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ACTION

DIST.	TR	NC
BENEDETTI, R L		
BENJAMIN, A		
BERMAN, H S		
CARNIVAL, G J		
COPP, R D		
CORDOVA, R C		
DAVIS, J G		
FERRERA, D W		
FRANZ, W A		
HANN, B J		
HEALY, T J		
HEDAHL, T G	X	X
HILBIG, J G		
HUTCHINS, N M		
KIRBY, W A		
KUESTER, A W		
MAHAFFEY, J W		
MANN, H P		
MARX, G E		
M'KENNA, F G		
MORGAN, R V		
PIZZUTO, V M		
POTTER, G L		
SANDLIN, N B		
SATTERWHITE, D G		
SCHUBERT, A L		
SELOCK, G H		
SULLIVAN, M T		
SWANSON, E R		
WILKINSON, R B		
WILSON, J M		
Rising, T	X	X
Peterson, J	X	X

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11-22-93
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DOE ORDER 5400.1

States Government

Department of Energy

Richland Operations Office

Memorandum

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TDD DET/94-TDD-034

SIX PHASE SOIL HEATING AT ROCKY FLATS PLANT

William C Schutte Director
Office of Demonstration Testing
and Evaluation
EM-55 HQ

As a result of discussions with EM-50 Headquarter staff Pacific Northwest Laboratory (PNL) has been exploring the possibility of completing a Six Phase Soil Heating (SPSH) demonstration/transfer of technology to EM-40 at the Rocky Flats site EM-50 has expressed interest in providing some funding for this work if the EM-40 staff at Rocky Flats Plant (RFP) decide to move forward with a demonstration of this technology

Scope of Work

Six Phase Soil Heating (SPSH) technology would be used to enhance soil vapor extraction removal of volatile and semi-volatile organics from vadose and saturated zone soils at Operable Unit 1 (OU-1) RFP The project is designed to demonstrate both the effectiveness of SPSH as a remediation technology and the ability of DOE to transfer newly developed technology from the laboratory into the field The degree of interaction between the PNL and EG&G-Rocky Flats is evident in the description of this work Industrial involvement will occur by inviting all interested licenses to the site during operations to demonstrate the technology Originally it had been envisioned that the supplier of the Soil Vapor Extraction (SVE) system would be a potential license However RFP has already procured an SVE system

The 119 1 Hillside site at OU-1 is a historic drum storage area identified as the probable source term for groundwater contaminated with Volatile Organic Carbon (VOC) including trichloroethylene (TCE) tetrachloroethylene (PCE) and carbon tetrachloride The waste storage history and groundwater chemistry data have lead investigators to suspect the presence of Dense Non-Aqueous Phase Liquid (DNAPL) at the interface of the bedrock and the saturated zone

ADMIN RECORD

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RF 7522 (R 9/93)

The application of SPSH heating at depth beneath the site will enhance the removal of contaminants existing below the water table and in the fractures of the bedrock interface which are not extractable using traditional Soil Vapor Extraction (SVE) methods Pre and post-test site characterization operations monitoring and mass balance analysis will provide a measure of the success of the remediation effort

Project Activities

The collaboration between PNL and EG&G to perform this demonstration requires many interdependent activities to be conducted over an estimated 15 month time period The attached table of activities and responsibilities indicates the level of interaction required between the two organizations (Attachment 1) The activity lists are based on the assumption that RFP will maintain overall project management responsibility required to meet remediation goals PNL will maintain project management responsibility to meet schedule and cost milestones associated with successful operation of the SPSH system and to provide support of SVE design activities

Progress to Date

PNL made an initial visit to the RFP on September 15-16 to discuss the technical feasibility of applying SPSH at several RFP sites During this visit PNL learned that RFP had a SVE system however the system would require modifications for this application as well as for other uses at the site This scope was added to the proposed project PNL staff subsequently developed the table of activities and responsibilities and prepared a detailed cost/schedule estimate for both PNL and EG&G activities required to perform a remediation demonstration at OU-1 (Attachment 2) This information and a discussion of the SPSH technology was transmitted on October 8 1993 to EG&G staff and Department of Energy Rocky Flats (DOE-RFO) for their review The estimate of RFP costs was preliminary At the invitation of DOE-RFO PNL staff attended another meeting on October 18 1993 to discuss this demonstration and the proposed activities responsibilities and estimated costs The October 8th letter and October 18th meeting were to finalize activities and assignments to permit RFP to complete their own estimate of costs for their work scope

