NATURAL RESOURCE TECHNOLOGY

TECHNICAL MEMORANDUM No. 4

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Date: **March 12, 2010**

Subject: **Evaluation of Closure Alternatives, Venice Ash Ponds**

From: **Eric Tlachac and Bruce Hensel**

Introduction and Background

This technical memorandum describes a focused evaluation of closure alternatives for the Venice ash ponds in support of AmerenUE's efforts to develop a regulatory closure mechanism applicable to the impoundments, The objective of this analysis is to identify, describe, and provide screening-level costs of several different alternatives for controlling direct contact and groundwater exposure pathways at this facility.

The ash ponds, hydrogeologic setting, and local groundwater quality are described in detail by Hanson Engineers (2000), and supplemented by NRT Technical Memorandum No. 2 "Supplemental Hydrogeological Assessment, Venice Ash Ponds" prepared in December 1999 and finalized on March 3, 2010. Ponds 2 and 3 cover an area of 58 acres. They received fly ash from the 1940s until 1977, and storm water discharge until 2005. The ash is currently uncapped, however vegetation ranging from grass to shrubs to trees covers most of the surface and ash is not readily visible in most places (Figure 1).

The base of ash has been observed as low as 400 feet MSL, which is 5 to 10 feet higher than the water table at normal river stage. In the spring, when river stage is greater than 400 feet, the water table may be above the base of ash; however, seepage into the ash is restricted beneath much of the footprint by the low-permeability fine-grained alluvial sediments that occur in the upper 20 to 30 feet of the stratigraphic column throughout this area. These fine-grained sediments also restrict the downward migration of leachate from the ponds during periods of low water. The fine-grained alluvium is underlain by coarse-grained sands and gravels that form a highly productive aquifer.

Figure 1. Outline of Venice ash ponds showing abundant vegetation growing on the surface.

Groundwater flow in the alluvial aquifer is typically west or southwest toward the Mississippi River; although temporary flow reversals occur during periods of high river stage. There is also evidence of perched groundwater within sand seams in the shallow, fine grained alluvial sediments during wet periods.

Groundwater quality monitoring shows concentrations of boron, the primary indicator of coal ash leachate for this site, higher than Class 1 groundwater quality standards both on site and extending for a distance of approximately 500 feet south of the ash ponds (Figure 2).

These observations and data indicate two potential exposure pathways for the Venice ash ponds, direct contact and groundwater. The focus of this closure analysis is therefore on alternatives for covering the ash to address the direct contact exposure pathway, and alternatives for addressing the groundwater pathway.

