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REPORT ON

HUMAN HEALTH AND ECOLOGICAL ASSESSMENT OF THE SIOUX ENERGY CENTER

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1. Introduction

The Sioux Energy Center (SEC) is a 1008 MW coal-fueled steam electrical power generating facility located near the confluence of the Mississippi and Missouri Rivers in St. Charles County, Missouri and is surrounded by agricultural fields. The facility began operations in 1967 and coal ash is managed in two (2) on-site surface impoundments. SCPA is an unlined impoundment, and SCPB is lined with high-density polyethylene (HDPE). In 2010, Ameren Missouri permitted a utility waste landfill in the areas designated SCPC and SCL4A. Figure 1 shows the location of the facility, and the locations of SCPA, SCPB, SCPC, and SCL4A.

The U.S. Environmental Protection Agency (USEPA) issued a final rule for "Disposal of Coal Combustion Residuals from Electric Utilities" in 2015 (the CCR Rule). One of the requirements in the CCR Rule is that utilities monitor groundwater at coal ash management facilities, and that the data be reported publicly. Ameren Missouri is complying with the CCR Rule, and has posted the required information on their publicly-available website: *https://www.ameren.com/Environment/ccr-rule-compliance*.

This Haley & Aldrich report is a companion document to the recently published 2017 Annual Groundwater Monitoring Report prepared by Golder Associates Inc. ("Golder") to provide interested reviewers with the information needed to interpret and meaningfully understand the groundwater monitoring data. Beyond the specific monitoring requirements of the CCR Rule, Ameren Missouri has also voluntarily taken the additional steps to determine if there has been any off-site impact to surface waters from the operation of the SCPA, SCPB, SCPC, and SCL4A. In this report, Haley & Aldrich examines the groundwater data reported under the CCR Rule, and the results of surface water samples collected from the Mississippi River, Missouri River, and an area referred to here as the Mississippi Offshoot, which border the Sioux Energy Center.

Ameren Missouri's comprehensive evaluation demonstrates that there are no adverse impacts resulting from coal ash management practices at the Sioux Energy Center on human health or the environment from either surface water or groundwater uses. In fact, as described in Sections 6 and 7, concentration levels of constituents detected in the groundwater would need to be multiple orders of magnitude higher before such a risk could exist. Details about the evaluation are provided below.

2. Approach

The analysis presented in this report was conducted by evaluating the environmental setting of the Sioux Energy Center, including its location and where ash management has occurred at the facility. Information on where groundwater is located at the facility, the rate(s) of groundwater flow, the direction(s) of groundwater flow, and where waterbodies may intercept groundwater flow was prepared by Golder, and is reviewed and summarized here.

A conceptual model was developed based on this physical setting information, and the model was used to identify what human populations could contact groundwater and/or surface water in the area of the facility. This information was also used to identify where ecological populations could come into contact with surface water. This conceptual model approach was used to identify where to collect surface water samples to allow evaluation of potential impact to the environment. Groundwater and surface water data are evaluated on a human health risk basis and an ecological 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. Generally, there are four components to the process: (1) Hazard Identification, (2) Toxicity Assessment, (3) Exposure Assessment, and (4) Risk Characterization.

The USEPA develops "screening levels" of constituent concentrations in groundwater (and other media) that are considered to be protective of specific human exposures. These screening levels are referred to as "Risk-Based Screening Levels" or RSLs, and are published by USEPA and updated twice yearly[1]. In developing the screening levels, USEPA uses a specific target risk level (component 4) 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). Similarly, ecological screening levels for surface water are developed by Federal and State agencies to be protective of the wide range of potential aquatic ecological resources, or receptors.

Risk-based screening levels are designed to provide a conservative estimate of the concentration to which a receptor (human or ecological) 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 indicate that a potential risk exists, but only indicate that further evaluation may be warranted.

The surface water and groundwater data were evaluated using human health risk-based and ecological risk-based screening levels drawn from Federal and State sources. The screening levels are used to determine if the concentration levels of constituents could pose a risk to human health or the environment. The evaluation also considers whether constituents are present in groundwater and surface water above screening levels, and if so, if the results could be due to the ash management operations.

Conceptual Site Model

A conceptual site model is used to evaluate the potential for human or ecological 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?

For the evaluation of the ash management operations at the Sioux Energy Center, the coal ash stored in SCPA, SCPB, SCPC, and SCL4A is the potential source. Constituents present in the coal ash can be dissolved into infiltrating water (either from precipitation or from groundwater intrusion) and those constituents may then be present in shallow groundwater, also referred to as the alluvial aquifer. Constituents could move with groundwater as it flows, usually in a downgradient/downhill direction.

[1] USEPA Risk-Based Screening Levels (November 2017). http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

Constituents derived from the coal ash present in groundwater could be introduced to adjacent surface water bodies; here, that could be the Mississippi River, Missouri River, and/or Mississippi Offshoot. Figure 1 shows the facility location and layout, and identifies direction of groundwater flow and the adjacent surface water bodies. Thus, the environmental media of interest for this evaluation are:

- Groundwater on the facility;
- Mississippi River;
- Missouri River; and
- Mississippi Offshoot.

The facility is located between the Mississippi and Missouri Rivers near their confluence, in a largely agricultural area that is provided with municipal water. The direction of groundwater flow has been cataloged for many years at the SEC. Figure 1 shows that the direction of groundwater flow in the northern portion of the site is north towards the Mississippi River, and in the southern portion of the site flow is south towards the Missouri River. It is important to note that groundwater flow within the confluence region is influenced by the flow stage of the Missouri and Mississippi Rivers. If surface water flow in the Mississippi River is higher, then groundwater flow within the confluence is southwest towards the Missouri River. In contrast, if the Missouri River is at a higher stage, then groundwater flow will be more towards the northeast and towards the Mississippi River. Based on their location, groundwater flow at ponds SCPA and SCPB is mainly towards the Mississippi River, but can vary.

The Mississippi Offshoot refers to a channelized area of the Mississippi River immediately adjacent to the SEC. One part of the offshoot is located to the west of the facility's cooling water intake channel. The other part of the offshoot is to the east of the facility's cooling water discharge channel. While these areas can be free-flowing during high river stages, at the time of the sampling of the Mississippi Offshoot (see below), the Mississippi River was in a low flow condition and water within the Offshoot was shallow and not free flowing.

According to a well survey database maintained by the Missouri Department of Natural Resources (MDNR), there are two private wells recorded within a one-mile radius of the facility, as shown on Figure 2. One is located at the facility and is not in service. The Sioux Energy Center obtains its drinking water from the City of Portage Des Sioux's public water supply, located upstream from the facility. The second private well is a deep well, screened in the bedrock aquifer and is located near the northern bank of the Missouri River. Thus, with respect to the shallow aquifer, there are no users of the groundwater from that aquifer.

The Mississippi River is a source of drinking water for the City of Alton, Illinois. The drinking water intake is located approximately 4.5 miles downstream from the SEC. Both the Mississippi and Missouri Rivers are also drinking water sources for the City of St. Louis. The Howard Bend drinking water intake is on the Missouri River well upstream of the Sioux Energy Center. The Chain of Rocks drinking water intake is on the Mississippi River approximately 15 miles downstream from the SEC. The Mississippi Offshoot does not serve as a source of drinking water.

The Mississippi and Missouri Rivers can be used for human recreation – wading, swimming, boating, fishing. Mississippi Offshoot is small in size and would be limited mostly to wading.

Both the rivers serve as habitat for aquatic species – fish, amphibians, etc.

A depiction of the conceptual site model is shown in Figure 3.

Based on this conceptual site model, samples have been collected from each of these environmental media – groundwater, Mississippi River, Missouri River and Mississippi Offshoot. The samples have been analyzed for constituents that are commonly associated with coal ash, as discussed below. However, it is recognized by the USEPA that all of these constituents are naturally occurring and can be found in rocks, soils, water, and sediments; thus, the challenge is to understand what the naturally occurring background levels are for these constituents. [See Attachment A for a more detailed discussion of the constituents present in coal ash and in our natural environment.] The CCR Rule requires sampling and analysis of upgradient and/or background groundwater just for this reason. The same reasoning applies to the surface water, thus, when sampling surface waters for this evaluation, samples for both rivers were collected upstream to assess background conditions, and downstream to assess whether the facility may be having an impact on surface water quality. The sampling is detailed in the next section.

To answer the question, "Are the constituent concentrations high enough to potentially exert a toxic effect?" health risk-based screening levels from Federal and State sources are used for comparison to the data. To be conservative, all data are compared to risk-based drinking water screening level levels, even though the closest downgradient drinking water intake is 4.5 miles downstream in the Mississippi River. All of the surface water data is compared to risk-based human recreational screening levels, and to ecological screening levels.

Thus, this conceptual site model has guided the sample collection, sample analysis, and the risk-based sample results evaluation that are provided in the following sections.

3. Sample Collection

Alluvial Aquifer Groundwater

Eight (8) groundwater monitoring wells were installed to evaluate shallow alluvial groundwater at the SCPA under the CCR Rule, as shown on Figure 1. Six (6) monitoring wells were installed around the perimeter of the SCPA to assess groundwater conditions at the ash management area (UMW-1D through UMW-6D), and two (2) monitoring wells were installed west of the facility to assess background groundwater conditions (S-BMW-1D and S-BMW-3D).

Eleven (11) groundwater monitoring wells were installed to evaluate shallow alluvial groundwater at the SCPB under the CCR Rule, as shown on Figure 1. Nine (9) monitoring wells were installed around the perimeter of the SCPB to assess groundwater conditions at the ash management area (LMW-1S through LMW-9S), and two (2) monitoring wells were installed west of the facility to assess background groundwater conditions (BMW-1S and BMW-3S).

Eight (8) groundwater monitoring wells were installed to evaluate shallow alluvial groundwater at the SCPC under the CCR Rule, as shown on Figure 1. Six (6) monitoring wells were installed around the perimeter of the SCPC to assess groundwater conditions at the ash management area (DG-1 through DG-4 and UG-1A and UG-2), and two (2) of the monitoring wells installed west of the facility are used to assess background groundwater conditions (BMW-1S and BMW-3S).

Six (6) groundwater monitoring wells were installed to evaluate shallow alluvial groundwater at the SCL4A under the CCR Rule, as shown on Figure 1. Four (4) monitoring wells were installed around the perimeter of the SCL4A to assess groundwater conditions at the ash management area (TMW-1 through

TMW-3 and UG-3), and two (2) of the monitoring wells installed west of the facility are used to assess background groundwater conditions (BMW-1S and BMW-3S).

Each groundwater monitoring well was sampled nine (9) times in 2016 and 2017[2].

Mississippi River

In September 2017, Golder collected surface water samples from twelve (12) locations in the Mississippi River (this sampling is not required under the CCR Rule). These locations are shown on Figure 4. At each sample location, shallow samples were collected near the surface of the river. Where the depth of water was greater than four (4) feet, a second sample was collected mid-depth in the river. For the Mississippi River, a total of twenty (20) samples were collected.

To assess water conditions unaffected by facility operations, Golder sampled the Mississippi River at three (3) locations approximately 0.25 miles upstream of the facility (S-MIR-10S through S-MIR-12S). Samples were collected to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MIR-10S), shallow depth;
- Midstream (S-MIR-12S/D), shallow depth, and deep depth; and
- Near midstream (S-MIR-11S/D), shallow depth, and deep depth.

Golder also sampled the Mississippi River at six (6) locations adjacent to the facility (S-MIR-4S through S-MIR-9S). The data from these locations are used to assess whether there is potential impact by the facility to river water quality. Similar to the upstream location, samples were collected to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MIR-4S and S-MIR-7S), shallow depth;
- Midstream (S-MIR-6S/D and S-MIR-9S/D), shallow depth, and deep depth; and
- Near midstream (S-MIR-5S/D and S-MIR-8S/D), shallow depth, and mid-depth.

In addition, Golder sampled three (3) locations approximately 0.25 miles downstream of the facility (S-MIR-1S through S-MIR-3S). The data from these locations are used to assess whether there is potential impact by the facility to river water quality. Similar to the upstream location, samples were collected to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MIR-1S), shallow depth;
- Midstream (S-MIR-3S/D), shallow depth, and deep depth; and
- Near midstream (S-MIR-2S/D), shallow depth, and deep depth.

Thus, a total of twenty (20) samples were collected from the Mississippi River.

[2] The CCR Rule requires eight (8) rounds of sampling events to establish baseline conditions in each well. Under the CCR Rule, the ninth sampling round is defined as the "Detection" sampling round.

Missouri River

The southern border of the Sioux Energy Center is near the Missouri River. Golder collected surface water samples from twelve (12) locations in the river in September 2017 (this sampling is not required under the CCR Rule).

Three (3) locations are approximately 0.25 miles upstream of the facility (S-MO-10S through S-MO-12S) and represent water conditions unaffected by facility operations. Golder collected samples to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MO-10S), shallow depth;
- Midstream (S-MO-12S/D), shallow depth, and deep depth; and
- Near midstream (S-MO-11S/D), shallow depth, and deep depth.

Six (6) locations are adjacent to the facility (S-MO-4S through S-MO-9S). The data from these locations are used to assess whether there is potential impact by the facility to river water quality. Similar to the upstream location, samples were collected to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MO-4S and S-MO-7S), shallow depth;
- Midstream (S-MO-6S/D and S-MO-9S/D), shallow depth, and deep depth; and
- Near midstream (S-MO-5S/D and S-MO-8S/D), shallow depth, and mid-depth.

Golder collected samples from three (3) locations approximately 0.25 miles downstream of the facility (S-MO-1S through S-MO-3S). The data from these locations are used to assess whether there is potential impact by the facility to river water quality. Similar to the upstream location, samples were collected to represent the following environments:

- Nearshore on the side closest to the Sioux Energy Center (S-MO-1S), shallow depth;
- Midstream (S-MO-3S/D), shallow depth, and deep depth; and
- Near midstream (S-MO-2S/D), shallow depth, and deep depth.

Thus, a total of twenty (20) samples were collected from the Missouri River.

Mississippi Offshoot

The northern border of the Sioux Energy Center is adjacent to a backwater area referred to here as the Mississippi Offshoot. As discussed above, water depth in this area can vary and was not freely flowing at the time of sampling. Golder collected surface water samples from six locations (S-MIO-1 through S-MIO-18) in September 2017. These locations are shown on Figure 4. Samples were collected along the offshoot adjacent to the facility:

- Twelve (12) shallow surface water samples were collected from the area west of the SEC raw water intake (S-MIO-7 through S-MIO-18); and
- Eight (8) surface water samples were collected from the area east of the SEC raw water intake (S-MIO-1 through S-MIO-6). At locations S-MIO-5 and S-MIO-6, the water was deep enough to collect a deep water sample from each location.

Thus, a total of twenty (20) samples were collected from the Mississippi Offshoot area.

4. Sample Analysis

The CCR Rule identifies the constituents that are included for groundwater testing; these are:

Boron	Antimony	Lead
Calcium	Arsenic	Lithium
Chloride	Barium	Mercury
pH	Beryllium	Molybdenum
Sulfate	Cadmium	Selenium
TDS	Chromium	Thallium
Fluoride	Cobalt	Radium 226/228

The CCR Rule requires eight (8) rounds of groundwater sampling and analysis – this was conducted for all wells to provide a baseline for current conditions. All eight rounds of groundwater samples collected through June 2017 were analyzed for all constituents. The samples from an additional ninth round from November 2017 were analyzed for the constituents listed in the first column above (these are the Appendix III constituents under the CCR Rule – the remaining are referred to as Appendix IV constituents). The CCR Rule requires statistical methods be used to determine whether a statistically significant increase (SSI) above background exists for the first column constituents. If so, additional assessment monitoring could be required.

So as to create an appropriate dataset for comparison, the above parameters were also used for the surface water sample analysis except for pH, TDS, and radium 226/228[3]. Two sets of analyses were conducted on the surface water samples. The samples were analyzed for the list above (referred to as the "total (unfiltered)" results), and then an aliquot of each sample was filtered to remove sediments/particulates and then analyzed (referred to as the "dissolved (filtered)" results). This is an important step for the analysis of surface water samples for two reasons:

- Surface water, especially in large rivers, can carry a large sediment load – the total (unfiltered results) include constituent concentrations that are associated with the sediment and not the water; and
- Some of the ecological screening levels used to evaluate the results apply only to dissolved (filtered) data.

The surface water samples were also analyzed for hardness, as some of the ecological screening levels are calculated based on site-specific hardness levels.

5. Risk-Based Screening Levels

A comprehensive set of risk-based screening levels have been compiled for this evaluation for the three types of potential exposures identified in the conceptual site model discussion above:

- Human health drinking water consumption;
- Human health recreational use of surface water; and
- Aquatic ecological receptors for surface water.

[3] As discussed in Section 6, radium was not included in the surface water sampling as it was not detected in the facility's CCR monitoring wells. pH was not outside of the drinking water screening level range in the CCR monitoring wells.

Table 1 provides the human health drinking water and recreational screening levels available from the State of Missouri sources and from Federal sources. Table 2 provides the ecological screening levels.

Drinking Water Screening Levels

The Missouri State drinking water supply levels are essentially the same as the Federal primary drinking water standards, also known as Maximum Contaminant Levels or MCLs. The Missouri State groundwater screening levels provide some additional screening levels not included on their list of drinking water screening levels.

In addition to the MCLs that are enforceable for municipal drinking water supplies, there are Federal secondary MCLs, or SMCLs, that are generally based on aesthetics (taste, color) and are not risk-based. The USEPA also provides risk-based screening levels (RSLs) for tapwater (drinking water).

The selected screening levels used to evaluate potential drinking water exposures are shown on Table 1. Missouri drinking water supply screening levels were used and supplemented with Federal MCLs, then the USEPA risk-based levels for tapwater (RSLs), and finally the Federal SMCLs.

It is important to note that the CCR Rule limits the evaluation of groundwater monitoring data of ash management areas to Federal MCLs or to a comparison with site-specific background. That comparison and evaluation is provided in the CCR Rule Groundwater Monitoring Report prepared by Golder, which this report supplements. The use of a more comprehensive set of screening levels in this evaluation provides a broader risk-based evaluation of the groundwater data than is provided by the CCR Rule requirements.

