BOUNTIFUL/ WOODS CROSS

Operable Unit 1
Superfund Site

Davis County, Utah

Value Engineering Study
For
U.S. Environmental Protection Agency
Regional office in Denver, Colorado

Study Date: April 2-4, 2007

Final Report

April 26, 2007

US Army
Corps of Engineers

US Environmental
Protection Agency

EXECUTIVE SUMMARY

General

The United States Army Corp of Engineers (USACE) Hazardous, Toxic, and Radioactive Waste (HTRW) Center of Expertise (CX) performed a Value Engineering Screen and Study (VE Study) on the Bountiful/Woods Cross Superfund Site, Operable Unit Number One (OU1) project located between Interstate 15 and 800 West Street, Davis County, Utah. The VE Study was conducted at the USEPA Regional office in Denver, Colorado on April 2-4, 2007. The study did not include a visit to the site.

The VE Studies are based on the principals and standards used in the Value Engineering (VE) Study process consisting of six phases. The EPA VE process is broken into two components, the screening phase that addresses the first four phases (Information Gathering, Function Analysis, Speculation, Analysis) and the study phase that encompasses the final two phases (Development and Presentation). A VE process studies the functions of individual items of a project and the relationships of those functions to the overall function of the project. The result of studying the functions in this way allows the team to take a critical look at how these functions are being met and then develop alternative ways to achieve the same function while increasing the value and maintaining the primary function of the project. In the end, it is hoped that the project will realize a reduction in cost, increase or maintain the execution of the primary function, and improve or maintain the bidability, constructability and maintainability of the completed operable unit thereby improving the site environment. Another objective in executing a VE Study is to meet the requirements of the Office of Solid Waste and Emergency Response (OSWER) Directive OSWER 9335.5-24, Value Engineering for Fund Financed Remedial Design and Remedial Action Projects dated 14 April 2006. The VE process accomplishes this within the existing design schedule with minimal disruption. Preliminary proposals and comments resulting from a VE Study are briefed to the primary stakeholder, EPA, for comment and content, and screened to eliminate those considered to be outside the scope prior to full development to eliminate lost effort. The resulting proposals are then developed and provided to the EPA RPM, remedial action design team, or others designated by the RPM for comment. Following review comment incorporation, the final report is presented to the designer for incorporation within the design concurrently with comments from the EPA, USACE, State, or other stakeholder with no impact on the overall schedule. Guidelines for incorporation of VE design comments and recommendations are addressed in OSWER 9335.5-24.

Estimate of Construction Costs and Budget

The total projected capital construction cost for all the entire scope of OU-1, as identified in the Intermediate Design, Basis of Design Report, dated March 26, 2007 is $1.2 million (total capital construction costs 2007-2014). Total O&M costs were estimated at $0.65 million, and include Long Term monitoring costs. [These are Current Costs, not life-cycle or present-value costs, and do not reflect a Bid Contingency fee of 10% to be held by EPA. Field labor only cost for a full round of routine groundwater LTM sampling estimated at $14,000 to $15,000 per event; minimum of one event per year over 15 years.]

Summary of VE Study Results

During the speculation phase of this study, 26 creative ideas were identified. Seven of these ideas were developed into VE recommendations with cost implications where applicable. Eleven ideas were developed into design comments

The following table presents a summary of the ideas that were developed into recommendations with cost implications where applicable. Cost is an important issue for comparison of VE recommendations. Cost estimates as prepared for this VE Study are from published cost databases and/or VE team member experience. The estimates provided should be of sufficient detail to allow a decision regarding implementation, but the estimates should not be used to compute actual savings associated with adoption of any one recommendation.

SUMMARY OF RECOMMENDATIONS

REC # NUMBER	DESCRIPTION	POTENTIAL SAVINGS (COST)
1	Incorporate passive groundwater sampling in Long Term Monitoring (LTM) to the maximum extent possible.	$7,000 per event
2	Change the diameter of the injection wells from 2 to 4 inches. The original remedy design proposes installing 134 injection wells to add approximately 200,000 gallons of Emulsified Oil Substrate (EOS) amendments to groundwater. By increasing the diameter of the injection well to 4 inches, the injection time to deliver the EOS amendments can be reduced	$22,000
3	Decrease the number of injection wells in the source area grid (optimize the area of the grid), based on existing soil gas and groundwater data. May also be based on membrane interface probe (MIP) direct push technology (DPT) investigation (if the MIP recommendation is implemented).	$30,000
4	Add MIP (membrane interface probe) investigation to DPT (direct push technology) characterization to obtain data for evaluation of	($22,000)

REC # NUMBER	DESCRIPTION	POTENTIAL SAVINGS (COST)
	vapor phase VOCs, as well as a vertical contaminant level profile across both the vadose zone and the saturated zone. This technique could also improve definition of source area injection point grid.	
5	Collect soil samples from saturated zone during DPT characterization as baseline for subsequent DPT monitoring to assess potential for rebound in groundwater.	($9,000)
6	Clean IDW water on site (via granular activated carbon) before releasing to the sanitary sewer system.	$1,500
7	Install wells of biobarrier #3 as part of initial well installations (time zero) to reduce drilling mobilization costs. Injections at any time after.	$6,000

Acknowledgments
As this is one of the first studies of this kind, VE Study, on a HTRW project, the study members should be commended for their effort and perseverance in accomplishing this very successful study. Special thanks are extended to the EPA RPM, the designer from the design firm, CDM, for their cooperation and full participation in this team VE study effort. Combined with the two team members from the USACE HTRW CX, these four technical experts shared information with each other and generated several significant ideas that could improve the value of this remediation. The designers and EPA RPM and other technical personnel are always encouraged to participate in these studies to the maximum extent possible. The combine efforts of all of these individuals are what produced the positive results of this study.