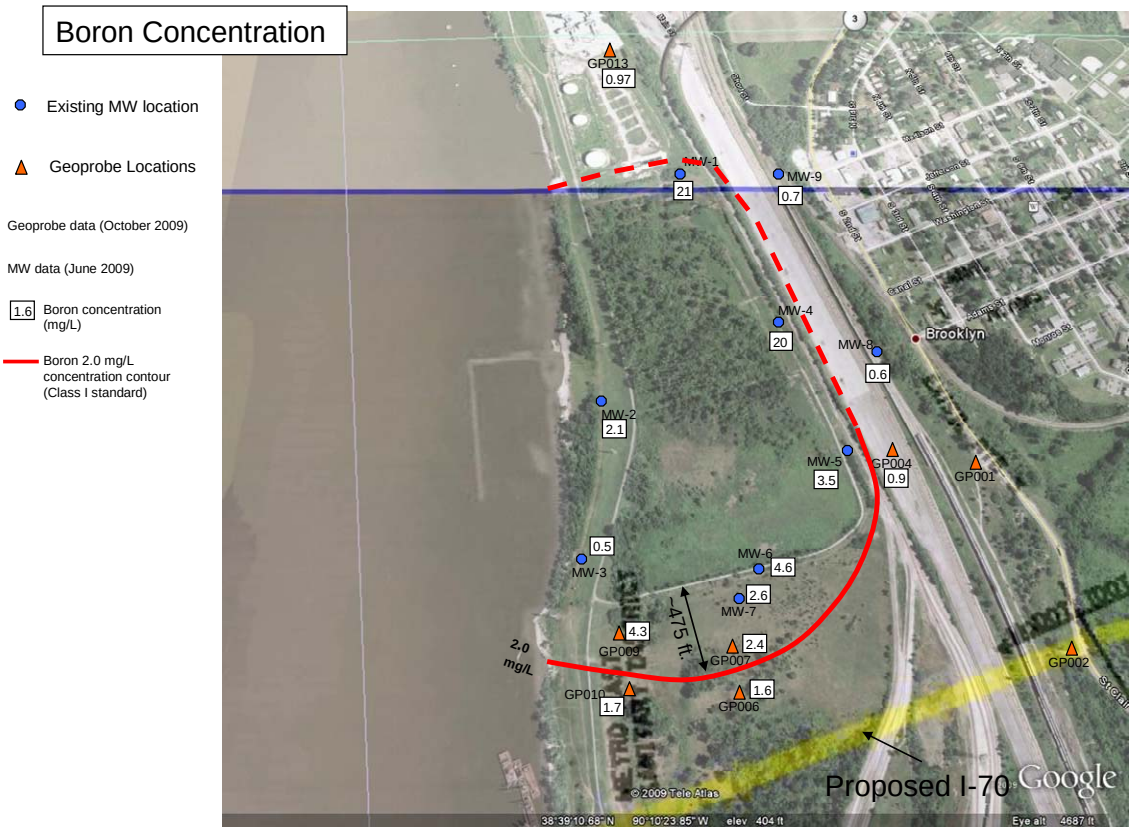

Figure 2. Extent of Class I exceedances attributable to seepage from Ponds 2 and 3, as defined by boron

Alternatives Analysis

The closure alternatives evaluated for the Venice ash ponds are described in Table 1. These alternatives were selected with the following considerations:

- The regulatory structure for closure of the Venice ash ponds will have a similar framework to that developed for Ameren Energy Generating Company's Hutsonville Pond D (IL. Title 35, Section 840).
- Groundwater flowing beneath the site ultimately discharges to the nearby Mississippi River, and, as noted in NRT technical memorandum 1, dated September 17, 2009, there is only one groundwater supply well within 2,500 feet of the facility. This is an industrial/commercial well, more than 2,000 feet south of the southern edge of Pond 3 and beyond the extent of Class I exceedances attributed to seepage from the impoundment. All of the local communities are connected to public drinking water supplies and groundwater in the area is not used for potable purposes.
- The west berm of the ash ponds is a Mississippi River levee. Construction activities near and adjacent to the levee will require a permit from the US Army Corps of Engineers (ACOE) and cannot negatively impact the structural integrity of the levee.

- The property boundary is very close to the ash ponds, essentially at the outer toe of the east and south berms.

- The Illinois Department of Transportation is planning to construct a new I-70 bridge about 1,000 feet south of the ash ponds, and an access road for this project will be constructed on the east berm.

Groundwater Management Alternatives

Three groundwater management alternatives were evaluated and are described in Table 1, and spreadsheets detailing the cost estimates are provided in Attachment 2. Each of these alternatives is capable of controlling risk associated with the groundwater pathway, although the approaches, areas covered, time frame for achieving control, and costs are significantly different.

The following assumptions were used in developing these alternatives:

Institutional Control Assumptions

- The critical assumption for this alternative is that all parties are agreeable to implementing these controls.

- There are no capital costs or engineering estimates associated with this alternative.

Groundwater Extraction Assumptions

- The primary goal of the groundwater extraction system would be to prevent future off-site migration of groundwater flowing beneath the Venice ash ponds, because the lower portions of the ash are intermittently wetted during periods of high groundwater elevation, that correspond to high river stage, resulting in leaching of the coal ash. Such a system may also capture some, but not all, of the groundwater already south of the ash ponds.

- Assumes that a groundwater extraction rate of 300 gallons per minute (gpm) is adequate to prevent migration of groundwater south of the property boundary. This assumption has a high degree of uncertainty, and the assumed value could increase or decrease by a factor of three or greater once sufficient data are collected for a more refined calculation (NRT believes that the final rate is more likely to be lower than the rate used in this estimate, rather than higher). If this alternative is advanced to final design, then a pump test will be necessary to accurately evaluate the drawdown response of the aquifer.

- Costs associated with this alternative assume that the quality of the extracted groundwater will allow direct discharge to the sanitary sewer without pretreatment. However, if the groundwater contains constituents from sources other than the ash ponds, then this assumption and the estimated costs associated with this alternative are no longer valid. In such a circumstance, pre-treatment of extracted groundwater may be necessary depending upon the particular constituent.

- Lifecycle costs for O&M have been calculated (Attachment 1). O&M will likely be required for at least 50 years into the future, because the coal ash will continue to leach for at least 50 years. Based on NRT calculations of the mass of the leachable constituents, particularly boron, at other CCP sites, and on the age of these ash ponds, this is a reasonable assumption.

- Finally, this alternative assumes that the sanitary sewer system has sufficient capacity to transmit and process the potentially significant flow of extracted groundwater from the system.

