Cost Savings Report Summary Page

Title: Drain Line Characterization Robot **Date:** 09/28/00

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Summary Description:

The characterization requirements for the Canyon Disposition Initiative are defined in the Sampling and Analysis Plan of the 221-U Facility. These requirements include (1) visual inspection, (2) radiological survey, and (3) analysis of scale or sludge sample. The Drain Line Characterization Robot was designed and constructed to address these requirements. The Drain Line Characterization Robot was deployed during August 2000.

The Drain Line Characterization Robot successfully achieved all requirements of the sampling and analysis plan for characterization of the 221-U Facility drain line. The cost savings realized from deployment of the Drain Line Characterization Robot are estimated to be $462,000. In addition, the remote capabilities of the Drain Line Characterization Robot greatly reduced actual and potential radiological dose to operations personnel.

Initial Capital Investment (C)	**$**	**160,000**	
Implementation Cost (E)	**$**	**10,000**	
Total Project Start Up Cost (C+E)	**$**	**170,000**	
Termination Cost (D)	**$**	**-**	
Annual Recurring Cost Before (B)	**$**	**706,160**	
Annual Recurring Cost After (A)	**$**	**73,840**	
Net Annual Recurring Cost (B-A)	**$**	**632,320**	
*** Useful Project Life in Years (L)**		**1**	
Total Savings ([(B - A) x L] - (C + E + D))	**$**	**462,320**	
Annualized Savings	**$**	**462,320**	
Return on Investment		**272**	**%**

* This Cost Savings Report was developed based on a one-time deployment of the technology. The technology will also be considered for future needs.

1. Baseline Description (Brief description of current baseline technology and/or methods)

A specific baseline method for data collection equivalent to that obtained by the Drain Line Characterization Robot has not been identified. A plausible scenario for collection of acceptable data would involve sequential opening of multiple process cells. The cell contents would be rearranged and/or removed to provide access to the existing drain line connection from each process cell to the 24-inch drainpipe.

Video, radiological, and sample collection equipment would then be lowered into the drainpipe. This method would result in localized characterization data of the drainpipe consisting of approximately 35 discrete points at about 22-foot increments. Due to personnel safety requirements and the relative congestion of deck space in the 221-U facility, only one process cell can be opened at one time. Each cell opening involves rearrangement of equipment stored on the canyon deck.

Such efforts would also include the development of detailed special purpose work procedures, increased coverage by radiological and safety personnel, and significant engineering evaluation necessary for manipulation of process cell contents. The labor required for such an effort, coupled with design, development and deployment of characterization equipment would be cost prohibitive.

2. Improved Technology Description (Brief description of improved technology and/or methods)

The Drain Line Characterization Robot is a tracked robotic vehicle with onboard video and radiation monitoring instrumentation. The robot is constructed with sharply tapering ends, front and rear to aid in navigating obstructions. Vehicle power, control, and data are carried over a ½-inch diameter cable bundle (tether) pulled by the vehicle. The tether terminates at the rear of the vehicle via electrical connectors. A robust strain relief is used to provide the physical interface between the vehicle and tether, and to mechanically isolate electrical connectors.

An adjustable iris/focus pan-tilt-zoom camera and two variable intensity headlights are mounted at the vehicle midplane. The vehicle is equipped with a MGP DMC 100 gross gamma sensor. Data is transmitted to the control station and is superimposed on the video image from the primary camera. A secondary camera and microphone with digitized RF output is also provided. The secondary camera is not necessary for operation of the Drain Line Characterization Robot. The RF instruments were deployed for evaluation purposes.

The vehicle is operated via a control station. Data presented for operation and recording at the control station includes video images from the primary on-vehicle

recording at the control station includes video images from the primary on-vehicle camera, an overview camera on the deployment platform, and video/sound from the RF instruments. Vehicle track motion control is via a self-centering return to zero bi-directional joystick. One joystick is proved for each of the two independently operated tracks. Controls for the tether management friction cable drive are also provided at the control station.

The deployment system involves two major elements, a deployment platform, which is lowered via overhead crane to the drainpipe outfalls, and a separate cable management system, which was located on the canyon deck.

3. Description of Benefits (List of benefits expected from deployment of improved technology)

The Drain Line Characterization Robot successfully achieved all requirements of the sampling and analysis plan for characterization of the 221-U Facility drain line. The cost savings realized from deployment of the Drain Line Characterization Robot are estimated to be $462,000. In addition, the remote capabilities of the Drain Line Characterization Robot greatly reduced actual and potential radiological dose to operations personnel.

ıtenance Annual Recurring Costs

Expense Cost Items *	Before (B) Annual Costs	After (A) Annual Costs
1 Equipment	$ 100,000.00	$ -
2 Purchased Raw Materials and Supplies	$ -	$ -
3 Process Operation Costs:		
Utility Costs	$ -	$ -
Labor Costs	$ 351,000.00	$ 52,840.00
Routine Maintenance Costs for Processes	$ 10,000.00	$ -
Subtotal	$ 361,000.00	$ 52,840.00
4 PPE and Related Health/Safety/Supply Costs	$ 234,000.00	$ 21,000.00
5 Waste Management Costs:		
Waste Container Costs	$ -	$ -
Treatment/Storage/Disposal Costs	$ -	$ -
Inspection/Compliance Costs	$ -	$ -
Subtotal	$ -	$ -
6 Recycling Costs		
Material Collection/Separation/Preparation Costs:		
a) Material and Supply Costs	$ -	$ -
b) Operations and Maintenance Labor Costs	$ -	$ -
Vendor Costs for Recycling	$ -	$ -
Subtotal	$ -	$ -
7 Administrative/other Costs	$ 11,160.00	$ -
Total Annual Cost:	$ 706,160.00	$ 73,840.00

* See attached Supporting Data and Calculations.

