

## **APPENDIX J**

### **Detailed Cost Estimate**

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**Feasibility Study for Wet Storage Area  
Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio  
Summary of Alternatives**

RVAAP-Wet Storage Area Alternatives		Duration	Non Discounted Cost		
			Soil		
			Capital Cost	O&M Cost	Total
1	No Action	0	\$0	\$0	\$0
2	Excavation and Off-site Disposal – Attain Unrestricted (Residential) Land Use	<1 yr	\$116,346	\$0	\$116,346
3	Ex-situ Thermal Treatment – Attain Unrestricted (Residential) Land Use <sup>3</sup>	<1 yr	\$134,587	\$0	\$134,587

Notes:

1. The base year of comparison and cost data will be CY2016.
2. Costs were estimated for comparison purposes only and are believed to be accurate within a range of -30% to +50%. Use of these costs for other purposes, including but not limited to, budgetary or construction cost estimating is not appropriate.
3. The Alternative 3 cost assumes an existing thermal treatment system is on site and ready for mobilization. The mobilization cost in that scenario is an estimated \$1,000 if the system is on site. If no treatment system is on site and readily available, the mobilization cost may increase to an estimated \$25,000.

**Feasibility Study for Wet Storage Area  
Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio  
Summary of AOC Areas and Volumes**

Exposure Unit	Media	Treatment Interval	Surface Area	In Situ		In-situ with Constructability <sup>1</sup>		Ex-situ <sup>1,2</sup>	
		(ft bgs)	(ft <sup>2</sup> )	Volume (ft <sup>3</sup> )	Volume (yd <sup>3</sup> )	Volume (ft <sup>3</sup> )	Volume (yd <sup>3</sup> )	Volume (ft <sup>3</sup> )	Volume (yd <sup>3</sup> )
WSA Area 1	Shallow Surface Soil	0-1	933	933	35	1,167	43	1,400	52
WSA Area 2	Shallow Surface Soil	0-1	933	933	35	1,167	43	1,400	52
<b>TOTALS</b>			1,866	1,866	69	2,333	86	2,800	104

<sup>1</sup> Constructability factor accounts for over excavation, sloping of sidewalls, and addresses limitations of removal equipment. The in situ volume is increased by 25% for a constructability factor.

<sup>2</sup> Includes 20% swell factor

**Feasibility Study for Wet Storage Area**  
**Alternative 2: Excavation and Off-site Disposal – Attain Unrestricted (Residential) Land Use**  
**Key Parameters and Assumptions**