Ash Removal and Disposal

- The first of several significant assumptions associated with this alternative is that a permit can be obtained from the US Army Corps of Engineers for excavating ash in contact with a Mississippi River Levee. The ability to obtain such a permit is uncertain at this point in time.

- This alternative assumes that all coal ash can be excavated. Since the ash is above water table most of the time, this appears to be a reasonable assumption; however, dewatering may be necessary if removal activities occur during periods of high river/groundwater stage, and removal activities may have to be suspended if the ash and/or underlying fine-grained sediments cannot be adequately dewatered. The effectiveness of this alternative is questionable, especially in light of the high cost, if pockets of ash at depth cannot be excavated.

- This alternative and cost estimate assumes that no backfill will be required to replace the ash removed from the ponds. The final bottom elevation in the ponds will be similar to the land elevation prior to ash management. This area was a closed depression behind the levee before the ash ponds were built and would be a closed depression after implementation of this alternative. Depending upon UACOE requirements, backfilling may be required to fill areas of depression. The cost and material availability for such of such backfilling has not been estimated.

- The cost for this alternative assumes that the ash removed from the ponds can be disposed in a municipal solid waste landfill. If the material is not suitable for disposal in a solid waste landfill, the disposal cost will be significantly higher than estimated here.

- An assumption is made that the transmission towers currently present on the surface of the ash ponds can be worked around, or temporarily relocated.

Other Groundwater Management Alternatives

Horizontal Groundwater Extraction

Another method of groundwater extraction that may be considered is a horizontal groundwater collection system, rather than collection using a vertical extraction system. This alternative was not considered in this focused analysis because the anticipated capital cost of a horizontal system is higher than that of a vertical extraction system. These anticipated higher costs are a result of the depth at which a horizontal system would need to be installed (30 to 40 feet). Installation of a system at this depth would either

require a large open trench, for which there is currently insufficient space on the property and permitting to work near the levees is uncertain, or a horizontal well which has higher per-foot installation cost than vertical wells. There is also uncertainty concerning the effectiveness of a horizontal system due to vertical stratification in the upper parts of the formation, and the greater than 10-foot fluctuation in water table elevations that occur at this site; to elaborate, a drawdown from a horizontal system installed for periods of low water table may not be evident during periods of high water table.

Alternatives to Direct Discharge to the Sanitary Sewer

Any direct discharge of extracted groundwater to the Mississippi River will require a new NPDES discharge point. There are numerous regulatory and permitting challenges associated with this option. In addition to constituents associated with coal ash leachate, the extracted groundwater may contain elevated concentrations of both organic and inorganic constituents which could trigger the implementation of various control mechanisms including pre-treatment. The costs associated with a pre-treatment system have not been estimated.

Barrier Wall Alternatives

Partial or fully-encapsulating barrier wall alternatives were considered and rejected because there is no known adequate key layer below the sand and gravel alluvial aquifer.

Final Cover Alternatives

Three cover alternatives were evaluated and are described in Table 1, and spreadsheets detailing the cost estimates are provided in Attachment 2. All of these alternatives are capable of controlling risk associated with the direct contact pathway, and some also provide a measure of source control, thereby reducing leachate generation and improving groundwater quality.

Final Cover Alternatives

- Compacted clay cover, consisting of 3 feet of compacted clay overlain by a 3-foot thick protective layer. The protective layer has 2.5 feet of rooting zone soil and 6 inches of topsoil. This cover meets the requirements of Title 35, Section 811.314, and provides a barrier to infiltration and subsequent generation and release of leachate.

- Geosynthetic cover, consisting of (from bottom up) a 4-inch ash bedding layer, 40-mil polyvinyl chloride (PVC) geomembrane, 200-mil geocomposite (to drain infiltrated surface water), and a 3-foot thick protective layer. The protective layer has 2.5 feet of rooting zone soil and 6 inches of topsoil. This cover meets the requirements of Title 35, Section 811.314, and provides a barrier to infiltration and subsequent generation and release of leachate.

- Earthen cover, consisting of 6 inches of topsoil over 1-foot of general fill. This alternative provides control of the direct contact pathway, but does not meet the requirements of Title 35, Section 811.314, nor does it provide a significant benefit for control of infiltration and subsequent leachate generation, and would need to be performed in conjunction with a long-term, possibly active, groundwater management alternative.

Assumptions associated with the final cover alternatives are:

- The transmission towers currently present on the surface of the ash ponds can be worked around, or temporarily relocated.