Summary Worksheet : Itemized Project Funding Requirements*
(i.e., One Time Implementation Costs)

Category	Cost $
INITIAL CAPITAL INVESTMENT	
1 Design	$ 93,000
2 Purchase	$ 67,000
3 Installation	$ -
4 Other Capital Investment (explain)	$ -
Subtotal: Capital Investment= (C)	$ 160,000
INSTALLATION OPERATING EXPENSES	
1 Planning/Procedure Development	$ -
2 Training	$ -
3 Miscellaneous Supplies	$ -
4 Startup/testing	$ -
5 Readiness Reviews/Management Assessment/Administrative Costs	$ 10,000
6 Other Installation Operating Expenses (explain)	$ -
Subtotal: Installation Operating Expense = (E)	$ 10,000
7 All company adders (G & A/PHMC Fee, MPR, GFS, Overhead, taxes, etc.)(if not contained in above items)	$ -
Total Project Funding Requirements=(C + E)	$ 170,000
Useful Project Life = (L) 1 Years Time to Implement: 0 Months	
Estimated Project Termination/Disassembly Cost (if applicable) = (D) (Only for Projects where L<5 years; D=0 if L>5 years)	$ -
RETURN ON INVESTMENT CALCULATION	

Return on Investment (ROI) % =

$$\frac{\textit{(Before - After) - [(Total Project Funding Requirements + Termination)/Useful Life]}}{\textit{[Total Project Funding Requirements + Project Termination]}} \times 100$$

$$ROI = \frac{(B-A)-[(C+E+D)/L]}{(C+E+D)} \times 100 \quad 272\ \%$$

O&M Annual Recurring Costs:				Project Funding Requirements:			
Annual Costs, Before=	$	706,160	(B)	Capital Investment=	$	160,000	(C)
Annual Costs, After=	$	73,840	(A)	Installation Op. Exp=	$	10,000	(E)
Net Annual Savings=	$	632,320	(B-A)	Total Project Funds=	$	170,000	(C+E)

Note: Before (B) and After (A) are Operating & Maintenance Annual Recurring Costs from Worksheet 1.

* See attached Supporting Data and Calculations.

SUPPORTING DATA AND CALCULATIONS

OPERATING & MAINTENANCE ANNUAL RECURRING COSTS (BEFORE)

Equipment	
Equipment (design, buy, fabricate, etc)	$ 100,000
SUBTOTAL	**$ 100,000**
Process Operation Costs	
Labor Costs	
5,850 person hours at $60/hr; 39 cells times 150 person-hours to open/close each cell and do inspection of drain line	$ 351,000
SUBTOTAL	**$ 351,000**
Routine Maintenance Costs for Processes	
Routine maintenance	$ 10,000
SUBTOTAL	**$ 10,000**
PPE and Related Health/Safety/Supply Costs	
Personal protective equipment; 468 entries at average cost of $500 each (5 craft - two each plus 2 sampler - one each, 39 day times 12)	$ 234,000
SUBTOTAL	**$ 234,000**
Administrative/Other Costs	
Training; 32 hours at $60/hr (8 craft 4 hours each)	$ 1,920
Work package preparation; 74 hours at $60/hr	$ 4,440
RWP & ALARA preparation/planning	$ 4,800
SUBTOTAL	**$ 11,160**

OPERATING & MAINTENANCE ANNUAL RECURRING COSTS (AFTER)

Process Operation Costs	
Labor Costs	
Facility costs; 714 person-hours at average cost of $60/hr (see next sheet for detailed labor breakout)	$ 42,840
Subcontractor deployment support	$ 10,000
SUBTOTAL	**$ 52,840**
PPE and Related Health/Safety/Supply Costs	
Personal protective equipment; 42 entries at average cost of $500 each	$ 21,000
SUBTOTAL	**$ 21,000**

ONE TIME IMPLEMENTATION COSTS

Initial Capital Investment	
Design	
Vehicle design/testing	$ 64,000
Design of lifting platform and cable management system	$ 15,000
Electronics design and development	$ 14,000
SUBTOTAL	**$ 93,000**
Purchase	
Equipment/parts/purchases	$ 50,000
Fabrication of platform and vehicle	$ 17,000
SUBTOTAL	**$ 67,000**
Installation Operating Expenses	
Readiness Reviews/Management Assessment/Administrative Costs	
Subcontractor management and administration	$ 10,000
SUBTOTAL	**$ 10,000**

Detailed Labor Breakout for Facility Costs															
	Crane	RCT	Rad	Rad	NPO	Sampler	Field	Design	Safety	QA	Rigger	Admin	Fac	Ops	**Total**
	Oper		Engr	Sup			Engr						Sup	Sup	**Hours**
Training and inspection prior to staging.	4	12	6	6	8	12									**48**
Work Package Preparation.							60	8	4	2					**74**
RWP and ALARA Planning.		20	40	20											**80**
Preparation in and around cell 10.	8	48			48						16				**120**
Pre-job, final preps, and equipment staging.		32	4	4	24							4	4		**72**
Equipment setup prior to deployment.	4	16		4	12						8			4	**48**
Deployment of robot through short side.	4	16		4	12									4	**40**
Deployment of robot down long side.	16	64		8	48	16								8	**160**
Demobilization from robot deployment.	8	24			16										**48**
Completion of survey reports etc.		24													**24**
															0
Total Hours per subtask	**44**	**256**	**50**	**46**	**168**	**28**	**60**	**8**	**4**	**2**	**24**	**4**	**4**	**16**	**714**