LOCKHEED MARTIN

Y/ER-288/R1

**ENVIRONMENTAL
RESTORATION
PROGRAM**

**Best Management Practices Plan
for Phase II
of the Bear Creek Valley
Treatability Study,
Oak Ridge Y-12 Plant,
Oak Ridge, Tennessee**

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and ENTECH, Inc.**

contributed to the preparation of this document and should not be
considered eligible contractors for its review.

**Best Management Practices Plan
for Phase II
of the Bear Creek Valley
Treatability Study,
Oak Ridge Y-12 Plant,
Oak Ridge, Tennessee**

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PREFACE

The *Best Management Practices Plan for Phase II of the Bear Creek Valley Treatability Study, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee* (Y/ER-288/R1) was prepared under the Environmental Restoration Program to support the investigation of the practicality of the use of passive, in situ treatment systems to remove contaminants from the Bear Creek Valley Characterization Area. This work was performed under Work Breakdown Structure 1.1.02.41.10.34.20 (Activity Data Sheet 2302 "Bear Creek Valley Operable Unit"). This report will be used to direct investigations during Phase II.

CONTENTS

PREFACE	iii
FIGURES	vii
TABLES	vii
ABBREVIATIONS	ix
1. INTRODUCTION	1
1.1 SITE DESCRIPTION	1
1.2 PREVIOUS TREATABILITY STUDY ACTIVITY	1
2. OBJECTIVES	1
3. OPERATING PLANS	3
3.1 MEDIA PERFORMANCE OPERATING PLAN	3
3.1.1 Dowex	3
3.1.2 Peat Moss	3
3.1.3 Zero Valence Iron	4
3.1.4 Goethite (Iron Oxide)	4
3.1.5 Native Soil	4
3.1.6 Combined Treatment	4
3.1.7 Operating Conditions	5
3.1.8 Operational Considerations	5
3.2 ALGAL MATS BIOREACTOR OPERATING PLAN	9
3.3 WETLANDS OPERATIONS	10
3.4 BASELINE SAMPLING	10
3.5 HYDRAULIC TEST FACILITIES	10
3.5.1 Hydraulic Test Trench	14
3.5.2 NT-1 Site	14
3.6 HYDRAULIC TESTING	18
4. HEALTH AND SAFETY	18
5. SAMPLING AND ANALYSIS	18
6. WASTE MANAGEMENT	18
7. ENVIRONMENTAL COMPLIANCE	18
8. SEDIMENT AND EROSION CONTROL	19
8.1 SILT FENCE	19
8.2 SEDIMENT REMOVAL/WATER FILTRATION	19
9. PROJECT TEAM	19

APPENDIX. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE BCV TREATABILITY STUDY	A-1
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FIGURES

1	Bear Creek Valley, showing the relationship between the main waste units and contaminants flux in tributary streams	2
2	Schematic of columns and ports	8
3	General site layout	11
4	Bear Creek Valley Treatability Study—NT-1 Site map (1)	12
5	Hydraulic Test Trench site plan (1)	13
6	Hydraulic Test Trench site plan (2)	15
7	Bear Creek Valley Treatability Study—NT-1 Site map (2)	16
8	Cross section A-A'	17
9	Silt fence detail	20
10	Settling pit and sediment removal swale	21
11	Project team	22

TABLES

1	Sequence of operations for media columns	6
2	Mats test conditions	9
3	Wetlands test conditions	10
4	BCV team roster	23
5	BCV responsibility matrix	24

ABBREVIATIONS

BCV	Bear Creek Valley
Energy Systems	Lockheed Martin Energy Systems, Inc.
FCO	Field Change Order
HASP	Health and Safety Plan
SAP	Sampling and Analysis Plan
WMP	Waste Management Plan
ZVI	zero valent ion

1. INTRODUCTION

1.1 SITE DESCRIPTION

The Oak Ridge Y-12 Plant is currently under a Federal Facility Agreement to define soil and groundwater contamination and develop remedies to protect human health and the environment. The western end of the site is known to have a former nitric acid disposal pit that has been remediated and capped. Remedial investigation data indicate this pit was a source of nitrate, uranium, technetium, and other metals contamination in groundwater. The downgradient receptor of this contamination includes Bear Creek and its tributaries (Fig. 1). A feasibility study is under way to develop a remedy to prevent further contaminant migration to this receptor. To support the feasibility study, a treatability study is being completed to examine groundwater treatment at the S-3 site.

This document serves as the top-level command medium for Phase II of the Bear Creek Valley (BCV) Treatability Study and, as such, will be the primary resource for management and implementation of field activities. Many of the details and standard operating procedures referred to herein can be found in other Lockheed Martin Energy Systems, Inc. (Energy Systems), documents. Several supporting documents specific to this project are also cited. These include the Sampling and Analysis Plan (SAP), the Health and Safety Plan (HASP), and the Waste Management Plan (WMP).

Chapter 1 describes the results of Phase I efforts. Chapter 2 describes the objectives of Phase II. Chapter 3 provides details of field testing. Chapter 4 addresses the HASP. Chapter 5 describes the SAP. Chapter 6 introduces the WMP. Environmental compliance issues are discussed in Chap. 7, and sediment and erosion control is addressed in Chap. 8. Information about the project team is provided in Chap. 9.

