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MISSOURI PUBLIC SERVICE COMMISSION

Case No. EA-2012-0281

SURREBUTTAL TESTIMONY

OF

STEVEN F. PUTRICH, P.E.

ON

BEHALF OF

UNION ELECTRIC COMPANY
d/b/a AMEREN MISSOURI

Cleveland, Ohio
September, 2013

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I. INTRODUCTION

Q1. Please state your name and business address.

A. Steven F. Putrich, P.E., 6500 Rockside Road, Suite 200, Cleveland, Ohio 44131.

Q2. By whom are you employed and in what capacity?

A. I am employed by Haley & Aldrich, Inc., as the National CCR Program Lead and Senior VP of Engineering.

Q3. What are your primary duties and areas of expertise?

A. I am a geo-environmental consultant with over 25 years of experience working on coal-fired power plant projects located throughout the United States. I specialize in the management and beneficial reuse of Coal Combustion Residuals (CCRs).[1] I provide that expertise and senior project management for projects involving both wet and dry ash disposal systems and the management and reuse of CCRs including gypsum from flue gas desulfurization (FGD) units (i.e., scrubbers). I have managed these type projects from inception through completion including feasibility and siting studies, geotechnical and hydrogeological investigations, permit and construction level designs and construction management and quality assurance oversight of CCR and industrial waste management facilities. CCR facilities with

[1] Byproducts from the combustion of coal can include fly ash, bottom ash, FGD and other byproducts and are referred to as coal combustion residuals (CCRs) in accordance with the proposed Federal CCR Rule. CCRs are also referred to in the industry as coal combustion products (CCPs), coal combustion byproducts (CCBs) and other variations based on whether the product is being beneficially reused or directly disposed of in a UWL. For the purposes of this testimony, CCR is the accepted nomenclature to describe byproducts derived from combusting coal.

which I have experience include wet ash ponds, dry stack ash/FGD landfills, and CCR structural fills and related beneficial reuse applications.

Q4. Are you a member of any professional organizations?

A. Yes. I am a member of:

- USWAG (Utility Solid Waste Activities Group)
- ACAA (American Coal Ash Association)

Q5. Please outline your background, employment history, education, and training.

A. I hold a Bachelor of Science Degree in Civil Engineering and a Master of Science Degree in Civil Engineering, with an emphasis in Geotechnical and Environmental Engineering. I have practiced in these areas for several firms throughout my career as follows:

- Woodward-Clyde, 1983 through 1997,
- URS Corporation, 1997 through 2007,
- Civil & Environmental Engineering, Inc. (CEC), 2007 through 2013, and
- Haley & Aldrich, 2013 through present.

A copy of my curriculum vitae is attached hereto as Schedule SFP-S1.

Q6. What is the purpose of your testimony?

A. The purpose of my testimony is to respond to testimony submitted by persons testifying in local public hearings held in Union, Missouri, and Washington, Missouri, in which were raised various concerns about the proposed Ameren Missouri Labadie Utility Waste Landfill (UWL). Based on the public testimony, I will address the following primary concerns as they relate to the subject UWL:

- Testimony review, document reliability and certainty of opinions;
- Siting appropriateness including issues related to floodplains, seismicity, stability and wetlands;

- UWL Siting and design adequacy related to seismicity, floodplain and erosion protection, liner adequacy, groundwater protectiveness, and UWL design and Missouri Department of Natural Resources (MDNR) comments on submitted landfill documents; and
- The MDNR permitting process, adequacy and comparability of MDNR UWL design requirements, public comment and involvement.

Q7. Please summarize your key conclusions.

A. Based on my review of the project documents, the siting criteria and design elements set forth by the MDNR UWL regulations have been met and therefore the location and design of the Labadie Power Plant UWL are appropriate. Furthermore, proper design and engineering standards of practice have been followed in the development of the Labadie UWL permit package and are in accordance with the intents and purposes of the proposed Federal CCR Rule. My review confirms that all design elements of the UWL meet or exceed MDNR UWL minimum design and the proposed Federal CCR requirements, and they are all designed in accordance with good engineering practices, including best engineering practices for a UWL of this type.

Q8. Are you sponsoring any schedules?

A. Yes, I am sponsoring the following schedules:

- **Schedule SFP-S1:** Curriculum Vitae of Steven F. Putrich,
- **Schedule SFP-S2**: Construction Permit Application (CPA) Drawing 3,
- **Schedule SFP-S3**: CPA Drawing 19, and
- **Schedule SFP-S4:** MDNR Permitting Timeline.

Q9. Did you review any testimony (filed or otherwise) taken in this case in completing your work and arriving at your opinions?

A. Yes.

Q10. What testimony did you review?

A. I reviewed the direct testimony of Craig Giesmann on behalf of Ameren Missouri, and the rebuttal testimonies of Claire Eubanks and John Cassidy of the Missouri Public Service Commission. Additionally, I reviewed the testimonies and exhibits from the Labadie UWL Public Hearings on June 25 and July 10, 2013.

Q11. What other primary documents did you review in arriving at your conclusions in this case?

A. I reviewed the Preliminary Site Investigation (PSI) and the Detailed Site Investigation (DSI) for the Labadie UWL, both of which were submitted to and approved by the MDNR. Additionally, I reviewed the CPA, which has been submitted for approval to the MDNR. I also reviewed the comments on the CPA from Franklin County's Independent Registered Professional Engineer (IRPE) and the MDNR, Ameren Missouri's responses to those comments, and supplements to the CPA provided to the MDNR.

Q12. To the extent you relied upon any documents, including your schedules, in forming your opinions, are those documents of the type reasonably relied upon by experts in your areas of expertise and do you consider such documents reasonably reliable?

A. Yes.

Q13. Are the opinions expressed in this testimony given within a reasonable degree of engineering certainty?

A. Yes. Based on over 25 years of my professional consulting experience designing, permitting and construction/operating industrial solid waste/CCR disposal facilities like the UWL proposed by Ameren Missouri for the Labadie station, my opinions are stated within a reasonable degree of engineering certainty.

II. UWL SITING CONSIDERATIONS

Q14. Various witnesses, including Ms. Petra Haynes, claimed in general terms that the site of the proposed UWL is inappropriate. Do you have an overall opinion about the appropriateness of the site?

A. Yes.

Q15. What is that opinion?

A. In my opinion, the site is appropriate for a UWL. This is supported by my professional judgment and experience, the MDNR Division of Geology and Land Survey's (MDNR-DGLS) approval of the project Preliminary Site Investigation (PSI) on February 2, 2009, and the subsequent approval by MDNR-DGLS of the project Detailed Site Investigation (DSI) on April 8, 2011. Per 10 CSR 80-2.015(1)(D), approval of the DSI indicates "...that the site has been found to have suitable geologic and hydrologic characteristics for development of an environmentally sound solid waste disposal area." My review of the relevant information for this site confirms this conclusion.

In addition, the CPA for the Ameren Missouri Labadie UWL prepared by Reitz & Jens, Inc. and Gredell Engineering Resources, Inc., on behalf of Ameren Missouri, addresses and demonstrates satisfaction of the four (4) specific location restriction criteria that must be evaluated when siting a UWL in the state of Missouri in accordance with 10 CSR 80-11.010(4)(B). In my experience, satisfying this kind of siting criteria are common to the regulatory siting process for UWLs and other solid waste disposal facilities. The four (4) siting criteria include: floodplains, wetlands, seismic impact zones, and unstable areas. The following discussion addresses those siting issues as they relate to the site and subject UWL.

Q16. Please outline the first siting criteria - Floodplains (see 10 CSR 80-11.010(4)(B)1).

A. MDNR regulations state that if a proposed UWL siting falls within the 100-year floodplain, "the applicant shall demonstrate to the department that the UWL will not:

(1) restrict the flow of the one hundred (100)-year flood,

(2) reduce the temporary water storage capacity of the floodplain, or

(3) result in washout of waste so as to pose a hazard to public health or the environment."

Q17. Are these three criteria satisfied?

A. Yes, in my opinion they are. My opinion is based upon my own experience and a review of the relevant documentation. One piece of documentation is a CDG Engineers flood analyses prepared as part of the CPA preparation process that analyzes the UWL's potential impact on the regulatory Base Flood Elevations (BFE) corresponding to the 100-year flood for the Missouri River. This analysis determined that the UWL project will create a "No Rise" condition in the regulatory BFE of the Missouri River. Franklin County's Independent Professional Registered Engineer, in a letter dated January 22, 2013, agreed with CDG Engineers' analysis and determination, as do I. Mr. Giesmann has included this letter as one of the schedules to his surrebuttal testimony.

A "No Rise" determination represents a scenario where under 100-year flood conditions the placement of fill (in this case the proposed Labadie UWL) does not result in a notable increase/rise in downstream water levels and does not reduce the size or effectiveness of the temporary water storage capacity of the floodplain. In other words, if the placement of the UWL "restricted the flow of the BFE" or "reduced the temporary water storage capacity of the floodplain," the analysis conducted by CDG Engineers would have shown notable increases in the velocity of flood waters and higher flood levels downstream of the UWL site, which was not the case.

Specifically regarding item (1), it has been shown that construction of the UWL will not restrict the flow of the 100-year flood (i.e., the UWL will not create a backup of flood waters into surrounding areas of the floodplain). Regarding item (2), the temporary water storage capacity of the floodplain is not reduced under the 100-year flood conditions. The floodwaters will neither move faster downstream nor create

greater flood damage in the area. A model was used by CDG Engineers to demonstrate these points using Federal Emergency Management Agency (FEMA) data.

