

## **APPENDIX J**

### **Detailed Cost Estimate**

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**Feasibility Study for Load Line 9  
Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio  
Summary of Alternatives**

<b>Load Line 9 Area Alternatives</b>		<b>Duration</b>	<b>Non Discounted Cost</b>		
			<b>Soil</b>		
			<b>Capital Cost</b>	<b>O&amp;M Cost</b>	<b>Total</b>
<b>1</b>	<b>No Action</b>	<b>0</b>	<b>\$0</b>	<b>\$0</b>	<b>\$0</b>
<b>2</b>	<b>Excavation and Off-site Disposal – Attain Unrestricted (Residential) Land Use</b>	<b>&lt;1 yr</b>	<b>\$410,360</b>	<b>\$0</b>	<b>\$410,360</b>
<b>3</b>	<b>Excavation and Off-site Disposal at LL9ss-011 and Ex-situ Thermal Treatment at LL9ss-096/097 – Attain Unrestricted (Residential) Land Use</b>	<b>&lt;1 yr</b>	<b>\$296,732</b>	<b>\$0</b>	<b>\$296,732</b>

Notes:

1. 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.

**Feasibility Study for Load Line 9  
Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio  
Summary of AOC Areas and Volumes**

ISM Sample Locations	Media	Treatment Interval (ft bgs)	Surface Area (sq ft)	<i>In situ</i>	<i>In situ with Constructability<sup>a</sup></i>	<i>Ex situ<sup>a,b</sup></i>	<i>Ex situ<sup>a,b</sup></i>
				Soil (cy)	Soil (cy)	Soil (cy)	Soil (tons)
LL9ss-011	Surface Soil	0-1	430	16	20	24	26
LL9ss-096 and LL9ss-097	Surface Soil	0-1	20,540	761	951	1,141	1,255
Totals			20,970	777	971	1,165	1,281

<sup>a</sup> Includes 25% constructability factor

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

**Feasibility Study for Load Line 9**  
**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>Site Work</u></b>			
Site Area	sf	20,970	
Civil Survey	day	1.0	Survey AOC areas and set monuments. RSMeans 017123131100.
Civil Survey	\$/day	1,025	
As Built Drawings	hours	8	Develop plat map for incorporation into the Base Master Plan.
As Built Drawings	\$/hr	70	
Sediment and Erosion Control	lf	400	Includes silt fence and straw bales along down slope of excavation.
Sediment and Erosion Control	\$/lf	12.19	RSMeans 312514161000 & 250.
<b><u>Delineation/Pre-Excavation</u></b>			
<b><u>Confirmation Sampling</u></b>			
Delineation Samples	ea	80	Assume 20 borings will be hand augured from 0-1, 1-2, 2-3, 3-4 ft bgs. Assume 8 borings/32 samples will be analyzed for lead and mercury and 12 borings/48 samples samples will be analyzed for PAHs.
Sampling Labor	hrs	100	
Sampling Labor	\$/hr	70	Includes 2 sampling technicians at 10 hours/day for 5 days.
Per Diem	\$/event	1,400	2 people x \$140/day
Truck Rental / Gas	\$/event	550	1 truck x \$90/day. Add \$100 for gas.
Sample Materials	ea	80	Reference ECHOS 33020401, 33020402, and 3302067 for ISM, processing, disposable sampling and decontamination materials.
Sample Materials	\$/lot	38	
Sample Analysis	\$/lot	7,416	Analyze samples for Lead (48 @ \$14), Mercury (48 @ \$18), and PAHs (56 @ \$105). Includes 15% for QA/QC samples.
Data Management	hrs	80	Data validation
Data Management	\$/hr	80	
<b><u>Waste Characterization Sampling and Analysis</u></b>			
Waste Characterization Samples	ea	2	Assume 2 samples to characterize waste and analyzed for TCLP.
Sampling Labor	hrs	4	
Sampling Labor	\$/hr	70	Assumes 1 sampling technician at 4 hours.
Per Diem	\$/event	140	1 person x \$140/day
Truck Rental / Gas	\$/event	110	1 truck x \$90/day. Add \$20 for gas.
Sample Materials	ea	2	Reference ECHOS 33020401, 33020402, and 3302067 for ISM, processing, disposable sampling and decontamination materials.
Sample Materials	\$/ea	38	
Sample Analysis	\$/ea	720	Analyze samples for TCLP VOCs, SVOCs, Metals, RCRA Characteristics, and Paint Filter. (2 @ \$360).
Data Management	hrs	8	Data validation
Data Management	\$/hr	80	

