N60211_000807
CROWS LANDING
SSIC NO. 5090.3.A

SAP Worksheet #1 -- Title and Approval Page

FINAL ADDENDUM 02 TO FINAL SAMPLING AND ANALYSIS PLAN (SAP)
(Field Sampling Plan and Quality Assurance Project Plan)
September 16, 2009

Document Control Number: TN&A- 1105-0009-0004.A2/F

Bioremediation Treatability Study
IRP Site 17 Administration Area Plume
NASA Crows Landing Flight Facility
Crows Landing, California

Prepared for:

U.S. Department of the Navy
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
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Prepared by:

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Prepared under:

ENVIRONMENTAL MULTIPLE AWARD CONTRACT
Contract Number N68711-04-D-1105
Contract Task Order 0009

Reviewed by: 9/16/2009
OTIE-TN&A QCO Signature
Mr. Richard Baldino

Approved by: 10/13/2009
NAVFAC SW QAO Signature
Mr. Narciso A. Ancog

OTIE-TN&A
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Transmittal Letter

To:	Ms. Diane Silva NAVFAC SW, Administrative Record 1220 Pacific Highway Code EVR, FISC Bldg. 1, 3rd Floor San Diego, CA 92132 (619) 532-3676
From:	Rebecca Lesher — **Date:** October 19, 2009
Re:	**Final Addendum 02 to Final Sampling and Analysis Plan (SAP), Bioremediation Treatability Study, IRP Site 17 Administration Area Plume, NASA Crows Landing Flight Facility, Crows Landing, California** DCN TN&A-1105-0009-0004.A2 **Final Addendum 03 to Final Work Plan, Bioremediation Treatability Study, IRP Site 17 Administration Area Plume, NASA Crows Landing Flight Facility, Crows Landing, California** DCN TN&A-1105-0009-0004.A3 Contract No. N68711-01-D-1105, CTO 0009

Dear Ms. Silva:

Enclosed, please find 2 electronic copies (CD) and 2 paper copies of the ***Final Addendum 02 to Final Sampling and Analysis Plan (SAP), Bioremediation Treatability Study, IRP Site 17 Administration Area Plume, NASA Crows Landing Flight Facility*** and 2 electronic copies (CD) and 2 paper copies of the ***Final Addendum 03 to Final Work Plan, Bioremediation Treatability Study, IRP Site 17 Administration Area Plume, NASA Crows Landing Flight Facility.***

Sincerely,
OTIE - TN & Associates, Inc.

Rebecca Lesher, PG
Project Geologist
rlesher@otiesolutions.com
(619) 230-1712, ext. 31

enclosure

N60211_000807
CROWS LANDING
SSIC NO. 5090.3

FINAL SAMPLING AND ANALYSIS PLAN IS APPENDIX A OF:

FINAL WORK PLAN
BIOREMEDIATION TREATABILITY STUDY
SITE 17 ADMINISTRATION AREA

DATED 17 APRIL 2008

THIS RECORD IS ENTERED IN THE DATABASE AND FILED AS

RECORD NO. N60211_000760

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APPENDIX

Appendix A Laboratory Standard Operating Procedures (SOP) for Silica Gel cleanup of the Extracts EPA 3630

Abbreviations and Acronyms

1,2-DCA	1,2-diochloroethane
bgs	below ground surface
BOD	Biochemical Oxygen Demand
COD	chemical oxygen demand
COPC	Chemicals of Potential Concern
CSIA	carbon specific isotope analysis
CT	carbon tetrachloride
CTO	contract task order
DGs	dissolved gases
EISB	Expanded Enhanced *In Situ* Bioremediation
EMAC	Environmental Multiple Award Contract
EPA	Environmental Protection Agency
FSP	Field Sampling Plan
ft	feet
ID	Identification
IRP	Installation Restoration Program
Mn	Manganese
MNA	Monitored Natural Attenuation
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NASA	National Aeronautics and Space Administration
NAVFAC SW	Naval Facility Southwest
OTIE-TN&A	Oneida Total Integrated Enterprises, LLC. - T N & Associates, Inc.
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAO	Remedial Action Objective
SAP	Sampling and Analysis Plan
SG	Silica gel
SOP	Standard Operating Procedure
TOC	total organic carbon
TPH-DRO	Total Petroleum Hydrocarbons-Diesel Range Organic
TPH-GROs	Total Petroleum Hydrocarbons-Gasoline Range Organics
UFP	Uniform Federal Policy
UST	underground storage tank
VFA	Volatile Fatty Acid
VOC	Volatile Organic Compounds

INTRODUCTION

Oneida Total Integrated Enterprises, LLC. - T N & Associates Inc. (OTIE-TN&A) has received the contract task order (CTO) 0009 from the Department of the Navy, Naval Facilities Engineering Command Southwest (NAVFAC SW), under the Environmental Multiple Award Contract (EMAC), Contract No. N68711-04-D-1105. OTIE-TN&A prepared the Final Sampling and Analysis Plan (SAP) consisting of Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP) under CTO 0009 to conduct a bioremediation treatability study at Installation Restoration Program (IRP) Site 17 Administration Area Plume located at National Aeronautics and Space Administration (NASA) Crows Landing Flight Facility, Crows Landing, California. The Final SAP (FSP/QAPP) was approved by the NAVFAC SW Quality Assurance Officer (QAO) on April 4, 2008. This Addendum 02 will be used in conjunction with the approved Final SAP (FSP/QAPP) and Addendum 01 to the Final SAP. All policies and procedures set forth in the original approved Final SAP and Addendum 01 to Final SAP that were not modified in this Addendum 02 will remain in effect for this pilot study.

The purpose of this Addendum 02 to Final SAP (FSP/QAPP) is to propose additional groundwater and vapor sampling to continue an ongoing bioremediation treatability study (Phase 3) at underground storage tank (UST) Cluster 1 and IRP Site 17. The following are the proposed additional groundwater and vapor monitoring activities for the expanded bioremediation treatability study at UST Cluster 1:

1. Additional operation and monitoring of the biosparge system at UST Cluster 1 for an estimated 3 months followed by temporary closure for 6 months during the rainy season and rebound test to assess long-term effectiveness of biosparge system to reduce the dissolved benzene concentrations. Six groundwater monitoring wells [CL1-MW12(S), CL1-MW12(MS), CL1-MW-19(MS), CL1-MW-20(S), CL1-EX-01(S), and CL1-MW-21(MS)] are proposed for additional two groundwater sampling events (October 2009 and April 2010), well locations are presented in Figure 1. In addition, three vapor monitoring probes (CL1-SV-01A, CL1-SV-01B, and CL1-SV-01C) are proposed for vapor sampling and 12 probes [CL1-SV-01A, CL1-SV-01B, CL1-SV-01C, CL1-MW-02(S), CL1-MW-20(S), CL1-EX-01(S), VP-02A, VP-02B, VP-02C, VP-03A, VP-03B, and VP-03C] for field testing, well locations are presented in Figure 2. Three vapor sampling and field monitoring events are proposed to evaluate efficiency of the biosparge system between April and May 2010. A summary of proposed field activities is provided in Table 1. (WS# 18-A, 20, and 30).
2. In addition to previously approved analytical requirements including Total Petroleum Hydrocarbons – Diesel Range Organics (TPH-DROs) by SW 3520C/8015M, silica gel (SG) cleanup by SW 3630 is proposed for additional TPH-DROs by SW 3520C/8015M for groundwater samples collected for biosparge remediation progress evaluation approved in the Final SAP (TN&A, 2008). The purpose of adding the TPH-DROs SG cleanup is to compare results to the TPH-DROs by SW 3520C/8015M (without SG cleanup). SG cleanup is used to remove polar compound interferences, notably biogenic interferences such as vegetable and animal products (oils, sugars, and fatty acids), but does not affect petroleum hydrocarbons, since most are non-polar. Laboratory Standard Operating Procedures (SOP) describing the procedure of sample preparation using SG cleanup by SW 3630 for TPH-DRO analysis by SW 3520C/8015M is provided in Appendix A. (WS# 18-A, 20, and 30).
3. Groundwater monitoring of chloride, alkalinity, and chemical oxygen demand (COD) included in the list of Monitored Natural Attenuation (MNA) parameters is proposed to be discontinued during the expanded pilot study Phase 3. During the Phase 1 and 2 sufficient data was collected to determine that further monitoring using reduced MNA list

will suffice to evaluate treatability study progress. (WS# 18-A, 20, and 30)

The following are the proposed additional groundwater monitoring activities for the expanded bioremediation treatability study at IRP Site 17:

1. Additional groundwater sampling for upgradient delineation of carbon tetrachloride (CT) plume in shallow groundwater. The proposed groundwater samples will be collected from seven groundwater monitoring wells (17-EX-01, 17-MP-02B, 17-MP-03B, 17-MP-05B, 17-MP-01D, 17-MP-03D, and 17-MP-04D) and up to 14 temporary borings (17-HP1 through 17-HP14). Proposed sampling locations are illustrated in Figure 3. A summary of proposed field activities is provided in Table 1. (WS# 18-B, 20, and 30).
2. Expanded Enhanced *In Situ* Bioremediation (EISB) pilot study (Phase 3) will include additional groundwater sampling at up to 4 wells during baseline sampling, up to 9 wells during post-injection sampling events, and up to 6 select wells for carbon specific isotope analysis (CSIA) evaluation in accordance with the approved Final SAP (TN&A, 2008). A summary of proposed field activities is provided in Table 1. (WS# 18-B, 20, and 30).
3. Groundwater monitoring of chloride, alkalinity, and COD included in the list of MNA parameters is proposed to be discontinued during the expanded pilot study Phase 3. During the Phase 1 and 2 sufficient data was collected to determine that further monitoring using reduced MNA list will suffice to evaluate treatability study progress. (WS# 18-B, 20, and 30).

