Final Report

Pilot Region-Based Optimization Program for Fund-Lead Sites in EPA Region 3

Site Optimization Tracker: AIW Frank/Mid-County Mustang Site Exton, Pennsylvania

EPA Region III

Solid Waste and Emergency Response (5102P)

EPA 542-R-06-006a
December 2006
www.epa.gov

Pilot Region-Based Optimization Program for Fund-Lead Sites in EPA Region 3

Site Optimization Tracker: AIW Frank/Mid-County Mustang Site Exton, Pennsylvania

EPA Region III

Site Optimization Tracker:

AIW Frank/Mid-County Mustang Site
Exton, Pennsylvania

EPA Region III

December 30, 2005

SECTION 1:

CURRENT SITE INFORMATION FORM

Date: 12/30/05 Filled Out By: GeoTrans, Inc.

A. Site Location, Contact Information, and Site Status

1. Site name	2. Site Location (city and State)	3. EPA Region
AIW Frank/Mid-County Mustang	**Exton, W. Whiteland Twp., PA**	**III**

4a. EPA RPM	5a. State Contact
Charlie Root	**Dave Ewald**
4b. EPA RPM Phone Number	5b. State Contact Phone Number
215-814-3193	**484-250-5725**
4c. EPA RPM Email Address	5c. State Contact Email Address
Root.Charlie@epa.gov	**Dewald@State.pa.us**

5. Is the ground water remedy an interim remedy or a final remedy? Interim [ ] Final [X]

6. Is the site EPA lead or State-lead with Fund money? EPA [X] State [ ]

B. General Site Information

1a. Date of Original ROD for Ground Water Remedy	1b. Dates of Other Ground Water Decision Documents (e.g., ESD, ROD Amendment)
09/29/1995	**N/A**
2a. Date of O&F	2b. Date for transfer to State
3/29/2001	**09/30/2011**

3. What is the primary goal of the P&T system (select one)?

- [ ] Contaminant plume containment
- [ ] Aquifer restoration
- [X] Containment and restoration
- [ ] Well-head treatment

4. Check those classes of contaminants that are contaminants of concern at the site.

- [X] VOCs (e.g., TCE, benzene, etc.)
- [ ] SVOCs (e.g., PAHs, PCP, etc.)
- [ ] metals (e.g., arsenic, chromium, etc.)
- [X] other **1,4-Dioxane (not official COC)**

5. Has NAPL or evidence of NAPL been observed at the site? Yes [ ] No [X]

6. What is the approximate total pumping rate? **100 gpm**

7. How many active extraction wells (or trenches) are there? **4**

8. How many monitoring wells are regularly sampled? **27**

9. How many samples are collected from monitoring wells or piezometers each year? (e.g., 40 if 10 wells are sampled quarterly) **57**

10. How many process monitoring samples (e.g., extraction wells, influent, effluent, etc.) are collected and analyzed each year? (e.g., 24 if influent and effluent are sampled monthly) **32**

11. What above-ground treatment processes are used (check all that apply)?

- [ ] Air stripping
- [X] Carbon adsorption (liquid phase only)
- [ ] Filtration
- [ ] Off-gas treatment
- [ ] Ion exchange
- [ ] Metals precipitation
- [ ] Biological treatment
- [ ] UV/Oxidation
- [ ] Reverse osmosis
- [ ] Other

12. What is the approximate percentage of system downtime per year? 10% [X] 10 - 20% [ ] >20% [ ]

C. Site Costs

1. Annual O&M costs

O&M Category	Actual[1] Annual Costs for FY04	Estimated Annual Costs for FY05[2]	Estimated Annual Costs for FY06[3]
Labor: project management, reporting, technical support	**$29,909**	**$28,000**	**$28,000**
Labor: system operation	**$86,416**	**$80,000**	**$80,000**
Labor: ground water sampling	**$31,845**	**$32,000**	**$32,000**
Utilities: electricity	**$21,180**	**$22,000**	**$7,000***
Utilities: other	**$14,824**	**$14,000**	**$14,000**
Consumables (GAC, chemicals, etc.)	**$27,108**	**$25,000**	**$25,000**
Discharge or disposal costs	**$3,803**	**$2,000**	**$2,000**
Analytical costs	**$12,500****	**$12,500****	**$8,000****
Other (parts, routine maintenance, etc.)	**$45,894**	**$48,000**	**$48,000**
O&M Total	**$273,479**	**$263,500**	**$244,000**

The O&M total should be equal to the total O&M costs for the specified fiscal years, including oversight from USACE or another contractor. For costs that do not fit in one of the above cost categories, include them in the "Other" category. If it is not possible to break out the costs into the above categories, use the categories as best as possible and provide notes in the following box.

2. Non-routine or other costs			
		$90,000***	**$90,000*****

Additional costs beyond routine O&M for the specified fiscal years should be included in the above spaces. Such costs might be associated with additional investigations, non-routine maintenance, additional extraction wells, or other operable units. The total costs billed to the site for the specified fiscal years should be equal to the O&M total plus the costs entered in item 2.

Notes on costs:

1. Costs, with the exception of the analytical costs, were provided by the RPM.

2. FY05 costs, with the exception of the analytical costs, were projected by the RPM.

3. FY06 costs were estimated by the ROET based on the RPM FY05 projections, discussions and discussions during the optimization follow-up meetings.

