February 15, 2023

Ms. Lisa Dunning
Task Order Contracting Officer's Representative
U.S. Environmental Protection Agency, Region 7
11201 Renner Boulevard
Lenexa, Kansas 66219

Subject: Contract No. 68HERH19D0018; Task Order No. 68E0719F0190
Nevada Habilitation Site, East Edwards Street,
Nevada, Vernon County, Missouri
Analysis of Brownfields Cleanup Alternatives

Dear Ms. Dunning:

Toeroek Associates, Inc. (Toeroek) and our teaming subcontractor, Tetra Tech, Inc. (Tetra Tech), (hereafter "Toeroek Team") are pleased to present the Analysis of Brownfields Cleanup Alternatives of the Nevada Habilitation Site (the Site) at East Edwards Street, Nevada, Vernon County, Missouri. This deliverable has been reviewed internally as part of Tetra Tech's quality assurance program, as well as Toeroek's quality assurance program, and is consistent with Toeroek's Quality Management Plan for the Resource Conservation and Recovery Act (RCRA) Enforcement and Permitting Assistance (REPA) contract. Documentation of this review is retained in the Toeroek Team's project files.

If you have any questions or comments, please contact Greg Hanna at 720-898-4102 or Kaitlyn Mitchell at 816-412-1742.

Sincerely,

Greg Hanna
Toeroek Team Program Manager

Kaitlyn Mitchell
Toeroek Team Project Manager

Enclosure: Analysis of Brownfields Cleanup Alternatives

cc: Leeanna Balsley, EPA Region 7
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ANALYSIS OF BROWNFIELDS CLEANUP ALTERNATIVES

NEVADA HABILITATION SITE
EAST EDWARDS STREET
NEVADA, VERNON COUNTY, MISSOURI

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 7

Task Order	:	68E0719F0190
Subtask	:	11.03
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Date Prepared	:	February 15, 2023
Contract No.	:	68HERH19D0018
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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) tasked Toeroek Associates, Inc. (Toeroek) and its teaming subcontractor, Tetra Tech, Inc. (Tetra Tech), (hereafter "Toeroek Team") to provide technical support to the EPA Region 7 Brownfields Program under Contract 68HERH19D0018, Task Order (TO) 68E0719F0190. EPA Region 7 requested that the Toeroek Team conduct an Analysis of Brownfields Cleanup Alternatives (ABCA) of the Nevada Habilitation Site (the Site) at East Edwards Street in Nevada, Missouri. The Site occupies sections of parcels 13-8.0-33-002-003-001.000 and 13-8.0-33-002-003-002.000, both on East Edwards Street. The Site includes a parking lot, green space, a portion of East Edwards Street, and a single structure used as a restroom.

The Toeroek Team has performed this ABCA based on results of the Targeted Brownfields Assessment (TBA), which consisted of a Phase II Environmental Site Assessment (ESA) and Hazardous Materials Survey (HMS) conducted by the Toeroek Team (Toeroek Team 2023a, b). Currently, the single structure is in use as a restroom. The Phase II ESA report concluded that based on analytical results from soil and soil-gas samples, further investigation and/or remediation appeared warranted. The HMS identified presence of asbestos-containing materials (ACM) within the roofing materials of the structure and concluded that these materials should be appropriately addressed prior to building renovation or demolition.

According to the Brownfields Assessment Application (EPA 2021), the Kaysinger Basin Regional Planning Commission and current property owner, the City of Nevada, have shown an interest in developing the Site contingent on findings from the Phase II ESA and HMS. Future use of the Site is unknown; however, to be conservative, residential land use will be assumed for this ABCA.

This ABCA considers state and federal regulations regarding ACM. The federal Asbestos Hazard Emergency Response Act (AHERA) defines ACM as any material or product that contains more than 1 percent asbestos. Missouri Department of Natural Resources (MoDNR) regulations outline ACM inspection, reporting, and disposal requirements for demolition or renovation of commercial buildings (MoDNR 2022).

This ABCA also considers state and federal regulations regarding soil and soil gas. Data from soils will be compared to Missouri Risk-Based Corrective Action (MRBCA) Tier 1 Risk-Based Target Levels (RBTLs) or EPA Regional Screening Levels (RSLs) if RBTLs are not available (MoDNR 2006; EPA 2022a). Soil-gas data will be compared to EPA Vapor Intrusion Screening Levels (VISLs) (EPA 2022b).

2.0 BACKGROUND AND DESCRIPTION

The Site is at East Edwards Street in Nevada, Vernon County, Missouri, and is depicted on the Nevada, Missouri, U.S. Geological Survey (USGS) 7.5-minute topographic series map (USGS 1991) (Appendix A, Figure 1). Coordinates at the approximate center of the Site are 37.859596 degrees north latitude and 94.359182 degrees west longitude. The Site encompasses approximately 12 acres and is improved with a 400-square-foot (SF) restroom building and a network of tunnels. The extensive underground utility corridor and tunnel system exists under the Site and adjoining properties. This network is associated with the existing Nevada State Hospital and with the former on-site structures associated with the historical Nevada State Hospital (Toeroek Team 2023a).

The Site is within a primarily residential area of the City of Nevada. This discussion of the Site history derives from a Phase I ESA report prepared by the Toeroek Team in 2022 (Toeroek Team 2022). The Nevada State Hospital and a mental health facility formerly occupied the Site. Buildings associated with the mental health facility within the Site footprint were built in 1890, closed in 1991, and demolished in 1999. Other buildings associated with the historical hospital on the Site and the current hospital on the adjoining property, including the mechanical shop, physical plant, and power station, remain on property adjacent to and north of the Site.

Currently, the Site is bounded north by multiple buildings associated with the Nevada State Hospital; northeast by Barone Alzheimer's Care Center; east by Ash Place apartment complex, Pentecostal Assembly, and residential housing; southeast by residential housing and a Conoco gasoline station; south by residential housing, Lyons Stadium baseball field, Osage Prairie YMCA Inc., and Crossroads Church; southwest by Newton Cemetery, farmland, and residential housing; west by residential housing, Crowder College Nevada Center, and Nevada Regional Technical Center; and northwest by buildings associated with the Nevada State Hospital, with farmland beyond.

3.0 PREVIOUS INVESTIGATIONS

In February 2022, the Toeroek Team conducted a Phase I ESA (Toeroek Team 2022), identifying the following recognized environmental conditions (RECs) and a business environmental risk (BER) for the Site:

RECs:

- The present-day Conoco gasoline station (previously known as Jordan Thain Enterprises, Inc. and Hop In 1811) at 1811 North Ash Street is adjacent to the southeast corner of the Site. This gasoline station is listed in the Underground Storage Tank (UST), Leaking UST (LUST), and Environmental Data Resources, Inc. (EDR) Historic Auto databases. Based on its close proximity to the Site and the limited information available regarding closure of the LUST, this facility was considered to pose a REC and vapor encroachment concern (VEC) for the Site.

- Observed conditions during the vicinity reconnaissance, and unknown operations and infrastructure associated with the historical Nevada State Hospital were considered to pose RECs for the Site. Observed conditions included uncontrolled drums and piles of tires, damaged transformers containing polychlorinated biphenyls (PCBs), diesel aboveground storage tanks (ASTs) without proper secondary containment and with visible staining, power plant facilities and generators and other possible ASTs and USTs associated with the power plant, automotive shop facilities, underground utility tunnels, a septic system, and a pond that reportedly received AST spill overflows, biohazardous waste, sewage, and other possibly dumped materials/items.

- A powerful petroleum odor was detected during the vicinity reconnaissance around the residential housing south of the Crowder College Nevada Center, adjacent to and west of the Site. The source of this odor could not be identified. The unknown source of the odor was considered to pose a REC for the Site.

BER:

- A restroom building is in the north-central portion of the Site, and underground utility tunnels associated with the Nevada State Hospital run beneath the Site. The tunnels also are in the adjacent parcel north of the Site. The utility tunnels likely contain insulated piping. Based on age of the building and the tunnels, ACM and/or lead-based paint (LBP) may have been used in their construction. Insulation on piping in the utility tunnels may contain ACM. Possible presence of ACM and LBP was considered to pose a BER for the Site.

No other assessments are known to have occurred at the Site.

The Toeroek Team conducted a Phase II ESA and HMS in 2022 (Toeroek Team 2023a, b). Results of that investigation are discussed in Section 5.1.

4.0 PLANS FOR FUTURE USE

Future use of the Site is unknown; however, the Kaysinger Basin Regional Planning Commission and current property owner have shown interest in developing the Site. It is improved with an approximately 400-SF restroom building, a network of tunnels, and a parking lot. Currently, groundwater at the Site is not a source of drinking water. The City of Nevada derives its drinking water from groundwater wells at four locations in the City of Nevada at least 1 mile south of the Site (Nevada Public Works Department 2022).

Based on analytical results from soil and soil-gas samples (Section 5.1), further investigation and/or remediation appears warranted. In addition, asbestos should be appropriately addressed prior to building renovation or demolition. No remedial activities have occurred at the Site to date.

5.0 POTENTIAL CLEANUP ALTERNATIVES

The overall goal of any brownfields cleanup action is to address environmental conditions preventing or impeding the preferred type of Site redevelopment, and to do so in a manner protective of human health and the environment. This ABCA considers ACM and environmental media. For ACM, the ABCA uses AHERA definitions, and considers the MoDNR requirements for ACM inspection, reporting, and disposal for demolition or renovation of commercial buildings. Cleanup alternatives for soil would conform to MRBCA Tier 1 RBTLs or EPA RSLs if RBTLs are not available. Cleanup alternatives for soil gas would conform to EPA VISLs.

The Toeroek Team evaluated brownfields cleanup alternatives to address environmental impacts identified during the Phase II ESA and HMS (Toeroek Team 2023a, b). The purpose of the ABCA is to present viable cleanup alternatives based on Site-specific conditions, technical feasibility, and preliminary cost evaluations.

The following sections describe brownfields cleanup alternatives for addressing the presence of ACM and contamination in soil and soil gas, including a "No Action" alternative. Following the description, each alternative is evaluated in terms of its effectiveness, implementability, and cost. The purpose of evaluating each alternative is to determine its advantages and disadvantages relative to the other alternatives in order to identify key tradeoffs that would affect selection of the preferred alternative.

Effectiveness of an alternative refers to its ability to meet objectives of the brownfields cleanup. Criteria applied to assess effectiveness of an alternative include all of the following:

- Overall protection of human health and the environment
- Long-term effectiveness
- Reduction of toxicity, mobility, or volume through treatment/removal
- Short-term effectiveness.