The "No Rise" determination is also consistent with the fact that the flows of the Missouri River are blocked from impacting the UWL site by the upstream agricultural levee and the structural fill for the Labadie Energy Center. The Labadie power plant was built on fill that impedes flows during all floods up to the 500-year event, creating an ineffective or low flow area downstream of the plant. The entire UWL is located within this ineffective/low flow area. Based on these analyses and discussions and the independent concurrence of the Franklin County's Independent Professional Engineer, items (1) and (2) of the MDNR regulations are satisfied.

Regarding item (3) of the MDNR regulations, a protective perimeter berm is included in the UWL design which will be constructed around the entire active disposal area to function as a flood protection dike. The crest of that dike is set at elevation 488 ft., which is well in excess of the MDNR's requirements. This is approximately 4 feet above the 100-year floodplain elevation (elevation 484 ft) and approximately 0.4 feet above the 500-year floodplain (elevation 487.6 ft). Extra precautions will be taken as part of the UWL operational plans to ensure the berms are maintained to a minimum elevation of 487.6 ft. Specifically, if land surveys reveal settling of the perimeter berm, that portion of the berm will be vertically re-extended to meet the design height of elevation 488 ft.

By way of reference, the "1993 Flood" (considered one of the worst floods for the area in modern history) peaked at elevation 483.6 ft. The 1993 plain was 4 ft. *below* the perimeter berm design crest elevation of 488 ft. The design of the perimeter berm also includes a fabric-formed concrete mat (FCM) constructed on a non-woven geotextile filter. The FCM is an industry accepted/demonstrated approach to what would be considered heavy duty erosion protection. Therefore the exterior berm is designed and expected to serve as long-term protection for the UWL against flood erosion.

Based on the demonstrations referenced above, it is my opinion that the Labadie UWL design meets all of the MDNR floodplain siting criteria and complies with the flow restriction, temporary storage, and washout provisions of the same. Though the regulations only mandate the criteria meet the 100-year flood, the perimeter berm protecting the UWL is engineered to withstand the 500-year flood. In conclusion, the MDNR siting requirements associated with floodplain issues (10 CSR 80-11.010(4)(B)1) are satisfied and correctly interpreted.

Q18. Please outline the second siting criteria - Wetlands (see 10 CSR 80-11.010(4)(B)2).

A. The MDNR UWL regulations state "proposed utility waste landfills shall not be located in wetlands."

Q19. Is this criteria satisfied?

A. Yes. The proposed UWL site has been evaluated for the presence of wetlands, and the Kansas City District US Army Corps of Engineers (COE) issued a Jurisdictional Determination (JD). Based on that JD, wetlands were identified proximate to the planned/permitted UWL boundary. However, as shown in Schedule SFP-S2 attached hereto, the UWL site has been designed such that impacts to all jurisdictional wetland areas will be avoided, and therefore, the UWL will not be located in wetlands. Therefore, this MDNR siting criterion associated with wetlands (10 CSR 80-11.010(4)(B)2) has been satisfied.

Q20. Please address the third siting criteria - Seismic Impact Zone (see 10 CSR 80-11.010(4)(B)3) and whether it has been satisfied.

A. According to the regulation, if a site is located in a "seismic impact zone," it must not be located within 200 feet of a Holocene era fault unless the owner/operator demonstrates to the department that an alternate setback is sufficient. The Labadie UWL site is located in a "seismic impact zone," but as

demonstrated by the data in the DSI, the UWL site is not located within 200 feet of a Holocene era fault. Consequently, the UWL satisfies the siting criteria for under 10 CSR 80-11.010(4)(B)3).

Q21. Please address the fourth siting criteria - Unstable Areas (see 10 CSR 80-11.010(4)(B)4).

A. It is important to first understand what an "unstable area" is. As stated in the regulation, "owners/operators of proposed utility waste landfills located in an unstable area shall demonstrate to the department that the utility waste landfill's design ensures that the integrity of the structural components of the utility waste landfill will not be disrupted." The MDNR regulations specify that, at a minimum, the following factors should be considered when determining whether an area is unstable:

(1) "On-site or local rock or soil conditions that may result in failure or significant differential settling;

(2) On-site or local geologic or geomorphologic features; and

(3) On-site or local human-made features or events (both surface and subsurface)."

10 CSR 80-2.010(114) further defines "unstable areas" as:

> "A location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of the landfill structural components responsible for preventing releases from a landfill. Unstable areas can include poor foundation conditions, areas susceptible to mass movements and karst terrains."

"Poor foundation conditions" are defined in 10 CSR 80-2.010(77) as: "Those areas where features exist which indicate that a natural or man-induced event may result in inadequate foundation support for the structural components of a landfill." "Areas susceptible to mass movement" are defined in 10 CSR 80-2.010(6) as: "Those areas of influence (for example, areas characterized as having an active or substantial possibility of mass movement) where the movement of the earth material at, beneath or adjacent to the sanitary landfill, because of

natural or man-induced events, results in the downslope transport of soil and rock material by means of gravitational influence. Areas of mass movement include, but are not limited to, landslides, avalanches, debris slides and flows, solifluction, block sliding and rock fall." "Karst terrains" are defined in 10 CSR 80-2.010(49) as: "Areas where karst, with its characteristic surface and subsurface features, is developed as the result of dissolution of limestone, dolomite or other soluble rock. Characteristic physiographic features present in karst terrains include, but are not limited to, sinkholes, losing streams, caves, solution channels or conduits, springs and solution valleys."

Q22. Is the proposed UWL located in an unstable area?

A. No. Studies have demonstrated that there are no geologic or geomorphologic features or human-made features or events (surface or subsurface) on site within the footprint of the UWL since there are no known springs, caves, or sinkholes within one-quarter mile of the landfill site, and that there are no karst terrains in the area. I concur in the results of those studies.

Studies forming the basis for the Labadie UWL design also addressed whether there are specific on-site or local soil conditions present. If present, these could result in significant differential settling (including poor foundation conditions) and could also result in areas susceptible to mass movement that could impact the integrity of the structural components. Those studies included:

- A stability analysis for the permanent exterior berms and the temporary interior berms;
- An analysis of the potential impact of liquefaction of foundation soils; and
- Seismic analyses to determine lateral deformation.

I have reviewed these analyses and conclude that these conditions are not present, and the design in fact does indicate that the integrity of the structural components of the UWL will not be disrupted. Consequently, in my opinion, the proposed UWL is not located in an "unstable area" and thus meets this MDNR siting requirement.

Q23. One or more witnesses criticized the design alleging that the proposed UWL will "sit on the groundwater" and that this reflects a flaw in its design. Do you agree?

A. No, I do not agree.

Q24. Why not?

A. First of all, the allegation that the UWL will "sit on the groundwater" is inaccurate and unfounded. Based on 11 years of groundwater monitoring at the Labadie UWL site (as discussed in Appendix Z of the CPA), the natural groundwater table is present at elevation 464 ft. The lowest point of the clay liner (which itself is two feet thick and which is then overlain by a HDPE geomembrane liner) is designed for elevation 466 ft, which is *2 feet above the natural groundwater level*. This is consistent with MDNR's UWL requirements and the proposed CCR Rule (i.e., 2 foot of vertical separation between the bottom of the landfill liner and the natural groundwater table). The exception to the 2 foot of separation standard are the fifteen (15) leachate collection sumps contained within the footprint of the UWL liner system. These sumps in aggregate make up less than 0.15% of the total UWL liner footprint area. These sumps are *by design* positioned lower than the overall landfill liner to support gravity drainage of leachate to the sumps. These isolated sump areas will be subject to periodic wetting during high water conditions at the UWL site. MDNR allows for exceptions to the separation requirement in the event that the "base of the landfill liner will be in contact with groundwater." In that case, MDNR requires the applicant to "demonstrate to the department's satisfaction that the groundwater will not adversely impact the liner." *See* 10 CSR 80-11.010(4)(B)6), which was addressed in Appendix Z of the CPA.

The criticism by the witnesses that the bottom of the clay liner may have intermittent contact with the groundwater during high water events (which is only the case at the isolated leachate sump locations) is not a legitimate source of concern. Calculations and analysis contained in Appendix Z of the CPA are

used to evaluate potential impacts of high groundwater table on the compacted clay liner. Those potential impacts include:

- Potential swelling of a compacted clay liner,
- Hydrostatic uplift against the bottom of the compacted clay liner,
- Potential loss of shear strength of the compacted clay liner,
- Potential decrease in stability of the exterior or interior UWL slopes,
- Constructability of a compacted clay liner in a high groundwater table, and finally,
- Long-term performance of the composite liner system.

In all the above considerations, the UWL liner system was shown to demonstrate satisfactory performance associated with these issues in consideration of the design, construction and long-term operation and post-closure life of the UWL. Furthermore, it was established in that same report that the intermittent wetting of the liner sumps (due to periodic high water events) was not a performance concern; specifically, that the structural integrity of the liner will be maintained, and secondly that compacted clay liner will perform as designed to consistently contain leachate within the UWL. It should be noted that MDNR has approved UWLs with this approach to liner design which includes a demonstration that the liner is not adversely impacted by intermittent wetting by the natural groundwater table. Case in point is the Ameren Missouri Sioux Plant UWL where MDNR approved a similar demonstration as was submitted with the CPA for the Labadie Sioux UWL. In summary, it is my professional opinion that the UWL liner system is designed to maintain the required vertical separation between the bottom of the liner and the natural groundwater table and, therefore, the allegation that the proposed UWL will "sit on the groundwater" is an inaccurate interpretation of site conditions. Furthermore, leachate sumps in the bottom of the liner which may be exposed to intermittent groundwater contact during high water events will not impair the structural integrity of the UWL liner and does not connote a "defect in the design" as alleged by some witnesses.