Recreational Screening Levels

Table 1 provides the State of Missouri human health recreational screening levels, based on fish consumption. The Federal Ambient Water Quality Criteria (AWQC) for consumption of organisms are also provided. Both sources were used to identify the screening levels used in this analysis, as listed on Table 1. The drinking water screening levels used to evaluate surface water are protective for other recreational uses of the river such as swimming, wading, and boating. Note that this evaluation of surface water and its potential uses is above and beyond the requirements of the CCR Rule.

Ecological Screening Levels

The ecological risk-based screening levels for surface water are provided in Tables 2. As noted above, some of the screening levels are based on the hardness of the water. Because the hardness of the Mississippi and Missouri Rivers are similar, Table 2 provides one set of ecological screening levels for the Mississippi and Missouri Rivers based on their combined hardness data. Note that this ecological evaluation of surface water is above and beyond the requirements of the CCR Rule.

6. Results

The level of analysis and comparison to risk-based screening levels presented below is above and beyond the requirements of the CCR Rule. The analysis of the groundwater results required by the CCR Rule is presented in the 2017 Groundwater Monitoring Annual Report: *https://www.ameren.com/Environment/managing-ccrs/ash-pond-closure*. This report serves to supplement that report by providing the risk-based analysis of groundwater and surface water, so that the groundwater results can be understood in their broader environmental context.

Groundwater – CCR Rule Evaluation

Ameren Missouri has filed on its website reports and notification required by the federal CCR Rule, as noted above, and additional reports will be prepared and posted on Ameren's website per the CCR Rule. The statistical analysis of the data has indicated an SSI for samples collected from the following monitoring wells (see Figure 1):

- SCPA – UMW-1D, UMW-2D, UMW-3D, UMW-4D, UMW-5D, UMW-6D
- SCPB – LMW-1S, LMW-2S, LMW-3S, LMW-4S, LMW-5S, LMW-6S, LMW-7S, LMW-8S, LMW-9S
- SCPC – UG-2
- SLC4A – none

Analytes exhibiting an SSI include pH, boron, calcium, chloride, fluoride, sulfate, and TDS.

The SSI values reflect a statistical evaluation that compares mathematically the results of the various rounds of samples to background water quality as required under the CCR rule. However, such values without further evaluation do not establish that there is an actual adverse impact to human health or the environment. The CSM process and screening analysis described in this report provides the relevant context for such groundwater monitoring results and whether the surface impoundments pose a true risk to human health and the environment. As explained in the remaining sections of this report, based upon surface water sampling data and the application of risk assessment principles uniformly adopted by USEPA and state environmental regulators including the Missouri Department of Natural Resources (MDNR), no such risk exists.

Groundwater – Risk-Based Evaluation

Groundwater data from all nine (9) rounds of groundwater monitoring were compared to the human health risk-based drinking water screening levels. Figure 1 shows that the monitoring wells are all located at the edges of the SCPA, SCPB, SCPC, and SCL4A and, therefore, provide worst-case groundwater results.

Tables 3 through 6 provide a summary of the results. Analytical results greater than the risk-based drinking water screening levels are provided; analytical results below the risk-based drinking water screening levels or not detected are indicated by "<". The vast majority of the results are below the human health risk-based drinking water screening levels.

UMW-2D, -3D, and -4D, along the perimeter of the SCPA, have the most results above the screening levels: these are for boron, sulfate, TDS, lithium (UMW-4D only), and molybdenum.

LMW-5S and LMW-8S, along the perimeter of the SCPB, have the most results above the screening levels: these are for LMW-5S – boron, sulfate, TDS, lithium, and molybdenum; and for LMW-8S – boron, sulfate, TDS, cobalt, and molybdenum. LMW-2S, -6S, and -9S also have results above screening levels for some of these constituents.

DG-1, DG-2, and DG-4, associated with the SCPC, are the only wells with a result above a screening level other than for TDS: these are for lithium only.

Only one well (UG-3) associated with the SCL4A, has a result above a screening level: these are for TDS and one result for cobalt.

The striking aspect of the analysis shown in Tables 3 through 6 is how few results are above a conservative risk-based drinking water screening level for human health, given that the wells are immediately adjacent to each of the ash management areas[4]. Even for the very few results that may be above screening values for some of the sampling events, including the SSI results identified under the CCR Rule, there is no complete drinking water exposure pathway to groundwater. Where there is no exposure, there is no risk.

Mississippi River

The comparison to risk-based screening levels of the analytical results for the Mississippi River are presented in Tables 7 through 9.

- Table 7 – Comparison to drinking water screening levels – No results are above risk-based screening levels.
- Table 8 – Comparison to human health recreational screening levels – Only total and dissolved concentrations of arsenic are above their screening levels. The arsenic results upstream and downstream are similar, thus, indicative of normal river conditions.
- Table 9 – Comparison to ecological screening levels – No results are above risk-based screening levels.

There are no analytical results for the Mississippi River that above drinking water screening or ecological levels. While arsenic concentrations in the river are slightly above the human health recreational screening levels, the concentrations are similar upstream and downstream and, therefore, not likely attributable to the ash impoundments. In fact, the concentrations of arsenic in all of the rivers sampled by Ameren for this evaluation (the Mississippi River at Sioux, Meramec, and Rush Island; the Missouri River at Labadie and Sioux; and the Meramec River at Meramec) are all very similar with total results ranging from 0.0012 to 0.005 mg/L. This underscores the fact that arsenic is naturally occurring in our environment, as discussed in more detail in Attachment A.

Thus, the Mississippi River sampling results do not show evidence of adverse impact of constituents derived from the ash management at SEC. This is important in that the absence of concentrations above risk-based screening levels means that there is not a significant pathway of exposure.

Missouri River

The comparison to risk-based screening levels of the analytical results for the Missouri River are presented in Tables 10 through 12.

- Table 10 – Comparison to drinking water screening levels – Only total and dissolved concentrations of lithium are above their screening levels. The lithium results upstream and downstream are similar, thus, indicative of normal river conditions.
- Table 11 – Comparison to human health recreational screening levels – Only total and dissolved concentrations of arsenic are above their screening levels. The arsenic results upstream and downstream are similar, thus, indicative of normal river conditions.

[4] Out of the 5453 groundwater analyses conducted, only 420 results are above a drinking water screening level (see Tables 3 through 6). Put another way, approximately 92% of the groundwater results for the CCR Rule monitoring wells located at the edge of the SEC impoundments are below drinking water screening levels.

- Table 12 – Comparison to ecological screening levels – No results are above risk-based screening levels.

Lithium concentrations are above drinking water screening levels and arsenic concentrations are above human recreational screening levels in the Missouri River. However, the concentrations of both constituents are similar upstream and downstream and, therefore, not likely attributable to the ash impoundments.

Thus, the Missouri River sampling results do not show evidence of adverse impact of constituents derived from of ash management at the SEC. This is important in that the absence of concentrations above risk-based screening levels means that there is not a significant pathway of exposure.

Mississippi Offshoot

The comparison to risk-based screening levels of the analytical results for the area referred to here as the Mississippi Offshoot are presented in Tables 13 through 15.

- Table 13 – Comparison to drinking water screening levels – No results are above risk-based screening levels.
- Table 14 – Comparison to human health recreational screening levels – Only total and dissolved concentrations of arsenic are above their screening levels. Concentrations seen in the Mississippi Offshoot are very low and similar to those seen in the samples collected from the Mississippi River, as discussed above. As such, these results are indicative of normal conditions.
- Table 15 – Comparison to ecological screening levels - Only total and dissolved concentrations of selenium are above screening levels. Selenium was detected above the ecological screening level of 5 ug/L in only 6 of the 20 total surface water analyses, and in only 4 of the 20 dissolved surface water analyses. Selenium was detected above the ecological screening level of 5 ug/L in only 10 of the 294 groundwater samples collected from CCR Rule monitoring wells. Selenium concentrations in these 10 samples ranged from 5.5 to 15.1 ug/L. Thus, it is unlikely that groundwater from the coal ash management areas at the facility is the source of selenium in the Mississippi Offshoot.

There are no analytical results for the Mississippi Offshoot that above drinking water screening levels. While arsenic concentrations in the Offshoot are slightly above the human health recreational screening levels, these concentrations are similar to background concentrations found in the Mississippi River. Selenium concentrations are slightly above ecological screening levels in some of the Mississippi Offshoot samples, but groundwater is unlikely to be the source of the selenium as only 10 of the 294 groundwater samples collected from CCR Rule monitoring wells are above the ecological screening level.

Thus, the Mississippi Offshoot sampling results do not show evidence of adverse impact of constituents derived from the ash management operations at SEC.

NPDES Outfall WET Testing Results

There are two permitted outfalls under the National Pollutant Discharge Elimination System (NPDES) program that are associated with impoundment operations: Outfall 002 and Outfall 006. The effluent water is tested for toxicity on a periodic basis, as required by the permit, for these two outfalls as well as Outfall 001, which is associated with facility non-contact cooling water. WET (whole effluent toxicity) testing involves mixing the effluent water from the outfalls with Mississippi River water collected

upstream to simulate mixing of the effluent upon discharge to the river. Tests are also conducted on the upstream Mississippi River water and on laboratory control water. If the effluent treatment results are not statistically different from the control results, then the effluent is considered to have passed the WET test.

Table 16 shows the results of the direct aquatic organism toxicity testing that is conducted using the effluent from each of the three outfalls. The results indicate no evidence of aquatic toxicity of the outfall effluents. This is a direct biological measure demonstrating the lack of toxicity of the Outfalls 002 and 006 effluents.

7. Derivation of Risk-Based Screening Levels for Groundwater

The results presented here demonstrate that the 51-year history of ash management activities at the surface impoundments have not had an adverse effect on human health or the environment. While some groundwater results are above drinking water screening levels, there is no pathway of exposure to the on-site groundwater (i.e., the shallow alluvial groundwater is not used as a source of drinking water). For those waters where a theoretical pathway of exposure exists (i.e., the Mississippi River and the Missouri River), with the exception of a few results for selenium in the Mississippi Offshoot, there is no evidence of impact and samples are either below screening levels or consistent with background.

Ameren's facilities are located on major river systems with a massive and rapid fiver flow. In this section, we have attempted to illustrate how the groundwater – which is a fraction of the volume and flow rate of the river – may interact with a surface body under an assumed set of criteria and conditions (see Attachment B). Such an exercise in assumptions can help put in context whether a theoretical risk to public water supplies exists, particularly where, as here, actual surface water samples have been collected and evaluated.

However, impacts to groundwater does not mean that surface waters are impaired. The degree of interface between groundwater and surface waters is variable and complex and dependent upon a variety of factors including gradient and flow rate. It is possible, however, to determine the maximum concentration level that would need to be present on-site in groundwater and still be protective of the surface water environment, assuming gradient and flow rates are such that groundwater flows into the surface water. Groundwater and surface waters flow at very different rates and volumes. The Mississippi River is the largest river system in North America and as depicted on Table 17 and Attachment B, when compared to groundwater, its dilution factor is greater than 90,000. The dilution factor for the Missouri River, one of the longest rivers in North America, is greater than 100,000 as shown in Table 18.

It is possible to calculate a protective screening level for groundwater based upon the amount of dilution that occurs under the above assumption. This calculated risk-based screening level for groundwater can be used to determine whether an on-site groundwater concentration level is protective of the river. Stated differently, at what concentration level does groundwater entering the river system pose a human health or ecological risk?

Table 17 for the Mississippi River and Table 18 for the Missouri River are summarized below and show the application of the dilution factor to calculate alternative risk-based screening levels for the following parameters: boron, sulfate, TDS, cobalt, lithium, and molybdenum. These constituents have one or more monitoring well concentrations above the drinking water screening levels, as shown in Tables 3 through 6. For each constituent, the human health drinking water and recreational screening levels are

presented as well as the ecological screening level. The lowest of the three screening levels is then identified for surface water. The dilution factor is then applied to this lowest screening level for surface water to result in the groundwater alternative risk-based screening level, which is what is shown in the table below.

This evaluation is not limited to only those constituents for which SSIs have been identified. The constituents listed here are those for which there is one or more groundwater result above a risk-based screening level[5].

DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSISSIPPI RIVER (see Table 17)

	Estimated Dilution Factor (d)	90,000			
Constituents*	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level** (mg/L)**	**Maximum SEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum SEC Groundwater Concentration**
Boron***	2	180000	31.2	S-UMW-4D	>5700
Sulfate***	250	22500000	1100	S-LMW-5S	>20000
TDS***	500	45000000	1760	S-LMW-5S	>25000
Cobalt	0.006	540	0.0122	S-LMW-9S	>44000
Lithium	0.04	3600	0.0623	S-LMW-5S	>57000
Molybdenum	0.1	9000	8.3	S-UMW-4D	>1000

DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSOURI RIVER (see Table 18)

	Estimated Dilution Factor (d)	100,000			
Constituents*	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level** (mg/L)**	**Maximum SEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum SEC Groundwater Concentration**
Boron***	2	200000	31.2	S-UMW-4D	>6400
Sulfate***	250	25000000	1100	S-LMW-5S	>22000
TDS***	500	50000000	1760	S-LMW-5S	>28000
Cobalt	0.006	600	0.0122	S-LMW-9S	>49000
Lithium	0.04	4000	0.0623	S-LMW-5S	>64000
Molybdenum	0.1	10000	8.3	S-UMW-4D	>1200

*** A dilution factor is not directly applicable to pH, thus it is not included in this analysis.**
**** Where the Groundwater Risk-Based Screening Level = Screening Level x Dilution Factor.**
***** Constituents for which an SSI has been identified. Note that although an SSI was identified for boron, sulfate, and TDS for SCPA and SCPB, these constituents are not present in surface water at concentrations above the risk-based screening levels. Also note that although an SSI has been identified for chloride and fluoride for SCPA and SCPB, and fluoride for one well at SCPC, these constituents are not present in groundwater at concentrations above risk-based screening levels.**

[5] Note that under the CCR Rule, statistically significant levels of Appendix IV constituents are determined after Assessment Monitoring has been conducted.

The screening levels depicted above are calculated in units of milligrams of constituent per liter of water (mg/L). One mg/L is equivalent to one million parts per million.[6,7]

The tables above identify the maximum groundwater concentration of each constituent detected in the SEC monitoring wells. The comparison between the target levels and the maximum concentrations indicates that there is a wide margin of safety between the two values. This margin is shown in the last column of the table. To illustrate, concentration levels of molybdenum and lithium would need to be more than 1,000 and 64,000 times higher, respectively, than currently measured levels before an adverse impact in the Missouri River could occur.

This evaluation indicates that not only do the present concentrations of constituents in groundwater at the Sioux Energy Center not pose a risk to human health or the environment, but even much higher concentrations would not be harmful.

8. Closure of the SCPA, SCPB, SCPC, SCL4A

Current plans for the facility are to convert to dry ash handling and to close the surface impoundments[8]. Following the scheduled completion of dry ash conversion projects in 2020, the ash impoundment system will be removed from service. Closure of the surface impoundments is expected to be completed by early 2022. Closure is estimated to reduce the movement of CCR constituents from the surface impoundments discharge (or flux) of water into the alluvial aquifer to groundwater by 90% or more. This reduction is the result of several factors: closure will cease the flow of water and ash to the surface impoundments, a cap will be installed that will limit infiltration of precipitation, and the closure plan includes stormwater run-on and run-off controls to route stormwater off of the capped area and away from the surface impoundments. It is likely that concentrations of constituents in groundwater at the surface impoundments will decrease post-closure.

9. Summary

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 Sioux Energy Center.

[6] Note that because the target level calculation is a mathematical exercise, certain results may not be applicable in the real world. For example, the result for sulfate is 22.5 million parts per million, which is not physically possible. However, what this means is that there is no level of sulfate that could be present in the groundwater at the SEC that could result in a risk of harm to human health or the environment.

[7] A million parts per million is equivalent to 1 penny in $10,000 worth of pennies, 1 second in 11.5 days, or 1 inch in 15.8 miles.

[8] Importantly, the CCR Rule promulgated by USEPA in 2015 is both under appeal [Utility Solid Waste Activities, et al v. EPA, Docket No. 15-01219, DC Circuit Court of Appeals Sept 13, 2017, Letter from Pruitt to reconsider.] and is being reconsidered by the current Administration. Notwithstanding any proposed changes to the federal CCR Rule, Ameren Missouri intends to implement its closure plan and schedule.

10. Attachments

TABLES

FIGURES

ATTACHMENTS

TABLES

TABLE 1
HUMAN HEALTH SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

			Missouri State Water Quality Screening Levels (mg/L)			Federal Water Quality Screening Levels (mg/L)				Selected Screening Level (mg/L)	
Constituent	Abbreviation	CASRN	Human Health Fish Consumption (a)	Drinking Water Supply (a)	Groundwater (a)	USEPA AWQC Human Health Consumption of Organism Only (b)	MCLs (c)	SMCLs (c)	November 2017 USEPA Tapwater RSLs (d)	Drinking Water (e)	Recreational Use (f)
Antimony	Sb	7440-36-0	4.3	0.006	0.006	0.64	0.006	NA	0.0078 (m)	0.006	4.3
Arsenic	As	7440-38-2	NA	0.05	0.05	0.00014 (i)	0.01	NA	0.000052	0.05	0.00014
Barium	Ba	7440-39-3	NA	2	2	NA	2	NA	3.8	2	NA
Beryllium	Be	7440-41-7	NA	0.004	0.004	NA	0.004	NA	0.025	0.004	NA
Boron	B	7440-42-8	NA	NA	2	NA	NA	NA	4	4 (q)	NA
Cadmium	Cd	7440-43-9	NA	0.005	0.005	NA	0.005	NA	0.0092	0.005	NA
Calcium	Ca	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	Cl	7647-14-5	NA	250	NA	NA	NA	250	NA	250	NA
Chromium	Cr	16065-83-1 (g)	NA	0.1	0.1	NA	0.1 (j)	NA	22 (n)	0.1	NA
Cobalt	Co	7440-48-4	NA	NA	1	NA	NA	NA	0.006	0.006	NA
Fluoride	Fl	16984-48-8	NA	4	4	NA	4	2	0.8	4	NA
Lead	Pb	7439-92-1	NA	0.015	0.015	NA	0.015 (k)	NA	0.015	0.015	NA
Lithium	Li	7439-93-2	NA	NA	NA	NA	NA	NA	0.04	0.04	NA
Mercury	Hg	7487-94-7 (h)	NA	0.002	0.002	NA	0.002 (l)	NA	0.0057 (o)	0.002	NA
Molybdenum	Mo	7439-98-7	NA	NA	NA	NA	NA	NA	0.1	0.1	NA
Radium 226/228 (pCi/L)	Ra 226/228	RADIUM226228	NA	NA	NA	NA	5	NA	NA	5	NA
Selenium	Se	7782-49-2	NA	0.05	0.05	4.2	0.05	NA	0.1	0.05	4.2
Sulfate	SO4	7757-82-6	NA	250	NA	NA	NA	250	NA	250	NA
Thallium	Tl	7440-28-0	0.0063	0.002	0.002	0.00047	0.002	NA	0.0002 (p)	0.002	0.0063
Total Dissolved Solids	TDS	TDS	NA	NA	NA	NA	NA	500	NA	500	NA
pH (std)	--	PHFLD	NA	NA	NA	NA	NA	6.5 - 8.5	NA	6.5 - 8.5	NA

Notes:

AWQC - Ambient Water Quality Criteria.
CASRN - Chemical Abstracts Service Registry Number.
HI - Hazard Index (noncancer child).
MCL - Maximum Contaminant Level.
mg/L - microgram per liter.
NA - not available.
pCi/L - picoCurie per liter.
RSL - Risk-based Screening Levels (USEPA).
TR - Target Risk (carcinogenic).
USEPA - United States Environmental Protection Agency.