Results of October 18th Meeting

DOE-RFO informed EG&G and PNL that it will pursue EM-40 funding for a SPSH remediation demonstration at the 119 Hillside Site OU-1 In order for the demonstration to be conducted in the FY94-95 time frame the demonstration will be conducted as a treatability study activity in support of the OU-1 Feasibility Study DOE-RFO stated however that the demonstration will be supported throughout site remediation DOE-RFO also expressed the understanding that the demonstration cost and schedule depends on the availability and modification of the existing on-site SVE unit They stated support for both its availability and the required modifications

Project Funding

The total estimated cost for the SPSH demonstration at OU-1 is $1386K PNL s portion of this cost is $712K The estimated cost for EG&G tasks is currently under review by EG&G and may change from the current $674K estimate The detailed breakdown of PNL costs including the split by activity and by fiscal year is shown in Table 1 This is the total request and has not been split between EM-40 and EM-50 It is anticipated HQ would need to take the effort in determining the appropriate split Some activities such as electrode and wetting system design modeling and lab testing seem appropriate for EM-50 funding Other activities (i e project management data analysis and reporting etc) could be shared Actual remediation operations seem appropriate for EM-40 to fund PNL can provide additional details if requested

Based on discussions with EG&G and DOE-RFO the following funding scenario is anticipated EG&G work will begin work immediately using 400K of existing funds committed for OU-1 treatability studies Additional funds will be requested by EG&G in mid-November (earliest date) through the change control board at RFO PNL would require funding in the December FINPLAN to initiate activities The PNL portion of the project is on the critical path for the start of heating Thus delays in acquiring funding by PNL will directly affect the proposed schedule PNL estimate the following near term spend plan to meet a September 1994 start date for remediation

Dec-	118K
Jan-	90K
Feb-	82K
	290K

Impacts to Cost/Schedule

The most immediate potential impact to cost/schedule would occur if it were determined after the Soil Gas Survey (SGS) that the Hillside in OU-1 is no longer an appropriate site for the SPSH Demonstration If it were determined that too little contamination exists at the OU-1 site DOE-RFO reserves the option to move the demonstration to a higher priority site at OU-2 Several design features would need to be adjusted for an application at OU-2 If the SGS indicates wider distribution of contaminants than was previously thought the criteria for a single setting application of SPSH may be exceeded In that case the project would have to be re-scoped for two or more settings

A second critical aspect of the project with potential impact to cost and schedule is the treatment of contaminated off-gas and liquid effluent streams The planned modifications to the on-site SVE system are critical path activities Any delay in the design and acquisition of adequate modifications to the SVE system will directly impact both cost and schedule

Several treatment options have been proposed for the contaminated liquid effluent It is important that the appropriate treatment option be determined and any modifications to existing systems be conducted early in the project

The entire project scope and conduct depends on successful heating at the SPSH demonstration currently underway at Savannah River (SRP) Heating activities will begin in the first week in November The decision point for determining success of SPSH at SRP will occur in mid-November

Success at SRP has been defined as being able to heat the soil Success for this demonstration however will be actual final remediation using this technology There is also the possibility of demonstrating remediation of a DNAPL The SRP site currently being used for the SPSH demonstration does not contain a DNAPL (The SRP DNAPL is located significantly deeper in ground in the groundwater)

If you have any questions regarding the above information please contact me on (509) 372-4035 or Lance Mamiya of my staff on (509) 372-4033

D E Trader

D E Trader
Technical Program Officer
Technology Development Division

Attachments
1) Table 1 PNL Budget Requests
2) Activities and Responsibilities
3) RFP Erace Project

cc with attach
D Biancosino EM-551 HQ
J Ciocco EM-40 HQ
S Grace EM-40/RFO
J Peterson EG&G/RF
R Tyler DOE/RFO
S Slate PNL

Table 1

PNL Budget Requests

Total Estimated Project Budget (EG&G and PNL)	$ 1 386 130
Total Estimated PNL Budget	$ 712 130

PNL Work breakdown

PNL Site and SVE System Design	$ 48 660
Electrode and Wetting System Design	$ 38 340
Control and Monitoring System	$ 43 150
Modeling	$ 72 540
Lab Testing	$ 120 270
Test Documentation	$ 26 820
Data Analysis and Reporting	$ 51 240
Project Management and Site Coordination	$ 227 280
PNL Test Site Prep Support	$ 12 310
PNL Testing and De-Mobilization	$ 71 520