III. UWL DESIGN

Q25. In terms of the UWL itself, have you carefully reviewed its design and determined whether that design is appropriate for the CCRs to be deposited in the particular site in question?

A. Yes.

Q26. What are your opinions about the UWL design and its appropriateness for the intended use at the proposed site?

A. The design of this UWL, as proposed, meets or exceeds MDNR UWL regulations and the proposed USEPA CCR regulations, which specifically call for UWL of the very type proposed by Ameren Missouri for the Labadie site. The predictive performance and protectiveness of a solid waste landfill rests principally on the appropriateness of the landfill site selected and the landfill design.

Regarding site appropriateness, as I have outlined above, it is my professional opinion that the Labadie UWL is appropriately sited.

Regarding the UWL design, I have reviewed the key design components and concluded they have all been appropriately studied and that the design appropriately addresses all of them. I will address three of those key design components in more detail below, as follows:

- Liner Design;
- Final Cover Design; and
- Stormwater management design.

Q27. Please describe the liner design.

A. The proposed UWL includes a composite bottom liner which exceeds the criteria set forth by MDNR (10 CSR 80-11.010(10)(B)(1, 2)); specifically, MDNR requires that composite liners consist of two components including a lower component of at least two (2) feet of compacted soil having a hydraulic conductivity no more than 1 x 10^{-5} cm/sec, overlain by a (60) mil thick high density polyethylene (HDPE)

liner. While the Labadie UWL design incorporates a 60 mil HDPE as specified in the MDNR regulations, it is designed to include a two-foot layer of clay having a hydraulic conductivity less than or equal to 1×10^{-7} cm/sec, which would provide additional levels of protection above and beyond that required by the MDNR regulations for UWLs. An important part of the liner functionality/performance is the installation of a leachate collection system (to collect stormwater falling on each cell of the UWL) directly above the composite liner which serves to maintain a minimum allowable head of leachate of one foot or less on the liner system; this design complies with MDNR regulations (CSR 80-11.010(9)(B)(1)E). Additionally, the leachate collection system has been designed to manage the 25-year, 24-hour storm event during all active portions of the UWL, in accordance with CSR 80-11.010(9)(B)3.

Q28. Please address the final cover design.

A. The planned final Cover system for the UWL consists of a 40 mil HDPE overlain by a 2-foot vegetative soil layer. This final cover design exceeds the minimum requirements of 1 foot of 1×10^{-5} clay and 1-foot vegetative soil layer specified by MDNR UWL regulations. A typical final cover slope design of 2% exceeds the 1% MDNR regulatory minimum.

Q29. Please address the stormwater runoff management design for the UWL.

A. All UWL stormwater calculations (associated with collection and control of runoff of stormwater for the UWL) are designed to meet or exceed the MDNR /design requirement for the appropriate storm—the 24-hour, 25-year storm event.

Q30. Are there also federal regulations applicable to the design of UWLs?

A. Not at present, but there are regulations that are being proposed by the U.S. Environmental Protection Agency (USEPA) under the Federal Resource Conservation and Recovery Act (RCRA). The proposed Labadie UWL has been designed to meet all of USEPA's proposed requirements. I would note that USEPA has proposed two regulatory designations for CCRs: regulating CCRs as

hazardous waste under RCRA Subtitle C, or regulating them as non-hazardous waste under RCRA Subtitle D. Recent indications by USEPA suggest that the USEPA will set forth a "Subtitle D" regulation for CCRs, which would classify them as a non-hazardous solid waste. USEPA is not expected to issue a final rule until sometime in 2014.

Q31. You mentioned USEPA's proposed regulations for handling CCRs, which include the handling of coal ash. How does the design of the proposed UWL match-up with EPA's proposed regulations?

A. The use of a UWL like that proposed by Labadie is the appropriate disposal method for CCRs under the proposed USEPA CCR rules. Regarding the liner (and leachate collection) system, the design of the proposed UWL composite liner system matches the composite liner system requirements consistent with the proposed USEPA CCR regulations. The CCR Rule proposes that composite liners shall consist of at least two feet of compacted soil having a hydraulic conductivity no more than 1×10^{-7} cm/sec, overlain by a (60) mil thick high density polyethylene (HDPE), overlain with a 1 foot leachate collection layer with permeability of 1×10^{-3} cm/sec.

The planned final cover system for the Labadie UWL consists of a 40 mil HDPE overlain by a 2 foot vegetative soil layer. This final cover design exceeds the minimum requirements of 1 foot of 1×10^{-5} clay and 1 foot vegetative soil layer specified by MDNR UWL regulations, and meets the cover requirements under the proposed Federal CCR Rules. The proposed cover system under the CCR Rule includes a three-tiered system. Per 40 CFR 257.100, the final cover must be designed and constructed to:

1. Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10−5 cm/sec, whichever is less, and

2. Minimize infiltration through the closed UWL by the use of an infiltration layer that contains a minimum 18-inches of earthen material, and

3. Minimize erosion of the final cover by the use of an erosion layer that contains a minimum of 6-inches of earthen material that is capable of sustaining native plant growth.

Stormwater management design for the Labadie UWL is based on the 24-hour, 25-year storm event which is comparable with the proposed Federal CCR regulations.

Q32. During the July 10, 2013 local public hearing, witness Adrian Hutton compared the design of the UWL to a municipal solid waste (MSW) landfill which he suggested was not appropriate for CCR disposal. Do you agree with Mr. Hutton's implied criticism of the UWL design?

A. No.

Q33. Why not?

A. Mr. Hutton correctly points out that the Labadie UWL and a typical MSW landfill have similar designs. The reason is that both landfills are designed to manage non-hazardous solid waste, and both are generally compliant with current solid waste disposal regulations under Subtitle D of RCRA. The major distinction for UWL versus MSW landfills is the lack of gas management and vector (e.g. buzzards, seagulls, rats, and other pests) controls in a UWL design that are an inherent part of all MSW landfill designs. They are omitted from the UWL regulations as utility wastes (in particular CCRs) because they do not produce gas or odor and do not attract vectors.

Mr. Hutton's implied criticism of the UWL design by relating it to a municipal waste facility design is misplaced and incorrect. In many ways, UWLs have less inherent design and operational challenges than MSW landfills primarily due to the nature of the MSW waste which is typically non-homogenous, comprised of all components of a typical municipal waste stream including organics (i.e., putrescible, deleterious

fractions). Those organic fractions (which can be significant depending on the makeup of the MSW stream, and in particular the role of pre-sorting via transfer stations, material recovery facilities, curbside recycling and green waste management programs which may be in place in those waste sheds) degrade over time and produce gas, and cause potential excessive differential settlements and a number of potentially challenging operational issues including larger volumes of leachate (due to the open graded nature of the MSW waste stream), litter and fugitive/windblown waste, odor, and attract vectors. Utility waste, in contrast to MSW, is a generally consistent/homogenous soil-like/granular benign and inorganic material which can be placed and compacted as an engineered fill thereby reducing settlement potentials and providing a stable base for placement of subsequent layers of the same in the landfill cell. Furthermore, the ash from the Labadie facility is derived from burning Powder River Basin coal, and it possesses cementitious properties. Those inherent properties allow the ash, when moisture conditioned and compacted in place, to exhibit cementitious behavior (i.e., the compacted ash sets up like concrete in the UWL cells). Therefore, any concerns about or negative comparisons between UWL and MSW landfills are unfounded.

Q34. Several witnesses at the local public hearings raised the concern that the design of the proposed UWL was insufficient in the event of an earthquake. For example, Ann Schwetye testified at the June 25, 2013 local public hearing that an earthquake could cause coal ash waste to be released into the environment due to liquefaction. Do you have an opinion as to the sufficiency of the UWL design to protect the environment during an earthquake?

A. Yes.

Q35. What is that opinion?

A. As discussed in my response to Questions 20 to 22, where there was a potential for liquefaction in strata, liquefaction analysis was conducted in accordance with the appropriate technical guidance. Based on the results of these liquefaction analyses, it is my opinion that sufficient factors of

safety exist against liquefaction. Furthermore, the calculated horizontal deformations (a typical parameter used to assess seismic loading and resulting impacts) are within the specified limit of acceptable horizontal deformation listed in the MDNR sanitary landfill regulations. It is important to note that the MDNR sanitary landfill regulations were followed in this instance because the MDNR regulations for UWL's do not specify a maximum allowable horizontal deformation which is an appropriate application of those standards.

As discussed in my answer to Q33, the compacted ash from the Labadie plant has inherent cementitious properties and therefore has a lower inherent vulnerability to seismic loading and liquefaction. In addition, the "dead load" of the UWL (i.e., the standing load from the CCR compacted within the UWL) provides additional consolidating forces which compact and naturally increase the strength of the alluvial deposits below the UWL over time, which again decreases the UWLs vulnerability to seismic loading and liquefaction over the life of the UWL.

Q36. Ms. Schwetye testified at the June 25, 2013 public hearing that a UWL should not be sited in a floodplain or floodway. Other witnesses echoed this sentiment. Do you agree that the Labadie site is an inappropriate site for the proposed UWL?