* Decrease in electricity reflects the expected savings in reduced electricity usage from implementing an optimization evaluation recommendation to streamline the VOC removal process. The RPM estimates savings between $12,000 and $18,000 per year.

** Analytical costs were estimated by the ROET based on the sampling program. The analytical costs are not incurred by the EPA site team because the samples are analyzed by the CLP program. However, analytical costs similar to those estimated by the ROET, will likely be incurred by the State if/when the site is transferred to the State after LTRA. The decrease from FY05 to FY06 reflects a sampling reduction undertaken by the site team.

*** The $90,000 spent in FY05 reflects the application of in-situ chemical oxidation. The same expenditure in FY06 assumes that a second application would occur.

D. Five-Year Review

1. Date of the Most Recent Five-Year Review	**N/A - Initial 5yr Review - 11/2005**

2. Protectiveness Statement from the Most Recent Five-Year Review

- ☐ Protective
- ☐ Not Protective
- ☐ Protective in the short-term
- ☐ Determination of Protectiveness Deferred

3. Please summarize the primary recommendations in the space below

E. Other Information

If there is other information about the site that should be provided please indicate that information in the space below. Please consider enforcement activity, community perception, technical problems to be addressed, and/or areas where a third-party perspective may be valuable.

Residences near the site that have wells have been placed on public water. Their wells have not been abandoned so that they can continue to be monitored as part of the ground water monitoring program. Three wells are sampled annually. This sampling is included in the value for item B.9 of this form.

1,4-Dioxane has been found in ground water at approximately 250 ug/L and in the influent at 8 to 10 ug/L. No reduction in 1,4-Dioxane is expected through the treatment train, and the site team does not have a documented discharge limit for it. For reference, the most stringent Pennsylvania Medium Specific Concentration (MSC) for 1,4-Dioxane is 5.6 ug/L. Recent efforts by the site team suggest tha the discharge limit, if applied to the site, might be as high as 200 ug/L.

Section B.11 of this form indicates liquid phase carbon is utilized for treatment and reflects recent implementation of recommendation to streamline the VOC removal process. Previously, the treatment plant included air stripping with off-gas treatment and liquid phase GAC.

SECTION 2:

FOLLOW-UP HISTORY AND SUMMARIES

Note: Follow-up summaries are provided in reverse chronological order and include updated and/or new recommendations.

FOLLOW-UP HISTORY

Date of Original Optimization Evaluation	December 15, 2004 (Evaluation meeting) July 29, 2005 (Final Report)

	Meeting Date	Report Date	Item
X	July 20, 2005	July 29, 2005	Follow-Up #1 (conducted as part of pilot project)
X	November 7, 2005	December 30, 2005	Follow-Up #2 (conducted as part of pilot project)
			Follow-Up #3
			Follow-Up #4
			Follow-Up #5
			Follow-Up #6
			Follow-Up #7
			Follow-Up #8

"x" in box indicates the item has been completed

SUMMARY OF FOLLOW-UP #2

Site or System Name	AIW Frank/Mid-County Mustang Site
Date of This Follow-Up Summary	December 30, 2005
Date of Follow-Up Meeting or Call (Indicate if Meeting or Call)	November 7, 2005 – Meeting

ROET MEMBERS CONDUCTING THE FOLLOW-UP EVALUATION:

Name	Affiliation	Phone	Email
Norm Kulujian	U.S. EPA Region 3	215-814-3130	kulujian.norm@epa.gov
Kathy Davies	U.S. EPA Region 3	215-814-3315	davies.kathy@epa.gov
Paul Leonard	U.S. EPA Region 3	215-814-3350	Leonard.paul@epa.gov
Peter Schaul	U.S. EPA Region 3	215-814-3183	schaul.peter@epa.gov
Peter Rich	GeoTrans, Inc.	410-990-4607	prich@geotransinc.com
Rob Greenwald	GeoTrans, Inc.	732-409-0344	rgreenwald@geotransinc.com
Doug Sutton	GeoTrans, Inc.	732-409-0344	dsutton@geotransinc.com
Steve Chang	U.S. EPA OSRTI	703-603-9017	Chang.steven@epa.gov

SITE TEAM MEMBERS (INCLUDING CONTRACTORS) INTERVIEWED

Name	Affiliation	Phone	Email
Charlie Root	U.S. EPA Region 3 (RPM)	215-814-3193	Root.charlie@epa.gov

Implementation Status of All Recommendations Under Consideration but not Previously Implemented

Recommendation	**E-2.1 Verify Appropriate Discharge and Cleanup Standards for 1,4-Dioxane**		
Recommendation Reason	Protectiveness	**Implementation Status**	In progress
Comments: The site team has not yet completed implementation of this recommendation but has initiated discussion with the State. Until the issue is resolved, the site team will likely assume that the most stringent MSC of 5.6 ug/L (based on potential impacts from discharge to surface water) will apply to both the cleanup and discharge limits. During the follow-up meeting, members of the ROET indicated that ground water standards for 1,4-Dioxane at other sites in Pennsylvania range from 5.6 ug/l to 200 ug/l. The highest observed ground water concentration in the last sampling round (May 2005) was 140 ug/l.			