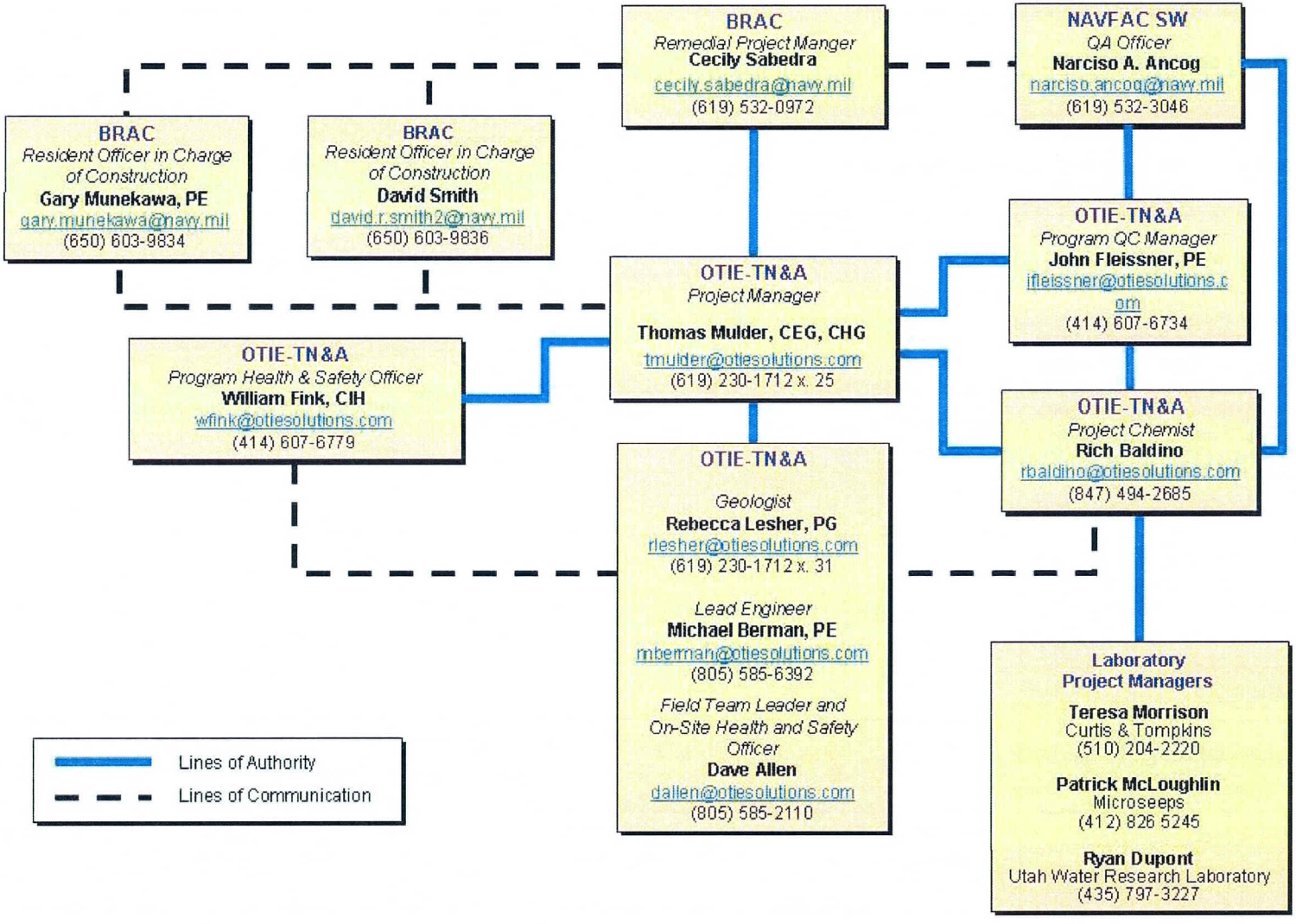
SAP Worksheet #3 -- Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address	Document Control Number (Optional)
Cecily Sabedra	Remedial Project Manager (RPM)	BRAC	(619) 532-0972	cecily.sabedra.ctr@navy.mil	TN&A-1105-0009-0004.A2/D
Gary Munekawa, PE	Resident Officer in Charge of Construction (ROICC)	BRAC	(650) 603-9834	gary.munekawa@navy.mil	TN&A-1105-0009-0004.A2/D
David Smith	ROICC	BRAC	(650) 603-9836	david.r.smith2@navy.mil	TN&A-1105-0009-0004.A2/D
Tom Mulder CEG, CHG	Project Manager	OTIE-TN&A	(619) 230-1712 x25	tmulder@otiesolutions.com	TN&A-1105-0009-0004.A2/D
Mike Berman, PE	Lead Project Engineer	OTIE-TN&A	(805) 585-6392	mberman@otiesolutions.com	TN&A-1105-0009-0004.A2/D
Rebecca Lesher, PG	Project Geologist	OTIE-TN&A	(619) 230-1712 x31	rlesher@otiesolutions.com	TN&A-1105-0009-0004.A2/D
Rich Baldino	Project Chemist	OTIE-TN&A	(847) 494-2685	rbaldino@otiesolutions.com	TN&A-1105-0009-0004.A2/D
Dave Allen	On-site Health and Safety Officer and Field Team Leader	OTIE-TN&A	(805) 585-6394	dallen@otiesolutions.com	TN&A-1105-0009-0004.A2/D
Greg Issinghoff	Project Manager/ Regulator	RWQCB	(559) 488-4390	gissinghoff@waterboards.ca.gov	TN&A-1105-0009-0004.A2/D
Francesca D'Onofrio	Project Manager/ Regulator	DTSC	(916) 255-3603	fdonofri@dtsc.ca.gov	TN&A-1105-0009-0004.A2/D
Alan Berry	Project Manager/ Regulator	CIWMB	(916) 341-6796	aberry@ciwmb.ca.gov	TN&A-1105-0009-0004.A2/D
Don Chuck	Project Manger/ Owner representative	NASA Ames Research Center	(650) 604-0237	donald.m.chuck@nasa.gov	TN&A-1105-0009-0004.A2/D
Nicole Damin	Program Manager/ Permitting agency representative	Stanislaus County	(209) 525-6725	ndamin@envres.org	TN&A-1105-0009-0004.A2/D
Keith Boggs	Program Manager/ Permitting agency representative	Stanislaus County	(209) 525-6333	boggsk@co.stanislaus.ca.us	TN&A-1105-0009-0004.A2/D
Kirk Ford	Program Manager/ Permitting agency representative	Stanislaus County	(209) 525-6330	fordk@co.stanislaus.ca.us	TN&A-1105-0009-0004.A2/D

SAP Worksheet #4 – Project Personnel Sign-Off Sheet

Name	Organization/Title/Role	Telephone Number (optional)	Signature/ email receipt	SAP Section Reviewed	Date SAP Read
Tom Mulder CEG, CHG	OTIE-TN&A / Project Manager	619-230-1712		✓	9-21-9
Rebecca Lesher, PG	OTIE-TN&A / Project Geologist	619·230·1712 x31		All	9·16·9
Dave Allen	OTIE-TN&A / Field Team Leader	(805) 358-9971		ALL	9-16-09
Patrick Devericks	OTIE-TN&A / On-site Health and Safety Officer	(805) 525·6381		ALL	9·21·09
Carol Wortham	Curtis & Tompkins / Laboratory Project Manager	(510) 204-2225		✓	9/21/09
Ryan Dupont, PhD	Utah Water Research Laboratory / Laboratory Project Manager	435/797-3227		All	September 21, 2009
Debbie Hallo	Microseeps, Inc. / Laboratory Project Manager	412-826-6245		9-17-09	9-17-09

SAP Worksheet #5 -- Project Organizational Chart



SAP Worksheet #6 -- Communication Pathways

Communication Drivers	Responsible Affiliation	Name e-mail	Phone Number	Procedure
Manage and oversee the project	Navy Remedial Project Manager	Cecily Sabedra cecily.sabedra.ctr@navy.mil	(619) 532-0972	E-mail/phone communication with Tom Mulder
Manage all Project Phases	OTIE-TN&A Project Manager	Tom Mulder tmulder@tnainc.com	(619) 230-1712 x25	All materials and information about the project will be forwarded by Tom Mulder to Cecily Sabedra. Tom Mulder will notify Cecily Sabedra of field-related problems by phone, email, or fax by COB the next business day.
QA/QC Issues, SAP/SAP Addendum Amendments	NAVFAC SW QA Officer	Narciso A. Ancog narciso.ancog@navy.mil	(619) 532-3046	Any major changes to the SAP must be approved by Nars Ancog before the changes can be implemented. During field work if any sampling or sampling-related procedures are changed, Nars Ancog and Cecily Sabedra will be notified via e-mail within 24 hrs. If there is any work-stoppage due to QA/QC issues, corrective action report will be submitted to Nars Ancog and Cecily Sabedra via e-mail within 24 hrs.
Daily Field Progress Reports	OTIE-TN&A Field Team Leader	Dave Allen dallen@tnainc.com	(805) 340-0376	Dave Allen will e-mail or fax daily field progress reports to Tom Mulder.
Reporting Lab Data Quality Issues	Laboratory QA Manager	Teresa Morrison teresa@ctberk.com	(510) 204-2220	All QA/QC issues with project field samples will be reported by Laboratory QAO to Rich Baldino within 2 business days.
Reporting Lab Data Quality Issues	Laboratory QA Manager	Patrick McLoughlin pmcloughlin@microseeps.com	(412) 826 5245	All QA/QC issues with project field samples will be reported by Laboratory QAO to Rich Baldino within 2 business days.

SAP Worksheet #6 -- Communication Pathways (Continued)

Communication Drivers	Responsible Affiliation	Name e-mail	Phone Number	Procedure
Reporting Lab Data Quality Issues	Laboratory QA Manager	Ryan Dupont rdupo@cc.usu.edu	(435) 797-3227	All QA/QC issues with project field samples will be reported by Laboratory QAO to Rich Baldino within 2 business days.
Field and Analytical Corrective Actions	OTIE-TN&A Project Chemist	Rich Baldino rbaldino@otiesolutions.com	(805) 585-6391	The need for corrective action for field and analytical issues will be determined by Rich Baldino and communicated to Tom Mulder within 2 business days of discovery.
Release of Analytical Data	OTIE-TN&A Project Chemist	Rich Baldino rbaldino@otiesolutions.com	(805) 585-6391	No analytical data can be released until validation is completed and Rich Baldino has approved the release.

