
- Soil Core Sampling – STAR Phase III SOP

1.2 Objectives

The objective of the installation of multi-level thermocouple and soil vapor components is to provide measurement points across the STAR Pilot Test Area (PTA) in order to understand subsurface conditions during the operation of the STAR Phase III pilot test. Thermocouples will be used to monitor combustion front propagation within the PTA, while the soil vapor probes

will be used to monitor vacuum propagation from the vapor collection system and to screen for the presence of combustion gases outside of the PTA during system operation.

1.3 Scope of Work

A direct push rig will be used to install the multi-level thermocouples. 52 shallow multi-level thermocouples are to be installed to a depth of approximately 10 ft below the excavated ground surface, while 16 deep multi-level thermocouples are to be installed to a depth of approximately 25 ft below the excavated ground surface. The locations of the multi-level thermocouples are shown in Drawings M04 and M06 of the Work Plan. Pre-pilot soil samples will be collected from each of the borings advanced to install multi-level thermocouples TC-8, TC-15, TC-23, TC-31, TC-38, TC-51, TC-52, TC-66, and TC-72 (up to 2 soil samples will be collected from each boring. Soil samples collected during installation of these thermocouples will be submitted for laboratory analysis of extractable petroleum hydrocarbons (EPHs).

A direct push rig will also be used to install 4 soil vapor probes around the outside of the PTA (Drawings C05 and M03). The soil vapor probes will be installed to a depth of approximately 3 ft below ground surface (outside of the excavated PTA). No soil samples are to be collected during the installation of the soil vapor probes.

2. EQUIPMENT

A direct-push rig will be used to install both the multi-level thermocouples and soil vapor probes during the construction of the STAR Phase III pilot test. The smallest allowable diameter push rods are to be used depending on the outside diameter of the components themselves. This ensures the least amount of backfill materials are required if in the event the borehole does not collapse. The following materials should be available, as required, during the installation of the multi-level thermocouple and soil vapor probes:

- equipment necessary for soil logging (see Borehole Soil Sampling STAR Phase III);
- Personal Protective Equipment (PPE) and air monitoring equipment as required by the HASP;
- decontamination equipment per the QAPP and Work Plan;

- tape measure;
- photoionization detector (PID);
- camera;
- field log book and forms as specified in other SOPs;
- stainless steel spoons and aluminum pans for soil homogenizing (non-VOC soil samples only);
- laboratory-supplied bottleware;
- Wire tie;
- Hose clamps;
- Various hand tools as required for soil vapor probe assembly; and
- Backfill materials as specified in the Work Plan.

3. PROCEDURES

The following procedures will be employed to complete the installation of the multi-level thermocouple probes:

1. Ensure that all drilling sites are safe by carrying out appropriate subsurface utility clearance.
2. Don the appropriate PPE and begin air monitoring as specified in the HASP.
3. Set-up an equipment cleaning station, and decontaminate reusable equipment as described in the Work Plan. Use new, clean, disposable materials when decontamination is not appropriate.
4. Ensure multi-level thermocouples are wrapped in a proper manner to ensure they do not separate or unwrap prior or during installation.
5. Advance rod with expendable tip to required depth based upon thermocouple type and location (See Drawings C06, MW04 and M06). Collect core samples as necessary

depending on location. If samples are to be collected, follow guidelines set forth in Soil Core Sampling – STAR Phase III SOP.

6. At required depth, thermocouples are to be installed within push rods. Rods are to be extracted, leaving only thermocouple bundles within the borehole. Boreholes are to be backfilled with materials specified in Drawings C06 as required. Backfill materials are not required if natural collapse of the borehole occurs.

7. Thermocouple wiring should be covered to protect connections from the elements after installation has been completed.

The following procedures will be employed to complete the installation of the soil vapor probes:

1. Ensure that all drilling sites are safe by carrying out appropriate subsurface utility clearance.
2. Don the appropriate PPE and begin air monitoring as specified in the HASP.
3. Assemble soil vapour probe components as specified in Drawing C05.
4. At the soil vapor probe locations marked on Drawing M03, advance direct push rod to depths specified in Drawing CO5 with expendable tip.
5. Install soil vapour probe with all required components within direct push rod. Add backfill materials as required as rods are extracted.
6. Install surface completion components as specified in Drawing C05.

APPENDIX B

Daily Operator Field Forms

Daily Field Report

Project Name:	STAR Pitt-Consol	Date:	8/20/2012	Page: 0	Of 0
Project Number:	TR0341D	On Site:			
Field Personnel:	Scott Douglas	Scott Douglas, Bill Bingham, Luana Jo			
Recorded By:	Scott Douglas				
Weather:	Sunny, 80s				
Primary Activities:					

Description of Activities - location of work, work performed, equipment and personnel used, incidential information

Time	Description of Activities
7:10	SD, BB, LJ onsite

Daily Field Report

Project Name:	STAR Pitt-Consol	Date:	8/22/2012	Page: 0	Of 0
Project Number:	TR0341D	On Site:			
Field Personnel:					
Recorded By:	Luana Jo				
Weather:					

Primary Activities:

Star Operation

Description of Activities - location of work, work performed, equipment and personnel used, incidential information

Time	Description of Activities
7:00	BB,SD,LJ ON-SITE

Daily Field Report

Project Name:	STAR Pitt-Consol	Date:	10/2/2012	Page: 0	Of 0
Project Number:	TR0341D	On Site:			
Field Personnel:	Dave Liefl	Jim (electrician) - GWTT, Dave Liefl, Scott Douglas			
Recorded By:	Dave Liefl				
Weather:	60 f overcast				

Primary Activities:

Deep Injection Test

Description of Activities - location of work, work performed, equipment and personnel used, incidential information

Time	Description of Activities
7:00	Scott Douglas, Jim onsite

Daily Field Report

Project Name:	STAR Pitt-Consol	Date:	10/19/2012	Page: 0	Of 0
Project Number:	TR0341D	On Site:			
Field Personnel:	Luana Jo	S. Douglas			
Recorded By:	Luana Jo				
Weather:	rainy				
Primary Activities:					

Description of Activities - location of work, work performed, equipment and personnel used, incidential information

Daily Field Report

Project Name:	STAR Pitt-Consol	Date:	10/20/2012	Page:	0	Of 0
Project Number:	TR0341D	On Site:				
Field Personnel:		SD AND CP				
Recorded By:						
Weather:						
Primary Activities:						

Description of Activities - location of work, work performed, equipment and personnel used, incidential information

Daily Operator Checklist

Date: 8/20/2012

List of expected visitors or subcontractors:

Site Operator: Scott Douglas

Time On Site: 7:10 Time Off Site:

Weather: Sunny, 80s

Status of exterior Beacon prior to entering PTA: On

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes:

Wind Direction:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing?

PTA Effluent Alarm Set Point of TIT-201 = ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 8/21/2012

Site Operator: Luana Jo

Time On Site: 7:00 Time Off Site:

Weather: Sunny, 80C

Status of exterior Beacon prior to entering PTA: Off

List of expected visitors or subcontractors:

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes:

Wind Direction:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing?

PTA Effluent Alarm Set Point of TIT-201 = 175 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= 140 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 8/24/2012

Site Operator: Luana Jo

Time On Site: 7:15 Time Off Site:

Weather: Sunny, 80C

Status of exterior Beacon prior to entering PTA: Off

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes:

Wind Direction:

List of expected visitors or subcontractors:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing? No

PTA Effluent Alarm Set Point of TIT-201 = 175 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= 140 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 8/25/2012

Site Operator: Luana Jo

Time On Site: 8:00 Time Off Site:

Weather: sunny

Status of exterior Beacon prior to entering PTA: Off

List of expected visitors or subcontractors:

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes:

Wind Direction:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing? No

PTA Effluent Alarm Set Point of TIT-201 = 175 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= 140 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 8/26/2012

Site Operator: Luana Jo

Time On Site: 8:00 Time Off Site:

Weather: Sunny

Status of exterior Beacon prior to entering PTA: Off

List of expected visitors or subcontractors:

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes:

Wind Direction:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing?

PTA Effluent Alarm Set Point of TIT-201 = 175 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= 140 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 9/22/2012

Site Operator: Russell Hyatt

Time On Site: 8:00 Time Off Site:

Weather: clear; 70sF

Status of exterior Beacon prior to entering PTA:

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes:

Wind Direction: North

List of expected visitors or subcontractors:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing?

PTA Effluent Alarm Set Point of TIT-201 = ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 10/2/2012

Site Operator: Dave Liefl

Time On Site: 7:15 Time Off Site:

Weather: cloudy, 65 F

Status of exterior Beacon prior to entering PTA: Off

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes:

Wind Direction: North

List of expected visitors or subcontractors:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing?

PTA Effluent Alarm Set Point of TIT-201 = 175 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= 140 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 10/3/2012

Site Operator: Dave Liefl

Time On Site: 7:00 Time Off Site:

Weather: Fog, 65 F

Status of exterior Beacon prior to entering PTA: Off

Carbon Monoxide of air space at PTA gate: CO% 0

List of expected visitors or subcontractors:

None

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes: None

Wind Direction: North

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing? No

PTA Effluent Alarm Set Point of TIT-201 = 175 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= 140 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Changes to be made

Daily Operator Checklist

Date: 10/4/2012

Site Operator: Dave Liefl

Time On Site: 7:30 Time Off Site:

Weather: 70 F Cloudy Rain

Status of exterior Beacon prior to entering PTA: Off

List of expected visitors or subcontractors:

None

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes: None

Wind Direction: North

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing? No

PTA Effluent Alarm Set Point of TIT-201 = 175 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= 140 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Odor from Phase one PTA

Daily Operator Checklist

Date: 10/5/2012

List of expected visitors or subcontractors:

Site Operator: Dave Liefl

Time On Site: 7:30 Time Off Site:

Weather: 80 F, Sunny No Wind

Status of exterior Beacon prior to entering PTA: Off

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes: None

Wind Direction: North

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing?

PTA Effluent Alarm Set Point of TIT-201 = 175 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= 140 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 10/6/2012

Site Operator: Dave Liefl

Time On Site: 7:30 Time Off Site:

Weather: 77, Sunny, No Wind

Status of exterior Beacon prior to entering PTA: Off

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes: None

Wind Direction: North

List of expected visitors or subcontractors:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing? No

PTA Effluent Alarm Set Point of TIT-201 = 175 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= 140 °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 10/7/2012

Site Operator: Scott Douglas

Time On Site: 7:30 Time Off Site:

Weather:

Status of exterior Beacon prior to entering PTA: Off

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes:

Wind Direction:

List of expected visitors or subcontractors:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing?

PTA Effluent Alarm Set Point of TIT-201 = ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 10/8/2012

Site Operator: Scott Douglas

Time On Site: 7:30 Time Off Site:

Weather:

Status of exterior Beacon prior to entering PTA: Off

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes:

Wind Direction:

List of expected visitors or subcontractors:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing?

PTA Effluent Alarm Set Point of TIT-201 = ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 10/9/2012

Site Operator: Scott Douglas

Time On Site: 7:30 Time Off Site:

Weather:

Status of exterior Beacon prior to entering PTA: Off

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes:

Wind Direction:

List of expected visitors or subcontractors:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing?

PTA Effluent Alarm Set Point of TIT-201 = ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Daily Operator Checklist

Date: 10/11/2012

Site Operator: Scott Douglas

Time On Site: 7:30 Time Off Site:

Weather:

Status of exterior Beacon prior to entering PTA: Off

Carbon Monoxide of air space at PTA gate: CO% 0

Completed Tailgate meeting: ○ Yes ◉ No

Security Briefing Notes:

Wind Direction:

List of expected visitors or subcontractors:

Thermocouple Datalogger

Download and backup Transducer data to external hardrive: ○ Complete ◉ Incomplete

Complete daily upload to FTP site: ○ Complete ◉ Incomplete

Copy of Active File Name: Time of Upload:

Have any Input Names (TC IDs) Changed: ○ Yes ◉ No (notified R.Roff of change): ○ Yes ◉ No

Additional System Checks

Local System Readout: ○ Complete ◉ Incomplete (see separate sheet)

Perform Equipment Inspections: ○ Complete ◉ Incomplete (see separate sheet)

Daily Screening and Sampling: ○ Complete ◉ Incomplete (see separate sheet)

CEMS System Check List (see Equipment Inspection Sheet)

Liquid Knock Out Tank (T-702)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Condensate Holding Tank (T-705)Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

Mist Accumulator Condensate Tote Check: ○ Yes ◉ No

Pumped out ○ Yes ◉ No Volume 0 /gal

PTA Inspection

Concrete Integrity: ○ Changes have occurred ◉ No changes since last inspections

Exhaust Gas Temperature Changing?

PTA Effluent Alarm Set Point of TIT-201 = ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Carbon Influent Alarm Set Point of TIT-203= ____ °F Alarm Set Point Modified: ○ Yes ◉ No to: 0

Complete Daily Summary Email: ○ Yes ◉ No

Notes:

Equipment Inspection

Date: 8/20/2012

Inspector Scott Douglas

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 3.5

Excess Flow (L/min): 2.9

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	10.94	0	0	9.5	9.5
CO (ppm)=	0	0	0	3000	3000
O2 (%)=	20.5	0	0	10.1	10.1

CO Regulator (psi)= 36 CO Cylinder (psi)= 1200

CO2/O2 Regulator (psi)= 46 CO2/O2 Cylinder (psi) = 2100

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Equipment Inspection

Date: 8/21/2012

Inspector Luana Jo

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 3

Excess Flow (L/min): 2.8

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0	0	0	0	9.5
CO (ppm)=	0	0	1.279	0	3040
O2 (%)=	0	0	0	0	10

CO Regulator (psi)= 44 CO Cylinder (psi)= 1200

CO2/O2 Regulator (psi)= 46 CO2/O2 Cylinder (psi) = 2200

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Equipment Inspection

Date: 8/22/2012

Inspector Scott Douglas

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 3.5

Excess Flow (L/min): 3

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0	0	0		9.3
CO (ppm)=	3.81		1.881		3040
O2 (%)=	20.6		0		10

CO Regulator (psi)= 42 CO Cylinder (psi)= 1200

CO2/O2 Regulator (psi)= 43 CO2/O2 Cylinder (psi) = 2100

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[ ]

Comments:

Equipment Inspection

Date: 8/23/2012

Inspector Luana Jo

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 3.5

Excess Flow (L/min): 2.9

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0.1	0	0	0	9.5
CO (ppm)=	0	0	2.07	0	3010
O2 (%)=	20.6	0	0	0	10

CO Regulator (psi)= 38 CO Cylinder (psi)= 1200

CO2/O2 Regulator (psi)= 46 CO2/O2 Cylinder (psi) = 2200

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Mike on-site taping seals around ducting to prevent and leaks after blower

Equipment Inspection

Date: 8/24/2012

Inspector Luana Jo

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 3.5

Excess Flow (L/min): 3

- [ ] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	12.07	0	0	0	9.5
CO (ppm)=	0	0	1.916	0	3000
O2 (%)=	20.7	0	0	0	10

CO Regulator (psi)= 42 CO Cylinder (psi)= 1200

CO2/O2 Regulator (psi)= 46 CO2/O2 Cylinder (psi) = 2200

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

data logger reading 3193 ppm for CO

Equipment Inspection

Date: 8/25/2012

Inspector Luana Jo

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 3.5

Excess Flow (L/min): 3

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0		0	0	9.6
CO (ppm)=	0.924		1.294	0	3030
O2 (%)=	20.7		0	0	10.1

CO Regulator (psi)= 44 CO Cylinder (psi)= 1100

CO2/O2 Regulator (psi)= 44 CO2/O2 Cylinder (psi) = 2200

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Equipment Inspection

Date: 8/26/2012

Inspector Luana Jo

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 3.5

Excess Flow (L/min): 3

- [ ] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0		0		9.6
CO (ppm)=	4.3		1.583		3070
O2 (%)=	20.7		0		10.1

CO Regulator (psi)= 34 CO Cylinder (psi)= 1100

CO2/O2 Regulator (psi)= 46 CO2/O2 Cylinder (psi) = 2200

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Equipment Inspection

Date: 8/27/2012

Inspector Russell Hyatt

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 3.5

Excess Flow (L/min): 2.8

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0	0	0	0	9.6
CO (ppm)=	0	0	1.248	0	3000
O2 (%)=	0	0	0	0	10

CO Regulator (psi)= 45 CO Cylinder (psi)= 2080

CO2/O2 Regulator (psi)= 44 CO2/O2 Cylinder (psi) = 1100

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Equipment Inspection

Date: 9/22/2012

Inspector Russell Hyatt

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [ ] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 3.25

Excess Flow (L/min): 2.75

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0	0	0	0	9.3
CO (ppm)=	0	0	1.4	0	3000
O2 (%)=	0	0	0	0	10

CO Regulator (psi)= 44 CO Cylinder (psi)= 1000

CO2/O2 Regulator (psi)= 45 CO2/O2 Cylinder (psi) = 1900

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Flow alarm light on SEM is red

Equipment Inspection

Date: 10/2/2012

Inspector Dave Liefl

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 4

Excess Flow (L/min): 3.5

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0	0	0	9.5	9.7
CO (ppm)=	0	0	4.69	0	3020
O2 (%)=	0	0	0.1	10.1	10.2

CO Regulator (psi)= 310 CO Cylinder (psi)= 1850

CO2/O2 Regulator (psi)= 300 CO2/O2 Cylinder (psi) = 1000

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Equipment Inspection

Date: 10/3/2012

Inspector Dave Liefl

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 4

Excess Flow (L/min): 3.5

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0.1	0	0	9.5	9.6
CO (ppm)=	0	0	2.74	3000	3040
O2 (%)=	20.6	0	0	10.1	10.1

CO Regulator (psi)= 300 CO Cylinder (psi)= 925

CO2/O2 Regulator (psi)= 310 CO2/O2 Cylinder (psi) = 1800

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

No Issues with form

Equipment Inspection

Date: 10/4/2012

Inspector Dave Liefl

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 4

Excess Flow (L/min): 3.25

- [ ] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0	0	0	0	0
CO (ppm)=	0	0	0	0	0
O2 (%)=	0	0	0	0	0

CO Regulator (psi)= 325 CO Cylinder (psi)= 1850

CO2/O2 Regulator (psi)= 300 CO2/O2 Cylinder (psi) = 900

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Equipment Inspection

Date: 10/5/2012

Inspector Dave Liefl

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 4

Excess Flow (L/min): 3.25

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0.2	0	0	9.6	9.6
CO (ppm)=	20.3		0	3000	3040
O2 (%)=	520		0.1	10.2	10.2

CO Regulator (psi)= 310 CO Cylinder (psi)= 1850

CO2/O2 Regulator (psi)= 300 CO2/O2 Cylinder (psi) = 925

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Equipment Inspection

Date: 10/6/2012

Inspector Dave Liefl

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 4

Excess Flow (L/min): 3.25

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0.2	0	0	9.5	9.5
CO (ppm)=	20.3	0	4.6	3000	3060
O2 (%)=	385	0	0	10.1	10.1

CO Regulator (psi)= 300 CO Cylinder (psi)= 1850

CO2/O2 Regulator (psi)= 300 CO2/O2 Cylinder (psi) = 925

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Equipment Inspection

Date: 10/7/2012

Inspector Scott Douglas

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 4

Excess Flow (L/min): 3.4

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	9.7	0	0	9.5	9.5
CO (ppm)=	3110	0	0	3010	3010
O2 (%)=	10.2	0	0	101	10.1

CO Regulator (psi)= 38 CO Cylinder (psi)= 900

CO2/O2 Regulator (psi)= 42 CO2/O2 Cylinder (psi) = 1750

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Equipment Inspection

Date: 10/8/2012

Inspector Scott Douglas

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 4

Excess Flow (L/min): 3.4

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0	0	0	0	9.5
CO (ppm)=	0	0	0	0	3000
O2 (%)=	0	0	0	0	10.1

CO Regulator (psi)= 42 CO Cylinder (psi)= 900

CO2/O2 Regulator (psi)= 42 CO2/O2 Cylinder (psi) = 1700

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Equipment Inspection

Date: 10/11/2012

Inspector Scott Douglas

CEMS System Checks

- [x] A/C unit is running and temp is ~65F in enclosure
- [x] Liquid Alarm Light and Flow Alarm Light is Green
- [x] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [x] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 4

Excess Flow (L/min): 3.4

- [ ] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0	0	0	0	0
CO (ppm)=	0	0	0	0	0
O2 (%)=	0	0	0	0	0

CO Regulator (psi)= 0 CO Cylinder (psi)= 0

CO2/O2 Regulator (psi)= 0 CO2/O2 Cylinder (psi) = 0

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
C-20	Secondary Air Compressor	motors are not generating excessive noise	[x]
		no oil leaks	[x]
T-701	Equalization Tank	Check for condensate and drain as needed	[x]
B-21	Primary Blower	motors are not generating excessive noise	[x]
B-21	Secondary Blower	motors are not generating excessive noise	[x]
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		[x]
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		[x]

Comments:

Regulator for O2/CO2 cylinder is not working. Replacement has been ordered.

Equipment Inspection

Date: 10/20/2012

Inspector Luana Jo

CEMS System Checks

- [ ] A/C unit is running and temp is ~65F in enclosure
- [ ] Liquid Alarm Light and Flow Alarm Light is Green
- [ ] Confirm probe heater controller temp is 250F +/- 10F
  if temperatire is approaching or above 300F need to call CEMS immediately
- [ ] Confirm umbilical heater controller temp is 250F +/- 10F

Sample Flow Rate (L/min): 0

Excess Flow (L/min): 0

- [x] Calibration check complete

		Zero		Cal. gas	
	Intial Reading	Calibrated to	Reading	Calibrated to	Reading
CO2 (%)=	0	0	0	0	5
CO (ppm)=	0	0	1.14	0	3010
O2 (%)=	20.9	0	0	0	10

CO Regulator (psi)= 0 CO Cylinder (psi)= 0

CO2/O2 Regulator (psi)= 0 CO2/O2 Cylinder (psi) = 0

Air Injection/SVE System Checks

C-20	Primary Air Compressor	motors are not generating excessive noise	☑
		no oil leaks	☑
C-20	Secondary Air Compressor	motors are not generating excessive noise	☑
		no oil leaks	☑
T-701	Equalization Tank	Check for condensate and drain as needed	☑
B-21	Primary Blower	motors are not generating excessive noise	☑
B-21	Secondary Blower	motors are not generating excessive noise	☑
	Inspect ducting/piping and air lines for vibration, loose fittings or leaks		☑
	Ensure whip checks and restraints are in place on hoses, and fittings are tight		☑

Comments:

Operator Checklist: Press Vac

Operator: Luana Jo | Date Measured: 8/21/2012 | Time Measured: 14:16

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	0.0	psi
R-205	IP-1 regulating valve pressure	0.0	psi
R-206	IP-2 regulating valve pressure	0.0	psi
R-207	IP-3 regulating valve pressure	0.0	psi
R-208	IP-4 regulating valve pressure	37	psi
R-209	IP-5 regulating valve pressure	0.0	psi

Ignition Well Flow rate calculation: **Time:** 14:25

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:	0	DP psi	PI 102 (psi):	0
IP-2	○ On	◉ Off	Off	FI 102:	0	DP psi	PI 103 (psi):	0
IP-3	○ On	◉ Off	Off	FI 103:	0	DP psi	PI 104 (psi):	0
IP-4	◉ On	○ Off	On	FI 104:	0.2	DP psi	PI 105 (psi):	8
IP-5	○ On	◉ Off	Off	FI 105:	0	DP psi	PI 106 (psi):	0

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	92.1
PIT 101:	Compressor discharge pressure	71.7
TIT 201:	PTA effluent temperuture indicator	83.4
TIT 202:	Pre-blower influent temperature	86.6
PIT 201:	Pre-blower pressure	22.1
PIT 202:	Post-blower pressure	26
PIT 203:	Carbon midpoint pressure	3.1
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	115.9
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	1865.4

Pilot Test Area Readings:

IP Units: psi

		Value:			Value:	Units:
IP-1 PI:	Ignition point pressure	0	VacMP-1:	Vacuum Monitoring Probe 1	2	in. H20
IP-2 PI:	Ignition point pressure	0	VacMP-2:	Vacuum Monitoring Probe 2	1.4	in. H20
IP-3 PI:	Ignition point pressure	2	VacMP-3:	Vacuum Monitoring Probe 3	1.4	in. H20
IP-4 PI:	Ignition point pressure	0	VacMP-4:	Vacuum Monitoring Probe 4	2	in. H20
IP-5 PI:	Ignition point pressure	0	PI-201:	PTA effluent vacuum	9	in. H20
			PI-202:	Pre-blower influent vacuum	21	in. H20
			PI-203:	Carbon influent pressure	26	in. H20
			PI-204:	Post carbon pressure	0	in. H20
CEMS	CEMS TIME: 2:32 PM		FI 111:	SVE-1 flow	670	ft/min
	Value:		FI 112:	SVE-2 flow	705	ft/min
CO (ppm)	6.13		FI 113:	SVE-3 flow	741	ft/min
CO2%	0		FI 114:	SVE-4 flow	677	ft/min
O2%	20.5		FI 115:	Pre-dilution flow	335	ft/min
			FI 116:	Post-dilution flow	3045	ft/min

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Press Vac

Operator: Scott Douglas | Date Measured: 8/22/2012 | Time Measured: 9:20

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	70	psi
R-205	IP-1 regulating valve pressure	5	psi
R-206	IP-2 regulating valve pressure	5	psi
R-207	IP-3 regulating valve pressure	5	psi
R-208	IP-4 regulating valve pressure	10	psi
R-209	IP-5 regulating valve pressure	O	psi

Ignition Well Flow rate calculation: **Time:** 9:25

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	On	FI 101:	0.25	DP psi	PI 102 (psi):	0
IP-2	○ On	◉ Off	On	FI 102:	0.25	DP psi	PI 103 (psi):	0
IP-3	○ On	◉ Off	On	FI 103:	0.25	DP psi	PI 104 (psi):	1
IP-4	◉ On	○ Off	On	FI 104:	0.25	DP psi	PI 105 (psi):	2
IP-5	○ On	◉ Off	Off	FI 105:		DP psi	PI 106 (psi):	

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	86.4
PIT 101:	Compressor discharge pressure	71
TIT 201:	PTA effluent temperuture indicator	81
TIT 202:	Pre-blower influent temperature	84.3
PIT 201:	Pre-blower pressure	22
PIT 202:	Post-blower pressure	26.7
PIT 203:	Carbon midpoint pressure	3.1
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	113.7
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	1930

Pilot Test Area Readings:

IP Units: psi

		Value:
IP-1 PI:	Ignition point pressure	0
IP-2 PI:	Ignition point pressure	0
IP-3 PI:	Ignition point pressure	3
IP-4 PI:	Ignition point pressure	0
IP-5 PI:	Ignition point pressure	0

		Value:	Units:
VacMP-1:	Vacuum Monitoring Probe 1	1.6	in. H20
VacMP-2:	Vacuum Monitoring Probe 2	1.1	in. H20
VacMP-3:	Vacuum Monitoring Probe 3	1.1	in. H20
VacMP-4:	Vacuum Monitoring Probe 4	1.6	in. H20
PI-201:	PTA effluent vacuum	8	in. H20
PI-202:	Pre-blower influent vacuum	22	in. H20
PI-203:	Carbon influent pressure	34	in. H20
PI-204:	Post carbon pressure	0	in. H20
FI 111:	SVE-1 flow	1480	ft/min
FI 112:	SVE-2 flow	1860	ft/min
FI 113:	SVE-3 flow	2660	ft/min
FI 114:	SVE-4 flow	1850	ft/min
FI 115:	Pre-dilution flow	2600	ft/min
FI 116:	Post-dilution flow	2670	ft/min

CEMS CEMS TIME: 10:25 AM

	Value:
CO (ppm)	63.8
CO2%	0
O2%	20.6

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Press Vac

Operator: Scott Douglas | Date Measured: 8/23/2012 | Time Measured: 8:15

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	70	psi
R-205	IP-1 regulating valve pressure	5	psi
R-206	IP-2 regulating valve pressure	5	psi
R-207	IP-3 regulating valve pressure	10	psi
R-208	IP-4 regulating valve pressure	4	psi
R-209	IP-5 regulating valve pressure	0.0	psi

Ignition Well Flow rate calculation: **Time:** 8:30

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	On	FI 101:	0.2	DP psi	PI 102 (psi):	3
IP-2	○ On	◉ Off	On	FI 102:	0.2	DP psi	PI 103 (psi):	3
IP-3	○ On	◉ Off	On	FI 103:	0.3	DP psi	PI 104 (psi):	8
IP-4	◉ On	○ Off	On	FI 104:	0.1	DP psi	PI 105 (psi):	5
IP-5	○ On	◉ Off	Off	FI 105:	0	DP psi	PI 106 (psi):	0

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	77.4
PIT 101:	Compressor discharge pressure	69
TIT 201:	PTA effluent temperuture indicator	79.2
TIT 202:	Pre-blower influent temperature	80.3
PIT 201:	Pre-blower pressure	22.2
PIT 202:	Post-blower pressure	26.8
PIT 203:	Carbon midpoint pressure	3.2
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	108.3
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	1975.8

Pilot Test Area Readings:

IP Units: psi

		Value:
IP-1 PI:	Ignition point pressure	2
IP-2 PI:	Ignition point pressure	2
IP-3 PI:	Ignition point pressure	6
IP-4 PI:	Ignition point pressure	1
IP-5 PI:	Ignition point pressure	0

		Value:	Units:
VacMP-1:	Vacuum Monitoring Probe 1	1.2	in. H20
VacMP-2:	Vacuum Monitoring Probe 2	0.7	in. H20
VacMP-3:	Vacuum Monitoring Probe 3	0.8	in. H20
VacMP-4:	Vacuum Monitoring Probe 4	1.2	in. H20
PI-201:	PTA effluent vacuum	8	in. H20
PI-202:	Pre-blower influent vacuum	22	in. H20
PI-203:	Carbon influent pressure	27	in. H20
PI-204:	Post carbon pressure	0	in. H20
FI 111:	SVE-1 flow	1640	ft/min
FI 112:	SVE-2 flow	2010	ft/min
FI 113:	SVE-3 flow	2830	ft/min
FI 114:	SVE-4 flow	1870	ft/min
FI 115:	Pre-dilution flow	3360	ft/min
FI 116:	Post-dilution flow	2870	ft/min

CEMS CEMS TIME: 9:08 AM

	Value:
CO (ppm)	0.878
CO2%	0
O2%	20.7

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Press Vac

Operator: Luana Jo | Date Measured: 8/24/2012 | Time Measured: 11:44

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	70	psi
R-205	IP-1 regulating valve pressure	37	psi
R-206	IP-2 regulating valve pressure	22	psi
R-207	IP-3 regulating valve pressure	37	psi
R-208	IP-4 regulating valve pressure	40	psi
R-209	IP-5 regulating valve pressure	0.0	psi

Ignition Well Flow rate calculation: **Time:** 11:44

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:		DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:		DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	Off	FI 103:		DP psi	PI 104 (psi):	
IP-4	◉ On	○ Off	On	FI 104:	0.1	DP psi	PI 105 (psi):	4
IP-5	○ On	◉ Off	Off	FI 105:		DP psi	PI 106 (psi):	

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	94.1
PIT 101:	Compressor discharge pressure	71.3
TIT 201:	PTA effluent temperuture indicator	83.3
TIT 202:	Pre-blower influent temperature	87
PIT 201:	Pre-blower pressure	83.2
PIT 202:	Post-blower pressure	26.3
PIT 203:	Carbon midpoint pressure	3.2
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	116.8
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	1885.2

Pilot Test Area Readings:

IP Units: psi

		Value:			Value:	Units:
IP-1 PI:	Ignition point pressure	0	VacMP-1:	Vacuum Monitoring Probe 1	1.7	in. H20
IP-2 PI:	Ignition point pressure	0	VacMP-2:	Vacuum Monitoring Probe 2	1.2	in. H20
IP-3 PI:	Ignition point pressure	0	VacMP-3:	Vacuum Monitoring Probe 3	1.3	in. H20
IP-4 PI:	Ignition point pressure	0	VacMP-4:	Vacuum Monitoring Probe 4	1.7	in. H20
IP-5 PI:	Ignition point pressure	0	PI-201:	PTA effluent vacuum	9	in. H20
			PI-202:	Pre-blower influent vacuum	22	in. H20
			PI-203:	Carbon influent pressure	26	in. H20
			PI-204:	Post carbon pressure	0	in. H20
CEMS	CEMS TIME: 12:25 PM		FI 111:	SVE-1 flow	1782	ft/min
	Value:		FI 112:	SVE-2 flow	2293	ft/min
CO (ppm)	26.7		FI 113:	SVE-3 flow	2923	ft/min
CO2%	0		FI 114:	SVE-4 flow	2396	ft/min
O2%	20.7		FI 115:	Pre-dilution flow	2290	ft/min
			FI 116:	Post-dilution flow	2298	ft/min

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Press Vac

Operator: Luana Jo | Date Measured: 8/25/2012 | Time Measured: 13:15

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	30	psi
R-205	IP-1 regulating valve pressure	30	psi
R-206	IP-2 regulating valve pressure	0.0	psi
R-207	IP-3 regulating valve pressure	5.0	psi
R-208	IP-4 regulating valve pressure	0.0	psi
R-209	IP-5 regulating valve pressure	0.0	psi

Ignition Well Flow rate calculation: **Time:** 13:28

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:		DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:		DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	Off	FI 103:		DP psi	PI 104 (psi):	
IP-4	◉ On	○ Off	Off	FI 104:		DP psi	PI 105 (psi):	
IP-5	○ On	◉ Off	Off	FI 105:		DP psi	PI 106 (psi):	

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	100.7
PIT 101:	Compressor discharge pressure	74.8
TIT 201:	PTA effluent temperuture indicator	84.9
TIT 202:	Pre-blower influent temperature	88.2
PIT 201:	Pre-blower pressure	22
PIT 202:	Post-blower pressure	26.2
PIT 203:	Carbon midpoint pressure	3.1
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	117.1
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	1843.1

Pilot Test Area Readings:

IP Units: psi

		Value:			Value:	Units:
IP-1 PI:	Ignition point pressure	0	VacMP-1:	Vacuum Monitoring Probe 1	1.9	in. H20
IP-2 PI:	Ignition point pressure	0	VacMP-2:	Vacuum Monitoring Probe 2	1.2	in. H20
IP-3 PI:	Ignition point pressure	0	VacMP-3:	Vacuum Monitoring Probe 3	1.3	in. H20
IP-4 PI:	Ignition point pressure	0	VacMP-4:	Vacuum Monitoring Probe 4	1.9	in. H20
IP-5 PI:	Ignition point pressure	0	PI-201:	PTA effluent vacuum	9	in. H20
			PI-202:	Pre-blower influent vacuum	22	in. H20
			PI-203:	Carbon influent pressure	26	in. H20
			PI-204:	Post carbon pressure	0	in. H20
CEMS	CEMS TIME: 3:06 PM		FI 111:	SVE-1 flow	1744	ft/min
	Value:		FI 112:	SVE-2 flow	2310	ft/min
CO (ppm)	1.248		FI 113:	SVE-3 flow	2600	ft/min
CO2%	0		FI 114:	SVE-4 flow	2510	ft/min
O2%	20.7		FI 115:	Pre-dilution flow	2410	ft/min
			FI 116:	Post-dilution flow	2600	ft/min

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Press Vac

Operator: Luana Jo | Date Measured: 8/26/2012 | Time Measured:

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	70.	psi
R-205	IP-1 regulating valve pressure	22	psi
R-206	IP-2 regulating valve pressure	0.0	psi
R-207	IP-3 regulating valve pressure	17	psi
R-208	IP-4 regulating valve pressure	0.0	psi
R-209	IP-5 regulating valve pressure	0.0	psi

Ignition Well Flow rate calculation: **Time:** 12:16

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:		DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:		DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	On	FI 103:	2	scfm	PI 104 (psi):	0
IP-4	◉ On	○ Off	Off	FI 104:		DP psi	PI 105 (psi):	
IP-5	○ On	◉ Off	Off	FI 105:		DP psi	PI 106 (psi):	

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	103
PIT 101:	Compressor discharge pressure	73.5
TIT 201:	PTA effluent temperuture indicator	82.7
TIT 202:	Pre-blower influent temperature	86.4
PIT 201:	Pre-blower pressure	21.9
PIT 202:	Post-blower pressure	26.5
PIT 203:	Carbon midpoint pressure	3.2
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	116
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	1884.1

Pilot Test Area Readings:

IP Units: psi

		Value:			Value:	Units:
IP-1 PI:	Ignition point pressure	0	VacMP-1:	Vacuum Monitoring Probe 1	1.9	in. H20
IP-2 PI:	Ignition point pressure	0	VacMP-2:	Vacuum Monitoring Probe 2	1.2	in. H20
IP-3 PI:	Ignition point pressure	0	VacMP-3:	Vacuum Monitoring Probe 3	1.2	in. H20
IP-4 PI:	Ignition point pressure	0	VacMP-4:	Vacuum Monitoring Probe 4	1.8	in. H20
IP-5 PI:	Ignition point pressure	0	PI-201:	PTA effluent vacuum	9	in. H20
			PI-202:	Pre-blower influent vacuum	22	in. H20
			PI-203:	Carbon influent pressure	26	in. H20
			PI-204:	Post carbon pressure	0	in. H20
CEMS	CEMS TIME: 2:42 PM		FI 111:	SVE-1 flow	1957	ft/min
	Value:		FI 112:	SVE-2 flow	2205	ft/min
CO (ppm)	2.14		FI 113:	SVE-3 flow	2525	ft/min
CO2%	0		FI 114:	SVE-4 flow	2332	ft/min
O2%	20.7		FI 115:	Pre-dilution flow	2475	ft/min
			FI 116:	Post-dilution flow	2660	ft/min

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Press Vac

Operator: Russell Hyatt | Date Measured: 8/27/2012 | Time Measured: 10:00

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	70	psi
R-205	IP-1 regulating valve pressure	0	psi
R-206	IP-2 regulating valve pressure	0	psi
R-207	IP-3 regulating valve pressure	40	psi
R-208	IP-4 regulating valve pressure	0	psi
R-209	IP-5 regulating valve pressure	0	psi

Ignition Well Flow rate calculation: **Time:** 10:00

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:		DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:		DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	On	FI 103:	0.4	DP psi	PI 104 (psi):	0.8
IP-4	◉ On	○ Off	Off	FI 104:		DP psi	PI 105 (psi):	
IP-5	○ On	◉ Off	Off	FI 105:		DP psi	PI 106 (psi):	

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	87.7
PIT 101:	Compressor discharge pressure	69.4
TIT 201:	PTA effluent temperuture indicator	82.7
TIT 202:	Pre-blower influent temperature	85.5
PIT 201:	Pre-blower pressure	21.7
PIT 202:	Post-blower pressure	26.9
PIT 203:	Carbon midpoint pressure	3.2
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	114.2
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	1877.6

Pilot Test Area Readings:

IP Units: psi

		Value:			Value:	Units:
IP-1 PI:	Ignition point pressure	0	VacMP-1:	Vacuum Monitoring Probe 1	1.2	in. H20
IP-2 PI:	Ignition point pressure	0	VacMP-2:	Vacuum Monitoring Probe 2	0.9	
IP-3 PI:	Ignition point pressure	4	VacMP-3:	Vacuum Monitoring Probe 3	1	
IP-4 PI:	Ignition point pressure	0	VacMP-4:	Vacuum Monitoring Probe 4	1.4	
IP-5 PI:	Ignition point pressure	0	PI-201:	PTA effluent vacuum	8	in. H20
			PI-202:	Pre-blower influent vacuum	21	in. H20
			PI-203:	Carbon influent pressure	25	in. H20
			PI-204:	Post carbon pressure	0	in. H20
CEMS	CEMS TIME: 8:54 PM		FI 111:	SVE-1 flow	2161	ft/min
	Value:		FI 112:	SVE-2 flow	2443	ft/min
CO (ppm)	1.535		FI 113:	SVE-3 flow	2731	ft/min
CO2%	0		FI 114:	SVE-4 flow	2395	ft/min
O2%	20.7		FI 115:	Pre-dilution flow	2609	ft/min
			FI 116:	Post-dilution flow	2567	ft/min

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Press Vac

Operator: Russell Hyatt | Date Measured: 9/22/2012 | Time Measured: 11:45

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	0.0	psi
R-205	IP-1 regulating valve pressure	0.0	psi
R-206	IP-2 regulating valve pressure	0.0	psi
R-207	IP-3 regulating valve pressure	20	psi
R-208	IP-4 regulating valve pressure	20	psi
R-209	IP-5 regulating valve pressure	0.0	psi

Ignition Well Flow rate calculation: **Time:** 8:35

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:	0	DP psi	PI 102 (psi):	0
IP-2	○ On	◉ Off	Off	FI 102:	0	DP psi	PI 103 (psi):	0
IP-3	○ On	◉ Off	On	FI 103:	0	DP psi	PI 104 (psi):	2
IP-4	◉ On	○ Off	On	FI 104:	0	DP psi	PI 105 (psi):	2
IP-5	○ On	◉ Off	Off	FI 105:	0	DP psi	PI 106 (psi):	0

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	78.1
PIT 101:	Compressor discharge pressure	66.2
TIT 201:	PTA effluent temperuture indicator	74.1
TIT 202:	Pre-blower influent temperature	76.1
PIT 201:	Pre-blower pressure	14.6
PIT 202:	Post-blower pressure	35.1
PIT 203:	Carbon midpoint pressure	4.8
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	10.4
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	2339.4

Pilot Test Area Readings:

IP Units: psi

		Value:
IP-1 PI:	Ignition point pressure	0
IP-2 PI:	Ignition point pressure	0
IP-3 PI:	Ignition point pressure	0
IP-4 PI:	Ignition point pressure	0
IP-5 PI:	Ignition point pressure	0

		Value:	Units:
VacMP-1:	Vacuum Monitoring Probe 1	0	in. H20
VacMP-2:	Vacuum Monitoring Probe 2	0	in. H20
VacMP-3:	Vacuum Monitoring Probe 3	0	in. H20
VacMP-4:	Vacuum Monitoring Probe 4	0	in. H20
PI-201:	PTA effluent vacuum	0	in. H20
PI-202:	Pre-blower influent vacuum	0	in. H20
PI-203:	Carbon influent pressure	0	in. H20
PI-204:	Post carbon pressure	0	in. H20
FI 111:	SVE-1 flow	0	ft/min
FI 112:	SVE-2 flow	0	ft/min
FI 113:	SVE-3 flow	0	ft/min
FI 114:	SVE-4 flow	0	ft/min
FI 115:	Pre-dilution flow	0	ft/min
FI 116:	Post-dilution flow	0	ft/min

CEMS CEMS TIME:

	Value:
CO (ppm)	
CO2%	
O2%	

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Press Vac

Operator: Dave Liefl | Date Measured: 10/2/2012 | Time Measured: 10:30

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	66	psi
R-205	IP-1 regulating valve pressure	0	psi
R-206	IP-2 regulating valve pressure	0	psi
R-207	IP-3 regulating valve pressure	0	psi
R-208	IP-4 regulating valve pressure	0	psi
R-209	IP-5 regulating valve pressure	27	psi

Ignition Well Flow rate calculation: **Time:** 11:00

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:	0	DP psi	PI 102 (psi):	0
IP-2	○ On	◉ Off	Off	FI 102:	0	DP psi	PI 103 (psi):	0
IP-3	○ On	◉ Off	Off	FI 103:	0	DP psi	PI 104 (psi):	0
IP-4	◉ On	○ Off	Off	FI 104:	0	DP psi	PI 105 (psi):	0
IP-5	○ On	◉ Off	On	FI 105:	0	DP psi	PI 106 (psi):	23

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	71.1
PIT 101:	Compressor discharge pressure	69.6
TIT 201:	PTA effluent temperuture indicator	70.2
TIT 202:	Pre-blower influent temperature	70.9
PIT 201:	Pre-blower pressure	11.2
PIT 202:	Post-blower pressure	39.6
PIT 203:	Carbon midpoint pressure	6.2
PIT 204:	Blower B-214 outlet pressure	0
TIT 203:	Carbon influent temperature	0
PIT 205:	Carbon mid-point pressure	0
FIT 201:	Discharge flow to stack	2134

Pilot Test Area Readings:

IP Units: psi

		Value:
IP-1 PI:	Ignition point pressure	0
IP-2 PI:	Ignition point pressure	0
IP-3 PI:	Ignition point pressure	0
IP-4 PI:	Ignition point pressure	0
IP-5 PI:	Ignition point pressure	20

		Value:	Units:
VacMP-1:	Vacuum Monitoring Probe 1	1.2	in. H20
VacMP-2:	Vacuum Monitoring Probe 2	0.95	in. H20
VacMP-3:	Vacuum Monitoring Probe 3	0.95	in. H20
VacMP-4:	Vacuum Monitoring Probe 4	1.25	in. H20
PI-201:	PTA effluent vacuum	7.5	in. H20
PI-202:	Pre-blower influent vacuum	12	in. H20
PI-203:	Carbon influent pressure	39	in. H20
PI-204:	Post carbon pressure		
FI 111:	SVE-1 flow	1080	ft/min
FI 112:	SVE-2 flow	1615	ft/min
FI 113:	SVE-3 flow	1790	ft/min
FI 114:	SVE-4 flow	1480	ft/min
FI 115:	Pre-dilution flow	3023	ft/min
FI 116:	Post-dilution flow	2800	ft/min

CEMS CEMS TIME: 11:18 AM

	Value:
CO (ppm)	183.3
CO2%	0
O2%	20.6

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

IP5 Dp not available

Operator Checklist: Press Vac

Operator: Dave Liefl | Date Measured: 10/3/2012 | Time Measured: 10:30

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	65	psi
R-205	IP-1 regulating valve pressure	0	psi
R-206	IP-2 regulating valve pressure	0	psi
R-207	IP-3 regulating valve pressure	0	psi
R-208	IP-4 regulating valve pressure	0	psi
R-209	IP-5 regulating valve pressure	49	psi

Ignition Well Flow rate calculation: **Time:** 10:35

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:	0	DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:	0	DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	Off	FI 103:	0	DP psi	PI 104 (psi):	
IP-4	◉ On	○ Off	Off	FI 104:	0	DP psi	PI 105 (psi):	
IP-5	○ On	◉ Off	On	FI 105:		DP psi	PI 106 (psi):	

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	68.9
PIT 101:	Compressor discharge pressure	65.8
TIT 201:	PTA effluent temperuture indicator	69.6
TIT 202:	Pre-blower influent temperature	69.7
PIT 201:	Pre-blower pressure	11.6
PIT 202:	Post-blower pressure	39.2
PIT 203:	Carbon midpoint pressure	98
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	0
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	2119

Pilot Test Area Readings:

IP Units: psi

		Value:
IP-1 PI:	Ignition point pressure	0
IP-2 PI:	Ignition point pressure	0
IP-3 PI:	Ignition point pressure	0
IP-4 PI:	Ignition point pressure	0
IP-5 PI:	Ignition point pressure	26

		Value:	Units:
VacMP-1:	Vacuum Monitoring Probe 1	1.9	in. H20
VacMP-2:	Vacuum Monitoring Probe 2	1.4	in. H20
VacMP-3:	Vacuum Monitoring Probe 3	1.4	in. H20
VacMP-4:	Vacuum Monitoring Probe 4	1.8	in. H20
PI-201:	PTA effluent vacuum	8	in. H20
PI-202:	Pre-blower influent vacuum	11	in. H20
PI-203:	Carbon influent pressure	38	in. H20
PI-204:	Post carbon pressure	0	in. H20
FI 111:	SVE-1 flow	1232	ft/min
FI 112:	SVE-2 flow	982	ft/min
FI 113:	SVE-3 flow	1826	ft/min
FI 114:	SVE-4 flow	1655	ft/min
FI 115:	Pre-dilution flow	3006	ft/min
FI 116:	Post-dilution flow	2837	ft/min

CEMS CEMS TIME: 11:46 AM

	Value:
CO (ppm)	399
CO2%	0.1
O2%	20.6

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

2400 ft/s post blower flow

Operator Checklist: Press Vac

Operator: Dave Liefl | Date Measured: 10/4/2012 | Time Measured: 11:17

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve		psi
R-205	IP-1 regulating valve pressure		psi
R-206	IP-2 regulating valve pressure		psi
R-207	IP-3 regulating valve pressure		psi
R-208	IP-4 regulating valve pressure		psi
R-209	IP-5 regulating valve pressure	72	psi

Ignition Well Flow rate calculation: **Time:** 11:17

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:		DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:		DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	Off	FI 103:		DP psi	PI 104 (psi):	
IP-4	◉ On	○ Off	Off	FI 104:		DP psi	PI 105 (psi):	
IP-5	○ On	◉ Off	On	FI 105:		DP psi	PI 106 (psi):	

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	79.9
PIT 101:	Compressor discharge pressure	79.3
TIT 201:	PTA effluent temperuture indicator	72.9
TIT 202:	Pre-blower influent temperature	37.7
PIT 201:	Pre-blower pressure	12.8
PIT 202:	Post-blower pressure	37.7
PIT 203:	Carbon midpoint pressure	5.5
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	102.1
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	2295

Pilot Test Area Readings:

IP Units: psi

		Value:
IP-1 PI:	Ignition point pressure	
IP-2 PI:	Ignition point pressure	
IP-3 PI:	Ignition point pressure	
IP-4 PI:	Ignition point pressure	
IP-5 PI:	Ignition point pressure	36

CEMS CEMS TIME: 11:25 AM

	Value:
CO (ppm)	603
CO2%	0.3
O2%	20.3

		Value:	Units:
VacMP-1:	Vacuum Monitoring Probe 1	1.9	
VacMP-2:	Vacuum Monitoring Probe 2	1.2	
VacMP-3:	Vacuum Monitoring Probe 3	1.2	
VacMP-4:	Vacuum Monitoring Probe 4	1.8	
PI-201:	PTA effluent vacuum	9	
PI-202:	Pre-blower influent vacuum	11	
PI-203:	Carbon influent pressure	36	
PI-204:	Post carbon pressure	40	
FI 111:	SVE-1 flow	850	
FI 112:	SVE-2 flow	1250	
FI 113:	SVE-3 flow	960	
FI 114:	SVE-4 flow	1530	
FI 115:	Pre-dilution flow	2838	
FI 116:	Post-dilution flow	3220	

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

VP-5 = 1.5

Operator Checklist: Press Vac

Operator: Dave Liefl | Date Measured: 10/5/2012 | Time Measured: 10:00

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve		psi
R-205	IP-1 regulating valve pressure		psi
R-206	IP-2 regulating valve pressure		psi
R-207	IP-3 regulating valve pressure		psi
R-208	IP-4 regulating valve pressure		psi
R-209	IP-5 regulating valve pressure	83	psi

Ignition Well Flow rate calculation: **Time:** 10:00

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:		DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:		DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	Off	FI 103:		DP psi	PI 104 (psi):	
IP-4	◉ On	○ Off	Off	FI 104:		DP psi	PI 105 (psi):	
IP-5	○ On	◉ Off	On	FI 105:		DP psi	PI 106 (psi):	

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	82.9
PIT 101:	Compressor discharge pressure	97.3
TIT 201:	PTA effluent temperuture indicator	72.4
TIT 202:	Pre-blower influent temperature	75.9
PIT 201:	Pre-blower pressure	12.3
PIT 202:	Post-blower pressure	38
PIT 203:	Carbon midpoint pressure	5.6
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	105.8
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	2282.6

Pilot Test Area Readings:

IP Units: psi

		Value:
IP-1 PI:	Ignition point pressure	
IP-2 PI:	Ignition point pressure	
IP-3 PI:	Ignition point pressure	
IP-4 PI:	Ignition point pressure	
IP-5 PI:	Ignition point pressure	43

CEMS CEMS TIME: 10:25 AM

	Value:
CO (ppm)	519
CO2%	0.2
O2%	20.3

		Value:	Units:
VacMP-1:	Vacuum Monitoring Probe 1	1.9	
VacMP-2:	Vacuum Monitoring Probe 2	1	
VacMP-3:	Vacuum Monitoring Probe 3	1	
VacMP-4:	Vacuum Monitoring Probe 4	1.8	
PI-201:	PTA effluent vacuum	8	
PI-202:	Pre-blower influent vacuum	43	
PI-203:	Carbon influent pressure	39	
PI-204:	Post carbon pressure	0	
FI 111:	SVE-1 flow	850	
FI 112:	SVE-2 flow	1059	
FI 113:	SVE-3 flow	850	
FI 114:	SVE-4 flow	1200	
FI 115:	Pre-dilution flow	2460	
FI 116:	Post-dilution flow	2820	

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

VPO5 9.4

Operator Checklist: Press Vac

Operator: Dave Liefl | Date Measured: 10/6/2012 | Time Measured: 11:00

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve		psi
R-205	IP-1 regulating valve pressure		psi
R-206	IP-2 regulating valve pressure		psi
R-207	IP-3 regulating valve pressure		psi
R-208	IP-4 regulating valve pressure		psi
R-209	IP-5 regulating valve pressure	80	psi

Ignition Well Flow rate calculation: **Time:** 11:00

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:		DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:		DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	Off	FI 103:		DP psi	PI 104 (psi):	
IP-4	◉ On	○ Off	Off	FI 104:		DP psi	PI 105 (psi):	
IP-5	○ On	◉ Off	On	FI 105:		DP psi	PI 106 (psi):	

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	90.3
PIT 101:	Compressor discharge pressure	97.8
TIT 201:	PTA effluent temperuture indicator	74.8
TIT 202:	Pre-blower influent temperature	79.1
PIT 201:	Pre-blower pressure	12
PIT 202:	Post-blower pressure	37.3
PIT 203:	Carbon midpoint pressure	5.6
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	0
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	2786

Pilot Test Area Readings:

IP Units: psi

		Value:
IP-1 PI:	Ignition point pressure	
IP-2 PI:	Ignition point pressure	
IP-3 PI:	Ignition point pressure	
IP-4 PI:	Ignition point pressure	
IP-5 PI:	Ignition point pressure	49

CEMS CEMS TIME: 11:00 AM

	Value:
CO (ppm)	377
CO2%	0.2
O2%	20.2

		Value:	Units:
VacMP-1:	Vacuum Monitoring Probe 1	1.6	
VacMP-2:	Vacuum Monitoring Probe 2	1.1	
VacMP-3:	Vacuum Monitoring Probe 3	1	
VacMP-4:	Vacuum Monitoring Probe 4	1.4	
PI-201:	PTA effluent vacuum	9	
PI-202:	Pre-blower influent vacuum	11	
PI-203:	Carbon influent pressure	37	
PI-204:	Post carbon pressure	37	
FI 111:	SVE-1 flow	850	
FI 112:	SVE-2 flow	1509	
FI 113:	SVE-3 flow	1883	
FI 114:	SVE-4 flow	1503	
FI 115:	Pre-dilution flow	3245	
FI 116:	Post-dilution flow	2609	

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

UPO5= 1.2

Operator Checklist: Press Vac

Operator: Scott Douglas | Date Measured: 10/7/2012 | Time Measured: 8:30

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	95	psi
R-205	IP-1 regulating valve pressure	0.0	psi
R-206	IP-2 regulating valve pressure	0.0	psi
R-207	IP-3 regulating valve pressure	0.0	psi
R-208	IP-4 regulating valve pressure	0.0	psi
R-209	IP-5 regulating valve pressure	80	psi

Ignition Well Flow rate calculation: **Time:** 8:30

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:		DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:		DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	Off	FI 103:		DP psi	PI 104 (psi):	
IP-4	◉ On	○ Off	Off	FI 104:		DP psi	PI 105 (psi):	
IP-5	○ On	◉ Off	On	FI 105:		DP psi	PI 106 (psi):	78

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	55.9
PIT 101:	Compressor discharge pressure	97.1
TIT 201:	PTA effluent temperuture indicator	63.8
TIT 202:	Pre-blower influent temperature	62.2
PIT 201:	Pre-blower pressure	12.5
PIT 202:	Post-blower pressure	39.3
PIT 203:	Carbon midpoint pressure	5.9
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	89.5
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	2356.8

Pilot Test Area Readings:

IP Units: psi

		Value:
IP-1 PI:	Ignition point pressure	0
IP-2 PI:	Ignition point pressure	0
IP-3 PI:	Ignition point pressure	0
IP-4 PI:	Ignition point pressure	0
IP-5 PI:	Ignition point pressure	50

		Value:	Units:
VacMP-1:	Vacuum Monitoring Probe 1	1	in. H20
VacMP-2:	Vacuum Monitoring Probe 2	0.8	in. H20
VacMP-3:	Vacuum Monitoring Probe 3	0.8	in. H20
VacMP-4:	Vacuum Monitoring Probe 4	1	in. H20
PI-201:	PTA effluent vacuum	8	in. H20
PI-202:	Pre-blower influent vacuum	11	in. H20
PI-203:	Carbon influent pressure	39	in. H20
PI-204:	Post carbon pressure	0	in. H20
FI 111:	SVE-1 flow	850	ft/min
FI 112:	SVE-2 flow	1210	ft/min
FI 113:	SVE-3 flow	1523	ft/min
FI 114:	SVE-4 flow	1120	ft/min
FI 115:	Pre-dilution flow	2176	ft/min
FI 116:	Post-dilution flow	3082	ft/min

CEMS CEMS TIME: 9:00 AM

	Value:
CO (ppm)	196.8
CO2%	0.1
O2%	20.5

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Press Vac

Operator: Scott Douglas | Date Measured: 10/8/2012 | Time Measured: 9:45

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	95	psi
R-205	IP-1 regulating valve pressure	0.0	psi
R-206	IP-2 regulating valve pressure	0.0	psi
R-207	IP-3 regulating valve pressure	0.0	psi
R-208	IP-4 regulating valve pressure	0.0	psi
R-209	IP-5 regulating valve pressure	80	psi

Ignition Well Flow rate calculation: **Time:** 9:45

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:		DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:		DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	Off	FI 103:		DP psi	PI 104 (psi):	
IP-4	◉ On	○ Off	Off	FI 104:		DP psi	PI 105 (psi):	
IP-5	○ On	◉ Off	On	FI 105:		DP psi	PI 106 (psi):	80

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	57.3
PIT 101:	Compressor discharge pressure	97.1
TIT 201:	PTA effluent temperuture indicator	59.4
TIT 202:	Pre-blower influent temperature	59.4
PIT 201:	Pre-blower pressure	12.8
PIT 202:	Post-blower pressure	39.6
PIT 203:	Carbon midpoint pressure	5.9
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	88.3
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	2339.6

Pilot Test Area Readings:

IP Units: psi

		Value:
IP-1 PI:	Ignition point pressure	0
IP-2 PI:	Ignition point pressure	0
IP-3 PI:	Ignition point pressure	0
IP-4 PI:	Ignition point pressure	0
IP-5 PI:	Ignition point pressure	50

		Value:	Units:
VacMP-1:	Vacuum Monitoring Probe 1	1.2	in. H20
VacMP-2:	Vacuum Monitoring Probe 2	0.8	in. H20
VacMP-3:	Vacuum Monitoring Probe 3	0.8	in. H20
VacMP-4:	Vacuum Monitoring Probe 4	1	in. H20
PI-201:	PTA effluent vacuum	8	in. H20
PI-202:	Pre-blower influent vacuum	11	in. H20
PI-203:	Carbon influent pressure	40	in. H20
PI-204:	Post carbon pressure	0	in. H20
FI 111:	SVE-1 flow	850	ft/min
FI 112:	SVE-2 flow	850	ft/min
FI 113:	SVE-3 flow	1640	ft/min
FI 114:	SVE-4 flow	1470	ft/min
FI 115:	Pre-dilution flow	1853	ft/min
FI 116:	Post-dilution flow	2248	ft/min

CEMS CEMS TIME: 10:00 AM

	Value:
CO (ppm)	122.1
CO2%	0.1
O2%	20.7

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Press Vac

Operator: Scott Douglas | Date Measured: 10/9/2012 | Time Measured: 9:00

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	98	psi
R-205	IP-1 regulating valve pressure	0.0	psi
R-206	IP-2 regulating valve pressure	0.0	psi
R-207	IP-3 regulating valve pressure	0.0	psi
R-208	IP-4 regulating valve pressure	0.0	psi
R-209	IP-5 regulating valve pressure	80	psi

Ignition Well Flow rate calculation: **Time:** 9:00

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:		DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:		DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	Off	FI 103:		DP psi	PI 104 (psi):	
IP-4	◉ On	○ Off	Off	FI 104:		DP psi	PI 105 (psi):	
IP-5	○ On	◉ Off	On	FI 105:		DP psi	PI 106 (psi):	80

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	54.1
PIT 101:	Compressor discharge pressure	97.2
TIT 201:	PTA effluent temperuture indicator	58.7
TIT 202:	Pre-blower influent temperature	57.2
PIT 201:	Pre-blower pressure	12.9
PIT 202:	Post-blower pressure	39.8
PIT 203:	Carbon midpoint pressure	6
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	84.4
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	2330

Pilot Test Area Readings:

IP Units: psi

		Value:			Value:	Units:
IP-1 PI:	Ignition point pressure	0	VacMP-1:	Vacuum Monitoring Probe 1	1.2	in. H20
IP-2 PI:	Ignition point pressure	0	VacMP-2:	Vacuum Monitoring Probe 2	0.8	in. H20
IP-3 PI:	Ignition point pressure	0	VacMP-3:	Vacuum Monitoring Probe 3	0.8	in. H20
IP-4 PI:	Ignition point pressure	0	VacMP-4:	Vacuum Monitoring Probe 4	1	in. H20
IP-5 PI:	Ignition point pressure	50	PI-201:	PTA effluent vacuum	8	in. H20
			PI-202:	Pre-blower influent vacuum	11	in. H20
			PI-203:	Carbon influent pressure	40	in. H20
			PI-204:	Post carbon pressure	0	in. H20
CEMS	CEMS TIME:		FI 111:	SVE-1 flow	850	ft/min
	Value:		FI 112:	SVE-2 flow	850	ft/min
CO (ppm)			FI 113:	SVE-3 flow	1015	ft/min
CO2%			FI 114:	SVE-4 flow	1280	ft/min
O2%			FI 115:	Pre-dilution flow	2325	ft/min
			FI 116:	Post-dilution flow	3230	ft/min

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Press Vac

Operator: Scott Douglas | Date Measured: 10/11/2012 | Time Measured: 10:30

Tag ID:	Description:	Value:	Units:
R-204	Influent main line pressure regulating valve	95	psi
R-205	IP-1 regulating valve pressure	0.0	psi
R-206	IP-2 regulating valve pressure	0.0	psi
R-207	IP-3 regulating valve pressure	0.0	psi
R-208	IP-4 regulating valve pressure	0.0	psi
R-209	IP-5 regulating valve pressure	80	psi

Ignition Well Flow rate calculation: **Time:** 10:30

Flow indicator (FI) and pressure indicator (PI) on individual IP air injection lines:

					Value:	Units:		Value:
IP-1	○ On	◉ Off	Off	FI 101:		DP psi	PI 102 (psi):	
IP-2	○ On	◉ Off	Off	FI 102:		DP psi	PI 103 (psi):	
IP-3	○ On	◉ Off	Off	FI 103:		DP psi	PI 104 (psi):	
IP-4	◉ On	○ Off	Off	FI 104:		DP psi	PI 105 (psi):	
IP-5	○ On	◉ Off	On	FI 105:		DP psi	PI 106 (psi):	80

PLC Readouts:

TIT Units: °F
PIT Units: in. H2O
FIT Units: scfm

		Value:
TIT 101:	Air injection temperature indicator	62.2
PIT 101:	Compressor discharge pressure	97.3
TIT 201:	PTA effluent temperuture indicator	61
TIT 202:	Pre-blower influent temperature	62.2
PIT 201:	Pre-blower pressure	12.7
PIT 202:	Post-blower pressure	39.4
PIT 203:	Carbon midpoint pressure	5.9
PIT 204:	Blower B-214 outlet pressure	
TIT 203:	Carbon influent temperature	91
PIT 205:	Carbon mid-point pressure	
FIT 201:	Discharge flow to stack	2243.3

Pilot Test Area Readings:

IP Units: psi

		Value:
IP-1 PI:	Ignition point pressure	0
IP-2 PI:	Ignition point pressure	0
IP-3 PI:	Ignition point pressure	0
IP-4 PI:	Ignition point pressure	0
IP-5 PI:	Ignition point pressure	50

		Value:	Units:
VacMP-1:	Vacuum Monitoring Probe 1	1.3	in. H20
VacMP-2:	Vacuum Monitoring Probe 2	0.8	in. H20
VacMP-3:	Vacuum Monitoring Probe 3	0.8	in. H20
VacMP-4:	Vacuum Monitoring Probe 4	1.1	in. H20
PI-201:	PTA effluent vacuum	8	in. H20
PI-202:	Pre-blower influent vacuum	11	in. H20
PI-203:	Carbon influent pressure	40	in. H20
PI-204:	Post carbon pressure	0	in. H20
FI 111:	SVE-1 flow	850	ft/min
FI 112:	SVE-2 flow	860	ft/min
FI 113:	SVE-3 flow	1170	ft/min
FI 114:	SVE-4 flow	890	ft/min
FI 115:	Pre-dilution flow	2900	ft/min
FI 116:	Post-dilution flow	3250	ft/min

CEMS CEMS TIME: 10:40 AM

	Value:
CO (ppm)	2.59
CO2%	0.1
O2%	20.7

For addition al CEMS measurements, open table:

For addition al FI SVE measurements, open table:

Air Space Monitoring (throughout the day)

General Comments:

Operator Checklist: Screening

Operator: Scott Douglas Date Measured: 8/20/2012

Calibration:

PID Daily Calibration:

Model and Serial No.: 100009024

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 100

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	35	0
O2:	0	0	0
CH4:	0	50	50
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 50

Serial No:

	270424713		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	50	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time: 14:13

CO2%: 0

O2%: 20.3

CO ppm: 14

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):	2.4	12:10
Carbon Midpoint (SP-04):	6.4	12:10
Stack Effluent (SP-05):	0	12:10

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM) No

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0.3	20.2	0	14:16
VapMP-2:	0	0	0	0	14:16
VapMP-3:	0	0	0	0	14:16
VapMP-4:	1.8	0	20	0	14:16

Opacity Testing - AM:

Observation Point: Stack

System Running: No

Start of Test: 11:50

End of Test: 12:20

3 minutes of consecutive emissions? No

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Luana Jo Date Measured: 8/21/2012

Calibration:

PID Daily Calibration:	730
Model and Serial No.:	110009024
Fresh Air Scan Reading:	0
100 ppm Isobutylene Reading:	99.7
GEM2000 Plus Calibration:	730
Model and Serial No.:	7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0.1	35	0
O2:	20.9	20.9	0
CH4:	0	50	0
CO:	0	0	0

Qrae/Vrae Calibration:	730
Span Gas Target:	50

Serial No:

	270424713		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	49	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):	0	12:30
Location 2 (E):	0	12:30
Location 3 (S):	0	12:30
Location 4 (W):	0	12:30

SVE Influent Concentrations (SP-01) - AM:

Time:	13:30
CO2%:	0.2
O2%:	20.2
CO ppm:	367

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):	19.9	12:45
Carbon Midpoint (SP-04):	13.4	12:45
Stack Effluent (SP-05):	2.3	12:45

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm): 13.4

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0.3	0	20.5	0	13:30
VapMP-2:	0	2.3	17.2	0	13:30
VapMP-3:	2.1	0.1	18.9	89	13:30
VapMP-4:	3.4	0	20	2	13:30

Opacity Testing - AM:

Observation Point:	Stack
System Running:	Yes
Start of Test:	12:30
End of Test:	12:33
3 minutes of consecutive emissions?	Yes

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:	
CO2%:	
O2%:	
CO ppm:	

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point:	Stack
System Running:	
Start of Test:	
End of Test:	
3 minutes of consecutive emissions?	