Recommendation	**E-3.1 Streamline VOC Removal Processes**		
Recommendation Reason	Cost Reduction	**Implementation Status**	Implemented
Comments: The site team coordinated a pilot test of bypassing the tray aerator (e.g., relying on liquid phase GAC for treatment) with the most recent GAC replacement. The pilot lasted approximately 3 months and the site team has learned that liquid phase GAC will provide reliable treatment of the influent VOCs (excluding 1,4-Dioxane). The site team has moved forward with adopting this treatment approach and estimates savings on the order of approximately $1,000 to $1,500 per month due to reduced electrical costs. The absence of the air stripper has also reduced the fouling of the GAC. The site team anticipates that GAC usage will remain the same but that the changeouts will be easier. Savings may result from the easier GAC changeouts. Given the success of this pilot test and the simplicity of moving forward with this approach, the site team will not evaluate bypassing the liquid phase GAC and relying on air stripping for VOC removal. The site team recognizes that both air stripping and GAC are ineffective at removing 1,4-Dioxane and that other treatment technologies will likely be required if the 1,4-Dioxane requires treatment.			

Recommendation	**E-5.1 Consider In-Situ Chemical Oxidation (Fenton's Reagent) Pilot Test in the Source Area**		
Recommendation Reason	Site Closeout	**Implementation Status**	Implemented
Comments: The site team is moving forward with a variation of this recommendation. To save cost and increase the likelihood that oxidant will be injected into the same fractures that are impacted, the site team will inject the oxidant into an old injection well (thought to be used for previous discharges of contamination by the facility) or into EW-4, which has some of the highest TCE and 1,4-dioxane concentrations at the site. The evaluation team agrees with this approach. The site team has also decided to inject permanganate instead of Fenton's Reagent (which was suggested by the ROET). Injections occurred in November, and overall cost for the work is approximately $90,000, including a total of five sampling events. The use of permanganate in place of Fenton's Reagent has both advantages and disadvantages. An advantage is that permanganate has a longer residence time in the subsurface, allowing injection from few locations to address a larger area. The use of permanganate is therefore one of the factors that has allowed the site team to apply in-situ chemical oxidation (along with the appropriate sampling) for approximately $90,000 compared to the higher estimate of $250,000 to $300,000 for Fenton's Reagent. However, permanganate is not a strong enough oxidant to remediate the 1,4-Dioxane, and a primary intent of the ROET's recommendation was to address the 1,4-Dioxane. This disadvantage is mitigated by recent findings by EPA that suggest an appropriate discharge standard for 1,4-Dioxane might be as high as 200 ug/L due to the relatively small effects on aquatic life.			

Key for recommendation numbers:

- *E denotes a recommendation from the original optimization evaluation*
- *F1, F2, etc. denote recommendations from the first, second, etc. follow-up meeting*
- *The number corresponds to the number of the recommendation as stated in the optimization evaluation or follow-up summary where the recommendation was provided*

RECOMMENDATIONS PREVIOUSLY IMPLEMENTED OR THAT WILL NOT BE IMPLEMENTED

Recommendation	**E-4.1 Add Influent Concentration Trend Graphs to the Monitoring Reports**		
Recommendation Reason	Technical Improvement	**Implementation Status**	Implemented
Comments: The site team reports that these changes have been implemented.			

Recommendation	**E-4.2 Modify Discussion of 1,1,1-Trichloroethane in the Reports**		
Recommendation Reason	Technical Improvement	**Implementation Status**	Implemented
Comments: The site team reports that these changes have been implemented.			

Key for recommendation numbers:

- *E denotes a recommendation from the original optimization evaluation*
- *F1, F2, etc. denote recommendations from the first, second, etc. follow-up meeting*
- *The number corresponds to the number of the recommendation as stated in the optimization evaluation or follow-up summary where the recommendation was provided*

OTHER CHANGES, UPDATES, OR SIGNIFICANT FINDINGS SINCE LAST FOLLOW-UP

- None.

NEW OR UPDATED RECOMMENDATIONS FROM THIS FOLLOW-UP

- None.

SUMMARY OF FOLLOW-UP #1

Site or System Name	AIW Frank/Mid-County Mustang Site
Date of This Follow-Up Summary	July 29, 2005
Date of Follow-Up Meeting or Call (Indicate if Meeting or Call)	July 20, 2005 – Meeting

ROET MEMBERS CONDUCTING THE FOLLOW-UP EVALUATION:

Name	Affiliation	Phone	Email
Norm Kulujian	U.S. EPA Region 3	215-814-3130	kulujian.norm@epa.gov
Kathy Davies	U.S. EPA Region 3	215-814-3315	davies.kathy@epa.gov
Paul Leonard	U.S. EPA Region 3	215-814-3350	Leonard.paul@epa.gov
Peter Rich	GeoTrans, Inc.	410-990-4607	prich@geotransinc.com
Rob Greenwald	GeoTrans, Inc.	732-409-0344	rgreenwald@geotransinc.com
Doug Sutton	GeoTrans, Inc.	732-409-0344	dsutton@geotransinc.com

SITE TEAM MEMBERS (INCLUDING CONTRACTORS) INTERVIEWED

Name	Affiliation	Phone	Email
Charlie Root	U.S. EPA Region 3 (RPM)	215-814-3193	Root.charlie@epa.gov
Bruce Rundell	U.S. EPA Region 3 (Hydro)	215-814-3317	Rundell.bruce@epa.gov

IMPLEMENTATION STATUS OF PREVIOUSLY IDENTIFIED RECOMMENDATIONS

Recommendation	**2.1 Verify Appropriate Discharge and Cleanup Standards for 1,4-Dioxane**		
Recommendation Reason	Protectiveness	**Implementation Status**	In progress
Comments: The site team has not yet completed implementation of this recommendation but has initiated discussion with the State. Until the issue is resolved, the site team will likely assume that the most stringent MSC of 5.6 ug/L will apply to both the cleanup and discharge limits.			