A. No. As stated earlier (see answer to Q17), I do not agree. The site characterizations and analyses of the site support the determination that the Labadie site is an appropriate location for the proposed UWL. As I have explained previously, a UWL is permit-able and can be constructed and operated in a floodplain/floodway as long as the proper siting conditions are met. In summary, the Labadie UWL design meets MDNR floodplain siting criteria (allowing the UWL to be sited where planned) because the UWL design will not restrict the flow of at the 100-year flood and does not reduce the storage capacity of the floodplain as evidenced by the "no rise" determination. In addition, the wastes to be disposed of in the UWL will be protected from washout/erosion during the 100-year and 500-year floods via a continuous perimeter berm which is protected with non-erodible fabric-formed concrete mats.

Q37. Given your prior answer, I assume that you do not share the concern raised at the local public hearings that questioned the ability of the UWL design to protect the environment in the event of a flood from the Missouri River.

A. I do not. As I explain in more detail above, the UWL is permitted with a flood berm crest at elevation 488 ft to protect against the 500-year flood event (elevation 487.6 ft). By way of reference, the 100-year flood elevation is approximately 484 ft and the 1993 peak flood peak elevation was recorded at 483.6 ft. Relative to typical design of man-made structures, the proposed landfill is more than adequately and safely designed to be protective based on a design standard of the 500-year flood event.

Q38. Several witnesses expressed concerns about what they characterized as a thin plastic liner and their concern that it could not be counted on to protect water quality. Aside from the fact that liner meets both state requirements and the proposed federal CCR Rule requirements, do you share their concerns?

A. Not at all.

Q39. Why not?

A. Their concerns are not based on science/engineering or the current practice and accepted use of geosynthetics in the solid waste disposal industry. Tests on the long term-performance of geomembrane (or plastic) liners have been conducted over the past three decades by the Solid Waste industry, USEPA and reputable professional industry organizations like the Geosynthetics Research Institute (GRI). A significant portion of that testing examined the interaction of waste leachate type and geomembrane type (HPDE, LLDPE, PVC, etc.), and the effects of liner installation/Construction Quality Assurance (CQA) factors. With HDPE (which is what is specified for the Labadie UWL liner system and is the most common geomembrane liner type for use in solid waste landfill liners and covers), degradation of liner associated with compatibility is caused by chemical, radioactive and oxidation degradation processes.

Degradation is marked by a change in the geomembrane liner physical properties; chemical degradation of HDPE is generally a concern for leachates containing high concentrations of organic solvents or highly reactive chemicals. Specifically, HDPE compatibility and performance in the presence of inorganics (e.g., trace metals which may leach from CCRs) is extremely good. HDPE liners in landfills (and other applications) have been shown to fail or "made to fail" due to primarily installation/construction issues like inadequate welding and attachment to structures (and related welding/seeming issues) and imposed stresses and mechanical damage during installation/construction. (Note: "failure" of a liner is defined by the solid waste industry as "developing a leak" in the geomembrane.) MDNR specifies a rigorous construction quality assurance and quality control program associated with the installation and certification of geomembrane liners which is planned for the UWL construction and post-construction certification per the CPA.

Understanding the long-term performance track record of geomembranes in landfill applications and the lack of incompatibility issues and planned rigorous CQA program associated with the Labadie UWL construction, it is my opinion that the purpose and function of the liner system (i.e., to contain CCR leachate) will perform as expected/designed and in so doing, will protect the environment.

Q40. Don't all liners eventually fail?

A. No, see the answer to Q39 above for the discussion regarding HDPE/geomembrane performance.

Q41. Related to concerns about the siting of the UWL at the Labadie plant and the liner design is the concern raised by several witnesses that the UWL would be located in an area where water is actually present on the surface. In your opinion, is the design of the UWL at the Labadie site sufficient to prevent contamination of the soil, surface water and groundwater with coal ash waste?

A. Yes.

Q42. Why?

A. This concern has been addressed both directly and indirectly in multiple questions of this testimony. However, the following answer is provided for clarification. First, in regard to the witnesses' concern associated with the "presence of water at the surface of the site," it is true that water will be present at the ground surface surrounding the UWL during flooding events. To address that concern, the site is protected by a perimeter flood berm with adequate erosion protection and adequate design height to protect against the 500-year flood. In addition, the UWL is underlain by a composite liner. The combination of the protective berm and the composite liner effectively prevents an interaction with the CCRs in the UWL and either surface water and or surface soils at the UWL site. Regarding the connection of water present at the surface and the potential for contamination of groundwater, the liner system for the UWL has been designed as a composite liner system which meets the proposed Federal CCR Rule requirements and exceeds the MDNR UWL liner requirements. The UWL has been designed with a 2-foot vertical separation between the bottom of the liner and the natural groundwater table with the exception of localized sumps; localized sumps will experience intermittent interaction with the natural groundwater but, as demonstrated in Appendix Z of the CPA, will not be adversely impacted by intermittent groundwater contact. Groundwater is protected with the UWL design and, therefore, will not be contaminated by CCRs in the UWL

Q43. Ms. Celeste Nohl-Smith raised questions about whether the landfill design is adequate and cited the fact that the MDNR had to come back and instruct Ameren Missouri to do more. Do you agree that there were or are valid concerns with the design?

A. No.

Q44. Why not?

A. It is typical and ordinary practice for the regulating agency (regardless of whether that agency is state or federal) to provide comments and requests for clarification in reply to permits of the size and complexity of the Labadie UWL CPA. It would be extremely unusual for a regulatory agency that reviews detailed design, engineering and construction plans for approval to simply reply that every last detail is exactly what they wanted or expected. In fact, MDNR's response to Ameren Missouri's extensive CPA was very typical for landfill permitting processes due to the very large volumes of technical information conveyed with the CPA documents (which Mr. Giesmann has included with his testimony) and similar permitting documents. That it is typical is demonstrated by my observations of similar processes in all the states in which I practice and have permitted similar UWL and other solid waste disposal facilities. After a careful review of the comments response letter dated August 5, 2013, and prepared by Reitz & Jens, Inc. and Gredell Engineering Resources, Inc., on behalf of Ameren, in my opinion there were no substantive technical changes to the design or permit package as a whole. Instead, MDNR requested and Ameren Missouri provided clarifications and drawing notes and minor revisions to select calculation appendices. In addition, MDNR did request more narrative and explanation regarding select appendices; for example, MDNR requested information on assumptions for seismic and static stability analysis and requested that Ameren Missouri provide mitigation steps for a particular seismic event. Ameren Missouri responded to all of the MDNR inquires/comments in a thorough and technically sound manner, and it would be my expectation that MDNR will find that all of the responses fully address their inquiries/comments. Although Ms. Celeste Nohl-Smith raised a very general concern that the landfill design was adequate based on the MDNR's typical and routine response letter, I see no basis to conclude that this very general concern has any basis. Simply put, the comments and response record for this type of permit submittal is normal and customary for any state or Federal agency to complete a check for compliance and completeness of design.

IV. MDNR'S PERMITTING PROCESS

Q45. As you noted earlier, several witnesses at the local public hearings were very critical of the site and even of the design of a UWL or its use to dispose of CCRs. You've extensively discussed the MDNR requirements for a UWL. Is the MDNR permitting process itself significant in relation to their criticisms or concerns?

A. Yes it is. The MDNR permitting and review/approval process is a very detailed and thorough process overseen by MDNR senior technical staff who understand geology, hydrology and engineering and who are thus able to make sound and reasonable judgments about projects like the proposed UWL.

Q46. Please discuss the MDNR process in more detail.

A. The process is a multi-year process including Preliminary Site Investigation (PSI), Detailed Site Investigation (DSI), Construction Permitting (CP) and Operating Permitting (OP). The PSI and DSI are defined by rigorous siting and site assessment/investigation requirements and an overall design and engineering analysis process that is governed by extensive rules. The Missouri Solid Waste Disposal Permitting Timeline is published by the MDNR. Several opportunities, including reviews of the PSI and DSI, are given to the MDNR to provide feedback regarding the proposed site of a UWL before the CPA is prepared. That process is unique to Missouri and provides a greater level of oversight than I typically see. Before the DSI report is submitted for approval, the public is also invited to submit comments.

Following approval of the PSI and DSI, preparation of the CPA begins. Two opportunities are given for engineering reviews before the CPA is approved. Additionally, opportunities are presented for public review and comment before final approval of the CPA.

The MDNR Permitting Process is a step-wise process, and steps cannot be skipped. The entire process, including PSI, DSI, and CPA, construction and final issuance of an OP, takes on average 4-5

years to complete according to MDNR's own guidance. It is my understanding that Ameren Missouri has been engaged in the MDNR process for nearly six years to-date, with the expectation that by the time construction is complete, the entire process will have spanned six to seven years. I have included the MDNR solid waste permitting timeline as Schedule SFP-S4.

Q47. Do you have experience with other state permitting programs?

A. Yes, including many states surrounding Missouri. Those states where I have completed similar and recent permitting efforts include Illinois, Ohio, Indiana, Pennsylvania and Kansas. Each of those states has their own unique process but similar permitting elements involving siting, site characterization, supporting permitting, engineering analysis and design, construction level design and certification.

Q48. In your opinion, how does MDNR's permitting processes and oversight compare?