- The ash in each pond can be graded to promote positive drainage from the final cover without the need to import additional fill (referred to as a "double crown" in the cost estimates). This would involve excavating ash at the perimeter of each pond and relocating it to the center to build slope, or a "crown". Storm water runoff from the cover would be managed in swales at the perimeter of each pond (i.e., within the existing berms) and conveyed through the berms at one or two points. This may require additional surface water drainage pipes and a pump station over the levee to the Mississippi River.

- A permit can be obtained from the US Army Corps of Engineers for regrading ash and placing cap materials in contact with a Mississippi River Levee. It seems plausible that a permit can be obtained; although the ACOE may require changes in design parameters to insure integrity of the levee, which could increase costs or impact implementation schedules.

Recommendation

The geosynthetic cover alternative is recommended over the compacted clay cover based on projected cost, and over the earthen cover based on anticipated effectiveness. Groundwater modeling documented in Technical Memorandum No. 6 suggests that reduced infiltration as a result of a geosynthetic cover will effectively mitigate off-site exceedances within 20 years. Considering that there is no current use of groundwater downgradient of the facility, and that future use can be prevented by use of an institutional control such as a groundwater management zone and/or deed restrictions, the environmental benefit of the groundwater extraction and ash removal and disposal options do not justify the high cost of implementing these options. Therefore the final recommended closure alternative for the Venice ash ponds consists of a geosynthetic cover to eliminate the direct contact exposure pathway and reduce infiltration into, and exfiltration out of, the coal ash, combined with institutional controls over the area of affected groundwater to prevent exposure via the groundwater pathway.

Table 1 - Closure Alternatives Screening Summary
Ash Ponds 2 and 3 Closure
AmerenUE - Venice, Illinois

NRT PROJECT NO.: 1949/1.6

Category	*Alternative*	*Description*	*Construction / Implementation Feasibility*	*Effectiveness*	*Relative Cost*		*Lifecycle cost (50-year)*
					Capital	*Annual O &M*	
Groundwater Management	**Institutional Controls**	Deed restrictions, ordinances, and a groundwater management zone would be obtained to prohibit withdrawal of groundwater south of the ash ponds in the area where groundwater from beneath the ponds has migrated.	The subject area is currently undeveloped, and future development options are limited, and possibly non-existent, because it is a railroad transitway and a freeway corridor will soon be passing through. If development is proposed for the subject property, then the region is served by municipal water supplies, and groundwater use restrictions will not hinder development.	This is the only groundwater management alternative that provides immediate control for groundwater that has previously migrated south of the property. Furthermore, this alternative provides permanent control for the groundwater pathway that will be in place until and beyond cessation of leachate release from the coal ash.	**Not applicable**	**Not applicable**	**Not applicable**
	Groundwater Extraction	Vertical groundwater extraction wells along the south edge of Pond 3 to capture groundwater impacted by ash leachate before it flows off site. Extracted groundwater would be discharged to the sanitary sewer without pretreatment.	Removal of ash along the southern edge of Pond 3 may be necessary to facilitate construction / implementation. Sanitary discharge permit needed from local wastewater treatment plant.	Provides immediate control on future migration of groundwater off-site, but does not control impacted groundwater that has previously migrated south of the property. System requires ongoing, and long-term maintenance to remain effective. Published case studies of groundwater extraction well systems at other CCP and non-CCP sites has demonstrated that the effectiveness of such systems can decline over time, even when maintained.	**$1,820,000**	**$600,000** High O&M costs due to sanitary sewer discharge fees.	**$12,225,400**
	Ash Removal and Disposal	Ash is excavated and transported to a solid waste landfill. It is assumed that carbon content of ash is too high for beneficial reuse.	Excavation involves standard construction equipment. Relocation of existing transmission towers within ash ponds would be required and may not be feasible. Excavation of saturated ash may require shoring, dewatering, and use of dragline bucket or mudcat, and is likely not technically or economically feasible. This alternative would require profiling of the ash waste for disposal in an appropriate landfill.	Provides long-term source control, assuming that all coal ash can be removed. However, leachate already released to the fine-grained alluvium underlying the ash ponds will continue to release to groundwater and may take years to dissipate, and this alternative does not provide any control for impacted groundwater that has previously migrated south of the property.	**$197,300,000**	**None**	**$215,837,520**
Final Cover	**Compacted Clay**	Ponds 2 & 3 are covered with compacted clay and a protective layer to prevent direct contact, control infiltration of surface water, reduce leachate generation, and provide erosion control.	Compacted clay has been used at other fly ash management facilities to reduce surface water infiltration and leachate generation. A local source for liner-quality clay would have to be identified and may not be available. The cover subgrade would need to be graded to promote site drainage. An approach to work around transmission towers within ash ponds will be required.	A compacted clay cover will effectively reduce surface water infiltration resulting in reduced leachate generation from Ponds 2 & 3. Additionally, the clay cover provides protection from erosion and prevents direct contact with ash.	**$12,400,000**	**$10,000** O & M costs associated with maintaining vegetation, 3-foot protective soil layer, and repairing erosion damage.	**$13,737,254**
	Geosynthetic	Ponds 2 & 3 are covered with a geomembrane and protective layer to prevent direct contact, control infiltration of surface water, reduce leachate generation, and provide erosion control. A geocomposite would be needed over the geomembrane to drain infiltrated surface water from above the geomembrane.	Geomembranes are readily available and have been installed at other coal ash management facilities to reduce surface water infiltration and leachate generation. The cover subgrade would need to be graded to promote site drainage. An approach to work around transmission towers within ash ponds will be required.	A geomembrane cover would effectively minimize infiltration and resulting leachate generation from Pond 2 & 3. Additionally, similar to a clay cover, the cover provides protection from erosion and prevents direct contact with ash.	**$11,200,000**	**$10,000** O & M costs associated with maintaining vegetation, 3-foot protective soil layer, and repairing erosion damage.	**$12,424,507**
	Earthen	An earthen cover is constructed to prevent direct contact, and provide erosion control.	An earthen cover could be constructed from locally available materials. There would be site grading and drainage limitations to overcome similar to the geomembrane and clay covers.	An earthen cover will allow more surface water infiltration and resulting leachate generation from Ponds 2 & 3 than a geomembrane or compacted clay cover. The layered earthen cover provides erosion control when properly vegetated and prevents direct contact with ash.	**$6,700,000**	**$10,000** O & M costs associated with maintaining vegetation, 3-foot protective soil layer, and repairing erosion damage.	**$7,501,705**

