



**ANALYSIS OF BROWNFIELDS CLEANUP
ALTERNATIVES (ABCA)**

**DRAFT REVISION
March 17, 2011**

**FORMER CHILLICOTHE CORRECTIONAL FACILITY
1500 WEST THIRD STREET
CHILLICOTHE, MISSOURI**

**Missouri Brownfields Revolving Loan Fund
EPA Region 7 Brownfields Grant Program**

Prepared for:

**ENVIRONMENTAL IMPROVEMENT AND
ENERGY RESOURCES AUTHORITY
Jefferson City, Missouri**

Prepared by:

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March 17, 2011

Kristin Allan Tipton
EIERA Development Director
P.O. Box 744
Jefferson City, MO 65102

RE: Analysis of Brownfields Cleanup Alternatives – DRAFT REVISION
Former Chillicothe Correctional Facility
1500 West Third Street, Chillicothe, Missouri

Dear Ms. Allan Tipton:

Environmental Works, Inc. (“EWI”) is pleased to submit this draft Analysis of Brownfield Cleanup Alternatives (ABCA) Report under our existing Environmental Consulting Agreement. This document has been developed consistent with the EWI Environmental Services Proposal dated February 9, 2011 and the Scope of Services presented therein.

The content and format of the enclosed ABCA are comparable to cleanup planning documents developed and approved in connection with previous EPA Region 7 Brownfields Grant programs. Specific cleanup alternatives and associated recommendations are presented in applicable sections of this report.

EWI appreciates the opportunity to support EIERA and the Missouri Brownfields Revolving Loan Fund. Please contact me direct at (816) 285-8414 or at brian@environmentalworks.com if you have questions regarding the enclosed report or wish to discuss the project in more detail. We look forward to a continued relationship with you and EIERA.

Sincerely,
ENVIRONMENTAL WORKS, INC.

Brian M. Conrad
Brownfields Contract Manager

Enclosure

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1.0 INTRODUCTION AND BACKGROUND

This Analysis of Brownfields Cleanup Alternatives (ABCA) Report documents brownfield cleanup planning specific to prospective redevelopment of a former women’s prison at 1500 West Third Street in southwest Chillicothe, Missouri, referred to herein as “Site”, “subject site”, or “subject property”. These efforts were implemented under the Missouri Brownfields Revolving Loan Fund administered by the Environmental Improvement and Energy Resources Authority (EIERA). Project funding is provided by the U.S. Environmental Protection Agency (EPA) through a Brownfields Revolving Loan Fund Grant.

Environmental Works Inc. (EWI) implemented project work consistent with our existing Environmental Consulting Agreement with EIERA (“Agreement”) and the EWI Environmental Services Proposal dated February 9, 2011 (“Proposal”). Report content and format are comparable to cleanup planning documents developed and approved in connection with previous EPA Region 7 Brownfields Grant projects.

Cleanup alternatives were evaluated in accordance with EPA Region 7 protocols and general guidance required prior to implementation of a cleanup design using EPA Brownfields Grant funding. More specifically, this ABCA has been developed to present viable cleanup alternatives based on site-specific conditions, technical feasibility, and preliminary cost/benefit analyses. Specific cleanup alternatives and associated recommendations are presented in applicable sections of this report.

Previous environmental assessments and building inspections identified asbestos-containing materials (ACM) within 12 on-site structures. Building inspections also identified lead-based paint (LBP) within several of these structures. Petroleum hydrocarbon and petroleum-related impacts were identified during previous soil testing implemented in response to Phase I findings of recognized environmental conditions (RECs).

Previous findings of ACM within remaining building structures remains the primary basis for the Brownfields Cleanup evaluations presented herein. Excluding supplemental considerations for commingled ACM and lead paint, expanded evaluations to address LBP and/or underground petroleum storage tanks (USTs) is considered beyond scope and intent of this project. Additional details regarding previous assessments activities and documented environmental conditions are further summarized in the following introductory sections.

1.1 Site Location and Description

The subject site occupies approximately 60 acres of developed land beginning at the intersection of Third Street and South Woodrow Street in southwest Chillicothe, Missouri. The property includes the former Chillicothe Woman’s Prison facility, which extends north and south of Third Street, and east from South Woodrow beyond Dickenson Street in some areas. Specific improvements include 32 buildings, ancillary structures, and associated driveway, parking, and landscaping features within the central portion of the site. Areas north and south of

the vacant buildings are primarily open green space. Wooded areas and a drainage way bound the property on the south. Surrounding properties in remaining directions are primarily residential.

According to the Livingston County, Missouri Assessor, the property includes north and south parcels as summarized below:

- North Parcel – North of Third Street ID #06-07-00-35-4-17-18.00
Approximately 16 acres
- South Parcel – South of Third Street ID #11-01.00-02-1-01-01.00
Approximately 44.5 acres with majority of former correctional facility

Additional property descriptions are provided with the loan and title documents attached to the Missouri Brownfields Revolving Loan Fund (RLF) application submitted by the City of Chillicothe.

1.2 Site History and Prospective Use

Available land use records indicate use of the subject site as the Missouri State Industrial Home for Girls from circa 1888 to 1981 when the facility was dedicated for use as a maximum security women's prison. Periodic renovations and facility improvements occurred during this use; however, significant construction, demolition and/or land use modifications are not documented. The women's prison was reportedly vacated in November 2008 and has not been dedicated to a specific use since closure of the prison.

EWI understands prospective land use includes residential developments and associated green space and civil design improvements. Both building renovation/reuse and demolition of several existing structures are anticipated in support of the redevelopment plan.