1.2 PREVIOUS TREATABILITY STUDY ACTIVITY

A three-phase treatability study has been developed to examine the feasibility of using in situ and ex situ systems to remove metals and nitrate from groundwater before its entry into Bear Creek. Phase I produced a ranking of applicable treatment media through preliminary laboratory screening tests using site water. It also delineated three major contaminant pathways that extend from the S-3 Ponds to Bear Creek and its tributaries. The results provided valuable guidance on which media may be effective; however, no long-term performance data exist. Before a successful treatment system can be designed, the implementability of the conceptual approach must be determined. Phase II is planned to develop long-term treatment efficiencies and to identify design considerations. Phase III will design and implement an early action treatment system.

2. OBJECTIVES

The BCV Treatability Study is intended to provide site-specific data defining potential treatment technologies applicable to contaminated groundwater and surface water. This program directly

Fig. 1 Rear Creek Valley, showing the relationship between the main waste units and contaminants flux in tributary streams.

supports Alternative 5 of the base action in the BCV Feasibility Study and indirectly supports other alternatives through proof of concept. In that role, the ultimate goal is to install a treatment system that will remove uranium and nitrate from groundwater before it reaches Bear Creek. An additional goal is the concurrent removal of technetium and several metals. This project is intended to produce treatment performance data required to design the treatment system to reach those goals.

In addition, this project will generate information that can be applied to other sites within the Y-12 Plant, East Tennessee Technology Park (formerly referred to as Oak Ridge K-25 Site), and Oak Ridge National Laboratory. The objectives are categorized as follows.

Media Performance Objective

Operate in-field continuous flow tests over an extended time period (6 weeks) to generate data on long-term treatment effects on potential treatment media including Dowex 21K anion exchange resin, peat moss, zero valent iron (ZVI), iron oxide, constructed wetlands, and algal mats treatment. The product will be performance data required to begin a treatment system design and recommended treatment media for locations within the S-3 area.

3. OPERATING PLANS

3.1 MEDIA PERFORMANCE OPERATING PLAN

This plan for operating the media columns in Phase II of the BCV Treatability Study was developed to meet the objectives taken from the *Bear Creek Valley Treatability Study Phase I Report* (Science Applications International Corporation 1997). The references for the objectives are noted in parentheses. The objectives are numbered for procedural purposes.

3.1.1 Dowex

1. Measure sorption capacity at breakthrough and effluent quality for uranium at GW-835 (pp. xi, 3-4, and B-23).
2. Compare sorption capacity at breakthrough and effluent quality for uranium at GW-835 with same for peat moss (pp. 3-4 and B-23). Does Dowex have technical advantages (in terms of sorption capacity at breakthrough and/or long-term stability) to overcome factor of 60 in difference of cost (\$4.16/lb vs \$0.07/lb)?

3.1.2 Peat Moss

1. Measure sorption capacity at breakthrough and effluent quality for uranium at GW-835 and GW-837 (pp. xi and B-23).
2. Verify sorption capacity at breakthrough and effluent quality for uranium are unaffected by high ionic strength (pp. xi and B-23).
3. Verify removals and effluent qualities for up to six other non-rad metals in both wells (p. 3-7).
4. Verify stability of peat moss over a long period of time (p. 3-6).

3.1.3 Zero Valence Iron

1. Investigate the mechanism of the removal of uranium (pp. xii and 3-27).
2. Demonstrate long-term fate of uranium and/or stability of the iron oxide floc (pp. xii, 3-27, and D-10).
3. Demonstrate that iron flocs containing sorbed uranium can be controlled, especially in passive system (p. 3-22) and watch out for colloidal ferrihydrate at high pH (pp. D-56, D-65, and D-66).
4. Verify which design scaleup model describes removal of uranium by ZVI; that is, is it by chemical reaction such that half life is the key design variable, or is it by adsorption such that loading capacities and/or isotherms are the key design variables? (p. 3-7).
5. Mix ZVI with other products to enhance the retention of uranium (p. 3-27).
6. Compare sorption capacities at breakthrough of uranium between GW-835 and GW-837 (p. 3-27).
7. Confirm that OH^- formed by the corrosion of iron is flushed from a media bed so that the adverse effect of passivating the iron at high pH is avoided (pp. D-9 and D-66).
8. Verify removal of up to six other non-rad metals in both wells (p. D-10).
9. Measure pressure drop to determine if bed is plugging as a result of cementation of iron (p. D-10).
10. Test a system that avoids the plugging/passivating of a ZVI bed by mixing an inert medium (sand) or reactive matrix (pelletized iron oxide) with ZVI. The objective is to separate iron particles so that they will not cement together and perhaps minimize the self-passivation of iron substrates by allowing for better dilution of OH^- byproduct (p. D-10).

3.1.4 Goethite (Iron Oxide)

1. Measure sorption capacity at breakthrough and effluent quality for uranium of pelleted forms (p. 3-27).
2. Compare sorption capacities at breakthrough and effluent qualities for uranium between GW-835 and GW-837 (p. 3-27).
3. Demonstrate that iron flocs containing sorbed uranium can be controlled, especially in a passive system (p. 3-22).

3.1.5 Native Soil

1. Measure compatibility of treated water with the surrounding subsurface environment (p. 4 of Phase II Project Plan).

3.1.6 Combined Treatment

1. Test effectiveness of sequence that removes uranium and heavy metals from GW-837 and then treats nitrate biologically (p. D-67).