Significant Aspects of the VE Study
Several aspects of this study need to be recognized. First, as mentioned above, the participation of both the EPA RPM and a representative from the remedial design (RD) firm had a very positive effect on the outcome of this study. The study team attempts to become familiar with the project prior to the start of the study on site. But the people with the best first hand information about any project are the owners, designers, and possibly some stakeholders. Having them present and participating in the study not only provides valuable insight, but assists in rapid solution to technical issues.

Another significant result of this study, in addition to the cost savings that might result from acceptance of recommendations, is the potential value added when recommendations regarding MIP and source area soil sampling are combined with the design comment regarding evaluation of vapor transport of VOC's from persistent residual VOC sources in the vadose zone. The net change in cost for these three items is essentially zero, but the value added for potential overall remediation of the site is very significant. The added characterization can potentially reduce the initial work required, and decrease the level of uncertainty regarding the long-term effectiveness of the remedy. Also, some of the recommendations would provide the necessary data to identify and solve potential problems that may be realized in the future, affecting the overall life-cycle cost of the remediation. .

VALUE ENGINEERING SCREENING STUDY TEAM MEMBERS

NAME	ORGANIZATION
Ken True	CVS, Contractor
Hugh Rieck	USACE-HTRW CX
Chuck Coyle	USACE-HTRW CX
Mario Robles	USEPA-RPM
Ryan Wymore	CDM

Certification

This is to verify that the Value Engineering Screening Study was conducted in accordance with standard Value Engineering principles and practices.

Kenneth True, PE, CVS, CCE
Value Engineering Screening Study Team Leader

TABLE OF CONTENTS

SECTION 1 – INTRODUCTION

This report documents the results of "the VE Study", on the project Bountiful/Woods Cross Superfund Site, Operable Unit Number One, located between Interstate 15 and 800 West Street, Davis County, Utah. The VE Study was conducted at USEPA Regional office in Denver Colorado on April 2-4, 2007. The study team was from the USACE HTRW Center of Expertise, the EPA RPM and a designer engineer from CDM and facilitated by Kenneth True, a Certified Value Specialist (CVS) and Professional Engineer. The names and telephone numbers of all participants in the study are listed in Appendix A.

The Job Plan

This study followed the basic VE methodology as endorsed by Society of American Value Engineers (SAVE) International, the professional organization of Value Engineering. This report does not include any detailed explanations of the value engineering/value analysis processes used during the workshop in development of the results presented herein. A summary of the basic processes used in the study are included to give the reader an idea of the standard VE methodology, consisting of six phases:

> **Information Phase:** The Team studied the current intermediate Design, Basis of Design Report dated March 26, 2007, the Record of Decision (ROD), portions of the Remedial Investigation and Feasibility Study, EPA criteria documents, figures, descriptions of project work, and the cost estimate to fully understand the project scope and required functions. This phase was largely done by the team prior to the on site portion of the VE Study.

> **Function Analysis Phase:** The purpose of this phase is to clearly identify the function(s) of the project, and to formulate a concept from which new directions can be taken. A Function Analysis Study Technique (FAST) Diagram is an end product of the Functional Analysis Phase. The FAST Diagram is included in Appendix C.

> **Speculation Phase:** The CVS led the Team brainstorming sessions to generate ideas that could potentially be beneficial to the remedial action. All team members contributed ideas and critical analysis of the ideas was discouraged until the Analysis Phase (see Appendix B).

> **Analysis Phase:** Evaluation, testing, and critical analysis of all ideas generated during speculation was performed to determine potential for savings or improvement to the site remediation. Ideas that did not survive critical analysis were deleted. Those feasible ideas that survive the analysis phase are then developed into proposals. Those surviving ideas were assigned to members of the team for further development and validation of the merit of the proposal. Sometimes this attempt to substantiate the proposal results in the modification or even elimination of the original idea.

> **Development Phase:** Usually during a full VE Study more research and in-depth resolution is pursued with the entire group present to substantiate an idea. The ideas were

developed enough on site to determine that they were worthy of refinement. After returning to their individual offices, the VE Study Team Members completed development of the surviving ideas into written proposals. Proposal descriptions, along with technical support documentation, and cost estimates were prepared to support implementation of ideas. Development generally takes the form of a written document that clearly expresses the proposed idea, with a "Before" and "After" depiction. In addition, the VE Study Team identified items of interest as Comments that were not developed as proposals. These comments follow the study proposals.

Presentation Phase: This portion of the study was done in a short presentation by the team to the EPA Region Eight Section Chief, Kathleen Atencio. The recommendations were in draft form at the time of the presentation. This report will be distributed for review by EPA to project supporters and decision makers. The EPA will determine responsibilities for implementation of accepted proposals.

This study differs slightly from a “standard” VE study. The differences lie in the applications of some of the methodologies and the way they can be applied to an ongoing HTRW Superfund site that has numerous operable units in order to achieve the desired end result. Also, the time the team spent together was considerably decreased in part to attempt to reduce costs, save or accommodate team members’ schedules and/or other obligations. The proposals were initially developed during the April 2-4 meeting, and completed when team members returned to their offices. In any case, the results should be considered as completion of a Value Engineering Study for this site.

Boundary of the Study

This study was performed for operable unit number one (OU1) Groundwater, for this site. All future work related to OU2 was not considered as part of this study. The boundary of the study was the proposed remediation as set forth in the ROD.

Ideas and Recommendations

Part of the VE methodology is to generate as many ideas as is practical, evaluate each idea, and then select as candidates for further development only those ideas that offer added value to the project. If an idea thus selected, turns out to work in the manner expected, that idea is put forth as a formal VE recommendations. Recommendations represent only those ideas that are proven to the VE team’s satisfaction.

Comments

Some ideas that did not make the selection for development as recommendations, were, nevertheless judged worthy of further consideration. These ideas have been written up as Design Comments and are included in Section 4.