1.3 Previous Assessment Findings

Phase I Targeted Brownfields Assessment (TBA)

Tetra Tech EM Inc. ("Tetra Tech") completed a Phase I Environmental Site Assessment (ESA) of the property in June 2008. This assessment identified the following Phase I recognized environmental conditions (RECs) in connection with the site:

- Evidence of historical petroleum contamination related to previous petroleum underground storage tank (UST) operations. The four USTs were reportedly removed in 1998. Documented closure of the USTs included excavation and disposal of contaminated soil. Verification sampling was limited and did not fully define the extent of related subsurface impacts.
- Two maintenance building located on site included vehicle maintenance facilities and storage of paints, solvents, herbicides and other potentially hazardous chemicals.

- Petroleum staining, stressed vegetation, and drum storage without secondary containment were also observed within or adjacent to several buildings.
- Asbestos and lead paint surveys and verification testing identified ACM within 12 of the 32 buildings and ancillary structures located on site. Lead-based paint (LBP) was identified in 15 of the buildings.

Phase II Targeted Brownfields Assessment (TBA)

In response to Phase I findings and associated RECs, Tetra Tech completed a Limited Phase II Environmental Site Assessment in February 2009. Phase II findings and laboratory data indicate petroleum and petroleum-related concentrations in soil above Missouri Risk Based Corrective Action (MRBCA) Default Target Levels (DTLs), which serve as preliminary benchmark screening criteria. Reported impacts were primarily within and downgradient of the former UST basin directly south of Building #7. Concentrations above non-residential Risk-Based Target Levels (RBTLs) were not identified. Reported metals concentrations were consistent with documented background levels for the region.

Phase I TBA Update

The previous Phase I was updated by Tetra tech in April 2009 to meet federal All Appropriate Inquiry (AAI) Rule [40 CFR Part 312] and ASTM Standard E 1527-05 requirements. Significant changes in site conditions were not noted; however, previous Phase II findings of a petroleum release to soil was documented as an REC in connection with the property.

Previous environmental assessments were performed under EPA oversight following EPA Region 7 START Contract and associated quality assurance guidelines. This work was performed with the sufficient level of care needed to assess environmental conditions and identify specific conditions in demand of future investigation and/or corrective action. Accordingly, the asbestos and lead paint survey findings presented above are the primary basis for the cleanup evaluations provided in this ABCA Report. EWI assumes this information remains reasonably accurate for cost/benefit analyses and related cleanup planning. Further evaluation of residual soil impacts associated with historical UST operations was not performed at the request of EIERA.

1.4 Project Scope and Objectives

The project Scope of Services includes evaluation of reliable asbestos-containing material (ACM) removal/abatement strategies based on technical relevance, property redevelopment objectives, and estimated cost. Applicable cleanup technologies were outlined and evaluated in response to existing Phase I / Phase II information, supporting data, and EWI experience with similar site conditions.

The quality objective was to provide technical analysis of demonstrated and documented quality, usable for site redevelopment/improvement determinations and development of a more definitive remedial design. Further, cleanup/removal alternatives are presented and assessed

with specific consideration to applicable Missouri Department of Natural Resources (MDNR) requirements for regulatory closure. Cleanup strategies therefore consider the specific measures necessary to receive formal closure and “No Further Action” status under MRBCA Technical Guidance. Specific abatement strategies were also evaluated consistent with National Emissions Standards for Hazardous Air Pollutants (NESHAP) requirements promulgated under 40 CFR Part 61.

Specific project tasks to meet these goals and objectives are summarized below:

- Initial inventory of applicable cleanup strategies based on reported site conditions, potential risk, and established remedial technologies;
- ACM removal/abatement evaluations generally based on the following:
 - Site conditions and potential risks
 - Anticipated building conditions, locations, and condition and type of materials to be addressed or removed
 - General advantages and disadvantages of each abatement approach
 - Overall protection of human health and the environment
 - Ability to address building structures to applicable MRBCA standards
 - Compliance with federal, state, and local laws and regulations
 - Long-term and short-term effectiveness
 - Technical and administrative feasibility
 - Capital cost and subsequent expenses (if applicable)
 - Community and regulatory acceptance
- Selection of a preferred/recommended remedial alternative using the evaluation criteria outlined above; and
- General assessment of planning and redevelopment considerations based on environmental conditions, preferred cleanup alternatives, and prospective land use.

1.5 General Assumptions and Scope Limitations

The planning discussions provided herein are primarily in response to site conditions documented through previous Phase I / Phase II activities performed by others. These evaluations are based exclusively on existing information and data obtained without EWI oversight or previous technical reviews. As such, this ABCA Report does not account for site conditions that may remain undocumented due to incomplete site characterization, technical oversights, or other variable conditions yet to be identified or accurately reported. Such conditions may warrant planning efforts and/or additional cleanup evaluations not specifically described in this report.

Consistent with EPA Brownfields Cleanup requirements, planning discussions assume site cleanup and abatement activities would be planned and implemented under the MDNR

Brownfields / Voluntary Cleanup Program (B/VCP). Accordingly, cleanup alternatives are presented consistent with MRBCA Technical Guidance and specific MRBCA closure requirements for asbestos containing materials. Yet EWI cannot predict or guarantee the specific MDNR requirements that may arise through subsequent planning, removal/closure, and remediation procedures. Site-specific MDNR requirements or technical requests may therefore warrant additional planning considerations beyond the scope of this report.

1.6 Report Limitations

EWI implemented and documented project work consistent with our existing Environmental Consulting Agreement and the associated Environmental Services Proposal dated February 9, 2011. Professional services remain contractually bound by the specific terms, conditions, and limitations outline in these documents and the Scope of Services presented therein.

The findings, conclusions, and EWI recommendations presented in this report are based solely upon the data and information obtained and reviewed through the authorized Scope of Services. Such information is subject to change over time and EWI cannot represent any conditions beyond those specifically identified through Client-authorized work. EWI makes no warranties, express or implied, with regard to cleanup planning determinations or any third party information used in connection with this project. These limitations must be considered by the user of this report for any associated planning or land use determinations.

1.7 Reliance

This project was funded through a federal Brownfields Grant awarded under the EPA Region 7 Brownfields Program. Project documents submitted to EPA, MDNR, or any other government agency may therefore become public record pursuant the Freedom of Information Act.