Criteria applied to assess implementability of an alternative are all of the following:

- Technical feasibility
- Administrative feasibility
- Availability of services and materials required during implementation of the alternative

- State acceptance
- Community acceptance.

Each alternative is evaluated to determine its estimated cost. The evaluations compare the alternatives' respective direct capital costs, which include equipment, services, and contingency allowances, as well as longer-term institutional controls (IC), engineering controls (EC), and operations and maintenance (O&M) costs. Again, the purpose of evaluating each alternative is to determine its advantages and disadvantages relative to the other alternatives in order to identify key tradeoffs that would affect selection of the preferred alternative.

5.1 EVALUATED CONTAMINATION

This ABCA evaluates ACM, soil, and soil gas at the Site. The sections below discuss contaminants/materials identified during the Phase II ESA and HMS at the Site. Additional details about sampling methodology and detected constituents are in the Phase II ESA and HMS reports (Toeroek Team 2023a, b).

5.1.1 Asbestos-Containing Materials

During the ACM survey, the Toeroek Team collected nine bulk samples of suspect ACM from the restroom building. The Toeroek Team did not have access and did not collect any potential ACM samples from the tunnels beneath the Site. Collection of samples of building materials accorded with National Emissions Standards for Hazardous Air Pollutants (NESHAP) as adopted by EPA, and with AHERA protocols. Suspect ACM samples were analyzed via polarized light microscopy (PLM), and in some cases, 400 point count. AHERA defines ACM as any material or product that contains more than 1% asbestos. Locations of ACM sampling appear on Figure 2 in Appendix A.

The ACM survey identified approximately 150 SF of roofing tar as the only regulated ACM.

5.1.2 Lead-Based Paint

During the LBP survey, the Toeroek Team tested six surfaces in the Site building using a handheld x-ray fluorescence (XRF) spectrometer. The Toeroek Team did not have access and did not perform any LBP testing in the tunnels beneath the Site. The HMS report includes figures showing LBP screening locations (Toeroek Team 2023b). The LBP survey accorded with protocols similar to the single-family housing inspection procedures in *Guidelines for the Evaluation and Control of LBP in Housing* (HUD Guidelines) (HUD 2012). HUD guidelines suggest that paint applied before 1978 may contain lead. HUD considers

LBP as paint with lead levels above 1.0 milligram per square centimeter (mg/cm^2). XRF readings indicated no LBP on any building material. Therefore, LBP is not addressed in this ABCA.

5.1.3 Polychlorinated Biphenyls

During the HMS, the Toeroek Team collected one sample of suspected PCB-containing caulk material. Figure 2 in Appendix A shows the PCB sample location. Collection of the sample accorded with EPA guidance (EPA 2022c). Upon completion of sampling activities, the bulk sample was sent for analysis for PCBs. EPA has set an action level of 50 parts per million (ppm) for PCBs in materials, and that was the benchmark used for the HMS. Laboratory results indicated that the sampled building material did not contain a concentration of PCBs above 50 ppm. Therefore, PCBs are not addressed in this ABCA.

5.1.4 Surface and Subsurface Soil

As part of the Phase II ESA in 2022, at each of seven locations across the Site (SB-1 through SB-7), the Toeroek Team collected a surface soil sample and a subsurface soil sample (Appendix A, Figure 3). Surface soil samples were collected from 0-3 feet below ground surface (bgs). Subsurface soil samples were collected within select intervals based on visual staining, detected odor, or elevated photoionization detector (PID) readings. If no staining/odor or elevated PID reading was noted, a sample was collected from the bottom of the soil core.

Surface and subsurface soil samples were analyzed for volatile organic compounds (VOCs); semivolatile organic compounds (SVOCs); total petroleum hydrocarbons (TPH) – gasoline-range organics (GRO), diesel-range organics (DRO), and oil-range organics (ORO); PCBs; and Target Analyte List (TAL) metals, including mercury. Sampling results from soil were compared to EPA RSLs for residential soil under residential scenarios, MRBCA LDTLs, and MRBCA Tier I RBTLs for residential soil in Type 1 (sandy) soils (EPA 2022a, MoDNR 2006).

Of the analytes detected in soil, only arsenic and beryllium were present at concentrations exceeding regulatory benchmarks. These analytes were detected at levels exceeding residential RBTLs only in surface soils (0-3 feet bgs). Of these, concentrations of arsenic were consistent with its USGS-identified background concentration in Vernon County (USGS 2022); therefore, this ABCA will not address arsenic. USGS has not established a background concentration of beryllium. Concentrations of beryllium exceeded the residential RBTL (0.737 milligrams per kilogram [mg/kg]) in surface soil samples collected from SB-6 and SB-7 (1.2 and 1.0 mg/kg, respectively) (Appendix A, Figure 3).

5.1.5 Soil Gas

As part of the Phase II ESA in 2022, to investigate possible presence of contaminants in soil gas from historical activities at the Site, the Toeroek Team collected seven soil-gas samples, three of which were collocated with soil samples (at SB-1, SB-2, and SB-5 through SB-7) (Appendix A, Figure 3). Soil-gas samples were analyzed for VOCs. Analytical data were compared to EPA VISLs (EPA 2022b) to provide an initial screen for potential residential exposure risk from vapor intrusion. Because risk from the detected constituents are primarily or entirely driven by cancer risk, a total hazard quotient of 1.0 was assumed.

VOCs were detected in all soil-gas samples. Detected benzene concentration at SG-5 exceeded the residential VISL of 12.0 micrograms per cubic meter (µg/m^3) but was below the commercial VISL of 52.4 µg/m^3. Concentrations of naphthalene exceeded the residential VISL of 2.75 µg/m^3 at SG-2, -4, -5, -6, and -7, and the commercial VISL of 12.0 µg/m^3 at SG-3. Concentrations of trichloroethene (TCE) exceeded the residential VISL of 15.9 µg/m^3 at SG-5 (24.9 µg/m^3) and the commercial VISL of 99.7 µg/m^3 at SG-7 (327 µg/m^3).

No VOC was detected at concentration above an associated VISL in the sample from SG-1. However, because of very high concentrations of trichlorofluoromethane (Freon-11) and propylene in that sample, detection limits exceeded the commercial VISLs for benzene, chloroform, ethylbenzene, naphthalene, 1,2,4-trichlorobenzene, and TCE.

5.2 EVALUATION OF CLEANUP ALTERNATIVES FOR ACM

Evaluations of cleanup alternatives are based on potential future use scenarios at the Site—residential development is assumed to be conservative. The Toeroek Team has developed three cleanup alternatives for ACM. Although demolition of the Site building is presumed, cleanup alternatives for ACM are developed to indicate alternatives for limited abatement of damaged ACM, as well as demolition or removal of all hazardous materials.

Regarding ACM, three options were evaluated: (1) no action; (2) abatement of all ACM wastes; and (3) O&M plan. Alternatives 2 and 3 are expected to achieve clearance criteria under MoDNR requirements.

5.2.1 Alternative 1: No Action

The no action alternative is included as a baseline for comparison to the other proposed alternatives. Alternative 1 (No Action) would leave ACM in place at the Site.

Effectiveness

This alternative would not be effective if the Site building is demolished. Redevelopment of areas containing ACM would have to be restricted to ensure that those materials remain undisturbed. Additionally, in accordance with NESHAP regulations, demolition of the Site building cannot proceed before proper abatement; therefore, demolition could not occur if this alternative would be selected. This alternative would also be ineffective in achieving the goal of reducing health risks.

Implementation

Implementation of this alternative is straightforward—ACM left in place. Future redevelopment would have to consider the location and condition of the ACM and ensure that those materials remain undisturbed. Demolition could not occur prior to abatement.

Cost

This alternative would not involve any direct costs.

5.2.2 Alternative 2: Abatement of all Asbestos-Containing Material

Alternative 2 would involve, prior to demolition or renovations, proper abatement of all ACM identified in the Site building. Abatement by a licensed State of Missouri asbestos abatement contractor would accord with applicable local, state, and federal regulations, and a pre-approved Remedial Action Plan (RAP). Regulatory clearance sampling would occur according to a pre-approved quality assurance project plan (QAPP), and MoDNR may conduct pre/post-abatement inspections (if required).

Effectiveness

Removal of all identified ACM under Alternative 2 would meet the applicable or relevant and appropriate requirements (ARARs) established by the NESHAP regulation and would address the risk to human health posed by ACM. In addition, full abatement would allow redevelopment of the Site without restrictions pertaining to disturbance of ACM.

Implementation

Abatement of ACM by a licensed State of Missouri asbestos abatement contractor would accord with applicable local, state, and federal regulations. EPA, state, and OSHA requirements must be met during removal of ACM and during demolition. A RAP and Health and Safety Plan would address these regulations.

Cost

Estimated total cost of Alternative 2 is $16,100. Table 1 lists total costs associated with this alternative. Estimated abatement costs were gathered from local vendors. Listed cost per SF includes removal and disposal costs. Estimated cost for abatement of the ACM associated with the Site building is $600. This estimate does not include restoration costs. Additional costs to be considered, particularly if the Site would be enrolled in the MoDNR Brownfields Voluntary Cleanup Plan (BVCP), include those for three technical reports (RAP, QAPP, and Final Abatement Report) and for collection of clearance samples. Estimated cost of technical plans/reports is $3,500 per plan/report (cost of plans includes consideration of all environmental issues to be addressed by cleanup activities). Additional costs for oversight and clearance sampling are considered variable based on requirements and duration of abatement. Estimated cost associated with oversight and clearance is $5,000.

TABLE 1

ACM ALTERNATIVE 2 – TOTAL COSTS

Line Item	Cost
Abatement of asbestos-containing material (ACM) (400 square feet at $4/square foot)	$600
Development of Remedial Action Plan (RAP)	$3,500
Development of Quality Assurance Project Plan (QAPP)	$3,500
Final Abatement Report	$3,500
Oversight and clearance sampling	$5,000
Total Alternative 2 Cost	**$16,100**

5.2.3 Alternative 3: Operations and Management Plan

If demolition of the Site building is not to occur, Alternative 3 would involve preparing an O&M plan for the Site to address any ACMs present. The O&M plan would include the following: maps and drawings showing locations of remaining ACMs; description of accessibility; protocols and schedules for regular inspections; and contingency plans for dealing with any damaged or necessarily disturbed ACM. In addition, filing the O&M Plan on the property's chain-of-title as an institutional control (IC) would be

required. If renovation of the structure is to occur, the remaining ACMs are not to be disturbed and may remain in place. The building may not be demolished unless the ACM is abated, so selection of this alternative would preclude demolition.