FY94 Funding Requirements	$ 533K
FY95 Funding Requirements	179K
	$ 712K

ATTACHMENT 1

EG&G Activities	PNL Activities
Document Generation Review and Clearance	
Overall Project Management Plan	PNL Project Management Plan
Overall Health and Safety Plan	PNL Health and Safety Plan
Overall QA Plan	PNL QA Plan
Overall Test Plan	PNL Test Plan
Overall Readiness Review	PNL Readiness Review
Overall Monitoring Plan	PNL Monitoring Plan
Final Remediation Report	PNL Demonstration Report
Permits and Agreements	
Water Injection	Provide Water Injection Data
Air Permit	
Surface Intrusion	
Drummed Cuttings Storage	
Site and SVE System Design	
Review Site Design	Provide Site Design
Review SVE System Design Basis	Provide SVE Design Basis
Provide SVE Process Design	Review SVE Process Design
Develop SOW-Subcontractor Support	Review SVE SOW
Review Subcontractor Response to SOW	Review Subcontractor Response to SOW
Review SVE System Design	Review SVE System Design
Accept Ship Install Inspect SVE	On-site SVE Inspection
Electrode and Wetting System Design	
	Design Fabricate Ship Electrodes and Wetting System
	Design Procure Transport Instrumentation and Control System
	Conduct Simulation Testing of Site Safety and Electrical Design

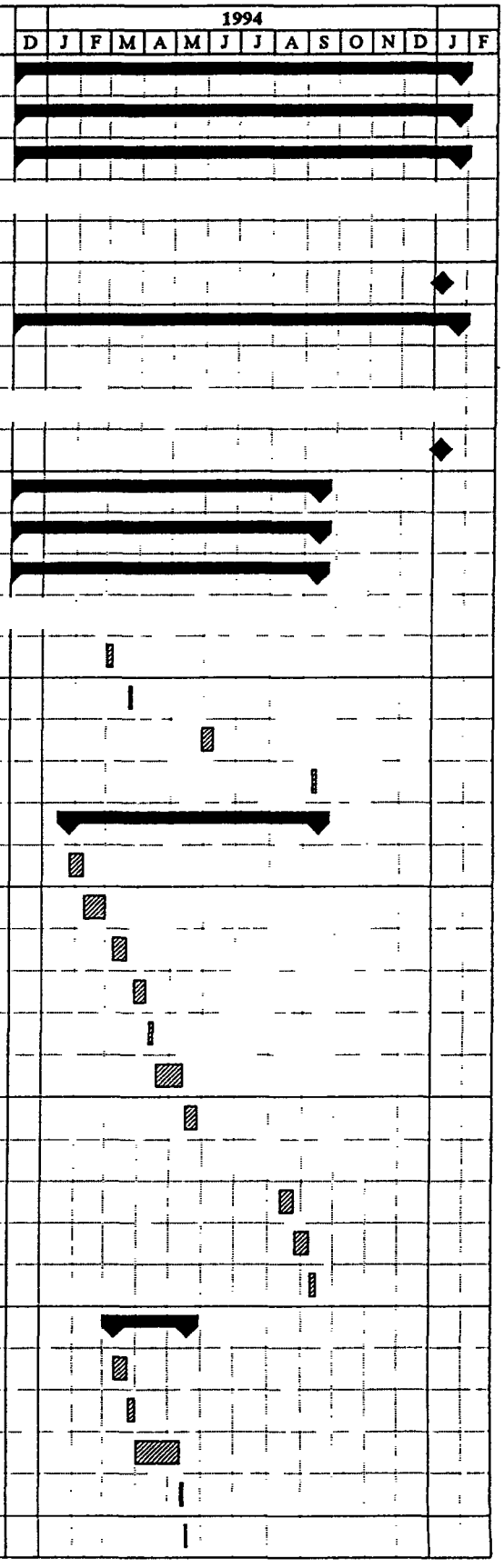
EG&G Activities	PNL Activities
Site Characterization/Preparation	
Conduct Soil Gas Survey and Analysis	Review SGS Results
Grading and Site Layout (excavation on-site structures)	
Water Storage and Conduit to WWTP	
RPT Support	
Conduct Drilling and Installation Electrodes/Vents	Supervise Electrode Installation
Conduct Pre-test Site Characterization	Provide Site Characterization Recommendations
Conduct Site Equipment Setup and Cover Installation	Supervise Site Equipment Setup
Laboratory Testing	
	Conduct Bench Scale Heating Properties Testing
	Conduct Pilot Scale Engineering Systems Testing
	Conduct Soil Column-Mass Transport Experiments
Testing and De-Mobilization	
Provide Diesel Generator and Fuel Supply	
Conduct Readiness Review and Training	Conduct PNL Readiness Review and Operator Training
Provide Field Support for Remediation Operations	Supervise Remediation Operations
Carbon Removal and Disposal	
Water and Off-gas Collection and Analysis	Supervise Water and Off-gas Collection and Analysis
Conduct Post-Test Site Characterization	On-site Review Post-test Characterization
Demobilize Site	De-Mobilize PNL Equipment