Contractual use and reliance on the ABCA Report is limited to the Environmental Improvement and Energy Resources Authority (EI ERA) through our current Environmental Consulting Agreement. Project work was also performed on behalf of the City of Chillicothe, Missouri in support of local brownfield redevelopment. Contractual reliance by any other party is prohibited without the written authorization of the EI ERA and Environmental Works, Inc. Reliance on the ABCA Report by the Client and all authorized parties is subject to the terms, conditions, and limitations stated in the existing Agreement, our Environmental Services Proposal, and this report.

2.0 EVALUATION OF CLEANUP ALTERNATIVES

2.1 General Cleanup Evaluation Approach

Brownfield cleanup alternatives were selected for expanded evaluation based on technical considerations specific to ACM abatement, potential environmental risks, and associated cost/benefit analysis. This approach included further review of applicable ACM abatement alternatives using the following evaluation criteria:

- Previous assessment findings and documented site conditions;
- Industry standards and practice specific to ACM abatement & demolition;
- Specific ACM characterization & removal/abatement requirements outlined in MRBCA Technical Guidance;
- Ability to address human health and environmental risks in accordance with MRBCA Technical Guidance and other related risk assessment tools;
- Current and prospective land use – both on-site and adjoining properties;
- Technical and economical feasibility; and
- Professional judgment and experience working under the Missouri B/VCP.

2.2 Cost Estimate Assumptions and Limitations

The cost estimates provided in this report are presented as variable order of magnitude estimates due to various unknowns regarding site/building conditions and final abatement specifications. Further, pending ACM abatement work plans, removal specifications, Remedial Action Plans, etc., may present remedial alternatives and technical procedures beyond the scope and intent of this report. Preliminary costs presented in this ABCA may therefore vary significantly from actual abatement and other associated environmental cleanup expenses. These estimates do not represent EWI cost proposals, fee schedules, or other cost warranties related to pending work performed consistent with ABCA recommendations and related technical evaluations.

Several assumptions were made specific to each ACM removal/abatement alternative, generally based on information provided in previous assessment reports prepared without EWI oversight. It should be noted that these assumptions may or may not accurately reflect final cleanup plans or other pending specifications. Accordingly, budget-level cost determinations would require more detailed building inspections, verified ACM volume determinations (and lead paint where applicable), and related planning beyond the current phase of this project. Preliminary ABCA cost estimates are intended solely for planning purposes and should be considered accurate for relative comparison only. EWI also recommends additional considerations be made in support of continued planning and site characterization consistent with Section 3.0 of this report.

2.3 Preliminary Cleanup Evaluations

Asbestos is usually addressed through direct removal of confirmed and suspect ACM prior to building renovations or demolition work. Given most conditions, this is the most practical and cost effective approach to address ACM to regulatory standards. Certain circumstances may warrant ACM enclosure or encapsulation as a less intrusive approach to maintain structural integrity, historical significance or desired aesthetic qualities when full demolition is not planned. Site-specific conditions and prospective reuse will ultimately dictate the most appropriate approach.

EWI understands pending brownfield redevelopment may make use of some existing buildings and infrastructure, while other buildings and structures are to be prepared for full demolition. Accordingly, the cleanup alternatives outlined below have been evaluated with specific consideration to this site preparation and redevelopment approach.

EWI evaluated three environmental cleanup/abatement alternatives in response to the Phase I / Phase II findings noted in previous sections of this report. These alternatives are outlined below. The following subsections present each alternative in greater detail, including estimated costs and potential contingency items.

Cleanup Alternative A – ACM Removal

Cleanup Alternative B – ACM Enclosure and/or Encapsulation

Cleanup Alternative C – No Action

2.3.1 Alternative A: Asbestos Removal

Approach Summary – Alternative A includes conventional removal/abatement of confirmed and reasonably suspect ACM using bulk removals, isolated scraping or removal of specific materials, selective demolition, or other similar procedures. Abatement areas would be contained prior to the removal using polyethylene sheeting, window boarding, controlled negative pressure conditions, and/or other applicable measures to prevent asbestos migration beyond the work zone. Some abatement procedures may require wet removals to further control potential spreading of damaged or friable asbestos and airborne particulates. During and following the abatement, ACM dust, particulates, and other residual materials would be vacuumed and filtered out using a high efficiency particulate air (HEPA) filtration system.

This is the most direct abatement alternative and does not demand subsequent controls to manage ACM left in place. ACM would simply be removed under an MDNR-approved Remedial Action Plan and containerized for off-site landfill disposal as a special or regulated waste. The most common removal method is “bag out” approach that uses labeled bags designed to contain ACM in manageable quantities. Leak-tight containers would be required if wet removals are performed. Landfill disposal authorizations would be secured prior to initiating the work. These authorizations are specific to the disposal facility and may require additional ACM characterization and profiling prior to disposal.

ACM removals must be performed by a Missouri-registered abatement contractor. In addition, this work requires a 10 business day notification to the MDNR Air Pollution Control Program and appropriate coordination with both B/VCP and Air Pollution Control representatives throughout the abatement project. An air monitoring program may be required for larger removals or high-risk conditions where friable or highly damaged ACM is involved. Clearance criteria would be demonstrated through a dust-wipe or other applicable post-removal sampling program as prescribed by MRBCA Technical Guidance.

Advantages – The ACM is permanently removed. Direct and relatively simple approach that is cost effective when implemented by efficient and experienced contractors. Common approach acceptable to regulatory agencies without bench tests or other preliminary evaluations. Usually does not significantly alter structural conditions due to typical ACM uses. Renovation or demolition restrictions would not remain following demonstration of clearance criteria. Excluding clearance sampling, follow-up inspections and maintenance not required. Use of common and industry standard abatement methods would likely expedite regulatory closure. Total costs are easier to predict and are not likely to vary significantly, absent of major oversights during previous site assessment & building surveys.

