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January 2014

Groundwater and Surface Water Data Demonstrate No Adverse Human Health Impact from Coal Ash Management at the Ameren Labadie Energy Center

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List of Acronyms

ACAA	American Coal Ash Association
AQL	Missouri State Protection of Aquatic Life Criteria
AWQC	Ambient Water Quality Criteria
CARES	Center for Applies Research and Environmental System
CPA	Construction Permit Application
CSM	Conceptual Site Model
DSI	Detailed Site Investigation
ft bgs	Feet Below Ground Surface
GIS	Geographic Information System
GPS	Global Positioning System
HDPE	High Density Polyethylene
ICIS	Integrated Compliance Information System
LEO	Labadie Environmental Organization
MCL	Maximum Contaminant Level
MDNR	Missouri Department of Natural Resources
MEGA	Missouri Environmental Geology Atlas
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MSDIS	Missouri Spatial Data Information System
NPDES	National Pollution Discharge Elimination System
ppm	Part per Million
PWS	Public Water Supply
RAGS	Risk Assessment Guidance for Superfund
RSL	Regional Screening Levels

SMCL	Secondary Maximum Contaminant Level
STORET	Storage and Retrieval (Database)
TDS	Total Dissolved Solids
ug/L	Micrograms per Liter
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UWL	Utility Waste Landfill
WET	Whole Effluent Toxicity

Groundwater and Surface Water Data Demonstrate No Adverse Human Health Impact from Coal Ash Management Practices at the Ameren Labadie Energy Center

Executive Summary

Ameren Missouri has conducted an investigation of groundwater and surface water in and around its coal-fired power plant at the Labadie Energy Center located in Franklin County, Missouri. This comprehensive evaluation demonstrates that there are **no adverse impacts on human health from either surface water or groundwater uses** resulting from coal ash management practices at the Facility, and refutes unsubstantiated comments made by citizen groups such as the Labadie Environmental Organization (LEO).

A critical aspect to any review of groundwater and surface water data associated with coal ash management practices generally is the presence, or lack thereof, of high concentrations of sulfate and boron. These "indicator parameters" will be present in high concentrations if a release from coal ash management practices has occurred. Sampling results discussed in this Report reveal that neither sulfate nor boron concentrations are elevated in groundwater or surface water and, therefore, potential off-site receptors are **not impacted** by the coal ash management practices at the Facility.

LEO's comments include allegations around threats to groundwater used as drinking water in the general area of the Facility, and the potential effect of the Facility coal ash management practices on surface water quality. LEO's comments have been expressed without reference to actual data or examples of impact. The conclusions expressed in this Report are based on actual data from **16 surface water** (Missouri River and Labadie Creek) samples and **90 groundwater** samples collected using protocols and evaluation methods that are consistent with State and Federal environmental programs. These conclusions and the data upon which they are based are technically sound and scientifically defensible.

The results of this investigation provide Ameren Missouri and the community with the information needed to understand that this Facility's coal ash management practices are not adversely impacting human health through current drinking water use of the Missouri River, current drinking water use of groundwater, or recreational use of Labadie Creek or the Missouri River.

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A short summary of this important investigation is provided below.

Ameren Missouri currently manages fly ash and bottom ash at the Facility in two ash ponds, one of which is lined. Ameren Missouri is in the process of permitting the construction of a utility waste landfill on property it owns adjacent to the Facility.

Ameren Missouri has addressed the community's concerns about health risks and coal ash management in the context of a descriptive conceptual site model for groundwater and surface water for the Facility and its environs. Conceptual site models are used in regulatory programs as the basis for gathering and evaluating environmental data by both the State of Missouri in its Risk-Based Corrective Action Program and by the United States Environmental Protection Agency (USEPA) in its Superfund program. The process used to evaluate environmental data in this Report follows such methodology and evaluates constituent sources (coal ash management practices); potential releases to the environment (groundwater); potential migration of constituents in the environment (within groundwater and to surface water); and identifies where human exposure could theoretically occur (for example, use of groundwater or surface water as drinking water).

Ameren Missouri retained the services of AECOM and Golder Associates Inc. (Golder) to apply this methodology to review available data, and to identify data gaps where additional information was needed to provide for a full evaluation. Ameren Missouri then directed the collection of the additional environmental data needed to fill these data gaps:

- Labadie Creek – Surface water samples were collected upstream (three samples) and downstream (three samples) from the Facility. The Creek borders the Facility to the west; the ash ponds are situated between 560 and 850 feet from the Creek.
- Missouri River – Surface water samples were collected 0.25 mile upstream (five samples) and 0.25 mile downstream (five samples) from the Facility. The River

Groundwater and Surface Water Data Demonstrate No Adverse Human Health Impact from Coal Ash Management Practices at the Ameren Labadie Energy Center

borders the Facility to the north; the ash ponds are situated approximately 0.5 miles from the River.

- Groundwater – Samples were collected from three bedrock groundwater monitoring locations in the bluff area immediately south of the Facility. One sample was collected from a location adjacent to private drinking water wells. This area is approximately 1.1 miles in an upgradient direction from the ash ponds. Two samples were collected from locations at the base of the bluff adjacent to the Labadie Bottoms and approximately 1200 feet upgradient of the Facility's coal ash management areas.

These data were used in a human health risk-based evaluation in combination with the following data available from Ameren Missouri's activities conducted as part of on-going regulatory programs:

- NPDES[1] – Two sets of data are available from Ameren Missouri's permitted Outfall 002 – these data were collected as part of 1998 and 2011 permit application submittals. The outfall is the discharge point for the fly ash and bottom ash ponds, and is located approximately 0.7 miles from the Missouri River.
- Utility Waste Landfill Permitting – Groundwater data are available for three rounds of sampling for 29 monitoring wells located around the proposed footprint of the landfill[2], for a total of 87 samples.

In total, analytical data for a comprehensive list of inorganic constituents from **16 surface water** samples and **90 groundwater** samples were used in this evaluation.

Surface water and groundwater sampling results reveal that the concentrations of the "indicator parameters" sulfate and boron are **not** elevated in groundwater or surface water and, therefore, there are **no offsite impacts** from the coal ash management practices. Moreover, the detected constituent concentrations in both surface water and groundwater reflect background conditions and do not indicate any release due to coal ash management practices. Such concentrations would occur in the surface water and the alluvial groundwater whether or not the Labadie Energy Center was present and result from the natural characteristics of the geologic materials that make up the region.

The surface water sample results were generally similar upstream and downstream in the Creek and in the River. While in the Missouri River boron concentrations were slightly higher downstream than upstream, the sulfate concentrations were slightly lower downstream than upstream; thus, there is not a consistent pattern in the River for the "indicator parameters." Concentrations are below screening levels, further indicating no adverse impact of the coal ash management practices on surface water quality. The results also indicate that there is no impact from the coal ash management practices on the public drinking water intake located on the Missouri River 19.5 miles downstream at Howard Bend.

The groundwater sampling results were used to directly test the allegation that the coal ash management practices have adversely impacted drinking water in the area. Two groundwater monitoring locations were installed in bedrock at the base of the bluffs immediately south of the facility and within 1200 feet of the coal ash management area. A third well was located further south in the bluffs in an area surrounded by residential wells. If the coal ash management practices were impacting the bedrock groundwater that is used for drinking water, such impact should be evident in these wells, and it is not. In fact, all results are **below** federal drinking water standards and/or risk-based screening levels, and neither the sulfate nor boron concentrations are elevated in the groundwater.

The approach used in this Report was designed to evaluate the surface water and groundwater in the vicinity of the Facility by collecting data from areas where impacts and human exposure could hypothetically occur, if at all.

The results of the evaluation demonstrate that there are **no adverse impacts on human health for either surface water or groundwater** as a result of coal ash management practices at the Labadie Energy Center.

[1] National Pollutant Discharge Elimination System.

[2] The proposed UWL will be located approximately 750 feet from the ash ponds and 0.5 mile from the River.

1.0 Introduction

Ameren Missouri has retained the services of AECOM and Golder Associates Inc. (Golder) to assess the potential for public health risks associated with coal ash management practices at the Labadie Energy Center (Facility), a coal-fired power plant located in Franklin County, Missouri (see **Figure 1**). This Report evaluates a large dataset of analytical results for surface water and groundwater samples taken at or adjacent to the Facility property. The results of the evaluation indicate no adverse impact on human health resulting from either surface water or groundwater uses and refutes unsubstantiated comments made by citizen groups such as the Labadie Environmental Organization (LEO) raised during public hearings on a proposed landfill for the Facility, and in formal comments submitted to the U.S. Environmental Protection Agency (USEPA) on a federal rulemaking associated with coal ash management and disposal. LEO's comments include allegations regarding threats to groundwater used as drinking water in the general area of the Facility, and the potential effect of the Facility on surface water quality. Such comments have been expressed without reference to actual data or examples of impact.

Ameren Missouri addresses these concerns in the context of a descriptive conceptual site model for groundwater and surface water for the Facility and its environs. Conceptual site models are used in regulatory programs as the basis for gathering and evaluating environmental data. USEPA used this concept as the basis for the development of its risk assessment guidance in its authoritative document, Risk Assessment Guidance for Superfund (RAGS), Part A (USEPA, 1989). The Missouri Department of Natural Resources (MDNR) has issued regulations for assessing risk-based corrective action that are based on a conceptual site model approach (10 CSR 25-18.010), and cites to USEPA's guidance. The process used in this Report follows such methodology and evaluates constituent sources (coal ash management practices); potential releases to the environment (groundwater); potential migration of constituents in the environment (within groundwater and to surface water); and identifies where human exposure could theoretically occur (for example, use of groundwater or surface water as drinking water). Available analytical data for groundwater and surface water have been summarized and evaluated to determine whether a complete exposure pathway exists (i.e., the potential for direct exposure to coal ash-derived constituents in groundwater and surface water). In addition, a human health risk-based screening and an ecological risk-based screening have been conducted for all of the data.

This detailed analysis of the potential environmental and human health impacts of coal ash management at the Labadie Energy Center is provided in this Report.

1.1 Background

Coal is a type of sedimentary rock that is a natural component of the earth's crust, and the inorganic minerals and elements it contains are also naturally occurring. Coal ash is the material remaining after the combustion of coal. The organic component of coal is burned to produce energy, and the inorganic minerals and elements that remain after combustion make up the coal ash.

There are generally two kinds of coal ash, fly ash and bottom ash. Fly ash is coal ash that exits from a combustion chamber in the flue gas and is captured by air pollution control equipment. Fly ash has cementitious and/or pozzolanic properties that make it suitable for use as a building material. Fly ash with high calcium content is cementitious, meaning that it will harden like concrete when mixed with

water. Cementitious ashes are typically generated from low sulfur, western coals like that burned at the Labadie plant.

Ameren Missouri has an active program for beneficial use of the fly ash and bottom ash produced at the Labadie Energy Center. Since 2010, in excess of 60% of fly and bottom ash produced at the Facility is put into various beneficial uses. This level of beneficial use is higher than the national average of 47% (ACAA, 2013). The remainder of the ash is managed in two on-site ash ponds.

Ameren Missouri proposes to construct a utility waste landfill (UWL) for the management of coal ash generated at its Labadie Energy Center. The proposed landfill has been designed to prevent and limit potential releases to the environment. The design includes 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 with a geomembrane layer above the clay; a leachate collection and disposal system; and a groundwater monitoring system. The landfill permitting process is ongoing and includes approval of the landfill design by the MDNR.

The proposed landfill is to be sited on less than 200 acres within an approximate 1,042-acre tract of land owned by Ameren Missouri adjacent to the Facility. This buffer property is currently used for agriculture but can be removed from such service at any time. The Facility is approximately two and one-half miles northeast of the town of Labadie and borders the Missouri River in northeast Franklin County, Missouri. The Facility and the proposed landfill site are located in an area called the Labadie Bottoms. Scattered rock out-croppings or bluffs make up much of the southern boundary of this area. Isolated farmsteads and single-family dwellings are located along the crest of the river bluffs above the Facility, but dwellings do not exist within one-quarter mile of the landfill site within the flood plain itself, and these locations and the bluffs are upgradient of the Facility.

Throughout the regulatory approval process, public hearings have been convened and attended by members of the community. LEO has conducted an active campaign against the landfill, has participated in public hearings, and distributed information regarding the proposed landfill. The stated concerns of LEO relate to the potential impact on drinking water quality, and their fear that releases from the Facility, and the proposed landfill in particular, will adversely impact drinking water. Groundwater is the main source of drinking water for Franklin County residents. With respect to surface water, the nearest drinking water intake on the Missouri River is located approximately 19.5 river miles downstream of the Facility, at Howard Bend. This intake services the City of St. Louis, which also supplies drinking water to other communities.

To respond to such concerns, Ameren Missouri performed a more in-depth review of environmental investigations previously performed, and voluntarily commissioned additional investigations. To address the issue of surface water quality, in the fall of 2013 Ameren Missouri conducted an investigation of surface water at locations both upstream and downstream of the Facility on the Missouri River and on Labadie Creek, which forms the western boundary of the Facility and is a tributary to the Missouri River. To address the issue of off-site groundwater quality, in January 2012 Ameren Missouri installed groundwater monitoring locations south of the Facility and in an area where private wells are used for drinking water. In addition, as part of the landfill permitting process, in 2013 Ameren Missouri collected groundwater data from a comprehensive monitoring well network installed around the perimeter of the proposed landfill site. Ameren Missouri also regularly monitors the water at its permitted discharge outfalls, as part of its National Pollution Discharge Elimination System (NPDES) permit.

This Report presents a human health-risk based assessment of these groundwater and surface water data sources and evaluates the results in the context of a conceptual site model for the Facility.

1.2 Methods Overview

A human health risk-based approach was used to identify and evaluate data needed to meet the study objective. A conceptual site model was developed to describe the process by which a potential constituent release to the environment and subsequent transport within the environment could affect environmental media (such as groundwater or surface water), and to identify locations where people could contact these environmental media. Existing data were evaluated, and data gaps were identified. Two additional environmental sampling activities were conducted to collect data to fill these data gaps. Thus, groundwater and surface water data from several sources are available for this analysis. All of the data were summarized and used in a human health risk evaluation. The new data and the risk evaluation results were used to evaluate the conceptual site model and derive conclusions.

2.0 Risk-Based Evaluation Methods

A conceptual site model, or CSM, is the method used to guide this risk-based evaluation of groundwater and surface water data for the Labadie Energy Center. Because this is an important concept, this section first provides a description of the methodology for developing a conceptual site model.

2.1 CSM Introduction

A CSM is developed to evaluate the potential for human exposure to constituents that may have been released to the environment. Some of the questions posed during the CSM evaluation include:

> What is the source? How can constituents be released from the source? What environmental media may be affected by constituent release? How and where do constituents travel within a medium? Is there a point where a receptor (human or ecological) could contact the constituents in the medium? Are the constituent concentrations high enough to potentially exert a toxic effect?

The first step in developing the CSM is the characterization of the setting of the study area and surrounding area. Current and potential future uses of the study area and people who may potentially contact the environmental media of interest are then identified. Potential exposure scenarios and pathways are developed that describe how people may contact constituents released to the environment. Barriers to access including engineering and institutional controls are considered when evaluating whether a specific exposure pathway is complete.

For an exposure pathway to be complete, the following conditions must exist (as defined by USEPA (1989)):

1. A source and mechanism of chemical release to the environment;
2. An environmental transport medium (e.g., air, water, soil);
3. A point of potential contact with the medium by a receptor; and
4. A receptor exposure route at the contact point (e.g., inhalation, ingestion, dermal contact).

A receptor in this context is an organism that could hypothetically contact constituents that have been released to the environment. For the purposes of this Report, receptors will refer to people that may contact environmental media that may contain constituents that may be released as a result of the Facility's operations. Unless all of the four above conditions are met, the potential exposure pathway will be deemed incomplete. In other words, the exposure pathway is considered complete only if there are no discontinuities in or impediments to movement of a constituent from the source to the receptor. Only complete exposure pathways can result in exposure to humans.

- For example, a chemical may be spilled on the ground at an industrial facility, but if the facility is secured and members of the public are not allowed to enter the facility, there is no exposure to the public and the exposure pathway is considered to be incomplete. Alternatively, a chemical may be spilled at a location outside an industrial facility boundary in a public area. In this case, the exposure pathway would be considered to be complete –

someone could be exposed to the chemical by directly contacting the spilled material, or contacting impacted soil.

- Similarly, a large quantity of a chemical may be spilled at a facility such that it may travel down through the soil and reach groundwater and it may travel in groundwater at high enough of a concentration that it may impact a downgradient drinking water well; in this case, the drinking water exposure pathway would be considered to be complete. However, if the spilled material reaches the water table and travels in groundwater, but the concentrations in groundwater decrease such that a downgradient well is not impacted, then the exposure pathway is incomplete. Alternatively, if that same spill is contained by engineering controls such as a concrete pad or other form of impervious lining, then the chemical will not reach groundwater and will not impact any downgradient drinking water wells; in this case, the exposure pathway would also be considered to be incomplete.

Not all complete exposure pathways, however, result in a risk to human health. **For human health risk to exist, the exposure must be of a sufficient magnitude and frequency.** If the exposure pathway is complete, but the magnitude, or concentration of the chemical in the environmental medium is below health risk-based levels, then the exposure would not pose an adverse risk. Thus an exposure pathway could be complete but be insignificant on a health-risk basis.

The CSM is used to identify potentially complete exposure pathways by evaluating the source → transport → medium → exposure linkage. The CSM can then be used to identify where data gaps may exist by asking the question, what data are needed to determine if the exposure pathway is complete, and if so, is there is a risk associated with that pathway.

2.2 Risk-Based Screening Levels

Groundwater and surface water data are evaluated on a human health risk basis. Human health risk assessment is a process used to estimate the chance that contact with constituents in the environment may result in harm to people (USEPA, 1989). Generally, there are four components to the process: (1) Hazard Identification, (2) Toxicity Assessment, (3) Exposure Assessment, and (4) Risk Characterization.

One method used by USEPA in risk assessments is to develop “screening levels” of constituent concentrations in groundwater (and other media) that are considered to be protective of specific human exposures. This type of evaluation follows USEPA’s Risk Assessment Guidance for Superfund, Part B (USEPA, 1991). In this approach, a specific target risk level (component 4) is combined with an assumed exposure scenario (component 3) and toxicity information from USEPA (component 2) to derive an estimate of a concentration of a constituent in an environmental medium, for example groundwater, (component 1) that is protective of a person in that exposure scenario (for example, drinking water).

Risk-based screening levels are designed to provide a conservative estimate of the concentration to which a person (receptor) can be exposed without experiencing adverse health effects. Due to the conservative methods used to derive risk-based screening levels, it can be assumed with reasonable certainty that concentrations below screening levels will not result in adverse health effects, and that no further evaluation is necessary. Concentrations above conservative risk-based screening levels do not necessarily indicate that a potential risk exists, but indicate that further evaluation may be warranted.

Human health risk-based screening levels for groundwater are generally derived to be protective of the use of groundwater as a drinking water source. Human health risk-based screening levels for surface water are generally derived to be protective of the use of surface water as a drinking water source and the consumption of fish from a surface water body. The drinking water screening levels are also protective of recreational uses of a surface water body (such as swimming or boating) because drinking water exposure is of a higher magnitude and frequency.

The human health screening levels for groundwater and surface water used in this analysis are from federal and state sources and address the drinking water exposure pathway and the fish consumption pathway (where such values are available from the State). These sources are:

- Rules of Missouri Department of Natural Resources, Division 60 Safe Drinking Water Commission Chapter 4 Contaminant Levels and Monitoring. (MDNR, 2010a)
- 10 Missouri Code of State Regulations, Division 20, Chapter 7, Table A. Provides surface water criteria protective of human health fish consumption, drinking water supplies, and groundwater. (MO CSR, 2012)
- USEPA 2012 Edition of the Drinking Water Standards and Health Advisories, Spring 2012. (USEPA, 2012)
- USEPA Regional Screening Levels, November 2013, values for tapwater. (USEPA, 2013a)

The screening levels obtained from these sources are primary drinking water standards or maximum contaminant levels (MCLs) and secondary drinking water standards (SMCLs); Missouri has adopted the federal MCLs and SMCLs for the State. MDNR provides screening levels for the fish consumption exposure pathway. Risk-based regional screening levels (RSLs) from USEPA for tapwater (drinking water) have also been used in this evaluation. **Table 1** presents the screening levels used in this evaluation (the constituent list is discussed in Section 4.2). The screening levels are reported in units of milligrams of constituent per liter of water (mg/L).

3.0 Conceptual Site Model

This section provides the description of the preliminary site model for the Facility. The geology and hydrogeology sections are provided by Golder and are summarized in part from reports prepared for the Facility; addition detail can be found in these reports (Gredell Engineering Resources, Inc., and Reitz & Jens, 2011; and Reitz & Jens, 2010).

3.1 Setting

The Ameren Missouri Labadie Energy Center is located approximately 2.5 miles northeast of the town of Labadie and borders the Missouri River in northeast Franklin County, Missouri. The Facility boundary is shown on **Figure 1**.

The Facility is bounded to the northwest by the Missouri River, extending approximately 1.3 miles along the riverfront. The Facility is bounded to the west by Labadie Creek, to the north and east by agricultural land, and scattered rock out-croppings or bluffs make up much of the southern boundary of the Facility. The bluffs and hilly upland areas are apparent on the topographical map of the Facility and surrounding area, shown on **Figure 2**.

The Labadie Energy Center includes the coal-fired power plant and two ash ponds used for coal ash management, which are located approximately 0.5 miles from the Missouri River. The coal ash ponds are located between approximately 560 and 850 feet from Labadie Creek. The eastern most ash pond is lined with high density polyethylene (HDPE). The proposed lined landfill is to be sited on less than 200 acres within an approximate 1,042-acre tract of land owned by Ameren Missouri adjacent and to the east of the power plant. The land is currently used for agriculture. The Facility, including the proposed landfill site, is located within the flood plain of the Missouri River, in an area called the Labadie Bottoms.

Land use to the east and west of the Facility is agricultural. The river bluffs and upland hills border the Facility to the south and rise 200 feet or more above the Labadie Bottoms. Isolated farmsteads and single-family dwellings are located along the crest of the bluffs, but dwellings are not present within one-quarter mile of the landfill site within the flood plain itself. **Figure 3** shows the locations of private wells within a one-mile radius of the Facility based on available State records. The majority of the wells are located to the south of the Facility in the upland hills beyond the bluff area. **Figure 4** shows the locations of community public water supply wells within seven miles of the Facility based on State database information. The closest community public water supplies (Hermit Hollow and St Albans) are located 1.78 and 2 miles from the power plant, respectively. The town of Labadie is located approximately 2.25 miles southwest of the power plant, and it is supplied drinking water from the Public Water Supply District #3 of Franklin County (http://www.franklincountywater.com/); the several wells that make up the Public Water Supply District #3 are all located more than 3 miles from the Facility boundary.

3.1.1 Geology

Surficial geology in the area is a result of the flow and deposits of the Missouri River. The underlying bedrock in this area of Missouri consists of sedimentary formations that extend across much of eastern and southern Missouri. The bedrock in the Labadie area is mainly limestone, sandstone, and dolomite (Starbuck, 2010) that are common in the region. Over time, the Missouri River has eroded

the bedrock forming the Missouri River valley. The deeper regions of the valley have filled in with sands, gravels, silts and clays. It is these materials that make up the floodplains of the Missouri River, and specifically the Labadie Bottoms in the vicinity of the Facility.

As a whole, the Labadie Bottoms area is relatively flat and shallowly slopes towards the Missouri River to the north and northeast. Geologically, the sands, gravels, silts, and clays of the Labadie Bottoms are called floodplain alluvium or alluvial deposits (Butler and Siemens, 2010; Missouri Environmental Geology Atlas, MEGA, 2007). The alluvium extends from bluff to bluff throughout the Missouri River valley with smaller alluvial deposits located along larger streams. **Figure 5** shows the extent of the alluvial deposits in the Labadie area, and depicts where these deposits are located along larger streams flowing towards the Missouri River. These alluvial deposits are Holocene age which means that they are relatively recent in age on the geologic time scale. By drilling holes into the ground in this area during the landfill site investigation, Reitz & Jens (2010) determined that these alluvial deposits are approximately 100 feet thick (**Figure 6**).

Below the sands and gravels of the floodplain alluvial deposits lies the sedimentary bedrock. This bedrock is much older than the alluvial deposits, and was formed in the geologic Ordovician Age. This bedrock material is stronger and tighter (less permeable to water) than the relatively looser sands and gravels in the alluvial deposits that lie above the bedrock.

The bluffs to the south of the Facility are comprised of the same general bedrock formations but have not been as deeply eroded by the Missouri River. The bedrock formations in the bluffs and underneath the floodplain alluvial deposits are continuous (**Figure 6**) while the alluvial deposits are limited to the river and creek floodplain areas in the Labadie Bottoms.

3.1.2 Hydrology and Hydrogeology

The geology provides the setting for the surface water and groundwater – or hydrology and hydrogeology, respectively – in the area. Three surface water features (e.g., streams, rivers) lie in the immediate area around the Facility (**Figure 2**). The Missouri River is on the northern boundary of the Facility, and flows towards the northeast in this area. Labadie Creek forms much of the western boundary of the Facility. It flows north and discharges into the Missouri River. To the south and south east of the Facility is a small agricultural ditch along the bluff called the Iman Branch that flows east and discharges into Fiddle Creek. Fiddle Creek continues to flow towards the east/northeast along the bluffs until it ultimately discharges into the Missouri River.

The headwaters of Labadie Creek are about 1 mile south of the town of Labadie, and about 3 miles south of the Facility. Labadie Creek drains an area along Highway MM, Labadie Bottom Road/Front Street, and Labadie Power Plant Road. The Creek runs through Labadie (at the junction of Highway MM, Highway T and Labadie Bottom Road/Front Street). Prior to joining the Missouri River, Labadie Creek drains past the Labadie Energy Center to the east.

Groundwater is present throughout this area in two distinctly different storage systems known as aquifers. Aquifers are underground layers of rock, sands, gravels, soils, etc., in which water is present and through which water can flow. A shallow aquifer consisting of sands, gravels, silts and clays of Missouri River alluvial floodplain deposits in Labadie Bottoms is called the alluvial aquifer. An aquifer is also present within the bedrock that lies below the Labadie Bottoms alluvial deposits and in the bedrock that makes up the bluffs to the south of the Facility (**Figure 6**). Regionally, the bedrock aquifer is part of the Ozark Aquifer system.

The top elevation of the groundwater is called the water table. In general, the surface of the water table in these areas mimics the land surface elevation (topography) above it. The water table is generally below the ground surface, except in areas such as wetlands and where there are streams and rivers – in these areas the water table reaches the ground surface.

3.1.2.1 Groundwater Flow

Groundwater flow is described by Darcy's Law which states that the rate at which groundwater flows is equal to the product of the hydraulic conductivity multiplied by the hydraulic gradient (http://www.ngwa.org/). In simplified terms, the hydraulic gradient is the difference in groundwater elevations between two locations (or the slope of the water table) and the hydraulic conductivity can be described as how easily water flows through soil or rock. The elevation of the groundwater, and how easily groundwater can flow through the materials that make up the specific aquifer are two major factors that determine the direction and velocity of groundwater flow.

3.1.2.2 Groundwater Elevation

Within an individual aquifer, groundwater flows from areas of higher water elevations (higher hydraulic pressure) to areas of lower water elevations. Groundwater flowing from a higher elevation to a lower elevation is considered to be flowing in a downgradient direction. Thus, water flows from upgradient locations to downgradient locations.

Areas of high water elevation are often associated with recharge areas, and are typically found at higher ground surface elevations. At these recharge areas, precipitation in the form of rain or melting snow percolates into the ground and reaches the aquifer. From these recharge areas, water will flow downgradient towards areas of lower water elevations where it may discharge. Discharge areas typically lie in low ground surface elevation areas and may contain surface water in the form of a lake or river.

3.1.2.3 Constraints on Groundwater Flow

Groundwater flows most easily in areas of least resistance. Water in streams and rivers is unconstrained – it can flow freely. Water will flow relatively easily through sand and gravel, and as the materials get more dense and compacted or contain more silt and clay, groundwater flow will become more constrained and consequently does not flow as easily. For example, water that is poured on more permeable sand and gravel will infiltrate or soak in quickly, whereas water poured on less permeable compacted clayey soil or limestone bedrock will take longer to infiltrate or soak in.

The same is generally true in the subsurface. Groundwater can flow more easily in aquifers that are comprised of unconsolidated sands and gravels. Groundwater flow is typically more constrained in bedrock aquifers when compared to alluvial sand and gravel aquifers. Along the Missouri River, the bedrock permeability is several orders of magnitude lower than that for the alluvial deposits (Emmett and Jeffrey, 1968; Grannemann and Sharp, 1979).

3.1.2.4 Groundwater Flow at Labadie

As discussed above, groundwater flows from areas of high water level elevations (recharge areas) to areas of lower water level elevations (discharge areas). In the Labadie area, the Missouri River under normal conditions is the lowest water level elevation towards which surface water and shallow groundwater flow, thus it acts as a shallow groundwater discharge location. Groundwater flow in the alluvial aquifer of the Labadie Bottoms can generally be described as flowing from the bluff areas in the south towards the Missouri River to the north under normal river conditions (Gredell Engineering

Resources, Inc., and Reitz & Jens, 2011). Groundwater in the bedrock aquifer under the bluffs and under the Labadie Bottoms generally flows from areas of topographically high ground, to areas of low ground, and ultimately discharges into the Missouri River (USGS, 1994). These concepts are illustrated on **Figure 6.**

The groundwater in the alluvial aquifer was studied in depth by Gredell Engineering Resources, Inc., and Reitz & Jens, Inc., (2011) during a yearlong investigation, as reported in the Detailed Site Investigation (DSI) report. This study measured groundwater levels within the alluvial aquifer at 100 locations for 1 year. During this study, the groundwater level within the floodplain alluvial aquifer was relatively shallow, and typically less than 13 feet below the ground surface. The groundwater level fluctuated between approximately 456-469 feet above mean sea level over the study period. However, at any one time, the total change in groundwater level across the study area was not more than 4 feet in elevation. This study concluded that the groundwater surface, or water table, in the alluvial aquifer is relatively flat and the water elevations reflect that groundwater flow in the alluvial aquifer is generally toward the Missouri River under normal river conditions.

During the study, it was concluded that groundwater in the alluvial aquifer typically flowed to the north or northeast (toward the Missouri River), however, the direction of groundwater flow is related to the water level of the Missouri River at any given time throughout the year. When the Missouri River water surface is high (i.e., above an elevation range of 461-463 feet above mean sea level), the direction of groundwater flow changes from a northerly to a more easterly direction. This variability is typical of shallow alluvial aquifer systems that fluctuate with changing river water levels.

Groundwater velocity rates were also calculated by Gredell Engineering Resources, Inc., and Reitz & Jens, Inc., (2011). In their report, they calculated that groundwater flow within the alluvial aquifer varies and groundwater velocity rates of 0.1 to 10 feet per year are typical. The variability in measured groundwater velocity in the alluvial aquifer can be attributed to changing Missouri River water levels, as these can greatly affect the water flow into and out of (recharge/discharge) the alluvial aquifer near the river.

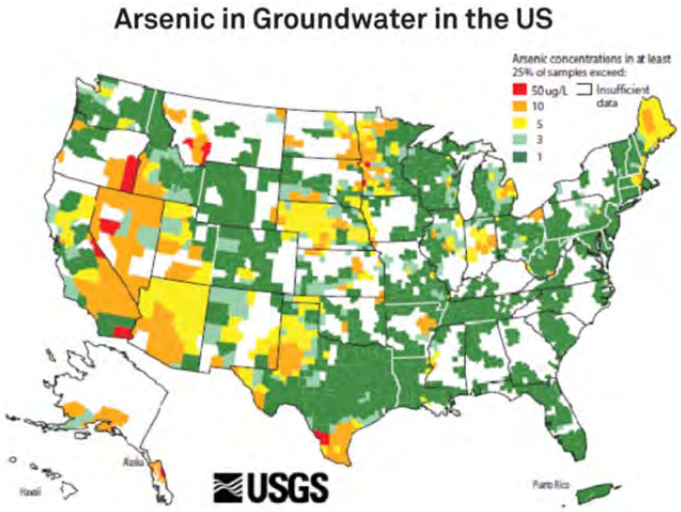
In 2012, Golder conducted a groundwater study to determine groundwater flow direction within the bedrock in a residential area in the bluffs south of the Facility. By installing monitoring wells and examining the groundwater elevations and resulting gradients within the bedrock aquifer, Golder determined that groundwater within the bedrock aquifer flows towards the River in a south to north direction (from high areas of the bluffs to the low areas of the Labadie Bottoms and the Missouri River). The monitoring well locations were located in proximity to the closest residential wells to the Labadie Energy Center ash management areas, based on State well coordinates. The details of this investigation are provided in Section 5. The results of this study are consistent with regional descriptions of the bedrock aquifer (Ozark Aquifer) where the Missouri River is considered a major discharge area for groundwater moving north and east (USGS, 1994).

3.2 Constituents of Interest

The Labadie Energy Center has been in operation since 1970. Coal ash pond management units have been utilized for on-site storage for more than four decades.

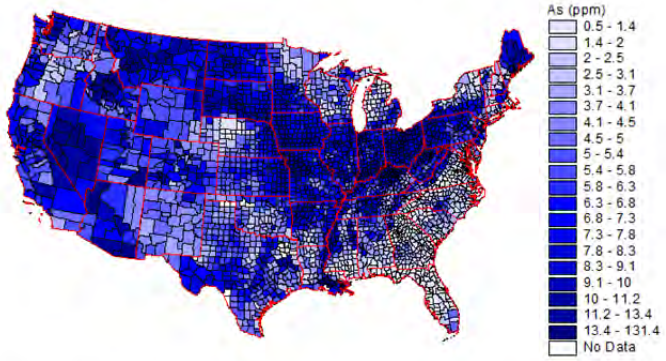
As coal ash is made up of inorganic elements and minerals left after the combustion of the organic material from the coal, the focus of this analysis is on inorganic elements and metals, including those that are mentioned most commonly by the local community groups such as arsenic, cadmium, lead, mercury, and selenium. It is important to note that coal is a naturally occurring material in our environment, and the inorganic constituents present in coal ash are similarly naturally occurring.

The U.S. Geological Survey (USGS) has studied extensively the presence of naturally occurring inorganic constituents in our environment and in 2011 published a report titled “Trace Elements and Radon in Groundwater Across the United States” (USGS, 2011). **Figure 7** shows a map of arsenic concentrations in groundwater in the U.S. (USGS, 2001). The area around Franklin County, and southern Missouri in general, are shown to have arsenic concentrations of 1 microgram per liter of water (ug/L) in at least 25% of groundwater samples in each county. The USEPA drinking water standard, or MCL, for arsenic is 10 ug/L. However, the USEPA risk-based screening level for tapwater for arsenic is 0.045 ug/L. As can be seen from **Figure 7**, the natural concentration of arsenic in almost all groundwater in the U.S. is above this level. The presence of arsenic in groundwater is related to the fact that arsenic is also naturally occurring in soils in the U.S. Information on naturally occurring levels in soils is provided by USGS as part of their national Geochemical Survey Program (USGS, 2013c). **Figure 8** shows a map of arsenic concentrations in soils in the U.S. (USGS, 2013b). These figures are shown below, and full page versions are provided in the figures section. Appendix A provides more detailed information on naturally occurring levels of inorganic constituents in soils in the U.S. and levels in coal ash.



The USEPA regional screening level for arsenic in tapwater at a 1 in one million risk level is 0.045 µg/L.

Background Levels in Soils in the U.S.



The USEPA regional screening level for arsenic in residential soil at a one in one million risk level is 0.61 mg/kg.

Because all of the constituents in coal ash are naturally occurring, it is important to distinguish between the natural, or background, concentrations in the environment, and those concentrations that may be derived from releases from coal ash management locations. For this Report, these latter concentrations are referred as coal ash-derived.

Because these constituents occur naturally, their presence alone in groundwater **does not** indicate that there has been a release from a coal ash management location. Several lines of evidence must be evaluated before a conclusion can be drawn about whether a specific groundwater sample has been impacted by a coal ash management location. These considerations include:

- *Is the sample location downgradient or upgradient from the coal ash management location?* It is only possible for coal-ash derived constituents to be present if the sampled location is hydrologically downgradient of the coal ash management location.
- *Do the samples and the coal ash management unit share the same aquifer?* For example, at the Labadie Energy Center, the coal ash management areas are ponds constructed above surface grade. The depth of the ponds determines at what depths released constituents may be present in groundwater. The ponds do not extend to the bedrock; thus, any impact from the ponds would be likely limited to the shallow, alluvial aquifer.
- *What is the pattern of constituents present and at what concentration?* Boron and sulfate are generally considered to be signature indicators of coal ash; however, both must be present at high concentrations (relative to background) (EPRI, 2006) in order for a potential release to be attributable to a coal ash management location.

3.3 Coal Ash Management Locations

There are several pathways for potential release of coal ash-derived constituents to the environment at the Facility.

3.3.1 Ash Ponds

There are two ash ponds at the Facility, the eastern one of which is lined with HDPE. The ash ponds are located approximately 560 to 850 feet from Labadie Creek and approximately 0.5 mile from the Missouri River. With respect to the unlined ash pond, coal ash at the bottom of the pond may be in contact with groundwater as groundwater levels fluctuate within the river basin. MDNR is requiring groundwater monitoring of the ash ponds as a condition of the Facility's pending NPDES permit when issued in final form. However, *surface* discharges from the ash ponds are monitored under the current NPDES permit, as discussed below. Available data were reviewed, data gaps identified, and data collection studies were conducted to assess the potential for offsite impacts from the coal ash management practices.

3.3.2 NPDES Permitted Outfalls

Surface discharges from the ash ponds are monitored under a NPDES permit to the Facility (NPDES Permit #: MO-0004812). The Facility's nine outfalls are covered under the NPDES permit:

- Outfall 001 - is the discharge from once-through cooling water systems. The outfall is considered a non-process waste stream.
- Outfall 002 is the discharge from the plant's wastewater treatment pond. The pond provides treatment for fly ash and bottom ash effluent, low volume wastes, sewage treatment plant

effluent (via Outfall 002A), and storm water runoff. The outfall is considered a process waste stream.

- Outfalls 003 through 008 are for storm water runoff.

Outfall 002 is monitored and the maximum daily values for a range of inorganic constituents are reported in the 1998 and 2011 NPDES permit applications; the location of Outfall 002 is shown on **Figure 9**. Outfall 002 discharges to a ditch that is located adjacent to the power plant and extends from the outfall approximately 0.7 miles to the Missouri River.

3.4 Potential Constituent Transport Pathways

Coal ash-derived constituents from the ash ponds can move into underlying soils and to groundwater, and can be transported within groundwater as a result of groundwater flow. A variety of geophysical/geochemical mechanisms can occur that can serve to attenuate constituent concentrations within groundwater. The extent of attenuation is dependent upon the constituent chemistry, the initial concentration, the local geology and hydrogeology, and the distance the groundwater travels. Groundwater from the Facility ultimately will discharge to the Missouri River, and depending on river stage and precipitation, Labadie Creek may function as a receptor for groundwater from the ash pond area.

Discharge of NPDES Outfall 002 is to the unnamed ditch located between the power plant and Labadie Creek. Depending on river stage and precipitation, the ditch may flow to the Missouri River, or the discharge may move into the ground and potentially to groundwater. That groundwater may also discharge to the Missouri River and/or Labadie Creek.

3.5 Receptors and Potential Exposure Pathways

Groundwater will flow from the coal ash management areas to downgradient areas. For users of drinking water to be impacted by groundwater associated with such coal ash management practices, water supply wells must be located in an aquifer hydrologically connected and downgradient of the ash ponds. As discussed in Section 3.1.2, typical groundwater flow will be in a north and northeast direction and away from areas where wells are located. **Figure 3** shows the locations of private wells within a 1-mile radius of the Facility. As can be seen, these wells are located south of the Facility. There are approximately 82 wells recorded in state databases within this 1-mile radius. Thus the use of groundwater as drinking water may be considered to be a complete exposure pathway if and only if coal ash-derived constituents from the Facility are impacting the local drinking water wells.

The discharge from the NPDES permitted Outfall 002 may flow to the Missouri River, or may move into groundwater, or both, depending on the meteorological conditions. Groundwater also may discharge to the Missouri River and to Labadie Creek. Labadie Creek is not a source of drinking water, thus this exposure pathway is incomplete. However, to the extent people may use the Creek for wading, the recreational user exposure pathway is treated here as potentially complete.

Users of the Missouri River include people who may enjoy recreational activities along the River that may bring them into direct contact with the River water. Thus, under this evaluation, the recreational user exposure pathway is treated here as potentially complete. In addition, the Missouri River is one source of drinking water for the City of St. Louis. The drinking water intake is located approximately 19.5 miles downstream from the Facility at Howard Bend. **Figure 11** shows the location of Howard Bend and the Facility. Thus under this evaluation the drinking water exposure pathway is treated here as potentially complete.

Available data are presented and reviewed below to determine if there are data gaps for groundwater, Labadie Creek, and the Missouri River potential exposure pathways that can be addressed by additional environmental investigation.

3.6 Evaluation of Groundwater CSM

As indicated above, due to their historical construction, one coal ash management impoundment is unlined and, therefore, may impact underlying groundwater. Because groundwater is used as source of drinking water within Franklin County, the use of groundwater as drinking water pathway may be considered to be a complete exposure pathway **if and only if** coal ash-derived constituents from the Facility are impacting the local drinking water well supplies.

3.6.1 Location of Wells in the Vicinity of the Facility

The locations of public, private and industrial wells within approximately 1 mile of the Facility property are plotted on **Figure 3** and details on the wells (reference ID number, year of installation, owner, coordinates, screened/open interval, total depth, etc.) are displayed in **Table 2**. The figure was generated using four different data sources which are: 1) the University of Missouri-Columbia, Missouri Spatial Data Information Service (MSDIS, 2013), 2) the MDNR Water Resources Center (MDNR, 2013a), 3) the Missouri Environmental Geology Atlas 2007 (MEGA, 2007), and 4) the MDNR Wellhead Protection Program data (MDNR, 2013b).

There are 82 wells in Franklin County recorded in state databases within the 1-mile radius of the Facility. As shown on **Table 2**, three are identified as Industrial wells, two are identified as Non-community Public Wells, and one is identified as an Irrigation well. Although six wells are identified in the state database as located within the Labadie Bottoms, the locations of these wells cannot be confirmed, and are believed to be incorrectly plotted in the state database. The results of the investigation into the location of these wells are provided in **Appendix B**. Thus, of the remaining 76 wells within a 1-mile radius of the facility, based on available State records, all are located in the bedrock bluffs and, therefore, **up gradient** from the Facility. Well depth and well screen information is available for 68 of these wells.

In addition to the private wells, the locations of the closest community public water supply wells are shown on **Figure 4**, and are listed on **Table 3**. None of these are within the 1-mile radius from the Facility. Five are within a 3-mile radius of the Facility, with the closest being the Hermit Hollow Subdivision, which is slightly less than 2 miles from the Facility to the south, and is located in the upland hills area beyond the bluffs. An additional five community public wells are located within a 5-mile radius of the Facility. These are all deep wells, with approximately half of them having total well depths in excess of 1,000 feet below ground surface.

The State of Missouri has regulations that govern the installation of drinking water wells. The MDNR regulations require that drinking water wells in this area of Franklin County that are drilled into bedrock must be installed with at least 80 feet of casing that extends a minimum of 30 feet into bedrock (10 CSR 23-3.090 of the Missouri well construction rules). Additionally, the lowermost 30 feet of casing must be sealed with approved grout materials, and full-length grouting is preferred by the MDNR. The seal is required so that surface contaminants cannot enter the drinkable groundwater. Below the seal and casing lies the open/screened interval, where water from the surrounding aquifer can enter into the well and be pumped out for use.

The location where wells can be drilled for the purpose of obtaining water for drinking, irrigation live stock or other uses (excluding monitoring wells and heat pumps) is discussed in section 10 CSR 23-

3.010. As stated in the Missouri well construction rules pertaining to landfills and lagoons, a well shall meet the following requirements:

- 10 CSR 23-3.010(2)(A)(1): Three hundred feet from a storage area for commercial fertilizers or chemicals, landfill, lagoon, above ground or underground storage tank, distribution lines for liquid petroleum, petroleum products or chemicals. Petroleum or petroleum products that are not liquid at standard temperatures and pressures are exempt from these set back requirements.
- 10 CSR 23-3.010(2)(B): Waste landfill or lagoons. The safe distance that a well should be located from a waste landfill or waste stabilization pond (lagoon) cannot be assigned a fixed number because of the varieties of hydrologic and geologic parameters associated with the undetermined types and amounts of materials that may be carried by groundwater from leachates discharged from the waste landfill or waste stabilization ponds (lagoons). It is recommended that wells not be located in an area between the landfill or waste stabilization ponds (lagoons) sites and the point of groundwater discharge to a surface water source. Any well that may intercept leachates from a waste landfill or waste stabilization pond (lagoon) by water withdrawal from the well shall not be used for human consumption and must be plugged unless it is used for a monitoring well.

3.6.2 Groundwater Flow, Well Depth, and Aquifer Source

As noted above, the groundwater flow within the alluvial aquifer in the Labadie Bottoms was analyzed in a yearlong study completed by Gredell Engineering Resources, Inc., and Reitz & Jens, Inc., (2011) as part of a DSI for the proposed landfill. Only under limited circumstances does groundwater within the alluvial aquifer flow in a direction away from the Missouri River. These short-lived changes in flow direction are typically localized and occur within the alluvium in response to high water levels in the Missouri River, and occur due to the relative ease of groundwater flow in the unconsolidated alluvial deposits.

As shown on **Figure 5**, the shallow alluvial aquifer thins, or pinches out, and does not extend into the bluff and hilly upland areas. Based on the information provided from state databases and presented in **Table 2**, all of the 68 wells with complete well records reported to be located in the bedrock bluff and uplands area are completed into the bedrock and not in the alluvial aquifer that underlies the Facility. A handful of wells (9) have a total well depth ranging from 100 to 200 feet. The vast majority of the remaining wells have depth ranges of 300 to 600 feet. All of the well screens are within bedrock, with the majority of the screened intervals beginning greater than 80 feet below ground surface, and all but six wells having screened intervals extending greater than 100 feet in length. This is shown graphically on **Figure 6.**

For ease of reference, the wells listed with a one-mile radius of the Facility have been numbered, as shown on **Table 2**. Based on state database coordinates, the private well closest to the current coal ash management areas is well #46 (Well ID 0403547), which is approximately 0.4 mile in an **upgradient** location, as shown on **Figure 3**. According to the state database information for this well, presented on **Table 2**, this well is 500 feet in depth and is screened from a depth of 120-500 feet. The location of this well, the depth of the well and the screened interval are shown graphically on **Figure 6**. Based on the database coordinates, the closest well to the Facility property boundary is well #59 (Well ID 0053051) located approximately 490 feet southeast of the southeast property boundary, as shown on **Figure 3**. This well is 363 feet deep and is screened from 121-363 feet. It is approximately 0.4 mile **upgradient** of the footprint of the proposed landfill.

Thus, the wells located in the bluffs and upland areas extract water from the bedrock aquifer and not the shallow alluvial aquifer.

Beyond the specific location of the wells, it is critical to note that the shallow alluvial aquifer does not extend beyond the floodplain of the Missouri River and the nearby creeks. As discussed above, any potential release of constituents due to coal ash management practices within the power plant footprint would impact the shallow alluvial aquifer. As noted by Gredell and Reitz &Jens (2011) from their Detailed Site Investigation Report:

> *"Although the alluvium is in contact with the underlying bedrock, the alluvial and bedrock aquifers are considered distinct due to their physical characteristics. Groundwater movement in alluvial materials is much faster due to the predominance of highly permeable sand and gravel. When groundwater moving within the alluvial aquifer encounters less permeable bedrock, the bedrock largely impeded flow due to its lower permeability and the groundwater will preferentially flow parallel to the barrier through the more permeable sands and gravels and remain in the alluvial aquifer system."*

Thus, from the well records alone, it can be concluded that the groundwater drinking water pathway is **incomplete**. Any potential release of constituents from coal ash management areas would result in an impact to the shallow alluvial aquifer, and this groundwater will normally flow towards the Missouri River and, potentially, to Labadie Creek. Based on bedrock groundwater gradients measured in the residential bluff areas and the strong flow direction to the north, any such constituents would not readily migrate in the shallow groundwater to the bedrock aquifer south of the facility, the aquifer used for drinking water. In other words, it is very unlikely for any constituent released from the coal ash management areas to impact groundwater that is used as drinking water, and without a complete exposure pathway, there is no significant risk to human health through use of the bedrock groundwater as a drinking water source in the bluff areas south of the Facility as a result of coal ash management practices.

3.6.3 Existing Groundwater Data

As part of the permitting of the proposed Labadie Energy Center UWL, 29 shallow monitoring wells have been installed in the alluvial aquifer around the proposed footprint of the landfill. **Figure 9** shows the monitoring well locations (green dots). The closest wells are approximately 630 feet from the lined ash pond, and approximately 0.5 miles from the unlined ash pond. Three rounds of sample collection and laboratory analysis for inorganic constituents have been conducted. These data represent current groundwater conditions at the location. These data are evaluated in the risk-based screening presented in Section 5.

3.6.4 Groundwater Data Gaps

Research on the local geology and hydrogeology, and the research conducted as part of the DSI for the proposed landfill indicate that groundwater under normal river conditions generally flows north toward the Missouri River. While database well records reflect that the private wells in the area are screened in the bedrock aquifer, specific groundwater level measurements and groundwater sample analysis had not been available for the bluff/bedrock aquifer area near the Facility. Therefore, in 2012, Ameren Missouri directed Golder to conduct a groundwater study to further determine, with additional site specific data, groundwater flow direction within the bedrock aquifer, and to collect groundwater quality data. By examining the groundwater gradient within the bedrock aquifer at three locations (TGP-A, TGP-B, and TGP-C) (**Figure 9**) located near the closest residential wells to the Facility, Golder determined that groundwater within the bedrock aquifer flows in a south to north

direction (from high areas of the bluffs to the low areas of the Labadie Bottoms and the Missouri River). The groundwater sample locations were located in proximity to the closest residential wells to the Labadie Energy Center property boundary and the existing ash management areas (see **Figure 10**). The groundwater quality data for these locations are evaluated in the risk-based screening presented in Section 5 and reflect that groundwater quality near and around such residential wells fully complies with safe drinking water standards.

3.7 Evaluation of Surface Water CSM

As indicated in Section 3, groundwater underlying the Labadie Energy Center can discharge to the Missouri River and potentially to Labadie Creek. Surface water discharges from the Labadie Energy Center are released pursuant to the terms of an NPDES permit to the Missouri River. Both the Creek and the River can be used for recreational purposes. The Missouri River is also used as source of drinking water for the City of St. Louis via a water intake at Howard Bend, approximately 19.5 river miles downstream from the Facility (**Figure 11**). Accordingly, for purposes of this evaluation of surface water, it is assumed that an exposure pathway is potentially complete, and this potential exposure pathway is evaluated further.

3.7.1 Data Gaps – Labadie Creek

Labadie Creek is not a source of drinking water, but can be used for recreational purposes such as wading. Since there are no existing water quality data available for Labadie Creek, Golder collected surface water quality data for locations on Labadie Creek upgradient and downgradient of the Facility. As the Creek forms or is very near to the western boundary of the Facility, a downgradient location near where the Creek discharges to the Missouri River was selected as an appropriate sample location. These sample locations are shown on **Figure 9**. These data are evaluated in the risk-based screening presented in Section 5.

3.7.2 Existing Surface Water Data – Missouri River

3.7.2.1 NPDES Outfall 002

Analytical data are available for the Facility's NPDES Outfall 002 from the 1998 and 2011 "Updated NPDES Permit MO-0004812 Renewal Application." These data represent the maximum daily values for the concentrations of a comprehensive list of inorganic constituents. The outfall location is shown on **Figure 9**. These data are evaluated in the risk-based screening presented in Section 5.

3.7.2.2 Surface Water Databases

The STORET (short for STOrage and RETrieval) Data Warehouse is a repository for water quality, biological, and physical data and is used by state environmental agencies, USEPA and other federal agencies (USEPA, 2013c). Locations within the Lower Missouri watershed were accessed, and **Figure 12** shows the locations of data collection points where quantitative analytical data are available within 30 miles upstream and downstream of the Facility. The data are available for a limited analytical list, and the majority of the data are for dissolved constituents. The data are shown on **Table 4**, and are discussed in Section 5.

The City of St. Louis drinking water intake at Howard Bend (**Figure 11**) provided data for the "Mineral Analysis of Untreated River Water from the Howard Bend Plant" for the years 2011 and 2012. These data are presented in **Tables 5 and 6**, respectively, and are discussed in Section 5. As for surface water, the available data are for a limited analytical list, and the majority of the data are for dissolved constituents. **Figure 13** shows the 5-mile upstream limit for the drainage basin for this intake. This is

the limit of the drainage basin area that the water intake evaluates for potential sources of releases that could affect the drinking water intake water quality.

3.7.3 Data Gaps – Missouri River

The Missouri River is a recreational resource as well as a source of drinking water for the City of St. Louis. Although surface water data are available for the Missouri River for various locations both upstream and downstream of the Facility, as well as the Howard Bend drinking water intake, such data are limited to specific analytical parameters only. Golder collected surface water quality data at locations on the Missouri River immediately upgradient and downgradient of the Facility, testing for a complete set of analytical parameters. These sample locations are shown on **Figure 9**. These data are evaluated in the risk-based screening presented in Section 5.

4.0 Data Collection

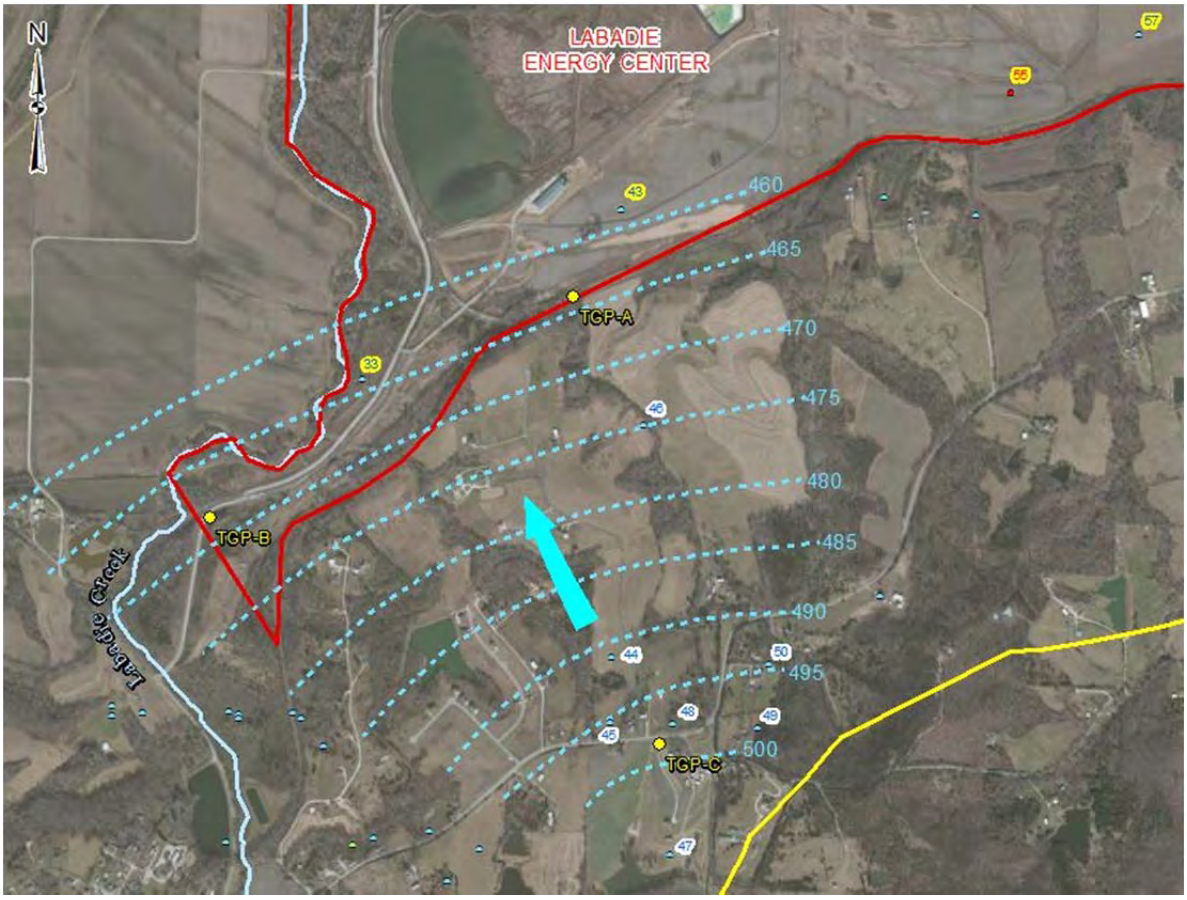
To further evaluate the potential exposure pathways, Ameren Missouri has conducted investigations to address the data gaps identified in Section 3. To further address the potential groundwater exposure pathway, Ameren Missouri installed monitoring wells south of the Facility and in an area where private wells are used for drinking water. To further address the potential surface water exposure pathway, Ameren Missouri conducted an investigation of surface water at locations both upstream and downstream of the Facility on the Missouri River and on Labadie Creek, which is on the western boundary of the Facility and is a tributary to the Missouri River. These investigations are discussed below.

4.1 Groundwater Sample Collection and Analysis

As noted above, in 2012, Ameren Missouri directed Golder to conduct a groundwater study to determine groundwater flow direction within the bedrock, and to collect groundwater quality data. Groundwater data and information from the study of the three groundwater piezometers or wells installed south of the Facility for temporary monitoring purposes are provided in the following reports prepared by Golder (provided in **Appendix C)**:

- "Laboratory Analytical Results for Groundwater Monitoring Samples Collected on April 12-13, 2012 from Temporary Groundwater Piezometers Installed Near Labadie Plant" (April 2012).
- "Report on Piezometer Installation, Water Level Monitoring, and Groundwater Sampling, Labadie, Missouri" (May 2012).
- "Groundwater Field Stabilization Parameters for Groundwater Monitoring Samples Collected on April 12-13, 2012 from Temporary Groundwater Piezometers Installed Near Labadie Plant" (July 2012).

Three piezometers were installed with screened intervals in bedrock at similar depths to nearby residential water wells. The piezometer locations are shown on **Figures 9 and 10**. As shown on **Figure 10**, and below, the piezometers were located in proximity to the residential wells closest to the Labadie Energy Center property boundary (approximately 1200 feet from the coal ash management areas). The geologic cross-section in **Figure 6** shows the location, depth, and screened interval for TGP-A and TGP-C and nearby residential wells. Groundwater quality data are presented and evaluated in Section 5.



4.2 Surface Water Sample Collection and Analysis

Surface water samples were collected by Golder on October 24 and 25, 2013 from Labadie Creek, as well as from the Missouri River. Sample locations are shown on **Figure 9**. Validated analytical results from this sampling are shown on **Table 7** and are discussed in Section 5. Water quality parameters are shown on **Table 8**. Samples were analyzed for the list of inorganic analytes shown on **Table 1** and included in the Surface Water Sampling Work Plan (**Appendix D**). The sample validation memorandum is also provided in **Appendix D**. The analyte list was selected to be the same as the NPDES permit application analyte list (see Section 3.3.2) as the list is comprehensive and approved by the State. Because the radiological parameters included on the NPDES list did not exceed the screening levels, these parameters were not included in the surface water sampling program. The following paragraphs summarize the surface water sampling effort.

Labadie Creek sampling was completed by Golder on Thursday October 24, 2013 and consisted of six surface water sample locations accessed by wading. Three locations were sampled both downstream and upstream of the Labadie Plant at the following locations within Labadie Creek:

- Near the bank on the side closest to the Labadie Energy Center (east side)
- At the midway point between the center of the Creek and the bank closest to the Labadie Energy Center
- In the center of the Creek

Surface water samples were analyzed by an independent environmental laboratory (Lancaster Laboratories, Lancaster, PA) for filtered (dissolved) and unfiltered (total) testing. For unfiltered samples, water was collected into a clean sample collection container by direct filling of the container from surface water. For filtered samples; a polyethylene bailer was filled, followed by field filtering the water out of the bailer using a 0.45 micron filter. Samples were then placed on ice and sent to Lancaster Laboratories for analytical testing under chain-of-custody procedures. Clean, new, sampling equipment (bailers, etc.) were used to collect each sample following industry standard protocols for environmental sampling.

Sampling of the Missouri River was completed on Friday October 25, 2013. Ten locations were sampled in the Missouri River. Five of these samples were collected approximately 0.25-mile upstream of the Labadie Energy Center property boundary and five samples were collected approximately 0.25-mile downstream of the Labadie Energy Center property boundary. Samples were collected both at the surface and at mid-depth within the Missouri River. Downstream and upstream samples were collected in the following places in the River:

- A surface sample near the bank of the River on the side nearest to the Labadie Energy Center (south side) in water less than 4 feet in depth
- A surface and mid-depth sample near midway point between the riverbank nearest the Labadie Energy Center and the center of the River
- A surface and mid-depth sample collected in the center of the River

A powered boat with sonar depth sounding equipment was used to access the Missouri River sampling locations and measure river water depths. Unfiltered surface samples were obtained by collecting water into a clean sample collection container by direct filling of the containers from surface water. Filtered surface samples were obtained by filling a polyethylene bailer, followed by field filtering the water out of the bailer using a 0.45 micron filter. Mid-depth samples were obtained by lowering tubing attached to a 35-pound weight to the mid-depth-point of the river. Once the desired depth was reached, a peristaltic pump was attached to the tubing and used to evacuate at least three tubing-volumes of water prior to water sample collection. Following the water purge, unfiltered samples were collected directly from the tubing. For filtered samples, a 0.45 micron filter was attached to the end of the tubing and water was transferred through the filter into the sample containers. Clean, new, sample containers, tubing, and bailers were used at each sample location, as needed. Samples were immediately placed on ice and shipped to Lancaster Laboratories for analytical testing using chain-of-custody procedures.

5.0 Results and Evaluation

This section presents the results and evaluation of the screening of available data sets to the screening levels provided in Section 2. Section 5.1 presents the groundwater data evaluation, and Section 5.2 presents the surface water screening results.

5.1 Groundwater Data

This section presents the proposed landfill monitoring well data evaluation and the upgradient monitoring well data evaluation.

5.1.1 Proposed UWL Groundwater Monitoring Data

As noted earlier, 29 groundwater monitoring wells have been installed to date around the proposed footprint of the UWL site at the Labadie Energy Center. Three of a total of eight rounds of groundwater sample collection events have been conducted and reported in the following documents:

- Groundwater data from samples collected in April 16-17, 2013, as reported by Reitz & Jens, Inc., in the report titled, "Groundwater Monitoring Report – 1st Background Sampling Event – April 16-17, 2013" (May 2013) (Reitz & Jens, 2013a). The samples were collected from 29 shallow monitoring wells, and represent the first of eight rounds of background sampling and analytical data collection required prior to construction of the proposed UWL for the Ameren Missouri Labadie Energy Facility. The monitoring well locations are shown on **Figure 9**.
- Groundwater data from samples collected in August 19-21, 2013, as reported by Reitz & Jens, Inc., in the report titled, "Groundwater Monitoring Report – 2nd Background Sampling Event – August 19-21, 2013" (September 2013) (Reitz & Jens, 2013b).
- Groundwater data from samples collected in November 19-20, 2013, as reported by Reitz & Jens, Inc., in the report titled, "Groundwater Monitoring Report – 3rd Background Sampling Event – November 19-20, 2013" (December 2013) (Reitz & Jens, 2013d).

These data will be used to define pre-landfill, or background, groundwater quality conditions. Groundwater analytical data from the first round (April 2013) of sample collection for the proposed UWL site are presented in **Table 9**. Groundwater analytical data from the second round (August 2013) of sample collection for the proposed UWL site are presented in **Table 10**. Groundwater analytical data from the third round (November 2013) of sample collection for the proposed UWL site are presented in **Table 11.** As shown in the first column of the tables, the wells are shallow, and the well depths range from 17 to 28 feet. More information on the monitoring wells and data collection and analysis is available in the Gredell Engineering Resources, Inc. and Reitz & Jens reports. These data represent site-specific background groundwater quality in the area of the proposed UWL.

The data presented in **Tables 9, 10 and 11** are compared to the state/federal drinking water standards as well as risk-based screening levels. The screening levels are provided in **Table 1**. The constituents with background concentrations that are generally above state/federal drinking water standards and/or risk-based screening levels are arsenic, iron and manganese, and total dissolved solids (TDS). Notably, and as discussed further below, boron and sulfate, the signature identifiers for coal ash, are present at low concentrations that are not above risk-based screening levels and are consistent with background water quality. Groundwater samples were collected using low-flow

sampling techniques, and samples were collected from the groundwater wells when low turbidity levels were stabilized.

There are, however, several qualifiers with respect to naturally occurring conditions that must be considered in any discussion of sampling results. First, as discussed earlier, the USGS has summarized concentrations of trace elements in groundwater regions across the U.S. (USGS, 2011), including arsenic, iron, manganese and boron. Elevated concentrations of iron, manganese, and arsenic are commonly present in groundwater when oxygen is reduced (anaerobic or anoxic conditions).

As noted in Section 3.1.1, the subsurface in the area around Labadie is made up of certain types of rocks, soil, and sediment. These geologic materials are made of various minerals, and the minerals themselves are made up of many elements, including those that have been analyzed as part of the various investigations conducted at the Labadie Energy Center. For example, the mineral quartz is made up of the elements silicon and oxygen; the mineral pyrite (fool's gold) is made up of iron and sulfur. Both of these minerals are present in rocks such as granite or siltstone. The elements in these rocks and minerals are naturally occurring, and figures in **Appendix A** show maps of the U.S. that the USGS has made indicating the levels of various elements in soil/rock across the U.S. Groundwater moves slowly through these rocks and minerals in the subsurface, and as it moves, the water and the rocks interact chemically – some minerals and elements may dissolve out of the rocks into the groundwater, and other minerals and elements may precipitate or fall out of solution and become part of the rocks and soils. Hard water is a condition that occurs when calcium and/or magnesium are dissolved from the rock and enter the groundwater; conversely, soft water is water that is low in calcium and/or magnesium. The types of interactions that occur between the groundwater and the rocks are determined by the chemistry of the groundwater and the rock. Some of the conditions that influence the chemistry of the groundwater are pH, which can range from low (acidic) to high (alkaline), and oxygen content of the water, which can range from low oxygen (called anoxic or reducing conditions) to high oxygen (called oxic or oxidizing conditions).

In simple terms, reducing, anoxic conditions (where oxygen is low) can be found in areas where microbes have used up the oxygen in the water by consuming organic matter that is present. Organic matter is commonly present in the subsurface in areas such as wetlands, and in depositional environments such as floodplains found along rivers and streams. The USGS has explained in a report about groundwater in the U.S. (USGS, 2011) that in certain geologic environments, when oxygen is low, arsenic, iron and manganese tend to dissolve out of rocks and to then be present in the groundwater. This relationship is so well established that the USGS uses the occurrence of high concentrations of arsenic, iron and manganese in groundwater as an indicator of a low oxygen/anoxic/reducing condition in groundwater.

Based on the classification method used by the USGS to identify whether aquifers are oxic (oxidizing) or anoxic (reducing) (see Table 2 on page 14 of the USGS, 2011 report), the levels of iron, manganese and sulfate at the proposed UWL site are consistent with a naturally occurring anoxic, or iron/high sulfate reducing aquifer. Thus, the presence of iron, manganese, and arsenic above screening levels at the proposed UWL site is attributed to the geochemical conditions of the aquifer and the rocks through which the groundwater has moved. Background levels of arsenic in soils in Franklin County, Missouri range from 3.4 to 12 milligrams arsenic per kilogram of soil (mg/kg) (USGS, 2013a). Iron ranges from 7,600 mg/kg to 26,000 mg/kg in this region (USGS, 2013a).