EG&G Activities	PNL Activities
Data Analysis and Reporting	
Analyze and Report Pre and Post-test Site Characterization Data	Review Pre and Post-test Site Characterization Data
Review Field Test Data	Reduce Analyze and Report Field Test Data
Provide Site Characterization Data and Analysis to PNL	Provide Data and Analysis to RF
Produce Final Remediation Report	Produce PNL Demonstration Report

ATTACHMENT 2

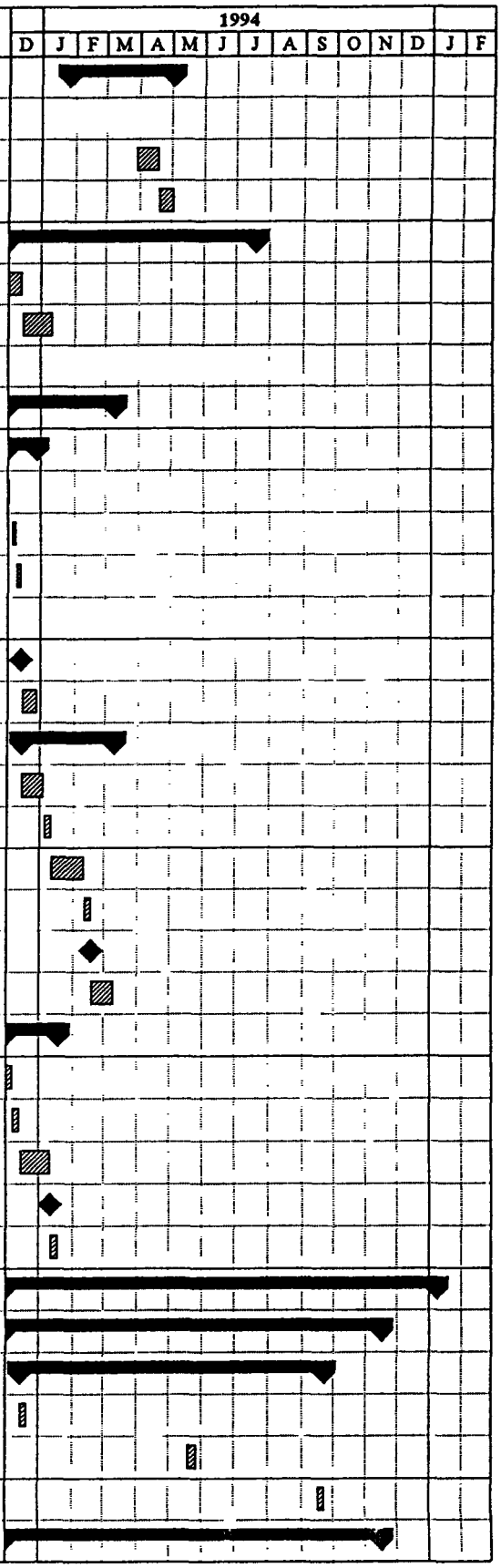
RFP ERACE PROJECT

Task	Cost	Fixed Cost
RFP IN SITU HEATING PROJECT	$1,386 130	$0
PROJECT MANAGEMENT	$331 288	$0
PNL PROJECT MANAGEMENT	$227 288	$0
Project Management Activities	$227 288	$20 000
Project Management Plan (PNL)	$0	$0
PNL Report Submittal Date Cl	*$0*	*$0*
RFP PROJECT MANAGEMENT	$104 000	$0
Project Management Plan (RFP)	$0	$0
RFP Project Management Activities	$104 000	$104 000
RFP Report Submittal Date Clea	*$0*	*$0*
SYSTEM DESIGN & DEVELOPMENT	$369 690	$0
SITE & SVE SYSTEM DESIGN	$215 656	$0
PNL SITE DESIGN & SVE SYSTEM DESIGN BASIS	$48 656	$0
PNL-Site Design and SVE System Design Basis	$30 400	$0
PNL-SVE Process Design Review	$5 968	$2 000
PNL-Review SOW & Respons	$2 336	$0
PNL-SVE System Design Review	$6 840	$1 000
PNL-System Review	$3 112	$1 000
RFP SVE SYSTEM DESIGN	$167 000	$0
RFP SVE Site & System Design Basis Review	$10 000	$10 000
RFP SVE Process Design	$20 000	$20 000
RFP Develop SOW for Subcontract RFP	$4 000	$4 000
RFP Issue and respond to SOW	$1 000	$1 000
RFP Review response to SOW	$4 000	$4 000
SUB- Design SVE System/ Construct drawings	$30 000	$30 000
RFP Design Review	$8 000	$8 000
Procure/Fabricate SVE System	$45 000	$45 000
RFP Ship	$5 000	$5 000
RFP Install	$20 000	$20 000
RFP System Inspect n/Acceptance	$20 000	$20 000
ELECTRODE & WETTING SYSTEM DESIGN	$38 342	$0
Design Electrod Wetting System	$4 320	$0
Detail Design Drawings	$3 150	$0
Order/Fabricate Electrod Material	$24 800	$20 000
Assembl Electrod Material f Shipment	$1 072	$0
Ship Electrod System	$5 000	$5 000