SAP Worksheet #7 -- Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Cecily Sabedra	Remedial Project Manager	BRAC	• Responsible for overall project execution and for coordination with base representatives, regulatory agencies, and Navy management • Actively participates in PQO process • Provides management and technical oversight during data collection
Narciso A. Ancog	Navy QA Officer	NAVFAC SW	• Responsible for QA issues for all Navy work • Provides government oversight of OTIE-TN&A's QA program • Reviews and approves SAP and any significant modifications • Has authority to suspend project activities if Navy quality requirements are not met
Tom Mulder CEG, CHG	Project Manager	OTIE-TN&A	• Responsible for implementing all activities called out in CTO • Prepares or supervises preparation of SAP and approves document • Monitors and directs field activities to ensure compliance with SAP requirements
John Fleissner, PE	Program QC Manager	OTIE-TN&A	• Responsible for resolution of QC issues with Navy QA Officer • Provides program-level QA/QC guidance to installation coordinator, project manager, and project team • Identifies nonconformances through QC review activities and recommends corrective action
Rich Baldino	Project Chemist	OTIE-TN&A	• Responsible for defining analytical requirements and developing SAP • May conduct laboratory and field audits • Coordinates with laboratory project manager on analytical requirements, delivery schedules, and logistics • Coordinates independent validation of laboratory data • Reviews laboratory data and validation reports before release to project team • Supports report preparation

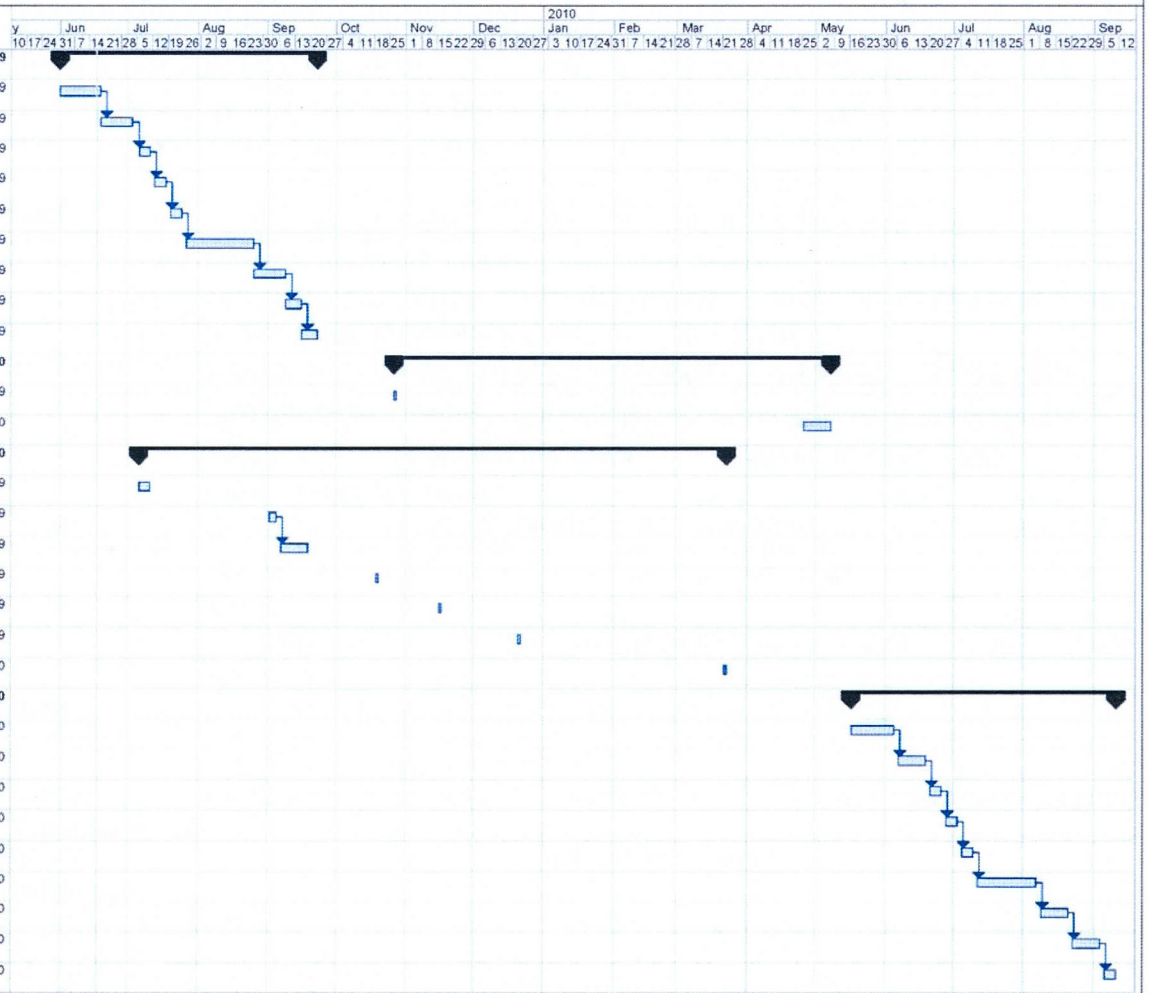
SAP Worksheet #7 -- Personnel Responsibilities and Qualifications Table (Continued)

Name	Title/Role	Organizational Affiliation	Responsibilities
Terry Baker, PG	Database Manager	OTIE-TN&A	• Responsible for developing, monitoring, and maintaining project database under guidance of project manager
Dave Allen	On-Site Health and Safety Officer	OTIE-TN&A	• Responsible for implementing health and safety plan and for determining appropriate site control measures and personal protection levels • Conducts safety briefings for OTIE-TN&A and subcontractor personnel and site visitors • Can suspend operations that threaten health and safety
Dave Allen	Field Team Leader (FTL)	OTIE-TN&A	• Responsible for directing day-to-day field activities conducted by OTIE-TN&A and subcontractor personnel • Verifies that field sampling and measurement procedures follow SAP • Provides project manager with regular reports on status of field activities
Anne Kathain	Laboratory Project Manager	Curtis & Tompkins	• Responsible for delivering analytical services that meet SAP requirements • Reviews SAP to understand analytical requirements • Works with OTIE-TN&A project chemist to confirm sample delivery schedules • Reviews laboratory data package before delivery to OTIE-TN&A
Debbie Hallo	Laboratory Project Manager	Microseeps	• Responsible for delivering analytical services that meet SAP requirements • Reviews SAP to understand analytical requirements • Works with OTIE-TN&A project chemist to confirm sample delivery schedules • Reviews laboratory data package before delivery to OTIE-TN&A
Ryan Dupont, PhD	Laboratory Project Manager	Utah Water Research Laboratory (UWRL)	• Responsible for delivering analytical services that meet SAP requirements • Reviews SAP to understand analytical requirements • Works with OTIE-TN&A project chemist to confirm sample delivery schedules • Reviews laboratory data package before delivery to OTIE-TN&A

SAP Worksheet #16 -- Project Schedule / Timeline Table

Project Schedule
Expanded Bioremediation Treatability Study at IRP Site 17 Administration Area Plume
NASA Crows Landing Flight Facility, Crows Landing, California

ID	Task Name	Duration	Start	Finish
1	**Work Plan and SAP Addendum Preparation**	**81 days**	**Mon 6/1/09**	**Tue 9/22/09**
2	Internal Draft Work Plan & SAP Addendum Preparation	14 days	Mon 6/1/09	Thu 6/18/09
3	Navy Review of ID WP & SAP Addendum	10 days	Fri 6/19/09	Thu 7/2/09
4	Response to Navy Comments	5 days	Mon 7/6/09	Fri 7/10/09
5	Navy Review of RTC	5 days	Mon 7/13/09	Fri 7/17/09
6	Draft Work Plan & SAP Addendum	5 days	Mon 7/20/09	Fri 7/24/09
7	Regulatory Review of Draft Work Plan Addendum	22 days	Mon 7/27/09	Tue 8/25/09
8	Response to Regulatory Comments	10 days	Wed 8/26/09	Tue 9/8/09
9	Navy review of RTC	5 days	Wed 9/9/09	Tue 9/15/09
10	Final Work Plan Addendum	5 days	Wed 9/16/09	Tue 9/22/09
11	**Field Activities at UST Cluster 1**	**139 days**	**Tue 10/27/09**	**Fri 5/7/10**
12	Biosparge System Off	1 day	Tue 10/27/09	Tue 10/27/09
13	Rebound sampling event	10 days	Mon 4/26/10	Fri 5/7/10
14	**Field Activities at IRP Site 17**	**186 days**	**Mon 7/6/09**	**Mon 3/22/10**
15	Aquifer Testing at IRP Site 17	5 days	Mon 7/6/09	Fri 7/10/09
16	Delineation at IRP Site 17 shallow with direct push rig.	3 days	Wed 9/2/09	Fri 9/4/09
17	Injection event	10 days	Mon 9/7/09	Fri 9/18/09
18	Month 1 Sampling Event	1 day	Mon 10/19/09	Mon 10/19/09
19	Month 2 Sampling Event	1 day	Mon 11/16/09	Mon 11/16/09
20	Month 3 Sampling Event	1 day	Mon 12/21/09	Mon 12/21/09
21	Month 6 Sampling Event	1 day	Mon 3/22/10	Mon 3/22/10
22	**Technical Memorandum (TM)**	**85 days**	**Mon 5/17/10**	**Fri 9/10/10**
23	Internal Draft TM Preparation	15 days	Mon 5/17/10	Fri 6/4/10
24	Navy Review of Internal Draft TM	10 days	Mon 6/7/10	Fri 6/18/10
25	Response to Navy Comments	5 days	Mon 6/21/10	Fri 6/25/10
26	Navy Review of RTC	5 days	Mon 6/28/10	Fri 7/2/10
27	Draft TM	5 days	Mon 7/5/10	Fri 7/9/10
28	Regulatory Review of Draft TM	20 days	Mon 7/12/10	Fri 8/6/10
29	Response to Regulatory Comments	10 days	Mon 8/9/10	Fri 8/20/10
30	Navy review of RTC	10 days	Mon 8/23/10	Fri 9/3/10
31	Final TM	5 days	Mon 9/6/10	Fri 9/10/10