(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. Updated January 29, 2014. Per 10 CSR 20-7.031(4)(B)(2), the criteria for Human Protection Fish Consumption apply to dissolved metals data. All other criteria apply to total concentrations.
http://www.sos.mo.gov/adrules/csr/current/10csr/10c20-7a.pdf
(b) - USEPA National Recommended Water Quality Criteria. USEPA Office of Water and Office of Science and Technology. Accessed November 2014.
https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table
USEPA AWQC Human Health for the Consumption of Organism Only apply to total concentrations.
(c) - USEPA 2012 Edition of the Drinking Water Standards and Health Advisories. Spring 2012.
http://water.epa.gov/drink/contaminants/index.cfm
(d) - USEPA Risk-Based Screening Levels (November 2017). Values for tapwater. HI = 1.0, TR = 1E-06.
http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
(e) - The hierachy for selecting the Human Health Screening Level for Drinking Water is: Missouri State Water Quality Criteria for Drinking Water Supply (a); Federal USEPA MCL for Drinking Water (c); Federal June 2017 USEPA Tapwater RSL (d); Federal USEPA SMCL for Drinking Water (c).
(f) - The hierachy for selecting the Human Health Screening Level for Recreational Use is: Missouri State Water Quality Criteria for Human Health Fish Consumption (a); Federal USEPA AWQC for Human Health Consumption of Organism Only (b).
(g) - CAS number for Trivalent Chromium.
(h) - CAS number for Mercuric Chloride.
(i) - Value applies to inorganic form of arsenic only.
(j) - Value for Total Chromium.
(k) - Lead Treatment Technology Action Level is 0.015 mg/L.
(l) - Value for Inorganic Mercury.
(m) - RSL for Antimony (metallic) used for Antimony.
(n) - RSL for Chromium (III), Insoluble Salts used for Chromium.
(o) - RSL for Mercuric Chloride used for Mercury.
(p) - RSL for Thallium (Soluble Salts) used for Thallium.
(q) - RSL selected for Boron as the Missouri State Water Quality Groundwater screening level is based on irrigation.

TABLE 2
ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Missouri State Water Quality Criteria (mg/L)						Federal Water Quality Criteria (mg/L)			
		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	CASRN	Total	Dissolved	Total	Dissolved	Total	Total	Total	Dissolved	Total	Dissolved
Antimony (c)	7440-36-0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	7440-38-2	NA	NA	NA	0.02	0.1	NA	0.34	0.34	0.15	0.15
Barium (c)	7440-39-3	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	7440-41-7	NA	NA	NA	0.005	0.1	NA	NA	NA	NA	NA
Boron	7440-42-8	NA	NA	NA	NA	2	NA	NA	NA	NA	NA
Cadmium	7440-43-9	0.013	0.011	0.00053	0.0005	NA	NA	0.0046 (f)	0.0042 (g)	0.0016 (f)	0.0014 (g)
Calcium (c)	7440-70-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloride	16887-00-6	NA	NA	NA	NA	NA	NA	860	NA	230	NA
Chromium	7440-47-3	3.8	1.2	0.18	0.16	0.1 (e)	NA	3.8 (e,f)	1.2 (e,g)	0.18 (e,f)	0.16 (e,g)
Cobalt	7440-48-4	NA	NA	NA	NA	NA	1	NA	NA	NA	NA
Fluoride	16984-48-8	NA	NA	NA	NA	NA	4	NA	NA	NA	NA
Lead	7439-92-1	0.26	0.17	0.0101	0.0066	NA	NA	0.26 (f)	0.17 (g)	0.0101 (f)	0.0066 (g)
Lithium (c)	7439-93-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	7439-97-6	0.0024	0.0024	0.0005	0.0005	NA	NA	0.0016	0.0014	0.00091	0.00077
Molybdenum (c)	7439-98-7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	7782-49-2	NA	NA	NA	0.005	NA	NA	0.013 (d)	0.013 (d)	0.005 (d)	0.005 (d)
Sulfate	14808-79-8	NA	NA	1690 (f,h)	NA	NA	NA	NA	NA	NA	NA
Thallium (c)	7440-28-0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Dissolved Solids (c)	TDS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

AWQC - USEPA Ambient Water Quality Criteria.
CASRN - Chemical Abstracts Service Registry Number.
CMC - Criterion Maximum Concentration.
mg/L - milligram per liter.
NA - Not Available.
USEPA - United States Environmental Protection Agency.

(a) - 10 Missouri Code of State Regulations Division 20 Chapter 7 Table A. January 29, 2014.
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 December 2014.
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) - Water quality criteria from the presented sources are not available for this constituent.

(d) - 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.

(e) - Value for trivalent chromium used.

(f) - Hardness dependent value for total metals. Site-specific total recoverable mean hardness value for the Mississippi and Missouri River of 247 mg/L as $CaCO_3$ used.

(g) - Hardness dependent value for total metals adjusted for dissolved fraction. Site-specific total recoverable mean hardness value for the Mississippi and Missouri River of 247 mg/L as $CaCO_3$ used.

(h) - Chloride dependent value (default chloride value of 25 mg/L is assumed) for Missouri River and Mississippi River.
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 3
SUMMARY OF SCPA SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	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
S-BMW-1D (b)	Mar-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	506	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-BMW-3D (b)	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Dec-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Feb-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Apr-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 1)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 2)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UMW-1D	Mar-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	588	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	551	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UMW-2D	Mar-16	15.1	<	<	<	524	1010	<	<	<	<	<	<	<	<	<	<	<	<	1.31	<	<
	May-16	18.8	<	<	<	641	1110	<	<	<	<	<	<	<	<	<	<	<	<	1.44	<	<
	Jul-16	16.8	<	<	<	594	1090	<	<	<	<	<	<	<	<	<	<	<	<	1.36	<	<
	Sep-16	14.7	<	<	<	528	1010	<	<	<	<	<	<	<	<	<	<	<	<	1.27	<	<
	Nov-16	10.6	<	<	<	444	823	<	<	<	<	<	<	<	<	<	<	<	<	0.989	<	<
	Jan-17	14.5	<	<	<	477	885	<	<	<	<	<	<	<	<	<	<	<	<	1.31	<	<
	Mar-17	25.2	<	<	<	738	1380	<	<	<	<	<	<	<	<	<	<	<	<	1.88	<	<
	Jun-17	24.2	<	<	<	784	1220	<	<	<	<	<	<	<	<	<	<	<	<	2.17	<	<
	Nov-17	22.1	<	<	NA	722	1000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UMW-3D	Mar-16	30.2	<	<	<	833	1450	<	<	<	<	<	<	<	<	<	<	<	<	4.8	<	<
	May-16	26.1	<	<	<	663	1210	<	<	<	<	<	<	<	<	<	<	<	<	4.25	<	<
	Jul-16	24	<	<	<	565	1150	<	<	<	<	<	<	<	<	<	<	<	<	3.77	<	<
	Sep-16	25.2	<	<	<	684	1170	<	<	<	<	<	<	<	<	<	<	<	<	4.28	<	<
	Nov-16	26.4	<	<	<	810	1120	<	<	<	<	<	<	<	<	<	<	<	<	4.23	<	<
	Jan-17	21.3	<	<	<	531	1020	<	<	<	<	<	<	<	<	<	<	<	<	3.43	<	<
	Mar-17	25	<	<	<	603	1090	<	<	<	<	<	<	<	<	<	<	<	<	4.12	<	<
	Jun-17	24.2	<	<	<	664	1130	<	<	<	<	<	<	<	<	<	<	<	<	3.92	<	<
	Nov-17	24.1	<	<	NA	710	1150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UMW-4D	Mar-16	31.2	<	<	<	511	1100	<	<	<	<	<	<	<	<	<	<	<	<	8.3	<	<
	May-16	26.3	<	<	<	397	1000	<	<	<	<	<	<	<	<	<	<	<	<	7.22	<	<
	Jul-16	26.5	<	<	<	522	1100	<	<	<	<	<	<	<	<	<	<	<	<	7.55	<	<
	Sep-16	24.1	<	<	<	624	1110	<	<	<	<	<	<	<	<	<	<	<	<	7.2	<	<
	Nov-16	24.6	<	<	<	600	1020	<	<	<	<	<	<	<	<	<	<	0.0413	<	7.19	<	<
	Jan-17	28.6	<	<	<	550	1120	<	<	<	<	<	<	<	<	<	<	0.0442	<	7.83	<	<
	Mar-17	23	<	<	<	484	1010	<	<	<	<	<	<	<	<	<	<	<	<	6.48	<	<
	Jun-17	21.6	<	<	<	439	947	<	<	<	<	<	<	<	<	<	<	<	<	6.12	<	<
	Nov-17	27	<	<	NA	544	1010	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UMW-5D	Mar-16	10.8	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.264	<	<
	May-16	11.8	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.271	<	<
	Jul-16	12.9	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.28	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.112	<	<
	Nov-16	12.4	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.253	<	<
	Jan-17	5.97	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.254	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.242	<	<
	Jun-17	7.24	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.27	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 3
SUMMARY OF SCPA SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	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
S-UMW-6D	Mar-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.106	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.109	<	<	<
	Sep-16	11.4	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.259	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.114	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.11	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.108	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	0.115	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summary Ratio of # Results above the SL : Total # Results		34:72	0:72	0:72	0:64	27:72	30:72	0:64	0:64	0:64	0:64	0:64	0:64	0:64	0:64	0:64	2:64	0:64	39:64	0:64	0:64	0:64

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not applicable/Not Analyzed.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.
(b) - Background wells.

TABLE 4
SUMMARY OF SCPB SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	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
S-BMW-1S (b)	Mar-16	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	517	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	526	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	565	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	540	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	532	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	526	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-BMW-3S (b)	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Dec-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Feb-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Apr-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 1)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 2)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-1S	Mar-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	431	915	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	307	865	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-2S	Mar-16	13.3	<	<	<	338	945	<	<	<	<	<	<	<	<	<	<	<	1.4	<	<	<
	May-16	12.7	<	<	<	371	915	<	<	<	<	<	<	<	<	<	<	<	1.47	<	<	<
	Jul-16	12.2	<	<	<	260	980	<	<	<	<	<	<	<	<	<	<	<	1.5	<	<	<
	Sep-16	11	<	<	<	<	1040	<	<	<	<	<	<	<	<	<	<	<	1.16	<	<	<
	Nov-16	10.7	<	<	<	<	987	<	<	<	<	<	<	<	<	<	<	<	1.04	<	<	<
	Jan-17	8.86	<	<	<	<	1100	<	<	<	<	<	<	<	<	<	<	<	0.861	<	<	<
	Mar-17	8.15	<	<	<	<	1180	<	<	<	<	<	<	<	<	<	<	<	0.798	<	<	<
	Jun-17	9.66	<	<	<	265	1090	<	<	<	<	<	<	<	<	<	<	<	1.07	<	<	<
	Nov-17	11.6	<	<	NA	268	958	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-3S	Mar-16	<	<	<	<	<	536	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	512	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	512	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	516	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	581	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	572	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	545	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-4S	Mar-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	626	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	593	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	542	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	525	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	527	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	592	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	604	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	544	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-5S	Mar-16	11.9	<	<	<	842	1610	<	<	<	<	<	<	<	<	<	<	0.0623	<	0.318	<	<	<
	May-16	11	<	<	<	812	1760	<	<	<	<	<	<	<	<	<	<	0.0595	<	0.373	<	<	<
	Jul-16	11.8	<	<	<	790	1620	<	<	<	<	<	<	<	<	<	<	0.0608	<	0.497	<	<	<
	Sep-16	13.8	<	<	<	968	1730	<	<	<	<	<	<	<	<	<	<	0.0604	<	0.753	<	<	<
	Nov-16	14.2	<	<	<	1100	1720	<	<	<	<	<	<	<	<	<	<	0.0604	<	0.872	<	<	<
	Jan-17	10.8	<	<	<	749	1390	<	<	<	<	<	<	<	<	<	<	0.0574	<	0.668	<	<	<
	Mar-17	11.1	<	<	<	713	1390	<	<	<	<	<	<	<	<	<	<	0.053	<	0.714	<	<	<
	Jun-17	12.6	<	<	<	771	1550	<	<	<	<	<	<	<	<	<	<	0.0555	<	0.87	<	<	<
	Nov-17	8.22	<	<	NA	585	1180	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4
SUMMARY OF SCPB SURFACE IMPOUNDMENT GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																			
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	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
S-LMW-6S	Mar-16	13.3	<	<	<	991	1750	<	<	<	<	<	<	<	0.0061	<	<	<	<	<	<	<
	May-16	13.9	<	<	<	880	1680	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	13.4	<	<	<	858	1680	<	<	<	<	<	<	<	0.0069	<	<	<	<	<	<	<
	Sep-16	13.4	<	<	<	842	1610	<	<	<	<	<	<	<	0.0075	<	<	<	<	<	<	<
	Nov-16	13.9	<	<	<	823	1560	<	<	<	<	<	<	<	0.0072	<	<	<	<	<	<	<
	Jan-17	15.6	<	<	<	856	1650	<	<	<	<	<	<	<	0.008	<	<	<	<	<	<	<
	Mar-17	16.2	<	<	<	1030	1720	<	<	<	<	<	<	<	0.0085	<	<	<	<	<	<	<
	Jun-17	14.5	<	<	<	774	1590	<	<	<	<	<	<	<	0.0072	<	<	<	<	<	<	<
	Nov-17	18	<	<	NA	792	1500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-7S	Mar-16	<	<	<	<	337	940	<	<	<	<	<	<	<	0.0065	<	<	<	<	<	<	<
	May-16	<	<	<	<	301	1030	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	313	1020	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	293	979	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	335	1050	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	371	1070	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	443	1090	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	426	1180	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	519	1140	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-8S	Mar-16	5.78	<	<	<	396	807	<	<	<	<	<	<	<	0.0076	<	<	<	<	<	<	<
	May-16	4.9	<	<	<	368	826	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	4.81	<	<	<	361	877	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	5.66	<	<	<	386	822	<	<	<	<	<	<	<	<	<	<	<	0.124	<	<	<
	Nov-16	5.89	<	<	<	386	823	<	<	<	<	<	<	<	<	<	<	<	0.148	<	<	<
	Jan-17	6.06	<	<	<	402	773	<	<	<	<	<	<	<	0.0066	<	<	<	0.169	<	<	<
	Mar-17	5.88	<	<	<	417	860	<	<	<	<	<	<	<	0.0089	<	<	<	0.173	<	<	<
	Jun-17	6.5	<	<	<	422	976	<	<	<	<	<	<	<	0.0061	<	<	<	0.346	<	<	<
	Nov-17	6.88	<	<	NA	463	941	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-LMW-9S	Mar-16	<	<	<	<	316	1040	<	<	<	<	<	<	<	0.0122	<	0.0446	<	<	<	<	<
	May-16	<	<	<	<	328	1160	<	<	<	<	<	<	<	0.0101	<	0.0451	<	<	<	<	<
	Jul-16	<	<	<	<	320	1220	<	<	<	<	<	<	<	0.0103	<	0.0456	<	<	<	<	<
	Sep-16	<	<	<	<	303	1170	<	<	<	<	<	<	<	0.0115	<	0.0487	<	<	<	<	<
	Nov-16	<	<	<	<	310	1150	<	<	<	<	<	<	<	0.0097	<	0.051	<	<	<	<	<
	Jan-17	<	<	<	<	286	1090	<	<	<	<	<	<	<	0.0094	<	0.054	<	<	<	<	<
	Mar-17	<	<	<	<	282	1110	<	<	<	<	<	<	<	0.0093	<	0.0481	<	<	<	<	<
	Jun-17	<	<	<	<	287	1090	<	<	<	<	<	<	<	<	<	0.0417	<	<	<	<	<
	Nov-17	<	<	<	NA	302	997	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summary Ratio of # Results above the SL : Total # Results		36:99	0:99	0:99	0:88	52:99	79:99	0:88	0:88	0:88	0:88	0:88	0:88	0:88	19:88	0:88	16:88	0:88	21:88	0:88	0:88	0:88

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not applicable/Not Analyzed.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.
(b) - Background monitoring well also associated with SCPC and SCL4A.