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Luana Jo Date Measured: 8/22/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 110009024

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 101

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0.1	33.8	20.9
O2:	20.8	20.9	20.9
CH4:	0	47.4	50
CO:	0	0	0

Qrae/Vrae Calibration:

Span Gas Target: 50

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	50	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):	0	14:56
Location 2 (E):	0	14:56
Location 3 (S):	0	14:56
Location 4 (W):	0	14:56

SVE Influent Concentrations (SP-01) - AM:

Time: 14:45

CO2%: 0.1

O2%: 20.4

CO ppm: 39

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):	4.2	14:00
Carbon Midpoint (SP-04):	6.7	14:00
Stack Effluent (SP-05):	0	14:00

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm): 6.6

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM) No

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0.2	20.3	0	
VapMP-2:	0	3.8	15.6	0	
VapMP-3:	0.5	0.1	18.9	19	
VapMP-4:	0.1	0	20.2	0	

Opacity Testing - AM:

Observation Point: Stack

System Running: Yes

Start of Test: 14:52

End of Test: 14:55

3 minutes of consecutive emissions? Yes

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Luana Jo Date Measured: 8/23/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 0

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 0

GEM2000 Plus Calibration: 0

Model and Serial No.: 0

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	0	0
O2:	0	0	0
CH4:	0	0	0
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	0		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	0	0	0	0	0
O2:	0	0	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - AM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Luana Jo Date Measured: 8/24/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 110009024

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 100

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0.1	34.3	0
O2:	20.9	20.9	0
CH4:	0	48.3	0
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	47	0	0	0	0
O2:	20.9	0	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):	0	9:45
Location 2 (E):	0	9:45
Location 3 (S):	0	9:45
Location 4 (W):	0	9:45

SVE Influent Concentrations (SP-01) - AM:

Time: 10:35

CO2%: 0

O2%: 20.7

CO ppm: 0.1

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):	10.3	10:39
Carbon Midpoint (SP-04):	4.6	10:39
Stack Effluent (SP-05):	0	10:39

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm): 4.1

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0.2	20.7	0	10:44
VapMP-2:	0	3.8	15	0	10:44
VapMP-3:	0	0.1	18.5	0	10:44
VapMP-4:	0	0.1	20.3	0	10:44

Opacity Testing - AM:

Observation Point: Stack

System Running: Yes

Start of Test: 7:15

End of Test: 7:20

3 minutes of consecutive emissions? No

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Luana Jo Date Measured: 8/25/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 110009024

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 98.9

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0.1	35	35
O2:	20.9	20.9	35
CH4:	0	48.9	50
CO:	0	0	0

Qrae/Vrae Calibration:

Span Gas Target: 0

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	48	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):	0	8:35
Location 2 (E):	0	8:35
Location 3 (S):	0	8:35
Location 4 (W):	0	8:35

SVE Influent Concentrations (SP-01) - AM:

Time: 11:45

CO2%: 0.1

O2%: 20.4

CO ppm: 2

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):	2	11:45
Carbon Midpoint (SP-04):	8.7	11:45
Stack Effluent (SP-05):	0	11:45

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm): 8.5

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM) No

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0.2	20.3	0	11:45
VapMP-2:	0	3.8	15.1	0	11:45
VapMP-3:	0	0.1	18.6	1	11:45
VapMP-4:	0	0	20.1	0	11:45

Opacity Testing - AM:

Observation Point: Stack

System Running: No

Start of Test: 8:05

End of Test: 8:10

3 minutes of consecutive emissions? No

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Luana Jo Date Measured: 8/26/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 110009024

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 101

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0.1	33.4	
O2:	20.9	20.9	
CH4:	0	46.6	50
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	47	0	0	0	0
O2:	20.9	0	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):	0	11:00
Location 2 (E):	0	11:00
Location 3 (S):	0	11:00
Location 4 (W):	0	11:00

SVE Influent Concentrations (SP-01) - AM:

Time: 11:45

CO2%: 0.1

O2%: 20.6

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):	0	11:45
Carbon Midpoint (SP-04):	0	11:45
Stack Effluent (SP-05):	0	11:45

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm): 0.0

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0.2	20.4	0	11:45
VapMP-2:	0	3.9	14.8	0	11:45
VapMP-3:	0	0.1	18.4	5	11:45
VapMP-4:	0	0	20.3	0	11:45

Opacity Testing - AM:

Observation Point: Stack

System Running: Yes

Start of Test: 11:45

End of Test: 12:00

3 minutes of consecutive emissions? No

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Luana Jo Date Measured: 8/27/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 110009024

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 99.9

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0.1	35	35
O2:	20.9	20.9	35
CH4:	0	50	50
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	47	0	0	0	0
O2:	0	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):	0	9:15
Location 2 (E):	0	9:15
Location 3 (S):	0	9:15
Location 4 (W):	0	9:15

SVE Influent Concentrations (SP-01) - AM:

Time: 9:00

CO2%: 0.1

O2%: 20.5

CO ppm: 0

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):	2.3	9:03
Carbon Midpoint (SP-04):	0	9:03
Stack Effluent (SP-05):	0	9:03

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm): 0.0

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM) No

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0.2	20.3	0	9:07
VapMP-2:	0	4.4	13.8	0	9:07
VapMP-3:	0	0.2	17.2	9	9:07
VapMP-4:	0	0	20	0	9:07

Opacity Testing - AM:

Observation Point: Stack

System Running: Yes

Start of Test: 7:00

End of Test: 7:05

3 minutes of consecutive emissions? No

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Russell Hyatt Date Measured: 8/28/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 110009024

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 101

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	34	35
O2:	20.9	0	35
CH4:	0	49	50
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 50

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	44	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - AM:

Observation Point: Stack

System Running: No

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Afternoon session not performed due to system not running

Operator Checklist: Screening

Operator: Scott Douglas Date Measured: 8/30/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 110009024

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 100

GEM2000 Plus Calibration: 0

Model and Serial No.: 75241104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	35	35
O2:	0	20.9	35
CH4:	0	50	50
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	50	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - AM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Russell Hyatt Date Measured: 9/22/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 0

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 0

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	35	35
O2:	20.6	0	35
CH4:	0	49	50
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	15931		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	50	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

PID reads NO GAS for span cal. Needs replacing

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - AM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Russell Hyatt Date Measured: 9/23/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 0

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 0

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	34.5	0
O2:	0	2	0
CH4:	0	49	0
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	170		200		359	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	50	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - AM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Scott Douglas Date Measured: 9/24/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 110009024

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 0

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	34.8	35
O2:	0	20.9	35
CH4:	0	50.5	50
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	170200389		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	50	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - AM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Scott Douglas Date Measured: 10/1/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 110001467

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 99.4

GEM2000 Plus Calibration: 0

Model and Serial No.: 0

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	35	35
O2:	0	20.9	35
CH4:	0	50	50
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	50	0	0	0	0
O2:	20.9	0	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0.2	20.3	73	14:37
VapMP-2:	0	0	17.7	1.9	14:39
VapMP-3:	0	0	17.5	0.3	14:41
VapMP-4:	0	0	20.3	0.1	14:44

Opacity Testing - AM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Dave Liefl Date Measured: 10/2/2012

Calibration:

PID Daily Calibration:

Model and Serial No.: 110012985

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 100

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	34.9	35
O2:	0	20.9	35
CH4:	0		
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	0		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	50	0	0	0	0
O2:	20.9	0	0	0	0	0

Calibration Comments:

PID returned - constant pump alarm

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):	0	11:00
Location 2 (E):	0	11:00
Location 3 (S):	0	11:00
Location 4 (W):	0	11:00

SVE Influent Concentrations (SP-01) - AM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM) No

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	3.1	0.7	19.7	450	11:08
VapMP-2:	0	1	19.1	2	11:05
VapMP-3:	8.8	1	15.7	292	11:03
VapMP-4:	1.1	0.1	19.9	75	11:00

Opacity Testing - AM:

Observation Point: Stack

System Running: Yes

Start of Test: 9:00

End of Test: 9:03

3 minutes of consecutive emissions? No

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time: 16:20

CO2%: 0.2

O2%: 20.2

CO ppm: 237

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):	11.2	16:28
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):	1.1	16:23

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	8	0.4	19.9	558	16:05
VapMP-2:	2.4	1	19.2	7	16:09
VapMP-3:	13.5	1.1	15.4	675	16:12
VapMP-4:	2.9	0.1	20	139	16:15

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)? No

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Dave Liefl Date Measured: 10/3/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 110012985

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 0

GEM2000 Plus Calibration:

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	0	0
O2:	0	0	0
CH4:	0	0	0
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	0	0	0	0	0
O2:	0	0	0	0	0	0

Calibration Comments:

screening results accurate

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):	0	9:00
Location 2 (E):	0	9:00
Location 3 (S):	0	9:00
Location 4 (W):	0	9:00

SVE Influent Concentrations (SP-01) - AM:

Time: 11:30

CO2%: 0.2

O2%: 20.3

CO ppm: 362

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		11:39
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		11:40

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM) No

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0.5	19.3	750	11:30
VapMP-2:	0	0.1	20	0	11:33
VapMP-3:	0	3.7	9	1500	11:36
VapMP-4:	0	0.2	18.9	410	11:42

Opacity Testing - AM:

Observation Point: Stack

System Running: Yes

Start of Test: 11:20

End of Test: 11:25

3 minutes of consecutive emissions? No

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):	0	15:30
Location 2 (E):	0	15:30
Location 3 (S):	0	15:30
Location 4 (W):	0	15:30

SVE Influent Concentrations (SP-01) - PM:

Time: 15:35

CO2%: 0.3

O2%: 19.8

CO ppm: 540

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0.8	18.6	1500	15:40
VapMP-2:	0	0.1	20.1	46	15:43
VapMP-3:	0	4.2	11.5	1500	15:48
VapMP-4:	0	0.2	19	704	15:51

Opacity Testing - PM:

Observation Point: Stack

System Running: Yes

Start of Test: 16:00

End of Test: 16:13

3 minutes of consecutive emissions? No

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)? Yes

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:	2596	Time:	15:30
Initial Vac (Hg):	-29.1	Final Vac (Hg):	0
Cannister ID:	pre-2596, post-3434	Flow Controller ID:	N/A

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:	43434	Time:	15:40
Initial Vac (Hg):	-29.1	Final Vac (Hg):	0
Cannister ID:	pre-2596, post-3434	Flow Controller ID:	N/A

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)? No

Notes:

Pid lamp error. No pid measurements taken

Operator Checklist: Screening

Operator: Dave Liefl Date Measured: 10/4/2012

Calibration:

PID Daily Calibration:	0
Model and Serial No.:	5929062830
Fresh Air Scan Reading:	0
100 ppm Isobutylene Reading:	101.2
GEM2000 Plus Calibration:	0
Model and Serial No.:	0

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	0	0
O2:	0	0	0
CH4:	0	0	0
CO:	0	0	0

Qrae/Vrae Calibration:	0
Span Gas Target:	0

Serial No:

		0		0		0
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	0	0	0	0	0
O2:	0	0	0	0	0	0

Calibration Comments:

Meter Calibration checks Completed: All reading properly

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):	0	8:00
Location 2 (E):	0	8:00
Location 3 (S):	0	8:00
Location 4 (W):	0	8:00

SVE Influent Concentrations (SP-01) - AM:

Time:	
CO2%:	
O2%:	
CO ppm:	

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:					
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - AM:

Observation Point:	Stack
System Running:	
Start of Test:	
End of Test:	
3 minutes of consecutive emissions?	

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):	0	14:00
Location 2 (E):	0	14:00
Location 3 (S):	0	14:00
Location 4 (W):	0	14:00

SVE Influent Concentrations (SP-01) - PM:

Time:	14:30
CO2%:	0.1
O2%:	20.7
CO ppm:	425

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):	23.9	14:35
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):	2	14:40

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM) No

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	43.4	1065	20.7	0.1	15:00
VapMP-2:	1.8	0.1	20.6	8	15:05
VapMP-3:	128	2.2	17	1500	15:10
VapMP-4:	20.7	0.3	19.1	1033	15:15

Opacity Testing - PM:

Observation Point:	Stack
System Running:	Yes
Start of Test:	13:45
End of Test:	13:50
3 minutes of consecutive emissions?	No

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)? No

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Dave Liefl Date Measured: 10/5/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 0

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 0

GEM2000 Plus Calibration: 0

Model and Serial No.: 0

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	0	0
O2:	0	0	0
CH4:	0	0	0
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	0		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	0	0	0	0	0
O2:	0	0	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - AM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)? Yes

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:	PTC-A-SP01-100312	Time:	9:00
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:	3278	Flow Controller ID:	N/A

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:	PTC-A-SP05-10052012	Time:	9:10
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:	4310	Flow Controller ID:	N/A

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)? Yes

Notes:

Operator Checklist: Screening

Operator: Dave Liefl Date Measured: 10/6/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 592906283

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 100.8

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	50	20.9
O2:	0	20.9	20.9
CH4:	0	0	0
CO:	0		0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	50	0	0	0	0	0
O2:	20.8	0	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):	0	9:00
Location 2 (E):	0	
Location 3 (S):	0	
Location 4 (W):	0	

SVE Influent Concentrations (SP-01) - AM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - AM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):	0	14:00
Location 2 (E):	0	
Location 3 (S):	0	
Location 4 (W):	0	

SVE Influent Concentrations (SP-01) - PM:

Time: 14:15

CO2%: 0.2

O2%: 20.2

CO ppm: 250

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):	26	14:20
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):	1.4	14:20

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM) No

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	32.2	0.5	19.9	738	14:25
VapMP-2:	8.4	0.4	19.5	0	14:30
VapMP-3:	112.2	2	17.8	1134	14:35
VapMP-4:	17	0.3	19.6	650	14:40

Opacity Testing - PM:

Observation Point: Stack

System Running: Yes

Start of Test: 13:10

End of Test: 13:15

3 minutes of consecutive emissions? No

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)? No

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Scott Douglas Date Measured: 10/7/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 592906283

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 100

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	35	35
O2:	0	20.9	35
CH4:	0	50	50
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 50

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	46	0	0	0	0
O2:	20.9	0	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time: 11:30

CO2%: 0.3

O2%: 20.6

CO ppm: 75

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):	21.3	11:30
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):	1.9	11:30

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	43.4	0.9	19.7	327	11:30
VapMP-2:	8.9	4.2	6.9	3	11:30
VapMP-3:	77.4	1.7	18.8	1000	11:30
VapMP-4:	20.9	0.4	19.9	329	

Opacity Testing - AM:

Observation Point: Stack

System Running: Yes

Start of Test: 11:00

End of Test: 11:30

3 minutes of consecutive emissions? No

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Scott Douglas Date Measured: 10/8/2012

Calibration:

PID Daily Calibration:	0
Model and Serial No.:	592906283
Fresh Air Scan Reading:	0
100 ppm Isobutylene Reading:	100.2
GEM2000 Plus Calibration:	0
Model and Serial No.:	75201104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	35	35
O2:	0	20.9	35
CH4:	0	50	50
CO:	0	0	0

Qrae/Vrae Calibration:	0
Span Gas Target:	50

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	50	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time:	
CO2%:	
O2%:	
CO ppm:	

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - AM:

Observation Point:	Stack
System Running:	
Start of Test:	
End of Test:	
3 minutes of consecutive emissions?	

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:	13:30
CO2%:	0.3
O2%:	20.9
CO ppm:	108

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):	12.4	13:30
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):	0	13:30

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	23	0.5	20.4	215	13:30
VapMP-2:	3	4.1	6.8	2	13:30
VapMP-3:	75	1.4	19	1500	13:30
VapMP-4:	22	0.3	19.9	527	13:30

Opacity Testing - PM:

Observation Point:	Stack
System Running:	Yes
Start of Test:	13:00
End of Test:	13:30
3 minutes of consecutive emissions?	No

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Scott Douglas Date Measured: 10/9/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 592906283

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 98.2

GEM2000 Plus Calibration: 0

Model and Serial No.: 0

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0	35	35
O2:	0	20.9	35
CH4:	0	50	50
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 50

Serial No:

	120200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	50	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - AM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Russell Hyatt Date Measured: 10/11/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 592906283

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 99.6

GEM2000 Plus Calibration: 0

Model and Serial No.: 7524104

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0.4	35	35
O2:	0	13	35
CH4:	0	50.1	50
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 50

Serial No:

	170200359				
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	1	51	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time: 10:00

CO2%: 0.2

O2%: 20.4

CO ppm: 3

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):	28	10:00
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):	0.4	10:00

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	58	0.5	20.7	5	9:45
VapMP-2:	1.6	0.1	20.7	0	10:15
VapMP-3:	90	1.3	19.2	30	10:15
VapMP-4:	34	0.3	19.7	23	10:00

Opacity Testing - AM:

Observation Point: Stack

System Running: Yes

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

water collected@MP.02. Bag replaced. Resample.

Operator Checklist: Screening

Operator: Luana Jo Date Measured: 10/19/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 18713

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 100.2

GEM2000 Plus Calibration: 7524104

Model and Serial No.: 0

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0.1	35	0
O2:	20.9	20.9	0
CH4:	0	50	0
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	49	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):	1	10:46
Location 2 (E):	1	10:46
Location 3 (S):	1	10:46
Location 4 (W):	1	10:46

SVE Influent Concentrations (SP-01) - AM:

Time: 10:30

CO2%: 0.1

O2%: 20.9

CO ppm: 2

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):	28.7	10:30
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):	0.4	10:30

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM)

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	3.4	0.2	20.9	0	10:30
VapMP-2:	0	3.3	18	1	10:30
VapMP-3:	18.4	0.1	19.9	1	10:30
VapMP-4:	1	0.1	20.9	0	10:30

Opacity Testing - AM:

Observation Point: Stack

System Running: Yes

Start of Test: 10:00

End of Test: 10:30

3 minutes of consecutive emissions? No

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

Operator Checklist: Screening

Operator: Dave Liefl Date Measured: 10/20/2012

Calibration:

PID Daily Calibration: 0

Model and Serial No.: 18713

Fresh Air Scan Reading: 0

100 ppm Isobutylene Reading: 100.3

GEM2000 Plus Calibration: 0

Model and Serial No.: 0

	Zero Span (%)	Calibration Span (%)	Span Target (%)
CO2:	0.1	35	0
O2:	20.9	20.9	0
CH4:	0	50	0
CO:	0	0	0

Qrae/Vrae Calibration: 0

Span Gas Target: 0

Serial No:

	170200359		0		0	
	Fresh Ai	Span Ga	Fresh Ai	Span Ga	Fresh Ai	Span Ga
CO:	0	50	0	0	0	0
O2:	20.9	20.9	0	0	0	0

Calibration Comments:

Morning Screening:

Carbon Monoxide Screening - AM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - AM:

Time: 14:00

CO2%: 0.3

O2%: 20.9

CO ppm: 1500

Carbon Breakthrough Testing (PID Screening) - AM:

	ppm:	Time:
Influent (SP-03):	48.5	14:44
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):	5.5	14:44

Midpoint (SP-04) sample greater than 50 ppm? No

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (AM) No

Vapor Monitoring Probe Screening - AM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	2.6	0.2	21.2	22	15:00
VapMP-2:	0	0	0	0	
VapMP-3:	10.3	0.1	20.5	0	15:00
VapMP-4:	1.4	0	21.3	0	15:00

Opacity Testing - AM:

Observation Point: Stack

System Running: Yes

Start of Test: 14:40

End of Test: 14:50

3 minutes of consecutive emissions? No

Description of Corrective Action:

Afternoon Screening:

Carbon Monoxide Screening - PM:

	CO ppm:	Time:
Location 1 (N):		
Location 2 (E):		
Location 3 (S):		
Location 4 (W):		

SVE Influent Concentrations (SP-01) - PM:

Time:

CO2%:

O2%:

CO ppm:

Carbon Breakthrough Testing (PID Screening) - PM:

	ppm:	Time:
Influent (SP-03):		
Carbon Midpoint (SP-04):		
Stack Effluent (SP-05):		

Midpoint (SP-04) sample greater than 50 ppm? NA

Re-confirm SP-04 (ppm):

Mid Point and Effluent Summa Canister Samples (24 Hour Rush) Collected? (PM)

Vapor Monitoring Probe Screening - PM:

	PID(ppm)	CO2%	O2%	CO%	Time:
VapMP-1:	0	0	0	0	
VapMP-2:	0	0	0	0	
VapMP-3:	0	0	0	0	
VapMP-4:	0	0	0	0	

Opacity Testing - PM:

Observation Point: Stack

System Running:

Start of Test:

End of Test:

3 minutes of consecutive emissions?

Description of Corrective Action:

SAMPLE COLLECTION

Analytical (Summa) Samples Required today (every other day)?

SVE Infuent Sample from SP-03 (INF-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Stack Sample from SP-05 (STACK-##-Initials)

Sample ID:		Time:	
Initial Vac (Hg):	0	Final Vac (Hg):	0
Cannister ID:		Flow Controller ID:	

Does Effluent sample also apply to the weekly assessment for benzene emissions (permit Req#11)?

Notes:

APPENDIX C

ERT Report

Time-lapse Electrical Resistivity Tomography (ERT) Monitoring of STAR at the Pitt-Consol Site, Newark, New Jersey, USA

Prepared for Geosyntec Consultants, Inc.

Christopher Power

Supervisor: Dr. Jason Gerhard

Western University

26 November 2012

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1 Introduction

1.1 Context and Objectives

Electrical resistivity tomography (ERT) is a non-invasive geophysical technique that has been proposed for time-lapse monitoring of subsurface (electrical resistivity) changes associated with the application of the self sustaining treatment for active remediation (STAR) technology during the shallow fill unit combustion test of the Phase III Start Pilot test at the former Pitt Consol Site in Newark, NJ (the Site).. Two ERT survey lines were permanently installed within the STAR pilot test area (PTA) to permit the continuous acquisition of electrical measurements during the shallow STAR test. Analysis of the time-lapse changes in electrical images during that STAR test was expected to help evaluate whether the STAR remediation technology is amenable to geo-electrical monitoring.

2 Preliminary Site and Modelling Investigations

2.1 Preliminary Site Survey

In June 2012, prior to the commencement of the Phase III trial, a preliminary ERT survey was conducted to evaluate the electrical conditions at the site in order to design the subsequent time-lapse survey. A plan view of the test cell area is shown in Figure A.1(a). As shown in the sectional view of the proposed test cell in Figure A.1(b), the target treatment zone for the STAR test was within the shallow fill unit, located between 6 and 10 feet bgs, overlying the Meadowmat. The ERT survey (dashed red lines in Figure A.1b) was designed for a depth of investigation of ~20 ft to ensure this zone of interest was captured. To achieve this depth of investigation, a lateral survey spread of 98.4 ft (30 metres) was used (Figure A.2). An inline electrode spacing of 3.2 ft (1 m) was chosen to provide the optimum balance between survey data acquisition time and the resolution of the ERT images. At this resolution, the approximately 540 measurements taken for each data acquisition sequence (i.e., snapshot) required approximately 12 min for data acquisition. Note that an electrode spacing of 1.6 ft (0.5 m) would provide higher resolution but it would take approximately 25 min for each snapshot, which may have been inadequate to capture the dynamic changes of a rapidly evolving STAR test.

The Iris Instruments Syscal Switch Pro 48 resistivity system consisting of 31 electrodes was utilized for this survey. Multiple parallel survey lines were traversed within the test cell for the preliminary survey and various

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electrode configurations, namely the dipole-dipole, Wenner-Schlumberger and their respective reciprocal arrays, were used for each survey line. Analysis of this initial ERT data indicated moderate levels of interference and random noise generated from components of the STAR pilot test infrastructure (e.g., steel injection wells and thermocouple probes). There was enough noise that static detection of targets (e.g., contaminated regions, lithologic units) was challenging; however, the data was shown to be repeatable and stable enough to pursue a time-lapse study that focuses on changes occurring between timesteps. Although the dipole-dipole electrode configuration provides better vertical and lateral resolution, the Wenner-Schlumberger configuration was selected for the time-lapse survey as it is less susceptible to random noise and provided a better signal-to-noise ratio, which proved helpful within the noisy environment existing at this site.

Two survey lines (PCTL1 and PCTL2), consisting of 31 electrodes each, were installed within the PTA in close proximity to the four ignition points (IP1 – IP4) associated with the shallow STAR test. As illustrated in Figures A.2 and A.3, the survey lines were extended ~26 ft to the east and west of the test cell, with Electrodes #9 through #23 installed within the PTA. At these locations, 40 inch long electrodes were inserted 10 inches into the soil prior to backfilling (i.e. vapor collection cover consisting of gravel and concrete layers) so that they would penetrate through the gravel and concrete layers to connect to the survey cables traversing the surface. In addition, each electrode was wrapped in an electrical/thermal insulation sleeve across the gravel and concrete layers to maximize the fraction of electrical current injected into the subsurface.

2.2 Sensitivity Simulations

2.2.1 Introduction

An ERT numerical modelling study was conducted to investigate the potential of time-lapse monitoring of electrical changes occurring during the shallow fill unit STAR test. For this purpose, a 2D ERT forward model was used (*Tsourlos and Ogilvy,* 1999) to predict the resistivity response associated with hypothetical reconstructions of the subsurface created to resemble the structure of the existing conceptual site model and electrical data. A 2D cross-sectional representation of the site in the vicinity of the Phase III PTA was employed (described further below). STAR remediation was not explicitly simulated with a numerical model; rather subsurface changes typical of STAR propagation were sequentially implemented. Two time series were examined, the first looking at a robust “large scale” STAR development from a single ignition well, and the second examining a shorter duration “small scale” STAR propagation from a single ignition well. In this two-dimensional work, it is assumed that the portion of the treated zone being monitored is directly below and oriented parallel to the surface array

of electrodes. This is equivalent to deploying a series of 2D surface arrays across the PTA and choosing to examine only the one best situated with respect to the STAR event.

A standard approach used for interpreting time-lapse data is to independently invert the measured data acquired at each monitoring step and to subtract the resulting tomographic images to look at the changes (here referred to as "Independent"). However, independent time-lapse inversion images are often contaminated with artefacts (i.e., areas where changes are inferred but where none actually occurred) due to independent measurement and inversion errors. Recently, four-dimensional inversion algorithms have been developed where the time dimension is included explicitly into the inversion procedure and having regularizations in both space and time is efficient in reducing artefacts and improving the stability of the inversion problem (*Kim,* 2009); here this will be referred to as "4D". Since the 4D inversion applies a uniform time regularization within all time-steps, it can generate excessive smoothing that suppresses real resistivity changes. A further improved 4D algorithm, the 4D-Active Time Constraint, here referred to as "4D-ATC", was recently proposed by *Karaoulis et al*. (2011) where the time regularization is allowed to vary depending on the degree of spatial changes occurring between different monitoring steps, with the regularization inferred from the initial independent inversion images. Current research at Western University is investigating the application of these four-dimensional algorithms for monitoring contamination clean-up scenarios. This modelling study investigated the use of independent, 4D and 4D-ATC inversion for monitoring the predicted changes generated during the Phase III shallow fill unit STAR pilot test.

2.2.2 Model domain and static detection

The initial conditions (electrical properties) employed in the base case model domain are shown in Figure A.4. These were inferred from the existing site conceptual model and electrical measurements recorded from previous surveys at the site in 2011 (see ERI Site Investigation Survey at Pitt Consol Site: Final Report, 2011). The shallow fill in the vadose zone was assigned high resistivity value (160 ohm-m) associated with coarse sand and gravels with a low water content. The water-saturated zone is represented by a significantly lower resistivity (50 ohm-m) at a depth of 3.2 ft below ground surface. This saturated shallow fill unit is then underlain by the highly conductive Meadowmat peaty clay layer commencing at 9.8 ft, and extending to 12 ft. The contaminated zone, and the target treatment area for this study, exist within the saturated zone overlying the Meadowmat and is 4 ft thick (Figure A.4). For this study, the contaminated zone was assigned a resistivity value of 80 ohm-m. This value is based on microscale on-site measurements (see ERI Site Investigation Survey at Pitt Consol Site: Final Report, 2011) and represents a relatively conservative contrast with the clean fill unit. It can be considered to

represent a relatively highly resistive coal tar residing within the fill at an average saturation of 30% or a less resistive coal tar occupying the fill at higher saturations. It is not expected that the resistivity values chosen for the various units has a significant impact on the results of this study as this work focuses on changes over time.

The ERT domain at time zero (t0) and the results using the three different inversion methods are shown in Figure A.5(b-d; leftmost column). It is noted that while ERT of this static scenario appears able to image the various units in the subsurface such as the saturated zone and Meadowmat, it is unable to resolve the contaminated region. This is likely related to the resolution of the ERT technique and the conservative value used for the contrast between the contaminated and clean zones. Furthermore, it underscores the challenge of detecting the distribution of coal tar at a single time.

2.2.3 Time-lapse detection of a large-scale STAR event

A suite of time-lapse data was generated by gradually altering the model domain based on predicted changes of the STAR test. A hypothetical ignition point is placed centrally (x distance of 50 ft) with an ignition and air injection screen at a depth of 9 feet. A time sequence of domains was generated by gradually increasing the size of the treated zone around the ignition point, modelled by assigning an electrical resistivity associated with contaminant-free and water-free fill (200 ohm-m) in the treated region. As shown in Figure A.5(a), the treated zone for "large-scale STAR" is assumed to have a thickness equal to that of the contaminated zone. The region of clean and dry fill gradually extends laterally outward from the ignition well, ranging from a 3.3 ft to a 13.1 ft Radius of Influence (ROI) (i.e., a total treated zone width increasing from 6.6 ft to 26.2 ft) for timesteps t1 – t4, respectively (Figure A.5a; top row of images). The final time-step, t5, employs the same treated region as t4 but assumes it is now water-saturated instead of dry.

The second, third, and fourth rows of Figure A.5 illustrate the ability of ERT to reconstruct the subsurface using the independent, 4D, and 4D-ATC algorithms respectively. This illustrates that direct imaging of the distribution of electrical conductivity has some benefit but the treated zone is not strongly resolved in any of the cases. As a result, little difference is observed between the techniques. Therefore, in order to focus specifically on the time-lapse changes, difference imaging is used. This involves calculating the ratio of changes occurring between the independently inverted time-steps shown in Figure A.5(b). This can be done in two ways: (A) Sequential time-step ratio images (Figure A.6), calculated between each sequential pair of time-steps (e.g., t1/t0; t2/t1; t3/t2); and (B) cumulative time-step ratio images (Figure A.7), calculated between the current timestep and time zero (e.g., t1/t0; t2/t0; t3/t0).

It is evident from Figures A.6(b) and A.7(b) that independent inversion is able to monitor the changes associated with the treated region, however some artefacts are introduced; for example, it incorrectly suggests that some treatment occurred in the deep sand unit below the Meadowmat. The 4D inversion ratio images shown in Figures A.6(c) and A.7(c) reduce these artefacts but incorporate excessive smoothing and, as a result, overestimate the size of the treated zone. The improved resolution of 4D-ATC is evident in Figures A.6(d) and A.7(d), which reveal that ERT is able to make a reasonable estimate of size and location of the treated region at all times. It is observed that the technique is expected to successfully map the STAR event at even the first observation time when the treated zone is smallest (ROI of 3.3 ft, width of treated zone is 6.6 ft). It is noted that all of the methods appear to be able to monitor the re-invasion of water into the treated zone (t5 in all figures).

Noise in the data is not always considered in modelling studies but is always present in real site data. Therefore, to render the modelling results more realistic and to investigate the potential role of interference and noise at the site, the synthetic data discussed above (and shown in Figure A.5) were numerically "contaminated" with random noise of 10 mV/A peak-to-peak amplitude; this represents a modest amount of noise similar to what might be found at a non-ideal site. It is evident from the corresponding images for this revised study, shown in Figures A.8 to A.10, that increased artefacts are now present, particularly in the independent inversions. However, the advantages of the 4D-ATC inversion method are clearly revealed. This work suggests that the magnitude of the changes in electrical contrasts expected during a robust STAR process, even at an ROI of 3.3 ft, should dominate artefacts associated with moderate levels of noise when using 4D-ATC.

2.2.4 Smaller-scale STAR-related changes

A second suite of simulations were generated to replicate smaller-scale changes associated with the STAR process (e.g., associated with a modest or short duration ignition event). In this case, the treated zone around the ignition well screen varied in thickness from 1.6 ft for t1 and t2, 3 ft for t3 to 4 ft for t4 and t5, while extending laterally from 3 ft for t1, 6 ft for t2, 10 ft for t3, to 20 ft wide for t4 and t5. In addition, the treated zone was assigned a resistivity value of 120 ohm-m (compared to 200 ohm-m in the previous modelling) in order to replicate a slower or less homogeneous or less complete level of treatment. The objective was to evaluate whether these changes are amenable to ERT detection, particularly in noisy environments where the magnitude of artefacts may now be on a similar scale to these smaller resistivity changes.

Figure A.11(a) shows the sequence of time-steps generated from this small-scale STAR process. The corresponding 'noise-free' time-lapse changes inferred from ERT (Figures A.12 and A.13) demonstrate that ERT

is unable to capture the initial small-scale changes but is able to capture larger changes at later time. Specifically, for the small scale STAR event modelled in this is study, the cumulative time-step ratio method is able to detect the treated zone only after it becomes at least 10 ft wide (ROI of 5 ft) in Figure A.13(t3/t0). Random noise is again added to the numerical data to replicate interference within a highly instrumented PTA and the 'noisy' time-lapse change images are shown in Figures A.15 and A.16. This provides an example where the magnitude of the artefacts approach the magnitude of the actual changes; in such a case, the results reveal increased difficulty in distinguishing between actual changes and those generated by noise. In this most conservative and challenging case (small scale STAR event, reduced resistivity signal associated with treatment, excessive noise) the results suggest that this ERT method is unable to adequately resolve the STAR event until the treated zone is 20 ft wide (i.e., ROI of 10') (t4/t0 in Figures A.15 and A.16).

2.3 Modelling Conclusions

The ROI of a STAR event that can be observed by ERT is highly dependent on a number of factors including: site heterogeneity (of permeability, of contaminant distribution), site specific noise, depth below water table, thickness of treated zone, level of dewatering, the lateral offset of the treated zone to the event, and the resistivity of the contaminant.

It is evident from these preliminary studies that potential changes associated with a STAR combustion event that occurs across the thickness of the contaminant zone in the interval 6 – 10 ft bgs at the Site is expected to be successfully mapped by ERT at all ROIs greater than 3.3 ft, , even in noisy environments. Note that 3.3 ft is not the lower limit, but simply the smallest ROI considered in this study. This conclusion is drawn from the case that considers the most reasonable set of parameter values as derived from the Phase II STAR work. Significant value in resolving the treatment zone and minimizing artefacts is found by employing routines that are being investigated for contaminant remediation tracking at Western, namely 4D-ATC inversion and time-lapse ratio plotting methods. This study reveals that those methods have the potential to track both the lateral and vertical extent of the treated zone located directly under a single surface array of electrodes.

The results also reveal that the minimum STAR ROI that can be mapped by ERT is expected to increase as the factors listed above become less favourable. For example, when the clean and dry versus contaminated fill has a significantly lower resistivity contrast than expected (due to, for example, significant heterogeneity in the treatment pathways). The specific situation modelled, which included this challenge as well as a treated thickness that only increased slowly as the ROI increased, demonstrated in this 'non-ideal scenario' the minimum STAR ROI that could be mapped was 5 ft (by 3 ft thick). The results reveal that under such challenging

conditions, noise-to-signal ratio plays a greater role. The same case considered in a much more noisy electrical environment, revealed that in such a 'worst case scenario' the minimum STAR ROI that could be mapped was 10 ft (by 4 ft thick).

The study suggests that the major change to monitor during the STAR process will be drying of the treated zone, which is expected to generate a more significant electrical change than removal of the contaminant alone. For this reason, the study suggests that monitoring the water reinvasion process is also promising. It is noted that ERT also has the ability to monitor temperature changes in the water-saturated soil, since bulk resistivity is sensitive to temperature (e.g., Samouelian et al., 2005); however, the potential to track the subsurface temperature changes associated with STAR using ERT was not considered in this preliminary modelling study. It is also noted that if a series of regularly spaced surface arrays were employed on a site, 3D data collection and inversion is possible, which would significantly increase sensitivity of the method to STAR changes occurring between the arrays; this was not considered but is another area of significant potential for future modelling and field studies. Finally, it is noted that putting known geological information (e.g., the location of aquitard layers not targeted by STAR) into the inversion model can result in significant improvements in the ability of an ERT survey to map temporal changes. Overall, this study reveals that ERT is highly promising for mapping STAR at typical (i.e., Phase II) conditions associated with the Site, and all of these additional techniques are expected to increase the potential further.

3 Time-Lapse ERT Monitoring of STAR

3.1 Overview and Data Collection

Prior to the commencement of the STAR test, electrical images from both installed survey lines (PCTL1 and PCTL2) were obtained to provide the baseline subsurface images. Due to the close proximity of the two survey lines and the potential for coupled responses, only one survey line was measured at one time with a data acquisition duration of 12 minutes. In order to record data off-site at night, the software program ComSys was utilised with a laptop to record measurements at pre-determined times.

3.2 The most significant period of combustion within the shallow fill unit pilot test occurred during shakedown activities ('premature ignition event'), and therefore the ERT survey collected only sporadic and preliminary (i.e., non-optimized, non-regular) data during this period. All subsequent ignition events were of a smaller scale, and may have been insufficient for resolution via ERT

monitoring, One such smaller scale ignition, however; the 'IP6 ignition event' was monitored in detail by the ERT survey and is discussed herein, along with the limited data set collected from the premature ignition event. Changes during 'Premature Ignition Event'

During shakedown activities (i.e. heater testing) a premature ignition event occurred in the subsurface between August 14, 2012 and August 17, 2012. Combustion was initiated at the location of ignition point IP-2 shown on Figure A.2. During this time period, only a few ERT measurements were recorded on Lines PCTL1 and PCTL2 and these were related to testing and experimentation with various electrode configurations. In other words, since the array was in testing mode, there is no consistent set of measurements to provide a robust evaluation of subsurface chances. In order to produce a set of time-lapse data to investigate whether the ERT equipment detected any changes during this time, some modifications were made to selected snapshots from the different datasets. In this manner, it was possible to produce a single, relatively compatible data set for a time-lapse comparison. Unfortunately, during this compatibility process, a large amount of data was eliminated and the data inversions were somewhat unstable. This instability is not related to normal ERT monitoring under planned testing conditions.

