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Witness: Craig J. Giesmann
Sponsoring Party: Union Electric Company
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MISSOURI PUBLIC SERVICE COMMISSION

Case No. EA-2012-0281

SURREBUTTAL TESTIMONY

OF

CRAIG J. GIESMANN

ON

BEHALF OF

UNION ELECTRIC COMPANY
d/b/a AMEREN MISSOURI

St. Louis, Missouri
September, 2013

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SURREBUTTAL TESTIMONY

OF

CRAIG J. GIESMANN

CASE NO. EA-2012-0281

I. INTRODUCTION

Q. Please state your name and business address.

A. Craig J. Giesmann, Union Electric Company Power Operation Services, 3700 South Lindbergh, Sunset Hills, Missouri 63127.

Q. What is your position with Union Electric Company d/b/a Ameren Missouri ("Ameren Missouri" or "Company")?

A. I am the Managing Supervisor of Hydro Engineering.

Q. Are you the same Craig J. Giesmann who filed direct testimony in this case on April 26, 2013?

A. Yes.

Q. What is the purpose of your surrebuttal testimony in this proceeding?

A. The purpose of my surrebuttal testimony is to address issues, questions and concerns raised during the Local Public Hearings held in Union, Missouri, on June 25, 2013, and in Washington, Missouri, on July 10, 2013, with regard to Ameren Missouri's planned new Utility Waste Landfill (UWL) at the Labadie Energy Center. The main questions raised at the public hearings that I will address are summarized as follows:

- Site suitability for the UWL;
- Siting of the UWL in a floodplain;
- Groundwater monitoring;

- Alternatives studied; and
- NPDES[1] Permit status.

Q. Are you sponsoring any schedules?

A. Yes, I am sponsoring the following schedules:

1. Aerial photo of site
2. Photo – Road Part Way Up the Bluffs to the South – Looking Northeast
3. Photo – Road Part Way Up the Bluffs to the South – Looking Northeast – UWL Superimposed
4. Photo – St. Albans Looking North
5. Photo – St. Albans Looking North – UWL Superimposed
6. Photo – From Powerhouse looking Southeast
7. Missouri Department of Natural Resources (MDNR) Regulations for UWLs
8. Preliminary Site Investigation
9. MDNR Preliminary Site Investigation Approval
10. Detailed Site Investigation
11. MDNR Detailed Site Investigation Approval
12. CDG Engineers Flood Study
13. Photo – Solid Coal Ash Cylinder
14. Franklin County Engineer's Flood Permit Approval Letter
15. Groundwater Monitoring Well Plan
16. Golder Associates Deep Well Installation Report
17. Golder Associates Deep Well Results

[1] "NPDES" stands for National Pollutant Discharge Elimination System, which is a permit required by the federal Clean Water Act, which in Missouri is administered by the Missouri Department of Natural Resources (MDNR).

18. MDNR Letter Re: Compliance with Water Law

19. Reitz & Jens Cost Study

19A. Reitz & Jens Cost Study Appendices (HC)

20. Spreadsheet Summarizing Off-Site Costs (HC)

21. PowerPoint Presentation Re: Costs/Options (HC)

22. Revenue Requirement Study Materials (HC)

23. Construction Permit Application to MDNR

Q. Are the opinions you express herein given within a reasonable degree of engineering certainty?

A. Yes, they are.

Q. To the extent you rely upon documents in forming your opinions, are those documents of the type reasonably relied upon by experts in engineering and the related disciplines with which civil engineers like yourself have expertise?

A. Yes, they are.

II. SUITABILITY OF SITE

Q. Several local public hearing witnesses questioned whether this site, which is next to the existing energy center and in the river bottoms next to the Missouri River, is a suitable site for the proposed UWL. First, can you provide some perspective on the location of the site vis-à-vis the existing plant's footprint and vis-à-vis neighbors in the area?

A. The proposed UWL site is situated right next to the existing Labadie Energy Center, just to the southeast of it. An aerial photo that shows the existing energy center and the

proposed UWL is attached[2] hereto as Schedule CJG-S1. The land is currently being utilized as agricultural fields. The closest homes are located atop the bluff towards the South of the site. Attached as Schedule CJG-S2 is a photo taken from a road leading from the fields part of the way up the bluffs to the south. The photo is looking to the northeast toward the UWL site with the energy center itself in the distance. The next photo (Schedule CJG-S3) is the same photo, but we have superimposed a drawing of the proposed UWL as built. Comparing the two photos, you can see less of the bottom of the powerhouse building at the plant in the second, which is partially obscured by the berm around the UWL. The next two photos (Schedules CJG-S4 and CJG-S5) are taken from Legacy Point in St. Albans (a community further south down the river), with the first photo showing the proposed UWL site without the UWL and the second one showing the view with the UWL superimposed on the site. I have also attached one more photo taken from the top of the powerhouse building looking at the site to the southeast (Schedule CJG-S6). You can see the existing fly ash pond in the foreground. The first cell of the UWL will be built just to the right of the tree you see on the left side of this photo.

Q. Regarding the criticisms made by local public hearing witnesses, do you have an opinion regarding the appropriateness of this site for a UWL?

A. Yes.

Q. What is your opinion?

A. The site is appropriate for locating the proposed UWL as demonstrated by the extensive geological and hydrological studies completed for the site, which have resulted in MDNR's approval of the site for construction and operation of a UWL subject to issuance of a Construction Permit from the Missouri Department of Natural Resources (MDNR). Franklin

[2] Given the number of schedules and the file sizes of many of them, when I refer to them as "attached," I mean that they are also being filed with my testimony.

County, Missouri, has also determined that it is appropriate to develop the UWL at this location, as evidenced by its issuance of a Floodplain Development Permit. Not only have these regulatory bodies with jurisdiction over the site and the proposed UWL determined the appropriateness of the site, but other experts agree that the site is appropriate from an engineering and hydrogeological perspective, as reflected in the surrebuttal testimonies of Ameren Missouri expert witnesses Tyler E. Gass (a hydrogeologist) and Steven F. Putrich, P.E. (a civil engineer and expert in the design and construction of facilities of this type).

Q. You indicated that the MDNR has approved the site. Please explain MDNR's site approval process.

A. MDNR regulations require anyone desiring to construct a solid waste landfill like the UWL to obtain geologic and hydrologic approval of the site. To obtain this approval, the applicant must submit detailed geologic and hydrologic analyses and documentation. MDNR's regulations governing this process are attached hereto as Schedule CJG-S7. As indicated in the regulations, the applicant must first submit a Preliminary Site Investigation (PSI) and if the PSI is approved, must then submit an even more comprehensive Detailed Site Investigation (DSI). In compliance with the MDNR's regulations, Ameren Missouri submitted a PSI request to the MDNR in December of 2008 seeking MDNR's preliminary approval of the site for the proposed UWL. The PSI, submitted pursuant to 10 CSR 80-2.015(1)(A), is attached hereto as Schedule CJG-S8. In February of 2009, the MDNR, through its Division of Geology and Land Survey, approved the PSI. MDNR's PSI approval is attached hereto as Schedule CJG-S9. Ameren Missouri then proceeded to prepare and submit the DSI which was submitted to MDNR in May 2009 and which is attached hereto as Schedule CJG-S10. The MDNR's Division of Geology and Land Survey completed its review of the DSI and approved it in April 2011. A copy of MDNR's approval is attached hereto as Schedule CJG-S11.

As can be readily observed from the exhaustive analyses and site characterization included in the PSI and the DSI included as Schedules to my testimony, engineering, geological and hydrological studies have been completed, submitted to MDNR, and reviewed by MDNR. Based on these submittals, MDNR determined that the site is suitable for the construction and operation of the proposed UWL. MDNR made this determination because the geological and hydrological conditions at the site make it appropriate for construction and operation of the UWL. Mr. Putrich also addresses the MDNR regulations and the MDNR permitting process in detail in his surrebuttal testimony.

Q. At least one local public hearing witness claimed that "obviously" the UWL could not be built in the floodplain. Do you agree?

A. No, I do not.

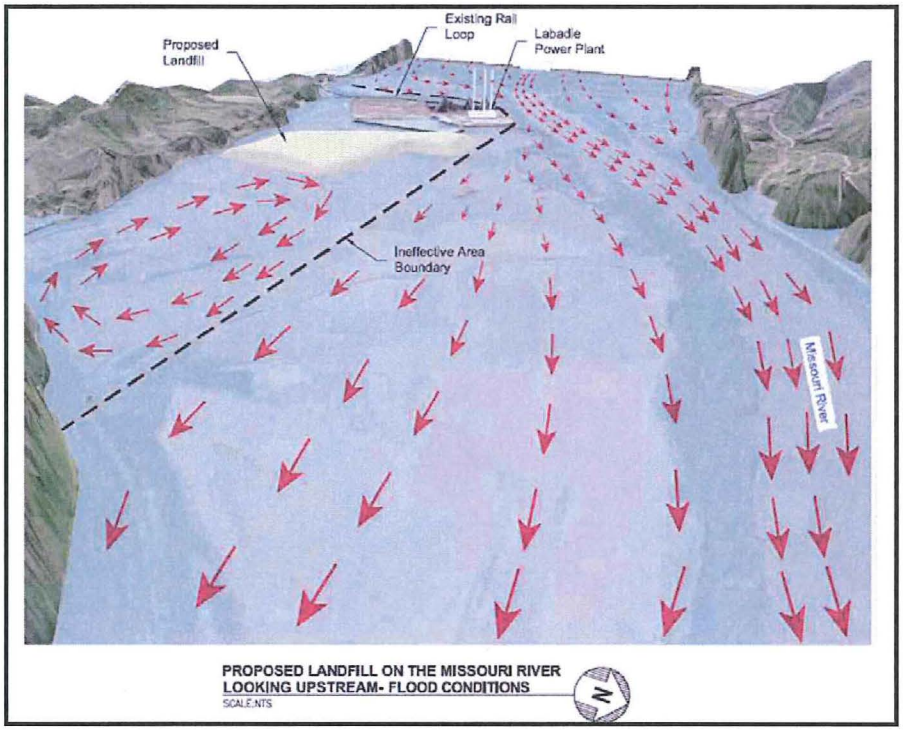
Q. Why not?

A. MDNR's regulations (as well as Franklin County's zoning ordinances) specifically contemplate that a UWL can be built in a floodplain. Consequently, it is "obvious" that a UWL can be built in a floodplain, just as it is obvious that power plants can be built (and have been built) in floodplains. In order to satisfy MDNR regulations for construction of a UWL within the floodplain, Ameren Missouri had to demonstrate that the UWL will not restrict the flow of a 100-year flood, reduce the temporary water storage capacity of the floodplain (i.e., will meet "no-rise" parameters), or result in a washout of waste so as to pose a hazard to public health or the environment. In order to satisfy the MDNR requirements in this regard, a comprehensive flood study was commissioned by Ameren Missouri and performed by CDG Engineers. CDG Engineers' study is attached hereto as Schedule CJG-S12. The results of this study demonstrated that construction of the proposed UWL will have no effect upon the 100-year base flood elevation of the Missouri River and meets all "no-rise" requirements, which means that

construction of the UWL meets the first two criteria. And as Mr. Putrich discusses in his surrebuttal testimony, the design of the proposed UWL will also ensure that there will be no washout that would pose a risk to the public. I think it is important to remember that coal combustion products (CCPs) disposed of in a UWL are nothing like wet-sluiced ash disposed of in ash ponds (like those that exist at Labadie today) or like municipal waste landfills that hold all kinds of waste. To the contrary, the CCPs disposed of in a UWL are stored as what is essentially concrete. Attached hereto as Schedule CJG-S13 is a picture of a cylinder created from CCPs of the type produced by Labadie. It is, for all practical purposes, a block of concrete. As you would imagine, this block of concrete would not "wash out"—even in the unlikely event that it was impacted by water.

Q. Please explain why the proposed UWL meets these "no-flow restriction" and "no-rise" requirements.

A. During flood conditions, the proposed UWL site will be situated in a "hydraulic shadow" created by the Labadie Energy Center, which is a much larger structure that blocks the high velocity main flow of the Missouri River during a flood. As the CDG Engineers' report explains, the UWL will sit inside an "ineffective area" where water flow during flooding conditions is unaffected. In essence, the water around the proposed UWL during flooding conditions will be "slack water" (i.e., an area of low velocity water). The following image created by CDG Engineers illustrates the slack water in the area where the UWL is planned.



Consequently, the proposed UWL meets the "no-flow restriction" and "no-rise" requirements in the regulations.

Q. Some witnesses made the point that because the facility would be located in the "floodway," it should not be built there. Please respond.

A. The current Federal Emergency Management Agency (FEMA) regulations recognize that certain structures have been and will need to be built within the regulatory floodway of the floodplain. Examples include bridges, water and wastewater treatment plants, power plants, docks, etc. As a result of this, FEMA has established the "no-rise" evaluation. This evaluation, performed by professional engineers, is comprised of a series of calculations that must prove that the construction of a new facility within the floodway will not cause a rise in the base flood elevation. I have performed these calculations for past projects, and CDG Engineers performed these calculations for this project. As noted earlier in this testimony, these

calculations demonstrated that there was indeed a "no-rise" situation, which resulted in Franklin County issuing a Floodplain Development Permit for the proposed UWL.

Q. You earlier mentioned that Franklin County, Missouri, had also approved construction of the UWL in the floodplain. Please explain.

A. Franklin County requires a Floodplain Development Permit in order to locate structures within the floodplain. CDG Engineers' floodplain analysis was submitted to the Franklin County Floodplain Manager as part of Franklin County's floodplain development permit approval process. The Floodplain Manager in turn requested an outside engineering firm review it. The CDG Engineers' report's conclusions were confirmed by the outside engineering firm and by Franklin County, and a floodplain development permit was issued by Franklin County in March 2013. A copy of the approval letter from the outside consulting firm (Andrews Engineering) is attached as Schedule CJG-S14.

III. GROUNDWATER MONITORING

Q. A principal theme of the testimony of several witnesses at the local public hearings related to their concerns about whether the UWL could adversely affect groundwater from which they draw drinking water. How has Ameren Missouri addressed those concerns?

A. First, we have chosen a site the geology and hydrology of which is suitable for the facility, as the MDNR has already concluded and as I discuss above. Second, we have addressed these concerns by designing a facility that has multiple layers of redundancy in order to protect groundwater in the area. These layers of redundancy include a liner system consisting both of an engineered clay liner 24" in depth, a geomembrane, a leachate collection and disposal system, and a groundwater monitoring system. Third, as discussed in detail in the surrebuttal testimony of Ameren Missouri witness Lisa J.N. Bradley, Ph.D, the basis for the testimony about drinking

water concerns reflects a complete misunderstanding of and gross misstatement of the risks associated with coal ash. As both Dr. Bradley and Mr. Gass testify, despite forty-plus years of operation of coal ash impoundments (ponds) at the energy center (one of which is unlined), we have affirmative evidence that the claim that contaminants from ash disposal from the plant will migrate south and east and contaminate drinking water supplies of the neighbors on the bluffs is simply not true. There is therefore no reason whatsoever to believe that there is any material risk of contamination from the proposed UWL, which will store the ash in a solid state, which has an engineered liner system and leachate collection system, and which is ringed by a network of 28 groundwater monitoring wells to serve as even more protection in the very unlikely event the liner or leachate collection systems were to fail.

Q. Since concerns related to possible contamination of groundwater were raised by several local public hearing witnesses, please describe the groundwater monitoring system you referred to in more detail.

A. As I noted, Ameren Missouri has already installed an extensive groundwater monitoring network that rings the UWL site. Schedule CJG-S1 depicts the groundwater monitoring wells that ring the proposed UWL site. The monitoring system is described in a January 2013 Groundwater Monitoring Plan (GMP) submitted to the MDNR, a copy of which is attached hereto as Schedule CJG-S15. Subsequent approval from MDNR was obtained, and the detection monitoring system was installed. Data collection needed to establish the baseline groundwater conditions is currently in progress, with samples being taken on a quarterly basis. Upon completion of this background sampling and prior to MDNR issuing an operating permit for the UWL, the results will be transmitted to MDNR for review.

Q. Do you have an opinion regarding whether these steps are protective of the groundwater in the area?

A. Yes, my opinion is that the combination of all of the measures I discuss above will protect the groundwater in the area. The liner system and the leachate collection system will prevent leachate from the UWL from reaching the groundwater in the first place. Moreover, even if those systems somehow failed, which is unlikely, the extensive groundwater monitoring network would allow early detection of any contaminants well before there would be any material threat to drinking water supplies.

Q. Is there other evidence that groundwater supplies for drinking water have not been impacted by the Labadie Energy Center's operations over the past 40-plus years?

A. Yes. Dr. Bradley also addresses this in her surrebuttal testimony. In addition to the two rounds of sampling data from the monitoring wells that ring the proposed UWL site, we also have results from deep water wells drilled into bedrock (the depth from which drinking water would be taken) near the boundary of the Company's property toward the residents who live on the bluffs. The results from sampling from those wells demonstrate the absence of any impact from coal ash management at the energy center which, for the reasons discussed earlier, is not surprising. Copies of the installation report and sampling results reports from these installations are attached hereto as Schedules CJG-S16 and CJG-S17, respectively.

Q. Did any local public hearing witnesses actually claim that their drinking water had been or was in actual danger of being impacted by constituents in CCPs from the Labadie Energy Center?

A. No, they did not. Despite the expression of such concerns and their knowledge that the plant has been operating on the site and disposing of CCPs there for decades, only two witnesses indicated that they had had their wells tested: Mr. John George (approximately seven years ago) and Mr. Adrian Hutton (approximately 15 years ago). According to their testimony, the test results in both instances indicated no contamination.

Q. Many of the local public hearing witnesses were members of Intervenor Labadie Environmental Organization (LEO), a group that opposes the UWL. Did Ameren Missouri request permission (at its expense) to sample drinking water wells in the vicinity, including those of LEO members?

A. Yes, we did. LEO filed a lawsuit in Franklin County Circuit Court challenging the adoption of the zoning amendment that authorizes UWLs in Franklin County. Ameren Missouri filed a motion asking for permission to sample drinking water wells in the area. LEO opposed the motion, and for reasons that I understand to have been procedural, the motion was denied.

Q. Why did Ameren Missouri seek to sample these wells?

A. Because we are confident that the Labadie Energy Center has not and will not impact the groundwater that is used for drinking water by those who own property east and south of the proposed UWL site. While LEO may claim that such sampling in the context of the lawsuit was inappropriate, my point is that they should welcome such sampling. If they were right and it showed a problem, they would want to know that. If they are wrong, which the evidence indicates is the case, it should alleviate their concerns. However, it would also undermine their opposition to the UWL.

Q. Several local public hearing witnesses raised questions about the existing ash impoundments and suggested that Ameren Missouri is out of compliance with permitting requirements for those impoundments. Is that true?

A. No, it is not. Ameren Missouri has in place a valid and in-effect NPDES permit governing discharges from the existing ash ponds. The current permit remains in effect pending MDNR approval of a new permit. Ameren Missouri has timely applied for a new permit. The reason Ameren Missouri has not received a new permit to date is because of *MDNR's* decision to

delay issuing new NPDES permits until the federal Environmental Protection Agency (EPA) finalizes pending federal regulation changes relating to thermal standards under Section 316b of the federal Clean Water Act. MDNR has indicated its belief that pending its renewal process, Ameren Missouri is in full compliance with the Missouri Clean Water Law (and thus its NPDES permit). A copy of MDNR's letter to LEO/Sierra Club attorney Maxine Lipeles confirming that this is true is attached hereto as Schedule CJG-S18.

Q. An issue was also raised during the public hearings noting that Ameren Missouri's current ash impoundments at its Labadie Plant have been leaking and potentially contaminating the groundwater – is this true?

A. During regular dam safety inspections of Labadie Plant's unlined bottom ash pond, two seeps at the toe of the berm around the pond were identified. Ameren Missouri met with MDNR officials at the site to review the issue. There were no immediate concerns from MDNR. However, out of an abundance of caution, Ameren Missouri installed a grouted slurry wall that has prevented these seeps. Of course, the proposed UWL, including its liner system and leachate collection system that will replace both the existing unlined bottom ash pond and the fly ash pond, is a significant improvement in ash management in accordance with best practices and, as Mr. Putrich discusses, USEPA's own proposed regulations for the disposal of ash.

IV. ALTERNATIVES TO PROPOSED UWL

Q. An issue was raised during the local public hearings regarding whether alternatives to constructing the UWL at the proposed site had been examined. The Commission also directed the parties to address the issue of whether there had been studies of alternative sites and to provide any such information. Were alternative sites studied?

A. Yes, they were. In fact, disposing of the CCPs from the Labadie Energy Center was studied for 22 other sites in the region before the decision was made to construct the UWL adjacent to the current Labadie footprint.

Q. Please explain.

A. While in the planning stages of the Labadie UWL project, Ameren Missouri engaged the services of a consultant – Reitz & Jens Consulting Engineers (R&J) – to review alternatives for CCP disposal at the Labadie Energy Center (as well as for Ameren Missouri's other coal-fired power plants). The 2003 study, attached hereto as Schedules CJG-S19 and CJG-19A (HC) (entitled *AmerenUE Utility Waste Landfill Feasibility Study*), provides details of the expected costs at the time of constructing and operating a UWL. Additionally, Ameren Missouri engineers reviewed existing third-party licensed landfills for potential disposal of CCPs. The attached spreadsheet (Schedule CJG-S20HC) was developed and provided approximate costs at the time for CCP disposal and transportation at various third party landfills. Documentation was also received from Fred Weber, Inc. (a local contractor who owned and operated several landfills at that time) that further demonstrated the approximate disposal costs for Labadie CCPs. I am also attaching as Schedule CJG-S21 HC, a PowerPoint presentation and site review matrix that provide details of sites that were reviewed as part of the study.

Q. What did the study show?

A. The R&J study demonstrated that estimated disposal costs for an Ameren Missouri-owned and operated UWL adjacent to the Labadie Energy Center would be far less than disposing of the CCPs at another site. The estimated costs of disposal at the proposed UWL were at the time between $5.40 - $8.00 per ton, as compared to disposal costs elsewhere of between $15.87 - $43.82 per ton. It should be noted that Ameren Missouri did not review CCP disposal options for the Labadie Energy Center alone, but rather, took a holistic review of the

disposal needs of all of the Ameren Missouri coal-fired power plants. As such and as demonstrated in the attached materials, various options were reviewed for each plant, and options were also reviewed for a regional landfill that would service multiple plants. Ultimately, Ameren Missouri was precluded from creating a regional landfill at Labadie by the Franklin County Land Use Ordinance which was recently passed and pertains to UWLs. Under various scenarios that were studied, however, it was clear that an on-site facility for disposal of Labadie's CCPs was the lowest cost option by a large margin.