Effectiveness

An O&M Plan for the Site under Alternative 3 would meet the ARARs established by the NESHAP regulation and would address the risk to human health posed by ACM. As such, ACM left to remain in place would have to be regularly monitored to ensure it is not damaged, and future redevelopment plans would have to consider locations and condition of the remaining ACM, and ensure those materials would not be disturbed.

Implementation

Regular inspections of ACM by a licensed State of Missouri asbestos inspector would accord with applicable local, state, and federal regulations. A Health and Safety Plan would address these regulations.

Cost

Estimated cost of an O&M plan is $3,500. Additional costs for oversight and regular inspections are considered variable based on requirements and duration of inspections. Estimated total cost of Alternative 3 is $3,500.

5.3 EVALUATION OF CLEANUP ALTERNATIVES FOR SURFACE SOIL

The Toeroek Team has also developed three cleanup alternatives for soil. Because a risk assessment of the Site has not been completed and the current property owner is expected to enroll the Site in MoDNR BVCP, the cleanup level for beryllium in soil will be based on the MRBCA Tier 1 RBTL for residential land use. Evaluations took into account MoDNR BVCP procedural requirements—because cleanup projects implemented with EPA Brownfields Cleanup funding require participation in the MoDNR BVCP. For reference, fees associated with enrollment in the MoDNR BVCP include a $200 application fee and refundable oversight deposit of $5,000. However, whether the Site will be enrolled in the MoDNR BVCP program is unknown.

Three options were evaluated for residential and/or commercial reuse: (1) no action; (2) soil management plan (SMP), ECs, and ICs; and (3) soil excavation with off-site disposal. Each approach (excluding no action) can satisfy clearance criteria under the MoDNR BVCP.

5.3.1 Alternative 1: No Action (Baseline)

The no action alternative is included as a baseline for comparison to the other proposed alternatives. This alternative would involve no containment, treatment, removal, or monitoring of contaminants. All contaminated soil would be left in place, and no restrictions on future land use would be imposed.

Effectiveness

Because the no action alternative would not be protective of human health and the environment, it is not considered effective.

Implementation

Implementation of this alternative would require no effort because no containment, treatment, removal, or monitoring of contaminants would occur. Future redevelopment would have to consider the potential threat to human health and the environment.

Cost

This alternative would not involve any direct costs.

5.3.2 Alternative 2: Soil Management Plan, Engineering Controls, and Institutional Controls

The alternative would leave contaminated soil in place in areas where beryllium had been detected at concentrations exceeding cleanup levels. Potential site receptors currently are not protected from exposure to contaminated soil via dermal contact and incidental ingestion. Concentrations of beryllium in surface soils are above the residential RBTLs but below the commercial RBTLs; therefore, the Site could be used in its current state for commercial purposes. However, an SMP would be necessary to guide proper handling of soil at the Site if the soil is disturbed (for example, during new structure construction). The SMP would present a tiered approach to soil management, regulatory approval, documentation, and record keeping to minimize administrative requirements.

ECs would be necessary to ensure that potential site receptors are protected from exposure to contaminated soils. Forty linear feet of security fencing—10 feet of galvanized fence with three strands of barbed wire—should be installed around areas with known soil contamination (SB-6 and SB-7), with one sign present for each fenced area.

ICs would be necessary to ensure that an SMP is in place to manage contaminated soils. ICs would be implemented in the form of a deed restriction/environmental covenant disallowing excavation of Site soil where beryllium has been detected at concentrations exceeding cleanup levels.

Alternative 2 would allow redevelopment of the Site as planned; however, ICs would be required in perpetuity.

Effectiveness

Alternative 2 would be effective in limiting exposure of affected soils to Site occupants and would allow residential and/or commercial redevelopment of the Site. However, this alternative would leave affected soil in place and would require long-term stewardship to ensure continuation of all restrictive measures over the life of the ECs and ICs.

Implementation

An SMP, ECs, and ICs would be easy to implement, as no physical remediation would be required. Implementation of ICs would include a restrictive covenant filed with the Register of Deeds to prohibit disturbance of contamination left in place under any future use scenario. This alternative would mandate annual inspections to ensure that Site occupants comply with restrictive covenants.

Cost

Estimated total cost of Alternative 2 in 2023 dollars is $111,000. Table 2 lists total costs associated with this alternative: $55,000 for capital costs, $43,000 for ICs, and $13,000 for O&M over a 30-year time period (about $727 per year). Costs were estimated by applications of selected functions of Remedial Action Cost Engineering and Requirements System (RACER) Version 11.2.16.0 and professional judgment. Details of costs are in Appendix B.

TABLE 2

SOIL ALTERNATIVE 2 – TOTAL COSTS

Line Item	Cost
Capital Costs	**$55,000**
Soil Management Plan	$20,000
Engineering Controls	$9,000
Management and Design	$13,000
Contingency	$12,000
Institutional Controls	**$43,000**
Land Use Controls Plan	$27,000
Meetings	$4,000
Restrictive Covenant	$2,000
Contingency	$10,000
Operations and Maintenance (30 years)	**$13,000**
Total Alternative 2 Cost	**$111,000**

5.3.3 Alternative 3: Soil Excavation with Off-Site Disposal

Alternative 3 would involve excavation of soil in the areas where beryllium has been detected at concentrations exceeding cleanup levels. Disposal of excavated soil then would occur off site at a landfill facility. This alternative would allow unrestricted use of the Site.

For cost estimating purposes, the Toeroek Team assumed the following:

- Soil Excavation around Sample Location SB-6 (0-3): The volume of soil to be excavated to cleanup levels is approximately 11 cubic yards (cy), assuming an area of 100 SF and depth of 3 feet bgs. The approximate area for excavation is depicted on Figure 4 in Appendix A.

- Soil Excavation around Sample Location SB-7(0-3): The volume of soil to be excavated to cleanup levels is approximately 11 cy, assuming an area of 100 SF and depth of 3 feet bgs. The approximate area for excavation is depicted on Figure 4 in Appendix A.

- Confirmation Sampling: Confirmation soil sampling will require collection of five five-point composite samples from each excavated area—four from the walls and one from the floor—to ensure contaminant concentrations in remaining soils are below cleanup levels.

- Backfill: Excavated areas will be backfilled with clean material from off site, graded and seeded as needed for redevelopment.

- Waste Disposal: Presumably, all excavated soil will be accepted at a landfill facility as non-hazardous waste.

Additional soil sampling is recommended to refine delineations of lateral and vertical extents of contamination and possibly reduce excavation volume.

Effectiveness

Soils with contaminant concentrations above MRBCA Tier 1 residential RBTLs would be removed from the Site, thus allowing Site redevelopment. This alternative would allow unrestricted use of the Site.

Implementation

Soil excavation by qualified equipment operators would accord with applicable state and federal regulations. Excavation of approximately 22 cy of soil is necessary to clean up the Site. All waste soil excavated during this process would be transported for disposal off site as either non-hazardous or hazardous waste, depending on results of toxicity characteristic leaching procedure (TCLP) analysis. For cost estimating purposes, assumptions are that none of the excavated soil would be used as backfill and all excavated soil would be handled as non-hazardous waste. In addition, planning this process would require careful consideration of precautions concerning worker health and safety.

Cost

Estimated total cost of Alternative 3 in 2023 dollars is $19,000. Table 3 lists total costs associated with this alternative. Costs were estimated by applying selected functions of RACER Version 11.2.16.0. Details of costs are in Appendix B. Estimated costs for this alternative could be reduced if additional sampling occurs to further delineate lateral and vertical extents of contamination, thereby possibly reducing excavation volume.

TABLE 3

SOIL ALTERNATIVE 3 – TOTAL COSTS

Line Item	Cost
Construction, Confirmation Sampling, and Transportation/Disposal	$10,000
Management and Design	$5,000
Contingency	$4,000
Total Alternative 3 Cost	**$19,000**

5.4 EVALUATION OF CLEANUP ALTERNATIVES FOR SOIL GAS

The Toeroek Team evaluated three cleanup alternatives for soil gas: (1) no action; (2) vapor intrusion mitigation of the existing structure on the Site, O&M, and ICs; and (3) vapor intrusion mitigation of any future structure on the Site, O&M, and ICs. Alternatives 2 and 3 can achieve clearance criteria under the MoDNR BVCP. Detected VOC concentrations exceeding EPA benchmarks in soil-gas samples from

across the Site suggest that vapor intrusion is a concern at the Site, and that soil or groundwater under the building may be contaminated with VOCs.

5.4.1 Alternative 1: No Action

Alternative 1 (No Action) is presented for baseline comparison. This alternative would provide no containment, treatment, removal, or monitoring of contaminants.

Effectiveness

Because the no action alternative would not be protective of human health and the environment, it is not considered effective.

Implementation

Implementation of this alternative would require no effort because no containment, treatment, removal, or monitoring of contaminants would occur. Future redevelopment would have to consider the potential threat to human health and the environment.

Cost

This alternative would not involve any direct costs.

5.4.2 Alternative 2: Vapor Intrusion Mitigation of the Existing Structure, Operation and Maintenance, and Institutional Controls

Alternative 2, assuming reuse of the current 400-SF structure on the Site, is intended to mitigate indoor air issues related to volatile contaminants migrating into that building; this alternative would involve installation of a vapor intrusion mitigation system within the building to address potential vapor intrusion. Fillers would be used to repair any cracks or other imperfections in the concrete. A primer coating then would be applied to increase adhesion and address moisture vapor transmission. Finally, a seal or coating would be applied.

Long-term O&M of each vapor mitigation system would be necessary as long as a structure is occupied on the Site.

ICs would be necessary to ensure (1) implementation of a vapor mitigation system for the existing structure on the Site or any new structure to be built in the future on the Site, and (2) continued integrity of each vapor mitigation system.

This is an indirect approach, as contaminated media would remain on site, and ICs would be required to manage that contamination. Monitoring and inspections of the Site would occur to ensure effectiveness of and compliance with vapor mitigation. As such, this alternative is expected to achieve regulatory compliance, and thus allow development of the Site as planned.

Effectiveness

Alternative 2 would be effective in limiting exposure of potential vapors to receptors at the building on the Site by sealing any cracks in the foundation. However, long-term O&M of each vapor mitigation system would be required. ICs would also be necessary to ensure implementation of a vapor mitigation system for the existing and any new structure to be built on the Site. This alternative would allow remodeling of the building on the Site.