Level of Development

VE Studies are working sessions for the purpose of developing and recommending alternative approaches to a given project. As such, the results and recommendations presented are of a conceptual nature, and are not intended as a final design. Detailed feasibility assessment and final design development of any of the recommendations presented herein, should they be accepted, remain the responsibility of the EPA.

SECTION 2 – PROJECT DESCRIPTION

Background

This report presents the results of the VE Study on the project "Bountiful/Woods Cross Superfund Site, OU1", located between Interstate 15 and 800 West Street, Davis County, Utah. The VE study is intended to add value to projects, in terms of improved quality, enhanced construction methods, reduction in waste volume generated, or money expended on the remediation process. This VE Study was funded as part of a pilot program funded by HQ EPA, and coordinated by EPA Region 8 and the USACE HTRW-CX.

Authority for the performance of these studies is contained in the Office of Solid Waste and Emergency Response (OSWER) Directive OSWER 9335.5-24, Value Engineering for Fund Financed Remedial Design and Remedial Action Projects, signed on 14 April 2006. This directive provides guidance concerning requirements addressing Value Engineering for Superfund Remedial Design and Remedial Action Projects.

Project Description

Bountiful/Woods Cross/ 5th South PCE plume National Priorities List site, OU1, is located between Interstate 15 and 800 West Street, in Davis County, Utah. EPA has issued a Record of Decision, 2006, for this site remediation. As described in the ROD the selected remedy for this OU1 is insitu bioremediation. A complete background of the site and reasons for the selected remediation can be found in the ROD. W.S. Hatch Company (Hatchco) initially operated on 13 acres, 10 of which are now owned by Kalahari Properties. All 13 acres are in transition to the Utah Transit Authority which plans to develop the property as a parking lot for the new Woods Cross commuter rail station. The property terrain is basically flat and lies at an elevation of 4300-ft above mean sea level. Hatchco operation at the site ended in the late 1980's. The operation generally included specialized carrier of bulk petroleum, petroleum products, solvents, such as toluene and xylene, asphalt, and mixed on site ammonium nitrate, fuel oil, and high-energy fuel used as explosives at mining operations nearby. The tractor-trailers and tank trucks were serviced and cleaned at the site, thus the plume. All of the contaminated surface soil was removed from the site in 1995. Currently, the remaining contaminated subsurface soil and the contaminated shallow groundwater are the primary sources of contamination. OU1 includes the three acre Hatchco property plus the extent of the TCE groundwater plume that consists of approximately 42 acres of land.

Estimate of Construction Costs

The total projected capital construction cost for all the entire scope of OU-1, as identified in the Intermediate Design, Basis of Design Report, dated March 26, 2007 is $1.2 million (total capital construction costs 2007-2014). Total O&M costs were estimated at $0.65 million, and include Long Term monitoring costs.

SECTION 3 – VE RECOMENDATIONS

Organization of Proposals

This section contains the complete documentation of all recommendations resulting from this study. Each recomendation has been marked with a unique identification number. The parent idea, or ideas from which the proposal began, can be determined from the Creative Idea List located in Appendix B of this report. For tracking purposes, the original idea numbers that make up a recommendation are shown within the recommendation.

Each recommendation is documented by a separate write-up that includes a description of both the original design and recommended change, a list of advantages and disadvantages, sketches where appropriate, calculations, cost estimate, and the economic impact of the recommendation on the first cost, and where applicable, the life cycle cost. The economic impact is shown in terms of savings or added cost.

VALUE ENGINEERING RECOMMENDATION # 1

PROJECT: Bountiful/Woods Cross Superfund Site
LOCATION: Davis County, Utah
STUDY DATE: April 2-4, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:

Passive Groundwater Sampling for Long Term Monitoring (LTM)

Creative Idea 1

ORIGINAL DESIGN:

Standard low-flow purge groundwater sampling techniques.

RECOMMENDED CHANGE:

Use passive groundwater sampling devices for long-term groundwater monitoring where possible. Development of new passive (*i.e.* no-purge) groundwater sampling devices during the last few years has provided the means to obtain high-quality samples for most analytes of interest (ions, VOCs, dissolved gases) from targeted depths in monitor wells. Relatively new passive groundwater sampling devices that may be cost effective for LTM at this site include the HydraSleeve, Rigid Porous Polyethylene Samplers, and the Snap Sampler. If VOCs are the only analytes of interest at some wells for some events, Polyethylene Diffusion Bag (PDB) samplers should be considered.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$15,000 per event		$15 k x 15 years $225,000
RECOMMENDED DESIGN	~ $8,000 per event		$8 k x 15 years $120,000
ESTIMATED SAVINGS OR (COST)	~ $7,000 per event		$7 k x 15 years $105,000

Cost reduction will be in field collection of long-term monitoring O&M. All other long-term monitoring costs (e.g. laboratory analytical costs) will remain as per intermediate design. Original cost estimate is by CDM for one complete sampling event for all 19 long-term monitor wells per year. Recommended design cost estimate based on typical sample collection savings of ~40% to 50% per sampling event by using passive sampling devices (ITRC, 2005).

VALUE ENGINEERING RECOMMENDATION # 1

ADVANTAGES:

- Substantially reduces field time for sampling (equipment set up, purge time, *etc.*)
- No equipment costs (no pump, no generator, compressed gas, *etc.*)
- No IDW water handling and disposal
- No decontamination of equipment
- Improved sampling consistency; eliminates variability associated with different purge rates/purge duration for long-term trend analysis.
- Samples are from known location in well under ambient conditions, not a flow-weighted mixture from zones of highest hydraulic conductivity. Can target specific depth interval in screen (*e.g.* zone of highest contaminant concentration).
- Minimizes turbidity; samples only the truly dissolved concentrations, or dissolved plus colloidal fraction mobile (suspended) under ambient flow (depends on sampling device). Does not entrain material otherwise immobile in the aquifer. Could sample the naturally mobile (suspended) fraction of bacterial population under ambient (laminar) flow conditions. Sample volume limitations may be a consideration, however HydraSleeve samplers can be constructed to any reasonable length to increase volume.