Q. What is the principal driver of the higher costs of disposal elsewhere?

A. Simply put – transportation costs. We estimate that initially we would have to run approximately 3,500 truckloads per month (approximately 42,000 per year or about 160 per working day) from the plant to an off-site disposal site. We presently would expect that in a few years, we will have to install flue gas desulfurization units (scrubbers) at Labadie, which would increase the required number of trucks to more than 53,000 per year, or more than 200 trucks per working day.[3] These trucks would be utilizing the Labadie community, Franklin County and other roadways and would add an extremely significant amount of traffic on a two-lane blacktop road running through Labadie and wherever else the trucks would have to traverse to reach their destination. The currently proposed UWL avoids this additional issue.

Q. Although the reduced risks from such traffic is one reason supporting selection of the area adjacent to the energy center for a UWL, wasn't Ameren Missouri more concerned with the cost than it was the environmental appropriateness of the site?

A. While Ameren Missouri is always concerned with providing safe and reliable electrical power to its customers at the lowest reasonable cost, if the proposed site did not meet

[3] Over an eight hour working day, these figures equate to 20 to 25 trucks *per hour* every single working day of the year for approximately 25 years.

the requirements set out by MDNR which are designed to protect both human health and the environment, cost considerations would not matter—the site would not have been approved, regardless of the cost savings to the ratepayers. However, in this case, we were able to design and construct an appropriate facility on a suitable site and, at the same time, dispose of the CCPs at the lowest reasonable cost to ratepayers.

Q. You made reference to the Reitz & Jens cost study, and have provided information about it with this testimony. Have any other studies been done?

A. Because the Commission specifically requested information on studies, I decided to conduct further study to confirm what the data from the Reitz & Jens study had already indicated. This additional study looked at two things that we had not previously examined formally or in detail. First, because the transportation and third-party landfill costs from the Reitz & Jens study were from 2003,[4] we updated those costs to current figures to account for changes (essentially inflation) since that time. Second, now that we have specifics on construction costs, timing of future cells, closure costs, etc. (that we did not have at an earlier time when the UWL had not been fully designed), we have conducted a revenue requirement study to compare the impact on rates of the proposed UWL versus a UWL elsewhere versus transporting the CCPs off-site for disposal.

Q. What do these studies show?

A. Updating the off-site transportation and disposal costs reveals that those costs have increased substantially (in general, transportation costs have roughly doubled since 2003, and third-party disposal fees have increased by at least that much). The increased costs are driven by a number of factors – in particular, inflation associated with the costs of trucking

[4] The dollars are from 2003 because we have been engaged in planning to address the fact that our current ash impoundments will reach capacity for some time and because the permitting process through MDNR is a thorough and lengthy one – typically five years or longer in length.

equipment, fuel, labor (truck drivers), etc. Moreover, when the original study was done, we assumed that if we did transport the CCPs off-site, we would do so in dump trucks. Franklin County's new land use ordinance prohibits this and requires that we use enclosed tanker trucks, which carry higher transportation costs, therefore, we will be unable to use dump trucks for a substantial majority of the ash. While the costs to build and operate the on-site UWL have also changed, the increase in those costs has been substantially out-paced by the increase in transportation/off-site disposal costs.

Also, when comparing the impact on rates, it can be readily seen that it is substantially less costly (by nearly $100 million or more) to dispose of the CCPs from Labadie on-site versus off-site. And this substantially lower cost is apart from the fact that any off-site disposal would require that we, and those using the roads from the plant to the disposal site, be exposed to the risks that the tens of thousands of trucks that would be needed per year would pose.

Q. Can you please explain how the revenue requirement analysis was done?

A. Yes. A revenue requirement for a capital improvement like the UWL consists of four components: the return (including income taxes thereon) on the asset, depreciation, property taxes and operating costs. We used the capital costs of the UWL – the initial cell and estimates for the future cells, applied the Company's Commission-approved return on rate base grossed up for income taxes to it, applied the Commission-approved depreciation rates for this kind of asset, and accounted for property taxes and operating and maintenance costs. We did this for the years 2016 to 2058, when all post-closure activities are expected to be complete. We then summed each year. We did the same analysis for an off-site UWL, but also accounted, as additional operating and maintenance costs, for the transportation costs to get the CCPs to the off-site facility. Finally, we ran a scenario of off-site disposal at a third-party landfill, which essentially consists of the annual costs of transportation and disposal fees. We compared the

sum of the annual revenue requirements for each scenario. As the table below shows, the on-site UWL results in ratepayers paying far less than the other options. As I noted earlier, the other options also pose risks and practical difficulties not present in the on-site UWL scenario.

SCENARIO	SCENARIO DESCRIPTION	COST OF SCENARIO
One	On-Site Labadie UWL	$256,878,736
Two	Transport CCPs to Off-Site UWL	$351,198,736
Three	Transport CCPs to Commercial Landfill	$516,402,000

Q. Can you please relate these updated figures to the figures from the earlier studies, when you had estimated that the cost per ton to dispose of the CCPs on-site was between $5.40 and $8.00 per ton versus between $15.87 and $43.82 per ton off-site, using the 2003 figures?

A. Yes. Nearly 16 million tons of CCPs must be disposed of over the life of the proposed UWL. The updated analysis using current information indicates that the cost per ton for disposal on-site will be more than $16 per ton. Corollary figures for the second scenario studied (disposal off-site in a new UWL not located at the plant) are more than $22 per ton and for the third scenario studied (disposal off-site at a third-party landfill), just under $33 per ton.

Q. In your opinion, are the updated studies conservative?

A. Yes, they are conservative in the sense that they very likely understate the true cost of scenarios two and three. Over the next 30 years, we can expect substantial increases in transportation costs, just as we saw those costs go up by a factor of about two in the last 10 years. Those transportation costs are a huge driver of the higher costs of scenarios two and three.

While we could see some increase in operating and maintenance costs for the UWL or items like property taxes, those kinds of items, based on history, just do not escalate at nearly the rate transportation does. Consequently, I would fully expect that the gap between scenario one and scenarios two and three will widen over time.

Q. When were these updated studies done?

A. They were completed this week. I would note that workpapers relating to them will be provided to the parties shortly after the filing of this testimony. I have also attached the study materials on Schedule CJG-S22.

Q. Aside from the higher costs and the risks of having thousands of trucks per year leaving the plant with coal ash, are there other concerns associated with having to truck the coal ash off-site?

A. Yes. The tanker trucks are pneumatic trucks. Wet fly ash cannot be transported in that kind of truck. The plant today does not have nearly enough dry ash handling and loading capacity to handle the volumes that will have to be disposed of, and we have not accounted for the capital and operating costs that would have to be incurred to design and install additional facilities to even make off-site disposal possible. Those costs will mean higher revenue requirements than we have depicted above for the scenarios for transporting the coal ash off-site. Moreover, we expect the disposal fees at third party landfills to be higher than we have assumed because those landfills do not have the equipment or configurations they would need to accept the dry coal ash from the thousands of trucks they would have to accept each year. They would have to invest in that equipment and configuration, and they would reflect that investment in the price we would have to pay.

Q. What about the suggestion made at the local public hearings that Ameren Missouri should just send the CCPs back to the mines in the rail cars used to deliver coal?

A. This is not a feasible option for several reasons. First, the mines, which are located more than a thousand miles away in Wyoming, are not equipped to receive or even permitted to receive CCPs. Second, even if they were (Ameren Missouri has no ability to force them to equip their mines to accept them or to obtain permits, even if doing so was possible), the transportation costs would be prohibitively high, as indicated by the R&J study and the updated data. Further, even those prices would (wrongly) assume that open hopper cars could be used for the transportation. In fact, the open hopper rail cars used to transport coal are not suitable for carrying the powder-like fly ash CCPs. Instead, tank type (enclosed) cars would need to be utilized, which substantially increases costs and disposal complexity. Additional costs would also be required to get the tank type cars from the railroads' mainline down the sidings to the plant and then back to the mainlines (i.e., Ameren Missouri contracts with a licensed locomotive operation firm to take the coal cars from the railroads and bring them into the plant; the same kind of arrangement and the associated costs would need to be entered into for the tank car trains). We would also have to invest in the additional dry ash handling and loading systems that I described earlier. In summary, sending the CCP back thousands of miles to Wyoming is neither practical nor cost-effective.

Q. Some local public hearing witnesses suggested that Ameren Missouri simply recycle all of the CCPs, and if Ameren Missouri did so, it would not need the UWL. Are they correct?

A. No, they are not. Ameren Missouri already aggressively recycles all of the CCPs that it can. Ash materials are typically utilized in the local construction market and compete against other available materials in the marketplace, including mined resources, other byproduct materials, and other ash production sources. Like many mined resources, it's difficult to transport ash materials any great distance and still have a competitive product in the marketplace.

Transportation is the single largest component in determining the ash customers' cost and, ultimately, demand for these materials.

Labadie produces two ash product materials – fly ash and bottom ash. Fly ash is the finely divided material which, when meeting all technical standards, has its highest market value when sold into the construction industry as a partial replacement for cement in concrete mixes. While not a necessary component, fly ash at a 20%-30% cement replacement rate improves the engineering performance characteristics of concrete mixes. Because fly ash is typically sold at a lower cost than cement, it can improve the profitability to the concrete producer. Bottom ash is a non-specification aggregate-like material which can be used in its raw form for winter traction control for public safety or as raw feed material for cement manufacturing. Bottom ash can also be screened to produce sized aggregate that can be in use in cement block production, paving aggregate and filler type applications. However, due to transportation costs, the limitation on nearby sites that need the ash, and overall supply/demand, there simply is not a market for nearly all of Labadie fly ash. In fact, fly ash production from Labadie alone exceeds the St. Louis area fly ash market demand by 200% to 300%. We are also unable to dispose of nearly all of the bottom ash we produce.

The bottom line is that even with the aggressive recycling program we have in place, we estimate that over the life of the UWL we will need to dispose of nearly 16 million tons of CCPs. We must have a UWL to properly dispose of these CCPs.

V. MDNR PERMITTING PROCESS

Q. Questions were raised at the local public hearings regarding the status of the permitting process at the MDNR. Can you please explain where that process stands?

A. As discussed in my direct testimony, a Construction Permit Application (CPA) was submitted to the MDNR in February 2013. MDNR provided their initial review comments

in May 2013. On August 7, 2013, Ameren responded to these comments (see Ameren Missouri's August 7, 2013 reply, in which Ameren Missouri sets out each MDNR comment and then provides its response). Ameren Missouri also updated the CPA at that time. Schedule CJG-S23, attached hereto, contains the updated CPA and the reply to MDNR. In summary, Ameren Missouri essentially agreed to any additional steps MDNR requested and agreed to provide any additional information requested by MDNR. MDNR is currently reviewing our responses, and we expect all outstanding issues to be resolved over the next 60-90 days. The issues raised were routine, and they should not impact our ability to satisfy all MDNR requirements needed to obtain the required Construction Permit, which we expect MDNR to issue in early February 2014. Approval of the CCN request in this case and issuance of MDNR's Construction Permit would allow construction to begin in the summer of 2014 and conclude in 2015. The UWL is planned to be operational in 2016. During operation of the UWL, Ameren Missouri will be required to perform regular and routine monitoring of the UWL. This will include regular groundwater monitoring, which will be submitted to and reviewed by MDNR. This process is on-going at Ameren Missouri's other UWL, located at its Sioux Plant. On an annual basis, Ameren Missouri is required to submit documentation to the MDNR of its financial ability to fund closure and post-closure care for the UWL.

VI. OTHER MISCELLANEOUS ISSUES

Q. At least one witness expressed concerns about whether the Labadie facility could accept waste from other locations. Can you comment on this concern?

A. Yes. Under the Franklin County Land Use Ordinance we are not allowed to accept CCPs from other locations. We have reflected this restriction in the CPA, and it will be a condition in the permit to be issued by MDNR.

Q. Local public hearing witnesses raised concerns about who would be responsible for cleanup costs that might arise in the future as the result of a disaster at the UWL; for example, Ms. Petra Haynes raised concerns at the June 25, 2013 local public hearing about potential cleanup costs should something go wrong with the landfill. In your opinion, are these concerns regarding the responsibility for cleanup costs valid?

A. No.

Q. Why not?

A. The plan for landfill construction shows that the UWL is to be constructed in phases, effectively one cell open at any one time of operation (this is a typical approach for UWLs and other solid waste disposal facilities). Once the active disposal area of one cell is approximately 70% filled, construction will begin on the subsequent cell. With this build-out plan in mind, the financial responsibility and capital outlay for closure is best managed. As a long-term plan, Ameren Missouri has voluntarily agreed to provide a 20-year post-closure plan, including groundwater monitoring. While we will need to invest a total of about $79 million over the next 10 to 15 years to fully construct the entire facility, these sums are relatively minor as compared to the approximately $600 million of capital investments annually that we have historically made in our electric generation and delivery infrastructure. To put the $79 million in further perspective, we currently have gross plant in service of nearly $15 billion.

VII. SUMMARY

Q. Please summarize your testimony.

A. Ameren Missouri has been working diligently towards providing the lowest reasonable cost alternative for disposal of its Labadie Plant's CCPs while also adhering to all applicable federal, state, and local regulations. Our engineers have worked closely with each regulatory entity to ensure that the design is both cost-effective and meets or exceeds all

requirements, the purpose of which is to ensure that the landfill is constructed at an appropriate site and does not threaten human health or the environment. The design will also be compliant with proposed federal EPA guidelines for CCP landfills, as Mr. Putrich explains. Since starting this process nearly six years ago, our engineers and consultants have met all zoning and permitting requirements from those agencies with jurisdiction, Franklin County and the MDNR (various divisions). As compared with other off-site facility alternatives, this design has been shown to be the most cost effective and eliminates the transportation of the CCPs to an off-site facility. The proposed UWL design is based on solid engineering, is the lowest cost alternative, and is protective of the environment.

Q. Does this conclude your direct testimony?

A. Yes, it does.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Union Electric Company d/b/a Ameren Missouri for Permission and Approval and a Certificate of Public Convenience and Necessity Authorizing it to Construct, Install, Own, Operate, Maintain, and Otherwise Control and Manage A Utility Waste Landfill and Related Facilities at its Labadie Energy Center.	))))))))	File No. EA-2012-0281

AFFIDAVIT OF CRAIG J. GIESMANN

STATE OF MISSOURI)
) **ss**
CITY OF ST. LOUIS)

Craig J. Giesmann, being first duly sworn on his oath, states:

1. My name is Craig J. Giesmann. I work in the City of St. Louis, Missouri, and I am employed by Union Electric Company d/b/a Ameren Missouri as Managing Supervisor of Hydro Engineering.

2. Attached hereto and made a part hereof for all purposes is my Surrebuttal Testimony on behalf of Union Electric Company d/b/a Ameren Missouri consisting of 24 pages and Schedules CJG-S1 to CJG-S23, all of which have been prepared in written form for introduction into evidence in the above-referenced docket.

3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct.

Craig J. Giesmann

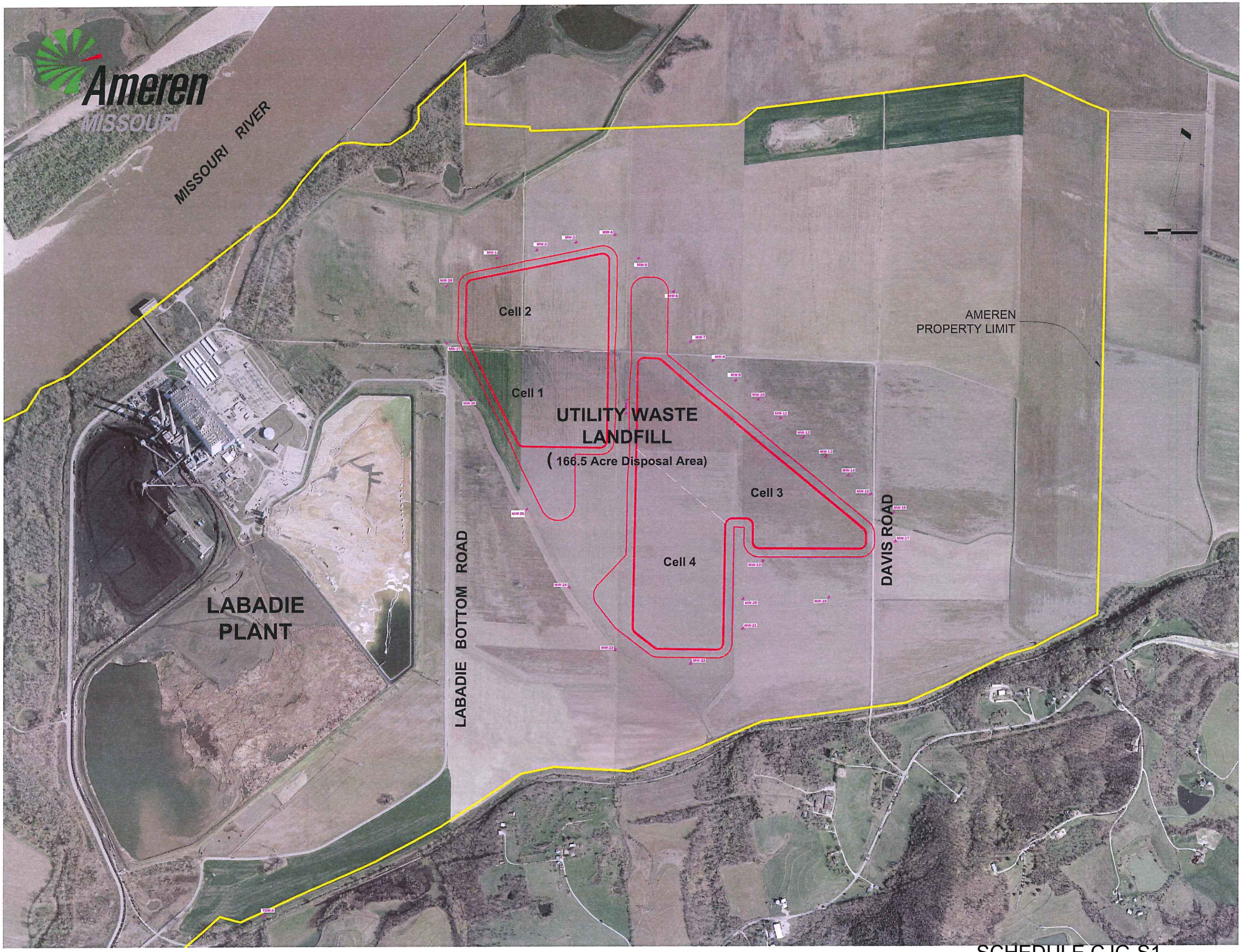
Subscribed and sworn to before me this 13 day of September, 2013.

Notary Public

My commission expires:
4/19/2017

SUSAN WESTERMEYER
NOTARY PUBLIC
NOTARY SEAL
COMMISSION #13772827
MY COMMISSION EXPIRES 4/19/2017
ST. LOUIS COUNTY
STATE OF MISSOURI

Schedules CJG-S10, CJG-S12 and CJG-S23HC are too voluminous to be uploaded into EFIS and will be provided via CD



SCHEDULE CJG-S1

SCHEDULE CJG-S2

SCHEDULE CJG-S3

SCHEDULE CJG-S4

SCHEDULE CJG-S5

SCHEDULE CJG-S6

Rules of
Department of Natural Resources
Division 80—Solid Waste Management
Chapter 2—General Provisions

Title 10—DEPARTMENT OF NATURAL RESOURCES
Division 80—Solid Waste Management
Chapter 2—General Provisions

10 CSR 80-2.010 Definitions

PURPOSE: This rule defines terms used in 10 CSR 80.

(1) Alkaline-manganese battery or alkaline battery means a battery having a manganese dioxide positive electrode, a zinc negative electrode, an alkaline electrolyte, including alkaline-manganese button cell batteries intended for use in watches, calculators, and other electronic products, and larger-sized alkaline-manganese batteries in general household use.

(2) Button cell battery or button cell means any small alkaline-manganese or mercuric-oxide battery having the size and shape of a button.

(3) Airport means a public-use airport open to the public without prior permission and without restrictions within the physical capacities of available facilities.

(4) Applicant means a person who applies for a solid waste permit from the department.

(5) Aquifer means a hydrostratigraphic unit capable of consistently yielding a sufficient amount of water to a monitoring well within twenty-four (24) hours of purging for sampling and analysis.

(6) Areas susceptible to mass movement means those areas of influence (for example, areas characterized as having an active or substantial possibility of mass movement) where the movement of 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.

(7) Bedrock means the solid rock strata underlying solid and unconsolidated surface materials.

(8) Bird hazard means an increase in the likelihood of bird/aircraft collisions that may cause damage to the aircraft or injury to its occupants.

(9) Cell means compacted solid wastes that are enclosed on all sides by natural soil or cover in a solid waste disposal area.

(10) City means any incorporated city, town or village.

(11) Clean fill means uncontaminated soil, rock, sand, gravel, concrete, asphaltic concrete, cinderblocks, brick, minimal amounts of wood and metal, and inert solids as approved by rule or policy of the department for fill, reclamation or other beneficial use.

(12) Closure means the permanent cessation of active disposal operations, abandonment of the disposal area, revocation of the permit or filling with waste of all areas and volumes specified in the permit and preparing the area for long-term care.

(13) Closure plan means plans, designs and relevant data which specify the methods and schedule by which the operator will complete or cease disposal operations, prepare the area for long-term care and make the area suitable for other uses, to achieve the purposes of the Solid Waste Management Law and the corresponding rules.

(14) Commercial waste means all types of solid waste generated by stores, offices, restaurants, warehouses and other nonmanufacturing activities, excluding residential and industrial wastes.

(15) Commingled recyclables means more than one(1) source separated recyclable material that has been placed in a single container for collection.

(16) Competent bedrock means solid rock that underlies unconsolidated deposits (including residuum) which displays limited evidence of weathering throughout the rock mass.

(17) Compost facility means a solid waste processing facility using a controlled process of microbial degradation of organic material which was not source-separated into a stable, nuisance-free humus-like product.

(18) Confining unit means a hydrostratigraphic unit of low permeability material above or below one (1) or more aquifers.

(19) Cover means soil or other suitable material that is used to cover compacted solid waste in a solid waste disposal area.

(20) Demolition landfill means a solid waste disposal area used for the controlled disposal of demolition wastes, construction materials, brush, wood wastes, soil, rock, concrete and inert solids insoluble in water.

(21) Department means the Department of Natural Resources.

(22) Detailed site investigation means the process of conducting a detail surface and subsurface geologic and hydrologic investigation for a proposed solid waste disposal area.

(23) Detail site investigation report means a written report that is submitted to the Missouri Department of Natural Resources concerning the results of a detailed surface and subsurface geologic and hydrologic investigation for a proposed solid waste disposal area.

(24) Detailed site investigation workplan means a plan for conducting a detailed surface and subsurface geologic and hydrologic investigation for a proposed solid waste disposal area.

(25) Director means the director of the Department of Natural Resources.

(26) Displacement means the relative movement of any two (2) sides of a fault measured in any direction.

(27) Existing sanitary landfill means any sanitary landfill that continues to receive solid waste in contiguous areas after October 9, 1993.

(28) Fault means a fracture or a zone of fractures in any material along which strata on one side have been displaced with respect to that on the other side.