Recommendation	**3.1 Streamline VOC Removal Processes**		
Recommendation Reason	Cost Reduction	**Implementation Status**	Substantial Progress
Comments: The site team coordinated a pilot test of bypassing the tray aerator (e.g., relying on liquid phase GAC for treatment) with the most recent GAC replacement. The pilot has lasted approximately 3 months and the site team has learned that liquid phase GAC will provide reliable treatment of the influent VOCs (excluding 1,4-Dioxane). The site team is planning to move forward with adopting this treatment approach and is attempting to quantify the estimated savings. Given the success of this pilot test and the simplicity of moving forward with this approach, the site team will not likely evaluate bypassing the liquid phase GAC and relying on air stripping for VOC removal. The site team recognizes that both air stripping and GAC are ineffective at removing 1,4-Dioxane and that other treatment technologies will likely be required if the 1,4-Dioxane is not removed by the in-situ methods.			

Recommendation	**4.1 Add Influent Concentration Trend Graphs to the Monitoring Reports**		
Recommendation Reason	Technical Improvement	**Implementation Status**	Implemented
Comments: The site team reports that these changes have been implemented.			

Recommendation	**4.2 Modify Discussion of 1,1,1-Trichloroethane in the Reports**		
Recommendation Reason	Technical Improvement	**Implementation Status**	Implemented
Comments: The site team reports that these changes have been implemented.			

Recommendation	**5.1 Consider In-Situ Chemical Oxidation (Fenton's Reagent) Pilot Test in the Source Area**		
Recommendation Reason	Site Closeout	**Implementation Status**	In progress
Comments: The site team is moving forward with a variation of this recommendation. To save cost and increase the likelihood that oxidant will be injected into the same fractures that are impacted, the site team will inject the oxidant into an old injection well (thought to be used for previous discharges of contamination by the facility) or into EW-4, which has some of the highest TCE and 1,4-dioxane concentrations at the site. The evaluation team agrees with this approach. The RPM expects a scoping document and cost estimate for the pilot test by the end of July and expects that field work may begin in September. The expected cost is substantially lower than that estimated by the evaluation team due to the use of existing wells (RPM indicated they have requested $90,000 for this effort).			

OTHER CHANGES, UPDATES, OR SIGNIFICANT FINDINGS SINCE LAST FOLLOW-UP

- None.

NEW OR UPDATED RECOMMENDATIONS FROM THIS FOLLOW-UP

- None.

UPDATED COST SUMMARY TABLE

Recommendation	Reason	Implementation Status	Estimated Capital Costs ($)	Actual Capital Costs ($)	Estimated Change in Annual Costs ($/yr)	Actual Change in Annual Costs ($/yr)
Original Optimization Evaluation Recommendations						
2.1 Verify Appropriate Discharge and Cleanup Standards for 1,4-Dioxane	Protectiveness	In progress	$0		$0	
3.1 Streamline VOC Removal Processes	Cost Reduction	Implemented	$0	$0*	($12,000 to $20,000)*	($12,000 to $18,000)
4.1 Add Influent Concentration Trend Graphs to the Monitoring Reports	Technical Improvement	Implemented	$0	<$500	$0	<$500
4.2 Modify Discussion of 1,1,1-Trichloroethane in the Reports	Technical Improvement	Implemented	$0	<$500	$0	<$500
5.1 Consider In-Situ Chemical Oxidation (Fenton's Reagent) Pilot Test in the Source Area	Site Closeout	Implemented	$250,000 to $300,000	$90,000	Not quantified	To be determined
New or Updated Recommendations from Follow-up #1, July 20, 2005						
None.						
New or Updated Recommendations from Follow-up #2, November 7, 2005						
None.						

Costs in parentheses imply cost reductions.

* *In the original evaluation, there were two options (GAC-only and stripping-only). The GAC-only option is the one the site team indicated they piloted and are implementing. After making the change to GAC-only, the RPM estimated an annual cost reduction from electricity usage of approximately $12,000 to $18,000 per year. Actual capital costs are noted as $0 because the site team indicated that the additional costs associated with conducting the pilot were offset by electrical savings.*

APPENDIX: A

ARCHIVE OF TECHNICAL ASSISTANCE PROVIDED BY THE ROET

Note: Technical assistance items are provided in reverse chronological order.

Technical Assistance Item #1
Provided December 30, 2005

Considerations for evaluating results of in-situ chemical oxidation

After modifying the treatment system to use only GAC for VOC removal, the annual O&M costs for the P&T system are approximately $230,000, excluding the costs of laboratory analyses covered by the CLP program. A successful application of in-situ chemical oxidation would substantially decrease the amount of time that this treatment system would need to operate, preferably allowing system shutdown before the site is transferred to the State in 2011. Therefore, the success of in-situ chemical oxidation is closely related to the conditions that would allow the P&T operation to be discontinued.

The P&T system likely only has an influence as far downgradient as EW-3 and EW-6 and TCE appears to be the only contaminant that is consistently above cleanup standards; therefore, evaluating the results of in-situ chemical oxidation should be limited to reductions of TCE in EW-3, EW-6, and areas upgradient of these two wells. Decreases in this upgradient area will eventually translate to decreases at downgradient locations.