The independently inverted images now available for this time period (t0 – t3) are shown in Figure A.17. Qualitative comparison shows reasonable repeatability and consistency among the direct images of the subsurface distribution of resistivity. However, it is evident from the sequential and cumulative ratio images shown in Figures A.18 and A.19 that a large amount of random changes occurred which are likely all due to random artefacts inherent in each independent image. It is not clear that any consistent changes exist that may be correlated to any actual changes in the subsurface during this time. This is likely the result of the data massaging required to get a consistent time lapse set to examine.

3.3 Changes during 'IP-6 Ignition Event'

The only stage where continuous and consistent ERT data were recorded while combustion was observed (i.e. subsurface temperatures were increasing, generation of combustion gases observed) occurred during the 'IP-6 Ignition Event) on October 18, 2012. . The thermocouple data during this time indicated combustion front propagation running South-East from IP-6. It was during this time that ERT data was recorded at frequent and consistent intervals from Line PCTL1 as it was the closest line to the heating well IP-6.

The independently inverted images recorded during this time are shown in Figure A.20, ranging from time-step t0 to time-step t9, spanning the period from 3:25 pm to 10:46 pm on October 18. It is evident from the images that the ERT data is very consistent and stable between all time-steps. The 'independent' ratio images shown in Figures A.21 and A.22 also show the consistency between all time-steps but do not reveal significant changes occurring between time-steps. There are a number of reasons for this. First, the changes shown are most likely related to inversion artefacts, especially since the majority of the changes exist in the areas of the cross-section that are the lowest resolution and traditionally least reliable for ERT images (i.e., the left and right hand sides and along the bottom). The only change that cannot easily be dismissed appears to have occurred at 72 ft < X < 78 ft at the approximate depth of the contaminated region. However, this area does not exist within the PTA so is likely also an artefact. Second, while the anomalies in Figures A.21 and A.22 appear large, this is simply the result of taking ratios; in fact, the actual magnitude of the changes in resistivity between timesteps is quite small as revealed by Figure A.20. Therefore, it is likely that if any significant changes did occur during this time, they would easily have dominated the small magnitude changes currently observed. Third, based on the modelling results presented in Section 2.2, is the combustion zone generated via the IP-6 ignition event is similar to the minimum size limit below which this ERT array was setup to detect. ERT is best employed to track changes that intersect the cross-section below the surface array; while there is some potential for ERT to observe changes occurring laterally to a 2D array, its sensitivity and resolution diminishes significantly with lateral distance.

4 Conclusions

It is evident from the field survey that, while the ERT data is affected by random noise and artefacts, the ERT survey established for this work provided very repeatable and acceptable resistivity cross-sections. Thus, surface ERT is likely to be compatible with STAR installations, even being co-located with such a dense array of STAR components (metal wells, thermocouples, heaters) as employed here. The modelling study indicates that the changes expected to be associated with a large scale STAR remediation event are likely to be observed by ERT, particularly using the advanced analysis tools (such as 4D-ATC) being developed and optimized for remediation mapping at Western. No conclusive evidence of subsurface changes is provided by the available ERT data for the two combustion events that occurred from the shallow fill unit pilot test discussed herein. There are numerous reasons why this is not a surprising result. It is not an indication that ERT is not suited to tracking STAR; rather it reveals only that the limited size/placement/timing of these particular events occurred outside the planned boundaries for this ERT study. The available evidence suggests significant potential for ERT to track STAR in the near subsurface using surface arrays. It is expected that the sensitivity of the technique

could be further increased in numerous ways, such as conducting 3D surveys and adding known geologic layers to the inversion routine. In addition, there is potential for tracking temperature changes with ERT as well as mapping deeper remediation with borehole-to-borehole and/or borehole-to-surface arrays. All of these are potentially valuable areas of research that will benefit from both modelling and field studies. Evaluating 4D inversion techniques to track DNAPL remediation in highly heterogeneous environments (heterogeneous permeability, clay content, and DNAPL distributions) is also important for better understanding the limits and best uses of the technique on treated sites.

References

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Kim, J.-H., Myeong-Jong, Yi., Sam-Gyu, Park, Jae Gon, Kim, 2009. 4-D inversion of DC resistivity monitoring data acquired over a dynamically changing earth model. Journal of Applied Geophysics, Volume 68 (Issue 4), 522–532 August 2009.

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Tsourlos, P., and R. Ogilvy, 1999, An algorithm for the 3-D inversion of tomographic resistivity and induced polarization data: preliminary results: Journal of the Balkan Geophysical Society, **2**, 30-45.

DRAFT

Appendix A

DRAFT

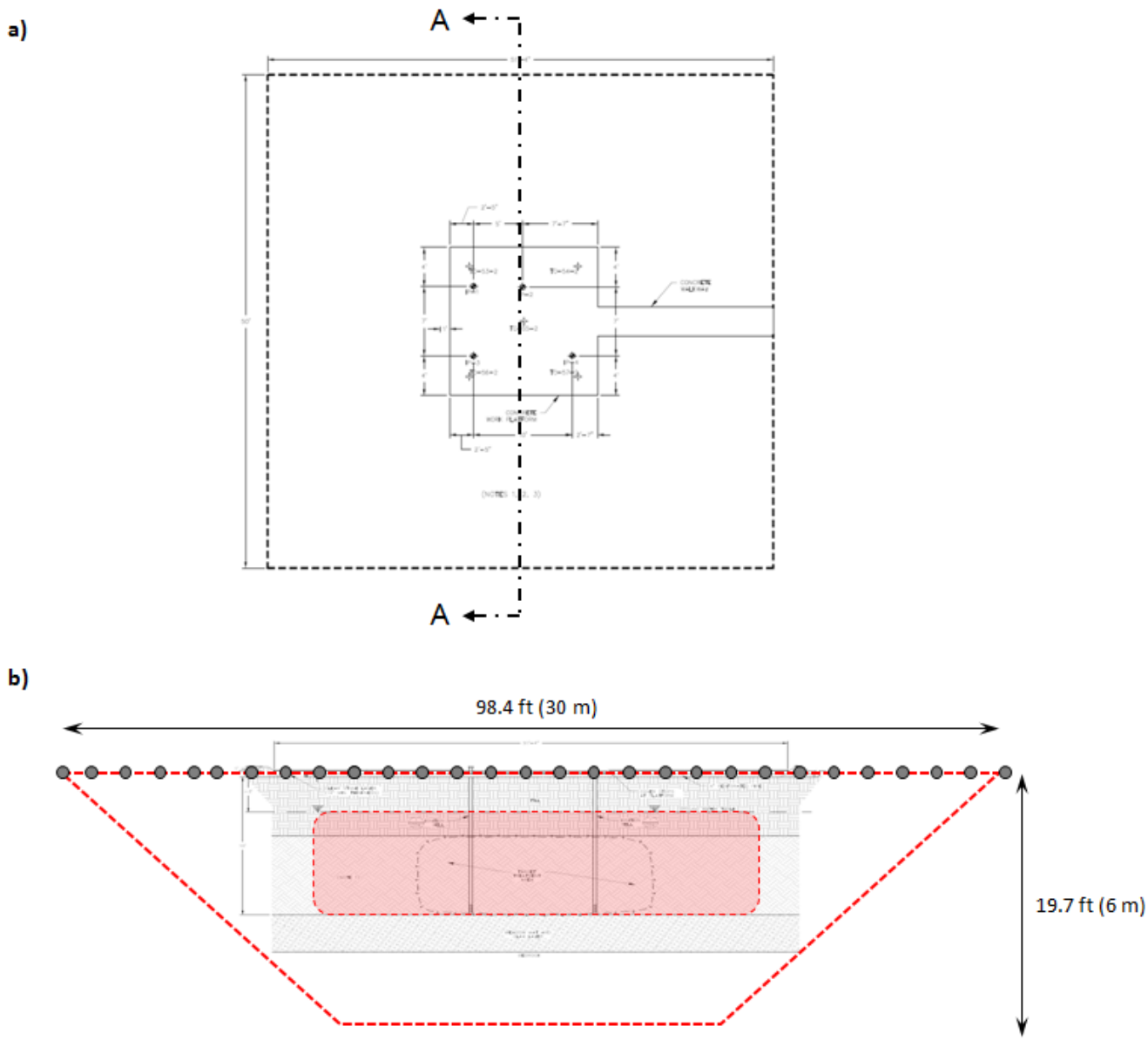

Figure A.1 (a) plan-view and (b) corresponding sectional-view (A-A) of the STAR test cell. The extent of the target treatment area shown in the sectional view informed the optimal design of the ERT survey. The boundary of the ERT survey measurement sequence and the ERT target area of interest are indicated by the dashed red lines in (b).

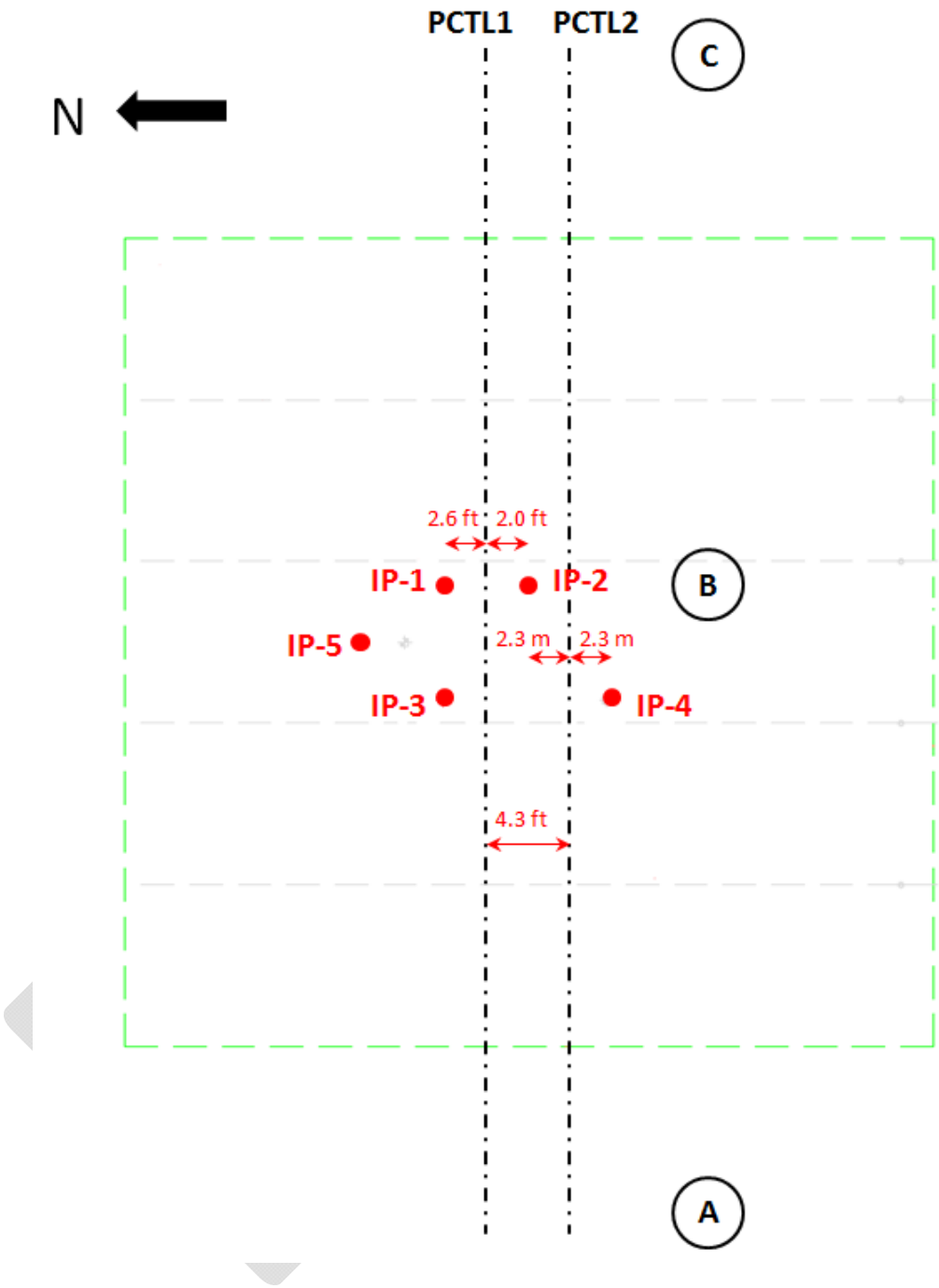

Figure A.2 Permanently-installed ERT survey lines within the STAR test cell (outline of test cell shown in green dashed box) at the Former Pitt-Consol Site, Newark, NJ. The proximity of these lines to the various heating wells (IP-1 to IP-5) is also illustrated. Locations 'A' and 'C' correspond to the start and end points of the ERT survey lines, respectively, while Location 'B' corresponds to the centre-point of the test cell and survey line.

a)

b)

Figure A.3 (a) PCTL1 and PCTL2 survey lines traversing through the test cell, and (b) close-up showing short electrodes installed outside test cell and extended electrodes within test cell.

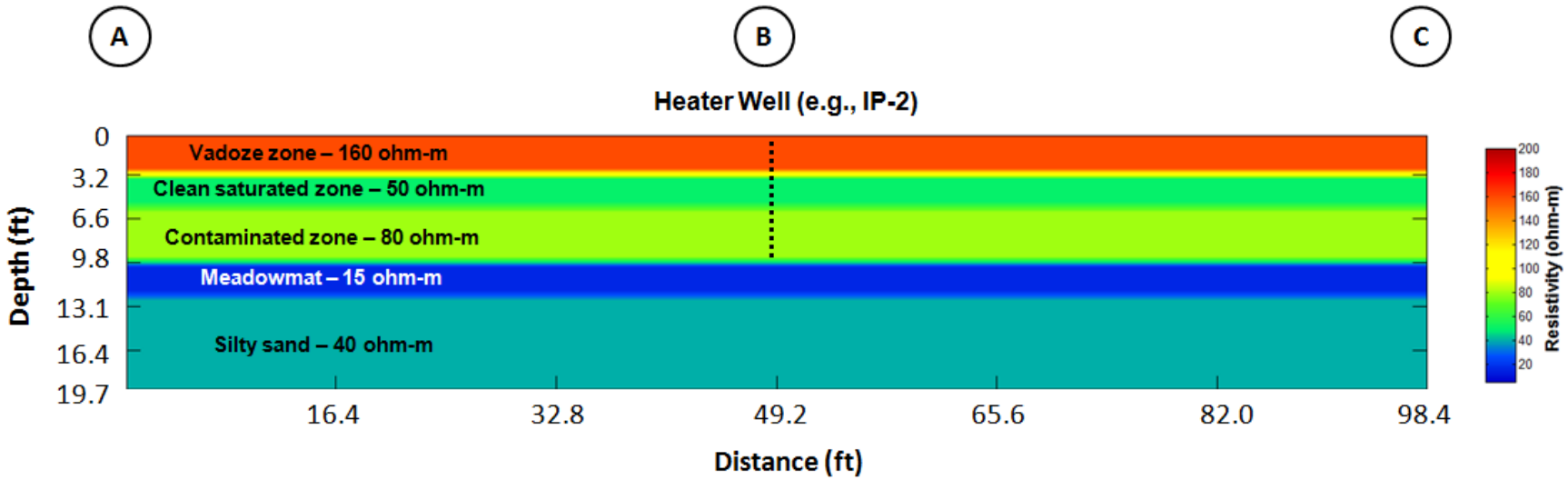

Figure A.4 Numerical model domain initial conditions for simulated ERT monitoring of a STAR remediation experiment.

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Large-Scale STAR: No Noise

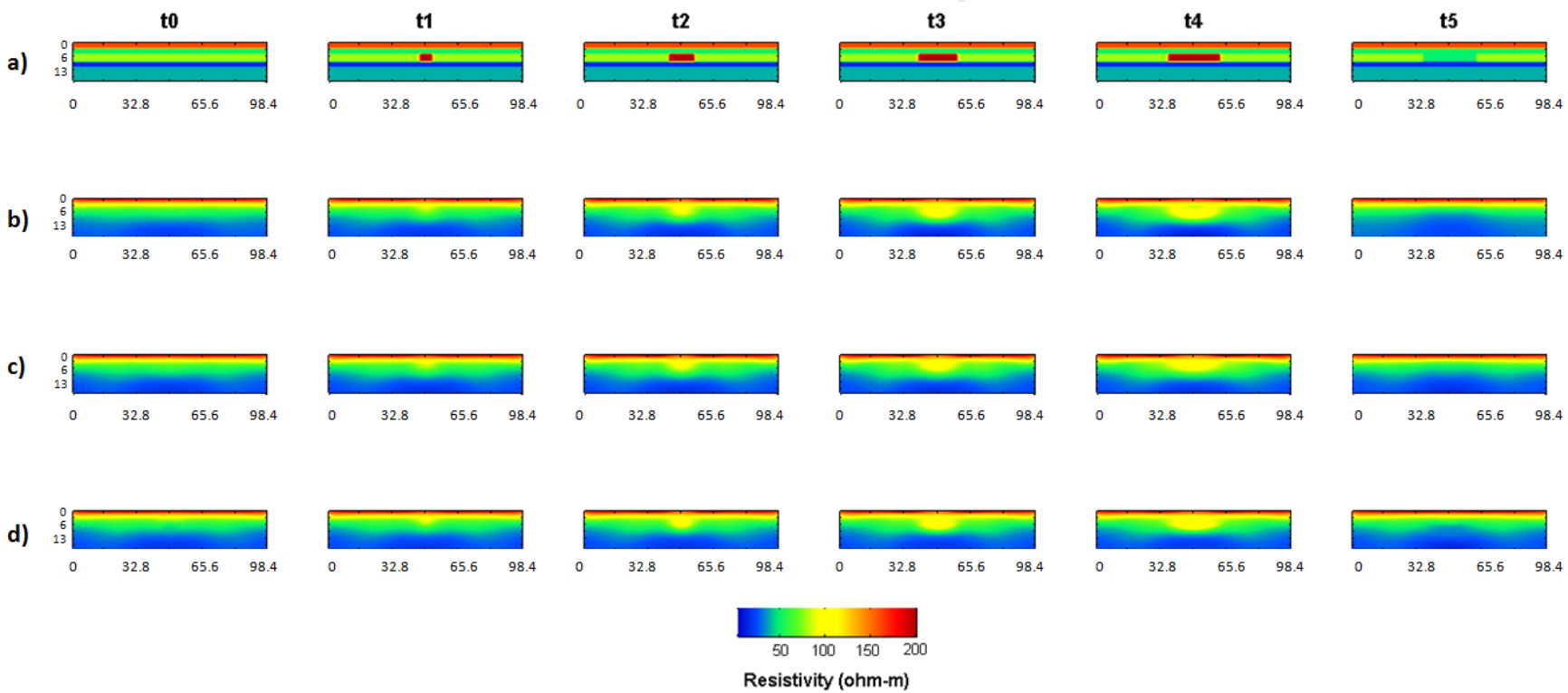


Figure A.5 'Full' inversions producing maps of the actual and estimated subsurface resistivity distribution for the time-lapse simulation: (a) actual resistivity images, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

Large-Scale STAR: No Noise

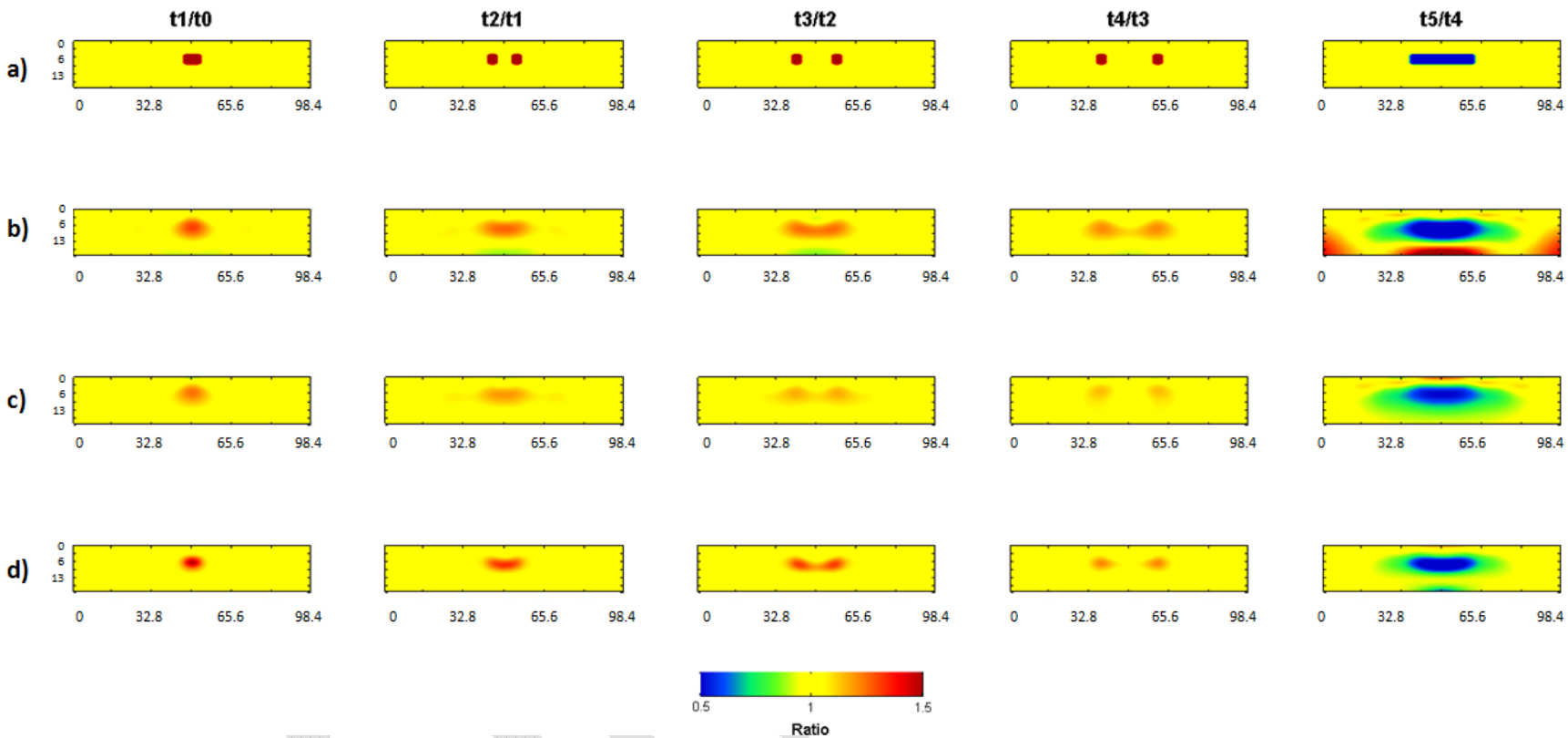


Figure A.6 Sequential time-lapse changes produced by difference imaging between each sequential time-step: (a) actual resistivity changes, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

Large-Scale STAR: No Noise

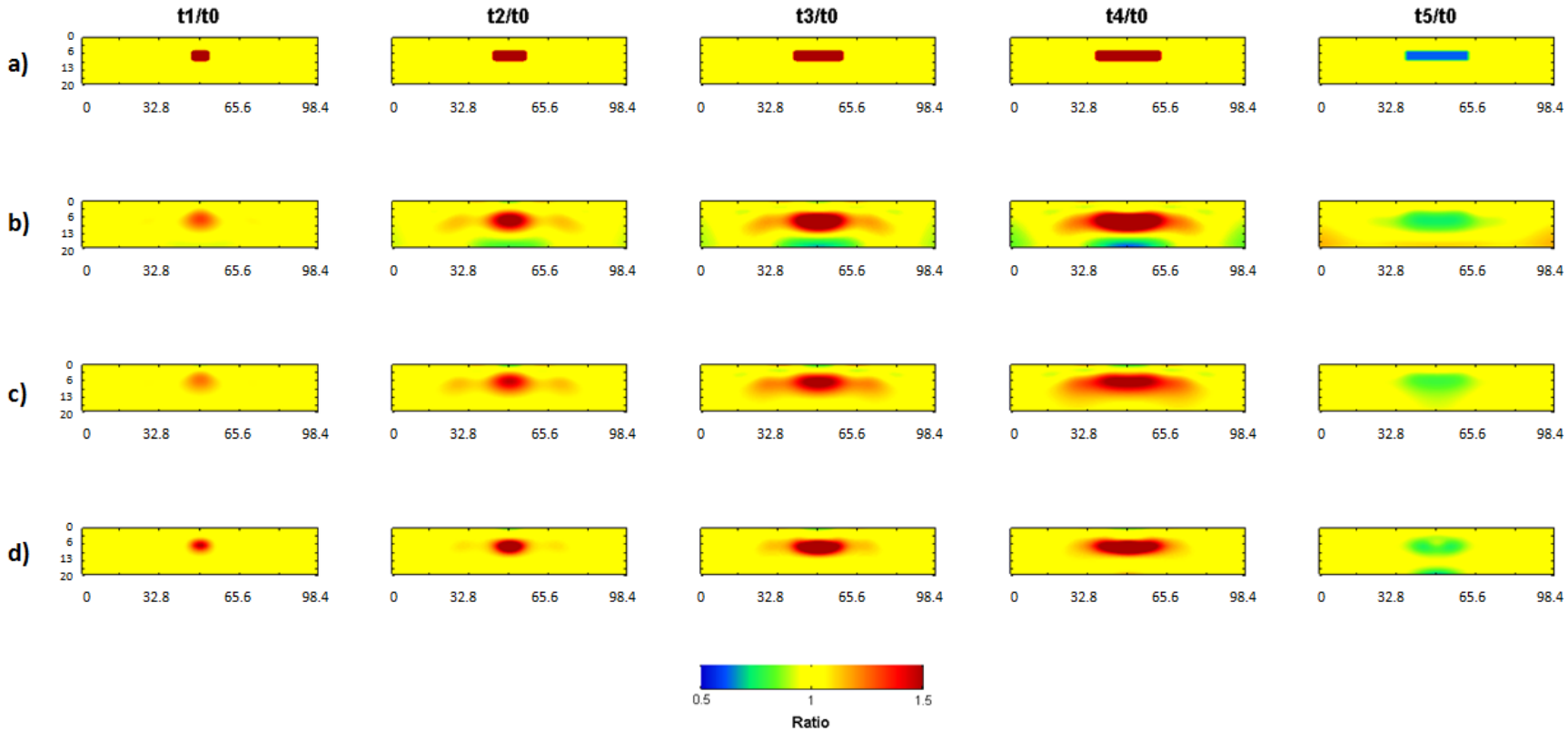


Figure A.7 Cumulative time-lapse changes produced by difference imaging between each sequential time-step and the first time-step: (a) actual resistivity changes, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

Large-Scale STAR: Noise

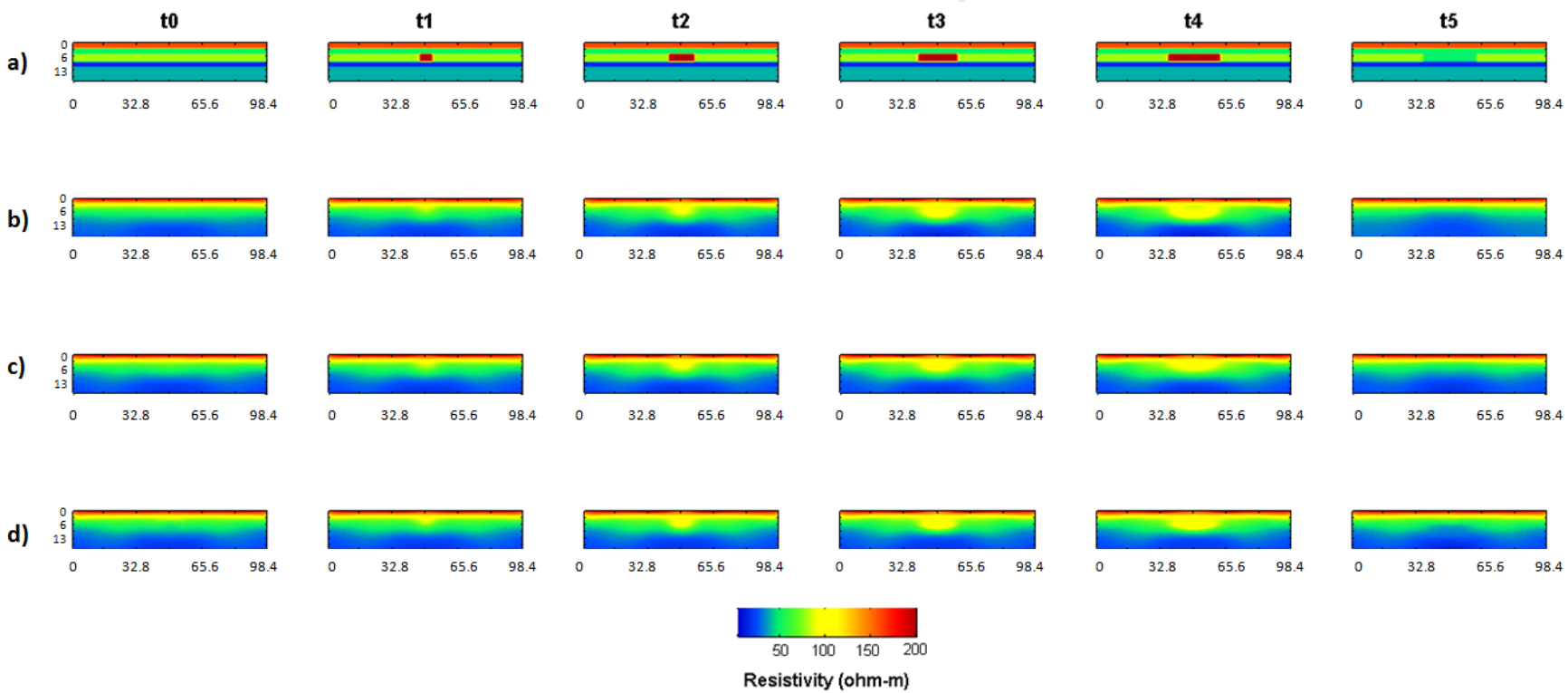


Figure A.8 'Full' inversions of the sequence of time-steps produced during the time-lapse simulation: (a) actual resistivity images, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

Large-Scale STAR: Noise

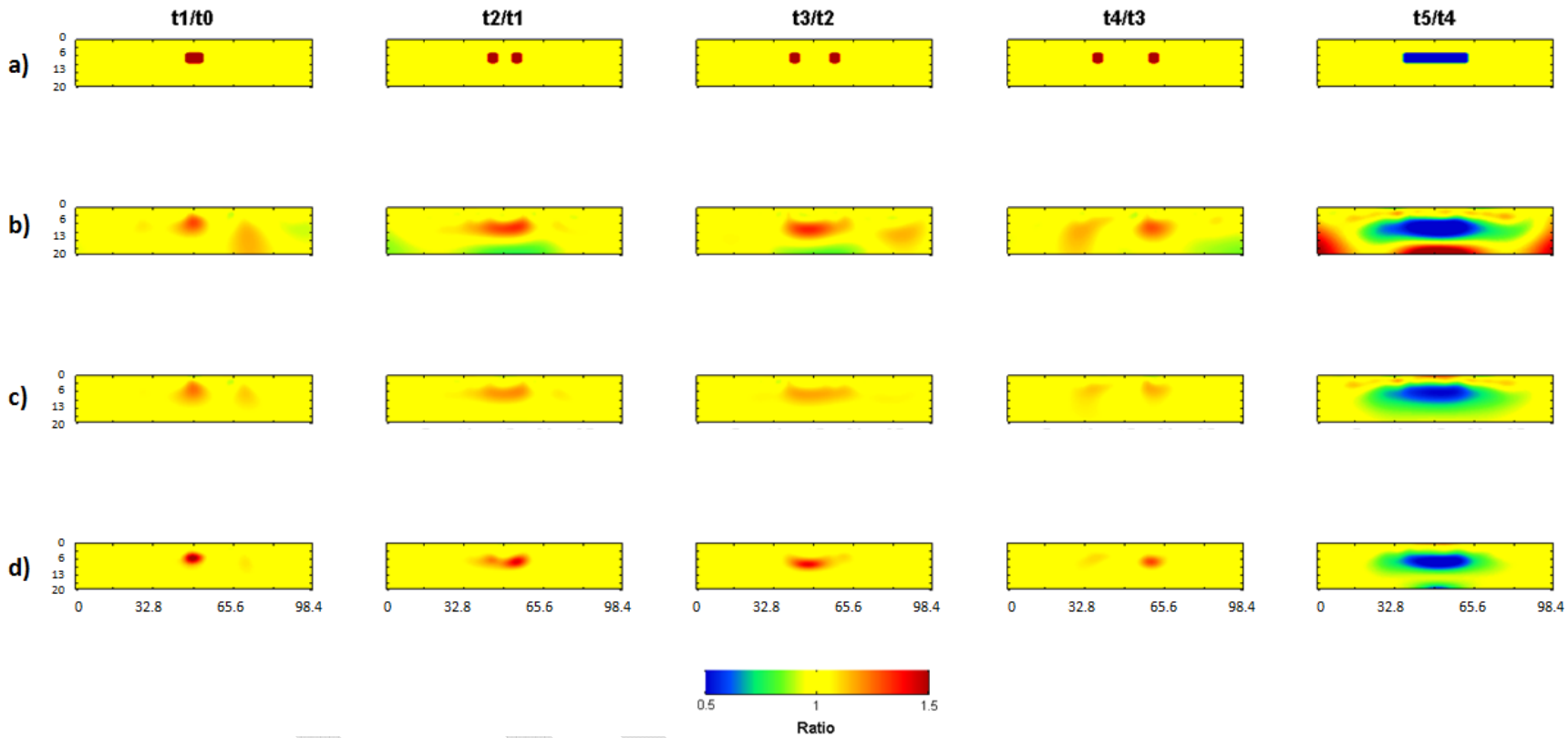


Figure A.9 Sequential time-lapse changes produced by difference imaging between each sequential time-step: (a) actual resistivity changes, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