3.1.7 Operating Conditions

The conditions for the tests are presented in Table 1. They were developed by considering the interaction of several factors, including the following:

- the sizes of the columns,
- the flow rates,
- the bulk densities of the media,
- the superficial velocities (low enough to be compatible with low available pressure of the passive design configuration but high enough to give good flow distribution),
- the loading capacity observed in Phase I, and
- the estimated times to breakthrough (trying to keep breakthrough time between 7 and 35 days).

3.1.8 Operational Considerations

The objective of each test is to measure the sorption capacity at breakthrough and the effluent quality. Each column will be run until the effluent uranium concentration is 50% of the feed concentration because the sorption capacity needs to be measured to breakthrough. Sorption capacity will be computed by integrating the breakthrough curve up through the breakthrough point.

On the basis of information currently available, the trailer from Portsmouth Gaseous Diffusion Plant containing test columns and auxiliary hardware will be used for the tests at GW-835, and the panel fabricated by the Y-12 Plant will be used for the tests at GW-837. The trailer was selected for the tests at GW-835 because it has the capability to monitor and record flows, pressures, and pressure drop, which is desirable for unattended operation. This will help ensure that the volume of water treated by each column is known throughout the test. The trailer will be retrofitted with 1.5- or 3-in.-diam columns, as noted in Table 1, because the data generated in these columns will meet the objectives of this project. The existing 12-in.-diam columns are too big for the available flow rates. A schematic of the columns and ports is provided in Fig. 2.

The volume of water treated by each column will be verified by collecting and measuring the volume of effluent every 1 to 2 days. This will give an independent verification of the readings taken from the flow meters. This backup measurement is a precaution against the probability of the flow to one or more columns varying as a result of changing pressure drops in the system. The effluents will be pumped to the water dissipation area.

Samples will be taken from the feed to the system and effluents of each column on the schedule shown in Table 1 and archived. Selected samples will be analyzed based on the expected breakthrough time so that 8 to 15 data points are obtained for each effluent breakthrough curve. This means that samples will be analyzed more frequently for tests with short breakthrough cycles. Archived samples will be analyzed to fill in data gaps identified by analytical results. The analyses of the sample of the common feed to the columns in the trailer will be used for all of the pertinent tests.

The media will be loaded in the columns as slurries with precautions taken to prevent air from entering the columns. This is because any portion of the bed that has air will be taken out of service

Table 1. Sequence of operations for media columns

Column/feed ^a source	Bed media		Column dimensions		Flow (L/min)	Est'd break- through (days)	Daily volume of effluent (55-gal drums)	Sampling	
	Objective (see text)	Specification	Diam (in.)	Length (ft)				Location	Frequency ^b
A-1 835	Dowex 1,2	Dowex 21k resin	1.5	1.25 each for 2 columns in series	0.15	18 for lead column	0.98	1-F, 1-M, 1-Eff.	Daily 1st 5 days, then every 2 days
A-2 835	Peat Moss 1,3,4	Peat Moss	3.0	2.5	0.10	27	0.67	2-Feed, 2-Eff.	Daily 1st 5 days, then every 2 days
A-3 835	ZVI 1,2,3,4,6	Masterbuilders (40 mesh)	3.0	2.5	0.05	30	0.33	3-Feed, 3-Eff.	Daily 1st 5 days, then every 2 days
A-4 835	Goethite 1,2,3	Goethite (foam)	3.0	2.5	0.10	30	0.67	4-Feed, 4-Eff.	Daily 1st 5 days, then every 2 days
A-5 837	Peat Moss 1,2,3,4	Peat Moss	3.0	2.5	0.05	4.8	0.33	5-Feed, 5-Eff.	Daily 1st 5 days, then every 2 days
A-6 837	ZVI 1,3,4,6,7,8	Masterbuilders (40 mesh)	3.0	2.5	0.05	30	0.33	6-Feed, 6-Eff	Daily 1st 5 days, then every 2 days
B-1 835	Dowex ^c	Dowex 21k resin	1.5	1.25 each for 2 columns in series	0.15		0.98	1-F, 1-M, 1-Eff.	Daily 1st 5 days, then every 2 days
B-2 835	"							2-Feed, 2-Eff.	Daily 1st 5 days, then every 2 days
B-3 835	"							3-Feed, 3-Eff.	Daily 1st 5 days, then every 2 days
B-4 835	"							4-Feed, 4-Eff.	Daily 1st 5 days, then every 2 days
B-5 837	Goethite 1,2,3	Goethite (foam)	3.0	2.5	0.10	30	0.67	5-Feed, 5-Eff.	Daily 1st 5 days, then every 2 days
B-6 837	"							6-Feed, 6-Eff.	Daily 1st 5 days, then every 2 days
C-1 835	"							1-F, 1-M, 1-Eff.	Daily 1st 5 days, then every 2 days
C-2 835	"							2-Feed, 2-Eff.	Daily 1st 5 days, then every 2 days

Table 1 (continued)