Implementation

A restrictive covenant would be filed with the Register of Deeds to ensure implementation of a vapor intrusion mitigation system for the existing structure and for any new structure to be built on the Site. In addition, a long-term stewardship plan would necessitate MoDNR approval. This alternative would mandate annual inspections to ensure compliance of site occupants with restrictive covenants. In addition, air monitoring may be required to verify performance of the vapor mitigation system as intended. For the purpose of this ABCA, costs for air monitoring have been included as part of O&M.

Cost

Estimated total cost of Alternative 2 in 2023 dollars is $156,000. Table 4 lists total costs associated with this alternative: $10,000 for capital costs, $43,000 for ICs, and $103,000 for O&M over a 30-year period. Costs were estimated by applications of selected functions of RACER Version 11.2.16.0, contractor quotes, and professional judgment. Details of costs are in Appendix B.

TABLE 4

SOIL-GAS ALTERNATIVE 2 – TOTAL COSTS

Line Item	Cost
Capital Costs	**$10,000**
Construction	$6,000
Management and Design	$2,000
Contingency	$2,000
Institutional Controls	**$43,000**
Land Use Controls Plan	$27,000
Meetings	$4,000
Restrictive Covenant	$2,000
Contingency	$10,000
Operations and Maintenance (30 years)	**$103,000**
Total Alternative 2 Cost	**$156,000**

5.4.3 Alternative 3: Vapor Intrusion Mitigation for New Structures, Operation and Maintenance, and Institutional Controls

Alternative 3, presuming removal of the current building on the Site, would involve construction of a vapor intrusion mitigation system for any new structure to be built on the Site. Each vapor intrusion mitigation system would create a small negative pressure and diffusion underneath the slab of the structure, providing a preferential flow pathway for the vapor and thus inducing movement of it through the perforated piping and outside rather than into the occupied structure. Each vapor mitigation system would include a gravel layer with perforated piping and a vapor barrier consisting of metalized film sheet, nitrile-modified asphalt, and protection fabric layers. Vent risers would extend through the roof of the structure. The soil-gas vapor collected would be vented outside to the atmosphere through these risers.

Regular inspections and possibly repairs or maintenance of each vapor mitigation system would be necessary as long as its associated structure is occupied on the Site and contamination remains above cleanup levels. ICs would be necessary to ensure (1) inclusion of a vapor intrusion mitigation system in design of any new structure to be built on the Site, and (2) continued integrity of that vapor intrusion mitigation system.

Whether and at what size a structure will be built on the Site is unknown. Therefore, for cost estimating purposes, one structure with a slab foundation encompassing 10,000 SF of first-floor space and one structure with a slab foundation encompassing 20,000 SF of first-floor space were assumed.

Effectiveness

This alternative would limit exposure of vapors from soil to receptors on the Site, and thus would allow redevelopment of the Site as proposed. However, the source of soil-gas contamination, either soil or groundwater, would remain in place, and maintenance of the vapor intrusion mitigation system would be required. ICs also would be necessary to ensure inclusion of a vapor intrusion mitigation system in the design of any new structure to be built on the Site, as well as continued integrity of that vapor intrusion mitigation system.

Implementation

Vapor intrusion mitigation is a common remediation practice, and the materials, services, and equipment necessary for implementation are readily available; however, the vapor intrusion mitigation system would require routine inspections and possibly repairs or maintenance until sub-slab and indoor air concentrations are below cleanup levels. In addition, air monitoring may be required to verify performance of the vapor mitigation system as intended. For the purpose of this ABCA, costs for air monitoring have been included as part of O&M. Any structure to be built on the Site would be designed with a vapor mitigation system, including a vapor barrier, gravel layer, perforated piping, and blowers. Implementation of ICs would include a restrictive covenant that would be filed with the Register of Deeds to ensure inclusion of a vapor mitigation system in the design of any new structure to be built on the Site.

Cost

Estimated total cost of Alternative 3 in 2023 dollars is $469,000. Table 5 lists total costs associated with this alternative: $303,000 for capital costs, $43,000 for ICs, and $123,000 for O&M over a 30-year period. Costs were estimated by applying selected functions of RACER Version 11.2.16.0, contractor quotes, and professional judgment. Details of costs are in Appendix B.

TABLE 5

SOIL-GAS ALTERNATIVE 3 – TOTAL COSTS

Line Item	Cost
Capital Costs	**$303,000**
Vapor Mitigation System, 10,000-square-foot building	$58,000
Vapor Mitigation System, 20,000-square-foot building	$117,000
Management and Design	$58,000
Contingency	$70,000
Institutional Controls	**$43,000**
Land Use Controls Plan	$27,000
Meetings	$4,000
Restrictive Covenant	$2,000
Contingency	$10,000
Operations and Maintenance (30 years)	**$123,000**
Total Alternative 3 Cost	**$469,000**

5.5 RECOMMENDED CLEANUP ALTERNATIVES

This section recommends cleanup alternatives for contaminated soil and groundwater, vapor intrusion, ACM, and LBP at the Site.

5.5.1 Asbestos-Containing Material

Alternative 2 (Abatement of ACM) is the recommended cleanup alternative for ACM. Future plans at the Site include either substantial rehabilitation/renovation or demolition; therefore, removal of the identified ACM would be required prior to initiation of those activities.

5.5.2 Affected Soils

Alternative 3 (Soil Excavation with Off-Site Disposal) is the recommended cleanup alternative for soils. This alternative would be a direct approach, and would allow unrestricted use of the Site. It would achieve regulatory compliance and would allow residential and/or commercial redevelopment of the Site. This alternative would be the more cost-effective option (excluding the no action alternative) to address contaminated soil at the Site.

5.5.3 Soil Gas

Alternative 3 (Vapor Intrusion Mitigation for New Structures, O&M, and ICs) is the recommended cleanup alternative for vapor intrusion, as demolition of the existing structure is anticipated with construction of new buildings. This alternative would limit exposure of vapors from soil to receptors at the Site and would allow redevelopment of the Site. It would achieve regulatory compliance and would

allow residential and/or commercial redevelopment of the Site. This alternative would be the most cost-effective option to address vapor intrusion. A restrictive covenant would be filed with the Register of Deeds to ensure installation of a vapor mitigation system for any building on the Site.

5.5.4 Total Cleanup Cost

Table 6 summarizes total cleanup costs for the recommended alternatives. Based on the recommended cleanup alternatives, estimated total cleanup cost is $504,100. As stated above, costs for demolition of the building, Site restoration, and any associated disposal costs for addressing construction and demolition waste materials have not been included in this ABCA.

TABLE 6

SUMMARY OF COSTS FOR RECOMMENDED ALTERNATIVES

Contaminant / Material	Recommended Alternative	Action - Cost	Total Cost
Asbestos-containing Material (ACM)	Alternative 2 – Abatement of all ACM	Abatement – $600	$16,100
		Oversight and Clearance Sampling – $5,000	
		Technical Reporting – $10,500	
Affected Soils	Alternative 3 – Soil Excavation with Off-Site Disposal	Capital Costs – $19,000	$19,000
Soil Gas	Alternative 3 – Vapor Intrusion Mitigation for New Structures, Operation and Maintenance, and Institutional Controls	Capital Costs – $303,000	$469,000
		Institutional Controls – $43,000	
		Operation and Maintenance –- $123,000	
Total Cost			**$504,100**

6.0 REFERENCES

Missouri Department of Natural Resources (MoDNR). 2006. Missouri Risk-Based Corrective Action (MRBCA) Technical Guidance. April. https://dnr.mo.gov/waste-recycling/investigations-cleanups/public-guidance-assistance/missouri-risk-based-corrective-action-mrbca/departmental

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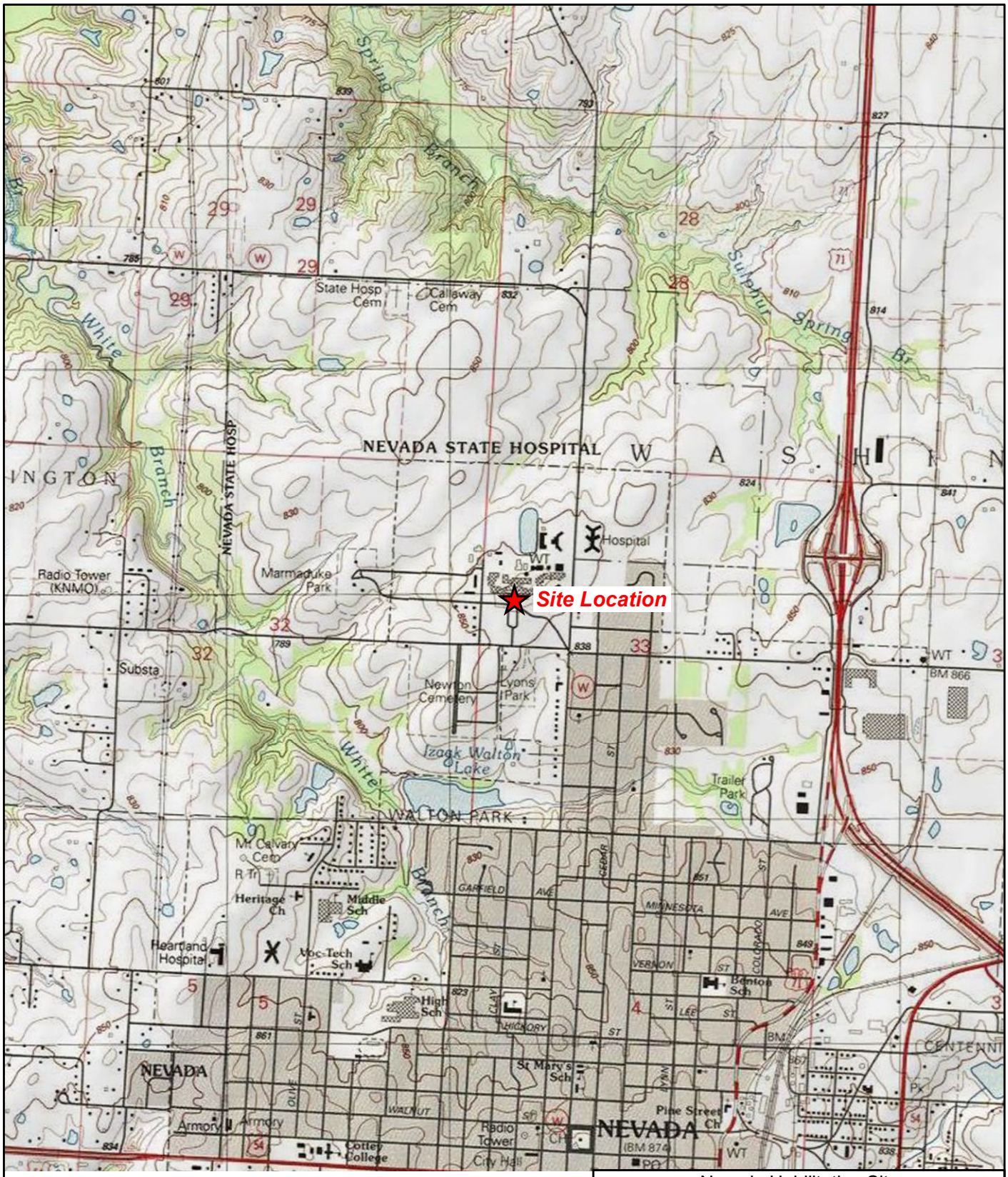
APPENDIX A

FIGURES

FIGURE 1 SITE LOCATION MAP



N

0 1,000 2,000

Feet

Source: USGS Horton, MO 7.5 Minute Topo Quad, 1991; USGS Metz, MO 7.5 Minute Topo Quad, 1991; USGS Moundville, MO 7.5 Minute Topo Quad, 1991; USGS Nevada, MO 7.5 Minute Topo Quad, 1991

Nevada Habilitation Site
East Edwards Street
Nevada, Missouri

Figure 1

Site Location Map

TETRA TECH

TOEROEK ASSOCIATES, INC.