(29) Final closure means that a solid waste disposal area has ceased taking waste, has completed all closure activities applicable to the Solid Waste Management Program's law and rules and has obtained closure approval from the program.

(30) Financial assurance instrument means an instrument or instruments including, but not limited to, cash or surety bond, letters of credit, corporate guarantee or secured trust fund, submitted by the applicant to ensure proper closure, post-closure care, or corrective action of a solid waste disposal area in the event that the operator fails to correctly perform closure, post-closure care, or corrective action except that the financial test for the corporate guarantee shall not exceed one and one-half (1 1/2) times the estimated cost of closure and post-closure. The form and content of the financial assurance instrument

shall meet or exceed the requirements of the department. The instrument shall be reviewed and approved or disapproved by the attorney general.

(31) Flood area means any area inundated by one hundred (100)-year flood event, or the flood event with a one percent (1%) chance of occurring in any given year.

(32) Floodplain means the lowland and relatively flat areas adjoining inland waters, that are inundated by the one hundred (100)-year flood.

(33) Gas condensate means the liquid generated as a result of gas recovery process(es) at the solid waste disposal area.

(34) Geologic structure means the post-depositional deformation of bedrock and surficial materials resulting from physical stresses, (e.g. faults, folds).

(35) Groundwater means water in the saturated zone beneath the land surface.

(36) Groundwater monitoring plan means a description of the strategy for effectively monitoring groundwater at a proposed or existing solid waste disposal area.

(37) Hazardous wastes means any waste or combination of wastes, as determined by the Hazardous Waste Commission by rules and regulations, which, because of quantity, concentration, or physical, chemical or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible illnesses, or pose a present or potential threat to the health of humans or the environment.

(38) Holocene means the most recent epoch of the Quaternary Period, extending from the end of the Pleistocene Epoch to the present.

(39) Horizontal expansion means an expansion of a disposal area beyond current permitted disposal area limits through issuance of a new permit by the department.

(40) Household consumer means an individual who generates used motor oil through the maintenance of the individual's personal motor vehicle, vessel, airplane, or other machinery powered by an internal combustion engine.

(41) Household consumer used motor oil collection center means any site or facility that accepts or aggregates and stores used motor oil collected only from household consumers or farmers who generate an average of twenty-five (25) gallons per month or less of used motor oil in a calendar year. This section shall not preclude a commercial generator from operating a household consumer used motor oil collection center.

(42) Household consumer used motor oil collection system means any used motor oil collection center at publicly owned facilities of private locations, any curbside collection of household consumer used motor oil, or any other household consumer used motor oil collection program determined by the department to further the purposes of the Solid Waste Management Law.

(43) Household waste means any solid waste (including garbage, trash and sanitary waste in septic tanks) derived from households (including single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds and day-use recreation areas).

(44) Hydrostratigraphic unit means a geologic stratum or group of strata that exhibit similar characteristics with respect to transmission of fluids or gases.

(45) Incinerator means a solid waste processing facility consisting of any device or structure resulting in weight or volume reduction of solid waste by combustion.

(46) Incinerator residue means all wastes that remain after combustion, including bottom ash, fly ash, slag and grate siftings.

(47) Infectious waste means waste in quantities and characteristics as determined by the department by rule that is capable of producing an infectious disease because it contains pathogens of sufficient virulence and quantity so that exposure to the waste by a susceptible human host could result in an infectious disease. These wastes include isolation wastes, cultures and stocks of etiologic agents, blood and blood products, pathological wastes, other contaminated wastes from surgery and autopsy; contaminated laboratory wastes, sharps, dialysis unit wastes, discarded biological materials known or suspected to be infectious; provided, however, that infectious waste does not mean waste treated to department specifications.

(48) Infectious waste processing facility means a solid waste processing facility permitted specifically for the treatment or other processing of infectious waste.

(49) Karst terranes means 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 terranes include, but are not limited to, sinkholes, losing streams, caves, solution channels or conduits, springs and solution valleys.

(50) Land surveyor means a land surveyor licensed to practice by the Missouri Board for Architects, Professional Engineers, Professional Land Surveyors, and Landscape Architects.

(51) Leachate means liquid that has percolated through solid waste or has come in contact with solid waste and has extracted, dissolved or suspended materials from it.

(52) Leachate collection system means any combination of landfill base slopes, liners, permeable zones, pipes, sumps, pumps or retention structures that is designed, constructed and maintained to monitor leachate generation in a solid waste disposal area and collect and remove leachate as necessary to reduce leachate depth over a landfill base.

(53) Lead acid battery means a battery designed to contain lead and sulfuric acid with a nominal voltage of a least six (6) volts and of the type intended for use in motor vehicles and watercraft.

(54) Liner means a continuous layer(s) of soil, man-made materials, or both, beneath and on the sides of a solid waste disposal area which controls and minimizes the downward or lateral escape of solid waste, solid waste constituents or leachate.

(55) Liquid waste means any waste material that is determined to contain free liquids as defined by Method 9095 (Paint Filter Liquids Test), as described in *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods* (EPA Pub. No. SW-846).

(56) Lithified earth material means all rock, including all naturally occurring and naturally formed aggregates or masses of minerals or small particles of older rock that formed by crystallization of magma or by induration of loose sediments. This term does not include man-made materials, such as fill, concrete and asphalt or unconsolidated earth materials, soil or regolith lying at or near the earth surface.

(57) Major appliance means clothes washers and dryers, water heaters, trash compactors,

dishwashers, microwave ovens, conventional ovens, ranges, stoves, woodstoves, air conditioners, refrigerators, and freezers.

(58) Maximum horizontal acceleration in lithified earth material means the maximum expected horizontal acceleration depicted on a seismic hazard map, with a ninety percent (90%) or greater probability that the acceleration will not be exceeded in two hundred fifty (250) years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment.

(59) Mercuric-oxide battery or mercury battery means a battery having a mercuric-oxide positive electrode, a zinc negative electrode, and an alkaline electrolyte, including mercuric-oxide button cell batteries generally intended for use in hearing aides and larger size mercuric-oxide batteries used primarily in medical equipment.

(60) Motor oil means any oil intended for use in a motor vehicle, as defined in section 301.010, RSMo, train, vessel, airplane, heavy equipment, or other machinery powered by an internal combustion engine.

(61) Municipal wastes means household waste, commercial, agricultural, governmental, industrial and institutional waste which have chemical and physical characteristics similar to those of household waste.

(62) New sanitary landfill means any sanitary landfill that has not received waste prior to October 9, 1993.

(63) On-site means the same or geographically contiguous property which may be divided by public or private right-of-way, provided the entrance and exit between the properties is at a crossroads intersection and access is by crossing, as opposed to going along, the right-of-way. Noncontiguous properties owned by the same person but connected by a right-of-way which s/he controls and to which the public does not have access is also considered on-site property.

(64) One hundred (100)-year flood means a flood that has a one percent (1%) or greater chance of recurring in any given year or a flood of a magnitude equalled or exceeded once in one hundred (100) years on the average over a significantly long period.

(65) Open burning means the combustion of solid waste without: 1) control of combustion air to maintain adequate temperature for efficient combustion, 2) containment of the combustion reaction in an enclosed device to provide sufficient residence time and mixing for complete combustion and 3) control of the emission of the combustion products.

(66) Open dump means an unpermitted solid waste disposal area at which solid wastes are disposed of in a manner that does not protect the environment, are susceptible to open-burning and are exposed to the elements, vectors and scavengers.

(67) Operator means a person who is responsible for the overall day-to-day operation and maintenance of a facility and along with the owner, obtains a solid waste permit from the department.

(68) Owner means any person holding a freehold interest in the land upon which the solid waste disposal area or solid waste processing facility is located.

(69) Owner/operator means owner and operator.

(70) Permeable geologic media means soil or lithified earth material that has a hydraulic conductivity of greater than 1.0×10^{-6} centimeters per second (cm/sec), as determined in situ aquifer tests, packer test or other methods approved by the department's geological survey program.

(71) Permit modification means any approval issued by the department which alters or modifies the provision of an existing permit previously issued by the department.

(72) Person means individual, partnership, corporation, association, institution, city, county, other political subdivision, authority, state agency or institution or federal agency or institution.

(73) Phase means a distinct area of a landfill, identifiable both in the plans and in the field by natural boundaries or permanent survey markers. A phase must include provisions for constructing and operating leachate collection systems, liners, gas collection systems and any other landfill structures independent of any other phase.

(74) Phased development means the division of the construction and operations of a solid waste disposal area permit into two (2) or more distinct phases in order to facilitate more orderly construction, operation, closure or post-closure care, or both, of the solid waste disposal area, with each phase being distinctly identifiable both in the plans and in the field by natural boundaries or permanent survey markers, or both.

(75) Piezometer means a well that is used to measure groundwater elevation or depth.

(76) Plans mean reports and drawings, including a narrative operating description, prepared to describe the solid waste disposal area or solid waste processing facility design, its proposed operation and closure and post-closure care.

(77) Poor foundation conditions means 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.

(78) Post-closure care means all maintenance and monitoring performed at a solid waste disposal area after closure is complete to prevent or minimize existing or potential health hazards, public nuisance or environmental pollution and in accordance with the terms of the permit, the Solid Waste Management Law and the corresponding rules.

(79) Post-closure plan means plans, designs and relevant data which specify the methods and schedules by which the operator shall perform necessary monitoring and care for the area after closure to achieve the purposes of the Solid Waste Management Law and the corresponding rules.

(80) Potable groundwater means groundwater that is safe for human consumption in that is is free from impurities in amounts sufficient to cause disease or harmful physiological effects and has less than ten thousand (10,000) parts per million total dissolved solids.

(81) Preliminary site investigation means an investigation conducted by the Division of Geology and Land Survey to determine the geohydrologic suitability for further exploration at a proposed solid waste disposal area.

(82) Professional engineer means a professional engineer licensed to practice by the Missouri Board for Architects, Professional Engineers, Professional Land Surveyors, and Landscape Architects.

(83) Qualified groundwater scientist means a scientist or licensed professional engineer who has received a baccalaureate or post-graduate degree in the natural sciences or engineering and has sufficient training and experience in groundwater hydrology and related fields as may be demonstrated by state registration, professional certifications or completion of accredited university programs

that enable that individual to make sound professional judgments regarding groundwater monitoring, contaminant fate and transport, and corrective action.

(84) Rapid migration means the movement of fluids at rates in excess of ten feet (10') per year as determined by: tracer tests, age dating, in situ aquifer testing, packer tests or other methods as approved by the Geological Survey Program.

(85) Recovered materials means those material which have been diverted or removed from the solid waste stream for sale, use, reuse or recycling, whether or not they require subsequent separation and processing.

(86) Recycled content means the proportion of fiber or content in a product which is derived from post-consumer waste.

(87) Recycling means the separation and reuse or remanufacture of materials which might otherwise be disposed of as solid waste.

(88) Recycling center means any collection (not manufacturing) facility or system that accepts source-separated recyclable or commingled recyclable materials for processing and resale to markets for resource recovery for example: aluminum cans and scraps, tin, copper, glass, paper products, plastics, bimetal and steel containers, ferrous and nonferrous metals.

(89) Resource recovery means a process by which recyclable and recoverable material is removed from the waste stream to the greatest extent possible, as determined by the department and pursuant to department standards, for reuse or remanufacture.

(90) Resource recovery facility means any facility including a material recovery facility in which recyclable and recoverable material is removed from the waste stream to the greatest extent possible, as determined by the department and pursuant to department standards, for reuse or remanufacture.

(91) Runoff means any liquid that drains over land from any part of a facility.

(92) Run-on means any liquid that drains over land onto any part of a facility.

(93) Salvaging means the controlled removal of solid waste materials for utilization.

(94) Sanitary landfill means a permitted solid waste disposal area employing an engineered method of disposing of solid wastes on land in a manner that minimizes environmental hazards by spreading the solid wastes in thin layers, compacting the solid wastes to the smallest practical volume and applying cover at the end of each operating day. Sanitary landfills include all disposal area that accept all types of solid waste including, but not limited to, commercial and residential solid waste.

(95) Scavenging means uncontrolled or unauthorized removal of solid waste from a solid waste disposal area or solid waste processing facility.

(96) Seismic impact zone means an area with a ten percent (10%) or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in two hundred fifty (250) years.

(97) Site means any area proposed for construction of a solid waste disposal area.

(98) Sludge means the accumulated semi-solid suspension of settled solids deposited from wastewaters or other fluids in tanks or basins.

(99) Soil means sediments or other unconsolidated accumulations of solid particles produced by the physical and chemical disintegration of rocks and which may or may not contain organic matter.

(100) Solid waste means garbage, refuse and other discarded materials including, but not limited to, solid and semisolid waste materials resulting from industrial, commercial, agricultural, governmental and domestic activities, but does not include hazardous waste as defined in sections 260.360 to 260.434, RSMo recovered materials, overburden, rock, tailings, matte, slag or other waste material resulting from mining, milling or smelting.

(101) Solid waste disposal area means any area used for the disposal of solid waste from more than one (1) residential premises, or one (1) or more commercial, industrial, manufacturing, recreational or governmental operation.

(102) Solid waste management plan means a set of documents legally adopted by a state recognized governing body of a local or regional solid waste management program to administer the solid waste management system(s) for a minimum of ten (10) years.

(103) Solid waste management system means the entire process of managing solid waste in a manner which minimizes the generation and subsequent disposal of solid waste, including waste reduction, source separation, storage, collection, transportation, recycling, resource recovery, volume minimization, processing market development and disposal of solid wastes.

(104) Solid waste processing facility means any facility where solid wastes are salvaged and processed, including:

(A) A transfer station; or

(B) An incinerator which operates with or without energy recovery but excluding waste tire end-user facilities; or

(C) A material recovery facility which operates with or without composting.

(105) Solid waste technician means an individual who has successfully completed training in the practical aspects of the design, operation and maintenance of a permitted solid waste processing facility or solid waste disposal area in accordance with the Solid Waste Management Law and rules.

(106) Source reduction means practices which avoid, eliminate or minimize the generation of solid waste.

(107) Source-separated recyclable material means a waste material, for which a market exists, which has not been commingled with other solid waste but has been kept separate at the point of generation.

(108) Special waste means waste which is not regulated hazardous waste, which has physical or chemical characteristics, or both, that are different from municipal, demolition, construction and wood wastes, and which potentially require special handling.

(109) Special waste landfill means a solid waste disposal area permitted specifically for the disposal of one (1) or more special waste(s).

(110) Special waste processing facility means a solid waste processing facility permitted specifically for the processing of one (1) or more special waste(s).

(111) Structural components means liners, leachate collection systems, final covers, run-on/runoff systems and any other component used in the construction and operation of the solid waste disposal area that is necessary for protection of human health and the environment.

(112) Tire means a continuous solid or pneumatic rubber covering encircling the wheel of any self-propelled vehicle not operated exclusively upon tracks, or a trailer as defined in Chapter 301, RSMo, except farm tractors and farm implements owned and operated by a family farm or family farm corporation as defined in section 350.010, RSMo.

(113) Transfer station means a site or facility which accepts solid waste for temporary storage, or consolidation and further transfer to a waste disposal, processing or storage facility. Transfer station includes, but is not limited to, a site or facility where waste is transferred from: a rail carrier, motor vehicle or water carrier to another carrier, if the waste is removed from the container or vessel.

(114) Unstable area means 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 terranes.

(115) Uppermost aquifer means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the property boundary.

(116) Uppermost regional aquifer means the hydrostratigraphic unit closest to the ground surface that is capable of consistently yielding at least three hundred sixty (360) gallons per day of potable water to a well and is commonly used for private or public drinking water supply.

(117) Used motor oil means any motor oil which as a result of use, becomes unsuitable for its original purpose due to loss of original properties or the presence of impurities, but used motor oil shall not include ethylene glycol oils used for solvent purposes, oil fibers that have been drained of free-flowing used oil, oily waste, oil recovered from oil tank cleaning operation, oil spilled to land or water, or industrial nonlube oils such as hydraulic oils, transmission oils, quenching oils, and transformer oils.

(118) Utility waste means fly ash waste, bottom ash waste, slag waste and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels.

(119) Utility waste landfill means a solid waste disposal area used for fly ash waste, bottom ash waste, slag waste and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels.

(120) Vector means a carrier including, but not limited to, arthropod, birds and rodents capable of transmitting a pathogen from one organism to another.

(121) Vegetation means plant materials that have been specified in the closure/post-closure plans and have been specifically cultivated for cover on the landfill and borrow area. Vegetation should provide at least eighty percent (80%) coverage in order to control erosion and limit water infiltration.

(122) Washout means the carrying away of solid waste by waters of the one hundred (100)-year flood.

(123) Waste tire means a tire that is no longer suitable for its original intended purpose because of wear, damage, or defect.

(124) Waste tire collection center means a site where waste tires are collected prior to being offered for recycling or processing and where fewer than five hundred (500) tires are kept on-site on any given day.

(125) Waste tire end-user facility means a site where waste tires are used as a fuel or fuel supplement or converted into a useable product. Baled or compressed tires used in structures, or used at recreational facilities, or used for flood or erosion control shall be considered an end use.

(126) Waste tire generator means a person who sells tires at retail or any other person, firm, corporation, or government entity that generates waste tires.

(127) Waste tire processing facility means a site where tires are reduced in volume by shredding, cutting, chipping or otherwise altered to facilitate recycling, resource recovery or disposal.

(128) Waste tire site means a site at which five hundred (500) or more waste tires are accumulated, but not including a site owned or operated by a waste tire end-user that burns waste tires for the generation of energy or converts waste tires to a useful product.

(129) Waters of the state mean all rivers, streams, lakes and other bodies of surface and subsurface water lying within or forming a part of the boundaries of the state which are not entirely confined and located completely upon lands owned, leased or otherwise controlled by a single person or by two (2) or more persons jointly or as tenants in common and includes waters of the United States lying within the state.

(130) Water table means the upper surface of a zone of saturation where the fluid pressure of the body of groundwater is equal to atmospheric pressure.

(131) Well means any hole drilled in the earth for or in connection with the discovery or recovery of water, minerals, oil, gas or for or in connection with the underground storage of gas in natural formations.

(132) Wetlands means those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands include, but are not limited to, swamps, marshes, bogs and similar areas.

(133) Working face means that portion of the solid waste disposal area where solid wastes are discharged and are spread and compacted prior to the placement of cover.

(134) Yard waste means leaves, grass clippings, yard and garden vegation and Christmas trees. This term does not include stumps, roots or shrubs with intact root balls.

AUTHORITY: sections 260.200, RSMo Supp. 2005 and 260.225, RSMo 2000. Original rule filed Dec. 11, 1973, effective Dec. 21, 1973. Amended: Filed July 14, 1986, effective Jan. 1, 1987. Amended: Filed Jan. 5, 1987, effective June 1, 1987. Amended: Filed Jan. 29, 1988, effective Aug. 1, 1988. Amended: Filed Aug. 15, 1988, effective Dec. 29, 1988. Emergency amendment Sept. 29, 1993, effective Oct. 9, 1993, expired Feb. 5, 1994. Amended: Filed May 3, 1993, effective Jan. 13, 1994. Amended: Filed March 17, 1992.** Emergency rescission of the 1992 amendment filed March 19, 1997, effective April 1, 1997, expired Sept. 27, 1997. Amended: Filed Oct. 10, 1996, effective July 30, 1997. Rescission of the 1992 amendment filed April 3, 1997, effective Aug. 30, 1997. Amended: Filed June 30, 2006, effective Feb. 28, 2007.*

**Original authority: 260.200, RSMo 1972, amended 1975, 1986, 1988, 1990, 1993, 1995, 2002, 2005 and 260.225, RSMo 1972, amended 1975, 1986, 1988, 1990, 1993, 1995.*

***The Missouri Supreme Court in **Missouri Coalition for the Environment, et al., v. Joint Committee on Administrative Rules, et al.**, Case No. 78628, dated February 25, 1997, ordered the secretary of state to publish this amendment. The Missouri Department of Natural Resources subsequently filed an emergency rescission of this amendment as well as a proposed rescission of this amendment which became effective August 30, 1997. See the above authority section for filing dates.*

10 CSR 80-2.011 Definitions

Emergency rule filed Sept. 29, 1993, effective Oct. 9, 1993, expired Feb 5, 1994. Emergency rule filed Jan. 28, 1994, effective Feb. 7, 1994, expired June 6, 1994.

10 CSR 80-2.015 Preliminary Site Investigation, Detailed Site Investigation Workplan, and Detailed Site Investigation and Characterization Report

PURPOSE: This rule describes the steps required to characterize the geologic and hydrologic conditions at a proposed solid waste disposal area prior to submittal of a construction permit application in compliance with section 260.205, RSMo (Cum. Supp. 1996).

(1) On and after January 1, 1996, no applicant may apply for, or obtain, a permit to construct a solid waste disposal area unless the person has obtained geologic and hydrologic site approval from the department. Geologic and hydrologic approval indicates that the site has been found to be suitable for development of a solid waste disposal area, provided the required plans and engineering reports detailing the construction and operation of the site are prepared and approved by the department. In order to obtain geologic and hydrologic site approval from the department, the following procedures must be followed:

(A) The potential disposal area construction permit applicant must obtain preliminary site approval from the department. The applicant shall provide the department a map that delineates the approximate horizontal boundaries of the proposed solid waste disposal area and provide the approximate elevation of the base of the proposed solid waste disposal area. The applicant may provide the department any other information pertinent to the site that may assist in the preliminary site investigation. The Division of Geology and Land Survey (DGLS) Geologic Survey Program (GSP) will conduct a preliminary site investigation and approve or disapprove the site for further investigation within sixty (60) days of receipt of a request. Preliminary site approval is provisional, as required additional investigations may reveal conditions that may lead to site disapproval. Disapproval may be reviewed by the DGLS division director. Preliminary site investigation requests shall be submitted to the GSP on the form included in Appendix 1 which is included herein. After performing a preliminary site investigation, the GSP shall make one (1) of the following determinations:

1. The geologic and hydrologic conditions of the site are not suitable for the development of a solid waste disposal area.

A. Sites proposed for sanitary or demolition waste landfills known to have one (1) or more of the following geologic or hydrologic conditions within its boundaries are considered unsuitable for the development of a solid waste disposal area:

(I) Groundwater that must be pumped in order to keep the wastes within the proposed solid waste disposal area isolated above the water table;

(II) Permeable geologic media, including soil or bedrock with karst terrane features, faults, joints, fractures, or voids, that provide a pathway for the rapid migration of fluids from the site into the uppermost regional aquifer or the rapid migration of groundwater from the site to a surface water body outside of the site;

(III) Permeable geologic media, including soil or bedrock with karst terrane features, faults, joints, fractures, or voids, that provide a pathway for the migration of landfill-derived gases outside of the site;

(IV) A fault that has experienced movement during the Holocene epoch that is located within the boundaries of the proposed solid waste disposal area;

(V) Groundwater that cannot effectively be monitored on-site due to karst terrane conditions; or

(VI) The presence of subsurface voids or conditions that present a significant potential for catastrophic collapse.

