Closed-Loop Bioremediation Pilot Demonstration NWIRP Bethpage, New York

Project Summary 26 March 2005 – 29 April 2005

From 26 March – 29 April, site activities focused on establishing a subsurface bioreactor. Captured, indigenous bacteria, collected since the beginning of the project were deposited in above-ground bio-growth cells (see photo below). Nutrients, including contaminants, surfactant, and growth promoters were added and growth of hydrocarbon degrading bacteria was monitored.

Subsurface introduction of the hydrocarbon degrading bacteria, surfactant, growth promoters, and nutrients began on 8 April 2005, utilizing the surfactant foam as the transport media, and powered by the new, high output 50 hp, 221 cfm compressor (see photo below) that was installed on 7 April 2005. To date, intensive foaming of the wells 7, 8, 9, and 10 to the north and 17, 18, and 19 to the south of the concrete pad has been completed.

The contaminant adsorption and mobilization activities from February through March have resulted in warmer, more liquid phase fuel oil contaminant. As a result, free product recovery was restarted after shutdown over the winter. Collection using skimmer pumps located in MW1 and MW2 have yielded approximately 50 gallons of mobile fuel oil in the last 3 weeks (see photo below).



Free Product Recovery



Indigenous Bacteria Growth Cells



A New High-Capacity Air Compressor For Accelerated Surfactant and Nutrient Foaming

A DIVISION OF AR UTILITY SPECIALISTS, INC. Proprietary Information

Closed Loop Bioremediation Pilot Demonstration

Project Information

Description:	Bioremediation of Diesel and Fuel Oil Impacted Soil
Client:	US Navy (NFESC / EFANE)
Contract Number:	N47408-04-C-7505
Contract Amount:	\$1,673,935
Contract Period:	Feb 2004 – May 2006
Prime Contractor:	Tierra Technologies
Subcontractors:	Locus Technologies, Inc. James Woerner, Inc. Gordon L. Seaman, Inc.
Project Manager:	Dan Lohavanijaya
	602-393-3932 (Phone) 602-509-5766 (Mobile) dan.lohavanijaya@arusi.net
Sr. Engineers:	Edmundo Uribe
	602-431-2175 (Phone) edmundo.uribe@arusi.net
	David Peskin
	602-685-1173 (Phone) peskind@locustec.com

Completed Activities

- Attended RAB Meeting on 6 April 2005
- Groundwater Sampling on 11 April 2005
- Installation of 50 hp, 221 cfm Compressor for Accelerated Subsurface Circulation
- Surfactant + Nutrients Foaming in Wells Surrounding Concrete Pad
- Free Product Recovery (On Going)
 - CLB Vapor Circulation and Treatment - Lines 1 – 5
 - Sparging on all Lines

Current/Future Activities

- Surfactant + Nutrients Foaming in Wells Surrounding Concrete Pad
- Free Product Recovery (On Going)
- CLB Vapor Circulation and Treatment
 - Lines 1 5
 - Sparging on all Lines
- Soil Confirmation Boring # 3 Scheduled for 16-20 May 2005