Arsenic concentrations vary in the monitoring wells. Concentrations reported from the August and November 2013 sampling event are much lower than those from the April 2013 sampling event. As shown on **Figure 9**, the wells closest to the current coal ash management areas that are likely

downgradient under certain groundwater flow conditions are MW-25 through MW-28. These wells have some of the lowest arsenic concentrations. As would be expected, the wells with the highest arsenic concentrations also have higher iron and manganese concentrations, due to the anoxic conditions, as described above. Selenium was detected more often and above screening levels in the November 2013 sampling event, however, this occurred in the wells that are the furthest from the coal ash management areas. Selenium is naturally occurring in soils (see **Appendix A**), and USGS reports the average background concentration in soils in Franklin County as 0.18 mg/kg (USGS, 2013a). These variations in concentration are not unexpected for an alluvial aquifer that consists of sands, gravels, silts, and clays of diverse geologic origin.

Secondly, the Labadie Energy Center is located in Franklin County, Missouri, an area which can have high levels of sulfate in groundwater. Groundwater in Franklin County is classified as within the Ozark aquifer of the Salem Plateau groundwater province, as reported by the MDNR (2013a). According to the MDNR:

> *"Large quantities of high-quality groundwater are generally easy to obtain in this province. Minimum construction standards for private domestic wells in much of this region call for at least 80 feet of casing set 30 feet into rock. In the northeastern part of the region, including parts of Phelps, Crawford, Maries, Osage, Gasconade and Franklin counties, Pennsylvanian-age sandstone and shale units overlie the Ordovician-age bedrock. Groundwater quality in the upper part of the Ozark aquifer in this area is different than in other parts of the Ozarks.* ***The sulfate content is commonly elevated, and may exceed the maximum recommended level of 250 mg/L.*** *Thus, where Pennsylvanian strata are present, at least 150 feet of casing is required for a private domestic well."*

In fact, USEPA (2003) reports that sulfates are naturally occurring substances that are found in minerals, soil, and rocks. Sulfate concentration in seawater is about 2,700 mg/L. It ranges from 3 to 30 mg/L in most freshwater supplies, although much higher concentrations (> 1000 mg/L) are found in some geographic locations. In the U.S. the median concentration for a 20-state region was 24 mg/L; the 99th percentile value was 560 mg/L. Thus the sulfate concentrations in the proposed landfill site wells are below drinking water standards, and are consistent with groundwater across the U.S. The results are also lower in concentration than reported by MDNR for the region.

Thirdly, according to MDNR recommendations, "at least 150 feet of casing is required for a private domestic well" in the areas where sulfate concentrations are naturally high, such as in Franklin County, so that the wells are not drawing from the upper part of the Ozark aquifer (MDNR, 2013a). MDNR notes that (the deeper) groundwater quality is generally high and that treatment of drinking water is not needed other than the optional use of water softeners to address hardness caused by calcium and magnesium levels.

Another critical aspect to any review of groundwater data associated with coal ash management units generally is the presence, or lack thereof, of high concentrations of sulfate and boron. These "indicator parameters" will be present in high concentrations if a release from a coal management unit has occurred (EPRI, 2006). At the Labadie Energy Center, groundwater sampling results reveal that neither the sulfate nor boron concentrations are elevated in groundwater.

More specifically, the boron concentrations in the proposed landfill site wells are low, and are consistent with groundwater across the U.S. (90^{th} percentile concentration of 220 ug/L), and in humid climates in particular (90^{th} percentile concentration of 160 ug/L) (USGS, 2011, Tables 4 and 5, respectively).

Taken together, these groundwater data are consistent with groundwater that is not affected by constituents from coal ash management facilities. This evaluation of the data from the shallow monitoring wells at the proposed landfill site indicates that while concentrations of arsenic, iron, manganese, selenium and TDS are above drinking water standards, these data represent natural conditions for the area. Such concentrations would occur in groundwater whether or not the Labadie Energy Center was present and result from the natural characteristics of the geologic materials that make up the region.

5.1.2 Groundwater Analytical Data for Upgradient Locations

As discussed in Section 4.1, upgradient groundwater analytical data were obtained from a report prepared by Golder, titled, "Laboratory Analytical Results for Groundwater Monitoring Samples Collected on April 12-13, 2012 from Temporary Groundwater Piezometers Installed Near Labadie Plant" (April 2012), and provided here in **Appendix C**. The piezometer (or well) locations are shown on **Figures 9 and 10**, and they are completed into bedrock at depths similar to nearby residential water wells, within 1200 feet of the coal ash management areas. The piezometer depths are: TGP-A – 103 feet below ground surface (ft bgs), TGP-B – 130 ft bgs, and TGP-C – 240 ft bgs.

As indicted in **Table 12**, all results are **below** federal drinking water standards and/or risk-based screening levels. Arsenic and boron were not detected in these wells, and sulfate concentrations are low and consistent with the background data from the monitoring wells in the proposed landfill site.

5.1.3 Groundwater Data Summary

This evaluation of groundwater indicates that the detected analyte concentrations in samples of the deeper bedrock groundwater taken from the three upgradient piezometers are **below** drinking water standards. There are no indications of potential impacts from coal ash management practices at the Labadie Energy Center on the shallow groundwater in the area of the proposed landfill or on the bedrock groundwater in the bluff and upland areas.

The TGP well depths are below the shallow (approximately 25-foot) depth of the groundwater monitoring wells at the proposed landfill site, which provide information on the shallow alluvial aquifer. If there was a direct connection between the shallow alluvial aquifer and the deep bedrock aquifer as members of LEO maintain, one would expect the groundwater quality profile for samples collected from the two aquifers to be the same – but this is clearly not the case. These results are consistent with groundwater from distinctly different aquifers flowing from areas of high elevation to areas of low elevation (generally from the bluffs to Labadie Bottoms).

5.2 Surface Water Data

Two data sets have been collected by Ameren Missouri and evaluated to address surface water:

- Labadie Power Plant National Pollutant Discharge Elimination System 1998 Reapplication Package – Outfall 002, and NPDES 2011 Renewal Package – Outfall 002.
- Surface Water samples collected from Labadie Creek and the Missouri River, October 2013.

5.2.1 NPDES Data

Table 13 presents a comparison of the NPDES data to the surface water surface water screening levels (presented in Section 2, and **Table 1**). The majority of constituents **did not** exhibit concentrations above surface water screening levels, including:

- Barium
- Beryllium
- Boron
- Bromide
- Cadmium
- Chromium
- Cobalt
- Copper
- Fluoride
- Lead
- Magnesium
- Mercury
- Nickel
- Nitrate-Nitrite (as N)
- Selenium
- Silver
- Sulfate
- Sulfide
- Sulfite
- Surfactants
- Tin
- Titanium
- Zinc

Radioactivity

- Alpha
- Beta
- Radium (total)
- Radium 226

Constituents detected in 1998 and/or 2011 above surface water screening levels include:

- Aluminum – USEPA SMCL
- Antimony – drinking water (state and federal)
- Arsenic – USEPA RSL (below MCL)
- Cyanide – USEPA RSL (below MCL)
- Iron – SMCL
- Manganese – SMCL
- Molybdenum – USEPA RSL (no MCL)
- Thallium – fish consumption, drinking water (state and federal)

The comparison of the discharge data directly to the surface water screening levels is very conservative as concentrations from the Outfall are mixed with surface water and diluted quickly. Thus, these data are not predictive of constituent concentrations in surface water. Therefore, a comparison of surface water data to screening levels is presented below.

5.2.2 Labadie Creek Surface Water Data

Surface water data for Labadie Creek are presented in **Table 14** (total/unfiltered results) and **Table 15** (dissolved/filtered results). Detected concentrations are compared to human health surface water screening levels in both tables; note that only the filtered/dissolved concentrations are compared to the human health fish consumption screening levels. Per the MDNR regulations, those screening levels are intended for use with filtered data.

A number of constituents were **not detected** in the Labadie Creek surface water samples; these are:

- Antimony
- Beryllium
- Cadmium
- Mercury
- Nitrite/Nitrate
- Selenium

- Cobalt
- Cyanide
- Fluoride
- Silver
- Thallium
- Tin

The following additional constituents were **not detected** in the Labadie Creek filtered samples:

- Chromium (dissolved)
- Copper (dissolved)
- Zinc (dissolved)

As indicated in **Table 14**, the majority of constituents in the total (unfiltered) samples do not have detected concentrations above screening levels, including the following (constituents lacking screening values are not included, such as essential nutrients and hardness):

- Barium
- Boron
- Chromium
- Copper
- Lead
- Molybdenum
- Nickel
- Sulfate
- Zinc

As indicated in **Table 15**, with the exception of arsenic and manganese, detected results for filtered samples are below human health surface water screening levels. **It is worth noting here that both boron and sulfate concentrations are low in the Labadie Creek samples.**

The following constituents have detected concentrations above risk-based screening levels in at least one total (unfiltered) sample:

- Aluminum – Total (unfiltered) aluminum concentrations both upstream and downstream are above the SMCL, which is a secondary standard based on prevention of post-treatment precipitation in a water distribution system. All of the detected concentrations of aluminum are below the USEPA tapwater screening level. Aluminum concentrations in the downstream samples are approximately 10-fold higher than the upstream samples. However, the aluminum was detected only once at a low concentration in the dissolved/filtered samples. Thus, it can be concluded that the downstream total aluminum concentrations are a result of suspended particulate/sediment in the samples, and are not associated with Facility operations.
- Arsenic – Arsenic concentrations are similar in all of the Labadie Creek surface water samples, both upstream and downstream, total and dissolved and, therefore, are not associated with Facility operations. All concentrations are below the state and federal drinking water standard, but are above the USEPA tapwater screening level.
- Iron – Iron was not detected in any dissolved/filtered samples, and was detected above the SMCL in five of the seven total/unfiltered samples. The SMCL is a secondary standard based on aesthetic effects (unpleasant metallic taste and staining of fixtures). All of the detected

concentrations are below the USEPA tapwater screening level. The iron concentrations in the downstream samples are approximately 10-fold higher than the upstream samples. Because iron was not detected in the dissolved/filtered samples, it can be concluded that the downstream total iron concentrations are a result of suspended particulate/sediment in the samples, and are not associated with Facility operations.

- Manganese – Manganese concentrations in the co-located total and dissolved samples are similar, indicating that the manganese is not likely associated with suspended sediments. The downstream sample concentrations are approximately 20-fold higher than in the upstream samples. The downstream concentrations are much higher than the concentrations measured in the NPDES Outfall 002; thus, the source of the manganese is not clear. All detected concentrations of manganese are above the SMCL, which is based on aesthetic effects (unpleasant taste and black staining of fixtures). The downstream concentrations of manganese are above the USEPA tapwater screening level, which addresses daily consumption of drinking water. Due to the low concentrations of boron and sulfate in these samples, Facility operations are not likely to be the source of manganese in the Creek.

The low concentrations of boron and sulfate in the Creek samples indicate that the coal ash management practices at the Labadie Energy Center are not likely impacting the Creek. In fact, the boron concentrations are 60% higher in the upstream samples than in the downstream samples; the sulfate concentrations are slightly higher in the upstream sample locations. Based on an evaluation of all the data**, no adverse health risks** are posed by coal ash-derived constituents for people who may use the Creek recreationally.

5.2.3 Missouri River Surface Water Data

Surface water data for the Missouri River are presented in **Table 16** (total/unfiltered results) and **Table 17** (dissolved/filtered results). Detected concentrations are compared to human health surface water screening levels in both tables; note that only the filtered/dissolved concentrations are compared to the human health fish consumption screening levels. Per the MDNR regulations, those screening levels are intended for use with filtered data.

A number of constituents **were not detected** in the Missouri River surface water samples; these are:

- Antimony
- Beryllium
- Cadmium
- Cobalt
- Cyanide
- Mercury
- Silver
- Thallium
- Tin

The following additional constituents were **not detected** in the Missouri River filtered/dissolved samples:

- Aluminum (dissolved)
- Chromium (dissolved)

- Copper (dissolved)
- Iron (dissolved)
- Lead (dissolved)
- Zinc (dissolved)

Because these constituents listed above are not present in the dissolved form (**Table 17**), their total concentrations in unfiltered/total samples (**Table 16**) are due entirely to their association with particulates/suspended sediment in those samples and are not associated with Facility operations.

As indicated in **Table 16**, the majority of constituents in the total (unfiltered) samples do not have detected concentrations above screening levels, including the following (constituents lacking screening values are not included, such as essential nutrients and hardness):

- Barium
- Boron
- Chromium
- Copper
- Fluoride
- Lead
- Molybdenum
- Nickel
- Nitrate/Nitrite
- Selenium
- Sulfate
- Zinc

Similar to the Labadie Creek results, as indicated in **Table 17**, with the exception of arsenic, detected results for filtered samples are below human health surface water screening levels. **It is worth noting here that both boron and sulfate concentrations are also low in the Missouri River samples**. While in the Missouri River boron concentrations were slightly higher downstream than upstream, the sulfate concentrations were slightly lower downstream than upstream; thus, there is not a consistent pattern in the River for the "indicator parameters." Sulfate concentrations were higher than groundwater concentrations both upstream and downstream. Concentrations are below screening levels, further indicating no adverse impact of the coal ash management practices on surface water quality.

The following constituents have detected concentrations above risk-based screening levels in at least one total (unfiltered) sample:

- Aluminum – The concentrations of total aluminum are essentially the same in the upstream and downstream samples; as aluminum was not detected in the dissolved form, it is associated with particulates/suspended sediments and is not associated with Facility operations. This is not unusual for a large river that carries a large suspended sediment load. While the concentrations are above the SMCL, which is based on prevention of post-treatment precipitation in a water distribution system, all concentrations are below the USEPA tapwater screening level. The Howard Bend intake data (**Tables 5 and 6**) indicate very low or non-detect levels of dissolved aluminum in the River water as well.

- Arsenic – As with the Creek, the arsenic concentrations are similar in all of the Missouri River surface water samples, both upstream and downstream, total and dissolved and, therefore, are not associated with Facility operations. All concentrations are below the state and federal drinking water standard, but are above the USEPA tapwater screening level.
- Iron – Iron was not detected in any dissolved/filtered samples, and was detected above the SMCL in all of the total/unfiltered samples. The SMCL is a secondary standard based on aesthetic effects (unpleasant metallic taste and staining of fixtures). All of the detected concentrations are below the USEPA tapwater screening level. The total iron concentrations are essentially the same in the upstream and downstream samples. Because iron was not detected in the dissolved/filtered samples, it can be concluded that the total iron concentrations are a result of suspended particulate/sediment in the samples and are not associated with Facility operations. The Howard Bend intake data (**Tables 5 and 6**) indicate very low or non-detect levels of dissolved iron in the River water as well.
- Manganese – The concentrations of total manganese are essentially the same in the upstream and downstream samples. Manganese was detected in the filtered samples, but at a much lower concentration that is below the screening levels. Therefore, it can be concluded that the total manganese concentrations are a result of suspended particulate/sediment in the samples and are not associated with Facility operations.

The concentrations of all analytes were similar in the upstream and downstream samples collected from the Missouri River, indicating that discharge of groundwater from the Facility is not having a measurable effect on the Missouri River water quality.

Detected concentrations of constituents in surface water from the Missouri River (total (unfiltered) and dissolved (filtered)) were also compared to the USEPA Ambient Water Quality Criteria (AWQC) Human Health Screening Levels for the Consumption of Organism Only (referred to here as Organism Only AWQC) (USEPA, 2009). The USEPA Organism Only AWQC screening levels apply to total concentrations but have been conservatively compared to dissolved concentrations as well. **Table 18** compares surface water data for the Missouri River unfiltered (total) results to the USEPA Organism Only AWQC screening levels and **Table 19** provides the same comparison for the filtered (dissolved) results. [Note that Labadie Creek is not large enough to sustain a recreational fishery, therefore, detected concentrations of constituents in surface water samples from Labadie Creek were not compared to the USEPA Organism Only AWQC screening levels.]

As indicated in **Table 18**, the majority of constituents in the total (unfiltered) samples do not have detected concentrations above the USEPA Organism Only AWQC, including the following (constituents lacking screening values are not included):

- Boron
- Nickel
- Selenium
- Zinc

As indicated in **Table 19**, the majority of constituents in the dissolved (filtered) samples do not have detected concentrations above the USEPA Organism Only AWQC, including the following (constituents lacking screening values are not included):

- Boron (dissolved)
- Manganese (dissolved)

- Nickel (dissolved)
- Selenium (dissolved)
- Zinc (dissolved)

The following constituents have detected concentrations above risk-based screening levels in at least one sample:

- Arsenic was detected above USEPA AWQC Human Health for the Consumption of Organism Only in upstream and downstream total (unfiltered) and dissolved (filtered) samples from the Missouri River.
- Manganese was detected above USEPA AWQC Human Health for the Consumption of Organism Only in upstream and downstream total (unfiltered) samples from the Missouri River.

Again, the low concentrations and the similarity of the constituent concentrations upstream and downstream, as well as a lack of a consistent pattern in the River for the "indicator parameters" boron and sulfate indicate no adverse impact of the coal ash management practices on surface water quality.

5.2.4 Surface Water Data Summary

A detailed evaluation of the results of the surface water investigation conducted in Labadie Creek and the Missouri River indicate that none of the constituents with concentrations above screening levels are present due to coal ash management practices at the Labadie Energy Center. The differences in the total and dissolved results for the Missouri River samples are consistent with what would be expected of a large river that carries a substantial sediment load. While in the Missouri River boron concentrations were slightly higher downstream than upstream, the sulfate concentrations were slightly lower downstream than upstream; thus, there is not a consistent pattern in the River for the "indicator parameters." Concentrations are below screening levels, further indicating no adverse impact of the coal ash management practices on surface water quality. While the arsenic concentrations in the River and the Creek are not associated with sediments (total and dissolved concentrations are essentially the same), the fact that the upstream and downstream concentrations are essentially the same indicates that the arsenic concentrations are consistent with background conditions in these water bodies. With the exception of manganese, the suspended sediments in Labadie Creek also account for the concentration results. While the source of the manganese at the downstream location in the Creek is not known, the coal ash management practices are not likely to be a potential source based on the boron and sulfate results.

Based on these results, the coal ash management practices at the Labadie Energy Center do not result in adverse impacts in Labadie Creek and the Missouri River, and do not pose an adverse risk to human health. This conclusion applies to both recreational uses of the Creek and River, and the use of the River as a source of drinking water by the City of St. Louis at the Howard Bend intake approximately 19.5 miles downstream from the Labadie Energy Center. Because impacts of coal ash management practices are not evident at a location 0.25 mile downstream from the facility boundary, there are no impacts from the Facility on the drinking water intake.

6.0 Ecological Evaluation

In addition to the human health evaluation, a comparison of surface water data for Labadie Creek and the Missouri River collected in October 2013 to ecological screening levels for surface water has also been conducted. The comparisons have been conducted on a sample-by-sample basis for both total (unfiltered) and dissolved (filtered) constituents for the Labadie Creek and the Missouri River samples. The results are summarized below.

In addition, whole effluent toxicity (WET) testing has been conducted annually as part of the Labadie NPDES permit requirements and the results of the testing are also discussed below.

6.1 Ecological Screening Levels

6.1.1 Sources of Screening Levels

Screening levels were obtained from both the State of Missouri and the USEPA:

- Missouri State Water Quality Criteria (MDNR, 2010b), and
- USEPA Ambient Water Quality Criteria (AWQC) (USEPA, 2009).

Screening levels from both sources applicable to total (unfiltered) and dissolved (filtered) results are presented in **Table 20**.

The Missouri State Water Quality Criteria for the Protection of Aquatic Life (acute and chronic) are applicable only to dissolved (filtered) forms of the constituents (with the exception of mercury and sulfate which are applicable to the total form). The Irrigation and the Livestock/Wildlife Watering criteria are applicable to the total (unfiltered) form of the constituents.

USEPA provides acute and chronic AWQC, some of which are applicable to total (unfiltered), and some of which are applicable to dissolved (filtered) results.

6.1.2 Site-Specific Adjustment for Hardness and Chloride

The Federal AWQC and the Missouri State Protection of Aquatic Life (AQL) criteria for cadmium, chromium III, copper, lead, nickel, silver, and zinc are calculated using hardness-dependent equations. The default USEPA AWQC and Missouri State AQLs are based on a hardness of 100 mg/L as $CaCO_3$, however AWQC and AQLs can be calculated with site-specific hardness values in accordance with USEPA and Missouri State guidance (USEPA, 2009; MDNR, 2010b). The average total hardness value of 270 mg/L from the October 2013 surface water sampling event for Labadie Creek was used for the evaluation of Labadie Creek data and the average total hardness value of 256 mg/L from the October 2013 surface water sampling event for Missouri River was used for the evaluation of Missouri River data.

The Missouri State AQL criterion for sulfate is calculated using site-specific hardness and chloride data. In the absence of chloride data, a default value of 25 mg/L was assumed to calculate the sulfate criteria for Labadie Creek and the Missouri River.

6.2 Screening Level Comparisons

Detected concentrations of constituents in surface water samples from Labadie Creek and the Missouri River were compared to the applicable ecological screening levels.

Detected concentrations of constituents in surface water for the total (unfiltered) analyses were compared to the screening levels applicable to total (unfiltered) results:

- Missouri State Water Quality Criteria (MDNR, 2010b):
  - Criteria for Protection of Aquatic Life (acute and chronic), Irrigation and Livestock and Wildlife Watering were used.
- Federal AWQCs (USEPA, 2009):
  - The chronic and acute values for freshwater aquatic life applicable to total/unfiltered results were used.

Detected concentrations of constituents in surface water for the dissolved (filtered) analyses were compared to the screening levels applicable to dissolved (filtered) results:

- Missouri State Water Quality Criteria (MDNR, 2010b):
  - Criteria for Protection of Aquatic Life (acute and chronic) were used.
- Federal AWQCs (USEPA, 2009):
  - The chronic and acute values for freshwater aquatic life applicable to dissolved (filtered) results were used.

6.3 Surface Water Screening Results

6.3.1 Labadie Creek Surface Water Data

Surface water data for Labadie Creek are presented in **Table 21** (total (unfiltered) results) and **Table 22** (dissolved (filtered) results). The USEPA AWQC and Missouri State AQL criteria for pH range from 6.5 to 9.0 for the protection of freshwater aquatic life. Field pH measurements obtained during the October 2013 Labadie Creek sampling event ranged from 7.08 to 8.24. All pH values are within the acceptable range.

A number of constituents were not detected in the Labadie Creek total (unfiltered) surface water samples (see **Table 21**); these are:

- Antimony
- Beryllium
- Cadmium
- Cobalt
- Cyanide
- Fluoride
- Mercury
- Nitrite/Nitrate
- Selenium
- Silver
- Thallium
- Tin

The following constituents were not detected in the Labadie Creek filtered (dissolved) samples (see **Table 22**):

- Antimony (dissolved)
- Beryllium (dissolved)
- Cadmium (dissolved)
- Chromium (dissolved)
- Cobalt (dissolved)
- Copper (dissolved)
- Iron (dissolved)
- Mercury (dissolved)
- Selenium (dissolved)
- Silver (dissolved)
- Thallium (dissolved)
- Tin (dissolved)
- Zinc (dissolved)

As indicated in **Table 21**, the majority of detected constituents in the total (unfiltered) samples do not have detected concentrations above screening levels, including the following (constituents lacking screening values are not included):

- Arsenic
- Boron
- Chromium
- Copper
- Lead
- Nickel
- Sulfate
- Zinc

As indicated in **Table 22**, all detected results for the dissolved (filtered) samples are below ecological surface water screening levels, including the following (constituents lacking screening values are not included):

- Aluminum
- Arsenic
- Lead
- Nickel

The following constituents have detected concentrations above risk-based screening levels in at least one total (unfiltered) sample:

- Aluminum – Aluminum was detected above USEPA Acute and Chronic Aquatic Life AWQC in downstream unfiltered samples from Labadie Creek. Aluminum was also detected above USEPA Chronic Aquatic Life AWQC in all three upstream unfiltered samples from Labadie Creek. Aluminum was detected only once and below the State screening level in the filtered (dissolved) samples, indicating that the aluminum is particulate bound.
- Iron – Iron was detected above USEPA Chronic Aquatic Life AWQC in downstream unfiltered (total) samples from Labadie Creek, but was below screening levels in the upstream samples, and was not detected in the filtered (dissolved) samples, indicating that the iron is particulate bound.

The use of total recoverable metals is likely to be a conservative estimate of metal bioavailability and may over-estimate potential risks to aquatic receptors.

6.3.2 Missouri River Surface Water Data

Surface water data for the Missouri River are presented in **Table 23** (unfiltered (total) results) and **Table 24** (filtered (dissolved) results). The USEPA AWQC and Missouri State AQL criteria for pH range from 6.5 to 9.0 for the protection of freshwater aquatic life. Field pH measurements obtained during the October 2013 Missouri River sampling event ranged from 7.32 to 8.24. All pH values are within the acceptable range.

A number of constituents were not detected in the Missouri River unfiltered (total) surface water samples (see **Table 23**); these are:

- Antimony
- Beryllium
- Cadmium
- Cobalt
- Cyanide
- Mercury
- Silver
- Thallium
- Tin

The following constituents were not detected in the Missouri River filtered (dissolved) samples (see **Table 24**):

- Aluminum (dissolved)
- Antimony (dissolved)
- Beryllium (dissolved
- Cadmium (dissolved)
- Chromium (dissolved)
- Cobalt (dissolved)
- Copper (dissolved)
- Iron (dissolved)
- Lead (dissolved)
- Mercury (dissolved)
- Silver (dissolved)
- Thallium (dissolved)
- Tin (dissolved)
- Zinc (dissolved)

As indicated in **Table 23**, the majority of constituents in the total (unfiltered) samples do not have detected concentrations above screening levels, including the following (constituents lacking screening values are not included):

- Arsenic
- Boron
- Chromium
- Copper
- Fluoride
- Lead
- Nickel
- Selenium
- Sulfate
- Zinc

Similar to the Labadie Creek results, as indicated in **Table 24**, all detected results for filtered samples from the Missouri River are below ecological surface water screening levels including the following (constituents lacking screening values are not included):

- Arsenic
- Boron
- Nickel
- Selenium

The following constituents have detected concentrations above risk-based screening levels in at least one total (unfiltered) sample:

- Aluminum – Aluminum was detected above USEPA Acute and Chronic Aquatic Life AWQC in upstream and downstream total (unfiltered) samples from the Missouri River. Aluminum was not detected in the dissolved (filtered) samples, indicating that the aluminum is particulate bound.

- Iron – Iron was detected above USEPA Chronic Aquatic Life AWQC in upstream and downstream total (unfiltered) samples from the Missouri River. Iron was not detected in the dissolved (filtered) samples, indicating that the iron is particulate bound.

Upstream and downstream constituent concentrations are essentially the same for both constituents, indicating that their presence in the samples is a result of background conditions. The use of total recoverable metals is likely to be a conservative estimate of metal bioavailability and may over-estimate potential risks to aquatic receptors.

6.4 Whole Effluent Toxicity Testing

As required by the current Labadie NPDES Permit MO-0004812, an Acute WET test is performed annually during the month of July for Outfall 002, the Ash Pond discharge point. To perform this test, grab samples of the ash pond effluent stream and of the Missouri River (representing the upstream receiving water) are collected and provided to the testing laboratory. Laboratory testing is conducted by Environmental Analysis South, Inc. using two freshwater test organisms: larval fathead minnow (*Pimephales promelas*) and water flea (*Ceriodaphnia dubia*). Testing is conducted according to USEPA guidance (2002) over a 48 hour period and measures test organism survival after exposure to a 15% effluent concentration (ash pond effluent diluted with Missouri River water).

Missouri River water is used to dilute the effluent in order to simulate mixing of the effluent upon discharge to the river. A Missouri River water sample is also included in the tests to provide a site-specific baseline result. Reconstituted laboratory water may be used to prepare the 15% effluent treatment if Missouri River water is not available; however, all tests conducted between 2009 and 2013 were diluted with Missouri River water.

Organism survival in the 15% effluent treatment is compared against survival in a Missouri River water treatment (referred to as an Upstream Control) and to a laboratory water treatment (referred to as a Reconstituted Control). If the effluent treatment results are not statistically different (alpha = 0.5) from the control results, then the effluent is considered to have passed the WET test. **Table 25** presents the results of the WET tests conducted between 2009 and 2013.

A review of the Labadie WET test results for the five year period from 2009 through 2013 indicates that survival in the effluent and control treatments was 100% in all cases with the exception of one *P. promelas* effluent treatment from 2010 (98% survival) and one *C. dubia* Reconstituted Control treatment from 2010 (95% survival). These results indicate that the effluent treatment passed all of the tests conducted between 2009 and 2013 and was in compliance with the NPDES permit requirement for WET testing.

7.0 Conceptual Site Model Summary

The CSM has been used as the basis for this health risk-based evaluation of the potential impact of coal ash management practices at the Labadie Energy Center on groundwater and surface water. The evaluation has been conducted using the source → transport → medium → exposure linkage framework. The evaluation provided in this Report has been used to refine the CSM to reflect all of the available data. The conceptual site model for this evaluation is provided in **Figure 14**.

7.1 Geology

The geology of the area is characterized by sedimentary bedrock that extends across much of eastern and southern Missouri. The bedrock in the Labadie area is made up of sedimentary formations, mainly limestone, sandstone, and dolomite. This bedrock has eroded over the years due to the flow of the Missouri River, and the river valley is filled in with unconsolidated alluvial deposits such as sands, gravels, silts, and clays forming the Labadie Bottoms. The alluvial deposits extend from bluff to bluff throughout the Missouri River valley with smaller alluvial deposits located along larger streams. The Labadie Energy Center is located in the Labadie Bottoms. The less-eroded bedrock makes up the bluffs and hilly uplands south of the Missouri River.

7.2 Groundwater and Potential for Exposure

The groundwater that flows through the unconsolidated deposits in the Labadie Bottoms forms the shallow alluvial aquifer. In the Labadie Bottoms where the alluvial aquifer is present, it flows above a deeper bedrock aquifer. The shallow aquifer is approximately 100 feet thick at its deepest, but this thickness pinches out, or generally thins, with increasing distance from the River. The shallow alluvial aquifer ends at the base of the bluffs to the south of the Missouri River. The bedrock aquifer is regionally continuous; at the Facility it extends from the Missouri River to the south and underlies the alluvial aquifer and the bluffs and hilly upland areas south of the Facility. Residences are located within the bluff areas and have private wells to provide groundwater as drinking water. These wells are located where the shallow alluvial aquifer is not present; they draw water from the bedrock aquifer. Many of these wells are greater than 200 feet deep, and can range in depth up to 600 feet or more.

The coal ash management areas of the Labadie Energy Center are located within the Labadie Bottoms in the area of the alluvial groundwater. Shallow groundwater flows from the coal ash management areas to downgradient areas and to the Missouri River and potentially Labadie Creek. If there are users of groundwater as drinking water in locations that are hydrologically connected and downgradient of the coal ash management areas, those users may come in contact with constituents released from the coal ash management areas. Therefore, private wells located within a one-mile radius of the Facility were evaluated based on location, well records, and groundwater data collected in the bluff and hilly upland area in the immediate vicinity of operation private drinking water wells. The evaluation indicates that the wells located in the bluffs and upland areas extract water from the bedrock aquifer and not the shallow alluvial aquifer.

Beyond the specific location of the wells, it is critical to note that the shallow alluvial aquifer does not extend beyond the floodplain of the Missouri River and near-by creeks. As noted in Section 3, any release of constituents due to coal ash management practices within the power plant footprint at the Labadie Energy Center, will impact the shallow alluvial aquifer where groundwater will generally flow to the Missouri River and potentially to Labadie Creek. Constituents will not flow from the coal ash

management areas in an upgradient direction and into the bedrock where residential wells are located in the bluff and hilly upland areas. Thus, from the well records alone, it can be concluded that the groundwater drinking water pathway is incomplete.

However, to test this, the monitoring locations TGP-A and TGP-B were located at the base of the bluffs immediately south of the facility and within approximately 1200 feet of the coal ash management areas. These wells are relatively shallow but completed into bedrock (TGP-A – 103 ft bgs), TGP-B – 130 ft bgs) (the well logs indicate that the alluvial aquifer does not extend to these locations, the alluvial aquifer pinches out at TGP-A). TGP-C was located further south in the bluffs in an area surrounded by residential wells. If the coal ash management practices were impacting the bedrock groundwater that is used for drinking water, that impact should be evident in these wells, and it is not. All results are **below** federal drinking water standards and/or risk-based screening levels.

As part of the permitting of the proposed Labadie Energy Center Utility Waste Landfill (UWL), 29 shallow monitoring wells have been installed to date around the proposed footprint of the landfill. Three rounds of sample collection and analysis by a laboratory for inorganic constituents has been conducted. There are no indications of potential impacts from coal ash management at the Labadie Energy Center on the shallow groundwater in the area of the proposed landfill, or in bedrock groundwater in the bluff and upland areas. A critical aspect to any review of groundwater data associated with coal ash management units generally is the presence, or lack thereof, of high concentrations of sulfate and boron. These “indicator parameters” will be present in high concentrations if a release for a coal management unit has occurred (EPRI, 2006). **At the Labadie Energy Center, groundwater sampling results reveal that neither the sulfate nor boron concentrations are elevated in the areas evaluated.**

In summary, the groundwater data and the evaluation of the geology and hydrogeology indicate that there is no evidence of any constituent released due to coal ash management practices resulting in an impact to groundwater that is used as drinking water, and there is no potential to pose a risk to human health through current use of the bedrock groundwater as a drinking water source. Thus, the drinking water pathway for groundwater is not a complete exposure pathway.

7.3 Surface Water and Potential for Exposure

A detailed evaluation of the results of the surface water investigation conducted in Labadie Creek and the Missouri River indicate that none of the constituents with concentrations above screening levels are present due to coal ash management practices at the Labadie Energy Center. The sample locations were selected such that if the coal ash management practices could impact these water bodies, it would be evident at these locations.

The Missouri River and Labadie Creek are both immediately adjacent to the Labadie Energy Center property. In both the Missouri River and Labadie Creek, constituent concentrations in samples from nearby locations both upstream and downstream from the Facility were similar, indicating that the downstream location results are consistent with background, and do not indicate adverse human health or ecological impact from coal ash management practices. The differences in the total and dissolved results for the Missouri River samples are consistent with what would be expected of a large river that carries a substantial sediment load. With the exception of manganese, the suspended sediments in Labadie Creek also account for the concentration results. While in the Missouri River boron concentrations were slightly higher downstream than upstream, the sulfate concentrations were slightly lower downstream than upstream; thus, there is not a consistent pattern in the River for the “indicator parameters.” Concentrations are below screening levels, further indicating no adverse impact of the coal ash management practices on surface water quality. The arsenic concentrations in

the River and the Creek are not associated with sediments (total and dissolved concentrations are essentially the same), and the fact that the upstream and downstream concentrations are also similar indicates that the arsenic concentrations are consistent with background conditions in these water bodies. While the source of the manganese at the downstream location in Labadie Creek is not known, the coal ash management practices are not likely a potential source. **It is worth noting here that both boron and sulfate concentrations are low in the Labadie Creek and Missouri River samples**.

In summary, there is no evidence of constituent release due to coal ash management practices at the Facility resulting in an adverse human health or ecological impact to surface water either in Labadie Creek or the Missouri River. While the surface water pathways for recreational use of the Creek and River and the use of the Missouri River as a source of drinking water are potentially complete, the potential risks are considered to be insignificant, because the majority of the constituent concentrations are below screening levels, and the few results above screening levels are not associated with releases from the Facility.

8.0 Conclusions

Ameren Missouri has retained the services of AECOM and Golder Associates, Inc. to assess the potential for public health and ecological risks associated with coal ash management practices at the Labadie Energy Center (Facility), a coal-fired power plant located in Franklin County, Missouri (see **Figure 1**). This Report evaluates a large dataset of analytical results for surface water and groundwater samples taken at or adjacent to the Facility property. The results of the evaluation indicate no adverse impact to the environment or human health for either surface water or groundwater. Specifically:

- Private drinking water wells in the area of the Facility draw water from the bedrock aquifer, not from the shallow alluvial aquifer that is present in the Labadie Bottoms where the Facility is located. Direct water quality sampling of the bedrock aquifer just south of the Facility in the area of the closest private drinking water wells has demonstrated that the groundwater used by the private wells in the area is upgradient of the Facility and is not impacted by the coal ash management practices at the Facility. In fact, all detected concentrations are below federal drinking water standards or human health risk-based screening levels.
- Concentrations of the "indicator parameters" boron and sulfate are not elevated in groundwater, either in the shallow alluvial aquifer or the bedrock aquifer. This demonstrates that there are no potential impacts from coal ash management practices at the Labadie Energy Center on the bedrock aquifer used as a source of drinking water, or on the shallow alluvial groundwater in the area of the proposed landfill, based on three rounds of sampling of the 26 monitoring wells installed around the perimeter of the proposed utility waste landfill location.
- The groundwater data from the shallow monitoring wells at the proposed landfill site are consistent with groundwater that is not affected by constituents from coal ash management practices at the Facility. While concentrations of arsenic, iron, manganese, selenium, and TDS are above drinking water standards, these data represent natural conditions for the area. Such concentrations would occur in groundwater whether or not the Labadie Energy Center was present and result from the natural characteristics of the geologic materials that make up the region.
- A detailed evaluation of the results of the surface water investigation conducted in Labadie Creek and the Missouri River indicate that constituents with concentrations above screening levels are not likely present due to coal ash management practices at the Labadie Energy Center, as both boron and sulfate concentrations are low in the Labadie Creek and Missouri River samples. The similarity of the upstream and downstream sample results underscores that the surface water quality is indicative of background conditions.
- Based on these results, the coal ash management practices at the Labadie Energy Center do not result in measurable impacts in Labadie Creek and the Missouri River, and do not pose a risk to human health or the environment. This conclusion applies to both recreational uses of the Creek and River, and the use of the River as a source of drinking water by the City of St. Louis at the Howard Bend intake approximately 19.5 miles downstream from the Labadie Energy Center. Because impacts of coal ash management practices are not evident at a location 0.25 mile downstream from the facility boundary, there are no impacts from the Facility on the drinking water intake.

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Tables

Table 1
Groundwater and Surface Water Screening Levels
Labadie Energy Center, Franklin County, MO
Ameren Missouri

			Missouri State Water Quality Screening Levels			Federal Water Quality Screening Levels		
Constituent	**CAS**	**Units**	**Human Health Fish Consumption (a)**	**Drinking Water Supply (f)**	**Groundwater (f)**	**USEPA MCLs (c)**	**USEPA SMCLs (c)**	**USEPA Tapwater RSLs (d)**
Inorganics								
Aluminum	7429-90-5	mg/L	NA	NA	NA	NA	0.05	16
Antimony	7440-36-9	mg/L	4.3	0.006	0.006	0.006	NA	0.006
Arsenic	7440-38-2	mg/L	NA	0.05	0.05	0.01	NA	0.000045
Barium	7440-39-3	mg/L	NA	2	2	2	NA	2.9
Beryllium	7440-41-7	mg/L	NA	0.004	0.004	0.004	NA	0.016
Boron	7440-42-8	mg/L	NA	NA	2	NA	NA	3.1
Cadmium	7440-43-9	mg/L	NA	0.005	0.005	0.005	NA	0.0069
Chromium	16065-83-1	mg/L	NA	0.1 (e)	0.1 (e)	0.1 (e)	NA	16 (g)
Cobalt	7440-48-4	mg/L	NA	NA	1	NA	NA	0.0047
Copper	7440-50-8	mg/L	NA	1.3	1.3	1.3 (b)	1	0.62
Cyanide	57-12-5	mg/L	NA	NA	NA	0.2	NA	0.0014
Fluoride	16984-48-8	mg/L	NA	4	4	4	2	0.62
Iron	7439-89-6	mg/L	NA	NA	0.3	NA	0.3	11
Lead	7439-92-1	mg/L	NA	0.015	0.015	0.015 (b)	NA	NA
Manganese	7439-96-5	mg/L	NA	NA	0.05	NA	0.05	0.32
Mercury	7487-94-7	mg/L	NA	0.002	0.002	0.002	NA	0.0043
Molybdenum	7439-98-7	mg/L	NA	NA	NA	NA	NA	0.078
Nickel	7440-02-0	mg/L	NA	0.1	0.1	NA	NA	0.3
Nitrate-Nitrite (as N)	NA	mg/L	NA	10	10	10	NA	NA
Selenium	7782-49-2	mg/L	NA	0.05	0.05	0.05	NA	0.078
Silver	7440-22-4	mg/L	NA	0.05	0.05	NA	0.1	0.071
Sulfate	7757-82-6	mg/L	NA	250	NA	NA	250	NA
Thallium	7440-28-0	mg/L	0.0063	0.002	0.002	0.002	NA	0.00016
Tin	7440-31-5	mg/L	NA	NA	NA	NA	NA	9.3
Zinc	7440-66-6	mg/L	NA	5	5	NA	5	4.7

Notes:
CAS - Chemical Abstracts Service.
MCL - Maximum Contaminant Level.
NA - Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. No MCL available.
USEPA - United States Environmental Protection Agency.
mg/L - Milligrams per liter.
(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012. http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf. Per 10 CSR 20-7.031(4)(B)(2), the criteria for Human Protection Fish Consumption should be compared to dissolved metals data (except for mercury). All other criteria are to be compared to total metals data.
(b) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(c) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm
(d) - USEPA Regional Screening Levels (November 2013). Values for tapwater. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(e) - The drinking water standard or MCL for chromium is based on total chromium.
(f) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012. http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
(g) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, and the basis of which has been questioned by USEPA's Science Advisory Board. This issue is discussed in detail in Appendix A.

Table 2
Private Well Search Results from State Databases
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Well Number	Missouri Reference ID Number	Date of Installation	Owner/Well Name	Well Type	Location (meters, UTM Coordinates, Zone 15N) EASTING	NORTHING	Data Source	Screen/open Interval (feet)	Well Depth (feet)	Depth to Bedrock (Feet)	Material at Screened Section
1	0281739	12/28/2001	Clinton Lewis	Private	686668.6	4267407.8	1,3,4	140-380	380	30	Bedrock
2	0347654	5/27/2005	Dave Monzuk	Private	686670.2	4267390.0	1,3,4	80-386	386	21	Bedrock
3	0318551	8/27/2003	Kim Ciccese	Private	686670.7	4267390.8	1,3,4	80-366	366	36	Bedrock
4	0064002	8/29/1995	Salvatore Astorino	N/A	686670.7	4267403.0	1,3,4	80-376	376	23	Bedrock
5	0098146	12/26/1994	Scott Mook	Private	686769.1	4267379.2	1,3,4	80-404	404	22	Bedrock
6	0021034	5/1/1962	Labadie School R-5	Noncommunity Public Well	686864.3	4266381.4	1,2	N/A	430	55	Note #7
7	0019624	3/23/1997	Dawn Stockton	Private	686869.0	4267383.8	1,3,4	100-425	425	15	Bedrock
8	0158680	3/19/1997	Kevin Howard	Private	686869.0	4267362.7	1,3,4	100-425	425	15	Bedrock
9	0020614	11/1/1961	George W. Jones	Private	686870.3	4266585.4	1,2	55-150	150	50	Bedrock
10	0006683	1941	Jim Wood	Private	686983.3	4266516.4	1,2	36-152	152	30	Bedrock
11	0015386	8/30/1956	Gus Steffens	Private	687235.3	4266776.4	1,2	41-200	200	30	Bedrock
12	0343786	12/14/2004	Carolyn Dietrich Ganz	Private	687269.2	4267403.3	1,3,4	120-405	405	15	Bedrock
13	0143744	10/25/1995	Henry Staas	Private	687269.9	4267369.6	1,3,4	120-435	435	15	Bedrock
14	0053091	9/6/1991	Wilson Hanebrink	N/A	687271.6	4267370.0	1,3,4	86-383	383	23	Bedrock
15	0019828	9/20/1996	Ray Kloppenburg	Private	687370.0	4267388.2	1,3,4	100-455	455	10	Bedrock
16	0065038	12/20/1991	E.C. Adams	Private	687370.0	4267388.2	1,3,4	81-383	383	42	Bedrock
17	0094898	10/12/1993	Robert L. Hoofman	Private	687370.0	4267388.2	1,3,4	80-404	404	20	Bedrock
18	0148633	8/1/1996	Kevin and Natalie Hardcastle	Private	687370.0	4267388.2	1,3,4	85-377	377	20	Bedrock
19	0158665	2/10/1997	Steve O'Connell	Private	687370.0	4267388.2	1,3,4	100-425	425	12	Bedrock
20	0188174	7/30/1997	Merle Newman	Reconstruction	687370.0	4267388.2	1,3,4	N/A	394	N/A	Note #9
21	0193861	11/12/1998	Steve and Sonia Leslie	Private	687370.0	4267388.2	1,3,4	100-385	385	26	Bedrock
22	0273030	7/27/2001	James Parris	Private	687370.0	4267388.2	1,3,4	80-326	326	13	Bedrock
23	0328470	10/6/2003	Jones Company	Private	687370.0	4267388.2	1,3,4	210-440	440	17	Bedrock
24	0288003	12/15/2001	Sheila Schultze	Private	687642.3	4267395.4	1,3,4	100-266	266	31	Bedrock
25	0002125	1926	Shell Pipeline Company	Industrial	687642.3	4266985.4	1,2	N/A	573	77	Note #7
26	0009313	6/9/1946	Della Stricker Lynn	Private	687642.3	4266985.4	1,2	93-118	118	80	Bedrock
27	0216903	8/2/1999	Brett and Lori Michalski	Private	687667.7	4267375.5	3,4	80-354	354	25	Bedrock
28	0015267	4/2/1989	Allen Pokrzuiski	Private	687670.8	4267389.8	3,4	89-373	373	20	Bedrock
29	0379942	1/27/2007	Ramonda Farinella	Private	687796.3	4266132.8	1,4	130-405	405	55	Bedrock
30	0009840	11/14/1946	Harry E. Stricker	Private	687842.3	4267395.4	1,2	18-180	180	5	Bedrock
31	0003658	2/20/1936	Louis Hausmann	Private	687870.3	4267380.4	1,2	82-195	195	8	Note #10
32	0128198	3/2/1996	Bill and Donna Jones	Private	687941.5	4267294.5	1,3,4	80-399	399	10	Bedrock
33	0019315	8/15/1996	Alecia Palmisano	Private	688029.0	4268449.2	1,3,4	80-295	295	29	Bedrock
34	0009430	08/10/1946	Labadie School	Noncommunity Public Well	688042.3	4266985.4	1,2	44-130	130	20	Bedrock
35	0017925	12/29/1958	J. Fennessey	Private	688106.3	4267011.4	1,2	41-203	203	20	Bedrock
36	0015655	10/10/1956	John Iman	Private	688282.3	4267034.4	1,2	46-252	252	15	Bedrock
37	0001703	4/12/1987	Bob Rosenhoffer	Private	688338.1	4266878.6	1,3,4	80-185	185	15	Bedrock
38	0084760	2/11/1992	Roy Queen	Private	688341.9	4266881.7	1,3,4	80-425	425	20	Bedrock
39	0143746	10/9/1995	Steve Parris	Private	688341.9	4266881.7	1,3,4	80-270	270	10	Bedrock
40	0247630	10/9/2002	Billie Caldwell	Reconstruction	688341.9	4266881.7	1,3,4	N/A	N/A	N/A	Note #9
41	0009839	12/12/1946	Otto E. Schulz	Private	688442.3	4266985.4	1,2	12-195	195	10	Bedrock
42	0307305	9/17/2002	Richard Jones	Private	688642.4	4266766.8	1,3,4	160-305	305	10	Bedrock
43	0334931	7/22/2004	Pete Duisen	Private	688831.2	4269010.1	1,3,4	80-340	340	40	Bedrock
44	0272810	5/16/2001	Nancy Campbell	Private	688840.8	4267602.3	1,3,4	80-225	225	18	Bedrock
45	0006139	5/25/1940	Harold Becker	Private	688842.3	4267395.4	1,2	44.5-220	220	15	Bedrock
46	0403547	7/27/2007	Kent Leopold Jr.	Private	688928.7	4268325.1	1,4	120-500	500	30	Bedrock

Table 2
Private Well Search Results from State Databases
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Well Number	Missouri Reference ID Number	Date of Installation	Owner/Well Name	Well Type	Location (meters, UTM Coordinates, Zone 15N) EASTING	NORTHING	Data Source	Screen/open Interval (feet)	Well Depth (feet)	Depth to Bedrock (Feet)	Material at Screened Section
47	0307293	8/28/2002	Mike Schmidt	Private	689037.9	4266987.1	1,3,4	180-265	265	10	Bedrock
48	0135063	3/14/1995	Wilbert Horn	Private	689043.2	4267394.6	1,3,4	100-250	250	25	Bedrock
49	0019821	11/15/1996	Frank Uhlenbrock	Private	689303.9	4267385.3	1,3,4	120-425	425	45	Bedrock
50	0432624	10/7/2008	Ron Gurnow	Private	689330.8	4267584.3	1,4	120-210	210	15	Bedrock
51	0018717	11/12/1959	James Heisel	Private	689658.4	4269073.5	1,2	72-225	225	60	Bedrock
52	0016005	3/16/1957	James Koelling	Private	689683.4	4267816.5	1,2	70-640	640	20	Bedrock
53	0189167	8/7/1997	David Roth	Private	689718.9	4270367.6	1,3,4	190-366	366	6	Bedrock
54	0024661	6/9/1966	J. Kopsky	Private	689949.4	4269025.5	1,2	97-257	257	15	Bedrock
55	0003211	3/1/1934	Franklin County Distillery	Industrial	690049.4	4269413.4	1,2	N/A	690	100	Note #7
56	0361016	10/27/2006	Charles Brunges	Private (Irrigation)	690071.7	4271817.6	1,4	N/A	91	N/A	Alluvium
57	0143737	7/25/1995	Marvin Newman	Private	690449.8	4269606.9	3,4	105-315	315	55	Bedrock
58	0443464	5/6/2010	Bradon Hoffstetter	Private	690918.3	4269129.4	1,4	85-360	360	25	Bedrock
59	0053051	11/8/1990	Jackie Barringhaus	Private	691158.0	4269446.2	1,3,4	121-363	363	36	Bedrock
60	0022924	2/19/1964	Marvin Newman	Private	691238.4	4269500.5	1,2	86-310	310	35	Bedrock
61	0009234	7/1/1946	Joseph Davis	Private	691363.4	4268545.5	1,2	50-438	438	45	Bedrock
62	0013700	4/28/1955	E. Schultz	Private	691363.4	4268731.5	1,2	21-455	455	10	Bedrock
63	0209837	02/19/2001	Dave Hidritch	Private	691453.3	4269498.7	3,4	N/A	N/A	N/A	Note #8
64	0347672	7/5/2005	Farris Hamlyr	Private	691553.3	4269420.8	1,3,4	160-366	366	8	Bedrock
65	0026189	7/19/1967	Carl Stettes	Private	691586.4	4269552.5	1,2	81-380	380	25	Bedrock
66	0290785	12/20/2005	Steve Mcatee	Private	691663.3	4268452.9	1,4	100-350	350	20	Bedrock
67	0021117	4/17/1962	H.E. Bohren	Private	691728.4	4269173.5	1,2	103-382	382	50	Bedrock
68	0018725	7/13/1996	Steven Gambaro	Private	691759.6	4269422.4	1,3,4	84-406	406	30	Bedrock
69	0026339	4/2/1990	Carl Lohrer	N/A	691764.4	4268177.8	1,3,4	80-537	537	9	Bedrock
70	0044782	8/29/1989	Marion and Rosena Thiebes	Private	692154.9	4269468.4	1,3,4	87-410	410	N/A	Note #8
71	0078747	5/21/1993	Merle Newman	Private	692154.9	4269423.9	1,3,4	115-256	256	30	Bedrock
72	0025545	3/1/1967	William Hassler	Private	692162.4	4269655.5	1,2	N/A	N/A	N/A	Note #8
73	0015387	8/18/1956	Harlin Weisler	Private	692363.4	4268915.5	1,2	167-225	225	10	Bedrock
74	0281696	9/13/2001	Steve Carrico	Private	692366.1	4268914.4	1,3,4	220-445	445	40	Bedrock
75	0394501	10/10/2006	J. George	Private	692484.7	4269436.3	1,4	105-266	266	70	Bedrock
76	0022926	4/22/1964	E.E. Elzemeyer	Private	692708.5	4269541.5	1,2	109-215	215	95	Bedrock
77	0000966	2/20/1987	Greg Smith	Private	692853.4	4269641.4	1,3,4	60-363	363	10	Bedrock
78	0021671	11/6/1962	Walter Schultz	Private	692925.5	4270066.5	1,2	48-303	303	50	Note #11
79	0021424	9/20/1962	Theodore C. Link	Private	692931.5	4270833.5	1,2	95-419	419	25	Bedrock
80	0012563	5/8/1989	Micheal Brinkman	Private	693046.1	4269116.4	1,3,4	N/A	311	85	Note #7
81	0087927	10/6/1992	David Wehner	N/A	693051.9	4269949.4	1,3,4	126-400	400	75	Bedrock
82	0011513	1/25/1951	Shell Pipeline Company	Industrial	693069.5	4270491.5	1,2	338-868	868	20	Bedrock

Table 2
Private Well Search Results from State Databases
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Sources

1. Data Source 1 = University of Missouri - Columbia - Department of Geography - MSDIS Database
2. Data Source 2 = Missouri Department of Natural Resources - Water Resources Center - Geologic Well Logs
3. Data Source 3 = Missouri Environmental Geology Atlas 2007 (MEGA)
4. Data Source 4 = MDNR Wellhead Protection Program

Notes

1) Database well locations are approximate.
2) Table displays non-community public, private and industrial wells within approximately one mile of the Labadie Energy Center property boundary in Franklin County, Missouri; monitoring wells, soil borings, heat pumps, stratigraphic test holes and abandonments are not listed on this table.
3) "N/A" - Data not available.
4) MDNR - Missouri Department of Natural Resources.
5) MSDIS - Missouri Spatial Data Information Service.
6) Locations of wells 33, 43, 53, 55, 56, and 57 appear to be listed incorrectly in MDNR Wellhead Protection Database and are discussed in section 4.1.1.
7) Material at screened depth cannot be determined because well logs do not contain data on casing depth.
8) Material at screened depth cannot be determined because no geological information is provided in the well logs.
9) Material at screened depth cannot be determined because well log displays information for well reconstruction. Full well length information on casing depth and geological units are not provided.
10) The drillers log from well 31 displays bedrock at 8 feet. The bedrock depth value of 85 feet in the MDNR water resources center database appears to be incorrect.
11) The depth of bedrock on well 78 appears to be listed incorrectly as 50 feet in the MDNR Geologic Well Log database. This well is presumed to be cased into bedrock at 48 feet.

Table 3
Public Well Search Results from State Databases
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Extended PWS Number	Status	Drill Date (Year)	Local Name	Well Name	Location		Casing Size (inches)	Ground Elevation	Casing Depth (feet)	Total Well Depth (feet)
					Latitude	Longitude				
6036219101	Active	1970	Well #1	Beauty View Acres Subd.	38.5053	-90.8428	6.0	N/A	108	335
6036139101	Active	1962	Well #1	Hermit Hollow Subd.	38.5259	-90.8151	6.0	680	250	795
6079516102	Active	1992	Well #1	St. Albans Water & Sewer Authority	38.5889	-90.7556	10.0	N/A	550	1450
6079516103	Active	2003	Well #2	St. Albans Water & Sewer Authority	38.5736	-90.7641	12.0	N/A	480	1115
6048153101	Active	1969	Well #1	Maple Hill Park	38.5064	-90.8521	N/A	N/A	52	380
6024213101	Active	1972	Gray Summit	Franklin Co. PWSD #3	38.4957	-90.8090	6.0	860	600	1255
6024213102	Active	1972	Villa Ridge	Franklin Co. PWSD #3	38.4836	-90.8848	6.0	745	556	955
6024213103	Active	1976	Villa Ridge	Franklin Co. PWSD #3	38.4712	-90.8592	12.0	N/A	600	1050
6024213104	Emergency	1971	Red Barn	Franklin Co. PWSD #3	38.4427	-90.8998	6.0	646	428	560
6024213105	Emergency	1970	Country Aire	Franklin Co. PWSD #3	38.5306	-90.7542	6.0	806	490	1020
6024213107	Active	1971	Old Lakewood MHP	Franklin Co. PWSD #3	38.4803	-90.9055	6.0	732	466	803

Sources
1. The University of Missouri and Missouri Department of Natural Recourses, Center for Applied Research and Environmental System (CARES), Public Drinking Water Systems Report Database.
2. Missouri Environmental Geology Atlas (MEGA) 2007.

Notes
1) Database well locations are approximate.
2) Table displays Active and Emergency Public Wells; Non-community, Proposed, and Plugged Wells are not displayed for clarity.
3) "N/A" - Data not available.
4) PWS = Public Water Supply.

Table 4
Publicly Available Surface Water Quality Monitoring Data for the Missouri River
Labadie Energy Center, Franklin County, MO
Ameren Missouri

			Upstream (j)								Downstream (j)															
Constituent	**CAS**	**Units**	**Missouri River Station ID: GRW04449-569 (a)**		**Missouri River Station ID: GRE06604-1251 (g)**		**Missouri River Station ID: GRE06604-1267 (b)**		**Missouri River Station ID: GRW04449-669 (c)**		**Missouri River Station ID: GRE06604-1271(d)**		**Missouri River Station ID: GRW04449-677 (e)**		**Missouri River Station ID: GRE06604-1255 (h)**		**Missouri River Station ID: GRW04449-557 (i)**						**Missouri River Station ID: 1604/27.6 (f)**			
Approximate Distance* (miles):			**25.9**		**20.2**		**14.5**		**2.2**		**8.3**		**8.6**		**10.8**		**23.1**						**28.1**			
Sample Collection Date:			**7/27/2004**		**7/25/2006**		**7/13/2006**		**8/23/2005**		**7/12/2006**		**8/18/2005**		**7/11/2006**		**7/21/2004**		**9/22/2004**		**8/17/2005**		**5/17/2007**		**5/14/2007**	
Inorganics			**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**	**Total**	**Dissolved**
Aluminum	7429-90-5	mg/L	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	--	--	--
Arsenic	7440-38-2	mg/L	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	--	--	--
Cadmium	7440-43-9	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.0003	ND	0.0004	ND
Copper	7440-50-8	mg/L	--	0.0050	--	0.0050	--	0.0050	--	0.0050	--	0.0050	--	0.0050	--	0.0050	--	0.0050	--	0.0050	--	0.0050	0.0151	0.0022	0.0186	0.0023
Iron	7439-89-6	mg/L	--	0.0232	--	0.0050	--	0.0050	--	0.0050	--	0.0050	--	0.0050	--	0.0050	--	0.0050	--	0.0050	--	0.0050	18.1	0.177	24.1	0.155
Lead	7439-92-1	mg/L	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	--	0.0250	0.0130	0.0003	0.017	0.0005
Magnesium	743-95-4	mg/L	--	17.3	--	21.7	--	23.3	--	14.9	--	22.7	--	17.7	--	22.4	--	13.9	--	21.9	--	20.9	14.2	--	12.7	--
Manganese	7439-96-5	mg/L	--	--	--	--	--	--	--		--	--	--	--	--	--	--	--	--	--	--	--	0.5900	0.0194	0.673	0.0200
Nickel	7440-02-0	mg/L	--	0.0100	--	0.0100	--	0.0100	--	0.0100	--	0.0100	--	0.0100	--	0.0100	--	0.0100	--	0.0100	--	0.0100	0.0189	0.0032	0.023	0.0031
Nitrogen	93037-13-9	mg/L	3.31	--	1.06	--	1.57	--	1.47	--	1.63	--	1.30	--	1.75	--	3.67	--	0.64	--	1.14	--	4.13	--	4.01	--
Nitrate-Nitrite (as N)	NA	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.81	--	2.33	--
Selenium	7782-49-2	mg/L	--	0.0500	--	0.0500	--	0.0500	--	0.0500	--	0.0500	--	0.0500	--	0.0500	--	0.0500	--	0.0500	--	0.0500	--	--	--	--
Sulfate	7757-82-6	mg/L	--	97.9	--	153	--	157	--	51.6	--	155	--	137	--	153	--	66	--	143	--	144	--	--	--	--
Zinc	7440-66-6	mg/L	--	0.0050	--	0.0050	--	0.0050	--	0.0191	--	0.0050	--	0.0050	--	0.0100	--	0.0640	--	0.0197	--	0.0050	0.0532	0.0027	0.0666	0.0030
Water Parameters (k)																										
Temperature, water	NA	deg C	25.2	--	29.6	--	27.8	--	27.5	--	28.4	--	27.0	--	27.57	--	28.90	--	23.03	--	27.03	--	21.8	--	23.7	--
Turbidity	NA	NTU	192	--	36	--	29	--	140	--	29	--	78	--	32.17	--	602.33	--	28.67	--	51.67	--	535	--	819	--
Conductivity	NA	uS/cm	502	--	740	--	770	--	598	--	748	--	557	--	588	--	461	--	672	--	750	--	368	--	313	--
pH	NA	----	8.00	--	8.33	--	8.24	--	7.90	--	8.27	--	8.04	--	8.19	--	7.92	--	8.44	--	8.10	--	7.80	--	7.80	--
Dissolved oxygen (DO)	NA	mg/L	6.92	--	7.38	--	7.73	--	6.44	--	6.89	--	7.13	--	6.89	--	6.27	--	9.14	--	6.62	--	5.20	--	5.50	--

Notes:
CAS - Chemical Abstracts Service.
NA - Not Available.
USEPA - United States Environmental Protection Agency.
mg/L - Milligrams per liter.
-- - Data not available.
* - Approximate surface water pathway distance, upstream or downstream, from the Labadie Energy Center.
(a) - Data was obtained from USEPA Surf Your Watershed website at http://ofmpub.epa.gov/apex/STORETSummary/f?p=WatershedUI:1:0::::P1_ORG_CHAR,P1_HUC:1,10300200 on October 24, 2013.Water quality monitoring data from EMAP-Great Rivers Ecosystems and collected on July 27, 2004. Sample location Latitude: 38.653298, Longitude: -91.235624, and Generated HUC:10300200.
(b) - Data was obtained from USEPA Surf Your Watershed website at http://ofmpub.epa.gov/apex/STORETSummary/f?p=WatershedUI:1:0::::P1_ORG_CHAR,P1_HUC:1,10300200 on October 30, 2013.Water quality monitoring data from EMAP-Great Rivers Ecosystems and collected on July 12, 2006. Sample location Latitude:38.65351, Longitude:-90.73378, and Generated HUC:10300200.
(c) - Data was obtained from USEPA Surf Your Watershed website at http://ofmpub.epa.gov/apex/STORETSummary/f?p=WatershedUI:1:0::::P1_ORG_CHAR,P1_HUC:1,10300200 on October 24, 2013.Water quality monitoring data from Data from EMAP-Great Rivers Ecosystems and collected on August 23, 2005. Sample location Latitude: 38.549372, Longitude:-90.882339, and Generated HUC:10300200.
(d) - Data was obtained from USEPA Surf Your Watershed website at http://ofmpub.epa.gov/apex/STORETSummary/f?p=WatershedUI:1:0::::P1_ORG_CHAR,P1_HUC:1,10300200 on October 24, 2013.Water quality monitoring data from Data from EMAP-Great Rivers Ecosystems collected on July 12, 2006. Sample location Latitude: 38.67808, Longitude: -90.70352, and Generated HUC:10300200.
(e) - Data was obtained from USEPA Surf Your Watershed website at http://ofmpub.epa.gov/apex/STORETSummary/f?p=WatershedUI:1:0::::P1_ORG_CHAR,P1_HUC:1,10300200 on October 30, 2013.Water quality monitoring data from EMAP-Great Rivers Ecosystems and collected on August 18, 2005. Sample location Latitude:38.656859, Longitude: -90.731829, and Generated HUC:10300200.
(f) - Data was obtained from USEPA Surf Your Watershed website at http://ofmpub.epa.gov/apex/STORETSummary/f?p=WatershedUI:1:0::::P1_ORG_CHAR,P1_HUC:1,10300200 on October 24, 2013.Water quality monitoring data from Missouri Dept. of Natural Resources and collected on May 14 and May 17, 2007. Sample location Latitude:38.7793308, Longitude: -90.4813784, and Generated HUC:10300200.
(g) - Data was obtained from USEPA Surf Your Watershed website at http://ofmpub.epa.gov/apex/STORETSummary/f?p=WatershedUI:1:0::::P1_ORG_CHAR,P1_HUC:1,10300200 on December 14, 2013.Water quality monitoring data from Data from EMAP-Great Rivers Ecosystems collected on July 25, 2006. Sample location Latitude: 38.60652, Longitude: -91.16757, and Generated HUC:10300200.
(h) - Data was obtained from USEPA Surf Your Watershed website at http://ofmpub.epa.gov/apex/STORETSummary/f?p=WatershedUI:1:0::::P1_ORG_CHAR,P1_HUC:1,10300200 on December 14, 2013.Water quality monitoring data from Data from EMAP-Great Rivers Ecosystems collected on July 11, 2006. Sample location Latitude: 38.67808, Longitude: -90.70352, and Generated HUC:10300200.
(i) - Data was obtained from USEPA Surf Your Watershed website at http://ofmpub.epa.gov/apex/STORETSummary/f?p=WatershedUI:1:0::::P1_ORG_CHAR,P1_HUC:1,10300200 on December 14, 2013.Water quality monitoring data from Data from EMAP-Great Rivers Ecosystems collected on July 21, 2004, September 22, 2004, and August 17, 2005. Sample location Latitude: 38.725031, Longitude: -90.534427, and Generated HUC:10300200.
(j) - The surface water monitoring data presented was obtained from the USEPA Surf Your Watershed website at http://cfpub.epa.gov/surf/locate/index.cfm. Water quality monitoring data was accessed through the Surf Your Watershed website by selecting the watershed name, or geographic unit of interested and then selecting to view the water quality monitoring data from this watershed. The water quality monitoring data presented is from the Lower Missouri watershed.
(k) - Where more than one value was available, the higher value was used.

Table 5
Mineral Analysis of River Water from the Howard Bend Plant - Calendar Year 2011 (a)
Labadie Energy Center, Franklin County, MO
Ameren Missouri

			Calendar Year 2011												
Constituent (b)	**Units**	**Method Detection Level**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Year Average**
Iron, Fe	mg/L	0.0001	0.0301	0.0596	ND	0.0387	ND	0.0137	0.0200	0.0072	ND	ND	0.0657	0.0697	0.0381
Aluminum, Al	mg/L	0.0001	ND	0.0417	0.0053	0.0766	0.0027	0.0135	0.0093	0.0020	0.0050	0.0177	0.0657	0.0367	0.0251
Calcium, Ca	mg/L		76.9	61.1	50.2	55.8	55.2	50.0	57.1	59.2	56.3	61.5	60.1	58.0	58.5
Magnesium, Mg	mg/L		26.0	23.1	15.5	20.5	22.6	19.3	19.2	21.0	21.4	22.6	22.3	20.4	21.2
Sodium, Na	mg/L	0.03	47.9	39.3	21.7	28.4	35.3	43.9	61.9	61.8	61.9	62.2	59.3	50.7	47.9
Potassium, K	mg/L	0.01	5.16	4.71	4.33	5.34	5.36	5.43	5.89	5.51	7.06	5.72	6.20	5.21	5.49
Carbonate, CO3	mg/L		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bicarbonate, HCO3	mg/L		260	217	172	173	184	196	208.6	211	210	223.3	225.7	208.6	207
Sulfate, SO4	mg/L		132.9	108.8	68.7	118.4	140.1	160.0	174.7	187.8	184.5	176.6	178.7	150.0	148.4
Chloride, Cl	mg/L		26.9	37.5	15.4	17.0	16.3	20.3	14.3	13.8	15.9	18.3	20.8	19.8	19.7
Nitrate, N	mg/L		1.91	1.76	2.02	1.73	1.42	1.61	1.00	0.53	0.37	0.57	1.17	1.07	1.26
Turbidity (NTU)	--		26	344	195	290	347	358	222	118	91	63	33	105	183
pH	--		8.16	8.09	8.08	8.05	8.07	8.07	8.00	8.13	8.22	8.33	8.29	8.20	8.14
Residual Chlorine	mg/L		0	0	0	0	0	0	0	0	0	0	0	0	0
Total Alkalinity, CaCO3	mg/L		213	178	141	148	151	161	171	173	172	183	185	171	171
Non Carb. Hardness, CaCO3	mg/L		90	71	51	84	87	75	72	65	70	72	72	70	73
Total Hardness, CaCO3	mg/L		299	245	191	233	239	237	243	237	241	256	256	241	243
Dissolved Solids	mg/L		485	426	288	425	401	421	459	468	470	475	478	540	445
Fluoride, F	mg/L		0.34	0.29	0.21	0.24	0.24	0.31	0.39	0.40	0.40	0.38	0.37	0.24	0.32
Phosphate, PO4	mg/L	0.01	0.22	0.27	0.23	0.28	0.22	NA	0.25	0.29	0.28	0.27	0.28	0.27	0.26

Notes:
mg/L - Milligrams per liter.
NA - Not Available.
ND - Not Detected.
(a) - Data from City of St. Louis. Department of Public Utilities Water Division. Supply and Purifying Section. Mineral Analysis of Missouri River Water from the Howard Bend Plant.
(b) - Results are for filtered (dissolved) samples, except for turbidity, pH, and fluoride.