A. As stated earlier, each state has a process to complete similar permitting, and some states, including Missouri, have a more defined and schedule-driven process. The rigorous permitting process, including the multiple steps of PSI, DSI and then CPA in Missouri, in addition to the multiple public venues for comment and input, puts Missouri's process near the top of the list for thoroughness and documentation requirements. In particular, Missouri's use of the PSI process provides a thoughtful initial look by the MDNR to rule out sites early on that are just not appropriate for siting a solid waste landfill, including a UWL. In my experience, few other states offer that level of initial review and feedback in a formal process that allows the applicant and the state to make early decisions regarding the appropriateness of potential landfill sites. I would characterize that step as prudent and helpful as it preemptively guides an applicant away from unsuitable sites before significant resources are expended on both sides of the permitting process (in terms of both the applicants' and the agencies' staff and time), so that both parties can focus on productive efforts to sensibly manage the state of Missouri's solid waste.

Q49. Local public hearing witness Adrian Hutton alleged that there were "last minute engineering recommendations" added to the design, the suggestion being that the design was not developed in a prudent, careful and appropriate manner. Do you have any opinion about Mr. Hutton's allegations in this regard?

A. Yes

Q50. What is that opinion?

A. As discussed earlier, his allegation is simply incorrect. Ameren Missouri's participation in the MDNR permitting process, including the multiple steps of siting, site investigation, engineering analysis and design and public review, is integral to a thoroughly vetted and sound permit. MDNR's comments and review of the CPA did not result in any significant technical issues that required attention, but rather sought mere clarifications and additional information (not "last minute engineering recommendations") to satisfy MDNR's permitting process.

Q51. Mr. Hutton asserted that "no engineering studies or various project alternatives that weigh risk, cost, and other important criteria was reviewed or presented at any public forum." Do you agree with his assertion?

A. No.

Q52. Why not?

A. Mr. Hutton's testimony indicates he did not review the DSI, and it is unclear if he has reviewed the many volumes of testing, analyses and information reflected in the totality of Ameren Missouri's submissions to MDNR. The volume and time associated with siting evaluation, site investigation and assessment, engineering testing, analysis and design, interaction between Ameren's Missouri's consultants and the MDNR and other ancillary agencies accumulates into tens of thousands of hours of manpower and technical work to develop and produce the PSI, DSI and CPA. I am very familiar with that

process (from similar work that I have been responsible on other UWLs and solid waste disposal facilities) which takes place over the course of years. MDNR's permitting process is thorough, prescriptive and well thought out and it is a mischaracterization to describe the efforts to date on this or similar projects as resulting in insufficient understanding of engineering facts related to the UWL. The consulting firms in charge of the Labadie UWL permitting efforts have had independent reviews as well as reviews from the MDNR's panel of experts which has led to, in my opinion, a very well understood project design based on thorough vetting of engineering facts. In terms of examination of alternatives related to cost, etc., it is my understanding that Ameren Missouri witness Craig J. Giesmann will address those issues.

Q53. Please summarize your conclusions.

A. Based on my review of the project documents, the siting criteria and design elements set forth by the MDNR UWL regulations have been met and therefore the location and design of the Labadie Power Plant UWL are appropriate. Furthermore, proper design and engineering standards of practice have been followed in the development of the Labadie UWL permit package and are in accordance with the intents and purposes of the proposed Federal CCR Rule. My review confirms that all design elements of the UWL meet or exceed MDNR UWL minimum design and the proposed Federal CCR requirements, and they are in accordance with good engineering practices, including best engineering practices for a UWL of this type.

Q54. Does this conclude your surrebuttal testimony?

A. Yes, it does.

STEVEN F. PUTRICH, P.E.

Principal – Geo-Environmental Projects
CCRs and Industrial Waste Management

Over 25 years of experience Geo-Environmental projects, specializing in CCRs & Industrial Waste Management

Education
North Carolina State University, 1983,
M.S.C.E. – Geotechnical Engineering

Cleveland State University,
Fenn College of Engineering , 1981
B.S.C.E. – Civil Engineering

Professional Registration
Professional Engineer:
OH, PA, IL, IN, MO (in process)

Professional Societies

American Coal Ash Association (ACAA)
USWAG (Affiliate Member)

Mr. Putrich has over 25 years of professional consulting experience. As a geo-environmental engineer, he integrates his background in geotechnical engineering and environmental science on a wide variety of industrial waste management and environmental assessment and remediation projects.

He is a senior consultant and manager for coal-fired power plant projects located throughout the United States and specializes in the management and beneficial reuse of Coal Combustion Residuals/Products (CCR/CCPs). He provides that expertise and senior project management support for projects involving both wet and dry ash disposal systems and the management and reuse of CCR/CCPs including FGD, Gypsum and IGCC byproducts. His projects include the siting, design and construction of waste management facilities including wet stacks, wet ponds and dry stack landfills constructed on greenfield sites and over former industrialized sites. He has served as manager and principal for projects involving RCRA Corrective Action and RCRA Clean Closure, CERCLA Sites, and a variety of multi-media environmental compliance projects which include the use of risk-based and IT-enabled compliance management solutions.

Mr. Putrich is a regular presenter and expert for industry and research groups, and manages an integrated consulting team comprised of engineers and scientists working to develop smart solutions for private-sector clients.

Relevant Project Experience

CCR & Industrial Waste Management Projects

Midwest Utility CCR Landfill. Mr. Putrich served as Project Principal for the development of this project to secure long-term CCR drystack airspace for the subject utility. The unique aspects of this project include the planned construction of a new CCR landfill on top of an existing 110-acre sluiced ash pond contiguous to the plant The project included an initial feasibility study to assess long-term disposal needs and suitability of the landfill concept. The project detailed site investigation including hydrogeologic and geotechnical site characterization, is underway, with ongoing work in the development site pond and landfill groundwater monitoring programs and landfill design development in support of permitting under state solid waste rules. Under state rules, the typical landfill permitting process requires approximately 5 years from conception through construction. This landfill is scheduled to be opened to receive waste in 2017.

Dynegy Baldwin Station, Baldwin, IL. As project Principal, Mr. Putrich's team was commissioned to evaluate the cause and potential cost-effective remedies for an ongoing TSS exceedance (both volatile (i.e., algae) and non-volatile TSS) for 600 acres of onsite bottom ash ponds. The work included dynamic flow modeling to understand and propose options to increase available

"wet storage" capacity in the ponds, along with real-time water quality sampling throughout the pond system to assess existing conditions and support a root-cause analysis associated with the TSS exceedances. Remedies implemented based on our recommendations included construction of an upstream supplemental 30-acre wet pond to better manage TSS, plus pond dredging and a rebuild of internal and outlet structures to facilitate pond flow control.

Dynegy Hennepin Station, Hennepin, Illinois. Mr. Putrich served as project principal for the comprehensive project which included closure in-place of a former 35-acre fly ash pond, construction of a new wet pond (to manage landfill contact water and leachate), and construction of Phase 1 of a new CCR landfill (built on the former ash pond). Our project work elements included initial project feasibility study, pond and landfill siting, design and permitting, leachate/stormwater pond construction and phase 1 construction for the new 20-year capacity CCR landfill. Related work activities included pursuit of DNR impoundment permits and teaming with other consultants supporting the project. Studies included alternate cap/liner systems, geotechnical and hydrogeological investigations, characterization testing of ash/FGD materials, and project financials including capital and cash flow analysis.

Prairie States Power (PSGC), Marissa, Illinois. Prairie State Energy Campus is a 1,600 megawatt base load, coal-fired electric power station and coal mine near Marissa, Illinois southeast of St. Louis, Missouri. As project Principal, Mr. Putrich was responsible for senior strategy and coordination for the development of a new 100M cyd (30-year) drystack landfill project. His team was responsible for the project feasibility study and 30% design for the new landfill site (including the assessment of all media permits and proposed landfill). Sub-project tasks included landfill airspace and stack height studies (in particular assessment of seismic impacts as the site was located in a high impact seismic zone), hydro-geologic/geotechnical and ecological site evaluations, stormwater and leachate/contact water management considerations, development of permitting timelines, and construction capital and cash flow projections.

Dayton Power & Light J.M. Stuart Generating Station, Aberdeen, Ohio. DP&L commissioned Mr. Putrich's team to site, design, and permitting a new 18 million ton "valley fill" landfill providing 35-years of CCR airspace capacity. Project work included (in the role of either leading or supporting) the pursuit of all multi-media permits and performance of all related engineering and environmental science work in support of the new landfill. Supporting studies included rigorous hydrogeologic and geotechnical characterization of complex geology associated with large topographic relief (valley fill landfill geometry). Additional studies included alternate cap/liner systems (including assessment of potential impacts of the 2010 proposed Federal CCR regulations); significant ecological mitigation permitting efforts and supplemental characterization testing of ash/FGD materials produced by several DP&L plants who's CCRs could be shipped to the new landfill. .

ArcelorMittal Burns Harbor Plant, Burns Harbor, Indiana. As project principal, Mr. Putrich's team was responsible for permit & construction level design and construction oversight for a new restricted waste Type I landfill for

approximately 13 million tons of industrial process wastes providing and extended life of airspace capacity for this client. The service package for this project included construction level design drawings, details, specifications, quantities, cost estimates, and bidding. Managed construction oversight/quality assurance, and construction completion reporting for 40 acre Phase 1 and 5 acre leachate/stormwater pond. Elaborate stabilization studies were required to find cost-effective ways to stabilize and place as an engineered fill the plant steel-making sludges which had been accumulated on-site. The landfill project provided a cost-effective remedy to an IDEM Consent Decree which saved will save the client over $150M in disposal costs over the next 30 years.