Attachment 1
Lifecycle Cost Estimation

Venice ash pond closure alternative costs were analyzed using the Ameren Economic Value Added (EVA) model, with the exception of the Institutional Controls Alternative because costs were not provided.

The corporate EVA model is an Excel based model that incorporates all, revenues, capital, operation and maintenance (O&M), allowances for funds used during construction (AFUDC), depreciation and tax elements in an economic analysis of projects. The EVA model Version 2009-Revision 05-15-2009 was used for the analyses. The key metric for choosing the best strategy is the cumulative net present value of revenue requirements of Annual Total Revenue Requirement. This value should be minimized.

Assumptions

Costs were the only items included in the EVA model, therefore the results produced negative EVAs. For all strategies, a 50-year economic life was modeled. The EVA model output ended at Year 49; however, the results were extrapolated to include Year 50. Below are the general assumptions used for the analysis:

- The study period was 2011 through 2062 (2 years construction, 50 years operation).
- The capital expenditures and O&M costs (2009 dollars) are as listed in Table 1.
- A 2-year planning and construction schedule (YR: 2011 and 2012), with the exception of the Groundwater Extraction Alternative. The Groundwater Extraction Alternative was a 1-year planning and construction schedule (YR: 2012).
- Capital expenditures split 50/50 between associated 2-year construction schedule.
- In-Service Date: 2013.
- Costs were escalated at 3.00% per year.
- Tax-Life: Expenses.

Attachment 2
Cost Estimation Sheets

GROUNDWATER MANAGEMENT ALTERNATIVE: Groundwater Extraction Wells

Ash Ponds 2 and 3 Closure — NRT PROJECT NO.: 1949/1.6

AmerenUE - Venice, Illinois — BY: EJT / RJG CHKD BY:JAZ

DATE: 10/28/09 DATE: 11/4/09

CONSULTING CAPITAL COSTS	SUB-TOTAL
Consulting	
Hydrogeologic Evaluation, Engineering Design, System Installation Oversight, Final System Documentatio	$200,000
SUBTOTAL, CONSTRUCTION CAPITAL COSTS	$200,000
30% Estimating Contingency	$60,000
TOTAL, CONSULTING CAPITAL COSTS	**$260,000**