Disadvantages – Non-friable ACM in good condition presents limited exposure risks prior to removal. Removals are likely to damage non-friable ACM and trigger additional containment and air monitoring regardless of previous conditions. Abatement costs can escalate if previous estimates do not quantify all ACM, particularly in hard to access locations. Complete removal may be tedious and time consuming, with diminishing cost/benefit returns as the project continues. Creates waste generation stream and associated liabilities for generator.

Project Cost Estimate – Estimated costs include contractor removal labor and expenses, work plans for MDNR approval, MDNR oversight, notifications, permitting, safety measures, and development of a final Asbestos Abatement Report for MDNR review and approval. The following Cost Estimate and Technical Summary provided below outlines specific activities, related assumptions and technical specifications, and projected costs in greater detail. These details may or may not accurately reflect the final removal/closure design and conditions encountered in the field.

**Table 1a. Cost Estimate and Technical Summary
Brownfield Cleanup Alternative A – Asbestos Removal**

ACTIVITY DESCRIPTION		Estimate of Probable Cost	
		Low Range Estimate	High Range Estimate
A1	Project Health & Safety Plan	\$800	\$1,500
A2	Remedial Action Plan and Abatement Specification for MDNR Review & Approval	\$2,200	\$4,800
A3	Field Mobilization & Demobilization – abatement equipment, personnel travel and other related field expenses.	\$1,200	\$2,500
A4	Building Access, Containment, Decontamination and Ambient Air Monitoring – create negative pressure work area to prevent contaminant migration. Implement monitoring, decontamination, dust controls/water application, and other related safety measures following MDNR and OSHA requirements.	\$3,800	\$4,800
A5	Remove ACM Roofing – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 2,400 square feet (SF) based on previous Tetra Tech survey information.	\$6,600	\$10,000
A6	Remove ACM Roof Caulking & Sealant – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 250 linear feet (LF) based on previous Tetra Tech survey information.	\$800	\$1,100
A7	Remove ACM Ceiling Texture – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 4,000 SF based on previous Tetra Tech survey information.	\$27,000	\$34,000
A8	Remove ACM Carpet Mastic – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 2,700 SF based on previous Tetra Tech survey information.	\$4,100	\$6,100
A9	Remove ACM Floor Tile – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 43,000 SF based on previous Tetra Tech survey information.	\$69,000	\$103,000
A10	Remove ACM Window Caulking – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 6,500 LF based on previous Tetra Tech survey information.	\$13,000	\$18,000
A11	Remove ACM Window Glaze – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 5,500 LF based on previous Tetra Tech survey information.	\$11,000	\$15,000
A12	Remove ACM Thermal Insulation – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 1,350 LF based on previous Tetra Tech survey information.	\$12,800	\$15,000
A13	Miscellaneous Controls – additional ambient air controls, site security, permitting and other miscellaneous expenses related to ACM abatement and disposal.	\$3,500	\$4,500
A14	ACM Abatement Report – draft & finals for MDNR Review & Approval	\$4,500	\$5,500
A15	MDNR Brownfields / Voluntary Cleanup Program Application Fee & Oversight	\$5,200	\$5,200
PROJECTED BASE TOTALS:		\$165,500	\$231,000

2.3.2 Alternative B: Asbestos Management in Place

Approach Summary – Alternative B includes isolated asbestos removals and management of ACM using enclosure and/or encapsulation procedures that would seal off and immobilize ACM in place. Enclosure methods often make use of drywall, vinyl siding, pipe chases, or other similar

structures and materials capable of a tight seal that prohibits particulate migration. Enclosed areas would be sealed and caulked at the edges and seams to prevent ACM contact and potential migration beyond the enclosure. Specific areas that require standard maintenance and upgrades – e.g. roofing & windows – would remain subject to full removals to prevent complications with future renovations and maintenance work.

Similar to enclosure, ACM encapsulation would entail use of a durable, air and dust-tight surface coating material to immobilize ACM in place. These materials may range from liquid encapsulants that dry and cure similar to paint, to fibrous material application scenarios. This approach is most practical for large, flat, homogenous surfaces such as floor tile, ceiling textures and walls. These procedures could be used as tool during ACM removals to reduce ACM waste disposal volumes.

Waste generation and disposal would remain subject to the same general procedures outlined for Alternative A, yet disposal volumes would be limited to materials that cannot be safely enclosed or encapsulated – e.g. badly damaged, limited-access, etc. Prior to the enclosure(s), enclosed ACM should be labeled accordingly for future identification. During and following the abatement, ACM dust, particulates, and other residual materials would be vacuumed and filtered out using a HEPA filtration system. Regulatory clearance would be obtained through post-enclosure/encapsulation inspections by the MDNR and/or verification sampling as deemed necessary by the agency.

Advantages – This approach could significantly reduce the amount of ACM for abatement, waste generation, and associated waste management, transportation, and disposal liabilities. Although generally a higher cost per square foot, costs to address specific conditions could be reduced if full abatement is not necessary. In-place management is also beneficial if planned renovations and reuse do not require significant modifications to existing building conditions. Related work could be limited to future inspections and maintenance of non-friable ACM in good condition (e.g. well-maintained floor tile). Enclosure methods (e.g. floor covering) could be incorporated into interior improvements unrelated to environmental conditions.

Disadvantages – Asbestos is not completely removed, or removed at all in some circumstances. Cost per square foot is generally higher and the potential range of cost is less certain than standard removals. Further, management costs could significantly escalate if ACM removal is required to address alternative building use or structural modifications in the future. This would result in duplicative abatement efforts and increased difficulty accessing the enclosed/encapsulated ACM. Continued maintenance, inspections and monitoring will be required, including a formal Operation and Maintenance Plan to be approved by MDNR. Ongoing inspections and maintenance will further escalate project costs over time. Additionally, remaining ACM may complicate and/or delay the MDNR Certificate of Completion timeline.