Current Completion Status

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ntra	ct No.	N47408-04-	C-7505	Tools Name	Duration	Start	Finish	1 12	stor	1 at Quarter	2nd Quarter	2rd Quarter	Ath Quarter	1 at Quarter	and Quarter	2rd Quarter	Ath Quester	Proprieta	1.1
_	0	Phase	ID	Task Name			Finish	% Compl	arter Nov Dec	1st Quarter Jan Feb Mar	2nd Quarter Apr May Jur	3rd Quarter Jul Aug Sep	4th Quarter Oct Nov Dec	1st Quarter Jan Feb Mar	2nd Quarter Apr May Jun	3rd Quarter Jul Aug Sep	4th Quarter Oct Nov Dec	1st Quarter Jan Feb Mar	2nd C ar Apr
_	✓	1000		Task 1 - Pre Design Meeting / Site Walk	56 days	Wed 12/3/03	Thu 2/26/04	100%											
	✓	1010		2 Fact Finding Conference Call	1 day	Wed 12/3/03			- h										
	✓	1020		3 Pre Design Meeting	3 days	Mon 12/15/03			-										
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14		2000		Task 2 - Develop RAP, HASP, System Design Drawings	94 days	Fri 2/27/04	Fri 7/9/04									U			
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20	-	2060	20	NAVFAC, NYSDEC Review of Drafts	29 days	Mon 5/3/04	Fri 6/11/04	100%											
21	-	2070	21	1 Response to NAVFAC, NYSDEC	14 days	Mon 6/14/04	Thu 7/1/04	100%											
22	~	2080	22	2 Final Draft Submission	4 days	Fri 7/2/04	Thu 7/8/04	100%											
23	~	2090	23	Final Draft - Client Approval (not to exceed 45 days)	1 day	Fri 7/9/04	Fri 7/9/04	100%				*							
24	~	3000	24	Task 3 - Site Construction, Environmental, and Drilling Permits	5 days	Fri 2/27/04	Thu 3/4/04	100%		w									
5	~	3010	25	5 Site Construction Permits (if Necessary)	5 days	Fri 2/27/04	Thu 3/4/04	100%		Ĩ									
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7	✓	3030	27	7 Drilling Permits (if Necessary)	5 days	Fri 2/27/04	Thu 3/4/04	100%											
28	\checkmark	3040	28	3 Site Cleared for Work	0 days	Thu 3/4/04	Thu 3/4/04	100%		₹ 3/	1	<u> </u>							
29	\checkmark	4000	29	Task 4 - CLB Well and Piping Infrastructure Installation	44 days	Mon 8/2/04	Fri 10/1/04	100%				•	V						
30	~	4010	30	Utility Location (Potholing)	2 days	Mon 8/2/04	Tue 8/3/04	100%				T I							
31	√ 🄌	4020	31	1 Drilling Mobilization	1 day	Wed 8/4/04	Wed 8/4/04	100%											
32	✓	4030	32		11 days	Thu 8/5/04	Thu 8/19/04	100%											
33	✓	4040	33	3 Drilling and Installation of 6 Shallow Treatment Wells	11 days	Thu 8/5/04	Thu 8/19/04	100%											
34	✓	4060	34		11 days	Thu 8/5/04	Thu 8/19/04	100%											
35	\checkmark	4070	35		0 days	Fri 8/13/04	Fri 8/13/04					8/13							
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37	✓	4090	37		19 days	Mon 8/30/04	Fri 9/24/04												
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40	\checkmark	4500		D Task 4.5 - Power Distribution System	91 days	Mon 4/19/04	Wed 8/25/04				V								
11	✓	4510	41		47 days	Mon 4/19/04	Fri 7/2/04	100%											
12	✓	4520	42		13 days	Mon 8/9/04	Wed 8/25/04		_										
13		5000		Task 5 - Start Up and Operation of the CLB System	468 days	Wed 12/3/03	Mon 10/10/05												
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93 🗸 06 🗸		5250 5315	93 106	3rd Treatment Cycle 4th Treatment Cycle	30 days	Fri 12/3/04 Fri 12/31/04	Tue 1/18/05 Tue 2/15/05	100%
19	_	5380	106	5th Treatment Cycle	32 days 32 days		Tue 2/15/05	100%
32	_	5445	132	6th Treatment Cycle	32 days 39 days	Fri 2/25/05	Thu 4/21/05	100%
45	_	5510	145	7th Treatment Cycle	32 days		Mon 5/23/05	58%
58	_	5575	158	8th Treatment Cycle	31 days	Thu 5/5/05	Mon 6/20/05	0%
71		5640	171	9th Treatment Cycle	32 days	Thu 6/2/05	Tue 7/19/05	0%
84		5705	184	10th Treatment Cycle	31 days	Thu 6/30/05	Mon 8/15/05	0%
97		5770	197	11th Treatment Cycle	32 days		Tue 9/13/05	0%