Column/feed ^a source	Bed media		Column dimensions		Flow (L/min)	Est'd break- through (days)	Daily volume of effluent (55-gal drums)	Sampling	
	Objective (see text)	Specification	Diam (in.)	Length (ft)				Location	Frequency ^b
C-3 835	c							3-Feed, 3-Eff.	Daily 1st 5 days, then every 2 days
C-4 835	c							4-Feed, 4-Eff.	Daily 1st 5 days, then every 2 days
C-5 837	ZVI-5	ZVI and peat moss	3.0	2.5	0.05		0.33	5-Feed, 5-Eff.	Daily 1st 5 days, then every 2 days
C-6 837	c							6-Feed, 6-Eff.	Daily 1st 5 days, then every 2 days
D-1 835	c							1-F, 1-M, 1-Eff	Daily 1st 5 days, then every 2 days
D-2 835	c							2-Feed, 2-Eff.	Daily 1st 5 days, then every 2 days
D-3 835	c							3-Feed, 3-Eff.	Daily 1st 5 days, then every 2 days
D-4 835	c							4-Feed, 4-Eff.	Daily 1st 5 days, then every 2 days
D-5 837	c							5-Feed, 5-Eff	Daily 1st 5 days, then every 2 days
D-6 837	c							6-Feed, 6-Eff.	Daily 1st 5 days, then every 2 days

^aTesting will be conducted at two different locations - Well 835 and Well 837. Numbering scheme for columns is as follows: the 4 series of tests will be A, B, C, D. The columns will be numbered 1 through 6. Columns 1-4 will be fed with groundwater from Well 835. Columns 5-6 will be fed with groundwater from Well 837.

^bMany samples will be archived but analyzed only to fill in gaps in the data. In addition, sampling frequency will be optimized based on results of samples early in each series of runs.

^cConditions for these runs will be selected based on the results of the tests in earlier series.

Fig. 2. Schematic of columns and ports.

because it is no longer in contact with the water being treated. This also means that the columns should be maintained liquid full and never drained out.

The quantity of media used in each column will be carefully measured on a dry basis so that sorption capacities can be computed in terms of grams of uranium per gram of dry media.

The pressure drop across each column will be monitored throughout each test to measure the pressure required to push the water through the media and how it changes with time (if at all). These data in conjunction with the superficial velocity can be used to determine the hydraulic conductivity of the media in this service.

Because one of the purposes of the tests with the ZVI and goethite is to verify that the iron flocs produced stay in the column, the effluent from these tests will be individually filtered to measure the amount of suspended solids and uranium in the effluent. In addition, solid samples of the used ZVI will be examined visually at the completion of the study. Subsequent column testing details will be generated based on the results of the first test. These tests may repeat media and flow rates to confirm breakthrough or other observations that may affect design. During these follow-on tests the interaction of effluent with native soil will be examined.

3.2 ALGAL MATS BIOREACTOR OPERATING PLAN

Objective: To determine the long-term capacity of mats to remove metals and nitrate from groundwater. In addition, a preliminary engineering study will be completed to determine possible configurations for in-stream deployment of this system.

During the column tests, an algal mat reactor will be plumbed to receive a continuous flow of groundwater from the same well used to feed the columns. Operating conditions are summarized in Table 2. Sampling and analysis details can be found in the project SAP. The mats will be monitored twice weekly for influent and effluent water quality criteria (pH, Eh, conductivity, temperature, nitrate). Effluent samples will be collected once per week for metals analysis. The mats reactor will be inspected 5 d/week. The inspection will include visual observation of the mats physical status and water flow rate. Observations will be noted in a bound field notebook. The mats will be maintained for 24 weeks to establish a long-term uptake rate. At the completion of the treatment period, solids samples will be collected from three locations within the reactor to determine uptake relative to biomass. The results of this testing will document the full denitrification and metal removal capacity relative to influent concentration.

Table 2. Mats test conditions

Operating condition	Details
Location	Well GW-837
Duration	24 weeks
Flow rate	60 mL/min, continual
Sampling locations (water)	Effluent only
Sampling frequency (water)	Twice per week
Solids sampling	3 locations at termination of test

3.3 WETLANDS OPERATIONS

Objective: To determine the denitrifying capacity and metal uptake capacity of mature wetlands systems operating without supplemental carbon. In addition, testing will determine the relative uptake of metals into the solid plant mass so that accumulation capacity can be predicted over longer treatment periods. The results of this work will provide the basis for design of constructed treatment wetlands to address the contaminated surface water tributaries.

The Phase I wetlands testing program provided preliminary data relative to removal of uranium and nitrate from spring SS-4 water. The test period was too short to demonstrate the full capacity of a mature wetlands system. A summary of Phase II operating conditions is provided in Table 3. Activities in this task will focus on re-establishing flow at approximately 200 mL/min through the wetlands and documenting uranium and metal uptake during the spring and summer season. A schematic of the wetland system and its sampling ports are shown in Fig. 3. During this period, field data (pH, oxidation-reduction potential, conductivity, temperature, nitrate) will be collected weekly, and water samples will be collected biweekly and archived. Monthly samples will be submitted for metals analysis as described in the SAP. Additional archived samples will be submitted based on technical observations of performance. At the beginning and end of the program, solid root mass will be collected and analyzed for metal uptake. Details of sampling and analysis are described in the SAP. The program will continue for 28 weeks. This information is required to produce an effective model for long-term treatment capacity.

Table 3. Wetlands test conditions

Operating condition	Details
Location	SS-4
Duration	28 weeks
Flow rate	200 mL/min, continual
Sampling locations (water)	Influent and effluent, each cell
Sampling frequency (water)	Twice per month
Solids sampling	3 locations per cell at beginning and termination of test

3.4 BASELINE SAMPLING

To determine the pretreatment characteristics of the downgradient receptor, six locations have been chosen for monthly monitoring. The locations are shown in Figs. 3–5. Three locations are surface water, and three are groundwater wells. Details of sampling and analysis are provided in the SAP. These locations will be sampled over a period of 7 months so that the impact of wet and dry seasons will be recorded.