Confidential Integrated Steel Manufacturer, IN. This project is in its early development stages, and is scheduled to provide the client with cost-effective on-site disposal for the next 25 to 30 years. With an annual production of 250,000 tons per year of integrated steel wastes, the financial drivers for this project are significant. Progress to date under Mr. Putrich's direction includes complete hydrogeologic and geotechnical investigations, cell design, permit preparation (90% complete), non-contact and contact/leachate water management and treatment, demolition and site preparation, public involvement, and integration with existing RCRA site-wide investigations at the property. Projected timeline to receipt of new waste in the Phase 1 cell is 3 years with a total overall landfill capacity of 10M tons.

ArcelorMittal, Cleveland, Ohio. Serving as Project Director/Principal, Mr. Putrich's team assisted ArcelorMittal in the design and construction oversight of an industrial waste landfill expansion with a construction costs of over $15M. The services package for this project included geotechnical and hydrogeologic investigations, engineering analysis and design, permitting, public involvement/public meetings, bidding and construction management/oversight. The on-site expansion remedy was capitalized by the client as an alternative to off-site disposal that was proposed to address the plant's dwindling on-site airspace capacity. Projected cost savings for the client were projected at $100M over the life of the permitted expansion.

CCB Disposal Management Studies, Progress Energy, Raleigh, NC - Mr. Putrich was the project manager for the evaluation of Progress Energy's CCB management/disposal strategy and 20 year plan. Studies include high-level strategic review of current and future planned disposal practices to define costs-effective and environmentally protective approach to both and wet and dry ash management. He was one of the team that worked closely with an internal technical management team from within Progress Energy to collectively evaluate long-term, cost-effective solutions. This particular study focused on nine coal-fired power plants located in North Carolina, South Carolina and Florida for which long-term CCB management plans for each power station.

CCB Disposal Management/Permitting Support, AES Hawaii, Inc. - Mr. Putrich was the project manager to support permit updates and evaluation of disposal/beneficial reuse options for AES's Honolulu coal-fired station. The plant is rated at approximately 200 MWs derived from circulating fluidized bed (CFB) boilers burning sub-bituminous coal and pet-coke. Project work included development of permitting strategies for off-site dedicated disposal and

beneficial reuse along with human health risk assessment and ash stabilization studies. Alternatives analysis was performed to help guide AES into making an informed decision on long-term management and reuse of the plant's ash production. Interface with local cement/ready-mix manufacturer's and solid waste management companies on the island of Awahu were conducted in 4Q 2005 in support of this study.

Siting, Design and Permitting FGD/Gypsum Landfills, Aberdeen, Ohio, Confidential Client - Mr. Putrich served as Principal manager for the siting, design and permitting for new ash/FGD/gypsum disposal facilities at two of these clients' coal-fired power stations. The planned facilities include landfills or large wet ponds to contain FGD byproducts sized for a 40-year design life. Airspace for the disposal facility will be in excess of 12,000,000 cubic yards.

CCB 3.0M ton Beneficial Reuse, Mixed Use Industrial Development, Progress Energy, Raleigh, NC - Mr. Putrich's team evaluated site-specific disposal alternatives and development of the implementation plan for the preferred alternative; an on-site industrial development for one of Progress's North Carolina coal-fired power plants. The work included an intensive siting and permitting evaluation including multi-media environmental, transportation, and site-civil/development related issues. A conceptual site development design was prepared which included reuse of over 3.0M tons of on-site ponded ash and potential future development revenues from lease or sale of the to-be developed property.

FGD/Gypsum Landfill Siting, Design and Permitting, Lakeland Power, City of Lakeland Florida - Project involved the siting, design and permitting of a new 3,000,000 cubic yard FGD/Gypsum landfill. Project including pursuing permits and performance of all related engineering and environmental science work in support of the new landfill. Studies included conveyance studies, alternate cap and liner studies, geotech/hydrogeo investigations, characterization testing of ash/FGD/gypsum mixtures from the current and planned future upgrades of the plants air scrubber systems.

FGD Gypsum/Ash Landfill Design and Permitting, Confidential Ohio Cooperative Energy Client — Provided expertise in support of permitting of a new 600 MW coal-fired power station in Ohio. Permitting activities focused on garnering a permit to install (PTI) for supporting waste disposal facilities and 100+ acre onsite Class 2 Residual Waste landfill. The facility will produce over 500,000 of CCB including FGD and combined fly/bottom ash. Services performed included comprehensive permitting and engineering design services in pursuit of the new landfill permit.

Design and Permitting New FGD Landfill, Confidential Midwest Power Company - Design and permitting services for a scrubber byproduct (FGD/Gypsum) disposal facility to accommodate a 20-year design life. Design aspects of the project include an evaluation of both dry and wet disposal management alternatives (e.g. traditional landfilling, wet stacking, and slurry ponding). As Project Principal, Mr. Putrich's responsibilities include senior peer review, strategic evaluations, and agency interactions. Project scope includes extensive siting study (over an 8 mile radius), project site investigations (e.g.

geotechnical, hydrogeological, and wetlands delineation), and design and permitting with all applicable Agencies (including USCOE, ODNR, OEPA, Ohio Department of Historical Preservation and others). In addition, assistance is provided to the Client with financial, schedule, and other overall project related tasks.

Ash FGD/Gypsum Management/Disposal Studies, Duke Energy, Charlotte, NC - This project evaluated Duke Energy's CCB management program, with a particular emphasis on alternative landfill liner and cap systems that will adequately control and treat CCB leachates in an environmentally protective manner. A subcontracted UNC Charlotte professor, Dr. John Daniels, assisted in various laboratory column test studies and related demonstration testing to evaluate affectivity of various alternative strategies. Study includes ash and FGD/gypsum byproducts from current and proposed scrubber systems at the client's power stations.

Industrial Waste Landfill Design, Permitting and Construction, ISG /Mittal Steel USA Corporation, Cleveland, Ohio - Permitting an industrial waste (Ohio Rule 29) landfill expansion located in Northeast Ohio. The new landfill will be permitted as a residual waste monofill providing 20-years of airspace capacity for this client. The services package for this project is comprehensive and includes geotechnical and hydrogeologic investigations, engineering analysis and design, permitting, public involvement, bidding and construction management/oversight.

Ash Management/Disposal Services, JM Stuart Station MW Plant, Dayton Power & Light, Aberdeen, Ohio — Ongoing design, permitting and construction oversight for new ash handling and disposal facilities at the Dayton Power & Light JM Stuart Station's 2,400 MW plant. New facilities include the recently completed 30-acre wet ash handling pond and a 120-acre dry landfill (under construction). The new ash landfill will provide over 10,000,000 cubic yards of air space capacity and feature innovative design features including construction (of the new landfill) atop recently filled ash ponds. The design will present a lower potential for environmental impacts in lieu of off-site disposal and cost savings in excess of over $10,000,000 due to negotiated requirements with regulating agencies and innovative ash management decisions. Project activities include working directly with OEPA, ODNR and USCOE along with local regulating agencies.

Coal Handling & CCB Permitting, Pennsylvania Power & Light, Pennsylvania - Two-coal handling and CCB management permitting projects were completed with Pennsylvania Power & Light (PP&L). The first project involved engineering and testing support services for design and construction of a 10-mile roadway project and golf course beneficially reusing over 1,000,000 tons of PP&L's fly ash for PP&L's Brunner Island plant. The second project addressed the development of on-site remedial management systems for utility wastes. Fly ash and supplemental amenders were evaluated to encapsulate or fixate pyritic coal mill rejects and serve as liners to control and neutralize leachate from coal stockpiles. The neutralization technology has already been applied in one of PP&L's plants and has saved an estimated $1,500,000 in capital costs associated with replacement of coal pile liners. A critical aspect of

the project was the successful negotiations with the PADEP to acquire necessary permits to allow the use of this new technology.

Feasibility Study & Ash Handling System, Confidential Utility Co., Southern Ohio - Completed a confidential feasibility study and ash handling system impacts evaluation for a Southern Ohio utility considering conversion to western coal fuel sources. Cradle to grave assessments were made including coal handling through air quality and dry ash handling, and all CCB related permits upgrades and modifications associated with the conversion. Although the client would benefit from reduction in SOX discharges with low-sulfur western coals, costs for retrofits and material handling changes mandated a decision by the utility to stay with their present eastern coal fuel source.

Testing & Engineering Program Development, LTV Steel, Taconite Harbor, Minnesota - Completed the development of a testing and engineering program to facilitate the marketing of a high quality Class C fly ash for LTV Steel's power plant located at Taconite Harbor, Minnesota. Also performed a landfill tipping fee analysis that was used to save the client estimated costs of over $2,000,000 for construction, long term operation and closure of a dedicated ash disposal facility. Project also included stabilization of a Minnesota logging road using Class C from LTV's power plant. Project involved working with state regulators to negotiate a favorable outcome for the use of the coal-derived byproducts in the state of Minnesota.

Disposal Options & Due Diligence Evaluation, Dayton Power & Light, Southern Ohio - Completed a disposal options and permitting due diligence evaluation for Dayton Power & Light (DP&L), located in southern Ohio. Disposal options included expansion of on-site wet and dry landfills, off site deep mine injection and development of new off site dedicated disposal facilities. As a result of the study, DP&L was positioned to beneficially reuse over 350,000 cy of fly and bottom ash in on-site construction and avoided more costly permit-intensive off site option that were previously considered.

Benefits, Options & Analysis Evaluation, Confidential Client, Tamuin, Mexico - Completed a confidential evaluation of potential environmental benefits, reuse options and permits analysis for combustion byproducts derived from petcoke-fired fluidized bed boilers. The new power plant using the petroleum coke-fired boilers is to be located in Tamuin, Mexico. Potential reuse scenarios include cement kiln feed stock, roadway stabilization, structural fills, and agricultural uses. The analysis included development of landfill specifications and conceptual design of the disposal and supporting facilities.