DISADVANTAGES:

- Finite sample volume (minimum volume consideration for lab).
- Device-specific analyte limitations; must match sampler type to analytes of interest.
- Results may be different from pumped sample results.
- Requires regulatory acceptance of innovative technology.
- Cannot collect some flow-through water quality parameters (*e.g.* ORP measurements).
- Volatization of dissolved gases may be difficult to avoid during sample transfer to lab containers (depending on sampler type).

JUSTIFICATION:

- Provides high quality, highly reproducible data representing conditions at targeted depth under ambient conditions in monitor wells.
- Can be expected to result in cost savings of about 50 percent for field collection costs of routine groundwater samples.

VALUE ENGINEERING RECOMMENDATION # 2

PROJECT: Bountiful/Woods Cross Superfund Site
LOCATION: Davis County, Utah
STUDY DATE: April 2-4, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:

Change the diameter of the injection wells from 2 to 4 inches, or from 2 to 3 inches. The original remedy design proposes installing 134 injection wells to add approximately 200,000 gallons of Emulsified Oil Substrate (EOS) amendments to groundwater.

Creative Idea 6

ORIGINAL DESIGN:

The original design proposes a total of 134, 2-inch diameter Schedule 40 PVC wells.

RECOMMENDED CHANGE:

Change diameter of injection wells to either 3 or 4 inches, schedule 40 PVC pipe.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$75,000		
RECOMMENDED DESIGN	$53,000		
ESTIMATED SAVINGS OR (COST)	$22,000		

VALUE ENGINEERING RECOMMENDATION # 2

ADVANTAGES:

- Faster delivery System
- Decrease labor cost and equipment rental cost for performing the electron donor injections.

DISADVANTAGES:

- May need a larger diameter auger
- Due to the larger diameter auger it may increase IDW and well abandonment cost
- May limit the mounding of water table during injection
- Will incur higher materials cost – well casing and stainless screen cost

JUSTIFICATION:
Based on the increase of the electron donor delivery system and the projected cost savings during the remedial action, increase the diameter of injection wells to either 3, or 4 inches.

A larger diameter well will increase the delivery rate to add EOS amendments to groundwater. Approximately 200,000 gallons of electron donor at the treatment zones, or 500 gallons/well will be used. There will be a significant reduction in time and therefore a reduction in labor and oversight cost when the delivery rate can be increased

VALUE ENGINEERING RECOMMENDATION # 3

PROJECT: Bountiful/Woods Cross Superfund Site
LOCATION: Davis County, Utah
STUDY DATE: April 2-4, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:

Decrease the number of injection wells in the source area grid (optimize the area of the grid), based on existing soil gas and groundwater data. May also be based on membrane interface probe (MIP) direct push technology (DPT) investigation (if the MIP recommendation is implemented).

Creative Idea 7

ORIGINAL DESIGN:

The proposed size of the source area injection point grid in the 60% design was based on the "inferred" 200 ppb contour for TCE in groundwater. This contour was not well defined because of the scarcity of monitoring wells in the source area.

RECOMMENDED CHANGE:

Optimize the size and shape of the source area injection point grid based on contaminant concentration data. Soil gas data are presented in the Focused Feasibility Study Report (July 2004), but the date when the soil gas survey was performed could not be located. Figure 2-7, dated March 2004, shows soil gas data from the depth interval (at 25 ft bgs), which was the closest to the water table. If the MIP investigation recommendation is implemented, then additional data will be available to better define the size and shape of the source area injection point grid. Using the existing soil gas data, and/or the MIP data, it may be possible to reduce the size of source area injection point grid, which would reduce the number of injection wells. It was also noted that the contract should be written to specify that, "up to 68 wells" will be required for the source area injection point grid; but in reality there could be fewer wells.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$204,000		
RECOMMENDED DESIGN	$174,000		
ESTIMATED SAVINGS OR (COST)	$30,000		

VALUE ENGINEERING RECOMMENDATION # 3

ADVANTAGES:

- Decreases labor for installation, materials, electron donor
- Reduces interference with parking area
- Fewer injection wells would have to be installed
- Less IDW would be generated
- Fewer wells would need to be abandoned

DISADVANTAGES:

Could result in less complete coverage of subsurface, reducing safety factor of the in-situ treatment design.

Using only existing data, the change would have to be based on sparse & old subsurface characterization data. The footprint defined in 60% design was based on inferred contour from sparce groundwater monitoring points. However, a more closely spaced grid was used during the soil gas survey. If the MIP recommendation is implemented, characterization would be refined during DPT investigation, and fresher data would be available for optimizing the size & shape of the grid.

If it was later discovered that the installed injection point grid area is inadequate, it might be necessary to have to remobilize & install more injection wells.

JUSTIFICATION:

The size and shape of the source area injection point grid would be optimized based on contaminant concentration data. The costs would be reduced if it was determined that the size of the source area injection point grid could be reduced, and it was determined that the number of injection wells could be reduced. Based on the CDM cost estimate for installation of all 68 source area grid wells and the 1st biobarrier, a per well cost of about $3000 was estimated. Thus the cost savings would be roughly. $3000 per eliminated well. Conservatively assuming that 10 wells could be eliminated, the total cost savings would be $30,000.

VALUE ENGINEERING RECOMMENDATION # 4

PROJECT: Bountiful/Woods Cross Superfund Site
LOCATION: Davis County, Utah
STUDY DATE: April 2-4, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:

Add MIP (membrane interface probe) investigation to DPT (direct push technology) characterization to obtain a vertical contaminant concentration profile across both the vadose zone and the saturated zone. This will provide improved definition of source area to optimize injection point grid (Recommendation #3) and will provide data for evaluation of long-term residual vapor phase migration of VOCs to groundwater.