Large-Scale STAR: Noise

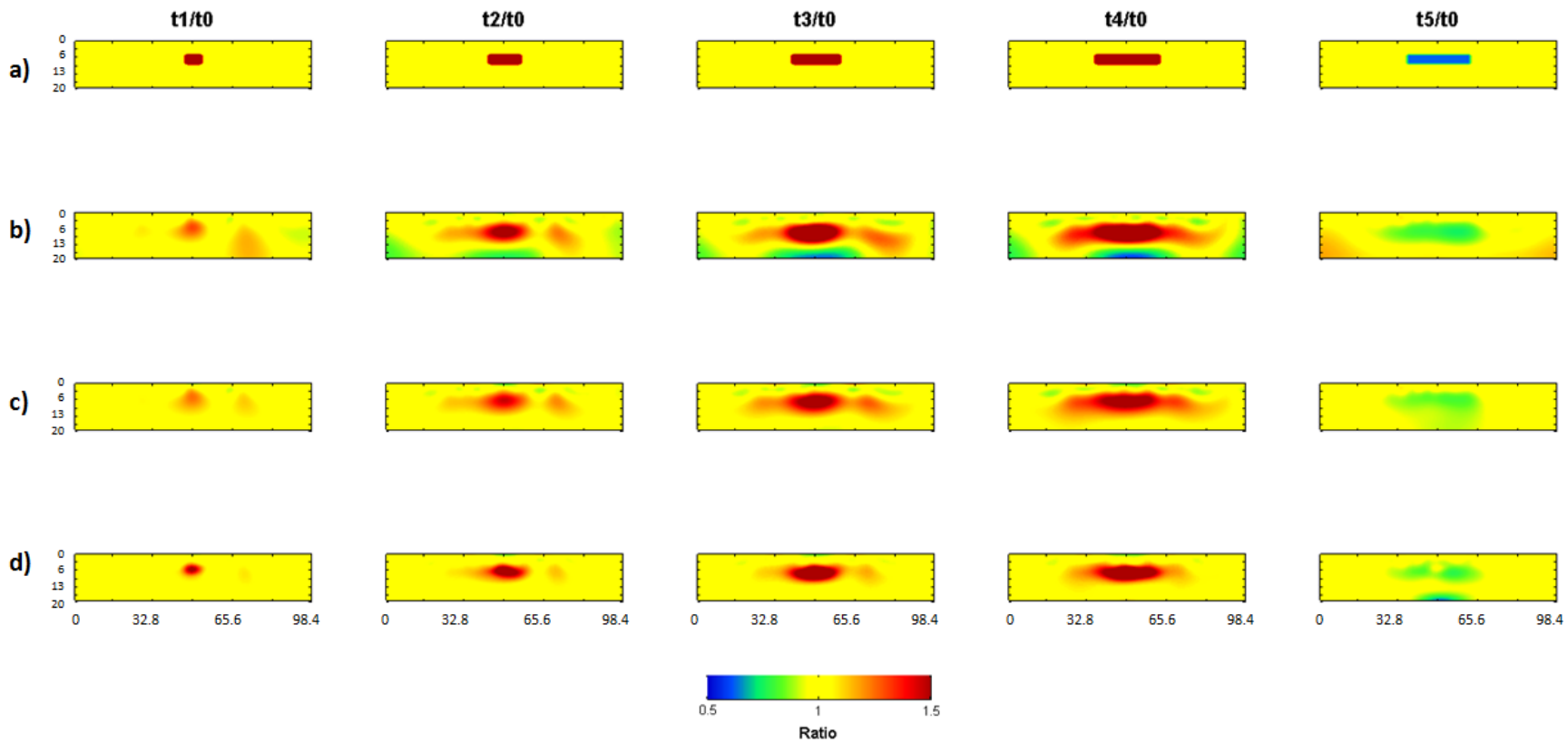


Figure A.10 Cumulative time-lapse changes produced by difference imaging between each sequential time-step and the first time-step: (a) actual resistivity changes, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

Small-Scale STAR: No Noise

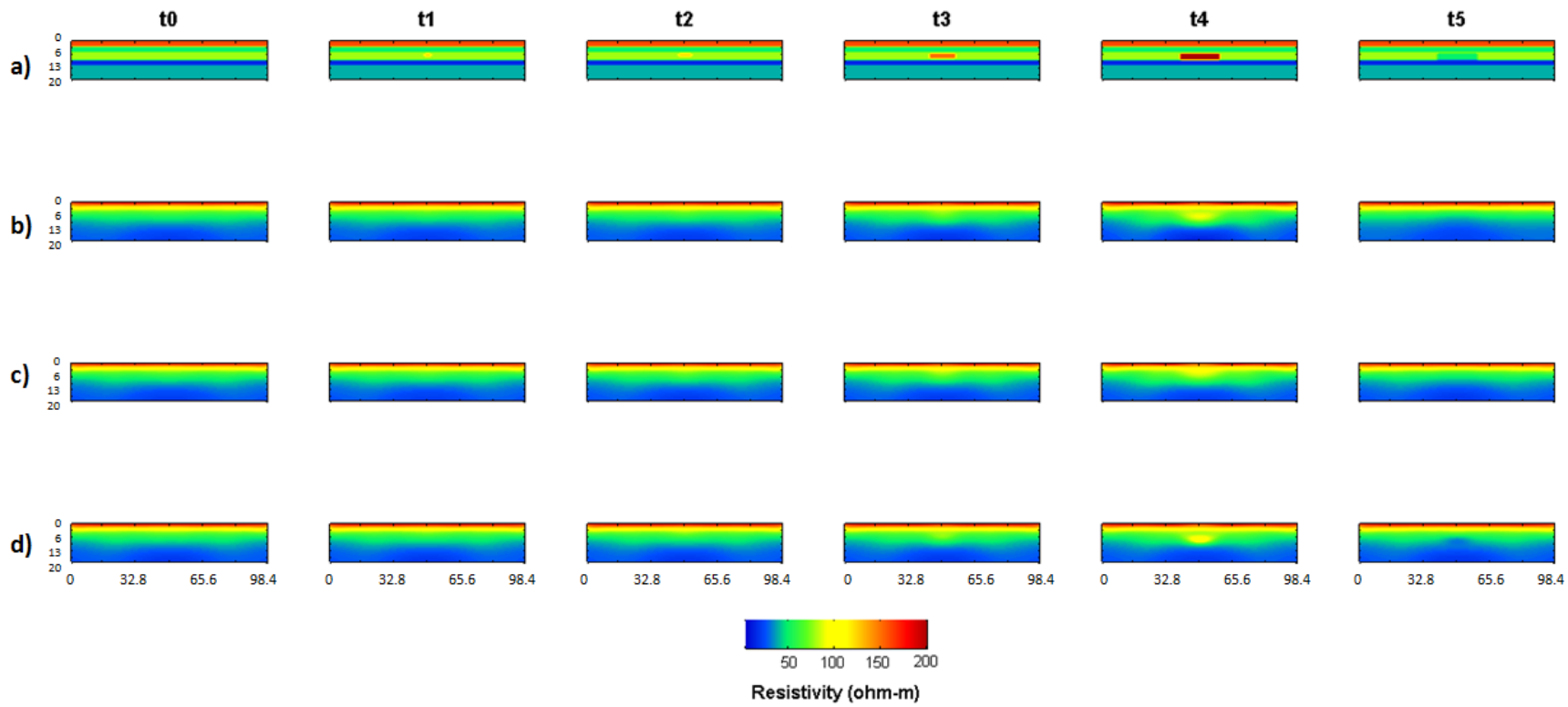


Figure A.11 'Full' inversions of the sequence of time-steps produced during the time-lapse simulation: (a) actual resistivity images, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

Small-Scale STAR: No Noise

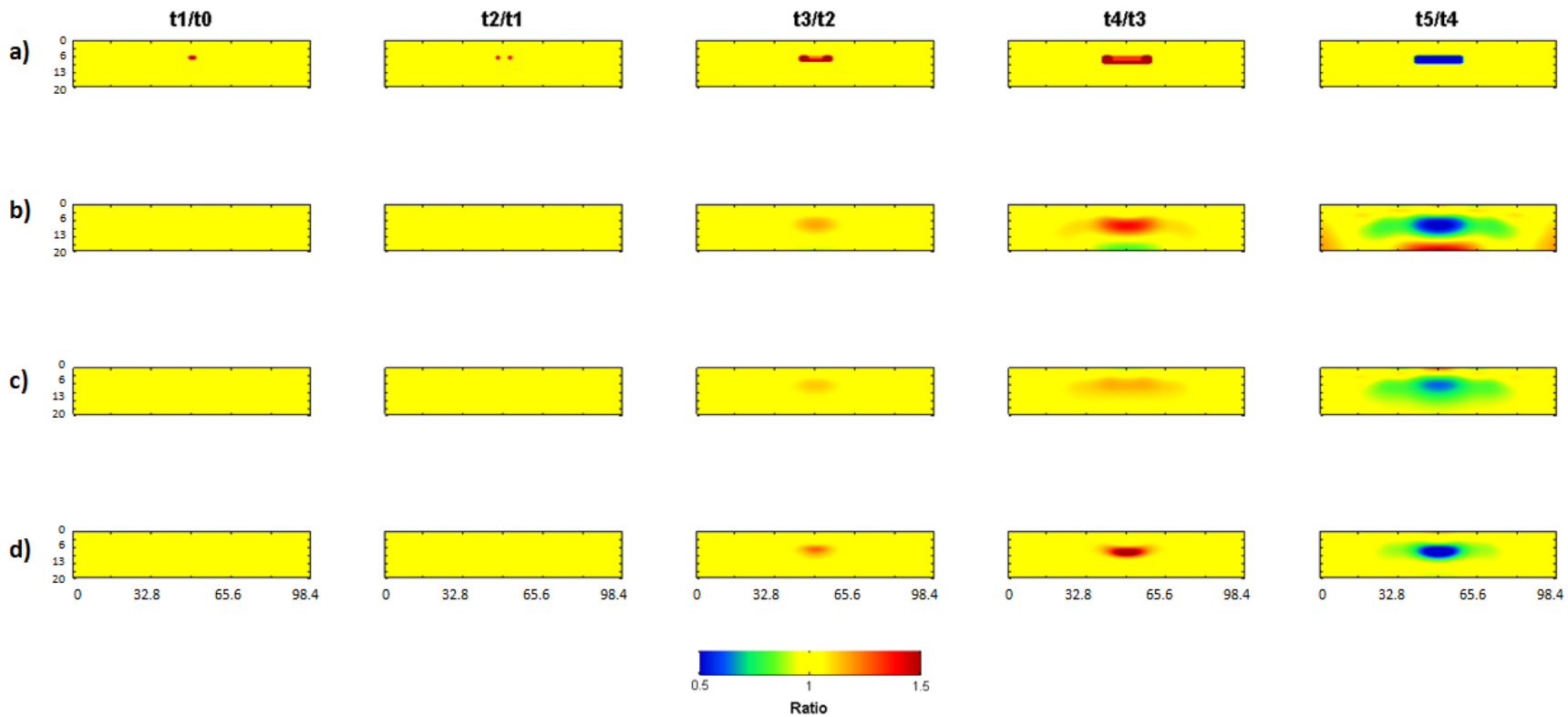


Figure A.12 Sequential time-lapse changes produced by difference imaging between each sequential time-step: (a) actual resistivity changes, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

Small-Scale STAR: No Noise

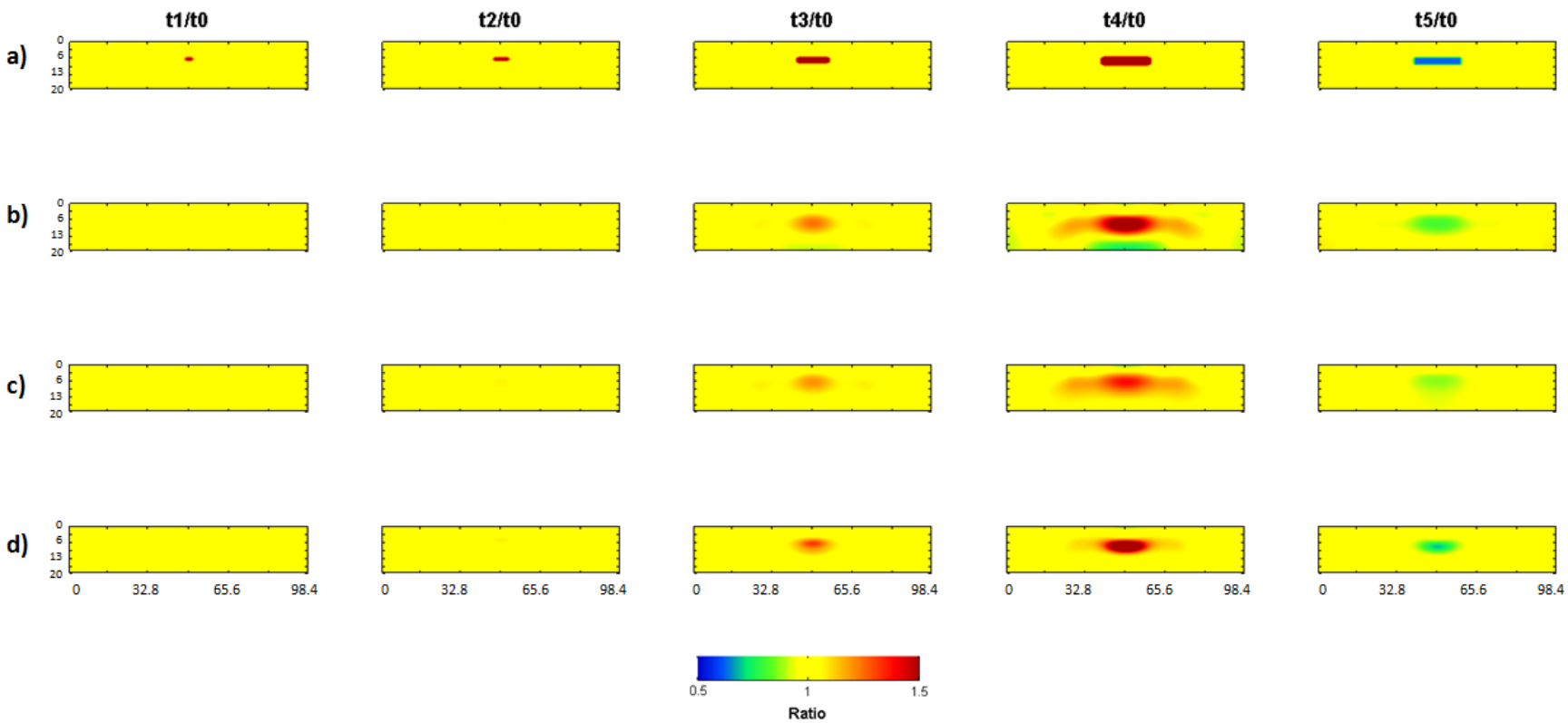


Figure A.13 Cumulative time-lapse changes produced by difference imaging between each sequential time-step and the first time-step: (a) actual resistivity changes, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

Small-Scale STAR: Noise

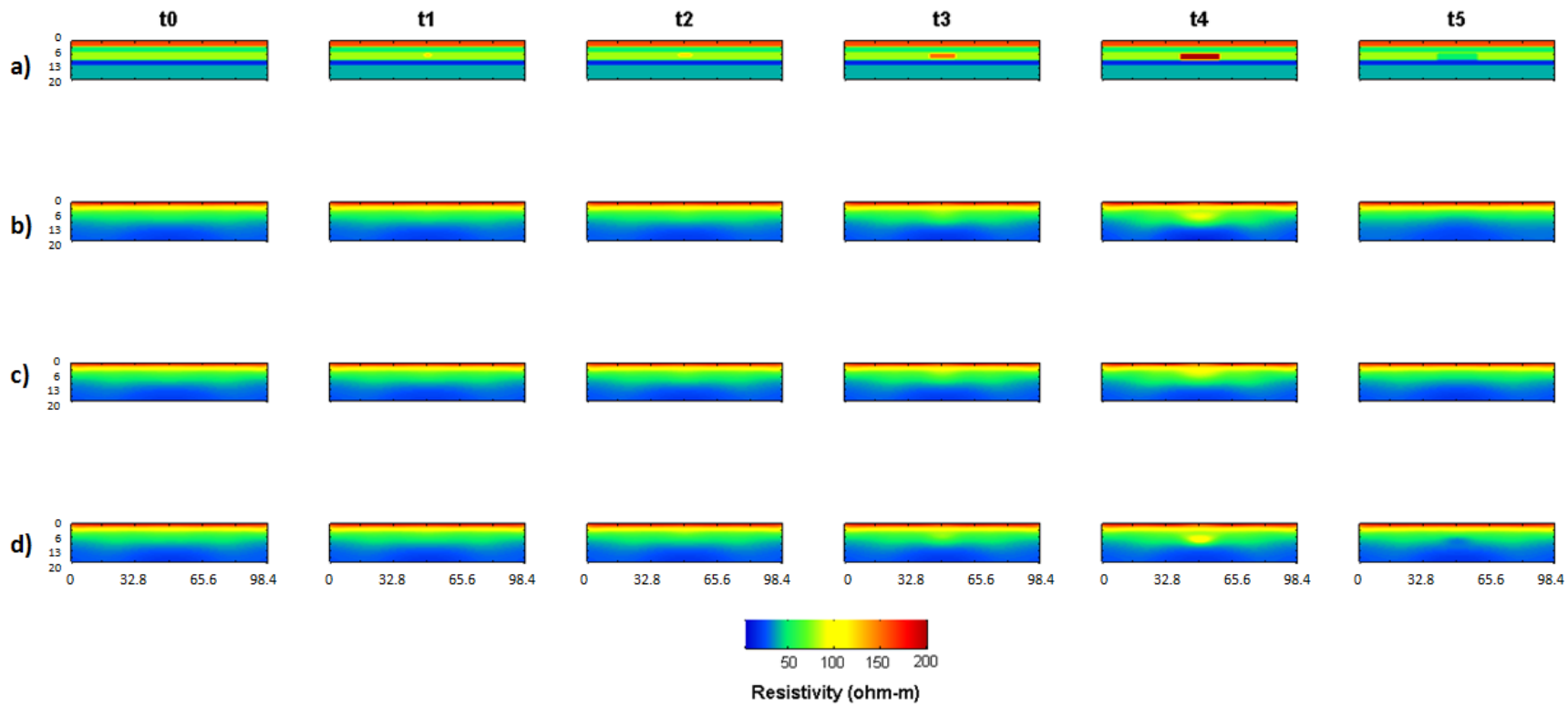


Figure A.14 'Full' inversions of the sequence of time-steps produced during the time-lapse simulation: (a) actual resistivity images, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

Small-Scale STAR: Noise

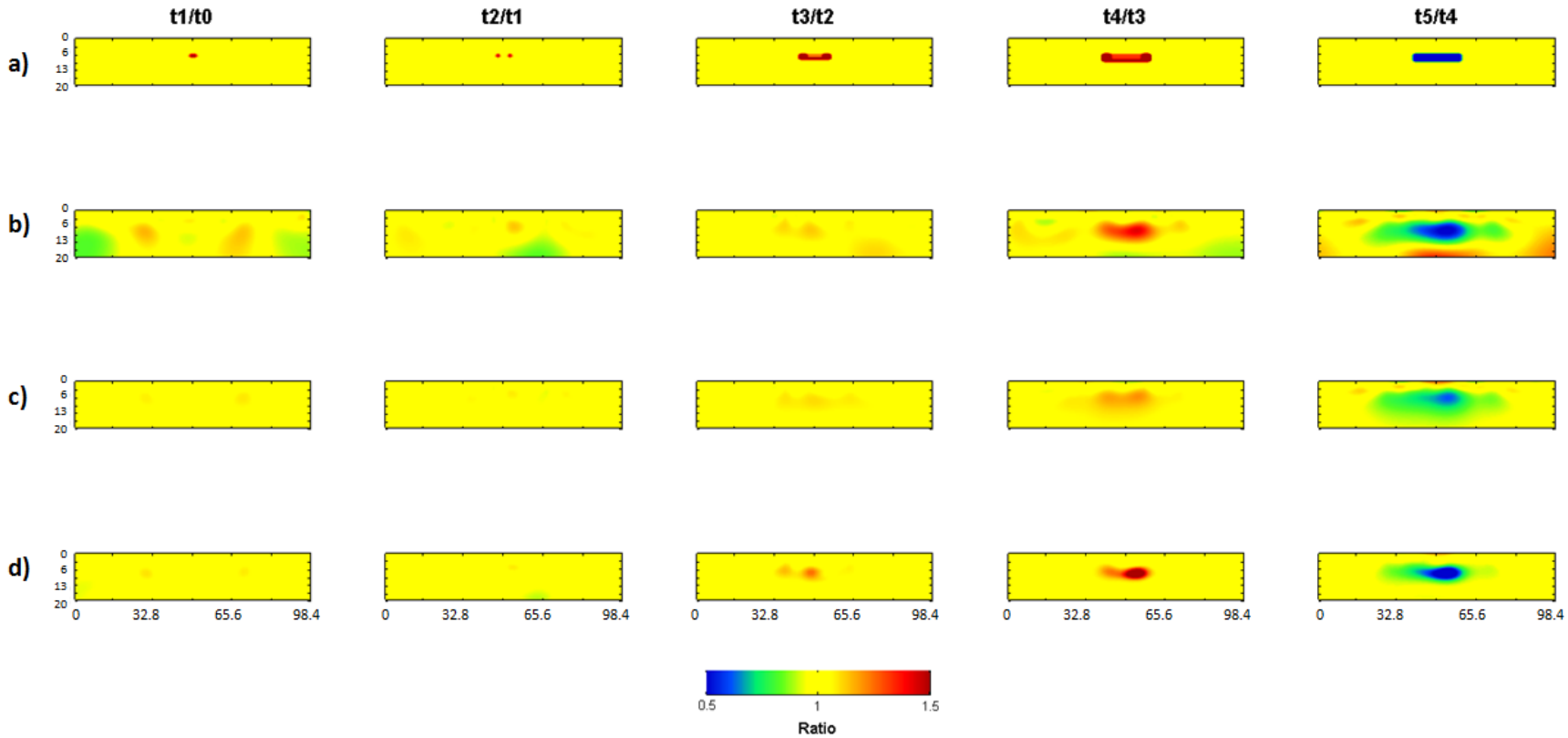


Figure A.15 Sequential time-lapse changes produced by difference imaging between each sequential time-step: (a) actual resistivity changes, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

Small-Scale STAR: Noise

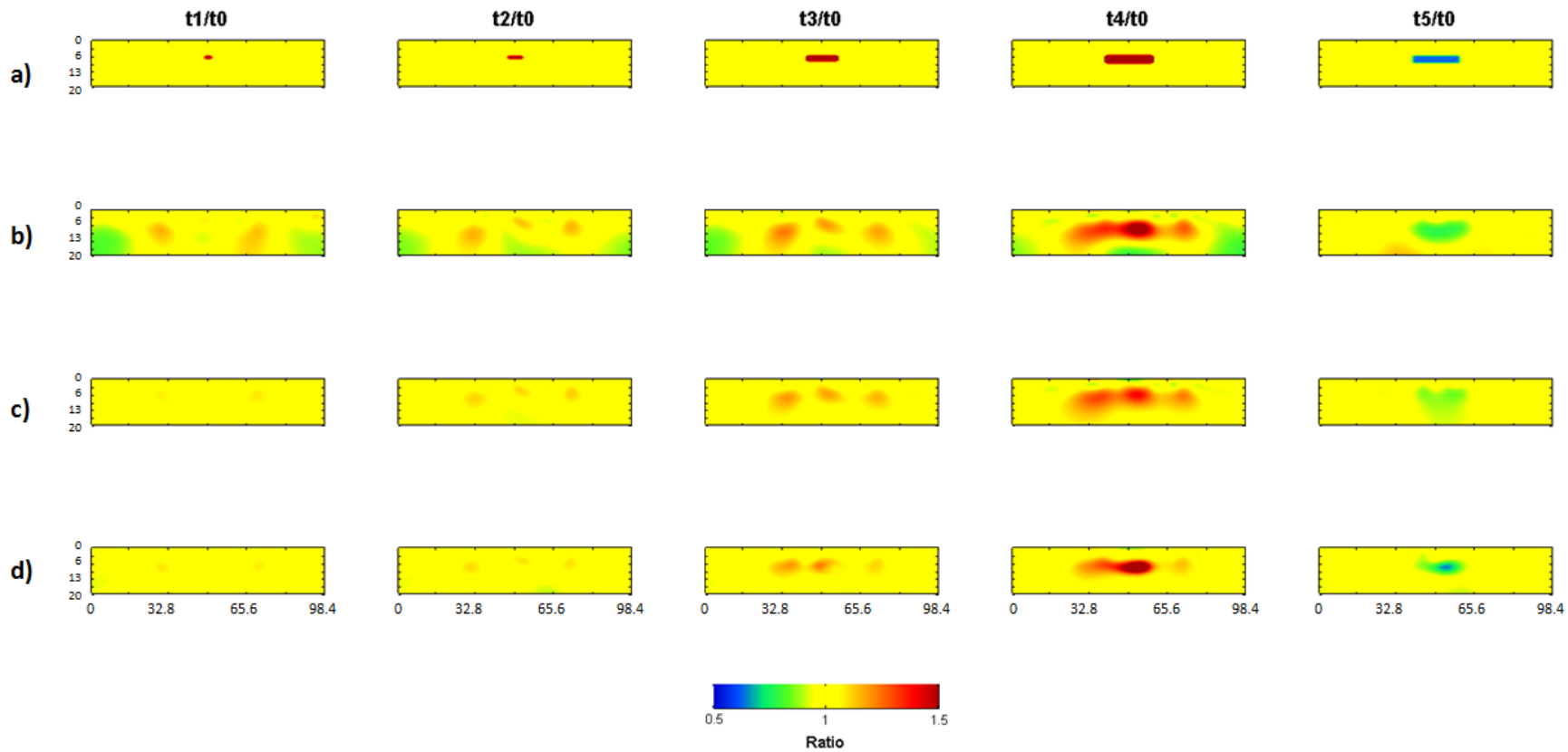


Figure A.16 Cumulative time-lapse changes produced by difference imaging between each sequential time-step and the first time-step: (a) actual resistivity changes, (b) independent inversion, (c) 4D inversion, and (d) 4D Active Time Constrained (ATC) inversion.

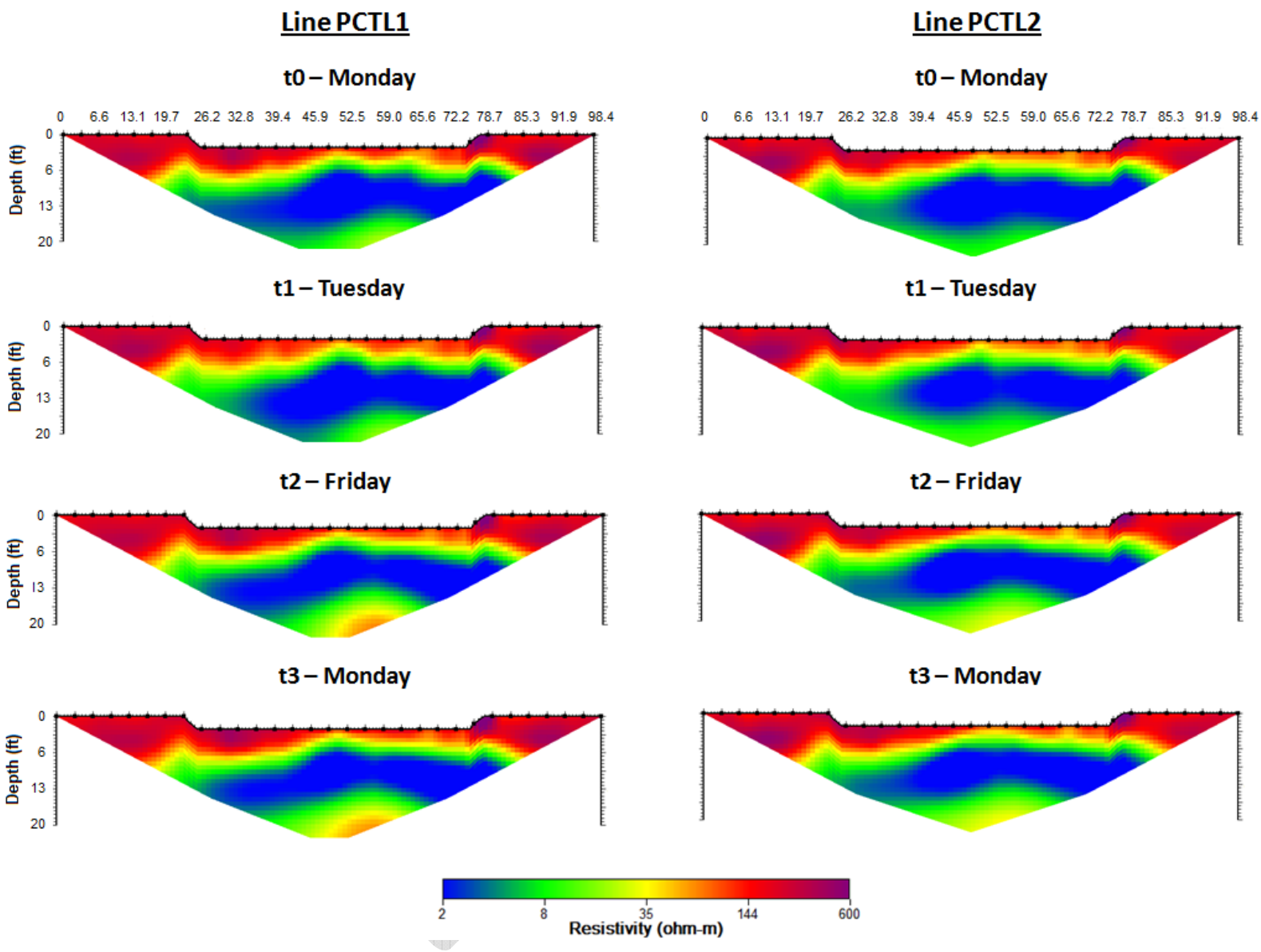


Figure A.17 Full inversion images of the sequence of time-steps recorded during the 'premature ignition event'.

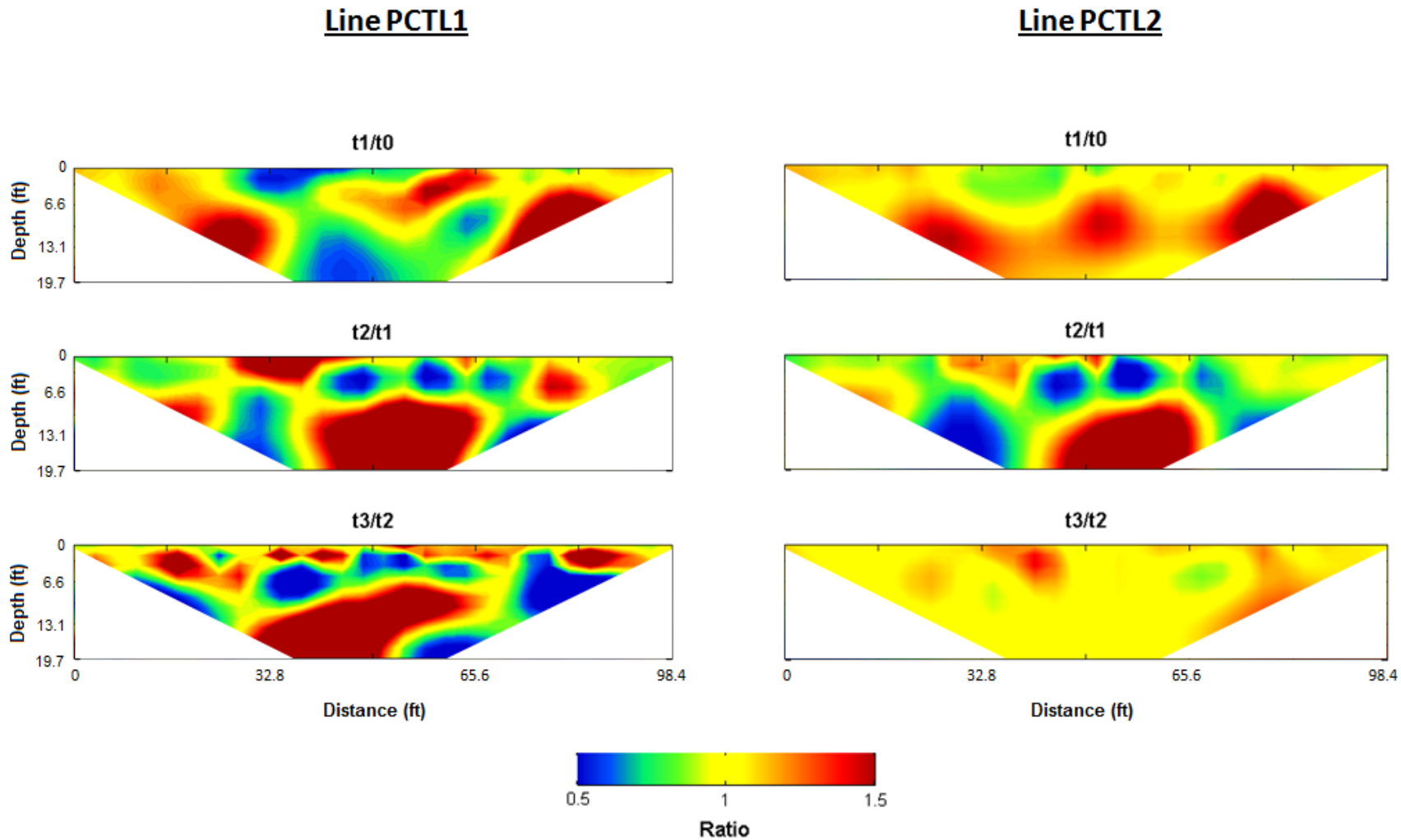


Figure A.18 Sequential time-lapse change images of the sequence of time-steps recorded during the 'premature ignition event'.

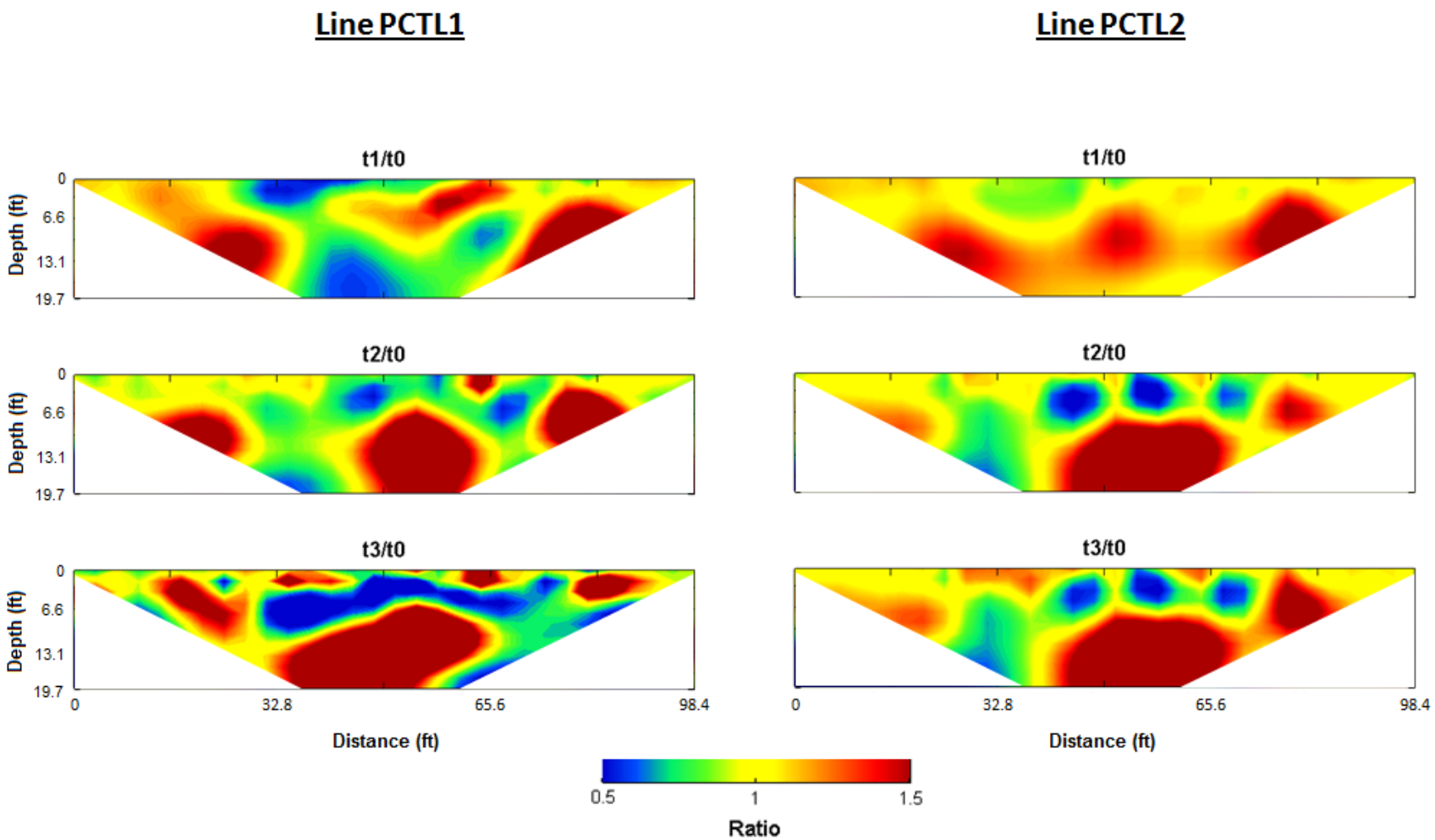


Figure A.19 Cumulative time-lapse change images (relative to time zero) of the sequence of time-steps recorded during the 'premature ignition event'.