As a preliminary analysis based on historical TCE concentrations, the ROET suggests the following example decision tree. This is only a suggestion that has been prepared after a preliminary look at the post-injection sampling results. The site team may have more insight on potential decision points after a more comprehensive review of the data.

- If TCE concentration decreases of less than 25% are noted in OB-1I, MW-108A, MW-111, EW-4, and EW-5 after rebound, a second injection of permanganate will probably not be cost-effective and should probably not be conducted.

- If TCE concentration decreases of more than 25% but less than 90% are noted in the same wells after rebound, then in-situ chemical oxidation will likely substantially decrease the amount of time the system will need to operate, and a second, and possibly a third, injection of permanganate should be considered.

- If TCE concentration decreases of more than 90% are noted in the same wells after one or more injections and after rebound, then the maximum TCE concentration on site will be approximately 200 ug/L, and the site team should consider analyses (potentially including simple analytical modeling) to determine under what conditions the P&T system can be shutdown. Given that there is a history of biodegradation and no immediate receptors downgradient of the site, it is possible that the P&T system could be shutdown in favor of MNA to ultimately achieve cleanup levels.

APPENDIX: B

BASELINE SITE INFORMATION SHEET AND OPTIMIZATION EVALUATION REPORT

Streamlined
Optimization Evaluation Report

AIW Frank/Mid-County Mustang Site
Exton, Pennsylvania

EPA Region III

July 29, 2005

SECTION 1:

BASELINE SITE INFORMATION FORM

Date: 1/14/05 Filled Out By: GeoTrans, Inc.

A. Site Location, Contact Information, and Site Status

1. Site name	2. Site Location (city and State)	3. EPA Region
AIW Frank/Mid-County Mustang	**Exton, W. Whiteland Twp., PA**	**III**

4a. EPA RPM	5a. State Contact
Charlie Root	**Dave Ewald**
4b. EPA RPM Phone Number	5b. State Contact Phone Number
215-814-3193	**484-250-5725**
4c. EPA RPM Email Address	5c. State Contact Email Address
Root.Charlie@epa.gov	**Dewald@State.pa.us**

5. Is the ground water remedy an interim remedy or a final remedy? Interim ☐ Final ☒

6. Is the site EPA lead or State-lead with Fund money? EPA ☒ State ☐

B. General Site Information

1a. Date of Original ROD for Ground Water Remedy	1b. Dates of Other Ground Water Decision Documents (e.g., ESD, ROD Amendment)
09/29/1995	**N/A**
2a. Date of O&F	2b. Date for transfer to State
3/29/2001	**09/30/2011**

3. What is the primary goal of the P&T system (select one)?

- ☐ Contaminant plume containment
- ☐ Aquifer restoration
- ☒ Containment and restoration
- ☐ Well-head treatment

4. Check those classes of contaminants that are contaminants of concern at the site.

- ☒ VOCs (e.g., TCE, benzene, etc.)
- ☐ SVOCs (e.g., PAHs, PCP, etc.)
- ☐ metals (e.g., arsenic, chromium, etc.)
- ☒ other **1,4-Dioxane (not official COC)**

5. Has NAPL or evidence of NAPL been observed at the site? Yes ☐ No ☒

6. What is the approximate total pumping rate? **100 gpm**

7. How many active extraction wells (or trenches) are there? **4**

8. How many monitoring wells are regularly sampled? **27**

9. How many samples are collected from monitoring wells or piezometers each year? (e.g., 40 if 10 wells are sampled quarterly) **57**

10. How many process monitoring samples (e.g., extraction wells, influent, effluent, etc.) are collected and analyzed each year? (e.g., 24 if influent and effluent are sampled monthly) **84**

11. What above-ground treatment processes are used (check all that apply)?

- ☒ Air stripping
- ☒ Carbon adsorption (liquid phase only)
- ☐ Filtration
- ☒ Off-gas treatment
- ☐ Ion exchange
- ☐ Metals precipitation
- ☐ Biological treatment
- ☐ UV/Oxidation
- ☐ Reverse osmosis
- ☐ Other

12. What is the approximate percentage of system downtime per year? 10% ☒ 10 - 20% ☐ >20% ☐

C. Site Costs

1. Annual O&M costs

O&M Category	Actual Annual Costs for FY03	Actual Annual Costs for FY04	Projected Annual Costs for FY05
Labor: project management, reporting, technical support	$23,773	$29,909	$28,000
Labor: system operation	$69,122	$86,416	$80,000
Labor: ground water sampling	$21,155	$31,845	$32,000
Utilities: electricity	$16,156	$21,180	$22,000
Utilities: other	$21,792	$14,824	$14,000
Consumables (GAC, chemicals, etc.)	$35,387	$27,108	$25,000
Discharge or disposal costs	$0	$3,803	$2,000
Analytical costs	EPA CLP	EPA CLP	EPA CLP
Other (parts, routine maintenance, etc.)	$56,711	$45,894	$48,000
O&M Total	$244,096	$260,979	$251,000

The O&M total should be equal to the total O&M costs for the specified fiscal years, including oversight from USACE or another contractor. For costs that do not fit in one of the above cost categories, include them in the "Other" category. If it is not possible to break out the costs into the above categories, use the categories as best as possible and provide notes in the following box.