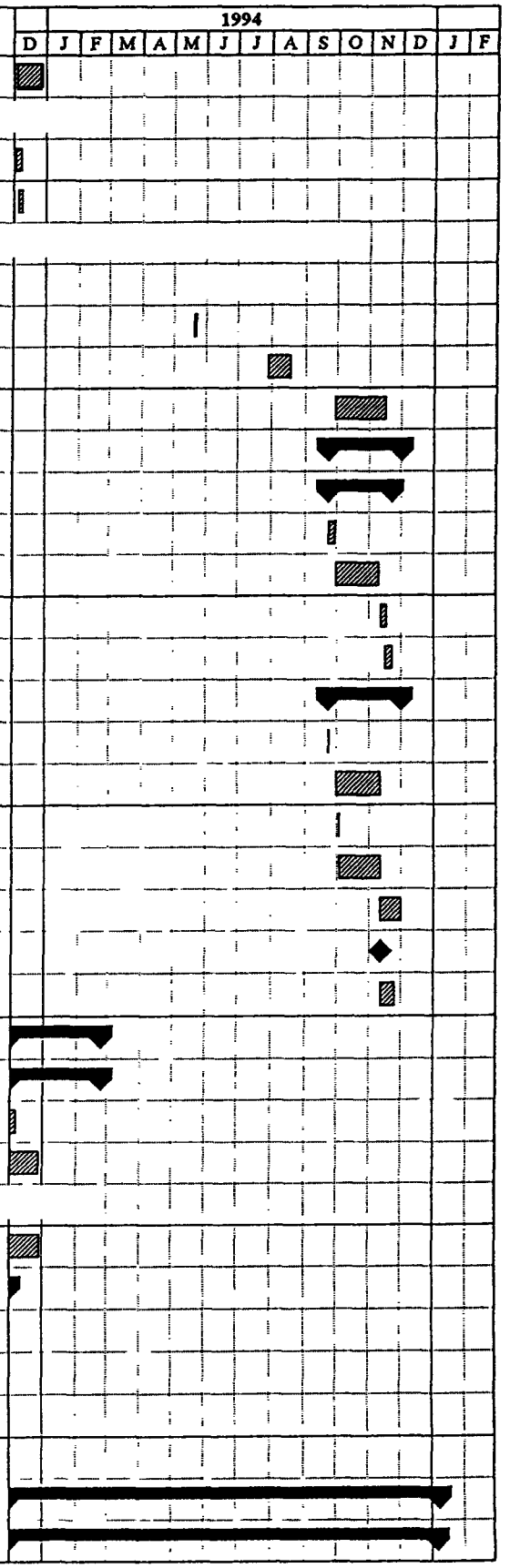
RFP ERACE PROJECT

Tl	Cost	Fixed Cost
CONTROL & MONITORING SYSTEM	$43 152	$0
Des gn Instrumentati & Co trol System (Manned)	$17,952	$0
Procure Instrumentation & Control System Materials	$16 120	$10 000
Assembl & Transport Instrumentation & Control System	$9 080	$5 000
ENGINEERING SIMULATION	$72 540	$0
Safety & Electrical Des gn	$7 440	$0
S te Des gn Sim lati n	$14 880	$0
E gineering Sim lati R vise/Val dation	$50 220	$0
LAB TESTING	$120 270	$0
HEATING PROPERTIES TESTING	$14 514	$0
Des gn Ben h Scal Tests	$1 574	$0
Order BS Materi ls	$5 640	$5 000
S t p BS Test	$1 908	$0
C d ct BS Test	$1 072	$0
B hS l T tC mpl t	*$0*	*$0*
BS Test Data Red ctio & An ly	$4 320	$0
ENGINEERING SYSTEMS TESTING	$85 996	$0
Des gn P l t Scal Test	$8 520	$0
Order PS Materi l	$11 600	$10 000
Set p PS Test	$23 036	$0
Co d ct PS Test	$31 080	$0
P l tS l T tC mpl t	*$0*	*$0*
PS Test Data Red ct & An lys	$11 760	$0
MASS TRANSPORT TESTING	$19 760	$0
Des gn S l Col mn Experiments	$1 080	$0
S t p S l Col mn Experiments	$5 920	$3 000
C d ct S l C l mn Experiments	$11 680	$0
S lC l m T ti g C mpl t	*$0*	*$0*
Analyz S l Col mn Experimental D ta	$1 080	$0
SITE LOGISTICS & OPERATIONS	$564 882	$0
SITE CHARACTERIZATION/PREPARATION	$225 304	$0
PNL TEST SITE PREP SUPPORT	$12 304	$0
PNL-R vi w SGS Results	$1 000	$1 000
PNL-Install t S pervi	$6 224	$2 000
PNL-S te Eq pment Set p	$5 080	$1 000
RFP TEST SITE PREPARATION	$213 000	$0



RFP ERACE PROJECT

Task	Cost	Fixed Cost
RFP-Soil Gas Survey	$10 000	$10 000
RFP Permitting	$10 000	$10 000
RFP-Site Grading/Layout	$5 000	$5 000