Table 6
Mineral Analysis of River Water from the Howard Bend Plant - Calendar Year 2012 (a)
Labadie Energy Center, Franklin County, MO
Ameren Missouri

			Calendar Year 2012												
Constituent (b)	**Units**	**Method Detection Level**	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Year Average**
Iron, Fe	mg/L	0.0001	0.0160	0.0420	0.0820	0.0680	0.0430	0.0120	0.0123	0.0104	ND	ND	ND	ND	0.0357
Aluminum, Al	mg/L	0.0001	ND	0.0128	0.0078	0.0181	ND	ND	0.0090	0.0058	ND	0.0123	ND	0.0136	0.0113
Calcium, Ca	mg/L		62.5	62.1	48.3	48.3	53.2	64.3	57.4	55.7	54.8	59.1	54.3	63.8	57.0
Magnesium, Mg	mg/L		21.9	19.7	15.0	15.0	17.1	23.1	22.4	22.3	22.1	22.8	22.2	24.5	20.7
Sodium, Na	mg/L	0.03	50.9	44.8	29.6	29.6	36.3	53.8	64.3	74.7	72.6	73.7	69.7	70.1	55.8
Potassium, K	mg/L	0.01	4.70	4.30	4.00	3.97	3.93	5.01	4.70	4.79	4.77	4.49	4.51	6.54	4.64
Carbonate, CO3	mg/L		0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	1.2	0.0	0.0	0.0	0.2
Bicarbonate, HCO3	mg/L		240.3	219.6	200	175.7	188	217.2	216	211	199	214	217	208	209
Sulfate, SO4	mg/L		151.0	123.2	84.9	84.9	113.9	113.6	194.0	247.0	203.2	185.8	210.0	176.8	157.4
Chloride, Cl	mg/L		25.1	22.7	14.8	14.8	16.9	16.3	22.8	25.3	20.4	16.0	21.0	22.9	19.9
Nitrate, N	mg/L		1.22	1.22	1.20	1.23	1.67	1.75	0.46	0.06	0.25	0.33	0.28	0.62	0.86
Turbidity (NTU)	--		26	48	155	430	178	79	28	34	32	37	24	18	91
pH	--		8.15	8.16	8.09	8.06	8.09	8.24	8.46	8.42	8.87	8.38	8.39	8.36	8.31
Residual Chlorine	mg/L		0	0	0	0	0	0	0	0	0	0	0	0	0
Total Alkalinity, CaCO3	mg/L		197	180	164	144	154	178	177	175	165	175	178	207	175
Non Carb. Hardness, CaCO3	mg/L		76	50	50	48	60	91	82	78	71	72	70	65	68
Total Hardness, CaCO3	mg/L		272	230	213	191	214	269	258	254	236	247	248	272	242
Dissolved Solids	mg/L		347	416	347	315	493	513	510	533	517	511	512	523	461
Fluoride, F	mg/L		0.32	0.26	0.25	0.24	0.30	0.38	0.39	0.40	0.41	0.41	0.42	0.38	0.35
Phosphate, PO4	mg/L	0.01	0.27	0.21	0.31	0.25	0.30	0.41	0.31	0.23	0.27	0.23	0.20	0.21	0.27

Notes:
mg/L - Milligrams per liter.
ND - Not Detected.
(a) - Data from City of St. Louis. Department of Public Utilities Water Division. Supply and Purifying Section. Mineral Analysis of Missouri River Water from the Howard Bend Plant.
(b) - Results are for filtered (dissolved) samples, except for turbidity, pH, and fluoride.

Table 7
Validated Analytical Results – Surface Water Sampling Event –
October 2013
Labadie Energy Center, Franklin County, MO
Ameren Missouri

				Labadie Creek																									
				Creek Downstream														Creek Upstream											
Constituent	CAS	Units	Analytical Method	LBD-C-1 Total		LBD-C-1 Filtered		LBD-C-1-DUP Total		LBD-C-2 Total		LBD-C-2 Filtered		LBD-C-3 Total		LBD-C-3 Filtered		LBD-C-4 Total		LBD-C-4 Filtered		LBD-C-5 Total		LBD-C-5 Filtered		LBD-C-6 Total		LBD-C-6 Filtered	
Aluminum	7429-90-5	mg/L	SW846 Method 6020	2.91		0.0163	J	2.98		3.17		0.0143	U	3.5		0.0143	U	0.0968	J	0.0143	U	0.139		0.0143	U	0.217		0.0143	U
Antimony*	7440-36-0	mg/L	SW846 Method 6010B	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	SW846 Method 6020	0.0065		0.0039		0.0067		0.0061		0.0039		0.0066		0.0043		0.0056		0.0056		0.0055		0.0051		0.0061		0.0051	
Barium	7440-39-3	mg/L	SW846 Method 6010B	0.161		0.141		0.165		0.164		0.145		0.172		0.146		0.124		0.116		0.122		0.118		0.125		0.12	
Beryllium*	7440-41-7	mg/L	SW846 Method 6010B	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U
Boron	7440-42-8	mg/L	SW846 Method 6010B	0.0978		0.108		0.0986		0.0959		0.1		0.0999		0.0994		0.166		0.165		0.164		0.169		0.167		0.17	
Cadmium*	7440-43-9	mg/L	SW846 Method 6020	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium	7440-70-2	mg/L	SW846 Method 6010B	56.1		NA		56.6		55.4		NA		57.7		NA		65.6		NA		64.4		NA		65.7		NA	
Chromium	7440-47-3	mg/L	SW846 Method 6010B	0.0026	J	0.0016	U	0.0031	J	0.0027	J	0.0016	U	0.0031	J	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U
Cobalt*	7440-48-4	mg/L	SW846 Method 6010B	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper	7440-50-8	mg/L	SW846 Method 6010B	0.0027	U	0.0027	U	0.004	J	0.0045	J	0.0027	U	0.0048	J	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U
Total Cyanide (water)*	57-12-5	mg/L	SW846 Method 9012B	0.005	U	NA		0.005	U	0.005	U	NA		0.005	U	NA		0.005	U	NA		0.005	U	NA		0.005	U	NA	
Fluoride	16984-48-8	mg/L	EPA Method 300.0	0.4	U	NA		0.4	U	0.4	U	NA		0.4	U	NA		0.4	U	NA		0.4	U	NA		0.4	U	NA	
Iron	7439-89-6	mg/L	SW846 Method 6010B	2.21	J	0.043	U	2.39	J	2.47	J	0.043	U	2.71	J	0.043	U	0.225	J	0.043	U	0.216	J	0.043	U	0.309	J	0.043	U
Lead	7439-92-1	mg/L	SW846 Method 6020	0.0017		0.0001	J	0.0018		0.0018		0.000085	U	0.0021		0.000085	U	0.00014	J	0.000085	U	0.00013	J	0.000085	U	0.0002	J	0.000085	U
Magnesium	7439-95-4	mg/L	SW846 Method 6010B	26.5		26.9		26.7		26.1		27		27.1		27.2		31		30.4		30.4		30.5		30.9		31.5	
Manganese	7439-96-5	mg/L	SW846 Method 6010B	1.31		1.19		1.34		1.32		1.19		1.4		1.24		0.0792		0.0581		0.0774		0.0598		0.0862		0.0619	
Mercury*	7439-97-6	mg/L	SW846 Method 7470A	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum	7439-98-7	mg/L	SW846 Method 6010B	0.0092	J	0.0036	J	0.005	J	0.0055	J	0.0031	J	0.0046	J	0.003	J	0.0029	J	0.0018	J	0.0024	J	0.0022	J	0.0024	J	0.002	J
Nickel	7440-02-0	mg/L	SW846 Method 6010B	0.004	J	0.0021	J	0.0036	J	0.0042	J	0.0015	U	0.0051	J	0.002	J	0.0024	J	0.0024	J	0.0022	J	0.0017	J	0.0017	J	0.0017	J
Total Nitrite/Nitrate Nitrogen	7727-37-9	mg/L	EPA Method 353.2	0.04	U	NA		0.04	U	0.04	U	NA		0.04	U	NA		0.04	U	NA		0.04	U	NA		0.04	U	NA	
Selenium	7782-49-2	mg/L	SW846 Method 6020	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U
Silver	7440-22-4	mg/L	SW846 Method 6010B	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate	14808-79-8	mg/L	EPA Method 300.0	19.4	J	NA		15.4	J	16.3	J	NA		15.3	J	NA		17.8	J	NA		17.6	J	NA		16.6	J	NA	
Thallium*	7440-28-0	mg/L	SW846 Method 6020	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin*	7440-31-5	mg/L	SW846 Method 6010B	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc	7440-66-6	mg/L	SW846 Method 6010B	0.0042	J	0.002	U	0.0048	J	0.0053	J	0.002	U	0.006	J	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
Total Hardness as CaCO3	471-34-1	mg/L	SM2340 Method B-1997	249		NA		251		246		NA		256		NA		291		NA		286		NA		291		NA	

Notes:
* Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L = Milligrams per liter.
NA - Not Analyzed.
Total - Not filtered.
U - Constituent was not detected.

Table 7
Validated Analytical Results – Surface Water Sampling Event –
October 2013
Labadie Energy Center, Franklin County, MO
Ameren Missouri

				Missouri River																									
				River Downstream																									
Constituent	CAS	Units	Analytical Method	LBD-R-1S Total		LBD-R-1S Filtered		LBD-R-2S Total		LBD-R-2S Filtered		LBD-R-2M Total		LBD-R-2M Filtered		LBD-R-2M-Dup Total		LBD-R-2M-Dup Filtered		LBD-R-3S Total		LBD-R-3S Filtered		LBD-R-3M Total		LBD-R-3M Filtered	
Aluminum	7429-90-5	mg/L	SW846 Method 6020	2.3		0.0143	U	3		0.0143	U	3		0.0143	U	2.82		0.0143	U	2.84		0.0143	U	2.85		0.0143	U
Antimony*	7440-36-0	mg/L	SW846 Method 6010B	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	SW846 Method 6020	0.0044		0.004		0.0045		0.0037		0.0047		0.0036		0.0047		0.0041		0.0048		0.0033		0.0049		0.0035	
Barium	7440-39-3	mg/L	SW846 Method 6010B	0.113		0.0936		0.122		0.0912		0.123		0.0914		0.121		0.0908		0.123		0.0915		0.124		0.0938	
Beryllium*	7440-41-7	mg/L	SW846 Method 6010B	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U
Boron	7440-42-8	mg/L	SW846 Method 6010B	0.12		0.123		0.121		0.122		0.123		0.123		0.123		0.124		0.118		0.116		0.119		0.119	
Cadmium*	7440-43-9	mg/L	SW846 Method 6020	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium	7440-70-2	mg/L	SW846 Method 6010B	63.8		NA		64.7		NA		63.6		NA		64.6		NA		64.2		NA		65.5		NA	
Chromium	7440-47-3	mg/L	SW846 Method 6010B	0.0023	J	0.0016	U	0.0027	J	0.0016	U	0.0031	J	0.0016	U	0.0031	J	0.0016	U	0.0029	J	0.0016	U	0.0032	J	0.0016	U
Cobalt*	7440-48-4	mg/L	SW846 Method 6010B	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper	7440-50-8	mg/L	SW846 Method 6010B	0.0042	J	0.0027	U	0.005	J	0.0027	U	0.0046	J	0.0027	U	0.0048	J	0.0027	U	0.0058	J	0.0027	U	0.005	J	0.0027	U
Total Cyanide (water)*	57-12-5	mg/L	SW846 Method 9012B	0.005	U	NA		0.005	U	NA		0.005	U	NA		0.005	U	NA		0.005	U	NA		0.005	U	NA	
Fluoride	16984-48-8	mg/L	EPA Method 300.0	0.5	J	NA		0.47	J	NA		0.48	J	NA		0.5	J	NA		0.47	J	NA		0.43	J	NA	
Iron	7439-89-6	mg/L	SW846 Method 6010B	1.6	J	0.043	U	2.11	J	0.043	U	2.08	J	0.043	U	2.07	J	0.043	U	2.25	J	0.043	U	2.23	J	0.043	U
Lead	7439-92-1	mg/L	SW846 Method 6020	0.0015		0.000085	U	0.0018		0.000085	U	0.0018		0.000085	U	0.0018		0.000085	U	0.0019		0.000085	U	0.0019		0.000085	U
Magnesium	7439-95-4	mg/L	SW846 Method 6010B	23.1		23.5		23.4		23.1		23.1		22.9		23.5		22.9		23.3		23.1		23.8		23.6	
Manganese	7439-96-5	mg/L	SW846 Method 6010B	0.208		0.0157		0.23		0.0039	J	0.23		0.0047	J	0.229		0.0049	J	0.233		0.00085	J	0.237		0.00089	J
Mercury*	7439-97-6	mg/L	SW846 Method 7470A	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum	7439-98-7	mg/L	SW846 Method 6010B	0.0044	J	0.0042	J	0.0044	J	0.0039	J	0.0044	J	0.0042	J	0.0045	J	0.004	J	0.0044	J	0.0036	J	0.0041	J	0.0037	J
Nickel	7440-02-0	mg/L	SW846 Method 6010B	0.0033	J	0.0015	U	0.0037	J	0.0015	U	0.0039	J	0.0015	U	0.0047	J	0.0015	U	0.0034	J	0.0015	U	0.0046	J	0.0015	U
Total Nitrite/Nitrate Nitrogen	7727-37-9	mg/L	EPA Method 353.2	0.5		NA		0.53		NA		0.52		NA		0.52		NA		0.53		NA		0.54		NA	
Selenium	7782-49-2	mg/L	SW846 Method 6020	0.0017	J	0.0016	J	0.0016	J	0.0016	J	0.0017	J	0.0016	J	0.0017	J	0.0015	J	0.0017	J	0.0016	J	0.0017	J	0.0016	J
Silver	7440-22-4	mg/L	SW846 Method 6010B	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate	14808-79-8	mg/L	EPA Method 300.0	174		NA		187		NA		193		NA		189		NA		189		NA		192		NA	
Thallium*	7440-28-0	mg/L	SW846 Method 6020	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin*	7440-31-5	mg/L	SW846 Method 6010B	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc	7440-66-6	mg/L	SW846 Method 6010B	0.0073	J	0.002	U	0.0064	J	0.002	U	0.0064	J	0.002	U	0.007	J	0.002	U	0.0072	J	0.002	U	0.0073	J	0.002	U
Total Hardness as CaCO3	471-34-1	mg/L	SM2340 Method B-1997	255		NA		258		NA		254		NA		258		NA		256		NA		261		NA	

Notes:
* Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L = Milligrams per liter.
NA - Not Analyzed.
Total - Not filtered.
U - Constituent was not detected.

Table 7
Validated Analytical Results – Surface Water Sampling Event –
October 2013
Labadie Energy Center, Franklin County, MO
Ameren Missouri

				Missouri River																			
				River Upstream																			
Constituent	CAS	Units	Analytical Method	LBD-R-4S Total		LBD-R-4S Filtered		LBD-R-5S Total		LBD-R-5S Filtered		LBD-R-5M Total		LBD-R-5M Filtered		LBD-R-6S Total		LBD-R-6S Filtered		LBD-R-6M Total		LBD-R-6M Filtered	
Aluminum	7429-90-5	mg/L	SW846 Method 6020	2.63		0.0143	U	2.67		0.0143	U	2.83		0.0143	U	3.04		0.0143	U	2.85		0.0143	U
Antimony*	7440-36-0	mg/L	SW846 Method 6010B	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	SW846 Method 6020	0.005		0.0035		0.005		0.0035		0.0048		0.0038		0.0047		0.0037		0.0047		0.0034	
Barium	7440-39-3	mg/L	SW846 Method 6010B	0.113		0.0928		0.119		0.0906		0.12		0.0917		0.123		0.0907		0.119		0.0886	
Beryllium*	7440-41-7	mg/L	SW846 Method 6010B	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.005	U
Boron	7440-42-8	mg/L	SW846 Method 6010B	0.111		0.12		0.114		0.115		0.114		0.118		0.115		0.115		0.113		0.113	
Cadmium*	7440-43-9	mg/L	SW846 Method 6020	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium	7440-70-2	mg/L	SW846 Method 6010B	62.3		NA		63.5		NA		63.4		NA		65.1		NA		64.5		NA	
Chromium	7440-47-3	mg/L	SW846 Method 6010B	0.0022	J	0.0016	U	0.0026	J	0.0016	U	0.0029	J	0.0016	U	0.0031	J	0.0016	U	0.0023	J	0.0016	U
Cobalt*	7440-48-4	mg/L	SW846 Method 6010B	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper	7440-50-8	mg/L	SW846 Method 6010B	0.0035	J	0.0027	U	0.0053	J	0.0027	U	0.0048	J	0.0027	U	0.0051	J	0.0027	U	0.0053	J	0.0027	U
Total Cyanide (water)*	57-12-5	mg/L	SW846 Method 9012B	0.005	U	NA		0.005	U	NA		0.005	U	NA		0.005	U	NA		0.005	U	NA	
Fluoride	16984-48-8	mg/L	EPA Method 300.0	0.41	J	NA		0.48	J	NA		0.45	J	NA		0.51	J	NA		0.44	J	NA	
Iron	7439-89-6	mg/L	SW846 Method 6010B	1.79	J	0.043	U	2.15	J	0.043	U	2.17	J	0.043	U	2.34	J	0.043	U	2	J	0.043	U
Lead	7439-92-1	mg/L	SW846 Method 6020	0.0015		0.000085	U	0.0018		0.000085	U	0.0018		0.000085	U	0.0019		0.000085	U	0.0019		0.000085	U
Magnesium	7439-95-4	mg/L	SW846 Method 6010B	22.7		23.3		23.2		22.9		23.1		23.4		23.6		22.7		23.4		22.7	
Manganese	7439-96-5	mg/L	SW846 Method 6010B	0.194		0.0111		0.219		0.0029	J	0.228		0.004	J	0.241		0.00083	U	0.236		0.00083	U
Mercury*	7439-97-6	mg/L	SW846 Method 7470A	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum	7439-98-7	mg/L	SW846 Method 6010B	0.004	J	0.0035	J	0.0044	J	0.0035	J	0.0042	J	0.0041	J	0.0043	J	0.0038	J	0.0041	J	0.0036	J
Nickel	7440-02-0	mg/L	SW846 Method 6010B	0.0028	J	0.0015	U	0.0042	J	0.0015	U	0.0045	J	0.0019	J	0.0036	J	0.0015	U	0.0039	J	0.0015	U
Total Nitrite/Nitrate Nitrogen	7727-37-9	mg/L	EPA Method 353.2	0.53		NA		0.53		NA		0.52		NA		0.55		NA		0.55		NA	
Selenium	7782-49-2	mg/L	SW846 Method 6020	0.0016	J	0.0016	J	0.0018	J	0.0015	J	0.0016	J	0.0015	J	0.0017	J	0.0016	J	0.0018	J	0.0014	J
Silver	7440-22-4	mg/L	SW846 Method 6010B	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate	14808-79-8	mg/L	EPA Method 300.0	194		NA		194		NA		193		NA		194		NA		197		NA	
Thallium*	7440-28-0	mg/L	SW846 Method 6020	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin*	7440-31-5	mg/L	SW846 Method 6010B	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc	7440-66-6	mg/L	SW846 Method 6010B	0.0056	J	0.002	U	0.0092	J	0.002	U	0.0067	J	0.002	U	0.0072	J	0.002	U	0.0065	J	0.002	U
Total Hardness as CaCO3	471-34-1	mg/L	SM2340 Method B-1997	249		NA		254		NA		253		NA		260		NA		257		NA	

Notes:
* Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L = Milligrams per liter.
NA - Not Analyzed.
Total - Not filtered.
U - Constituent was not detected.

Table 8
Field Parameters - Surface Water Sampling Event - October 2013
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Sample ID	LBD-C-1	LBD-C-2	LBD-C-3	LBD-C-4	LBD-C-5	LBD-C-6	LBD-R-1S	LBD-R-2S	LBD-R-2M	LBD-R-3S	LBD-R-3M	LBD-R-4S	LBD-R-5S	LBD-R-5M	LBD-R-6S	LBD-R-6M
Date Sampled	10/24/13	10/24/13	10/24/13	10/24/13	10/24/13	10/24/13	10/25/13	10/25/13	10/25/13	10/25/13	10/25/13	10/25/13	10/25/13	10/25/13	10/25/13	10/25/13
Time Sampled	1200	1215	1230	1430	1445	1500	0905	0940	0950	1050	1110	1220	1240	1300	1320	1340
Field Parameters																
pH (Standard Units)	7.08	7.57	7.70	8.02	8.19	8.24	7.32	8.12	8.41	8.47	8.53	8.52	8.59	8.57	8.56	8.58
Specific Conductance (mS/cm)	0.659	0.642	0.622	0.752	0.754	0.755	0.846	0.836	0.826	0.825	0.824	0.825	0.821	0.820	0.823	0.823
Turbidity (NTU)	59.0	57.5	55.1	12.5	6.10	5.96	41.5	60.7	66.0	82.7	58.5	65.6	76.0	58.1	104.0	82.9
Temperature (˚C)	9.23	9.23	9.24	10.69	10.32	10.19	13.30	13.68	14.14	13.56	13.87	12.54	12.26	12.91	12.69	12.80
Dissolved Oxygen (mg/l)	8.46	7.03	6.60	9.50	9.93	10.01	9.29	8.75	10.09	8.59	10.36	9.10	8.61	10.24	10.84	10.32
Redox Potential mV	155.5	149.1	134.8	147.4	128.3	174.0	180.7	160.2	130.0	122.5	133.0	187.4	186.7	159.0	133.9	145.7

Notes:

Ph, specific conductance, temperature, dissolved oxygen and redox potential were measured using a YSI 556 MPS
Turbidity was measured using a HACH 2100P turbidometer
mS/cm is milli Siemens per centimeter
NTU is Nephelometric Turbidity Units
˚C is degrees Celsius
mg/l is milligrams per liter
mV is millivolts

Table 9
Comparison of Proposed Landfill Groundwater Monitoring Results to Screening Levels – April 2013 Sampling Event (a)
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Monitoring Well ID	Well Depth (feet, btor)	pH S.U.	Chloride mg/L	Fluoride mg/L	Sulfate mg/L	TDS mg/L	Aluminum ug/L	Antimony ug/L	Arsenic ug/L	Boron ug/L	Barium ug/L	Beryllium mg/L	Cadmium ug/L	Cobalt ug/L	Chromium ug/L	Copper ug/L	Iron ug/L	Manganese ug/L	Mercury ug/L	Molybdenum ug/L	Nickel mg/L	Lead ug/L	Selenium ug/L	Silver ug/L	Thallium ug/L	Zinc ug/L
MCL/SMCL (b)		6.5-8.5	250	4	250	500	50	6	10	NA	2000	0.004	5	NA	100	1300	300	50	2	NA	NA	15	50	100	2	5000
RSL (c)		NA	NA	0.62	NA	NA	16000	6	0.045	3100	2900	0.016	6.9	4.7	16000	620	11000	320	4.3	78	0.3	NA	78	71	0.16	4700
MW-1	27.76	6.83	10	0.11	26	536			22.1	79.4	402			3.3			17000	1470			0.0058					
MW-2	26.35	6.85	17	0.21	31	696			29.5	121	416			2.9			28400	2960								2.5
MW-3	25.15	6.99	9	0.12	54	516			1.2	63.6	415					3.3	16200	2760								2.2
MW-4	25.54	6.94	6	0.18	25	532				72.8	274						115	1240			0.0091					
MW-5	24.68	6.86	2	0.16	16	482				52.9	293						210	458			0.0116					2.1
MW-6	23.1	6.82	3	0.14	19	566	37			62.2	227						53	106			0.0101					4.3
MW-7	21.94	7.07	15	0.2	26	568	246		66.6	72.6	480						30300	1670								2.9
MW-8	21.82	6.83	8	0.16	10	460			13.6	45.3	285						23600	896								2.7
MW-9	20.18	7.16	5	0.18	20	414			26.4	53.6	265						16700	1450								
MW-10	21.45	6.99	6	0.17	54	430	27		8.8	56.7	462						16900	1350				0.4				
MW-11	20.95	6.89	2	0.12	64	460			0.8	54.8	301			3.1			436	523			0.0068	0.5				
MW-12	20.48	6.93	2	0.1	42	448	18		1.4	52.9	253			3			419	483			0.0052					4
MW-13	20.4	6.87	2	0.12	64	498	33			53.5	295						59.2	117								5.1
MW-14	19.79	6.95	3	0.14	42	490	30		7.1	48.2	268			3.3			3590	979			0.0039					5.5
MW-15	17.91	6.84	2	0.16	27	404				58.1	206						16	18.1			0.0058					4.1
MW-16	18.5	6.85	6	0.22	30	554	31		12.5	102	102			4.4			8580	3740			0.0041					5
MW-17	19.72	6.79	2	0.13	59	580	119		5.3	64.9	275			3.4			1620	1270			0.0037	0.7				3.5
MW-18	18.24	7	1	0.18	34	476				45.8	147						22.3	89.5				0.4	38.5			4
MW-19	18.19	6.83	2	0.15	72	500				72.1	228						136	98.9			0.0057					4.2
MW-20	17.62	6.99	2	0.19	21	356				48.7	182						30.9	154			0.0074	0.5				4
MW-21	17.71	6.92	3	0.16	30	262			1	57.7	237						1080	412			0.0036					3.8
MW-22	17.92	6.88	6	0.25	30	560			45.7	156	238						19900	1900				0.5				4.1
MW-23	19.65	6.84	4	0.18	21	508	153		3.4	94	210						3600	180			0.0039					3.5
MW-24	19.99	6.94	3	0.18	36	426	154			47.1	190					3	277	4.1			0.0048	0.6	45.5			4.1
MW-25	20.84	7.18	4	0.14	17	406	38		6.5	124	511						4850	2730			0.0036	0.7				3.8
MW-26	23	7.02	4	0.16	45	504	55.5			82.7	286						630	3000			0.0043	0.7				
MW-27	25.91	6.83	11	0.18	29	576	31		3.3	98.6	268			4.1			3220	1280			0.0058	0.5				5.2
MW-28	27.06	6.78	6	0.16	31	556	16		1.5	86.7	269						2020	402			0.0082	1				4.5
TMW-1	21.58	7.01	6	0.26	128	674			29.5	100	355						12100	4690			0.0036					5.5

Notes:
Blank data cells indicate a non-detect value.
btor - below top of riser.
MCL - Maximum Contaminant Level.
mg/L - Milligrams per liter.
NA - Not available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. Value used if no MCL available.
S.U. - Standard Units.
ug/L - Micrograms per liter.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.
(a) - Numerical values were obtained from the Ameren Missouri Labadie Energy Center Utility Waste Landfill, Solid Waste Disposal Area, Franklin County, Missouri, Groundwater Detection Monitoring Wells Installation Report prepared by Reitz & Jens, Inc., May 2013. Samples collected on 4/16/2013.
(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm; adopted as Missouri state values at 10 CSR 60-4.
(c) - USEPA Regional Screening Levels (November 2013). Values for tapwater. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

greater than MCL
greater than MCL and RSL
greater than RSL

Table 10
Comparison of Proposed Landfill Groundwater Monitoring Results to Screening Levels – August 2013 Sampling Event (a)
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Monitoring Well ID	Well Depth (feet, btor)	pH S.U.	Chloride mg/L	Fluoride mg/L	Sulfate mg/L	TDS mg/L	Aluminum ug/L	Antimony ug/L	Arsenic ug/L	Boron ug/L	Barium ug/L	Beryllium mg/L	Cadmium ug/L	Cobalt ug/L	Chromium ug/L	Copper ug/L	Iron ug/L	Manganese ug/L	Mercury ug/L	Molybdenum ug/L	Nickel mg/L	Lead ug/L	Selenium ug/L	Silver ug/L	Thallium ug/L	Zinc ug/L
MCL/SMCL (b)		6.5-8.5	250	4	250	500	50	6	10	NA	2000	0.004	5	NA	100	1300	300	50	2	NA	NA	15	50	100	2	5000
RSL (c)		NA	NA	0.62	NA	NA	16000	6	0.045	3100	2900	0.016	6.9	4.7	16000	620	11000	320	4.3	78	0.3	NA	78	71	0.16	4700
MW-1	27.76	6.76	7	0.16	27	600				82.6	298						178	539			0.0066					
MW-2	26.35	6.74	6	0.18	38	738			1	109	233			4.1			707	1300			0.005					
MW-3	25.15	6.88	5	0.18	66	606			2.4	67.2	266						3110	1580			0.0053					
MW-4	25.54	6.93	5	0.17	33	600				71.8	240		0.3				8.5	155								
MW-5	24.68	6.83	2	0.18	21	562				55	260							3.8								
MW-6	23.1	6.79	3	0.17	23	608				58.5	211															
MW-7	21.94	6.96	5	0.23	39	598			18.9	67.7	347			2.4			5900	1800			0.0036					
MW-8	21.82	6.85	3	0.21	23	514			2.1	48.5	252						3440	997			0.0039					
MW-9	20.18	7.05	4	0.26	18	370			1.2	43	196						255	534			0.0082					17.6
MW-10	21.45	6.86	3	0.21	30	516				55.6	252						768	52								2.1
MW-11	20.95	6.79	3	0.16	48	596				60.9	179						22.1	4.3								
MW-12	20.48	6.8	3	0.16	37	540				53.5	186						19	2.3					24			
MW-13	20.4	6.77	3	0.17	49	590				62.9	178						12				0.004		70.9			3.8
MW-14	19.79	6.77	2	0.2	36	528			1.9	61.4	223			4.1			347	252			0.0044					
MW-15	17.91	6.75	3	0.22	29	538				66.8	243						111	41.1			0.0044					2.8
MW-16	18.5	6.83	3	0.26	34	636			1.6	106	392			7.2			1060	3810			0.0062					2.3
MW-17	19.72	6.85	4	0.25	21	532	21			64.4	236						17	17.4								3.4
MW-18	18.24	6.96	2	0.24	37	536				86	172							219								2.2
MW-19	18.19	6.73	2	0.27	39	506				69.1	195						83.8	249			0.0043					
MW-20	17.62	6.92	3	0.27	36	466				60.2	176						9.2	8.3								
MW-21	17.71	7.03	3	0.3	22	396			2.5	81.7	169						12	60.3								2.9
MW-22	17.92	6.86	3	0.25	30	572	20		16.1	140	230						8410	1510								3.1
MW-23	19.65	6.9	5	0.24	24	624	284		8.8	146	260						5600	519			0.0034					3.1
MW-24	19.99	6.88	4	0.22	35	486				60.1	184						15	7.1			0.0036		42.7			
MW-25	20.84	7.04	3	0.18	39	506			1.4	144	464						294	1150			0.0048					
MW-26	23	7.01	5	0.21	38	556				69.8	236						37.5	141								
MW-27	25.91	6.73	20	0.2	37	690			2	86.1	264			5.4			1190	667			0.0083					3.4
MW-28	27.06	6.78	8	0.19	32	600	203		1.5	91.2	261						800	147			0.0081		44.3			2.8
TMW-1	21.58	6.93	5	0.28	83	658			8.5	91.7	348			3.9			1010	4600	0.06		0.0042					

Notes:
Blank data cells indicate a non-detect value.
btor - below top of riser.
MCL - Maximum Contaminant Level.
mg/L - Milligrams per liter.
NA - Not available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. Value used if no MCL available.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
ug/L - Micrograms per liter.
USEPA - United States Environmental Protection Agency.
(a) - Numerical values were obtained from the Ameren Missouri Labadie Energy Center Utility Waste Landfill, Solid Waste Disposal Area, Franklin County, Missouri, Groundwater Detection Monitoring Wells Installation Report prepared by Reitz & Jens, Inc., Samples collected on 8/21/2013.
(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm; adopted as Missouri state values at 10 CSR 60-4.
(c) - USEPA Regional Screening Levels (November 2013). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
greater than MCL
greater than MCL and RSL
greater than RSL

Table 11
Comparison of Proposed Landfill Groundwater Monitoring Results to Screening Levels – November 2013 Sampling Event (a)
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Monitoring Well ID	Well Depth (feet, btor)	pH S.U.	Chloride mg/L	Fluoride mg/L	Sulfate mg/L	TDS mg/L	Aluminum ug/L	Antimony ug/L	Arsenic ug/L	Boron ug/L	Barium ug/L	Beryllium mg/L	Cadmium ug/L	Cobalt ug/L	Chromium ug/L	Copper ug/L	Iron ug/L	Manganese ug/L	Mercury ug/L	Molybdenum ug/L	Nickel mg/L	Lead ug/L	Selenium ug/L	Silver ug/L	Thallium ug/L	Zinc ug/L
MCL/SMCL (b)		6.5-8.5	250	4	250	500	50	6	10	NA	2000	0.004	5	NA	100	1300	300	50	2	NA	NA	15	50	100	2	5000
RSL (c)		NA	NA	0.62	NA	NA	16000	6	0.045	3100	2900	0.016	6.9	4.7	16000	620	11000	320	4.3	78	0.3	NA	78	71	0.16	4700
MW-1	27.76	6.63	6	0.2	24	602				103.0	349			2.8			192	425			0.0076		62.5			
MW-2	26.35	6.66	5	0.17	44	616			1.8	116.0	196						1090	32			0.0042		35.1			
MW-3	25.15	6.77	5	0.14	75	558			1.0	81.3	313			3.1			1020	1840			0.0071					3.2
MW-4	25.54	6.87	6	0.15	25	506			0.9	83.5	213						21.1	33.1			0.0039		36			4.5
MW-5	24.68	6.82	3	0.18	18	476			0.8	65.4	240						8.6	6.7					27			
MW-6	23.1	6.78	3	0.16	20	536			0.8	69.1	221						7.1	1.6			0.0047					
MW-7	21.94	6.83	3	0.17	40	568			2.2	60.6	296			3.9			855	1060			0.0046		76.9			
MW-8	21.82	6.76	3	0.24	22	434			1.1	53.7	276						389	556			0.0055		33.8			
MW-9	20.18	7.00	3	0.22	21	382			1.5	49.9	225						447	712					50.4			
MW-10	21.45	6.82	3	0.16	33	502			0.9	63.6	255						640						53.1			
MW-11	20.95	6.76	3	0.14	51	542				69.0	191						18	35.7			0.0062		39.1			
MW-12	20.48	6.79	3	0.14	43	516			1.3	63.4	194						20.4	8.1			0.0042		44.6			
MW-13	20.4	6.79	3	0.15	61	538			1.2	76.8	173						9	1.6			0.0064		92.5			2.5
MW-14	19.79	6.74	3	0.17	41	496			3.1	64.2	202			3.2			460	156			0.0070		66.5			
MW-15	17.91	6.74	3	0.17	23	464			1.0	59.2	229							26.7			0.0050					2.2
MW-16	18.5	6.69	3	0.16	49	580			1.0	88.0	270						103	772			0.0122		32.5			
MW-17	19.72	6.77	3	0.19	33	502			0.8	68.2	218						17	4.9			0.0036					
MW-18	18.24	6.87	3	0.25	32	470			1.3	142.0	210						99.8	1110			0.0033					
MW-19	18.19	6.82	3	0.2	55	470			1.3	76.6	230						407	806			0.0063					
MW-20	17.62	6.87	3	0.25	36	404			1.1	61.2	174						7.1	3.3			0.0039		33.8			
MW-21	17.71	6.96	4	0.29	25	330			4.4	86.0	155		0.7				1930	536		3.4	0.0033					8.3
MW-22	17.92	6.89	4	0.25	37	528			49.9	169.0	315						23500	1720				0.5				
MW-23	19.65	6.82	6	0.23	9	620	62.4		26.2	209.0	274						18300	467								
MW-24	19.99	6.87	4	0.2	36	438				58.7	193						21.1	4.6			0.0034		40.4			3
MW-25	20.84	6.97	4	0.14	32	464				148.0	481						174	762			0.0043					
MW-26	23	6.93	4	0.18	30	446				59.7	212						15	131								
MW-27	25.91	6.65	16	0.18	43	606				104.0	242						129	149			0.0092	0.4	37.6			2.2
MW-28	27.06	6.64	9	0.18	24	542				92.1	249						29.9	12.7			0.0069		41.9			4.8
TMW-1	21.58	6.89	5	0.25	85	576			6.1	99.5	283			3.2			784	3620			0.0043					

Notes:
Blank data cells indicate a non-detect value.
btor - below top of riser.
MCL - Maximum Contaminant Level.
mg/L - Milligrams per liter.
NA - Not available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. Value used if no MCL available.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
ug/L - Micrograms per liter.
USEPA - United States Environmental Protection Agency.
(a) - Numerical values were obtained from the Ameren Missouri Labadie Energy Center Utility Waste Landfill, Solid Waste Disposal Area, Franklin County, Missouri, Groundwater Detection Monitoring Wells Installation Report prepared by Reitz & Jens, Inc., Samples collected on 11/19/2013.
(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm; adopted as Missouri state values at 10 CSR 60-4.
(c) - USEPA Regional Screening Levels (November 2013). Values for tapwater. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

greater than MCL
greater than MCL and RSL
greater than RSL

Table 12
Comparison of Bluff Area Groundwater Monitoring Results to Screening Levels – April 2012 Sampling Event (a,f)
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Piezometer Sample ID (d)	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Chloride	Chromium	Copper	Fluoride	Lead	Mercury	Nickel	Nitrate as N	Selenium	Silver	Sulfate	Thallium	Zinc
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MCL/SMCL (b)	0.006	0.01	2	0.004	NA	0.005	250	0.1	1.3	4	0.015	0.002	NA	10	0.05	0.1	250	0.002	5
RSL (c)	0.006	0.000045	2.9	0.016	3.1	0.0069	NA	16	0.62	0.62	NA	0.0043	0.3	NA	0.078	0.071	NA	0.00016	4.7
TGP-A			0.21				5.8	0.0029		0.20	0.0031		0.002	1.3			13		
DUP-1 (e)			0.22				5.7	0.0034		0.18	0.0037		0.0021	1.3			14		
TGP-B	0.0026		0.1				29	0.0025		0.25	0.0036			7.9			25		
TGP-C			0.15				43	0.0013		0.16	0.0044			5.0			34		0.0064

Notes:
Blank data cells indicate a non-detect value.
mg/L - Milligrams per liter.
MCL - Maximum Contaminant Level.
NA - Not available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. Used if no MCL available.
USEPA - United States Environmental Protection Agency.
(a) - Numerical values were obtained from the Ameren Missouri Labadie Energy Center Utility Waste Landfill, Missouri, Solid Waste Disposal Area, Franklin County, Laboratory Analytical Results for Groundwater Monitoring Samples Collected on April 12-13, 2012 from Temporary Groundwater Piezometers Installed Near Labadie Plant, April 2012.
(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2013). Values for tapwater. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - Piezometers are screened in bedrock.
(e) - Duplicate sample from TGP-A.
(f) - No groundwater monitoring results are above the screening levels presented.

Table 13
Comparison of NPDES Monitoring Results for Outfall 002 to Screening Levels
Labadie Energy Center, Franklin County, MO
Ameren Missouri

					Missouri State Water Quality Screening Levels			Federal Water Quality Criteria Screening Levels		
Constituent	**CAS**	**Units**	**NPDES 1998 Reapplication Package – Outfall 002 (g)**	**NPDES 2011 Renewal Package – Outfall 002 (g)**	**Human Health Fish Consumption (a)**	**Drinking Water Supply (i)**	**Groundwater (i)**	**USEPA MCLs (c)**	**USEPA SMCLs (c)**	**USEPA Tapwater RSLs (d)**
Inorganics, Total										
Aluminum	7429-90-5	mg/L	1.36	0.855	NA	NA	NA	NA	0.05	16
Antimony	7440-36-9	mg/L	0.019	NA	4.3	0.006	0.006	0.006	NA	0.006
Arsenic	7440-38-2	mg/L	0.002	NA	NA	0.05	0.05	0.01	NA	0.000045
Barium	7440-39-3	mg/L	0.285	0.212	NA	2	2	2	NA	2.9
Beryllium	7440-41-7	mg/L	0.001	NA	NA	0.004	0.004	0.004	NA	0.016
Boron	7440-42-8	mg/L	1.62	1.150	NA	NA	2	NA	NA	3.1
Bromide	24959-67-9	mg/L	<1	<0.5	NA	NA	NA	NA	NA	NA
Cadmium	7440-43-9	mg/L	0.0014	NA	NA	0.005	0.005	0.005	NA	0.0069
Chromium	16065-83-1	mg/L	0.008	NA	NA	0.1 (h)	0.1 (h)	0.1 (h)	NA	16 (k)
Cobalt	7440-48-4	mg/L	NA	NA	NA	NA	1	NA	NA	0.0047
Copper	7440-50-8	mg/L	0.004	NA	NA	1.3	1.3	1.3 (e)	1	0.62
Cyanide	57-12-5	mg/L	0.007	NA	NA	NA	NA	0.2	NA	0.0014
Fluoride	16984-48-8	mg/L	0.25	0.58	NA	4	4	4	2	0.62
Iron	7439-89-6	mg/L	0.47	0.536	NA	NA	0.3	NA	0.3	11
Lead	7439-92-1	mg/L	0.003	NA	NA	0.015	0.015	0.015 (e)	NA	NA
Magnesium	743-95-4	mg/L	11.4	18.3	NA	NA	NA	NA	NA	NA
Manganese	7439-96-5	mg/L	0.03	0.057	NA	NA	0.05	NA	0.05	0.32
Mercury	7487-94-7	mg/L	<0.0005	NA	NA	0.002	0.002	0.002	NA	0.0043
Molybdenum	7439-98-7	mg/L	0.128	0.052	NA	NA	NA	NA	NA	0.078
Nickel	7440-02-0	mg/L	0.009	NA	NA	0.1	0.1	NA	NA	0.3
Nitrate-Nitrite (as N)	NA	mg/L	2.1	0.62	NA	10	10	10	NA	NA
Selenium	7782-49-2	mg/L	<0.005	NA	NA	0.05	0.05	0.05	NA	0.078
Silver	7440-22-4	mg/L	0.001	NA	NA	0.05	0.05	NA	0.1	0.071
Sulfate	7757-82-6	mg/L	210	57	NA	250	NA	NA	250	NA
Sulfide	NA	mg/L	NA	NA	NA	NA	NA	NA	NA	NA
Sulfite	NA	mg/L	NA	2	NA	NA	NA	NA	NA	NA
Surfactants	NA	mg/L	<1	0.14	NA	NA	NA	NA	NA	NA
Thallium	7440-28-0	mg/L	0.009	NA	0.0063	0.002	0.002	0.002	NA	0.00016
Tin	7440-31-5	mg/L	NA	NA	NA	NA	NA	NA	NA	9.3
Titanium	7440-32-6	mg/L	0.043	0.033	NA	NA	NA	NA	NA	NA
Zinc	7440-66-6	mg/L	0.03	NA	NA	5	5	NA	5	4.7
Radioactivity										
Alpha	NA	pCi/L	1.2 +/- 1.0	1.68+/-1.4	NA	NA	NA	15	NA	NA
Beta	NA	pCi/L	5.6 +/- 1.5	6.93+/-1.79	NA	NA	NA	4 mrem/yr (b)	NA	NA
Radium (f)	NA	NA	NA	NA	NA	NA	NA	5	NA	NA
Radium 226	NA	NA	NA	NA	NA	NA	NA	NA	NA	9.06E-04 (j)

Notes presented on following page.

Table 13
Comparison of NPDES Monitoring Results for Outfall 002 to Screening Levels
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Notes:
CAS - Chemical Abstracts Service.
MCL - Maximum Contaminant Level.
mrem/year - millirem per year.
NA - Not Available.
NPDES - National Pollutant Discharge Elimination System.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. No MCL available.
USEPA - United States Environmental Protection Agency.
mg/L - Milligrams per liter.
pCi/L - picoCurie per liter.

NPDES 1998 and 2011 Renewal Package – Outfall 002 Detected Concentration > Indicated Screening Value.
NPDES 1998 Reapplication Package – Outfall 002 Detected Concentration> Indicated Screening Value.
NPDES 2011 Renewal Package – Outfall 002 Detected Concentration> Indicated Screening Value.

(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012. http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf
Per 10 CSR 20-7.031(4)(B)(2), the criteria for Human Protection Fish Consumption should be compared to dissolved metals data (except for mercury). All other criteria are to be compared to total metals data. Dissolved data are not available; therefore, total data have conservatively been compared to the aquatic life and fish protection criteria.
(b) - MCL of 4 mrem/year is not comparable to data in pCi/L. Therefore, no comparison has been made.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
(c) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm
(d) - USEPA Regional Screening Levels (November 2013). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(e) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(f) - Sum of Radium 226 and Radium 228.
(g) - Data from Labadie Power Plant NPDES 1998 Reapplication Package – Outfall 002, and NPDES 2011 Renewal Package – Outfall 002.
(h) - The drinking water standard or MCL for chromium is based on total chromium.
(i) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012. http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf
(j) - USEPA Preliminary Remediation Goals for Radionuclides. August 2010. http://epa-prgs.ornl.gov/radionuclides/download.html.
(k) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, and the basis of which has been questioned by USEPA's Science Advisory Board. This issue is discussed in detail in Appendix A.

Table 14
Comparison of Labadie Creek Surface Water Results to Screening Levels – Total (Unfiltered) Sample Results
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Constituent	CAS	Units	Missouri State Water Quality Screening Levels		Federal Water Quality Screening Levels			Labadie Creek						
								Creek Downstream				Creek Upstream		
			Drinking Water Supply (a)	Groundwater (a)	USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)	LBD-C-1 Total	LBD-C-1-DUP Total	LBD-C-2 Total	LBD-C-3 Total	LBD-C-4 Total	LBD-C-5 Total	LBD-C-6 Total
Aluminum	7429-90-5	mg/L	NA	NA	NA	0.05	16	2.91	2.98	3.17	3.5	0.0968 J	0.139	0.217
Antimony*	7440-36-0	mg/L	0.006	0.006	0.006	NA	0.006	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U	0.0053 U
Arsenic	7440-38-2	mg/L	0.05	0.05	0.01	NA	0.000045	0.0065	0.0067	0.0061	0.0066	0.0056	0.0055	0.0061
Barium	7440-39-3	mg/L	2	2	2	NA	2.9	0.161	0.165	0.164	0.172	0.124	0.122	0.125
Beryllium*	7440-41-7	mg/L	0.004	0.004	0.004	NA	0.016	0.00067 U	0.00067 U	0.00067 U	0.00067 U	0.00067 U	0.00067 U	0.00067 U
Boron	7440-42-8	mg/L	NA	2	NA	NA	3.1	0.0978	0.0986	0.0959	0.0999	0.166	0.164	0.167
Cadmium*	7440-43-9	mg/L	0.005	0.005	0.005	NA	0.0069	0.00023 U	0.00023 U	0.00023 U	0.00023 U	0.00023 U	0.00023 U	0.00023 U
Calcium (e)	7440-70-2	mg/L	NA	NA	NA	NA	NA	56.1	56.6	55.4	57.7	65.6	64.4	65.7
Chromium	7440-47-3	mg/L	0.1 (d)	0.1 (d)	0.1 (d)	NA	16 (i)	0.0026 J	0.0031 J	0.0027 J	0.0031 J	0.0016 U	0.0016 U	0.0016 U
Cobalt*	7440-48-4	mg/L	NA	1	NA	NA	0.0047	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U	0.0013 U
Copper	7440-50-8	mg/L	1.3	1.3	1.3 (f)	1	0.62	0.0027 U	0.004 J	0.0045 J	0.0048 J	0.0027 U	0.0027 U	0.0027 U
Total Cyanide (water)*	57-12-5	mg/L	NA	NA	0.2	NA	0.0014	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Fluoride*	16984-48-8	mg/L	4	4	4	2	0.62	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Iron	7439-89-6	mg/L	NA	0.3	NA	0.3	11	2.21 J	2.39 J	2.47 J	2.71 J	0.225 J	0.216 J	0.309 J
Lead	7439-92-1	mg/L	0.015	0.015	0.015 (f)	NA	NA	0.0017	0.0018	0.0018	0.0021	0.00014 J	0.00013 J	0.0002 J
Magnesium (e)	7439-95-4	mg/L	NA	NA	NA	NA	NA	26.5	26.7	26.1	27.1	31	30.4	30.9
Manganese	7439-96-5	mg/L	NA	0.05	NA	0.05	0.32	1.31	1.34	1.32	1.4	0.0792	0.0774	0.0862
Mercury*	7439-97-6	mg/L	0.002	0.002	0.002	NA	0.0043	0.00006 U	0.00006 U	0.00006 U	0.00006 U	0.00006 U	0.00006 U	0.00006 U
Molybdenum	7439-98-7	mg/L	NA	NA	NA	NA	0.078	0.0092 J	0.005 J	0.0055 J	0.0046 J	0.0029 J	0.0024 J	0.0024 J
Nickel	7440-02-0	mg/L	0.1	0.1	NA	NA	0.3	0.004 J	0.0036 J	0.0042 J	0.0051 J	0.0024 J	0.0022 J	0.0017 J
Total Nitrite/Nitrate Nitrogen*	7727-37-9	mg/L	10	10	10	NA	NA	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
Selenium*	7782-49-2	mg/L	0.05	0.05	0.05	NA	0.078	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U
Silver*	7440-22-4	mg/L	0.05	0.05	NA	0.1	0.071	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U
Sulfate	14808-79-8	mg/L	250	NA	NA	250	NA	19.4 J	15.4 J	16.3 J	15.3 J	17.8 J	17.6 J	16.6 J
Thallium*	7440-28-0	mg/L	0.002	0.002	0.002	NA	0.00016	0.00015 U	0.00015 U	0.00015 U	0.00015 U	0.00015 U	0.00015 U	0.00015 U
Tin*	7440-31-5	mg/L	NA	NA	NA	NA	9.3	0.0029 U	0.0029 U	0.0029 U	0.0029 U	0.0029 U	0.0029 U	0.0029 U
Zinc	7440-66-6	mg/L	5	5	NA	5	4.7	0.0042 J	0.0048 J	0.0053 J	0.006 J	0.002 U	0.002 U	0.002 U
Total Hardness as CaCO3 (e)	471-34-1	mg/L	NA	NA	NA	NA	NA	249	251	246	256	291	286	291

Notes:
* Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. No MCL available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.

Detected Concentration> USEPA Tapwater RSL.
Detected Concentration> USEPA SMCL.
Detected Concentration> Missouri Groundwater Quality Criteria.
Detected Concentration> Missouri Groundwater Quality Criteria and USEPA. SMCL.
Detected Concentration> Missouri Groundwater, USEPA SMCL and Tapwater RSL.

(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2013). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - The drinking water standard or MCL for chromium is based on total chromium.
(e) - Screening levels from the presented sources are not available for this constituent.
(f) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(g) - Surface Water Samples collected in October 2013.
(i) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, and the basis of which has been questioned by USEPA's Science Advisory Board. This issue is discussed in detail in Appendix A.

Table 15
Comparison of Labadie Creek Surface Water Results to Screening Levels – Dissolved (Filtered) Sample Results
Surface Water Sampling Event, October 2013
Ameren Labadie Energy Center

Constituent	CAS	Units	Missouri State Water Quality Screening Levels			Federal Water Quality Screening Levels			Labadie Creek													
									Creek Downstream										Creek Upstream			
			Human Health Fish Consumption (a)	Drinking Water Supply (a)	Groundwater (a)	USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)	LBD-C-1 Filtered		LBD-C-2 Filtered		LBD-C-3 Filtered		LBD-C-4 Filtered		LBD-C-5 Filtered		LBD-C-6 Filtered			
Aluminum	7429-90-5	mg/L	NA	NA	NA	NA	0.05	16	0.0163	J	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U		
Antimony*	7440-36-0	mg/L	4.3	0.006	0.006	0.006	NA	0.006	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U		
Arsenic	7440-38-2	mg/L	NA	0.05	0.05	0.01	NA	0.000045	0.0039		0.0039		0.0043		0.0056		0.0051		0.0051			
Barium	7440-39-3	mg/L	NA	2	2	2	NA	2.9	0.141		0.145		0.146		0.116		0.118		0.12			
Beryllium*	7440-41-7	mg/L	NA	0.004	0.004	0.004	NA	0.016	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U		
Boron	7440-42-8	mg/L	NA	NA	2	NA	NA	3.1	0.108		0.1		0.0994		0.165		0.169		0.17			
Cadmium*	7440-43-9	mg/L	NA	0.005	0.005	0.005	NA	0.0069	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U		
Calcium (g,e)	7440-70-2	mg/L	NA	NA	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA			
Chromium*	7440-47-3	mg/L	NA	0.1 (d)	0.1 (d)	0.1 (d)	NA	16 (i)	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U		
Cobalt*	7440-48-4	mg/L	NA	NA	1	NA	NA	0.0047	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U		
Copper*	7440-50-8	mg/L	NA	1.3	1.3	1.3 (f)	1	0.62	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U		
Total Cyanide (water) (e)	57-12-5	mg/L	NA	NA	NA	0.2	NA	0.0014	NA		NA		NA		NA		NA		NA			
Fluoride (e)	16984-48-8	mg/L	NA	4	4	4	2	0.62	NA		NA		NA		NA		NA		NA			
Iron*	7439-89-6	mg/L	NA	NA	0.3	NA	0.3	11	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U		
Lead	7439-92-1	mg/L	NA	0.015	0.015	0.015 (f)	NA	NA	0.0001	J	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U		
Magnesium (g)	7439-95-4	mg/L	NA	NA	NA	NA	NA	NA	26.9		27		27.2		30.4		30.5		31.5			
Manganese	7439-96-5	mg/L	NA	NA	0.05	NA	0.05	0.32	1.19		1.19		1.24		0.0581		0.0598		0.0619			
Mercury*	7439-97-6	mg/L	NA	0.002	0.002	0.002	NA	0.0043	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U		
Molybdenum	7439-98-7	mg/L	NA	NA	NA	NA	NA	0.078	0.0036	J	0.0031	J	0.003	J	0.0018	J	0.0022	J	0.002	J		
Nickel	7440-02-0	mg/L	NA	0.1	0.1	NA	NA	0.3	0.0021	J	0.0015	U	0.002	J	0.0024	J	0.0017	J	0.0017	J		
Total Nitrite/Nitrate Nitrogen (e)	7727-37-9	mg/L	NA	10	10	10	NA	NA	NA		NA		NA		NA		NA		NA			
Selenium*	7782-49-2	mg/L	NA	0.05	0.05	0.05	NA	0.078	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U		
Silver*	7440-22-4	mg/L	NA	0.05	0.05	NA	0.1	0.071	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U		
Sulfate (e)	14808-79-8	mg/L	NA	250	NA	NA	250	NA	NA		NA		NA		NA		NA		NA			
Thallium*	7440-28-0	mg/L	0.0063	0.002	0.002	0.002	NA	0.00016	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U		
Tin*	7440-31-5	mg/L	NA	NA	NA	NA	NA	9.3	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U		
Zinc*	7440-66-6	mg/L	NA	5	5	NA	5	4.7	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U		
Total Hardness as CaCO3 (g,e)	471-34-1	mg/L	NA	NA	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA			

Notes:
* Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. No MCL available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.

Detected Concentration> USEPA Tapwater RSL.
Detected Concentration> USEPA SMCL.
Detected Concentration> Missouri Groundwater Quality Criteria.
Detected Concentration> Missouri Groundwater Quality Criteria and USEPA SMCL.
Detected Concentration> Missouri Groundwater, USEPA SMCL and Tapwater RSL.

(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012.
http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2013). Values for tapwater.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - The drinking water standard or MCL for chromium is based on total chromium.
(e) - Constituent not analyzed.
(f) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(g) - Screening levels from the presented sources are not available for this constituent.
(h) - Surface Water Samples collected in October 2013.
(i) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, and the basis of which has been questioned by USEPA's Science Advisory Board. This issue is discussed in detail in Appendix A.

Table 16
Comparison of Missouri River Surface Water Results to Screening Levels – Total (Unfiltered) Sample Results
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Constituent	CAS	Units	Missouri State Water Quality Screening Levels		Federal Water Quality Screening Levels			Missouri River – River Downstream												Missouri River – River Upstream											
			Drinking Water Supply (a)	Groundwater (a)	USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)	LBD-R-1S Total		LBD-R-2S Total		LBD-R-2M Total		LBD-R-2M-Dup Total		LBD-R-3S Total		LBD-R-3M Total		LBD-R-4S Total		LBD-R-5S Total		LBD-R-5M Total		LBD-R-6S Total		LBD-R-6M Total			
Aluminum	7429-90-5	mg/L	NA	NA	NA	0.05	16	2.3		3		3		2.82		2.84		2.85		2.63		2.67		2.83		3.04		2.85			
Antimony*	7440-36-0	mg/L	0.006	0.006	0.006	NA	0.006	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	0.05	0.05	0.01	NA	0.000045	0.0044		0.0045		0.0047		0.0047		0.0048		0.0049		0.005		0.005		0.0048		0.0047		0.0047			
Barium	7440-39-3	mg/L	2	2	2	NA	2.9	0.113		0.122		0.123		0.121		0.123		0.124		0.113		0.119		0.12		0.123		0.119			
Beryllium*	7440-41-7	mg/L	0.004	0.004	0.004	NA	0.016	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U
Boron	7440-42-8	mg/L	NA	2	NA	NA	3.1	0.12		0.121		0.123		0.123		0.118		0.119		0.111		0.114		0.114		0.115		0.113			
Cadmium*	7440-43-9	mg/L	0.005	0.005	0.005	NA	0.0069	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium (e)	7440-70-2	mg/L	NA	NA	NA	NA	NA	63.8		64.7		63.6		64.6		64.2		65.5		62.3		63.5		63.4		65.1		64.5			
Chromium	7440-47-3	mg/L	0.1 (d)	0.1 (d)	0.1 (d)	NA	16 (h)	0.0023	J	0.0027	J	0.0031	J	0.0031	J	0.0029	J	0.0032	J	0.0022	J	0.0026	J	0.0029	J	0.0031	J	0.0023	J	0.0023	J
Cobalt*	7440-48-4	mg/L	NA	1	NA	NA	0.0047	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper	7440-50-8	mg/L	1.3	1.3	1.3 (f)	1	0.62	0.0042	J	0.005	J	0.0046	J	0.0048	J	0.0058	J	0.005	J	0.0035	J	0.0053	J	0.0048	J	0.0051	J	0.0053	J	0.0053	J
Total Cyanide (water)*	57-12-5	mg/L	NA	NA	0.2	NA	0.0014	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Fluoride	16984-48-8	mg/L	4	4	4	2	0.62	0.5	J	0.47	J	0.48	J	0.5	J	0.47	J	0.43	J	0.41	J	0.48	J	0.45	J	0.51	J	0.44	J	0.44	J
Iron	7439-89-6	mg/L	NA	0.3	NA	0.3	11	1.6	J	2.11	J	2.08	J	2.07	J	2.25	J	2.23	J	1.79	J	2.15	J	2.17	J	2.34	J	2	J	2	J
Lead	7439-92-1	mg/L	0.015	0.015	0.015 (f)	NA	NA	0.0015		0.0018		0.0018		0.0018		0.0019		0.0019		0.0015		0.0018		0.0018		0.0019		0.0019			
Magnesium (e)	7439-95-4	mg/L	NA	NA	NA	NA	NA	23.1		23.4		23.1		23.5		23.3		23.8		22.7		23.2		23.1		23.6		23.4			
Manganese	7439-96-5	mg/L	NA	0.05	NA	0.05	0.32	0.208		0.23		0.23		0.229		0.233		0.237		0.194		0.219		0.228		0.241		0.236			
Mercury*	7439-97-6	mg/L	0.002	0.002	0.002	NA	0.0043	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum	7439-98-7	mg/L	NA	NA	NA	NA	0.078	0.0044	J	0.0044	J	0.0044	J	0.0045	J	0.0044	J	0.0041	J	0.004	J	0.0044	J	0.0042	J	0.0043	J	0.0041	J	0.0041	J
Nickel	7440-02-0	mg/L	0.1	0.1	NA	NA	0.3	0.0033	J	0.0037	J	0.0039	J	0.0047	J	0.0034	J	0.0046	J	0.0028	J	0.0042	J	0.0045	J	0.0036	J	0.0039	J	0.0039	J
Total Nitrite/Nitrate Nitrogen	7727-37-9	mg/L	10	10	10	NA	NA	0.5		0.53		0.52		0.52		0.53		0.54		0.53		0.53		0.52		0.55		0.55			
Selenium	7782-49-2	mg/L	0.05	0.05	0.05	NA	0.078	0.0017	J	0.0016	J	0.0017	J	0.0017	J	0.0017	J	0.0017	J	0.0016	J	0.0018	J	0.0016	J	0.0017	J	0.0018	J	0.0018	J
Silver*	7440-22-4	mg/L	0.05	0.05	NA	0.1	0.071	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate	14808-79-8	mg/L	250	NA	NA	250	NA	174		187		193		189		189		192		194		194		193		194		197			
Thallium*	7440-28-0	mg/L	0.002	0.002	0.002	NA	0.00016	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin*	7440-31-5	mg/L	NA	NA	NA	NA	9.3	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc	7440-66-6	mg/L	5	5	NA	5	4.7	0.0073	J	0.0064	J	0.0064	J	0.007	J	0.0072	J	0.0073	J	0.0056	J	0.0092	J	0.0067	J	0.0072	J	0.0065	J	0.0065	J
Total Hardness as CaCO3 (e)	471-34-1	mg/L	NA	NA	NA	NA	NA	255		258		254		258		256		261		249		254		253		260		257			

Notes:
* Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. No MCL available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.
Detected Concentration> USEPA Tapwater RSL.
Detected Concentration> USEPA SMCL.
Detected Concentration> Missouri Groundwater Quality Criteria.
Detected Concentration> Missouri Groundwater Quality Criteria and USEPA. SMCL.
(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012. http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2013). Values for tapwater. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - The drinking water standard or MCL for chromium is based on total chromium.
(e) - Screening levels from the presented sources are not available for this constituent.
(f) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(g) - Surface Water Samples collected in October 2013.
(h) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, and the basis of which has been questioned by USEPA's Science Advisory Board. This issue is discussed in detail in Appendix A.

Table 17
Comparison of Missouri River Surface Water Results to Screening Levels – Dissolved (Filtered) Sample Results
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Constituent	CAS	Units	Missouri State Water Quality Screening Levels			Federal Water Quality Screening Levels			Missouri River River Downstream													
			Human Health Fish Consumption (a)	Drinking Water Supply (a)	Groundwater (a)	USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)	LBD-R-1S Filtered		LBD-R-2S Filtered		LBD-R-2M Filtered		LBD-R-2M-Dup Filtered		LBD-R-3S Filtered		LBD-R-3M Filtered	
Aluminum*	7429-90-5	mg/L	NA	NA	NA	NA	0.05	16	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U
Antimony*	7440-36-0	mg/L	4.3	0.006	0.006	0.006	NA	0.006	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	NA	0.05	0.05	0.01	NA	0.000045	0.004		0.0037		0.0036		0.0041		0.0033		0.0035	
Barium	7440-39-3	mg/L	NA	2	2	2	NA	2.9	0.0936		0.0912		0.0914		0.0908		0.0915		0.0938	
Beryllium*	7440-41-7	mg/L	NA	0.004	0.004	0.004	NA	0.016	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U
Boron	7440-42-8	mg/L	NA	NA	2	NA	NA	3.1	0.123		0.122		0.123		0.124		0.116		0.119	
Cadmium*	7440-43-9	mg/L	NA	0.005	0.005	0.005	NA	0.0069	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium (g,e)	7440-70-2	mg/L	NA	NA	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA	
Chromium*	7440-47-3	mg/L	NA	0.1 (d)	0.1 (d)	0.1 (d)	NA	16 (i)	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U
Cobalt*	7440-48-4	mg/L	NA	NA	1	NA	NA	0.0047	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper*	7440-50-8	mg/L	NA	1.3	1.3	1.3 (f)	1	0.62	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U
Total Cyanide (water) (e)	57-12-5	mg/L	NA	NA	NA	0.2	NA	0.0014	NA		NA		NA		NA		NA		NA	
Fluoride (e)	16984-48-8	mg/L	NA	4	4	4	2	0.62	NA		NA		NA		NA		NA		NA	
Iron*	7439-89-6	mg/L	NA	NA	0.3	NA	0.3	11	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U
Lead*	7439-92-1	mg/L	NA	0.015	0.015	0.015 (f)	NA	NA	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U
Magnesium (g)	7439-95-4	mg/L	NA	NA	NA	NA	NA	NA	23.5		23.1		22.9		22.9		23.1		23.6	
Manganese	7439-96-5	mg/L	NA	NA	0.05	NA	0.05	0.32	0.0157		0.0039	J	0.0047	J	0.0049	J	0.00085	J	0.00089	J
Mercury*	7439-97-6	mg/L	NA	0.002	0.002	0.002	NA	0.0043	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum	7439-98-7	mg/L	NA	NA	NA	NA	NA	0.078	0.0042	J	0.0039	J	0.0042	J	0.004	J	0.0036	J	0.0037	J
Nickel	7440-02-0	mg/L	NA	0.1	0.1	NA	NA	0.3	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U
Total Nitrite/Nitrate Nitrogen (e)	7727-37-9	mg/L	NA	10	10	10	NA	NA	NA		NA		NA		NA		NA		NA	
Selenium	7782-49-2	mg/L	NA	0.05	0.05	0.05	NA	0.078	0.0016	J	0.0016	J	0.0016	J	0.0015	J	0.0016	J	0.0016	J
Silver*	7440-22-4	mg/L	NA	0.05	0.05	NA	0.1	0.071	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate (e)	14808-79-8	mg/L	NA	250	NA	NA	250	NA	NA		NA		NA		NA		NA		NA	
Thallium*	7440-28-0	mg/L	0.0063	0.002	0.002	0.002	NA	0.00016	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin*	7440-31-5	mg/L	NA	NA	NA	NA	NA	9.3	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc*	7440-66-6	mg/L	NA	5	5	NA	5	4.7	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
Total Hardness as CaCO3 (g,e)	471-34-1	mg/L	NA	NA	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA	

Notes:
* Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. No MCL available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.
Detected Concentration> USEPA Tapwater RSL.
(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012. http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2013). Values for tapwater. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - The drinking water standard or MCL for chromium is based on total chromium.
(e) - Constituent not analyzed.
(f) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(g) - Screening levels from the presented sources are not available for this constituent.
(h) - Surface Water Samples collected in October 2013.
(i) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, and the basis of which has been questioned by USEPA's Science Advisory Board. This issue is discussed in detail in Appendix A.