3.5 HYDRAULIC TEST FACILITIES

Objective: To install an interception trench and assess the hydraulic performance of the trench under both active and passive (pumped and unpumped) modes of operation. To install groundwater wells into target zones beneath seeps on NT-1 and perform pump tests to assess groundwater flow characteristics. The results of this work will provide the basis of design for groundwater interception and treatment facilities.

Fig. 3. General site layout.

12

PROJECT NO.	96030	LEGEND: BEAR CREEK & TRIBUTARIES GW-834 AUGERED PIEZOMETER PTW-0, PTW-01 PROPOSED MONITORING WELL LOCATIONS	 SCALE: 1" = 60'	VIEW A NT1 SITE
DRAWING NO.	/DWGS/797SAMP2			
REVISION DATE	REV. 0/ 08-29-97			
XREF. FILES	94020/XREF/XRBCV13 94020/XREF/XRBCV14

Fig. 5. Hydraulic Test Trench site plan (1).

3.5.1 Hydraulic Test Trench

A narrow trench will be installed parallel to Bear Creek as shown in Fig. 6. The location of the trench was selected to facilitate hydraulic testing of an interception trench to determine the applicability of in situ treatment for remediation of contaminated sites in BCV. The trench will be installed across the pre-1940s location of Bear Creek. Well data indicates that the old stream bed is a preferential flow path for local groundwater. The trench will be filled with relatively high conductivity backfill, creating a new preferential flow path along the trench. In addition, a section of the trench will be filled with iron filings treatment media to evaluate the hydraulic and treatment performance of an in situ installation.

The trench will be constructed as follows. An initial bench approximately 30 ft wide, 4 ft deep, and 225 ft long will be excavated in relatively uncontaminated surface soil. Approximately half of the clean excavated soil will be disposed of in an on-site ravine west of the trench location, and the remaining soil will be stockpiled for refilling the excavated bench. The bench will serve as a location for stockpiling and eventually disposing of potentially contaminated soils from the trench excavation. A trench 2 ft wide, 225 ft long, and approximately 22 ft deep (excavated to the top of bedrock) will be excavated along the length of the bench. Material excavated from the trench will be placed on the bench south of the trench. Backfill material, coarse silica sand and iron filings, will be placed in the trench to the bottom of the bench. The backfilled trench will be covered with a geotextile to prevent cover soil from migrating into the backfill from above. The soil excavated from the trench will then be spread across the bench along with stockpiled soil originally excavated from the bench. Finally, the gravel surface will be replaced and the site restored to its initial contours.

A vertical extraction well with 6-in. polyvinyl chloride casing and well screen will be installed at the west end of the trench. The extraction well will serve as a dewatering sump during construction and later as the extraction well for trench pump testing. Additional monitoring wells will be installed in the trench backfill and surrounding the trench. The monitoring wells will be used to provide water level data to assess the hydraulic performance of the trench under both active and passive (pumped and unpumped) modes of operation. Water from trench dewatering during construction and pump testing will be filtered and discharged overland to Bear Creek.

3.5.2 NT-1 Site

A pump test well will be installed adjacent to NT-1 immediately south of where NT-1 crosses Bear Creek Road. The well will be located west of Tank Farm 4, as shown in Fig. 7. The well will be installed at a 45° angle from horizontal at a bearing parallel to Y-12 Plant grid north, to a total depth of 110 ft below ground surface (length ~156 ft). The pumping well and monitoring wells to be installed (PTMW-01 and PTMW-02) are shown schematically in Fig. 8. The intent is locate the screened sections of the angled well and vertical well within the dipping beds of shale bedrock identified during the Remedial Investigation and BCV Treatability Study Phase I as significant contaminant pathways. The angled well will have a pumping test conducted to determine its hydraulic performance and potential for inhibiting the migration of contaminants into NT-1.

The wells will be constructed in accordance with Energy Systems Procedure ESP-601, Groundwater Well Management: Well Installation. Well development will be performed in accordance with Energy Systems Procedure ESP-602, Groundwater Well Management: Well Development. Drill cuttings and fluids will be handled in a manner which will be consistent with U.S. Department of Energy and Y-12 Plant policies, protect worker health and safety, and prevent uncontrolled release to the environment.

Fig. 6. Hydraulic Test Trench site plan (2).

Fig. 7. Bear Creek Valley Treatability Study—NT-1 Site map (2).

Fig. 8. Cross section A-A'.

3.6 HYDRAULIC TESTING

A total of four pumping tests will be performed as part of the BCV Treatability Study Phase II for the Treatability Study Trench and NT-1 sites to approximate production capabilities of the Trench and NT-1 wells. One stepped and one constant rate pumping test will be performed at each of the two sites: the Trench site and the NT-1 Site. In addition to the active pumping tests, an ambient flow test will be conducted at the Trench site. These pumping tests are intended to provide information on the capability of the underlying formation to produce groundwater during pumping conditions within the Trench and NT-1 inclined wells.

4. HEALTH AND SAFETY

A project HASP has been developed by using Energy Systems standard practices, when applicable. This plan describes all of the requirements to conduct project activities at the Y-12 Plant. It is the responsibility of the project managers, field managers, and site safety and health officers to ensure that this work is done safely. These personnel will verify that the HASP is sufficiently protective. If it is determined that the requirements of the HASP are not sufficiently protective, a Field Change Order (FCO) will be prepared. FCOs will include a completed job hazard analysis or similar worksheet to ensure complete hazard assessment. FCOs must be approved by the Program Manager, Health and Safety Manager, subcontractor project or field manager, and subcontractor Health and Safety representative. As a minimum, FCOs will be prepared if additional tasks will be performed.