Date: Wed 6/17/09

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

Page 1

SAP Worksheet #17 -- Sampling Design and Rationale

1.0 Additional Sampling Design and Rationale

Additional groundwater monitoring at UST Cluster 1 and IRP Site 17 and soil vapor monitoring at UST Cluster 1 will be performed to further evaluate effectiveness of proposed bioremediation technologies in reducing Chemicals of Potential Concern (COPC) contamination of groundwater and vapor and achieving the site-specific Remedial Action Objectives (RAOs). A summary of the proposed monitoring program for both sites is presented in Table 1 of this document. Groundwater and soil vapor monitoring wells included in the proposed monitoring program are listed below:

Pilot Test Area	Sampling Zone	Upgradient	Downgradient	Treatment Zone	Figure Reference for Well Locations
UST Cluster 1	Groundwater Shallow Zone	CL1-MW-20(S)	CL1-EX-01(S)	CL1-MW12(S)	Figure 1
	Groundwater Mid-Shallow Zone	CL1-MW-19(MS)	CL1-MW-21(MS)	CL1-MW12(MS)	Figure 1
	Vapor Shallow Zone	None	None	CL1-SV-01A	Figure 2
	Vapor Mid-Shallow Zone	None	None	CL1-SV-01B	Figure 2
	Vapor Deep Zone	None	None	CL1-SV-01C	Figure 2
IRP Site 17	Shallow	17-MW-23(S)	17-MP-06B	17-MP-02B	Figure 4
	Mid-Shallow	17-MW-23(MS)	17-MW-44(MS)	17-MP-02C	Figure 4
	Mid-Deep	17-MW-14(MD)	17-MW-45(MD)	17-MP-02D	Figure 4

In addition, upgradient delineation at IRP Site 17 is proposed to further define the CT plume extent in shallow groundwater. Groundwater samples will be collected from 7 proposed monitoring wells and up to 14 temporary borings, for well and boring locations refer to Figure 3. Summary of the proposed sampling program is presented in Table 1 of this document.

2.0 Discrete-Depth Groundwater Sampling Methodology

Discrete-depth groundwater samples will be collected from the proposed 14 temporary borings (17-HP1 through 17-HP14 illustrated in Figure 3) using a HydroPunch II™ (QED Environmental Services, Inc.) or equivalent brand device. This sampling procedure provides field-screening type of results that can be used in delineation efforts when groundwater samples cannot be taken using traditional sampling techniques such as low-flow or three well volume purge.

SAP Worksheet #17 -- Sampling Design and Rationale (Continued)

This sampling protocol will be strictly followed to ensure comparability and consistency of the generated data. Sample collection and handling procedures will be properly documented in the field logbooks, groundwater sampling logs, and chain-of-custody forms in accordance with approved SAP (TN&A, 2008).

The following equipment will be required to complete discrete-depth groundwater sampling:

- Personal protective equipment as required by the site-specific Health and Safety Plan
- Decontamination equipment and supplies
- HydroPunch II™ sampling device (or equivalent) provided by drilling subcontractor
- Drill rods having an effective inside diameter of at least 1.25 inches provided by drilling subcontractor
- 1-inch diameter stainless steel or disposable Teflon bailer
- Electronic water-level indicator
- Sample containers provided by the testing laboratory (as required by the approved site-specific SAP)

The following steps will be followed during the collection of discrete-depth groundwater samples:

1. The drilling subcontractor will advance the borehole to an appropriate depth for the collection of groundwater samples. The bottom of the borehole will be approximately 2 feet above the depth from which a discrete water sample is desired.
2. Static water level will be measured below the top of drill casing with an electronic water-level indicator. The depth to water and distance from top of casing to ground surface will be recorded.
3. Prior to each sample collection, the HydroPunch™ sampling device will be decontaminated according to the decontamination procedures in TN&A's SOP No. TNFLDO011A provided in the approved site-specific SAP (TN&A, 2008). The drilling subcontractor will prepare the HydroPunch™ sampling device according to the manufacturer's instructions and lower the device to the bottom of the borehole. Drill rod will be sealed with built-in gaskets, Teflon tape, or an equivalent sealing method.
4. The drilling subcontractor will drive the sampling device to the proper sampling depth into undisturbed materials below the borehole bottom.
5. The drilling subcontractor will withdraw the rod to expose the screen of the sampling device in accordance with manufacturer's instructions.
6. After the sampler is filled with water, collect a groundwater sample by lowering the bailer through the rods and body of the sampler. Raise the bailer gently to prevent excess aeration of the sample.

SAP Worksheet #17 -- Sampling Design and Rationale (Continued)

7. In the event that excess sediment is present in the sample container (approximately more than 0.5 inch in 40-mL vial) and additional purging is not an option due to low productivity of water, additional 3 vials will be filled to provide enough sample volume for completion of the analysis.
8. Laboratory-supplied sample containers are filled with sample and handled in accordance with approved site-specific SAP
9. Field water quality measurements (pH, dissolved oxygen, oxidation-reduction potential, temperature, conductivity, and turbidity) will be performed and recorded in the field logbook and purge/sample log.
10. Sample labeling, control, and shipping will be conducted in accordance with TN&A's SOP No. TNFLDO010C provided in the approved site-specific SAP (TN&A, 2008).
11. Investigation-derived waste will be disposed of following TN&A's SOP No. TNFLDO012A provided in the approved site-specific SAP (TN&A, 2008).

Additional groundwater samples at UST Cluster 1 and IRP Site 17 and soil vapor samples at UST Cluster 1 will be collected in accordance with the approved Final SAP (TN&A, 2008).

SAP Worksheet #18-A -- Sampling Locations and Methods/SOP Requirements Table for UST Cluster 1 Site

Sampling Location / ID Number	Matrix	Depth (ft bgs)	Analytical Group	Frequency and Sampling Events	Number of Samples[1] (identify field duplicates)	Sampling SOP Reference[2]
CL1-MW12(S)	Water	43-68	Volatile Organic Compounds (VOCs), TPH- Gasoline Range Organics (GROs), TPH-DROs, TPH-DROs SG cleanup, Anions (nitrate as N and sulfate), Biochemical Oxygen Demand (BOD), Dissolved Manganese (Mn), dissolved gases (DGs), and Ferrous Iron (Fe2+)	At biosparge system shutdown (October 2009) and 6 months after biosparge system shutdown (April 2010)	2 + FD	TNFLD008F
CL1-MW12(MS)	Water	100-110	VOCs, TPH-GROs, TPH-DROs, TPH-DROs SG cleanup, Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, and Fe2+	At biosparge system shutdown (October 2009) and 6 months after biosparge system shutdown (April 2010)	2	TNFLD008F
CL1-MW-19(MS)	Water	94-104	VOCs, TPH-GROs, TPH-DROs, TPH-DROs SG cleanup, Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, and Fe2+	At biosparge system shutdown (October 2009) and 6 months after biosparge system shutdown (April 2010)	2	TNFLD008F
CL1-MW-20(S)	Water	57-82	VOCs, TPH-GROs, TPH-DROs, TPH-DROs SG cleanup, Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, and Fe2+	At biosparge system shutdown (October 2009) and 6 months after biosparge system shutdown (April 2010)	2	TNFLD008F
CL1-EX-01(S)	Water	56-76	VOCs, TPH-GROs, TPH-DROs, TPH-DROs SG cleanup, Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, and Fe2+	At biosparge system shutdown (October 2009) and 6 months after biosparge system shutdown (April 2010)	2	TNFLD008F
CL1-MW21(MS)	Water	100-110	VOCs, TPH-GROs, TPH-DROs, TPH-DROs SG cleanup, Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, and Fe2+	At biosparge system shutdown (October 2009) and 6 months after biosparge system shutdown (April 2010)	2 + FD	TNFLD008F

SAP Worksheet #18-A -- Sampling Locations and Methods/SOP Requirements Table for UST Cluster 1 Site (Continued)

Sampling Location / ID Number	Matrix	Depth (ft bgs)	Analytical Group	Frequency and Sampling Events	Number of Samples[1] (identify field duplicates)	Sampling SOP Reference[2]
CL1-SV-01A	Vapor	20-30	VOCs, TPH-GROs, TPH-DROs, and Fixed Gases	(1) at system shutdown (October 2009), (2) 6 months after biosparge system shutdown and prior to restart (April 2010), (3) at restart after one complete cycle of operations (approximately day 2 of restart); and (4) 2 weeks after restart (May 2010)	4	TNFLD009D
CL1-SV-01B	Vapor	35-40	VOCs, TPH-GROs, TPH-DROs, and Fixed Gases	(1) at system shutdown (October 2009), (2) 6 months after biosparge system shutdown and prior to restart (April 2010), (3) at restart after one complete cycle of operations (approximately day 2 of restart); and (4) 2 weeks after restart (May 2010)	4	TNFLD009D
CL1-SV-01C	Vapor	45-60	VOCs, TPH-GROs, TPH-DROs, and Fixed Gases	(1) at system shutdown (October 2009), (2) 6 months after biosparge system shutdown and prior to restart (April 2010), (3) at restart after one complete cycle of operations (approximately day 2 of restart); and (4) 2 weeks after restart (May 2010)	4	TNFLD009D

SAP Worksheet #18-B -- Sampling Locations and Methods/SOP Requirements Table for IRP Site 17