TABLE 5
SUMMARY OF SCPC UTILITY WASTE LANDFILL CELL 1 GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	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
S-BMW-1S (b)	Mar-16	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	517	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	526	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	565	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	540	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	532	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	526	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-BMW-3S (b)	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Dec-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Feb-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Apr-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 1)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 2)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-DG-1	May-16	<	<	<	<	<	526	<	<	<	<	<	<	<	<	<	<	0.0413	<	<	<	<
	Jun-16	<	<	<	<	<	530	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	518	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-DG-2	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	504	<	<	<	<	<	<	<	<	<	<	0.0404	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-DG-3	May-16	<	<	<	<	<	540	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	557	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	531	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	580	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	535	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	528	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	545	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	532	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	521	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-DG-4	May-16	<	<	<	<	<	551	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	564	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	543	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	637	<	<	<	<	<	<	<	<	<	<	0.0419	<	<	<	<
	Nov-16	<	<	<	<	<	563	<	<	<	<	<	<	<	<	<	<	0.0414	<	<	<	<
	Jan-17	<	<	<	<	<	587	<	<	<	<	<	<	<	<	<	<	0.0422	<	<	<	<
	Mar-17	<	<	<	<	<	637	<	<	<	<	<	<	<	<	<	<	0.0433	<	<	<	<
	Jun-17	<	<	<	<	<	624	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	528	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-UG-1A	May-16	<	<	<	<	<	678	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	665	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	576	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	688	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	599	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	503	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	632	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	515	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 5
SUMMARY OF SCPC UTILITY WASTE LANDFILL CELL 1 GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	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
S-UG-2	May-16	<	<	<	<	<	519	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	522	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	521	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	584	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	565	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Summary Ratio of # Results above the SL : Total # Results		0:72	0:72	0:72	0:64	0:72	43:72	0:64	0:64	0:64	0:64	0:64	0:64	0:64	0:64	0:64	6:64	0:64	0:64	0:64	0:64	0:64

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not applicable/Not Analyzed.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.
(b) - Background monitoring well also associated with SCPB and SCL4A.

TABLE 6
SUMMARY OF SCL4A UTILITY WASTE LANDFILL CELL 4A GROUNDWATER MONITORING RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron	Calcium	Chloride	pH	Sulfate	TDS	Fluoride	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Lead	Lithium	Mercury	Molybdenum	Selenium	Thallium	Radium-226/228
	HH DW SL	4	NA	250	6.5-8.5	250	500	4	0.006	0.05	2	0.004	0.005	0.1	0.006	0.015	0.04	0.002	0.1	0.05	0.002	5
Monitoring Well ID	**Sampling Event Date**	mg/L	mg/L	mg/L	S.U.	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
S-BMW-1S (b)	Mar-16	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	May-16	<	<	<	<	<	517	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	526	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	565	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	540	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	533	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	532	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	526	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-BMW-3S (b)	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Dec-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Feb-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Apr-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 1)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17 (Event 2)	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S-TMW-1	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	<	<	NA
S-TMW-2	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	<	<	NA
S-TMW-3	May-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	<	NA	NA	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	<	<	NA
S-UG-3	May-16	<	<	<	<	<	515	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-16	<	<	<	<	<	553	<	<	<	<	<	<	<	0.0103	<	<	<	<	<	<	<
	Jul-16	<	<	<	<	<	506	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Sep-16	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-16	<	<	<	<	<	<	<	<	<	<	<	<	<	0.0061	<	<	<	<	<	<	<
	Jan-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Mar-17	<	<	<	<	<	570	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Jun-17	<	<	<	<	<	585	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
	Nov-17	<	<	<	NA	<	521	NA	NA	<	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	<	NA
Summary Ratio of # Results above the SL : Total # Results		0:54	0:54	0:54	0:48	0:54	14:54	0:48	0:48	0:52	0:48	0:48	0:48	0:48	2:48	0:48	0:48	0:48	0:48	0:48	0:52	0:48

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not applicable/Not Analyzed.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.
(b) - Background monitoring well also associated with SCPB and SCPC.

TABLE 7
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH DW SL**	4	4	NA	NA	250	6.5-8.5	250	500	4	0.006	0.006	0.05	0.05	2	2	0.004	0.004	0.005	0.005	0.1	0.1
Locationl ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	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
UPSTREAM																						
S-MIR-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
S-MIR-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MIR-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 7
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**HH DW SL**	0.006	0.006	0.015	0.015	0.04	0.04	0.002	0.002	0.1	0.1	0.05	0.05	0.002	0.002	5	NA
Location ID	**Sampling Event Date**	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	pCi/L	mg/L
UPSTREAM																	
S-MIR-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MIR-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MIR-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 8
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH REC SL**	NA	NA	NA	NA	NA	6.5-8.5	NA	NA	NA	4.3	4.3	0.00014	0.00014	NA	NA	NA	NA	NA	NA	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	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
UPSTREAM																						
S-MIR-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0016	<	<	<	<	<	<	<	<
S-MIR-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0018	0.0016	<	<	<	<	<	<	<	<
S-MIR-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0016	0.0015	<	<	<	<	<	<	<	<
S-MIR-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0017	<	<	<	<	<	<	<	<
S-MIR-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0016	<	<	<	<	<	<	<	<
ADJACENT																						
S-MIR-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0021	0.0017	<	<	<	<	<	<	<	<
S-MIR-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0018	0.0015	<	<	<	<	<	<	<	<
S-MIR-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0017	0.0015	<	<	<	<	<	<	<	<
S-MIR-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0021	0.0018	<	<	<	<	<	<	<	<
S-MIR-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0018	<	<	<	<	<	<	<	<
S-MIR-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0016	<	<	<	<	<	<	<	<
S-MIR-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0014	<	<	<	<	<	<	<	<
S-MIR-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0017	0.0016	<	<	<	<	<	<	<	<
S-MIR-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0016	<	<	<	<	<	<	<	<
S-MIR-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0016	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MIR-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0017	<	<	<	<	<	<	<	<
S-MIR-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0019	0.0016	<	<	<	<	<	<	<	<
S-MIR-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0018	0.0016	<	<	<	<	<	<	<	<
S-MIR-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0022	0.0018	<	<	<	<	<	<	<	<
S-MIR-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0022	0.0018	<	<	<	<	<	<	<	<

Notes:
< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 8
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**HH REC SL**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2	4.2	0.0063	0.0063	NA	NA
Location ID	**Sampling Event Date**	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	pCi/L	mg/L
UPSTREAM																	
S-MIR-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MIR-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MIR-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 9
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**ECO SL**	2	2	NA	NA	230	6.5-8.5	1690	NA	4	NA	NA	0.15	0.02	NA	NA	0.1	0.005	0.0005	0.0005	0.181	0.155
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U	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
UPSTREAM																						
S-MIR-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
S-MIR-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MIR-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIR-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:

< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 9
SUMMARY OF MISSISSIPPI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**ECO SL**	1	1	0.0101	0.0066	NA	NA	0.0005	0.0005	NA	NA	0.005	0.005	NA	NA	NA	NA
Location ID	**Sampling Event Date**	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	pCi/L	mg/L
UPSTREAM																	
S-MIR-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MIR-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MIR-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIR-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 10
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																				
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH DW SL**	4	4	NA	NA	250	6.5-8.5	250	500	4	0.006	0.006	0.05	0.05	2	2	0.004	0.004	0.005	0.005	0.1	0.1
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	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
UPSTREAM																						
S-MO-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
S-MO-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MO-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 10
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**HH DW SL**	0.006	0.006	0.015	0.015	0.04	0.04	0.002	0.002	0.1	0.1	0.05	0.05	0.002	0.002	5	NA
Location ID	**Sampling Event Date**	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	pCi/L	mg/L
UPSTREAM																	
S-MO-10S	Sep-17	<	<	<	<	0.0435	0.0422	<	<	<	<	<	<	<	<	NA	<
S-MO-11D	Sep-17	<	<	<	<	0.044	0.0423	<	<	<	<	<	<	<	<	NA	<
S-MO-11S	Sep-17	<	<	<	<	0.0429	0.0435	<	<	<	<	<	<	<	<	NA	<
S-MO-12D	Sep-17	<	<	<	<	0.0441	0.0423	<	<	<	<	<	<	<	<	NA	<
S-MO-12S	Sep-17	<	<	<	<	0.0436	0.0417	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MO-4S	Sep-17	<	<	<	<	0.0442	0.0422	<	<	<	<	<	<	<	<	NA	<
S-MO-5D	Sep-17	<	<	<	<	0.0444	0.0422	<	<	<	<	<	<	<	<	NA	<
S-MO-5S	Sep-17	<	<	<	<	0.0422	0.0428	<	<	<	<	<	<	<	<	NA	<
S-MO-6D	Sep-17	<	<	<	<	0.0427	0.0412	<	<	<	<	<	<	<	<	NA	<
S-MO-6S	Sep-17	<	<	<	<	0.0431	0.0421	<	<	<	<	<	<	<	<	NA	<
S-MO-7S	Sep-17	<	<	<	<	0.042	0.0432	<	<	<	<	<	<	<	<	NA	<
S-MO-8D	Sep-17	<	<	<	<	0.0428	0.0424	<	<	<	<	<	<	<	<	NA	<
S-MO-8S	Sep-17	<	<	<	<	0.0449	0.044	<	<	<	<	<	<	<	<	NA	<
S-MO-9D	Sep-17	<	<	<	<	0.042	0.042	<	<	<	<	<	<	<	<	NA	<
S-MO-9S	Sep-17	<	<	<	<	0.0423	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MO-1S	Sep-17	<	<	<	<	0.042	0.0441	<	<	<	<	<	<	<	<	NA	<
S-MO-2D	Sep-17	<	<	<	<	0.0431	0.0421	<	<	<	<	<	<	<	<	NA	<
S-MO-2S	Sep-17	<	<	<	<	0.0427	0.0446	<	<	<	<	<	<	<	<	NA	<
S-MO-3D	Sep-17	<	<	<	<	0.0434	0.0405	<	<	<	<	<	<	<	<	NA	<
S-MO-3S	Sep-17	<	<	<	<	0.0435	0.0437	<	<	<	<	<	<	<	<	NA	<

Notes:
< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 11
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH REC SL**	NA	NA	NA	NA	NA	6.5-8.5	NA	NA	NA	4.3	4.3	0.00014	0.00014	NA	NA	NA	NA	NA	NA	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	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
UPSTREAM																						
S-MO-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0034	<	<	<	<	<	<	<	<
S-MO-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0034	<	<	<	<	<	<	<	<
S-MO-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0032	<	<	<	<	<	<	<	<
S-MO-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0033	<	<	<	<	<	<	<	<
S-MO-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0033	<	<	<	<	<	<	<	<
ADJACENT																						
S-MO-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0033	<	<	<	<	<	<	<	<
S-MO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0034	<	<	<	<	<	<	<	<
S-MO-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0033	<	<	<	<	<	<	<	<
S-MO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0032	<	<	<	<	<	<	<	<
S-MO-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0033	<	<	<	<	<	<	<	<
S-MO-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0034	0.0032	<	<	<	<	<	<	<	<
S-MO-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0033	<	<	<	<	<	<	<	<
S-MO-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0033	<	<	<	<	<	<	<	<
S-MO-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0034	<	<	<	<	<	<	<	<
S-MO-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0032	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MO-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0034	0.0033	<	<	<	<	<	<	<	<
S-MO-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0034	<	<	<	<	<	<	<	<
S-MO-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0034	0.0033	<	<	<	<	<	<	<	<
S-MO-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0035	0.0032	<	<	<	<	<	<	<	<
S-MO-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0036	0.0033	<	<	<	<	<	<	<	<

Notes:
< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 11
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**HH REC SL**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2	4.2	0.0063	0.0063	NA	NA
Location ID	**Sampling Event Date**	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	pCi/L	mg/L
UPSTREAM																	
S-MO-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MO-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MO-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 12
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	ECO SL	2	2	NA	NA	230	6.5-8.5	1690	NA	4	NA	NA	0.15	0.02	NA	NA	0.1	0.005	0.0005	0.0005	0.181	0.155
Location ID	Sampling Event Date	mg/L	mg/L	mg/L	mg/L	mg/L	S.U	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
UPSTREAM																						
S-MO-10S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-11D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-11S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-12D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-12S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
ADJACENT																						
S-MO-4S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-5S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-6S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-7S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-8D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-8S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-9D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-9S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
DOWNSTREAM																						
S-MO-1S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-2D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-2S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-3D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MO-3S	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:

< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 12
SUMMARY OF MISSOURI RIVER SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**ECO SL**	1	1	0.0101	0.0066	NA	NA	0.0005	0.0005	NA	NA	0.005	0.005	NA	NA	NA	NA
Location ID	**Sampling Event Date**	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	pCi/L	mg/L
UPSTREAM																	
S-MO-10S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-11D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-11S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-12D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-12S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
ADJACENT																	
S-MO-4S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-5S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-6S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-7S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-8D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-8S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-9D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-9S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
DOWNSTREAM																	
S-MO-1S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-2D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-2S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-3D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MO-3S	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 13
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH DW SL**	4	4	NA	NA	250	6.5-8.5	250	500	4	0.006	0.006	0.05	0.05	2	2	0.004	0.004	0.005	0.005	0.1	0.1
Locationl ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	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
S-MIO-18	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-17	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-16	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-15	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-14	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-13	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-12	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-11	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-10	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-9	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-8	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-7	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-6	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-5	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-4	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-3	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-2	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-1	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:

< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 13
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH DRINKING WATER SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Drinking Water Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**HH DW SL**	0.006	0.006	0.015	0.015	0.04	0.04	0.002	0.002	0.1	0.1	0.05	0.05	0.002	0.002	5	NA
Location ID	**Sampling Event Date**	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	pCi/L	mg/L
S-MIO-18	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-17	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-16	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-15	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-14	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-13	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-12	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-11	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-10	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-9	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-8	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-7	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-6	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-4	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-3	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-2	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-1	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - less than the Human Health Drinking Water Screening Level.
DW - Drinking Water.
HH - Human Health.
MCL - Maximum Contaminant Level.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
RSL - Risk-Based Screening Level.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

TABLE 14
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**HH REC SL**	NA	NA	NA	NA	NA	6.5-8.5	NA	NA	NA	4.3	4.3	0.00014	0.00014	NA	NA	NA	NA	NA	NA	NA	NA
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U.	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
S-MIO-18	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0066	0.0053	<	<	<	<	<	<	<	<
S-MIO-17	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0062	0.0053	<	<	<	<	<	<	<	<
S-MIO-16	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0064	0.0055	<	<	<	<	<	<	<	<
S-MIO-15	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0067	0.0057	<	<	<	<	<	<	<	<
S-MIO-14	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.006	0.0053	<	<	<	<	<	<	<	<
S-MIO-13	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0066	0.0052	<	<	<	<	<	<	<	<
S-MIO-12	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0077	0.0065	<	<	<	<	<	<	<	<
S-MIO-11	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0078	0.0071	<	<	<	<	<	<	<	<
S-MIO-10	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0077	0.0072	<	<	<	<	<	<	<	<
S-MIO-9	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0062	0.0056	<	<	<	<	<	<	<	<
S-MIO-8	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0069	0.0061	<	<	<	<	<	<	<	<
S-MIO-7	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0072	0.0064	<	<	<	<	<	<	<	<
S-MIO-6	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0017	<	<	<	<	<	<	<	<
S-MIO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0021	0.0017	<	<	<	<	<	<	<	<
S-MIO-5	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0017	<	<	<	<	<	<	<	<
S-MIO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.002	0.0016	<	<	<	<	<	<	<	<
S-MIO-4	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0025	0.0021	<	<	<	<	<	<	<	<
S-MIO-3	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0023	0.0021	<	<	<	<	<	<	<	<
S-MIO-2	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0024	0.002	<	<	<	<	<	<	<	<
S-MIO-1	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	0.0024	0.0021	<	<	<	<	<	<	<	<

Notes:

< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 14
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO HUMAN HEALTH RECREATIONAL USE SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Human Health Recreational Use Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**HH REC SL**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.2	4.2	0.0063	0.0063	NA	NA
Location ID	**Sampling Event Date**	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	pCi/L	mg/L
S-MIO-18	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-17	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-16	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-15	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-14	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-13	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-12	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-11	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-10	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-9	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-8	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-7	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-6	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-4	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-3	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-2	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-1	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:

< - less than the Human Health Recreational Use Screening Level.
HH - Human Health.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
REC - Recreational Use.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

(a) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

TABLE 15
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)																			
	Constituent	Boron		Calcium		Chloride	pH	Sulfate	TDS	Fluoride	Antimony		Arsenic		Barium		Beryllium		Cadmium		Chromium	
	Fraction	Total	Dissolved	Total	Dissolved	Total	Total	Total	Total	Total	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved
Sample	**ECO SL**	2	2	NA	NA	230	6.5-8.5	1690	NA	4	NA	NA	0.15	0.02	NA	NA	0.1	0.005	0.0005	0.0005	0.181	0.155
Location ID	**Sampling Event Date**	mg/L	mg/L	mg/L	mg/L	mg/L	S.U	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
S-MIO-18	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-17	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-16	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-15	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-14	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-13	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-12	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-11	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-10	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-9	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-8	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-7	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-6	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-6D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-5	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-5D	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-4	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-3	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-2	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
S-MIO-1	Sep-17	<	<	<	<	<	NA	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<

Notes:
< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

Qualifiers:
J - Value is estimated.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 15
SUMMARY OF MISSISSIPPI RIVER OFFSHOOT SURFACE WATER TOTAL (UNFILTERED) AND DISSOLVED (FILTERED) RESULTS COMPARISON TO ECOLOGICAL SCREENING LEVELS
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

		Ecological Screening (a)															
	Constituent	Cobalt		Lead		Lithium		Mercury		Molybdenum		Selenium		Thallium		Radium-226/228	Hardness
	Fraction	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Total
Sample	**ECO SL**	1	1	0.0101	0.0066	NA	NA	0.0005	0.0005	NA	NA	0.005	0.005	NA	NA	NA	NA
Location ID	**Sampling Event Date**	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	pCi/L	mg/L
S-MIO-18	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-17	Sep-17	<	<	<	<	<	<	<	<	<	<	<	0.0061 J	<	<	NA	<
S-MIO-16	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-15	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-14	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-13	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-12	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0067 J	0.0062 J	<	<	NA	<
S-MIO-11	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0069 J	0.0091 J	<	<	NA	<
S-MIO-10	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0077 J	0.0052 J	<	<	NA	<
S-MIO-9	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0055 J	<	<	<	NA	<
S-MIO-8	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0054 J	<	<	<	NA	<
S-MIO-7	Sep-17	<	<	<	<	<	<	<	<	<	<	0.0093 J	<	<	<	NA	<
S-MIO-6	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-6D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-5D	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-4	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-3	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-2	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<
S-MIO-1	Sep-17	<	<	<	<	<	<	<	<	<	<	<	<	<	<	NA	<

Notes:
< - Less than the Ecological Screening Level.
ECO - Ecological.
mg/L - milligram per liter.
NA - Not Applicable/Not Analyzed.
pCi/L - picoCurie per liter.
SL - Screening Level.
S.U. - Standard Units.
TDS - Total Dissolved Solids.
USEPA - United States Environmental Protection Agency.