Publications and Papers

"Coal Ash Wet Impoundment Closure Methods", Putrich, S., EUCI CCR Management Webinar Series, Denver, CO, August, 2013.

"Ash Pond Decommissioning Strategies: Case Study for a Midwest Coal-Fired Utility", Putrich, S. and McDaniels, R.T., 2013 World of Coal Ash Conference, Lexington, Kentucky, April 2013.

"New Developments in CCR Pond Closure Technologies: The End of an Era & New Paradigm", Putrich, S., 2013 World of Coal Ash Conference, Lexington, Kentucky, April 2013.

"Decommissioning of Coal Fired Power Plants, Coal Pile and CCR Impoundments/Ponds", Putrich, S.F., Salyer, J.R., and Nairn, J., 2012 Ash Consortium, Knoxville, Tennessee, September, 2012.

"How Utilities are Coping – CCR Management Strategies While Waiting on Federal Regulations", Putrich, S., Midwest Energy Association (MEA), Minneapolis, Minnesota, September, 2012.

"CCR Management – Landfills Constructed on Former Ash Ponds", Putrich, S., Electric Power Research Institute, Ashville, North Carolina, July, 2011.

"CCR Management Technology Advances; Innovative Ash Pond Closures", Putrich, S., 63rdAnnual Association of Rural Electric Generating Cooperatives (AREGC), Minneapolis, Minnesota, June, 2012.

"Ash Management Technology Advances Landfills Constructed on Ash Ponds", Putrich, S., EUCI, Nashville, Tennessee, February, 2012.

"1.5 million ton CCB Golf Course Reuse Success", Putrich, S.F. and Schuler, Peggy, 15th Annual Technical Symposium, 2003 American Coal Ash Association Proceeding, Saint Petersburg, Florida, January 2003.

"Recovering Lost Air Space - An Innovative Approach to Coal Combustion Byproduct Management", Putrich, S.F. and Clarke, Peter, 14th Annual Technical Symposium, 2001 American Coal Ash Association Proceeding, San Antonio, Texas, January 2001.

"Using Stabilized Fly Ash To Neutralize Acidic Coal Pile Leachate", Putrich, S.F., Spear, A., 13th Annual Technical Symposium, 1999 American Coal Ash Association Proceeding, Orlando, Florida, January 1999.

"Bioremediation of PCBs - A Bench Scale Evaluation & Remediation Overview", Putrich, S.F. and McKim, M.J. – 14th Annual Conference on Contaminated Soils, University of Massachusetts at Amherst, October, 1998.

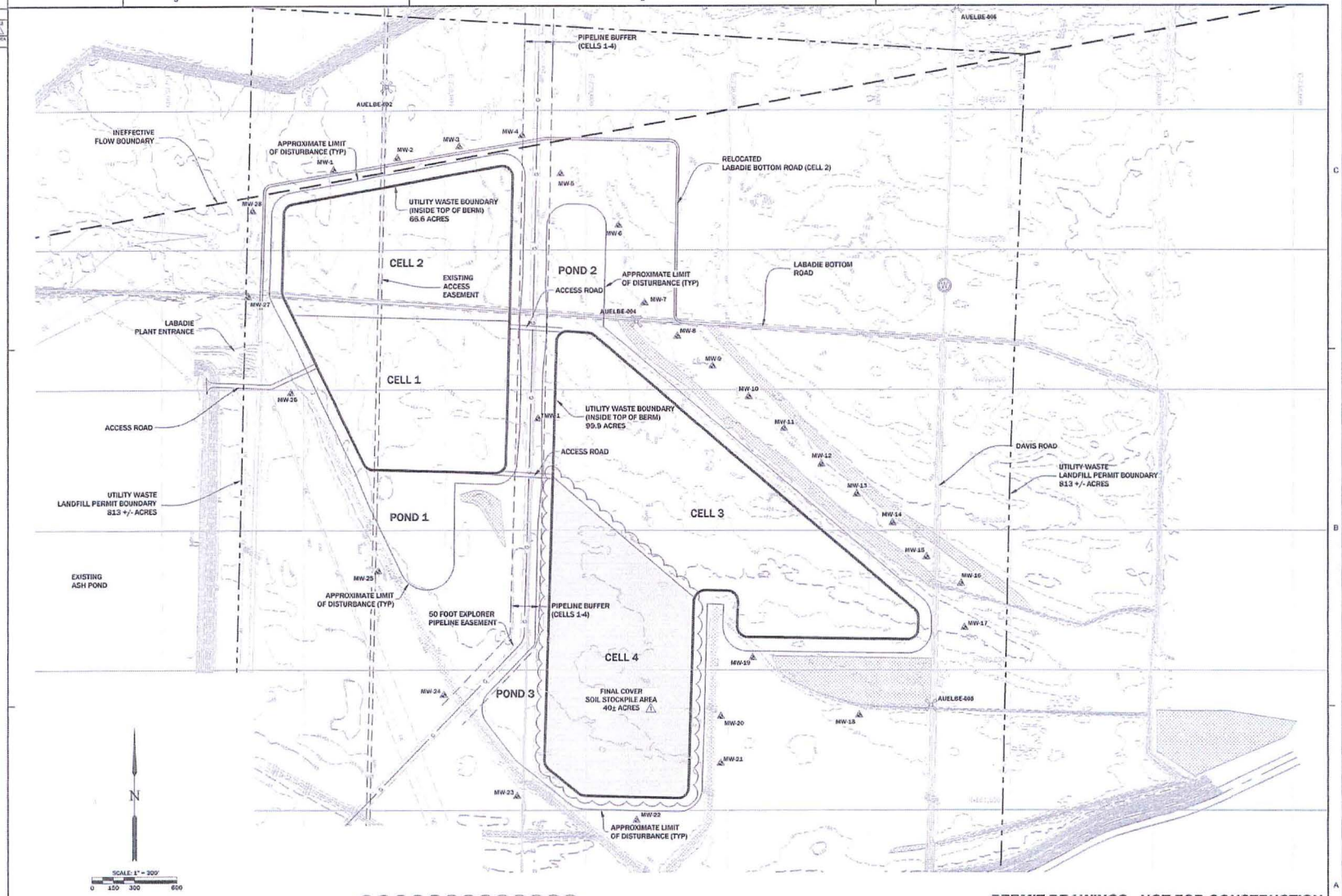
"Stabilization of Logging Roads with Class C Fly Ash", Putrich, S.F. and Heyerly, J., 12th Annual Technical Symposium, 1997 American Coal Ash Association Proceeding, Orlando, Florida, January, 1997.

"Regional Solid Waste Management Systems - A Case Study in Central Illinois", Putrich, S.F. and Sobers, D., Technical Proceedings, Wastecon 1996 34th International Solid Waste Exposition, Portland, Oregon, September, 1996.

"Drained Strength Parameters from Direct Shear Tests for Slope Stability Analysis in Over Consolidated Fissured Residual Soils", Borden, R.H. and

Putrich, S.F., Transportation Research Board Publication, 1985.

"Analysis of Slope Failure in Residual Soils: A Case Study", Putrich, S.F., Borden, R.H. Lambe, PC Transportation Research Board Publication, 1985.



SURVEY MONUMENTS

MONUMENT ID	NORTHING	EASTING	ELEVATION
AUELBE-001	990484.82	726569.81	467.19
AUELBE-002	996166.50	727588.30	470.70
AUELBE-003	989921.39	728508.32	467.59
AUELBE-004	994487.78	729353.29	467.02
AUELBE-005	991746.97	731438.29	462.78
AUELBE-006	996729.00	731621.70	467.67

Missouri State Plane Coordinate System Datum:
Horizontal Datum NAD 1983,
Vertical Datum NAVD 1988

NOTES:
1. NO FILL MAY BE PLACED NORTH OF THE INEFFECTIVE FLOW BOUNDARY.
2. ALL LAND DISTURBANCE ACTIVITIES WILL HAVE A 25' MINIMUM SETBACK FROM JURISDICTIONAL WETLANDS WITH A STORMWATER BMP INSTALLED BETWEEN THE DISTURBANCE AND THE WETLAND DURING CONSTRUCTION. SEE DETAIL 4 ON SHEET 19.

SETBACK NOTES:
1. WETLAND – MIN. 25'
2. INEFFECTIVE FLOW AREA – MIN. 0'
3. PIPELINE SETBACK – VARIES

NOTES TO THE CONTRACTOR:

UNDERGROUND FACILITIES, STRUCTURES, AND UTILITIES HAVE BEEN PLOTTED FROM AVAILABLE SURVEYS AND RECORDS AND THEREFORE, THEIR LOCATIONS MUST BE CONSIDERED APPROXIMATE ONLY. THERE MAY BE OTHERS, THE EXISTENCE OF WHICH IS AT PRESENT NOT KNOWN. VERIFICATION OF THE LOCATIONS OF UNDERGROUND UTILITIES, SHOWN OR NOT SHOWN, WILL BE THE RESPONSIBILITY OF THE CONSTRUCTION CONTRACTOR.

THE CONTRACTOR SHALL MAKE SUITABLE AND TIMELY REQUESTS TO ALL UTILITY COMPANIES, PIPELINE OWNERS, AND UTILITIES PARTIES AFFECTED TO HAVE ALL NECESSARY ADJUSTMENTS OF PUBLIC OR PRIVATE UTILITIES, PIPELINES, OR OTHER APPURTENANCES WITHIN, OR ADJACENT TO THE LIMITS OF CONSTRUCTION, AS SOON AS PRACTICAL OR POSSIBLE.