Sampling Location / ID Number	Matrix	Depth (ft bgs)	Analytical Group	Frequency and Sampling Events	Number of Samples[1] (identify field duplicates)	Sampling SOP Reference
17-EX-01	Water	60-120	VOCs	Delineation sampling	1 + FD	TNFLD008F
17-MP-02B	Water	69-79	VOCs	Delineation sampling	1	TNFLD008F
			Anions (nitrate as N and sulfate), 1,2-diochloroethane (1,2-DCA), Dissolved Mn, DGs, Fe2+ , TOC, Volatile Fatty Acid (VFAs), and VOCs	Baseline and post-injection sampling (1, 2, 3, and 6 months after injections)	5	
			CSIA (CT & chloroform)	6 months after injections	1	
17-MP-03B	Water	69-79	VOCs	Delineation sampling	1	TNFLD008F
17-MP-05B	Water	69-79	VOCs	Delineation sampling	1	TNFLD008F
17-MP-01D	Water	148-158	VOCs	Delineation sampling	1	TNFLD008F
17-MP-03D	Water	148-158	VOCs	Delineation sampling	1	TNFLD008F
17-MP-04D	Water	148-158	VOCs	Delineation sampling	1	TNFLD008F
17-HP1 through 17-HP14[2]	Water	67-70	VOCs	Delineation sampling	14 + 2 FD	TNFLD008F
17-MW-23(S)	Water	45-70	Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, Fe2+ , TOC, VFAs, and VOCs	Baseline and post-injection sampling (1, 2, 3, and 6 months after injections)	5 + FD	TNFLD008F
17-MW-23(MS)	Water	100-110	Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, Fe2+ , TOC, VFAs, and VOCs	Baseline and post-injection sampling (1, 2, 3, and 6 months after injections)	5	TNFLD008F
17-MW-14(MD)	Water	170-180	Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, Fe2+ , TOC, VFAs, and VOCs	Baseline and post-injection sampling (1, 2, 3, and 6 months after injections)	5 + FD	TNFLD008F

SAP Worksheet #18-B -- Sampling Locations and Methods/SOP Requirements Table for IRP Site 17 (Continued)

Sampling Location / ID Number	Matrix	Depth (ft bgs)	Analytical Group	Frequency and Sampling Events	Number of Samples[1] (identify field duplicates)	Sampling SOP Reference
17-MP-02C	Water	99-109	Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, Fe2+ , TOC, VFAs, and VOCs	Post-injection sampling (1, 2, 3, and 6 months after injections)	4	TNFLD008F
			CSIA (CT & chloroform)	6 months after injections	1	
17-MP-02D	Water	148-158	Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, Fe2+ , TOC, VFAs, and VOCs	Post-injection sampling (1, 2, 3, and 6 months after injections)	4 + FD	TNFLD008F
			CSIA (CT & chloroform)	6 months after injections	1	
17-MP-06B	Water	69-79	Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, Fe2+ , TOC, VFAs, and VOCs	Baseline, post-injection sampling (1, 2, 3, and 6 months after injections)	5	TNFLD008F
			CSIA (CT & chloroform)	6 months after injections	1	
17-MW-44(MS)	Water	100-110	Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, Fe2+ , TOC, VFAs, and VOCs	Post-injection sampling (1, 2, 3, and 6 months after injections)	4 + FD	TNFLD008F
			CSIA (CT and chloroform)	6 months after injections	1	TNFLD008F
17-MW-45(MD)	Water	170-180	Anions (nitrate as N and sulfate), BOD, Dissolved Mn, DGs, Fe2+ , TOC, VFAs, and VOCs	Post-injection sampling (1, 2, 3, and 6 months after injections)	4	TNFLD008F
			CSIA (CT and chloroform)	6 months after injections	1	TNFLD008F

[1] Number of samples represents the total number of samples for the whole duration of the project.
[2] Sampling locations 17-HP1 through 17-HP14 are temporary borings for discrete-depth groundwater sampling to conduct upgradient delineation at IRP Site 17.

SAP Worksheet #20 -- Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations[2]	No. of Field Duplicates	No. of MS/MSDs[1]	No. of Equip. Blanks[3]	No. of Source Blanks[3]	No. of VOA Trip Blanks	No. of PT Samples	Total No. of Samples to Lab
Water	VOCs	74	8	4 / 4	2	1	10	0	103
Water	TPH-GROs	12	0	1 / 1	0	0	0	0	14
Water	TPH-DROs	12	0	1 / 1	0	0	0	0	14
Water	TPH-DROs SG cleanup	12	0	1 / 1	0	0	0	0	14
Water	Sulfate, nitrate as N	53	0	3 / 3	0	0	0	0	59
Water	BOD	53	0	3 / 3	0	0	0	0	59
Water	Ferrous Iron	53	0	3 / 3	0	0	0	0	59
Water	Dissolved Mn	53	0	3 / 3	0	0	0	0	59
Water	Dissolved Gasses	53	0	3 / 3	0	0	0	0	59
Water	Volatile Fatty Acids	41	0	2 / 2	0	0	0	0	45
Water	Total Organic Carbon	41	0	2 / 2	0	0	0	0	45
Water	CSIA (CT and chloroform)	6	0	N/A	0	0	0	0	6
Vapor	VOCs	12	0	N/A	0	0	0	0	12
Vapor	TPH-GROs, and TPH-DROs	12	0	N/A	0	0	0	0	12
Vapor	Fixed Gases	12	0	N/A	0	0	0	0	12

[1] Although the Matrix Spike/Matrix Spike Duplicate (MS/MSD) is not typically considered a field QC it is included here because location determination is often established in the field.
[2] If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location or station.
[3] Groundwater samples will be collected using well-dedicated or disposable equipment and therefore no equipment blanks are anticipated, except for discrete-depth groundwater samples from temporary borings 17-HP1 through 17-HP-14 (WS# 17).

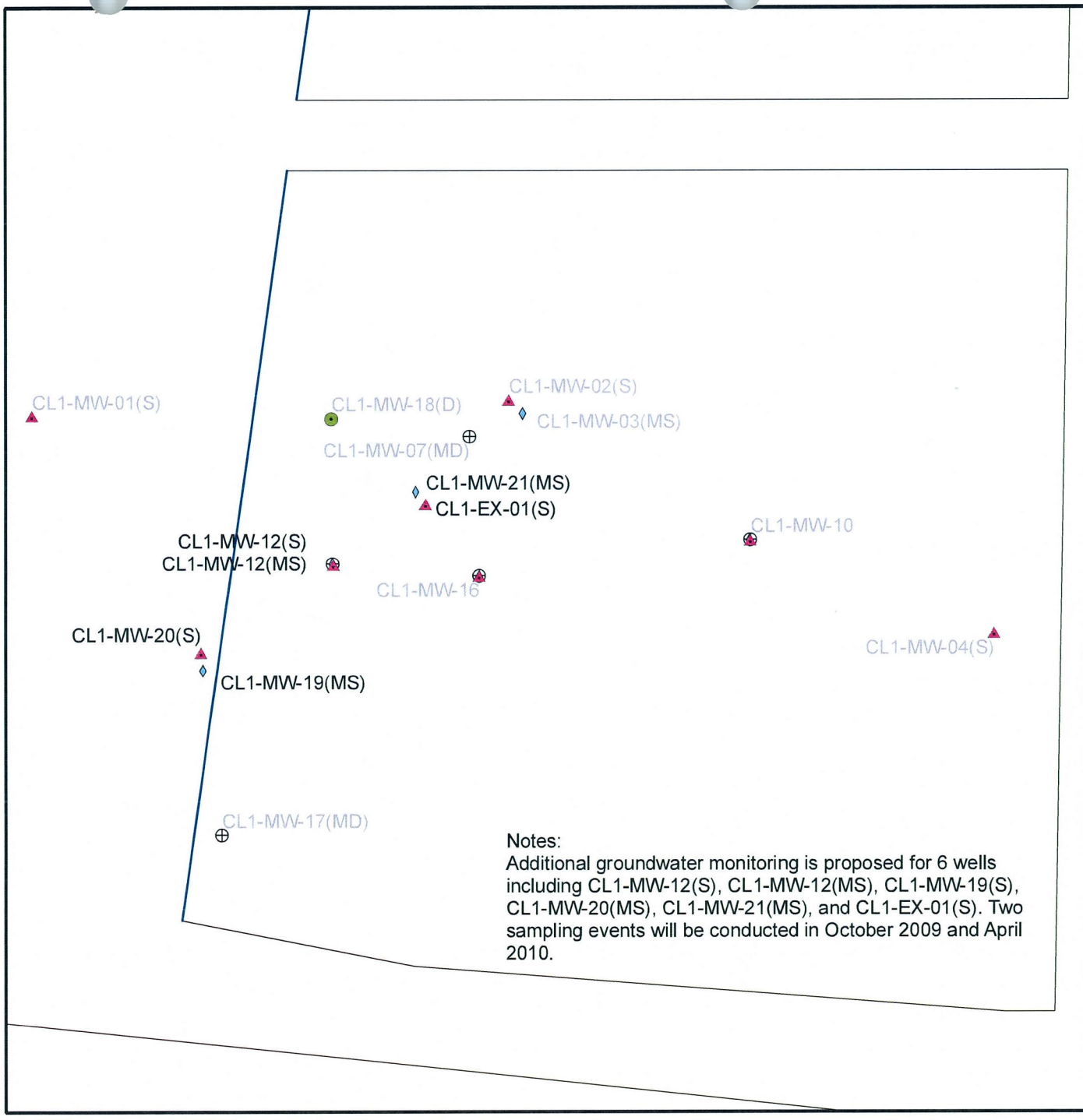
SAP Worksheet #30 -- Analytical Services Table