Table 17
Comparison of Missouri River Surface Water Results to Screening Levels – Dissolved (Filtered) Sample Results
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Constituent	CAS	Units	Missouri State Water Quality Screening Levels			Federal Water Quality Screening Levels			Missouri River River Upstream									
			Human Health Fish Consumption (a)	Drinking Water Supply (a)	Groundwater (a)	USEPA MCLs (b)	USEPA SMCLs (b)	USEPA Tapwater RSLs (c)	LBD-R-4S Filtered		LBD-R-5S Filtered		LBD-R-5M Filtered		LBD-R-6S Filtered		LBD-R-6M Filtered	
Aluminum*	7429-90-5	mg/L	NA	NA	NA	NA	0.05	16	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U
Antimony*	7440-36-0	mg/L	4.3	0.006	0.006	0.006	NA	0.006	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	NA	0.05	0.05	0.01	NA	0.000045	0.0035		0.0035		0.0038		0.0037		0.0034	
Barium	7440-39-3	mg/L	NA	2	2	2	NA	2.9	0.0928		0.0906		0.0917		0.0907		0.0886	
Beryllium*	7440-41-7	mg/L	NA	0.004	0.004	0.004	NA	0.016	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.005	U
Boron	7440-42-8	mg/L	NA	NA	2	NA	NA	3.1	0.12		0.115		0.118		0.115		0.113	
Cadmium*	7440-43-9	mg/L	NA	0.005	0.005	0.005	NA	0.0069	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium (g,e)	7440-70-2	mg/L	NA	NA	NA	NA	NA	NA	NA		NA		NA		NA		NA	
Chromium*	7440-47-3	mg/L	NA	0.1 (d)	0.1 (d)	0.1 (d)	NA	16 (i)	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U
Cobalt*	7440-48-4	mg/L	NA	NA	1	NA	NA	0.0047	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper*	7440-50-8	mg/L	NA	1.3	1.3	1.3 (f)	1	0.62	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U
Total Cyanide (water) (e)	57-12-5	mg/L	NA	NA	NA	0.2	NA	0.0014	NA		NA		NA		NA		NA	
Fluoride (e)	16984-48-8	mg/L	NA	4	4	4	2	0.62	NA		NA		NA		NA		NA	
Iron*	7439-89-6	mg/L	NA	NA	0.3	NA	0.3	11	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U
Lead*	7439-92-1	mg/L	NA	0.015	0.015	0.015 (f)	NA	NA	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U
Magnesium (g)	7439-95-4	mg/L	NA	NA	NA	NA	NA	NA	23.3		22.9		23.4		22.7		22.7	
Manganese	7439-96-5	mg/L	NA	NA	0.05	NA	0.05	0.32	0.0111		0.0029	J	0.004	J	0.00083	U	0.00083	U
Mercury*	7439-97-6	mg/L	NA	0.002	0.002	0.002	NA	0.0043	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum	7439-98-7	mg/L	NA	NA	NA	NA	NA	0.078	0.0035	J	0.0035	J	0.0041	J	0.0038	J	0.0036	J
Nickel	7440-02-0	mg/L	NA	0.1	0.1	NA	NA	0.3	0.0015	U	0.0015	U	0.0019	J	0.0015	U	0.0015	U
Total Nitrite/Nitrate Nitrogen (e)	7727-37-9	mg/L	NA	10	10	10	NA	NA	NA		NA		NA		NA		NA	
Selenium	7782-49-2	mg/L	NA	0.05	0.05	0.05	NA	0.078	0.0016	J	0.0015	J	0.0015	J	0.0016	J	0.0014	J
Silver*	7440-22-4	mg/L	NA	0.05	0.05	NA	0.1	0.071	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate (e)	14808-79-8	mg/L	NA	250	NA	NA	250	NA	NA		NA		NA		NA		NA	
Thallium*	7440-28-0	mg/L	0.0063	0.002	0.002	0.002	NA	0.00016	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin*	7440-31-5	mg/L	NA	NA	NA	NA	NA	9.3	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc*	7440-66-6	mg/L	NA	5	5	NA	5	4.7	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
Total Hardness as CaCO3 (g,e)	471-34-1	mg/L	NA	NA	NA	NA	NA	NA	NA		NA		NA		NA		NA	

Notes:
* Constituent was not detected in any samples.
CAS - Chemical Abstracts Service.
J - Estimated value.
MCL - Maximum Contaminant Level.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
RSL - Regional Screening Level.
SMCL - Secondary Maximum Contaminant Level. No MCL available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.
Detected Concentration> USEPA Tapwater RSL.
(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012. http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
(b) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012. http://water.epa.gov/drink/contaminants/index.cfm
(c) - USEPA Regional Screening Levels (November 2013). Values for tapwater. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(d) - The drinking water standard or MCL for chromium is based on total chromium.
(e) - Constituent not analyzed.
(f) - The Action Level presented is recommended in the USEPA Drinking Water Standards.
(g) - Screening levels from the presented sources are not available for this constituent.
(h) - Surface Water Samples collected in October 2013.
(i) - Value for trivalent chromium used. USEPA provides a screening level for hexavalent chromium that is not a drinking water standard, and the basis of which has been questioned by USEPA's Science Advisory Board. This issue is discussed in detail in Appendix A.

Table 18
Comparison of Missouri River Surface Water Results to USEPA AWQC Human Health Consumption of Organism Only - Total (Unfiltered) Sample Results
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Constituent	CAS	Units	Federal Water Quality Criteria: USEPA AWQC Human Health for the Consumption of Organism Only (a)	Missouri River, River Downstream: LBD-R-1S Total		LBD-R-2S Total		LBD-R-2M Total		LBD-R-2M-Dup Total		LBD-R-3S Total		LBD-R-3M Total		Missouri River, River Upstream: LBD-R-4S Total		LBD-R-5S Total		LBD-R-5M Total		LBD-R-6S Total		LBD-R-6M Total	
Aluminum (b)	7429-90-5	mg/L	NA	2.3		3		3		2.82		2.84		2.85		2.63		2.67		2.83		3.04		2.85	
Antimony*	7440-36-0	mg/L	0.64	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	0.00014	0.0044		0.0045		0.0047		0.0047		0.0048		0.0049		0.005		0.005		0.0048		0.0047		0.0047	
Barium (b)	7440-39-3	mg/L	NA	0.113		0.122		0.123		0.121		0.123		0.124		0.113		0.119		0.12		0.123		0.119	
Beryllium* (b)	7440-41-7	mg/L	NA	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U
Boron (b)	7440-42-8	mg/L	NA	0.12		0.121		0.123		0.123		0.118		0.119		0.111		0.114		0.114		0.115		0.113	
Cadmium* (b)	7440-43-9	mg/L	NA	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium (b)	7440-70-2	mg/L	NA	63.8		64.7		63.6		64.6		64.2		65.5		62.3		63.5		63.4		65.1		64.5	
Chromium (b)	7440-47-3	mg/L	NA	0.0023	J	0.0027	J	0.0031	J	0.0031	J	0.0029	J	0.0032	J	0.0022	J	0.0026	J	0.0029	J	0.0031	J	0.0023	J
Cobalt* (b)	7440-48-4	mg/L	NA	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper (b)	7440-50-8	mg/L	NA	0.0042	J	0.005	J	0.0046	J	0.0048	J	0.0058	J	0.005	J	0.0035	J	0.0053	J	0.0048	J	0.0051	J	0.0053	J
Total Cyanide (water)*	57-12-5	mg/L	0.140	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Fluoride (b)	16984-48-8	mg/L	NA	0.5	J	0.47	J	0.48	J	0.5	J	0.47	J	0.43	J	0.41	J	0.48	J	0.45	J	0.51	J	0.44	J
Iron (b)	7439-89-6	mg/L	NA	1.6	J	2.11	J	2.08	J	2.07	J	2.25	J	2.23	J	1.79	J	2.15	J	2.17	J	2.34	J	2	J
Lead (b)	7439-92-1	mg/L	NA	0.0015		0.0018		0.0018		0.0018		0.0019		0.0019		0.0015		0.0018		0.0018		0.0019		0.0019	
Magnesium (b)	7439-95-4	mg/L	NA	23.1		23.4		23.1		23.5		23.3		23.8		22.7		23.2		23.1		23.6		23.4	
Manganese	7439-96-5	mg/L	0.1	0.208		0.23		0.23		0.229		0.233		0.237		0.194		0.219		0.228		0.241		0.236	
Mercury*	7439-97-6	mg/L	0.0003	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum (b)	7439-98-7	mg/L	NA	0.0044	J	0.0044	J	0.0044	J	0.0045	J	0.0044	J	0.0041	J	0.004	J	0.0044	J	0.0042	J	0.0043	J	0.0041	J
Nickel	7440-02-0	mg/L	4.6	0.0033	J	0.0037	J	0.0039	J	0.0047	J	0.0034	J	0.0046	J	0.0028	J	0.0042	J	0.0045	J	0.0036	J	0.0039	J
Total Nitrite/Nitrate Nitrogen (b)	7727-37-9	mg/L	NA	0.5		0.53		0.52		0.52		0.53		0.54		0.53		0.53		0.52		0.55		0.55	
Selenium	7782-49-2	mg/L	4.2	0.0017	J	0.0016	J	0.0017	J	0.0017	J	0.0017	J	0.0017	J	0.0016	J	0.0018	J	0.0016	J	0.0017	J	0.0018	J
Silver* (b)	7440-22-4	mg/L	NA	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate (b)	14808-79-8	mg/L	NA	174		187		193		189		189		192		194		194		193		194		197	
Thallium*	7440-28-0	mg/L	0.00047	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin* (b)	7440-31-5	mg/L	NA	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc	7440-66-6	mg/L	26	0.0073	J	0.0064	J	0.0064	J	0.007	J	0.0072	J	0.0073	J	0.0056	J	0.0092	J	0.0067	J	0.0072	J	0.0065	J
pH (b)	NA	--	NA	7.32		8.12		8.41				8.47		8.53		8.52		8.59		8.57		8.56		8.58	
Total Hardness as CaCO3 (b)	471-34-1	mg/L	NA	255		258		254		258		256		261		249		254		253		260		257	

Notes:
* Constituent was not detected in any samples.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.
Detected Concentration> USEPA AWQC Human Health for the Consumption of Organism Only
(a) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed September 2013.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(b) - Water quality criteria from the presented sources are not available for this constituent.

Table 19
Comparison of Missouri River Surface Water Results USEPA AWQC Human Health Consumption of Organism Only – Dissolved (Filtered) Sample Results
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Constituent	CAS	Units	Federal Water Quality Criteria	Missouri River												Missouri River											
				River Downstream												River Upstream											
			USEPA AWQC Human Health for the Consumption of Organism Only (a)	LBD-R-1S Dissolved (Filtered)		LBD-R-2S Dissolved (Filtered)		LBD-R-2M Dissolved (Filtered)		LBD-R-2M-Dup Dissolved (Filtered)		LBD-R-3S Dissolved (Filtered)		LBD-R-3M Dissolved (Filtered)		LBD-R-4S Dissolved (Filtered)		LBD-R-5S Dissolved (Filtered)		LBD-R-5M Dissolved (Filtered)		LBD-R-6S Dissolved (Filtered)		LBD-R-6M Dissolved (Filtered)	
Aluminum* (c)	7429-90-5	mg/L	NA	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U
Antimony*	7440-36-0	mg/L	0.64	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	0.00014	0.004		0.0037		0.0036		0.0041		0.0033		0.0035		0.0035		0.0035		0.0038		0.0037		0.0034	
Barium (c)	7440-39-3	mg/L	NA	0.0936		0.0912		0.0914		0.0908		0.0915		0.0938		0.0928		0.0906		0.0917		0.0907		0.0886	
Beryllium* (c)	7440-41-7	mg/L	NA	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.005	U
Boron (c)	7440-42-8	mg/L	NA	0.123		0.122		0.123		0.124		0.116		0.119		0.12		0.115		0.118		0.115		0.113	
Cadmium* (c)	7440-43-9	mg/L	NA	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium (b,c)	7440-70-2	mg/L	NA	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Chromium* (c)	7440-47-3	mg/L	NA	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U
Cobalt* (c)	7440-48-4	mg/L	NA	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper* (c)	7440-50-8	mg/L	NA	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U
Total Cyanide (water) (b)	57-12-5	mg/L	0.140	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Fluoride (b,c)	16984-48-8	mg/L	NA	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Iron* (c)	7439-89-6	mg/L	NA	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U
Lead* (c)	7439-92-1	mg/L	NA	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U
Magnesium (c)	7439-95-4	mg/L	NA	23.5		23.1		22.9		22.9		23.1		23.6		23.3		22.9		23.4		22.7		22.7	
Manganese	7439-96-5	mg/L	0.1	0.0157		0.0039	J	0.0047	J	0.0049	J	0.00085	J	0.00089	J	0.0111		0.0029	J	0.004	J	0.00083	U	0.00083	U
Mercury*	7439-97-6	mg/L	0.0003	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum (c)	7439-98-7	mg/L	NA	0.0042	J	0.0039	J	0.0042	J	0.004	J	0.0036	J	0.0037	J	0.0035	J	0.0035	J	0.0041	J	0.0038	J	0.0036	J
Nickel	7440-02-0	mg/L	4.6	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0019	J	0.0015	U	0.0015	U
Total Nitrite/Nitrate Nitrogen (b,c)	7727-37-9	mg/L	NA	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Selenium	7782-49-2	mg/L	4.2	0.0016	J	0.0016	J	0.0016	J	0.0015	J	0.0016	J	0.0016	J	0.0016	J	0.0015	J	0.0015	J	0.0016	J	0.0014	J
Silver* (c)	7440-22-4	mg/L	NA	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate (b,c)	14808-79-8	mg/L	NA	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
Thallium*	7440-28-0	mg/L	0.00047	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin* (c)	7440-31-5	mg/L	NA	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc*	7440-66-6	mg/L	26	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
pH (c)	NA	--	NA	7.32		8.12		8.41		NA		8.47		8.53		8.52		8.59		8.57		8.56		8.58	
Total Hardness as CaCO3 (b,c)	471-34-1	mg/L	NA	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	

Notes:
* Constituent was not detected in any samples.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.
Detected Concentration> USEPA AWQC Human Health for the Consumption of Organism Only
(a) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed September 2013.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations but have been conservatively compared to dissolved concentrations.
(b) - Constituent not analyzed.
(c) - Water quality criteria from the presented sources are not available for this constituent.

Table 20
Ecological Risk-Based Screening Levels
Labadie Energy Center, Franklin County, MO
Ameren Missouri

			Missouri State Water Quality Criteria						Federal Water Quality Criteria							
			Site-Specific Protection of Aquatic Life Acute (a)		Site-Specific Protection of Aquatic Life Chronic (a)		Irrigation (a)	Livestock Wildlife Watering (a)	Site-Specific USEPA Aquatic Life AWQC Freshwater Acute (b)				Site-Specific USEPA Aquatic Life AWQC Freshwater Chronic (b)			
Constituent	CAS	Units	Dissolved - Labadie Creek	Dissolved - Missouri River	Dissolved - Labadie Creek	Dissolved - Missouri River	Total	Total	Total - Labadie Creek	Total - Missouri River	Dissolved - Labadie Creek	Dissolved - Missouri River	Total - Labadie Creek	Total - Missouri River	Dissolved - Labadie Creek	Dissolved - Missouri River
Aluminum	7429-90-5	mg/L	0.75	0.75	NA	NA	NA	NA	0.75 (e)	0.75 (e)	NA	NA	0.087 (e)	0.087 (e)	NA	NA
Antimony	7440-36-0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	7440-38-2	mg/L	NA	NA	0.02	0.02	0.1	NA	0.34	0.34	0.34	0.34	0.15	0.15	0.15	0.15
Barium	7440-39-3	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	7440-41-7	mg/L	NA	NA	0.005	0.005	0.1	NA	NA	NA	NA	NA	NA	NA	NA	NA
Boron	7440-42-8	mg/L	NA	NA	NA	NA	2	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	7440-43-9	mg/L	0.0125 (f)	0.0119 (f)	0.0005 (f)	0.0005 (f)	NA	NA	0.006 (f)	0.006 (f)	0.005 (f)	0.005 (f)	0.0006 (f)	0.0005 (f)	0.0005 (f)	0.0005 (f)
Calcium	7440-70-2	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	7440-47-3	mg/L	1.29 (d,f)	1.23 (d,f)	0.17 (d,f)	0.16 (d,f)	0.1 (d)	NA	4.067 (d,f)	3.892 (d,f)	1.285 (d,f)	1.230 (d,f)	0.194 (d,f)	0.186 (d,f)	0.17 (d,f)	0.16 (d,f)
Cobalt	7440-48-4	mg/L	NA	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	NA	NA	NA
Copper	7440-50-8	mg/L	0.034 (f)	0.033 (f)	0.021 (f)	0.020 (f)	NA	0.5	0.036 (f)	0.034 (f)	0.034 (f)	0.033 (f)	0.022 (f)	0.021 (f)	0.021 (f)	0.020 (f)
Total Cyanide (water)	57-12-5	mg/L	0.022	0.022	0.005	0.005	NA	NA	0.022	0.022	0.022	0.022	0.005	0.005	0.005	0.005
Fluoride	16984-48-8	mg/L	NA	NA	NA	NA	NA	4	NA	NA	NA	NA	NA	NA	NA	NA
Iron	7439-89-6	mg/L	NA	NA	1	1	NA	NA	NA	NA	NA	NA	1	1	NA	NA
Lead	7439-92-1	mg/L	0.1868 (f)	0.1765 (f)	0.0073 (f)	0.0069 (f)	NA	NA	0.289 (f)	0.270 (f)	0.187 (f)	0.177 (f)	0.011 (f)	0.011 (f)	0.007 (f)	0.007 (f)
Magnesium	7439-95-4	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	7439-96-5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	7439-97-6	mg/L	0.0024	0.0024	0.0005	0.0005	NA	NA	0.0016	0.0016	0.0014	0.0014	0.001	0.001	0.00077	0.00077
Molybdenum	7439-98-7	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	7440-02-0	mg/L	1.086 (f)	1.037 (f)	0.121 (f)	0.115 (f)	NA	NA	1.087 (f)	1.039 (f)	1.085 (f)	1.037 (f)	0.121 (f)	0.116 (f)	0.121 (f)	0.115 (f)
Total Nitrite/Nitrate Nitrogen	7727-37-9	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	7782-49-2	mg/L	NA	NA	0.005	0.005	NA	NA	12.820 (c)	12.820 (c)	NA	NA	0.005	0.005	NA	NA
Silver	7440-22-4	mg/L	0.018 (f)	0.016 (f)	NA	NA	NA	NA	0.021 (f)	0.019 (f)	0.018 (f)	0.016 (f)	NA	NA	NA	NA
Sulfate	14808-79-8	mg/L	NA	NA	1773 (f,g)	1722 (f,g)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	7440-28-0	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	7440-31-5	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	7440-66-6	mg/L	0.27 (f)	0.26 (f)	0.27 (f)	0.26 (f)	NA	NA	0.28 (f)	0.27 (f)	0.27 (f)	0.26 (f)	0.28 (f)	0.27 (f)	0.27 (f)	0.26 (f)
pH	NA	--	NA	NA	6.5-9	6.5-9	NA	NA	NA	NA	NA	NA	6.5-9	6.5-9	6.5-9	6.5-9
Total Hardness as CaCO3	471-34-1	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
mg/L - Milligrams per liter.
NA -Not Available.
USEPA - United States Environmental Protection Agency.
(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
Total and dissolved (filtered) values provided separately.
Values adjusted for site-specific hardness and chloride, as applicable - see notes (f) and (g).
Missouri State Protection of Aquatic Life Acute and Chronic values apply only to dissolved results (except mercury, sulfate, and pH);
irrigation, livestock/wildlife watering, and mercury Aquatic Life Acute and Chronic values apply only to totals results.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science
and Technology. Accessed September 2013.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total and dissolved (filtered) values provided separately.
Values adjusted for site-specific hardness - see notes (f) and (h).
USEPA provides AWQC for both total and dissolved results.
(c) - Acute AWQC is equal to 1/[(f1/CMC1) + (f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and
CMC1 and CMC2 are 185.9 ug/L and 12.82 ug/L, respectively. Calculated assuming that all selenium is present as selenate, a likely overly conservative assumption.
(d) - Value for trivalent chromium used.
(e) - Values for pH range of 6.5-9.0.
(f) - Hardness dependent values were adjusted using the mean site-specific total recoverable hardness values, as follows:
Site-specific mean total recoverable hardness value for Labadie Creek data of 270 mg/L as CaCO3 was used to calculate values for comparison with Labadie Creek results.
Site-specific mean total recoverable hardness value for the Missouri River data of 256 mg/L as CaCO3 was used to calculate values for comparison with Missouri River results.
(g) - Chloride dependent value (default chloride value of 25 mg/L is assumed).
When chloride is greater than or equal to 25 and less than or equal to 500 mg/L and hardness
is between 100 and 500 mg/L, sulfate limit in mg/L = [1276.7 + 5.508 (hardness) − 1.457 (chloride)] * 0.65.

Table 21
Comparison of Labadie Creek Surface Water Results to Ecological Risk-Based Screening Levels - Total (Unfiltered) Sample Results
Labadie Energy Center, Franklin County, MO
Ameren Missouri

			Missouri State Water Quality Criteria				Federal Water Quality Criteria		Labadie Creek															
									Creek Downstream										Creek Upstream					
Constituent	CAS	Units	Protection of Aquatic Life Acute (a)	Protection of Aquatic Life Chronic (a)	Irrigation (a)	Livestock Wildlife Watering (a)	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	LBD-C-1 Total		LBD-C-1-DUP Total		LBD-C-2 Total		LBD-C-3 Total		LBD-C-4 Total		LBD-C-5 Total		LBD-C-6 Total	
Aluminum	7429-90-5	mg/L	NA	NA	NA	NA	0.75 (e)	0.087 (e)	2.91		2.98		3.17		3.5		0.0968	J	0.139		0.217	
Antimony* (g)	7440-36-0	mg/L	NA	NA	NA	NA	NA	NA	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	NA	NA	0.1	NA	0.34	0.15	0.0065		0.0067		0.0061		0.0066		0.0056		0.0055		0.0061	
Barium (g)	7440-39-3	mg/L	NA	NA	NA	NA	NA	NA	0.161		0.165		0.164		0.172		0.124		0.122		0.125	
Beryllium*	7440-41-7	mg/L	NA	NA	0.1	NA	NA	NA	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U
Boron	7440-42-8	mg/L	NA	NA	2	NA	NA	NA	0.0978		0.0986		0.0959		0.0999		0.166		0.164		0.167	
Cadmium*	7440-43-9	mg/L	NA	NA	NA	NA	0.006 (f)	0.0006 (f)	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium (g)	7440-70-2	mg/L	NA	NA	NA	NA	NA	NA	56.1		56.6		55.4		57.7		65.6		64.4		65.7	
Chromium	7440-47-3	mg/L	NA	NA	0.1 (d)	NA	4.067 (d,f)	0.194 (d,f)	0.0026	J	0.0031	J	0.0027	J	0.0031	J	0.0016	U	0.0016	U	0.0016	U
Cobalt*	7440-48-4	mg/L	NA	NA	NA	1	NA	NA	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper	7440-50-8	mg/L	NA	NA	NA	0.5	0.036 (f)	0.022 (f)	0.0027	U	0.004	J	0.0045	J	0.0048	J	0.0027	U	0.0027	U	0.0027	U
Total Cyanide (water)*	57-12-5	mg/L	NA	NA	NA	NA	0.022	0.005	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Fluoride*	16984-48-8	mg/L	NA	NA	NA	4	NA	NA	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
Iron	7439-89-6	mg/L	NA	NA	NA	NA	NA	1	2.21	J	2.39	J	2.47	J	2.71	J	0.225	J	0.216	J	0.309	J
Lead	7439-92-1	mg/L	NA	NA	NA	NA	0.289 (f)	0.011 (f)	0.0017		0.0018		0.0018		0.0021		0.00014	J	0.00013	J	0.0002	J
Magnesium (g)	7439-95-4	mg/L	NA	NA	NA	NA	NA	NA	26.5		26.7		26.1		27.1		31		30.4		30.9	
Manganese (g)	7439-96-5	mg/L	NA	NA	NA	NA	NA	NA	1.31		1.34		1.32		1.4		0.0792		0.0774		0.0862	
Mercury* (g)	7439-97-6	mg/L	0.0024	0.0005	NA	NA	0.0016	0.00091	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum (g)	7439-98-7	mg/L	NA	NA	NA	NA	NA	NA	0.0092	J	0.005	J	0.0055	J	0.0046	J	0.0029	J	0.0024	J	0.0024	J
Nickel	7440-02-0	mg/L	NA	NA	NA	NA	1.087 (f)	0.121 (f)	0.004	J	0.0036	J	0.0042	J	0.0051	J	0.0024	J	0.0022	J	0.0017	J
Total Nitrite/Nitrate Nitrogen* (g)	7727-37-9	mg/L	NA	NA	NA	NA	NA	NA	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U	0.04	U
Selenium*	7782-49-2	mg/L	NA	NA	NA	NA	12.820 (c)	0.005	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U
Silver*	7440-22-4	mg/L	NA	NA	NA	NA	0.021 (f)	NA	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate	14808-79-8	mg/L	NA	1773 (f,h)	NA	NA	NA	NA	19.4	J	15.4	J	16.3	J	15.3	J	17.8	J	17.6	J	16.6	J
Thallium* (g)	7440-28-0	mg/L	NA	NA	NA	NA	NA	NA	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin* (g)	7440-31-5	mg/L	NA	NA	NA	NA	NA	NA	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc	7440-66-6	mg/L	NA	NA	NA	NA	0.28 (f)	0.28 (f)	0.0042	J	0.0048	J	0.0053	J	0.006	J	0.002	U	0.002	U	0.002	U
pH	NA	--	NA	6.5-9	NA	NA	NA	6.5-9	7.08		NA		7.57		7.7		8.02		8.19		8.24	
Total Hardness as CaCO3 (g)	471-34-1	mg/L	NA	NA	NA	NA	NA	NA	249		251		246		256		291		286		291	

Notes:
* Constituent was not detected in any samples.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.
Detected Concentration> USEPA Aquatic Life AWQC Chronic.
Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.
(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf. Total values provided.
Missouri State Protection of Aquatic Life Acute and Chronic values apply only to dissolved results (except mercury);
irrigation, livestock/wildlife watering, and mercury Aquatic Life Acute and Chronic values apply only to totals results.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science
and Technology. Accessed September 2013.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (f).
USEPA provides AWQC for both total and dissolved results.
(c) - Acute AWQC is equal to 1/[(f1/CMC1) + (f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and
CMC1 and CMC2 are 185.9 ug/L and 12.82 ug/L, respectively. Calculated assuming that all selenium is present as selenate, a likely overly conservative assumption.
(d) - Value for trivalent chromium used.
(e) - Values for pH range of 6.5-9.0.
(f) - Hardness dependent value. Site-specific (Labadie Creek) total recoverable mean hardness value of 270 mg/L as CaCO3 used.
(g) - Water quality criteria from the presented sources are not available for this constituent.
(h) - Chloride dependent value (default chloride value of 25 mg/L is assumed).
When chloride is greater than or equal to 25 and less than or equal to 500 mg/L and hardness
is between 100 and 500 mg/L, sulfate limit in mg/L = [1276.7 + 5.508 (hardness) − 1.457 (chloride)] * 0.65.

Table 22
Comparison of Labadie Creek Surface Water Results to Ecological Risk-Based Screening Levels - Dissolved (Filtered) Sample Results (h)
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Constituent	CAS	Units	Missouri State Water Quality Criteria		Federal Water Quality Criteria		Labadie Creek																	
							Creek Downstream										Creek Upstream							
			Protection of Aquatic Life Acute (a)	Protection of Aquatic Life Chronic (a)	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	LBD-C-1 Dissolved (Filtered)		LBD-C-2 Dissolved (Filtered)		LBD-C-3 Dissolved (Filtered)		LBD-C-4 Dissolved (Filtered)		LBD-C-5 Dissolved (Filtered)		LBD-C-6 Dissolved (Filtered)							
Aluminum	7429-90-5	mg/L	0.75	NA	NA	NA	0.0163	J	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U						
Antimony* (g)	7440-36-0	mg/L	NA	NA	NA	NA	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U						
Arsenic	7440-38-2	mg/L	NA	0.02	0.34	0.15	0.0039		0.0039		0.0043		0.0056		0.0051		0.0051							
Barium (g)	7440-39-3	mg/L	NA	NA	NA	NA	0.141		0.145		0.146		0.116		0.118		0.12							
Beryllium*	7440-41-7	mg/L	NA	0.005	NA	NA	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U						
Boron (g)	7440-42-8	mg/L	NA	NA	NA	NA	0.108		0.1		0.0994		0.165		0.169		0.17							
Cadmium*	7440-43-9	mg/L	0.0125 (f)	0.0005 (f)	0.005 (f)	0.0005 (f)	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U						
Calcium (d,g)	7440-70-2	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA							
Chromium*	7440-47-3	mg/L	1.29 (c,f)	0.17 (c,f)	1.285 (c,f)	0.17 (c,f)	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U						
Cobalt*	7440-48-4	mg/L	NA	NA	NA	NA	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U						
Copper*	7440-50-8	mg/L	0.034 (f)	0.021 (f)	0.034 (f)	0.021 (f)	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U						
Total Cyanide (water) (d)	57-12-5	mg/L	0.022	0.005	0.022	0.005	NA		NA		NA		NA		NA		NA							
Fluoride (d,g)	16984-48-8	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA							
Iron*	7439-89-6	mg/L	NA	1	NA	NA	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U						
Lead	7439-92-1	mg/L	0.1868 (f)	0.0073 (f)	0.187 (f)	0.007 (f)	0.0001	J	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U						
Magnesium (g)	7439-95-4	mg/L	NA	NA	NA	NA	26.9		27		27.2		30.4		30.5		31.5							
Manganese (g)	7439-96-5	mg/L	NA	NA	NA	NA	1.19		1.19		1.24		0.0581		0.0598		0.0619							
Mercury*	7439-97-6	mg/L	NA	NA	0.0014	0.00077	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U						
Molybdenum (g)	7439-98-7	mg/L	NA	NA	NA	NA	0.0036	J	0.0031	J	0.003	J	0.0018	J	0.0022	J	0.002	J						
Nickel	7440-02-0	mg/L	1.086 (f)	0.121 (f)	1.085 (f)	0.121 (f)	0.0021	J	0.0015	U	0.002	J	0.0024	J	0.0017	J	0.0017	J						
Total Nitrite/Nitrate Nitrogen (d,g)	7727-37-9	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA							
Selenium*	7782-49-2	mg/L	NA	0.005	NA	NA	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U	0.0005	U						
Silver*	7440-22-4	mg/L	0.018 (f)	NA	0.018 (f)	NA	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U						
Sulfate (d,g)	14808-79-8	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA							
Thallium* (g)	7440-28-0	mg/L	NA	NA	NA	NA	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U						
Tin* (g)	7440-31-5	mg/L	NA	NA	NA	NA	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U						
Zinc*	7440-66-6	mg/L	0.27 (f)	0.27 (f)	0.27 (f)	0.27 (f)	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U						
pH	NA	--	NA	6.5-9	NA	6.5-9	7.08		7.57		7.7		8.02		8.19		8.24							
Total Hardness as CaCO3 (d,g)	471-34-1	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA							

Notes:
* Constituent was not detected in any samples.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.
(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
Dissolved (filtered) values provided. Values adjusted for site-specific hardness - see notes (c) and (f).
Missouri State Protection of Aquatic Life Acute and Chronic values apply only to dissolved results (except mercury);
irrigation, livestock/wildlife watering, and mercury Aquatic Life Acute and Chronic values apply only to totals results.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
Accessed September 2013. http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Dissolved (filtered) values provided. Values adjusted for site-specific hardness - see notes (c) and (f).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Constituent not analyzed.
(e) - Values for pH range of 6.5-9.0.
(f) - Hardness dependent value for filtered (dissolved) metals. Site-specific (Labadie Creek) mean total recoverable hardness value of 270 mg/L as CaCO3 used.
(g) - Water quality criteria from the presented sources are not available for this constituent.
(h) - No results are above the relevant screening levels.

Table 23
Comparison of Missouri River Surface Water Results to Ecological Risk-Based Screening Levels - Total (Unfiltered) Sample Results
Labadie Energy Center, Franklin County, MO
Ameren Missouri

			Missouri State Water Quality Criteria				Federal Water Quality Criteria		Missouri River River Downstream													
Constituent	CAS	Units	Protection of Aquatic Life Acute (a)	Protection of Aquatic Life Chronic (a)	Irrigation (a)	Livestock Wildlife Watering (a)	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	LBD-R-1S Total		LBD-R-2S Total		LBD-R-2M Total		LBD-R-2M-Dup Total		LBD-R-3S Total		LBD-R-3M Total	
Aluminum	7429-90-5	mg/L	NA	NA	NA	NA	0.75 (e)	0.087 (e)	2.3		3		3		2.82		2.84		2.85	
Antimony* (g)	7440-36-0	mg/L	NA	NA	NA	NA	NA	NA	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	NA	NA	0.1	NA	0.34	0.15	0.0044		0.0045		0.0047		0.0047		0.0048		0.0049	
Barium (g)	7440-39-3	mg/L	NA	NA	NA	NA	NA	NA	0.113		0.122		0.123		0.121		0.123		0.124	
Beryllium*	7440-41-7	mg/L	NA	NA	0.1	NA	NA	NA	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U
Boron	7440-42-8	mg/L	NA	NA	2	NA	NA	NA	0.12		0.121		0.123		0.123		0.118		0.119	
Cadmium*	7440-43-9	mg/L	NA	NA	NA	NA	0.006 (f)	0.0005 (f)	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium (g)	7440-70-2	mg/L	NA	NA	NA	NA	NA	NA	63.8		64.7		63.6		64.6		64.2		65.5	
Chromium	7440-47-3	mg/L	NA	NA	0.1 (d)	NA	3.892 (d,f)	0.186 (d,f)	0.0023	J	0.0027	J	0.0031	J	0.0031	J	0.0029	J	0.0032	J
Cobalt*	7440-48-4	mg/L	NA	NA	NA	1	NA	NA	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper	7440-50-8	mg/L	NA	NA	NA	0.5	0.034 (f)	0.021 (f)	0.0042	J	0.005	J	0.0046	J	0.0048	J	0.0058	J	0.005	J
Total Cyanide (water)*	57-12-5	mg/L	NA	NA	NA	NA	0.022	0.005	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Fluoride	16984-48-8	mg/L	NA	NA	NA	4	NA	NA	0.5	J	0.47	J	0.48	J	0.5	J	0.47	J	0.43	J
Iron	7439-89-6	mg/L	NA	NA	NA	NA	NA	1	1.6	J	2.11	J	2.08	J	2.07	J	2.25	J	2.23	J
Lead	7439-92-1	mg/L	NA	NA	NA	NA	0.270 (f)	0.011 (f)	0.0015		0.0018		0.0018		0.0018		0.0019		0.0019	
Magnesium (g)	7439-95-4	mg/L	NA	NA	NA	NA	NA	NA	23.1		23.4		23.1		23.5		23.3		23.8	
Manganese (g)	7439-96-5	mg/L	NA	NA	NA	NA	NA	NA	0.208		0.23		0.23		0.229		0.233		0.237	
Mercury*	7439-97-6	mg/L	0.0024	0.0005	NA	NA	0.0016	0.001	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum (g)	7439-98-7	mg/L	NA	NA	NA	NA	NA	NA	0.0044	J	0.0044	J	0.0044	J	0.0045	J	0.0044	J	0.0041	J
Nickel	7440-02-0	mg/L	NA	NA	NA	NA	1.039 (f)	0.116 (f)	0.0033	J	0.0037	J	0.0039	J	0.0047	J	0.0034	J	0.0046	J
Total Nitrite/Nitrate Nitrogen (g)	7727-37-9	mg/L	NA	NA	NA	NA	NA	NA	0.5		0.53		0.52		0.52		0.53		0.54	
Selenium	7782-49-2	mg/L	NA	NA	NA	NA	12.820 (c)	0.005	0.0017	J	0.0016	J	0.0017	J	0.0017	J	0.0017	J	0.0017	J
Silver*	7440-22-4	mg/L	NA	NA	NA	NA	0.019 (f)	NA	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate	14808-79-8	mg/L	NA	1722 (f,h)	NA	NA	NA	NA	174		187		193		189		189		192	
Thallium* (g)	7440-28-0	mg/L	NA	NA	NA	NA	NA	NA	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin* (g)	7440-31-5	mg/L	NA	NA	NA	NA	NA	NA	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc	7440-66-6	mg/L	NA	NA	NA	NA	0.27 (f)	0.27 (f)	0.0073	J	0.0064	J	0.0064	J	0.007	J	0.0072	J	0.0073	J
pH	NA	--	NA	6.5-9	NA	NA	NA	6.5-9	7.32		8.12		8.41		NA		8.47		8.53	
Total Hardness as CaCO3 (g)	471-34-1	mg/L	NA	NA	NA	NA	NA	NA	255		258		254		258		256		261	

Notes:
* Constituent was not detected in any samples.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.
Detected Concentration> USEPA Aquatic Life AWQC Chronic.
Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.
(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf. Total values provided.
Missouri State Protection of Aquatic Life Acute and Chronic values apply only to dissolved results (except mercury);
irrigation, livestock/wildlife watering, and mercury Aquatic Life Acute and Chronic values apply only to totals results.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science
and Technology. Accessed September 2013.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (f).
USEPA provides AWQC for both total and dissolved results.
(c) - Acute AWQC is equal to 1/[(f1/CMC1) + (f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate,
respectively, and CMC1 and CMC2 are 185.9 ug/L and 12.82 ug/L, respectively. Calculated assuming that all selenium is present as selenate,
a likely overly conservative assumption.
(d) - Value for trivalent chromium used.
(e) - Values for pH range of 6.5-9.0.
(f) - Hardness dependent value for total metals. Site-specific (Missouri River) total recoverable mean hardness value of 256 mg/L as CaCO3 used.
(g) - Water quality criteria from the presented sources are not available for this constituent.
(h) - Chloride dependent value (default chloride value of 25 mg/L is assumed).
When chloride is greater than or equal to 25 and less than or equal to 500 mg/L and hardness
is between 100 and 500 mg/L, sulfate limit in mg/L = [1276.7 + 5.508 (hardness) − 1.457 (chloride)] * 0.65.

Table 23
Comparison of Missouri River Surface Water Results to Ecological Risk-Based Screening Levels - Total (Unfiltered) Sample Results
Labadie Energy Center, Franklin County, MO
Ameren Missouri

			Missouri State Water Quality Criteria				Federal Water Quality Criteria		Missouri River									
									River Upstream									
Constituent	CAS	Units	Protection of Aquatic Life Acute (a)	Protection of Aquatic Life Chronic (a)	Irrigation (a)	Livestock Wildlife Watering (a)	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	LBD-R-4S Total		LBD-R-5S Total		LBD-R-5M Total		LBD-R-6S Total		LBD-R-6M Total	
Aluminum	7429-90-5	mg/L	NA	NA	NA	NA	0.75 (e)	0.087 (e)	2.63		2.67		2.83		3.04		2.85	
Antimony* (g)	7440-36-0	mg/L	NA	NA	NA	NA	NA	NA	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	NA	NA	0.1	NA	0.34	0.15	0.005		0.005		0.0048		0.0047		0.0047	
Barium (g)	7440-39-3	mg/L	NA	NA	NA	NA	NA	NA	0.113		0.119		0.12		0.123		0.119	
Beryllium*	7440-41-7	mg/L	NA	NA	0.1	NA	NA	NA	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U
Boron	7440-42-8	mg/L	NA	NA	2	NA	NA	NA	0.111		0.114		0.114		0.115		0.113	
Cadmium*	7440-43-9	mg/L	NA	NA	NA	NA	0.006 (f)	0.0005 (f)	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium (g)	7440-70-2	mg/L	NA	NA	NA	NA	NA	NA	62.3		63.5		63.4		65.1		64.5	
Chromium	7440-47-3	mg/L	NA	NA	0.1 (d)	NA	3.892 (d,f)	0.186 (d,f)	0.0022	J	0.0026	J	0.0029	J	0.0031	J	0.0023	J
Cobalt*	7440-48-4	mg/L	NA	NA	NA	1	NA	NA	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper	7440-50-8	mg/L	NA	NA	NA	0.5	0.034 (f)	0.021 (f)	0.0035	J	0.0053	J	0.0048	J	0.0051	J	0.0053	J
Total Cyanide (water)*	57-12-5	mg/L	NA	NA	NA	NA	0.022	0.005	0.005	U	0.005	U	0.005	U	0.005	U	0.005	U
Fluoride	16984-48-8	mg/L	NA	NA	NA	4	NA	NA	0.41	J	0.48	J	0.45	J	0.51	J	0.44	J
Iron	7439-89-6	mg/L	NA	NA	NA	NA	NA	1	1.79	J	2.15	J	2.17	J	2.34	J	2	J
Lead	7439-92-1	mg/L	NA	NA	NA	NA	0.270 (f)	0.011 (f)	0.0015		0.0018		0.0018		0.0019		0.0019	
Magnesium (g)	7439-95-4	mg/L	NA	NA	NA	NA	NA	NA	22.7		23.2		23.1		23.6		23.4	
Manganese (g)	7439-96-5	mg/L	NA	NA	NA	NA	NA	NA	0.194		0.219		0.228		0.241		0.236	
Mercury*	7439-97-6	mg/L	0.0024	0.0005	NA	NA	0.0016	0.001	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum (g)	7439-98-7	mg/L	NA	NA	NA	NA	NA	NA	0.004	J	0.0044	J	0.0042	J	0.0043	J	0.0041	J
Nickel	7440-02-0	mg/L	NA	NA	NA	NA	1.039 (f)	0.116 (f)	0.0028	J	0.0042	J	0.0045	J	0.0036	J	0.0039	J
Total Nitrite/Nitrate Nitrogen (g)	7727-37-9	mg/L	NA	NA	NA	NA	NA	NA	0.53		0.53		0.52		0.55		0.55	
Selenium	7782-49-2	mg/L	NA	NA	NA	NA	12.820 (c)	0.005	0.0016	J	0.0018	J	0.0016	J	0.0017	J	0.0018	J
Silver*	7440-22-4	mg/L	NA	NA	NA	NA	0.019 (f)	NA	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate	14808-79-8	mg/L	NA	1722 (f,h)	NA	NA	NA	NA	194		194		193		194		197	
Thallium* (g)	7440-28-0	mg/L	NA	NA	NA	NA	NA	NA	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin* (g)	7440-31-5	mg/L	NA	NA	NA	NA	NA	NA	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc	7440-66-6	mg/L	NA	NA	NA	NA	0.27 (f)	0.27 (f)	0.0056	J	0.0092	J	0.0067	J	0.0072	J	0.0065	J
pH	NA	--	NA	6.5-9	NA	NA	NA	6.5-9	8.52		8.59		8.57		8.56		8.58	
Total Hardness as CaCO3 (g)	471-34-1	mg/L	NA	NA	NA	NA	NA	NA	249		254		253		260		257	

Notes:
* Constituent was not detected in any samples.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.
Detected Concentration> USEPA Aquatic Life AWQC Chronic.
Detected Concentration> USEPA Aquatic Life AWQC Acute and Chronic.
(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf. Total values provided.
Missouri State Protection of Aquatic Life Acute and Chronic values apply only to dissolved results (except mercury);
irrigation, livestock/wildlife watering, and mercury Aquatic Life Acute and Chronic values apply only to totals results.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science
and Technology. Accessed September 2013.
http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Total values provided. Values adjusted for site-specific hardness - see note (f).
USEPA provides AWQC for both total and dissolved results.
(c) - Acute AWQC is equal to 1/[(f1/CMC1) + (f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate,
respectively, and CMC1 and CMC2 are 185.9 ug/L and 12.82 ug/L, respectively. Calculated assuming that all selenium is present as selenate,
a likely overly conservative assumption.
(d) - Value for trivalent chromium used.
(e) - Values for pH range of 6.5-9.0.
(f) - Hardness dependent value for total metals. Site-specific (Missouri River) total recoverable mean hardness value of 256 mg/L as CaCO3 used.
(g) - Water quality criteria from the presented sources are not available for this constituent.
(h) - Chloride dependent value (default chloride value of 25 mg/L is assumed).
When chloride is greater than or equal to 25 and less than or equal to 500 mg/L and hardness
is between 100 and 500 mg/L, sulfate limit in mg/L = [1276.7 + 5.508 (hardness) − 1.457 (chloride)] * 0.65.

Table 24
Comparison of Missouri River Surface Water Results to Ecological Risk-Based Screening Levels - Filtered Sample Results (h)
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Constituent	CAS	Units	Missouri State Water Quality Criteria		Federal Water Quality Criteria		Missouri River											
							River Downstream											
			Protection of Aquatic Life Acute (a)	Protection of Aquatic Life Chronic (a)	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	LBD-R-1S Dissolved (Filtered)		LBD-R-2S Dissolved (Filtered)		LBD-R-2M Dissolved (Filtered)		LBD-R-2M-Dup Dissolved (Filtered)		LBD-R-3S Dissolved (Filtered)		LBD-R-3M Dissolved (Filtered)	
Aluminum*	7429-90-5	mg/L	0.75	NA	NA	NA	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U
Antimony* (g)	7440-36-0	mg/L	NA	NA	NA	NA	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	NA	0.02	0.34	0.15	0.004		0.0037		0.0036		0.0041		0.0033		0.0035	
Barium (g)	7440-39-3	mg/L	NA	NA	NA	NA	0.0936		0.0912		0.0914		0.0908		0.0915		0.0938	
Beryllium*	7440-41-7	mg/L	NA	0.005	NA	NA	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.00067	U
Boron	7440-42-8	mg/L	NA	NA	NA	NA	0.123		0.122		0.123		0.124		0.116		0.119	
Cadmium*	7440-43-9	mg/L	0.0119 (f)	0.0005 (f)	0.005 (f)	0.0005 (f)	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium (d,g)	7440-70-2	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA	
Chromium*	7440-47-3	mg/L	1.23 (c,f)	0.16 (c,f)	1.230 (c,f)	0.16 (c,f)	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U
Cobalt*	7440-48-4	mg/L	NA	NA	NA	NA	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper*	7440-50-8	mg/L	0.033 (f)	0.020 (f)	0.033 (f)	0.020 (f)	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U
Total Cyanide (water) (d)	57-12-5	mg/L	0.022	0.005	0.022	0.005	NA		NA		NA		NA		NA		NA	
Fluoride (d)	16984-48-8	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA	
Iron*	7439-89-6	mg/L	NA	1	NA	NA	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U
Lead*	7439-92-1	mg/L	0.1765 (f)	0.0069 (f)	0.177 (f)	0.007 (f)	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U
Magnesium (g)	7439-95-4	mg/L	NA	NA	NA	NA	23.5		23.1		22.9		22.9		23.1		23.6	
Manganese (g)	7439-96-5	mg/L	NA	NA	NA	NA	0.0157		0.0039	J	0.0047	J	0.0049	J	0.00085	J	0.00089	J
Mercury*	7439-97-6	mg/L	NA	NA	0.0014	0.00077	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum (g)	7439-98-7	mg/L	NA	NA	NA	NA	0.0042	J	0.0039	J	0.0042	J	0.004	J	0.0036	J	0.0037	J
Nickel	7440-02-0	mg/L	1.037 (f)	0.115 (f)	1.037 (f)	0.115 (f)	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U	0.0015	U
Total Nitrite/Nitrate Nitrogen (d,g)	7727-37-9	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA	
Selenium	7782-49-2	mg/L	NA	0.005	NA	NA	0.0016	J	0.0016	J	0.0016	J	0.0015	J	0.0016	J	0.0016	J
Silver*	7440-22-4	mg/L	0.016 (f)	NA	0.016 (f)	NA	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate (d,g)	14808-79-8	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA	
Thallium* (g)	7440-28-0	mg/L	NA	NA	NA	NA	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin* (g)	7440-31-5	mg/L	NA	NA	NA	NA	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc*	7440-66-6	mg/L	0.26 (f)	0.26 (f)	0.26 (f)	0.26 (f)	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
pH	NA	--	NA	6.5-9	NA	6.5-9	7.32		8.12		8.41		NA		8.47		8.53	
Total Hardness as CaCO3 (d,g)	471-34-1	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA		NA	

Notes:
* Constituent was not detected in any samples.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.
(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
Dissolved (filtered) values provided. Values adjusted for site-specific hardness - see notes (c) and (f).
Missouri State Protection of Aquatic Life Acute and Chronic values apply only to dissolved results (except mercury);
irrigation, livestock/wildlife watering, and mercury Aquatic Life Acute and Chronic values apply only to totals results.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
Accessed September 2013. http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Dissolved (filtered) values provided. Values adjusted for site-specific hardness - see notes (c) and (f).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Constituent not analyzed.
(e) - Values for pH range of 6.5-9.0.
(f) - Hardness dependent value for filtered (dissolved) metals. Site-specific (Missouri River) mean total recoverable
hardness value of 256 mg/L as CaCO3 used.
(g) - Water quality criteria from the presented sources are not available for this constituent.
(h) - No results are above the relevant screening levels.

Table 24
Comparison of Missouri River Surface Water Results to Ecological Risk-Based Screening Levels - Filtered Sample Results (h)
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Constituent	CAS	Units	Missouri State Water Quality Criteria		Federal Water Quality Criteria		Missouri River									
							River Upstream									
			Protection of Aquatic Life Acute (a)	Protection of Aquatic Life Chronic (a)	USEPA Aquatic Life AWQC Freshwater Acute (b)	USEPA Aquatic Life AWQC Freshwater Chronic (b)	LBD-R-4S Dissolved (Filtered)		LBD-R-5S Dissolved (Filtered)		LBD-R-5M Dissolved (Filtered)		LBD-R-6S Dissolved (Filtered)		LBD-R-6M Dissolved (Filtered)	
Aluminum*	7429-90-5	mg/L	0.75	NA	NA	NA	0.0143	U	0.0143	U	0.0143	U	0.0143	U	0.0143	U
Antimony* (g)	7440-36-0	mg/L	NA	NA	NA	NA	0.0053	U	0.0053	U	0.0053	U	0.0053	U	0.0053	U
Arsenic	7440-38-2	mg/L	NA	0.02	0.34	0.15	0.0035		0.0035		0.0038		0.0037		0.0034	
Barium (g)	7440-39-3	mg/L	NA	NA	NA	NA	0.0928		0.0906		0.0917		0.0907		0.0886	
Beryllium*	7440-41-7	mg/L	NA	0.005	NA	NA	0.00067	U	0.00067	U	0.00067	U	0.00067	U	0.005	U
Boron	7440-42-8	mg/L	NA	NA	NA	NA	0.12		0.115		0.118		0.115		0.113	
Cadmium*	7440-43-9	mg/L	0.0119 (f)	0.0005 (f)	0.005 (f)	0.0005 (f)	0.00023	U	0.00023	U	0.00023	U	0.00023	U	0.00023	U
Calcium (d,g)	7440-70-2	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA	
Chromium*	7440-47-3	mg/L	1.23 (c,f)	0.16 (c,f)	1.230 (c,f)	0.16 (c,f)	0.0016	U	0.0016	U	0.0016	U	0.0016	U	0.0016	U
Cobalt*	7440-48-4	mg/L	NA	NA	NA	NA	0.0013	U	0.0013	U	0.0013	U	0.0013	U	0.0013	U
Copper*	7440-50-8	mg/L	0.033 (f)	0.020 (f)	0.033 (f)	0.020 (f)	0.0027	U	0.0027	U	0.0027	U	0.0027	U	0.0027	U
Total Cyanide (water) (d)	57-12-5	mg/L	0.022	0.005	0.022	0.005	NA		NA		NA		NA		NA	
Fluoride (d)	16984-48-8	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA	
Iron*	7439-89-6	mg/L	NA	1	NA	NA	0.043	U	0.043	U	0.043	U	0.043	U	0.043	U
Lead*	7439-92-1	mg/L	0.1765 (f)	0.0069 (f)	0.177 (f)	0.007 (f)	0.000085	U	0.000085	U	0.000085	U	0.000085	U	0.000085	U
Magnesium (g)	7439-95-4	mg/L	NA	NA	NA	NA	23.3		22.9		23.4		22.7		22.7	
Manganese (g)	7439-96-5	mg/L	NA	NA	NA	NA	0.0111		0.0029	J	0.004	J	0.00083	U	0.00083	U
Mercury*	7439-97-6	mg/L	NA	NA	0.0014	0.00077	0.00006	U	0.00006	U	0.00006	U	0.00006	U	0.00006	U
Molybdenum (g)	7439-98-7	mg/L	NA	NA	NA	NA	0.0035	J	0.0035	J	0.0041	J	0.0038	J	0.0036	J
Nickel	7440-02-0	mg/L	1.037 (f)	0.115 (f)	1.037 (f)	0.115 (f)	0.0015	U	0.0015	U	0.0019	J	0.0015	U	0.0015	U
Total Nitrite/Nitrate Nitrogen (d,g)	7727-37-9	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA	
Selenium	7782-49-2	mg/L	NA	0.005	NA	NA	0.0016	J	0.0015	J	0.0015	J	0.0016	J	0.0014	J
Silver*	7440-22-4	mg/L	0.016 (f)	NA	0.016 (f)	NA	0.0021	U	0.0021	U	0.0021	U	0.0021	U	0.0021	U
Sulfate (d,g)	14808-79-8	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA	
Thallium* (g)	7440-28-0	mg/L	NA	NA	NA	NA	0.00015	U	0.00015	U	0.00015	U	0.00015	U	0.00015	U
Tin* (g)	7440-31-5	mg/L	NA	NA	NA	NA	0.0029	U	0.0029	U	0.0029	U	0.0029	U	0.0029	U
Zinc*	7440-66-6	mg/L	0.26 (f)	0.26 (f)	0.26 (f)	0.26 (f)	0.002	U	0.002	U	0.002	U	0.002	U	0.002	U
pH	NA	--	NA	6.5-9	NA	6.5-9	8.52		8.59		8.57		8.56		8.58	
Total Hardness as CaCO3 (d,g)	471-34-1	mg/L	NA	NA	NA	NA	NA		NA		NA		NA		NA	

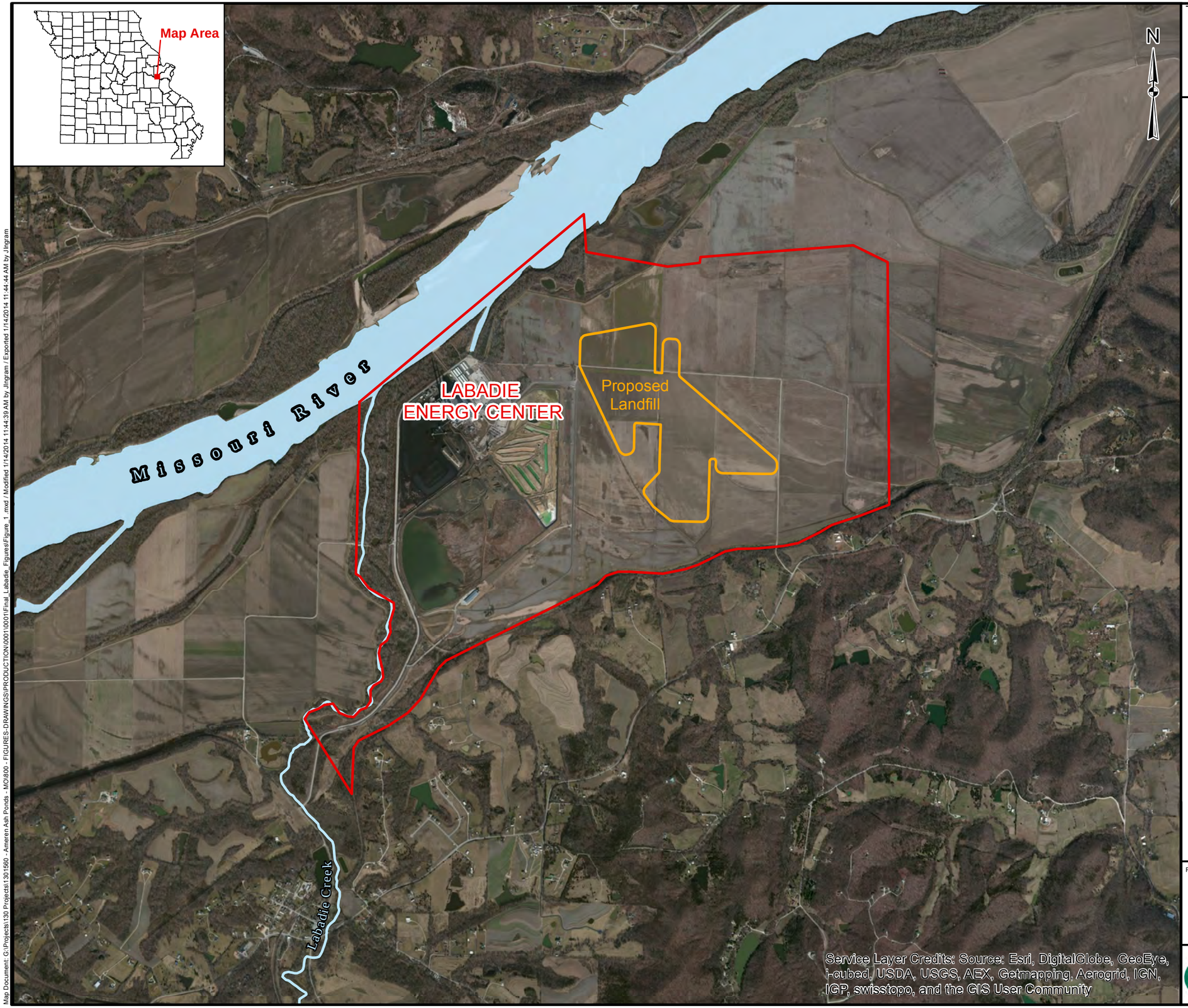
Notes:
* Constituent was not detected in any samples.
AWQC - USEPA Ambient Water Quality Criteria.
CAS - Chemical Abstracts Service.
J - Estimated value.
mg/L - Milligrams per liter.
NA - Not Analyzed/Not Available.
U - Constituent was not detected.
USEPA - United States Environmental Protection Agency.
(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. May 31, 2012.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf.
Dissolved (filtered) values provided. Values adjusted for site-specific hardness - see notes (c) and (f).
Missouri State Protection of Aquatic Life Acute and Chronic values apply only to dissolved results (except mercury);
irrigation, livestock/wildlife watering, and mercury Aquatic Life Acute and Chronic values apply only to totals results.
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology.
Accessed September 2013. http://water.epa.gov/scitech/swguidance/standards/criteria/current/index.cfm
Dissolved (filtered) values provided. Values adjusted for site-specific hardness - see notes (c) and (f).
USEPA provides AWQC for both total and dissolved results.
(c) - Value for trivalent chromium used.
(d) - Constituent not analyzed.
(e) - Values for pH range of 6.5-9.0.
(f) - Hardness dependent value for filtered (dissolved) metals. Site-specific (Missouri River) mean total recoverable
hardness value of 256 mg/L as CaCO3 used.
(g) - Water quality criteria from the presented sources are not available for this constituent.
(h) - No results are above the relevant screening levels.

Table 25
Summary of Whole Effluent Toxicity Testing Results for NPDES Outfall 002
Labadie Energy Center, Franklin County, MO
Ameren Missouri

Sampling Event	Treatment	Percent Survival	
		Pimephales promelas	***Ceriodaphnia dubia***
July 2013	15% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%
July 2012	15% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%
July 2011	15% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%
July 2010	15% Effluent	98%	100%
	Reconstituted Control	100%	95%
	Upstream Control	100%	100%
July 2009	15% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%

Notes:
No significant difference (alpha = 0.5) between effluent and control survival data for any test.
Effluent passes all tests conducted between 2009 and 2013.
15% Effluent - Outfall 002 effluent mixed with Missouri River water.
Reconstituted Control - Laboratory reconstituted water.
Upstream Control - Missouri River water.

Figures



TITLE

SITE LOCATION AERIAL MAP

LEGEND

- Labadie Energy Center Property Boundary
- Proposed Landfill

NOTES

1.) Proposed landfill boundary outlines the proposed fence perimeter around the landfill.
2.) All boundaries and locations are approximate.

REFERENCES

1.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.
2.) Ameren Missouri Labadie Energy Center, Construction Permit Application (CPA) for Proposed Utility Waste Landfill (UWL), Solid Waste Disposal Area, Franklin County, Missouri, Revised November 2013.
3.) Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.

0 3,000 6,000
Feet

PROJECT

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

Golder Associates

PROJECT No. 130-1560			FILE No.	Figure_1 .mxd
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REVIEW	MNH	1/14/2014		

FIGURE 1

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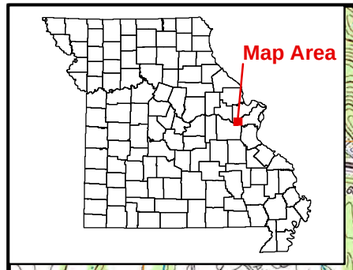

TITLE

SITE LOCATION TOPOGRAPHIC MAP

LEGEND

- Labadie Energy Center Property Boundary
- Proposed Landfill

NOTES

1.) Contour interval = 20 feet.
2.) Proposed landfill boundary outlines the proposed fence perimeter around the landfill.
3.) All boundaries and locations are approximate.

REFERENCES

1.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.
2.) Ameren Missouri Labadie Energy Center, Construction Permit Application (CPA) for Proposed Utility Waste Landfill (UWL), Solid Waste Disposal Area, Franklin County, Missouri, Revised November 2013.
3.) Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.
4.) Labadie, MO, 7.5 minute USGS Quadrangle Map, 2012.

0 3,000 6,000
Feet

PROJECT

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

PROJECT No. 130-1560			FILE No.		Figure_2.mxd
DESIGN	-	-	SCALE: AS SHOWN		REV. 0
GIS	JSI	1/14/2014	**FIGURE 2**		
CHECK	MWD	1/14/2014			
REVIEW	MNH	1/14/2014			

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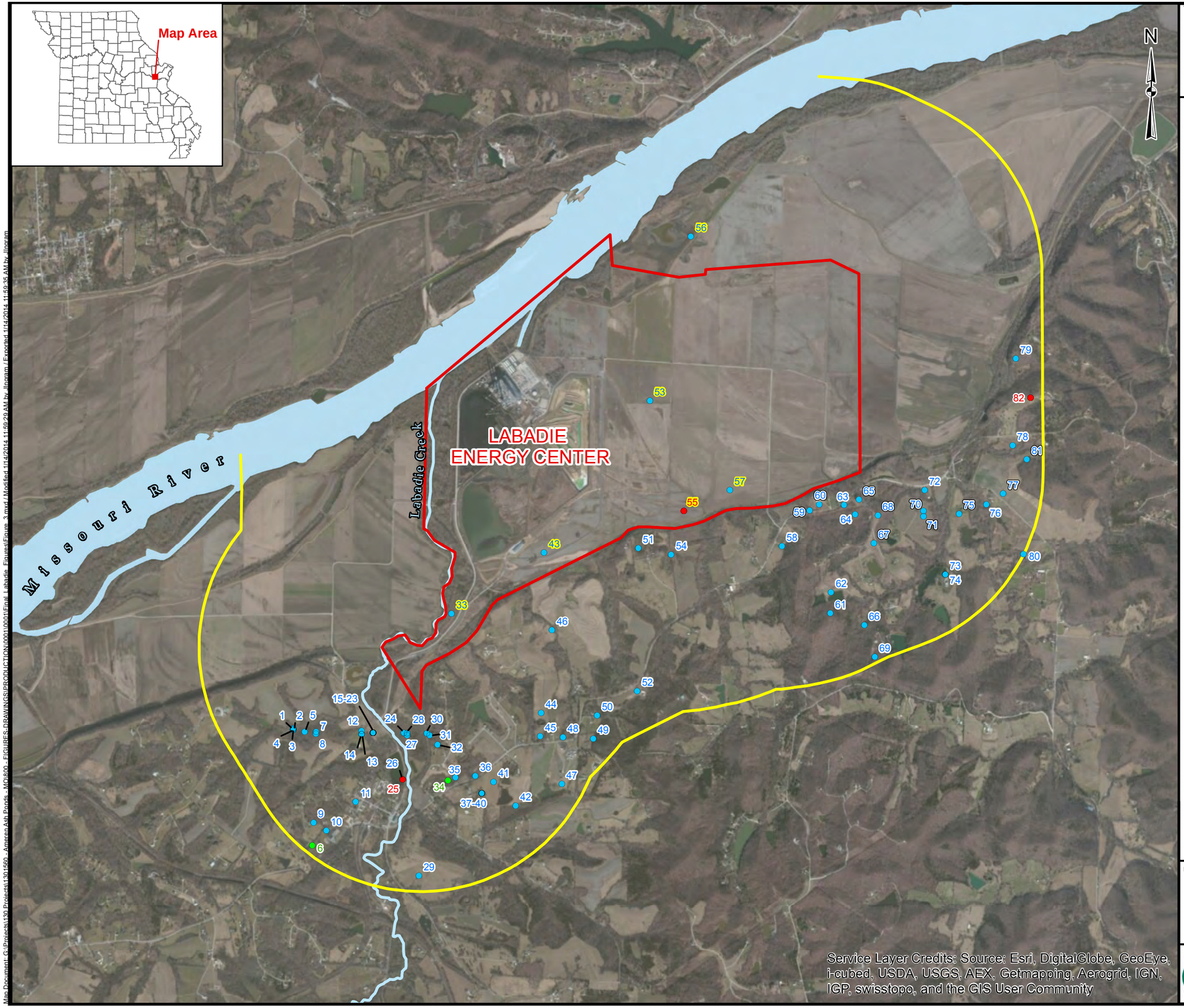
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



TITLE

PRIVATE WELL LOCATIONS WITHIN 1-MILE RADIUS OF FACILITY BOUNDARY

LEGEND

- Labadie Energy Center Property Boundary
- Approximate 1-Mile Radius
- Private Well
- Industrial Well
- Non-Community Public Well

*Yellow highlighted wells appear to be located incorrectly in the MDNR Wellhead Protection Database.

NOTES

1.) Search radius is approximately 1-mile beyond the Ameren Missouri Labadie Energy Center property boundary within Franklin County, Missouri.
2.) See Table 2 for details on wells within the 1-mile radius.
3.) Wells outside of the approximate 1-mile radius and those outside of Franklin County, Missouri are not shown.
4.) Yellow highlighted wells (33, 43, 53, 55, 56, 57) appear to be located incorrectly in MDNR Wellhead Protection Database. Further information for these wells is provided in Appendix B.
5.) This figure displays non-community public, private and industrial wells within approximately one mile of the Ameren Missouri Labadie Energy Center property boundary in Franklin County, Missouri; monitoring wells, soil borings, heat pump borings, stratigraphic test holes and abandonments are not displayed on this figure.
6.) All boundaries and locations are approximate. Wells are plotted according to database coordinates.
7.) MDNR - Missouri Department of Natural Resources.
8.) MSDIS - Missouri Spatial Data Information Service.

REFERENCES

1.) University of Missouri - Columbia - Department of Geography - MSDIS Database (MSDIS, 2013).
2.) Missouri Department of Natural Resources - Water Resources Center - Geologic Well Logs (MDNR, 2013c).
3.) Missouri Environmental Geology Atlas 2007 (MEGA) (MDNR, 2007).
4.) MDNR Wellhead Protection Program (MDNR, 2013b).
5.) Ameren Missouri Labadie Energy Center, Labadie Property. Control Map, November 2011.
6.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.