Date: 11/11/2022 Drawn By: Nick Wiederholt Project No: 103G65210190.011.03

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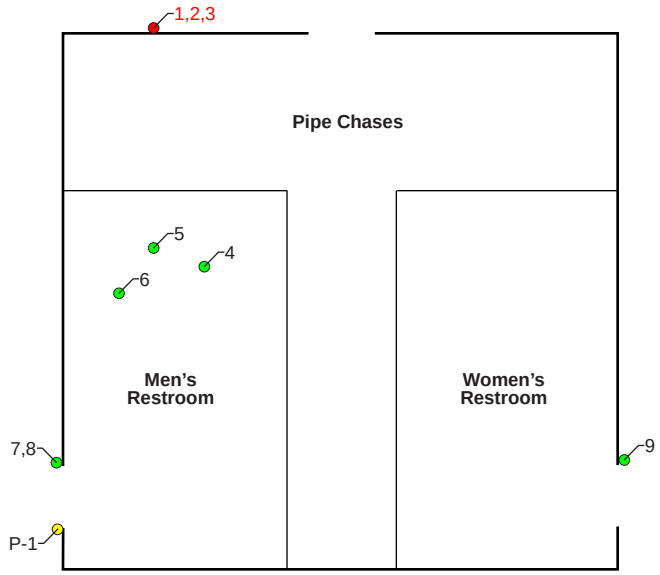
FIGURE 2 SAMPLE LOCATION MAP (ACM)

Sample Key Table

Key	Sample No.
Asbestos	
1	NH-RT-01
2	NH-RT-02
3	NH-RT-03
4	NH-DW-01
5	NH-DW-02
6	NH-DW-03
7	NH-CLK-01
8	NH-CLK-02
9	NH-CLK-03
PCB	
P-1	PCB-1

Note: Red text indicates positive asbestos results.

Restroom Building



Legend

- Asbestos-containing material sample location
- Non-asbestos-containing material sample location
- Polychlorinated biphenyl sample location

N

Not to Scale

Nevada Habilitation Site
East Edwards Street
Nevada, Missouri

Figure 2
Sample Location Map

TETRA TECH

TOEROEK ASSOCIATES, INC.

Date: 11/15/2022 Drawn By: Nick Wiederholt Project No: 103G65210190.011.05

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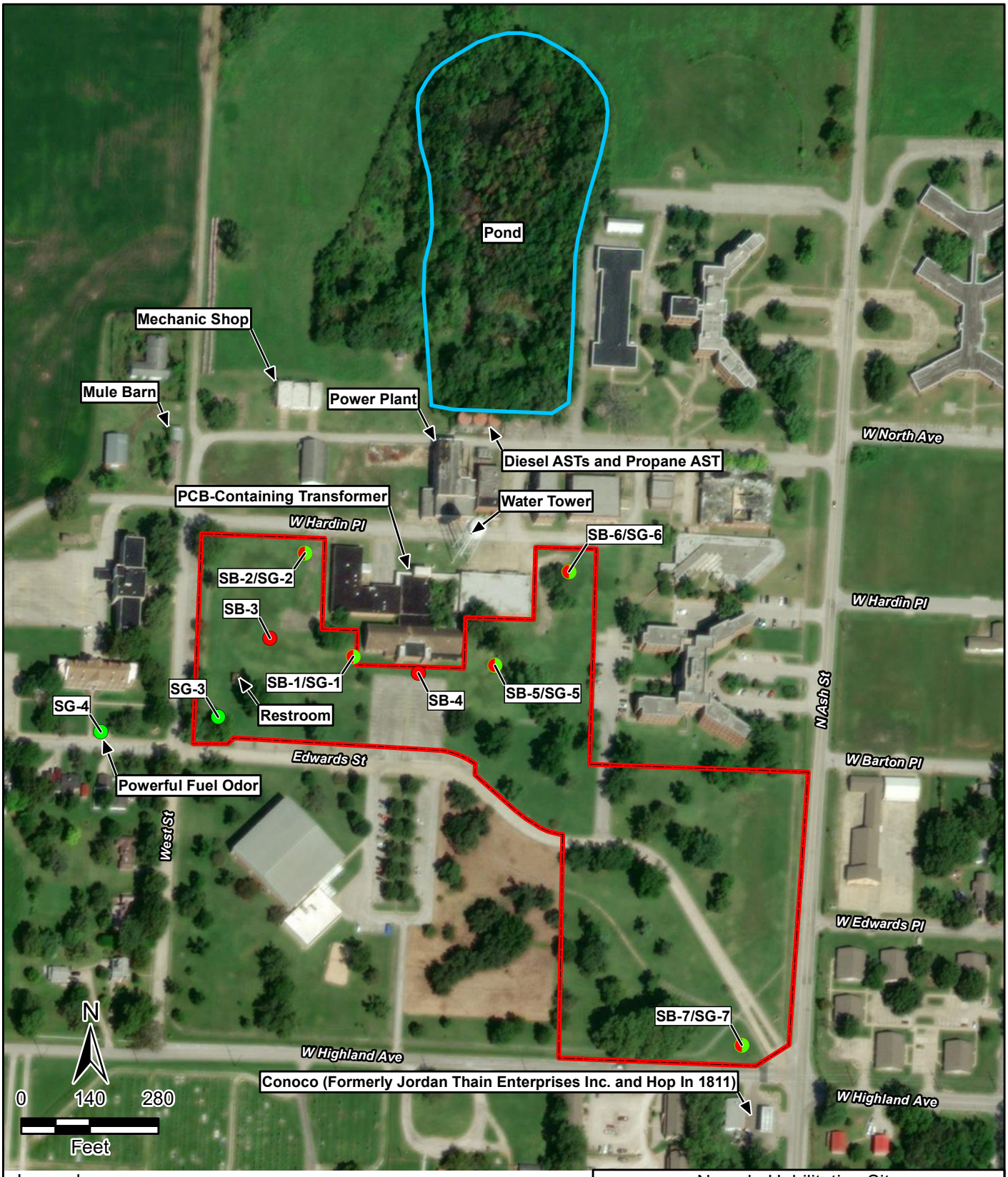
FIGURE 3 SAMPLE LOCATION MAP (SOIL AND SOIL GAS)



Legend

- DPT soil sample location
- DPT soil-gas sample location
- DPT soil/soil-gas sample location
- Approximate site boundary
- Pond
- AST Aboveground storage tank
- DPT Direct-push technology
- PCB Polychlorinated biphenyl

Source: Esri, ArcGIS Online, World Imagery, 2021

Nevada Habilitation Site
East Edwards Street
Nevada, Missouri

Figure 3
DPT Sample Location Map

TETRA TECH
TOEROEK ASSOCIATES, INC.

Date: 11/11/2022 Drawn By: Nick Wiederholt Project No: 103G65210190.011.03

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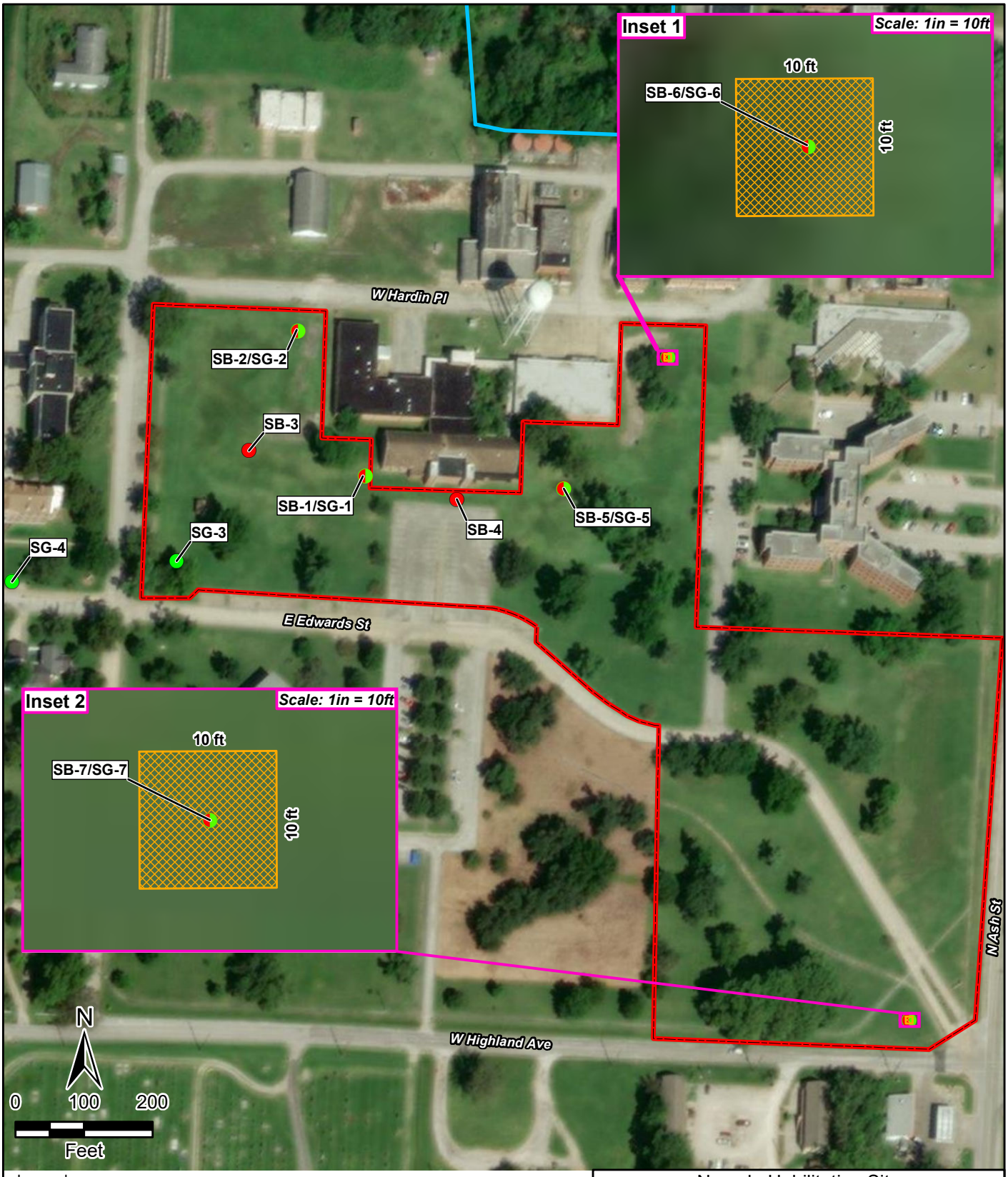
FIGURE 4 EXCAVATION AREA MAP