Matrix	Analytical Group	Sample Locations/ID Number	Analytical Method	Data Package Turnaround Time (working days)	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory / Organization (name and address, contact person and telephone number)
Water	VOCs	**UST Cluster 1** CL1-MW12(S), CL1-MW12(MS), CL1-MW-19(MS), CL1-MW-20(S), CL1-MW-21(MS), and CL1-EX-01(S) **IRP Site 17** 17-EX-01, 17-MP-02B, 17MP-03B, 17-MP-04D, 17-HP1 through 17-HP14 17-MW-23(S), 17-MW-23(MS), 17-MW-14(MD), 17-MP-02C, 17-MP-02D, 17-MP-06B, 17-MW-44(MS), and 17-MW-45(MD)	SW 5030B/8260B	15	Curtis & Tompkins Laboratories, Inc. (Curtis & Tompkins) 2323 5th St. Berkeley, CA 94710 Contact: John Goyette (510) 204-2222	Calscience Environmental Laboratories, Inc. (Calscience) 7440 Lincoln Way Garden Grove, CA 92841 Contact: Kim Banks (714) 895-5494
Water	Sulfate	**UST Cluster 1** CL1-MW12(S), CL1-MW12(MS), CL1-MW-19(MS), CL1-MW-20(S), CL1-MW-21(MS), and CL1-EX-01(S) **IRP Site 17** 17-MW-23(S), 17-MW-23(MS), 17-MW-14(MD), 17-MP-02C, 17-MP-02D, 17-MP-06B, 17-MW-44(MS), and 17-MW-45(MD)	EPA 300.0	15	Curtis & Tompkins (as above)	Calscience (as above)
Water	Nitrate as N		EPA 300.0	15	Curtis & Tompkins (as above)	Calscience (as above)
Water	Ferrous Iron		SM 3500 FeD Mod	15	Curtis & Tompkins (as above)	Calscience (as above)
Water	Dissolved Mn		SW 6010B	15	Curtis & Tompkins (as above)	Calscience (as above)
Water	BOD		SM 5210B	15	Curtis & Tompkins (as above)	Calscience (as above)
Water	Dissolved Gasses		RSK 175	15	Microseeps	Calscience (as above)
Water	Volatile Fatty Acids		EPA 300M	15	Utah Water Research Laboratory Utah State University 8200 Old Main Hill Logan, Utah 84322 Contact: Ryan Dupont, PhD (435) 797-3227	Calscience (as above)
Water	Total Organic Carbon		SM 5310C	15	Curtis & Tompkins (as above)	Calscience (as above)

SAP Worksheet #30 -- Analytical Services Table (Continued)

Matrix	Analytical Group	Sample Locations/ID Number	Analytical Method	Data Package Turnaround Time (working days)	Laboratory / Organization (name and address, contact person and telephone number)	Backup Laboratory / Organization (name and address, contact person and telephone number)
Water	TPH-GROs	**UST Cluster 1** CL1-MW12(S), CL1-MW12(MS), CL1-MW-19(MS), CL1-MW-20(S), CL1-MW-21(MS), and CL1-EX-01(S)	SW 5030B/8015	15	Curtis & Tompkins (as above)	Calscience (as above)
Water	TPH-DROs		SW 3520C/8015	15	Curtis & Tompkins (as above)	Calscience (as above)
Water	TPH-DROs SG cleanup		SW 3520C/3630/ 8015M	15	Curtis & Tompkins (as above)	Calscience (as above)
Vapor	VOCs	**UST Cluster 1** CL1-SV-01A, CL1-SV-01B, and CL1-SV-01C	TO-15	15	Columbia Analytical Services, Inc. (CAS) 2655 Park Center Drive, Ste. A Simi Valley, California 93065 (805) 526-7161	Calscience (as above)
Vapor	TPH-GROs and TPH-DROs		TO-3/TO-14	15	Curtis & Tompkins (as above) / Environmental Analytical Services, Inc. (EAS) 173 Cross Street San Luis Obispo, CA 93401 Contact: Steven Hoyt (805) 781-3585	Calscience (as above)
Vapor	Fixed Gases		ASTM D-1946	15	Curtis & Tompkins (as above) / CAS (as above)	Calscience (as above)

FIGURES



Notes:
Additional groundwater monitoring is proposed for 6 wells including CL1-MW-12(S), CL1-MW-12(MS), CL1-MW-19(S), CL1-MW-20(MS), CL1-MW-21(MS), and CL1-EX-01(S). Two sampling events will be conducted in October 2009 and April 2010.

LEGEND

- Shallow Well
- Mid-Shallow Well
- Mid-Deep Well
- Deep Well
- Former Building
- Road
- Runway/Taxiway

N

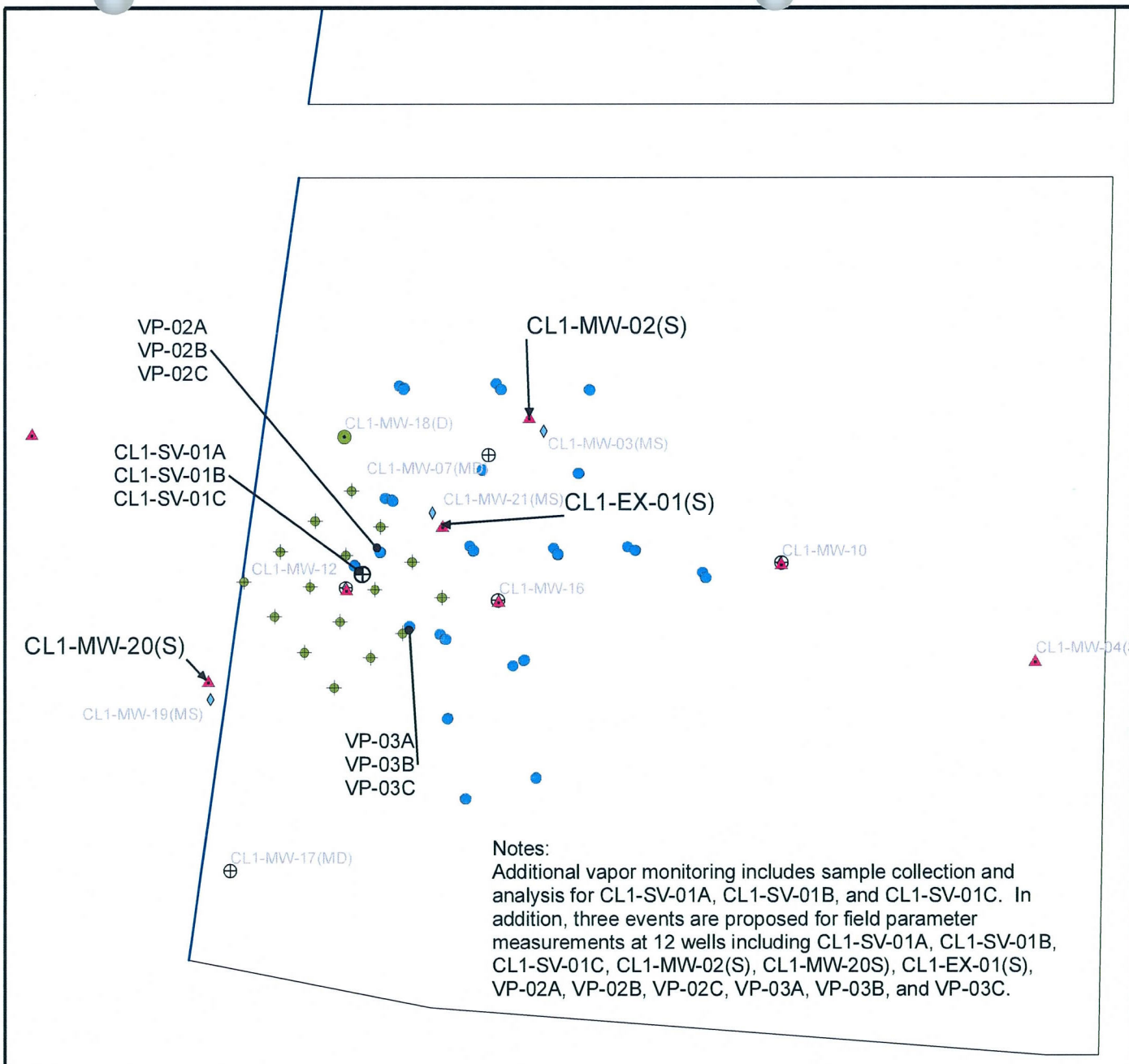
Feet
0 30 60 120

PREPARED: 5/14/2009 REVISED: 5/14/2009

GROUNDWATER SAMPLING LOCATIONS
UST CLUSTER 1
FORMER NASA CROWS LANDING
FLIGHT FACILITY
CROWS LANDING, CALIFORNIA

OTIE-TN&A Oneida Total Integrated Enterprises

FIGURE
1



Notes:
Additional vapor monitoring includes sample collection and analysis for CL1-SV-01A, CL1-SV-01B, and CL1-SV-01C. In addition, three events are proposed for field parameter measurements at 12 wells including CL1-SV-01A, CL1-SV-01B, CL1-SV-01C, CL1-MW-02(S), CL1-MW-20S), CL1-EX-01(S), VP-02A, VP-02B, VP-02C, VP-03A, VP-03B, and VP-03C.

LEGEND

- Shallow Well
- Mid-Shallow Well
- Mid-Deep Well
- Deep Well
- Vapor Well
- SVE Well
- Biosparge Well
- Former Building
- Road
- Runway/Taxiway