Qualifiers:
J - Value is estimated.

(a) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

TABLE 16
SUMMARY OF WHOLE EFFLUENT TOXICITY TESTING RESULTS FOR NPDES OUTFALL 001, 002, AND 006
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

Sampling Event	Treatment	Percent Survival at 48 hours	
		Pimephales promelas	***Ceriodaphnia dubia***
Outfall 001 (Non Contact Cooling Water)			
June 2005	10% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%
Outfall 002 (Ash Pond #1)			
June 2005	10% Effluent	100%	100%
	Reconstituted Control	98%	100%
	Upstream Control	100%	100%
July 2017	Whole Effluent Dilution Series: 100, 50, 25, 7, 3.5%	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%
Outfall 006 (Ash Pond #2)			
June 2005	10% Effluent	100%	100%
	Reconstituted Control	100%	100%
	Upstream Control	100%	100%

Notes:
NPDES - Natual Pollutant Discharge Elimination System.

No statistically significant difference (alpha = 0.05) between effluent and control survival data for the above tests. July 2017 also saw no significant effect on growth or survival of fathead minnows in all dilution series after a 7-day exposure.
Effluent passes in all tests conducted from 2005 through 2017.
10% Effluent - Outfall 001, 002, and 006 effluent mixed with Mississippi River water.
Reconstituted Control - Laboratory reconstituted water.
Upstream Control - Mississippi River water.

TABLE 17
DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSISSIPPI RIVER
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

				Estimated Dilution Factor (d) =	90,000			
Constituents	**HH DW SL (a) (mg/L)**	**HH REC SL (b) (mg/L)**	**ECO SL (c) (mg/L)**	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum SEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum SEC Groundwater Concentration**
Boron	4	NA	2	2	180000	31.2	S-UMW-4D	>5700
Sulfate	250	NA	1690	250	22500000	1100	S-LMW-5S	>20000
TDS	500	NA	NA	500	45000000	1760	S-LMW-5S	>25000
Cobalt	0.006	NA	1	0.006	540	0.0122	S-LMW-9S	>44000
Lithium	0.04	NA	NA	0.04	3600	0.0623	S-LMW-5S	>57000
Molybdenum	0.1	NA	NA	0.1	9000	8.3	S-UMW-4D	>1000

Notes:
* Where the Groundwater Risk-Based Screening Level = Screening Level x Dilution Factor.
ECO SL - Ecological Screening Level.
HH DW SL - Human Health Drinking Water Screening Level.
HH REC SL - Human Health Recreational Use Screening Level.
mg/L - milligram per liter.
NA - Not Available.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

(b) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

(c) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

(d) - Estimated value, see text and Attachment B for derivation.

TABLE 18
DERIVATION OF RISK-BASED SCREENING LEVELS FOR GROUNDWATER BASED ON THE MISSOURI RIVER
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI

				Estimated Dilution Factor (d) =	100,000			
Constituents	**HH DW SL (a) (mg/L)**	**HH REC SL (b) (mg/L)**	**ECO SL (c) (mg/L)**	**Lowest of the Human Health and Ecological Screening Levels (mg/L)**	**Groundwater Risk-Based Screening Level* (mg/L)**	**Maximum SEC Groundwater Concentration (mg/L)**		**Ratio Between Groundwater Risk-Based Screening Level and the Maximum SEC Groundwater Concentration**
Boron	4	NA	2	2	200000	31.2	S-UMW-4D	>6400
Sulfate	250	NA	1690	250	25000000	1100	S-LMW-5S	>22000
TDS	500	NA	NA	500	50000000	1760	S-LMW-5S	>28000
Cobalt	0.006	NA	1	0.006	600	0.0122	S-LMW-9S	>49000
Lithium	0.04	NA	NA	0.04	4000	0.0623	S-LMW-5S	>64000
Molybdenum	0.1	NA	NA	0.1	10000	8.3	S-UMW-4D	>1200

Notes:
* Where the Groundwater Risk-Based Screening Level = Screening Level x Dilution Factor.
ECO SL - Ecological Screening Level.
HH DW SL - Human Health Drinking Water Screening Level.
HH REC SL - Human Health Recreational Use Screening Level.
mg/L - milligram per liter.
NA - Not Available.

(a) - Drinking Water Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Drinking Water Supply.
Federal USEPA MCL for Drinking Water.
Federal November 2017 USEPA Tapwater RSL.
Federal USEPA SMCL for Drinking Water.

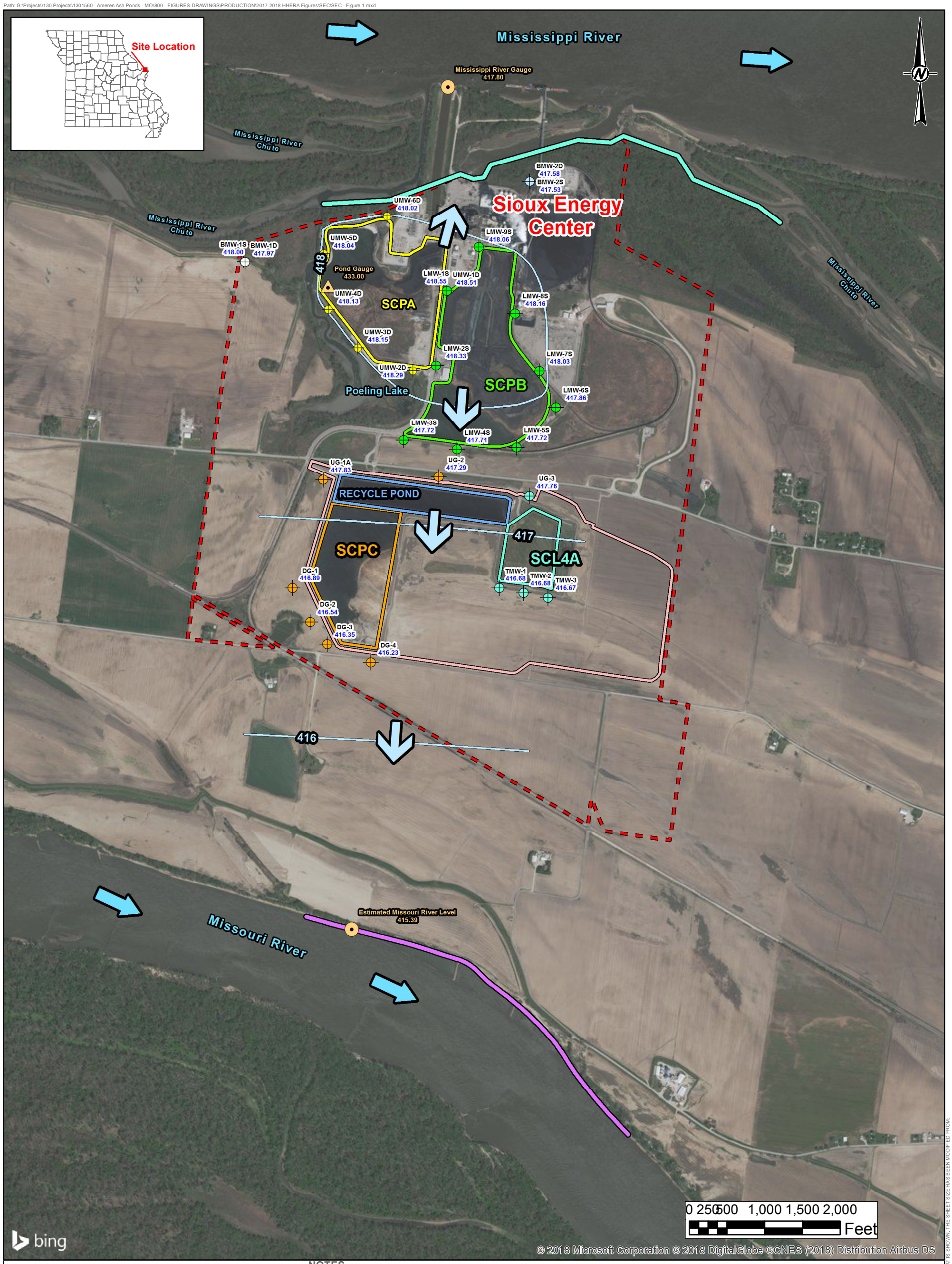
(b) - Recreational Use Screening Levels selected in Table 1 following the following hierarchy:
Missouri State Water Quality Criteria for Human Health Fish Consumption.
USEPA Ambient Water Quality Criteria for Human Health Consumption of Organism Only.

(c) - Ecological Screening Levels selected in Table 2 following the following hierarchy:
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Chronic).
USEPA Aquatic Life Ambient Water Quality Criteria (Chronic).
Missouri State Water Quality Criteria for the Protection of Aquatic Life (Acute).
USEPA Aquatic Life Ambient Water Quality Criteria (Acute).
Missouri State Water Quality Criteria for Irrigation.
Missouri State Water Quality Criteria for Livestock Wildlife Watering.

(d) - Estimated value, see text and Attachment B for derivation.

FIGURES

Path: G:\Projects\130 Projects\1301560 - Ameren Ash Ponds - MO\800 - FIGURES-DRAWINGS\PRODUCTION\2017-2018 HHERA Figures\SEC\SEC - Figure 1.mxd



LEGEND

- Sioux Energy Center Property Boundary
- Length of Groundwater Discharge Used in the Mississippi River Dilution Factor Calculation
- Length of Groundwater Discharge Used in the Missouri River Dilution Factor Calculation
- Groundwater Flow Direction
- Surface Water Flow Direction

Groundwater Elevation Contours

- Groundwater Elevation Contour (FT MSL)
- Inferred Groundwater Elevation Contour (FT MSL)

Surface Impoundments

- SCPA - Bottom Ash Surface Impoundment
- SCPB - Fly Ash Surface Impoundment

Utility Waste Landfill (UWL)

- Active Dry CCR Disposal Area
- Active WFGD Disposal Area
- Active Water Recycle Pond
- UWL Perimeter Fence

Ground/Surface Water Measurement

- Background Monitoring Well
- SCPA - Bottom Ash Surface Impoundment Monitoring Well
- SCL4A - UWL Cell 4A Monitoring Well
- Groundwater Elevation Piezometer
- SCPB - Fly Ash Surface Impoundment Monitoring Well
- SCPC - WFGD Surface Impoundment Monitoring Well
- SPCA Pond Gauge
- River Elevation

NOTES

1.) ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2.) GOLDER GROUNDWATER MONITORING WELLS SURVEYED BY ZAHNER AND ASSOCIATES, INC. ON JANUARY 14, APRIL 29, AND DECEMBER 8, 2016.
3.) GROUNDWATER AND SURFACE WATER ELEVATIONS DISPLAYED IN FT MSL (FEET ABOVE MEAN SEA LEVEL).
4.) GROUNDWATER AND POND GAUGE MEASUREMENTS OBTAINED BY GOLDER ON NOV. 7, 2016.
5.) MISSOURI RIVER ELEVATION ESTIMATED BASED ON NEARBY USGS (UNITED STATES GEOLOGICAL SURVEY) RIVER GAUGING LOCATIONS.
6.) MISSISSIPPI RIVER ELEVATION PROVIDED BY AMEREN MISSOURI.
7.) UWL BOUNDARIES, DESIGNATIONS AND STATE MONITORING WELL LOCATIONS BASED ON DRAWINGS IN THE UWL PROPOSED LANDFILL PERMIT (#0918301).
8.) WFGD - WET FLUE GAS DESULFURIZATION.

REFERENCE

1.) AMEREN MISSOURI SIOUX ENERGY CENTER, SIOUX PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATE PLANE MISSOURI EAST FIPS 2,401 FEET.
3.) USGS NATIONAL WATER INFORMATION SYSTEM, USGS GAUGES 06935965 (ST. CHARLES), 07010000 (ST. LOUIS), 05587498 (ALTON), GRAFTON (05587450).
4.) AMEREN MISSOURI SIOUX POWER PLANT UTILITY WASTE LANDFILL PROPOSED CONSTRUCTION PERMIT MODIFICATION (#0918301), AUGUST 2014.

CLIENT
AMEREN MISSOURI
SIOUX ENERGY CENTER

PROJECT
HYDROGEOLOGICAL CONSULTING

TITLE
ESTIMATED LENGTH OF DISCHARGE AND EXAMPLE GROUNDWATER FLOW MAP

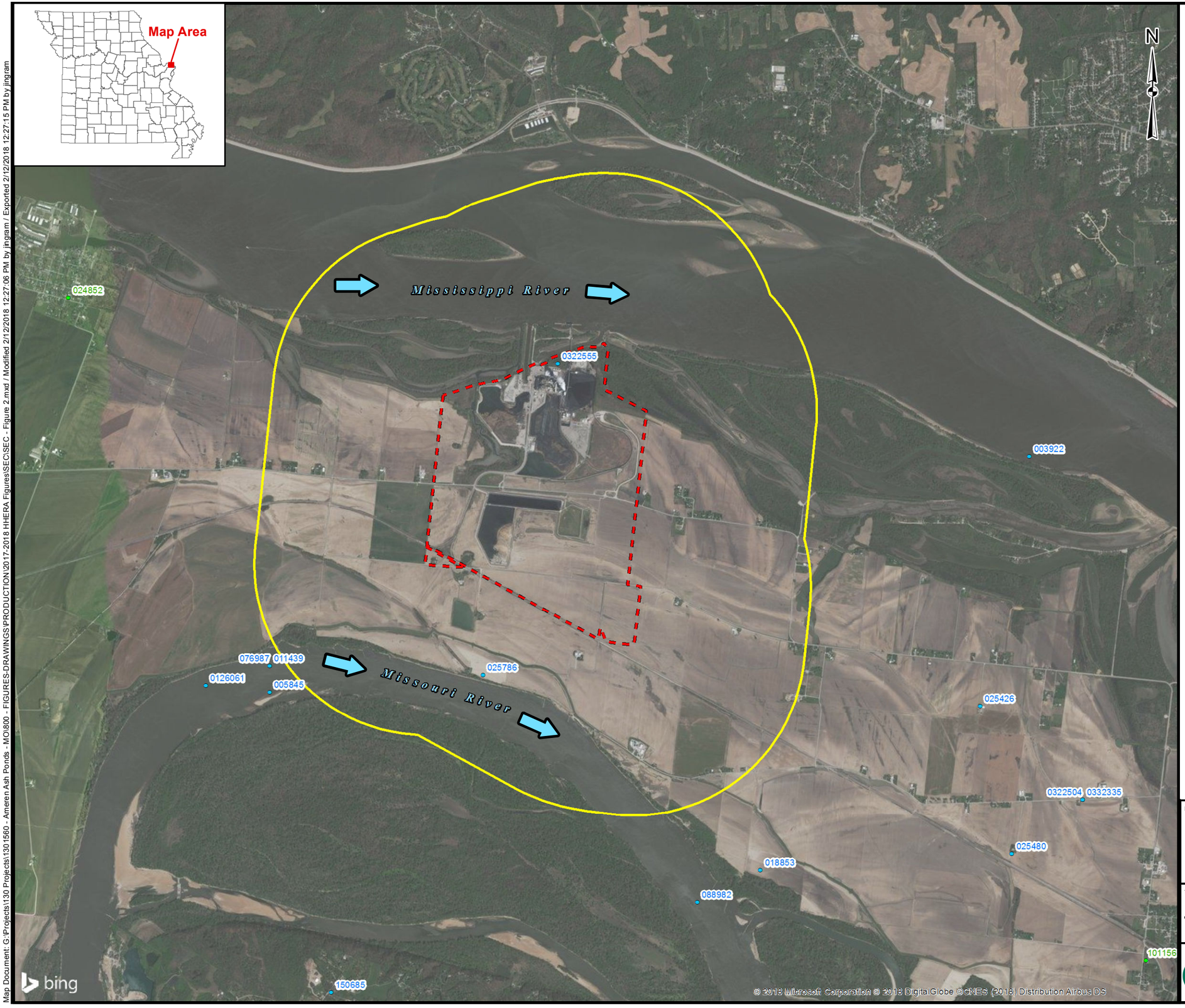
CONSULTANT
Golder Associates

YYYY-MM-DD	2017-12-19
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No.
130-1560

FIGURE
1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 1 in 0



LEGEND

- Sioux Property Boundary
- Approximate 1-Mile Radius
- Private Well
- Public Well
- Surface Water Flow Direction

NOTES

1.) Wells are labeled with state issued reference number or log ID.
2.) Search radius is approximately one mile beyond the Ameren property boundary line.
3.) See Table 1 for details on wells listed on the map.
4.) Locations of wells 0126061, 076987, 011439, 005845, 003922 and 088982 appear to be listed incorrectly in MDNR Wellhead Protection Database.
5.) Wells in Illinois are not shown.