B. Sites proposed for utility waste landfills known to have one (1) or more of the following geologic or hydrologic conditions within its boundaries are considered unsuitable for the development of a solid waste disposal area:

(I) A fault that has experienced movement during the Holocene epoch that is located within the boundaries of the proposed solid waste disposal area;

(II) Groundwater that cannot effectively be monitored on-site due to karst terrane conditions; or

(III) The presence of subsurface voids or conditions that present a significant potential for catastrophic collapse;

2. There is insufficient data to allow a proper determination to be made about site suitability at the preliminary site investigation phase. Such sites shall receive preliminary site investigation approval but data must be collected during the subsequent detailed site investigation that fully characterizes the geologic and hydrologic conditions of the site and demonstrates that the site is suitable for the development of a solid waste disposal area. GSP will assist the applicant in identifying geologic and hydrologic conditions that must be fully characterized during the detailed site investigation. If geologic or hydrologic conditions pursuant to 10 CSR 80-2.015(1)(A)1. are identified during the detailed site investigation, the site shall be disapproved;

3. The geologic and hydrologic conditions of the site may be well suited for the development of a solid waste disposal area. Such sites shall receive preliminary site investigation approval and may be subject to reduced requirements during the detailed site investigation. Sites that do not have any conditions pursuant to 10 CSR 80-2.015(1)(A)1. and are underlain by one (1) or more of the following geologic and hydrologic conditions below the proposed sub-base grade may be well suited for the development of a solid waste disposal area:

A. A combined minimum thickness of fifty feet (50') of low-permeability geologic material that inhibits the movement of fluids into the uppermost regional aquifer that is currently used or is reasonably likely to be used as a future domestic drinking water source. The low-permeability geologic material must:

(I) Be comprised of shale, mudstone or glacial deposits comprised primarily of clay or silt size particles; and

(II) Lack karst terrane features, continuous sand or gravel layers, faults, fractures, cracks, voids, or other features that provide a pathway for the rapid migration of fluids or gases off the site;

B. Aquifers that are in geohydrologic connection with the proposed solid-waste disposal area that do not yield potable groundwater or are not capable of producing greater than three hundred sixty (360) gallons of water per day from a domestic water well;

(B) Prior to conducting further investigation of the proposed site, the potential disposal area construction permit applicant must retain a qualified groundwater scientist who

is a registered geologist per section 256.453, RSMo who shall request and attend a workplan development meeting with the GSP. This meeting shall include, at a minimum, discussion of the geology and hydrology of the proposed site and specific elements to be included in the workplan, time frames for completion of work and a discussion of the regulatory process;

(C) The qualified groundwater scientist who is a registered geologist per section 256.453, RSMo shall then prepare and submit to the department a workplan for conducting a detailed surface and subsurface geologic and hydrologic investigation. The elements and format of the workplan are listed in Appendix 1 which is included herein. The GSP will review and approve or disapprove the detailed site investigation workplan within thirty (30) days of receipt; and

(D) After the workplan is approved, a qualified groundwater scientist shall investigate and characterize the geology and hydrology of the site in accordance with the approved workplan, applicable rules and department guidance. All geologic and hydrologic data collection and interpretation shall be under the direction of a geologist registered in the state of Missouri. The applicant or a representative shall notify the GSP when drilling, testing, or field investigations are to take place so that department personnel may be present on-site during the investigations.

1. The approved workplan will provide site-specific guidance for the applicant to complete the detailed site investigation. The workplan may be amended and changed with the approval of the GSP, as the investigation proceeds.

2. The qualified groundwater scientist shall interpret and summarize the geologic and hydrologic characteristics of the site in a detailed site investigation and characterization report which is to be submitted to the GSP. Guidance for conducting and reporting a detailed site investigation is included herein as Appendix 1 of this rule. The report shall be signed and sealed by a geologist registered in the state of Missouri. The report shall be submitted to the GSP for review.

(2) The GSP will review the report within sixty (60) days of receipt and approve or disapprove the site.

(A) Approval will indicate that:

1. The site has been found to have suitable geologic and hydrologic characteristics for the development of an environmentally sound solid waste disposal area; or

2. That the detailed site investigation and characterization report adequately addresses geologic or hydrologic conditions that can be overcome by engineering pursuant to 10 CSR 80-3.010(5)(B)3., 10 CSR 80-4.010(4)(B)8. and 10 CSR 80-11.010(5)(A)3. for the development of an environmentally sound solid waste disposal area. Approval shall not be granted to a site that has a condition specified as unsuitable pursuant to 10 CSR 80-2.015(1)(A)1.

(B) The potential disposal area construction permit applicant who has received approval may then apply for a permit by submitting the required documents, plans, and engineering reports to the department.

(C) Disapproval will indicate one (1) or more of the following:

1. The site has been found to have unsuitable geologic and hydrologic conditions for the development of an environmentally sound solid waste disposal area; or

2. The characterization of the site is not adequate to show that the site has suitable geologic and hydrologic conditions for the development of an environmentally sound solid waste disposal area; or

3. The characterization report is not adequate to show that the site has suitable geologic and hydrologic conditions for the development of an environmentally sound solid waste disposal area.

(D) The GSP will specify the inadequacies of the site, characterization of the site, or site characterization report in the written disapproval of the site. Disapprovals may be reviewed by the DGLS division director.

APPENDIX 1

GUIDANCE FOR CONDUCTING AND REPORTING DETAILED GEOLOGIC AND HYDROLOGIC INVESTIGATIONS AT A PROPOSED SOLID-WASTE DISPOSAL AREA

Missouri Department of Natural Resources
Division of Environmental Quality
Division of Geology and Land Survey

This appendix contains the following:

- Elements and format of a workplan for conducting the Detailed Site Investigation.
- Guidance for conducting an acceptable detailed geologic and hydrologic investigation of a proposed solid-waste disposal area.
- Guidance for the acceptable presentation of site characterization data.
- Form for requesting a preliminary investigation for a proposed solid-waste disposal area.

ELEMENTS AND FORMAT OF A DETAILED SITE INVESTIGATION WORKPLAN

The detailed site investigation workplan must contain the following elements plus any additional site-specific elements which may be requested by the Geological Survey Program (GSP).

1. Topographic map at a scale of 1:24,000 showing the pertinent property boundaries, as well as the location of the proposed solid-waste disposal area, and potential borrow areas

2. Site map at a suitable scale to display proposed locations for pits, borings, and piezometers

3. A general description of the proposed facility to include:
   a. Maximum depth of excavation
   b. Total acreage to be developed as a solid-waste disposal area

4. Description of proposed methods for site exploration to include:
   a. Drilling methods
   b. Sampling methods
   c. Piezometer and monitoring well construction methods (must comply with 10CSR23-4):
      (1) Approximate depth intervals to be screened
      (2) Specific grout mixtures and emplacement methods to be used
   d. Aquifer test methods
   e. Alternative exploration methods (such as geophysical methods)

5. Record keeping procedures for:
   a. Well logs, boring logs, drilling logs, pit logs
   b. On-site precipitation data
   c. Periodic water-level measurement data from piezometers
   d. Aquifer test data

DETAILED SITE INVESTIGATION

General Procedures for Detailed Site Investigations

The potential disposal area construction permit applicant is responsible for retaining a qualified groundwater scientist to provide the GSP with a complete and accurate evaluation of the geologic and hydrologic conditions of the proposed solid-waste disposal area. All geologic and geohydrologic work must be completed under the direction of a geologist registered in the State of Missouri per RSMo 256.450 through 256.483 and the rules promulgated pursuant thereto. A consultant who subcontracts the drilling of piezometers or monitoring wells must hold a restricted or a nonrestricted monitoring well installation contractor's permit. Drilling must be done by a driller holding a nonrestricted monitoring well installation contractor's permit and appropriate permit numbers must be prominently displayed on all drill rigs used for site characterization, as required by 10 CSR 23 Chapters 1, 2 and 4. The detailed site investigation is intended to provide the GSP with sufficient geohydrologic data to determine if the site is suitable for the development of a solid waste disposal area.

The minimum elements of a detailed site investigation are partially dependent on site-specific geologic conditions. As a result of data gathered during the preliminary or detailed site investigation, the GSP may require additional investigations to adequately define the geology and hydrology of the site. The GSP may require less detailed investigation based upon site geohydrologic conditions.

Geophysical methods may be used to help characterize the site; however borings or pits must be located and drilled to verify the results of the geophysical survey(s). Where geologic structures or solution features are present or suspected, additional borings or pits will be required to adequately define the extent and distribution of these features across the site, and to determine the relationships between these features and hydrostratigraphic units.

Sinkholes, solution-enlarged fractures and caves may have very small, near-surface expressions that a boring program would not be expected to detect. Sites will be rejected during preliminary or detailed site investigations where the site is characterized by karst terrane features which may affect the structural integrity or effective monitoring of the site.

Field Direction

A qualified groundwater scientist must direct the excavation of all pits, the drilling of all borings, the performance of any geophysical surveys, and the installation, development and abandonment of all exploratory wells or piezometers. Interpretations of geological data must be conducted under the direction of a geologist registered in the State of Missouri per RSMo 256.450 through 256.483.

A qualified groundwater scientist must supervise all field testing to determine the geologic and hydrologic characteristics of the material encountered or intended for use at the proposed site. A qualified groundwater scientist must maintain accurate and complete field notes of the investigation activities.

A land surveyor registered in the State of Missouri must determine the location and elevation of all wells and piezometers. Borings, excavation pits and all transects performed as part of a geophysical exploration will be located to the nearest one-tenth (0.1) foot by a land surveyor registered in the State of Missouri. All elevation measurements, grid patterns, and coordinates must be established and used consistently throughout the investigation and referenced to North American Datum (NAD) 1983 and National Geodetic Vertical Datum (NGVD) 1929 or North American Vertical Datum (NAVD) 1988. Monitoring well and piezometer measuring-point elevations must be accurate to the nearest one-hundredth (0.01) foot.

Field Investigations

The minimum requirements for conducting a detailed subsurface investigation are listed below. Alternative investigation techniques and procedures may be approved at the discretion of the GSP. Additional borings or pits may be required, subject to site-specific conditions, to fully characterize the geology of the area. The number of borings, pits, and piezometers required is dependent upon the anticipated size of the proposed disposal area and the site geohydrology. Borings that are not used as monitoring wells or piezometers must be permanently abandoned and reported as per 10 CSR 23-4. Exploration pits must be backfilled using native material, compacted to natural density condition, and their locations clearly marked on site maps.

1. Surficial Materials

A qualified groundwater scientist must determine the thickness, and geotechnical characteristics of significant hydrostratigraphic units, where they exist at the site, above competent bedrock. At least one boring must be drilled per two acres of the proposed disposal area. All borings must be extended to at least 25 feet below the anticipated disposal area sub-base grade or to competent bedrock, whichever is less. All borings must be continuously sampled. Exploration pits may be substituted for borings in areas where the surficial materials can be fully penetrated by the pits. For sites that meet the conditions pursuant to 10 CSR 80-2.015(1)(A)3 the GSP shall require only one boring per four acres of the site.

If geologic structures or solution features are suspected, at least one boring must be completed per acre of the proposed disposal area. All of these borings will be drilled to competent bedrock. Exploration pits may be substituted if approved by GSP.

The borings or pits must be distributed in a grid pattern across the site or located in a manner that will optimize characterization of the site. Deviations from a regular grid pattern must be approved by the GSP. The locations and elevations of borings or pits must be surveyed by a land surveyor.

2. Aquifers

A qualified groundwater scientist must determine the depth, thickness and lateral extent of the uppermost aquifer(s) beneath the proposed site and additional aquifers which are potentially at risk (as determined by the GSP).

Piezometers are required to adequately characterize the groundwater at the proposed site. There must be at least five piezometers, or one piezometer per four acres of the site, whichever is greater, installed in each aquifer to be characterized. For sites that meet the conditions pursuant to 10 CSR 80-2.015(1)(A)3 there must be at least five piezometers, or one piezometer per eight acres of the site, whichever is greater. Piezometer construction and development standards must be in accordance with 10 CSR 23-4.

All piezometers must be distributed in a grid pattern across the proposed site or located in a manner that will optimize characterization of the site. Deviations from a regular grid pattern must be approved by the GSP. An adequate number of piezometers must be located outside the anticipated fill area to sufficiently characterize each aquifer investigated. The measuring-point elevation of the piezometers must be determined by a land surveyor. Additional piezometers may be required to demonstrate the effectiveness of confining units and extent of aquifers. If geophysical methods are used, piezometers must be installed to verify the results of the geophysical survey(s).

A continuously recording precipitation gauge, capable of measuring precipitation events greater than one-tenth (0.1) inch, must be installed at the site concurrent with, or prior to, installation of piezometers. Data from the gauge will be used to interpret any fluctuations in potentiometric level(s) throughout the site characterization period and may be used for other purposes later, at the discretion of the department.

The hydraulic conductivity of the uppermost aquifer(s) beneath the proposed disposal area must be determined. The hydraulic conductivity must be determined in one out of every four piezometers installed for each aquifer tested. The hydraulic conductivity must be determined in the field. Accepted field tests are *in situ* slug and/or pump tests, as determined through the workplan process, which isolate the geologic unit of interest.

3. Other Hydrostratigraphic Units

At least one boring per four acres of the proposed disposal area or five borings, whichever is greater, must be drilled to characterize hydrostratigraphic units, including the uppermost confining unit, below the anticipated sub-base grade of the site. The depth of these borings will be determined based on geohydrologic conditions at the site. At least five of these borings must be continuously sampled, unless otherwise approved by the GSP. For sites that meet the conditions pursuant to 10 CSR 80-2.015(1)(A)3 there must be at least five of these borings or one boring per eight acres of the site, whichever is greater.

Rules of
Department of Natural Resources
Division 80—Solid Waste Management
Chapter 11—Utility Waste Landfill

Title 10—DEPARTMENT OF NATURAL RESOURCES
Division 80—Solid Waste Management
Chapter 11—Utility Waste Landfill

10 CSR 80-11.010 Design and Operation

PURPOSE: This rule pertains to the design and operation of a utility waste landfill.

(1) General Provisions. This rule is intended to provide for utility waste landfill operations that will have minimal impact on the environment. The rule sets forth requirements and the method of satisfactory compliance to ensure that the design, construction and operation of utility waste landfills will protect the public health, prevent nuisances and meet applicable environmental standards. The requirement subsections contained in this rule delineate minimum levels of performance required of any utility waste landfill operation. The satisfactory compliance subsections are presented as the authorized methods by which the objectives of the requirements can be realized. The satisfactory compliance subsections are based on the practice of landfilling utility waste. If techniques other than those listed as satisfactory compliance in design or operation are used, it is the obligation of the utility waste landfill owner/operator to demonstrate to the department in advance that the techniques to be employed will satisfy the requirements. Procedures for the techniques shall be submitted to the department in writing and approved by the department in writing prior to being employed. Notwithstanding any other provision of these rules, when it is found necessary to meet objectives of the requirement subsections, the department may require changes in design or operation as the condition warrants. This rule applies to new utility waste landfill construction and operating permits issued on or after the effective date of this rule.

(2) Solid Waste Accepted.

(A) Requirement. Fly ash, bottom ash, boiler slag or other slag waste and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels may be accepted at a utility waste landfill. Clean fill may also be accepted.

(B) Satisfactory Compliance—Design. The plans shall specify the types of waste to be accepted for disposal at a utility waste landfill.

(C) Satisfactory Compliance—Operations.

1. The first layer of waste placed above the liner shall be monitored to ensure that the liner's integrity has been maintained.

2. The disposal of waste approved in the construction permit shall be conducted in accordance with approved design and operating plans plus any additional procedures determined by the department as necessary to protect the water, air and land resources and to provide for safety of the operators and waste haulers.

(3) Solid Waste Excluded.

(A) Requirement. In consultation with the department, the applicant shall determine what wastes are to be accepted and shall identify them in the plan and the application for construction permit form.

(B) Satisfactory Compliance—Design.

1. The criteria used to determine whether the waste can be accepted shall include the design of the landfill, the physical and chemical characteristics of the wastes, the quantity of the wastes, the proposed operating procedures.

2. The plans shall specify the operating procedures for screening and removal of wastes which are excluded from disposal.

(C) Satisfactory Compliance—Operations.

1. The operating procedures for screening of wastes and for removal of wastes which are excluded from disposal shall be implemented.

2. Bulk liquid waste shall not be placed in a utility waste landfill unless the waste is leachate derived from the utility waste landfill, and the utility waste landfill is designed with a liner and leachate collection system as described in sections (9) and (10) of this rule.

3. Sluicing of waste for transport to proposed utility waste landfills shall be allowed only so long as the hydraulic head on top of the landfill liner can be maintained at less than one foot (1') of head, and the collected leachate and runoff meet all Water Pollution Control Program permit requirements.

(4) Site Selection.

(A) Requirement. Site selection and utilization shall include a study and evaluation of geologic and hydrologic conditions and soils at the proposed utility waste landfill and an evaluation of the environmental effect upon the projected use of the completed utility waste landfill. Applications for utility waste landfill construction permits received on or after the effective date of this rule shall document compliance with all applicable siting restriction requirements contained in paragraphs (4)(B)1. through 5. of this rule.

(B) Satisfactory Compliance—Design.

1. Owners/operators of proposed utility waste landfills, located in one hundred (100)-year floodplains shall demonstrate to the department that the utility waste landfill will not restrict the flow of the one hundred (100)-year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of waste so as to pose a hazard to public health or the environment.

2. Wetlands.

A. Proposed utility waste landfills shall not be located in wetlands, unless the owner/operator can make the following demonstrations to the department:

(I) The presumption that a practicable alternative to the proposed landfill is available which does not involve wetlands is clearly rebutted;

(II) The construction and operation of the utility waste landfill will not—

(a) Cause or contribute to violations of any applicable state water quality standard;

(b) Violate any applicable toxic effluent standard or prohibition under section 307 of the federal Clean Water Act;

(c) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973; and

(d) Violate any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary;

(III) The utility waste landfill will not cause or contribute to significant degradation of wetlands. The owner/operator shall demonstrate the integrity of the utility waste landfill and its ability to protect ecological resources by addressing the following factors:

(a) Erosion, stability and migration potential of native wetland soils, muds and deposits used to support the landfill;

(b) Erosion, stability and migration potential of dredged and fill materials used to support the landfill;

(c) The volume and chemical nature of the waste disposed of in the landfill;

(d) Impacts on fish, wildlife and other aquatic resources and their habitat from potential release of waste from the landfill;

(e) The potential effects of contamination of the wetland and the resulting impacts on the environment; and

(f) Any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected;

(IV) Steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent practicable as required by subparagraph (4)(B)2.A. of this rule, then minimizing unavoidable impacts to the maximum

extent practicable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and practicable compensatory mitigation actions (for example, restoration of existing degraded wetlands or creation of man-made wetlands); and

(V) The requirements of paragraph (4)(B)3. may be satisfied by the owner/operator obtaining a United States Army Corps of Engineers permit for construction in a wetland or by demonstrating that the wetland is not regulated by the United States Army Corps of Engineers or other appropriate agency.

3. Proposed utility waste landfills located in the seismic impact zone shall not be located within two hundred feet (200') of a fault that has had displacement in Holocene time unless that owner/operator demonstrates to the department that an alternative setback distance of less than two hundred feet (200') will prevent damage to the structural integrity of the landfill and will be protective of public health and the environment.

4. 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 owner/operator shall consider the following factors, at a minimum, when determining whether an area is unstable:

A. On-site or local rock or soil conditions that may result in failure or significant differential settling;

B. On-site or local geologic or geomorphologic features; and

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

5. Plans shall include:

A. A map showing initial and proposed topographies at contour intervals of five feet (5') or less. This map shall have a scale of not less than one inch (1") equal to one hundred feet (100'). If the entire site cannot be illustrated on one (1) plan sheet, an additional map with appropriate horizontal and vertical scales that allows the site to be shown on one (1) plan sheet is required;

B. A map showing the land use and zoning within one-fourth (1/4) mile of the utility waste landfill including location of all residences, buildings, wells, water courses, springs, lakes, rock outcroppings, caves, sinkholes and soil or rock borings. All electric, gas, water, sewer and other utility easements or lines that are located on, under or over the utility waste landfill shall be shown on the map. This map shall have a scale of not less than one inch (1") equals four hundred feet (400');

C. A description of the projected use of the closed utility waste landfill if the landfill is not located on the power plant site. In addition to maintenance programs and provisions, where necessary for monitoring and controlling leachate, the plans shall specify appropriate design, construction and operating provisions for the utility waste landfill to complement the projected future use;

D. An evaluation of the characteristics and quantity of available on-site soil with respect to its suitability for utility waste landfilling operations. The engineering properties and quantity estimates of the on-site soil shall be discussed and shall include:

(I) Texture. Sieve and hydrometer analyses shall be performed to determine grain size distribution of representative soil samples. Texture may be determined by using the procedures described in ASTM method D422-63 or the procedures described in Appendix D of *Engineer Manual 1110-2-1906* prepared by the United States Army Corps of Engineers;

(II) Plasticity. The liquid limit, plastic limit and plasticity index of representative soil samples shall be determined. Plasticity may be determined by using the procedures described in ASTM method D4318-84 or the procedures described in Appendix III of *Engineer Manual 1110-2-1906*, prepared by the United States Army Corps of Engineers;

(III) Hydraulic conductivity. Laboratory hydraulic conductivity tests shall be performed upon undisturbed representative soil samples using a flexible wall permeameter (ASTM D-5084). If an aquifer is found to be laterally continuous across the anticipated limit of the proposed landfill, the hydraulic conductivity of each significant continuous geologic unit must be determined. Examples of accepted field tests are *in situ* slug or pump tests which isolate the geologic unit of interest.

(IV) Areal extent and depth. The areal extent and depth of soil suitable for landfill construction shall be determined. Variations in soil depth shall be clearly described.

6. If the base of the landfill liner will be in contact with groundwater, the applicant shall demonstrate to the department's satisfaction that the groundwater will not adversely impact the liner.

7. Owners/operators of proposed utility waste landfills shall demonstrate how adverse geologic and hydrologic conditions may be altered or compensated for via surface water drainage diversion, underdrains, sumps, and other structural components. All alterations of the site shall be detailed in the plans. Precipitation, evapotranspiration and climatological conditions shall be considered in site selection and design.

8. The results of the detailed site investigation report will be the basis to determine if a secondary liner, such as a geomembrane, or a leachate collection system is mandatory to ensure that there is no environmental impact from the landfill. Owner/operators of proposed utility waste landfills shall make a demonstration based on the following:

A. An evaluation of the physical and/or chemical characteristics of the waste; and

B. Documentation through modeling, testing, or other research data proving that the quality of groundwater underlying the proposed site will not be affected and that there is no potential for migration of fluids from the utility waste landfill.

(C) Satisfactory Compliance—Operations.

1. The utility waste landfill shall be accessible to vehicles which the utility waste landfill is designed to serve.

2. Temporary storage of waste for more than sixty (60) days is not permitted. Temporarily stored wastes shall be managed so as to prevent uncontrolled surface water runoff and erosion. All Water Pollution Control Program permits and approvals necessary to comply with the Missouri Clean Water Law and corresponding rules shall be obtained from the department.