Legend

- DPT soil sample location
- DPT soil gas sample location
- DPT soil/soil gas sample location
- Pond
- Approximate excavation area
- Approximate subject site boundary
- DPT Direct-push technology

Source: Esri, ArcGIS Online, World Imagery, 2021

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Nevada Habilitation Site
East Edwards Street
Nevada, Missouri

Figure 4
Excavation Area Map

TETRA TECH
TOEROEK ASSOCIATES, INC.

Date: 1/12/2023 Drawn By: Nick Wiederholt Project No: 103G65210190.011.03

APPENDIX B

COST ESTIMATES

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 11 - Nevada Habilitation Site
Nevada, Vernon County, Missouri

TABLE B-1
COST SUMMARY

Alternative	Description	Capital Cost	Institutional Controls	Operation & Maintenance	Total
1	No Action	$0	$0	$0	$0
2	Soil Management Plan, ECs, and ICs	$ 55,000	$ 43,000	$ 13,000	$ 111,000
3	Soil Excavation with Off-Site Disposal	$ 19,000	$ -	$ -	$ 19,000

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 11 - Nevada Habilitation Site
Nevada, Vernon County, Missouri

ALTERNATIVE 2
SOIL MANAGEMENT PLAN, ECs, AND ICs

Table B-2
Cost Summary
Alternative 2 - Soil Management Plan, ECs, and ICs

Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-3	Capital Cost	$ 42,456	$ 12,737	$ 55,000
Table B-4	Institutional Controls	$ 32,995	$ 9,899	$ 43,000
Tables B-5, B-8	Operation and Maintenance	$ 9,748	$ 2,925	$ 13,000

Contingency	30%		$ 25,559.81
Total			**$ 111,000**

Overhead and Profit (O&P)

Means	15%	
RACER	35%	Assumed markup for costing purposes
Contractor quote	15%	Assumed prime contractor markup for costing purposes
Professional judgment	0%	

Inflation 3.27% Avg. annual inflation from 2015 to 2022

Table B-3
Capital Cost
Alternative 2 - Soil Management Plan, ECs, and ICs

Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Total Cost
	Construction Subtotal							**$ 29,280**
	Soil Management Plan							**$ 20,000**
1	Soil Management Plan	1	ls	Professional judgment	2022	$ 20,000.00	$ 20,000.00	$ 20,000
	Engineering Controls							**$ 9,280**
2	Security fence, 10 ft galvanized with 3 strands barbed wire	80	lf	RACER	2015	$ 66.98	$ 113.30	$ 9,064
3	Signage	2	ea	RACER	2015	$ 63.84	$ 107.99	$ 216

Construction subtotal		$ 29,280
Construction management[1]	15%	$ 4,392
Remedial design[1,2]	20%	$ 5,856
Project management[1]	10%	$ 2,928
Capital Cost Subtotal		**$ 42,456**

Table B-4

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 11 - Nevada Habilitation Site
Nevada, Vernon County, Missouri

Institutional Controls								
Alternative 2 - Soil Management Plan, ECs, and ICs								
Item	**Description**	**Quantity**	**Unit**	**Source**	**Year**	**Unit Price**	**Unit Price (Incl. O&P and Inflation)**	**Periodic Cost**
	Institutional Controls Subtotal							**$ 32,995**
	Prepare LUC Implementation Plan							**$ 27,104**
4	Project manager	22	hrs	RACER	2015	$ 76.23	$ 128.95	$ 2,837
5	Project engineer	30	hrs	RACER	2015	$ 55.79	$ 94.37	$ 2,831
6	Staff engineer	45	hrs	RACER	2015	$ 67.62	$ 114.38	$ 5,147
7	QA/QC officer	11	hrs	RACER	2015	$ 63.57	$ 107.53	$ 1,183
8	Word processing/clerical	60	hrs	RACER	2015	$ 34.31	$ 58.04	$ 3,482
9	Draftsman/CADD	30	hrs	RACER	2015	$ 36.80	$ 62.25	$ 1,867
10	Attorney, partner, real estate	22	hrs	RACER	2015	$ 244.43	$ 413.47	$ 9,096
11	Other direct costs	1	ls	RACER	2015	$ 390.83	$ 661.11	$ 661
	Meetings with Agencies							**$ 4,324**
12	Per diem (per person)	1	day	RACER	2015	$ 129.00	$ 218.21	$ 218
13	Project manager	20	hrs	RACER	2015	$ 76.23	$ 128.95	$ 2,579
14	Word processing/clerical	16	hrs	RACER	2015	$ 34.31	$ 58.04	$ 929
15	Draftsman/CADD	8	hrs	RACER	2015	$ 36.80	$ 62.25	$ 498
16	Other direct costs	1	ls	RACER	2015	$ 59.20	$ 100.14	$ 100
	Restrictive Covenant							**$ 1,567**
17	Overnight deliver, 8 oz letter	3	ea	RACER	2015	$ 19.23	$ 32.53	$ 98
18	Project manager	1	hrs	RACER	2015	$ 76.23	$ 128.95	$ 129
19	Word processing/clerical	3	hrs	RACER	2015	$ 34.31	$ 58.04	$ 174
20	Attorney, associate, real estate	3	hrs	RACER	2015	$ 172.46	$ 291.72	$ 875
21	Paralegal, real estate	3	hrs	RACER	2015	$ 50.17	$ 84.87	$ 255
22	Other direct costs	1	ls	RACER	2015	$ 21.18	$ 35.83	$ 36

Table B-5								
Operation and Maintenance								
Alternative 2 - Soil Management Plan, ECs, and ICs								
Item	**Description**	**Quantity**	**Unit**	**Source**	**Year**	**Unit Price**	**Unit Price (Incl. O&P and Inflation)**	**Periodic Cost**
	O&M (cost per year)							**$ 727**
23	Routine inspection	1	ls	Professional judgment	2022	$ 500.00	$ 500.00	$ 500
24	Fencing	2	lf	RACER	2015	$ 66.98	$ 113.30	$ 227

Notes:
Labor rates will be required to conform to the Davis-Bacon Act.

1	Based on "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000).
2	Remedial design includes developing plans and specifications, such as a remedial action work plan, design analysis, and construction cost estimating.
CADD	Computer-aided Drafting and Design
ea	Each
EC	Engineering control
EPA	U.S. Environmental Protection Agency
hrs	Hours
IC	Institutional control
lf	Linear foot

ls	Lump sum
LUC	Land use control
O&M	Operation and maintenance
O&P	Overhead and profit
QA/QC	Quality assurance/quality control
RACER	Remedial Action Cost Engineering and Requirements System

Reference:

EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study." EPA 540-R-00-002, Office of Solid Waste and Emergency Response 9355.0-75. July.

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 11 - Nevada Habilitation Site
Nevada, Vernon County, Missouri

ALTERNATIVE 3
SOIL EXCAVATION WITH OFF-SITE DISPOSAL

Table B-6
Cost Summary
Alternative 3 - Soil Excavation with Off-Site Disposal

Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-7	Capital Cost	$ 14,957	$ 4,487	$ 19,000
--	Institutional Controls	$ -	$ -	$ -
--	Operation and Maintenance	$ -	$ -	$ -

Contingency	30%	$	4,487.03
Total			**$ 19,000**

Overhead and Profit (O&P)

Means	15%	
RACER	35%	Assumed markup for costing purposes
Contractor quote	15%	Assumed prime contractor markup for costing purposes
Professional judgment	0%	

Inflation 3.27% Avg. annual inflation from 2015 to 2022

Table B-7
Capital Cost
Alternative 3 - Soil Excavation with Off-Site Disposal

Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Total Cost
	Construction Subtotal							**$ 10,315**
	Excavation at SB-6 to 3 feet bgs (~11 cy)							**$ 4,502**
1	12-cy dump truck haul/hour	2	hrs	RACER	2015	$ 111.15	$ 188.02	$ 376
2	Excavate and load, bank measure, medium material, 3/4-cy bucket, hydraulic excavator	12	bcy	RACER	2015	$ 4.36	$ 7.38	$ 89
3	Unclassified fill, 6-inch lifts, off-site (includes delivery, spreading, and compaction)	14.44	cy	RACER	2015	$ 28.47	$ 48.16	$ 695
4	Seeding, vegetative cover	13.33	sy	RACER	2015	$ 1.58	$ 2.67	$ 36
5	Disposable material per sample	25	ea	RACER	2015	$ 10.55	$ 17.85	$ 446
6	Testing, TAL metals (6010/7000s)	5	ea	RACER	2015	$ 126.93	$ 214.71	$ 1,074
7	Project Manager	5	hrs	RACER	2015	$ 92.97	$ 157.26	$ 786
8	Project Scientist	5	hrs	RACER	2015	$ 77.53	$ 131.15	$ 656
9	QA/QC Officer	1	hrs	RACER	2015	$ 77.53	$ 131.15	$ 131
10	Field Technician	1	hrs	RACER	2015	$ 38.97	$ 65.92	$ 66
11	Word Processing/Clerical	1	hrs	RACER	2015	$ 41.85	$ 70.79	$ 71
12	Draftsman/CADD	1	hrs	RACER	2015	$ 44.87	$ 75.90	$ 76
	Excavation at SB-7 to 3 feet bgs (~11 cy)							**$ 4,502**
13	12-cy dump truck haul/hour	2	hrs	RACER	2015	$ 111.15	$ 188.02	$ 376