Project Cost Estimate – Estimated costs include contractor labor and expenses, work plans for MDNR approval, MDNR oversight, notifications, permitting, safety measures, and development of a final Asbestos Abatement Report and Operations 7 Maintenance Plan for MDNR review and approval. The following Cost Estimate and Technical Summary provided below outlines specific activities, related assumptions and technical specifications, and projected costs in greater detail. These details may or may not accurately reflect the final removal design and site conditions encountered in the field.

**Table 1b. Cost Estimate and Technical Summary
Brownfield Cleanup Alternative B – Asbestos Management in Place**

ACTIVITY DESCRIPTION		Estimate of Probable Cost	
		Low Range Estimate	High Range Estimate
B1	Project Health & Safety Plan	\$800	\$1,500
B2	Remedial Action Plan and Abatement Specification for MDNR Review & Approval	\$2,200	\$4,800
B3	Field Mobilization & Demobilization – abatement equipment, personnel travel and other related field expenses	\$1,200	\$2,500
B4	Building Access, Containment, Decontamination and Ambient Air Monitoring – create negative pressure work area to prevent contaminant migration. Implement monitoring, decontamination, dust controls/water application, and other related safety measures following MDNR and OSHA requirements.	\$3,800	\$4,800
B5	Remove ACM Roofing – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 2,400 SF based on previous Tetra Tech survey information.	\$6,600	\$10,000
B6	Remove ACM Roof Caulking & Sealant – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 250 LF based on previous Tetra Tech survey information.	\$800	\$1,100
B7	Encapsulate ACM Ceiling Texture – Includes costs to remove damaged ceiling texture and encapsulate remaining areas suitable for this approach. Assumes removal/encapsulation of approximately 4,000 SF based on previous Tetra Tech survey information.	\$24,000	\$40,000
B8	Encapsulate ACM Carpet Mastic – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 2,700 SF based on previous Tetra Tech survey information.	\$9,400	\$13,500
B9	Maintain and/or Enclose ACM Floor Tile – Includes costs to maintain existing floor tile in good condition. Compromised areas and/or areas in contrast with planned reuse and building renovations would be enclosed accordingly. Approximately 43,000 SF based on previous Tetra Tech survey information - approximately half subject to enclosure procedures.	\$55,000	\$162,000
B10	Remove ACM Window Caulking – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 6,500 LF based on previous Tetra Tech survey information.	\$13,000	\$18,000
B11	Remove ACM Window Glaze – Includes costs to remove, contain and dispose of confirmed ACM. Assumes removal of approximately 5,500 LF based on previous Tetra Tech survey information.	\$11,000	\$15,000
B12	Encapsulate ACM Thermal Insulation – Includes costs to fully enclose confirmed ACM within thermal insulation. Assumes enclosure of approximately 1,350 LF based on previous Tetra Tech survey information.	\$7,500	\$12,800
B13	Miscellaneous Controls – additional ambient air controls, site security, permitting and other miscellaneous expenses related to ACM abatement and disposal.	\$3,500	\$4,500
B14	ACM Abatement Report – draft & finals for MDNR Review & Approval	\$4,500	\$5,500
B15	MDNR Brownfields / Voluntary Cleanup Program Application Fee & Oversight	\$5,200	\$5,200
B16	MDNR Operations and Maintenance Plan – Includes draft Plan, MDNR review and approval and one year of quarterly inspections/monitoring, following by 10 years of annual inspection and monitoring.	\$14,000	\$17,800
PROJECTED BASE TOTALS:		\$162,500	\$319,000

2.3.3 Alternative C: No Action

This cleanup alternative would not include any specific efforts to remove or maintain ACM in place. There would be no direct cleanup costs associated with this alternative, but potential environmental and financial liabilities would not be addressed. Further, this alternative may later result demolition complications, delays, and increased demolition costs due to ACM remaining within the structures.

2.4 Recommended Cleanup Alternative

The Recommended Cleanup Alternative – *Asbestos Removal* (Alternative A) – includes ACM abatement consistent with the technical discussion provided under Section 2.3.1. This alternative would address exposure risks using a proven approach consistent with recognized industry standards. This option would remain cost-competitive under almost all abatement scenarios and building conditions.

ACM removal would also prevent the need for subsequent inspections, maintenance, and regulatory oversight. Complete abatement to MDNR clearance criteria may present slightly increased removal expenses; however, related cost projections are relatively simple and are not likely to vary considerably, particularly on a cost per square foot (SF) and linear foot (LF) basis. Complete abatement to MDNR clearance criteria may be difficult for specific structures due to accessibility and structural concerns. Yet these conditions could be easily addressed with a deed notification and/or localized in-place management consistent with Cleanup Alternative B. EWI estimates a limited volume of ACM with significant access complications.

In-place management or the No Action Alternative would not address ACM liabilities, potential contaminant sources, or potential limitations to future land use and brownfield redevelopment potential. In contrast, ACM removal via Alternative A would effectively address these issues using a direct and simple technical approach that is cost effective and routinely applied under MDNR regulatory programs.

If applied on a relatively small scale, enclosure and/or encapsulation alternatives consistent with Cleanup Alternative B may present opportunities for reduced costs under specific conditions. Accordingly, EWI recommends these measures be evaluated on a building and material specific basis in the Remedial Action Plan (RAP). EWI also recommends use of alternative bid items to include this option, on a limited basis, during the Solicitation for Bid process.

3.0 ADDITIONAL CONSIDERATIONS

3.1 Additional Site Characterization

EWI reviewed previous assessment reports prepared by Tetra Tech in support of Brownfields Cleanup evaluations. Related building inspections and ACM surveys were generally thorough based on available records and data; however, EWI noted one particular data gap as summarized in the following:

- The Tetra Tech report documents 11,000 SF of cinder block and texture within Building #4. Laboratory results indicate asbestos content <1%, which does not characterize the material as ACM subject to NESHAP standards. Yet material characterization was limited to three samples.