Creative Idea 16

ORIGINAL DESIGN:

A DPT investigation was already planned, but this would have been limited to collection of continuous cores to define stratigraphy. This, in turn, would be used to determine the depths and lengths of the screened intervals of the injection wells

RECOMMENDED CHANGE:

Add a MIP component to the DPT investigation to improve subsurface characterization.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$18,000		
RECOMMENDED DESIGN	$40,000		
ESTIMATED SAVINGS OR (COST)	($22,000)		

ADVANTAGES:

- Improves our understanding of the site conceptual model, in that it helps us determines relative contribution of the vadose zone as a potential continuing source. Also should decrease the level of uncertainty regarding the long-term effectiveness of the remedy.
- Would also allow for a vertical groundwater contaminant level profile to be obtained.
- Allows for improved characterization of subsurface; both stratigraphy (for placement of well screens), & relative contaminant concentration profile. Would improve characterization of aquifer properties for electron donor injection.
- Would improve definition of footprint of source area grid, which may allow the number of injection wells to be decreased.

DISADVANTAGES:

- Adds to labor & equipment requirements for DPT investigation.
- Increases labor for data management, and data analysis.
- Does not provide absolute, quantitative contaminant level data (i.e., mg/kg, mg/L).
- New subcontract may be required for MIP equipment / operator.
- In order to better define the footprint of source area grid, it will probably require addition of more push-point locations than what had originally been anticipated for the DPT investigation.

JUSTIFICATION:

A DPT investigation was already planned, but this would have been limited to collection of continuous cores to define stratigraphy. The MIP would allow for determination of relative contaminant levels across both the vadose zone and the saturated zone. The MIP also allows for contaminant characterization in clay layers in the vadose zone, which is generally not possible with soil gas sampling. Adding the MIP component to the DPT investigation will increase the cost of the DPT investigation, but will provide much more characterization data (i.e., will allow us to locate which subsurface zones have the highest levels of contamination). This, in turn, should decrease the level of uncertainty regarding the long-term effectiveness of the remedy. Per discussion with the VE Study Group, it was crudely estimated that adding the MIP component would roughly double the cost of the investigation (increasing costs from roughly $18,000 to $36,000). If more push-point locations than what had originally been anticipated for the DPT investigation are required, this could further increase the costs (perhaps from $18,000 to $40,000).

VALUE ENGINEERING RECOMMENDATION # 5

PROJECT: Bountiful/Woods Cross Superfund Site
LOCATION: Davis County, Utah
STUDY DATE: April 2-4, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:

Collect soil samples from saturated zone during DPT characterization as baseline for subsequent DPT monitoring to assess potential for rebound in groundwater.

Creative Idea 21

ORIGINAL DESIGN:

Perform DPT characterization only for lithologic data, and not for contaminant concentrations.

RECOMMENDED CHANGE:

During the DPT characterization, collect soil samples from both the vadose zone and the saturated zone for VOC contaminant analysis. Collect a minimum of 1 vadose zone sample and 1 saturated zone sample, with provisions to collect additional samples based on MIP results. Also collect additional, post-treatment soil samples from the source area to document effectiveness of treatment.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	0		
RECOMMENDED DESIGN	$9,000		
ESTIMATED SAVINGS OR (COST)	($9,000)		

Assume $150/sample for both collection and analysis; assume 60 samples (30 pre-bio and 30 post-bio)

ADVANTAGES:

- Additional performance metric for bioremediation
- Provide basis of comparison to MIP data (may allow the MIP data to be translated into approximate concentration units).
- Provide the means to assess potential for rebound in source area

DISADVANTAGES:

- Added time in the field during DPT characterization
- Added mobilization costs
- Results from pre- and post-bioremediation samples not directly comparable because locations won't be exactly the same
- Results from MIP and soil samples not directly comparable because locations won't be exactly the same
- Potential difficulties in sample handling, especially from the vadose zone, due to VOC volatilization

JUSTIFICATION:

This recommendation will provide more complete contaminant characterization in the source area. This information could prove to be invaluable in refining the injection well layout, and in assessing the long-term performance of bioremediation in the source area. The incremental cost to collect these samples is negligible compared to overall project costs, and considering the technical benefit to the project.

VALUE ENGINEERING RECOMMENDATION # 6

PROJECT: Bountiful/Woods Cross Superfund Site
LOCATION: Davis County, Utah
STUDY DATE: April 2-4, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:

Clean IDW water on site (via granular activated carbon) before releasing to the sanitary sewer system.

Creative Idea 25

ORIGINAL DESIGN:

The RD provides several options for handling the IDW water generated at the site. Depending on the DW water analytical results, the SOP provides the following options: discharge to surface water, discharge to the ground surface close to the well, or discharge to the sanitary sewer.

RECOMMENDED CHANGE:

Treat the IDW water on site prior to discharging into the sanitary sewer system.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$3,000		
RECOMMENDED DESIGN	$1,500		
ESTIMATED SAVINGS OR (COST)	$1,500		

VALUE ENGINEERING RECOMMENDATION # 6

ADVANTAGES:

- Eliminate testing of waste water
- Reduce analytical cost
- Minimize/eliminate transporting of IDW
- Reduce the visual and public sensitivity to site activities
- Eliminate IDW storage time while waiting for analytical results
- Prevent potential vandalism on site

DISADVANTAGES:

- Cost of carbon disposal/regeneration
- Additional equipment and maintenance cost

JUSTIFICATION:

Based on the value gain by minimizing the handling, transportation of IDW and the value of decreasing potential harm to public perception of site activities the IDW could be treated and disposed of on site. This provides an effective solution to handle IDW and will minimize the public concern of the remedial action activities conducted at the site. RD 60% estimated development water IDW disposal cost to POTW is $3000; estimated cost of GAC treatment is 1000 - $1500. These costs do not include savings that would derive from IDW development water at biobarrier #3 if developed at same time.