CONSTRUCTION CAPITAL COSTS	QUANTITY	UNIT	UNIT COST	ITEM COST	SUB-TOTAL
General Construction					$320,000
Design Pump Test	1	LS	$50,000	$50,000	
Mob./Demob.	1	LS	$20,000	$20,000	
Erosion Controls	1	LS	$10,000	$10,000	
Site Vegetation Clearing	1	LS	$5,000	$5,000	
3-phase electrical power service	1	LS	$200,000	$200,000	
Startup/Testing	1	LS	$20,000	$20,000	
Construction and Documentation Surveying	1	LS	$10,000	$10,000	
Restoration of Disturbed Areas	1	LS	$5,000	$5,000	
Extraction Well Construction					$877,900
Extraction Well Installation	5	WELL	$40,000	$200,000	
Trenching	6,400	LF	$20.00	$128,000	
Underground Conveyance Piping	1,120	LF	$15.00	$16,800	
Underground Discharge Piping	5,280	LF	$30.00	$158,400	
Electrical and Control Wiring for Each Well	1,120	LF	$15.00	$16,800	
Pre-Engineered System Enclosure and Foundation	1	LS	$100,000	$100,000	
Piping in Pre-Engineered Building	1	LS	$50,000	$50,000	
Pre-Engineered Building Electrical	1	LS	$20,000	$20,000	
PLC Control System and Electrical	1	LS	$75,000	$75,000	
Groundwater Extraction Pumps	5	EA	$5,000	$25,000	
Sanitary Discharge Pump	1	EA	$10,000	$10,000	
Additional Trench Backfill	3,040	TON	$10.00	$30,400	
Stockpile and Replace Trench Material	9,500	CY	$5.00	$47,500	
SUBTOTAL, CONSTRUCTION CAPITAL COSTS					$1,197,900
30% Estimating Contingency					$359,400
TOTAL, CONSTRUCTION CAPITAL COSTS					**$1,560,000**
TOTAL CAPITAL COSTS					**$1,820,000**

ANNUAL COSTS					
Annual O & M Costs					$450,000
O & M Sampling Labor & Equipment	1	LS	$20,000	$20,000	
Discharge Fees	160	MGAL	$2,500	$400,000	
Discharge Sampling Analytical	1	LS	$10,000	$10,000	
Annual Equipment Maintenance	1	LS	$10,000	$10,000	
Electric Costs	1	LS	$10,000	$10,000	
ANNUAL SUBTOTAL					$450,000
30% Estimating Contingency					$135,000
TOTAL ANNUAL COSTS					**$585,000**

ASSUMPTIONS

1. Groundwater extraction along south edge of Pond 3 via 5 wells - 200 ft. spacings - total flow of approximately 300 gpm.
2. Annual O&M cost represents average lifecycle cost; actual O&M costs will likely be higher than average initially.
3. This options assumes no treatment of extracted groundwater and pumped discharge directly to the sanitary sewer located approximately 1 mile from wells.
4. Results of further hydrogeological assessment and design pump test could impact size and scope of the groundwater extraction system.
5. Above is a preliminary estimate and may be revised if selected for final design.

GROUNDWATER MANAGEMENT ALTERNATIVE: Excavation & Disposal

Ash Ponds 2 and 3 Closure — NRT PROJECT NO.: 1949/1.6

AmerenUE - Venice, Illinois — BY: RJG CHKD BY: EJT — DATE: 11/9/09 DATE: 11/9/09

CONSULTING CAPITAL COSTS	SUB-TOTAL
Consulting	
Hydrogeologic Evaluation, Engineering Design, System Installation Oversight, Final System Documentatic	$700,000
Ameren Labor	$600,000
SUBTOTAL, CONSULTING CAPITAL COSTS	$1,300,000
30% Estimating Contingency	$390,000
TOTAL, CONSULTING CAPITAL COSTS	**$1,690,000**

CONSTRUCTION CAPITAL COSTS	QUANTITY	UNIT	UNIT COST	ITEM COST	SUB-TOTAL
Construction					$150,439,300
Mob./Demob.	1	LS	$50,000	$50,000	
Site Vegetation Clearing Pond 2 & 3	58	ACRES	$7,000	$404,600	
Ash-Contact Water Management	1	LS	$750,000	$750,000	
Excavate Ash from Ponds 2 and 3	2,427,260	CY	$5.00	$12,136,300	
Transmission Tower Contingency	1	LS	$750,000	$750,000	
Transport & Disposal for Ash	2,949,121	TONS	$40	$117,964,800	
Import and Place General Fill in Ash Excavation Area	2,236,300	CY	$8	$17,890,400	
Place 6" of Topsoil for Revegetation	46,622	CY	$5.00	$233,100	
Documentation Surveying	58	ACRES	$1,000	$57,800	
Revegetation (mulch, seed, fertilizer)	58	ACRES	$3,500	$202,300	
SUBTOTAL, CONSTRUCTION CAPITAL COSTS					$150,439,300
30% Estimating Contingency					$45,131,800
TOTAL, CONSTRUCTION CAPITAL COSTS					**$195,600,000**