(5) Design.

(A) Requirement. Plans, addendums, as-built drawings, or other documents which describe the design, construction, operation, or closure of a utility waste landfill or which request an operating permit modification for the utility waste landfill shall be prepared or approved by a professional engineer. These documents shall be stamped or sealed by the professional engineer and submitted to the department for review and approval.

1. Plans submitted as part of an application for a construction permit after the effective date of this rule shall provide for the maintenance of a one hundred foot (100')-buffer zone between utility waste landfill operations and any property line(s) or any right of way(s) of adjoining road(s) when the property line(s) is inside the right of way(s) to provide for assessment and/or remedial actions.

2. The plan shall include an operating manual describing the various tasks that shall be performed during a typical shift.

3. Owners/operators of utility waste landfills shall demonstrate how adverse geologic and hydrologic conditions may be altered or compensated for via surface water drainage diversion, underdrains, sumps, and

other structural components. All alterations of the site shall be detailed in the plans.

A. Precipitation, evapotranspiration and climatological conditions shall be considered in site selection and design.

B. Engineering plans and specifications that have computer model attached to them shall list the limitations and assumptions of each model used in the application.

4. Plans for stability analyses for all stages of construction shall include:

A. Settlement and bearing capacity analyses shall be performed on the in-place foundation material beneath the disposal area. The effect of foundation material settlement on the liner and leachate collection shall be evaluated;

B. Stability analyses shall be performed on all liner and leachate system components;

C. Leachate collection pipe material and drainage media shall be analyzed to demonstrate that these components possess structural strength to support maximum loads imposed by overlying waste materials and equipment;

D. Waste mass stability analyses shall be performed on the disposal area at final waste grade conditions and at intermediate slope conditions; and

E. Stability analyses shall be performed on all final cover system components, including an evaluation of the effect of waste settlement on the final cover system components, side slope liner system components, surface water management system components and gas migration system components.

(B) Satisfactory Compliance—Operations.

1. Construction and operation of the utility waste landfill shall be conducted in accordance with the engineering plans and specifications approved by the department.

2. The operating manual describing the various tasks that shall be performed during a typical shift shall be available to employees for reference and to the department upon request.

3. Phase development drawings shall be included with the application.

(6) Quality Assurance/Quality Control (qa/qc).

(A) Requirement. The construction, operation and closure of the utility waste landfill shall include quality assurance and quality control measures to ensure compliance with approved plans and all applicable federal, state and local requirements. The permittee shall be responsible for ensuring that the qa/qc supervision is conducted by a qualified professional.

(B) Satisfactory Compliance—Design.

1. Plans shall include:

A. A detailed description of the qa/qc testing procedures that will be used for every major phase of construction. The description must include at a minimum, the frequency of inspections, field testing, laboratory testing, equipment to be utilized, the limits for test failure, and a description of the procedures to be used upon test failure; and

B. A detailed procedure for the reporting and recording of qa/qc activities and testing results.

2. All qa/qc reports shall be reviewed and approved by a professional engineer.

(C) Satisfactory Compliance—Operations.

1. At a minimum qa/qc testing shall include:

A. Testing of each lift of the soil component of the final cover and landfill liner for field density and field moisture once per every ten thousand (10,000) square feet and providing relatively uniform coverage over the landfill surface;

B. Laboratory hydraulic conductivity testing of the soil used for liner construction once for every five thousand (5,000) cubic yards of liner constructed;

C. Continuous visual classification of borrow soil during landfill construction by qualified qa/qc inspector(s) or certifying professional engineer;

D. Measuring the elevations of the final cover and the landfill liner on a maximum spacing of one hundred-foot (100') centers and at one hundred-foot (100') intervals along each line where a break in slope occurs.

(I) Landfill liner. Measuring the elevations of the top and bottom of the landfill liner;

(II) Final cover. Measuring the elevations of the top and bottom of—

(a) The compacted clay layer; and

(b) The soil layer supporting vegetative growth; and

E. Verification of the thickness of the leachate collection media shall be made by the qualified qa/qc inspector(s) or certifying professional engineer on one hundred-foot (100') centers.

2. If a geomembrane is proposed—

A. Nondestructive testing of all seams of the geomembrane in the landfill liner; and

B. Random destructive testing of the seams of the geomembrane liner in the landfill liner on an average frequency of at least one (1) every five hundred (500) linear feet of seams.

3. All testing shall be performed under the direction of qualified qa/qc inspectors for every major phase of construction.

4. The qa/qc plan shall include the following components:

A. Leachate collection system. Reports prepared or approved by the professional engineer transmitting the results of the qa/qc procedures and stating that the leachate collection system was constructed according to the approved design or describing any deviations from the approved design; and

B. Liner. The liner specified by section (10) of this rule shall be constructed in accordance with the approved design specifications. The qa/qc procedures shall include:

(I) Evidence that the liner material(s) utilized meet the minimum design specifications;

(II) Evidence that field construction techniques are resulting in the minimum design specifications (for example, soil density tests);

(III) Evidence that the liner construction is proceeding as designed through regular verification using a predetermined system of horizontal and vertical survey controls; and

(IV) Oversight of the liner construction and qa/qc procedures by a professional engineer. This shall include reports prepared, or approved, by the professional engineer transmitting the results of the qa/qc procedures and stating that the liner was constructed according to design or describing any deviations from the design.

(7) Survey Control.

(A) Requirement. Benchmarks, horizontal controls and boundary markers shall be established by a land surveyor to check and mark the location and elevations of the utility waste landfill. Construction stakes marking an individual section(s) or phase(s) shall be established as necessary to ensure the construction and operation(s) proceed in accordance with approved plans.

(B) Satisfactory Compliance—Design.

1. Boundary survey. A survey of the entire permitted acreage shall be conducted in accordance with the current Minimum Standards for Property Boundary Surveys, 10 CSR 30-2.010.

2. Vertical control. The land surveyor shall establish a permanent monument as a benchmark or confirm the prior establishment of a benchmark on or adjacent to the property. The elevation shall be on the North American Vertical Datum, 1929 or similar well-documented datum. If no such established datum exists within one (1) mile of the property, a project datum may be assigned to the benchmark. The benchmark shall be clearly shown on the survey plat.

3. Horizontal control. The land surveyor shall establish three (3) permanent monuments as horizontal control stations. These stations shall form a triangle whose sides shall not be less than one thousand feet (1,000'). The location of the horizontal control will be shown on the survey plat.

4. The land surveyor shall establish boundary markers designating the entire permitted acreage which shall be composed of material which will last throughout the life of the utility waste landfill.

5. Construction stakes. Stakes marking the individual section(s) or phase(s) specifically designated for the placement of waste are to be placed in locations and composed of material that is consistent with the operating life of the section or phase.

(C) Satisfactory Compliance—Operations.

1. All boundary markers, benchmarks, horizontal control stations and construction stakes shall be clearly marked and identified.

2. Missing or displaced benchmarks or horizontal control stations shall be replaced or reestablished by or under the supervision of a land surveyor. The registered surveyor shall prepare a plat showing the replacement or reestablishment and furnish a copy to the department.

3. Missing or displaced construction stakes shall be replaced or reestablished as necessary to ensure the operations proceed in accordance with approved plans.

4. The permanent monuments designating vertical and horizontal control stations and boundary markers designating the entire permitted acreage shall be placed prior to receiving an operating permit as required by 10 CSR 80-2.020(2)(B).

5. Construction stakes marking the active area shall be placed prior to deposition of waste in individual areas, sections or phases of the utility waste landfill as designated by the approved engineering plans.

(8) Water Quality.

(A) Requirement. The location, design, construction and operation of the utility waste landfill shall minimize environmental hazards and shall conform to applicable ground and surface water quality standards and requirements. Applicable standards are federal, state or local standards and requirements that are legally enforceable.

(B) Satisfactory Compliance—Design.

1. Plans shall include:

A. A report on the detailed geologic and hydrologic investigation of the site as required by 10 CSR 80-2.015;

B. Current and projected use of water resources in the potential zone of influence of the utility waste landfill;

C. Groundwater elevation and proposed separation between the lowest point of the lowest cell and the predicted maximum water table elevation;

D. Potential interrelationship of the utility waste landfill, local aquifers and surface waters based on historical records or other sources of information;

E. Proposed location and design of observation wells, sampling stations and testing program planned; and

F. Provisions for surface water runoff control to minimize infiltration and erosion of cover. All Water Pollution Control Program permits and approvals necessary to comply with requirements of the Missouri Clean Water Law and corresponding rules shall be obtained from the department.

(I) The area of the watershed which will be affected by the utility waste landfill shall be specified.

(II) On-site drainage structures and channels shall be designed to prevent flow onto the active portion of the utility waste landfill during peak discharge from at least a twenty-five (25)-year storm. The engineering calculations and assumptions shall be included and explained in the engineering report.

(III) On-site drainage structures and channels shall be designed to collect and control at least the water volume resulting from a twenty-four (24)-hour, twenty-five (25)-year storm.

(IV) On-site drainage and channels shall be designed to empty expeditiously after storms to maintain the design capacity of the system.

(V) Contingency plans for on-site management of surface water which comes in contact with solid waste shall be specified.

(C) Satisfactory Compliance—Operations.

1. Surface water courses and runoff shall be diverted from the utility waste landfill (especially from the working face) by devices such as ditches, berms, and proper grading. The utility waste landfill shall be constructed and graded so as to promote rapid surface water runoff without excessive erosion. Regrading shall be done as required during construction and after completion to avoid ponding of precipitation and to maintain cover integrity.

2. The quantity of water coming in contact with solid waste shall be minimized by the daily operational practices. Water which comes in contact with the waste shall be managed as leachate in accordance with the approved plans.

(9) Leachate Collection Systems.

(A) Requirement. A leachate collection system shall be designed, constructed, maintained and operated to collect, and remove leachate from the utility waste landfill, unless the applicant provides adequate demonstrations specified in paragraph (4)(B)8. of this rule, and as determined by the department on a site-by-site basis.

(B) Satisfactory Compliance—Design. The potential for leachate generation shall be evaluated in determining the design of the system. Leachate flow quantities shall be estimated and the method(s) of leachate management shall be outlined. Leachate storage facilities shall comply with all currently applicable requirements of the Missouri Clean Water Law and corresponding rules. Construction qa/qc procedures shall be included. Where a leachate treatment system is designed to have a discharge to the waters of the state, any required discharge permit(s) shall be obtained from the department in accordance with requirements of the Missouri Clean Water Law and corresponding rules.

1. Minimum design criteria for leachate collection systems shall include the following:

A. Ponds and/or tanks of sufficient capacity to store, equalize flow to disposal systems, and allow system/operating flexibility;

B. Construction material chemically resistant to the waste managed in the utility waste landfill and the leachate expected to be generated;

C. Construction materials of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying utility wastes, cover, leachate, and by any equipment used at the utility waste landfill;

D. Design and operate systems to function without clogging through the scheduled operating life, closure and post-closure of the utility waste landfill;

E. Design and operate to maintain less than one foot (1') depth of leachate over the disposal area liner; and

F. Design and operate collection systems so that any leachate formed will flow by gravity into collection areas from which the leachate can be removed, treated, and disposed.

2. Leachate management by recirculation within the permitted fill area shall be conducted in accordance with an approved engineering method.

3. Any leachate collection system open to the atmosphere must be designed to prevent discharge during a twenty-five (25)-year, twenty-four (24)-hour storm event. Plans shall include the calculations detailing the design.

4. The applicant shall provide a method of leachate management in the application. A

secondary or "backup" method of leachate disposal will be required unless the applicant can demonstrate that a secondary method will not be necessary.

(C) Satisfactory Compliance—Operations.

1. The leachate collection system specified by subsection (9)(B) shall be properly installed and operated in accordance with the permit and the approved design and plans and maintained for the twenty (20)-year post-closure care period, or as long as the department determines necessary.

2. Leachate generated by the utility waste landfill shall be controlled on-site and not be allowed to discharge off the utility waste landfill property or discharge into the waters of the state, except in accordance with the approved plans and the Missouri Clean Water Law and corresponding rules.

(10) Liner System.

(A) Requirement. A liner shall be placed on all surfaces to minimize the migration of leachate from the utility waste landfill.

(B) Satisfactory Compliance—Design. A composite or a clay liner shall be required at all utility waste landfills applying for a construction permit after the effective date of this rule that includes—

1. For a composite liner a lower component that consists of at least a two-foot (2') layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-5} cm/sec. A compacted soil liner at a minimum shall be constructed of six to eight-inch (6–8") lifts, compacted to ninety-five percent (95%) of standard Proctor density with the moisture content between optimum moisture content and four percent (4%) above the optimum moisture content, or within other ranges of density and moisture such that are shown to provide for the liner to have a hydraulic conductivity no more than 1×10^{-5} cm/sec. For a single compacted clay liner a component that consists of at least a two-foot (2') layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. A compacted soil liner at a minimum shall be constructed of six to eight-inch (6–8") lifts, compacted to ninety-five percent (95%) of standard Proctor density with the moisture content between optimum moisture content and four percent (4%) above the optimum moisture content, or within other ranges of density and moisture such that are shown to provide for the liner to have a hydraulic conductivity no more than 1×10^{-7} cm/sec. The design shall include a detailed explanation of the construction techniques and equipment necessary to achieve ninety-five percent (95%) of the standard Proctor density under field conditions. The design also shall include qa/qc procedures to be followed during construction of the liner. The composite liner and the compacted clay liner shall be protected from the adverse effects of desiccation or freeze/thaw cycles after construction, but prior to placement of waste. Traffic shall be routed so as to minimize the detrimental impact on the constructed liner prior to placement of waste. The soils used for this purpose shall meet the following minimum specifications:

A. Be classified under the Unified Soil Classification Systems as CL, CH, or SC (ASTM Test D2487-85);

B. Allow more than thirty percent (30%) passage through a No. 200 sieve (ASTM Test D1140);

C. Have a liquid limit equal to or greater than twenty (20) (ASTM Test D4318-84);

D. Have a plasticity index equal to or greater than ten (10) (ASTM Test D4318-84); and

E. Have a coefficient of permeability equal to or less than 1×10^{-7} cm/sec for the compacted clay liner and 1×10^{-5} cm/sec for the composite liner when compacted to ninety-five percent (95%) of standard Proctor density with the moisture content between optimum moisture content and four percent (4%) above the optimum moisture content, when tested by using a flexible wall permeameter (ASTM D-5084) or other procedures approved by the department;

2. For the composite liner an upper component consisting of a minimum thirty (30) mil thick geomembrane shall be installed if the applicant for a proposed utility waste landfill does not provide adequate demonstrations specified in paragraph (4)(B)8. of this rule, and as determined by the department on a site-by-site basis. Geomembrane components consisting of high density polyethylene (HDPE) shall be at least sixty (60) mil thick;

3. The geomembrane component shall be installed in direct and uniform contact with the compacted soil component so as to minimize the migration of leachate through the geomembrane should a break occur; and

4. All utility waste landfills shall have a minimum bottom slope in any direction of flow of at least one percent (1%).

(C) Satisfactory Compliance—Operations.

1. A test pad shall be constructed at the site and tested to verify that the proposed construction and quality control (qc) procedures are adequate to ensure that the soil component of the composite liner system will meet the requirements of paragraph (10)(B)1. of this rule.

A. Construction and qc procedures to be used during test pad construction shall be described in detail in the approved engineering report, and shall be identical to those proposed for liner construction with the following additions:

(I) At least two (2) laboratory hydraulic conductivity tests shall be performed on undisturbed samples of the completed test pad;

(II) At least one (1) *in situ* hydraulic conductivity test shall be performed on the completed test pad; and

(III) At least two (2) test pits shall be excavated into the completed test pad to observe interlift bonding.

B. If test pad construction and testing shows that the proposed methods are not sufficient to meet the requirements of paragraph (10)(B)1. of this rule, a new test pad shall be constructed using revised procedures approved by the department.

2. For phased construction, only one (1) test pad will be required.

3. A final report shall be submitted to the department which describes in detail the construction and qc procedures which were used to achieve satisfactory test pad performance.

A. The report must be approved by the department prior to beginning construction of any portion of the composite liner system in the disposal area.

B. The report shall serve as guidance for construction of the soil component of the composite liner system.

4. The requirement for a test pad may be waived provided—

A. The applicant can demonstrate to the department's satisfaction the construction and qc procedures are identical to those described in the approved engineering report and will result in construction of a liner which meets the requirements of paragraph (10)(B)1. of this rule; and

B. The soils proposed for liner construction meet the following minimum specifications:

(I) Have a plasticity index greater than fifteen (15) and less than thirty (30) (ASTM test D4318-84);

(II) Allow more than fifty percent (50%) passage through a number 200 seive (ASTM D11400); and

(III) Have less than ten percent (10%) by weight particle sizes greater than two (2) mm.

5. The liner specified in subsection (10)(B) of this rule shall be constructed in accordance with the approved design specifications.

(11) Groundwater Monitoring.

(A) Requirements. The owner/operator of a utility waste landfill shall implement a

groundwater monitoring program capable of determining the utility waste landfill's impact on the quality of groundwater underlying the utility waste landfill.

(B) Satisfactory Compliance—Design.

1. All utility waste landfills permitted after the effective date of this rule, must be in compliance with all groundwater monitoring requirements of section (11).

2. The department may require utility waste landfills permitted prior to the effective date of this rule, to comply with part or all of section (11) if it is determined necessary by the department.

3. The owner/operator of a utility waste landfill shall establish the potential for migration of fluid generated by the utility waste landfill into the groundwater by an evaluation of—

A. A water balance of precipitation, evapotranspiration, runoff and infiltration;

B. At a minimum, the following characteristics:

(I) Geologic materials;

(II) Description of soil and bedrock to a depth adequate to allow evaluation of water quality protection provided by the soil and bedrock;

(III) Groundwater elevation;

(IV) Proposed separation between the lowest point of the lowest cell and the maximum water table elevation;

(V) Proximity of the utility waste landfill to water supply wells or surface water;

(VI) Rate and direction of groundwater flow; and

(VII) Current and projected use of water resources in the potential zone of influence of the utility waste landfill.

4. A groundwater monitoring system shall be capable of yielding groundwater samples for analysis and shall consist of—

A. Monitoring wells (at least one (1)) installed hydraulically upgradient; that is, in the direction of increasing static head from the utility waste landfill. The numbers, locations and depths shall be sufficient to yield groundwater samples that are—

(I) Representative of background water quality in the groundwater near the utility waste landfill; and

(II) Not affected by the utility waste landfill; and

B. Monitoring wells (at least three (3)) installed hydraulically downgradient; that is, in the direction of decreasing hydraulic head from the utility waste landfill. The number, locations and depths shall ensure that they detect any significant amounts of fluids generated by the utility waste landfill that migrate from the utility waste landfill to the groundwater. Monitoring wells, or clusters of monitoring wells, shall be capable at a minimum, of monitoring all saturated zones down to and including the uppermost aquifer.

5. All monitoring wells shall be constructed as per 10 CSR 23-4.

(C) Satisfactory Compliance—Operations.

1. Groundwater monitoring wells.

A. Groundwater monitoring wells shall be installed so that the number, spacing and depths of monitoring systems shall be determined based upon site-specific technical information that shall include thorough characterization of:

(I) Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow; and

(II) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer; including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities and porosities.

B. The design and installation of groundwater monitoring well systems shall be observed, supervised, and certified by a qualified groundwater scientist and approved by the department.

C. All groundwater monitoring wells shall be operational prior to the acceptance of wastes, unless other arrangements are approved by the department.

D. The design, installation, development, and decommissioning of monitoring wells and piezometers must be performed in accordance with 10 CSR 23-4.

2. Sampling and reporting.

A. Each groundwater monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and downgradient wells installed in compliance with subsection (11)(B). The owner/operator must submit the sampling and analysis program to the department for approval. The program must include procedures and techniques for—

(I) Monitoring well maintenance;

(II) Monitoring well redevelopment;

(III) Monitoring well depth measurement and hydraulic levels;

(IV) Monitoring well purging and sampling utilizing dedicated equipment;

(V) Equipment calibration;

(VI) Decontamination and field blanks;

(VII) Sample and duplicate sample collection;

(VIII) Sample preservation;

(IX) Sample labeling;

(X) Sample handling;

(XI) Field measurements;

(XII) Field documentation;

(XIII) Chain of custody control;

(XIV) Sample shipment;

(XV) Analytical procedures;

(XVI) Qa/qc control—field and laboratory; and

(XVII) Statistical testing strategy per paragraph (11)(C)5. for each parameter's concentrations.

B. Each groundwater monitoring program shall include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents and other monitoring parameters in groundwater samples. Analysis shall be performed on unfiltered samples.

C. The sampling procedures and frequency shall be protective of human health and the environment.

D. Groundwater elevations shall be measured in each well immediately prior to purging, each time groundwater is sampled. The owner/operator shall determine the rate and direction of groundwater flow each time groundwater is sampled. Groundwater elevations in wells which monitor the same utility waste landfill shall be measured within a period of time short enough to avoid temporal variations in groundwater flow which could preclude accurate determination of groundwater flow rate and direction.

3. Baseline/background monitoring.

A. The owner/operator shall establish background groundwater quality for each of the monitoring parameters or constituents required under paragraph (11)(C)4. To establish background, a minimum of four (4) quarterly samples of statistically independent sample data shall be obtained and analyzed from all monitoring wells during a minimum of one (1) year following well installation.

B. The number of samples collected to establish background values for groundwater quality data shall satisfy the requirements of subsection (11)(C) and shall be consistent with the appropriate statistical procedures determined pursuant to paragraph (11)(C)5. The sampling procedures shall be those specified under paragraph (11)(C)4. for detection monitoring and paragraph (11)(C)6. for assessment monitoring.

4. Detection monitoring.

A. The owner/operator shall obtain and analyze water samples from the groundwater monitoring wells during the months of May and November of each calendar year.

B. The following parameters shall be analyzed each time a sample is obtained:

Chemical Oxygen Demand (COD in milligrams per liter (mg/l));

Chlorides (Cl, mg/l);

Iron (Fe, (mg/l));

pH (units);

Specific Conductance (Conductivity at twenty-five degrees Celsius (25°C) (μmho/cm));

Total Dissolved Solids (TDS, in mg/l);

All parameters listed in Appendix I of this rule; and

Additionally, the water level in each well shall be measured at the time the sample is taken.

C. The sample results, and any results of statistical analysis determining statistically significant increases for any parameter per paragraph (11)(C)5., shall be submitted to the department in one (1) report within ninety (90) days of when samples are collected.

D. In the case of all detection monitoring requirements previously listed, the department may specify an appropriate alternative frequency for repeated sampling and analysis during the active life of the utility waste landfill (including closure) and the post-closure period. The department may add additional parameters or delete parameters on a site-by-site basis through an evaluation of waste and leachate characteristics of the utility waste landfill.

E. The electronic submission of groundwater data is required. This submission shall be in the format and method as prescribed by the department.