0 3,000 6,000 Feet

PROJECT

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

Golder Associates

PROJECT No. 130-1560			FILE No.	Figure_3.mxd
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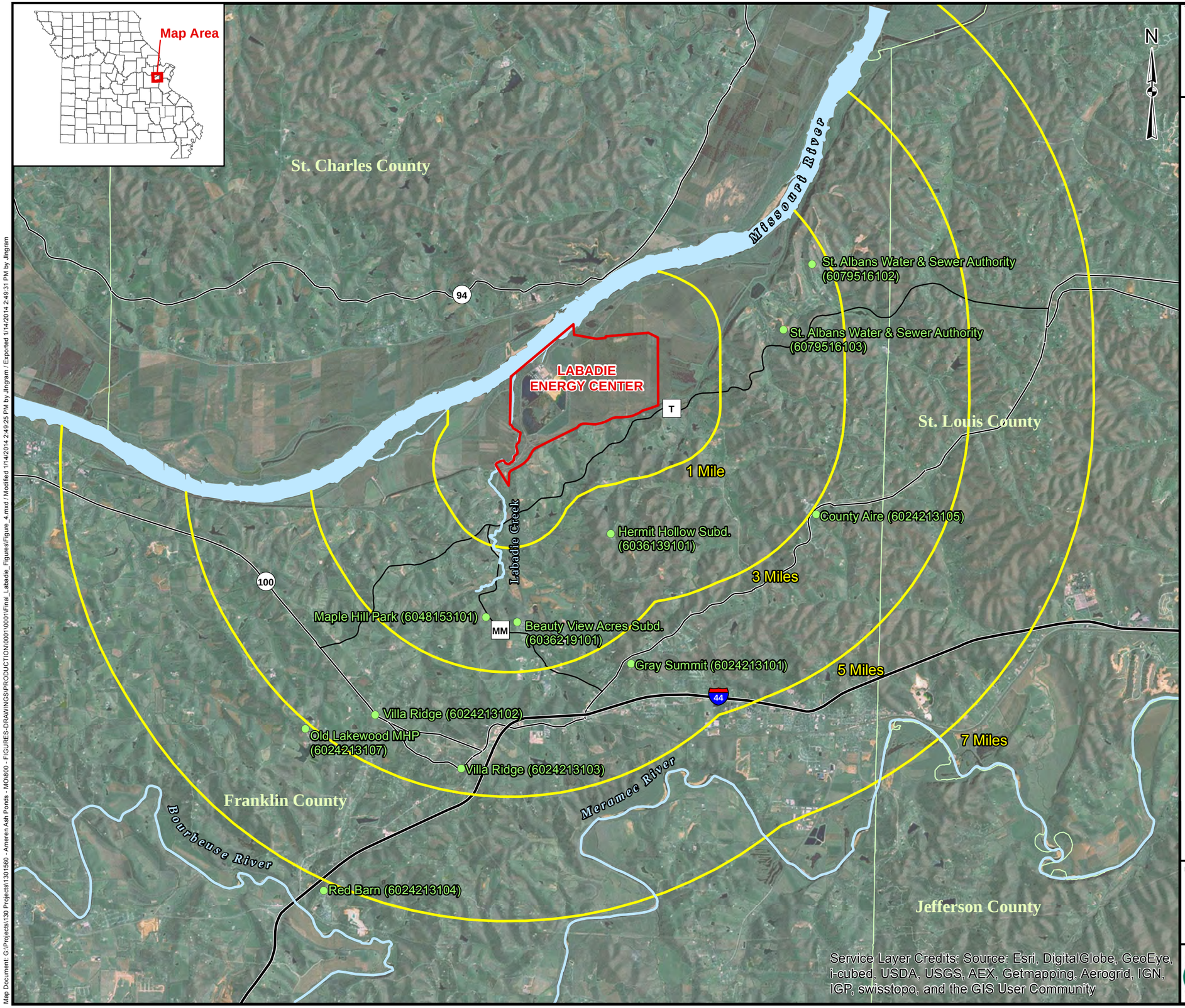
REVIEW	MNH	1/14/2014		

FIGURE 3



TITLE

PUBLIC WELL LOCATIONS WITHIN 7-MILE RADIUS OF FACILITY BOUNDARY

LEGEND

- Labadie Energy Center Property Boundary
- Approximate Distance from Property Boundary
- Public Wells

NOTES

1.) Wells are labeled with state issued well names or local names and extended public water supply (PWS) numbers.
2.) See Table 3 for details of wells listed in this figure.
3.) Figure displays active and emergency public wells near the Ameren Missouri Labadie Energy Center. Non-community public wells, proposed public wells and abandoned public wells are not shown.
4.) All boundaries and locations are approximate. Wells are plotted according to database coordinates.

REFERENCES

1.) The University of Missouri and Missouri Department of Natural Resources, Center for Applied Research and Environmental System (CARES), Public Drinking Water Systems Report Database (CARES, 2013).
2.) Missouri Environmental Geology Atlas (MEGA) 2007 (MDNR, 2007).
3.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.
4.) Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.

0 10,000 20,000 Feet

PROJECT

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

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PROJECT No. 130-1560			FILE No.	Figure_4.mxd
DESIGN	-	-	SCALE: AS SHOWN	REV. 0
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CHECK	MWD	1/14/2014		
REVIEW	MNH	1/14/2014		

FIGURE 4

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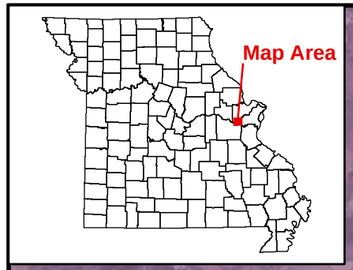

Missouri River

ALLUVIAL AQUIFER

Proposed Landfill

LABADIE ENERGY CENTER

BEDROCK AQUIFER

Labadie Creek

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

TITLE

REGIONAL GEOLOGY AND UPPERMOST AQUIFER MAP

LEGEND

- Labadie Energy Center Property Boundary
- Proposed Landfill
- Sand, Gravel, Silt, and Clay (Alluvial Deposits)
- Bedrock

NOTES

1.) This figure illustrates the uppermost groundwater aquifer. The bedrock aquifer consists of many geologic formations and is continuous and underlies the alluvial aquifer.
2.) Alluvial deposit is a general term for sand, gravel, silt, and clay materials deposited by streams and rivers.
3.) Proposed landfill boundary outlines the proposed fence perimeter around the landfill.
4.) All boundaries and locations are approximate.

REFERENCES

1.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.
2.) Missouri Environmental Geology Atlas (MEGA) 2007 (MDNR, 2007).
3.) Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.
4.) Ameren Missouri Labadie Energy Center, Construction Permit Application (CPA) for Proposed Utility Waste Landfill (UWL), Solid Waste Disposal Area, Franklin County, Missouri, Revised November 2013.

0 3,000 6,000 Feet

PROJECT

Ameren

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

Golder Associates

PROJECT No. 130-1560			FILE No.	Figure_5.mxd
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REVIEW	MNH	1/14/2014		

FIGURE 5

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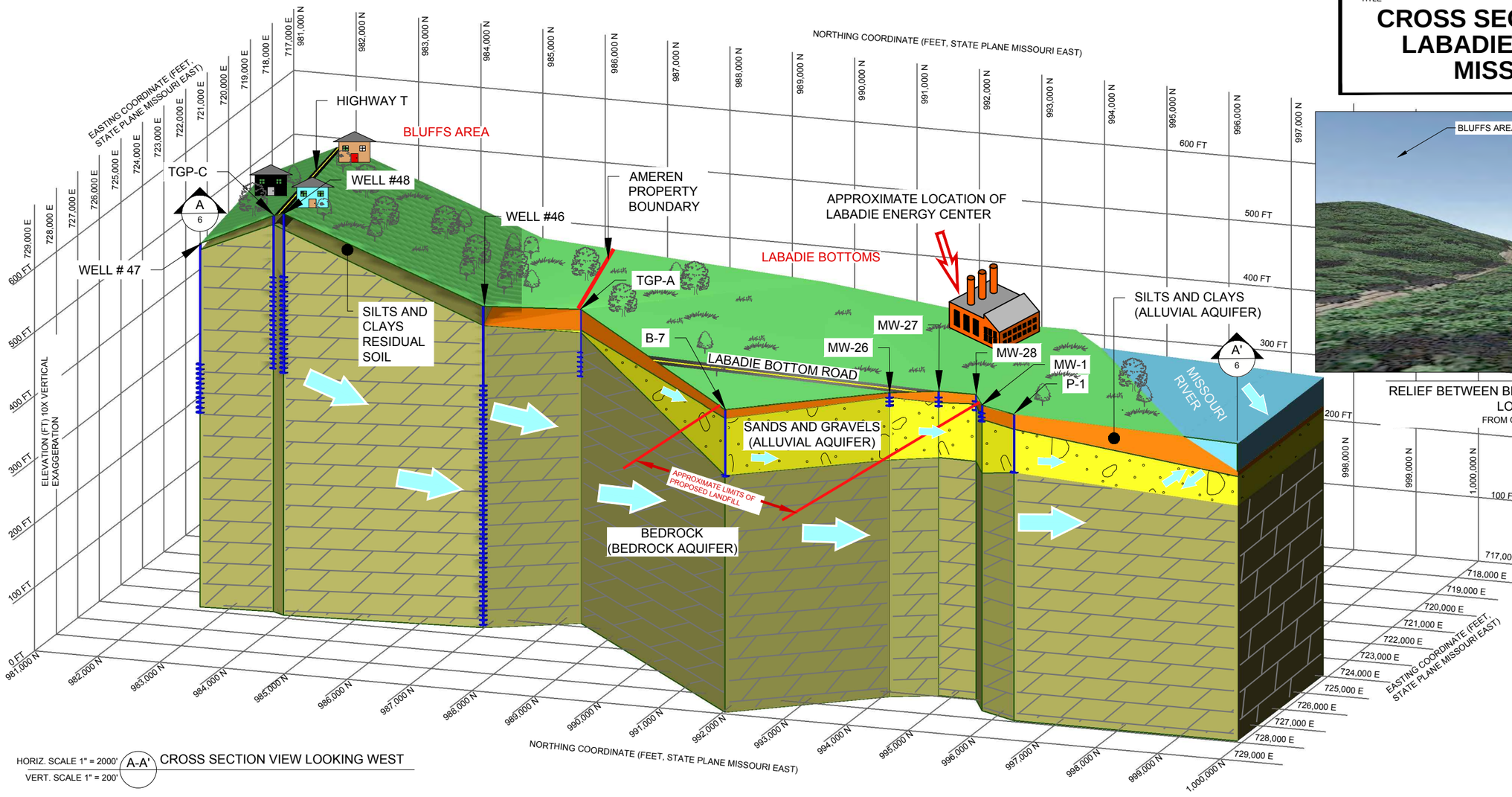
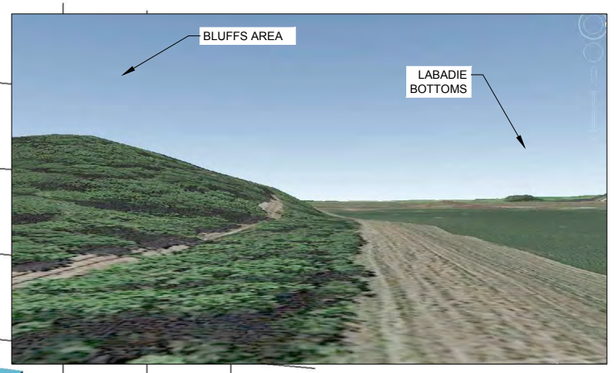
TITLE

CROSS SECTION OF BLUFFS, LABADIE BOTTOMS, AND MISSOURI RIVER



HORIZ. SCALE 1" = 2000'
VERT. SCALE 1" = 200'

A-A' CROSS SECTION VIEW LOOKING WEST



RELIEF BETWEEN BLUFFS AND LABADIE BOTTOMS LOOKING WEST
FROM GOOGLE EARTH IMAGE

LEGEND

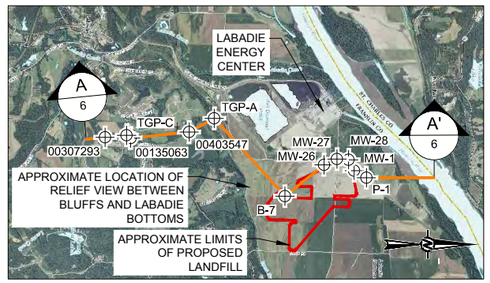
- BH — Available well and boring records located along section line
- Groundwater flow direction
- Well screen interval

NOTES

1.) Depth and composition of subsurface materials shown in cross section are approximate and conceptualized based on available borehole logs and well record forms.
2.) Ground surface topography was interpolated from USGS topographic contours.
3.) Cross section displays a 10x vertical exaggeration.
4.) Missouri River elevation was taken as 457 ft. above mean sea level based on the 0 ft. guage river level at the Washington, Missouri guage station recorded on the national weather service website (water.weather.gov).
5.) Elevations are feet above mean sea level using the navd88 datum.
6.) Locations are in the state plane coordinate system wgs84 datum. US survey feet. zone 2401 - Missouri East.
7.) P-1 and B-7 are borings not completed as wells and are included to show alluvial thickness.
8.) The bedrock aquifer consists of multiple rock types including dolomite, sandstone, limestone and shale.

REFERENCES

1.United States Geological Survey (USGS) 7.5-minute series quadrangle map of Labadie, Missouri - 2012.
2.) Golder Associates Inc. (2012) Report on Piezometer Installations, Water Level Monitoring, and Groundwater Sampling, Labadie, Missouri. May 9, 2012 (Golder, 2012).
3.) Missouri Department of Natural Resources (MDNR) Wellhead Protection Program Database of Private Wells (MDNR, 2013b).
4.) Reitz & Jens. Ground Water Detection Monitoring Well Installation Report. May 9, 2013. Ameren Missouri, Labadie Energy Center (Reitz & Jens, 2013c).
5.) Reitz & Jens. Summary of Geotechnical Investigation. November 10, 2010. Ameren Missouri, Labadie Energy Center (Reitz & Jens, 2010).
6.) Google Earth image downloaded on December 19, 2013.



CROSS SECTION LOCATION

PROJECT

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

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CHECK	BEF	12/30/13		
REVIEW	MNH	01/14/14		

FIGURE 6

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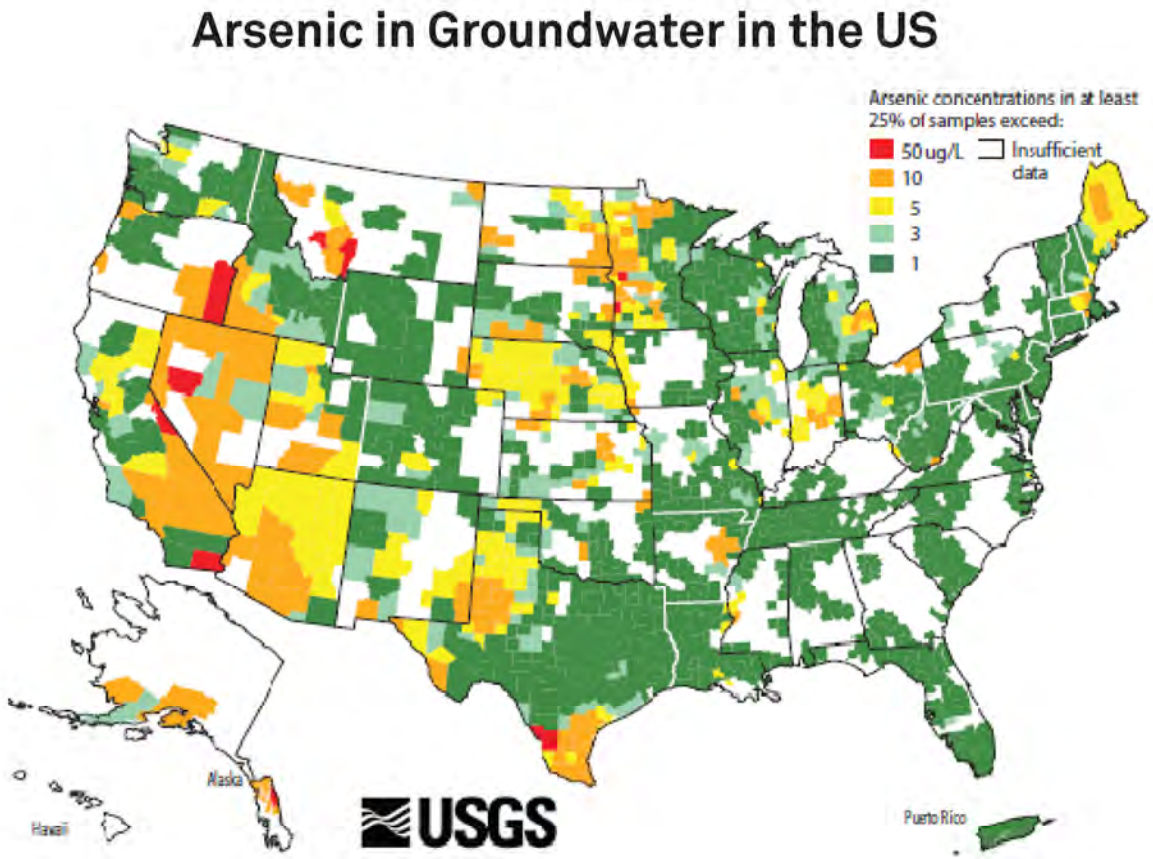
Figure 7
Arsenic is Present in our Natural Environment –

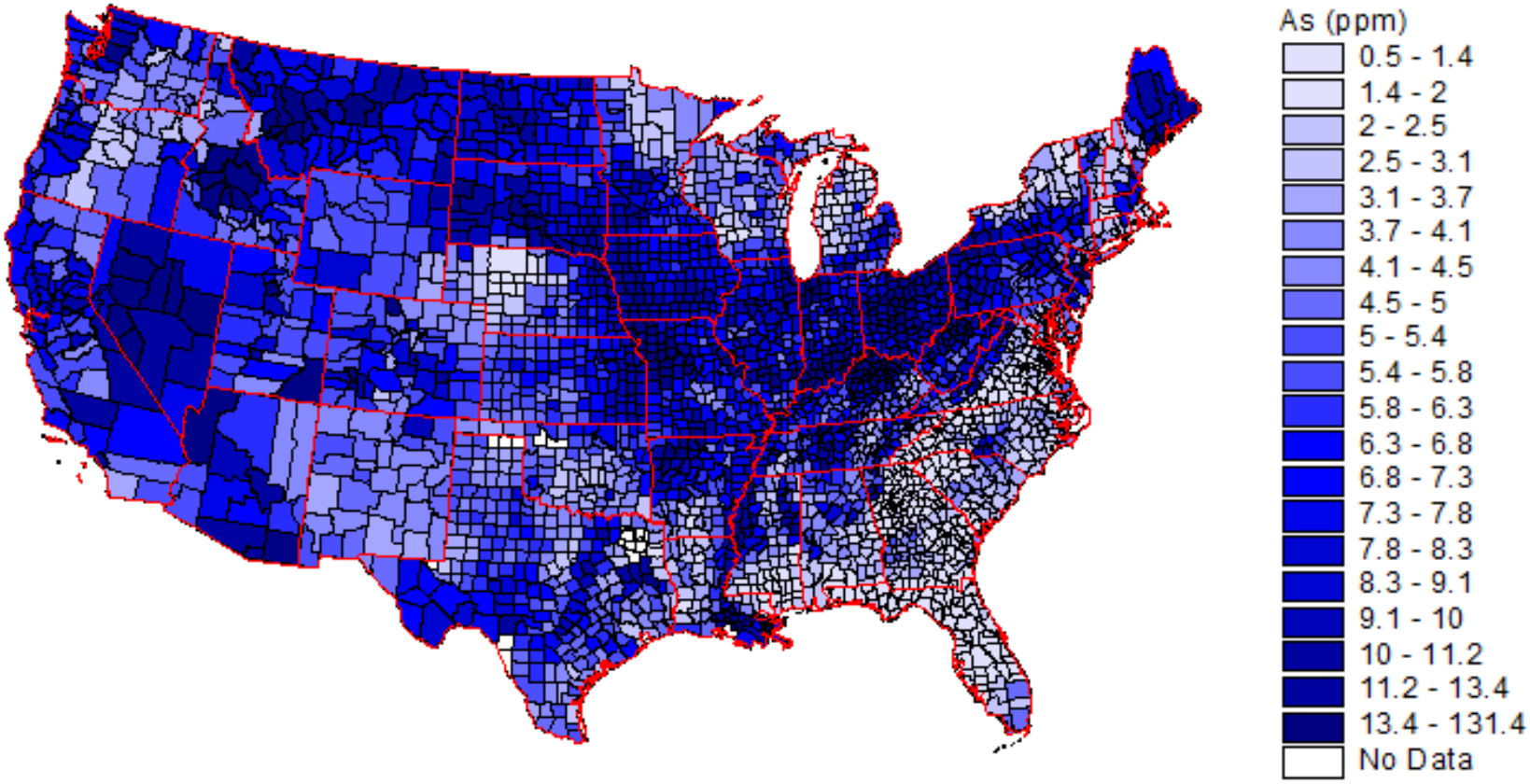


The USEPA regional screening level for arsenic in tapwater at a 1 in one million risk level is 0.045 µg/L.

Sources:

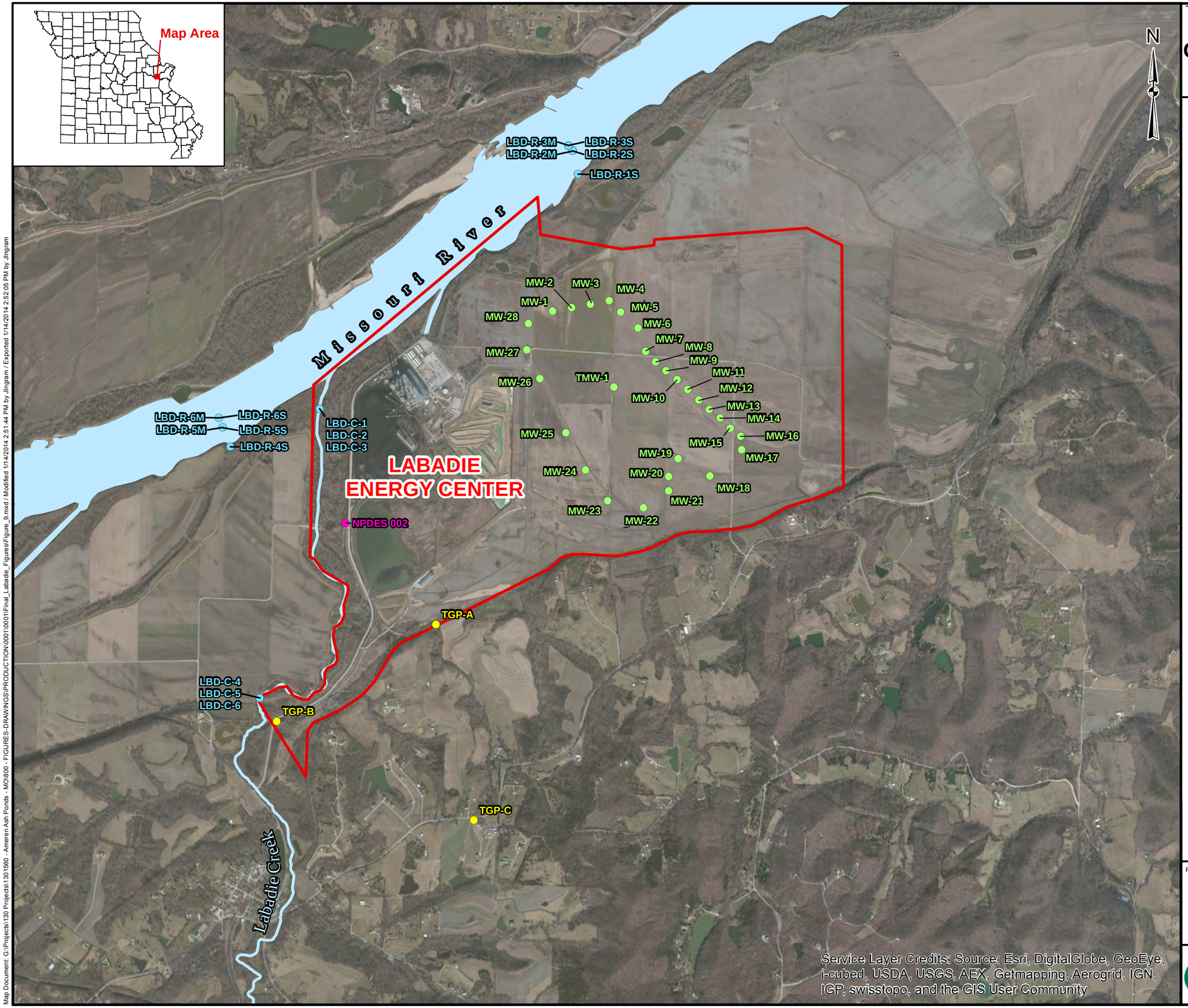
- **Groundwater. USGS, 2001. Trace Elements National Synthesis Project. http://water.usgs.gov/nawqa/trace/pubs/geo_v46n11/fig2.html**
- **USEPA, 2010. Regional Screening Level Table. May 2010. http://www.epa.gov/region09/superfund/prg/index.html**

Figure 8
Arsenic is Present in our Natural Environment – Background Levels in Soils in the U.S.



The USEPA regional screening level for arsenic in residential soil at a one in one million risk level is 0.61 mg/kg. Thus the arsenic concentration in the majority of the soils in the U.S. are above the one in one million risk level.

Source: USGS. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm



TITLE

SURFACE WATER AND GROUNDWATER INVESTIGATIONS SAMPLE LOCATIONS

LEGEND

- Labadie Energy Center Property Boundary
- Shallow (Alluvial) Groundwater Sample Locations
- Bedrock Groundwater Sample Locations
- Surface Water Sample Locations
- NPDES Outfall Sample Location

NOTES

1.) Sample locations for surface water samples were obtained during sampling using a Trimble GeoXH GPS unit.
2.) Sample locations for the alluvial aquifer were surveyed by KDG, Inc.
3.) Sample locations for the bedrock aquifer were surveyed by Zahner & Associates.
4.) Sample location for NPDES 002 is from the Missouri Environmental Geology Atlas (MEGA) 2007 database.
5.) NPDES = National Pollutant Discharge Elimination System.
6.) Alluvial deposit is a general term for sand, gravel, silt, and clay materials deposited by streams and rivers.
7.) All boundaries and locations are approximate.

REFERENCES

1.) COORDINATE SY STEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.
2.) Golder. 2012. Report on Piezometer Installation, Water Level Monitoring, and Groundwater Sampling, Labadie Missouri (Golder, 2012).
3.) Reitz & Jens. 2013a. Groundwater Monitoring Report – 1st Back ground Sampling Event – April 16-17, 2013. Ameren Missouri, Labadie Energy Center (Reitz & Jens, 2013a).
4.) Reitz & Jens. 2013b. Groundwater Monitoring Report – 2nd Back ground Sampling Event – August 19-21, 2013. Ameren Missouri, Labadie Eneregy Center (Reitz & Jens, 2013b).
5.) Reitz & Jens. 2013c. Ground Water Detection Monitoring Well Installation Report - May 9, 2013. Ameren Missouri, Labadie Energy Center (Reitz & Jens, 2013c).
6.) Missouri Environmental Geology Atlas (MEGA) 2007 (MDNR, 2007).
7.) United States Environmental Protection Agency (USEPA), Envirofacts, Integrated Compliance Information System (ICIS) Database (USEPA, 2013b).
8.) Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.

0 3,000 6,000 Feet

PROJECT

Ameren

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

Golder Associates

PROJECT No. 130-1560			FILE No.	Figure_9.mxd
DESIGN	-	-	SCALE: AS SHOWN	REV. 0
GIS	JSI	1/14/2014	FIGURE 9	
CHECK	MWD	1/14/2014		
REVIEW	MNH	1/14/2014		

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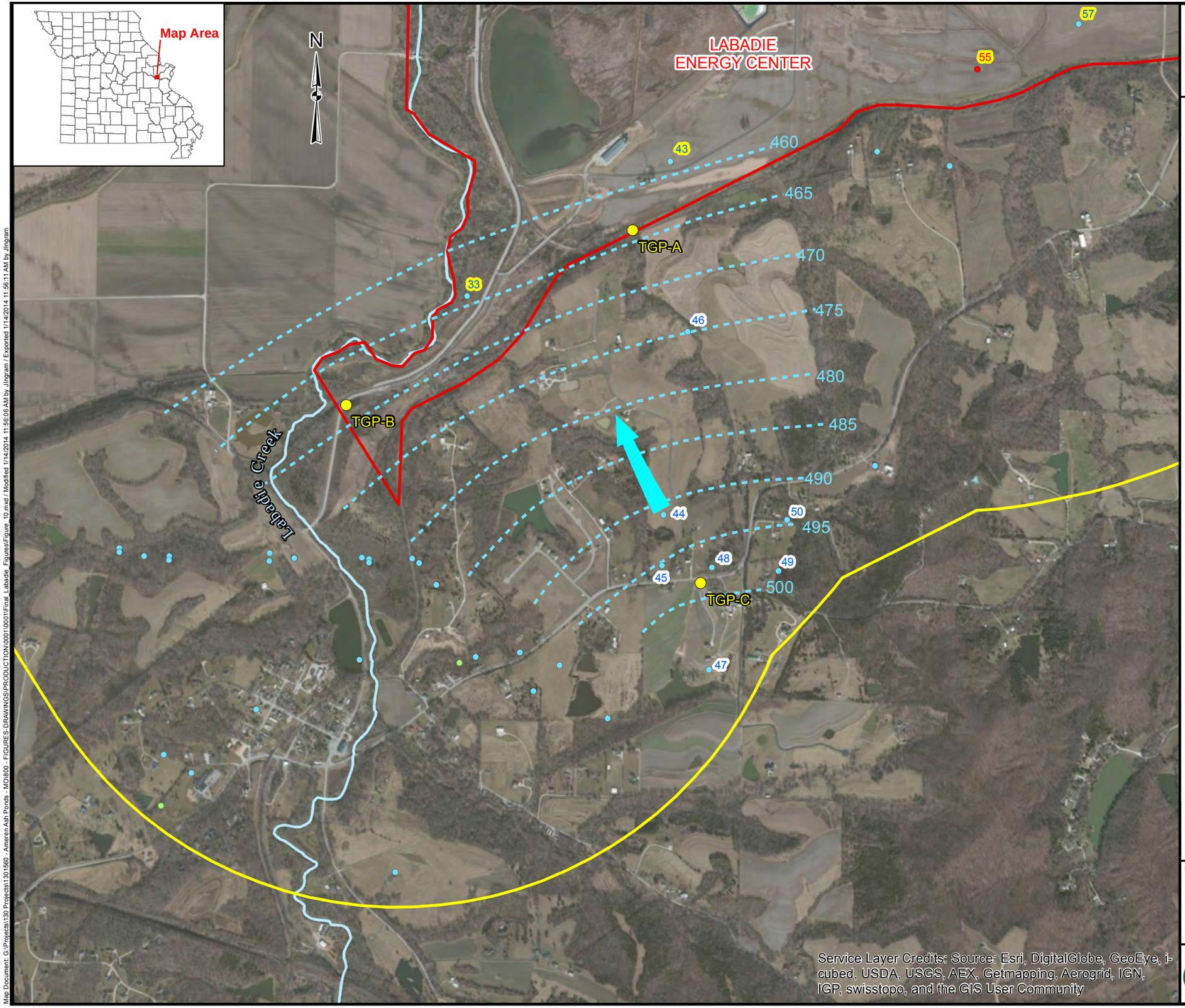

TITLE

BEDROCK GROUNDWATER INVESTIGATION - LOCATION OF INVESTIGATION WELLS AND NEARBY PRIVATE WELLS

LEGEND

- Labadie Energy Center Property Boundary
- Approximate 1-Mile Radius
- Industrial Well
- Private Well
- Non-Community Public Well
- Bedrock Aquifer Piezometer and Sample Well
- Bedrock Groundwater Potentiometric Surface Contours (Feet above MSL)
- Groundwater Flow Direction

*Yellow highlighted wells appear to be located incorrectly in the MDNR Wellhead Protection Database.

NOTES

1.) Wells outside of the approximate 1-mile radius are not shown for clarity.
2.) Figure displays non-community public, private, and industrial wells within approximately 1-mile of the Ameren Missouri Labadie Energy Center in Franklin County, Missouri. This figure also displays piezometer monitoring wells from Golder (2012). All other monitoring wells, soil borings, heat pump borings, stratigraphic test holes and abandonments are not shown.
3.) Yellow highlighted wells (33, 43, 55, 57) appear to be located incorrectly in MDNR Wellhead Protection Database. Further information for these wells is provided in Appendix B.
4.) All boundaries and locations are approximate. Wells are plotted according to database coordinates.
5.) Private wells near TGP-C are labeled for illustration purposes.
6.) MSL = Mean Sea Level.
7.) Bedrock groundwater potentiometric surface contours are from Golder (2012) Groundwater Potentiometric Surface Map. Groundwater elevations were measured on April 12, 2012.
8.) MDNR - Missouri Department of Natural Resources.
9.) MSDIS - Missouri Spatial Data Information Service.

REFERENCES

1.) University of Missouri - Columbia - Department of Geography - MSDIS Database (MSDIS, 2013).
2.) Missouri Department of Natural Resources - Water Resources Center - Geologic Well Logs (MDNR, 2013c).
3.) Missouri Environmental Geology Atlas 2007 (MEGA) (MDNR, 2007).
4.) MDNR Wellhead Protection Program (MDNR, 2013b).
5.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.
6.) Golder. 2012. Report on Piezometer Installation, Water Level Monitoring, and Groundwater Sampling, Labadie Missouri (Golder, 2012)
7.) Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.

0 2,000 4,000 Feet

PROJECT

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

Golder Associates

PROJECT No. 130-1560			FILE No.	Figure_10.mxd
DESIGN	-	-	SCALE: AS SHOWN	REV. 0
GIS	JSI	1/14/2014	FIGURE 10	
CHECK	MWD	1/14/2014		
REVIEW	MNH	1/14/2014		

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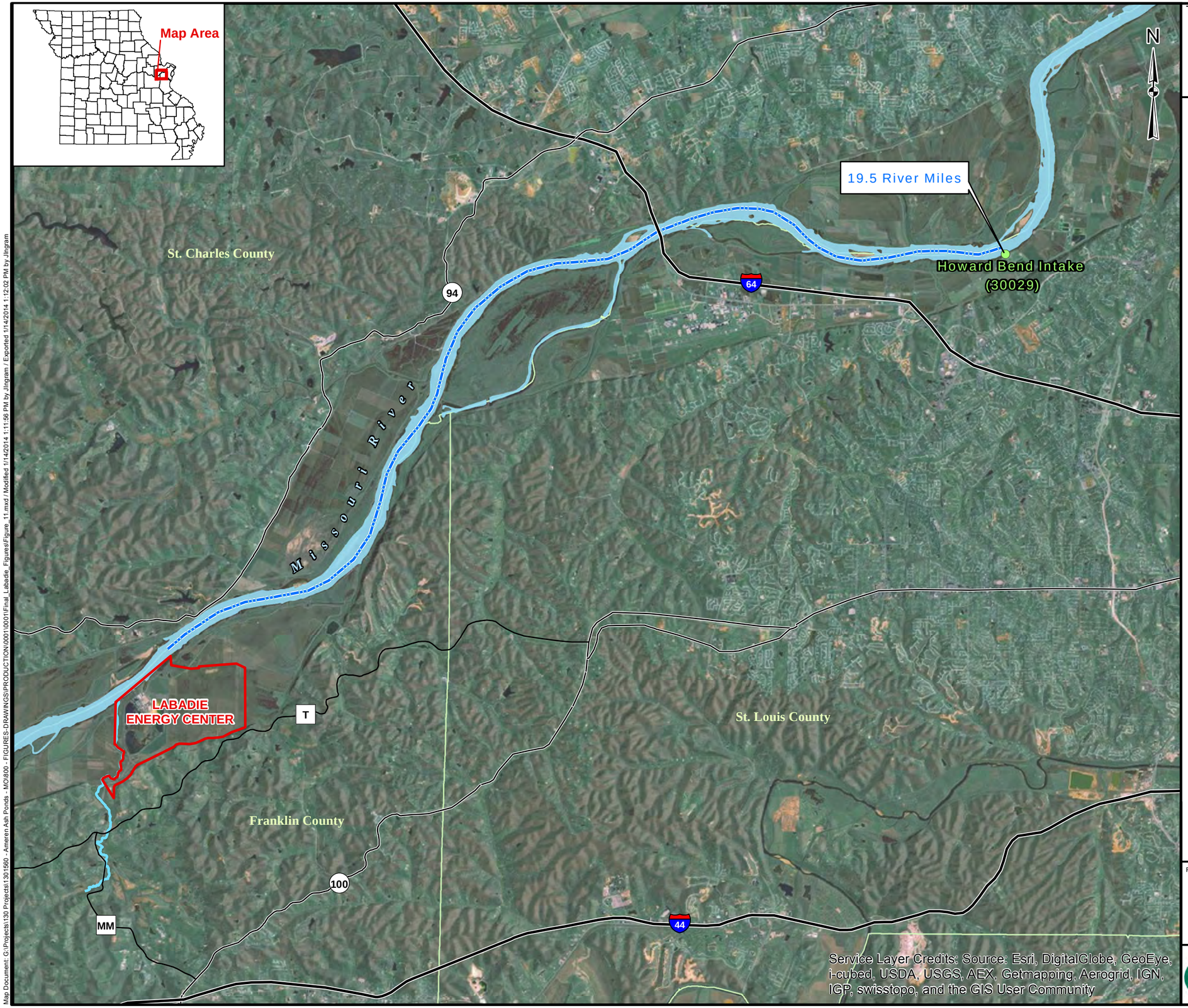

TITLE

NEAREST DOWNSTREAM DRINKING WATER INTAKE

LEGEND

- Labadie Energy Center Property Boundary
- Approximate River Distance
- Water Intake

NOTES

1.) Water intakes labeled with the Missouri Public Water Supply Local Intake Name and Identification Number (Intake ID).
2.) All boundaries and locations are approximate.

REFERENCES

1.) Missouri Department of Natural Resources - Source Water Assessment Plan (MDNR, 2013d)
2.) Census of Missouri Public Water Systems (MDNR, 2000).
3.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.
4.) Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.
5.) The University of Missouri and Missouri Department of Natural Resources, Center for Applied Research and Environmental System (CARES), Public Drinking Water Systems Report Database (CARES, 2013).

0 2 4 Miles

PROJECT

Ameren

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

Golder Associates

PROJECT No. 130-1560			FILE No.	Figure_11.mxd
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CHECK	MWD	1/14/2014		
REVIEW	MNH	1/14/2014		

FIGURE 11

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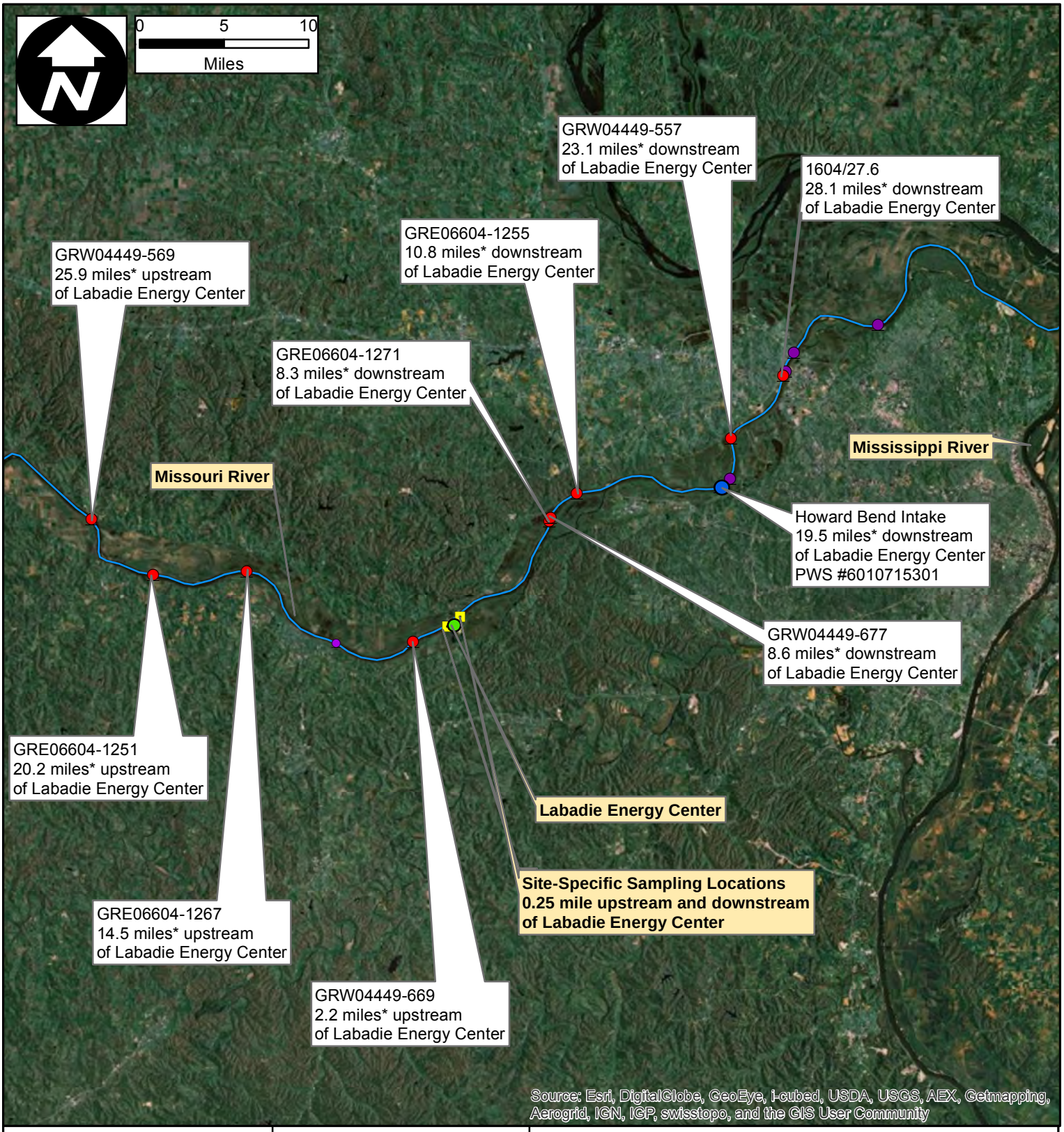


AECOM

Created On: 10/30/2013

Created by: C. Puopolo

Project #: 60307162.1

Figure 12

Missouri River Water Quality Monitoring Stations

Labadie Energy Center
Franklin County, MO
Ameren Missouri

Legend

- Labadie Energy Center
- Ameren Missouri Upstream and Downstream Data Collection Points
- Missouri River

Publicly Available Data Sources

- Public Water Intake - Howard Bend
- Water Monitoring Locations - Water Monitoring Data Available from STORET
- Water Monitoring Locations - No applicable data available at this location from STORET

Notes:
1.) * Approximately
2.) Water Monitoring Locations GIS shapefile is available from USEPA Surf Your Watershed via http://epamap32.epa.gov.
3.) Imagery - Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Figure 13
Howard Bend Intake - St. Louis City Water System - 5-Mile Upstream Limit for Potential Sources
Labadie Energy Center, Franklin County, MO
Ameren Missouri

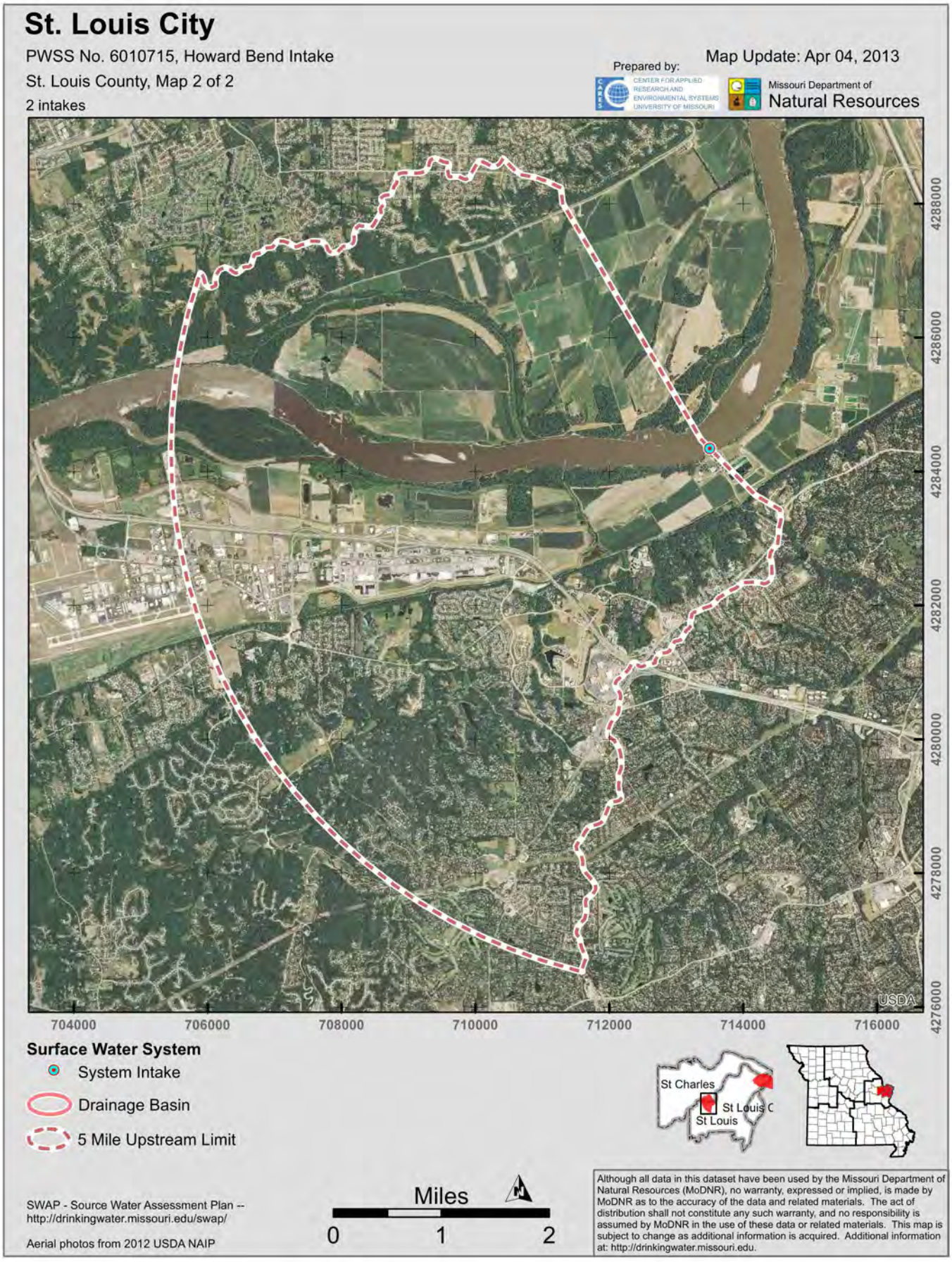
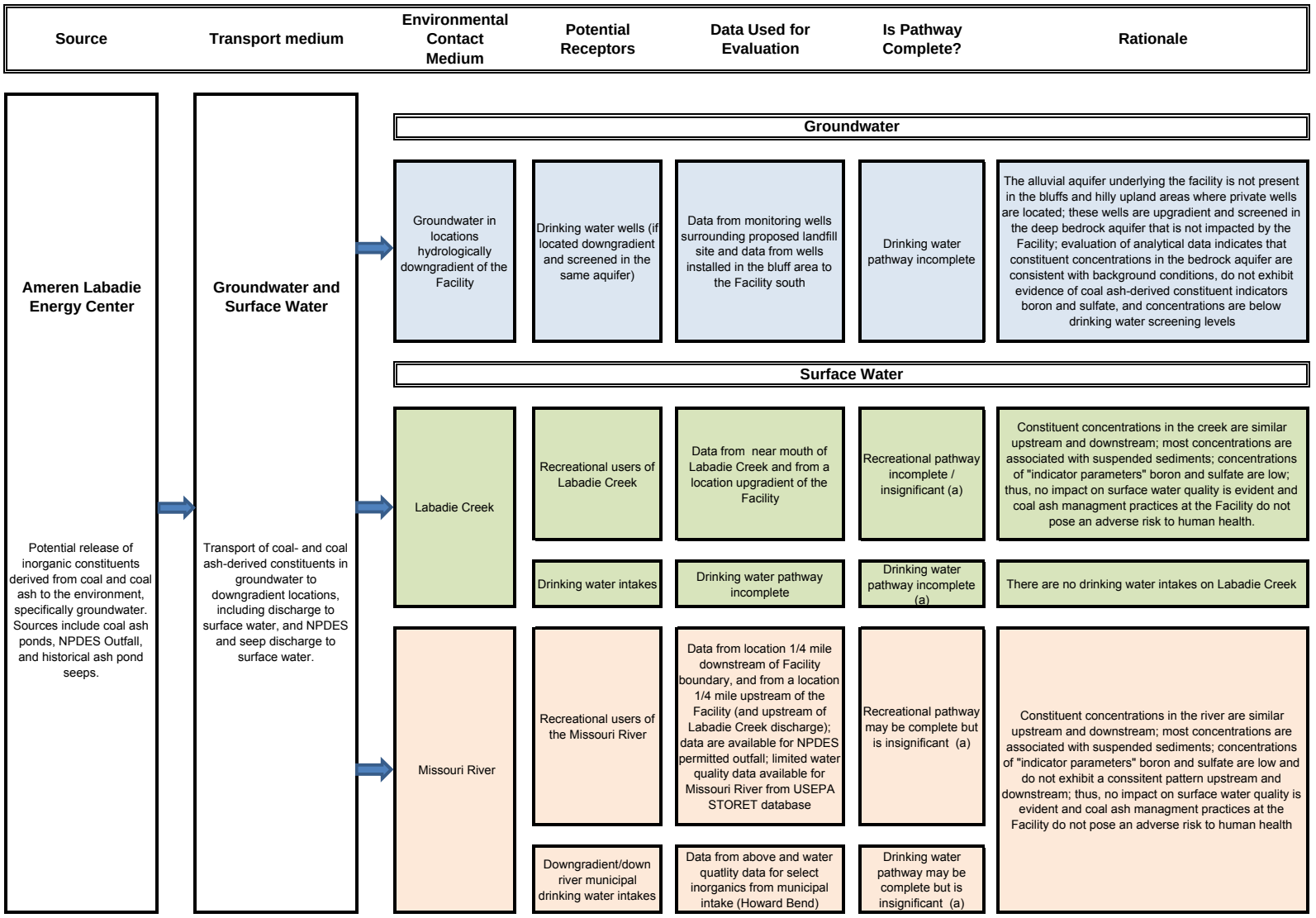


Figure 14
Conceptual Site Model
Labadie Energy Center, Franklin County, MO
Ameren Missouri



Notes:

(a) - An exposure pathway is complete only if there is a source→ transport → medium → exposure linkage. If an exposure pathway is complete, but the magnitude, or concentration of the chemical in the environmental medium is below health risk-based levels, then the exposure would not pose an adverse risk. Thus an exposure pathway could be complete but be insignificant on a health-risk basis.

Appendix A

Constituents Present in Coal Ash and in Our Natural Environment

Appendix A

Constituents Present in Coal Ash and in Our Natural Environment

It is important to understand what constituents are present in coal ash, which can be released to the environment, and to understand the natural occurrence of these constituents in our environment.

Coal is a type of sedimentary rock that is a natural component of the earth's crust and the inorganic minerals and elements it contains are also naturally occurring. It is the organic component of coal that burns and produces energy, and it is the inorganic minerals and elements that remain after combustion the make up the coal ash, or coal combustion products (CCPs).

A.1 Major, Minor and Trace Constituents in Coal Ash

All of the inorganic minerals and elements that are present in coal ash are also present in our natural environment. This is one fact that that the public seems either not to understand or will not acknowledge. **Figure A-1** shows the major and minor components of fly ash, bottom ash, volcanic ash, and shale. It is important to understand that the constituents that are the focus of many of the concerns expressed by the public about the toxicity of coal ash (e.g., lead, arsenic, mercury, cadmium, selenium, etc.) are trace elements, so called because they are present in such low concentrations (in the mg/kg or part per million (ppm) range). Together, the trace elements generally make up less than 1 percent of the total mass of these materials. To put these concentrations into context, a mg/kg or ppm is equivalent to:

- 1 penny in a large container holding $10,000 worth of pennies, or
- 1 second in 11.5 days, or
- 1 inch in 15.8 miles

These trace elements have been referred to by the public and even in the popular press as "toxic"—without any context provided for what this means. Moreover, claims have been made that there is no safe level of exposure to any of these elements.

This is simply not true, and there are two important facts that must be understood to put this in context. The first relates to background levels of constituents in our environment and the second relates to toxicity.

A.2 Background Levels in Soils

The first fact that must be understood is that all of the constituents present in coal ash occur naturally in our environment. U.S. Geological Survey (USGS) data demonstrate the presence of these constituents in the soils across the U.S. Prime examples include arsenic, lead, mercury and selenium. With respect to arsenic, **Figure A-2** shows the range of background levels of arsenic in soils across the U.S., as published by the USGS. The USGS is conducting a "national geochemical survey" to identify background levels of elements in soils in the U.S. (USGS, 2013). **Figures A-3 – A-6** provide maps prepared by the USGS demonstrating the naturally-occurring presence of other trace elements in soils in the U.S., including aluminum and copper (**Figure A-3**), iron and lead (**Figure A-4**), manganese and mercury (**Figure A-5**), and selenium and zinc (**Figure A-6**).

These soils are found in our backyards, schools, parks, etc., and because of their presence in soil, these constituents are also present in the foods we eat. Some of these constituents are present in

our vitamins, such as manganese and selenium. Thus, we are exposed to these trace elements in our natural environment every day, and in many ways.

A.3 Toxicity and Risk

The second fact is that all constituents and materials that we encounter in our natural environment can be toxic, but what determines whether a toxic effect actually occurs is how one is exposed to the constituent, the amount of material to which one may be exposed, and the timing and duration of that exposure. Without sufficient exposure the science tells us that there are no toxic effects. Put another way, when a toxic effect is demonstrated by a particular constituent, it is generally caused by high levels of exposure over a long-term duration. The fundamental principles here are:

- All constituents can exert toxic effects (from aspirin[3] to table salt to water to minerals).
- For such toxic effects to occur, exposure must occur at a sufficiently high level for a sufficiently long period of time.
- If there is no exposure, there is no risk.

A.4 Risk-Based Screening Levels

The U.S. Environmental Protection Agency (USEPA) uses information on the potential toxicity of constituents to identify concentrations of trace elements in soil in a residential setting that are considered by USEPA to be protective for humans (including sensitive groups) over a lifetime (USEPA, 2013). Specifically, residential soil screening levels are levels that are protective of a child and adult's daily exposure to constituents present in soil or a solid matrix over a residential lifetime. In the context of regulatory decision making, at sites where constituent concentrations fall below these screening levels, no further action or study is warranted under the federal Superfund program. Missouri Department of Natural Resources also applies this concept to the development of screening levels in its Risk-Based Corrective Action program (MDNR, 2006).

Figure A-7 shows USEPA's residential soil screening levels for a variety of trace elements that are present in coal ash. USEPA considers it to be safe for children to be exposed to these concentrations of each of these trace elements in soils on a daily basis, throughout their lifetime. What this tells us is that by developing these residential soil screening levels, USEPA considers the presence of these levels of these constituents in soils to be safe for humans, even for exposure on a daily basis. It is, therefore, simply not true that there are no safe levels of exposure to these constituents.

A.5 Comparison of Coal Ash Constituent Concentrations to Risk-Based Screening Levels and Background

A comparison of constituent concentrations in coal ash, as reported by the USGS (USGS, 2011a) to USEPA's risk-based screening levels for residential soil indicates that with only a few exceptions, constituent concentrations in coal ash are below screening levels developed by the USEPA for residential soils, and are similar in concentration to background U.S. soils. Details of this evaluation are provided in the report titled "Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS

[3] For example, if one takes two aspirin every four hours as directed, aspirin is not toxic. If one takes the entire bottle at once, the aspirin is very toxic.

Coal Ash Data from Five US Power Plants" (AECOM, 2012). The study is available at: http://www.acaa-usa.org/associations/8003/files/ACAA_CoalAshMaterialSafety_June2012.pdf.

Figure A-8 is an updated chart from this study comparing ranges of trace element concentrations in fly ash produced from coal from the Powder River Basin in Wyoming (the same type of coal used at Labadie) to USEPA screening levels, and to background levels in soils in the U.S. The USEPA screening levels for residential soils are shown as the green vertical bars, the ranges for the Wyoming coal fly ash are shown in purple on top of the green vertical bars, and the ranges of background levels in U.S. soils are shown in the grey bars. What this figure shows is that all but one of the constituents are present in the Wyoming fly ash at concentrations that are below the USEPA residential soil screening levels; and for cobalt, the concentration range is only marginally above the screening level. As noted in detail in the report itself, the toxicity value upon which the USEPA soil screening level for cobalt is based is two levels of magnitude lower than what has been derived by other regulatory agencies; thus a much higher health protective soil screening level for cobalt exists. What the data also show is that constituent concentrations in coal ash are not that different from concentrations in soils in the U.S.

The results are similar for all of the coal ashes evaluated in the report (AECOM, 2012). The evaluation in the report included not only the simple comparison of constituent concentrations in coal ash to USEPA screening levels, but also provided a detailed cumulative risk screen for each coal ash data set to account for potential additive effects of combined exposures to the trace elements in coal ash. The results confirm the simple screening results, which indicate that no significant risk would be posed by direct exposure to coal ash in a residential setting.

Thus, by considering the levels of trace elements in coal ash in comparison to the background levels in soils in the U.S., and in comparison to the USEPA screening levels for these constituents in residential soil, screening levels that are protective of daily exposure to soils by children and adults, including sensitive subgroups, it is concluded that even daily direct contact to trace elements in coal ash would not pose a significant risk to human health.

A.6 Background Levels in Groundwater

Because these constituents are naturally present in soils and rocks, they are also naturally present in our groundwaters and surface waters. The USGS has published a report titled "Trace Elements and Radon in Groundwater Across the United States" (USGS, 2011b). Just as for soil, it is important to understand that there are background levels of constituents in groundwater. Constituent concentrations in groundwater that is upgradient of a source represent background conditions. To demonstrate a release to groundwater by a source, concentrations downgradient of the source must be greater than the background/upgradient concentrations at a statistically significant level for a consistent period of time.

The same concept applies to surface water. These same constituents are naturally present in surface water due to discharge of groundwater to surface water and the effect of erosion of soil into our surface waters. To demonstrate an effect of a source on surface water, the concentrations downgradient/downstream of the source must be greater than the background/upstream concentrations at a statistically significant level for a consistent period of time.

Constituents in groundwater and surface water can be in a dissolved form, or they can be adhered to or part of a soil or sediment particle. Movement of these particles in groundwater is generally more difficult because of the presence of the soil and rock that the groundwater must move through. Surface water is constantly impacted by erosion of soils, thus in surface water, it is much more

common for constituents to be bound to particles rather than dissolved in the water. For this reason, it is important to evaluate both total concentrations of constituents in water (which represents constituents dissolved in the water and as part of a soil or sediment particle) and the dissolved component (by filtering out the soil/sediment particles).

A.7 Toxicity Evaluation for Cobalt and Chromium

A.7.1 Cobalt

Cobalt is the only constituent in the Powder River Basin coal ash (the coal that is used at the Labadie Energy Center) with concentrations above the USEPA screening level for residential soils. There is much uncertainty associated with the USEPA dose-response value for cobalt, and with the resulting screening level for residential soil. The World Health Organization (WHO) indicates that "there are no suitable data with which to derive a tolerable intake for chronic ingestion of cobalt" (WHO, 2006). Agency for Toxic Substances and Disease Registry (ATSDR, 2004) states that "adequate chronic studies of the oral toxicity of cobalt or cobalt compounds in humans and animals are not presently available." However, using a short-term study in six human volunteers, ATSDR (2004) derived an intermediate-term (15–364 days) minimal risk level (MRL) of 0.05 mg/kg-day. The "adverse" effect was identified as increased red blood cell count, although it is also noted that cobalt is used as a treatment for anemia (low red blood cell count). ATSDR also notes that "Since cobalt is naturally found in the environment, people cannot avoid being exposed to it. However, the relatively low concentrations present do not warrant any immediate steps to reduce exposure." WHO notes that the largest source of exposure to cobalt for the general population is the food supply; the estimated intake from food is 5–40 ug/day, most of which is inorganic cobalt (WHO, 2006). Expressed on a mg/kg-day basis, this is 0.00007–0.0005 mg/kg-day from the diet.

USEPA however has derived a Provisional Peer-Reviewed Toxicity Value (PPRTV) for cobalt of 0.0003 mg/kg-day, this is two orders of magnitude lower than the ATSDR intermediate term MRL, and is higher that most dietary intake estimates. Thus the RSL for cobalt for residential soil is much lower than values derived by other regulatory bodies.

A.7.2 Hexavalent Chromium

The data provided by USGS (2011a) for chromium is for total chromium in the samples; the Ameren data for groundwater and surface water are also based on analysis of total chromium. Many metals can exist in different oxidation states; for some metals, the oxidation state can have different toxicities. This is the case for chromium. Chromium exists in two common oxidation states: trivalent chromium (chromium-3, Cr(III) or Cr+3), and hexavalent chromium (chromium-6, Cr(VI) or Cr+6). Trivalent chromium is essentially nontoxic, as evidenced by its RSL of 120,000 mg/kg. It can be bought over-the-counter as a supplement, and is included in most vitamins. Hexavalent chromium has been concluded to be a human carcinogen by the inhalation route of exposure (USEPA, 2014a).

Currently on USEPA's toxicity database, the Integrated Risk Information System (IRIS) (USEPA, 2014a), the primary source of dose-response information for risk assessment and for the RSL tables, an oral reference dose is available for trivalent chromium, and IRIS provides an inhalation IUR for potential inhalation carcinogenic effects and an oral reference dose and inhalation reference concentration for hexavalent chromium. The oral noncancer dose-response value for hexavalent chromium is based on a study where no adverse effects were reported; thus the target endpoint is identified as "none reported."

Recent studies by the National Toxicology Program (NTP) have shown that when present in high concentrations in drinking water, hexavalent chromium can cause gastrointestinal tract tumors in mice (NTP, 2008). IRIS does not present an oral CSF for hexavalent chromium; a value developed by the New Jersey Department of Environmental Protection (NJDEP, 2009) was used in the development of the RSLs. USEPA developed a draft oral cancer dose-response value for hexavalent chromium, based on the same study and was the same as the NJDEP value. However, it should be noted that USEPA's Science Advisory Board (SAB) provided comments in July 2011 on the draft USEPA derivation of the oral CSF for hexavalent chromium and indicated many reservations with the assumptions of mode of action, and in the derivation itself. The SAB review can be accessed at http://cfpub.epa.gov/ncea/iris_drafts/recordisplay.cfm?deid=221433. Thus, the value used to develop the RSLs for hexavalent chromium has been called into question by USEPA's peer review panel. Currently there is much scientific debate about whether the mode of action of hexavalent chromium in very high concentrations in drinking water is relevant to the low concentrations most likely to be encountered in environmental situations (Proctor, et al., 2012).

Therefore, for this evaluation of chromium in the Powder River Basin coal ash, total chromium is evaluated assuming the total concentration is hexavalent chromium and using RSLs calculated using USEPA's on-line RSL calculator (USEPA, 2014b), based on the primary dose-response values provided in the IRIS database (USEPA, 2014a) for both potential carcinogenic and noncarcinogenic endpoints.

The assumption that all chromium in CCPs is in the hexavalent form is very conservative, and in fact unrealistic. Data for the Alaska Power Plant indicate that hexavalent chromium comprises 0.25% of the total chromium concentration in the combined fly ash/bottom ash material from that facility. Literature data for analyses of CCPs from US coals (total CCPs) indicate that hexavalent chromium can comprise up to 5% of the total chromium (Huggins, et al., 1999); thus over 95% of the total chromium is present in the nontoxic trivalent form. This is consistent with data from USEPA, though there are some single higher results (USEPA, 2009).

A.8 Summary

Constituents present in coal ash are also present in our natural environment, and we are exposed to them every day, in the soils that we contact and the food that we eat. All of these constituents have USEPA-derived risk-based screening levels for residential soils. The constituent concentrations in coal ash from the Powder River Basin, the source of the coal used at the Labadie Energy Center, are below risk-based screening levels for residential soils (with one exception) and the concentrations are similar to background levels in U.S. soils.

A.9 References

AECOM. 2012. Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants. Prepared for the American Coal Ash Association. Available at: http://www.acaa-usa.org/associations/8003/files/ACAA_CoalAshMaterialSafety_June2012.pdf

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USEPA. 2014b. Regional Screening Levels (RSLs) Calculator. U.S. Environmental Protection Agency. Available at: http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

USGS. 2011a. Geochemical Database of Feed Coal and Coal Combustion Products (CCPs) from Five Power Plants in the United States. Data Series 635. U.S. Geological Survey. Available at: http://pubs.usgs.gov/ds/635/

USGS. 2011b. Trace Elements and Radon in Groundwater Across the United States. U.S. Geological Survey. Scientific Investigations Report 2011-5059. Authors: Ayotte, J.D. Gronberg, J.M., and Apodaca, L.E. Available at: http://pubs.usgs.gov/sir/2011/5059/pdf/sir2011-5059_report-covers_508.pdf

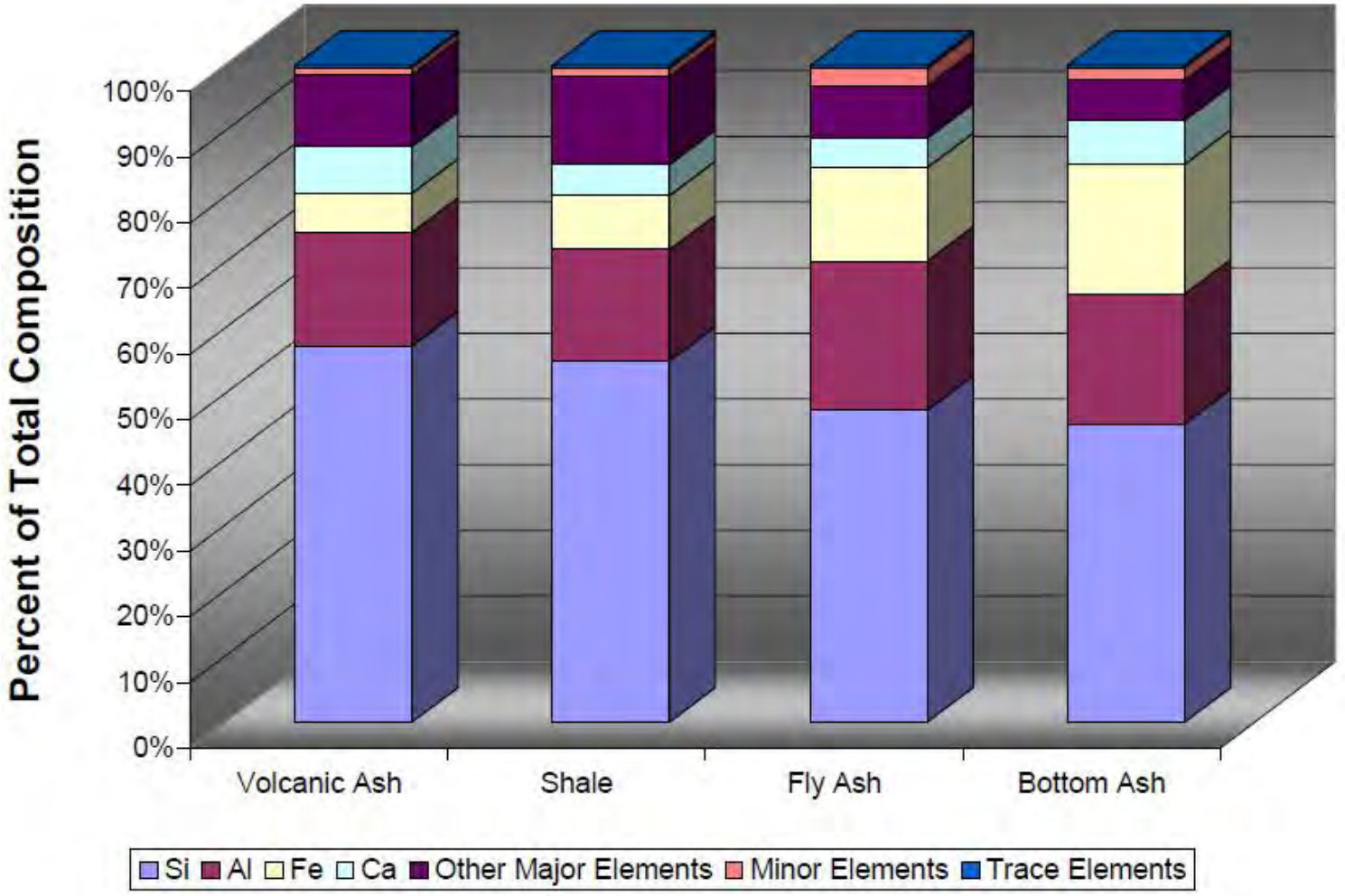
USGS, 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

WHO. 2006. Cobalt and Inorganic Cobalt Compounds. Concise International Chemical Assessment Document 69. World Health Organization.