TOTAL CAPITAL COSTS	**$197,300,000**

ASSUMPTIONS

1. Total surface area of Ash Ponds #2 and #3 estimated at 2,517,580 sf between the tops of the berms.
2. The depth of ash in Ponds #2 and #3 is 27 feet.
3. Transmission towers within ash ponds can be worked around or relocated.
4. Ash quantities based on a 2430 pounds per cubic yard ratio; all ash quantities are approximate and need to be field verified during design/construction.
5. Ash Ponds 2 and 3 will be backfilled with general fill to an elevation of 425 feet. A bulking factor of 30% is estimated.
6. Above is a preliminary estimate and may be revised if selected for final design.

FINAL COVER ALTERNATIVE: Compacted Clay Cover with Double Crown

Ash Ponds 2 and 3 Closure
AmerenUE - Venice, Illinois

NRT PROJECT NO.: 1949/1.6
BY: RJG CHKD BY: EJT
DATE: 11/9/09 DATE: 11/9/09

CONSULTING CAPITAL COSTS	SUB-TOTAL
Consulting	
Hydrogeologic Evaluation, Engineering Design, System Installation Oversight, Final System Documentatic	$700,000
Ameren Labor	$600,000
SUBTOTAL, CONSULTING CAPITAL COSTS	$1,300,000
30% Estimating Contingency	$390,000
TOTAL, CONSULTING CAPITAL COSTS	**$1,690,000**

CONSTRUCTION CAPITAL COSTS	QUANTITY	UNIT	UNIT COST	ITEM COST	SUB-TOTAL
2,517,580					
Construction					$8,235,900
Mob./Demob.	1	LS	$50,000	$50,000	
Site Facilities & Maintenance (Erosion Controls)	1	LS	$12,000	$12,000	
Site Vegetation Clearing Pond 2 & 3	58	ACRES	$7,000	$404,600	
Storm Water Management	1	LS	$750,000	$750,000	
Transmission Tower Contingency	1	LS	$750,000	$750,000	
Grade Ash to Drain Site	200,000	CY	$5.00	$1,000,000	
Clay - Purchased, Delivered and Installed (3.0')	279,731	CY	$8	$2,237,800	
Grain Size Analysis/Geotechnical Testing	1	LS	$500,000	$500,000	
Place Rooting Zone to Complete Protective Layer	233,109	CY	$8	$1,864,900	
Place 6" of Topsoil as part of Protective Layer	46,622	CY	$5.00	$233,100	
Documentation Surveying	58	ACRES	$4,000	$231,200	
Revegetation (mulch, seed, fertilizer)	58	ACRES	$3,500	$202,300	
SUBTOTAL, CONSTRUCTION CAPITAL COSTS					$8,235,900
30% Estimating Contingency					$2,470,800
TOTAL, CONSTRUCTION CAPITAL COSTS					**$10,700,000**

TOTAL CAPITAL COSTS	**$12,400,000**

ASSUMPTIONS

1. Total surface area of Ash Ponds #2 and #3 estimated at 2,517,580 sf between the tops of the berms.
2. The depth of ash in Ponds #2 and #3 is 27 feet.
3. Transmission towers within ash ponds can be worked around or relocated.
4. Compacted Clay cover consists of: 3-ft Compacted Clay Layer - 3-ft Protective Soil Layer (2.5 ft Rooting Zone & 0.5 ft Topsoil).
5. Storm water management includes costs to manage ash-contact water during construction.
6. No additional fill material would be needed to adequately drain covers.
7. Above is a preliminary estimate and may be revised if selected for final design.

FINAL COVER ALTERNATIVE: Geosynthetic Cover with Double Crown
Ash Ponds 2 and 3 Closure
AmerenUE - Venice, Illinois

NRT PROJECT NO.: 1949/1.6
BY: RJG CHKD BY: EJT
DATE: 11/9/09 DATE: 11/9/09

CONSULTING CAPITAL COSTS	SUB-TOTAL
Consulting	
Hydrogeologic Evaluation, Engineering Design, System Installation Oversight, Final System Documentatio	$650,000
Ameren Labor	$600,000
SUBTOTAL, CONSULTING CAPITAL COSTS	$1,250,000
30% Estimating Contingency	$375,000
TOTAL, CONSULTING CAPITAL COSTS	**$1,630,000**