N

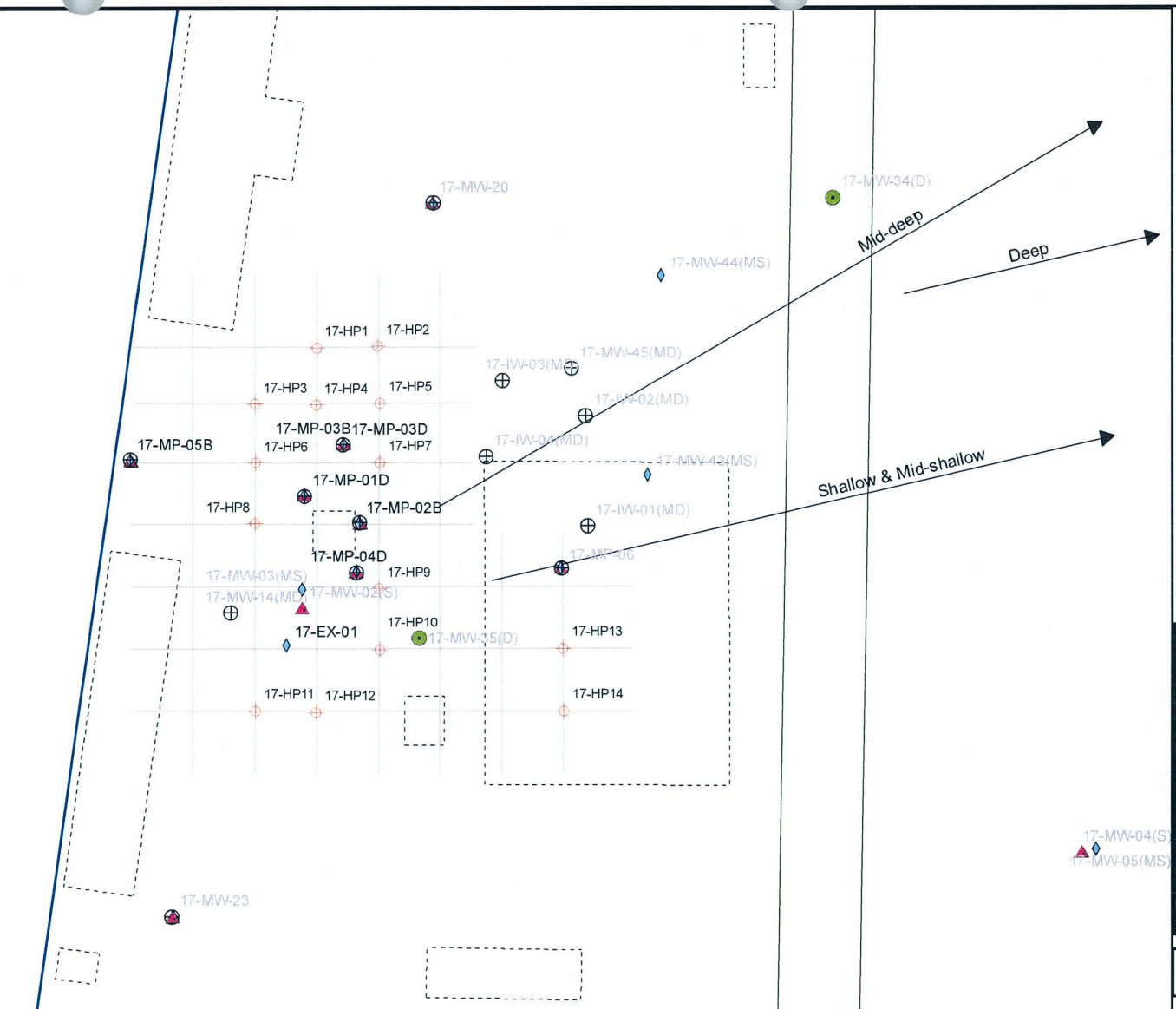
Feet
0 30 60 120

PREPARED: 5/14/2009 REVISED: 5/14/2009

VAPOR SAMPLING LOCATIONS
UST CLUSTER 1
FORMER NASA CROWS LANDING
FLIGHT FACILITY
CROWS LANDING, CALIFORNIA

OTIE-TN&A

FIGURE
2



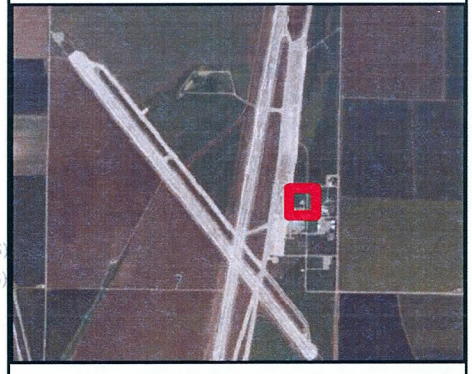
Note:
The proposed groundwater sampling for upgradient delineation will include sample collection from 7 monitoring wells (17-EX-01, 17-MP-02B, 17-MP-03B, 17-MP-05B, 17-MP-01D, 17-MP-03D, and 17-MP-04D) and 14 temporary borings (17-HP1 through 17-HP14).

LEGEND

- Proposed Locations
- Shallow Well
- Mid-Shallow Well
- Mid-Deep Well
- Deep Well
- Approx dir of GW flow
- Former Building
- Grid
- Road
- Runway/Taxiway

N

Feet
0 30 60 120

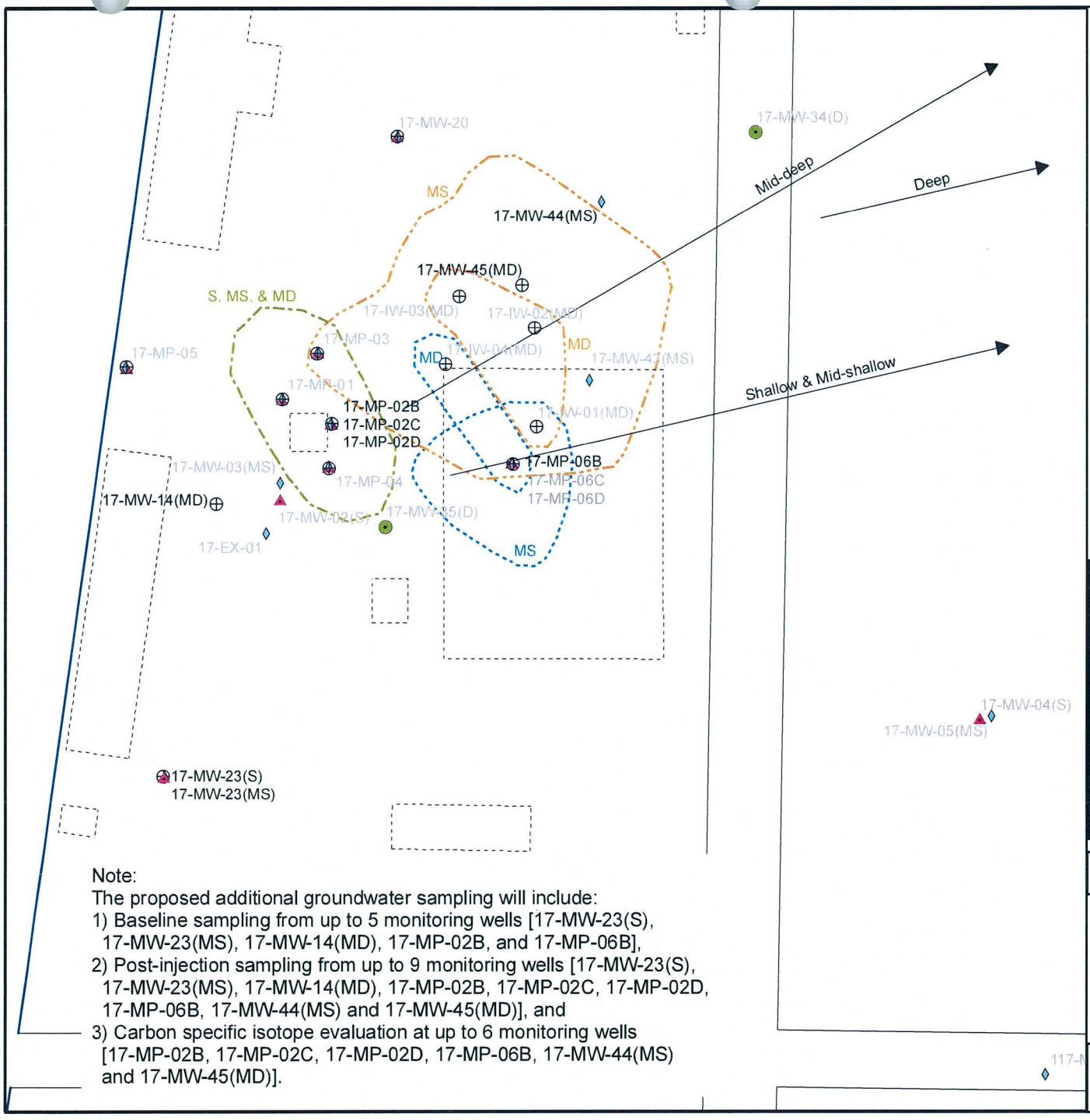


PREPARED: 5/14/2009 REVISED: 5/14/2009

UPGRADIENT DELINEATION SAMPLES
IRP SITE 17
FORMER NASA CROWS LANDING
FLIGHT FACILITY
CROWS LANDING, CALIFORNIA

OTIE-TN&A

FIGURE
3



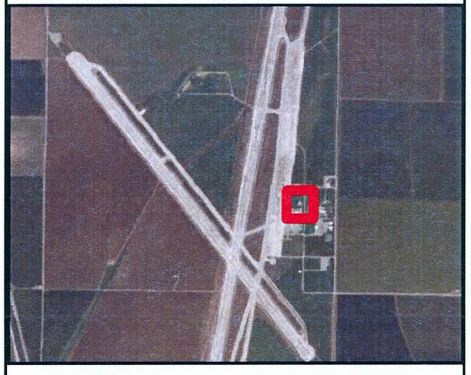
Note:
The proposed additional groundwater sampling will include:
1) Baseline sampling from up to 5 monitoring wells [17-MW-23(S), 17-MW-23(MS), 17-MW-14(MD), 17-MP-02B, and 17-MP-06B],
2) Post-injection sampling from up to 9 monitoring wells [17-MW-23(S), 17-MW-23(MS), 17-MW-14(MD), 17-MP-02B, 17-MP-02C, 17-MP-02D, 17-MP-06B, 17-MW-44(MS) and 17-MW-45(MD)], and
3) Carbon specific isotope evaluation at up to 6 monitoring wells [17-MP-02B, 17-MP-02C, 17-MP-02D, 17-MP-06B, 17-MW-44(MS) and 17-MW-45(MD)].