REFERENCES

1.) MDNR - Missouri Department of Natural Resources
2.) MSDIS - Missouri Spatial Data Information Service
3.) University of Missouri - Columbia - Department of Geography - MSDIS Database
4.) Missouri Department of Natural Resources - Water Resources Center - Geologic Well Logs
5.) Missouri Environmental Geology Atlas 2007 (MEGA)
6.) MDNR Wellhead Protection Program
7.) COORDINATE SYSTEM: NAD 1983 UTM Zone 15N

0 3,000 6,000 Feet

PROJECT

Ameren

AMEREN MISSOURI COAL FIRED POWER PLANTS
ST. CHARLES COUNTY, MISSOURI

TITLE

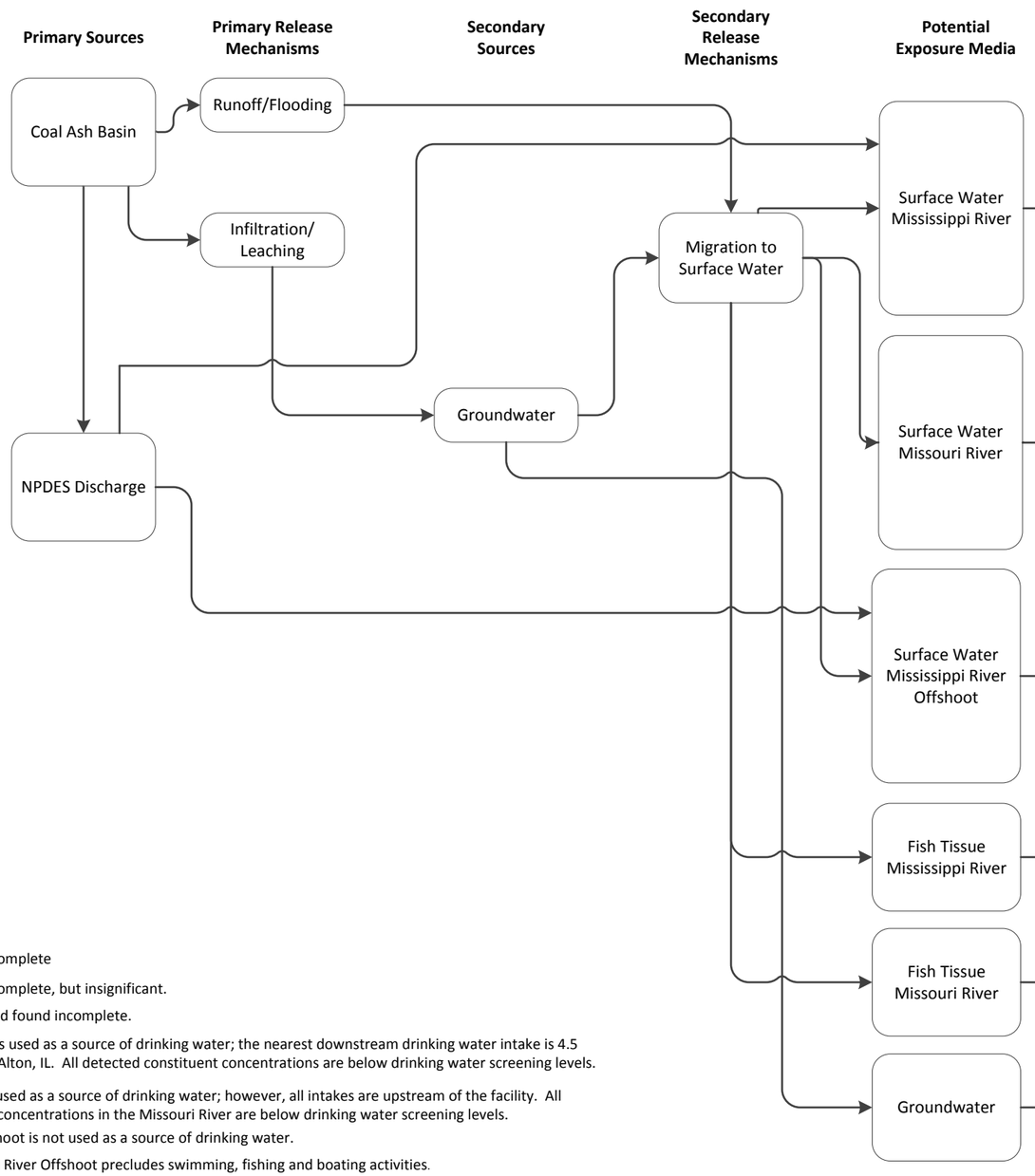
PRIVATE WELL LOCATIONS WITHIN 1-MILE RADIUS OF THE FACILITY BOUNDARY

Golder Associates

PROJECT No. 130-1560			FILE No.	SEC - Figure 2.mxd
DESIGN	-	-	SCALE: AS SHOWN	REV. 0
GIS	JSI	2/12/2018	FIGURE 2	
CHECK	MWD	2/12/2018		
REVIEW	MNH	2/12/2018		

Map Document: G:\Projects\130 Projects\1301560 - Ameren Ash Ponds - MO\800 - FIGURES-DRAWINGS\PRODUCTION\2017-2018 HHERA Figures\SEC\SEC - Figure 2.mxd / Modified 2/12/2018 12:27:06 PM by jingram / Exported 2/12/2018 12:27:15 PM by jingram

FIGURE 3
CONCEPTUAL SITE MODEL
SIOUX ENERGY CENTER, ST CHARLES COUNTY, WEST ALTON, MO
AMEREN MISSOURI



	Potential Human Health Receptors					Potential Ecological Receptors
Potential Exposure Route	**Current/Future Off-Site Resident Adult/Child**	**Current/Future Off-Site Recreational Swimmer**	**Current/Future Off-Site Recreational Wader**	**Current/Future Off-Site Recreational Boater**	**Current/Future Off-Site Recreational Fisher**	**Aquatic Receptors**
Drinking Water Use	⊙ (a)	O	O	O	O	NA
Incidental Ingestion	O	⊙	⊙	⊙	⊙	NA
Dermal Contact	O	⊙	⊙	⊙	⊙	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Drinking Water Use	⊙ (b)	O	O	O	O	NA
Incidental Ingestion	O	⊙	⊙	⊙	⊙	NA
Dermal Contact	O	⊙	⊙	⊙	⊙	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Drinking Water Use	O	O	O	O	O	NA
Incidental Ingestion	O	⊙	⊙	⊙	⊙	NA
Dermal Contact	O	⊙	⊙	⊙	⊙	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Ingestion	O	O	O	O	●	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Ingestion	O	O	O	O	●	NA
Aquatic Exposure	NA	NA	NA	NA	NA	⊙
Drinking Water Use	O (e)	O	O	O	O	NA
Aquatic Exposure	NA	NA	NA	NA	NA	O (f)

Notes:

● Pathway potentially complete

⊙ Pathway potentially complete, but insignificant.

O Pathway evaluated and found incomplete.

(a) The Mississippi River is used as a source of drinking water; the nearest downstream drinking water intake is 4.5 miles downstream at Alton, IL. All detected constituent concentrations are below drinking water screening levels.

(b) The Missouri River is used as a source of drinking water; however, all intakes are upstream of the facility. All detected constituent concentrations in the Missouri River are below drinking water screening levels.

(c) Mississippi River Offshoot is not used as a source of drinking water.

(d) The size of Mississippi River Offshoot precludes swimming, fishing and boating activities.

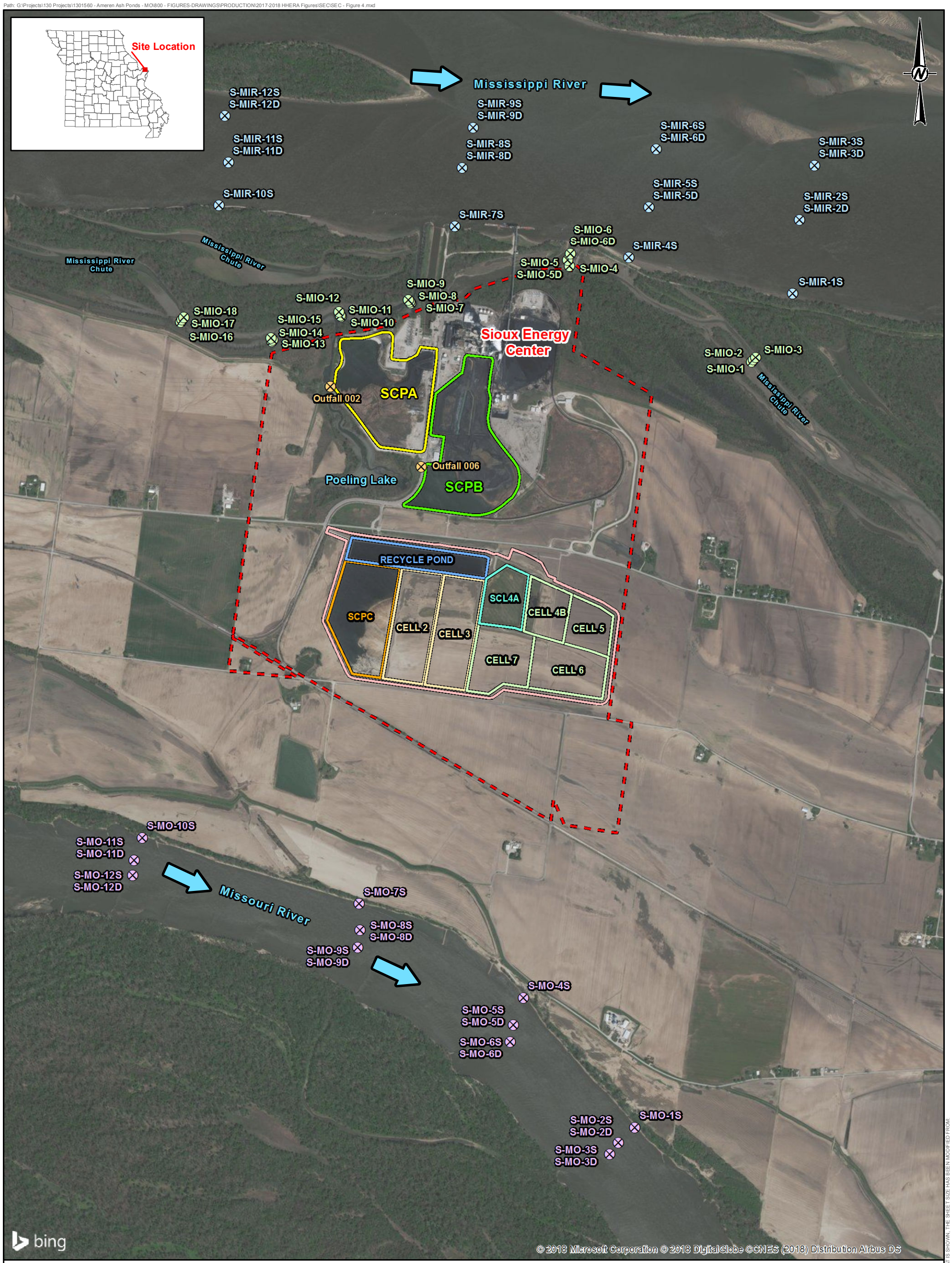
(e) The shallow alluvial aquifer in the vicinity of the coal ash management area is not used for drinking water purposes.

(f) Ecological receptors are not exposed to groundwater.

NPDES - National Pollutant Discharge Elimination System

HALEY ALDRICH

Path: G:\Projects\130 Projects\1301560 - Ameren Ash Ponds - MO\800 - FIGURES-DRAWINGS\PRODUCTION\2017-2018 HHERA Figures\SEC\SEC - Figure 4.mxd



LEGEND

- Sioux Energy Center Property Boundary
- NPDES Outfalls
- Surface Water Flow Direction

Surface Impoundments

- SCPB - Fly Ash Surface Impoundment
- SCPA - Bottom Ash Surface Impoundment

Utility Waste Landfill (UWL)

- Active Dry CCR Disposal Area
- Active WFGD Disposal
- Active Water Recycle Pond
- Proposed Dry CCR Disposal Area
- Proposed WFGD Disposal Area
- UWL Perimeter Fence

Surface Water Sampling Locations

- Missouri River Sample
- Mississippi River Sample
- Mississippi River Offshoot Sample

NOTES

1. ALL LOCATIONS AND BOUNDARIES ARE APPROXIMATE.
2. NPDES - NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM.
3. OUTFALL LOCATIONS BASED ON MISSOURI SPATIAL DATA INFORMATION SERVICE (MSDIS) 2015 NPDES OUTFALL MAP WITH DATA FROM THE MISSOURI DEPARTMENT OF NATURAL RESOURCES'S (MDNR) MISSOURI CLEAN WATER INFORMATION SYSTEM (MOCWIS).
4. SAMPLE LOCATIONS BASED ON HANDHELD TRIMBLE GPS MEASUREMENTS. SAMPLE LOCATION REPRESENTS CENTERPOINT BETWEEN SAMPLE STARTING AND ENDING LOCATION.

REFERENCE

1.) AMEREN MISSOURI SIOUX ENERGY CENTER, SIOUX PROPERTY CONTROL MAP, FEBRUARY 2011.
2.) COORDINATE SYSTEM: NAD 1983 STATE PLANE MISSOURI EAST FIPS 2,401 FEET.
3.) MSDIS INLAND WATER RESOURCES MO 2015 NPDES OUTFALL SHAPEFILE.

0 500 1,000 2,000 3,000 4,000 Feet

CLIENT
AMEREN MISSOURI
SIOUX ENERGY CENTER

PROJECT
AMEREN HYDROGEOLOGICAL CONSULTING

TITLE
SURFACE WATER SAMPLING LOCATIONS
SIOUX ENERGY CENTER

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-09-28
PREPARED	JSI
DESIGN	JSI
REVIEW	JS
APPROVED	MNH

PROJECT No. 130-1560
PHASE 0005
FIGURE 4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 1 in 0

ATTACHMENT A

Constituents Present in Coal Ash and in Our Natural Environment

Attachment 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[1] 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, 2014c). 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

[1] 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 Rush Island Energy Center) to USEPA screening levels, and to background levels in soils in the U.S. The USEPA screening levels for residential soils (USEPA, 2014c) 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 Rush Island 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 Rush Island 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

ATSDR. 2004. Toxicological Profile for Cobalt. Agency for Toxic Substances and Disease Registry. Available at: http://www.atsdr.cdc.gov/ToxProfiles/tp.asp?id=373&tid=64

Huggins, FE, M Najih, and GP Huffman. 1999. Direct speciation of chromium in coal combustion by-products by X-ray absorption fine-structure spectroscopy. Fuel 78:233–242.

MDNR. 2006. Missouri Risk-Based Correction Action (MRBCA) Technical Guidance. April, 2006. Available at: http://www.dnr.mo.gov/env/hwp/mrbca/docs/mrbca-sections6-06.pdf

NJDEP. 2009. Derivation of Ingestion-Based Soil Remediation Criterion for Cr+6 Based on the NTP Chronic Bioassay Data for Sodium Dichromate Dihydrate. Division of Science, Research and Technology New Jersey Department of Environmental Protection. Risk Assessment Subgroup of the NJDEP Chromium Workgroup. April 8, 2009.

NTP. 2008. NTP technical report on the toxicology and carcinogenesis studies of sodium dichromate dihydrate (CAS No. 7789-12-0) in F344/N rats and B6C3F1 mice (drinking water studies), NTP TR 546. NIH Publication No. 08-5887. National Toxicology Program.

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USEPA. 2014a. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office. U.S. Environmental Protection Agency, Cincinnati, OH. Available at: http://cfpub.epa.gov/ncea/iris/index.cfm

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USEPA. 2014c. USEPA Regional Screening Levels. May 2014. U.S. Environmental Protection Agency. Available at http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

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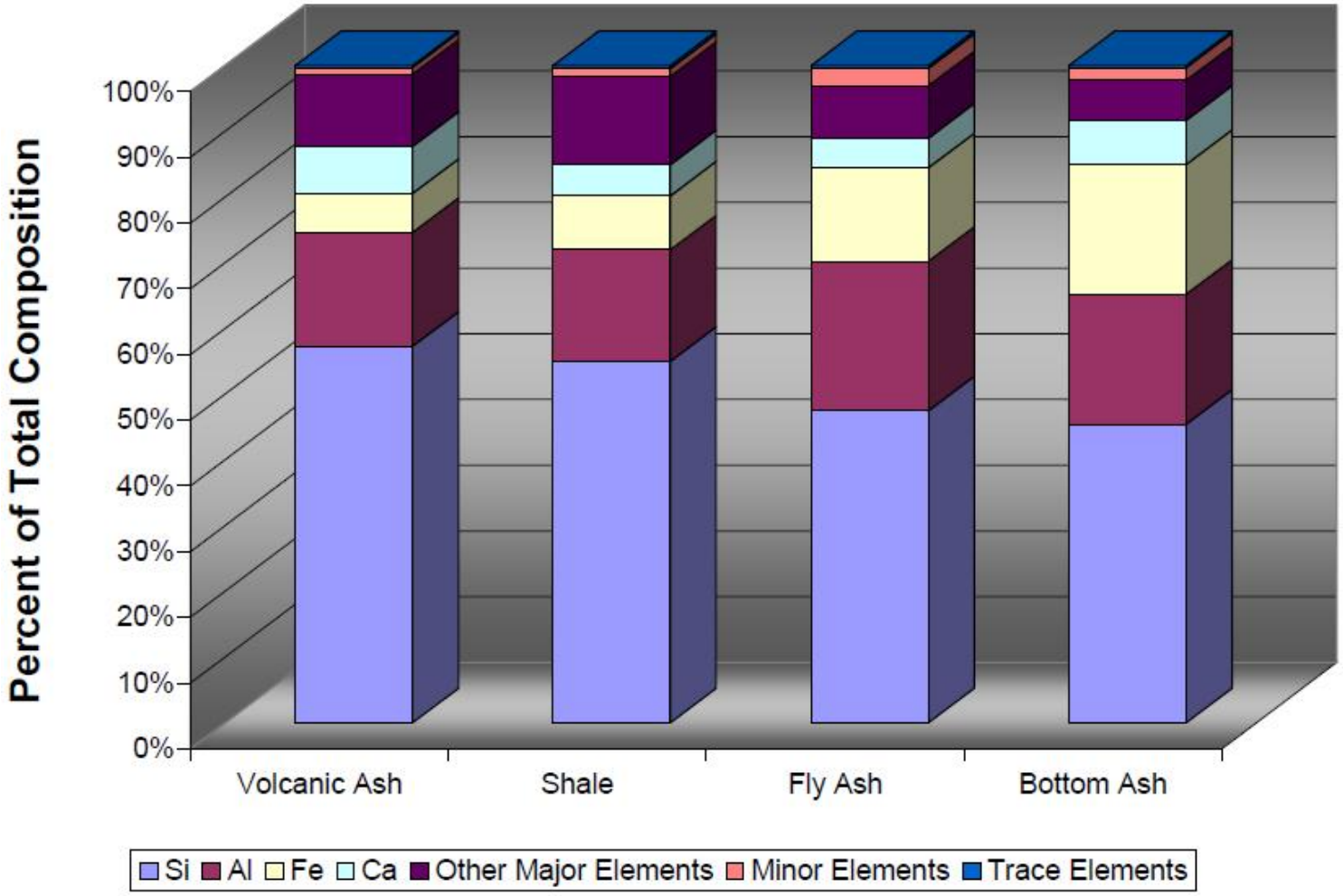
USGS. 2013. National Geochemical Survey. http://mrdata.usgs.gov/geochem/doc/averages/countydata.htm