Due to the relatively high square footage of the cinder block and texture materials, EWI recommends additional sampling to further verify asbestos levels <1%. This approach would prevent potentially significant unforeseen costs if cinder block removals as ACM are later required by MDNR. This effort could be included as a supplemental bid item.

3.2 Lead-Based Paint (LBP) Abatement

Previous assessment reports prepared by Tetra Tech indicate approximately 28,000 SF of damaged LBP and 250 LF of damaged LBP along door/window frames, etc. Based on these findings, EWI has provided supplemental cost evaluations for LBP removal/stripping and encapsulation, as appropriate based on documented site conditions. Related procedures are summarized in the following subsections.

3.2.1 Paint Removal / Stripping

This approach includes removal of LBP using wet scraping, planing or other wet stripping procedures. Chemical or heat application measures may be applied to enhance the process. This is the most direct LBP abatement approach and does not demand subsequent controls to manage LBP left in place. LBP would simply be removed and containerized for off-site disposal as special or hazardous waste. Disposal characterization testing would be required prior to specific waste disposal determinations. Regulatory clearance would be obtained through successful implementation of a pre-approved RAP – likely developed in coordination with the ACM Plan – and a post-removal dust-wipe sampling program as prescribed by MRBCA Technical Guidance.

Opinion of Probable Cost (SF) – \$9.50 to \$13.00

Opinion of Probable Cost (LF) – \$2.75 to \$3.50 (door/window frames, etc.)

3.2.2 Lead-Based Paint Encapsulation

This approach includes encapsulation of LBP surfaces with a durable, air and dust-tight surface coating material. These materials may range from liquid encapsulants that dry and cure similar to paint, to fibrous material application systems. EWI recommends use of a proven liquid application approach sufficient to address most deteriorating paint conditions with primer as a stabilizing agent. Encapsulation procedures would be coupled with wet removal of significantly deteriorated or peeling surfaces to prevent further chipping and spreading of LBP, regardless of the specific encapsulation methods applied. Regulatory clearance would be obtained through successful implementation of a pre-approved RAP and pre/post-encapsulation inspections by the MDNR. Demonstration of clearance criteria may require a dust-wipe sampling program consistent with MRBCA Technical Guidance

Opinion of Probable Cost (SF) – \$3.25 to \$7.00 (includes surface preparation)

Supplemental LBP Cost Estimate – Estimated costs include contractor labor and expenses, work plans for MDNR approval, MDNR oversight, notifications, permitting, safety measures, and development of a final LBP Abatement Report for MDNR review and approval. The following Cost Estimate and Technical Summary provided below outlines specific activities, related assumptions and technical specifications, and projected costs in detail. These details may or may not accurately reflect the final removal/closure design and conditions encountered in the field.

**Table 2. Cost Estimate and Technical Summary
Supplemental Cleanup Alternative – LBP Removal & Encapsulation**

ACTIVITY DESCRIPTION		Estimate of Probable Cost	
		Low	High
ALT-1	Remove flaking, deteriorated or otherwise damaged LPB via wet removal, stripping, planing, or other appropriate methods – Cost ranges assume approximately 20% of the total damaged LBP square footage documented for flat surfaces.	\$53,000	\$73,000
ALT-2	Remove flaking, deteriorated or otherwise damaged LPB via wet removal, stripping, planing, or other appropriate methods – Cost ranges assume the maximum linear footage documented for window/door frame and other related materials.	\$1,000	\$1,500
ALT-3	Encapsulate LBP – Cost ranges assume approximately 80% of the total damaged LBP square footage documented for flat surfaces. Includes preparation work.	\$72,000	\$155,000
ALT-4	Additional Planning, MDNR Coordination / Oversight & Reporting	\$5,000	\$8,000
PROJECTED BASE TOTALS:		\$131,000	\$237,500

If required, EWI anticipate performance of LBP abatement/encapsulation work in direct coordination with asbestos removals. This approach would result in the potential for cost reductions at various levels, due to commingled LBP/ACM materials, reduced mobilization expenses, and cross-utilization of field personnel, equipment/materials, etc. EWI estimates these reductions could total up to 15 to 25 percent of the costs presented in Table 2 above. Further, structures planned for demolition may not require LBP abatement prior to demolition work. These

costs are primarily applicable in the event existing structures are planned for reuse and occupancy and/or if paint conditions are so deteriorated that peeling/flaking conditions present potential contaminant migration and exposure risks.

3.3 Petroleum Storage Tanks

Previous assessment work performed by Tetra Tech identified former underground petroleum storage tank (UST) basins and related subsurface impacts adjacent to Buildings #10, #7, and west of #26. Phase II testing identified petroleum and petroleum-related concentrations above applicable MRBCA cleanup standards, primarily within the vicinity of “UST-4”, directly south of Building #7.

Consistent with EIERA scope or work requests and Client-authorized work, a formal review petroleum UST and subsurface conditions was not performed within the scope and intent of this project. Accordingly, subsurface conditions and UST removal/closure procedures should be fully evaluated prior to adjoining redevelopment or construction work within the vicinity of the building locations noted above. Contaminated soil removals and/or risk assessment costs to satisfy MDNR petroleum UST closure requirements could be fairly significant, in the range of \$10,000 to \$30,000, or higher if related soil contamination is wide spread. Extensive groundwater contamination is not likely base in the field conditions noted in the Tetra Tech report – i.e. groundwater not encountered.

3.4 Missouri Voluntary Cleanup Program

Cleanup projects implemented with EPA Brownfields Cleanup funding generally require participation in the state Voluntary Cleanup Program (or general equivalent) to verify specific environmental cleanup procedures. Accordingly, this ABCA Report has been developed with specific consideration to MNDR Brownfields / Voluntary Cleanup Program (B/VCP) procedural requirements and MRBCA Technical Guidance, the primary tool used to design, implement, and verify environmental remediation by the State of Missouri.