**Key Parameters and Assumptions:**

Item	Unit	Value	Notes
<b><u>Capital Cost</u></b>			
<b><u>Pre-excavation Delineation and Waste Characterization Sampling</u></b>			
Samples	ea	98	Delineation sampling includes 12 sampling locations with 4 samples intervals (0-1, 1-2, and 2-3 ft bgs) at both excavation area for a total of 96 samples analyzed for PAHs. Waste characterization includes 2 composite samples for full TCLP analysis.
Sampling Labor	hrs	24	Assumes 1 sampling technician at 16 hours to layout sample grid, collect, and ship samples.
Sampling Labor	\$/hr	70	
Truck Rental / Gas	\$/event	290	1 truck @ \$90/day. Add \$20 for gas.
Sample Materials	ea	98	Reference ECHOS 33 02 0401/0402 for ISM, processing, disposable sampling and decontamination materials.
Sample Materials	\$/ea	98	
Analytical Cost	\$/event	8,876	Analyze samples for PAHs including 15% for QA/QC samples (111 @ \$70) and TCLP VOCs, SVOCs, Metals, RCRA Characteristics, and Paint Filter (2 @ \$553).
<b><u>Site Work</u></b>			
Site Area	sf	1,866	
Civil Survey	day	0.5	Survey AOC areas to document excavation area. RSMMeans 017123131100.
Civil Survey	\$/day	940	
As Built Drawings	hours	2	Develop plat map for incorporation into the Base Master Plan.
As Built Drawings	\$/hr	70	
Sediment and Erosion Control	lf	300	Includes silt fence and straw bales along down slope of excavation.
Sediment and Erosion Control	\$/lf	5.41	RSMMeans 312514161000 & 250.
<b><u>Soil Excavation</u></b>			
Soil Excavation Volume (In situ)	cy	86	Includes excavation of the AOC area based on the areas and depths presented in the summary table. In situ volumes include a 25% constructability factor.
Soil Excavation Volume (Ex situ)	cy	104	Includes soil volume to be transported and disposed. Ex situ volumes include 20% swell factor.
Volume to Weight Conversion	tons/cy	1.60	In situ soil conversion.
Soil Excavation Mass	tons	138	Includes soil mass to be transported and disposed.
Soil Excavation Surface Area	sf	1,866	
<b><u>Mobilization/Demobilization</u></b>			
	ls	3,000	Includes mob/demob of excavation equipment and preparing submittals.
<b><u>Excavate Soils</u></b>			
	day	1	Includes 3/4 cy excavator, 3-22 cy dump trucks, 1 O.E., 3 T.D., 1 L.S. spotter, 1 L.S. to prep trucks and misc. Reduced productivity by 50% for loading trucks, precise excavations, and security/S&H requirements. Assume trucks are direct loaded. Average 135 cy/day. RSMMeans Crew B12F and B34D.
	\$/day	5,841	
<b><u>Nonhazardous Waste</u></b>			
Transport and Offsite Disposal	tons	138	Based on shipping waste to American Landfill, Waynesburg, Ohio (approximately 80 mi RT). Assumes a minimum of 22 tons /load. Rate includes \$16.60/ton tax from Portage County.
	\$/ton	52.00	

**Feasibility Study for Wet Storage Area**  
**Alternative 2: Excavation and Off-site Disposal – Attain Unrestricted (Residential) Land Use**  
**Key Parameters and Assumptions**

**Key Parameters and Assumptions:**

<b><u>Restoration</u></b>			Includes native soil backfill. Assume productivity has been reduced by 25% to account for security and safety requirements.
Native Soil Backfill	cy	104	Borrow, topsoil or loam, 1 C.Y. bucket, loading and/or spreading, from stockpile. Includes fill delivery, spreading, and compaction with loader. RSMMeans 312323160040.
Native Soil Backfill	\$/cy	33.81	
Seeding, Vegetative Cover	MSF	11	Seeding with mulch and fertilizer. Assume 0.25 acre is revegetated for restored areas and equipment damage. RSMMeans 329219142200. Add 25% for planting native seed and plants.
Seeding, Vegetative Cover	\$/MSF	70.46	
SWPPP Inspections	hrs	4	Assume one follow-up inspection.
SWPPP Inspections	\$/hr	70	
<b><u>Plans and Reports</u></b>			
Remedial Action Completion Report	hrs	200	Includes Construction QC data and preparing report.
Technical Labor	\$/hr	90	

## Feasibility Study for Wet Storage Area

### Alternative 2: Excavation and Off-site Disposal – Attain Unrestricted (Residential) Land Use Cost Estimate

#### CAPITAL COST

**\$116,346**

Activity (unit)	Quantity	Unit Cost	Total
<b><u>Pre-excavation Delineation and Waste Characterization Sampling</u></b>			
Sampling Labor (hrs)	24	\$70.00	\$1,680
Truck Rental / Gas (event)	1	\$290.00	\$290
Sample Materials (ea)	98	\$98.00	\$9,604
Sample Analysis (event)	1	\$8,876.00	\$8,876
<b><u>Site Work</u></b>			
Civil Survey (day)	0.5	\$940.00	\$470
As Built Drawings (hrs)	2	\$70.00	\$140
Sediment and Erosion Control (lf)	300	\$5.41	\$1,623
<b><u>Soil Excavation</u></b>			
Mobilization/Demobilization (ls)	1	\$3,000.00	\$3,000
Excavate Soil (day)	1	\$5,841.00	\$5,841
Nonhazardous Transport and Offsite Disposal (ton)	138	\$52.00	\$7,155
<b><u>Restoration</u></b>			
Native Soil Backfill (cy)	104	\$33.81	\$3,517
Seeding, Vegetative Cover (MSF)	11	\$70.46	\$775
SWPPP Inspections (hrs)	4	\$70.00	\$280
<b><u>Plans and Reports</u></b>			
Remedial Action Completion Report (hrs)	200	\$90.00	\$18,000
Subtotal			\$61,251
Design		25%	\$15,313
Office Overhead		10%	\$6,125
Field Overhead		10%	\$6,125
Subtotal			\$88,814
Profit		6%	\$5,329
Contingency		25%	\$22,203
Total			\$116,346