10		5835	210	12th Treatment Cycle	31 days	Thu 8/25/05	Mon 10/10/05	0%
23		6000	223	Task 6 - Confirmation Borings	225 days	Mon 12/13/04	Fri 10/28/05	31%
24 🗸		6010	224	Soil Confirmation Boring 1	20 days	Mon 12/13/04	Tue 1/11/05	100%
25 🗸		6020	225	Drilling Mobilization	1 day	Mon 12/13/04	Mon 12/13/04	100%
26		6030	226	Drilling and Sample Collection	3 days	Tue 12/14/04	Thu 12/16/04	100%
27 🗸		6040	227	IDW Collection, Transportation, and Disposal	1 day	Fri 12/17/04	Fri 12/17/04	100%
28	۵	6050	228	Soil Analytical	15 days	Mon 12/20/04	Tue 1/11/05	100%
29 🗸		6060	229	Soil Confirmation Boring 2	26 days	Mon 3/7/05	Mon 4/11/05	100%
30 🗸		6070	230	Drilling Mobilization	1 day	Mon 3/7/05	Mon 3/7/05	100%
31		6080	231	Drilling and Sample Collection	5 days	Tue 3/8/05	Mon 3/14/05	100%
32		6090	232	IDW Collection, Transportation, and Disposal	5 days	Tue 3/15/05	Mon 3/21/05	100%
33 🗸		6100	233	Soil Analytical	15 days	Tue 3/22/05	Mon 4/11/05	100%
34		6110	234	Soil Confirmation Boring 3	26 days		Tue 6/28/05	0%
35		6120	235	Drilling Mobilization	1 day	Mon 5/23/05	Mon 5/23/05	0%
36		6130 6140	236 237	Drilling and Sample Collection	5 days	Tue 5/24/05	Tue 5/31/05	0%
37				IDW Collection, Transportation, and Disposal	5 days		Tue 6/7/05	
	_	6150	238	Soil Analytical	15 days	Wed 6/8/05	Tue 6/28/05	0%
39		6160 6170	239 240	Soil Confirmation Boring 4 Drilling Mobilization	26 days	Fri 7/1/05	Mon 8/8/05 Fri 7/1/05	0% 0%
240	_	6180	240	Drilling mobilization Drilling and Sample Collection	5 days	Tue 7/5/05	Mon 7/11/05	0%
41	_	6190	241	IDW Collection, Transportation, and Disposal	5 days 5 days	Tue 7/12/05	Mon 7/18/05	0%
43	_	6200	242	Soil Analytical	15 days		Mon 8/8/05	0%
44	_	6210	243	Soil Confirmation Boring 5	26 days	Fri 8/26/05	Mon 10/3/05	0%
15	_	6220	245	Drilling Mobilization	1 day	Fri 8/26/05	Fri 8/26/05	0%
46	_	6230	246	Drilling and Sample Collection	5 days	Mon 8/29/05	Fri 9/2/05	0%
7	_	6240	247	IDW Collection, Transportation, and Disposal	5 days	Tue 9/6/05	Mon 9/12/05	0%
48		6250	248	Soil Analytical	15 days	Tue 9/13/05	Mon 10/3/05	0%
49	_	6260	249	Soil Confirmation Boring 6	26 days	Fri 9/23/05	Fri 10/28/05	0%
50		6270	250	Drilling Mobilization	1 day	Fri 9/23/05	Fri 9/23/05	0%
:51		6280	251	Drilling and Sample Collection	5 days	Mon 9/26/05	Fri 9/30/05	0%
52		6290	252	IDW Collection, Transportation, and Disposal	5 days	Mon 10/3/05	Fri 10/7/05	0%
53		6300	253	Soil Analytical	15 days	Mon 10/10/05	Fri 10/28/05	0%
54		7000	254	Task 7 - Final Report and Petition for Site Closure	90 days	Mon 10/31/05	Tue 3/7/06	0%
55		7010	255	Final Report - 50% Draft	20 days	Mon 10/31/05	Mon 11/28/05	0%
56		7020	256	Final Report - Draft	20 days	Tue 11/29/05	Tue 12/27/05	0%
57		7030	257	NAVFAC, NYSDEC Review of Drafts	20 days	Wed 12/28/05	Tue 1/24/06	0%
58		7040	258	Final Draft Submission	10 days	Wed 1/25/06	Tue 2/7/06	0%
59		7050	259	Final Draft - Client Approval (not to exceed 45 days)	20 days	Wed 2/8/06	Tue 3/7/06	0%
60		8000		Task 8 - Site Restoration	32 days		Thu 4/20/06	0%
61 🔌		8010	261	Drill Rig Mobilization	1 day			0%
62		8020	262	Well Abandonment	10 days	Thu 3/9/06	Wed 3/22/06	0%
63		8030	263	Drill Rig Demobilization	1 day		Thu 3/23/06	0%
64		8040	264	Site Restoration	20 days		Thu 4/20/06	0%
65		8050 4050		Optional Two Shallow Treatment Well Installation	565 days		Fri 2/24/06 Tue 12/16/03	0% 0%
	_	8060	266 267	Two Shallow Treatment Well Installation Two Shallow Treatment Well Abandonment	10 days		Fri 2/24/06	0%
67		8000	207	I wo Shallow Treatment Well Abandonment	10 days	won 2/13/06	FTI 2/24/06	U%
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