VALUE ENGINEERING RECOMMENDATION # 7

PROJECT: Bountiful/Woods Cross Superfund Site
LOCATION: Davis County, Utah
STUDY DATE: April 2-4, 2007

DESCRIPTIVE TITLE OF RECOMMENDATION:

Install wells of biobarrier #3 as part of initial well installations (time zero) to reduce drilling mobilization costs. Injections at any time after.

Creative Idea 26

ORIGINAL DESIGN:

Install the biobarrier #3 wells 2 years after the initiation of the RA. The location and number of wells was to be determined at this time.

RECOMMENDED CHANGE:

Install the biobarrier #3 wells at the same time as the source area wells and biobarrier #1 wells are installed. However, the donor injection into the biobarrier #3 wells will not necessarily be performed at this same time – this could be done anytime after the wells are installed.

SUMMARY OF COST ANALYSIS			
	First Cost	O & M Costs (Present Worth)	Total LC Cost (Present Worth)
ORIGINAL DESIGN	$12,000		
RECOMMENDED DESIGN	$6,000		
ESTIMATED SAVINGS OR (COST)	$6,000		

VALUE ENGINEERING RECOMMENDATION # 7

ADVANTAGES:

- Stop plume expansion
- Accelerate remediation timeframe
- Reduce mobilization/demobilization for drilling
- Actively protect domestic wells (benefit both technically and in terms of public perception
- Can perform the donor injections at any time, including the original plan of doing them at Year 2.
- Potentially save money by eliminating out-year sampling events (i.e. if remedy is completed 2 years faster then we'll eliminate 2 annual sampling rounds)

DISADVANTAGES:

- Potential to pay for installing wells that might not be needed
- We won't have any lessons learned from the source area well installations/donor injections (e.g. we might find out that we needed a slightly different well spacing)

JUSTIFICATION:

This recommendation will provide the means to stop plume expansion and reduce risk to receptors faster than the baseline design. Also, cost savings will be realized because only 1 mobilization will be needed for the driller to install the source area wells, biobarrier #1 wells, and biobarrier #3 wells. Also, out-year sampling rounds could be eliminated, resulting in further cost savings. Savings from potential early attainment of remedial goals are not estimated.

SECTION 4 -SUMMARY OF DESIGN COMMENTS

SUMMARY OF DESIGN COMMENTS	
ID # CMT #	**Design Comment / Description**
2	**EVALUATE POTENTIAL FOR VAPOR TRANSPORT OF RESIDUAL OF VOC SOURCE IN VADOSE ZONE TO GROUNDWATER.** One-time measurements of soil vapor concentration data from the Feasibility Study four years ago (Figure 2-7) show that vapor phase TCE concentrations just above the water table are as high as 22,000 micrograms per liter. This indicates that a significant mass of TCE remains in the lower vadose zone, and/or the clayey layer of the vadose zone. Although infiltration probably is and will continue to be negligible at the site, and the adsorbed phase, pore water, and any residual microglobules (i.e., ganglia) of DNAPL that may be present are immobile, vapor phase transport of TCE to groundwater is continuing by diffusion and dispersion (barometric pumping). This ongoing source also will be reflected by sustained aqueous phase concentrations in long term groundwater monitoring data. In arid and semi-arid environments such vadose zone sources of chlorinated solvents are known to persist for decades. Although vadose zone residual source remediation is outside the scope of the remedial design, a very long-term ongoing vapor phase flux of TCE to groundwater in the source area may require continued electron donor injections to maintain anaerobic conditions favorable for reductive dechlorination to avoid rebound of groundwater concentrations above the targeted cleanup level. Such a need for continued injections beyond the anticipated four to six year time frame for injections may significantly impact the overall life-cycle costs of the project.
3	**INTENTIONAL PLACEMENT OF EOS (AND BIOAUGMENTATION CULTURE) IN LOWER PORTION OF VADOSE ZONE (MOUNDING OF WATER TABLE DURING INJECTION; SCREENS EXTEND A FEW FEET UP INTO TYPICALLY UNSATURATED ZONE).** Design the injection wells so that the upper portion of the screened interval is 2-5 ft above the highest water levels typically observed at the site. During injections, intentionally mound the donor solution in the well above the screened interval in order to push some donor into the unsaturated zone, without injecting under pressure. While it is recognized that this won’t provide widespread distribution of donor in the vadose zone, it will allow the emulsified oil to sorb to soils in the vadose zone. This will provide some treatment of contaminants that are present in pore water, and in the capillary fringe. It will also provide additional substrate that can dissolve into groundwater if/when water levels rise. Note that vadose zone emplacement could also be accomplished by packing off all but the upper most portion of the screened interval, while injecting electron donor.
5	**THERE HAS BEEN NO HYDRAULIC AND / OR TRACER TESTING OF INJECTION.** The design should consider conducting an injection/tracer test after a few of the injection wells have been installed in the source area. The purpose of this test would be to confirm that the desired radius of influence can be achieved. This test could be conducted as follows:

SUMMARY OF DESIGN COMMENTS	
ID # CMT #	**Design Comment / Description**
	• Install a few of the injection wells in the source area • Use the injection wells, and/or install a temporary monitoring wells located 5' and 10' from the injection well to be tested. Ideally there would be monitoring points on 4 sides (i.e., radiating out at 0, 90, 180, & 270 degrees) of the injection well being tested. At a minimum the monitoring points should be on at least 2 sides (e.g,, i.e., radiating out at 0, & 90 degrees). • While the driller continues to install additional wells, perform the injection test – inject up to 3000 gallons of potable water mixed with tracer, while continuously monitoring the temporary wells for tracer, as well as measuring the total water injected. Once the test is finished, the spacing of the remainder of the injection wells could be adjusted based on the results – i.e. if closer spacing is needed or if larger spacing is appropriate, then the remainder of the wells can be installed accordingly. This will avoid installing wells too far apart or too close together, and will also provide a true estimate of injection time.
9	**EVALUATE INFLUENCE OF SURFACE CAPPING ON VAPOR TRANSPORT OF GASES IN VADOSE ZONE.** The planned pavement capping of the source area may slow the venting and depletion of residual vapor phase contamination and other gases from the vadose zone. The boundary condition at the surface will increase the downward concentration gradient and potential for gas transfer into groundwater. In the absence of electron donor injection, groundwater concentrations of vadose zone gases may increase after paving. In zones where electron donor has been injected, and dechlorination is occurring, biodegradation of TCE would be expected to occur before the vapors could impact groundwater
10	**SEQUENCE OF PAVING/WELL INSTALLATIONS. COMPLETE PAVING BEFORE WELL INSTALLATION TO AVOID RESETTING WELL VAULTS.** The Utah Department of transportation plans to pave part or all of the area where the wells are to be installed. The planned use is to provide a park and ride parking area. If the wells and vaults are installed before the paving is done, protecting and resetting the wells and vaults will be a costly time consuming effort. The possibility that some wells could be damaged beyond repair is very high. Suggest that the UDOT be encouraged to complete all of the planned paving prior to installations of the wells. Use of the parking lot could be delayed until the wells are installed. This is more of a communication of ideas to all parties to be sure the work is coordinated. (Does the state have a schedule for paving or are they waiting until the wells are installed?)
11	**REVALUATE LOCATION, INSTALLATION SEQUENCE, AND/OR NEED FOR BIOBARRIERS IMMEDIATELY DOWNGRADIENT OF DOWNGRADIENT HOT SPOT (BARRIERS 2 & 3).** The designer should evaluate whether biobarriers #1 and #2 are needed. If it is determined that biobarrier #2 is needed, then the designer should consider relocating it so that it is placed downgradient of the "hotspot" that has been historically present near HMW-14S.
14	**MANIFOLD ACTIVE VAPOR EXTRACTION ON INJECTION WELLS.** This was discussed as a contingency, in case it was determined that there is a continuous

SUMMARY OF DESIGN COMMENTS	
ID # CMT #	**Design Comment / Description**
	source in the vadose zone that is resulting in mass transfer (through the vapor phase) from the vadose zone to groundwater. Vapor extraction, using existing wells could be used to reduce vapor phase contaminants. It is anticipated that the remedy will effectively degrade any contamination that is moving toward groundwater, so long as the reducing conditions and electron donor levels persist. However, if there is still a substantial mass of VOCs "hung up" in the vadose zone after the electron donor has dissipated, and the groundwater has returned to oxidizing conditions, then there is potential for the groundwater to be recontaminated.
17	**ACTIVE SOIL VAPOR SAMPLING FROM UNSATURATED SCREENED INTERVALS OF NEW SOURCE AREA WELLS.** Soil vapor sampling from immediately above the water table will be possible from any of the injection or monitor wells in the source area that have open screen intervals that extend above the water table. In combination with aqueous phase analyte concentrations from the same wells, such vapor samples allow evaluation of the potential for migration of constituents between gas and dissolved phases. Active soil vapor sampling (purge and sample), rather than passive sampling, should be considered to avoid effects of diurnal barometric pumping on vapor concentrations in the wells. Soil vapor data will allow monitoring of residual VOC sources in the vadose zone, and production of gases from bioremediation. The injection well screens are anticipated to extend a few feet above the water table to allow mounding of the water table and distribution of amendments into the capillary fringe during injection if desired.
18	**DISCUSS SEQUENCE OF INJECTIONS.** The designer should provide more detail on the sequence of donor injections into the source area and biobarrier #1 wells. For example, discuss whether injections should be started at the perimeter wells, upgradient wells of the source, in the middle, at the downgradient edge, etc. Also discuss whether injections should be performed into adjacent wells at the same time, or every other well, etc.
20	**CONTACT JRW RE: NEW DONOR/SUBSTRATE AMENDMENT PRODUCT (LOWER COST THAN EOS?)** The designer should contact JRW to determine the availability and readiness of an alternative emulsified oil product, of equivalent quality, which might be lower cost than EOS. Quality criteria would include factors such as: size and uniformity of microemulsion droplets, stability of emulsion, oil content, organic acid content, food grade certification, etc. If it is determined that this new product might be viable for this site, then the designer should propose a way to incorporate it into the injection program.
23	**ADD DEPTH SPECIFIC GROUNDWATER SAMPLING IN THE SATURATED ZONE TO DIRECT PUSH TECHNOLOGY (DPT) CHARACTERIZATION.** This was discussed as a characterization enhancement. Currently we do not know if contaminant levels in groundwater vary with depth. If the recommendation for adding the membrane interface probe (MIP) component to the DPT investigation is implemented, then a relative concentration vs. depth profile could obtained using the MIP data. However, the MIP provides relative levels of contamination, rather than absolute values of contaminant levels. Depth-specific dissolved phase contaminant concentrations could help "calibrate" the MIP data.

SUMMARY OF DESIGN COMMENTS	
ID # CMT #	**Design Comment / Description**
	Locating the depth interval with the highest contaminant levels could help us better define the location(s) of the source area(s). This, in turn, could help us determine whether future electron donor injection events could be focused at one or more specific depth intervals. This could also help with refining the conceptual site model by answering questions regarding whether or not the bulk of the contamination is moving from a vadose zone source area to groundwater.

APPENDICES

The appendices in this report contain backup information supporting the body of the report, and the mechanics of the workshop. The following appendices are included.