MISSOURI ONE CALL SYSTEM (DIGRITE) 1-800-344-7483

CALL BEFORE YOU DIG - DRILL - BLAST 1 (800) 344-7483 (TOLL FREE)
MISSOURI ONE CALL SYSTEM, INC.

PERMIT DRAWINGS - NOT FOR CONSTRUCTION

THE ENGINEER WHOSE SIGNATURE AND PERSONAL SEAL APPEAR HEREON ASSUMES RESPONSIBILITY ONLY FOR WHAT APPEARS ON THIS PAGE AND DISCLAIMS PURSUANT TO SECTION 327.411 RSMO ANY RESPONSIBILITY FOR ALL OTHER PLANS, SPECIFICATIONS, ESTIMATES, REPORTS OR OTHER DOCUMENTS OR INSTRUMENTS NOT SEALED BY THE UNDERSIGNED ENGINEER RELATING TO OR INTENDED TO BE USED FOR ANY PART OR PARTS OF THE PROJECT TO WHICH THIS PAGE REFERS.

Reitz & Jens, Inc. ENGINEERING CONSULTANTS
GREDELL Engineering Resources, Inc. ENVIRONMENTAL ENGINEERING

PREPARED FOR Ameren

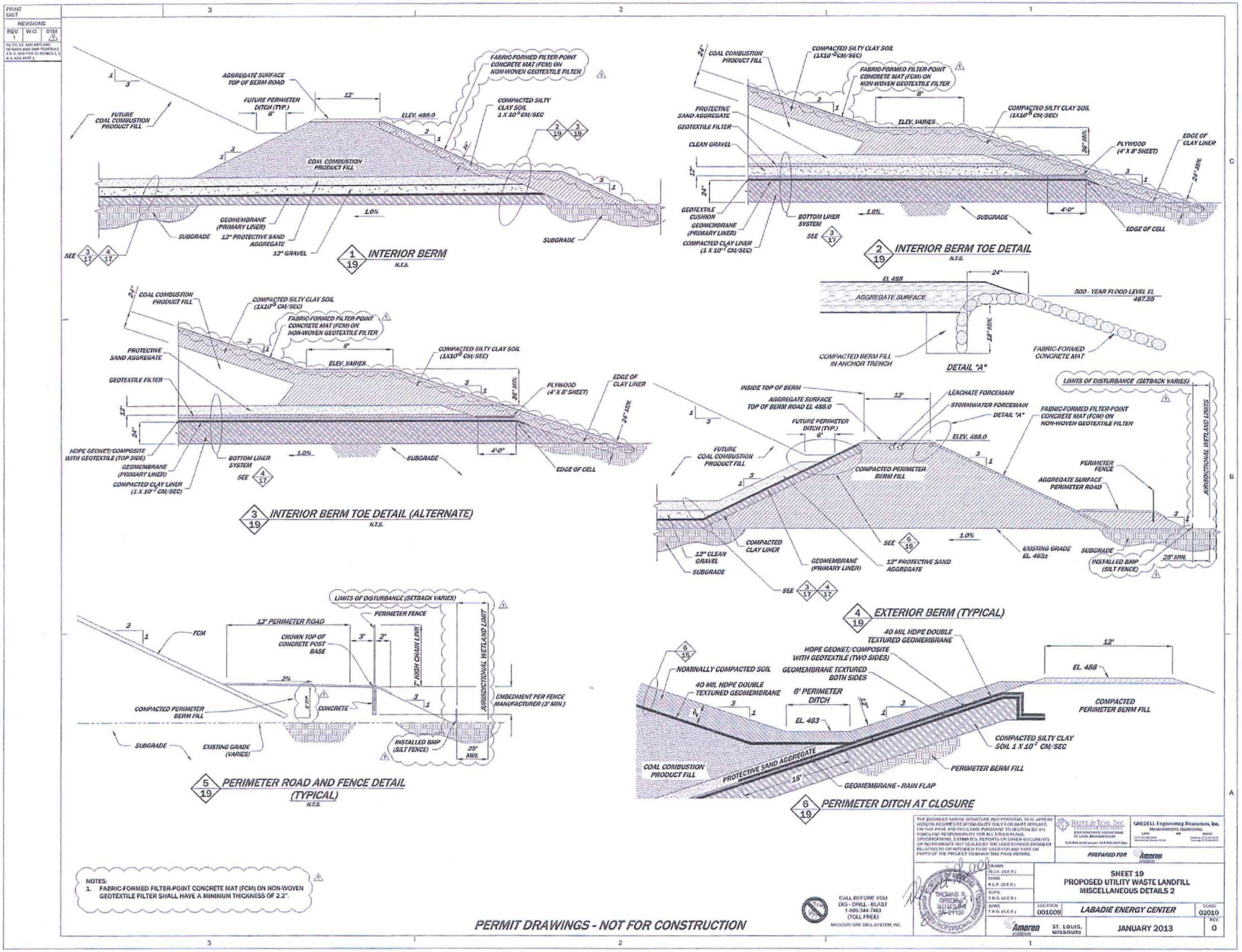
DRAWN: W.J.A. (GER)
CHKD: B.L.R. (GER)
SUPV: T.R.G. (GER)
APPD: T.R.G. (GER)

SHEET 3
PROPOSED UTILITY WASTE LANDFILL
PROJECT OVERVIEW

LOCATION: 001009 | LABADIE ENERGY CENTER | CLASS: 02010

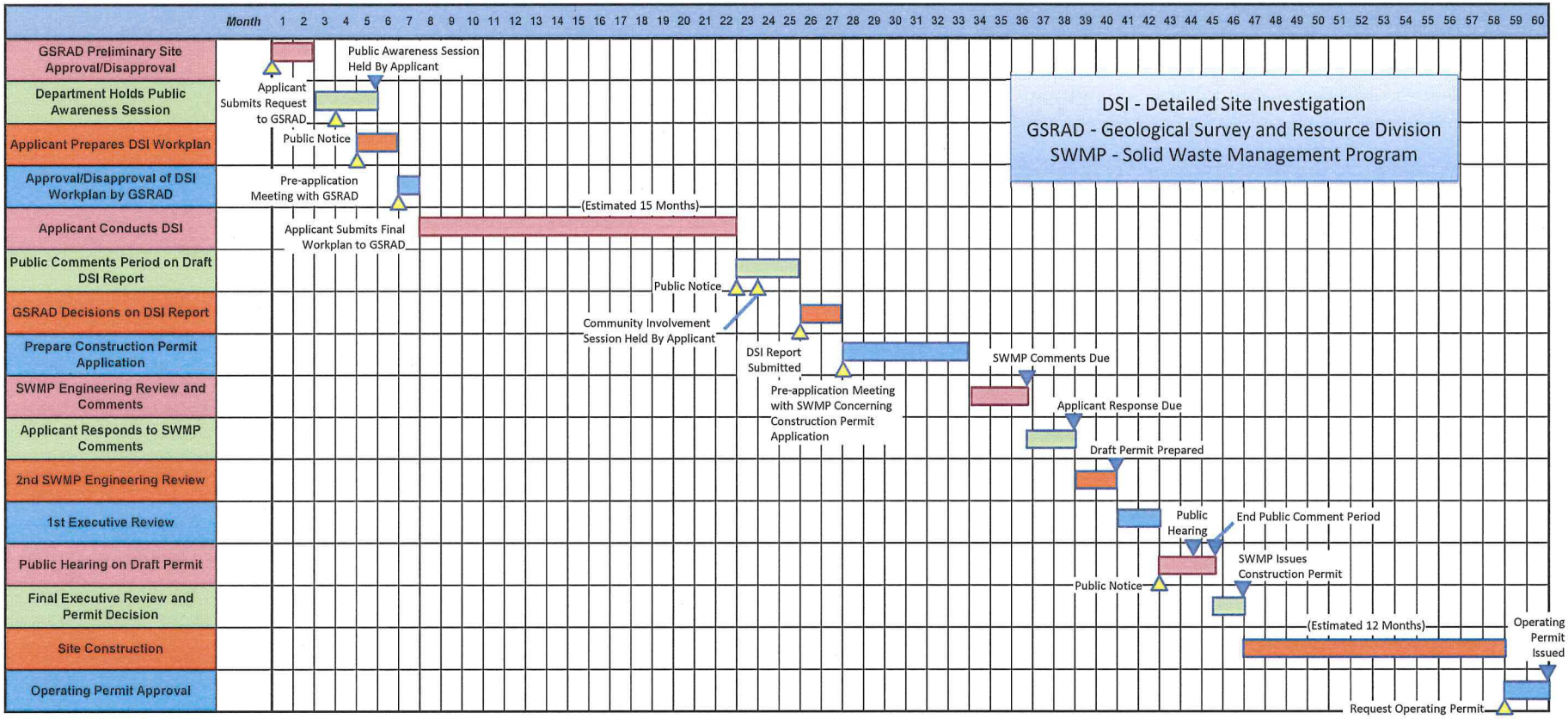
Ameren ST. LOUIS, MISSOURI | JANUARY 2013 | REV: 0

SCHEDULE SFP-S2



SCHEDULE SFP-S3

Missouri Solid Waste Disposal Permitting Timeline



**Timeline is identical to Missouri DNR "Solid Waste Disposal Area Permitting Timeline": http://dnr.mo.gov/env/swmp/images/Timeline.jpg. Retrieved June 24, 2011.*

SCHEDULE SFP-S4