5. SAMPLING AND ANALYSIS

A SAP has been developed for each of the tests planned during Phase II. This plan is provided under separate cover and includes tabulated sample descriptions, methods, quality assurance, and data management plans.

6. WASTE MANAGEMENT

A WMP has been developed for this project. This plan has been approved by the West End site environmental coordinator and by an Energy Systems waste management professional. This plan is subject to modification if variations in waste production occur.

7. ENVIRONMENTAL COMPLIANCE

The Tennessee Department of Environment and Conservation has been informed of the described project activity including the intention to follow a Best Management Practices Plan. Compliance requirements will be maintained throughout all construction, testing, and sampling activity. The applicable or relevant and appropriate requirements for the BCV Treatability Study are in the Appendix.

8. SEDIMENT AND EROSION CONTROL

Sediment and erosion control is specifically addressed to mitigate environmental stress during the Tennessee Dace mating season. To achieve this goal, silt fencing and water filtration will be implemented throughout the construction phase and subsequent groundwater pump testing.

8.1 SILT FENCE

Silt fence will be installed in accordance with Energy Systmes Engineering Standard ES-7.16-1 in locations necessary to control soil loss from all of the construction activities. Silt fence will be placed downgradient from areas to be excavated, stockpile locations, and the clean soil fill area. See Engineering Standard ES-7.16-1 (Fig. 9) for silt fence detail.

The silt fence will be inspected during the construction activities and following construction until the establishment of vegetation or until areas are stabilized with riprap or gravel. Inspection will be performed weekly by the construction engineer and following any significant precipitation event. The routine inspections will focus on preventing sediment from overtopping the silt fence or moving under the silt fence in the event of a failed anchor trench. Any location where significant amounts of sediment are accumulating behind the silt fence will be identified and the sediment removed. Locations where the silt fence is not securely embedded in the shallow anchor trench will be identified and repaired.

8.2 SEDIMENT REMOVAL/WATER FILTRATION

Trench and well construction, pump testing, and equipment decontamination will produce large quantities of investigation-derived waste soil and water. All soils will be contained either in the immediate vicinity of the trench or west of the trench in an existing ravine. Liquids will be placed into lined settlement basins that overflow to unlined sediment filtration swales and eventually discharge overland to adjacent tributaries. The equipment decontamination area is located adjacent to one of the sediment removal structures, and all discharge from the decontamination area flows through the settlement pits and filtration swales before release. The settling basins and filtration trenches should be very effective, as the water will undergo settlement and then pass through a silt fence and several feet of sand filter before discharge. A sediment removal basin and filtration swale is shown in Fig. 10.

9. PROJECT TEAM

The project team is shown in Fig. 11. The key individuals and communication information are provided in Table 4. This team will be informed of all progress and project changes for the duration of activity.

The responsibility matrix (Table 5) describes the role of each team member according to tasks. A single team member is primarily responsible for each task, with secondary or supporting responsibility from other team members as needed.

Fig. 10. Settling pit and sediment removal swale.

Fig. 11. Project team.

Table 4. BCV team roster

Name	Organization	Address	Phone number	Pager number	Fax number	E-mail address
John H. Vanderlan	Energy Systems/ Project Manager	9734, MS-8130	576-2745	873-6229	574-1660	vanderlanjh@ornl.gov (JHV)
Mike A. Travaglini	U.S. Department of Energy/Program Manager	IRC, MS-EW911	576-0848	--	576-6074	travaglinima@oro.doe.gov
Rick Adkisson	ENTECH, Inc.	560 Oak Ridge Turnpike, Suite 2, Oak Ridge 37830	481-3231	--	481-3501	entechoakridge@sprintmail.com
Jim A. Davis	Energy Systems/ Environmental Restoration Sample Mgmt.	K-1001, MS-7169	241-5066	873-4382	574-9433	davisjal@ornl.gov (J9D)
Virginia M. Forsberg	Energy Systems/Data Mgmt.	9734, MS-8130	574-7000	--	574-1660	forsbergvm@ornl.gov (VMF)
Jeff C. Henderson	Energy Systems/ WMO	K-1037, MS-7346	241-2410	873-6112	241-2533	hendersonjc@ornl.gov (HCJ)
Peter Salpas	SAIC	SAIC/Jackson Plaza	481-4747	--	481-8797	peter.a.salpas@cpmx.saic.com
Rebecca L. Marcum	PWT/Energy Systems	9983-67, MS-8248	576-0539	873-1623	576-3808	marcumr@onrl.gov (6RM)
Michael Cox	Energy Systems/Health & Safety	K-1001, MS-7125	574-8398	873-4783	576-5291	coxma@ornl.gov (AOX)
P. Duncan Moss	SAIC	SAIC/Jackson Plaza	481-4752	--	481-8797	philip.d.moss@cpmx.saic.com
Becky Sams	Jacobs	3 Main, MS-Jacobs	220-4869	--	220-4848	becky.sams@jacobs.com
L. Gay Schaffer	Energy Systems/ Project Secretary	9734, MS-8130	576-6189	--	574-1660	schafferlg@ornl.gov (GSQ)
Dave B. Watson	Energy Systems/Tech Lead	1509, MS-6400	241-4749	873-4822	574-7420	watsondb@ornl.gov (V6I)
Steve A. White	Energy Systems/Civil	K-1550-U, MS-7233	576-6492	--	241-4634	whitesal@ornl.gov (WHZ)
Mick C. Wiest	Energy Systems/ Compliance	9116, MS-8098	574-3390	417-5261	574-9041	wiestmcjr@ornl.gov (MXY)

WMO = Waste Management Organization; SAIC = Science Applications International Corporation; PWT = Pacific Western Technologies, Ltd.; Jacobs = Jacobs Engineering Group.