**Feasibility Study for Load Line 9**  
**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>Soil Excavation</u></b>			
Soil Excavation Volume (In situ)	cy	971	Includes soil volume to be excavated. In situ volumes include a 25% constructability factor.
Soil Excavation Volume (Ex situ)	cy	1,165	Includes soil volume to be transported and disposed offsite. Ex situ volumes include a 25% constructability and 20% swell factor.
Soil Excavation Mass	tons	1,281	Includes soil mass to be transported and disposed.
Volume to Weight Conversion	tons/cy	1.10	Ex situ or loose soil conversion.
Soil Excavation Surface Area	sf	20,970	
<u>Mobilization/Demobilization</u>	ls	1,200	Includes mob/demob of excavation equipment and preparing submittals.
<u>Excavate, Load, and Transport Soils</u>	day	4	Includes 1 cy excavator, 10-22 cy off highway trucks, 1 O.E., 7 T.D., 1 L.S. spotter, 2 L.S. to prep trucks/and misc. Reduced productivity by 25% for loading trucks, small precise excavations, and security/S&H requirements. Average 300 cy/day. RSMMeans Crew B12-E. Does not include transportation of hazardous soils.
	\$/day	15,330.00	
<u>Offsite Transportation and Disposal (Lead and Mercury)</u>	tons	26	Based on shipping hazardous waste to Clean Harbors, Canadian Facility approximately 600 mi RT.
	\$/ton	360.00	
<u>Offsite Transportation and Disposal (PAHs)</u>	tons	1,255	Assume non-hazardous waste disposal. 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	
<b><u>Restoration</u></b>			
Native Soil Backfill	cy	1,165	Includes native soil backfill. Assume productivity has been reduced by 25% to account for security and safety requirements. Includes 12-in lift of native fill assuming 20% swell. ECHOS 17030423 and RSMMeans 312323160040, Unclassified Fill, 6" Lifts, offsite Source @ 20 miles, Includes delivery, spreading, and compaction.
Native Soil Backfill	\$/cy	33.74	
Seeding, Vegetative Cover	MSF	44.0	RSMMeans 329219142200. Seeding with mulch and fertilizer. Assume 1 acres is revegetated for excavation areas and equipment damage.
Seeding, Vegetative Cover	\$/MSF	58.00	
SWPPP Inspections	hrs	20	Assume 4 hrs per week for 5 weeks.
SWPPP Inspections	\$/hr	70	
<b><u>Plans and Reports</u></b>			
Report	hrs	200	Includes Construction QC data and preparing report.
Technical Labor	\$/hr	90	

**Feasibility Study for Load Line 9**  
**Alternative 2 - Excavation and Off-site Disposal – Attain Unrestricted (Residential) Land Use**  
**Cost Estimate**

**CAPITAL COST**

**\$410,360**

Activity (unit)	Quantity	Unit Cost	Total
<b><u>Site Work</u></b>			
Civil Survey (day)	1	\$1,025.00	\$1,025
As Built Drawings (hrs)	8	\$70.00	\$560
Sediment and Erosion Control (lf)	400	\$12.19	\$4,876
<b><u>Delineation/Pre-Excavation Confirmation</u></b>			
<b><u>Sampling</u></b>			
Sampling Labor (hrs)	100	\$70.00	\$7,000
Per Diem (event)	1	\$1,400.00	\$1,400
Truck Rental / Gas (event)	1	\$550.00	\$550
Sample Materials (ea)	80	\$38.00	\$3,040
Sample Analysis (lot)	1	\$7,416.00	\$7,416
Data Management (hrs)	80	\$80.00	\$6,400
<b><u>Waste Characterization Sampling &amp; Analysis</u></b>			
Sampling Labor (hrs)	4	\$70.00	\$280
Per Diem (event)	1	\$140.00	\$140
Truck Rental / Gas (event)	1	\$110.00	\$110
Sample Materials (ea)	2	\$38.00	\$76
Sample Analysis (lot)	1	\$720.00	\$720
Data Management (hrs)	8	\$80.00	\$640
<b><u>Soil Excavation</u></b>			
Mobilization/Demobilization (ls)	1	\$1,200.00	\$1,200
Excavate Soil (days)	4	\$15,330.00	\$61,320
Offsite Disposal (Lead and Mercury) (ton)	26	\$360.00	\$9,360
Offsite Disposal (PAH) (ton)	1,255	\$52.00	\$65,260
<b><u>Restoration</u></b>			
Native Soil Backfill (cy)	1,165	\$33.74	\$39,305
Seeding, Vegetative Cover (MSF)	44	\$58.00	\$2,552
SWPPP Inspections (hrs)	20	\$70.00	\$1,400
<b><u>Plans and Reports</u></b>			
Corrective Action Completion Report (ea)	200	\$90.00	\$18,000
Subtotal			\$232,630
Design		20%	\$46,526
Office Overhead		5%	\$11,632
Field Overhead		15%	\$34,895
Subtotal			\$325,683
Profit		6%	\$19,541
Contingency		20%	\$65,137
Total			\$410,360