Figures

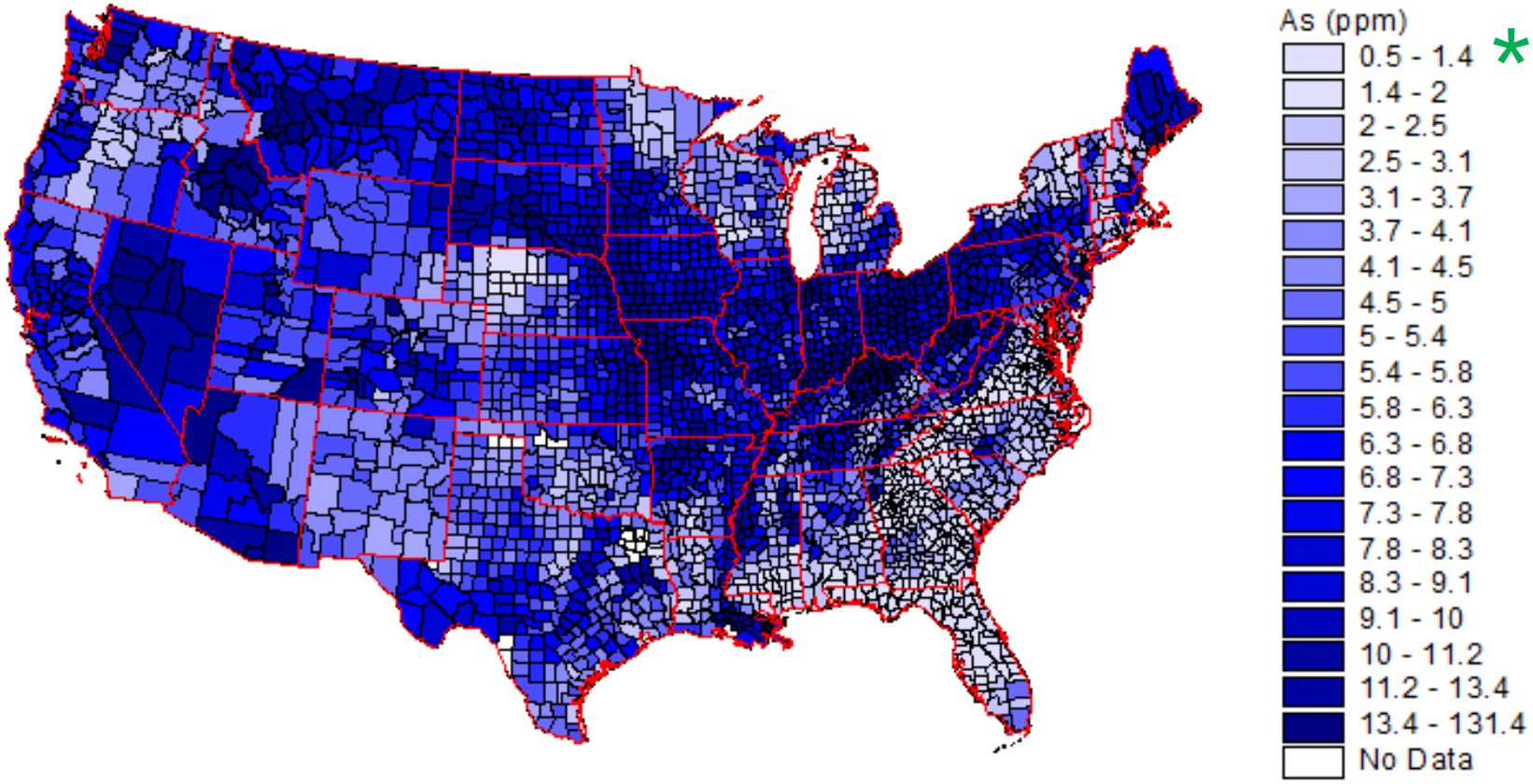
Figure A-1
Composition of Coal Ash and Other Natural Materials

AECOM



Source: EPRI. 2010. Comparison of Coal Combustion Products to Other Common Materials – Chemical Characteristics. Report No. 1020556. Available for download at www.epri.com.

Figure A-2
Arsenic is Present in our Natural Environment –
Background Levels in Soils in the U.S.



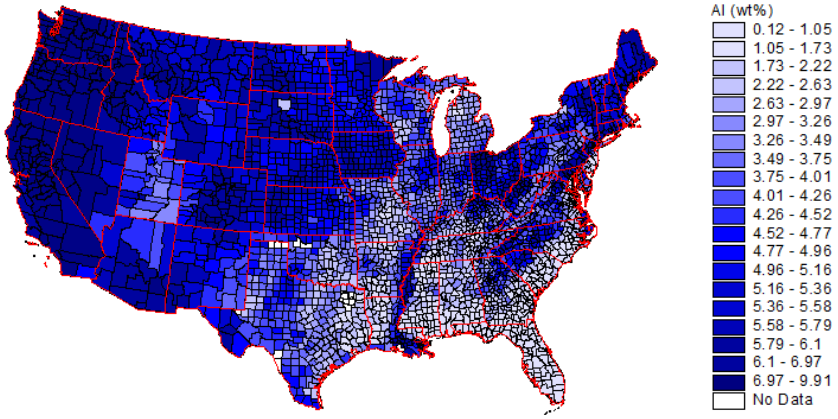
* **The USEPA regional screening level for arsenic in residential soil at a one in one million risk level is 0.61 mg/kg. USEPA. 2013a.** http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
Thus the arsenic concentration in the majority of the soils in the U.S. are above the one in one million risk level.

Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Figure A-3

Aluminum is Present in our Natural Environment – Background Levels in Soils in the U.S.

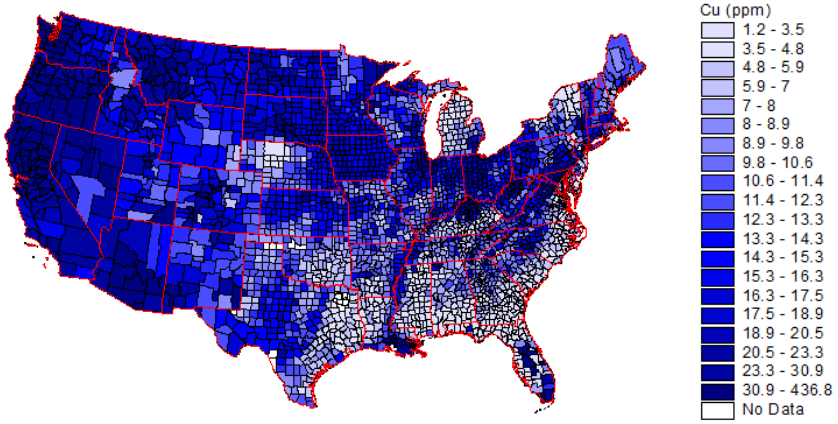
AECOM



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Copper is Present in our Natural Environment – Background Levels in Soils in the U.S.

AECOM

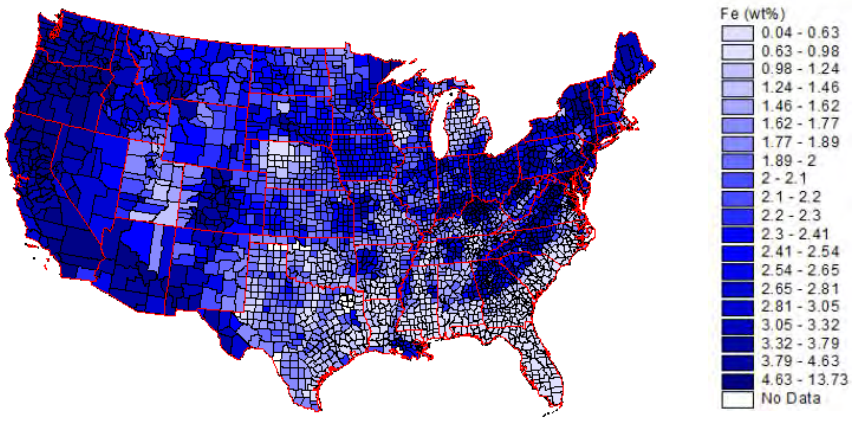


Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Figure A-4

AECOM

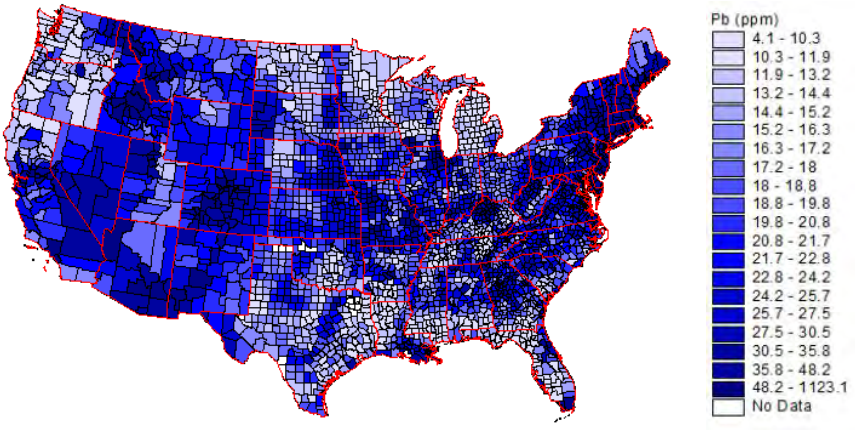
Iron is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

AECOM

Lead is present in our natural environment –
Background levels in soils in the U.S.

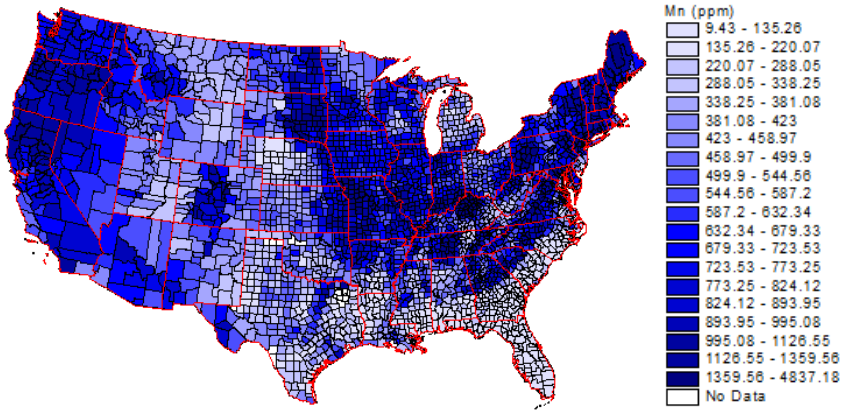


Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Figure A-5

AECOM

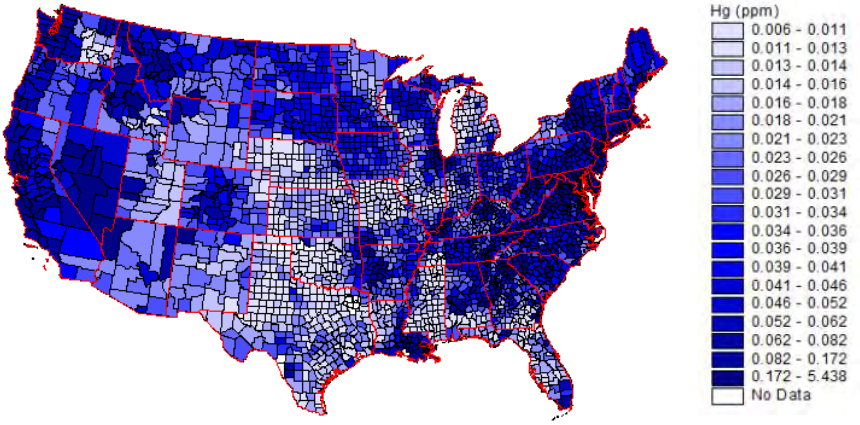
Manganese is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

AECOM

Mercury is present in our natural environment –
Background levels in soils in the U.S.

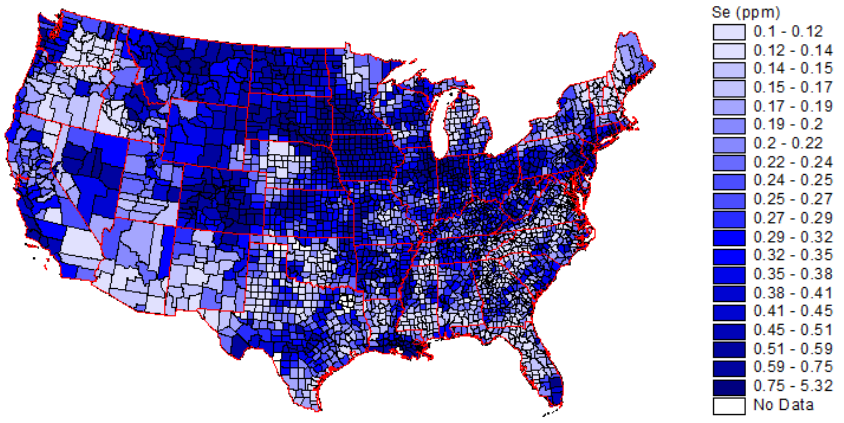


Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Figure A-6

AECOM

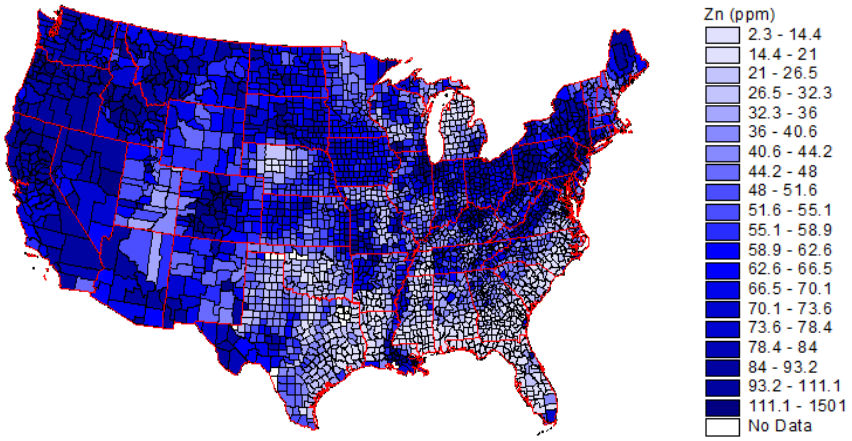
Selenium is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

AECOM

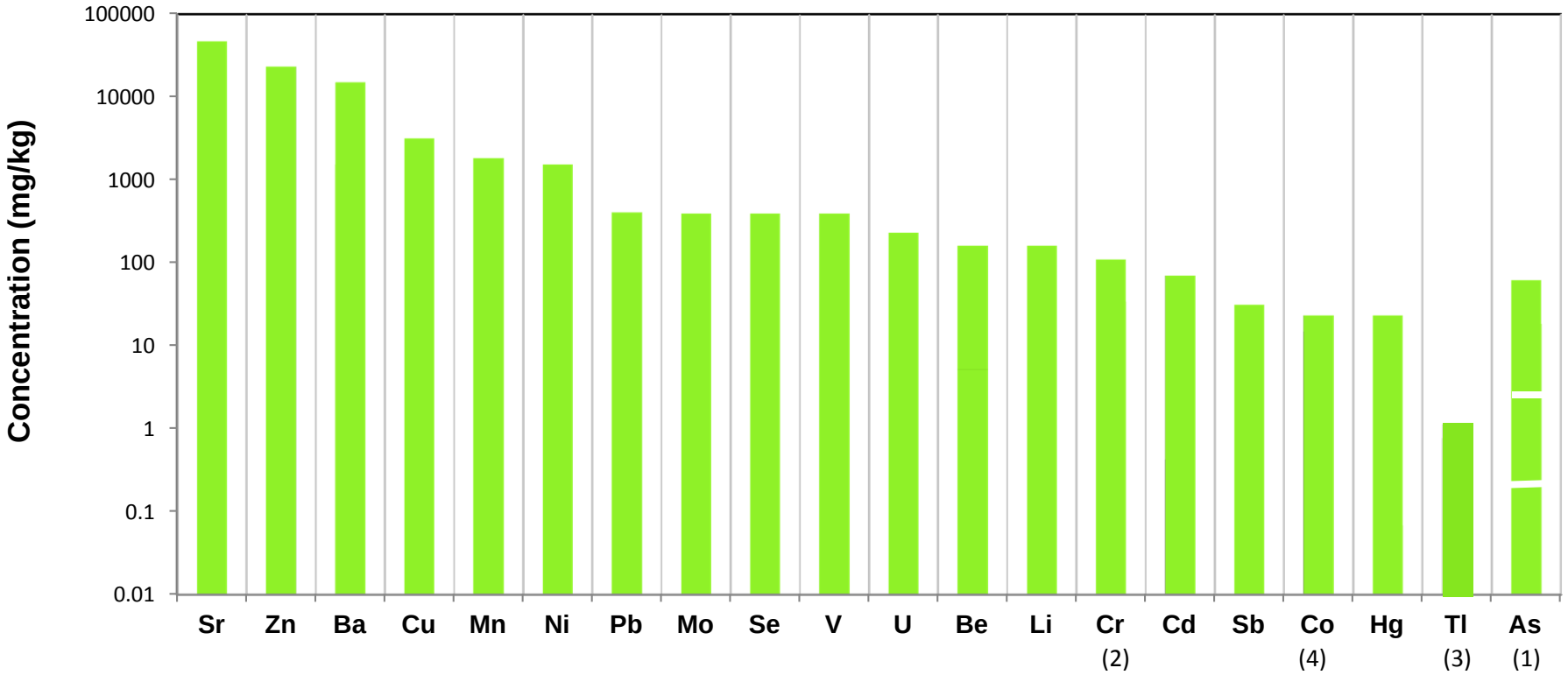
Zinc is present in our natural environment –
Background levels in soils in the U.S.



Source: USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

Figure A-7

USEPA Regional Screening Levels for Residential Soils - Coal Ash Constituents



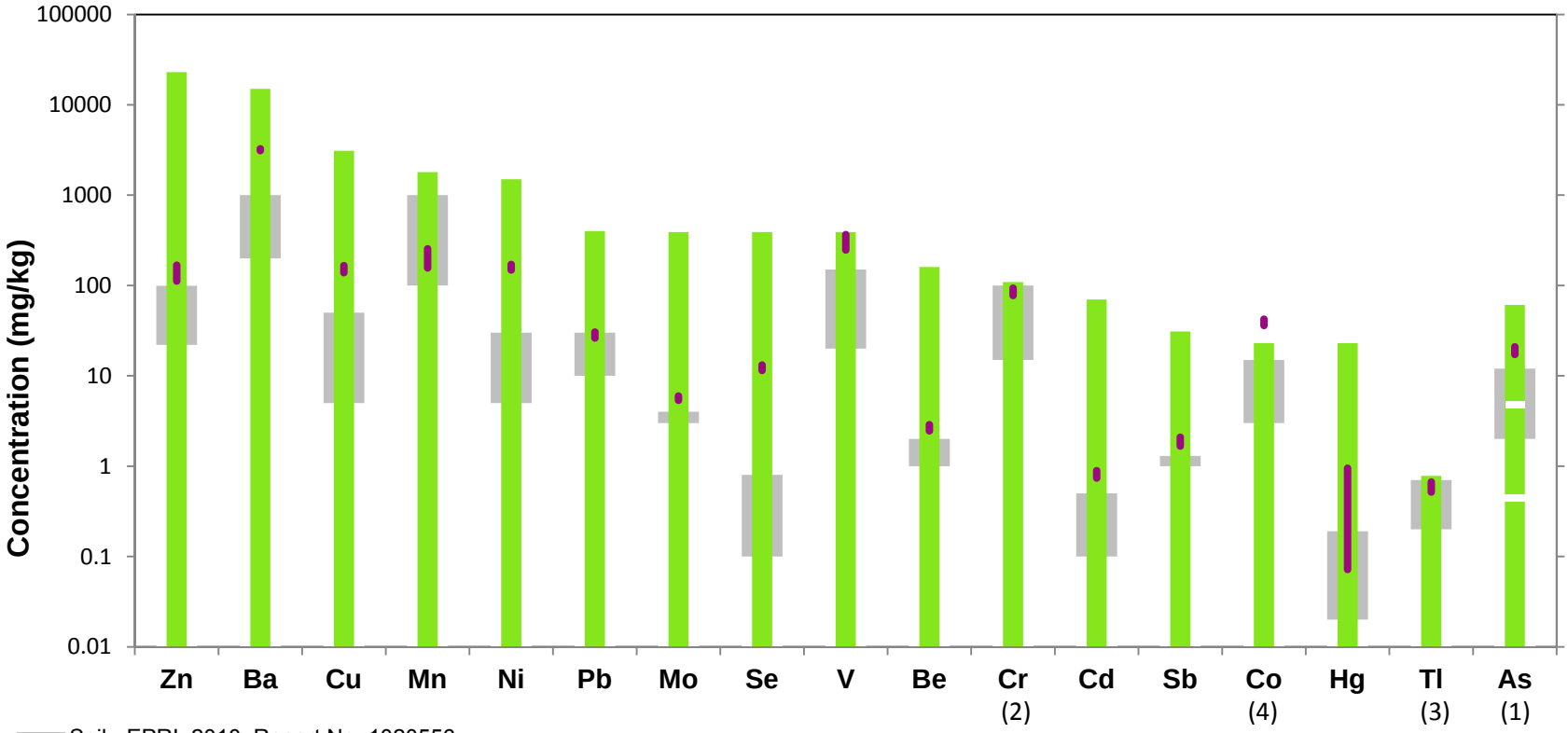
- Top of bar corresponds to the USEPA Regional Screening Level (RSL) - Residential Soil (Nov 2013)

http://www.epa.gov/region9/superfund//prg/index.html

Notes:
(1) Arsenic RSLs for target risk level of 10^{-4} (top of green bar), 10^{-5} (middle white bar), 10^{-6} (lower white bar.
(2) The screening level shown for chromium is the value calculated using toxicity information for hexavalent chromium currently available on USEPA's IRIS database [http://www.epa.gov/iris/subst/0144.htm]. The screening level for trivalent chromium is 120,000 mg/kg.
(3) The RSL for thallium is identified by USEPA as a "provisional value" of "limited usefulness" that was developed for information purposes although USEPA states "it is inappropriate to derive a provisional subchronic or chronic [toxicity value] for thallium" [http://hhpprtv.ornl.gov/issue_papers/ThalliumandCompounds.pdf]
(4) The RSL for cobalt is based on a provisional dose-response value that is two orders of magnitude lower than values from other regulatory sources, and higher than most dietary intake estimates. Thus, a more realistic RSL could be two orders of magnitude higher than the value shown here.

Figure A-8

Comparison of 10th and 90th percentile USGS Database Constituent Concentrations in Fly Ash from the Wyoming Coal Power Plant and Background Levels in US Soils to the USEPA Regional Screening Levels for Residential Soils



Soil - EPRI, 2010. Report No. 1020556. Available for download at www.epri.com

USEPA Regional Screening Level (RSL) - Residential Soil (November 2013) http://www.epa.gov/region9/superfund//prg/index.html

Concentration Range (10th - 90th Percentile) in Wyoming Fly Ash; USGS, 2011. http://pubs.usgs.gov/ds/635/

Notes:
(1) Arsenic RSLs for target risk level of 10^{-4} (top of green bar), 10^{-5} (middle white bar), 10^{-6} (lower white bar).
(2) The screening level shown for chromium is the value calculated using toxicity information for hexavalent chromium currently available on USEPA's IRIS database [http://www.epa.gov/iris/subst/0144.htm]. The screening level for trivalent chromium is 120,000 mg/kg.
(3) The RSL for thallium is identified by USEPA as a "provisional value" of "limited usefulness" that was developed for information purposes although USEPA states "it is inappropriate to derive a provisional subchronic or chronic [toxicity value] for thallium" [http://hhpprtv.ornl.gov/issue_papers/ThalliumandCompounds.pdf]
(4) The RSL for cobalt is based on a provisional dose-response value that is two orders of magnitude lower than values from other regulatory sources, and higher than most dietary intake estimates. Thus, a more realistic RSL could be more than an order of magnitude higher than the value shown here.

Appendix B

Evaluation of Misreported Well Locations

Appendix B

Evaluation of Misreported Well Locations

As with any large database records, some errors exist in the dataset. The locations of some of the wells on this map do not appear to be listed correctly in the databases (Wells 33, 43, 53, 55, 56, and 57 – these are highlighted in yellow on **Figure 3**). These six wells are listed as being located within the Labadie Energy Center property boundary, however, previous studies have not discovered any of these wells and have reported these locations to be incorrect (Gredell Engineering Resources, Inc., and Reitz & Jens, Inc., 2011). A review of the available data for the locations of these six wells was conducted, and supports the conclusion that the well locations are incorrect.

- Well 33 (MO reference #0019315) is a private well that is reported as being located near the intersection of Labadie Power Plant Road and Labadie Bottom Road (MDNR Wellhead Protection). This well is listed as having a total depth of 295 feet, a casing length of 80 feet, a static water level of 95 feet, and intersects bedrock at around 29 feet. In addition, this well is listed as being drilled at an elevation of 590 feet (MDNR Wellhead Protection). These properties are much more consistent with wells drilled into bluffs to the south. Additionally, the address listed on the well certification report lists the owner address as 478 Riverview Drive, which lies ~4700 feet to the southwest of the listed location (MDNR Wellhead Protection). No address is listed in the section of "address of well" ("if different than above") (MDNR Wellhead Protection), but this well is also believed to be incorrectly located in the State database records.
- Well 43 (MO reference #0334931) is reported as being drilled in 2004 just north of Labadie Bottom Road with a total depth of 366 feet, casing depth of 190 feet, a static water level of 160 feet and a depth to bedrock of 40 feet (MDNR Wellhead Protection). These properties are much more characteristic of wells drilled into the bedrock bluffs to the south. Additionally, the Owner is listed as being Pete Duisen of Total Building Concepts and the address is listed as 5 Trevillian, Glendale, Missouri which is located in St. Louis County. No address is provided in the address of well ("if different than above") section. This well is also believed to be incorrectly located in the State database records.
- Well 53 (MO reference #0189167) is a private well that was drilled in 1997. This well has a total depth of 366 feet, a casing depth of 190 feet, and a static water level of 100 feet (MDNR Wellhead Protection). These properties are much more consistent with that of a well drilled into the bedrock bluffs to the south. The location of the well in the certification report is listed as being near the center of the Labadie Energy Center property. The well certification report displays that the legal location of the well is S-17, T-44N, R-2E, however, the owner address is listed as 1969 Fiddle Creek Road, Gray Summit, Missouri which is located at S-27, T-44N, R-2E not S-17 (MDNR Wellhead Protection, Gredell Engineering Resources, Inc., and Reitz & Jens, Inc., 2011). The difference between its plotted location and 1969 Fiddle Creek Road is approximately 3.5 miles. This well is also believed to be incorrectly located in the State database records.
- Well 55 (MO reference #003211) is reported as being a high-capacity industrial well owned by the Franklin County Distillery and was drilled in 1934 (MDNR, Water Resource Center). The well log displays that the well was drilled 690 feet into bedrock and that bedrock was not reached until 100 feet. Both of these properties are consistent with what would be expected in the area around the plant. However, currently there is no distillery or building located near the reported location for the well. Additionally, During Gredell Engineering Resources, Inc., and Reitz & Jens, Inc., (2011) field work no evidence of this well was discovered. While the

reported accuracy of the well's location is uncertain, it should be noted that no historical evidence of a distillery at this location can be found (Gredell Engineering Resources, Inc., Reitz & Jens, Inc., 2011). As a result, this location is believed to be incorrectly listed in the State database records.

- Well 56 (MO reference #0361016) is reported as a private irrigation well drilled into unconsolidated materials. In the State database the owners address is listed as being at 4460 Augusta Shores Dr., Augusta, Missouri, 63332 which is located north of the Missouri River. No address is listed in the "address of well" ("if different than above") section. The legal location of the well is located as Section 8, T-44N, R-2E. While a very small sliver of Section 8 is present on the south side of the Missouri River, the majority of Section 8 is located on the north side of the Missouri River, near the city of Augusta. This well is also believed to be incorrectly located in the State database records.
- Well 57 (MO reference #0143737) is listed as being owned by Marvin Newman and was drilled in 1995 (MDNR Wellhead Protection). This information is consistent with previous land ownership of areas near the Labadie plant (Gredell Engineering Resources, Inc., Reitz & Jens, Inc., 2011). However, the total depth is reported as being 315 feet with a casing depth of 105 feet and a static water level of 88 feet (MDNR Wellhead Protection). In addition, the elevation of where the well was drilled is reported as 540 feet above mean sea level (MDNR Wellhead Protection). These properties are more consistent with wells drilled in the bedrock bluffs to the south of the plant rather than a well drilled into the alluvial aquifer. During Gredell Engineering Resources, Inc., and Reitz & Jens, Inc., (2011) field work, no well was discovered near the location listed. Additionally, the address provided to the MDNR displays an address simply as Highway T (MDNR Wellhead Protection). As a result, this location is believed to be incorrectly listed in the State database records.

Appendix C

Golder Associates Inc., Groundwater Reports, 2012

AECOM

Laboratory Analytical Results for Groundwater Monitoring Samples Collected on April 12-13, 2012 from Temporary Groundwater Piezometers Installed Near Labadie Plant (April 2012)

January 2014

April 24, 2012 123-84274

Ameren Services
One Ameren Plaza
1901 Chouteau Avenue
St. Louis, MO 63103

RE: LABORATORY ANALYTICAL RESULTS FOR GROUNDWATER MONITORING SAMPLES COLLECTED ON APRIL 12-13, 2012 FROM TEMPORARY GROUNDWATER PIEZOMETERS INSTALLED NEAR LABADIE PLANT

At the request of Ameren, Golder Associates Inc. (Golder) has prepared this letter summarizing the laboratory analytical results from groundwater samples collected from three piezometers installed for temporary monitoring purposes near the Labadie Plant in Franklin County, Missouri. A piezometer installation report including details of the drilling, piezometer installation, and groundwater sampling effort is being prepared by Golder and will follow this laboratory results summary letter. The following is a summary of the laboratory results for groundwater samples collected on April 12-13, 2012 from piezometers TGP-A, TGP-B, and TGP-C.

LABORATORY ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

A groundwater sample from each piezometer was collected by Golder using standard groundwater sampling procedures and shipped to TestAmerica Inc. for laboratory analytical testing (TestAmerica Job ID: 500-45460-1) under chain-of-custody. The samples were analyzed for boron, an indicator constituent for leachate from coal combustion products, and inorganic constituents that have regulatory standards for protection of drinking water supplies specified in Table A of 10 CSR 20-7.031. With the exception of arsenic, these standards are identical to federal drinking water standards. The federal drinking water standard for arsenic is 10 ug/L, and is lower than the Missouri standard of 50 ug/L. The laboratory analytical data are contained in TestAmerica's report included as Attachment A.

Boron concentrations were below detection limits in all three samples, indicating that groundwater at the three monitoring points is not affected by leachate from coal combustion products. Other inorganic constituents were detected; however, concentrations of the other constituents were lower than the Missouri and federal drinking water standards. It is not uncommon to detect low levels of inorganic constituents in uncontaminated groundwater samples because these elements are often naturally present in the soils and rocks that are in contact with the groundwater.

Several analytical results are qualified with a B, J, or ^ data flag. The B flag indicates that the constituent was detected in a laboratory blank, and therefore the analytical result may be biased high. Since all results were low and below drinking water standards, any such bias was minimal and does not significantly affect interpretation of the results. The J flag indicates that the constituent was detected at a very low level, in a range where the precision of the laboratory instruments is low, and therefore the reported concentration is qualified as estimated. Again, this does not adversely affect interpretation because all results were lower than drinking water standards. The ^ flag indicates that the ICSA interference check was slightly above acceptance limits; however, all of the results for the affected constituent were non-detect, so there was no relevant bias affecting results.

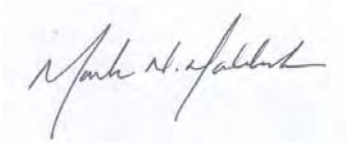
Golder Associates Inc.
820 S. Main Street, Suite 100
St. Charles, MO 63301 USA
Tel: (636) 724-9191 Fax: (636) 724-9323 www.golder.com

If you have any questions regarding this information, please do not hesitate to contact the undersigned.

Sincerely,

GOLDER ASSOCIATES INC.

Michael W. Dreyer, E.I.T.
Staff Engineer



Mark N. Haddock, R.G., P.E.
Senior Engineer
Associate

Attachments: Attachment A – TestAmerica Laboratory Analytical Report

MWD/MNH

Comparison of Analytical Results to Missouri and Federal Drinking Water Standards
Groundwater Samples Collected Upgradient of the Labadie Power Plant
Samples Collected April 12-13, 2012

Analyte*	Missouri[1]	Federal[2]	TGP-A 4/12/12	TGP-B 4/13/12	TGP-C 4/12/12	DUP-1** 4/12/12
Antimony	0.006	0.006	<0.0026	0.0026 J	<0.0026	<0.0026
Arsenic	0.05	0.01	<0.0024	<0.0024	<0.0024	<0.0024
Barium	2.0	2.0	0.21 B	0.10 B	0.15 B	0.22 B
Beryllium	0.004	0.004	<0.00044	<0.00044	<0.00044	<0.00044
Boron	no DWS	no MCL	<0.024	<0.024	<0.024	<0.024
Cadmium	0.005	0.005	<0.00054 ^	<0.00054 ^	<0.00054 ^	<0.00054 ^
Chloride	250	[250]	5.8 B	29 B	43 B	5.7 B
Chromium	0.1	0.1	0.0029 J	0.0025 J	0.0013 J	0.0034 J
Copper	1.3	1.3	<0.0011	<0.0011	<0.0011	<0.0011
Fluoride	4	4	0.20	0.25	0.16 J	0.18 J
Lead	0.015	0.015	0.0031 JB	0.0036 JB	0.0044 JB	0.0037 JB
Mercury	0.002	0.002	<0.000070	<0.000070	<0.000070	<0.000070
Nickel	0.1	no MCL	0.0020 J	<0.0019	<0.0019	0.0021 J
Nitrate as N	10	10	1.3	7.9	5.0	1.3
Selenium	0.05	0.05	<0.0027	<0.0027	<0.0027	<0.0027
Silver	0.05	[0.10]	<0.0011	<0.0011	<0.0011	<0.0011
Sulfate	250	[250]	13	25	34	14
Thallium	0.002	0.002	<0.0013	<0.0013	<0.0013	<0.0013
Zinc	5.0	[5.0]	<0.0047	<0.0047	0.0064 J	<0.0047

Notes

* Concentrations listed in mg/L

** Duplicate sample from TGP-A

1 Missouri drinking water supply (DWS) standard per 10 CSR 20-7.031 Table A
- There is no DWS for boron

2 Federal Maximum Contaminant Level (MCL)
- [ ] indicates that there is no MCL for the constituent, and the non-enforceable Secondary MCL is displayed
- There is no MCL or Secondary MCL for boron and nickel
- Federal standards listed at: http://water.epa.gov/drink/contaminants/index.cfm#List

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Chicago
2417 Bond Street
University Park, IL 60484
Tel: (708)534-5200

TestAmerica Job ID: 500-45460-1
Client Project/Site: Ameren Groundwater Testing
Revision: 1

For:
Golder Associates Inc.
820 South Main Street
Suite 100
St. Charles, Missouri 63301

Attn: Mike Dreyer

Donna L. Ingersoll

Authorized for release by:
4/24/2012 5:06:53 PM

Donna Ingersoll
Project Manager II
donna.ingersoll@testamericainc.com

Table of Contents

Job ID: 500-45460-1

Laboratory: TestAmerica Chicago

Narrative

Job Narrative
500-45460-1

Comments
Client requested report format be changed to present non-detects as < MDL.

Receipt
The samples were received on 4/14/2012 9:30 AM; the samples arrived in good condition, properly preserved and on ice. The temperature of the cooler at receipt was 0.30 C.

Metals
Method(s) 6010B: The ICSA for batch 146602 exceeded the acceptance limits for Cd. All samples were below the RL and therefore, reported.

Method(s) 7470A: The matrix spike / matrix spike duplicate (MS/MSD) recoveries for sample 500-45460-1 were outside control limits for Hg. The associated laboratory control sample (LCS) recovery met acceptance criteria.

No other analytical or quality issues were noted.

General Chemistry
Method(s) 9056: The following samples were analyzed outside of the 48-hour analytical holding time for nitrate-nitrogen due to instrument malfunction: DUP-1 (500-45460-4), RB-1 (500-45460-5), TGP-A (500-45460-1), TGP-B (500-45460-2), TGP-C (500-45460-3). The samples were received on Saturday, 4/14/12, and set up on the ion chromatograph (IC) upon receipt, within hold, but after the analyst had left for the day, the IC pressure dropped and no chromatograms past sample -1 were readable. None of the injections were reportable because they were not bracketed by end-run QC. The samples were re-analyzed on Tuesday, 4/17/12. The result obtained on Saturday for sample -1 was 1.4 mg/L as N. That compares well with the result reported from Tuesday, which was 1.3 mg/L. Typically, any nitrite-nitrogen that may have been present in the sample is often converted to nitrate-nitrogen, so it is possible that these reported nitrate results are biased high.

Method(s) 9056: Compound nitrate eluted outside the retention time window on the Ion Chromatography (IC) column for the following samples in batch 146758: (CCV 500-146758/13), (CCV 500-146758/39), (ICV 500-146758/1), (LCS 500-146758/4), DUP-1 (500-45460-4). This retention time shift was taken into account and corrected for when reviewing the samples for target compounds.

Method(s) 9056: The IC continuing calibration verification (CCV) for chloride associated with batch 146758 recovered above the upper control limit. The sample's spikes (MS/MSD) bracketed by this CCV were in control; therefore, the data have been reported.

No other analytical or quality issues were noted.

Detection Summary

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

Client Sample ID: TGP-A — Lab Sample ID: 500-45460-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.21	B	0.010	0.00044	mg/L	1		6010B	Total/NA
Chromium	0.0029	J	0.010	0.00096	mg/L	1		6010B	Total/NA
Lead	0.0031	J B	0.0050	0.0016	mg/L	1		6010B	Total/NA
Nickel	0.0020	J	0.010	0.0019	mg/L	1		6010B	Total/NA
Chloride	5.8	B	0.20	0.083	mg/L	1		9056	Total/NA
Fluoride	0.20		0.20	0.029	mg/L	1		9056	Total/NA
Nitrate as N	1.3		0.10	0.023	mg/L	1		9056	Total/NA
Sulfate	13		2.0	0.90	mg/L	10		9056	Total/NA

Client Sample ID: TGP-B — Lab Sample ID: 500-45460-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Antimony	0.0026	J	0.020	0.0026	mg/L	1		6010B	Total/NA
Barium	0.10	B	0.010	0.00044	mg/L	1		6010B	Total/NA
Chromium	0.0025	J	0.010	0.00096	mg/L	1		6010B	Total/NA
Lead	0.0036	J B	0.0050	0.0016	mg/L	1		6010B	Total/NA
Chloride	29	B	2.0	0.83	mg/L	10		9056	Total/NA
Fluoride	0.25		0.20	0.029	mg/L	1		9056	Total/NA
Nitrate as N	7.9		1.0	0.23	mg/L	10		9056	Total/NA
Sulfate	25		2.0	0.90	mg/L	10		9056	Total/NA

Client Sample ID: TGP-C — Lab Sample ID: 500-45460-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.15	B	0.010	0.00044	mg/L	1		6010B	Total/NA
Chromium	0.0013	J	0.010	0.00096	mg/L	1		6010B	Total/NA
Lead	0.0044	J B	0.0050	0.0016	mg/L	1		6010B	Total/NA
Zinc	0.0064	J	0.020	0.0047	mg/L	1		6010B	Total/NA
Chloride	43	B	2.0	0.83	mg/L	10		9056	Total/NA
Fluoride	0.16	J	0.20	0.029	mg/L	1		9056	Total/NA
Nitrate as N	5.0		1.0	0.23	mg/L	10		9056	Total/NA
Sulfate	34		2.0	0.90	mg/L	10		9056	Total/NA

Client Sample ID: DUP-1 — Lab Sample ID: 500-45460-4

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.22	B	0.010	0.00044	mg/L	1		6010B	Total/NA
Chromium	0.0034	J	0.010	0.00096	mg/L	1		6010B	Total/NA
Lead	0.0037	J B	0.0050	0.0016	mg/L	1		6010B	Total/NA
Nickel	0.0021	J	0.010	0.0019	mg/L	1		6010B	Total/NA
Chloride	5.7	B	0.20	0.083	mg/L	1		9056	Total/NA
Fluoride	0.18	J	0.20	0.029	mg/L	1		9056	Total/NA
Nitrate as N	1.3		0.10	0.023	mg/L	1		9056	Total/NA
Sulfate	14		2.0	0.90	mg/L	10		9056	Total/NA

Client Sample ID: RB-1 — Lab Sample ID: 500-45460-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.0028	J B	0.010	0.00044	mg/L	1		6010B	Total/NA
Chromium	0.0011	J	0.010	0.00096	mg/L	1		6010B	Total/NA
Copper	0.0017	J	0.010	0.0011	mg/L	1		6010B	Total/NA
Lead	0.0020	J B	0.0050	0.0016	mg/L	1		6010B	Total/NA
Zinc	0.052		0.020	0.0047	mg/L	1		6010B	Total/NA
Chloride	0.64	B	0.20	0.083	mg/L	1		9056	Total/NA

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

Client Sample ID: RB-1 (Continued)

Lab Sample ID: 500-45460-5

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Nitrate as N	0.28		0.10	0.023	mg/L	1		9056	Total/NA
Sulfate	0.17	J	0.20	0.090	mg/L	1		9056	Total/NA

Method Summary

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL CHI
7470A	Mercury (CVAA)	SW846	TAL CHI
9056	Anions, Ion Chromatography	SW846	TAL CHI

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL CHI = TestAmerica Chicago, 2417 Bond Street, University Park, IL 60484, TEL (708)534-5200

Sample Summary

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
500-45460-1	TGP-A	Water	04/12/12 17:05	04/14/12 09:30
500-45460-2	TGP-B	Water	04/12/12 11:35	04/14/12 09:30
500-45460-3	TGP-C	Water	04/12/12 15:00	04/14/12 09:30
500-45460-4	DUP-1	Water	04/12/12 00:00	04/14/12 09:30
500-45460-5	RB-1	Water	04/12/12 12:00	04/14/12 09:30

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

Client Sample ID: TGP-A

Date Collected: 04/12/12 17:05
Date Received: 04/14/12 09:30

Lab Sample ID: 500-45460-1

Matrix: Water

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<0.0026		0.020	0.0026	mg/L		04/16/12 10:44	04/16/12 19:04	1
Arsenic	<0.0024		0.010	0.0024	mg/L		04/16/12 10:44	04/16/12 19:04	1
Barium	**0.21**	**B**	0.010	0.00044	mg/L		04/16/12 10:44	04/16/12 19:04	1
Beryllium	<0.00044		0.0040	0.00044	mg/L		04/16/12 10:44	04/16/12 19:04	1
Boron	<0.024		0.050	0.024	mg/L		04/16/12 10:44	04/16/12 19:04	1
Cadmium	<0.00054	^	0.0020	0.00054	mg/L		04/16/12 10:44	04/16/12 19:04	1
Chromium	**0.0029**	**J**	0.010	0.00096	mg/L		04/16/12 10:44	04/16/12 19:04	1
Copper	<0.0011		0.010	0.0011	mg/L		04/16/12 10:44	04/16/12 19:04	1
Lead	**0.0031**	**J B**	0.0050	0.0016	mg/L		04/16/12 10:44	04/16/12 19:04	1
Nickel	**0.0020**	**J**	0.010	0.0019	mg/L		04/16/12 10:44	04/16/12 19:04	1
Selenium	<0.0027		0.010	0.0027	mg/L		04/16/12 10:44	04/16/12 19:04	1
Silver	<0.0011		0.0050	0.0011	mg/L		04/16/12 10:44	04/16/12 19:04	1
Thallium	<0.0013		0.010	0.0013	mg/L		04/16/12 10:44	04/16/12 19:04	1
Zinc	<0.0047		0.020	0.0047	mg/L		04/16/12 10:44	04/16/12 19:04	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.070		0.20	0.070	ug/L		04/16/12 14:40	04/17/12 13:16	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**5.8**	**B**	0.20	0.083	mg/L			04/17/12 13:33	1
Fluoride	**0.20**		0.20	0.029	mg/L			04/17/12 13:33	1
Nitrate as N	**1.3**		0.10	0.023	mg/L			04/17/12 13:33	1
Sulfate	**13**		2.0	0.90	mg/L			04/17/12 13:47	10

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

Client Sample ID: TGP-B
Date Collected: 04/12/12 11:35
Date Received: 04/14/12 09:30

Lab Sample ID: 500-45460-2
Matrix: Water

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	**0.0026**	**J**	0.020	0.0026	mg/L		04/16/12 10:44	04/16/12 19:10	1
Arsenic	<0.0024		0.010	0.0024	mg/L		04/16/12 10:44	04/16/12 19:10	1
Barium	**0.10**	**B**	0.010	0.00044	mg/L		04/16/12 10:44	04/16/12 19:10	1
Beryllium	<0.00044		0.0040	0.00044	mg/L		04/16/12 10:44	04/16/12 19:10	1
Boron	<0.024		0.050	0.024	mg/L		04/16/12 10:44	04/16/12 19:10	1
Cadmium	<0.00054	^	0.0020	0.00054	mg/L		04/16/12 10:44	04/16/12 19:10	1
Chromium	**0.0025**	**J**	0.010	0.00096	mg/L		04/16/12 10:44	04/16/12 19:10	1
Copper	<0.0011		0.010	0.0011	mg/L		04/16/12 10:44	04/16/12 19:10	1
Lead	**0.0036**	**J B**	0.0050	0.0016	mg/L		04/16/12 10:44	04/16/12 19:10	1
Nickel	<0.0019		0.010	0.0019	mg/L		04/16/12 10:44	04/16/12 19:10	1
Selenium	<0.0027		0.010	0.0027	mg/L		04/16/12 10:44	04/16/12 19:10	1
Silver	<0.0011		0.0050	0.0011	mg/L		04/16/12 10:44	04/16/12 19:10	1
Thallium	<0.0013		0.010	0.0013	mg/L		04/16/12 10:44	04/16/12 19:10	1
Zinc	<0.0047		0.020	0.0047	mg/L		04/16/12 10:44	04/16/12 19:10	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.070		0.20	0.070	ug/L		04/16/12 14:40	04/17/12 13:33	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**29**	**B**	2.0	0.83	mg/L			04/17/12 14:16	10
Fluoride	**0.25**		0.20	0.029	mg/L			04/17/12 14:02	1
Nitrate as N	**7.9**		1.0	0.23	mg/L			04/17/12 14:16	10
Sulfate	**25**		2.0	0.90	mg/L			04/17/12 14:16	10

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

Client Sample ID: TGP-C
Date Collected: 04/12/12 15:00
Date Received: 04/14/12 09:30

Lab Sample ID: 500-45460-3
Matrix: Water

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<0.0026		0.020	0.0026	mg/L		04/16/12 10:44	04/16/12 19:16	1
Arsenic	<0.0024		0.010	0.0024	mg/L		04/16/12 10:44	04/16/12 19:16	1
Barium	**0.15**	**B**	0.010	0.00044	mg/L		04/16/12 10:44	04/16/12 19:16	1
Beryllium	<0.00044		0.0040	0.00044	mg/L		04/16/12 10:44	04/16/12 19:16	1
Boron	<0.024		0.050	0.024	mg/L		04/16/12 10:44	04/16/12 19:16	1
Cadmium	<0.00054	^	0.0020	0.00054	mg/L		04/16/12 10:44	04/16/12 19:16	1
Chromium	**0.0013**	**J**	0.010	0.00096	mg/L		04/16/12 10:44	04/16/12 19:16	1
Copper	<0.0011		0.010	0.0011	mg/L		04/16/12 10:44	04/16/12 19:16	1
Lead	**0.0044**	**J B**	0.0050	0.0016	mg/L		04/16/12 10:44	04/16/12 19:16	1
Nickel	<0.0019		0.010	0.0019	mg/L		04/16/12 10:44	04/16/12 19:16	1
Selenium	<0.0027		0.010	0.0027	mg/L		04/16/12 10:44	04/16/12 19:16	1
Silver	<0.0011		0.0050	0.0011	mg/L		04/16/12 10:44	04/16/12 19:16	1
Thallium	<0.0013		0.010	0.0013	mg/L		04/16/12 10:44	04/16/12 19:16	1
Zinc	**0.0064**	**J**	0.020	0.0047	mg/L		04/16/12 10:44	04/16/12 19:16	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.070		0.20	0.070	ug/L		04/16/12 14:40	04/17/12 13:35	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**43**	**B**	2.0	0.83	mg/L			04/17/12 14:44	10
Fluoride	**0.16**	**J**	0.20	0.029	mg/L			04/17/12 14:30	1
Nitrate as N	**5.0**		1.0	0.23	mg/L			04/17/12 14:44	10
Sulfate	**34**		2.0	0.90	mg/L			04/17/12 14:44	10

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

Client Sample ID: DUP-1
Date Collected: 04/12/12 00:00
Date Received: 04/14/12 09:30

Lab Sample ID: 500-45460-4
Matrix: Water

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<0.0026		0.020	0.0026	mg/L		04/16/12 10:44	04/16/12 19:23	1
Arsenic	<0.0024		0.010	0.0024	mg/L		04/16/12 10:44	04/16/12 19:23	1
Barium	**0.22**	**B**	0.010	0.00044	mg/L		04/16/12 10:44	04/16/12 19:23	1
Beryllium	<0.00044		0.0040	0.00044	mg/L		04/16/12 10:44	04/16/12 19:23	1
Boron	<0.024		0.050	0.024	mg/L		04/16/12 10:44	04/16/12 19:23	1
Cadmium	<0.00054	^	0.0020	0.00054	mg/L		04/16/12 10:44	04/16/12 19:23	1
Chromium	**0.0034**	**J**	0.010	0.00096	mg/L		04/16/12 10:44	04/16/12 19:23	1
Copper	<0.0011		0.010	0.0011	mg/L		04/16/12 10:44	04/16/12 19:23	1
Lead	**0.0037**	**J B**	0.0050	0.0016	mg/L		04/16/12 10:44	04/16/12 19:23	1
Nickel	**0.0021**	**J**	0.010	0.0019	mg/L		04/16/12 10:44	04/16/12 19:23	1
Selenium	<0.0027		0.010	0.0027	mg/L		04/16/12 10:44	04/16/12 19:23	1
Silver	<0.0011		0.0050	0.0011	mg/L		04/16/12 10:44	04/16/12 19:23	1
Thallium	<0.0013		0.010	0.0013	mg/L		04/16/12 10:44	04/16/12 19:23	1
Zinc	<0.0047		0.020	0.0047	mg/L		04/16/12 10:44	04/16/12 19:23	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.070		0.20	0.070	ug/L		04/16/12 14:40	04/17/12 13:37	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**5.7**	**B**	0.20	0.083	mg/L			04/17/12 14:59	1
Fluoride	**0.18**	**J**	0.20	0.029	mg/L			04/17/12 14:59	1
Nitrate as N	**1.3**		0.10	0.023	mg/L			04/17/12 14:59	1
Sulfate	**14**		2.0	0.90	mg/L			04/17/12 15:13	10

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

Client Sample ID: RB-1
Date Collected: 04/12/12 12:00
Date Received: 04/14/12 09:30

Lab Sample ID: 500-45460-5
Matrix: Water

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<0.0026		0.020	0.0026	mg/L		04/16/12 10:44	04/16/12 19:29	1
Arsenic	<0.0024		0.010	0.0024	mg/L		04/16/12 10:44	04/16/12 19:29	1
Barium	**0.0028**	**J B**	0.010	0.00044	mg/L		04/16/12 10:44	04/16/12 19:29	1
Beryllium	<0.00044		0.0040	0.00044	mg/L		04/16/12 10:44	04/16/12 19:29	1
Boron	<0.024		0.050	0.024	mg/L		04/16/12 10:44	04/16/12 19:29	1
Cadmium	<0.00054	^	0.0020	0.00054	mg/L		04/16/12 10:44	04/16/12 19:29	1
Chromium	**0.0011**	**J**	0.010	0.00096	mg/L		04/16/12 10:44	04/16/12 19:29	1
Copper	**0.0017**	**J**	0.010	0.0011	mg/L		04/16/12 10:44	04/16/12 19:29	1
Lead	**0.0020**	**J B**	0.0050	0.0016	mg/L		04/16/12 10:44	04/16/12 19:29	1
Nickel	<0.0019		0.010	0.0019	mg/L		04/16/12 10:44	04/16/12 19:29	1
Selenium	<0.0027		0.010	0.0027	mg/L		04/16/12 10:44	04/16/12 19:29	1
Silver	<0.0011		0.0050	0.0011	mg/L		04/16/12 10:44	04/16/12 19:29	1
Thallium	<0.0013		0.010	0.0013	mg/L		04/16/12 10:44	04/16/12 19:29	1
Zinc	**0.052**		0.020	0.0047	mg/L		04/16/12 10:44	04/16/12 19:29	1

Method: 7470A - Mercury (CVAA)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.070		0.20	0.070	ug/L		04/16/12 14:40	04/17/12 13:38	1

General Chemistry

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	**0.64**	**B**	0.20	0.083	mg/L			04/17/12 15:56	1
Fluoride	<0.029		0.20	0.029	mg/L			04/17/12 15:56	1
Nitrate as N	**0.28**		0.10	0.023	mg/L			04/17/12 15:56	1
Sulfate	**0.17**	**J**	0.20	0.090	mg/L			04/17/12 15:56	1

Qualifiers

Metals

Qualifier	Qualifier Description
B	Compound was found in the blank and sample.
^	ICV,CCV,ICB,CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Instrument related QC exceeds the control limits.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F	MS or MSD exceeds the control limits

General Chemistry

Qualifier	Qualifier Description
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
☼	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DL, RA, RE, IN	Indicates a Dilution, Reanalysis, Re-extraction, or additional Initial metals/anion analysis of the sample
EDL	Estimated Detection Limit
EPA	United States Environmental Protection Agency
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Metals

Prep Batch: 146493

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-45460-1	TGP-A	Total/NA	Water	3010A	
500-45460-2	TGP-B	Total/NA	Water	3010A	
500-45460-3	TGP-C	Total/NA	Water	3010A	
500-45460-4	DUP-1	Total/NA	Water	3010A	
500-45460-5	RB-1	Total/NA	Water	3010A	
500-45460-5 DU	RB-1	Total/NA	Water	3010A	
500-45460-5 MS	RB-1	Total/NA	Water	3010A	
500-45460-5 MSD	RB-1	Total/NA	Water	3010A	
LCS 500-146493/2-A	Lab Control Sample	Total/NA	Water	3010A	
MB 500-146493/1-A	Method Blank	Total/NA	Water	3010A	

Prep Batch: 146542

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-45460-1	TGP-A	Total/NA	Water	7470A	
500-45460-1 DU	TGP-A	Total/NA	Water	7470A	
500-45460-1 MS	TGP-A	Total/NA	Water	7470A	
500-45460-1 MSD	TGP-A	Total/NA	Water	7470A	
500-45460-2	TGP-B	Total/NA	Water	7470A	
500-45460-3	TGP-C	Total/NA	Water	7470A	
500-45460-4	DUP-1	Total/NA	Water	7470A	
500-45460-5	RB-1	Total/NA	Water	7470A	
LCS 500-146542/8-A	Lab Control Sample	Total/NA	Water	7470A	
MB 500-146542/7-A	Method Blank	Total/NA	Water	7470A	

Analysis Batch: 146602

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-45460-1	TGP-A	Total/NA	Water	6010B	146493
500-45460-2	TGP-B	Total/NA	Water	6010B	146493
500-45460-3	TGP-C	Total/NA	Water	6010B	146493
500-45460-4	DUP-1	Total/NA	Water	6010B	146493
500-45460-5	RB-1	Total/NA	Water	6010B	146493
500-45460-5 DU	RB-1	Total/NA	Water	6010B	146493
500-45460-5 MS	RB-1	Total/NA	Water	6010B	146493
500-45460-5 MSD	RB-1	Total/NA	Water	6010B	146493
LCS 500-146493/2-A	Lab Control Sample	Total/NA	Water	6010B	146493
MB 500-146493/1-A	Method Blank	Total/NA	Water	6010B	146493

Analysis Batch: 146679

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-45460-1	TGP-A	Total/NA	Water	7470A	146542
500-45460-1 DU	TGP-A	Total/NA	Water	7470A	146542
500-45460-1 MS	TGP-A	Total/NA	Water	7470A	146542
500-45460-1 MSD	TGP-A	Total/NA	Water	7470A	146542
500-45460-2	TGP-B	Total/NA	Water	7470A	146542
500-45460-3	TGP-C	Total/NA	Water	7470A	146542
500-45460-4	DUP-1	Total/NA	Water	7470A	146542
500-45460-5	RB-1	Total/NA	Water	7470A	146542
LCS 500-146542/8-A	Lab Control Sample	Total/NA	Water	7470A	146542
MB 500-146542/7-A	Method Blank	Total/NA	Water	7470A	146542

QC Association Summary

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

General Chemistry

Analysis Batch: 146758

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
500-45460-1	TGP-A	Total/NA	Water	9056	
500-45460-1	TGP-A	Total/NA	Water	9056	
500-45460-2	TGP-B	Total/NA	Water	9056	
500-45460-2	TGP-B	Total/NA	Water	9056	
500-45460-3	TGP-C	Total/NA	Water	9056	
500-45460-3	TGP-C	Total/NA	Water	9056	
500-45460-4	DUP-1	Total/NA	Water	9056	
500-45460-4	DUP-1	Total/NA	Water	9056	
500-45460-5	RB-1	Total/NA	Water	9056	
500-45460-5 MS	RB-1	Total/NA	Water	9056	
500-45460-5 MSD	RB-1	Total/NA	Water	9056	
LCS 500-146758/4	Lab Control Sample	Total/NA	Water	9056	
MB 500-146758/3	Method Blank	Total/NA	Water	9056	

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 500-146493/1-A
Matrix: Water
Analysis Batch: 146602

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 146493

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Antimony	<0.0026		0.020	0.0026	mg/L		04/16/12 10:44	04/16/12 18:37	1
Arsenic	<0.0024		0.010	0.0024	mg/L		04/16/12 10:44	04/16/12 18:37	1
Barium	0.000540	J	0.010	0.00044	mg/L		04/16/12 10:44	04/16/12 18:37	1
Beryllium	<0.00044		0.0040	0.00044	mg/L		04/16/12 10:44	04/16/12 18:37	1
Boron	<0.024		0.050	0.024	mg/L		04/16/12 10:44	04/16/12 18:37	1
Cadmium	<0.00054	^	0.0020	0.00054	mg/L		04/16/12 10:44	04/16/12 18:37	1
Chromium	<0.00096		0.010	0.00096	mg/L		04/16/12 10:44	04/16/12 18:37	1
Copper	<0.0011		0.010	0.0011	mg/L		04/16/12 10:44	04/16/12 18:37	1
Lead	0.00204	J	0.0050	0.0016	mg/L		04/16/12 10:44	04/16/12 18:37	1
Nickel	<0.0019		0.010	0.0019	mg/L		04/16/12 10:44	04/16/12 18:37	1
Selenium	<0.0027		0.010	0.0027	mg/L		04/16/12 10:44	04/16/12 18:37	1
Silver	<0.0011		0.0050	0.0011	mg/L		04/16/12 10:44	04/16/12 18:37	1
Thallium	<0.0013		0.010	0.0013	mg/L		04/16/12 10:44	04/16/12 18:37	1
Zinc	<0.0047		0.020	0.0047	mg/L		04/16/12 10:44	04/16/12 18:37	1

Lab Sample ID: LCS 500-146493/2-A
Matrix: Water
Analysis Batch: 146602

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 146493

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	0.500	0.487		mg/L		97	80 - 120
Arsenic	0.100	0.0925		mg/L		93	80 - 120
Barium	2.00	1.88		mg/L		94	80 - 120
Beryllium	0.0500	0.0481		mg/L		96	80 - 120
Boron	1.00	0.919		mg/L		92	80 - 120
Cadmium	0.0500	0.0477	^	mg/L		95	80 - 120
Chromium	0.200	0.196		mg/L		98	80 - 120
Copper	0.250	0.245		mg/L		98	80 - 120
Lead	0.100	0.102		mg/L		102	80 - 120
Nickel	0.500	0.485		mg/L		97	80 - 120
Selenium	0.100	0.0847		mg/L		85	80 - 120
Silver	0.0500	0.0473		mg/L		95	80 - 120
Thallium	0.100	0.0938		mg/L		94	80 - 120
Zinc	0.500	0.476		mg/L		95	80 - 120

Lab Sample ID: 500-45460-5 MS
Matrix: Water
Analysis Batch: 146602

Client Sample ID: RB-1
Prep Type: Total/NA
Prep Batch: 146493

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Antimony	<0.0026		0.500	0.493		mg/L		99	75 - 125
Arsenic	<0.0024		0.100	0.0917		mg/L		92	75 - 125
Barium	0.0028	J B	2.00	1.91		mg/L		95	75 - 125
Beryllium	<0.00044		0.0500	0.0489		mg/L		98	75 - 125
Boron	<0.024		1.00	0.926		mg/L		93	75 - 125
Cadmium	<0.00054	^	0.0500	0.0483	^	mg/L		97	75 - 125
Chromium	0.0011	J	0.200	0.200		mg/L		100	75 - 125
Copper	0.0017	J	0.250	0.251		mg/L		100	75 - 125
Lead	0.0020	J B	0.100	0.103		mg/L		101	75 - 125
Nickel	<0.0019		0.500	0.492		mg/L		98	75 - 125

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: 500-45460-5 MS — **Client Sample ID: RB-1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 146602 — **Prep Batch: 146493**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Selenium	<0.0027		0.100	0.0838		mg/L		84	75 - 125
Silver	<0.0011		0.0500	0.0476		mg/L		95	75 - 125
Thallium	<0.0013		0.100	0.0955		mg/L		95	75 - 125
Zinc	0.052		0.500	0.533		mg/L		96	75 - 125

Lab Sample ID: 500-45460-5 MSD — **Client Sample ID: RB-1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 146602 — **Prep Batch: 146493**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Antimony	<0.0026		0.500	0.499		mg/L		100	75 - 125	1.25	20
Arsenic	<0.0024		0.100	0.0952		mg/L		95	75 - 125	3.72	20
Barium	0.0028	J B	2.00	1.93		mg/L		96	75 - 125	1.08	20
Beryllium	<0.00044		0.0500	0.0490		mg/L		98	75 - 125	0.000	20
Boron	<0.024		1.00	0.932		mg/L		93	75 - 125	1.00	20
Cadmium	<0.00054	^	0.0500	0.0487	^	mg/L		97	75 - 125	1.00	20
Chromium	0.0011	J	0.200	0.201		mg/L		100	75 - 125	1.00	20
Copper	0.0017	J	0.250	0.252		mg/L		100	75 - 125	1.00	20
Lead	0.0020	J B	0.100	0.103		mg/L		101	75 - 125	1.00	20
Nickel	<0.0019		0.500	0.495		mg/L		99	75 - 125	1.00	20
Selenium	<0.0027		0.100	0.0852		mg/L		85	75 - 125	1.61	20
Silver	<0.0011		0.0500	0.0482		mg/L		96	75 - 125	1.13	20
Thallium	<0.0013		0.100	0.0954		mg/L		95	75 - 125	0.000	20
Zinc	0.052		0.500	0.534		mg/L		96	75 - 125	0.000	20

Lab Sample ID: 500-45460-5 DU — **Client Sample ID: RB-1**
Matrix: Water — **Prep Type: Total/NA**
Analysis Batch: 146602 — **Prep Batch: 146493**

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Antimony	<0.0026		<0.0026		mg/L		NC	20
Arsenic	<0.0024		<0.0024		mg/L		NC	20
Barium	0.0028	J B	0.000800	J	mg/L		110	20
Beryllium	<0.00044		<0.00044		mg/L		NC	20
Boron	<0.024		<0.024		mg/L		NC	20
Cadmium	<0.00054	^	<0.00054	^	mg/L		NC	20
Chromium	0.0011	J	0.00120	J	mg/L		12.0	20
Copper	0.0017	J	0.00189	J	mg/L		11.0	20
Lead	0.0020	J B	0.00294	J	mg/L		40.0	20
Nickel	<0.0019		<0.0019		mg/L		NC	20
Selenium	<0.0027		<0.0027		mg/L		NC	20
Silver	<0.0011		<0.0011		mg/L		NC	20
Thallium	<0.0013		<0.0013		mg/L		NC	20
Zinc	0.052		0.0515		mg/L		1.00	20

Method: 7470A - Mercury (CVAA)

Lab Sample ID: MB 500-146542/7-A
Matrix: Water
Analysis Batch: 146679

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 146542

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.070		0.20	0.070	ug/L		04/16/12 14:40	04/17/12 13:12	1

Lab Sample ID: LCS 500-146542/8-A
Matrix: Water
Analysis Batch: 146679

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 146542

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	2.00	1.89		ug/L		95	80 - 120

Lab Sample ID: 500-45460-1 MS
Matrix: Water
Analysis Batch: 146679

Client Sample ID: TGP-A
Prep Type: Total/NA
Prep Batch: 146542

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	<0.070		1.00	0.684	F	ug/L		68	75 - 125

Lab Sample ID: 500-45460-1 MSD
Matrix: Water
Analysis Batch: 146679

Client Sample ID: TGP-A
Prep Type: Total/NA
Prep Batch: 146542

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	<0.070		1.00	0.651	F	ug/L		65	75 - 125	4.96	20

Lab Sample ID: 500-45460-1 DU
Matrix: Water
Analysis Batch: 146679

Client Sample ID: TGP-A
Prep Type: Total/NA
Prep Batch: 146542

Analyte	Sample Result	Sample Qualifier	DU Result	DU Qualifier	Unit	D	RPD	RPD Limit
Mercury	<0.070		<0.070		ug/L		NC	20

Method: 9056 - Anions, Ion Chromatography

Lab Sample ID: MB 500-146758/3
Matrix: Water
Analysis Batch: 146758

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Chloride	0.140	J	0.20	0.083	mg/L			04/17/12 13:04	1
Fluoride	<0.029		0.20	0.029	mg/L			04/17/12 13:04	1
Nitrate as N	<0.023		0.10	0.023	mg/L			04/17/12 13:04	1
Sulfate	<0.090		0.20	0.090	mg/L			04/17/12 13:04	1

Lab Sample ID: LCS 500-146758/4
Matrix: Water
Analysis Batch: 146758

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	3.00	3.01		mg/L		100	80 - 120
Fluoride	1.00	1.07		mg/L		107	80 - 120
Nitrate as N	2.00	2.07		mg/L		104	80 - 120
Sulfate	5.00	4.58		mg/L		92	80 - 120

QC Sample Results

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

Lab Sample ID: 500-45460-5 MS
Matrix: Water
Analysis Batch: 146758

Client Sample ID: RB-1
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Chloride	0.64	B	3.00	3.28		mg/L		88	75 - 125
Fluoride	<0.029		1.00	1.07		mg/L		107	75 - 125
Nitrate as N	0.28		2.00	2.08		mg/L		90	75 - 125
Sulfate	0.17	J	5.00	4.82		mg/L		93	75 - 125

Lab Sample ID: 500-45460-5 MSD
Matrix: Water
Analysis Batch: 146758

Client Sample ID: RB-1
Prep Type: Total/NA

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Chloride	0.64	B	3.00	3.26		mg/L		87	75 - 125	1.00	20
Fluoride	<0.029		1.00	1.05		mg/L		105	75 - 125	2.15	20
Nitrate as N	0.28		2.00	2.09		mg/L		90	75 - 125	0.000	20
Sulfate	0.17	J	5.00	4.80		mg/L		92	75 - 125	0.000	20

Certification Summary

Client: Golder Associates Inc.
Project/Site: Ameren Groundwater Testing

TestAmerica Job ID: 500-45460-1

Laboratory	Authority	Program	EPA Region	Certification ID
TestAmerica Chicago	Alabama	State Program	4	40461
TestAmerica Chicago	California	NELAC	9	01132CA
TestAmerica Chicago	Florida	NELAC	4	E871072
TestAmerica Chicago	Georgia	State Program	4	939
TestAmerica Chicago	Georgia	State Program	4	N/A
TestAmerica Chicago	Hawaii	State Program	9	N/A
TestAmerica Chicago	Illinois	NELAC	5	100201
TestAmerica Chicago	Indiana	State Program	5	C-IL-02
TestAmerica Chicago	Iowa	State Program	7	82
TestAmerica Chicago	Kansas	NELAC	7	E-10161
TestAmerica Chicago	Kentucky	State Program	4	90023
TestAmerica Chicago	Kentucky (UST)	State Program	4	66
TestAmerica Chicago	L-A-B	DoD ELAP		L2304
TestAmerica Chicago	L-A-B	ISO/IEC 17025		L2304
TestAmerica Chicago	Louisiana	NELAC	6	30720
TestAmerica Chicago	Massachusetts	State Program	1	M-IL035
TestAmerica Chicago	Mississippi	State Program	4	N/A
TestAmerica Chicago	North Carolina DENR	State Program	4	291
TestAmerica Chicago	Oklahoma	State Program	6	8908
TestAmerica Chicago	South Carolina	State Program	4	77001
TestAmerica Chicago	Texas	NELAC	6	T104704252-09-TX
TestAmerica Chicago	USDA	Federal		P330-12-00038
TestAmerica Chicago	Virginia	NELAC	3	460142
TestAmerica Chicago	Wisconsin	State Program	5	999580010
TestAmerica Chicago	Wyoming	State Program	8	8TMS-Q

Accreditation may not be offered or required for all methods and analytes reported in this package. Please contact your project manager for the laboratory's current list of certified methods and analytes.