LEGEND

- Shallow Well
- Mid-Shallow Well
- Mid-Deep Well
- Deep Well
- Approx dir of GW flow
- Former Building
- Road
- Runway/Taxiway
- Ph 1 treatment area
- Ph 2 treatment area
- Approx Ph 3 treatment area

N

Feet
0 35 70 140



PREPARED: 5/14/2009 REVISED: 5/14/2009

PHASE 3 SAMPLE LOCATIONS
IRP SITE 17
FORMER NASA CROWS LANDING FLIGHT FACILITY
CROWS LANDING, CALIFORNIA

OTIE-TN&A
Oneida Total Integrated Enterprises

FIGURE
4

TABLES

TABLE 1
GROUNDWATER AND VAPOR MONITORING PROGRAM FOR EXPANDED TREATABILITY STUDY AT UST CLUSTER 1 and IRP SITE 17
NASA CROWS LANDING FLIGHT FACILITY, CROWS LANDING, CA

Site	Pilot Test Phase	Sampling Event	No. of Events	Well IDs	Matrix	No. of Wells	Analysis & Method	Field Measurements
UST Cluster 1	Groundwater Rebound Testing	1) At biosparge system shutdown (October 2009), and 2) 6 months after biosparge system shutdown (April 2010)	2	CL1-MW12(S), CL1-MW12(MS), CL1-MW-19(MS), CL1-MW-20(S), CL1-EX-01(S), and CL1-MW-21(MS);	Water	6	VOCs by SW 8260B, TPH-GROs by SW 5030B/8015M, TPH-DROs by SW 3520C/8015M, TPH-DROs with silica-gel cleanup by SW 3520C/3630/8015M, and MNA Parameters by various methods	DO, pH, ORP, conductivity, and temperature
			2	CL1-MW02(S), CL1-MW03(MS), CL1-MW-07(MD), CL1-MW12(MD), CL1-MW16(S), CL1-MW16(MS), and CL1-MW16(MD)	Water	7	not applicable (n/a)	DO, pH, ORP, conductivity, and temperature
	Vapor Rebound Testing	1) at system shutdown (October 2009); 2) 6 months after biosparge system shutdown and prior to restart (April 2010); 3) at restart after one complete cycle of operations (approximately day 2 of restart); and 4) 2 weeks after restart (May 2010)	4	CL1-SV-01A, CL1-SV-01B, and CL1-SV-01C;	Vapor	3	TPH-GROs and TPH-DROs by TO-3, VOCs by TO-15, and Fixed Gases (CO_2, O_2, CH_4, and N_2) by ASTM 1946	n/a
			4	CL1-SV-01A, CL1-SV-01B, CL1-SV-01C, CL1-MW-02(S), CL1-MW-20(S), CL1-EX-01(S), VP-02A, VP-02B, VP-02C, VP-03A, VP-03B, and VP-03C;	Vapor	12	not applicable (n/a)	O_2, CO_2, total volatiles, and pressure
IRP Site 17	Prior to Expanded EISB	Upgradient Delineation	1	17-EX-01, 17-MP-02B, 17-MP-03B, 17-MP-05B, 17-MP-01D, 17-MP-03D, 17-MP-04D, and 14 hydropuch samples collected from temporary borings (17-HP1 through 17-HP14)	Water	21	VOCs by SW 8260B	n/a
	Expanded EISB	Baseline Sampling Event	1	17-MW-23(S)**, 17-MW-23(MS), 17-MW-14(MD), 17-MP-02B**, and 17-MP-06B**	Water	5	VOCs by SW 8260B MNA by various methods VFAs by EPA 300.0Mod TOC by 415	DO, pH, ORP, conductivity, and temperature
		Post-injection events: 1, 2, 3, and 6 months after injections	4	17-MW-23(S)**, 17-MW-23(MS), 17-MW-14(MD), 17-MP-02B**, 17-MP-02C, 17-MP-02D, 17-MP-06B**, 17-MW-44(MS), and 17-MW-45(MD);	Water	9	VOCs by SW 8260B MNA by various methods VFAs by EPA 300.0Mod TOC by 415	DO, pH, ORP, conductivity, and temperature
		Carbon specific isotope analysis (CSIA) evaluation 6 months after injections	1	17-MP-02B**, 17-MP-02C, 17-MP-02D, 17-MP-06B**, 17-MW-44(MS), and 17-MW-45(MD);	Water	6	CSIA (CT & chloroform)	n/a

Notes:
1) * CSIA analysis will be performed for wells located within treatment area and downgradient from the treatment area.
2) ** Shallow zone wells are identified here but will only be sampled if substrate is injected into the shallow zone.
3) *** Downgradient monitoring wells may change based on locations of new injection wells. Final locations of wells and designation of monitoring points will be made following delineation phase.
4) MNA parameters will include:
   - Anions (nitrate as N and sulfate) by EPA 300.0
   - Biological oxygen demand by EPA 405.1
   - Dissolved gases (methane, ethane, and ethylene) by RSK 175
   - Dissolved manganese by SW 6010B
   - Ferrous iron by SM 3500FeD Mod
5) VFAs will include at minimum lactic, acetic, propionic, and butyric acid
6) Sample collection and analysis details are provided in the Navy approved project-specific *Sampling and Analysis Plan (TN&A, 2008)*

Acronyms & Abbreviations:
CH_4 - methane
CO_2 - carbon dioxide
CSIA - Compound Specific Isotope Analysis
DO - dissolved oxygen
MNA - monitored natural attenuation
N_2 - nitrogen
O_2 - oxygen
ORP - oxidation-reduction potential
VFAs - volatile fatty acids

APPENDIX A

Laboratory Standard Operating Procedures (SOP) for Silica Gel Clean-up of the Extracts EPA 3630

Curtis & Tompkins, Ltd.

SILICA GEL CLEANUP
Of
TEH EXTRACTS

EPA 3630

Approved by:

A. Elizabeth Cottrell 6/15/01
Extraction Lab Supervisor / Date

Teresa K Morrison 6/8/01
QA Director / Date

05/19/09

Re-approved:

Teresa K Morrison 2/15/04
Signature/ Date

Carol Whitlum 5/15/09
Signature/ Date

Read & Understood by:

Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
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SILICA GEL CLEANUP OF TEH EXTRACTS

SCOPE

This document details the silica gel cleanup of extracts to be later analyzed by for extractable fuel hydrocarbons (TEH). The procedure allows for reporting limits of 50 ug/L in water samples and 1 mg/Kg in soil samples (10 mg/L in the extract).

Silica gel cleanup is used to remove polar compound interferences, notably biogenic interferences – vegetable and animal products (oils, sugars, and fatty acids), but does not affect petroleum hydrocarbons, since most are non-polar.

Recommended for:

1. Aquatic sites because it removes contributions that are due algae and decomposing matter often found in bay mud.
2. Agricultural sites that have never been used for industrial purposes.

REFERENCE

EPA 3630C, Silica Gel Cleanup, SW-846, Update 3, Dec.1996

SAFETY

Assume that all samples contain hazardous and/or potentially toxic materials and should be handled with care. Safety glasses, gloves, and a lab coat should be worn at all times when handling samples, standards, or reagents.

EQUIPMENT

1.0g Silica Gel Cartridges, VWR Catalog# BJ7058G

QC REQUIREMENTS

The size, supplier, and lot number of the silica gel cartridges must be documented in the benchbook, along with the supplier and lot number of the solvent used.

All cartridges must be activated prior to use. A "QC-check" must be performed upon receipt of each lot of cartridges before use on real samples. See Appendix_1 for these procedures.

CLEAN-UP PROCEDURE

The cleanup of TEH extracts has been studied and recoveries of surrogates OTP and hexacosane and target analyte fuels: diesel #2, JP-5, and 10W-40 motor oil have been verified. Any other fuel should be tested prior to cleanup of samples.

1.) The cartridges are 6 mL glass tubes containing 1 gram of silica gel and teflon frits.

2.) Solvent-rinse one receiver for each extract with Dichloromethane.

3.) Place a silica gel cartridge in the vacuum block manifold.

4.) Wash each 1 gram cartridge with at least 3 volumes of Dichloromethane. Wash each 2 gram cartridge with at least 6 volumes of Dichloromethane.

5.) Bring the volume of Dichloromethane right to the top of the frit and add 1.0 mL of extract. Allow this volume to pass into the silica gel.

a.) **1 gram cartridge**: Just before the liquid level drops below the frit, add 2.0 mL of Dichloromethane and place the cartridge in a receiver. Allow all of the solvent to pass through the column.

b.) **2 gram cartridge:** Just before the liquid level drops below the frit, add 1.0 mL of Dichloromethane and allow to pass into the silica gel. Just before the liquid level drops below the frit, add 2.0 mL of dichloromethane and place the cartridge in a receiver. Allow all of the solvent to pass through the column.

Visually monitor the cartridge for possible overloading of the column. If any colored band has passed all the way through the cartridge, the capacity of the column may have been exceeded and the extract may need to be diluted then cleaned again. Document this monitoring step in the laboratory notebook.

6.) When the solvent has all passed through, remove the cartridge and discard.

7.) Place the receiver in a water bath and use a stream of nitrogen to reduce the volume back to 1.0 mL.

8.) Transfer a small aliquot of this extract into an autosampler vial fitted with a low volume insert and crimp seal tightly. Transfer the remainder to a screw cap autosampler vial and label both vials with the sample number, batch number and "S.G."

9.) Place the extracts in Refrigerator #9.

APPENDIX_1: CARTRIDGE SCREENING & ACTIVATION

CARTRIDGE PREP (ACTIVATION & STORAGE)

Before the cartridges can be used, the silica gel must be dried and activated by baking at 140°C for at least 4 hours. Transfer the cartridges from the oven to a dessicator to cool. Store deactivated cartridges in the dessicator.

SCREENING ("QC-check")

Each new lot of cartridges must be screened upon receipt, before being used for samples.

1.) Label 4 cartridges with the new lot# and deactivate described above.
2.) After the cartridges have cooled to room temperature in the dessicator, rinse the cartridges with Dichloromethane.
3.) Create a "QC-check" extract by diluting 1.0 mL TEH spike and 1.0 mL TEH surrogate to 5.0 mL in Dichloromethane. Mix thoroughly.
4.) Using the rinsed cartridges, clean up four 1.0mL aliquots of the extract.
5.) Ask the analysts to run both the remaining uncleaned extract and the four cleaned extracts and calculate the recoveries. The recoveries should be between 85-115%.

CONTAMINATION CHECK

If silica-gel cleaned method blanks are contaminated, verify that the cartridges are not the source of contamination by thoroughly rinsing a cartridge and collecting all of the rinsate in a clean, solvent-rinsed K-D. Concentrate the rinsate almost to dryness, then have the analyst run it and compare the chromatogram to the contamination pattern.