EWI recommends property enrollment in the Missouri B/VCP prior to subsequent phases of this project. The enrollment process includes completion of a three-page application submitted with a non-refundable application fee of \$200.00. Program enrollment also requires execution of a property access agreement with the agency. MDNR will subsequently request a refundable oversight deposit usually not to exceed \$5,000.00. This is an eligible expense covered by EPA Cleanup or Revolving Loan Fund Grants.

Project completion under the B/VCP allows MDNR to issue a Certificate of Completion, which verifies regulatory closure and provides an additional level of liability protection. This protection applies to both state and federal environmental liabilities through a Memorandum of Agreement between EPA and MDNR. Required steps prior to receiving the Certificate of Completion generally include the following:

- Full characterization of the nature and extent of environmental impact
- MDNR approval of a Remedial Action Plan
- Demonstrated implementation of the Remedial Action Plan
- Clearance sampling or demonstration of other relevant clearance criteria
- Associated documentation and reporting

Clearance criteria are generally demonstrated through dust wipe sampling program implemented following abatement procedures. In-place management consistent would require development and implementation of an Operation and Maintenance Plan to be filed with the property deed. This would serve as an institutional control to ensure protective measures are monitored and maintained over time.

3.5 Training and Safety Requirements

Abatement activities shall be managed in the field by properly trained personnel, as required under governing federal NESHAP and State of Missouri licensing, training, and accreditation programs. These include specific requirements for project design, abatement, and verification inspections and sampling. Regulatory references and links to specific regulations and requirement are provided below:

[The National Emission Standard for Asbestos - 40 CFR Part 61, Subpart M \(61.140 - 61.157\)](#)

[Missouri Air Conservation Law Sections 643.225 - 643.250 of the Revised Statutes of Missouri](#)
[643.225](#) [643.228](#) [643.230](#) [643.232](#) [643.235](#) [643.237](#) [643.240](#) [643.242](#) [643.245](#) [643.250](#)

[Missouri State Regulations 10 CSR 10-6.241 Asbestos Projects-Registration, Notification and Performance Requirements, and 10 CSR 10-6.250 Asbestos Abatement Projects - Certification, Accreditation and Business Exemption Requirements](#)

OSHA and EPA training and certification requirements also apply, including OSHA 40-Hour Hazwoper Training [29 CFR 1910.120]. Additional training and certifications will apply for LBP removal and encapsulation if performed. These include specific State of Missouri requirements for project design, abatement, and verification inspections and sampling [19 CSR 30-70]. This information is available for download at the following Missouri [Department of Health and Senior Services](#) link. Specific training and licensing requirements should be fully evaluated and outlined during development of Remedial Action Plan and Solicitation for Bid package.

Abatement procedures will require specific safety and air monitoring provisions to maintain worker safety and ensure additional public exposure risks are not introduced. Abatement contractors should clearly demonstrate the ability to maintain a safe work environment prior to the selection process. These provisions are usually outlined in a site-specific Health and Safety Plan or general equivalent. Formats may vary but should include the following components:

- Designation of Site Safety Manager with appropriate certifications
- Specific dust controls and measures to maintain negative pressure within abatement areas
- HEPA cleaning and air filtration procedure
- Worker protection – i.e. personal protective equipment (PPE) and safe working practice

- Identification potential chemical/physical hazards and protective measures
- Emergency procedures and hospital directions

3.6 Contractor Evaluation and Selection

EWI recommends development of a Solicitation for Bid package to evaluate and select a qualified ACM abatement contractor. Completion of a bid walk prior to contractor submittals will allow for more reliable technical and cost determinations. This approach, particularly if issued as a pre-bid requirement, may also bias the solicitation towards local contractors. Technical considerations may be further outlined and evaluated through a preliminary Abatement Specification (or technical equivalent) to be required with the bid packages.

EWI recommends evaluation of the specific line-item costs consistent with Table 1a of Section 2.3.1. Use of unit rate costs – e.g. price per linear and/or square foot – would allow for reasonable variations in the estimated removal/abatement volume without the need for contractor change orders. Supplemental line items may be beneficial to account for additional tasks related to project completion such as lead paint and removal of additional materials that may be required prior to building renovations or demolition – e.g. household hazardous waste, ballast and light fixtures, etc. This approach would also present the cost structure for use of alternative measures (e.g. localized ACM enclosure/encapsulation) if identified as a more practical approach for isolated conditions. Lastly, the Solicitation for Bid should account for specific MDNR requirements under the Brownfields Program such as development of a Remedial Action Plan, verification sampling as deemed necessary by the agency, and draft and final Abatement Reports.

In addition to the above, EWI strongly recommends selection of an abatement contractor with relevant experience under the MDNR Brownfields / Voluntary Cleanup Program, MRBCA Technical Guidance, and the sampling, data quality, field documentation, and reporting procedures required by this Program. A third-party oversight consultant is often used for verification sampling and reporting to further ensure compliance with MDNR requirements and increase general liability protection.

3.7 Phase I Updates

The previous Tetra Tech Phase I Report and report update dated April 13, 2009 are outdated pursuant to the EPA All Appropriate Inquiries (AAI) Rule [40 CFR Part 312] and ASTM Standard E 1527-05, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*. Future property transactions or other legal restructuring of ownership status will therefore require a Phase I update – issued as a new full report – to main federal liability protection for prospective purchasers or other parties in need of Phase I due diligence.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Project Summary & Background

The subject site occupies approximately 60 acres of developed land in southwest Chillicothe, Missouri, formerly used as the Chillicothe Woman's Prison. Specific improvements include 32 buildings ancillary structures and associated driveway, parking, and landscaping features within the central portion of the site.

Available land use records indicate use of the subject site as the Missouri State Industrial Home for Girls from circa 1888 to 1981 when the facility was dedicated for use as a maximum security women's prison. Periodic renovations and facility improvements occurred during in connection with this use; however, significant construction, demolition and/or land use modifications are not documented. The correctional facility was reportedly vacated in November 2008 and has not been dedicated to a specific use since closure of the prison. EWI understands prospective land use includes residential developments and associated green space and civil design improvements. Both building renovation/reuse and demolition of several existing structures are anticipated in support of the redevelopment plan.