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 11 - Nevada Habilitation Site
Nevada, Vernon County, Missouri

14	Excavate and load, bank measure, medium material, 3/4-cyY bucket, hydraulic excavator	12	bcy	RACER	2015	$ 4.36	$ 7.38	$	89
15	Unclassified fill, 6-inch lifts, off-site (includes delivery, spreading, and compaction)	14.44	cy	RACER	2015	$ 28.47	$ 48.16	$	695
16	Seeding, vegetative cover	13.33	sy	RACER	2015	$ 1.58	$ 2.67	$	36
17	Disposable material per sample	25	ea	RACER	2015	$ 10.55	$ 17.85	$	446
18	Testing, TAL metals (6010/7000s)	5	ea	RACER	2015	$ 126.93	$ 214.71	$	1,074
19	Project Manager	5	hrs	RACER	2015	$ 92.97	$ 157.26	$	786
20	Project Scientist	5	hrs	RACER	2015	$ 77.53	$ 131.15	$	656
21	QA/QC Officer	1	hrs	RACER	2015	$ 77.53	$ 131.15	$	131
22	Field Technician	1	hrs	RACER	2015	$ 38.97	$ 65.92	$	66
23	Word Processing/Clerical	1	hrs	RACER	2015	$ 41.85	$ 70.79	$	71
24	Draftsman/CADD	1	hrs	RACER	2015	$ 44.87	$ 75.90	$	76
	Transportation and Off-Site Disposal (Nonhazardous)							**$**	**1,311**
25	Bulk solid waste loading into disposal vehicle or bulk disposal container	22	bcy	RACER	2015	$ 2.61	$ 4.41	$	97
26	Transport bulk solid hazardous waste, maximum 20-cy (per mile)	50	mile	RACER	2015	$ 2.63	$ 4.45	$	222
27	Waste stream evaluation fee, not including 50% rebate on 1st shipment	1	ea	RACER	2015	$ 50.50	$ 85.42	$	85
28	32-ft dump truck, 6-mil liner, disposable	2	ea	RACER	2015	$ 26.00	$ 43.98	$	88
29	Landfill non-hazardous solid bulk waste by cy	22	cy	RACER	2015	$ 22.00	$ 37.21	$	819

Construction subtotal		$	10,315
Construction management[1]	15%	$	1,547
Remedial design[1,2]	20%	$	2,063
Project management[1]	10%	$	1,032
Capital Cost Subtotal		**$**	**14,957**

bcy	Bank cubic yard
CADD	Cuputer-aided Drafting and Design
cy	Cubic yard
ea	Each
EPA	U.S. Environmental Protection Agency
ft	Feet
hrs	Hours
mil	0.001 inch
O&P	Overhead and profit
QA/QC	Quality assurance / quality control
RACER	Remedial Action Cost Engineering and Requirements System
sy	Square yard
TAL	Target Analyte List

Reference:

EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study." EPA 540-R-00-002, Office of Solid Waste and Emergency Response 9355.0-75. July.

Appendix B
Remedial Alternatives Cost Estimates for Soil
Site 11 - Nevada Habilitation Site
Nevada, Vernon County, Missouri

Annual Discount Rate:

30-Yr	7.0%

Table B-8
Present Value Analysis

Year	Annual Discount Factor [1, 2]	Alternative 2 - Soil Management Plan and ICs		
		O&M Costs		
	30-Yr	O&M Future Cost[3]		Present Value (2022)
0	1.000	$727		$727
1	0.935	$727		$679
2	0.873	$727		$635
3	0.816	$727		$593
4	0.763	$727		$555
5	0.713	$727		$518
6	0.666	$727		$484
7	0.623	$727		$453
8	0.582	$727		$423
9	0.544	$727		$395
10	0.508	$727		$370
11	0.475	$727		$345
12	0.444	$727		$323
13	0.415	$727		$302
14	0.388	$727		$282
15	0.362	$727		$263
16	0.339	$727		$246
17	0.317	$727		$230
18	0.296	$727		$215
19	0.277	$727		$201
20	0.258	$727		$188
21	0.242	$727		$176
22	0.226	$727		$164
23	0.211	$727		$153
24	0.197	$727		$143
25	0.184	$727		$134
26	0.172	$727		$125
27	0.161	$727		$117
28	0.150	$727		$109
29	0.141	$727		$102
30	0.131	$727		$96
Total Present Value of Periodic Cost				**$9,748**

Notes:

1	Based on "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (U.S. Environmental Protection Agency [EPA] 2000).
2	Annual discount factor = $1/(1+i)^t$, where i = discount rate (includes inflation and interest) and t
3	Current dollar cost of future event
IC	Institutional control
O&M	Operation and maintenance
Yr	Year

Reference:

EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study." EPA 540-R-00-002, Office of Solid Waste and Emergency Response 9355.0-75. July.

Appendix B
Remedial Alternatives Cost Estimates for Vapor Intrusion
Site 11 - Nevada Habilitation Site
Nevada, Vernon County, Missouri

TABLE B-9					
COST SUMMARY					
Alternative	**Description**	**Capital Cost**	**Institutional Controls**	**Operation & Maintenance**	**Total**
1	No Action	$0	$0	$0	$0
2	Vapor Intrusion Mitigation for the Existing Structure, O&M, and ICs	$ 10,000	$ 43,000	$ 103,000	$ 156,000
3	Vapor Intrusion Mitigation for New Structures, O&M, and ICs	$ 303,000	$ 43,000	$ 123,000	$ 469,000

Appendix B
Remedial Alternatives Cost Estimates for Vapor Intrusion
Site 11 - Nevada Habilitation Site
Nevada, Vernon County, Missouri

ALTERNATIVE 2
VAPOR INTRUSION MITIGATION FOR THE EXISTING STRUCTURE, O&M, ICs

Table B-10
Cost Summary
Alternative 2 - Vapor Intrusion Mitigation for the Existing Structure, O&M, and ICs

Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-11	Capital Cost	$ 8,004	$ 2,401	$ 10,000
Table B-12	Institutional Controls	$ 32,995	$ 9,899	$ 43,000
Tables B-13, B-18	Operation and Maintenance	$ 78,885	$ 23,666	$ 103,000
	Contingency 30%			$ 35,965.32
	Total			**$ 156,000**

Overhead and Profit (O&P)

Means	15%	
RACER	35%	Assumed markup for costing purposes
Contractor quote	15%	Assumed prime contractor markup for costing purposes
Professional judgment	0%	

Inflation 3.27% Avg. annual inflation from 2015 to 2022

Table B-11
Capital Cost
Alternative 2 - Vapor Intrusion Mitigation for the Existing Structure, O&M, and ICs

Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Total Cost
	Construction Subtotal							**$ 5,520**
	Vapor Mitigation							**$ 5,520**
1	Vapor Mitigation Subcontractor (RetroCoat)	400	sf	Contractor quote	2022	$ 12.00	$ 13.80	$ 5,520

Construction subtotal		$ 5,520
Construction management[1]	15%	$ 828
Remedial design[1,2]	20%	$ 1,104
Project management[1]	10%	$ 552
Capital Cost Subtotal		**$ 8,004**

Table B-12
Institutional Controls
Alternative 2 - Vapor Intrusion Mitigation for the Existing Structure, O&M, and ICs

Appendix B
Remedial Alternatives Cost Estimates for Vapor Intrusion
Site 11 - Nevada Habilitation Site
Nevada, Vernon County, Missouri

Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Periodic Cost
	Institutional Controls Subtotal							**$ 32,995**
	Prepare LUC Implementation Plan							**$ 27,104**
2	Project manager	22	hrs	RACER	2015	$ 76.23	$ 128.95	$ 2,837
3	Project engineer	30	hrs	RACER	2015	$ 55.79	$ 94.37	$ 2,831
4	Staff engineer	45	hrs	RACER	2015	$ 67.62	$ 114.38	$ 5,147
5	QA/QC officer	11	hrs	RACER	2015	$ 63.57	$ 107.53	$ 1,183
6	Word processing/clerical	60	hrs	RACER	2015	$ 34.31	$ 58.04	$ 3,482
7	Draftsman/CADD	30	hrs	RACER	2015	$ 36.80	$ 62.25	$ 1,867
8	Attorney, partner, real estate	22	hrs	RACER	2015	$ 244.43	$ 413.47	$ 9,096
9	Other direct costs	1	ls	RACER	2015	$ 390.83	$ 661.11	$ 661
	Meetings with Agencies							**$ 4,324**
10	Per diem (per person)	1	day	RACER	2015	$ 129.00	$ 218.21	$ 218
11	Project manager	20	hrs	RACER	2015	$ 76.23	$ 128.95	$ 2,579
12	Word processing/clerical	16	hrs	RACER	2015	$ 34.31	$ 58.04	$ 929
13	Draftsman/CADD	8	hrs	RACER	2015	$ 36.80	$ 62.25	$ 498
14	Other direct costs	1	ls	RACER	2015	$ 59.20	$ 100.14	$ 100
	Restrictive Covenant							**$ 1,567**
15	Overnight deliver, 8 oz letter	3	ea	RACER	2015	$ 19.23	$ 32.53	$ 98
16	Project manager	1	hrs	RACER	2015	$ 76.23	$ 128.95	$ 129
17	Word processing/clerical	3	hrs	RACER	2015	$ 34.31	$ 58.04	$ 174
18	Attorney, associate, real estate	3	hrs	RACER	2015	$ 172.46	$ 291.72	$ 875
19	Paralegal, real estate	3	hrs	RACER	2015	$ 50.17	$ 84.87	$ 255
20	Other direct costs	1	ls	RACER	2015	$ 21.18	$ 35.83	$ 36

Table B-13
Operation and Maintenance
Alternative 2 - Vapor Intrusion Mitigation for the Existing Structure, O&M, and ICs

Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Periodic Cost
	O&M (cost per year)							**$ 5,883**
21	Sampling (indoor air)	1	ls	RACER	2015	$ 2,000.00	$ 3,383.10	$ 3,383
22	Reporting	1	ls	Professional Judgment	2022	$ 2,500.00	$ 2,500.00	$ 2,500

Notes:
Labor rates will be required to conform to the Davis-Bacon Act.