5. The owner/operator shall specify in the operating record one (1) or more of the following statistical methods to be used in evaluating groundwater monitoring data for each monitoring constituent. The statistical test chosen shall be conducted separately for each constituent—

A. A parametric analysis of variance (ANOVA) followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The procedure shall include estimation and testing of the contrasts between each downgradient well's mean and the upgradient means for each parameter;

B. An ANOVA based on ranks followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The procedure shall include estimation and testing of the contrasts between each downgradient well's median and the background medians for each parameter;

C. A confidence interval procedure in which an interval for each parameter in each downgradient well is constructed around the mean/median of the particular well's data or data residuals and compared to the mean/median of pooled background well data;

D. A prediction interval procedure in which an upper prediction limit for an interval for each parameter in each well is compared to subsequently obtained values from the same well;

E. A prediction interval procedure in which an upper prediction limit for an interval for each parameter constructed on the pooled background well data or data residuals is compared to subsequently obtained values from each downgradient well;

F. A tolerance interval procedure in which an upper tolerance limit for an interval for each parameter's pooled background well data is compared to each downgradient well's concentration values;

G. A multicomparison procedure utilizing any recommended U.S. Environmental Protection Agency combinations of intra-well and inter-well procedures for each parameter;

H. A control chart approach meeting the performance standards of part (11)(C)5.J.(III), that gives control limits for each parameter;

I. A different statistical test method that meets the performance standards of subparagraph (11)(C)5.J. of the rule. The owner/operator must submit the statistical test method to the department for approval before the use of the alternative test; and

J. Any statistical method chosen under paragraph (11)(C)5. of this rule shall comply with the following performance standards, as appropriate:

(I) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of the concentration data for the chemical parameters or hazardous constituents. If the distribution of the concentration data for the chemical parameters or hazardous constituents is shown by the owner/operator to be inappropriate for a normal data distribution theory test, then the data should be transformed or a distribution-free (nonparametric) theory test should be used. If the concentration data distributions for the constituents of each well differ, more than one (1) statistical method will be needed;

(II) If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentration or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparisons procedure is used, the Type I experiment-wide error rate for each testing period shall be no less than 0.05, however, the Type I error of no less than 0.01 for individual well comparisons shall be maintained. This performance standard does not apply to tolerance intervals, prediction intervals or control charts;

(III) If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be protective of human health and the environment. The selection of this method shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern;

(IV) If a confidence interval, tolerance interval or a prediction interval is used to evaluate groundwater monitoring data, then the level of confidence for each interval, and the percentage of the population that each interval contains, shall be protective of human health and the environment. Selection of one (1) or more of these methods shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern;

(V) The statistical method shall account for data below the limit of detection with one (1) or more statistical procedures that are protective of human health and the environment. Any practical quantization limit that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility; and

(VI) If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

6. Response to statistical analysis.

A. If the comparison for the upgradient wells shows a statistically significant increase (or pH change) over background, the owner/operator shall submit this information to the department.

B. If the comparisons for downgradient wells show a statistically significant increase (or pH change), resulting from the landfill, over background, the owner/operator shall within ninety (90) days of the last sampling event obtain additional groundwater samples from those downgradient wells where a statistically significant difference was detected, split the samples in two (2), and obtain analyses of all additional samples to determine whether the significant statistical difference was a result of laboratory error.

C. If the additional samples show a statistically significant increase (or pH change) over background, the owner/operator must demonstrate to the department within ninety (90) days that a source other than the utility waste landfill caused the contamination or that the statistically significant increase resulted from an error in sampling, analysis, statistical evaluation or natural variation. If the owner/operator cannot make this demonstration to the department, the owner/operator shall submit a plan to the department for a groundwater assessment monitoring program and implement the program as described in subparagraphs (11)(C)6.D. through H. of this rule. The plan shall specify the following:

(I) The number, location and depth of wells;

(II) Sampling and analytical methods for the monitoring parameters listed in Appendix I of this rule on a quarterly basis;

(III) Evaluation procedures, including any use of previously gathered groundwater quality information;

(IV) The rate and extent of migration of the contaminant plume in the groundwater; and

(V) The concentrations of the contaminant plume in the groundwater.

D. After obtaining the results from the initial or subsequent sampling events required in subparagraph (9)(C)6.D. the owner/operator shall—

(I) Within fourteen (14) days, notify the department and place a notice in the operating record identifying the constituents that have been detected;

(II) Within ninety (90) days, and on a quarterly basis after that, resample all wells and conduct analysis for all constituents listed in Appendix I to this rule and notify the department of the constituent concentrations. A minimum of one (1) sample from each well sampled (background and downgradient) shall be collected and analyzed during these sampling events;

(III) Establish background concentrations for any new constituents detected during subsequent monitoring events; and

(IV) Establish groundwater protection standards for all new constituents detected during subsequent monitoring events.

E. If the concentrations of all constituents listed in Appendix I to this rule are shown to be at or below background levels as established in paragraph (11)(C)3. of this rule for two (2) consecutive sampling periods, the owner/operator may reinstate detection monitoring at the utility waste landfill as specified under subparagraph (11)(C)3.C. of this rule.

F. If the concentrations of any constituents listed in Appendix I of this rule are above background values, but all concentrations are below the groundwater protection standard established under subparagraph (11)(C)6.D. of this rule using the statistical procedures in paragraph (11)(C)5. of this rule, the owner/operator shall notify the department and the department may require the owner/operator to—

(I) Continue assessment monitoring; or

(II) Develop a corrective measures assessment, or both.

G. If one (1) or more constituents listed in Appendix I of this rule are detected at levels above the groundwater protection standard as established under subparagraph (11)(C)6.D., the owner/operator shall—

(I) Provide the department with a report assessing potential corrective measures;

(II) Characterize the nature and extent of the release by installing additional monitoring wells as necessary; install at least one (1) additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well in accordance with paragraph (11)(C)6. of this rule and, if required by the department, notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off-site if indicated by sampling of wells; and

(III) Continue assessment monitoring as per the groundwater quality assessment plan, and implement the approved corrective action program specified in part (11)(C)6.G.(I) of this rule.

H. The results of implementation of the assessment monitoring program shall be submitted to the department at the end of each year or an alternate time period approved by the department.

(12) Air Quality.

(A) Requirement. The design, construction and operation of the utility waste landfill shall minimize environmental hazards and shall conform to applicable ambient air quality and source control regulations.

(B) Satisfactory Compliance—Design. Plans shall include an effective dust control program.

(C) Satisfactory Compliance—Operations. A burning permit or exemption may be obtained from the department permitting the burning of tree trunks, tree limbs, and vegetation during clearing and grubbing. In areas operating under exemption certificates authorized by Chapter 643, RSMo approval shall be obtained from the local pollution control agency. The operating procedures and location for burning practices shall be submitted to the department for review and written approval. Burning at the utility waste landfill shall be conducted in accordance with Chapter 643, RSMo, the corresponding rules, the terms, conditions, or both, of the plans, permit, or both, and all local requirements.

(13) Aesthetics.

(A) Requirement. The utility waste landfill shall be designed and operated at all times in an aesthetically acceptable manner.

(B) Satisfactory Compliance—Design. Plans shall include an effective vegetative growth program.

(C) Satisfactory Compliance—Operations.

1. Wastes that are easily moved by wind shall be covered, as necessary, to prevent becoming airborne and scattered.

2. On-site vegetation should be cleared only as necessary. Natural windbreaks, such as green belts, should be maintained where they will improve the appearance and operation of the utility waste landfill.

3. Mining operations for the purpose of removing waste for beneficial reuse shall be conducted in such a manner as to not detract from the appearance of the utility waste landfill. Materials removed from the utility waste landfill shall be stored for not more than sixty (60) days prior to beneficial reuse. Materials removed from the utility waste landfill shall be stored so as to prevent infiltration, surface water runoff and erosion from these removed materials. All Water Pollution Control Program permits and approvals necessary to comply with the Missouri Clean Water Law and corresponding rules shall be obtained from the department.

(14) Cover.

(A) Requirement. Cover shall be applied to minimize infiltration of precipitation, airborne waste; and provide a pleasing appearance.

(B) Satisfactory Compliance—Design. The owner/operator shall prepare a written closure plan that describes the steps necessary to close all utility waste landfill phases at any point during the active life of the utility waste landfill in accordance with the requirements of 10 CSR 80-2.030(4)(A). In addition, the final cover requirements specified in the closure and post-closure plans shall specify—

1. Cover sources, quantities and soil classification (Unified Soil Classification System or United States Department of Agriculture classification system);

2. The capability of the cover to perform the functions listed in subsection (14)(A) of this rule;

3. Surface grades and side slopes needed to promote maximum runoff, without excessive erosion, and to minimize infiltration. Final side slopes shall not exceed twenty-five percent (25%) unless it has been demonstrated in a detailed slope stability analysis approved by the department that the slopes can be constructed and maintained throughout the entire operational life and post-closure period of the landfill;

4. Procedures to establish and maintain vegetative growth to combat erosion and improve appearance of idle and completed areas. Procedures shall include seeding rate, fertilizer rate, soil conditioning rate and provisions for mulching;

5. Procedures to maintain a cover integrity, for example, regrading and recovering;

6. Methods for borrow areas to be reclaimed so as to restore aesthetic qualities and prevent excessive erosion;

7. The final slope of the top of the utility waste landfill shall have a minimum slope of one percent (1%); and

8. Shear failure analyses shall be included where intermediate or final slopes exceed twenty-five percent (25%). However, the department will waive the analyses for the slopes of twenty-five percent (25%) or less except in seismic impact zones.

(C) Satisfactory Compliance—Operations.

1. Cover shall be applied at a total thickness of at least one foot (1') of compacted soil on filled areas of the utility waste landfill which are idle for more than sixty (60) days, and on all final side slopes at the end of each filling sequence.

2. No active, intermediate or final slope shall exceed thirty-three and one-third percent (33 1/3%).

3. As each phase of the utility waste landfill is completed, a final cover system shall be installed consisting of one foot (1') of compacted clay with a coefficient of permeability of 1×10^{-5} cm/sec or less and overlaid with one foot (1') of soil capable of sustaining vegetative growth.

4. The installation of the final cover systems shall include provisions for slope stability.

5. The department may approve the use of an alternative final cover system provided that the owner/operator can demonstrate to the department that the alternative design will be at least equivalent to the final cover system described in paragraph (14)(C)3. of this rule.

6. Surface grades and side slopes shall be maintained to promote runoff without excessive erosion.

7. Vegetation shall be established within one hundred eighty (180) days of application of the cover required by paragraphs (14)(C)3. and 4. of this rule. Vegetation shall be established and maintained to minimize erosion and surface water infiltration.

8. Regrading and recovering shall be performed as necessary to maintain cover slope and integrity.

9. Borrow areas shall be reclaimed in accordance with the approved plans.

10. The compacted clay portion of the final cover shall consist of soils classified under the Unified Soil Classification System as CH, CL, ML, SC or MH.

(15) Compaction.

(A) Requirement. In order to conserve utility waste landfill site capacity, thereby preserving land resources and to minimize moisture infiltration and settlement, waste and cover shall be compacted to the smallest practicable volume.

(B) Satisfactory Compliance—Design.

1. Arrangements shall be made and indicated in the plans where substitute equipment will be available to provide uninterrupted service during routine maintenance periods or equipment breakdowns.

2. The plans shall specify the equipment that should be available to conduct the utility waste landfill operation.

(C) Satisfactory Compliance—Operations.

1. Waste handling equipment, during filling operations, shall be capable of performing and shall perform the following functions:

A. Spread the wastes to be compacted in layers no more than two feet (2') thick, while confining it to the smallest practicable area;

B. Compact the spread wastes to the smallest practicable volume; and

C. Place, spread and compact the final cover as much as practicable.

2. A preventive maintenance program should be employed to maintain equipment in operating order.

3. No waste shall be disposed of in water where the presence of the water will prohibit the proper spreading and compaction of the waste or where a mosquito breeding problem would be created.

(16) Safety.

(A) Requirement. The utility waste landfill shall be designed, constructed and operated in a manner so as to protect the health and safety of personnel and others associated with and affected by the operation.

(B) Satisfactory Compliance—Design.

1. Provisions shall be included in the plans to control and limit access to the utility waste landfill in a manner that is compatible with the surrounding land use.

2. Provisions shall be included in the plans to control dust for safety purposes and to prevent a nuisance to the surrounding area.

(C) Satisfactory Compliance—Operation.

1. Adequate communications equipment shall be available at the utility waste landfill for emergency situations.

2. Access to the utility waste landfill shall be controlled and shall be by established roadways only. The utility waste landfill shall be accessible only when operating personnel are on duty.

3. Traffic signs or markers should be provided to promote an orderly traffic pattern to and from the discharge area and, if necessary, to maintain efficient operating conditions.

4. Dust control provisions shall be utilized as necessary for safety purposes and to prevent a nuisance to the surrounding area.

(17) Records.

(A) Requirement. The owner/operator of a utility waste landfill shall maintain records and monitoring data as specified by the department and file appropriate documents with the county recorder(s) of deeds.

(B) Satisfactory Compliance—Design. Plans shall prescribe methods to be used in maintaining records and monitoring the environmental impact of the utility waste landfill. Information on recording and monitoring requirements may be obtained from the department.

(C) Satisfactory Compliance—Operations.

1. Records shall be maintained at the facility site. Records five (5) years old or older may be stored at an alternate site if approved by the department; such stored records must be made available at the landfill upon request of department personnel. Records must cover at least the following:

A. Major operational problems, complaints or difficulties;

B. Any demonstration, certification, finding, monitoring, testing or analytical data required under sections (4) and (9) of this rule;

C. Dust and litter control efforts;

D. Quantitative measurements of the waste handled and an estimate of the air space left at the facility. Every two (2) years after the date of the permit issuance and within sixty (60) days of the anniversary date of the permit issuance, the owner/operator shall

submit to the department two (2) copies of a topographic map, prepared under the direction of a land surveyor or by aerial photography, showing the current horizontal and vertical boundaries of waste in the utility waste landfill and the boundaries of the utility waste landfill. Maps prepared by aerial photography shall meet the current National Map Accuracy Standards for Photogrammetry as indicated in United States Bureau of the Budget "Circular A-16 Exhibit C," dated October 10, 1958;

E. Closure and post-closure care plans and any monitoring, testing or analytical data as required under 10 CSR 80-2.030(4)(A);

F. Any cost estimates and financial assurance documentation required under 10 CSR 80-2.030(4);

G. Inspection records and training procedures as required under subsection (3)(B) of this rule;

H. Records associated with corrective measures as required under section (10) of this rule; and

I. The landfill operator shall keep a detailed report of the origin of all waste received. Effective January 1, 1998, on or before January 31 of each calendar year and annually thereafter each utility waste landfill shall submit a report to the department specifying the amount of utility waste received for disposal from states other than Missouri.

2. Upon closing of the utility waste landfill, the existence of the utility waste landfill shall be recorded with the recorder(s) of deeds in the county(ies) where the utility waste landfill is located. The owner/operator may request permission from the department to remove the notation from the deed if all wastes are removed from the facility.

A. A survey and plat meeting the requirements of the current Minimum Standards of Property Boundary Survey 10 CSR 30-2.010 and detailed description of the utility waste landfill shall be prepared by a land surveyor. The survey plat and detailed description, at a minimum, shall contain the following information:

(I) The name of the property owner as it appears on the property deed;

(II) The detailed description of the property;

(III) The general types and location of the wastes and the depth(s) of fill within the property; and

(IV) The location of any leachate control or water monitoring systems which shall be maintained after closure and the length of time that these systems are to be maintained.

B. The owner/operator shall obtain approval from the department of the survey plat and detailed description prior to filing with the county recorder of deeds. Filing the plat and detailed description shall be accomplished within thirty (30) days of departmental approval. Two (2) copies of the properly recorded plat and detailed description showing the recorder of deeds' seal or stamp, the book and page numbers and the date of filing shall be submitted to the department within thirty (30) days of filing.

C. Owners of all proposed utility waste landfills as a part of closure of the solid waste disposal area shall—

(I) Execute an easement with the department, which allows the department, its agents or its contractors to enter the premises to complete work specified in the closure plan; and

(II) Submit evidence to the department that a notice and covenant running with the land has been recorded with the recorder of deeds in the county where the utility waste landfill is located. The notice and covenant shall specify the following:

(a) That the property has been permitted as a utility waste landfill; and

(b) That use of the land in any manner which interferes with closure plans, and post-closure plans filed with the department, is prohibited.

AUTHORITY: section 260.225, RSMo (Cum. Supp. 1996). Original rule filed Oct. 10, 1996, effective July 30, 1997.*

**Original authority 1972, amended 1975, 1986, 1988, 1990, 1993, 1995.*

Appendix I—Constituents for Detection Monitoring

Arsenic (As, μg/l)
Aluminum (Al, μg/l)
Antimony (Sb, μg/l)
Barium (Ba, μg/l)
Beryllium (Be, mg/l)
Boron (B, μg/l)
Cadmium (Cd, μg/l)
Calcium (Ca, mg/l)
Chemical Oxygen Demand (COD,mg/l)
Chloride (Cl, mg/l)
Chromium (Cr, μg/l)
Cobalt (Co, μg/l)
Copper (Cu, μg/l)
Fluoride (Fl, mg/l)
Hardness (calculated, mg/l)
Iron (Fe, μg/l)
Lead (Pb, μg/l)
Magnesium (Mg, mg/l)
Manganese (Mn, μg/l)
Mercury (Hg, μg/l)
Nickel (Ni, mg/l)
pH (units)
Selenium (Se, μg/l)
Silver (Ag, μg/l))
Sodium (Na, mg/l)
Specific Conductance (Conductivity at 25°C, mho/cm)
Sulfate (SO, mg/l)
Thallium (Tl, μg/l)
Total Dissolved Solids (TDS, mg/l)
Total Organic Carbon (TOC, mg/l)
Total Organic Halogens (TOX, mg/l)
Zinc (Zn, μg/l).

Ameren Services

Environmental Services
314.554.2388 (Phone)
314.554.4182 (Facsimile)
ppike@ameren.com

One Ameren Plaza
1901 Chouteau Avenue
PO Box 66149
St. Louis, MO 63166-6149
314.621.3222

December 3, 2008

Mr. Larry Pierce, R.G.
Unit Chief - Geological Survey Program
Division of Geology and Land Survey
Department of Natural Resources
P.O. Box 250
Rolla, MO 65402-0250

RE: Preliminary Site Investigation Request - Proposed Utility Waste Landfill
AmerenUE Labadie Power Plant, Franklin County, Missouri

Dear Mr. Pierce,

As discussed in our November 12 meeting in your office, enclosed is a Preliminary Site Investigation (PSI) request for a proposed Utility Waste Landfill at AmerenUE's Labadie Power Plant in Franklin County, Missouri. This PSI request is being made in accordance with 10 CSR 80-2.015(1)(A). The PSI request encompasses approximately 1,042 acres, however only a portion of the area will be permitted as a solid waste disposal area. Following the Department's PSI findings, AmerenUE will identify and delineate a smaller footprint for the Detailed Site Investigation (DSI), design and permitting of the actual solid waste disposal area.

Ameren either currently owns, or has a verbal agreement to purchase all of the land within the PSI limits by February 27, 2009. The purchase agreement includes the rights to access the site for the purpose of completing the DSI.

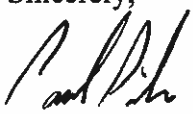
A USGS map at 1" = 2000' scale is attached to the PSI request form. The limits of the PSI area are shown on this map. Generally the PSI area extends from Labadie Bottom Road on the west to a property line approximately 1500 feet east of Davis Road on the east, and from the existing agricultural levee on the south to the existing levee on the north. Additional site information, including site maps, boring logs, piezometer locations, and piezometric water level data were provided to you on November 12th. This additional information is referenced but not submitted with this PSI request. Additional copies of this information can be provided at your request.

We understand that 10 CSR 80-2.015(1)(A) requires review and approval/disapproval of the PSI within sixty (60) days of receipt. It is also our understanding that Department staff will make a site visit during this 60 day time

period to observe site conditions. AmerenUE requests notification of this site visit so that the necessary and appropriate representatives can be present during that visit. Please coordinate the date of your site visit with either myself or Paul H. Reitz, P.E. with Reitz & Jens, Inc. I can be reached at prpike@ameren.com or 314-554-2388. Mr. Reitz can be reached at preitz@reitzjens.com or 314-993-4132, ext. 224. Once contacted, we will subsequently notify other appropriate AmerenUE representatives of the planned date and time of your staff's site visit.

If you have any questions or would like additional information regarding this PSI request, please contact me at 314-554-2388 or prpike@ameren.com.

Sincerely,



Paul R. Pike
Strategic Analyst
Environmental Services

Enclosures

cc: Bill Duley, R.G., Geological Survey Program w/enclosure
Charlene Fitch, Waste Management Program, w/enclosure
Paul Reitz, P.E., Reitz & Jens, Inc., w/enclosure
Mikel Carlson, R.G., GREDELL Engineering Resources, Inc., w/enclosure

MISSOURI DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGY AND LAND SURVEY, GEOLOGICAL SURVEY PROGRAM

REQUEST FOR PRELIMINARY INVESTIGATION OF PROPOSED SOLID-WASTE DISPOSAL SITE

FOR OFFICE USE ONLY
PROJECT CODE
DATE RECEIVED

FACILITY OR PROJECT LOCATION

FACILITY OR PROJECT NAME: AmerenUE Labadie Plant Utility Waste Landfill

¼ ¼ ¼ SECTION	¼ ¼ SECTION	¼ SECTION	SECTION	TOWNSHIP	RANGE	QUADRANGLE NAME
			*	44 North	2 ☒ East ☐ West	Labadie

WRITTEN LOCATION IF LEGAL DESCRIPTION IS UNAVAILABLE: *Section 17/20 also includes SUR 354 and 735

COUNTY: Franklin

OWNER INFORMATION

OWNER'S NAME	TELEPHONE		
Ameren	(314) 342-1000		
ADDRESS	**CITY**	**STATE**	**ZIP CODE**
One Ameren Plaza, 1901 Chouteau Ave	St. Louis	MO	63166-1419

EVALUATION REQUESTED BY

NAME AND COMPANY OF REQUESTOR	TELEPHONE		
Paul Pike, Ameren Services	(314) 554-2388		
ADDRESS	**CITY**	**STATE**	**ZIP CODE**
One Ameren Plaza, 1901 Chouteau Ave	St. Louis	MO	63166-1419

FACILITY INFORMATION

TYPE OF DISOPSAL AREA PROPOSED

☐ SANITARY LANDFILL ☐ DEMOLITION LANDFILL
☒ UTILITY WASTE LANDFILL ☐ **SPECIAL WASTE LANDFILL*

* Please specify type of special waste _____.

ESTIMATED SIZE OF DISPOSAL AREA IN ACRES: +/- 1042**

ESTIMATED ELEVATION OF THE SUB-BASE GRADE IN FEET ABOVE MEAN SEA LEVEL: 455 ft.