Chain of Custody Record

Temperature on Receipt 0.3

Drinking Water? Yes ☐ No ☐

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

500-45460

TAL-4124 (1007)

Client	Project Manager	Date	Chain of Custody Number
GOLDER ASSOC.	MARK HADDOCK	4-13-12	101373

Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page
820 S MAIN ST, SUITE 100	636 724-9191	—	Page 1 of 1

City	State	Zip Code	Site Contact	Lab Contact
ST CHARLES	MO	63301	MIKE DREYER	DONNA INGERSOLL

Project Name and Location (State)	Carrier/Waybill Number
AMEREN LABADIE / MO	FEDEX

Contract/Purchase Order/Quote No.: 12384274

	Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: 6010B Metals	9056 Anions	Special Instructions/ Conditions of Receipt
1	TGP-A	4-12-12	1705		X			1		1				X	X	
2	TGP-B	4-13-12	1135		X			1		1				X	X	
3	TGP-C	4-12-12	1500		X			1		1				X	X	
4	DUP-1	4-12-12	—		X			1		1				X	X	
5	RB-1	4-13-12	1200		X			1		1				X	X	

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☒ Archive For 1 Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☒ Other 3 DAY

QC Requirements (Specify)

	Relinquished By	Date	Time	Received By	Date	Time
1.	[signature]	4-13-12	1345	[signature]	04/14/12	0930
2.						
3.						

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Login Sample Receipt Checklist

Client: Golder Associates Inc.

Job Number: 500-45460-1

Login Number: 45460
List Number: 1
Creator: Kelsey, Shawn M

List Source: TestAmerica Chicago

Question	Answer	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	True	

AECOM

Report on Piezometer Installation, Water Level Monitoring, and Groundwater Sampling, Labadie, Missouri (May 2012)

January 2014

May 9, 2012 Project #: 123-84274

Ameren Services
One Ameren Plaza
1901 Chouteau Avenue
St. Louis, Missouri 63103

RE: REPORT ON PIEZOMETER INSTALLATION, WATER LEVEL MONITORING, AND GROUNDWATER SAMPLING
LABADIE, MISSOURI

Golder Associates Inc. (Golder) is pleased to submit this letter report summarizing drilling and piezometer installation south of the Ameren Missouri (Ameren) Labadie Power Plant facility in Franklin County, Missouri. This letter summarizes piezometer installation, groundwater sampling methods, water level monitoring methods, and laboratory analyses of the groundwater samples collected during April 2012. A tabulated summary of the periodic water level data collected to date is provided in Table 1. Laboratory analytical results are summarized in Table 2. The site layout and piezometer locations are shown on Figure 1 with the groundwater potentiometric surface map. Borehole logs are provided as Attachment A. Piezometer construction forms are provided as Attachment B. Attachment C contains copies of the MDNR Well Registration Forms and receipt confirmation from the MDNR Wellhead Protection Program.

1.0 PROJECT SCOPE OF WORK

Our scope of work included the following:

- Drill and install three new groundwater piezometers
- Develop and sample the three new groundwater piezometers
- Survey the ground surface and casing elevations of the new piezometers
- Install electronic instruments in the new piezometers for periodic water level measurements
- Tabulate sampling results and prepare a summary report

2.0 DRILLING, PIEZOMETER INSTALLATION, AND DEVELOPMENT

Three new groundwater piezometers were installed based on the January 24, 2012 map of proposed locations provided by Ameren in the Preliminary Work Plan. Roberts Environmental Drilling, Inc. performed the drilling and piezometer installation under the direct supervision of Golder. The new piezometers were installed with open or screened intervals in bedrock at similar depths to nearby residential water wells in general accordance with Missouri Department of Natural Resources (MDNR) Well Construction Rules (10 CSR 23-4.060 Construction Standards for Monitoring Wells). New piezometers were installed using air rotary drilling methods. Geologic borehole logs and piezometer construction logs were prepared for each new piezometer installation and are included as Attachments A and B. Two of the new piezometers (TGP-A and TGP-B) were constructed of two-inch diameter, schedule 80 polyvinyl chloride (PVC) riser pipe with 0.01-inch machine slotted PVC screen. The screened portion was constructed with a sand pack consisting of environmental silica sand. A bentonite seal was placed in the annulus above the sand pack and extended up to two feet below ground surface to

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form a well seal. A small concrete surface pad and protective steel cover extends down to the top of the bentonite seal. The riser extends to approximately three feet above ground surface to facilitate groundwater sampling. The third piezometer (TGP-C) was constructed as a six-inch open-hole completion in bedrock with six-inch steel surface casing extending to 95 feet below ground surface. The surface casing was grouted into bedrock using a cement bentonite grout to form a seal above the open-hole interval. A small concrete surface pad and flush-mount protective steel cover extend down to the top of the grouted casing seal.

Zahner & Associates, Inc. provided professional land survey of the three new piezometers. Surveyed piezometer coordinates and elevations are located on monitoring well construction logs in Attachment B.

New piezometers were developed using surging and purging techniques. A stainless steel bailer was lowered into each piezometer and used to surge and remove drilling sediment from the bottom of each installation. A submersible electric pump with polyethylene tubing was lowered into each piezometer and at least three well-bore volumes of groundwater were removed. Development was deemed complete when at least three consecutive readings of field parameters (pH, turbidity, conductivity, and temperature) were within 10% of previous measurements.

3.0 WATER LEVEL MONITORING

Following development, Golder installed electronic instruments in each piezometer for the purpose of periodic (daily) water level measurements. An In-Situ Inc. Level Troll 500 device with vented cable was installed in each piezometer for this purpose. The devices electronically measure water column pressures (piezometric head) and record the data in on-board dataloggers at the selected intervals. The water level data was then retrieved from the surface using a readout device and downloaded to a computer for tabulation. Golder manually measured water levels in each piezometer when the instrument data was retrieved. A tabulated summary of daily water level data collected to date is provided in Table 1. Table 1 will be regularly updated during the monitoring period. Figure 1 provides a groundwater potentiometric surface map showing the gradient and direction of groundwater flow using the surveyed piezometer coordinates and elevations and the most recent water level data. Figure 1 shows that the groundwater flow direction observed in these three piezometers is from the southeast to the northwest, towards the Missouri River.

4.0 GROUNDWATER SAMPLING AND ANALYTICAL RESULTS

After the piezometers equilibrated for a minimum one month period following development, groundwater samples were collected from each piezometer. Samples were collected after three well-bore volumes had again been purged from each piezometer using a submersible electric pump with dedicated polyethylene tubing. Field parameters including pH, conductivity, temperature, and turbidity were measured and recorded during purging and sampling.

After three well-bore volumes were removed and three consecutive sets of field parameter measurements were stabilized within 10% of previous measurements for conductivity and temperature and within 0.1 for pH, groundwater samples were collected and submitted to Test America - Chicago for total metals analysis using USEPA Method 6010B, anions analysis using USEPA Method 9056, and mercury analysis using USEPA Method 7470A. The samples were analyzed for boron, an indicator constituent for leachate from coal combustion products, and inorganic constituents that have regulatory standards for protection of drinking water supplies specified in Table A of 10 CSR 20-7.031.

Groundwater sampled for analysis was collected into laboratory-supplied containers directly from the pump tubing discharge. One duplicate groundwater sample was collected from one of the piezometers for quality assurance/quality control (QA/QC) purposes. One equipment rinsate blank was collected from the submersible sampling pump using laboratory grade de-ionized water and analyzed at the laboratory. After collection in the field, groundwater samples were labeled with the sample identification number,

requested analysis, collection date, and sampler's initials, and placed on ice in a cooler for shipment under chain-of-custody protocol via overnight transport to the Test America – Chicago Laboratory.

Analytical results for groundwater are summarized below and tabulated in Table 2. Boron concentrations were below detection limits in all three samples, suggesting that groundwater at the three monitoring points is not affected by leachate from coal combustion products. Other metal constituents and anions were detected; however, concentrations of the other constituents were lower than both the Missouri and federal drinking water standards. It is not uncommon to detect low levels of inorganic constituents in uncontaminated groundwater samples because these elements are often naturally present in the soils and rocks that are in contact with the groundwater.

Several analytical results are qualified with a B, J, or ^ data flags. The B flag indicates that the constituent was detected in a laboratory blank, and therefore the analytical result may be biased high. Since all results were low and below drinking water standards, any such bias was minimal and does not significantly affect interpretation of the results. The J flag indicates that the constituent was detected at a very low level, in a range where the precision of the laboratory instruments is low, and therefore the reported concentration is qualified as estimated. Again, this does not adversely affect the interpretation because all results were lower than the drinking water standards. The ^ flag indicates that the laboratory interference check was slightly above acceptance limits; however, all of the results for the affected constituents were non-detect, so there was no relevant bias affecting results.

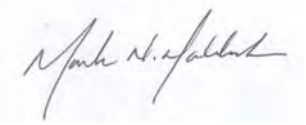
5.0 CLOSING

Golder appreciates the opportunity to serve as your consultant on this project. If you have any questions concerning this letter report or need additional information, please contact the undersigned at 636-724-9191.

Sincerely,

GOLDER ASSOCIATES INC.

Michael Dreyer, E.I.T.
Staff Engineer



Mark N. Haddock, R.G., P.E.
Senior Engineer
Associate

Mark R. Sandfort, P.E.
Senior Consultant
Principal

Attachments:
Table 1 – Record of Water Level Readings
Table 2 – Summary of Groundwater Analytical Results
Figure 1 – Groundwater Potentiometric Surface Map
Attachment A – Borehole Logs
Attachment B – Well Construction Logs
Attachment C – MDNR Well Registration Forms and Receipt Confirmation

MWD/MNH

TABLES

TABLE 1: RECORD OF WATER LEVEL READINGS

Ameren, Labadie MO Hydrogeology Study

Labadie, MO

	TGP-A		TGP-B		TGP-C	
Ground Surface Elevation (ft MSL)* NAVD 88	479.78		491.27		612.23	
Top of Casing Elevation (ft MSL)* NAVD 88	482.32		494.62		611.5	
Date	**Water Level (ft BTOC)**	**Water Elevation (ft MSL)**	**Water Level (ft BTOC)**	**Water Elevation (ft MSL)**	**Water Level (ft BTOC)**	**Water Elevation (ft MSL)**
3/17/2012	21.60	460.72	28.24	466.38	114.23	497.27
3/18/2012	21.31	461.01	28.00	466.62	114.10	497.40
3/19/2012	20.91	461.41	27.64	466.98	114.04	497.46
3/20/2012	20.77	461.55	27.35	467.27	113.89	497.61
3/21/2012	20.78	461.55	27.31	467.31	113.63	497.87
3/22/2012	20.77	461.55	27.29	467.33	113.63	497.87
3/23/2012	20.51	461.81	27.23	467.39	113.63	497.87
3/24/2012	20.08	462.24	27.04	467.58	113.34	498.16
3/25/2012	19.62	462.70	26.95	467.67	113.50	498.00
3/26/2012	19.14	463.18	26.83	467.79	113.66	497.84
3/27/2012	18.62	463.71	26.63	467.99	113.63	497.87
3/28/2012	18.33	463.99	26.42	468.20	113.41	498.09
3/29/2012	18.35	463.97	26.34	468.28	113.47	498.04
3/30/2012	18.29	464.03	26.19	468.44	113.18	498.32
3/31/2012	18.41	463.91	26.20	468.42	113.18	498.32
4/1/2012	18.31	464.01	26.14	468.48	113.33	498.17
4/2/2012	18.06	464.26	26.01	468.61	113.41	498.09
4/3/2012	18.13	464.19	26.07	468.56	113.67	497.83
4/4/2012	18.17	464.15	26.28	468.34	113.55	497.95
4/5/2012	18.10	464.22	26.02	468.60	113.48	498.03
4/6/2012	18.29	464.03	26.13	468.49	113.35	498.15
4/7/2012	18.40	463.92	26.14	468.48	113.42	498.08
4/8/2012	18.53	463.79	26.20	468.42	113.40	498.10
4/9/2012	18.58	463.74	26.12	468.50	113.45	498.05
4/10/2012	18.58	463.74	26.13	468.49	113.57	497.93
4/11/2012	18.71	463.62	26.27	468.35	113.56	497.94
4/12/2012	18.80	463.52	26.38	468.25	113.87	497.63

Notes:

* - Survey performed by Zahner & Associates, 3-5-12 and 3-6-12

BTOC - Below the Top of Casing (water level depth)

MSL - Elevation in feet above Mean Sea Level

Prepared By: MWD Date: 4/19/2012

Checked By: ALD Date: 4/20/2012

Reviewed By: MNH Date: 5/8/2012

Table 2
Summary of Groundwater Analytical Results
Ameren, Labadie MO

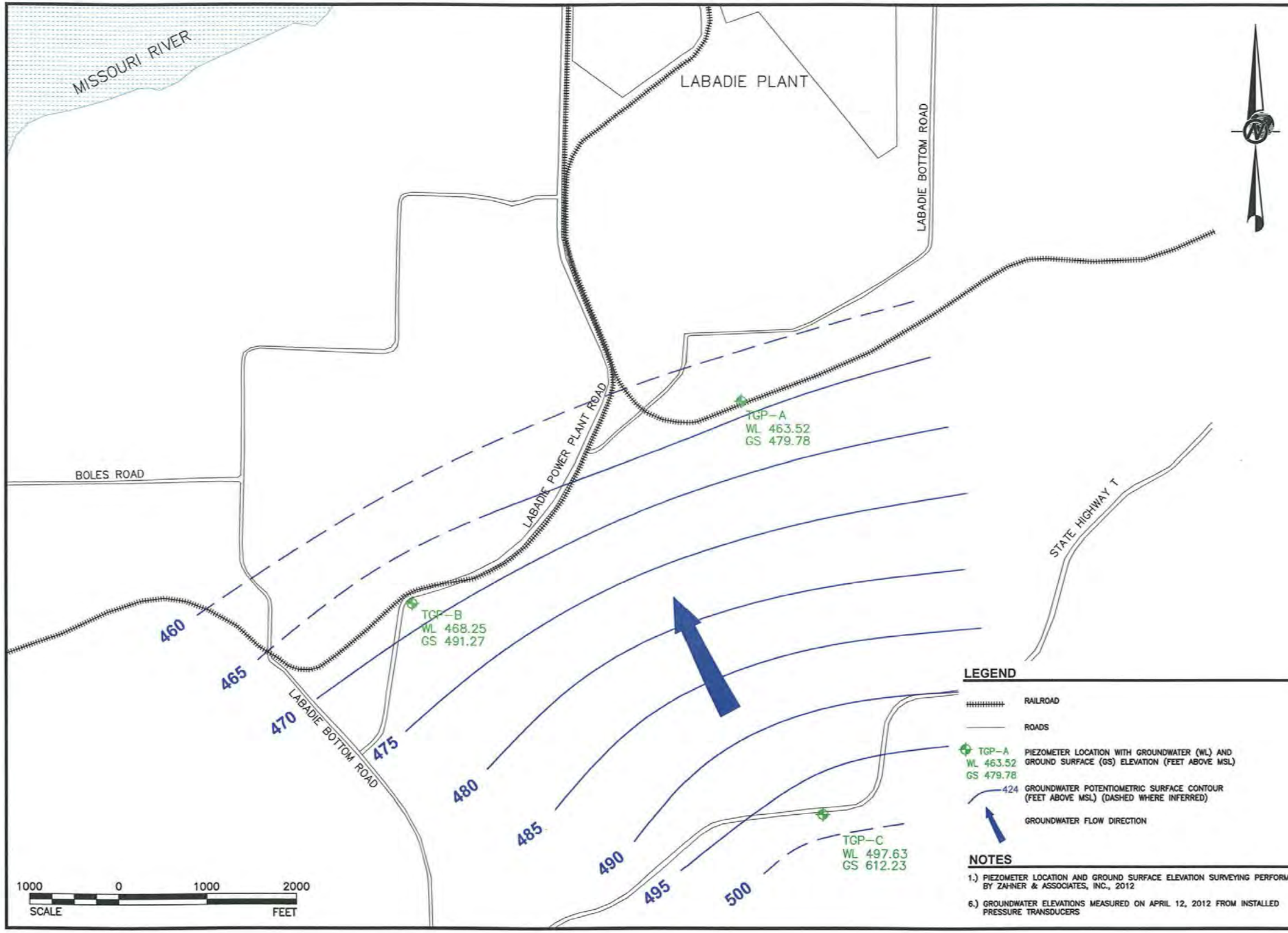
	Missouri Drinking Water Supply (DWS) Standard[1]	US EPA Federal Maximum Contaminant Level (MCL)[2]	TGP-A	MDL	TGP-B	MDL	TGP-C	MDL	DUP-1	MDL	RB-1	MDL
Sample Date			4/12/12		4/13/12		4/12/12		4/12/12		4/13/12	
Sample Time			17:05		11:35		15:00		0:00		12:00	
Total Metals (SW846 Method 6010B)												
Analyte	**CAS No.**	mg/L	mg/L		mg/L		mg/L		mg/L		mg/L	
Antimony	7440-36-0	0.006	0.006	< 0.0026	0.0026	**0.0026 J**	0.0026	< 0.0026	0.0026	< 0.0026	0.0026	< 0.0026	0.0026
Arsenic	7440-38-2	0.05	0.01	< 0.0024	0.0024	< 0.0024	0.0024	< 0.0024	0.0024	< 0.0024	0.0024	< 0.0024	0.0024
Barium	7440-39-3	2.0	2.0	**0.21 B**	0.00044	**0.10 B**	0.00044	**0.15 B**	0.00044	**0.22 B**	0.00044	**0.0028 JB**	0.00044
Beryllium	7440-41-7	0.004	0.004	< 0.00044	0.00044	< 0.00044	0.00044	< 0.00044	0.00044	< 0.00044	0.00044	< 0.00044	0.00044
Boron	7440-42-8	No DWS[3]	No MCL[4]	< 0.024	0.024	< 0.024	0.024	< 0.024	0.024	< 0.024	0.024	< 0.024	0.024
Cadmium	7440-43-9	0.005	0.005	< 0.00054 ^	0.00054	< 0.00054 ^	0.00054	< 0.00054 ^	0.00054	< 0.00054 ^	0.00054	< 0.00054 ^	0.00054
Chromium	7440-47-3	0.1	0.1	**0.0029 J**	0.00096	**0.0025 J**	0.00096	**0.0013 J**	0.00096	**0.0034 J**	0.00096	**0.0011 J**	0.00096
Copper	7440-50-8	1.3	1.3	< 0.0011	0.0011	< 0.0011	0.0011	< 0.0011	0.0011	< 0.0011	0.0011	**0.0017 J**	0.0011
Lead	7439-92-1	0.015	0.015	**0.0031 JB**	0.0016	**0.0036 JB**	0.0016	**0.0044 JB**	0.0016	**0.0037 JB**	0.0016	**0.0020 JB**	0.0016
Nickel	7440-02-0	0.1	No MCL[4]	**0.0020 J**	0.0019	< 0.0019	0.0019	< 0.0019	0.0019	**0.0021 J**	0.0019	< 0.0019	0.0019
Selenium	7782-49-2	0.05	0.05	< 0.0027	0.0027	< 0.0027	0.0027	< 0.0027	0.0027	< 0.0027	0.0027	< 0.0027	0.0027
Silver	7440-22-4	0.05	[0.10]	< 0.0011	0.0011	< 0.0011	0.0011	< 0.0011	0.0011	< 0.0011	0.0011	< 0.0011	0.0011
Thallium	7440-28-0	0.002	0.002	< 0.0013	0.0013	< 0.0013	0.0013	< 0.0013	0.0013	< 0.0013	0.0013	< 0.0013	0.0013
Zinc	7440-66-6	5.0	[5.0]	< 0.0047	0.0047	< 0.0047	0.0047	**0.0064 J**	0.0047	< 0.0047	0.0047	**0.052**	0.0047
Anions, Ion Chromotography (SW846 Method 9056)												
Analyte	**CAS No.**	mg/L	mg/L		mg/L		mg/L		mg/L		mg/L	
Chloride	16887-00-6	250	[250]	**5.8 B**	0.083	**29 B**	0.83	**43 B**	0.83	**5.7 B**	0.083	**0.64 B**	0.083
Fluoride	16984-48-8	4	4	**0.20**	0.029	**0.25**	0.029	**0.16 J**	0.029	**0.18 J**	0.029	< 0.029	0.029
Nitrate as N	14797-55-8	10	10	**1.3**	0.023	**7.9**	0.23	**5.0**	0.23	**1.3**	0.023	**0.28**	0.023
Sulfate	14808-79-8	250	[250]	**13**	0.90	**25**	0.90	**34**	0.90	**14**	0.90	**0.17 J**	0.090
Mercury (SW846 Method 7470A)												
Analyte	**CAS No.**	µg/L	µg/L		µg/L		µg/L		µg/L		µg/L	
Mercury	7439-97-6	2.0	2.0	< 0.070	0.070	< 0.070	0.070	< 0.070	0.070	< 0.070	0.070	< 0.070	0.070

Notes:

1) Missouri Drinking Water Supply (DWS) Standard per 10 CSR 20-7.031 Table A
2) Federal Maximum Contaminant Level (MCL)
   - [ ] indicates that there is no MCL for the constituent, and the non-enforceable secondary MCL is displayed
3) A DWS for Boron does not exist
4) MCL or secondary MCL values for Boron and Nickel do not exist
5) The following qualifiers are used;
   - **B**, the compound was found in the blank and the sample
   - **J**, the result is less than the reporting limit (RL) but greater than or equal to the method detection limit (MDL) and the concentration is an appoximate value
   - ^, ICV, CCV, ICB, CCB, ISA, ISB, CRI, CRA, DLCK or MRL standard: Insturment related QC exceeds the control limits.
6) **BOLD** values indicate a detection
7) SW846 - "Test Method for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates
8.) mg/l = milligrams per liter
9.) µg/l = micrograms per liter

Prepared By: MWD 4/19/2012
Checked By: ALD 4/20/2012, MWD 5/8/2012
Reviewed By: MNH 5/8/2012

FIGURES



Golder Associates
St. Louis, Missouri

PROJECT
GROUNDWATER PIEZOMETER INSTALLATION
AMEREN LABADIE PIEZOMETERS
Labadie, MO

TITLE
GROUNDWATER POTENTIOMETRIC SURFACE MAP (APRIL 2012)

PROJECT No. 123-84274		
FILE No. 12384274-F01		
REV. 0	SCALE AS SHOWN	
DESIGN	MWD	04/09/12
CADD	MWD	04/20/12
CHECK	ALD	04/20/12
REVIEW	MAH	05/08/12

FIGURE
1

APPENDIX A

BOREHOLE LOGS

RECORD OF BOREHOLE TGP-A

SHEET 1 of 3

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-A

DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/27/2012
DRILL RIG: CME 75

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 988,186.35 E: 724,460.71

ELEVATION: 482.32
INCLINATION: -90

DEPTH (feet)	BORING METHOD	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
0	6 1/4" HSA	(0.0 - 0.5) Soft, brownish black (5YR 2/1), CLAYEY SILT, some organics, tree roots, moist (ML) TOPSOIL	CL-ML		481.8 / 0.5							Soil and rock type and descriptions determined from cuttings. Strength and weathering inferred from drilling. Sampling and discontinuity measurements not conducted.
		(0.5 - 10.0) Soft, dark yellowish brown (10YR 4/2), SILT, some clay, some fine to medium sand, trace fine gravel (ML), moist	ML									
10		(10.0 - 25.0) Soft, olive gray (5Y 4/1), CLAYEY SILT, little fine to medium sand (CL-ML), moist	CL-ML		472.3 / 10.0							
20												▽ Water Level 21.55 ft bgs 3/2/12 prior to development
25		(25.0 - 32.5) Firm, light brownish gray (5YR 6/1), SILTY CLAY, trace fine sand (CL), very moist	CL		457.3 / 25.0							
30		(32.5 - 36.0) Compact, moderate brown (5YR 4/4), fine to medium grained, SILTY SAND, trace fine gravel, trace organics (SM), very moist	SM		449.8 / 32.5							(32.5) Drilling penetration resistance increases
35	6" Air Rotary	(36.0 - 53.0) Slightly to moderately weathered, yellowish gray (5Y 8/1), very fine to fine crystaline, medium strong (R3), DOLOMITE, little chert (likely SMITHVILLE POWELL FORMATION)			446.3 / 36.0							(36.0) HSA refusal on top of bedrock switch to air rotary drilling
40		Log continued on next page										

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: J. Crank/C. Hebel

LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

RECORD OF BOREHOLE TGP-A

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-A

DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/27/2012
DRILL RIG: CME 75

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 988,186.35 E: 724,460.71

ELEVATION: 482.32
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
40	6" Air Rotary	(36.0 - 53.0) Slightly to moderately weathered, yellowish gray (5Y 8/1), very fine to fine crystaline, medium strong (R3), DOLOMITE, little chert (likely SMITHVILLE POWELL FORMATION) *(Continued)*										(41.0) Stop rock drilling after roughly 5 feet. Attempt to push casing deeper to cut off flowing sands.
45		(45.0) Color changes to yellowish gray (5Y 8/1) and pale olive (10Y 6/2)			437.3 45.0							
50					429.3							
55		(53.0 - 57.0) Slightly weathered, light gray (N7), very fine crystalline, medium strong (R3), DOLOMITE and yellowish gray (5Y 8/1) and grayish orange (10YR 7/4), fine to medium grained, SANDSTONE, little chert.			53.0 425.3							Unable to seal off flowing sands on top fo bedrock. Offset ~5' north, set 6" steel casing and resume.
60		(57.0 - 62.0) Slightly weathered, yellowish gray (5Y 8/1) and pale olive (10Y 6/2), very fine to fine crystalline, medium strong (R3), DOLOMITE, little chert			57.0							
		(61.0) Very light gray (N8), solutioned limestone			421.3 61.0							
		(62.0 - 67.0) Mud filled void			420.3 62.0							(62.0) Stop drilling. Pump grout into mud filled void to seal mud and rock debris from falling into borehole
65					415.3							
70		(67.0 - 105.0) Slightly to moderately weathered, yellowish gray (5Y 8/1) and pale olive (10Y 6/2), very fine to fine crystalline, medium strong (R3), DOLOMITE, some chert, little solutioned limestone			67.0							
75		(76.0) Slightly weathered, little chert, trace solutioned limestone			406.3 76.0							
80		Log continued on next page										

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: J. Crank/C. Hebel

LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

RECORD OF BOREHOLE TGP-A

SHEET 3 of 3

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-A

DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/27/2012
DRILL RIG: CME 75

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 988,186.35 E: 724,460.71

ELEVATION: 482.32
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
80	6" Air Rotary	(67.0 - 105.0) Slightly to moderately weathered, yellowish gray (5Y 8/1) and pale olive (10Y 6/2), very fine to fine crystalline, medium strong (R3), DOLOMITE, some chert, little solutioned limestone *(Continued)*										
85												
90												
95												
100												
105		END OF BORING AT 105 FT BGS			377.3 / 105.0							Terminate boring at 105 ft BGS, 3/1/2012 @ 1100. Install piezometer TPG-A. See monitoring well construction log TGP-A for details.
110												
115												
120												

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: J. Crank/C. Hebel

LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

GOLDER STL RECORD OF BOREHOLE MWD 12384274_AMEREN LABADIE WELLS.GPJ GLDR_CO.GDT 4/20/12

RECORD OF BOREHOLE TGP-B

SHEET 1 of 4

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-B
DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/20/2012
DRILL RIG: Ingersol Rand T3W
DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 985,894.58 E: 720,699.99
ELEVATION: 494.62
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
0	6" Air Rotary	(0.0-1.0) Dense, yellowish gray (5Y 8/1), medium to coarse GRAVEL, some fine to coarse sand (GW), dry (OVERBURDEN)	GW		493.6 / 1.0							(1.0) Top of bedrock at 1.0 ft BGS
		(1.0 - 10.0) Moderately to slightly weathered, yellowish gray (5Y 8/1), very fine to fine crystalline, medium strong (R3), DOLOMITE, little chert										Soil and rock type and descriptions determined from cuttings. Strength and weathering inferred from drilling. Sampling and discontinuity measurements not conducted.
10		(10.0 - 20.0) Slightly weathered to fresh, yellowish gray (5Y 8/1) to moderate yellowish brown (10YR 5/4), very fine to fine crystalline, medium strong (R3), DOLOMITE, some chert, little sandstone			484.6 / 10.0							
20		(20.0 - 76.0) Fresh, yellowish gray (5Y 8/1) and pale olive (10Y 6/2), very fine to fine crystalline, medium strong (R3), DOLOMITE, little chert			474.6 / 20.0							(19.0) Driller notes ~1 foot water pocket (20.0) Cuttings pulverized to sandlike consistency
40		Log continued on next page			454.6							▽ Water Level 28.04 ft bgs 2/24/12 at 08:00

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: C. Hebel
LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

GOLDER STL RECORD OF BOREHOLE MWD 12384274_AMEREN LABADIE WELLS.GPJ GLDR_CO.GDT 4/20/12

RECORD OF BOREHOLE TGP-B

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-B
DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/20/2012
DRILL RIG: Ingersol Rand T3W
DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 985,894.58 E: 720,699.99
ELEVATION: 494.62
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
40	6" Air Rotary	(20.0 - 76.0) Fresh, yellowish gray (5Y 8/1) and pale olive (10Y 6/2), very fine to fine crystalline, medium strong (R3), DOLOMITE, little chert *(Continued)* (40.0) Dolomite becomes strong (R4)			40.0							(40.0) Water encountered
45												
50												
55												
60												
65												
70												
75					418.6							
		(76.0 - 95.0) Fresh, light gray (N7), very fine to fine crystalline, strong (R4), DOLOMITE, little chert			76.0							
80		Log continued on next page										

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: C. Hebel
LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

RECORD OF BOREHOLE TGP-B

SHEET 3 of 4

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-B

DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/20/2012
DRILL RIG: Ingersol Rand T3W

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 985,894.58 E: 720,699.99

ELEVATION: 494.62
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
80	6" Air Rotary	(76.0 - 95.0) Fresh, light gray (N7), very fine to fine crystalline, strong (R4), DOLOMITE, little chert *(Continued)*										
95		(95.0 - 115.0) Fresh, light brownish gray (5YR 6/1) and brownish gray (5YR 4/1), very fine to fine crystalline, strong (R4), DOLOMITE, little chert			399.6 / 95.0							
110		(110.0) Also some light bluish gray (5B 7/1)			384.6 / 110.0							
115		(115.0 - 130.0) Fresh, light gray (N7), very fine to fine crystalline, strong (R4), DOLOMITE, little chert			379.6 / 115.0							
120		Log continued on next page										

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: C. Hebel

LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

GOLDER STL RECORD OF BOREHOLE MWD 12384274_AMEREN LABADIE WELLS.GPJ GLDR_CO.GDT 4/20/12

RECORD OF BOREHOLE TGP-B

SHEET 4 of 4

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-B

DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/20/2012
DRILL RIG: Ingersol Rand T3W

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 985,894.58 E: 720,699.99

ELEVATION: 494.62
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in / 140 lb hammer 30 inch drop	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
120	6" Air Rotary	(115.0 - 130.0) Fresh, light gray (N7), very fine to fine crystalline, strong (R4), DOLOMITE, little chert *(Continued)*										
125												
130		END OF BORING AT 130 FT BGS			364.6 / 130.0							Terminate boring at 130 ft BGS, 2/20/2012 @ 1200. Installed Well TGP-B. Install piezometer TGP-A. See monitoring well construction log TGP-A for details.
135												
140												
145												
150												
155												
160												

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: C. Hebel

LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

RECORD OF BOREHOLE TGP-C

SHEET 1 of 7

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-C

DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/21/2012
DRILL RIG: Ingersol Rand T3W

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 983,559.90 E: 725,352.32

ELEVATION: 611.50
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
0	10" Tri-Cone Air Rotary	(0.0 - 14.0) Firm, moderate brown (5YR 3/4), CLAYEY SILT, little fine sand (CL-ML), slightly moist	CL-ML		597.5							Soil and rock type and descriptions determined from cuttings. Strength and weathering inferred from drilling. Sampling and discontinuity measurements not conducted.
15		(14.0 - 17.0) Moderately to highly weathered, moderate brown (5YR 4/4), fine to medium grained, weak (R2), SANDSTONE			14.0 594.5							
20		(17.0 - 23.0) Moderately weathered, pale yellowish orange (10YR 8/6), fine grained, weak (R2), SANDSTONE (20.0) color changes to very pale orange (10YR 8/2)			17.0 591.5 20.0 588.5							
25		(23.0 - 30.0) Highly weathered, pale yellowish brown (10YR 6/2), very fine to fine crystalline, weak (R2), DOLOMITE, some chert, little clay			23.0 581.5							
30		(30.0 - 36.0) Moderately to slightly weathered, yellowish gray (5Y 8/1) and light greenish gray (5GY 8/1), very fine to fine crystalline, medium strong (R3), DOLOMITE, little chert			30.0 575.5							
35		(36.0 - 42.0) Highly weathered, grayish orange (10YR 7/4) and light greenish gray (5GY 8/1), fine to medium grained, weak (R2), DOLOMITE, and sand, some silt, trace clay			36.0							
40		Log continued on next page										

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: C. Hebel

LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

RECORD OF BOREHOLE TGP-C

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-C
DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/21/2012
DRILL RIG: Ingersol Rand T3W
DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 983,559.90 E: 725,352.32
ELEVATION: 611.50
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
40	10" Tri-Cone Air Rotary	(42.0 - 95.0) Moderately weathered, light olive gray (5Y 6/1) and greenish gray (5G 6/1), very fine to fine crystalline, medium strong (R3), DOLOMITE, little chert, little silt			569.5 / 42.0							
60												(60.0 - 65.0) Several voids observed
65												(65.0) Encounter water
												(65.0 - 70.0) Driller notes suspected sand/sandstone pocket
80		Log continued on next page										

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: C. Hebel
LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

GOLDER STL RECORD OF BOREHOLE MWD 12384274_AMEREN LABADIE WELLS.GPJ GLDR_CO.GDT 4/20/12

RECORD OF BOREHOLE TGP-C

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-C
DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/21/2012
DRILL RIG: Ingersol Rand T3W
DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 983,559.90 E: 725,352.32
ELEVATION: 611.50
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
80	10" Tri-Cone Air Rotary	(42.0 - 95.0) Moderately weathered, light olive gray (5Y 6/1) and greenish gray (5G 6/1), very fine to fine crystalline, medium strong (R3), DOLOMITE, little chert, little silt *(Continued)*										
85												
90												
95					516.5 / 95.0							(95.0) Set 6" steel casing at 95 ft BGS. Conitnue drilling open hole with 6" air rotary hammer.
100	6" Air Rotary Hammer	(95.0 - 105.0) Slightly weathered to fresh, pale yellowish brown (10YR 6/2) and moderate yellowish brown (10YR 5/4), fine crystalline, medium strong (R3), DOLOMITE, trace chert, trace quartz sandstone										
105		(105.0 - 125.0) Slightly to moderately weathered, light olive gray (5Y 6/1), fine crystalline, weak to medium strong (R2 to R3), DOLOMITIC LIMESTONE, some shale			506.5 / 105.0							
110												
115												▽ Water Level 115.4 ft bgs 2/24/12 at 10:45
120		Log continued on next page										

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: C. Hebel
LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

RECORD OF BOREHOLE TGP-C

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-C
DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/21/2012
DRILL RIG: Ingersol Rand T3W
DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 983,559.90 E: 725,352.32
ELEVATION: 611.50
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in (140 lb hammer 30 inch drop)	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
120	6" Air Rotary Hammer	(105.0 - 125.0) Slightly to moderately weathered, light olive gray (5Y 6/1), fine crystalline, weak to medium strong (R2 to R3), DOLOMITIC LIMESTONE, some shale *(Continued)*			486.5 / 125.0							
125		(125.0 - 138.0) Slightly weathered to fresh, pale yellowish brown (10YR 6/2), and moderate yellowish brown (10YR 5/4), fine crystalline, medium strong (R3), DOLOMITE, little sandstone, trace chert			479.5 / 132.0							
130		(132.0) little chert			473.5 / 138.0							
135		(138.0 to 240.0) Slightly weathered, pale yellowish brown (10YR 6/2) and medium light gray (N6), very fine crystalline, medium strong (R3), DOLOMITE, trace quartz sandstone, trace chert			461.5 / 150.0							
140		(150.0 - 190.0) occasional shale layers										
145												
150												
155												
160		Log continued on next page										

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: C. Hebel
LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

RECORD OF BOREHOLE TGP-C

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-C
DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/21/2012
DRILL RIG: Ingersol Rand T3W
DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 983,559.90 E: 725,352.32
ELEVATION: 611.50
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in / 140 lb hammer 30 inch drop	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
160	6" Air Rotary Hammer	(138.0 to 240.0) Slightly weathered, pale yellowish brown (10YR 6/2) and medium light gray (N6), very fine crystalline, medium strong (R3), DOLOMITE, trace quartz sandstone, trace chert *(Continued)*										
165												
170												
175												
180												
185												
190												
195												
200		Log continued on next page										

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: C. Hebel
LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

RECORD OF BOREHOLE TGP-C

SHEET 6 of 7

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-C

DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/21/2012
DRILL RIG: Ingersol Rand T3W

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 983,559.90 E: 725,352.32

ELEVATION: 611.50
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in, 140 lb hammer 30 inch drop	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
200	6" Air Rotary Hammer	(138.0 to 240.0) Slightly weathered, pale yellowish brown (10YR 6/2) and medium light gray (N6), very fine crystalline, medium strong (R3), DOLOMITE, trace quartz sandstone, trace chert *(Continued)*										
205												
210												
215												
220												
225												
230												
235												
240		Log continued on next page			371.5							

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: C. Hebel

LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

Golder Associates

GOLDER STL RECORD OF BOREHOLE MWD 12384274_AMEREN LABADIE WELLS.GPJ GLDR_CO.GDT 4/20/12

RECORD OF BOREHOLE TGP-C

SHEET 7 of 7

PROJECT: Ameren Labadie Wells
PROJECT NUMBER: 123-84274
LOCATION: TGP-C

DRILLING METHOD: Air Rotary 6"
DRILLING DATE: 2/21/2012
DRILL RIG: Ingersol Rand T3W

DATUM: NAVD88
AZIMUTH: N/A
COORDINATES: N: 983,559.90 E: 725,352.32

ELEVATION: 611.50
INCLINATION: -90

DEPTH (feet)	BORING METHOD	SOIL/ROCK PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in / 140 lb hammer 30 inch drop	N	REC / ATT	PENETRATION RESISTANCE BLOWS / ft ■ (10 20 30 40)	REMARKS
240		END OF BORING AT 240 FT BGS			240.0							Terminate boring at 240 ft BGS, 2/23/12. Piezometer TGP-C installed in borehole as open hole completion. See monitoring well construction log TGP-A for details.
245												
250												
255												
260												
265												
270												
275												
280												

SCALE: 1 in = 5 ft
DRILLING CONTRACTOR: Roberts Environmental Drilling, Inc.
DRILLER: C. Hebel

LOGGED: MWD
CHECKED: PJJ
REVIEWED: MNH

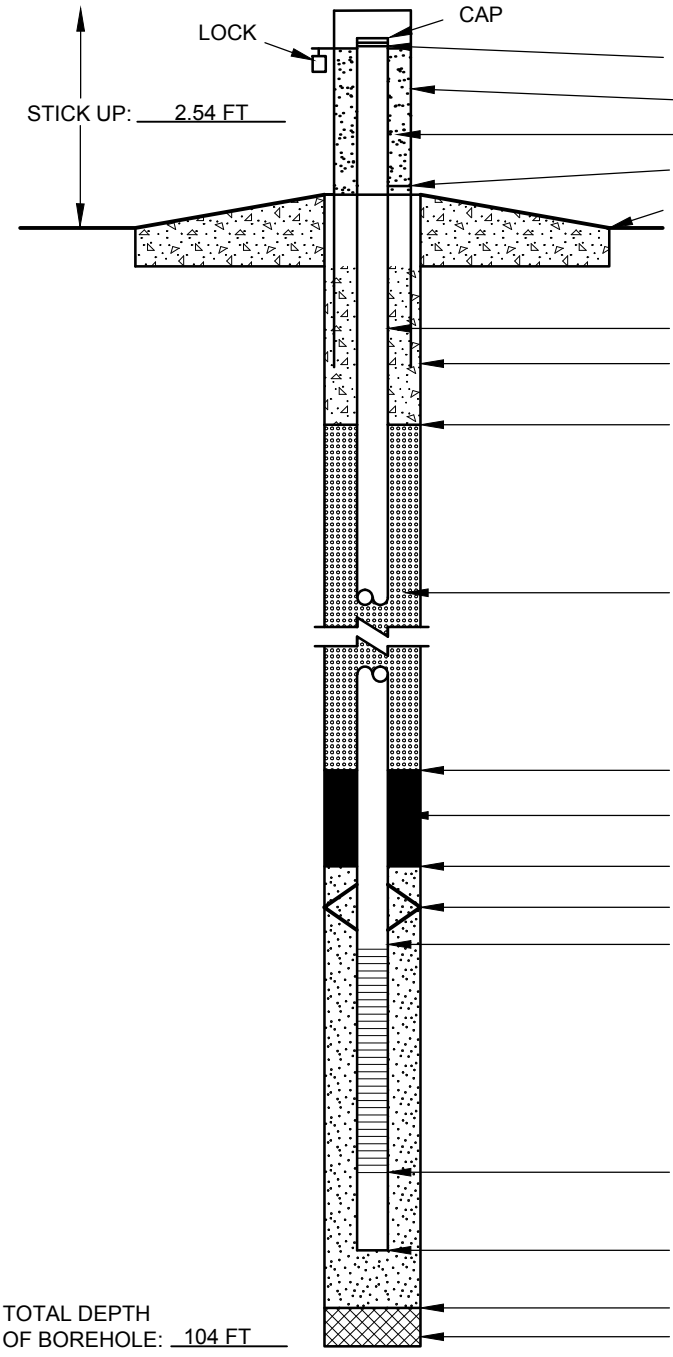
Golder Associates

APPENDIX B

WELL CONSTRUCTION LOGS

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG TGP-A

PROJECT NAME: AMEREN LABADIE WELLS	PROJECT NUMBER: 123-84274	
SITE NAME: AMEREN, LABADIE MO	LOCATION: TGP-A	
CLIENT: AMEREN MO	SURFACE ELEVATION: 479.78 FT	
GEOLOGIST: M. DREYER	NORTHING: 988186.35	EASTING: 724460.71
DRILLER: C. HEBEL	STATIC WATER LEVEL: 21.55 FT BTOC	COMPLETION DATE: 3-1-2012
DRILLING COMPANY: ROBERTS ENVIRONMENTAL	DRILLING METHODS: 6 $\frac{1}{4}$" HSA/ 6" AIR ROTARY	



TOP OF CASING ELEVATION: 482.32 FT

PROTECTIVE CASING (yes / no): YES, AND 3 STEEL BOLLARDS

PEA GRAVEL OR (SAND)

WEEP HOLE

GROUND SURFACE ELEVATION: 479.78 FT

DIAMETER OF RISER PIPE (in.): 2 IN.

DIAMETER OF BOREHOLE (in.): 6 IN

CONCRETE SEAL DEPTH (ft. bgs): 2.0 FT

TYPE AND AMOUNT OF ANNULAR SEAL: HIGH SOLIDS CEMENT BENTONITE GROUT

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 67.0 FT

TYPE AND AMOUNT OF BENTONITE SEAL: COATED $\frac{1}{2}$" CHIPS

TOP OF SAND PACK DEPTH (ft. bgs): 70.4 FT BGS

CENTRALIZER (yes / no) - TYPE: NO

TOP OF SCREEN DEPTH (ft. bgs): 74 FT

TYPE OF SCREEN: 2" X 10' SCHEDULE 80 PVC

SCREEN SLOT SIZE (in.): 0.010 IN.

SIZE OF SAND PACK: WG1 UNIMIN FILTERSIL QUARTZ

AMOUNT OF SAND: 7x 50 LB BAGS

BOTTOM OF SCREEN DEPTH (ft. bgs): 103.6 FT

BOTTOM OF WELL DEPTH (ft. bgs): 103.85 FT

BOTTOM OF FILTER PACK (ft. bgs): 103.85 FT

TYPE AND AMOUNT OF BACKFILL: 0.15 FT BROKEN ROCK DEBRIS

ADDITIONAL NOTES: CENTRALIZER WAS NOT INSTALLED DUE TO CAVING FORMATION AND INABILITY TO GET RISER WITH CENTERALIZER TO DEPTH.

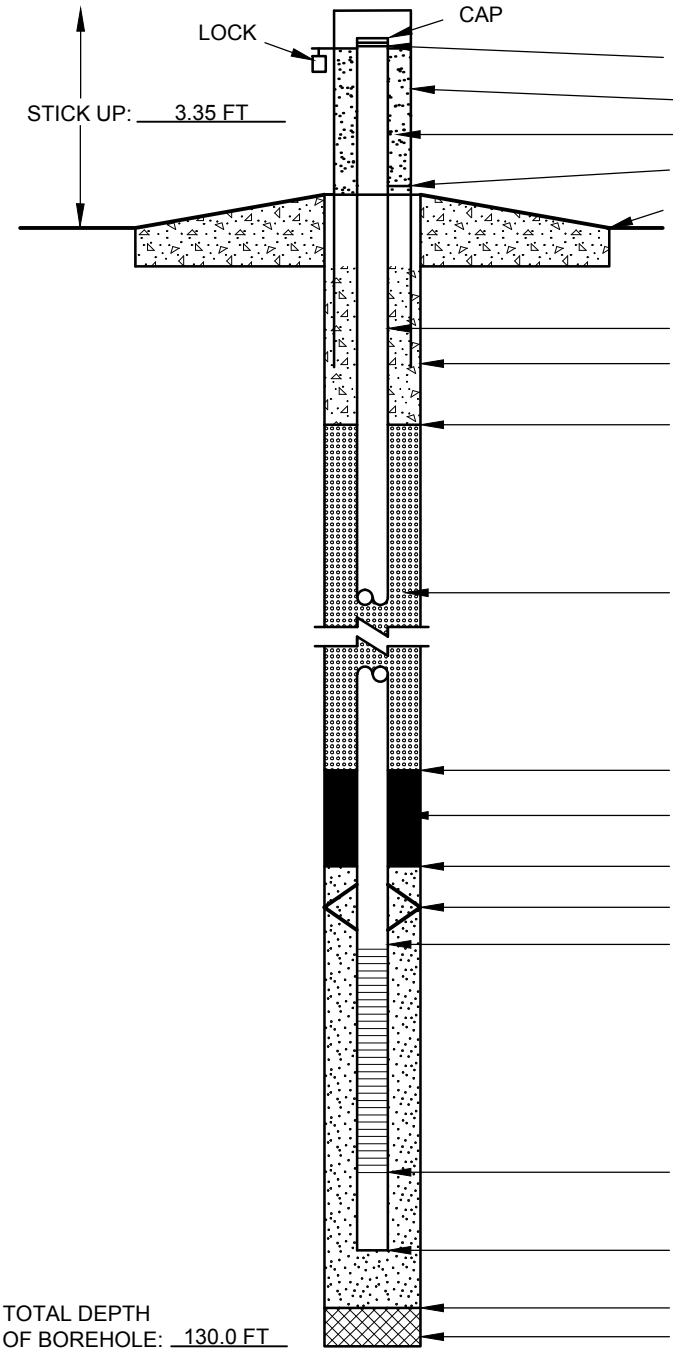
CHECKED BY: P. JOPLIN

DATE CHECKED: 3-16-2012

PREPARED BY: M. DREYER

ABOVE GROUND MONITORING WELL CONSTRUCTION LOG TGP-B

PROJECT NAME: AMEREN LABADIE WELLS	PROJECT NUMBER: 123-84274	
SITE NAME: AMEREN, LABADIE MO	LOCATION: TGP-B	
CLIENT: AMEREN MO	SURFACE ELEVATION: 491.27 FT	
GEOLOGIST: M. DREYER	NORTHING: 985894.54	EASTING: 720699.99
DRILLER: C. HEBEL	STATIC WATER LEVEL: 28.00 FT BTOC	COMPLETION DATE: 2-20-2012
DRILLING COMPANY: ROBERTS ENVIRONMENTAL	DRILLING METHODS: 6" AIR ROTARY	



TOP OF CASING ELEVATION: 494.62 FT

PROTECTIVE CASING (yes / no): STEEL W/ 3 BOLLARDS

PEA GRAVEL OR (SAND)

WEEP HOLE

GROUND SURFACE ELEVATION: 491.27 FT

DIAMETER OF RISER PIPE (in.): 2 IN.

DIAMETER OF BOREHOLE (in.): 6 IN

CONCRETE SEAL DEPTH (ft. bgs): 2.0 FT

TYPE AND AMOUNT OF ANNULAR SEAL: N/A

TOP OF BENTONITE SEAL DEPTH (ft. bgs): 1.0 FT

TYPE AND AMOUNT OF BENTONITE SEAL: 4 BAGS, COATED $\frac{1}{2}$" CHIPS

TOP OF SAND PACK DEPTH (ft. bgs): 17.0 FT BGS

CENTRALIZER (yes / no) - TYPE: SS (TOP/MIDDLE/BOTTOM OF SCREEN)

TOP OF SCREEN DEPTH (ft. bgs): 20.0 FT BGS

TYPE OF SCREEN: 2" X 10' SCHEDULE 80 PVC

SCREEN SLOT SIZE (in.): 0.010 IN.

SIZE OF SAND PACK: WG1 UNIMIN FILTERSIL QUARTZ

AMOUNT OF SAND: 30x 50 LB BAGS

BOTTOM OF SCREEN DEPTH (ft. bgs): 129.7 FT

BOTTOM OF WELL DEPTH (ft. bgs): 130.0 FT

BOTTOM OF FILTER PACK (ft. bgs): 130.0 FT

TYPE AND AMOUNT OF BACKFILL: N/A

ADDITIONAL NOTES:

CHECKED BY: P. JOPLIN

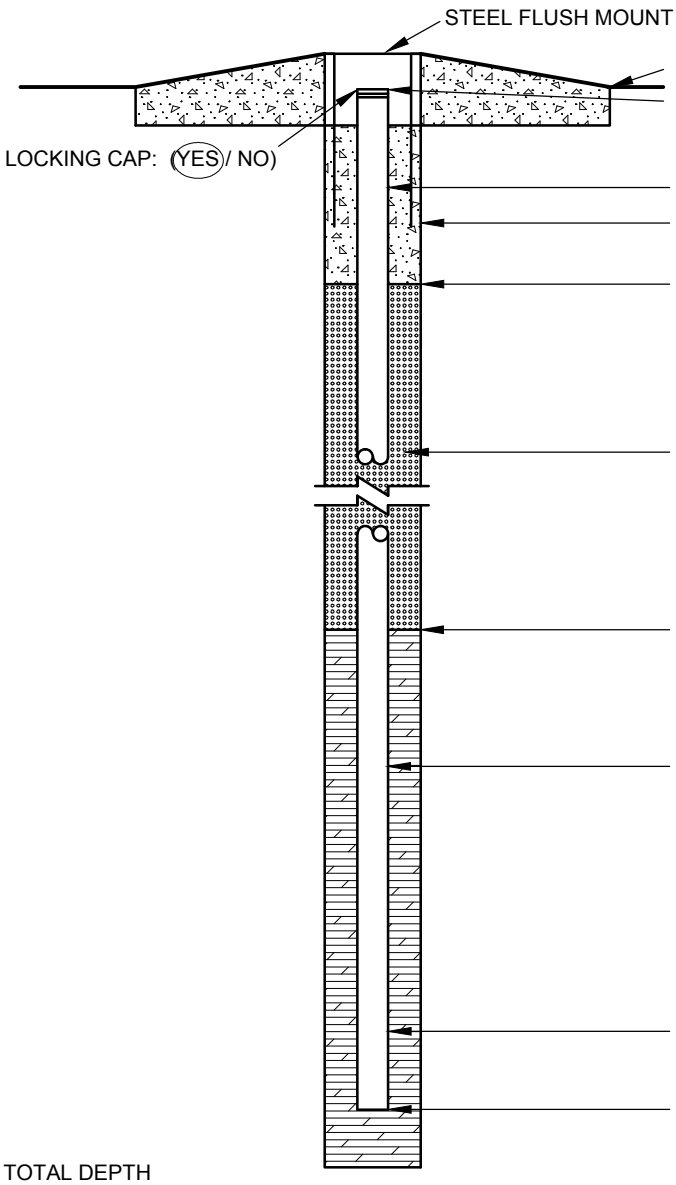
DATE CHECKED: 3-16-2012

PREPARED BY: M. DREYER

FLUSH-MOUNT MONITORING WELL CONSTRUCTION LOG

TGP-C

PROJECT NAME: AMEREN LABADIE PIEZOMETERS	PROJECT NUMBER: 123-84274	
SITE NAME: AMEREN, LABADIE MO	LOCATION: TGP-C	
CLIENT: AMEREN MO	SURFACE ELEVATION: 612.23 FT	
GEOLOGIST: M. DREYER	NORTHING: 983559.9	EASTING: 725352.32
DRILLER: C. HEBEL	STATIC WATER LEVEL: 115.4 FT BGS	COMPLETION DATE: C. HEBEL
DRILLING COMPANY: ROBERTS ENVIRONMENTAL	DRILLING METHODS: ROBERTS ENVIRONMENTAL	



GROUND SURFACE ELEVATION: 612.23 FT

TOP OF CASING ELEVATION: 611.50 FT

DIAMETER OF RISER PIPE (in.): 6 IN.

DIAMETER OF BOREHOLE (in.): 10 IN. (0' - 95' BGS) 6 IN. (95' - 240' BGS)

CONCRETE SEAL DEPTH (ft. bgs): 2.0 FT

TYPE AND AMOUNT OF ANNULAR SEAL: CEMENT BENTONITE GROUT

GROUT THICKNESS: 94 FT

TOP OF SCREEN DEPTH (ft. bgs): 95 FT BGS

TYPE OF SCREEN: 6" OPEN BOREHOLE FROM 95 TO 240 FT BGS

CASING - TYPE: 6" OPEN BOREHOLE

BOTTOM OF SCREEN DEPTH (ft. bgs): 240 FT

BOTTOM OF WELL DEPTH (ft. bgs): 240 FT

TOTAL DEPTH OF BOREHOLE: 240 FT

ADDITIONAL NOTES: INSTALLED AS 6" OPEN BOREHOLE FROM 95' TO 240' BGS.

CHECKED BY: P. JOPLIN

DATE CHECKED: 3-16-2012

Golder Associates

PREPARED BY: M. DREYER

APPENDIX C

MDNR WELL REGISTRATION FORMS AND RECEIPT CONFIRMATION

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED	
REFERENCE NO. 449718		
C.R. NO.	CHECK NO.	
STATE WELL NUMBER	REVENUE NO.	
ENTERED Ph1 Ph2 Ph3	APPROVED BY	ROUTE

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME	CONTACT NAME	VARIANCE GRANTED BY DNR
Ameren Missouri	314-342-1000	

OWNER ADDRESS	CITY	STATE	ZIP CODE	NUMBER
One Ameren Plaza, 1901 Chouteau Ave.	St. Louis	MO	63166	

SITE NAME	WELL NUMBER	COUNTY
Labadie Energy Center	TGP-A	St. Louis

SITE ADDRESS	CITY	STATIC WATER LEVEL
226 Labadie Power Plant Road	Labadie	21.55 ft

SURFACE COMPLETION

TYPE: ☒ ABOVE GROUND ☐ FLUSH MOUNT

LENGTH AND DIAMETER OF SURFACE COMPLETION: LENGTH 5 FT. DIAMETER 4x4 IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: DIAMETER 12 IN. LENGTH 2.5 FT.

SURFACE COMPLETION GROUT: ☒ CONCRETE ☐ OTHER

☒ LOCKING CAP

☒ WEEP HOLE

ELEVATION 479.78 FT.

ANNULAR SEAL

LENGTH 64.5 FT.

☒ SLURRY ☐ CHIPS ☐ PELLETS ☐ GRANULAR ☒ CEMENT/SLURRY

IF CEMENT/BENTONITE MIX:

BAGS OF CEMENT USED 12

% OF BENTONITE USED 5

WATER USED/BAG 7 GAL.

SECONDARY FILTER PACK

LENGTH NA FT.

DEPTH TO TOP OF PRIMARY FILTER PACK 70 FT.

LENGTH OF PRIMARY FILTER PACK 34 FT.

SURFACE COMPLETION

☒ STEEL ☐ ALUMINUM ☐ PLASTIC

RISER

RISER PIPE DIAMETER 2 IN.

RISER PIPE LENGTH 76.5 FT.

DIAMETER OF DRILL HOLE 6 IN.

WEIGHT OR SDR# 80

MATERIAL

☒ STEEL ☒ THERMOPLASTIC (PVC) ☐ OTHER

STEEL = 0 - 40ft.

BENTONITE SEAL

LENGTH 3 FT.

☒ CHIPS ☐ PELLETS ☐ GRANULAR ☐ SLURRY

☐ SATURATED ZONE ☐ HYDRATED

SCREEN

SCREEN DIAMETER 2 IN.

SCREEN LENGTH 30 FT.

DIAMETER OF DRILL HOLE 6 IN.

DEPTH TO TOP 74 FT.

SCREEN MATERIAL

☐ STEEL ☒ THERMOPLASTIC (PVC) ☐ OTHER

LOCATION OF WELL (D/M/S FORMAT ONLY)

LAT. 38 ° 32 ' 49.5 "

LONG. 90 ° 50 ' 5.0 "

SMALLEST NE ¼ SW ¼ LARGEST NE ¼

SECTION 19 TOWNSHIP 44 NORTH

RANGE 2 ☒ EAST ☐ WEST

MONITORING FOR: (CHECK ALL THAT APPLY)

☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY ☐ EXPLOSIVES ☐ METALS ☐ VOC ☐ SVOCS ☐ PESTICIDES/HERBICIDES

PROPOSED USE OF WELL

☐ GAS MIGRATION WELL ☐ OBSERVATION ☐ EXTRACTION WELL ☐ OPEN HOLE ☒ PIEZOMETERS ☐ INJECTION WELL ☐ DIRECT PUSH

DEPTH TO	DEPTH FROM	FORMATION DESCRIPTION
(REDI	JOB#	121014-AR/D)
0'	25'	Silt/Clayey Silt
25'	32'	Silty Clay
32'	36'	Silty Sand
36'	53'	Dolomite
53'	62'	Dolomite and Sandstone
62'	67'	Mud Filled VOID
67'	105'	Dolomite
*	SEE	ATTACHED
TOTAL DEPTH:		104 FT.

* FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE & SIZE OF ALL CASING, HOLE DIAMETER & GROUT USED.

SIGNATURE (PRIMARY CONTACTOR)	PERMIT NUMBER	DATE WELL DRILLING WAS COMPELTED
	004753 -M	03/01/2012

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS. ☐ PUMP INSTALLED

SIGNATURE (WELL DRILLER)	PERMIT NUMBER	SIGNATURE (OF APPRENTICE)	APPRENTICE PERMIT NUMBER
	444 MPMH		

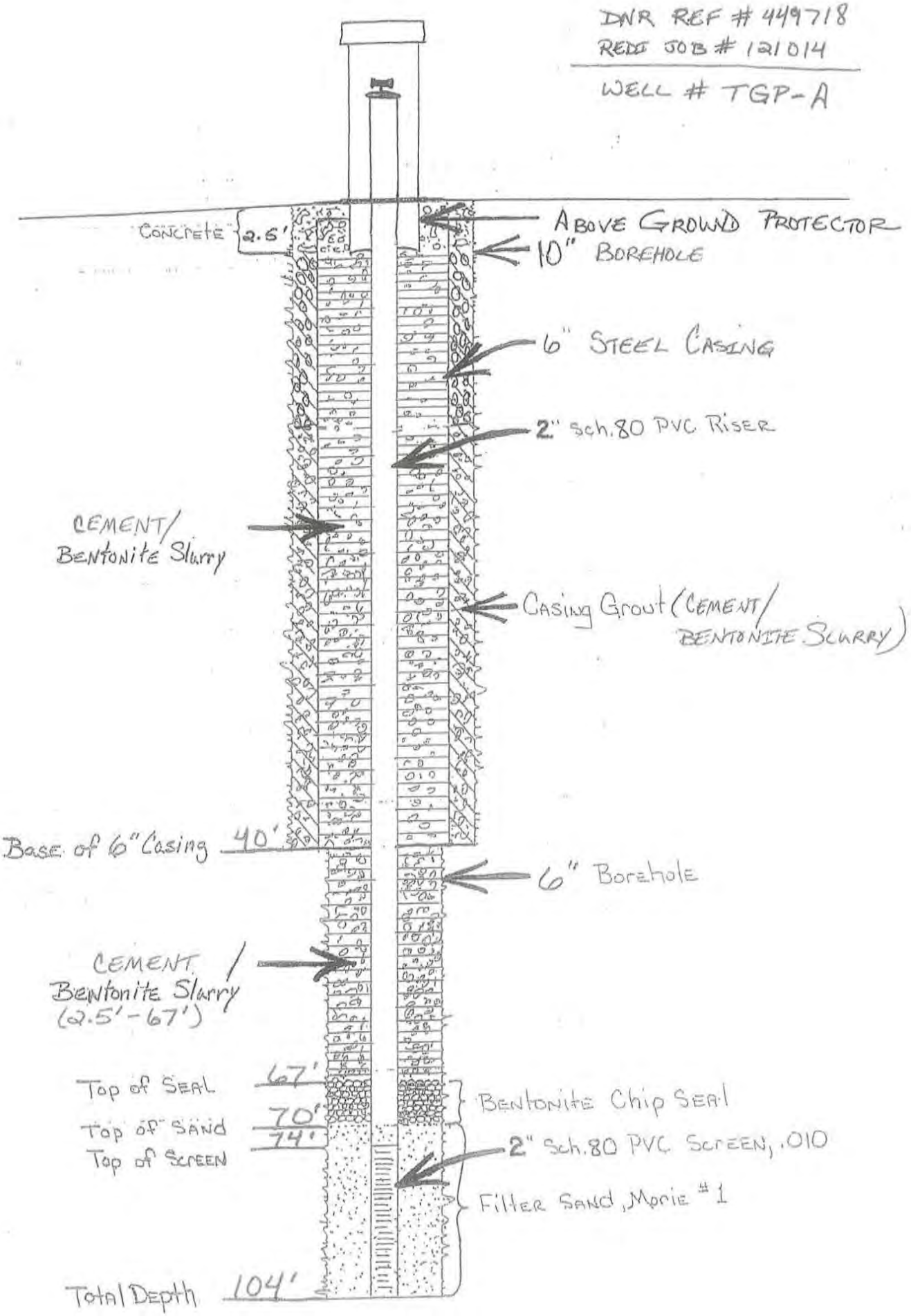
MO 780-1415 (07-11)

DISTRIBUTION: WHITE/DIVISION CANARY/CONTACTOR PINK/OWNER

RETURN WHITE COPY WITH APPROPRIATE FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, DIVISION OF GEOLOGY AND LAND SURVEY, WELLHEAD PROTECTION SECTION, PO BOX 250, ROLLA, MO 65402 573-368-2165

DNR REF # 449718
REDI JOB # 121014

WELL # TGP-A



MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED	
REFERENCE NO. 449719		
C.R. NO.	CHECK NO.	
STATE WELL NUMBER	REVENUE NO.	
ENTERED Ph1 Ph2 Ph3	APPROVED BY	ROUTE

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME	CONTACT NAME	VARIANCE GRANTED BY DNR
Ameren Missouri	314-342-1000	

OWNER ADDRESS	CITY	STATE	ZIP CODE	NUMBER
One Ameren Plaza, 1901 Chouteau Ave.	St. Louis	MO	63166	

SITE NAME	WELL NUMBER	COUNTY
Labadie Energy Center	TGP-B	St. Louis

SITE ADDRESS	CITY	STATIC WATER LEVEL
226 Labadie Power Plant Road	Labadie	28 ft

SURFACE COMPLETION

TYPE: ☒ ABOVE GROUND ☐ FLUSH MOUNT

LENGTH AND DIAMETER OF SURFACE COMPLETION: LENGTH 5 FT. DIAMETER 4x4 IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: DIAMETER 12 IN. LENGTH 2.5 FT.

SURFACE COMPLETION GROUT: ☒ CONCRETE ☐ OTHER

☒ LOCKING CAP
☒ WEEP HOLE

ELEVATION 491.27 FT.

SURFACE COMPLETION
☒ STEEL ☐ ALUMINUM ☐ PLASTIC

RISER
RISER PIPE DIAMETER 2 IN.
RISER PIPE LENGTH 22.5 FT.
DIAMETER OF DRILL HOLE 6 IN.
WEIGHT OR SDR# 80

MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER

ANNULAR SEAL
LENGTH NA FT.
☐ SLURRY ☐ CHIPS
☐ PELLETS ☐ GRANULAR
☐ CEMENT/SLURRY
IF CEMENT/BENTONITE MIX:
BAGS OF CEMENT USED
% OF BENTONITE USED
WATER USED/BAG GAL.

BENTONITE SEAL
LENGTH 14.5 FT.
☒ CHIPS ☐ PELLETS ☐ GRANULAR ☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SECONDARY FILTER PACK
LENGTH NA FT.

SCREEN
SCREEN DIAMETER 2 IN.
SCREEN LENGTH 110 FT.
DIAMETER OF DRILL HOLE 6 IN.
DEPTH TO TOP 20 FT.

DEPTH TO TOP OF PRIMARY FILTER PACK 17 FT.

SCREEN MATERIAL
☐ STEEL ☒ THERMOPLASTIC (PVC)
☐ OTHER

LENGTH OF PRIMARY FILTER PACK 113 FT.

LOCATION OF WELL (D/M/S FORMAT ONLY)
LAT. 38 · 32 · 26.3 "
LONG. 90 · 50 · 51.6 "

SMALLEST NW ¼ SW ¼ LARGEST SW ¼
SECTION 19 TOWNSHIP 44 NORTH
RANGE 2 ☒ EAST ☐ WEST

MONITORING FOR: (CHECK ALL THAT APPLY)
☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY
☐ EXPLOSIVES ☐ METALS ☐ VOC
☐ SVOCS ☐ PESTICIDES/HERBICIDES

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL ☐ OBSERVATION
☐ EXTRACTION WELL ☐ OPEN HOLE
☒ PIEZOMETERS ☐ INJECTION WELL
☐ DIRECT PUSH

DEPTH TO	DEPTH FROM	FORMATION DESCRIPTION
(REDI	JOB#	121014-AR/D)
0'	20'	Moderately Weathered to Fresh Dolomite
20'	130'	Fresh Dolomite
TOTAL DEPTH:		130 FT.

FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE & SIZE OF ALL CASING, HOLE DIAMETER & GROUT USED.