**Feasibility Study for Wet Storage Area**  
**Alternative 3: Ex-situ Thermal Treatment – Attain Unrestricted (Residential) Land Use**  
**Key Parameters and Assumptions**

**Key Parameters and Assumptions:**

Item	Unit	Value	Notes
<b><u>Capital Cost</u></b>			
<b><u>Pre-excavation Delineation and Waste Characterization Sampling</u></b>			
Samples	ea	98	Delineation sampling includes 12 sampling locations with 4 samples intervals (0-1, 1-2, and 2-3 ft bgs) at both excavation area for a total of 96 samples analyzed for PAHs. Waste characterization includes 2 composite samples for full TCLP analysis.
Sampling Labor	hrs	24	Assumes 1 sampling technician at 16 hours to layout sample grid, collect, and ship samples.
Sampling Labor	\$/hr	70	
Truck Rental / Gas	\$/event	290	1 truck @ \$90/day. Add \$20 for gas.
Sample Materials	ea	98	Reference ECHOS 33 02 0401/0402 for ISM, processing, disposable sampling and decontamination materials.
Sample Materials	\$/ea	98	
Analytical Cost	\$/event	8,876	Analyze samples for PAHs including 15% for QA/QC samples (111 @ \$70) and TCLP VOCs, SVOCs, Metals, RCRA Characteristics, and Paint Filter (2 @ \$553).
<b><u>Site Work</u></b>			
Site Area	sf	1,866	
Civil Survey	day	0.5	Survey AOC areas to document excavation area. RSMMeans 017123131100.
Civil Survey	\$/day	940	
As Built Drawings	hours	2	Develop plat map for incorporation into the Base Master Plan.
As Built Drawings	\$/hr	70	
Sediment and Erosion Control	lf	300	Includes silt fence and straw bales along down slope of excavation. RSMMeans 312514161000 & 250.
Sediment and Erosion Control	\$/lf	5.41	
<b><u>Soil Excavation</u></b>			
Soil Excavation Volume (In situ)	cy	86	Includes excavation of the AOC area based on the areas and depths presented in the summary table. In situ volumes include a 25% constructability factor.
Soil Excavation Volume (Ex situ)	cy	104	Includes soil volume to undergo thermal treatment. Ex situ volumes include a 25% constructability and 20% swell factor.
Volume to Weight Conversion	tons/cy	1.60	In situ soil conversion.
Soil Excavation Mass	tons	138	Includes soil mass to be treated
Soil Excavation Surface Area	sf	1,866	
<b><u>Mobilization/Demobilization</u></b>	ls	3,000	Includes mob/demob of excavation equipment and preparing submittals.
<b><u>Excavate Soils</u></b>	day	2	Includes 3/4 cy excavator, 1-22 cy dump trucks, 1 O.E., 1 T.D., 1 L.S. spotter, 1 L.S. to prep trucks and misc. Reduced productivity by 50% for loading trucks, precise excavations, and security/S&H requirements. Average 135 cy/day. Assume 1 day to load for thermal treatment and 1 day to return to excavation area. RSMMeans Crew B12F and B34D.
	\$/day	3,449	
<b><u>Standby Time</u></b>	day	3	Assume 3 days excavator standby while analysis is being performed.
	\$/day	1815	
<b><u>Thermal Treatment of Contaminated Soil</u></b>	cy	86	Source: Endpoint Technology cost estimate using Vapor Energy Generator (VEG) Soil Remediation.
	\$/cy	41.00	