2. Non-routine or other costs			

Additional costs beyond routine O&M for the specified fiscal years should be included in the above spaces. Such costs might be associated with additional investigations, non-routine maintenance, additional extraction wells, or other operable units. The total costs billed to the site for the specified fiscal years should be equal to the O&M total plus the costs entered in item 2.

Notes on costs:

1. All labor costs include direct, indirects, and fees for all activities and subcontractors associated with the tasks.
2. Electricity increased mainly due to the reduced downtime in FY04 and the FY04/FY05 costs are expected to continue but will be influenced by electricity rates.
3. Other utilities include water, phones, propane gas, security services, mail, reproduction, temp, utilities, etc.
4. Consumables include carbon exchange services, equipment rental, travel expenses, etc.
5. Other (part, routine maintenance, etc.) includes routine O&M subcontractor costs, well maintenance services, etc.

D. Five-Year Review

1. Date of the Most Recent Five-Year Review	**N/A - Initial 5yr Review - 11/08/2005**

2. Protectiveness Statement from the Most Recent Five-Year Review

- ☐ Protective
- ☐ Not Protective
- ☐ Protective in the short-term
- ☐ Determination of Protectiveness Deferred

3. Please summarize the primary recommendations in the space below

E. Other Information

If there is other information about the site that should be provided please indicate that information in the space below. Please consider enforcement activity, community perception, technical problems to be addressed, and/or areas where a third-party perspective may be valuable.

Residences near the site that have wells have been placed on public water. Their wells have not been abandoned so that they can continue to be monitored as part of the ground water monitoring program. Three wells are sampled annually. This sampling is included in the value for item B.9 of this form.

1,4-Dioxane has been found in ground water at approximately 250 ug/L and in the influent at 8 to 10 ug/L. No official discharge or cleanup standards have been applied to the site for this contaminant.

SECTION 2:

STREAMLINED OPTIMIZATION EVALUATION FINDINGS AND RECOMMENDATIONS

AIW Frank/Mid-County Mustang

Date of Evaluation Meeting: December 15, 2004 Date of Final Report: July 29, 2005

ROET MEMBERS CONDUCTING THE STREAMLINED OPTIMIZATION EVALUATION:

Name	Affiliation	Phone	Email
Kathy Davies	U.S. EPA Region 3	215-814-3315	Davies.kathy@epa.gov
Norm Kulujian	U.S. EPA Region 3	215-814-3130	Kulujian.norm@epa.gov
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1.0 SIGNIFICANT FINDINGS BEYOND THOSE REPORTED ON SITE INFORMATION FORM

The evaluation team observed an RPM who appears to be an effective manager of a complex site, making decisions based on a comprehensive understanding of the site that considers the hydrogeology, engineering, costs, and relationships with other entities. The RPM appears to effectively utilize Regional technical resources (e.g., hydrogeologists), and Regional Management appears to be well informed regarding site progress. The observations and recommendations herein are not intended to imply a deficiency in the work of either the designers or operators, but are offered as constructive suggestions in the best interest of the EPA and the public. Recommendations made herein obviously have the benefit of site characterization data and the operational data unavailable to the original designers.

Findings beyond those reported on the site information form include the following:

- Downgradient residential wells (denoted by HW on report tables and figures) have all been disconnected and the residences placed on public water. The wells are still accessible for sampling as monitoring wells. Three of them are sampled on an annual basis for VOCs.

- There are no concerns about new supply wells being installed in the body of the plume. The Chester County Health Department keeps track of wells and is aware of the plume. EPA has annual or biannual meetings to keep the health department updated.

- Given that there are no downgradient receptors, the cleanup philosophy is to control and remediate the source area while applying natural attenuation to the downgradient portion of the plume, which extends approximately 1,500 feet beyond the extraction wells. The maximum TCE concentration in this downgradient portion is approximately 100 ug/L (MW-112B), but most of the concentrations in this area are approximately 10 ug/L.

- Sampling indicates that 1,4-Dioxane is present in the source area at approximately 250 ug/L and in the treatment system influent at approximately 8 to 10 ug/L. No reduction in 1,4-Dioxane is expected through the treatment train, and the site team does not have a documented discharge limit for it. For reference, the most stringent Pennsylvania Medium Specific Concentration (MSC) for 1,4-Dioxane is 5.6 ug/L.

- No formal capture zone analysis has been conducted. The karst geology makes it difficult to reliably determine ground water flow velocities and capture zones based on hydraulic gradients. The site team will rely on sampling results from dowgradient performance wells to evaluate capture. Concentrations that decrease to background would suggest complete capture. Concentrations that remain steady or increase would suggest incomplete capture. The P&T system has only operated for approximately 3 years; therefore, there are not enough data at this point to analyze capture.

- The total extraction rate is approximately 100 gpm from four bedrock extraction wells (EW-3, EW-4, EW-5, and EW-6) completed between 180 and 300 feet below ground surface. Approximately 95 gpm is extracted from EW-6. EW-3 extracts about 5 gpm. Approximately 2 gpm is extracted from EW-4 and EW-5 combined. EW-4 is the extraction well with the highest TCE concentration. It was hydrofraced in 2003 to improve flow.

- Between January 2004 and October 2004 (10 months) TCE influent concentrations ranged from 12 ug/L to 42 ug/L with an average concentration of approximately 29 ug/L. PCE and 1,1,1-TCA influent concentrations were well below their respective MCLs (there is no discharge standard for either constituent). Given a flow rate of 100 gpm, this translates to TCE mass removal of approximately 12 to 13 pounds per year. The influent concentrations have decreased by 80% since start up in November 2000.