** A special waste is defined as "solid-waste requiring handling other than normally used for municipal waste."

SKETCH OR MAP MUST BE SUBMITTED WITH REQUEST !

A topographic map must be provided with this request that contains the following information: all known wells, springs, sinkholes, caves, mines, roads, and dwellings within ¼ mile of the facility. Show the estimated boundaries of the disposal facility and any existing borings, test pits, or excavations which expose soil or bedrock. Include a scale and north arrow on the map.

COMMENTS

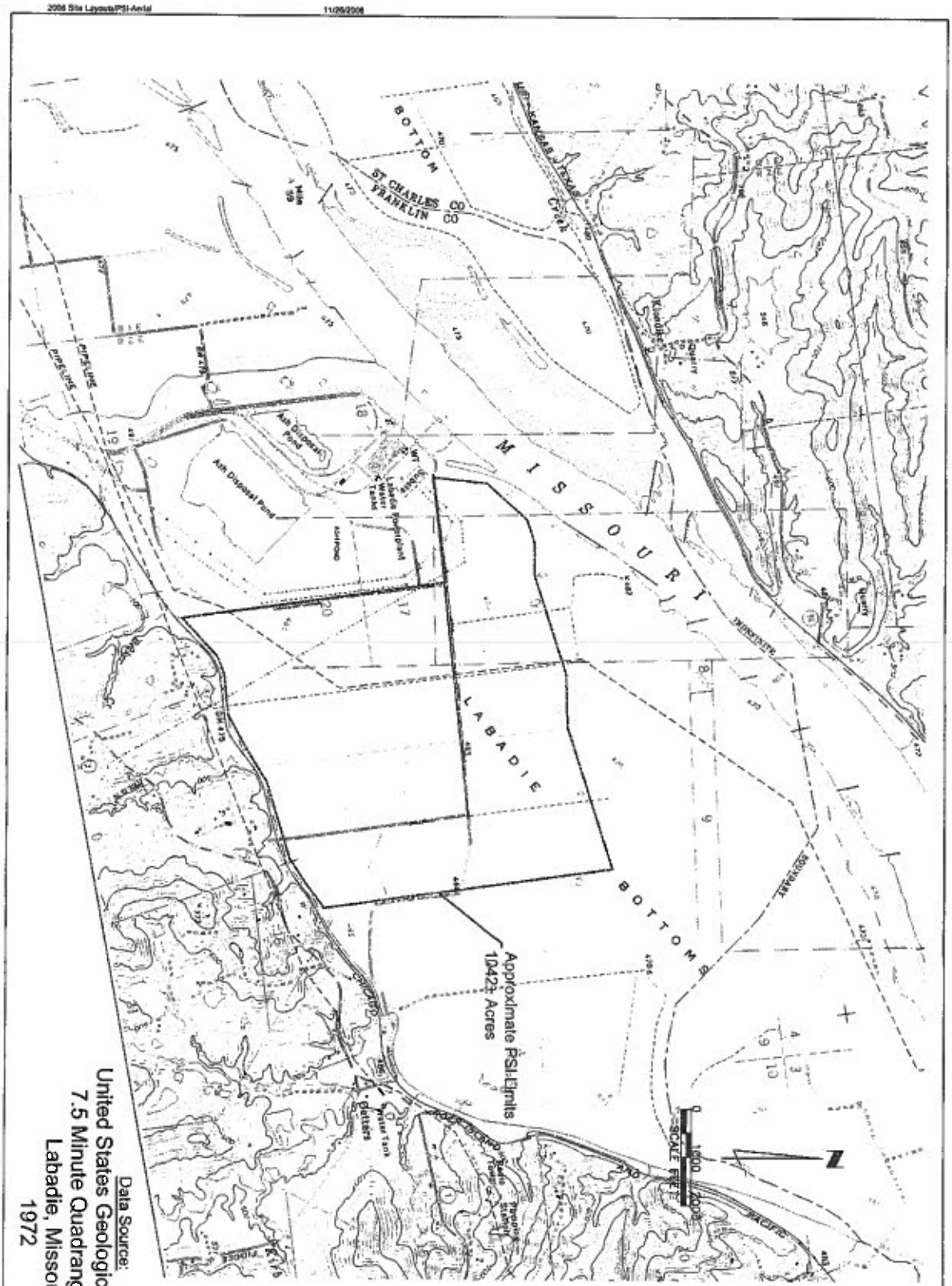
**A USGS topographic map is attached, which outlines the approximate boundaries of the requested PSI investigation area. The area delineated includew qncillary and support features of the future solid waste disposal area. Following receipt of DGLS's PSI report, AmerenUE intends to delineate a final, smaller disposal area footprint for evaluation during the DSI process.

Additional site information, including site maps, soil borings, and groundwater data, was provided to DGLS at our November 12, 2008 meeting in Rolla.

Please contact Paul Pike at 314-554-2388 or Paul Reitz (Reitz & Jens, Inc.) at 314-993-4132 to coordinate the PSI site visit.

REQUESTOR'S SIGNATURE	DATE
Paul Pike	12/3/2008
OWNER'S SIGNATURE (INDICATES PERMISSION TO ACCESS PROPERTY)	DATE
Paul Pike	12/3/2008

2008 Site Layouts/PSI-Aerial 11/26/2008



Data Source:
United States Geological Survey
7.5 Minute Quadrangle Map
Labadie, Missouri
1972

SHEET 1 OF 1	Labadie UWL PSI Site Layout 2008012455	Ameren UE	Designed g.h.r. Checked g.h.r. Drawn g.h.r. Issued 11/26/2008	REITZ & JENS, INC. CONSULTING ENGINEERS 1055 CORPORATE SQUARE DRIVE ST. LOUIS MISSOURI 63132 (314) 993-4132

SHEET 1 OF 1	Labadie UWL PSI Site Layout 2008012455	Ameren UE	Designed g.h.r. Checked g.h.r. Drawn g.h.r. Issued 11/26/2008	REITZ & JENS, INC. CONSULTING ENGINEERS 1055 CORPORATE SQUARE DRIVE ST. LOUIS MISSOURI 63132 (314) 993-4132

Bcc: J. Thee, w/enclosure
K.D. Stumpe w/enclosure
M. J. Tomasovic w/enclosure
D. V. Fox, w/o enclosure
E. J. Kammerer w/o enclosure
S. B. Knowles, w/o enclosure
T. J. Fox w/o enclosure
B. S. Skitt, w/o enclosure
C. R. Henderson w/o enclosure
W.E. Kahl w/o enclosure
M. L. Menne, w/o enclosure
S. C. Whitworth, w/o enclosure
J. C. Pozzo, w/o enclosure
File WM 3.5.8 w/enclosure

REITZ & JENS, INC.
CONSULTING ENGINEERS

1055 corporate square drive
st. louis, missouri 63132
phone: 314.993.4132
fax: 314.993.4177
www.reitzjens.com

MEMORANDUM

Subject: Preliminary Site Conditions
AmerenUE Labadie Power Plant
Proposed Utility Waste Landfill Site

Date: November 12, 2008

This report presents the results of a preliminary evaluation and field exploration of a proposed Utility Waste Landfill (UWL) site on property adjacent to AmerenUE's Labadie Power Plant. The investigation was completed in the spring of 2007.

Site Description

The proposed UWL site (Site) is on approximately 300 acres of Ameren owned property east of the Labadie Power Plant as shown in Figure 1. The Site is generally bounded on the west by Labadie Bottom Road, on the south by a Laclede Gas pipeline and agricultural levee, on the north by an agricultural levee along the Missouri River, and on the east by the Ameren property line. The entire Site is in the 100-year floodplain of the Missouri River and protected from frequent flooding by the agricultural levee system. Being in the floodplain, the ground surface is relatively flat. Existing ground surface elevations are estimated to range from 465 and 471 NGVD.

Existing improvements that need to be addressed during Site development include AmerenUE transmission lines that run parallel to the north-south portion of Labadie Bottom Road and diagonally cross the Site from northwest to southeast; a 24-inch Explorer natural gas pipeline that diagonally crosses the southern half of the Site from southwest to northeast; and the east-west portion of Labadie Bottom Road that divides the northern third of the Site. There is also a Laclede Gas pipeline running along the southern property line immediately north of the agricultural levee, and the levee itself on the northern and southern edges of the Site.

Floodplain

The Site is shown on panel 105 of the Flood Boundary and Floodway Map (FBFM) and Flood Insurance Rate Map (FIRM) for Franklin County, Missouri, effective dates of October 16, 1982. The FIRM shows the Site to be between Missouri River Mile (RM) 57 and 58 which is immediately north of the Site. The nearest river gage is located in Washington, Missouri at river mile 67.0. According to the FIRM, the regulatory 100-year flood elevation (Base Flood Elevation or BFE) at the Site is approximately 480 NGVD. The FBFM shows the floodway of the Missouri River to generally follow the agricultural levee to the north of the Site, suggesting that the entire UWL Site is in the regulatory 100-year floodplain but outside the regulatory floodway.

With the existing ground surface estimated to be between 465 and 471 NGVD, the 100-year flood will inundate the Site with 10 to 15 feet of water. The height of the agricultural levee and amount of flood protection it provides is unknown, but it appears to be 8 to 10 feet. The Site is immediately downstream of the Labadie Plant and its access roads which are at or above the 500-year flood elevation. These higher upstream elevations at least partially block flow across most of the Site during larger flood events, creating an ineffective flow area, or area of low flow velocity, over most of the Site.

Geology

The site is located on the 100-year floodplain of the Missouri River, approximately 1/2 mile south of the River channel. Alluvium, or sediment deposited by flowing water, covers the entire site. To the south, the site is bordered by loess covered uplands or the River Hills landform.

Geologic structural features closest to the proposed site are the Eureka-House Springs anticline, Moselle normal fault and the Jeffreisburg fault. These features were formed as a result of periods of uplift in the Ozarks. The Eureka-House Springs anticline is approximately 7 miles to the northeast. The Moselle normal fault is approximately 10 miles to the southwest. The Jeffreisburg fault is approximately 14 miles to the southwest. There is no literature indicating that these faults are currently active or have been active during Holocene time. The Dam and Reservoir Safety Council Permit Requirements (10 CSR 22-2.010) classifies all of Franklin County in Zone D with Probable Maximum Acceleration of bedrock of 0.23 g, somewhat greater than the St. Charles County PMA of 0.20 g.

There do not appear to be any geologic conditions such as active Holocene era faults, unstable ground or karst topography that would preclude the development of a UWL on the Site. The primary potential seismic or stability issue at the Site is liquefaction of the natural alluvial deposits. A liquefaction analysis of the UWL Site will be completed during preliminary design. However, experience with similar sites suggests that the general soil stratigraphy on the Site should be able to support a utility waste landfill that is 100 feet high, or higher.

Field Investigation

Our spring 2007 field investigation consisted of 8 borings at the approximate locations shown in Figure 1. Temporary standpipe piezometers were installed in three borings, designated P-1, P-2 and P-3. Borings P-1 and B-7 were drilled to refusal in cobbles or limestone bedrock. The completed depths of these borings were 91.5 feet and 104.5 feet, respectively. The other borings were 20 to 30 feet deep, and were terminated in the underlying medium-dense sand.

Below the surface topsoil and disturbed zone (due to farming), the 8 borings encountered 0 to 8.5 feet of high plastic clay which should have a permeability of 1×10^{-7} cm/sec or less when compacted, and thus would be suitable for a composite liner for the UWL. Boring P-1 on the north end and Boring B-8 on the south end had no clay stratum. The thickness of the high plastic clay in the remaining 6 borings ranged from 2.5 feet to 8.5 feet, and averaged about 6 feet. The remainder of the soils in the upper 13.5 feet consisted of sandy silts, silty clay, silt, and silty sand.

Below about 13.5 feet, the borings encountered strata of medium-dense to very dense sand and gravelly sand. Cobbles and boulders were encountered below about 50 feet in the two deep borings.

Since they were installed in March 2007, the water levels in the piezometers have been periodically read and recorded along with the reported Missouri River Stage at the Washington gage. These results are included in Table I. Once the elevation and location of the piezometers have been determined by survey, the piezometer water levels will be compared to the reported river elevations based on the gage data.

p:\amerenue\2008012455\reports\geologic reports\psi geology report - 111208.doc

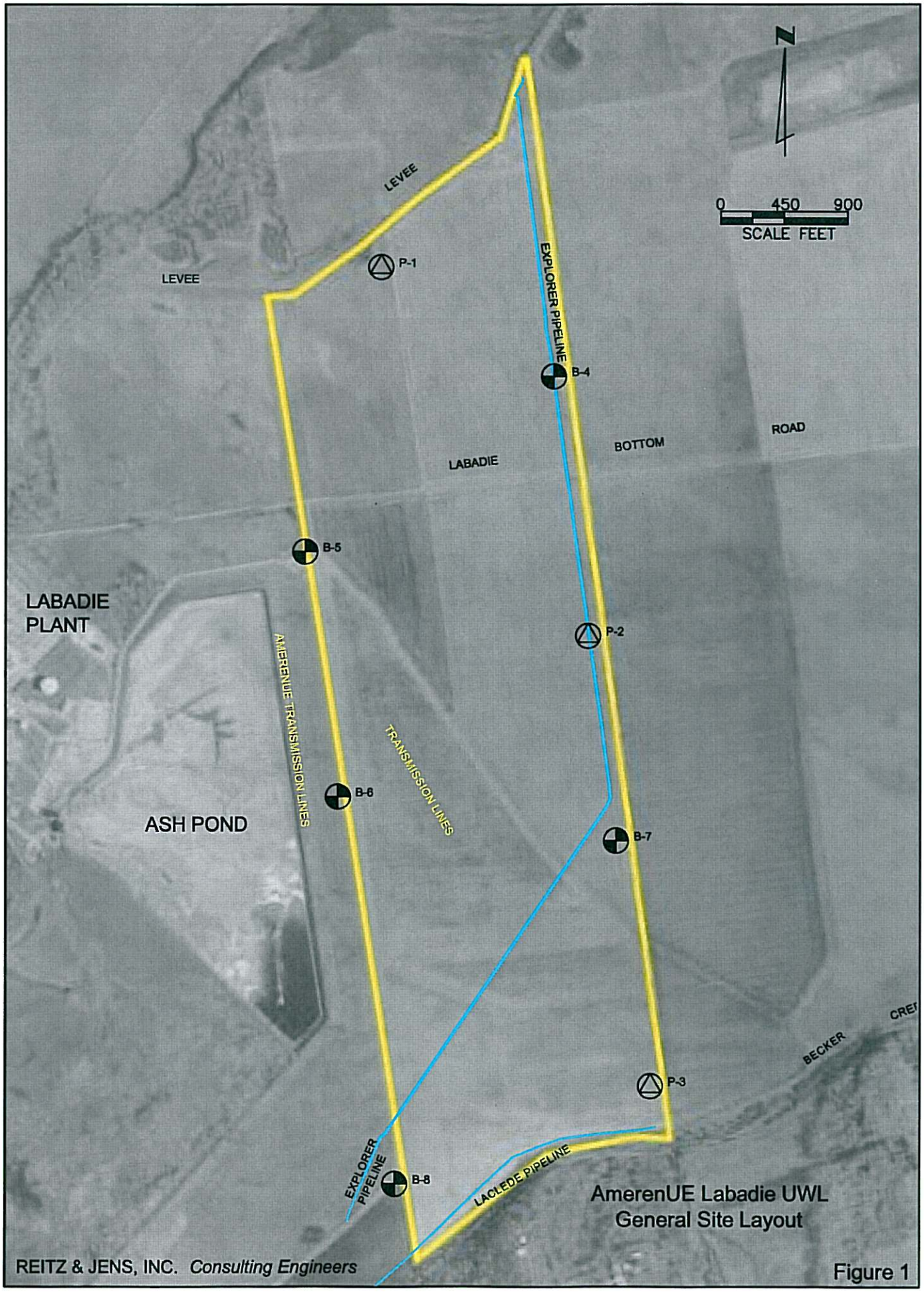

N
0 450 900
SCALE FEET
LEVEE
LEVEE
P-1
EXPLORER PIPELINE
B-4
BOTTOM
ROAD
LABADIE
B-5
LABADIE
PLANT
P-2
AMERENUE TRANSMISSION LINES
TRANSMISSION LINES
B-6
ASH POND
B-7
BECKER
P-3
EXPLORER
PIPELINE
B-8
LACLEDE PIPELINE
AmerenUE Labadie UWL
General Site Layout
REITZ & JENS, INC. Consulting Engineers
Figure 1

TABLE 1

AmerenUE Labadie Plant
Piezometer Readings

Piezometer	Top Elevation (NGVD)
P-1	
P-2	
P-3	

* River Stage data obtained from Washington gage @ RM 67.0
O gage = 457.20 NGVD
** Measured from notch in top of 2"-PVC riser

			P-1				P-2				P-3			
	River Stage (ft)*		Field Measurements**		Elevation (NGVD)		Field Measurements**		Elevation (NGVD)		Field Measurements**		Elevation (NGVD)	
Date	Stage*	Elevation	Bottom Depth (ft)	Water Depth (ft)	Bottom Elevation	Water Elevation	Bottom Depth (ft)	Water Depth (ft)	Bottom Elevation	Water Elevation	Bottom Depth (ft)	Water Depth (ft)	Bottom Elevation	Water Elevation
3/16/2007	6.0	463.2	32.25	21.99	-32.25	-21.99	31.61	17.90	-31.61	-17.90	32.30	17.63	-32.30	-17.63
4/5/2007	11.2	468.4		20.63		-20.63		16.71		-16.71		16.30		-16.30
5/4/2007	14.9	472.1		17.56		-17.56		13.95		13.95		13.56		-13.56
5/10/2007	22.2	479.4		14.45		-14.45		12.62		-12.62		12.58		-12.58
5/13/2007	24.2	481.4		11.18		-11.18		11.22		-11.22		10.68		-10.68
11/19/2007	1.2	458.4		20.71		-20.71		15.37		-15.37		14.92		-14.92
1/11/2008	7.8	465.0		21.52		-21.52		16.53		-16.53		15.90		-15.90
3/12/2008	9.3	466.5		18.07		-18.07		13.92		-13.92		13.30		-13.30
6/13/2008	21.6	478.8		8.06		-8.06		4.92		-4.92		not read		
6/18/2008	23.0	480.2		6.99		-6.99		4.45		-4.45		5.49		-5.49
10/30/2008	10.5	467.7		15.37		-15.37		10.62		-10.62		10.28		-10.28

Observations were taken at dirt road crossing of levee north of P-1
5/10/2007 Flood waters at toe of levee on unprotected side approx. 6" to 12" deep
5/13/2007 Flood waters are approx 2.5' to 3.5' deep on unprotected side

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG P-1

AmerenUE Labadie Power Plant UWL
Franklin County, Missouri
CLIENT: **Ameren Services**

LOCATION: N E
ELEVATION: 471 DATUM: U.S.G.S.
DATE DRILLED: 3-14-2007

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
0	470					TOPSOIL (4")		
					83	Sandy SILT (ML), brown, loose, dry	3-4-3	18.4
					78	Becoming grayish brown, less sandy, with clay laminations, moist	2-2-3	28.5
5	465				67	Becoming more sandy, medium-dense, dry	2-3-5	15.7
					72	Becoming tan	3-5-6	15.0
10	460							
					89	Silty SAND (SP-SM), tan, fine, loose	3-3-4	12.4
15	455							
		▽			100	Becoming gray, slightly silty, very loose, with clay balls, free water	1-1-1	
20	450							
					94	SAND (SP), tan, fine, medium-dense	3-5-7	
25	445							
					89	Becoming gray, fine- to medium-grain, with decaying wood, loose	3-2-4	
30	440							

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

DRILLER: Midwest
METHOD: CFA/Mud Rotary
TYPE OF SPT HAMMER: Automatic
HAMMER EFFICIENCY (%):
LOGGED BY: J. Pruett

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING 19 FEET
N BORING DRY AT COMPLETION OF DRILLING
AT ____ FEET AFTER ____ HOURS
AT ____ FEET AFTER ____ HOURS
PIEZOMETER: INSTALLED AT 30 FEET

File: 2007012401

Figure A-1 Sheet 1 of 3

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG P-1

AmerenUE Labadie Power Plant UWL

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
35	435				83	Becoming tan, fine- to coarse, medium- dense	6-8-10	
40	430				72	Becoming gray, fine- to medium-grain, dense, with decaying wood	10-15-10	
45	425				72	Without decaying wood	13-21-15	
50	420				39	SAND and GRAVEL (SP-GP), gray, dense, with clay balls and fragments of dolomite (up to 1.5") Very stiff drilling at 51' (heavy gravels and cobbles)	9-16-7	
55	415							
60	410				78	Becoming medium-dense, without clay and fragments of dolomite Very stiff drilling from 60.5' to 61.5' possible limestone cobbles or boulders	12-10-8	
65	405							
70	400				72		2-8-9	

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

File: 2007012401

Figure A-1 Sheet 2 of 3

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG P-1

AmerenUE Labadie Power Plant UWL

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES ROD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
75	395					Very stiff drilling at 71', 73', and 77' to 78', possible cobbles or boulders		
					44		7-8-9	
80	390					Very stiff drilling from 80' to 91.5' possible cobbles		
85	385							
					33	Becoming dense	10-11-12	
90	380					Boring terminated at 91'-6" in cobbles.		
95	375					Note: terminated boring due to very difficult drilling; rods were binding during advancement, near breaking point.		
100	370							
105	365							

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

File: 2007012401

Figure A-1 Sheet 3 of 3

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG P-2

AmerenUE Labadie Power Plant UWL
Franklin County, Missouri
CLIENT: **Ameren Services**

LOCATION: N E
ELEVATION: 467 DATUM: U.S.G.S.
DATE DRILLED: 3-12-2007

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
0						TOPSOIL (5")		
	465				100	CLAY (CH), dark grayish brown, high plastic, moist, stiff	3-3-6	27.3
5					94	Becoming firm, with seams of grayish brown silt	3-3-3	36.4
	460				100	SILT (ML), tan, medium-dense, with fine sand, dry	3-4-4	14.7
					89	Becoming loose, with traces of iron stains	2-1-3	25.9
10	455							
		▽			100	SAND (SP), grayish tan, fine, medium- dense	4-6-7	
15	450							
					78	Becoming dark gray	1-3-5	
20	445							
					100	Becoming fine- to medium-grain	2-3-5	
25	440							
					100	Becoming fine to coarse	7-7-8	
30	435					Boring terminated at 30'-0"		

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

DRILLER: Midwest
METHOD: CFA/Mud Rotary
TYPE OF SPT HAMMER: Automatic
HAMMER EFFICIENCY (%):
LOGGED BY: J. Pruett

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING 14 FEET
N BORING DRY AT COMPLETION OF DRILLING
AT _____ FEET AFTER ____ HOURS
AT _____ FEET AFTER ____ HOURS
PIEZOMETER: INSTALLED AT 30 FEET

File: 2007012401

Figure A-2 Sheet 1 of 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG P-3

AmerenUE Labadie Power Plant UWL
Franklin County, Missouri
CLIENT: **Ameren Services**