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

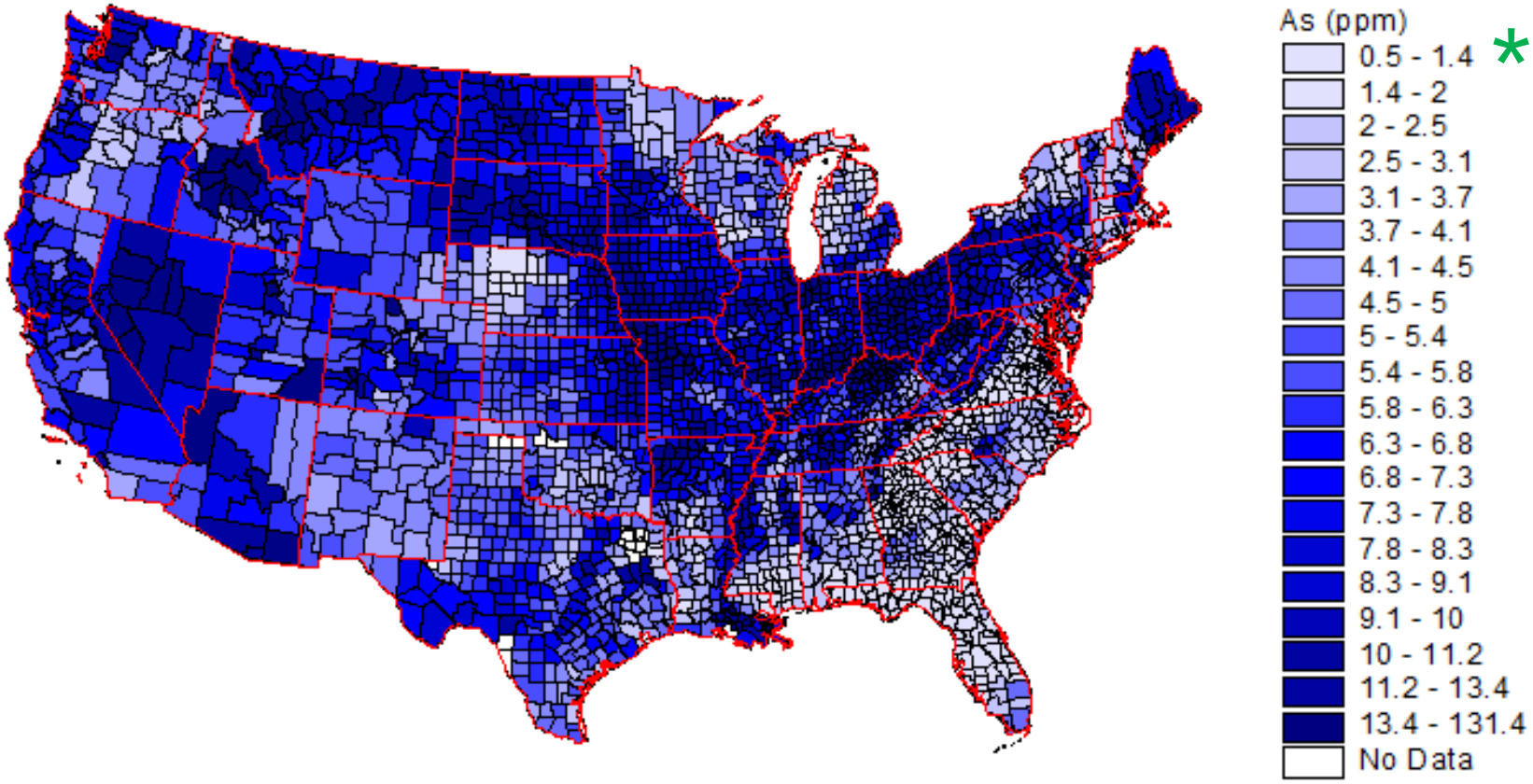
Attachment A – Figures

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



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.

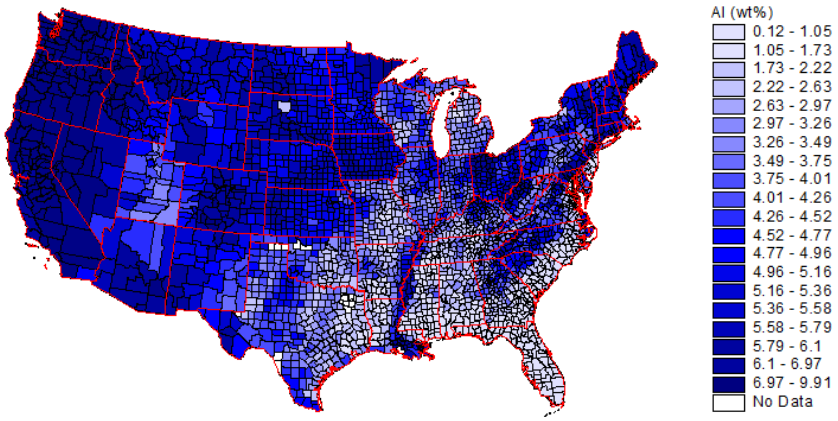


***The USEPA regional screening level for arsenic in residential soil at a one in one million risk level is 0.67 mg/kg. USEPA. 2014c.** http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm
Thus the arsenic concentration in the majority of the soils in the U.S. are above the one in one million risk level.

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

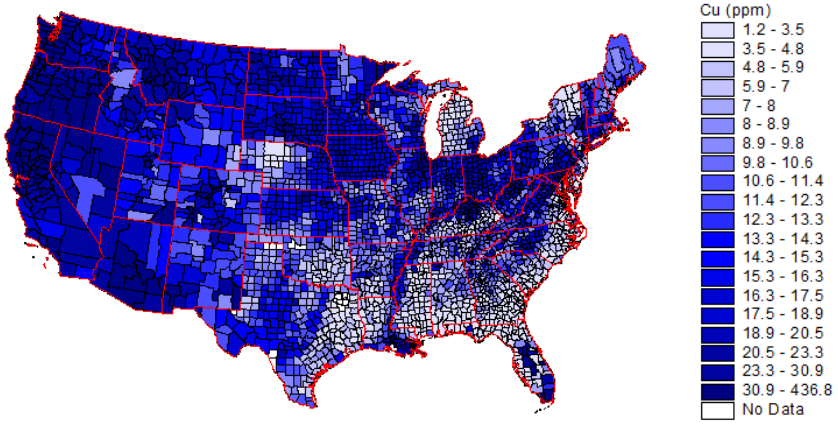
Figure A-3

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



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

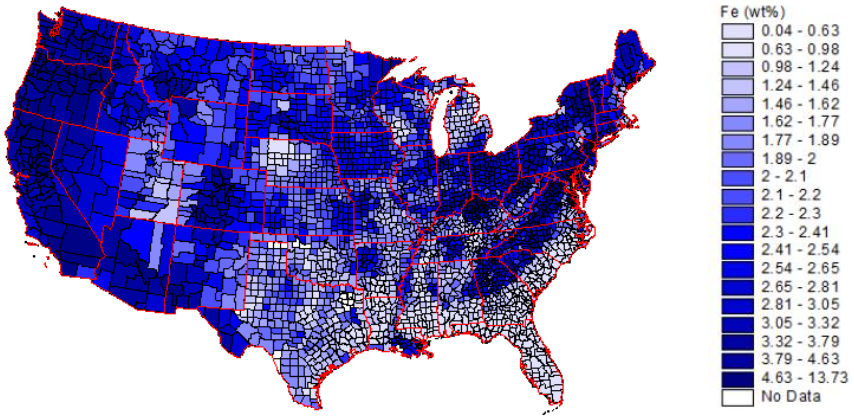
Copper is Present in our Natural Environment –
Background Levels in Soils in the U.S.



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

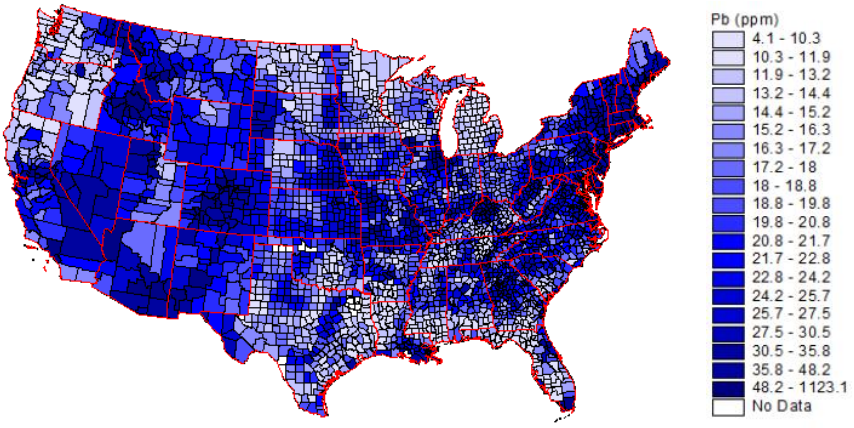
Figure A-4

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

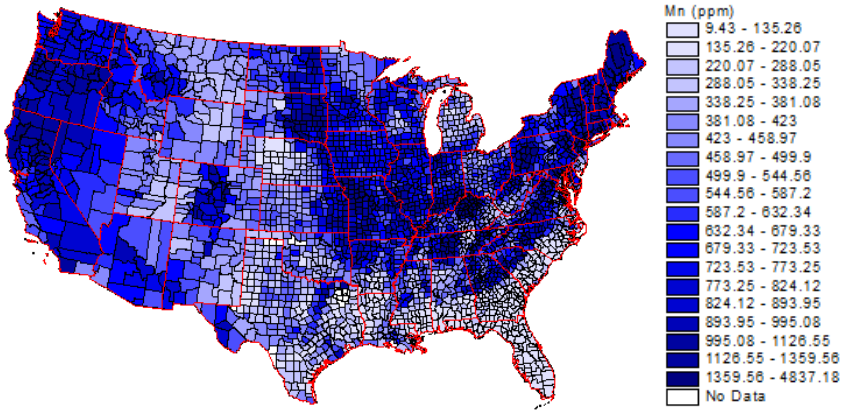
Lead is present in our natural environment –
Background levels in soils in the U.S.



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

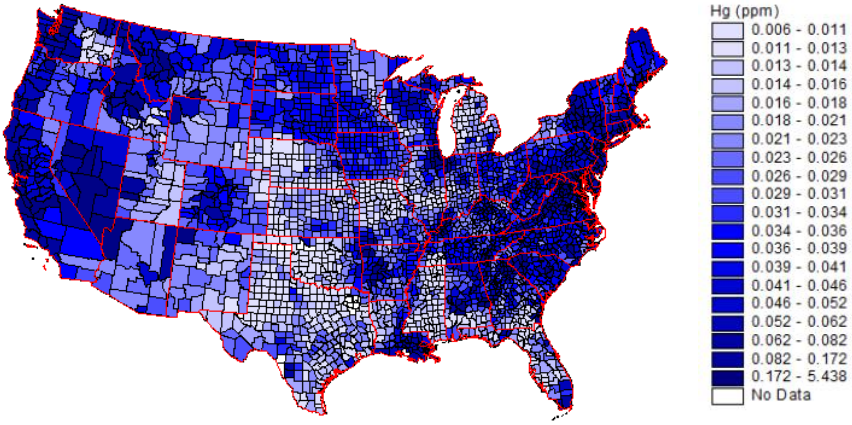
Figure A-5

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

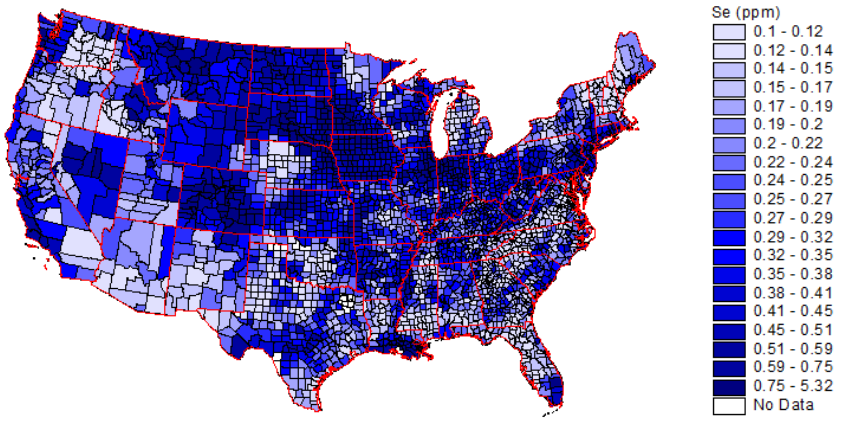
Mercury is present in our natural environment –
Background levels in soils in the U.S.



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

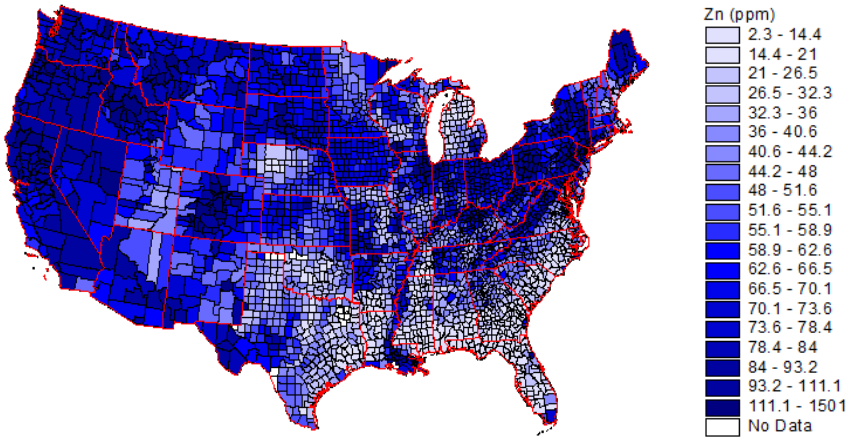
Figure A-6

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

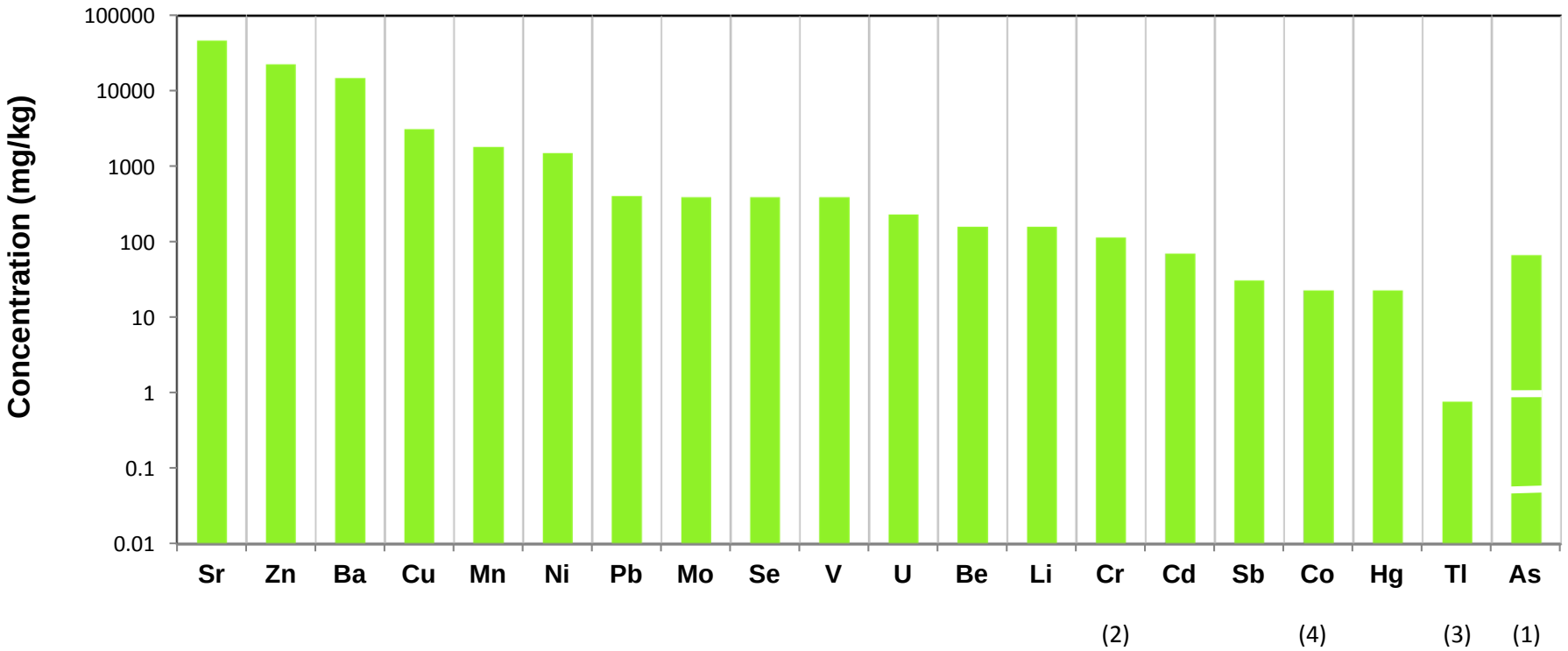
Zinc is present in our natural environment –
Background levels in soils in the U.S.