CONTENTS

APPENDIX A
STUDY PARTICIPANTS

Value Engineering Screening Study												
Attendees				**Participation**								
Bountiful Woods OU 1, Salt Lake City, Utah. 2-4 April 2007				**Meetings**			**Study Sessions**					
Name	Organization and Address (Organization first, with complete address underneath)	Tel # and FAX. (Tel first with FAX underneath)	Role in wk shop	Site Visit	Mid Wk Rev	Out Brief	Day 1	Day 2	Day 3	Day 4	Day 5
Kenneth True	VE Contractor kentrue@maladon.com	402-339-1936 C 402-516-2635	Team Facilitator, CVS			X	X	X	X		
Hugh Rieck	USACE, HTRW CX Hugh.j.rieck@usace.army.mil	402-697-2660	Geologist, VE Team member			X	X	X	X		
Chuck Coyle	USACE, HTRW CX Charles.g.coyle@usace.army.mil	402-697-2578	Environmental Engineer, VE Team Member			X	X	X	X		
Mario Robles	EPA Robles.mario@epa.gov	303-312-6160	RPM			X	X	X	X		
Ryan Wymore	CDM wymorera@cdm.com	303-298-1311	Designer			X	O	X	X		
Tim Rehder	EPA Rehder.timothy@epa.gov	303-312-6293	Observer			O	O	O	O		
Kathleen M Atencio	EPA Atencio.kathie@epa.gov	303-312-6803	R8 Section Chf			X					
Helen Dawson	EPA Dawson.helen@epa.gov	303-312-7841	Hydrogeologist					O			
Frank Morris	CDM morrisfr@cdm.com	720-264-1119	Geologist					O			

Attendees Role in this workshop (column 4 of the form). Use more than one description if appropriate.
C = Consultant Cl = ClientD = Designer DM = Design Manager FM = Facility Manager FO = Facility Operator
Ob = Observer Ow = Owner PM = Project Manager PrM = Program Manager TM = Team Member U = User
Note: X = Present most of the day. O = Present part of the day Blank = not present that day.

APPENDIX B
CREATIVE IDEAS LIST

List of CREATIVE IDEAS			
Idea Category: Bountiful Woods Cross OU1			
ID #	**Name of Idea / description**	**Value Potential**	**To be Developed**
1	Passive Groundwater Sampling for LTM	R	Hugh
2	Evaluate vapor transport of VOCs from residual VOC source in vadose zone to groundwater (impact of possible continuing source on life cycle costs). (see also #16,17)	D	Hugh
3	Intentional placement of EOS (and DHC?) in lower portion of vadose zone (mounding of water table during injection; screens extend a few feet up into typically unsaturated zone)	D	Ryan
4	Trade-off between size of wells vs. number of wells (radius of influence).	E	
5	There has been no hydraulic and / or tracer testing of injection.	D	Ryan
6	Rationale for 2” inj. wells vs. larger in 8” borehole to reduce field injection time.	R	Mario
7	Decrease number of injection wells (optimizing the size of grid area). Based on old soil vapor data or sparse GW concentrations? Base number of wells on results of DPT?	R	Chuck
8	Decrease frequency of monitoring events to optimize LTM.	E	Mario
9	Evaluate influence of surface capping on vapor transport.	D	Hugh
10	Sequence of paving/well installations. (Complete paving before well installation to avoid resetting well vaults.)	D	Mario
11	Revaluate location, installation sequence, and/or need(?) for biobarriers immediately downgradient of downgradient hot spot (barriers 2 & 3)	D	Ryan
12	Grid over downgradient “hotspot” instead of transverse biobarrier.	E	
13	Passive barometric venting (extraction) of VOCs from injection wells’ headspace.	E	
14	Manifold active vapor extraction on injection wells.	D	Chuck
15	Passive aeration (injection”) of vadose zone for co-metabolic dechlorination.	E	
16	Add MIP investigation to DTP sediment characterization to obtain data for evaluation of vapor phase VOCs.	R	Chuck
17	Active soil vapor sampling from unsaturated screened interval of new injection wells.	D	Hugh
18	Discuss sequence of injections	D	Ryan
19	Stainless steel screens (wire-wrap) vs. PVC (slotted) screens. (recommend to **retain** SS screens as designed)	E	

List of CREATIVE IDEAS			
Idea Category: Bountiful Woods Cross OU1			
ID #	**Name of Idea / description**	**Value Potential**	**To be Developed**
20	Contact JRW re: new donor/substrate amendment product (lower cost than EOS?)	D	Ryan
21	Collect soil samples from saturated zone during DPT characterization as baseline for subsequent DPT monitoring to assess potential for rebound in groundwater.	R	Ryan
22	Use straddle packer in screens during injection to focus injection to specific stratigraphic intervals.	E	
23	Add depth-specific groundwater sampling in saturated zone to DPT characterization.	D	Chuck
24	Write contract to have an established baseline quantity; do not include variation-in-estimated-quantity clause as a special provision.	E	
25	On-site carbon treatment of IDW water from well development for possible discharge to storm water system.	R	Mario
26	Install wells of biobarrier #3 as part of initial well installations (time zero) to reduce drilling mobilization costs. Injections at any time after.	R	Ryan

R = Recommendation
D – Design comment
E = Eliminated

APPENDIX C
FUNCTION ANALYSIS SYSTEM TECHNIQUE (FAST) DIAGRAM

<u>Function Model</u>
Bountiful Woods

Item	Function
Baseline Sampling	Establish starting point
Drill Wells	Create access
Decontamination area	Control contamination
DTP Characterization	Characterize geology
Install inject wells 2’ in 8’ bore	Facilitate injection
Monitoring Wells, Soil Vapor	Monitor Contaminates
Monitor Wells, Ground water	Monitor contaminates
Develop ground war monitoring wells	Develop wells
Mix/ Delivery system	Inject electron donor
Mob/demobilization	Prepare equipment
Injection Bio culture	Install bugs
IDW Disposal	Comply with regulations
Survey Wells	Locate positions
Bio barriers	Polish/treat hot spots

Bountiful/Wood Cross April 2, 2007
Function Analysis System Technique (FAST) Diagram