Table 5. BCV responsibility matrix

Task	SAIC	ENTECH	LMES WM	LMES SMO	LMES WETF	LMES Eng'g	LMER ESD	LMES HP
1. Hydraulic Performance								
1.1 Existing Systems Review	2	1						
1.2 Field Preparation & Mobilization								
1.2.1 Permits		1	2					
1.2.2 Readiness Review	2	1	2		2	2		
1.3 Field Installation								
monitoring wells		1						
trench		1					2	
horizontal well		1				2	2	
IDW/Demob		1	2			2	2	
H&S compliance	1	2						2
1.4 System Performance								
Hydraulic Testing		1						
Sampling								
hydraulic		1						
surface Water	1							
Analytical				1				
Waste Management		1	2		2			
Technical Memo	2	1				2		
1.5 Modeling								
1.5.1 Calibration	1	2					2	
1.5.2 Treatment Simulation	1	2					2	
2. Media Performance								
2.1 Existing Systems Review	1		2				2	
2.2 Field Panel Studies								
2.2.1 Workplan finalization	1		2	2	2		2	
2.2.2 Installation/start-up	1		2			2	2	
2.2.3 Maint/sampling	1		2	2				
2.2.4 Wetlands/Algal Design	1						2	

Table 5 (continued)

Task	SAIC	ENTECH	LMES WM	LMES SMO	LMES WETF	LMES Eng'g	LMER ESD	LMES HP
2.2.5 Technical lab mgmt	1			2			2	
2.2.6 Analytical	1							2
2.2.7 H&S Compliance	1							
2.3 Technical Memo	1						2	
3. Project Management								
3.1 Work Plans								
3.1.1 BMP	1	2						
3.1.2 SAP	1	2						
3.1.3 HASP	1	2						
3.1.4 WMP	2	1	1			2	2	
3.1.5 Trench Designs	2	1				2	2	
3.1.6 Well Designs	2	1					2	
3.1.7 Hydraulic Test Design	2	1						
3.2 Monthly reports	1	1						
3.3 Meeting minutes	1							
3.4 Envirowall Coordination	2						1	
3.5 Data Management	1	2						
3.6 Phase II Report	1	2					2	

1 = primary responsibility; 2 = secondary responsibility. SAIC = Science Applications International Corporation; WM = Waste Management; SMO = Sampling Management Organization; WETF = West End Treatment Facility; LMER = Lockheed Martin Energy Research Corporation; ESD = Environmental Sciences Division; HP = Health Physics; IDW = investigation-derived waste; H&S = Health and Safety.

APPENDIX

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE BCV TREATABILITY STUDY

Treatability studies involving Superfund wastes are subject to various requirements under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986. On-site treatability studies may be conducted without any federal, state, or local permits [Title 40, *Code of Federal Regulations*, Pt. 300.400(e)(1)]. However, the U.S. Environmental Protection Agency (EPA) has determined that such studies must comply with applicable or relevant and appropriate requirements (ARARs) under federal and state environmental laws to the extent practicable or justify a waiver under CERCLA Section 121(d)(4)(Office of Solid Waste and Emergency Response Directive 9380.3-10, November 1992). The National Contingency Plan (NCP) identifies two factors that should be considered in determining whether identifying and complying with ARARs is practicable: (1) the urgency of the situation and (2) the scope of the action to be taken. This treatability study is designed to test various treatment media and treatment system conceptual designs for the removal or destruction of particular contaminants of concern (i.e., uranium, nitrates, metals, volatile organic compounds, total dissolved solids). On the basis of the above guidance, ARARs identified for this groundwater interception treatability study are listed on Table A.1 and highlighted below. ARARs apply to those federal and state regulations that are designed to protect the environment and do not generally apply to occupational safety or worker protection regulations. EPA requires compliance with the Occupational Safety and Health Act and worker protection regulations in §300.150 of the NCP, not through the ARARs process. Therefore, these regulations are not included as ARARs; these standards will be addressed through the Health and Safety Plan for this project.

No endangered or threatened species or habitats, or archeological or historic resources that might be affected, were identified at the site. The horizontal trench at NT-1 may need to be placed in a floodplain/wetlands area; the project has been designed, however, to minimize impacts to the area from trench activities. As currently designed, no activities will take place within the streams.

Concentration of contaminants in the various treatment media as the groundwater flows through them could be sufficient to cause the exhausted treatment media to test as Resource Conservation and Recovery Act (RCRA)—characteristic waste, as well as low-level waste, when they are removed from the system. All such media must be characterized and, if necessary, managed and disposed of as a mixed waste under the Federal Facility Compliance Agreement (FFCA) and the Tennessee Department of Environment and Conservation (TDEC) Commissioner's Order for the Oak Ridge Reservation (ORR) Site Treatment Plan (STP). Some of the soil excavated during the trench and treatment systems installation activities will be reused as fill and, therefore, is not considered a waste. Any remaining soils will remain within the area of contamination. These soils, as well as any personal protective equipment or secondary waste streams, will be characterized and, if contaminated, will be managed or disposed of as RCRA-characteristic, low-level, or mixed waste under the FFCA and the TDEC Commissioner's Order for the ORR STP.