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

Figure A-7

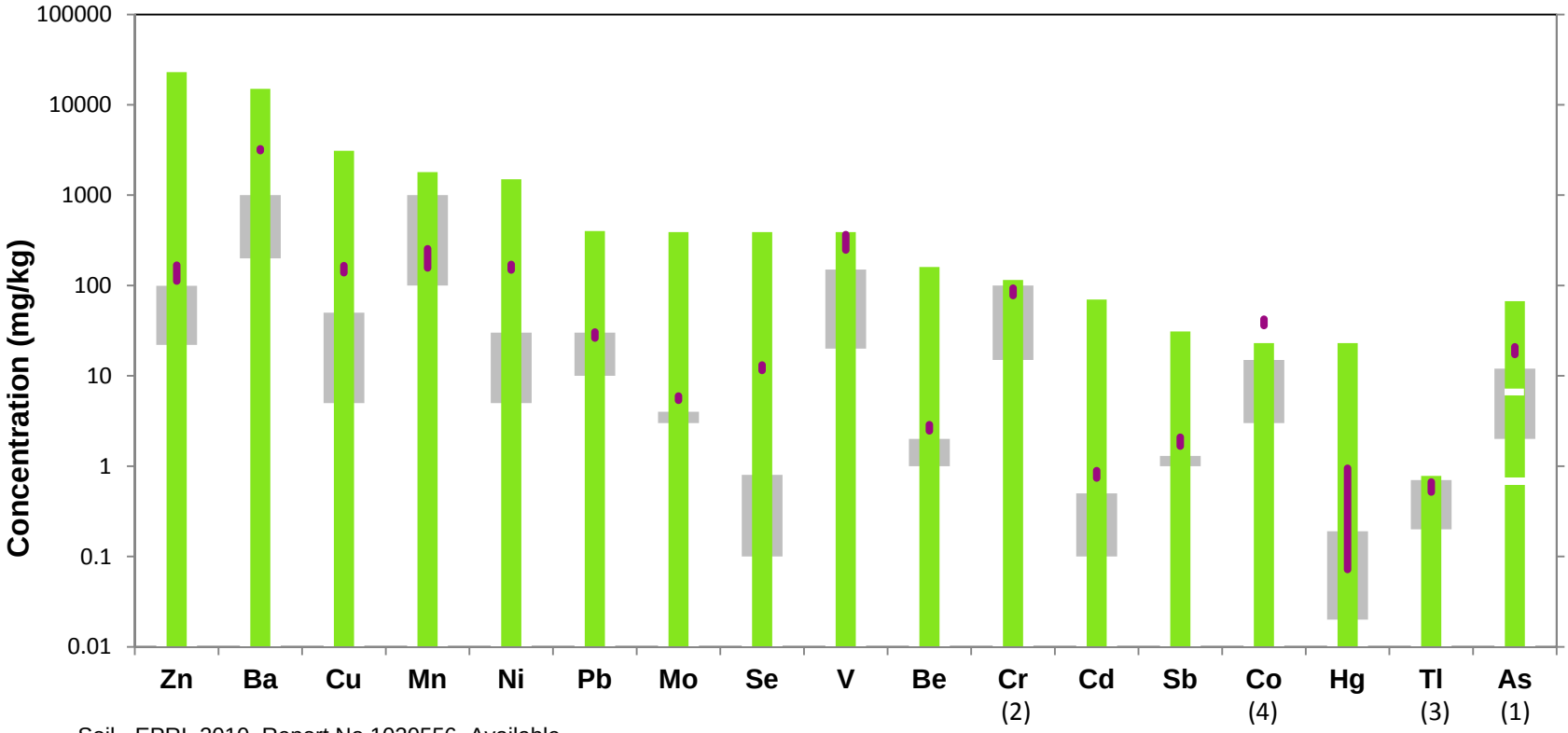
USEPA Regional Screening Levels for Residential Soils - Coal Ash Constituents



Top of bar corresponds to the USEPA Regional Screening Level (RSL) - Residential Soil (May 2014)
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 more than an order 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 (May 2014)
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.

ATTACHMENT B

Sioux Energy Center Dilution Factor Calculations

CALCULATIONS

Date: February 8, 2018 | **Made by:** J. Ingram

Project No.: 130-1560 | **Checked by:** E. Kidner

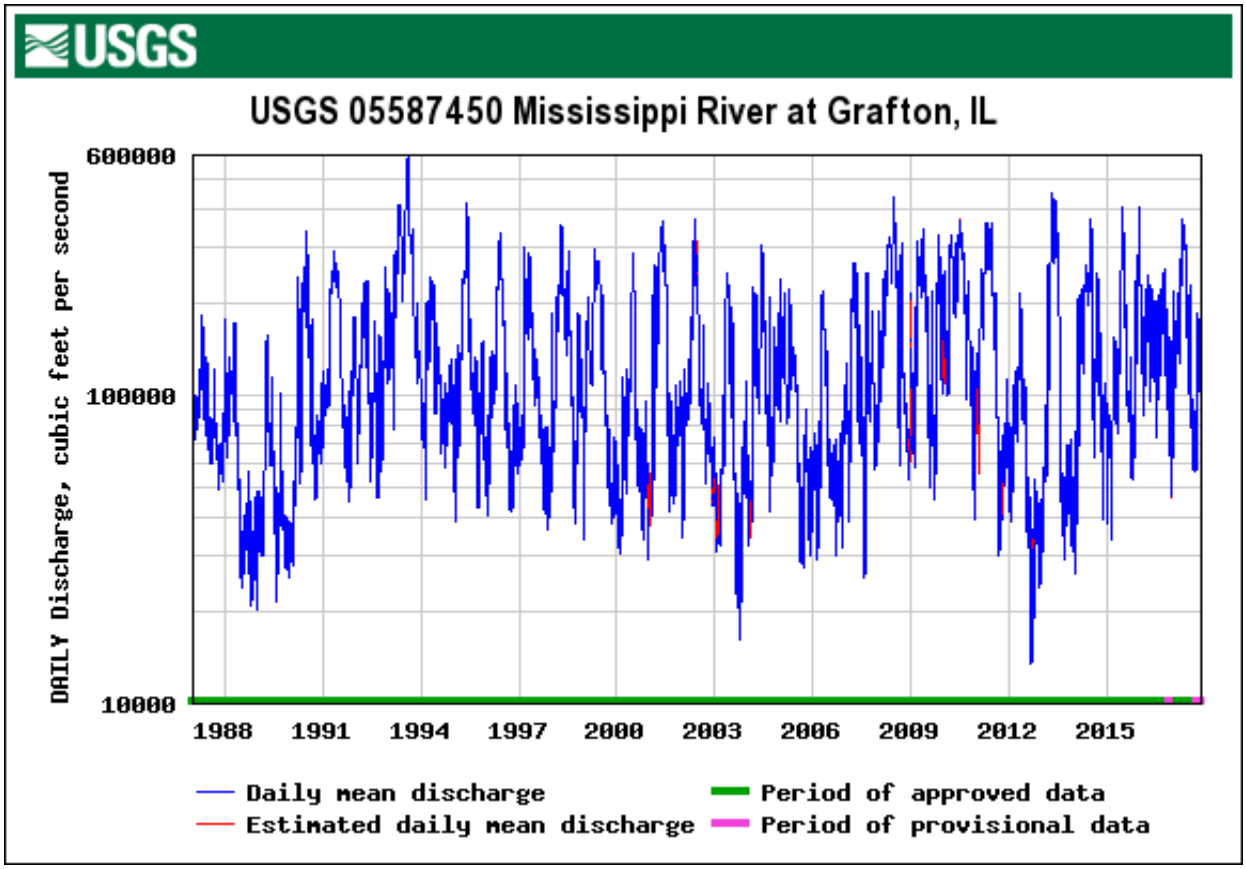
Subject: Sioux Energy Center Dilution Factor Calculations | **Reviewed by:** M.Haddock

1.0 Introduction

The Mississippi River is a large, flowing water body and daily flow at the Sioux Energy Center is estimated to range between 8 and 385 billion gallons per day, depending upon the river stage. In contrast, during low river flow conditions, average daily groundwater flow into the river is a fraction (estimated to be 92,000 gallons or 0.001%) of the receiving water body. This ratio of flow is referred to as a "dilution factor" and is useful when assessing the relationship between smaller and larger water bodies. Set forth below is a calculation of a dilution factor based on specific criteria and assumptions delineated in Section 1.6.

1.1 Low Discharge Conditions

The Mississippi River at the Sioux Energy Center lies between two lock and dam systems. These lock and dam systems effect the gradient and velocity of the Mississippi River and low river conditions do not always reflect the lowest discharge. Therefore, for this calculation, the lowest discharge is the most conservative value and was used.



Notes:

1) Discharge data for Grafton available at https://waterdata.usgs.gov/nwis/dv?referred_module=sw&site_no=05587450.

2) Minimum Discharge is 13,400 cubic feet per second on 9/12/2012.

Golder Associates

CALCULATIONS

Date: February 8, 2018 **Made by:** J. Ingram

Project No.: 130-1560 **Checked by:** E. Kidner

Subject: Sioux Energy Center Dilution Factor Calculations **Reviewed by:** M.Haddock

1.2 Low River Conditions

Date	Grafton Gauge Height	Grafton Gauge Elevation	Mississippi River Elevation at the Grafton Gauge	Winfield Gauge Height	Winfield Gauge Elevation	Mississippi River Elevation at the Winfield Gauge
Units	FT Above Gauge	FT MSL	FT MSL	FT Above Gauge	FT MSL	FT MSL
9/12/2012	15.51	403.79	419.3	12.65	407.00	419.7

Notes:
1) FT MSL - feet above mean sea level.
2) Information on the Grafton Gauge available at https://waterdata.usgs.gov/nwis/uv?05587450.
3) Information on the Winfield Gauge available at https://www.weather.gov/lsx/archive_river and http://water.weather.gov/ahps2/hydrograph.php?wfo=lsx&gage=CAGM7.

Mississippi River Elevation at the Grafton Gauge	Mississippi River Elevation at the Winfield Gauge	Distance Between Grafton and Winfield Gauges	Estimated Mississippi River Gradient	Distance from Grafton Gauge to SEC	Estimated Mississippi River Elevation at SEC
FT MSL	FT MSL	River Miles	feet/feet	River Miles	FT MSL
419.3	419.7	22.5	0.000003	7.9	419.2

Notes
1) Estimated Mississippi River level calculated by subtracting the gradient of the Mississippi River multiplied by the distance from the Grafton Gauge (in river feet) from the Grafton Gauge Mississippi River elevation.

1.3 Aquifer Discharge Length and Area

Description	Value	Units
Estimated length of discharge zone	6,045	feet
Estimated top of discharge zone (river level)	419	feet above mean sea level
Estimated bottom of discharge zone (Bedrock)	310	feet above mean sea level
Estimated thickness of discharge zone (Top - Bottom)	109	feet
Estimated area of discharge zone (length x thickness)	658,905	$feet^2$

1.3 Groundwater Properties

Description	Symbol	Value	Units
Average Hydraulic Conductivity (CCR Rule Monitoring Wells)	K	49	feet/day
Average Groundwater Gradient (from GMP)	I	0.0004	feet/feet
Effective Porosity (from GMP)	n	35	%
Average linear groundwater velocity (V=KI/n)	*V*	0.05	feet/day

CALCULATIONS

Date: February 8, 2018 **Made by:** J. Ingram

Project No.: 130-1560 **Checked by:** E. Kidner

Subject: Sioux Energy Center Dilution Factor Calculations **Reviewed by:** M.Haddock

1.4 Groundwater Discharge

Description	*Symbol*	Value	Units
Average linear groundwater velocity	*V*	0.05	feet/day
Estimated Discharge zone area	*A*	658,905	$feet^2$
Effective Porosity (from GMP)	*n*	35	%
Estimated total GW Discharge (Q=V*A*n)	*Q*	12,269	$feet^3$/day

1.5 Mississippi River Flow

Description	*Value*	Units
Estimated low Missouri River Conditions (9/12/2012)	419	feet above mean sea level
Corresponding Discharge from Grafton Gauge (9/12/2012)	13,400	$feet^3$/sec
Seconds per Day	86,400	seconds/day
Estimated low Flow Daily Discharge (Average Discharge * seconds per day)	1,157,760,000	$feet^3$/day

1.5 Dilution Factor

Description	Values	Units
Estimated Daily Groundwater Discharge	12,269	$feet^3$/day
Estimated Daily Groundwater Discharge	91,777	gallons/day
Estimated Daily River Flow	1,157,760,000	$feet^3$/day
Estimated Daily River Flow	8,660,646,835	gallons/day
Estimated Dilution Factor (River / GW)	**94,366 or >90,000**	Unitless

1.6 List of Conservative Assumptions Used

1) Calculations are based on estimated flow rates and discharge under low flow river conditions. As an example, low flow values used for Sioux Energy Center are from September 12, 2012 which is the lowest discharge value since 1988 according to publically available United States Geological Survey (USGS) data. Using river flow averages would greatly increase the dilution by an order of magnitude. Mississippi River data is available at https://waterdata.usgs.gov/nwis/uv?05587450.
2) To simplify the calculations, the alluvial aquifer was assumed to consist of higher permeability sands, resulting in conservative (higher) estimates of groundwater discharge.
3) The calculations do not take into account any dilution from the alluvial aquifer itself. The river locally recharges the aquifer at varying rates depending on river stage. In addition, on a near continuous basis, groundwater flows from the bedrock aquifer into the shallow alluvial aquifer. All of these sources increase dilution within the alluvial aquifer.

Although these calculations use conservative assumptions which would serve to increase the dilution factor ratio, the calculated value for the dilution factor has been rounded down. This dilution factor ratio represents a worst case scenario and actual dilution factors are likely greater.

CALCULATIONS

Date: February 12, 2018 | **Made by:** J. Ingram

Project No.: 130-1560 | **Checked by:** R. Feldmann

Subject: Sioux Energy Center Dilution Factor Calculations - Missouri River | **Reviewed by:** M. Haddock

1.0 Introduction

The Sioux Energy Center in St. Charles County, Missouri lies between the Mississippi and Missouri Rivers. Groundwater gradients are low, and groundwater can flow both to the north and south depending on river levels in the adjacent Mississippi and Missouri Rivers. The Missouri River is a large, flowing water body south of the facility and daily flow at the Sioux Energy Center is estimated to range between 18 and 333 billion gallons per day, depending upon the river stage. In contrast, during low river flow conditions, average daily groundwater flow into the river is a fraction (estimated to be 71,000 gallons or 0.0004%) of the receiving water body. This ratio of flow is referred to as a "dilution factor" and is useful when assessing the relationship between smaller and larger water bodies. Set forth below is a calculation of a dilution factor based on specific criteria and assumptions delineated in Section 1.6.

1.1 Low River Conditions

Date	Washington Gauge Height (Feet Above Gauge)	Washington Gauge Elevation (Feet Above Mean Sea Level)	Missouri River Elevation at the Washington Gauge (feet MSL)	St. Charles Gauge Height (Feet Above Gauge)	St. Charles Gauge Elevation (Feet Above Mean Sea Level)	Missouri River Elevation at the St. Charles Gauge (feet MSL)
1/25/2013	-1.19	457.27	456.08	5.06	413.47	418.53

Notes:
1) feet MSL - feet above mean sea level.
2) Information on the Washington Gauge available at https://waterdata.usgs.gov/usa/nwis/uv?06935450.
3) Information on the St. Charles Gauge available at https://waterdata.usgs.gov/mo/nwis/uv?site_no=06935965.
4) 5.06 is the lowest gauge height for the St. Charles Gauge on the Missouri River since October, 2007. This date is used because prior to this date no publicly available flow data was collected at the St. Charles Gauge.

Missouri River Elevation at the Washington Gauge (feet MSL)	St. Charles Gauge Elevation (Feet Above Mean Sea Level)	Distance Between Washington and St. Charles Gauges (River Miles)	Missouri River Gradient (feet/feet)	Distance from St. Charles Gauge to SEC (River Miles)	Estimated Missouri River Elevation at SEC (feet MSL)
456.08	418.53	39.1	0.00018	13.9	405

Notes:
1) Estimated Missouri River level calculated by subtracting the gradient of the Missouri River multiplied by the distance from the St. Charles Gauge (in river feet) from the St. Charles Gauge elevation.

1.2 Aquifer Discharge Length and Area

Description	Value	Units
Estimated length of discharge zone	5,400	feet
Estimated top of discharge zone (low river level)	405	feet above mean sea level
Estimated bottom of discharge zone (bedrock)	310	feet above mean sea level
Estimated thickness of discharge zone (top - bottom)	95	feet
Estimated area of discharge zone (length x thickness)	513,000	$feet^2$

Date: February 12, 2018 **Made by:** J. Ingram

Project No.: 130-1560 **Checked by:** R. Feldmann

Subject: Sioux Energy Center Dilution Factor Calculations - Missouri River **Reviewed by:** M. Haddock

1.3 Groundwater Properties

Description	Symbol	Value	Units
Average Hydraulic Conductivity (CCR Rule Monitoring Wells)	K	49	feet/day
Average Groundwater Gradient (from GMP)	I	0.0004	feet/feet
Effective Porosity (from GMP)	n	35	%
Average linear groundwater velocity (V=KI/n)	*V*	0.05	feet/day

1.4 Groundwater Discharge

Description	Symbol	Value	Units
Average linear groundwater velocity	*V*	0.05	feet/day
Estimated Discharge zone area	*A*	513,000	$feet^2$
Effective Porosity (from GMP)	*n*	35	%
Estimated total GW Discharge (Q=V*A*n)	*Q*	9,552	$feet^3$/day

1.5 Missouri River Flow

Description	Value	Units
Estimated low Missouri River Conditions (1/25/13)	405	feet above mean sea level
Corresponding Discharge from St. Charles Gauge (1/25/13)	27,800	$feet^3$/sec
Seconds per Day	86,400	seconds/day
Estimated low Flow Daily Discharge (Average Discharge * seconds per day)	2,401,920,000	$feet^3$/day

1.5 Dilution Factor

Description	Values	Units
Estimated Daily Groundwater Discharge	9,552	$feet^3$/day
Estimated Daily Groundwater Discharge	71,454	gallons/day
Estimated Daily River Flow	2,401,920,000	$feet^3$/day
Estimated Daily River Flow	17,967,610,598	gallons/day
Estimated Dilution Factor (River / GW)	**251,456 or >100,000**	Unitless

1.6 List of Conservative Assumptions Used

1) Calculations are based on estimated flow rates and discharge under low flow river conditions. As an example, low flow values used for Sioux Energy Center are from January 25, 2013, which is the lowest discharge value since October 2007 according to publicly available United States Geological Survey (USGS) data. Using river flow averages would greatly increase the dilution by an order of magnitude. Missouri River data is available at https://waterdata.usgs.gov/usa/nwis/uv?06935965.

2) To simplify the calculations, the alluvial aquifer was assumed to consist of higher permeability sands, resulting in conservative (higher) estimates of groundwater discharge.
3) The calculations do not take into account any dilution from the alluvial aquifer itself. The river locally recharges the aquifer at varying rates depending on river stage which increases dilution within the alluvial aquifer.

Although these calculations use conservative assumptions which would serve to increase the dilution factor ratio, the calculated value for the dilution factor has been rounded down. This dilution factor ratio represents a worst case scenario and actual dilution factors are likely greater.