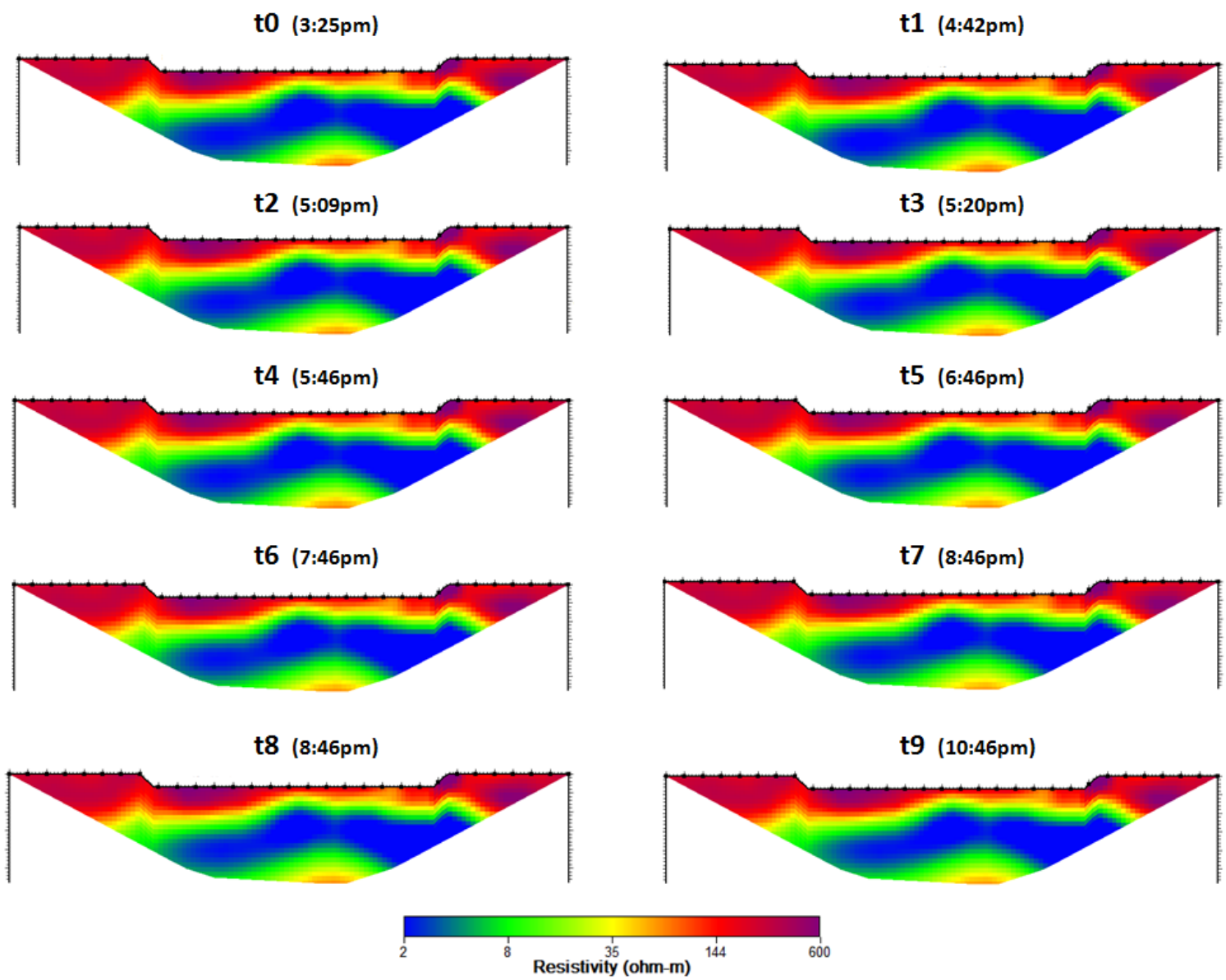


Figure A.20 Full inversion images of the sequence of time-steps recorded during the 'IP-6 Ignition Event' on Line PCTL1.

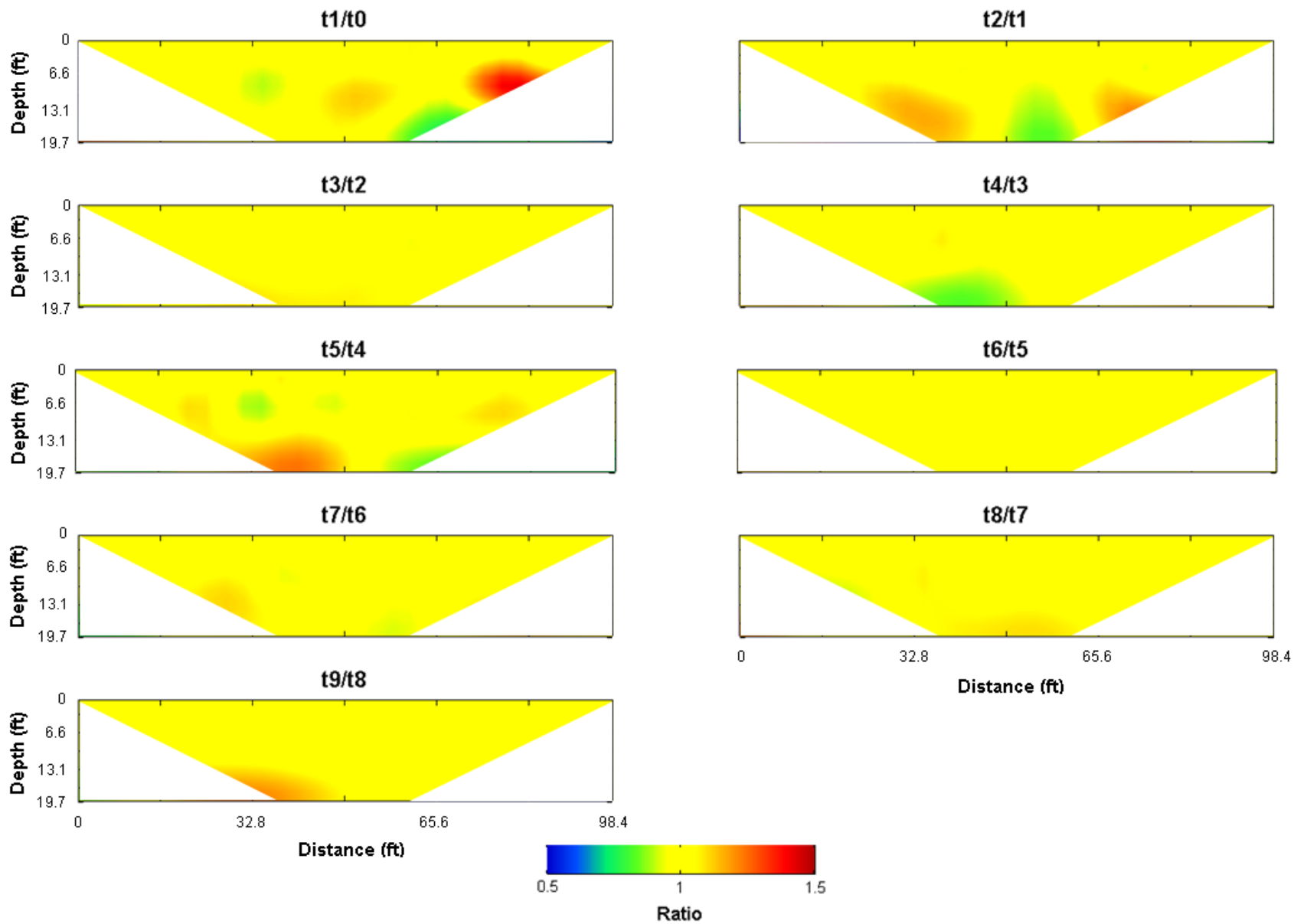


Figure A.21 Sequential time-lapse change images of the sequence of time-steps recorded during the 'IP-6 Ignition Event'.

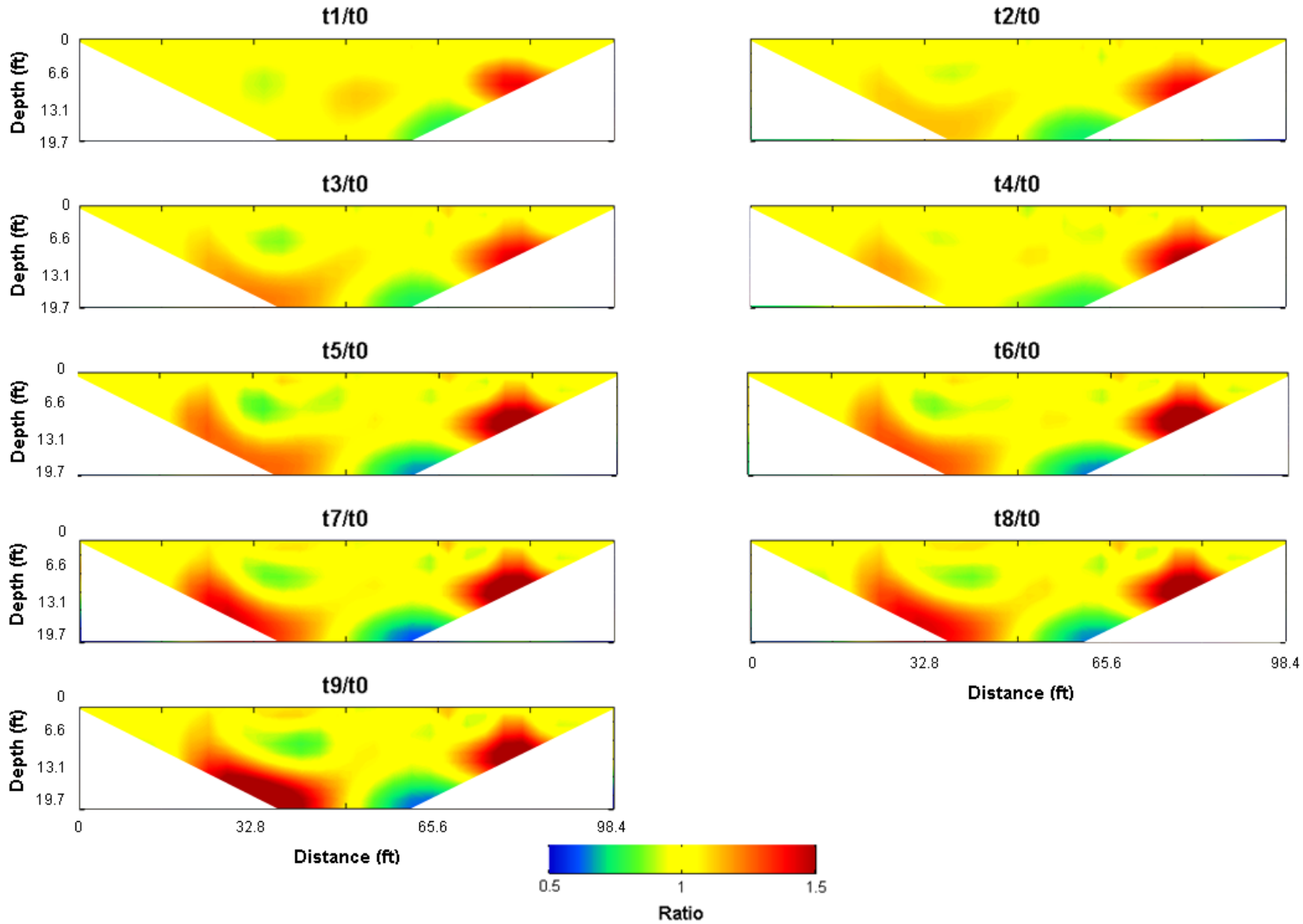


Figure A.22 Cumulative time-lapse change images (relative to time zero) of the sequence of time-steps recorded during the 'IP-6 Ignition Event'.

APPENDIX D

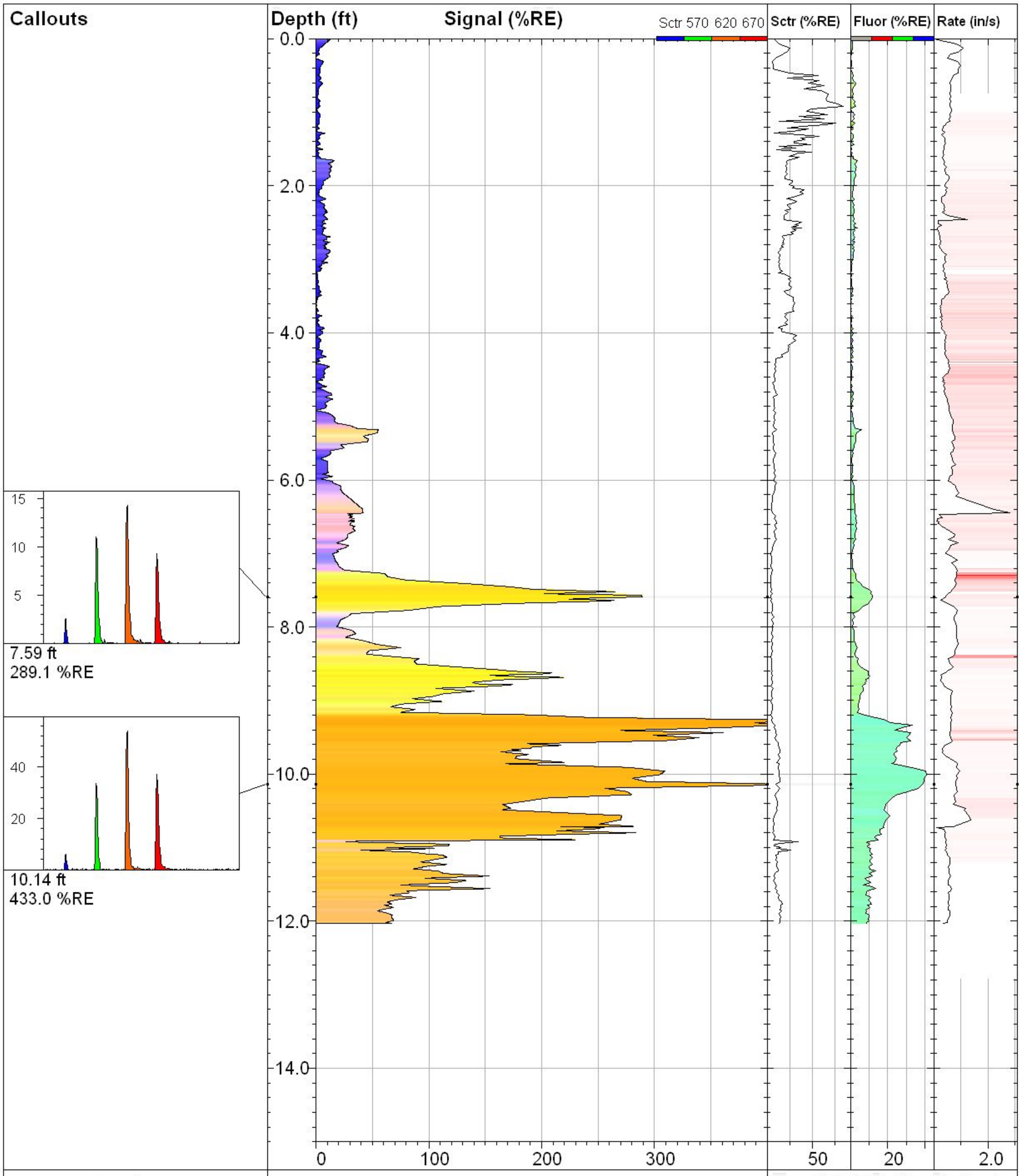
TarGOST® Profiles

Geosyntec consultants

Post TarGOST®

TR0341D

2013.05.06



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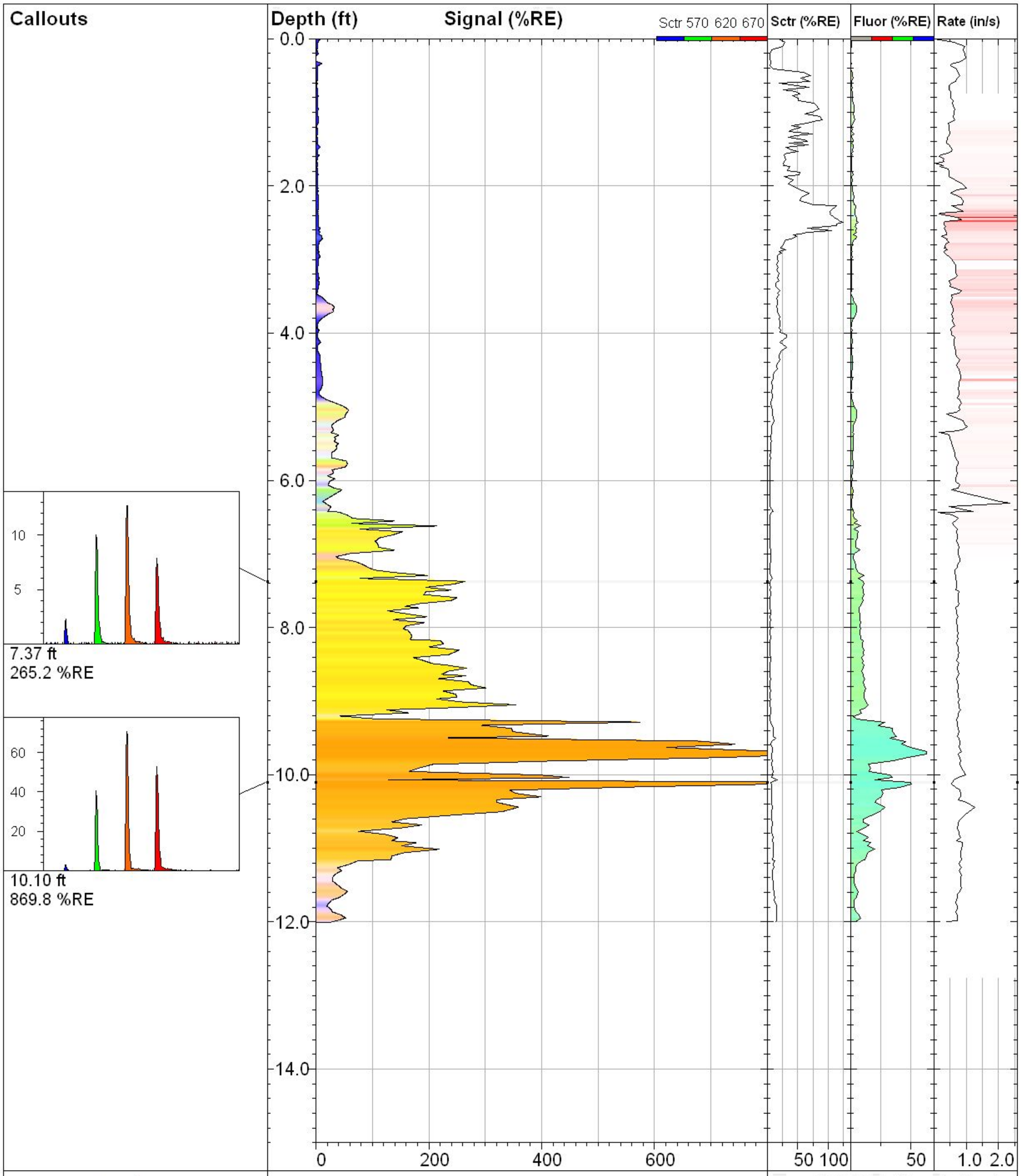
Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **12.03 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **437.6 %RE @ 9.27 ft**
Operator / Unit: **SDA / TG1001**	*Elevation:* **Unavailable**	*Date & Time:* **2013-01-22 08:00 CST**



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Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **12.00 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **889.3 %RE @ 9.72 ft**
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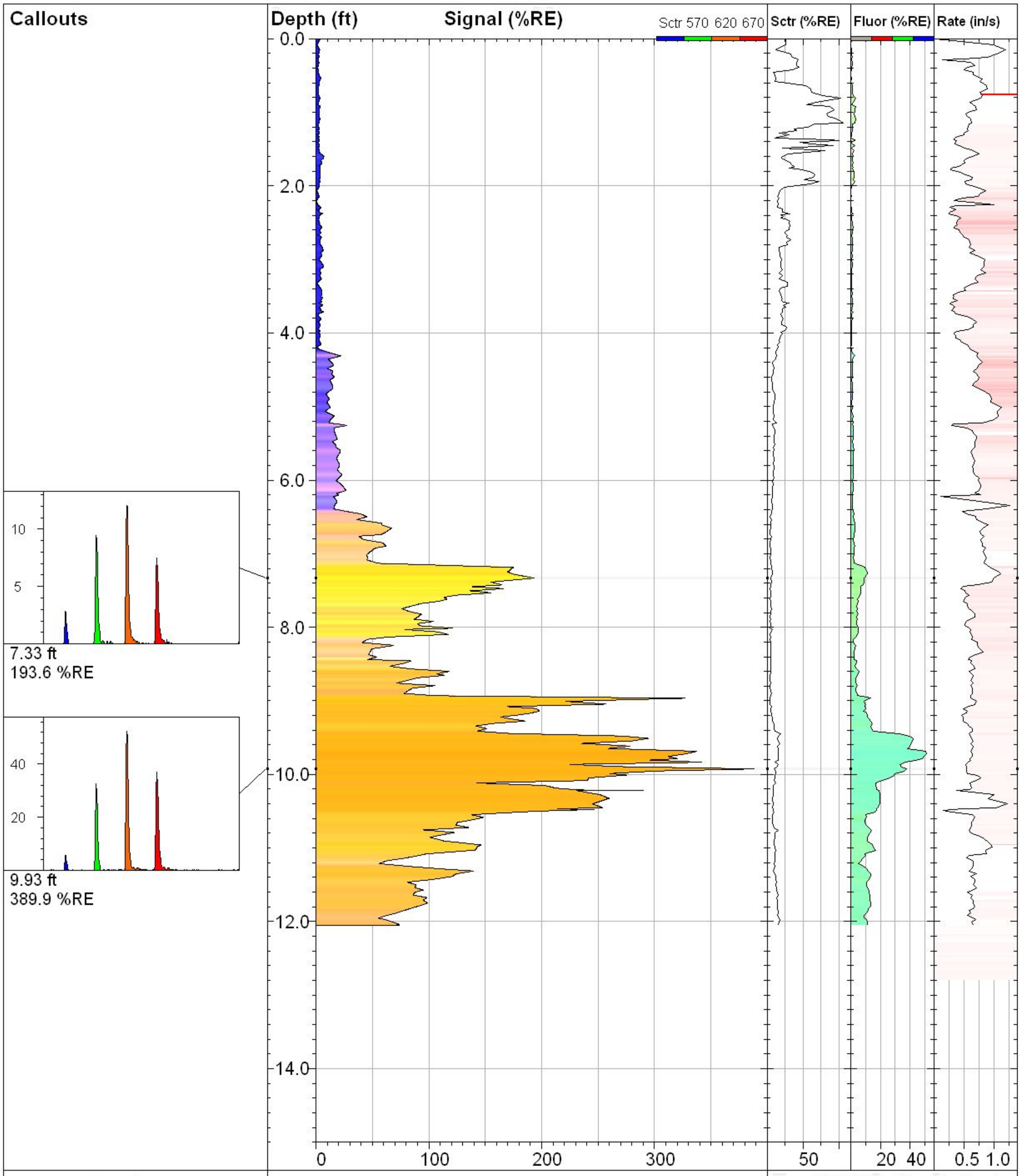

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Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **12.05 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **389.9 %RE @ 9.93 ft**
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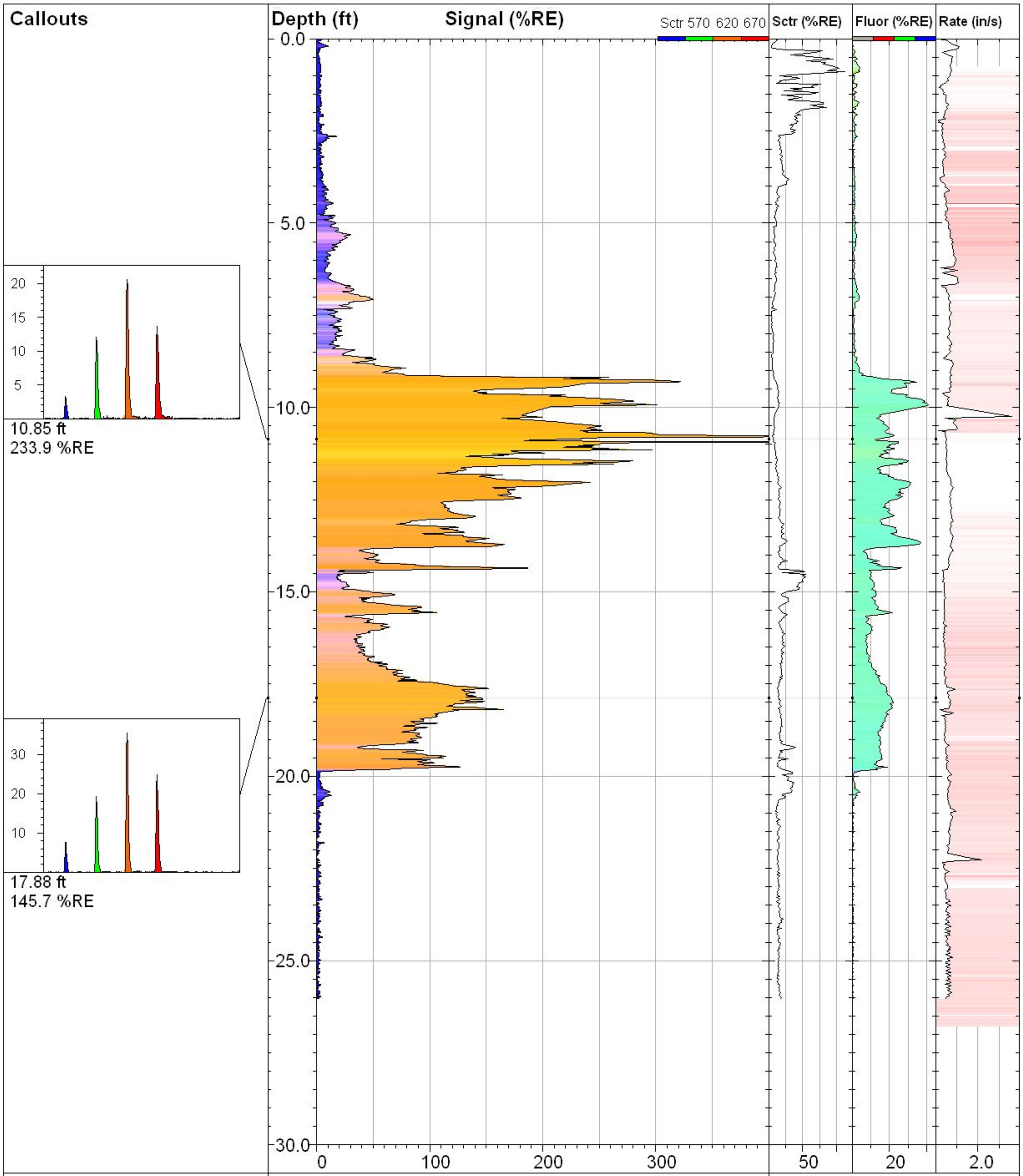

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Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **26.02 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **431.0 %RE @ 10.79 ft**
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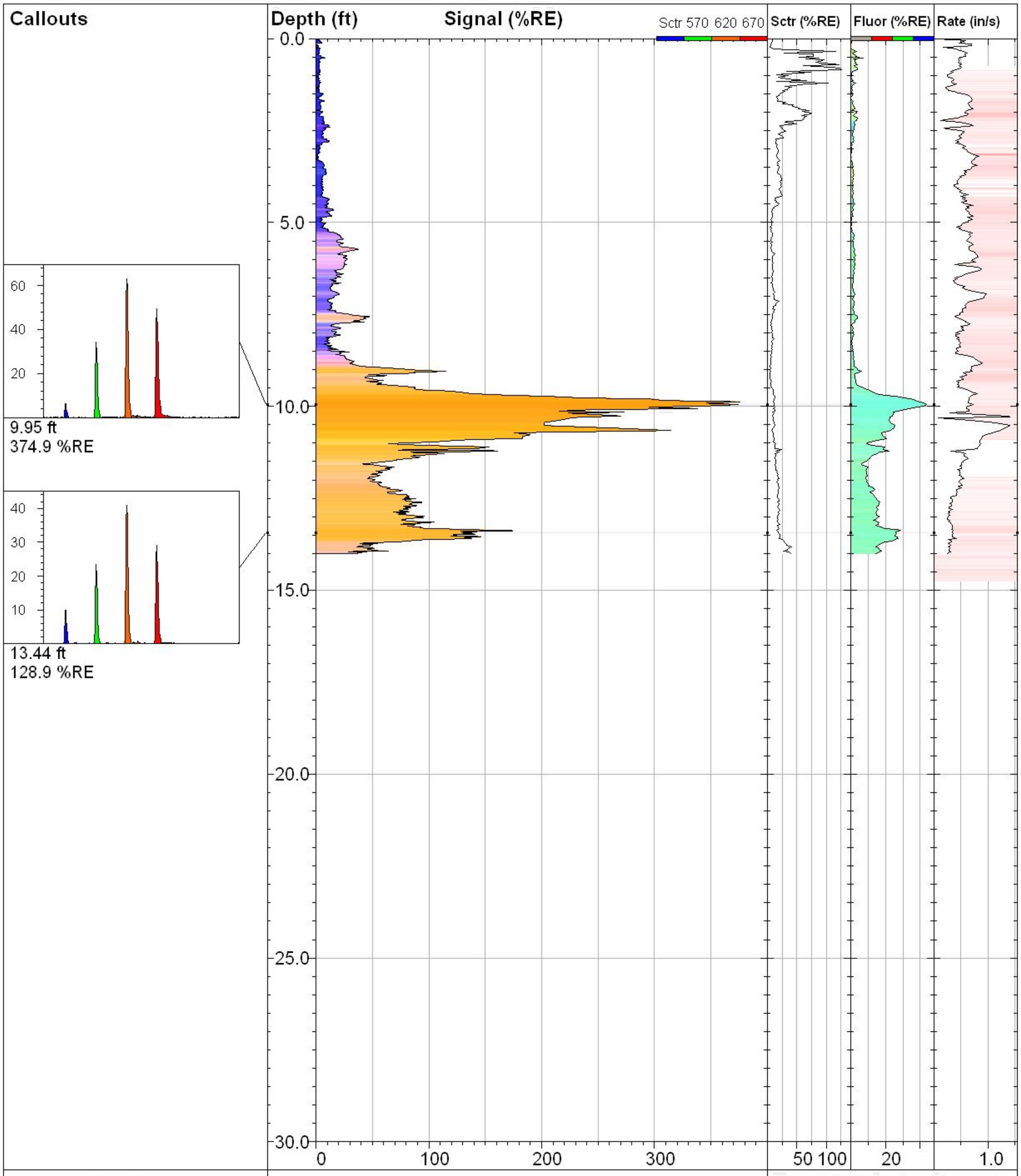

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Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **14.00 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **376.7 %RE @ 9.87 ft**
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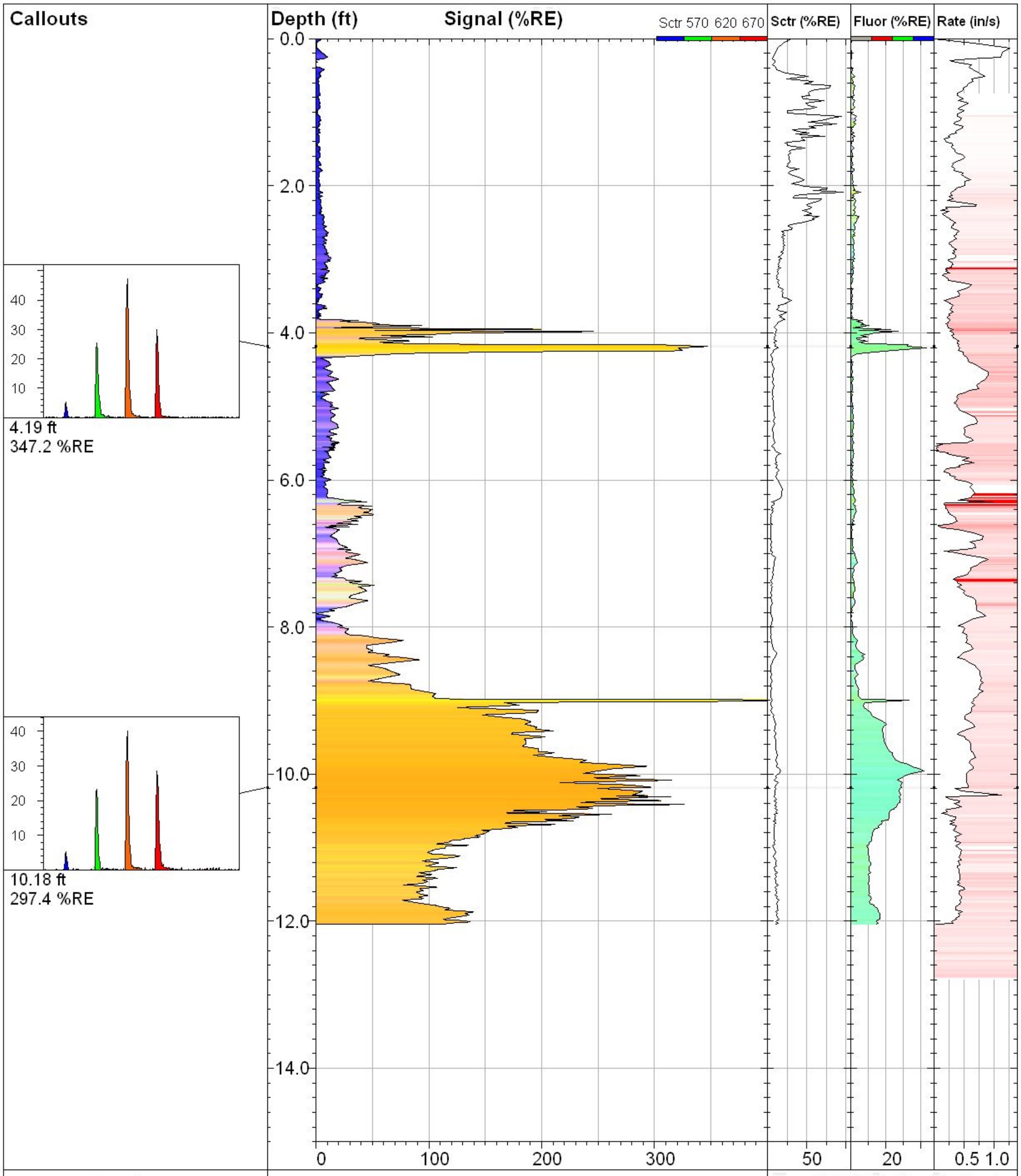