RFP Water Removal, storage setup	$20 000	$20 000
RFP RPT Support	$6 000	$6 000
RFP Drilling/Install Electrodes/Vents	$55 000	$55 000
RFP Site Characterization (Pre Test)	$10 000	$10 000
RFP Site Equipment Set up/cover install	$15 000	$15 000
RFP Generator Rental and Fuel Supply	$82 000	$82 000
TESTING & DE-MOBILIZATION	$261 520	$0
PNL TESTING & DE MOBILIZATION SUPPORT	$71 520	$0
PNL-Readiness Review	$9 600	$2 000
PNL-Remediation Operations Support	$43 640	$3 000
PNL-Post Test Characterization On Site view	$1 000	$1 000
PNL-Demobilize Site PNL Equipment	$17 280	$10 000
RFP TESTING & DEMOBILIZATION	$190 000	$0
RFP Readiness Review	$0	$0
RFP-Conduct Remediation Operations	$100 000	$100 000
RFP Water and off gas analytical	$25 000	$25 000
RFP-Carbon removal and disposal	$30 000	$30 000
RFP Site Characterization (Post Test)	$25 000	$25 000
RFP Remediation Operation Complete	*$0*	*$0*
RFP Demobilize Site/RPT Support	$10 000	$10 000
TEST DOCUMENTATION	$26 818	$0
PNL DOCUMENTATION	$26 818	$0
PNL Health and Safety Plan	$744	$0
PNL QA Plan	$2 800	$0
PNL Test Plan	$11 346	$0
PNL Monitoring Plan	$11 928	$0
RFP DOCUMENTATION	$0	$0
Overall Health & Safety Plan	$0	$0
Overall QA Plan	$0	$0
Overall Test Plan	$0	$0
Overall Monitoring Plan	$0	$0
DATA ANALYSIS & REPORTING	$51 240	$0
PNL ACTIVITIES	$51 240	$0



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RFP ERACE PROJECT

T tl	Cost	F xed Cost
PNL R port mod fi tio	*$0*	*$0*
PNL Data Red cti	$10 760	$0
PNL Data Analysis	$25 840	$0
PNL Dem nstrati Report	$14 640	$2 000
RFP ACTIVITIES	$0	$0
RFP Final Remediation Report	$0	$0