Although there is a low potential for volatile organic compound emissions during operations (e.g., not greater than 200 ppb range for tetrachloroethene at NT-1), TDEC exempts pilot plants (i.e., test facilities or operations) from its standards provided the operation would not significantly affect ambient air quality and is operated only for the purpose of defining the design of a future process or plant [TDEC 1200-3-9-.04(5)(f)(107)].

Table A.1. ARARs for the BCV treatability studies

Activity	Requirement	Prerequisite	Citation
<i>Location-specific</i>			
Installation of intercept trench in or across wetlands	Whenever possible, actions must avoid or minimize adverse affects to wetlands and act to preserve and enhance their natural and beneficial values. New construction in wetlands areas should be particularly avoided unless there are no practicable alternatives. Wetlands protection consideration shall be incorporated into planning, regulating, and decision-making processes.	Presence of wetlands as defined in EO 11990 §6(c) - applicable	EO 11990 (May 24, 1977) 10 <i>CFR</i> 1022
Installation of intercept trench in or across floodplains	The potential effects of actions in floodplains shall be evaluated and consideration of flood hazards and floodplain management ensured. If action is taken in floodplains, alternatives that avoid adverse effect and minimize potential harms shall be considered.	Presence of floodplains as defined in EO 11988 §6(c) - applicable	EO 11988 (May 24, 1977) 10 <i>CFR</i> 1022
<i>Chemical-specific</i>			
Control of radionuclide emissions	Exposures to members of the public from all radiation sources released into the atmosphere shall not cause an EDE to be greater than 10 mrem (0.1 mSv) per year	Point source discharge of radionuclides into the ambient air from DOE facilities - applicable	40 <i>CFR</i> 61.92 TDEC 1200-3-11-.08
	Radiological emission measurements must be performed at all release points that have a potential to discharge radionuclides into the air in quantities which could cause an EDE in excess of 1% of the standard (0.1 mrem/yr). All radionuclides that could contribute greater than 10% of the standard (1 mrem/year) for the release point shall be measured.		40 <i>CFR</i> 61.93 TDEC 1200-3-11-.08
	DOE will carry out all DOE activities to ensure that radiation doses to individuals will be ALARA.	Release of radionuclides into the environment - TBC	DOE Order 5400.5(L4) 10 <i>CFR</i> 834 (proposed)

Table A.1 (continued)

Activity	Requirement	Prerequisite	Citation
	Exposures to members of the public from all radiation sources shall not cause an EDE to be greater than 100 mrem (1 mSv) per year		DOE Order 5400.5(IL.1a) 10 <i>CFR</i> 834 (proposed)
<i>Action-specific</i>			
Control of surface water runoff	<p>Implement good site planning and best management practices to control storm water discharges, including</p> <ul style="list-style-type: none"> • document best management practices in a stormwater control plan or equivalent document • minimal clearing for grading • removal of vegetation cover only within 20 days of construction • perform weekly erosion control inspections and maintenance • control measures to detain runoff • discharges must not cause erosion 	Applicable to the control of stormwater discharges associated with construction activities at industrial sites that result in a disturbance of greater than 5 acres of total land area. For those sites with less than 5 acres affected - relevant and appropriate	TDEC 1200-4-10-.05 40 <i>CFR</i> 122
Control of fugitive dust emissions	Take reasonable precautions to prevent particulate matter from becoming airborne; no visible emissions are permitted beyond property boundary lines for more than 5 min/h or 20 min/d.	Nonpoint source air emissions from environmental restoration activities - applicable	TDEC 1200-3-8-.010

Table A.1 (continued)

Activity	Requirement	Prerequisite	Citation
Characterization/management of excavated soils, PPE, and any secondary wastes streams generated	<p>A person who generates solid waste must determine whether that waste is hazardous, using various methods, including application of knowledge of the hazardous characteristics of the waste based on information regarding the materials or processes used. If the waste is determined to be hazardous, the waste must be handled in accordance with 40 <i>CFR</i> 260-268.</p> <p>LLW generators must characterize and segregate LLW from uncontaminated waste and otherwise minimize the amount of LLW generated. Subsequent management of LLW must be accordance with DOE Order 5820.2A. The Commissioner's Order for the STP and §105 of the FFCA will allow storage of mixed waste on the ORR for periods longer than 1 year pending development of treatment capacity.</p>	Wastes/soils generated/ excavated potentially contaminated with RCRA-characteristic waste - applicable	DOE <i>CFR</i> 262.11 TDEC 1200-1-11.03(1)(b)

ALARA = as low as reasonably achievable; ARARs = applicable or relevant and appropriate requirements; BCV = Bear Creek Valley; *CFR* = *Code of Federal Regulations*; DOE = U.S. Department of Energy; EO = Executive Order; EDE = effective dose equivalent; FFCA = Federal Facilities Compliance Act; LLW = low-level waste; ORR = Oak Ridge Reservation; PPE = personal protective equipment; RCRA = Resource Conservation and Recovery Act; STP = Site Treatment Plan; TBC = to be considered; TDEC = Tennessee Department of Environment and Conservation.

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