**Feasibility Study for Load Line 9**  
**Alternative 3 - Excavation and Off-site Disposal at LL9ss-011 and Ex-situ Thermal Treatment at LL9ss-096/097 –**  
**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>Site Work</u></b>			
Site Area	sf	20,970	
Civil Survey	day	1.0	Survey AOC areas and set monuments. RSMMeans 017123131100.
Civil Survey	\$/day	1,025	
As Built Drawings	hours	8	Develop plat map for incorporation into the Base Master Plan.
As Built Drawings	\$/hr	70	
Sediment and Erosion Control	lf	400	Includes silt fence and straw bales along down slope of excavation.
Sediment and Erosion Control	\$/lf	12.19	RSMMeans 312514161000 & 250.
<b><u>Delineation/Pre-Excavation Confirmation Sampling</u></b>			
Delineation Samples	ea	80	Assume 20 borings will be hand augured from 0-1, 1-2, 2-3, 3-4 ft bgs. Assume 8 borings/32 samples will be analyzed for lead and mercury and 12 borings/48 samples will be analyzed for PAHs.
Sampling Labor	hrs	100	Includes 2 sampling technicians at 10 hours/day for 5 days.
Sampling Labor	\$/hr	70	
Per Diem	\$/event	1,400	2 people x \$140/day
Truck Rental / Gas	\$/event	550	1 truck x \$90/day. Add \$100 for gas.
Sample Materials	ea	80	Reference ECHOS 33020401, 33020402, and 3302067 for ISM, processing, disposable sampling and decontamination materials.
Sample Materials	\$/lot	38	
Sample Analysis	\$/lot	7,416	Analyze samples for Lead (48 @ \$14), Mercury (48 @ \$18), and PAHs (56 @ \$105). Includes 15% for QA/QC samples.
Data Management	hrs	80	Data validation
Data Management	\$/hr	80	
<b><u>Waste Characterization Sampling and Analysis</u></b>			
Waste Characterization Samples	ea	2	Assume 2 samples to characterize waste and analyzed for TCLP.
Sampling Labor	hrs	4	Assumes 1 sampling technician at 4 hours.
Sampling Labor	\$/hr	70	
Per Diem	\$/event	140	1 person x \$140/day
Truck Rental / Gas	\$/event	110	1 truck x \$90/day. Add \$20 for gas.
Sample Materials	ea	2	Reference ECHOS 33020401, 33020402, and 3302067 for ISM, processing, disposable sampling and decontamination materials.
Sample Materials	\$/ea	38	
Sample Analysis	\$/ea	720	Analyze samples for TCLP VOCs, SVOCs, Metals, RCRA Characteristics, and Paint Filter. (2 @ \$360).
Data Management	hrs	8	Data validation
Data Management	\$/hr	80	



**Feasibility Study for Load Line 9**  
**Alternative 3 - Excavation and Off-site Disposal at LL9ss-011 and Ex-situ Thermal Treatment at LL9ss-096/097 –**  
**Attain Unrestricted (Residential) Land Use**  
**Key Parameters and Assumptions**