Tetra Tech completed Phase I and Phase II Targeted Brownfields Assessments under contract with EPA Region in 2008 and 2009, respectively. The Phase I Report was updated in April 2009 to maintain federal due diligence protections under federal law. These assessments identified asbestos, lead paint, and residual petroleum UST impacts to subsurface soil as recognized environmental conditions (RECs).

Based on EWI review of the corresponding Tetra Tech reports, previous assessments were performed with the standard of care needed to assess environmental conditions identify specific conditions in demand of future investigation and/or corrective action. The asbestos and lead paint survey findings presented in the Tetra Tech reports were the primary basis for the cleanup evaluations provided in this ABCA Report Further evaluation of residual soil impacts associated with historical UST operations was not performed at the request of EI ERA.

Cleanup Planning Objectives and Findings

The project objective was to provide a thorough evaluation of reliable cleanup strategies consistent with technical feasibility, property redevelopment initiatives, and cost. Applicable cleanup and risk management technologies were outlined and evaluated based on EWI experience with similar ACM removal/closure projects, local planning objectives, and regulatory obligations.

Based on EWI review of previous site assessment reports and the additional considerations discussed herein, EWI has developed the following conclusions and recommendations regarding subsequent measures to address ACM in building structures, associated exposure risks, and potential environmental liability and financial risk:

1. Brownfields Cleanup evaluations were performed consistent with EPA Cooperative Agreement requirements and the EWI Environmental Services Proposal dated February 9, 2011. EWI reviews of previous Phase I / Phase II assessment activities indicate historical information and data usable for continued brownfield cleanup planning. Although limited, data gaps regarding complete ACM characterization were identified (see Section 3.6)
2. EWI estimated costs for three (3) individual ACM removal/abatement alternatives in response to documented site conditions. Associated cost estimates range from zero direct costs for No Action (Alternative C) to \$319,000 for selective removal and enclosure/encapsulation procedures consistent with Cleanup Alternative B. Specific cost details are outlined in cost summary Tables 1a and 1b provided under Section 2.3 of this report.
3. The Recommended Cleanup Alternative – *Asbestos Removal* (Alternative A) – includes ACM abatement following the technical discussion provided under Section 2.3.1. This alternative would address exposure risks using a proven approach consistent with accepted industry standards. This option would remain cost-competitive under almost all abatement scenarios and building conditions.

Estimated cost for the Recommended Alternative range from \$165,500 to \$231,000 (Table 1a), excluding related contingency measures that may apply. EWI recommends development of a bid form that accounts for specific contingency measures such as additional ACM characterization (specifically cinder block and texture), expanded removals and/or added controls to safely complete the project. EWI does not anticipate these measures would exceed 15 to 25 percent of the existing projections due to relatively thorough ACM survey information. Use of a competitive bid process would further limit the potential for elevated costs beyond the Table 1a projections.

4. If required in response building reuse, planned occupancy, and/or significantly deteriorated LBP conditions, LBP removals and/or encapsulation could significantly increase total project costs. Related line items provided in Table 2 of Section 3.2.2 estimate costs ranging from \$131,000 to \$237,500. Yet LBP abatement strategies offer the potential for cost reductions at various levels, due to commingled LBP/ACM materials, reduced mobilization expenses, and cross-utilization of field personnel, equipment/materials, etc. EWI estimates these reductions could total up to 15 to 25 percent of the projected costs shown in Table 2.

Future Planning & Recommendations

Property reuse and redevelopment without specific measures to address documented ACM and LBP (to a certain extent) would likely increase exposure risks and associated liabilities. Due to the restrictions associated with in-place closure, EWI recommends conventional removals and abatement consistent with the Recommended Cleanup Alternative – *Asbestos Removal* (Alternative A) – presented under Section 2.3.1 of this report. Recommended measures in support of this cleanup alternative include the following:

- Prior coordination with the MDNR Brownfields / Voluntary Cleanup Program to determine specific regulatory oversight procedures and applicable MRBCA abatement objectives consistent with prospective land use.
- Development of an MDNR Remedial Action Plan, Abatement Specification, or other work plan equivalents to further support the Recommended Cleanup Alternative as presented above. This Plan should specifically outline the selected removal/abatement approach, specific waste removal and disposal requirements, and the specific measures to demonstrate clearance criteria.
- Development of a Solicitation for Bid package for contractor selection and implementation of project work. This process may occur before or following Remedial Action development based on the desired selection approach – e.g. contractor with oversight verses consultant/contractor to manage all aspects of subsequent work. EWI recommends that prospective contractors provide an abbreviated draft Abatement Specification with the Bid Package submittal to demonstrate technical qualifications early in the selection process.
- Development of a site-specific Health and Safety Plan to be used in conjunction with the approved Remedial Action Plan.
- Complete disclosure of previous Phase I / Phase II Assessment and ABCA Report findings and recommendations to all project stakeholders and prospective abatement contractors. EWI recommends this information be supplemented with a bid walk for prospective contractors. These efforts will help prevent unforeseen encounters with unidentified or uncharacterized ACM, LBP or other hazardous materials potentially subject to removal.

General Contingencies

This report has been prepared as a general planning document and is not intended to provide the engineering or bidding specifications required to pursue specific ACM removal/abatement procedures. EWI therefore recommends subsequent development of an ACM Abatement Specification, Remedial Action Plan, or other general work plan equivalents as discussed above.

The conclusions and recommendations provided herein are primarily based on previous Phase I and Phase II assessments performed by others. This analysis assumes site conditions remain consistent with those previously documented. Future discoveries may warrant further investigation and/or ACM abatement evaluations not specifically described herein.

5.0 REFERENCES

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