- The treatment system is designed for a capacity of 200 gpm and is operating at approximately half capacity. It consists of the following items:

  - 400-gallon equalization tank
  - two parallel 25-micron bag filters
  - one QED 24.4 tray aerator (which has two subunits arranged in parallel) with a 10 HP blower
  - 15-HP tray-aerator effluent pump
  - eight parallel 10-micron bag filters
  - two 5,000-pound liquid phase GAC units in series
  - 12-kW tray-aerator off-gas heater
  - two 3,000-pound vapor phase GAC units in series
  - discharge to either a pond for spray irrigation (not used) or to surface water

- The air strippers were designed for relatively low efficiency (approximately 90%) and efficiency is further hampered by calcium fouling. The trays are being cleaned quarterly at which time the calcium deposits must be drilled and chipped away in a process that requires 2 days. Bag filters require replacement weekly and liquid phase GAC replacement is on an every 3 to 4 month frequency due to fouling/channelizing of the GAC (not contaminant loading).

- The site has effectively negotiated a reasonable arsenic discharge limit. The original limit was lower than background concentrations. With the help of the State the NPDES permit was modified accordingly.

- The contractor provides all site data in electronic format to EPA and PADEP. These data include all laboratory and field data in a Microsoft Access™ database designed by the Region, and all site maps are provided in CAD format. These data are incorporated into an Intranet-based GIS system and used to track remedial progress.

2.0 RECOMMENDATIONS TO IMPROVE SYSTEM PROTECTIVENESS

2.1 VERIFY APPROPRIATE DISCHARGE AND CLEANUP STANDARDS FOR 1,4-DIOXANE

Given that 1,4-Dioxane is present at concentrations up to 250 ug/L in ground water and is likely being discharged in the treatment plant effluent at approximately 8 to 10 ug/L, EPA and PADEP should work together to verify the appropriate discharge and cleanup standards for 1,4-Dioxane. PADEP has developed Medium Specific Concentrations (MSCs) for 1,4-

Dioxane that are specific to used and unused aquifers in residential and non-residential areas. The most stringent MSC for 1,4-Dioxane is 5.6 ug/L but another less stringent standard of 24 ug/L might also apply. Implementing this recommendation should not require immediate costs being directly assigned to the site, but may impact site closeout (discussed in Section 5.1).

3.0 RECOMMENDATIONS TO REDUCE SYSTEM COST

3.1 STREAMLINE VOC REMOVAL PROCESSES

With designed efficiency of only 90% removal, the effluent from the tray-aerators has historically required polishing with liquid phase GAC to meet TCE discharge standards, especially given the potential for fouling due to calcium. However, influent concentrations are sufficiently low that TCE treatment could likely be accomplished with either the tray-aerators or the GAC (i.e., likely does not require both). It is recommended that the site team further evaluate the following two options and implement the most promising one. The options are ordered below by greatest potential O&M savings without sacrificing effectiveness.

- Clean the tray aerators on a more frequent basis (perhaps biweekly or monthly) using a power washer and bypass the liquid phase GAC units. Overall, this approach should be less time consuming than the current approach and should not result in an increase in O&M labor costs. By keeping the tray aerator clean, the tray aerator efficiency will likely be sufficient for the site team to bypass or to eliminate polishing with liquid phase GAC. The site team could also consider sampling the effluent at the discharge point rather than directly from the effluent tank. With frequent cleaning of the tray aerator, the liquid phase GAC may no longer be needed to polish the air stripper effluent, and the liquid phase GAC replacement costs, which might be as high $15,000 to $20,000 per year, could be eliminated.

- Turn off the blower to the tray aerator and allow process water from the equalization tank to flow through the tray aerator without being aerated. Even in the absence of the aeration, the GAC will be sufficient for contaminant removal and will still likely need to be replaced due to fouling and channeling rather than contaminant loading. The bag filters should provide adequate protection of the GAC, especially in the absence of aeration and the associated reduction in calcium precipitation. GAC replacement could likely continue at a frequency of once every three to four months. This would likely reduce the electrical usage by approximately 85,000 kWh per year or more ($6,000 per year assuming an electrical rate of $0.07 per kWh). This modification would also eliminate tray aerator cleaning, which is a two-day event every quarter (a savings of labor of approximately $6,000 per year). Site visits by the RACs contractor as a result of alarms might also be decreased, resulting in potential savings. Costs associated with replacing the vapor phase GAC would also be eliminated.

4.0 RECOMMENDATIONS FOR TECHNICAL IMPROVEMENT

4.1 ADD INFLUENT CONCENTRATION TREND GRAPHS TO THE MONITORING REPORTS

The monitoring reports in their current form are well done. They could be slightly improved by adding a trend graph for the influent concentration. The influent concentration has decreased substantially since operation began, it would be helpful to visualize the trend. Implementing this recommendation should not require any additional cost.