1	Based on "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000).
2	Remedial design includes developing plans and specifications, such as a remedial action work plan, design analysis, and construction cost estimating.
CADD	Computer-aided design
ea	Each
EPA	U.S. Environmental Protection Agency
hrs	Hours
IC	Institutional control
ls	Lump sum
LUC	Land use control
O&M	Operation and maintenance
O&P	Overhead and profit

QA/QC	Quality assurance/quality control
RACER	Remedial Action Cost Engineering and Requirements System
sf	Square foot

Reference:

EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study." EPA 540-R-00-002, Office of Solid Waste and Emergency Response 9355.0-75. July.

Appendix B
Remedial Alternatives Cost Estimates for Vapor Intrusion
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ALTERNATIVE 3
VAPOR INTRUSION MITIGATION FOR NEW STRUCTURES, O&M, AND ICs

Table B-14
Cost Summary
Alternative 3 - Vapor Intrusion Mitigation for New Structures, O&M, and ICs

Source	Description	Subtotal	Contingency	Total (Rounded)
Table B-15	Capital Cost	$ 233,378	$ 70,013	$ 303,000
Table B-16	Institutional Controls	$ 32,995	$ 9,899	$ 43,000
Table B-19, B-19	Operation and Maintenance	$ 94,472	$ 28,342	$ 123,000

Contingency	30%	$	108,253.35
Total			**$ 469,000**

Overhead and Profit (O&P)

Means	15%	
RACER	35%	Assumed markup for costing purposes
Contractor quote	15%	Assumed prime contractor markup for costing purposes
Professional judgment	0%	

Inflation 3.27% Avg. annual inflation from 2015 to 2022

Table B-15
Capital Cost
Alternative 3 - Vapor Intrusion Mitigation for New Structures, O&M, and ICs

Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Total Cost
	Construction Subtotal							**$ 175,472**
	Vapor Mitigation (10,000 sf Footprint)							**$ 58,491**
1	Vapor Mitigation Subcontractor (TerraShield)	10,000	sf	Contractor quote	2022	$ 5.00	$ 5.75	$ 57,500
2	Blowers (each covers 8,000 to 10,000 sf)	1	each	Contractor quote	2021	$ 834.00	$ 990.51	$ 991
	Vapor Mitigation (20,000 sf Footprint)							**$ 116,981**
3	Vapor Mitigation Subcontractor (TerraShield)	20,000	sf	Contractor quote	2022	$ 5.00	$ 5.75	$ 115,000
4	Blowers (each covers 8,000 to 10,000 sf)	2	each	Contractor quote	2021	$ 834.00	$ 990.51	$ 1,981

Construction subtotal		$ 175,472
Construction management[1]	10%	$ 17,547
Remedial design[1,2]	15%	$ 26,321
Project management[1]	8%	$ 14,038
Capital Cost Subtotal		**$ 233,378**

Table B-16

Appendix B
Remedial Alternatives Cost Estimates for Vapor Intrusion
Site 11 - Nevada Habilitation Site
Nevada, Vernon County, Missouri

Institutional Controls								
Alternative 3 - Vapor Intrusion Mitigation for New Structures, O&M, and ICs								
Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Periodic Cost
	Institutional Controls Subtotal							**$ 32,995**
	Prepare LUC Implementation Plan							**$ 27,104**
5	Project manager	22	hrs	RACER	2015	$ 76.23	$ 128.95	$ 2,837
6	Project engineer	30	hrs	RACER	2015	$ 55.79	$ 94.37	$ 2,831
7	Staff engineer	45	hrs	RACER	2015	$ 67.62	$ 114.38	$ 5,147
8	QA/QC officer	11	hrs	RACER	2015	$ 63.57	$ 107.53	$ 1,183
9	Word processing/clerical	60	hrs	RACER	2015	$ 34.31	$ 58.04	$ 3,482
10	Draftsman/CADD	30	hrs	RACER	2015	$ 36.80	$ 62.25	$ 1,867
11	Attorney, partner, real estate	22	hrs	RACER	2015	$ 244.43	$ 413.47	$ 9,096
12	Other direct costs	1	ls	RACER	2015	$ 390.83	$ 661.11	$ 661
	Meetings with Agencies							**$ 4,324**
13	Per diem (per person)	1	day	RACER	2015	$ 129.00	$ 218.21	$ 218
14	Project manager	20	hrs	RACER	2015	$ 76.23	$ 128.95	$ 2,579
15	Word processing/clerical	16	hrs	RACER	2015	$ 34.31	$ 58.04	$ 929
16	Draftsman/CADD	8	hrs	RACER	2015	$ 36.80	$ 62.25	$ 498
17	Other direct costs	1	ls	RACER	2015	$ 59.20	$ 100.14	$ 100
	Restrictive Covenant							**$ 1,567**
18	Overnight deliver, 8 oz letter	3	ea	RACER	2015	$ 19.23	$ 32.53	$ 98
19	Project manager	1	hrs	RACER	2015	$ 76.23	$ 128.95	$ 129
20	Word processing/clerical	3	hrs	RACER	2015	$ 34.31	$ 58.04	$ 174
21	Attorney, associate, real estate	3	hrs	RACER	2015	$ 172.46	$ 291.72	$ 875
22	Paralegal, real estate	3	hrs	RACER	2015	$ 50.17	$ 84.87	$ 255
23	Other direct costs	1	ls	RACER	2015	$ 21.18	$ 35.83	$ 36

Table B-17								
Operation and Maintenance								
Alternative 3 - Vapor Intrusion Mitigation for New Structures, O&M, and ICs								
Item	Description	Quantity	Unit	Source	Year	Unit Price	Unit Price (Incl. O&P and Inflation)	Periodic Cost
	O&M (cost per year)							**$ 6,979**
24	Electricity	4,440	kWh	Contractor quote	2022	$ 0.08	$ 0.09	$ 419
25	Sampling (indoor air)	1	ls	RACER	2015	$ 2,400.00	$ 4,059.72	$ 4,060
26	Reporting	1	ls	Professional Judgment	2022	$ 2,500.00	$ 2,500.00	$ 2,500
	Blower Replacement (cost every 10 years)							**$ 991**
27	Blower	1	each	Contractor quote	2021	$ 834.00	$ 990.51	$ 991

bcy	Bank cubic yard
CADD	Computer-aided Drafting and Design
cy	Cubic yard
ea	Each
EPA	U.S. Environmental Protection Agency
hrs	Hours
IC	Institutional control
kWh	Kilowatt-hour
LUC	Land use control

ls	Lump sum
NA	Not applicable
O&P	Overhead and profit
QA/QC	Quality assurance / quality control
RACER	Remedial Action Cost Engineering and Requirements System
sf	Square foot

Reference:

EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study." EPA 540-R-00-002, Office of Solid Waste and Emergency Response 9355.0-75. July.

Appendix B
Remedial Alternatives Cost Estimates for Vapor Intrusion
Site 11 - Nevada Habilitation Site
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Annual Discount Rate:

30-Yr	7.0%

Table B-18				
Present Value Analysis				
	Annual Discount Factor [1, 2]	**Alternative 2 - Vapor Intrusion Mitigation for the Existing Structure, O&M, and ICs**		
		O&M Costs		
Year	**30-Yr**	**O&M Future Cost[3]**		**Present Value (2021)**
0	1.000	$5,883		$5,883
1	0.935	$5,883		$5,498
2	0.873	$5,883		$5,138
3	0.816	$5,883		$4,802
4	0.763	$5,883		$4,488
5	0.713	$5,883		$4,194
6	0.666	$5,883		$3,920
7	0.623	$5,883		$3,664
8	0.582	$5,883		$3,424
9	0.544	$5,883		$3,200
10	0.508	$5,883		$2,991
11	0.475	$5,883		$2,795
12	0.444	$5,883		$2,612
13	0.415	$5,883		$2,441
14	0.388	$5,883		$2,282
15	0.362	$5,883		$2,132
16	0.339	$5,883		$1,993
17	0.317	$5,883		$1,862
18	0.296	$5,883		$1,741
19	0.277	$5,883		$1,627
20	0.258	$5,883		$1,520
21	0.242	$5,883		$1,421
22	0.226	$5,883		$1,328
23	0.211	$5,883		$1,241
24	0.197	$5,883		$1,160
25	0.184	$5,883		$1,084
26	0.172	$5,883		$1,013
27	0.161	$5,883		$947
28	0.150	$5,883		$885
29	0.141	$5,883		$827
30	0.131	$5,883		$773
Total Present Value of Periodic Cost				**$78,885**

Table B-19		
Present Value Analysis		
	Annual Discount Factor [1, 2]	**Alternative 3 - Vapor Intrusion Mitigation for New Structures, O&M, and ICs**
		O&M Costs

Appendix B
Remedial Alternatives Cost Estimates for Vapor Intrusion
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Year	30-Yr	O&M Future Cost [3]	Blower Replacement Future Cost[3]	Present Value (2021)
0	1.000	$6,979		$6,979
1	0.935	$6,979		$6,522
2	0.873	$6,979		$6,096
3	0.816	$6,979		$5,697
4	0.763	$6,979		$5,324
5	0.713	$6,979		$4,976
6	0.666	$6,979		$4,650
7	0.623	$6,979		$4,346
8	0.582	$6,979		$4,062
9	0.544	$6,979		$3,796
10	0.508	$6,979	$991	$4,052
11	0.475	$6,979		$3,316
12	0.444	$6,979		$3,099
13	0.415	$6,979		$2,896
14	0.388	$6,979		$2,707
15	0.362	$6,979		$2,530
16	0.339	$6,979		$2,364
17	0.317	$6,979		$2,209
18	0.296	$6,979		$2,065
19	0.277	$6,979		$1,930
20	0.258	$6,979	$991	$2,060
21	0.242	$6,979		$1,686
22	0.226	$6,979		$1,575
23	0.211	$6,979		$1,472
24	0.197	$6,979		$1,376
25	0.184	$6,979		$1,286
26	0.172	$6,979		$1,202
27	0.161	$6,979		$1,123
28	0.150	$6,979		$1,050
29	0.141	$6,979		$981
30	0.131	$6,979	$991	$1,047
Total Present Value of Periodic Cost				**$94,472**

Notes:

1	Based on "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000).
2	Annual discount factor = $1/(1+i)^t$, where i = discount rate (includes inflation and interest) and t =
3	Current dollar cost of future event
IC	Institutional control
O&M	Operation and maintenance
OMB	Office of Management and Budget
yr	Year

Reference:

EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study." EPA 540-R-00-002, Office of Solid Waste and Emergency Response 9355.0-75. July.