LOCATION: N E
ELEVATION: 467 DATUM: U.S.G.S.
DATE DRILLED: 3-12-2007

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
0						TOPSOIL (5")		
	465				78	CLAY (CH), dark gray, high plastic, with silt seams, moist, stiff	2-3-4	24.5
						SILT (ML), grayish tan, with fine sand		
5					94	Silty SAND (SP-SM), grayish tan, fine, loose	1-3-1	26.6
	460				100	With lenses of gray high plastic clay	1-1-4	29.9
					100	With alternating layers of fine silty sand and high plastic clay	2-3-4	31.4
10	455	▽						
					83	SAND (SP), gray, fine, loose	2-4-3	
15	450							
					100	Becoming medium-dense	2-5-8	
20	445							
					100		5-7-8	
25	440							
					100		6-7-7	
30	435					Boring terminated at 30'-0"		

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

DRILLER: Midwest
METHOD: CFA/Mud Rotary
TYPE OF SPT HAMMER: Automatic
HAMMER EFFICIENCY (%):
LOGGED BY: J. Pruett

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING 13.5 FEET
N BORING DRY AT COMPLETION OF DRILLING
AT ____ FEET AFTER ____ HOURS
AT ____ FEET AFTER ____ HOURS
PIEZOMETER: INSTALLED AT 30 FEET

File: 2007012401

Figure A-3 Sheet 1 of 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG B-4

AmerenUE Labadie Power Plant UWL
Franklin County, Missouri
CLIENT: **Ameren Services**

LOCATION: N E
ELEVATION: 468 DATUM: U.S.G.S.
DATE DRILLED: 3-9-2007

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
0						TOPSOIL (3")		
					78	Sandy SILT (ML-SM), tan, loose, wet	3-3-1	37.4
	465					CLAY (CH), grayish brown, high plastic, moist, soft		
5					100			
					89	Becoming dry and firm	1-2-3	34.0
	460							
					72	Sandy SILT (ML-SM), tan, medium-dense, moist	5-9-7	18.6
10								
	455							
					67	SAND (SP), tan, fine, medium-dense with organic clay balls	4-4-10	
15								
	450	▽						
					89	Becoming tan and gray, fine- to medium-grain, loose	1-2-3	
20								
	445							
					100	Becoming medium-dense	4-7-10	
25						Boring terminated at 25'-0"		
	440							
30								

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

DRILLER: Midwest
METHOD: CFA
TYPE OF SPT HAMMER: Automatic
HAMMER EFFICIENCY (%):
LOGGED BY: J. Pruett

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING 18.5 FEET
N BORING DRY AT COMPLETION OF DRILLING
AT ____ FEET AFTER ____ HOURS
AT ____ FEET AFTER ____ HOURS
PIEZOMETER: INSTALLED AT ____ FEET

File: 2007012401

Figure A-4 Sheet 1 of 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG B-5

AmerenUE Labadie Power Plant UWL
Franklin County, Missouri
CLIENT: **Ameren Services**

LOCATION: N E
ELEVATION: 467 DATUM: U.S.G.S.
DATE DRILLED: 3-12-2007

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
0						TOPSOIL (4")		
	465				100	Silty CLAY (CL-CH), brown, moderately plastic, stiff, dry	2-3-4	20.2
					78	CLAY (CH), grayish brown, high plastic, stiff, moist	2-4-6	33.2
5						With tan silty fine sand laminations		
	460				94		2-3-4	30.6
					83	SAND (SP), tan, fine, medium-dense with sporatic clay balls	4-5-6	
10								
	455							
					72	Becoming grayish tan, without clay balls	3-4-4	
15		▽						
	450							
					89		1-3-4	
20								
	445							
					100		1-4-4	
25						Boring terminated at 25'-0"		
	440							
30								
	435							

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

DRILLER: Midwest
METHOD: CFA
TYPE OF SPT HAMMER: Automatic
HAMMER EFFICIENCY (%):
LOGGED BY: J. Pruett

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING 16.5 FEET
N BORING DRY AT COMPLETION OF DRILLING
AT ____ FEET AFTER ____ HOURS
AT ____ FEET AFTER ____ HOURS
PIEZOMETER: INSTALLED AT ____ FEET

File: 2007012401

Figure A-5 Sheet 1 of 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG B-6

AmerenUE Labadie Power Plant UWL
Franklin County, Missouri
CLIENT: **Ameren Services**

LOCATION: N E
ELEVATION: 467 DATUM: U.S.G.S.
DATE DRILLED: 3-12-2007

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
0	465				61	TOPSOIL (4") CLAY (CH), grayish brown, high plastic, slightly silty, firm, dry	2-3-3	22.4
5	460				78	Sandy SILT (ML-SM), tan, medium-dense, becoming more sandy with depth	3-4-4	23.0
					94	With seams of dark grayish brown, stiff, high plastic clay	3-5-9	16.6
10	455				100	SAND (SP), tan, fine, medium-dense	6-6-5	
15	450	▽			72	Becoming brown	3-4-5	
20	445				78	Becoming loose Boring terminated at 20'-0"	1-2-3	
25	440							
30	435							

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

DRILLER: Midwest
METHOD: CFA
TYPE OF SPT HAMMER: Automatic
HAMMER EFFICIENCY (%):
LOGGED BY: J. Pruett

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING 16 FEET
N BORING DRY AT COMPLETION OF DRILLING
AT ____ FEET AFTER ____ HOURS
AT ____ FEET AFTER ____ HOURS
PIEZOMETER: INSTALLED AT ___ FEET

File: 2007012401

Figure A-6 Sheet 1 of 1

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG B-7

AmerenUE Labadie Power Plant UWL
Franklin County, Missouri
CLIENT: **Ameren Services**

LOCATION: N E
ELEVATION: 465 DATUM: U.S.G.S.
DATE DRILLED: 3-12-2007

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
0	465					TOPSOIL (4")		
					100	CLAY (CH), grayish brown, high plastic, with silty fine sand laminations, firm, moist	2-3-4	30.0
					83			
5	460							
					94	Becoming dry	1-2-4	14.2
					100	Silty CLAY (CL), gray and tan, very soft, becoming more silty with depth, wet	1-1-1	40.1
10	455							
		▽			100	SAND (SP), gray, fine, slightly silty, medium-dense	1-4-4	
15	450							
					100	Becoming grayish tan and gray	2-2-5	
20	445							
					100	SAND and GRAVEL (GP-SP), grayish tan, fine sand to coarse gravel, medium-dense	3-2-5	
25	440							
					28	Becoming very dense, with less coarse gravel	23-30-28	
30	435							

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL ⊢——⊣ LL
20 40 60

DRILLER: Midwest
METHOD: CFA/Mud Rotary
TYPE OF SPT HAMMER: Automatic
HAMMER EFFICIENCY (%):
LOGGED BY: J. Pruett

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING 14 FEET
N BORING DRY AT COMPLETION OF DRILLING
AT ____ FEET AFTER ____ HOURS
AT ____ FEET AFTER ____ HOURS
PIEZOMETER: INSTALLED AT ____ FEET

File: 2007012401

Figure

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG B-7

AmerenUE Labadie Power Plant UWL

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
35	430				78	Becoming dense with coarse gravel (up to 1")	17-15-13	
40	425				100	SAND (SP), gray, fine, very dense	10-17-24	
45	420				100		15-23-30	
50	415				89		14-19-19	
55	410							
60	405				94	SAND & GRAVEL (SP-GP), gray, coarse sand and fine gravel, dense	9-13-12	
65	400							
70	395				100	With medium gravel (to 3/8")	11-11-14	

SHEAR STRENGTH, tsf

△ QU/2 ■ PP □ SV ◇ TV

1 2 3

STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)

● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)

PL — LL

20 40 60

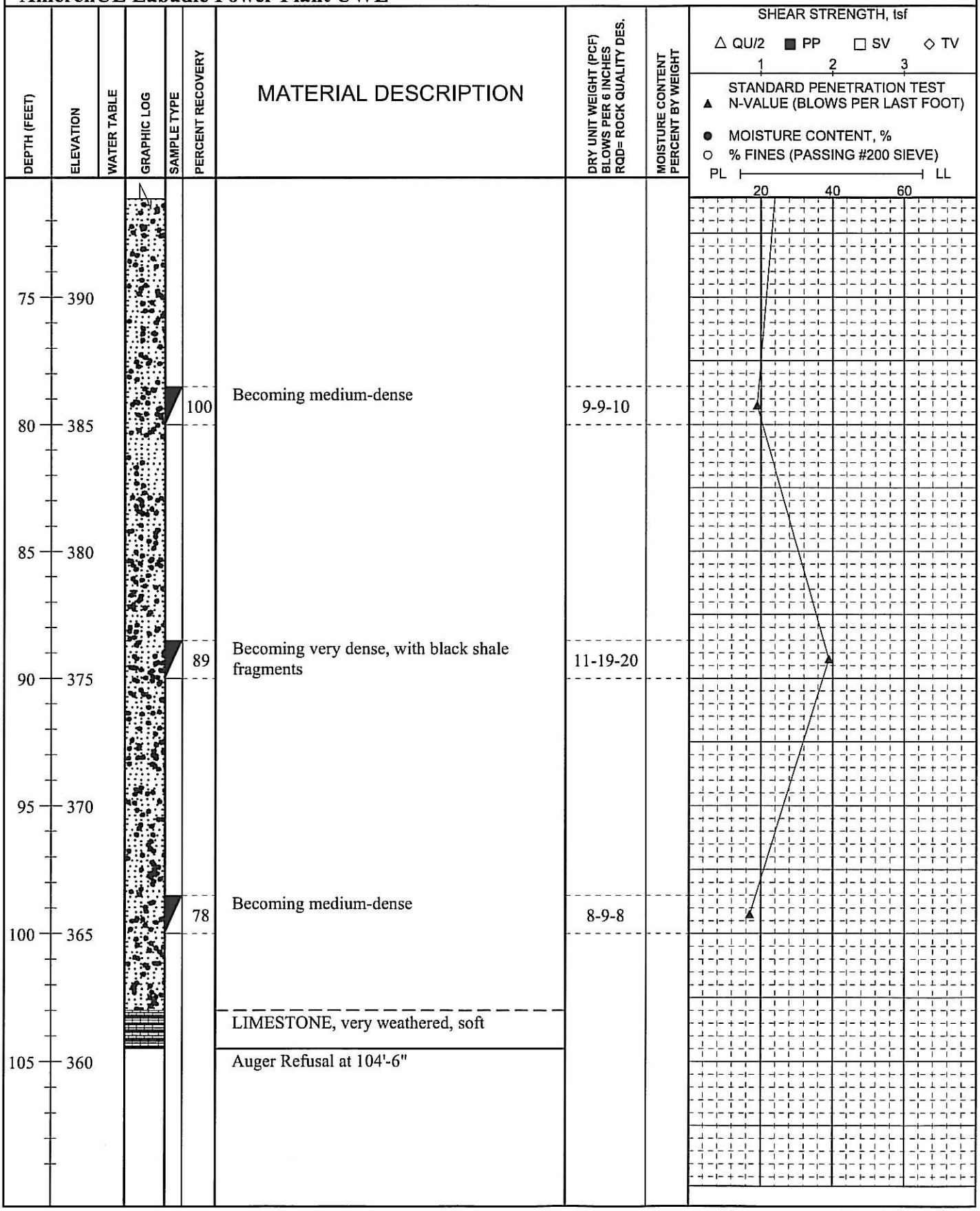
File: 2007012401

Figure

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG B-7

AmerenUE Labadie Power Plant UWL



File: 2007012401

Figure Sheet 3 of 3

REITZ & JENS, INC.
CONSULTING ENGINEERS

BORING LOG B-8

AmerenUE Labadie Power Plant UWL
Franklin County, Missouri
CLIENT: **Ameren Services**

LOCATION: N E
ELEVATION: 468 DATUM: U.S.G.S.
DATE DRILLED: 3-9-2007

SHEAR STRENGTH, tsf
△ QU/2 ■ PP □ SV ◇ TV
1 2 3
STANDARD PENETRATION TEST
▲ N-VALUE (BLOWS PER LAST FOOT)
● MOISTURE CONTENT, %
○ % FINES (PASSING #200 SIEVE)
PL LL
20 40 60

DEPTH (FEET)	ELEVATION	WATER TABLE	GRAPHIC LOG	SAMPLE TYPE	PERCENT RECOVERY	MATERIAL DESCRIPTION	DRY UNIT WEIGHT (PCF) BLOWS PER 6 INCHES RQD= ROCK QUALITY DES.	MOISTURE CONTENT PERCENT BY WEIGHT
0						TOPSOIL (4")		
					83	Sandy SILT (ML-SM), gray and tan, loose, with seams of grayish brown high plastic clay, dry	2-2-3	17.5
	465							
					67		2-2-3	12.6
5								
					89	Becoming medium-dense, without clay seams, with fine sand laminations	3-5-4	23.0
	460							
					94	SAND (SP), tan, fine, medium-dense, with sporatic clay balls	3-5-4	
10								
	455							
					78	Becoming grayish brown, loose	2-3-3	
15								
	450	▽						
					94	Becoming very loose	1-1-3	
20						Boring terminated at 20'-0"		
	445							
25								
	440							
30								

DRILLER: Midwest
METHOD: CFA
TYPE OF SPT HAMMER: Automatic
HAMMER EFFICIENCY (%):
LOGGED BY: J. Pruett

STRATIFICATION LINES ARE APPROXIMATE SOIL BOUNDARIES ONLY; ACTUAL CHANGES MAY BE GRADUAL OR MAY OCCUR BETWEEN SAMPLES.

WATER LEVELS: DURING DRILLING 17.5 FEET
N BORING DRY AT COMPLETION OF DRILLING
AT ____ FEET AFTER ____ HOURS
AT ____ FEET AFTER ____ HOURS
PIEZOMETER: INSTALLED AT ____ FEET

File: 2007012401

Figure A-8 Sheet 1 of 1

KEY TO BORING LOGS

Symbol	Description
KEY TO SOIL SYMBOLS	
	Topsoil
	Silty SAND or Sandy SILT (SM)
	Poorly-graded SAND (SP)
	Poorly-graded SAND & GRAVEL (GP)
	High plastic CLAY (CH)
	Inorganic, non-plastic SILT (ML)
	Medium to high plastic CLAY
	Low plastic Silty CLAY (CL)
	Very Weathered LIMESTONE

Symbol	Description
	Moisture content (%)
	N-value from Standard Penetration Test (blows/ft)
	Shear strength from Pocket Penetrometer (tsf)
SOIL SAMPLERS	
	2-in. O.D. Split-Spoon
	3-in. O.D. Shelby Tube

MISCELLANEOUS SYMBOLS

 Water table during drilling

 Boring continues

Notes:

1. Borings were drilled March 9 - 14, 2007, by Midwest Drilling, Inc. The borings were advanced using continuous flight augers (CFA) to below the water table, and then with mud rotary drilling techniques using Bentonite slurry.

2. Boring locations were selected and located by Reitz and Jens, Inc.

3. Borings were logged in the field by a Reitz & Jens' soils technician based upon the recovered samples, cuttings and drilling characteristics. Samples were transported to Reitz & Jens' lab for testing. Field logs were revised, if needed, based upon laboratory classification and testing.

4. Stratification lines shown on the log represent approximate soil boundaries; actual changes in strata may be gradual or occur between samples.

5. Piezometers were installed in Borings labeled P-1, P-2, and P-3.

Figure A-0

Electronic copy of letterhead

STATE OF MISSOURI Jeremiah W. (Jay) Nixon, Governor Joseph P. Bindbeutel, Acting Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

February 2, 2009

CERTIFIED MAIL 7005 3110 0004 3988 9017
RETURN RECEIPT REQUESTED

Mr. Paul Pike
Ameren
One Ameren Plaza
1901 Chouteau Avenue
St. Louis, MO 63166

Re: Preliminary investigation of the proposed expansion of the AmerenUE-Labadie Utility Waste Landfill, (Section 17 and 20, Township 44 North, Range 2 East, Labadie 7.5 Minute Quadrangle, Franklin County)

Dear Mr. Pike:

The Geological Survey Program (GSP) has completed the Preliminary Site Investigation (PSI) for the proposed expansion to the AmerenUE-Labadie Utility Waste Landfill. The proposed landfill is approximately 1042 acres.

The site is approved to proceed to the next phase of the permitting process. Please find enclosed the PSI report (ID# F00409) that summarizes the geologic and hydrologic evaluation of the proposed expansion area.

Also enclosed is a copy of Appendix 1, Guidelines for Planning, Conducting, and Reporting Detailed Geologic and Hydrologic Investigations at a Proposed Solid Waste Disposal Area. This document summarizes the elements and format that should be used to develop a detailed site investigation workplan. We encourage you and your consultant to meet with the GSP staff prior to finalizing a workplan for the detailed site investigation to discuss the elements to be included within the report. Please contact Mr. Larry Pierce, telephone 573-368-2191, or email larry.pierce@dnr.mo.gov, to schedule this workplan meeting.

Current procedures call for an applicant receiving approval at the preliminary site investigation stage to participate in public involvement activities as part of the solid

waste disposal area permit application process. Within 30 days of the approval, the applicant must notify both the governing body of the county or city, and the solid waste management district in which the proposed disposal area is to be located. This notification is to be by certified mail.

Within 90 days of the Preliminary Site Investigation approval, the department will conduct a public awareness session in the county in which the proposed disposal area is to be located. For further information concerning these public involvement requirements, please contact the Solid Waste Management Program at (573) 751-5401.

If you have any questions, please feel free to contact Larry "Boot" Pierce at P.O. Box 250, Rolla, Missouri 65402, telephone (573) 368-2191, or email at larry.pierce@dnr.mo.gov. Thank you for your interest.

Sincerely,

DIVISION OF GEOLOGY AND LAND SURVEY

James W. Duley, RG
Deputy Division Director

cc: Charlene Fitch, Waste Management Program, w/enclosure
Paul Reitz, P.E., Reitz & Jens, Inc., w/enclosure
Mike Carlson, R.G., Gredell Engineering Resources, Inc., w/enclosure
Region I – East Central SWMD

Missouri Department Of Natural Resources
Division of Geology and Land Survey
P.O. Box 250
Rolla, Missouri 65402-0250
Phone - 573.368.2161 Fax - 573.368.2111
E-mail - gspgeol@dnr.mo.gov

Project ID Number
F00409

County
Franklin

Solid Waste Disposal Site - Geologic Evaluation

Project Name AmerenUE Labadie, Utility Waste Landfill Quadrangle LABADIE

Location Section 17 Township 44N Range 2E

Additional Location Inforamtion Also Section 20, includes SUR 354 and 735

Latitude 38 Deg 34 Min 0 Sec North Longitude 90 Deg 49 Min 31 Sec West

Owner: Ameren

One Ameren Plaza, 1901 Chouteau Ave., St. Louis, MO 63166-1419 (314) 342-1000

Requestor: Ameren Services

Paul Pike, One Ameren Plaza, 1901 Chouteau Ave., St. Louis, MO 63166-1419 (314) 554-2388

Date of Field Visit

Slope

- (●) < 4%
- ( ) 4% to 8%
- ( ) 8% to 15%
- (◉) >15

Landscape position

- ( ) Broad uplands
- ( ) Ridgetop
- ( ) Hillslope
- (◉) Narrow ravine
- (●) Floodplain
- ( ) Alluvial plain
- ( ) Terrace
- ( ) Other

Groundwater of concern

- ( ) Perched
- (●) Local
- ( ) Regional

Groundwater located in

- (●) Overburden
- ( ) Bedrock

Bedrock

The uppermost bedrock is the Ordovician-age Everton Formation or the Jefferson City-Cotter Dolomite, which both exhibit low permeability in this area. These formations are typically composed of an undulating dolomite overlying a thicker, massive sandstone, and a light-gray to light brown, medium- to finely crystalline, cherty dolomite, respectively.

Overburden

The surficial materials are best described as ranging from brown to tan, silty-sand alluvium with some clay (SM/SC) to brown to gray, highly plastic, inorganic clay (CH) in the upper 20-30 feet. Two soil borings (P-1 and B-7) indicate cobble and boulder-size limestone and dolomite debris below 50 feet. Bedrock is contacted at approximately 100 feet. These materials typically exhibit moderate to high permeability in this environment.

Site Hydrology

The Missouri River alluvial aquifer is the uppermost continuous water-bearing unit. Groundwater in the alluvial aquifer largely flows in the same direction but is variable depending on the river stage. Surface water and groundwater also flow due north from the Franklin Low Hills of the Ozark Uplands south of the site and contribute to the overall water balance at the site. Overland flow on the site tends to travel north-northeast.

Underlying the Quaternary alluvium of the proposed site, the uppermost continuous bedrock water-bearing unit is within the Ordovician dolomites. Though no confining unit separating the alluvial aquifer from the underlying Ozark Aquifer has been identified, the thickness of saturated alluvium and the groundwater direction and gradient makes it highly unlikely that this lower aquifer could become contaminated by the proposed site.

Remarks

The proposed AmerenUE utility-waste landfill was visited to conduct preliminary site investigations and determine the general suitability for use as a utility waste disposal area. The site is located in the east halves of Sections 17 and 20, Township 44 North, Range 2 East, in the Lower Missouri River Alluvial Plain. The elevation of the proposed site is approximately 465 msl. The area of the proposed site is an alluvial bottomland bounded by the Missouri River on the north, east and west; and the Ozark Uplands to the south. The proposed utility landfill is tentatively sited in the alluvial bottoms, approximately one-third of a mile to the east of the existing Ameren Labadie power plant.

Examination of the well logs of on-site boreholes indicates the presence of alluvial materials ranging from silts and clays to fine to coarse grained sand, to gravel, cobble and boulder-size clasts of limestone, dolomite and insoluble clasts at depth. Some organic materials, such as decaying trees were observed at depth in the logs. There is no evidence of a lower confining unit within the alluvium. However, the thickness of the alluvium (over 100 feet thick) and the shallow depth to groundwater (ranging from eight to 20 feet) and the existing groundwater gradients indicate a low probability of groundwater contamination from this facility into the lower Missouri River alluvial aquifer or the Ozark Aquifer.

During the site visit for the preliminary site investigation, fault displacement was observed in the bed cut of a railroad bordering the southern edge of the proposed utility landfill. This fault appeared to transect the Ordovician-age Everton Formation and the overlying Ordovician-age St. Peter Sandstone. Inactive bedrock faults are not uncommon, however, further exploration may be warranted during the detailed site investigation.

Results of Preliminary Investigation ☑ Approval ☐ Disapproval

Further exploration not recommended due to unstable or unsuitable conditions in the following areas

○ Hydrological ○ Collapse Potential ○ Bedrock ○ Soil

Report By Blake Smotherman for Blake Smotherman Report Date 02/03/2009

CC Charlene Fitch, Paul Reitz (Reitz & Jens, Inc.), Mike Carlson (Gredell Engineering), Region I - East Central SWMD

STATE OF MISSOURI LARRY D. PIERCE RG0179 REGISTERED GEOLOGIST