**Feasibility Study for Wet Storage Area**  
**Alternative 3: Ex-situ Thermal Treatment – Attain Unrestricted (Residential) Land Use**  
**Key Parameters and Assumptions**

**Key Parameters and Assumptions:**

Item	Unit	Value	Notes
<b><u>Confirmation Sampling</u></b>			
Samples	ea	3	Includes 3 ISM samples for confirmation for PAHs. Approximately 1 sample per 40 cy.
Sampling Labor	hrs	4	Assumes 1 sampling technician at 4 hours to collect and ship samples.
Sampling Labor	\$/hr	70	
Truck Rental / Gas	\$/event	110	1 truck x \$90/day. Add \$20 for gas.
Sample Materials	ea	3	Reference ECHOS 33 02 0401/0402 for ISM, processing, disposable sampling and decontamination materials.
Sample Materials	\$/ea	35	
Analytical Cost	\$/event	210	Analyze samples for PAHs (3 @ \$70).
<b><u>Restoration</u></b>			
			Includes native soil backfill. Assume productivity has been reduced by 25% to account for spreading treated backfill and security/safety requirements.
Native Soil Backfill	cy	23	Quantity is based on 4-in of native soil over the removal area to facilitate vegetation growth. Borrow, topsoil or loam, 1 C.Y. bucket, loading and/or spreading, from stockpile. Includes fill delivery, spreading, and compaction with loader. RSMMeans 312323160040.
Native Soil Backfill	\$/cy	33.81	
Seeding, Vegetative Cover	MSF	11	Seeding with mulch and fertilizer. Assume 0.25 acre is revegetated for restored areas and equipment damage. RSMMeans 329219142200. Add 25% for planting native seed and plants.
Seeding, Vegetative Cover	\$/MSF	70.46	
SWPPP Inspections	hrs	4	Assume one follow-up inspection.
SWPPP Inspections	\$/hr	70	
<b><u>Plans and Reports</u></b>			
Remedial Action Completion Report	hrs	280	Includes Construction QC data and preparing report.
Technical Labor	\$/hr	90	

## Feasibility Study for Wet Storage Area

### Alternative 3: Ex-situ Thermal Treatment – Attain Unrestricted (Residential) Land Use Cost Estimate

#### CAPITAL COST

**\$134,587**

Activity (unit)	Quantity	Unit Cost	Total
<b><u>Pre-excavation Delineation and Waste Characterization Sampling</u></b>			
Sampling Labor (hrs)	24	\$70.00	\$1,680
Truck Rental / Gas (event)	1	\$290.00	\$290
Sample Materials (ea)	98	\$98.00	\$9,604
Sample Analysis (event)	1	\$8,876.00	\$8,876
<b><u>Site Work</u></b>			
Civil Survey (day)	0.5	\$940.00	\$470
As Built Drawings (hrs)	2	\$70.00	\$140
Sediment and Erosion Control (lf)	300	\$5.41	\$1,623
<b><u>Soil Excavation</u></b>			
Mobilization/Demobilization (ls)	1	\$3,000.00	\$3,000
Excavate Soil (day)	2	\$3,449.00	\$6,898
Thermal Treatment of Contaminated Soil (cy)	86	\$41.00	\$3,526
<b><u>Confirmation Sampling</u></b>			
Sampling Labor (hrs)	4	\$70.00	\$280
Truck Rental / Gas (event)	1	\$110.00	\$110
Sample Materials (ea)	3	\$35.00	\$105
Sample Analysis (event)	1	\$210.00	\$210
<b><u>Restoration</u></b>			
Native Soil Backfill (cy)	23	\$33.81	\$779
Seeding, Vegetative Cover (MSF)	11	\$70.46	\$775
SWPPP Inspections (hrs.)	4	\$70.00	\$280
<b><u>Plans and Reports</u></b>			
Remedial Action Completion Report (hrs)	280	\$90.00	\$25,200
Subtotal			\$63,846
Design		30%	\$19,154
Office Overhead		10%	\$6,385
Field Overhead		15%	\$9,577
Subtotal			\$98,961
Profit		6%	\$5,938
Contingency		30%	\$29,688
Total			\$134,587