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Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **12.04 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **549.5 %RE @ 9.00 ft**
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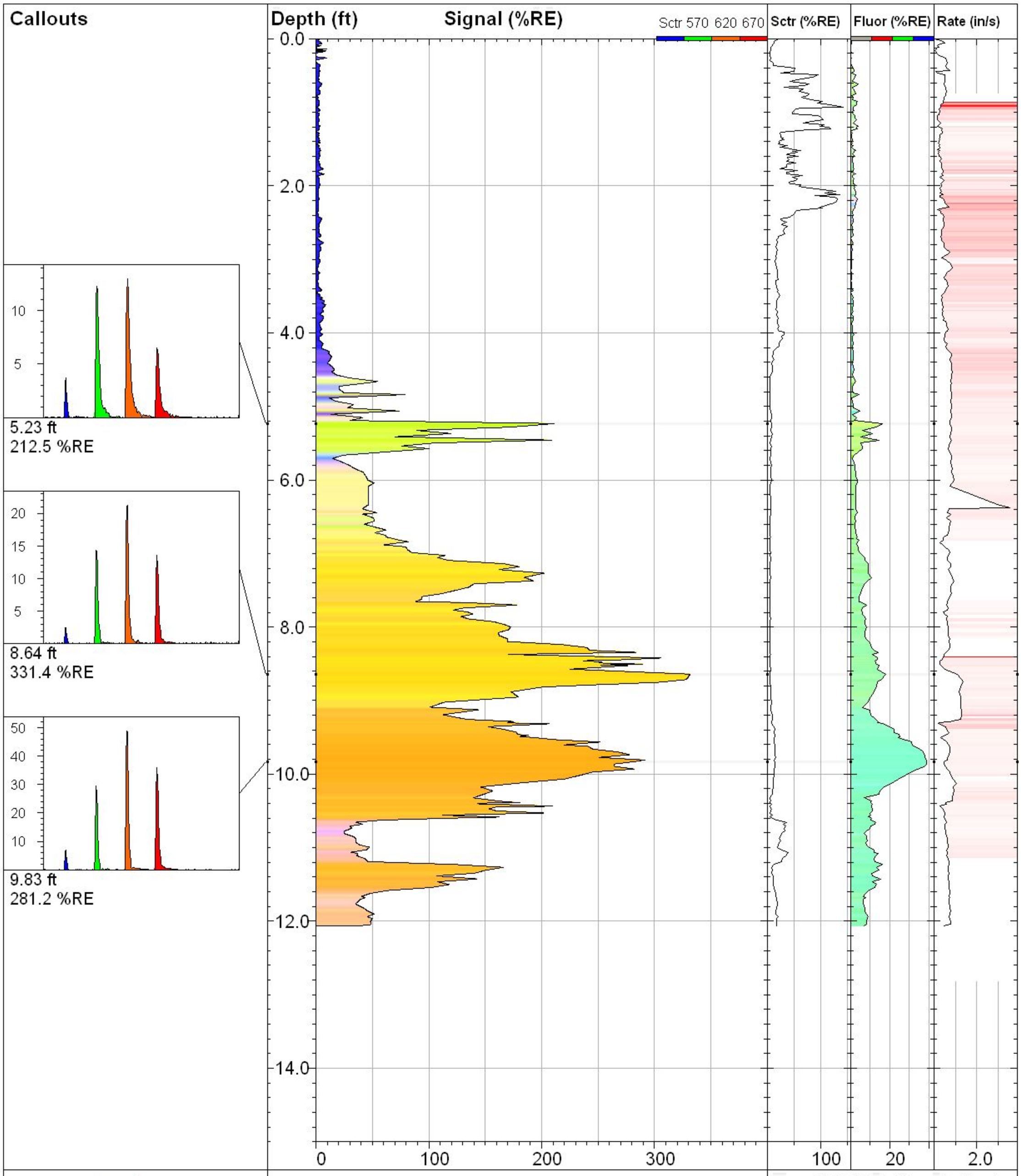

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Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **12.07 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **331.4 %RE @ 8.64 ft**
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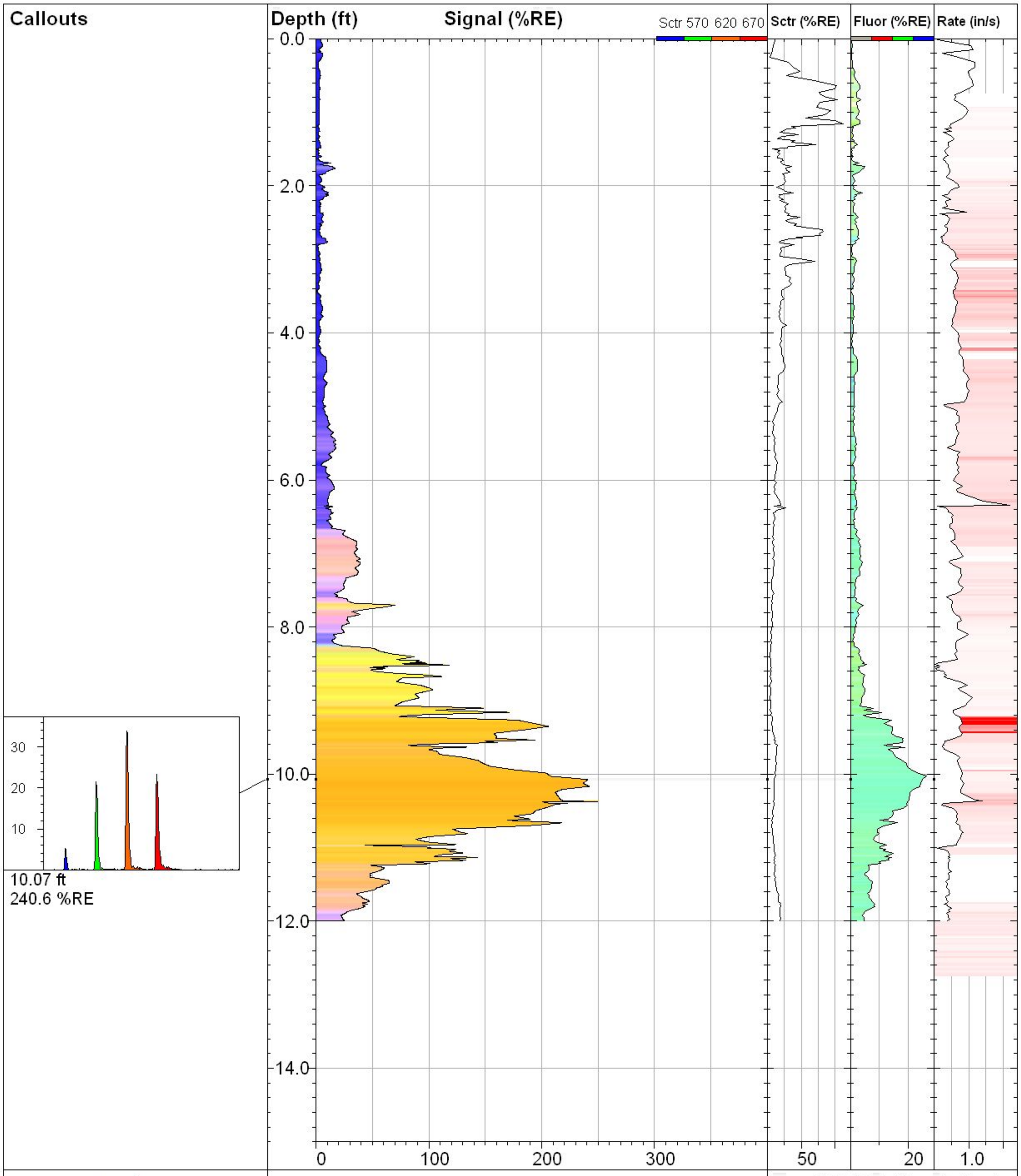

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Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **12.00 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **251.1 %RE @ 10.37 ft**
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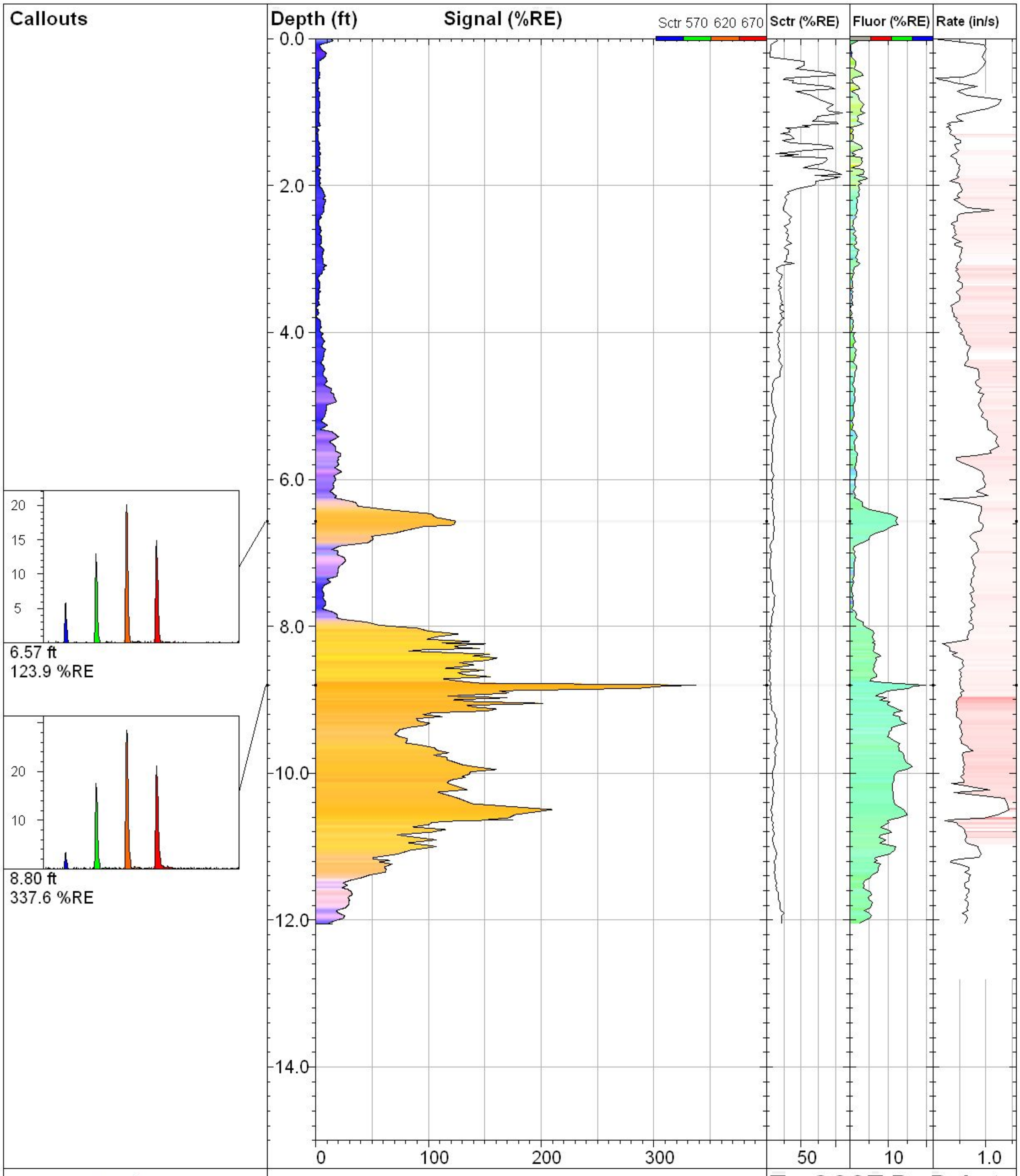

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Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **12.05 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **337.6 %RE @ 8.80 ft**
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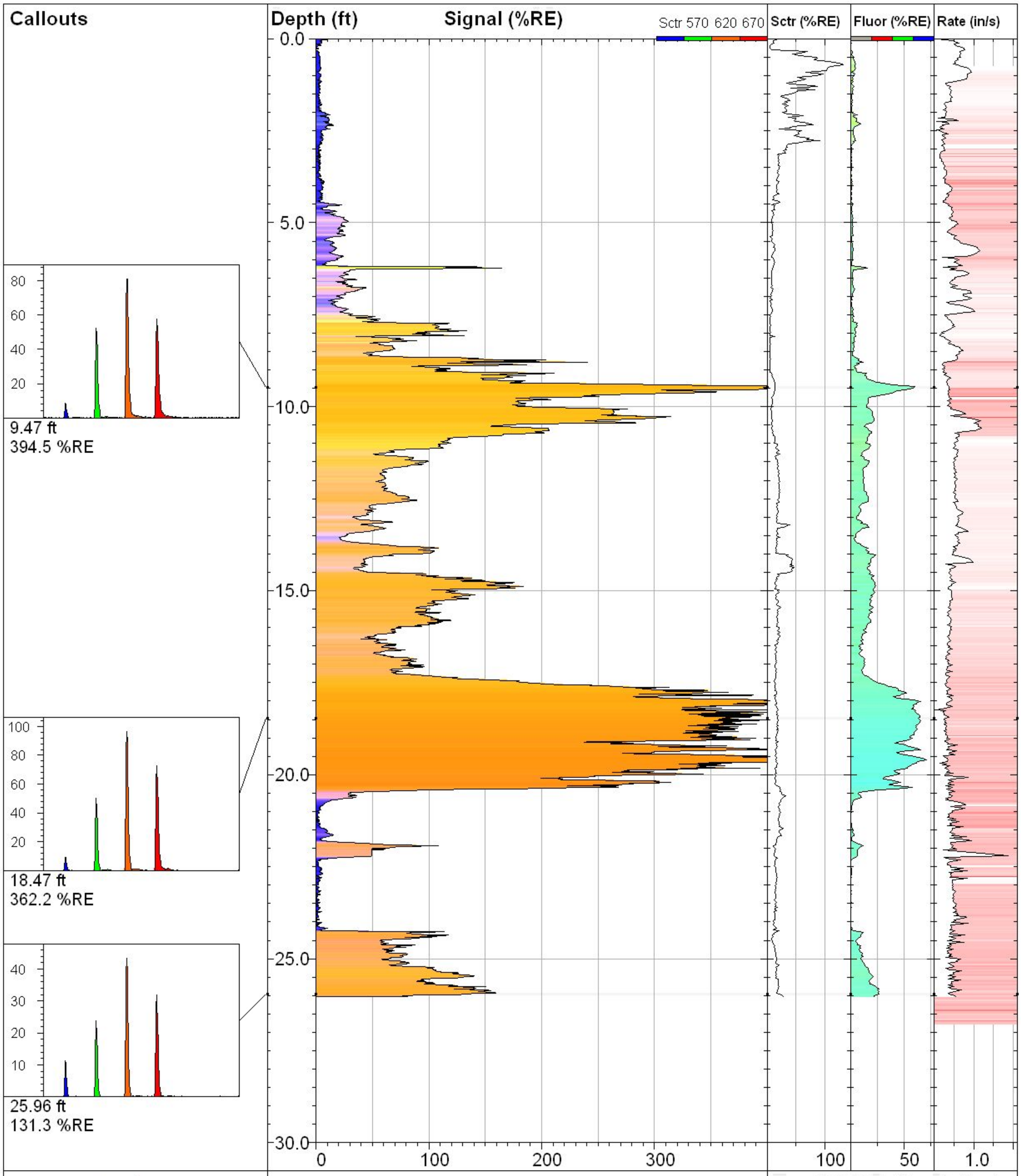

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PTG-B18

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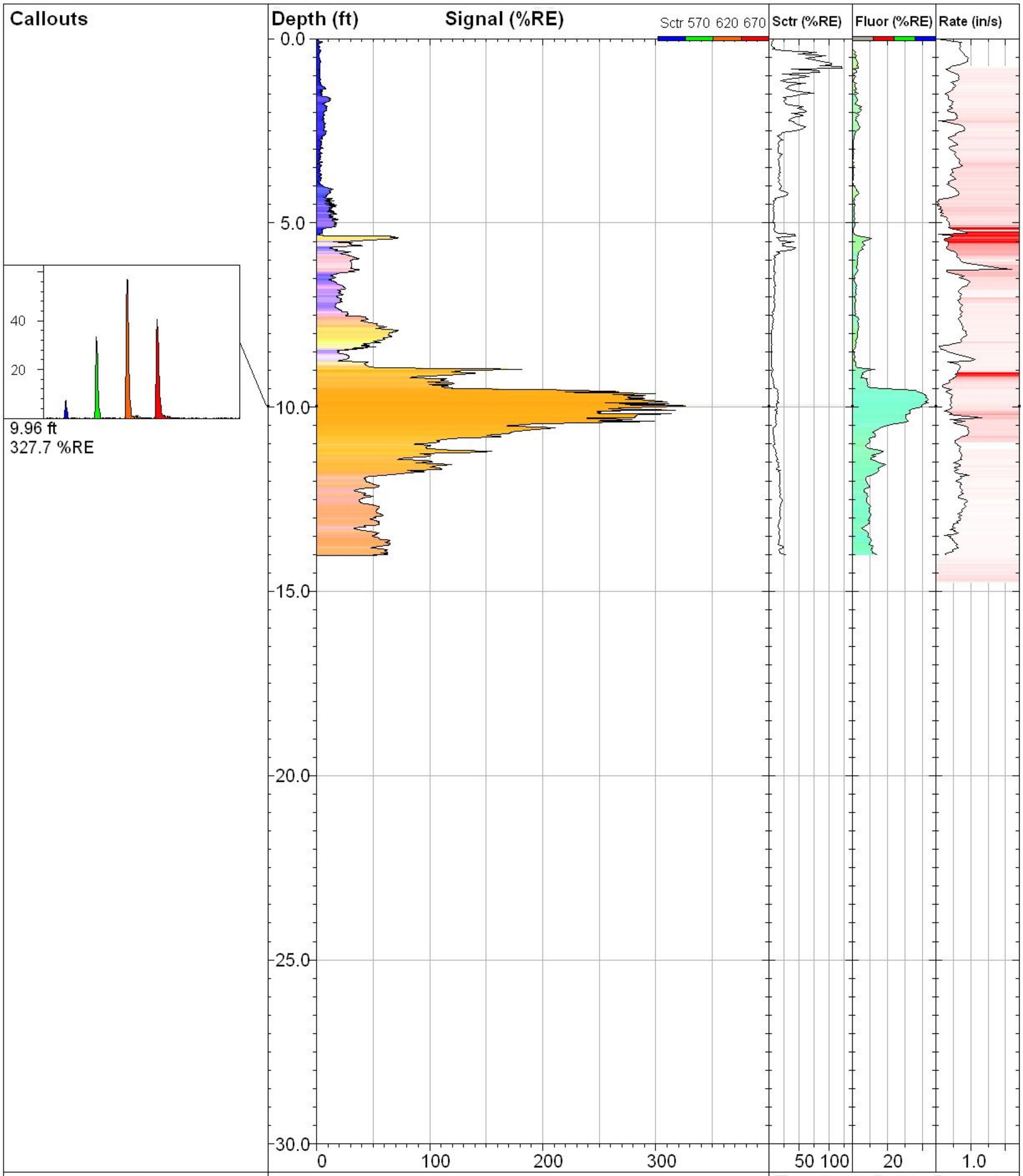
Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **26.02 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **503.8 %RE @ 19.31 ft**
Operator / Unit: **SDA / TG1001**	*Elevation:* **Unavailable**	*Date & Time:* **2013-01-21 12:30 CST**



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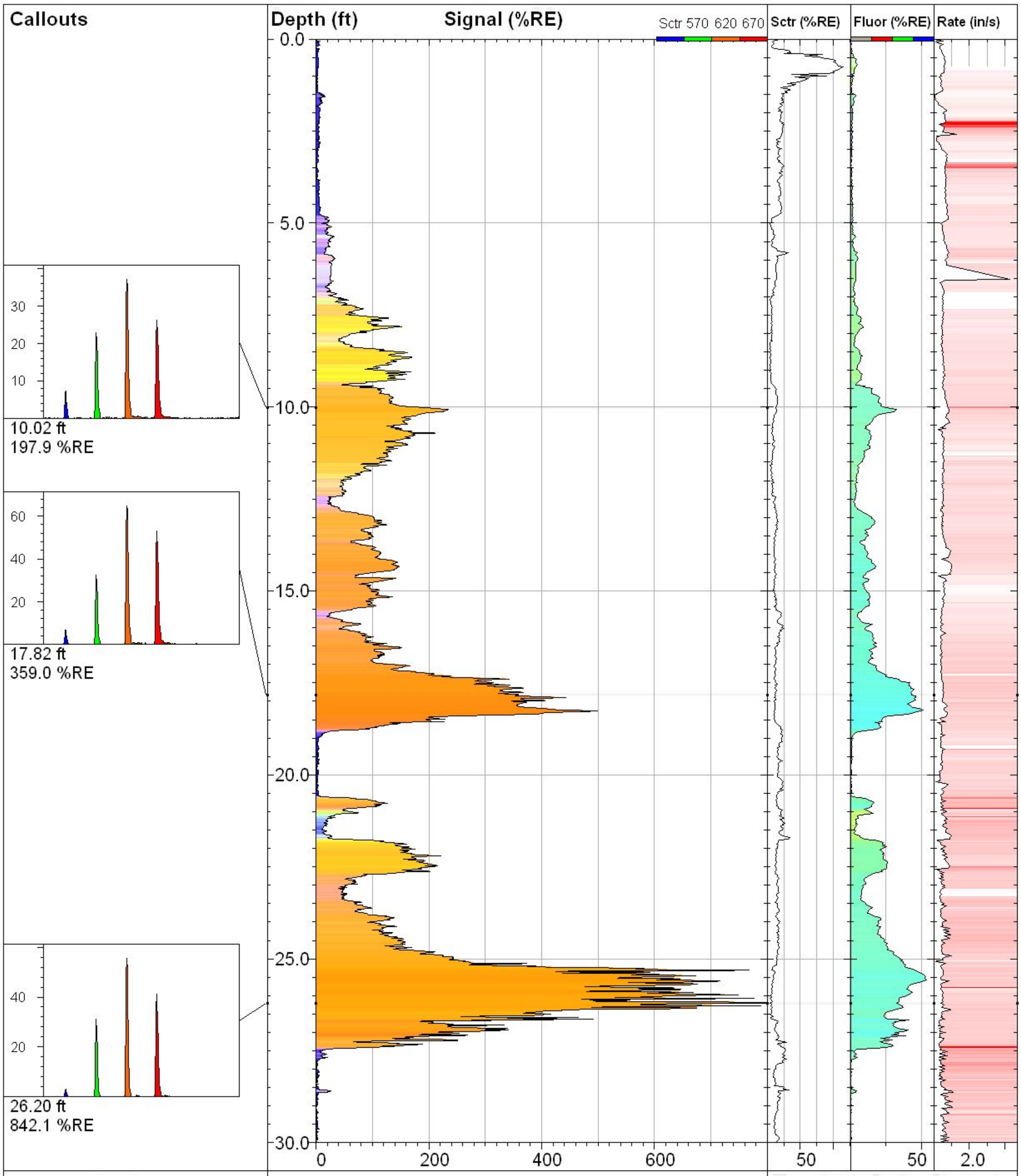
Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **14.03 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **327.7 %RE @ 9.96 ft**
Operator / Unit: **SDA / TG1001**	*Elevation:* **Unavailable**	*Date & Time:* **2013-01-21 14:20 CST**



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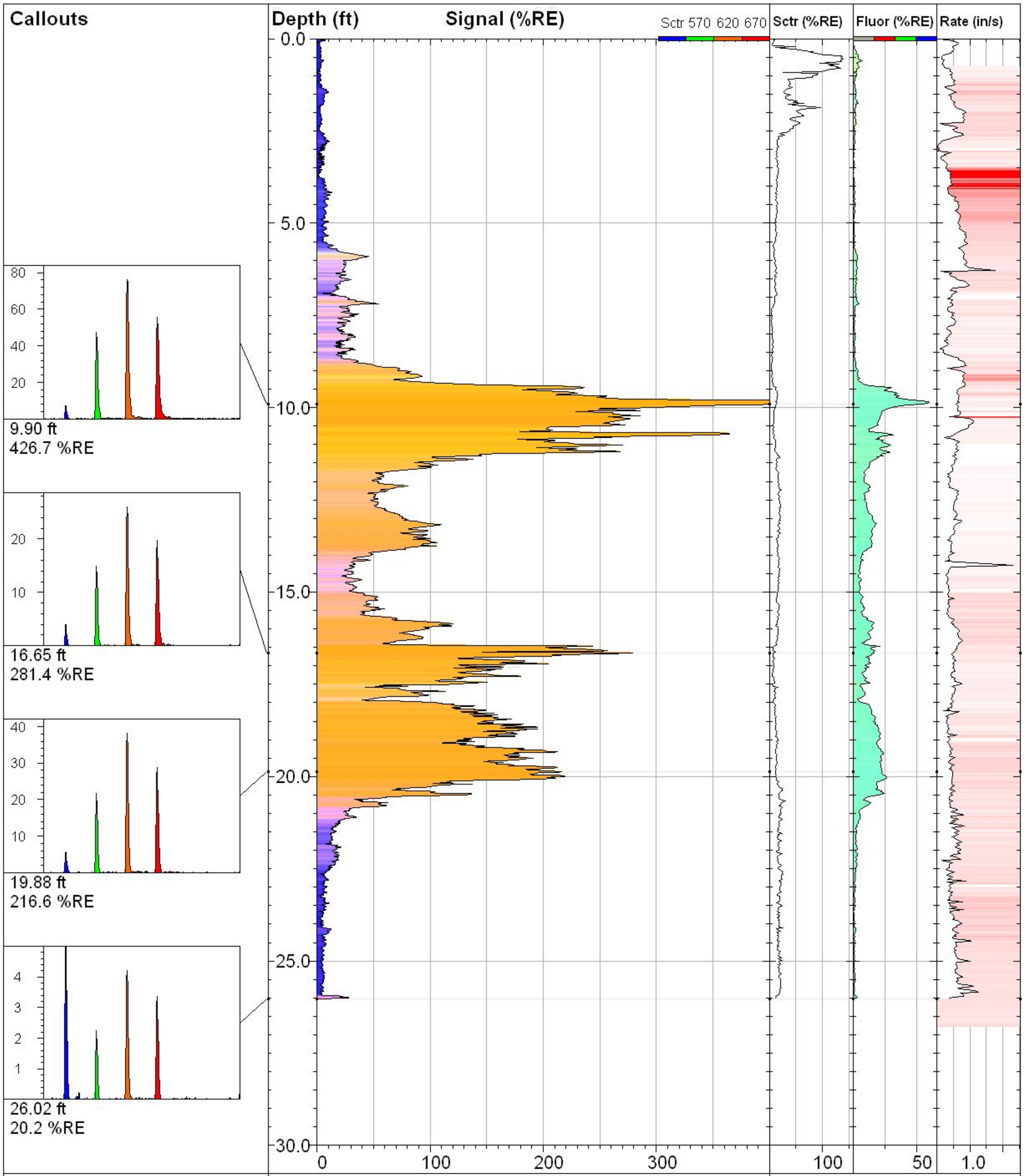
Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **30.11 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **842.1 %RE @ 26.20 ft**
Operator / Unit: **SDA / TG1001**	*Elevation:* **Unavailable**	*Date & Time:* **2013-01-21 09:53 CST**



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TarGOST By Dakota
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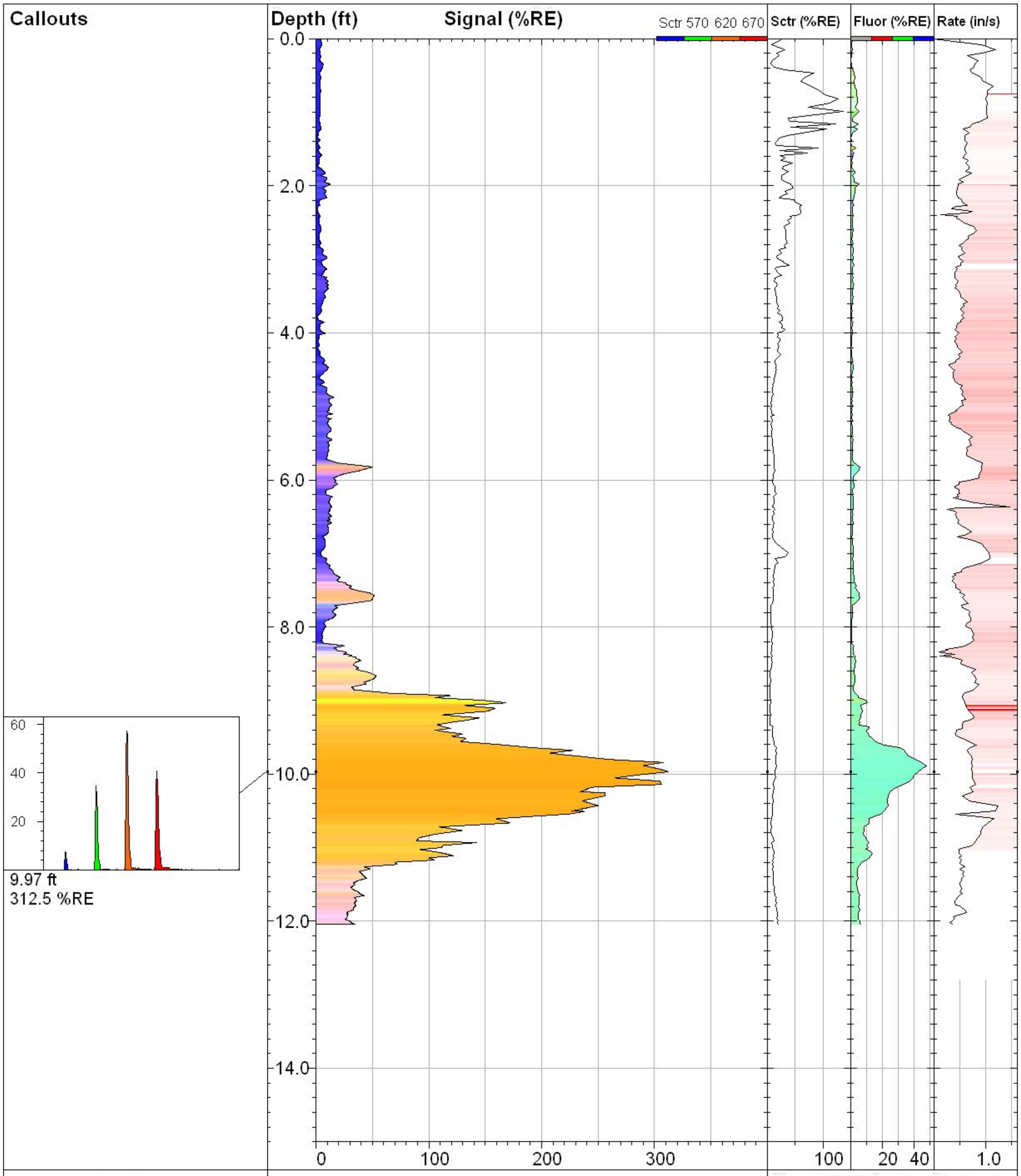
Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **26.02 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **511.7 %RE @ 9.83 ft**
Operator / Unit: **SDA / TG1001**	*Elevation:* **Unavailable**	*Date & Time:* **2013-01-21 13:16 CST**



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PTG-B22

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Site: **Pitt Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **12.04 ft**
Client / Job: **DuPont /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **312.5 %RE @ 9.97 ft**
Operator / Unit: **SDA / TG1001**	*Elevation:* **Unavailable**	*Date & Time:* **2013-01-22 10:14 CST**

Geosyntec consultants

Pre TarGOST®

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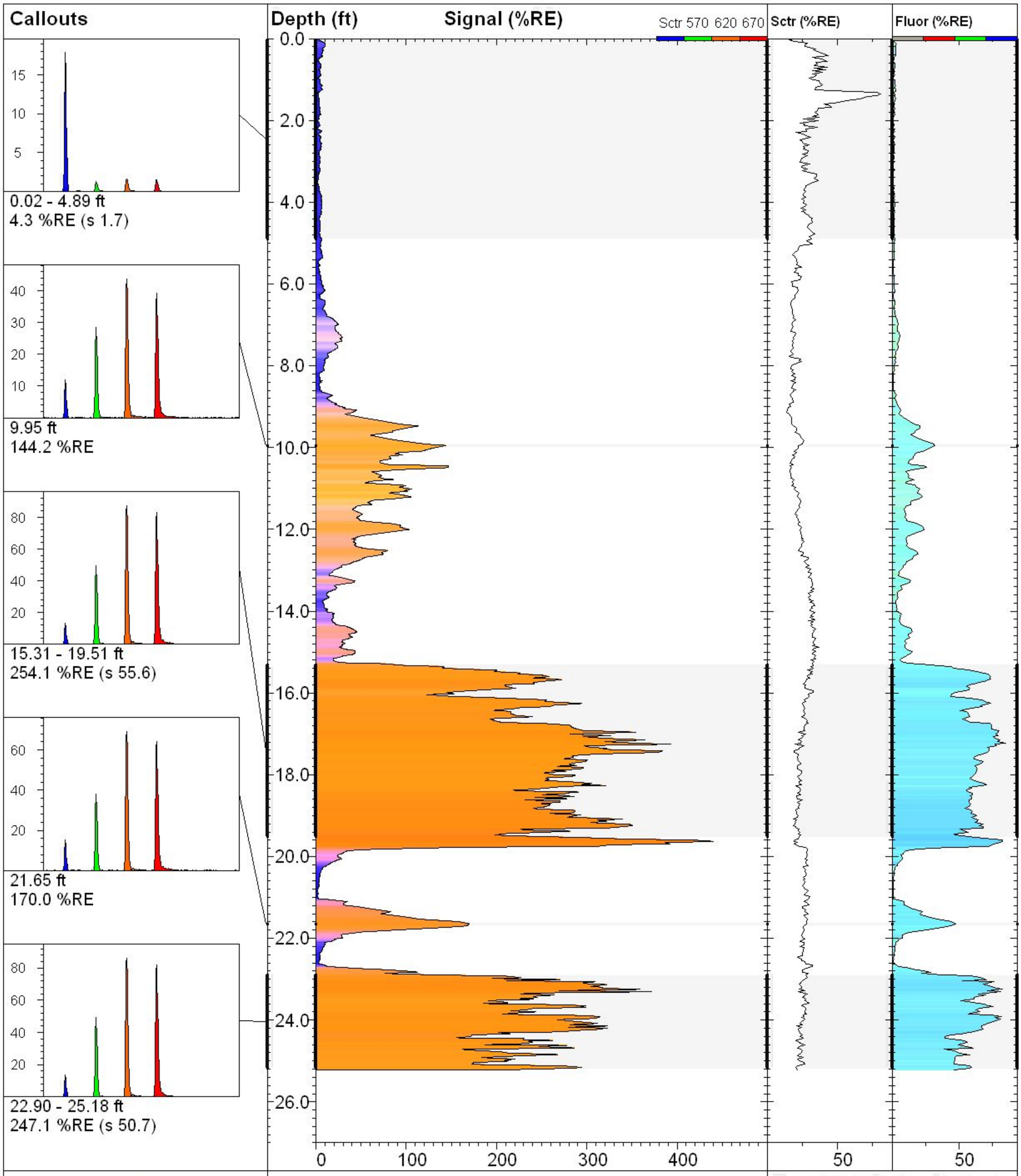
2013.05.06