CONSTRUCTION CAPITAL COSTS	QUANTITY	UNIT	UNIT COST	ITEM COST	SUB-TOTAL
Construction					$7,416,700
Mob./Demob.	1	LS	$50,000	$50,000	
Site Facilities & Maintenance (Erosion Controls)	1	LS	$12,000	$12,000	
Site Vegetation Clearing Pond 2 & 3	58	ACRES	$7,000	$404,600	
Storm Water Management	1	LS	$750,000	$750,000	
Transmission Tower Contingency	1	LS	$750,000	$750,000	
Grade Ash to Drain Site	200,000	CY	$5.00	$1,000,000	
Install 40 mil PVC Geomembrane Cover	2,542,756	SF	$0.42	$1,068,000	
Install 200 mil Geocomposite Drainage Layer	2,542,756	SF	$0.38	$966,200	
Place Rooting Zone to Complete Protective Layer	233,109	CY	$8.00	$1,864,900	
Place 6" of Topsoil as part of Protective Layer	46,622	CY	$5.00	$233,100	
Documentation Surveying	58	ACRES	$2,000	$115,600	
Revegetation (mulch, seed, fertilizer)	58	ACRES	$3,500	$202,300	
SUBTOTAL, CONSTRUCTION CAPITAL COSTS					$7,416,700
30% Estimating Contingency					$2,225,000
TOTAL, CONSTRUCTION CAPITAL COSTS					**$9,600,000**

TOTAL CAPITAL COSTS	**$11,200,000**

ASSUMPTIONS

1. Total surface area of Ash Ponds #2 and #3 estimated at 2,517,580 sf between the tops of the berms.
2. The depth of ash in Ponds #2 and #3 is 27 feet.
3. Transmission towers within ash ponds can be worked around or relocated.
4. Geosynthetic Cover consists of: 4-inch ash bedding layer - 40-mil PVC Geomembrane - 200-mil Geocomposite Drainage Layer - 3-foot Protective Soil Layer.
5. Storm water management includes costs to manage ash-contact water during construction.
6. No additional fill material would be needed to adequately drain covers.
7. Above is a preliminary estimate and may be revised if selected for final design.

FINAL COVER ALTERNATIVE: Earthen Cover with Double Crown

Ash Ponds 2 and 3 Closure — NRT PROJECT NO.: 1949/1.6

AmerenUE - Venice, Illinois — BY: RJG CHKD BY: EJT

DATE: 11/9/09 DATE: 11/9/09

CONSULTING CAPITAL COSTS					SUB-TOTAL
Consulting					
Hydrogeologic Evaluation, Engineering Design, System Installation Oversight, Final System Document					$500,000
Ameren Labor					$600,000
SUBTOTAL, CONSULTING CAPITAL COSTS					$1,100,000
30% Estimating Contingency					$330,000
TOTAL, CONSULTING CAPITAL COSTS					**$1,430,000**

CONSTRUCTION CAPITAL COSTS	QUANTITY	UNIT	UNIT COST	ITEM COST	SUB-TOTAL
Construction					$4,095,100
Mob./Demob.	1	LS	$50,000	$50,000	
Site Facilities & Maintenance (Erosion Controls)	1	LS	$12,000	$12,000	
Site Vegetation Clearing Pond 2 & 3	58	ACRES	$7,000	$404,600	
Storm Water Management	1	LS	$750,000	$750,000	
Transmission Tower Contingency	1	LS	$750,000	$750,000	
Grade Ash to Drain Site	200,000	CY	$5.00	$1,000,000	
Place 1 foot of General Fill as part of Earthen Cover	93,244	CY	$8.00	$745,900	
Place 6" of Topsoil as part of Earthen Cover	24,503	CY	$5.00	$122,500	
Documentation Surveying	58	ACRES	$1,000	$57,800	
Revegetation (mulch, seed, fertilizer)	58	ACRES	$3,500	$202,300	
SUBTOTAL, CONSTRUCTION CAPITAL COSTS					$4,095,100
30% Estimating Contingency					$1,228,500
TOTAL, CONSTRUCTION CAPITAL COSTS					**$5,300,000**

TOTAL CAPITAL COSTS	**$6,700,000**

ASSUMPTIONS

1. Total surface area of Ash Ponds #2 and #3 estimated at 2,517,580 sf between the tops of the berms.
2. The depth of ash in Ponds #2 and #3 is 27 feet.
3. Transmission towers within ash ponds can be worked around or relocated.
4. Earthen Cover Consists of: 6 inches Topsoil - 1 foot General Fill.
5. Storm water management includes costs to manage ash-contact water during construction.
6. No additional fill material would be needed to adequately drain covers.
7. Above is a preliminary estimate and may be revised if selected for final design.