4.2 MODIFY DISCUSSION OF 1,1,1-TRICHLOROETHANE IN THE REPORTS

The reports discuss in depth the plume and concentration trends for 1,1,1-Trichloroethane (1,1,1-TCA). Although 1,1,1-TCA is a contaminant of concern for the site, all sampling results indicate that it is below the cleanup goal of 200 ug/L. On the other hand, 1,1-Dichloroethene (1,1-DCE) is above standards but discussion is limited to a single bullet item under "Other VOCs". It appears reasonable to greatly simplify the discussion of 1,1,1, TCA concentrations, including that discussion under "Other VOCs", removing 1,1,1-TCA plume maps from the report, and emphasizing the concentrations are below the cleanup standard. The discussion of 1,1-DCE appears appropriate. The extent of 1,1-DCE contamination is far less than the TCE contamination, and it is clear that the TCE plume is the primary driver for remediation efforts and changes in TCE concentrations are the primary indicators of remedial progress.

5.0 RECOMMENDATIONS TO SPEED SITE CLOSEOUT

5.1 CONSIDER IN-SITU CHEMICAL OXIDATION (FENTON'S REAGENT) PILOT TEST IN THE SOURCE AREA

The evaluation team agrees with the site team that the source area at the site is relatively small and may be amenable to more aggressive source removal using in-situ chemical oxidation. Successful source removal could result in the discontinuation of pump and treat if the remaining portion of the plume is allowed to naturally attenuate as per current practice. Most of the annual O&M costs would be eliminated, but some ground water monitoring (and the associated costs) would likely remain for several years. The presence of 1,4-Dioxane in the source area and treatment plant influent further justifies the use of aggressive source removal because the treatment plant may not be able to meet a 1,4-Dioxane discharge level without significant and expensive modifications. It is therefore recommended that the source area be treated using Fenton's reagent. Unlike permanganate, Fenton's reagent is a strong enough oxidant to oxidize both TCE and 1,4-Dioxane. Fenton's reagent should be applied to the source area (in the area near EW-4 and OB-1I) and perhaps a few locations between EW-4 and EW-5. During the pilot test, pumping from EW-4 and EW-5 should be discontinued.

Prior to conducting the pilot, the site team should determine criteria for evaluating the success of the pilot. The following should be considered when developing these criteria.

- Is the concentration of contaminants in the source area greater than or less than the concentrations at MW-112B? The concentrations at MW-112B were sufficiently low to monitor (at least temporarily) rather than address by pump and treat. It is reasonable to assume similar or lower concentrations in the source area would also not require continued pump and treat.

- Do concentrations downgradient of the Fenton's Reagent application decrease or remain the same over time? If they decrease, it is evidence that source removal has been sufficiently effective and may lead to discontinuing pump and treat.

- Have 1,4-Dioxane concentrations in the source area substantially decreased (by more than an order of magnitude)?

- Are 1,4-Dioxane concentrations downgradient of the Fenton's reagent application decreasing over time? When (or if) the pump and treat system is restarted, does the 1,4-Dioxane concentration decrease to at or near the Pennsylvania MSC of 5.6 ug/L, perhaps eliminating the need for enhancing the treatment system to address 1,4-Dioxane?

Based on the success of the pilot study, additional applications (either as additional pilot tests or full-scale applications) could be made if cost-effective. The evaluation team notes that the cost of modifying the treatment system to treat 1,4-Dioxane and operating the modified system would be substantial and that the site team is encouraged to attempt other in-situ efforts if this initial application of Fenton's Reagent is not successful. As an approximate estimate, the evaluation team estimates that the costs of modifying the treatment system could require as much as $500,000 in capital expenses, and operating the system could increase by approximately $150,000 per year to a total annual O&M cost of $400,000 per year.

The cost for developing these criteria, writing a work plan, conducting the pilot test, and documenting the results should cost on the order of $250,000 to $300,000, including oversight by the site contractor and two rounds of follow-up sampling from eight locations six months apart. This assumes up to 5 injection points are installed at 100 feet to 200 feet below ground surface and that two applications are made.

PRIORITIZATION AND SEQUENCING OF RECOMMENDATIONS

Recommendation 2.1 (1,4-Dioxane standards) is an issue facing EPA and PADEP and is not necessarily site-specific. Therefore, EPA and PADEP can continue to work on this recommendation without using site resources or interfering with implementation of the other recommendations.

Recommendation 3.1 (streamline VOC removal processes) should be implemented immediately. The site team can choose which approach to attempt first: modifying the approach for tray aerator cleaning or relying on GAC. The site team's choice would likely depend on the schedule for the next GAC replacement and other site related factors.

Recommendations 4.1 and 4.2 (regarding monitoring reports) should be implemented prior to the next ground water monitoring report.

Work on the criteria and work plan for Recommendation 5.1 (in-situ chemical oxidation) should begin in the first quarter of 2005, with the hope of conducting the pilot test at some point during calendar year 2005 (perhaps between October and December).

OTHER ACTION ITEMS

No other action items are provided.

Cost Summary Table

Recommendation	Reason	Estimated Additional Capital Costs ($)	Estimated Change in Annual Costs ($/yr)
2.1 Verify Appropriate Discharge and Cleanup Standards for 1,4-Dioxane	Effectiveness	$0	$0
3.1 Streamline VOC Removal Processes	Cost Reduction	$0	($12,000 to $20,000)
4.1 Add Influent Concentration Trend Graphs to the Monitoring Reports	Technical Improvement	$0	$0
4.2 Modify Discussion Of 1,1,1-Trichloroethane in the Reports	Technical Improvement	$0	$0
5.1 Consider In-Situ Chemical Oxidation (Fenton's Reagent) Pilot Test in the Source Area	Site Closeout	$250,000 to $300,000	Unquantifiable decrease in lifecycle costs

Costs in parentheses imply cost reductions.