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LCC-C5

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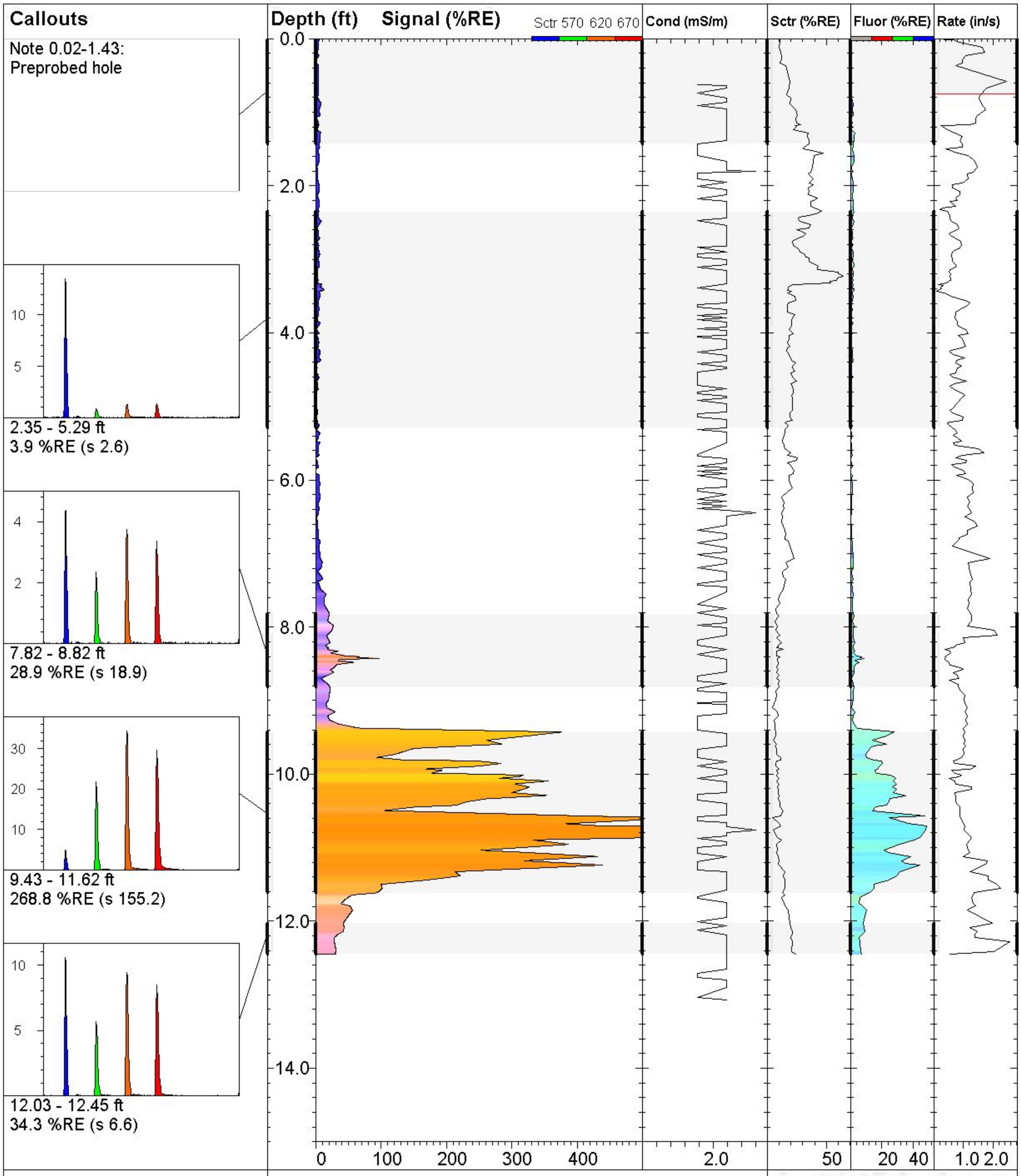
Site: **Dupont Pitt-Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **25.22 ft**
Client / Job: **Geosyntec / TR0388**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **441.6 %RE @ 19.63 ft**
Operator / Unit: **T.Rudolph / TG1002**	*Elevation:* **Unavailable**	*Date & Time:* **2012-03-12 11:03 EDT**



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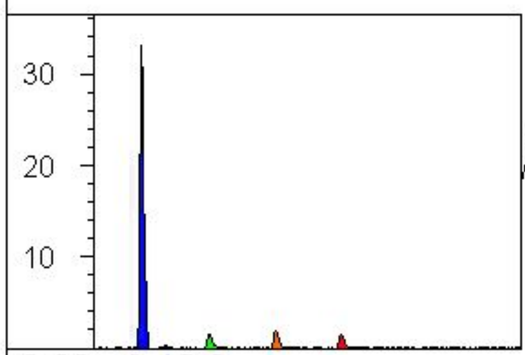
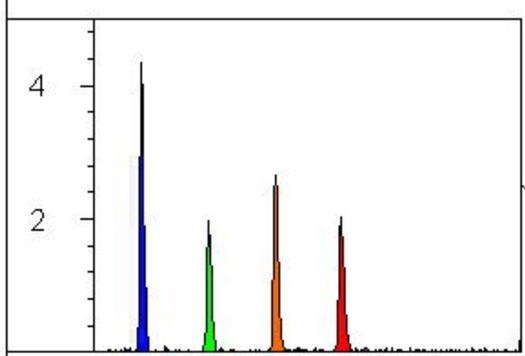
Site: **DuPont Pitt-Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **38.26 ft**
Client / Job: **Geosyntec /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **1024.5 %RE @ 10.76 ft**
Operator / Unit: **T. Rudolph / TG1001**	*Elevation:* **Unavailable**	*Date & Time:* **2011-07-14 11:30 EDT**

Callouts

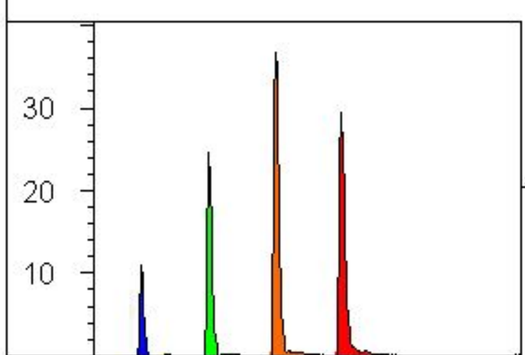
Note 0.00-1.56:
Preprobed hole



2.22 - 3.18 ft
2.7 %RE (s 1.7)



6.90 - 7.72 ft
23.5 %RE (s 13.0)



9.31 - 10.77 ft
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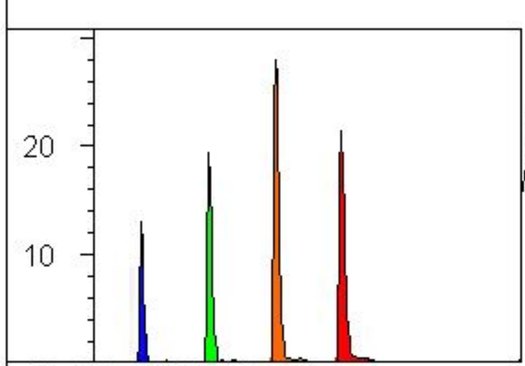
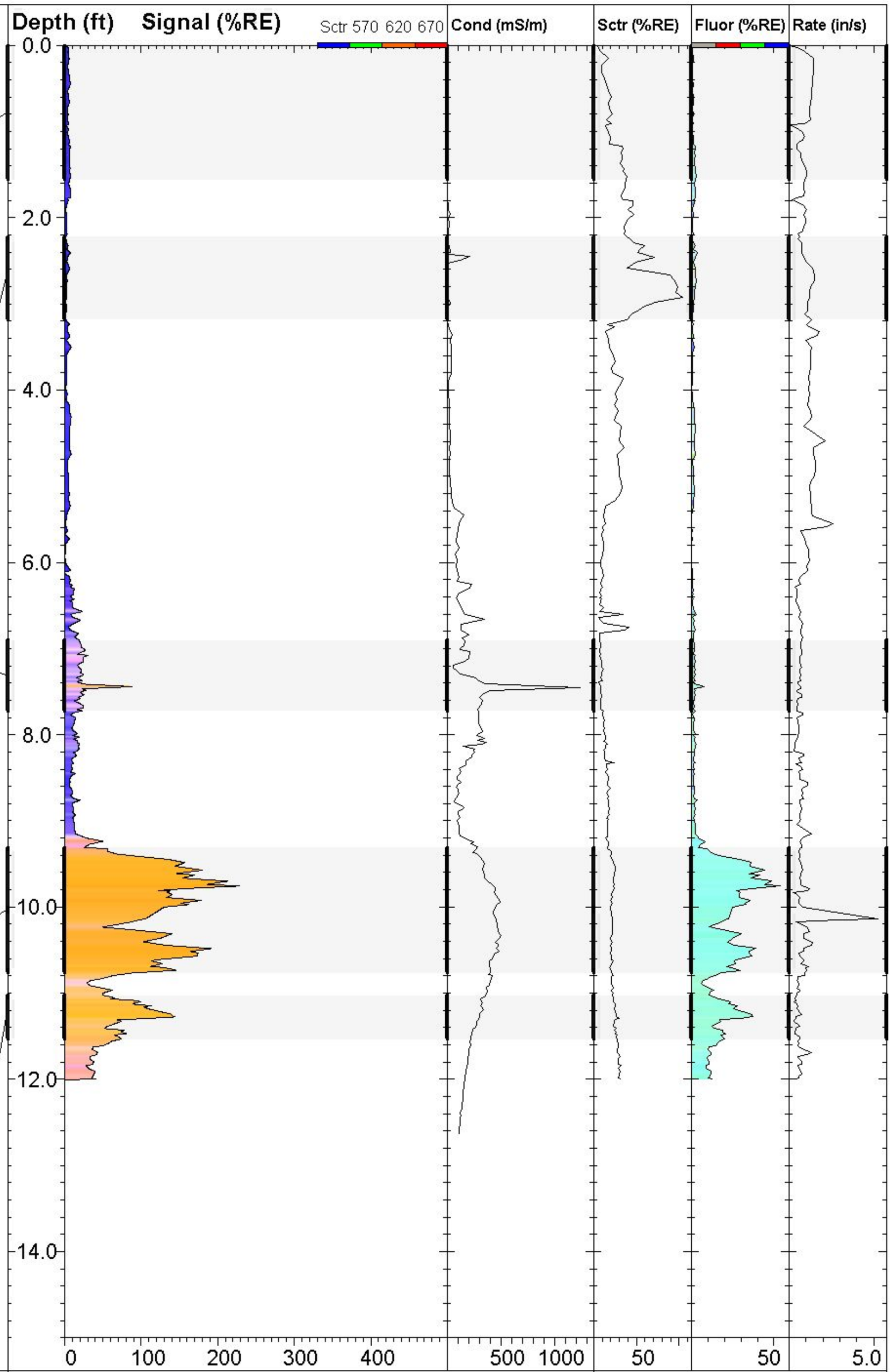


11.02 - 11.53 ft
86.6 %RE (s 27.5)



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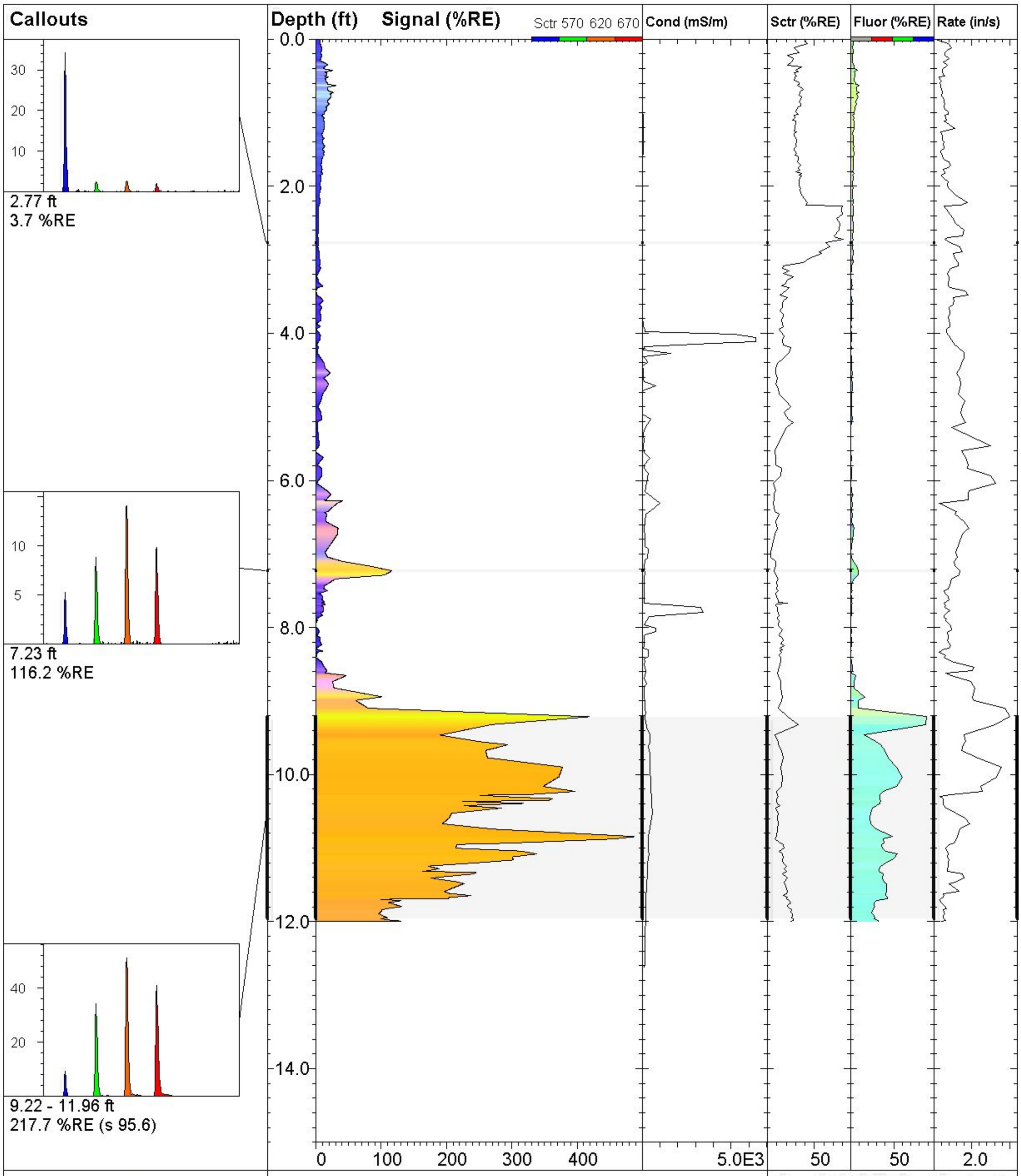
Site: **DuPont Pitt-Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **38.26 ft**
Client / Job: **Geosyntec /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **229.7 %RE @ 9.76 ft**
Operator / Unit: **T. Rudolph / TG1001**	*Elevation:* **Unavailable**	*Date & Time:* **2011-07-14 08:37 EDT**



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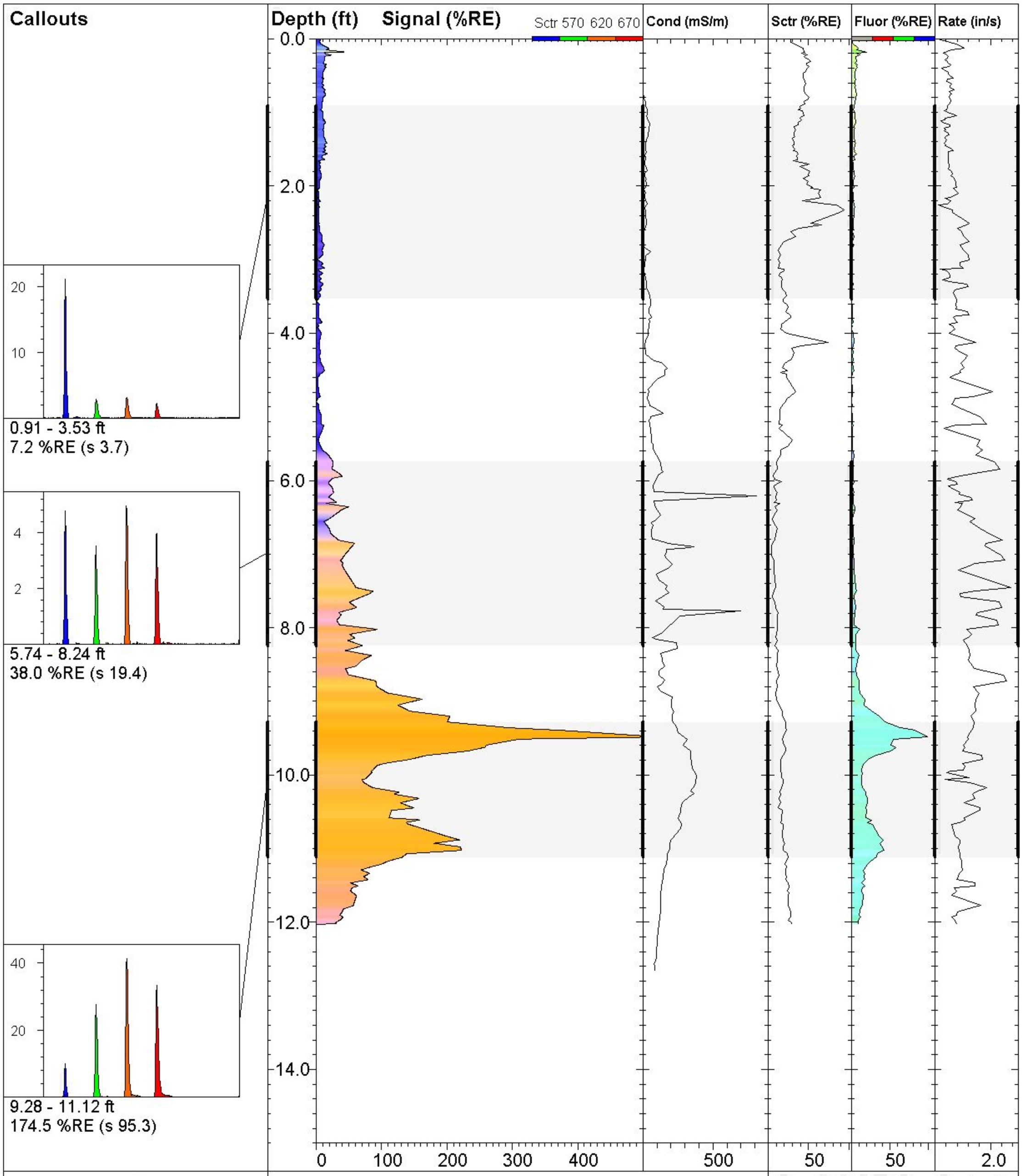
Site: **DuPont Pitt-Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **38.26 ft**
Client / Job: **Geosyntec /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **489.1 %RE @ 10.84 ft**
Operator / Unit: **T. Rudolph / TG1001**	*Elevation:* **Unavailable**	*Date & Time:* **2011-07-12 15:42 EDT**



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Site: **DuPont Pitt-Consol**	*Y Coord.(Lat-N) / System:* **Unavailable / NA**	*Final depth:* **38.26 ft**
Client / Job: **Geosyntec /**	*X Coord.(Lng-E) / Fix:* **Unavailable / NA**	*Max signal:* **526.7 %RE @ 9.48 ft**
Operator / Unit: **T. Rudolph / TG1001**	*Elevation:* **Unavailable**	*Date & Time:* **2011-07-12 14:56 EDT**

APPENDIX E

STAR FUNCTIONAL DESCRIPTION

Prepared for

DuPont Corporate Remediation Group
4417 Lancaster Pike
Chestnut Run Plaza, Building 715 – 252
Wilmington, Delaware 19808

STAR FUNCTIONAL DESCRIPTION

PRELIMINARY DESIGN

Pitt-Consol Chemical Co.
191 Doremus Avenue
Newark, New Jersey 07105
SRP-PI # G000002172

Prepared by

Geosyntec consultants

engineers | scientists | innovators

130 Research Lane, Suite 2
Guelph, Ontario N1G 5G3

Project Number TR0388

June 2013

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LIST OF ABBREVIATIONS

AOC	area of concern
bgs	below ground surface
CEMS	continuous emissions monitoring system
CO	carbon monoxide
CO_2	carbon dioxide
DuPont	E. I. du Pont de Nemours and Company
ft	feet
Geosyntec	Geosyntec Consultants, Inc.
N.J.A.C.	New Jersey Administrative Code
Pitt-Consol	Pitt-Consol Chemical Co.
RAWP	Remedial Action Work Plan
ROI	radius of influence
STAR	Self-Sustaining Treatment for Active Remediation
ThermOx	thermal oxidizer

1. INTRODUCTION

This Functional Description Report outlines the Self-Sustaining Treatment for Active Remediation (STAR) treatment system for the former Pitt-Consol Chemical Co. (Pitt-Consol) property located at 191 Doremus Avenue in Newark, Essex County, New Jersey (the Site). The STAR treatment system will be designed, constructed and operated to remediate on-Site soils in Area of Concern (AOC 6) at the Site. Geosyntec Consultants, Inc. (Geosyntec) has prepared this Function Description Report for and on behalf of E. I. du Pont de Nemours and Company (DuPont). Revisions to this Functional Description will be made during the process of detailed remedial design to reflect modifications and improvements made to the system, the implementation strategy, and the deployment plan.

1.1 STAR Treatment System

The STAR treatment system is composed of a number of subsystems. Associated with these systems are the required instrumentation and controls to effectively operate and monitor the implementation of STAR, and the delivery of Site services and utilities to power STAR, which will be addressed in the remedial design drawing and specification package. The subsystems, as well as the implementation strategy and deployment plan for STAR operations, are described in further detail in the subsections below. It is intended that a number of these subsystems will be constructed off-Site and brought to the Site for operations; however, this will be finalized during remedial design.

2. IMPLEMENTATION STRATEGY

Treatment of AOC 6 materials will be administered across the Site through a number of mobile skids (estimated to be three skids). Each skid will carry the majority of the controls and equipment to effect and monitor treatment, and will be moved around the Site as required to efficiently cover the Site areas requiring remediation. The mobile skids will be powered by associated mobile or mounted liquid fueled generators, and will receive compressed air from a fixed air distribution system or a portable compressor.

Direct push, temporary ignition wells will be installed and removed on a continuous basis over the course of treatment, such that wells are always in place and ready for use when a skid becomes available, but minimizing the number of installed wells required at any one time (to reduce well tooling costs and Site complexity). Skid placement locations will be identified such that the maximum number of wells can be serviced from the minimum number of skid relocations. Each individual location is referred to as a node and each node can treat the wells within the radius defined by the maximum reach of the air supply and heater power lines. The practical limit based on preliminary design activities is approximately 150 feet (ft), so a skid at each node will treat the wells within a 300 ft diameter circle.

Within a given node, ignition wells will be grouped into cells. The population of wells in a cell is defined by the heater power and air flow available at a treatment skid. The maximum number of shallow (Fill) and deep (Alluvium) wells treatable by a single skid is estimated to be 20 and 6, respectively. Cell shapes will largely be dictated by local conditions (Site boundary, physical obstacles, and defined treatment area). Shallow (Fill) and deep (Alluvium) wells will be grouped into independent but potentially overlapping cells, based on differences in well spacing, treatment depths, number of screens per well, and differences in anticipated cycle time. Because shallow (Fill) and deep (Alluvium) treatment will require dedicated equipment, areas requiring remediation within both geologic units will likely require more than one skid mobilization. Methods of converting a deep treatment skid to a shallow treatment skid (or vice versa) without relocating the skid will also be considered when developing the remedial design drawing and specification package.

Vacuum extraction wells will be installed approximately concurrently with the installation of ignition wells and connected to an exhaust blower mounted on each treatment skid. The blower will discharge the recovered combustion vapors to a dedicated vapor treatment system for that skid. The surface of the treatment areas will be sealed with a working surface/vapor cover as discussed in the Remedial Action Work Plan (RAWP).

Process monitoring for safety, process control and data acquisition will be distributed throughout the STAR treatment subsystems. Process data will be electronically monitored and logged, reducing the need for reliance on manual data gathering and field forms, and improving the ability to monitor and optimize the process in real time.

3. STAR SUBSYSTEMS

The STAR treatment system is composed of the following subsystems:

- Compressed Air Production;
- Combustion Air Distribution;
- Ignition Wells and Heaters;
- Combustion Exhaust Management; and
- Vapor Treatment.

Each individual subsystem is described below.

3.1 Compressed Air Production

A steady supply of compressed air is required for the proper function of the individual combustion wells, as pressurized air is the main means of combustion support following initial ignition.

Compressed air will be generated at a fixed location in the vicinity of the current high voltage power drop on the west central side of the Site. There is sufficient electrical power available to operate two air compressors, with combined capacity to supply two of the estimated three treatment skids. This compressed air will be distributed around the treatment zone in dedicated piping, with process connections at each node. This allows use of the existing electrical capacity without the additional design, code and safety constraints of distributing electrical power to each node. The third skid will be supplied with a portable, liquid fueled compressor and thus be more mobile, allowing treatment of contaminated zones at the periphery of the Site, which will otherwise be hard to reach efficiently with distributed air and fixed treatment nodes.

Both compressors may operate simultaneously during treatment and the distribution system will be sized for this combined capacity. In the event of compressor failure or servicing, the distribution system may be supplied with back-up liquid-fueled compressors tied into the main supply header. The third mobile compressor will serve this function in a process critical situation. If required, a rental compressor can be obtained for bridging service at relatively short notice.

3.2 Combustion Air Distribution

Compressed air surge capacity will be stored in an accumulator downstream of the air plant. Air piping will be distributed across the densest area of AOC 6 for remediation, using compression or groove lock joints to facilitate ease of relocation and repair. Piping will be run along the surface with appropriately designed supports and impact protection (bollards, Jersey barrier, etc.) and routed so as not to interfere with the movement of the treatment skids and supporting equipment. The fixed air piping layout will also be optimized by considering the number of wells that can be treated by the third, fully mobile treatment skid in an equivalent time period; it will not be necessary to pipe air to a zone that can be treated effectively by the mobile plant and still minimize the overall schedule.

There will be large diameter quick connect ports at each node. When a treatment skid is relocated to a new node, it will be connected to the main air distribution header by means of this port. On the skid will be a manifold of 20 air injection lines, for which only 6 will be used for deep treatment. Fewer deep wells can be treated with a given air supply because the larger radius of influence (ROI) combined with its depth require higher flows and pressures. The air distribution lines will be connected to the wellheads by means of quick connect fittings to minimize turnaround time. Each skid will be constructed identically with the full 20-line manifold. This will maximize treatment flexibility, particularly towards the end of the deployment schedule.

Air pressure will be reduced from the main header to the manifold by means of either a single regulator downstream of the skid connection, or dedicated regulators in each leg of the manifold. Flow to the ignition wells will be controlled by high turndown hand valves; it will typically be necessary to adjust the flow during the course of a given cell treatment in response to local conditions. Pressure and flow instrumentation will transmit process data to a central location and provide the operator with real time data during operation in order to properly balance the injection air across the manifold. Automatic actuators may be used to facilitate rapid adjustment of these valves and also potentially support automatic control loops. A check valve and sampling port will also be present within each injection leg. There will be an additional isolation valve at each wellhead that can be set so that the controlling backpressure in each flow leg of the manifold is at the wellhead, and not within the well or the formation that surrounds it.

3.3 Ignition Wells and Heaters

Wells will be installed with a Geoprobe direct push rig to minimize well construction expense, waste generation, and cycle time before a well is ready for STAR operations. The wellhead will consist of a threaded drive point attached to a screen section approximately

one foot in length. The screen will be made up of a series of machined slots to facilitate airflow down the well and into the formation. The remainder of the well casing will consist of four foot lengths of drive rod connected with “rope thread” style couplings. Material thickness will be selected to maximize robustness of the assembly, as it is intended to extract and reuse a number of well assemblies over the course of treatment. The inner diameter of the drive rods and wellheads will be selected to allow a tight fit of the inserted heater, which will allow the most efficient heating of the injected air.

Shallow (Fill) wells are intended to be installed on 10 ft spacing and deep (Alluvium) wells on 20 ft spacing, based on anticipated ROI of the combustion process at these depths. This spacing may be adjusted based on initial field results and practicability in the field. Well installation depth will vary according to depth of impacted soils, but is assumed to be to the top of the Meadow Mat for shallow (Fill) wells at an approximate depth of 10 to 12 ft below ground surface (bgs), and varying depth intervals for the deep (Alluvium) wells ranging from 14 ft bgs to 38 ft bgs. Operation of STAR may be required at multiple depths as determined by contaminant distribution at a given location.

Wells will be extracted and installed on a rolling basis (wells will be appropriately abandoned pursuant to New Jersey Administrative Code (N.J.A.C.) 7-9D). Cells will be installed based on previously established coordinates in the overall master deployment plan. While treatment proceeds in one cell, heaters will be extracted, the air manifold will be disconnected, and the wells will be removed from the neighboring cell that has just completed treatment. Simultaneously, a new set of wells and heaters will be installed and necessary connections will be made in the cell scheduled for treatment following the completion of operation at the current cell. Thus, well installation and associated preparation work will occur in advance of operation within a given cell to allow for treatment to proceed in a continuous manner. The schedule may be further optimized by installing wells two cells in advance of the currently treated cell, but the benefits of this will be weighed against the cost of the additional tooling and the logistics of relocating the well rig as part of the remedial design.

The wells will be terminated on surface with a wellhead assembly consisting of a tee attached to the well riser by means of a large compression fitting. The wellhead will also contain the process air connection and an instrumentation connection for well head pressure.

Heaters will be installed at the end of a rigid conduit which will be added in sections as the heater travels down the interior of the drive rod. The conduit will pass through the wellhead tee and be sealed with a smaller compression fitting at the top of the assembly. Conductor wires will be connected to the heater power supply and control panel at the skid

by means of cables associated with each airline in the manifold. Heaters will be controlled from the local treatment skid, convectively preheating the target treatment zone surrounding each well until ignition occurs. Heater operation will be staggered to minimize total overall power requirements. Once ignition is achieved, the heaters will be switched off and will not typically be switched on again so that the combustion process continues in a self-sustaining manner (i.e., no energy input following ignition). Heaters are intended to be removable and reused at multiple STAR well ignition locations.

Interstitial thermocouples will be installed between the wells to monitor the progression of pre-heating, ignition, and propagation of combustion and to assist in verifying completion of treatment at a given well. Long rigid multilevel thermocouples will be used to speed overall installation, versus requiring a discrete thermocouple installation for each elevation of interest. The standard drive rods will be equipped with a sacrificial tip and driven to the target depth. The thermocouple will then be inserted within the drive rod, and then the drive rod will be withdrawn. The uncollapsed annular space at the top end of the drive rod boring will be backfilled with sand or bentonite. The thermocouples will be connected to the data acquisition system via the wiring bundle that accompanies each air manifold line. The optimum layout of interstitial thermocouples will be determined and defined in the remedial design drawing and specification package; it is currently assumed that approximately two thermocouple bundles (multi-level) will be required for each well.

3.4 Combustion Exhaust Management

In situ combustion, which is a key feature of the STAR process, will produce carbon dioxide (CO_2), carbon monoxide (CO), and water vapor, and the heat of the process will result in the volatilization of a fraction of the target treatment compounds that will be captured and treated prior to discharge. The surface of the treatment zones will be sealed to prevent fugitive losses of combustion products and volatile compounds into the air (described in the RAWP). A series of vapor extraction standpipes will be installed surrounding a treatment cell or group of cells, and the combustion products and volatile compounds will flow to these wells. Vapor extraction well spacing requirements have been estimated based on field measurements of vacuum influence in native on-Site soils; the selected nominal spacing is 25 ft. Soil vapor extraction wells will be operated on an ‘as needed’ basis to capture vapors emitted by the combustion process. Soil vapor probes will be installed, recovered, and re-used as described for the ignition/air injection wells, with re-sealing of the surface vapor cover (asphalt cap) as needed following removal.

Similar to the air injection manifold connections, the vacuum extraction standpipes will be routed to a central manifold via low pressure flexible hose to an extraction blower mounted on the treatment skid. Vacuum conditions will be measured locally and the manifold will

be balanced with manual valves. The blower discharge will be hooked up to the air treatment stage. This recovery method will be essentially identical for shallow (Fill) and deep (Alluvium) STAR processes.

3.5 Vapor Treatment

The captured volatile compounds will be treated via a catalytic, recuperative thermal oxidizer (ThermOx). There will be a dedicated unit for each of the treatment plants, either integrated into or collocated with the treatment skid. This approach is deemed necessary because a single large ThermOx unit cannot accommodate the range of flows encountered when zero, one, two, or three treatment skids are variously on line.

A thermal oxidizer destroys the trace organics in a vapor stream using high temperature combustion under a fixed minimum flame temperature and residence time condition. An external fuel source (propane or natural gas) is typically required to supplement the energy content of the contaminated air stream, particularly at the low contamination levels anticipated in this process. The recuperative aspect of the selected units arises from heat being exchanged between the clean, hot post-combustion exhaust stream and the incoming contaminated stream. Preheating the inlet stream in this manner reduces the energy input required to combust the contaminants. Finally, the presence of a precious metal-based catalyst bed accelerates the combustion reaction and allows it to occur at lower temperatures, which further reduces the supplemental fuel input required to effect complete treatment. This configuration will allow for a tenfold reduction in supplemental fuel relative to a conventional ThermOx unit.

In addition to the main extraction blower, the ThermOx will come equipped with a dedicated supplemental combustion blower. A local control panel will also require its own power.

A continuous emissions monitoring system (CEMS) will be used to measure the characteristics of the exhaust gas prior to treatment, and aid in the estimation of mass destroyed during treatment.

Some degree of preconditioning of the inlet stream may be required to effectively treat the entrained contaminants. The extracted exhaust stream will contain water vapor and may also contain a free hydrocarbon phase, present as an entrained mist or droplets. Residual particulate (ash) from the combustion process may also be present although this may reasonably be expected to remain in the treated soil for the most part. Any residual hydrocarbon thus entrained should be treatable by the thermox without issue, and may reduce the supplemental fuel required. Threshold incoming moisture limits may require a knockout (potentially with coalescer or demister pads) upstream of the thermox, and this

will need to be drained of condensate occasionally. The recovered condensate is anticipated to be treated as a controlled waste.

4. DEPLOYMENT PLAN

The STAR deployment plan will rely on the flexibility, mobility, adaptability, and recyclability of system components (wells, heaters, compressors, blowers, etc.) to complete the remedial action. The remedial design will incorporate a detailed deployment plan for the movement, installation, and use of equipment that will consist of the following components and consider the following assumptions:

- Each set of twenty shallow wells operates for approximately 1.5 days to treat the contaminated zone targeted by these wells (5ft ROI assuming a horizontal propagation velocity of 5 ft/day plus 0.5 days for pre-heat/ignition). For planning purposes a 3-day turnaround is currently assumed for a shallow cell, to account for well installation and process connections;
- Each set of six deep wells operates for approximately 6 days to treat the contaminated zone targeted by these wells (10ft ROI assuming a horizontal propagation velocity of 2 ft/day plus 1 day for pre-heat/ignition). For planning purposes a 7-day turnaround is currently assumed for a deep cell, to account for well installation and process connections;
- Each treatment skid will be constructed with a full 20-element manifold and heater control panel, such that any skid will be able to treat shallow or deep cells;
- A skid will only treat a shallow or deep cell; simultaneous treatment of shallow and deep wells within a given cell area will not be possible due to large differences in cycle time and other process conditions;
- Treatment skids will generally be well separated across the Site to facilitate movement of equipment and personnel and prevent interferences during installation and operation of treatment equipment;
- For some portion of the treatment program it may be advantageous to leave a treatment skid at a dedicated location and switch from deep to shallow treatment, or the reverse.
- Distribution of treatment between fixed and mobile infrastructure (air plant, air treatment, generated power) will be selected to optimize total cost and schedule and conduct the work in a health and safety conscious manner.