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Item	Unit	Value	Notes
<b><u>Soil Excavation</u></b>			
Soil Excavation Volume (In situ)	cy	971	Includes soil volume to be excavated. In situ volumes include a 25% constructability factor.
Soil Excavation Volume (Ex situ)	cy	1,165	
Soil Excavation Mass	tons	1,281	Includes soil mass to be transported and disposed.
Volume to Weight Conversion	tons/cy	1.10	
Soil Excavation Surface Area	sf	20,970	Ex situ or loose soil conversion.
<u>Mobilization/Demobilization</u>	ls	1,200	Includes mob/demob of excavation equipment and preparing submittals. Assumes thermal treatment system is on site and does not require mobilization.
<u>Excavate, Load, and Backfill Soils</u>	day \$/day	5 3,660.00	Includes 3/4 cy excavator, 1-22 cy off highway trucks, 1 O.E., 1 T.D., 1 L.S. spotter, 1 L.S. to prep trucks/and misc. Reduced productivity by 25% for loading trucks, small precise excavations, and security/S&H requirements. Average 200 cy/day based on treatment system production rate. Assume 4 days to excavate and treat and 1 additional day to backfill treated soils. RSMMeans.
<u>Standby Time</u>	day \$/day	2 1404.00	Assume 2 days equipment standby while analysis is being performed. Assume no additional hot spot excavation.
<u>Thermal Treatment of PAH Soils</u>	cy \$/cy	1141 41.00	Source: Endpoint Technology cost estimate using Vapor Energy Generator (VEG) Soil Remediation.
<u>Offsite Transportation and Disposal (Lead and Mercury)</u>	tons \$/ton	26 360.00	Based on shipping hazardous waste to Clean Harbors, Canadian Facility approximately 600 mi RT.
<b><u>Confirmation Sampling</u></b>			
Confirmation Samples	ls \$/ls	1 1,972	Source: Endpoint Technology cost estimate using Vapor Energy Generator (VEG) Soil Remediation Ten 7-point composite confirmation soil samples to be collected for each stockpile.
<b><u>Restoration</u></b>			
Native Soil Backfill	cy	320	Includes 4-inches of native soil backfill at LL9ss-096 and )(& 12-inches at LL9ss-011 to assist with re-establishing vegetation, as remediated soil will be placed back in removal area. Assume productivity has been reduced by 25% to account for security and safety requirements.
Native Soil Backfill	\$/cy	33.74	
Seeding, Vegetative Cover	MSF	44.0	RSMMeans 329219142200. Seeding with mulch and fertilizer. Assume 1 acres is revegetated for excavation areas and equipment damage.
Seeding, Vegetative Cover	\$/MSF	58.00	
SWPPP Inspections	hrs	20	Assume 4 hrs per week for 5 weeks.
SWPPP Inspections	\$/hr	70	
<b><u>Plans and Reports</u></b>			
Report	hrs	240	Includes Construction QC data and preparing report.
Technical Labor	\$/hr	90	

**Feasibility Study for Load Line 9**  
**Alternative 3 - Excavation and Off-site Disposal at LL9ss-011 and Ex-situ Thermal Treatment at LL9ss-096/097 –**  
**Attain Unrestricted (Residential) Land Use**  
**Cost Estimate**

**CAPITAL COST**

**\$296,732**

Activity (unit)	Quantity	Unit Cost	Total
<b><u>Site Work</u></b>			
Civil Survey (day)	1	\$1,025.00	\$1,025
As Built Drawings (hrs)	8	\$70.00	\$560
Sediment and Erosion Control (lf)	400	\$12.19	\$4,876
<b><u>Delineation/Pre-Excavation Confirmation</u></b>			
<b><u>Sampling</u></b>			
Sampling Labor (hrs)	100	\$70.00	\$7,000
Per Diem (event)	1	\$1,400.00	\$1,400
Truck Rental / Gas (event)	1	\$550.00	\$550
Sample Materials (ea)	80	\$38.00	\$3,040
Sample Analysis (lot)	1	\$7,416.00	\$7,416
Data Management (hrs)	80	\$80.00	\$6,400
<b><u>Waste Characterization Sampling &amp; Analysis</u></b>			
Sampling Labor (hrs)	4	\$70.00	\$280
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Sample Materials (ea)	2	\$38.00	\$76
Sample Analysis (lot)	1	\$720.00	\$720
Data Management (hrs)	8	\$80.00	\$640
<b><u>Soil Excavation</u></b>			
Mobilization/Demobilization (ls)	1	\$1,200.00	\$1,200
Excavate Soil (days)	5	\$3,660.00	\$18,300
Standby Time (days)	2	\$1,404.00	\$2,808
Thermal Treatment of Contaminated Soil (cy)	1,141	\$41.00	\$46,781
Offsite Disposal (Lead and Mercury) (ton)	26	\$360.00	\$9,360
<b><u>Confirmation Samples</u></b>			
Confirmation Samples (cy)	1	\$1,972.00	\$1,972
<b><u>Restoration</u></b>			
Native Soil Backfill (cy)	320	\$33.74	\$10,803
Seeding, Vegetative Cover (MSF)	44	\$58.00	\$2,552
SWPPP Inspections (hrs)	20	\$70.00	\$1,400
<b><u>Plans and Reports</u></b>			
Corrective Action Completion Report (ea)	240	\$90.00	\$21,600
Subtotal			\$151,009
Design		30%	\$45,303
Office Overhead		5%	\$7,550
Field Overhead		15%	\$22,651
Subtotal			\$226,513
Profit		6%	\$13,591
Contingency		25%	\$56,628
Total			\$296,732