SIGNATURE (PRIMARY CONTACTOR)	PERMIT NUMBER	DATE WELL DRILLING WAS COMPELTED
	004753-M	03/01/2012

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS. ☐ PUMP INSTALLED

SIGNATURE (WELL DRILLER)	PERMIT NUMBER	SIGNATURE (OF APPRENTICE)	APPRENTICE PERMIT NUMBER
	444 WPRM		

MO 780-1415 (07-11)

DISTRIBUTION: WHITE/DIVISION CANARY/CONTACTOR PINK/OWNER
RETURN WHITE COPY WITH APPROPRIATE FEE TO: MISSOURI DEPARTMENT OF NATURAL RESOURCES, DIVISION OF GEOLOGY AND LAND SURVEY, WELLHEAD PROTECTION SECTION, PO BOX 250, ROLLA, MO 65402 573-368-2165

MISSOURI DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY PROGRAM

MONITORING WELL CERTIFICATION RECORD

OFFICE USE ONLY	DATE RECEIVED	
REFERENCE NO. 449780		
C.R. NO.	CHECK NO.	
STATE WELL NUMBER	REVENUE NO.	
ENTERED Ph1 Ph2 Ph3	APPROVED BY	ROUTE

INFORMATION SUPPLIED BY PRIMARY CONTRACTOR OR DRILLING CONTRACTOR

NOTE: THIS FORM IS NOT TO BE USED FOR NESTED WELLS

OWNER NAME	CONTACT NAME			VARIANCE GRANTED BY DNR
Ameren Missouri	314-342-1000			
OWNER ADDRESS	**CITY**	**STATE**	**ZIP CODE**	**NUMBER**
One Ameren Plaza, 1901 Chouteau Ave.	St. Louis	MO	63166	5214
SITE NAME		**WELL NUMBER**		**COUNTY**
Labadie Energy Center Project - PRIVATE RESIDENCE		TGP-C		St. Louis
SITE ADDRESS	**CITY**			**STATIC WATER LEVEL**
2272 Highway T	Labadie			115.4 ft

SURFACE COMPLETION

TYPE: ☐ ABOVE GROUND ☒ FLUSH MOUNT

LENGTH AND DIAMETER OF SURFACE COMPLETION: LENGTH 1 FT. DIAMETER 8 IN.

DIAMETER AND DEPTH OF THE HOLE SURFACE COMPLETION WAS PLACED: DIAMETER 14 IN. LENGTH 1 FT.

SURFACE COMPLETION GROUT: ☒ CONCRETE ☐ OTHER

☒ LOCKING CAP

☐ WEEP HOLE

ELEVATION 612.93 FT.

SURFACE COMPLETION
☒ STEEL ☐ ALUMINUM ☐ PLASTIC

RISER
RISER PIPE DIAMETER 6 IN.
RISER PIPE LENGTH 95 FT.
DIAMETER OF DRILL HOLE 10 IN.
WEIGHT OR SDR#

MATERIAL
☒ STEEL ☐ THERMOPLASTIC (PVC)
☐ OTHER

ANNULAR SEAL
LENGTH 94 FT.
☐ SLURRY ☐ CHIPS
☐ PELLETS ☐ GRANULAR
☒ CEMENT/SLURRY
IF CEMENT/BENTONITE MIX:
BAGS OF CEMENT USED 16
% OF BENTONITE USED 5
WATER USED/BAG 7 GAL.

BENTONITE SEAL
LENGTH NA
☐ CHIPS ☐ PELLETS ☐ GRANULAR ☐ SLURRY
☐ SATURATED ZONE ☐ HYDRATED

SECONDARY FILTER PACK
LENGTH NA FT.

SCREEN
SCREEN DIAMETER NA IN.
SCREEN LENGTH NA FT.
DIAMETER OF DRILL HOLE 6 IN.
DEPTH TO TOP NA FT.

DEPTH TO TOP OF PRIMARY FILTER PACK NA FT.

SCREEN MATERIAL
☐ STEEL ☐ THERMOPLASTIC (PVC)
☒ OTHER OPEN HOLE

LENGTH OF PRIMARY FILTER PACK NA FT.

LOCATION OF WELL (D/M/S FORMAT ONLY)
LAT. 38 ° 32 ' 3.8 "
LONG. 90 ° 50 ' 53.8 "

SMALLEST SE ¼ NE ¼ LARGEST NE ¼
SECTION 30 TOWNSHIP 44 NORTH
RANGE 2 ☒ EAST ☐ WEST

MONITORING FOR: (CHECK ALL THAT APPLY)
☐ RADIONUCLIDES ☐ PETROLEUM PRODUCTS ONLY
☐ EXPLOSIVES ☐ METALS ☐ VOC
☐ SVOCS ☐ PESTICIDES/HERBICIDES

PROPOSED USE OF WELL
☐ GAS MIGRATION WELL ☐ OBSERVATION
☐ EXTRACTION WELL ☒ OPEN HOLE
☐ PIEZOMETERS ☐ INJECTION WELL
☐ DIRECT PUSH

DEPTH TO	DEPTH FROM	FORMATION DESCRIPTION
(REDI	JOB#	121014-AR/D)
0'	14'	Clayey Silt
14'	23'	Sandstone
23'	105'	Dolomite
105'	125'	Dolom. Limestone
125'	240'	Dolomite
@ 150'	190'	Occassional Shale
		Layers
*	SEE	ATTACHED
0	95'	10" Borehole
95'	240'	6" OPEN Borehole
TOTAL DEPTH:		240 FT.

* FOR CASED WELLS, SUBMIT ADDITIONAL AS BUILT DIAGRAMS SHOWING WELL CONSTRUCTION DETAILS INCLUDING TYPE & SIZE OF ALL CASING, HOLE DIAMETER & GROUT USED.

SIGNATURE (PRIMARY CONTACTOR)	PERMIT NUMBER	DATE WELL DRILLING WAS COMPELTED
	004753-M	03/01/2012

I HEREBY CERTIFY THAT THE MONITORING WELL HEREIN DESCRIBED WAS CONSTRUCTED IN ACCORDANCE WITH MISSOURI DEPARTMENT OF NATURAL RESOURCES REQUIREMENTS FOR THE CONSTRUCTION OF MONITORING WELLS. ☐ PUMP INSTALLED

SIGNATURE (WELL DRILLER)	PERMIT NUMBER	SIGNATURE (OF APPRENTICE)	APPRENTICE PERMIT NUMBER
	440 WPRH		

MO 780-1415 (07-11)

DISTRIBUTION: WHITE/DIVISION CANARY/CONTACTOR PINK/OWNER
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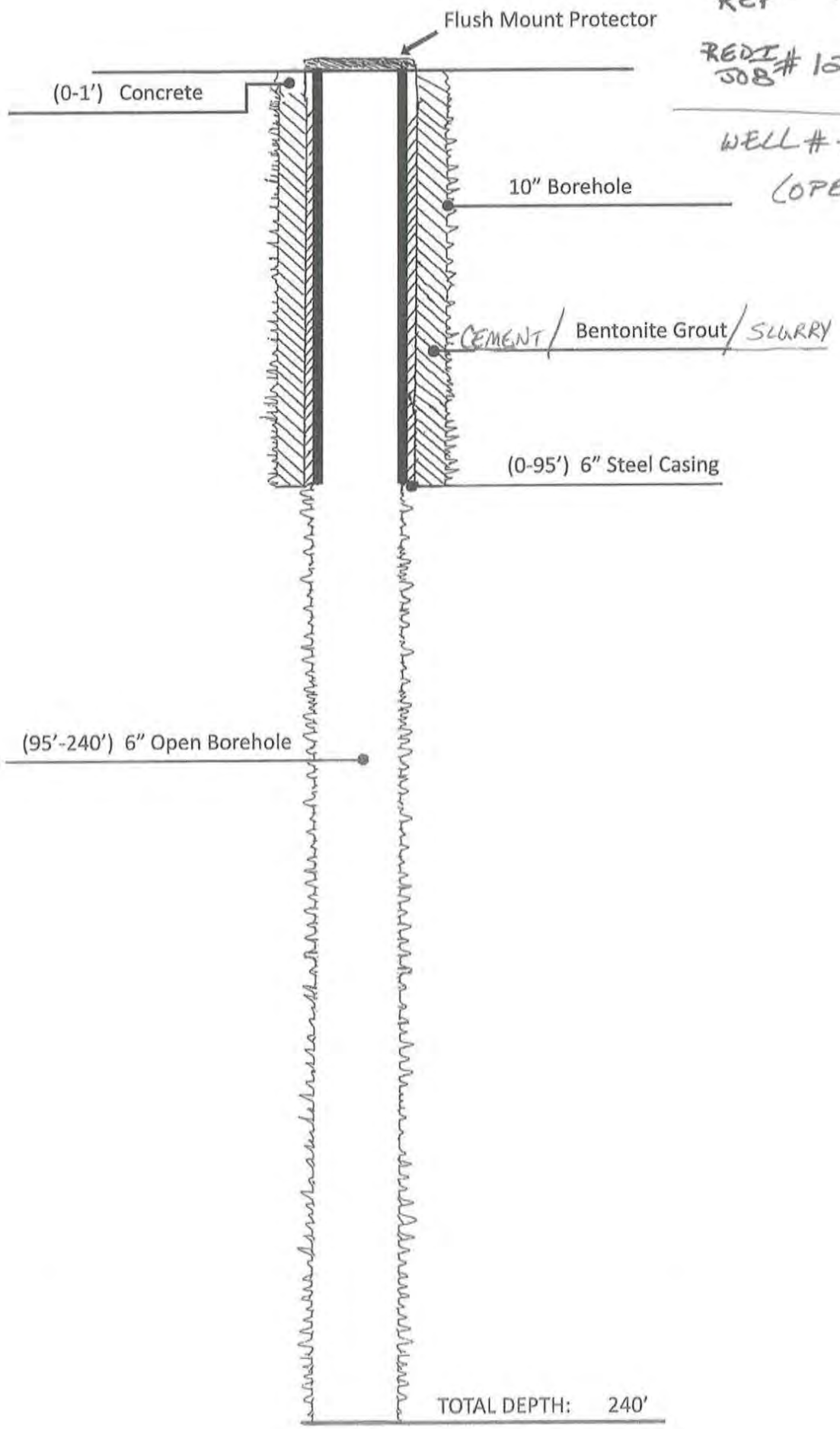
DNR REF# 449720

REDI SOB# 121014-AR/D

WELL # TGP-C
(OPEN HOLE)



STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

P.O. Box 250 111 Fairgrounds Rd. Rolla, MO 65402-0250
(573) 368-2165
FAX(573) 368-2317

VARIANCE: Approved **VARIANCE NUMBER:** 5214

WELL OWNER INFORMATION									
NAME:	AMEREN UE								
ADDRESS LINE 1:	ONE AMEREN PLAZA							**FAX:**	
ADDRESS LINE 2:	1901 CHOTEAU AVE								
CITY:	ST. LOUIS		**STATE:** MO		**ZIP:** 63103			**TELEPHONE:**	
WELL LOCATION									
COUNTY:	FRANKLIN		**LAT.**	38	32	3.8	**LONG.**	90 50 53.8	
1/4	**1/4**	**1/4**	NW		**SEC.** 30		**TWN.** 44 N	**RNG.** 2E	
CONTRACTOR INFORMATION									
COMPANY NAME:	ROBERTS ENVIRONMENTAL DRLG INC						**PERMIT NUMBER:**	004440	
CONTRACTOR NAME:	TRAVIS ROBERTS								
ADDRESS:	1107 S MULBERRY ST							**FAX:** 618-476-3619	
CITY:	MILLSTADT		**STATE:** IL		**ZIP:** 62260			**TELEPHONE:** 618-476-7334	

VARIANCE INFORMATION

VARIANCE EXPLANATION

APPROVAL GRANTED TO COMPLETE AN OPEN-HOLE MONITORING WELL AT THIS LOCATION. REQUIRED: THE WELL MUST MEET MINIMUM CASING REQUIREMENTS FOR DOMESTIC WELLS IN AREA 1: SET NO LESS THAN 80 FEET OF CASING, NO LESS THAN 30 FEET INTO COMPETENT BEDROCK.

RULE NUMBER MODIFIED: 10 CSR 23-4.060

REASON FOR VARIANCE

VERBAL APPROVAL GIVEN 2/10/2012 BY MATTHEW PARKER. WELL WAS CONSTRUCTED TO A TOTAL DEPTH OF 200 FEET AND CONTAINS 95 FEET OF CASING.

DATE:	04/18/2012	**BY:**	MOLLY STARKEY MS
COPY SENT TO OWNER (DATE):		**BY:**	
COPY SENT TO CONTRACTOR (DATE):		**BY:**	
Cc:	**Cc:**		

WIMS
Bi-Monthly Well and Pump Report

Report Date: 05/01/2012 **From - 03/01/2012 to - 04/30/2012**

The table below lists the well and/or pump reports that the Wellhead Protection Section received from your company during the time period identified above. Compare these reports with your record of reports submitted. If you have turned in reports during this time period that are not on the list, please call us at (573) 368-2165.

GOLDER ASSOCIATES INC
820 SOUTH MAIN STREET
ST CHARLES, MO 63303

Ref Num	Rec Type	Date Rcvd	Owner	City	Contractor	Permit #	Cert #
00449718	Monitoring Well	04/26/2012	AMEREN MISSOURI	ST. LOUIS	GOLDER ASSOCIAT	004753	
00449719	Monitoring Well	04/26/2012	AMEREN MISSOURI	ST. LOUIS	GOLDER ASSOCIAT	004753	
00449720	Monitoring Well	04/26/2012	AMEREN MISSOURI	ST. LOUIS	GOLDER ASSOCIAT	004753	

AECOM

Groundwater Field Stabilization Parameters for Groundwater Monitoring Samples Collected on April 12-13, 2012 from Temporary Groundwater Piezometers Installed Near Labadie Plant (July 2012)

January 2014

July 16, 2012 123-84274

Ms. Susan B. Knowles
Ameren Services
One Ameren Plaza
1901 Chouteau Avenue
St. Louis, MO 63103

RE: GROUNDWATER FIELD STABILIZATION PARAMETERS FOR GROUNDWATER MONITORING SAMPLES COLLECTED ON APRIL 12-13, 2012 FROM TEMPORARY GROUNDWATER PIEZOMETERS INSTALLED NEAR LABADIE PLANT

Dear Ms. Knowles:

At the request of Ameren, Golder Associates Inc. (Golder) has prepared this letter summarizing the groundwater stabilization parameters collected during groundwater sampling of the three piezometers installed for temporary monitoring purposes near the Labadie Plant in Franklin County, Missouri. The following is a summary of the field stabilization parameters for groundwater samples collected on April 12-13, 2012 from piezometers TGP-A, TBP-B, and TBP-C.

GROUNDWATER STABILIZATION PARAMETERS AND SAMPLE COLLECTION

Groundwater samples were collected from each piezometer after the piezometers had equilibrated for a minimum one month period following development. Samples were collected after three well-bore volumes had been purged from each piezometer using a submersible electric pump with dedicated polyethylene tubing. Field parameters including pH, conductivity, temperature, dissolved oxygen, and turbidity were measured and recorded during purging and sampling.

Groundwater samples were collected and submitted for laboratory analyses after three well-bore volumes were removed, turbidity was below 20 NTU, and three consecutive sets of field parameter measurements were stabilized within 10% of previous measurements for conductance, temperature, and dissolved oxygen, and within 0.1 for pH. The following table summarizes field groundwater stabilization parameters collected for the three piezometers.

Table 1: Summary of Groundwater Field Stabilization Parameters

TGP-A					
Date Sampled	4/12/2012				
	1st. Meas.	**2nd. Meas.**	**3rd. Meas.**	**4th. Meas.**	**Sample**
Volume Discharged (gal)	10	30	50	70	90
pH (STD Units)	7.32	7.33	7.30	7.27	7.27
Specific Conductance (µS/cm)	452	453	455	456	459
Turbidity (NTU)	184	132	113	88.3	19.2
Temperature (˚C)	12.00	11.97	11.98	11.97	11.98
Dissolved Oxygen (mg/l)	3.24	2.44	2.56	2.73	2.93

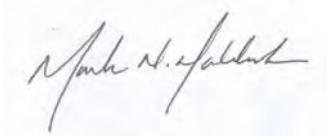
TGP-B					
Date Sampled	4/13/2012				
	1st. Meas.	**2nd. Meas.**	**3rd. Meas.**	**4th. Meas.**	**Sample**
Volume Discharged (gal)	40	80	120	160	195
pH (STD Units)	7.08	7.14	7.15	7.16	7.16
Specific Conductance (µS/cm)	559	554	550	546	540
Turbidity (NTU)	55.7	20.6	4.48	2.19	0.65
Temperature (˚C)	13.26	13.15	13.14	13.11	12.87
Dissolved Oxygen (mg/l)	4.79	4.40	4.25	4.13	3.87
TGP-C					
Date Sampled	4/12/2012				
	1st. Meas.	**2nd. Meas.**	**3rd. Meas.**	**4th. Meas.**	**Sample**
Volume Discharged (gal)	110	220	330	440	555
pH (STD Units)	7.07	7.08	7.15	7.12	7.17
Specific Conductance (µS/cm)	656	653	643	646	636
Turbidity (NTU)	1.97	0.74	0.58	0.60	0.87
Temperature (˚C)	13.80	13.76	13.72	13.69	13.61
Dissolved Oxygen (mg/l)	3.19	3.21	3.20	3.47	3.51

Notes: pH, Specific Conductance, Temperature, and Dissolved Oxygen measured using a YSI 556 MPS. Turbidity measured using a HACH turbidimeter.

If you have any questions regarding this information, please do not hesitate to contact the undersigned.

Sincerely,

GOLDER ASSOCIATES INC.



Michael W. Dreyer, E.I.T.
Staff Engineer

Mark N. Haddock, R.G., P.E.
Senior Engineer
Associate

MWD

Appendix D

Golder Associates, Inc., Surface Water Sampling Work Plan – 2013; Data Validation Memorandum

TECHNICAL MEMORANDUM

Date:	October 23, 2013	**Project No.:**	1301560
To:	Renee Cipriano	**Company:**	Schiff Hardin / Ameren
From:	M Haddock, T Stanko		
cc:	Susan Knowles, (Ameren), Lisa Bradley (AECOM)	**Email:**	
RE:	**SURFACE WATER SAMPLE COLLECTION AND ANALYSIS PLAN – LABADIE PLANT**		

1.0 OBJECTIVES AND BACKGROUND

The objective of this effort is to collect surface water samples in Labadie Creek and the Missouri River in locations upstream and downstream of Ameren's Labadie Plant in Franklin County Missouri. In turn, send collected samples to an analytical laboratory for analysis of targeted constituents. Sampling methods, procedures and equipment described herein are adapted from those prescribed by the U.S. Environmental Protection Agency (EPA) in surface water sampling operating procedures and field operations manuals as well as guidance provided in the U.S. Geological Survey National Field Manual for the Collection of Water-Quality Data. For the purpose of this exercise, Golder has assumed that each water body is mixed vertically and laterally across the channel at sample locations depicted on Figure 1 (see attached figure).

2.0 EQUIPMENT AND MATERIALS

The following list of equipment and materials is recommended:

- Safety equipment as prescribed in project specific Health and Safety Plan
- Sample bottles provided by analytical laboratory
- Filters (0.45 micron filters)
- Coolers
- Ice
- De-ionized water (for blank samples)
- Surface Water Sampling Field Forms
- Peristaltic pump
- Tubing (silicone tubing for peristaltic pump and polyethylene tubing)
- 35lb weight
- Winch and wire cable capable of supporting weight
- 50 – 60 ft rope with graduated markings and 10 lb. weight (for confirming water depths should water craft not have a depth sounding capability)
- Clear sealable bags (Ziploc bags, assorted sizes)
- Large plastic garbage bags
- Powder-free gloves

Golder Associates Inc.
820 S. Main Street, Suite 100
St. Charles, MO 63301 USA
Tel: (636) 724-9191 Fax: (636) 724-9323 www.golder.com

- Paper towels
- Permanent markers
- Protractor
- Self-retracting knife or hose cutter (for cutting hosing to desired lengths)
- Camera
- GPS Unit (Trimble GeoXH)
- Turbidity Meter (Hach 2100P)
- YSI multi-parameter instrument (YSI 556 WQM with 4 meter cable)
- Flow through cell (556 flow cell)
- YSI calibration fluids (PH 4, PH 7, PH 10, 240.0mV ORP, and 1.413mS/cm)
- Laboratory chain of custody forms (COC)

3.0 PREPARATION FOR SAMPLING

Prior to sampling the following should be carried out:

1. Clean out all coolers to prevent possibility of contamination of the samples.
2. Compile the necessary sampling containers.
3. Include extra sets of bottles to accommodate blanks and duplicate samples.
4. Pack sufficient filters.
5. Pack sufficient ice supply for the day's sampling.
6. Calibrate all instruments used for sample collection.

4.0 COLLECTING SAMPLES

Surface water samples will be collected from the sampling locations shown on **Figure 1**. Samples will be collected from downstream to upstream locations. At each non-wadeable location (greater than 4 feet deep) samples will be collected at the surface and at mid-level depths. In wadeable locations (less than 4 feet deep) only surface water samples will be collected. A full list of analytes that will be tested can be found in Appendix A. The full list of bottles that will be filled at each location can be found in Appendix B.

4.1 Non-wadeable Locations (Missouri River)

At a non-wadeable sample location, use a boat for access and perform the following:

1. Take photos of the sampling location including the following and record the photo number on the field form:
    a. Upstream;
    b. Downstream; and
    c. Nearest bank.
2. Label all sample bottles using a permanent marker. Use the label provided by the laboratory and include the following information:
    a. Project: Ameren Hydrogeological Consulting
    b. Client: Ameren Missouri
    c. Sample ID: (ex. LBD-R-1)
    d. Date/Time Collected: (ex. 01/02/13 12:30)
3. Determine water depth via boat sounding equipment or by pluming with graduated rope-weight assembly and record water depth on field forms.

4. Record GPS coordinates of sampling location and maintain boat position throughout sampling.
5. Deploy YSI multi-parameter instrument and Hach turbidimeter and record field water parameters at the sample depth. Field parameters to be measured include:
    - FIELD DISSOLVED OXYGEN – mg/l
    - FIELD OXIDATION REDUCTION – POTENTIAL mV
    - FIELD PH – pH
    - FIELD SPECIFIC CONDUCTIVITY – mS/cm
    - FIELD TEMPERATURE – DEG C
    - TURBIDITY – NTU
6. For unfiltered surface samples, collect water in a clean sample collection container by direct filling of the container from the surface water.
7. For filtered samples; fill bailer by pouring surface water from a clean sample collection container into bailer then transfer water from bailer through filter into sample containers. Replace the filter if it gets clogged.
8. Collect mid-level samples by plumbing the peristaltic pump with silicone and appropriate length of polypropylene tubing and attach polypropylene tubing to weight and winch cable.
9. Lower weight and tubing into the water to desired depth for sample collection.
10. Once at a desired sample collection depth, turn pump on and pump and discard three tubing volumes of water before filling sample containers. While pumping water and filling sample containers, maintain not more than a 20 degree angle off of vertical on the winch cable so that collection of water is at desired depth position.
11. For filtered samples, attach filter to tubing, then transfer water through filter into sample containers. Replace the filter if it gets clogged.
12. Once all samples have been collected, turn off the pump, retrieve the weight and place collected samples in a cooler on ice.
13. After sample collection record GPS coordinates of location at the end of sample collection.
14. Disconnect silicone and polypropylene tubing from pump and discard.
15. Proceed to next sample collection location and repeat steps 1 – 14 or return to shore.
16. Fill out Chain-of-custody forms.
17. Transport samples to the laboratory. If the samples are not going to be transported to the lab on the same day, store the samples in a refrigerator or in an ice-packed cooler until the day of shipment.

4.2 Wadeable Locations

At a wadeable sample location, perform the following:

1. Take photos of the sampling location including the following and record the photo number on the field form:
    a. Upstream
    b. Downstream
2. Label all sample bottles using a permanent marker. Use the label provided by the laboratory and include the following information:
    a. Project: Ameren Hydrogeological Consulting
    b. Client: Ameren Missouri
    c. Sample ID: (ex. LBD-C-1)
    d. Date/Time Collected: (ex. 01/02/13 12:30)
3. Determine depth with wading rod or other device (e.g., meter stick or tape measure) and record on the field form.
4. Record GPS coordinates of sampling location.
5. Deploy YSI multi-parameter instrument and Hach Turbidity Meter and record field water parameters at the sample depth. Field parameters to be measured include:
    - FIELD DISSOLVED OXYGEN – mg/l

- FIELD OXIDATION REDUCTION – POTENTIAL mV
- FIELD PH – pH
- FIELD SPECIFIC CONDUCTIVITY – mS/cm
- FIELD TEMPERATURE – DEG C
- TURBIDITY – NTU

6. For unfiltered samples; collect water in a clean sample collection container by direct filling of the container from the surface water.
7. For filtered samples; fill bailer by pouring surface water from a clean sample collection container into bailer, then transfer water from bailer through filter into sample containers. Replace the filter if it gets clogged.
8. Repeat steps 1-7 for each sample location.
9. Once all samples have been collected, place collected samples in a cooler on ice.
10. Fill out Chain-of-custody forms.
11. Transport samples to the laboratory. If the samples are not going to be transported to the lab on the same day, store the samples in a refrigerator until the day of shipment.

5.0 QA/QC SAMPLES

5.1 Field Blanks

Field blank samples will be collected once per sampling event as follows:

1. Collect one set of field blank samples by pouring laboratory deionized water into a full set of sample bottles while on the boat.

5.2 Equipment Blanks

Equipment blank samples will be collected once per sampling event as follows (these are not necessary if dedicated, disposable equipment is used for sample collection):

1. Collect one set of equipment blank samples after collection of the downstream samples and before the upstream samples are collected.
2. Pour laboratory provided deionized water into a clean receptacle.
3. Plumb peristaltic pump with silicone and appropriate length of polypropylene tubing and attach polypropylene tubing to sounding weight.
4. Turn pump on and pump and discard three tubing volumes of water before filling sample containers.

5.3 Field Duplicates

Field duplicate samples will be collected once per sampling event as follows:

1. Collect field duplicate samples at one of the sampling locations following procedures described in Section 4.0.

6.0 REFERENCES

Lane, S.L., and Fay, R.G., 1997, Safety in field activities: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A9, October 1997, accessed October 22, 2013, at http://pubs.water.usgs.gov/twri9A9/.

U.S. Environmental Protection Agency, Office of Water, Office of Environmental Information, EPA-841-B-07-009, National Rivers and Streams Assessment – Field Operations Manual, April 2009, accessed

October 22, 2013, at
http://water.epa.gov/type/rsl/monitoring/riverssurvey/upload/NRSA_Field_Manual_4_21_09.pdf.

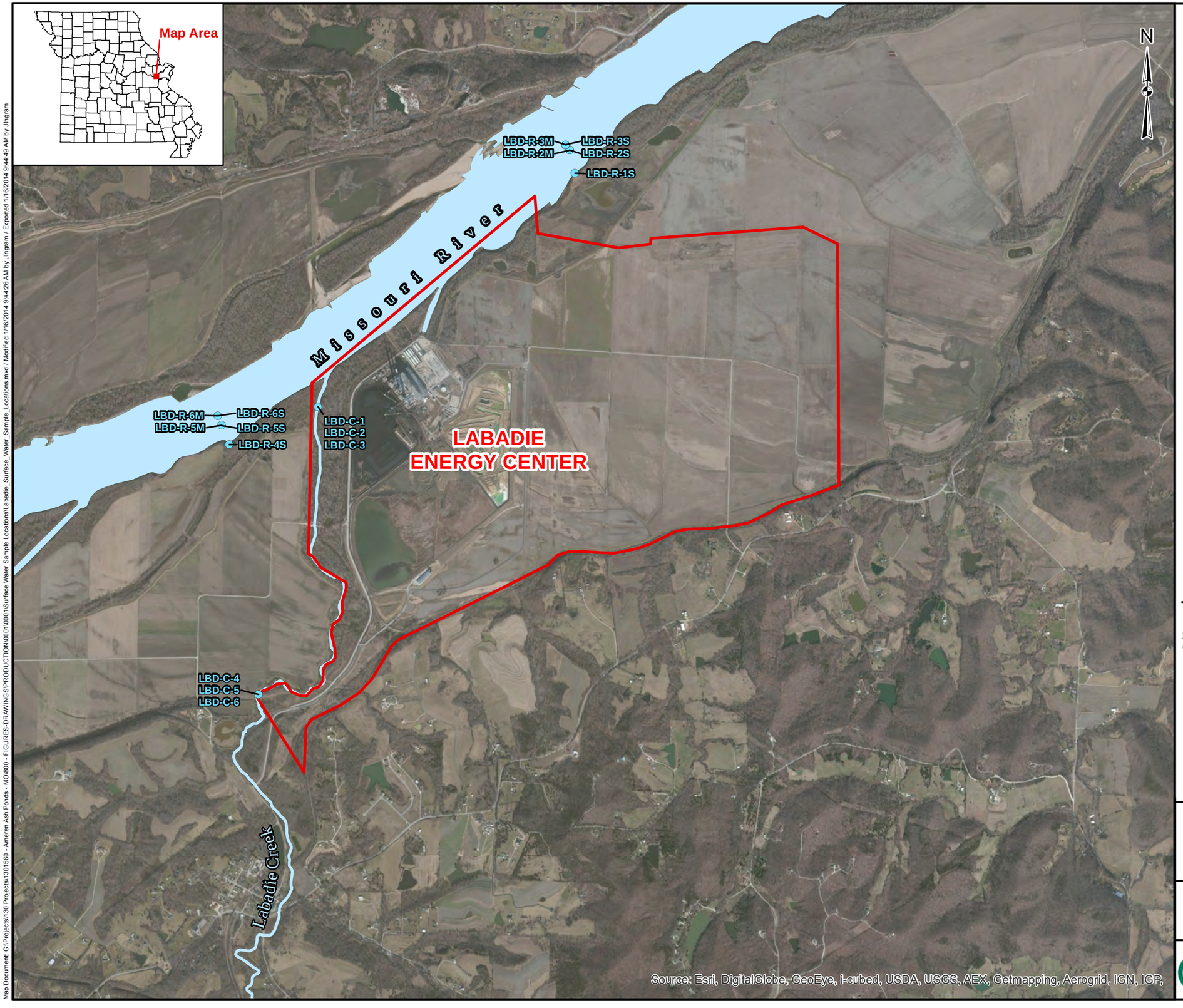
U.S. Environmental Protection Agency, Region 4, Science and Ecosystem Support Division, Athens, Georgia, Operating Procedure – Surface Water Sampling, February 28, 2013, accessed October 22, 2013, at http://www.epa.gov/region4/sesd/fbqstp/Surfacewater-Sampling.pdf.

APPENDIX A

Analyte List
Aluminum
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Chromium (total)
Cobalt
Copper
Cyanide
Fluoride
Total Hardness (CaCO3)
Iron
Lead
Magnesium
Manganese
Mercury
Molybdenum
Nickel
Total Nitrate-Nitrite (as N)
Selenium
Silver
Sulfate
Thallium
Tin
Zinc

APPENDIX B

Sample Bottles Used at Each Sample Location (includes Total and Dissolved)		
Number of Bottles	**Description**	**Preservative**
1	120 mL round amber glass	H2SO4
1	250mL wide mouth plastic	NaOH/asc
1	250 mL wide mouth plastic	HNO3
2	40 mL glass vial	None
1	250 mL wide mouth plastic	None
1	250 mL wide mouth plastic	HNO3



LEGEND

- Labadie Energy Center Property Boundary
- Surface Water Sample Locations

NOTES

1.) Sample locations for surface water samples were obtained during sampling using a Trimble GeoXH GPS unit.
2.) All boundaries and locations are approximate.

REFERENCES

1.) COORDINATE SYSTEM: NAD 1983 StatePlane Missouri East FIPS 2401 Feet.
2.) Ameren Missouri Labadie Energy Center, Labadie Property Control Map, November 2011.

0 3,000 6,000 Feet

PROJECT

AMEREN MISSOURI LABADIE ENERGY CENTER
FRANKLIN COUNTY, MISSOURI

TITLE

SURFACE WATER SAMPLING LOCATIONS

Golder Associates

PROJECT No. 130-1560			Labadie_Surface_Water_Sample_Locations.mxd
DESIGN	-	-	SCALE: AS SHOWN / REV. 0
GIS	JSI	1/16/2014	FIGURE 1
CHECK	MWD	1/16/2014	
REVIEW	MNH	1/16/2014	

Map Document: G:\Projects\130 Projects\1301560 - Ameren Ash Ponds - MO\800 - FIGURES\DRAWINGS\PRODUCTION\000\1000\10001\Surface Water Sample Locations\Labadie_Surface_Water_Sample_Locations.mxd / Modified 1/16/2014 9:44:26 AM by JIngram / Exported 1/16/2014 9:44:49 AM by JIngram

MEMORANDUM

Date:	November 19, 2013	**Project No.:**	1301560
To:	File	**Company:**	Golder Associates
From:	Amanda W. Derhake, Ph.D., PE		
cc:		**Email:**	aderhake@golder.com
RE:	**DATA VALIDATION SUMMARY**		

Level 2 data validation was carried out on the laboratory analytical data for the Labadie water samples collected in October 2013. Analytical testing and reporting was performed by Eurofins Lancaster Laboratories Environmental.

Sample analytical data for all samples from sample groups 1429418 (total analysis) and 1431302 (dissolved analysis), matrix spike/matrix spike duplicate (MS/MSD), laboratory control sample (LCS) recoveries, method blanks, hold times, and dilutions were reviewed during the validation. The USEPA National Functional Guidelines for validating inorganic data were used as guidance when evaluating results and raw data.

The following notes and qualifications are applicable to Sample Group 1429418 (total analysis):

- A Site-specific MS/MSD and duplicate were submitted for analysis.
- Positive iron results were qualified as estimated values (J) for all samples because the percent recovery (%R) for the MS sample was greater than 125%.
- Sulfate detections were qualified as estimated values (J) for samples LBD-C-1, LBD-C2, LBD-C-3, LBD-C-4, LBD-C-5, LBD-C-6, and LBD-C-1-MS because the detections were less than five times the limit of quantitation (LOQ) and the absolute value of the relative percent difference (RPD) in the MS/MSD was greater than the LOQ.
- Fluoride detections were qualified as estimated values (J) for samples LBD-R-6S and LDB-C-1-MS because the detections were less than five times the limit of quantitation (LOQ) and the absolute value of the relative percent difference (RPD) in the MS/MSD was greater than the LOQ.
- The associated sample with the duplicate sample LBD-DUP is LBD-R-2M.

The following notes and qualifications are applicable to Sample Group 1431302 (dissolved analysis):

- Separate, Site-specific MS/MSD and duplicate were not submitted for analysis.
- Beryllium was qualified as non-detect (U) in sample LBD-R-6M because the detection in the sample was not five times greater than the detection in the method blank and/or field blank.
- The associated sample with the duplicate sample LBD-DUP is LBD-R-2M.

No items in either Sample Group required the rejection of data results.

Appendix E

Resumes

Lisa J. N. Bradley, Ph.D., DABT
Senior Toxicologist and Vice President

Professional History

AECOM (formerly ENSR)
Massachusetts Institute of Technology
University of Idaho

Education

PhD (Toxicology) Massachusetts Institute of Technology, 1991
BS (Zoology) University of Idaho, 1983
BS (Chemistry) University of Idaho, 1983

Years of Experience 25

Technical Specialties

Toxicology
Risk Assessment
Environmental Communication
Regulatory Negotiation
Site Strategy Development

Professional Affiliations

Diplomate, American Board of Toxicology, 1994
Society of Toxicology
Phi Beta Kappa

Dr. Lisa Bradley is a Senior Toxicologist/Risk Assessor and Vice President with AECOM. She has a Ph.D. in toxicology from the Massachusetts Institute of Technology. She has 21 years of experience in risk assessment and toxicology, and is certified by the American Board of Toxicology. She has managed risk assessments for hazardous waste sites in many EPA Regions, and under many state programs. Dr. Bradley is experienced in agency negotiations, as well as public speaking and environmental communications, and she has published articles in peer reviewed scientific journals based on both her laboratory and risk assessment work.

Dr. Bradley is the project manager for the Pines Area of Investigation in Indiana, a coal ash site being managed under the Superfund Alternative program in USEPA Region 5. She has also conducted risk assessments for coal ash landfills, environmental communications for proposed landfills, and has worked with clients to evaluate and comment on state groundwater standards for coal ash related constituents. Dr. Bradley is the manager and technical lead for AECOM's coal combustion product (CCP) initiative, and has been active with utilities and industry trade groups in responding to EPA's proposed rulemaking. She has published and given many talks on various aspects of CCP risk assessment issues and the proposed rules. She has been active with ACAA and with the Government Relations Committee, and was recently elected to the ACAA Executive Committee by the Board of Directors. She is a global risk practice technical lead for AECOM, and leads the Environment Innovation Council for AECOM.

Representative Coal Combustion Product Experience

Pines Area of Investigation, Indiana. Serving as project manager for a multi-disciplinary team conducting the Remedial Investigation/Feasibility Study for the Respondents of an Administrative Order on Consent (AOC) being administered under the Superfund Alternative program in USEPA Region 5. The AOC addresses the placement of coal combustion by-products (CCBs) within a local permitted landfill and allegedly used as fill in other locations within the Area of investigation. Activities to date include agency negotiations on the AOC and scope of work; submission of a Site Management Strategy document, and subsequent approval by the Agency; submittal of the RI/FS Work Plan (including a Field Sampling Plan, Human Health and Ecological Risk Assessment Work Plans, HASP, QAPP, and a Quality Management Plan), and subsequent approval by the agency; submission of additional Sampling and Analysis Plans; and communications activities (including a website and regular mailings of information updates to the community: www.pinesupdate.com). Regular communications with the agency is also a cornerstone of the project. As the site covers not a facility, but a town and surrounding area, executing access agreements with the land owners for sampling and well installation was a critical task. Four rounds of sampling and analysis have been successfully completed. The Final RI Report has been approved and posted to USEPA's website, and the Human Health Risk Assessment Report and the Ecological Risk Assessment Report have been approved. The Draft Feasibility Study has been submitted to the agency. Approved project documents to date are available on USEPA's website: http://www.epa.gov/region5/sites/pines/index.htm.

Aurora Energy, Fairbanks, AK. Providing consulting services for an EPA HRS scoring investigation of the coal-fired power plant. Activities have included fact sheet preparation, frequently asked questions and answers, document review, strategy development, and risk-based evaluation of detailed coal and coal ash data sets for the facility.

Utility Solid Waste Activities Group (USWAG), Washington, DC. Worked with USWAG on developing comments on USEPA's October 2011 Notice of Data Availability (NODA), specifically on the risk assessment aspects of the NODA. Comments were submitted to EPA under USWAG cover, November 2011.

Utility Solid Waste Activities Group (USWAG), Washington, DC. Worked with USWAG on developing comments on USEPA's June 2010 proposed rule for the regulation of the disposal of coal combustion residuals (CCR). Reviewed and developed comments on the USEPA's revised risk assessment, on the USEPA's draft fugitive dust report, and developed comments on the Subtitle C listing criteria provided by USEPA in the proposed rule. Comments were submitted to EPA under USWAG cover, November 2010.

Utility Solid Waste Activities Group (USWAG), Washington, DC. Reviewed and developed comments on the USEPA's risk assessment for

coal combustion wastes. The risk assessment was released in 2007, and comments were submitted under USWAG cover in January 2008. AECOM addressed all aspects of the risk assessment including human health, ecological risk and fate and transport. Provided oral comments during a national teleconference.

Electric Power Research Institute. Developed the report "Comparison of Risks for Leachate from Coal Combustion Product Landfills and Impoundments with Risks for Leachate from Municipal Solid Waste Landfill Facilities," EPRI Report Number 1020555, available at www.epri.com.

Utility Solid Waste Activities Group (USWAG), Washington, DC. Developed information sheet on "What is Coal Ash" for use by the USWAG membership for community relations.

Prairie State Energy Campus, Washington County, IL. Provided presentation to county board on coal ash composition and health risk issues as part of a coal ash landfill siting matter. Provided similar presentation to the public in an informational meeting.

We Energies, Milwaukee, WI. Reviewed the basis of the state and USEPA screening levels and toxicity values for molybdenum, and demonstrated the over-conservatism used in their derivation. Provided the review to the state agency, and developed a fact sheet on molybdenum in groundwater for communications with a local community.

We Energies, Milwaukee, WI. Reviewed the basis of the state screening levels and toxicity values for aluminum as part of review of the Wisconsin Department of Natural Resources proposed groundwater standards under NR 140. Provided testimony for a board hearing, and met with the state regulators, and demonstrated the over-conservatism used in their derivation.

Ameren UE, St. Louis, MO. Developed a human health and ecological risk assessment to support the regulatory closure under the state agency of a former ash impoundment located along a major river at the Hutsonville, IL Power Station. Boron and molybdenum were constituents of interest. Pathways evaluated in the risk assessment included use of groundwater for irrigation purposes and the migration of groundwater to the river and potential impact on the benthic community. Work included negotiation meeting with the local agency.

Ameren UE, St. Louis, MO. Serving as an expert for a landfill siting project in Missouri, for issues related to exposure, toxicity and risk assessment. Provided public testimony at a county board meeting as well as written comments that have been submitted into the record.

Ameren UE, St. Louis, MO. Serving as an expert for the development of site-specific regulation for the closure of Ameren coal ash impoundments in Illinois. Participated in the development of a risk-based system for prioritization closure of the impoundments and developed a white paper on

the program that was submitted to the State as part of the rule-making process.

Ameren UE, St. Louis, MO. Providing toxicology and risk assessment support for various coal ash related projects in Illinois and Missouri.

AES, New York. Provided expert testimony on the lack of human health effects of ammonia in groundwater associated with coal ash landfills. Developed expert opinion, reviewed and critiqued opposing opinions, and testified at hearing.

AES, Puerto Rico. Provided review and synthesis of data associated with a beneficial use product, AGREMAX™ manufactured by AES Puerto Rico using bottom ash and fly ash from the coal-fired power plant. Specifically, evaluation of data on metals content, leaching of metals, and radionuclides were shown not to pose a human health or environmental risk based on the beneficial uses of AGREMAX™. Testified twice at Puerto Rico Senate hearings on potential coal ash legislation.

South Carolina Electric & Gas, Columbia, SC. Provided presentation materials for use in a landfill siting and zoning process. Materials addressed the comparison of arsenic and other metals and radionuclides in coal ash and in our natural environment, and background levels of arsenic in foods and background levels of exposure to radioactivity in our natural environment.

South Carolina Electric & Gas, Columbia, SC. Provided a risk-based review of data related to closure of a former coal storage facility.

Confidential Client. Provided a review of a state's beneficial use regulations and standards as they relate to coal ash.

Confidential Client. Evaluation of Imminent and Substantial Endangerment Claim. Conducted an evaluation of surface water, sediment, and soil data used by USEPA to support an Imminent and Substantial Endangerment (ISE) claim in a draft Administrative Order on Consent. The evaluation included a review of USEPA's approach to evaluating the risks associated with the placement of fill material containing fly ash in a wetland and the potential for downstream impacts. The review concluded that the data did not support USEPA's ISE claim.

Charah, Inc. Louisville, KY. Developed a Safety Data Sheet (SDS) for a flue gas desulfurization (FGD) gypsum project for commercial use.

Committees

Leader, AECOM's Risk Assessment Technical Practice Group including practitioners internationally within AECOM with specialties in human health and ecological risk assessment and other supporting disciplines.

Leader, AECOM's Coal Combustion Products Management Initiative, which

includes engineers, scientists, and related professionals across the national AECOM community.

Leader, AECOM's Environment Innovation Council, that seeks to foster innovation at all levels of the Environment business line.

Elected member of the American Coal Ash Association (ACAA) Executive Committee, and member of the Government Relations Committee, and the Women's Leadership Forum.

Relevant Publications

Bradley, L.J.N., G.M. Fent, and S.W. Casteel. "In Vivo Bioavailability of Arsenic in Coal Combustion By-Products." Poster presented at the Society of Toxicology 2008 annual meeting in Seattle, WA; and the World of Coal Ash 2009 meeting in Lexington, KY.

Bradley, L.J.N., A.E. Perry, K.A.S. Vosnakis, and C. Archer. "PAHs and Dioxins are not Present in Fly Ash at Levels of Concern." Poster presented at the Society of Toxicology 2010 annual meeting in Salt Lake City, UT; and the World of Coal Ash 2009 meeting in Lexington, KY.

Bradley, L.J.N., "Comparison of Risks for Leachate from Coal Combustion Product Landfills and Impoundments with Risks for Leachate from Municipal Solid Waste Landfill Facilities." EPRI Report Number 1020555, available at www.epri.com.

"Coal Ash in Context: Separating Science from Sound Bites As Regulatory and News Media Debates Continue." LJN Bradley and J Ward. Ash at Work, Issue 1, 2011. Available at www.acaa-usa.org.

"Management of Coal Ash Disposal and Household Trash – Do They Need to be Different?" LJN Bradley. Energeia, Volume 22, No. 4, 2011. Available at: http://www.caer.uky.edu/energeia/enerhome.shtml.

"Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants." June 2012. Report prepared for the American Coal Ash Association. Available at: www.acaa-usa.org.

"Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants." LJN Bradley. Ash at Work, Issue 1, 2012. Available at www.acaa-usa.org.

Presentations

"Conceptual Site Models for Coal Ash Use and Disposal, and Putting Toxicity and Risk into Context." Invited presentation at the World of Coal Ash (WOCA) Short Course on The Science of Ash Utilization, Lexington, KY, April 2013.

"Health Hazards and Risk Issues: Sorting Fact from Fear." Invited presentation at the Coal Combustion Products Utilization & Management: A Practical Workshop. Lexington, KY. October 9-10, 2012.

"Is this Risk for Real? Putting Risk Results into Context." Invited presentation at the Midwest Energy Association meeting, Minneapolis, MN. September 2012.

"Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants."

American Coal Ash Association Summer Meeting, Portsmouth, VA. June 2012; and webinar July 2012 with ACAA.

Technical Focus Group, Environmental & Energy Committee Meetings, Council of Industrial Boiler Owners (CIBO), Washington, DC, December 2012.

World of Coal Ash (WOCA), Lexington, KY, April 2013.

National Ready Mix Concrete Association (NRMCA), Redwood City, CA, May 2013.

Electric Power 2013, Chicago, IL, May 2013.

Fluid Bed & Stoker Fired Boiler Operations And Performance Conference, CIBO, Louisville, KY, May 2013.

Air & Waste Management Association (AWMA), Chicago, IL, June 2013.

"Coal Ash Material Safety: A Health Risk-Based Evaluation of USGS Coal Ash Data from Five US Power Plants." Press Conference, National Press Club, Washington, DC. June 6, 2012.

"Health Risk of CCPs: Is Coal Ash Toxic?" Presentation at the South Carolina SWANA Meeting. Myrtle Beach, SC, May 2012.

"Health Risk of CCPs: Is Coal Ash Toxic?" Presentation at Electric Power 2012. Baltimore, MD, May 2012.

"Health Risk of CCPs." Invited presentation at the Coal Ash Consortium, Scottsdale, AZ, March 28, 2012.

"Health Risk of CCPs." Presented at the EUCI conference on CCR Management: Impacts of Regulations and Technological Advances. , Nashville, TN, February 28-29, 2012.

"Risk Assessment: How the EPA Looks at Coal Combustion Products." Presented at the ACAA Fall meeting, Indianapolis, IN, September 27, 2011.

"Risk assessment: An overview of how the U.S. Environmental Protection Agency looks at coal combustion residuals." Presented at the American Chemical Society meeting in Denver, CO, August 28, 2011.

"Is Coal Ash Toxic?" Keynote Presentation at the World of Coal Ash May 10-12, 2011, and invited presentation at The Coal Institute/NCCI meeting July 11, 2011.

"Potential Effect of Proposed Coal Combustion Residuals Regulation and Alternative Leach Testing on Beneficial Reuse." World of Coal Ash May 10-12, 2011.

"Comparison of Risks for Leachate from Coal Combustion Product Landfills and Impoundments with Risks for Leachate from Municipal Solid Waste Landfill Facilities." World of Coal Ash May 10-12, 2011, and poster at Society of Toxicology, March 6-10, 2011.

"Overview of Coal Ash Regulatory Issues." NCASI Northern Regional Meeting May 18-19, 2011.

"Perspectives on Health Risks Associated with Beneficial Re-Use of Byproducts of Coal Combustion." McIlvaine Hot Topic Hour. April 28, 2011.

"Risk Assessment: How the EPA Looks at Coal Combustion Products." Presented at the EUCI conference on Future of Coal Combustion Products (CCPs): Regulatory, Legal, Technical, and New Markets, March 2011, Denver, CO.

"Coal Ash Business Planning and Management: Addressing Risks and Liabilities in a Changing Regulatory Environment." Workshop presented at the EUCI Conference on the Future of Coal Combustion Products, March 2010, Houston, TX.

"Overview of a CCP Site Investigation Conducted Under the Superfund Alternative Program." Presented at the ACAA spring meeting, March 2010, Nashville, TN.

"USEPA's Proposed Rule for Coal Combustion Residuals (CCRs): Beneficial Use Aspects." Presented at the ACAA summer meeting, June 2010, Baltimore, MD.

Education

M.S. Geological Engineering - Graduate research focused on insitu geotechnical testing, University of Missouri-Rolla, Rolla, Missouri, 1996

B.S. Geological Engineering, University of Missouri-Rolla, Rolla, Missouri, 1995

Certifications

Professional Engineer, Missouri, Illinois P.E.

Registered Professional Geologist, Missouri R.G.

OSHA 40-Hour Hazardous Waste Training Certification

OSHA 10-Hour Construction Training Certification

MSHA Part 46, Part 48 Training Certification

Golder Associates Inc. – St. Louis

Employment History

Golder Associates Inc – St. Louis, Missouri

Associate and Senior Geological Engineer / Senior Consultant (2008 to Present)

Responsible for management, preparation, and review of project work plans, hydrogeological characterization, engineering design and construction of geo environmental and geotechnical engineering projects. Project manager for multiple environmental monitoring programs and remediation systems at CERCLA, RCRA, and waste containment facilities and impoundments working with State and USEPA regulators. Project manager and regulatory liaison for investigation, risk assessment, and remediation of petroleum, solvent, and waste impacted sites. Prepared assessment monitoring plans for solid waste facilities, remedial investigation reports, feasibility studies, site closure reports, hydrogeological characterization reports, geotechnical characterization reports, design specifications, bid documents, and remediation design documents. Designed hydrogeological characterization programs for waste landfill siting in Missouri and Illinois and prepared conceptual site models. Certifying engineer for design and construction of corrective action remedies applied to contaminated sites and solid waste facilities. Prepared Remedial Action Plans for on-site disposal of impacted soil and sediments. Project manager and technical lead for preparation of mine and solid waste closure plans.

Golder Associates Inc. – St. Louis, Missouri

Staff then Project then Senior Geological/Geotechnical Engineer (1997 to 2007)

Responsible for preparing project work plans, managing field investigation projects, analyzing project data, making design recommendations, performing construction management, and preparing comprehensive reports. Performed extensive field work for geotechnical and environmental projects including geotechnical and hydrogeological characterization, contaminant transport modeling, seepage analysis, foundation inspection and shallow foundation design. Assessed geotechnical stability of soil and rock slopes; designed embankments and containment systems; performed seepage studies at dams and embankments; and performed and oversaw field quality assurance for soil and groundwater testing. Engineer of Record for final cap and closure of a solid waste landfill and toe drain system for leachate collection.

University of Missouri - Rolla – Rolla, Missouri

Graduate Research Assistant/Teaching Assistant (1995 to 1996)

Researched the use of mined-land for municipal solid waste landfill applications in southwest Missouri as a graduate research assistant. Research work involved field mapping and focused on geotechnical characterization of mine spoil derived soils utilizing plate load testing and insitu geotechnical methods. Instructed several laboratory sections throughout graduate school including Subsurface Exploration and Geomorphic Terrain Analysis.

SELECTED PROJECT EXPERIENCE – WASTE AND HYDROGEOLOGICAL

Landfill Hydrogeological Characterization
Illinois, USA

Designed hydrogeological characterization study for new landfill siting in Illinois. Managed data collection, soil and rock logging, well installation, and hydrogeological characterization activities and developed site conceptual monitoring for new landfill development. Prepared summary reports and plans for submittal to regulatory agencies.

Ash and Surface Impoundment Inspections
Indiana, USA

Performed engineering and environmental inspections of ash impoundment integrity for a power utility company. Reviewed operation and maintenance records and performed detailed inspections of all ash landfills and impoundments. Prepared summary reports and made recommendations to the utility company for rehabilitation of structures, where needed.

TSCA Waste Containment Cell
Illinois, USA

Project manager and engineer for operation and maintenance inspection, landfill leachate and groundwater sampling, groundwater and leachate monitoring plans, and statistical analysis plan for on-going operation of a hazardous waste TSCA containment cell. Prepared summary reports and plans for submittal to regulatory agencies.

Waste Properties
Illinois, USA

Managed day-to-day activities of numerous environmental investigation and remediation projects at several CERLCA, RCRA, and containment cell waste sites at a large clean-up property. Managed and coordinated on-site project work for a two year period including TSCA landfill construction, soil remediation, leachate collection and treatment, groundwater extraction and monitoring system installation, groundwater remediation and treatment, surface water sampling and creek restoration. Prepared bid documents and made contractor selection recommendations for key components of remediation activities. Oversaw and coordinated the work of numerous environmental contractors on behalf of the site ownership group. Reviewed remediation plans and worked with a management team to develop remediation alternatives for approval by state and federal regulatory agencies.

Quad Cities Landfill, Backridge Landfill, Prairie View Landfill and Orchard Hills Landfill
Missouri & Illinois, USA

Installed numerous groundwater monitoring wells and landfill gas monitoring probes at several landfill sites in Illinois and Missouri. Activities included extensive soil sampling and logging using multiple drilling methods and technologies, geologic interpretation for proper well screen placement, monitoring well and gas monitoring probe construction and abandonment of monitoring wells and piezometers. Prepared summary reports, groundwater monitoring reports, and construction documentation for submittal to regulatory agencies.

TSCA Waste Containment Cell
Illinois, USA

Project manager and engineer for operation and maintenance inspection, landfill leachate and groundwater sampling, groundwater and leachate monitoring plans, and statistical analysis plan for on-going operation of a hazardous waste TSCA containment cell. Prepared summary reports and plans for submittal to regulatory agencies.

Northside Landfill
Missouri, USA

Engineer of Record for the certification of an engineered cap system and closure of an existing solid waste landfill. Oversaw and reviewed CQA testing and prepared CQA reports for submittal to MDNR SWMP. Guided the site through the corrective action process for groundwater impacts in site monitoring wells and led public meetings to discuss and defend selected remedies. Performed a Corrective Action Assessment and served as the lead engineer on the design of an interceptor trench and leachate collection system (toe drain) to collect shallow groundwater impacts at the site. Prepared and certified stormwater diversion plans for the final grades at the site. Prepared closure plan and closure report for the site.

Zion Landfill
Illinois, USA

Responsible for the installation of an extensive groundwater and gas monitoring system which was installed in conjunction with new waste cell construction. Activities included geologic logging and sampling of glacial soils, geologic interpretation and sieve analysis for well screen design and depth selection, installation of 14 groundwater monitoring wells and 10 gas probes, abandonment of 17 wells and oversight of all field activities.

Proposed Ste. Genevieve Landfill
Missouri, USA

Performed hydrogeological characterization to create a hydrogeologic model for a potential landfill site in southeastern Missouri. The results of numerous geologic and hydrogeologic investigations at the site were incorporated into a detailed hydrogeologic model of the site. Analyses were performed on slug test data, packer testing data, potentiometric data and geologic and geophysical data to characterize the hydrogeologic setting at the site. Particle travel times and migration pathways were calculated from the results. A hydrogeologic characterization report was written and submitted to the State of Missouri.

City of Lamar Landfill
Missouri, USA

Prepared an assessment monitoring plan for submittal to MDNR SWMP for an active landfill site. Activities included review of existing site data including geologic and hydrogeologic information, statistical groundwater quality data, and landfill monitoring system details. A supplemental evaluation of the landfill monitoring system and its relation to natural geologic conditions was performed in conjunction with the compilation of the assessment monitoring plan.

Gasoline Fuel Release Site
Missouri, USA

Project manager for characterization, risk assessment and remediation of a 20,000 gallon subsurface fuel release. Worked closely with the site owner, stakeholders, regulators and insurance fund personnel to delineate the gasoline impacts to soil and groundwater and guide the project to risk assessment and remediation.

Chemical Plant
Sauget, Illinois

Worked with a team of engineers and hydrogeologists in the design and construction of a groundwater extraction system to pump and treat impacted groundwater from an alluvial aquifer system at a CERCLA site. Responsibilities included layout, geotechnical design, and hydraulic design review of a temporary pipeline. Performed oversight of the installation of telescoping 12-inch diameter extraction wells installed using cable-tool methods. Prepared a summary report and construction documentation for submittal to regulatory agencies.

Industrial Property Remediation
St. Louis, Missouri

Conducted a soil and groundwater investigation at a manufacturing facility to confirm the nature and extent of impacts. Developed remedial alternatives for the site and coordinated with excavation and hauling contractors to remove impacted soil from the property. Work included delineation of impacts, waste profiling, and evaluation of remedial alternatives, coordination and oversight of source and impact removal, and contracting with nearby landfill and hazardous waste facilities for proper disposal. Risk assessment and redevelopment interests were integral to the selection of the final remedy.

Smelting and Chemical Processing Facility
Illinois

Responsible for field activities for a remedial investigation at a listed NPL CERCLA site. Activities included drilling and sampling of soil and water in borings and the installation of shallow, intermediate and deep groundwater monitoring wells. Field activities required stringent sample collection and handling practices and involved continuous oversight by regulatory agency personnel and private consultant representatives.

Industrial Property Remediation
Sterling, Illinois

Conducted a Phase III soil sampling investigation at a manufacturing facility in northern Illinois to confirm the nature and extent of impacted soil. Developed remedial alternatives for the site and coordinated with excavation and hauling contractors to remove the impacted soil from the property. Work included construction management, waste profiling and contracting with a nearby Subtitle D landfill for proper disposal. The excavated soil was replaced with clean granular backfill and the site was restored to pre-impact conditions. Prepared a summary report and construction documentation for submittal to regulatory agencies.

Manufacturing Plant
Illinois

Performed an environmental field investigation to determine the nature and extent of free-product impact at an active manufacturing plant. Oversaw soil and groundwater sampling using direct-push and conventional drilling methods. Work included delineation of impacts and calculation of free-product and groundwater gradients at the site. Involved in the selection process of remediation methods to contain and remediate free-product impacts and minimize operational impact to the facility.

Chemical Plant
Wichita, Kansas

Coordinated field investigation activities and provided oversight of multiple site investigation activities at an active chemical plant. Directed soil and groundwater sampling using direct-push and conventional drilling methods. Coordinated the work of multiple subcontractors to achieve investigation goals within a short timeframe.

Wichita Public Schools
Wichita, Kansas

Coordinated soil and groundwater investigation activities and provided oversight of multiple site investigation and sampling activities. Coordinated source removal as part of the interim remedial measure. Removal action included delineation of impacts, waste profiling, evaluation of remedial alternatives, coordination and oversight of removal, and contracting with nearby landfill and hazardous waste facilities for proper disposal. Refined site hydrogeological model with the use of direct-push methods and geophysical logging. Conductivity logs were compared with conventional geologic data and used to refine remedial alternatives to treat groundwater impacts. Involved in the design and application of bioremediation methods to treat groundwater impacts.

Fenton Creek Dump Site
Fenton, Missouri

Conducted a comprehensive field investigation at a USEPA regulated hazardous waste site. Field activities included installation, development and slug testing of monitoring wells, excavation of numerous test pits and extensive sampling and logging of site soils, water and wastes for geotechnical and environmental chemical testing.

Limestone Mine Hydrogeological Characterization
Missouri, USA

Designed a hydrogeologlical characterization study to assess groundwater and aquifer conditions for development of an underground limestone mine. Study included detailed rock coring, insitu aquifer testing, deep well installation, and preparation of a hydrogeological site conceptual model.

City of Fulton Landfill
Fulton, Missouri

Responsible for sampling groundwater monitoring wells for quarterly analytical testing at a central Missouri landfill in accordance with MDNR solid waste guidelines. Prepared reports and data for submittal to State agency.

Industrial Property Site Closure
Burlington, Iowa

Evaluated a former leaking underground storage tank site and conducted a risk-based site closure under Iowa DNR regulation. Work included upgrading the existing groundwater monitoring system at the site and collecting additional groundwater and soil samples for the purposes of obtaining site closure and delisting from the State's LUST program.

LUST Phase II Investigation
St. Louis, Missouri

Responsible for field investigation at a listed Leaking Underground Storage Tank site. Activities included drilling and sampling of soil borings and the installation, development, slug testing and sampling of groundwater monitoring wells to determine the nature and extent of migration of waste oil contamination.

PROFESSIONAL AFFILIATIONS

American Society of Civil Engineers

Association of State Dam Safety Officials

Society of American Military Engineers

Association of Engineering Geologists

Appendix F

Questions and Answers Fact Sheet

Questions & Answers

Environmental Investigations at the Labadie Energy Center

January 2014

Ameren Missouri has conducted an environmental study of groundwater and surface water in and around its coal-fired power plant at the Labadie Energy Center located in Franklin County, Missouri. This comprehensive study demonstrates that there are **no adverse impacts on human health from either surface water or groundwater uses** resulting from coal ash management practices at the Facility. The following provides responses to common questions that community has asked about the project.

What type of environmental monitoring does Ameren Missouri perform at the Labadie Energy Center?

Ameren Missouri routinely monitors the following for its ash ponds:

- Surface water discharges are monitored from the ash ponds on a monthly basis under conditions and requirements set forth in a NPDES Permit issued by Missouri DNR.
- On an annual basis, as required by the NPDES Permit, the Company performs Whole Effluent Toxicity tests to evaluate the environmental toxicity of the discharge to aquatic life.
- The pending NPDES Permit will require the installation of monitoring wells around the ash ponds, and groundwater in that vicinity will also be monitored.

Also, Ameren is conducting groundwater monitoring for the area of the proposed utility waste landfill (UWL).

- The UWL is located east of the power plant, approximately 630 feet from the ash ponds at the Labadie Energy Center.
- The UWL, will be surrounded by a 35 well groundwater monitoring network comprised of 32 wells that are finished at depths within the shallow portion of the aquifer and three (3) wells will be screened at depths of 75 to 85 feet.
- The UWL wells are sampled on a quarterly basis and to date three rounds of data have been collected.
- Data from this well network will be used to define background concentrations prior to the construction of the UWL, and in the future once operational, these data will be used to detect any leaks from the landfill.

In addition, as indicated in AECOM's Risk Assessment Report, Ameren Missouri has collected and analyzed samples of:

- Surface water from Labadie Creek from locations upstream and downstream of the Facility, and
- Surface water from the Missouri River from locations upstream and downstream of the Facility.

All available groundwater and surface water sampling data have been analyzed and presented in the Report and the results indicate no adverse impacts on human health for either surface water or groundwater as a result of coal ash management practices at the Labadie Energy Center.

Is it safe to eat fish from the lower Missouri River?

Yes. The Missouri Department of Health and Senior Services (DHSS) provides fish consumption information for the Missouri River. In their current report for all sections of the Missouri and Mississippi Rivers, DHSS has only one "do not eat" advisory, which is for sturgeon eggs. Some limitations on consumption of specific fish exist for the entire Missouri and Mississippi Rivers and are detailed in the *DHSS – 2013 Fish Advisory*.

http://health.mo.gov/living/environment/fishadvisory/pdf/fishadvisory.pdf.

Have public or private water supplies in Franklin County been adversely impacted by the facilities operations?

No. Drinking water wells used by Franklin County residents are located *upgradient* of the Facility and are installed at deep levels within the bedrock aquifer (typically in excess of 300 feet).

In 2012, Ameren Missouri installed monitoring wells near the closest residential wells to the existing ash ponds to confirm the direction of groundwater flow and to assess the quality of drinking water used by such residents. These wells are located between approximately 1,200 feet and 1 mile south of the facility. That testing confirmed such wells are *upgradient a*nd therefore groundwater will flow *towards* the Facility and the Missouri River.

Furthermore, Ameren Missouri tested water from the bedrock drinking water supplies and confirmed compliance with drinking water standards.

Community Public Water supplies for St. Albans and the Hermit Hollow Subdivision are located even further south from the Facility – approximately 2 and 3 miles upgradient from the Facility – and are completed deep (i.e., >790 feet) within the bedrock aquifer.

Can the Missouri River be safely used as a public drinking water supply?

Yes. The closest drinking water intake (Howard Bend) on the Missouri River is located 19.5 miles downstream from the Facility.

According to Consumer Confidence Reports for Howard Bend, water used for drinking water supplies complies with all applicable state and federal requirements.

Surface water sampling performed adjacent to the Facility and as part of this Report evaluation, demonstrates the lack of adverse impact from coal ash management practices on Missouri River water quality.

Doesn't the flow of groundwater fluctuate with river levels and do those periodic episodes alter groundwater flow towards drinking water wells?

Such period shifts in shallow groundwater flow are temporary in the alluvial aquifer and will reverse when the Missouri River levels return to normal flow conditions. Drinking water wells are installed deeper in the bedrock aquifer which does not experience flow reversal due to river levels where such wells are located. An investigation into groundwater flow direction in the bedrock aquifer where the drinking water wells are located showed that groundwater flows from south to north, toward the Missouri River. Furthermore, the bedrock aquifer is much less permeable than the alluvial aquifer.

In presentations that Robert Criss of Washington University has provided as part of the public comment period, he notes that the bedrock permeability is several orders of magnitude lower than that for the alluvial deposits. The Detailed Site Investigation for the UWL concluded that when groundwater moving within the alluvial aquifer encounters less permeable bedrock, the bedrock largely impeded flow due to its lower permeability and the groundwater will preferentially flow parallel to the barrier through the more permeable sands and gravels and remain in the alluvial aquifer system.

I have heard claims that arsenic levels in one of the wells near the proposed UWL are six times the drinking water standards. Is that true?

Three rounds of sampling have been taken at the UWL monitoring network to determine background levels. Wells within the network monitor groundwater within the shallow alluvial aquifer (e.g., approximately 25 feet). In the first round of sampling, one well reflected a value of 66 ug/l which is above the drinking water standard of 10 ug/l. In the most recent (Nov. 2013) round of sampling, that same well reported a concentration of 2 ug/l, well below the drinking water standard. It is not uncommon to see variations in the first few rounds of sampling in this type of alluvial formation.

Furthermore, as set forth in the Report, arsenic is a naturally occurring element that is found in Missouri in both groundwater and soil. Since the UWL sampling did not contain elevated levels of boron and sulfate, which are "indicator parameters" for releases from coal ash management areas, the presence of arsenic is not associated with ash management practices at the Facility and instead reflects background conditions.

Lastly, sampling of groundwater used for drinking water and Consumer Confidence Report for Howards Bend reflect compliance with drinking water standards. As detailed in the Report, drinking water wells are installed deep within the bedrock aquifer, and not within the alluvial aquifer in the vicinity of the Facility.

Why is the presence or absence of boron and sulfate so critical in determining whether an impact from ash management unit has occurred?

Boron and sulfate are considered to be the primary indicators of releases from coal ash management areas, when present at high levels. This is because they are more soluble than the other constituents in coal ash, thus they will be the first to be detected in groundwater, and because they are more mobile in groundwater than other constituents in coal ash.

Is it true that EPA has suggested that coal ash will be treated as non-hazardous under rules to be proposed by EPA governing ash management and disposal?

Yes. We believe EPA will continue to treat coal ash as "non-hazardous." EPA in the preamble to the proposed Effluent Limitation Guideline rule (June 7, 2013) states:

> "Although a final risk assessment for the CCR rule has not yet been completed, reliance on the data and analyses discussed above may have the potential to lower the CCR rule risk assessment results by as much as an order of magnitude. If this proves to be the case, EPA's current thinking is that, the revised risks, coupled with the ELG requirements that the Agency may promulgate, and the increased Federal oversight such requirements could achieve, could provide strong support for a conclusion that regulation of CCR disposal under RCRA Subtitle D would be adequate."

Are Ameren's coal ash management units in compliance with applicable environmental rules and regulations?

Yes. The ash management units are regulated as water treatment devices and are operated pursuant to requirements set forth in the facilities NPDES permit. The ash ponds are inspected regularly to confirm structural integrity. Unlike TVA at the Kingston site, Ameren has never permitted the stacking of wet ash at heights well above the berms. Accordingly, the safety issues posed at Kingston cannot and will not occur here.