



Risk-Based Groundwater and Surface Water Investigation to Evaluate Potential Environmental Impact of Coal Ash Management Practices at Coal-Fired Power Plants

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CSM Case Study



Challenge

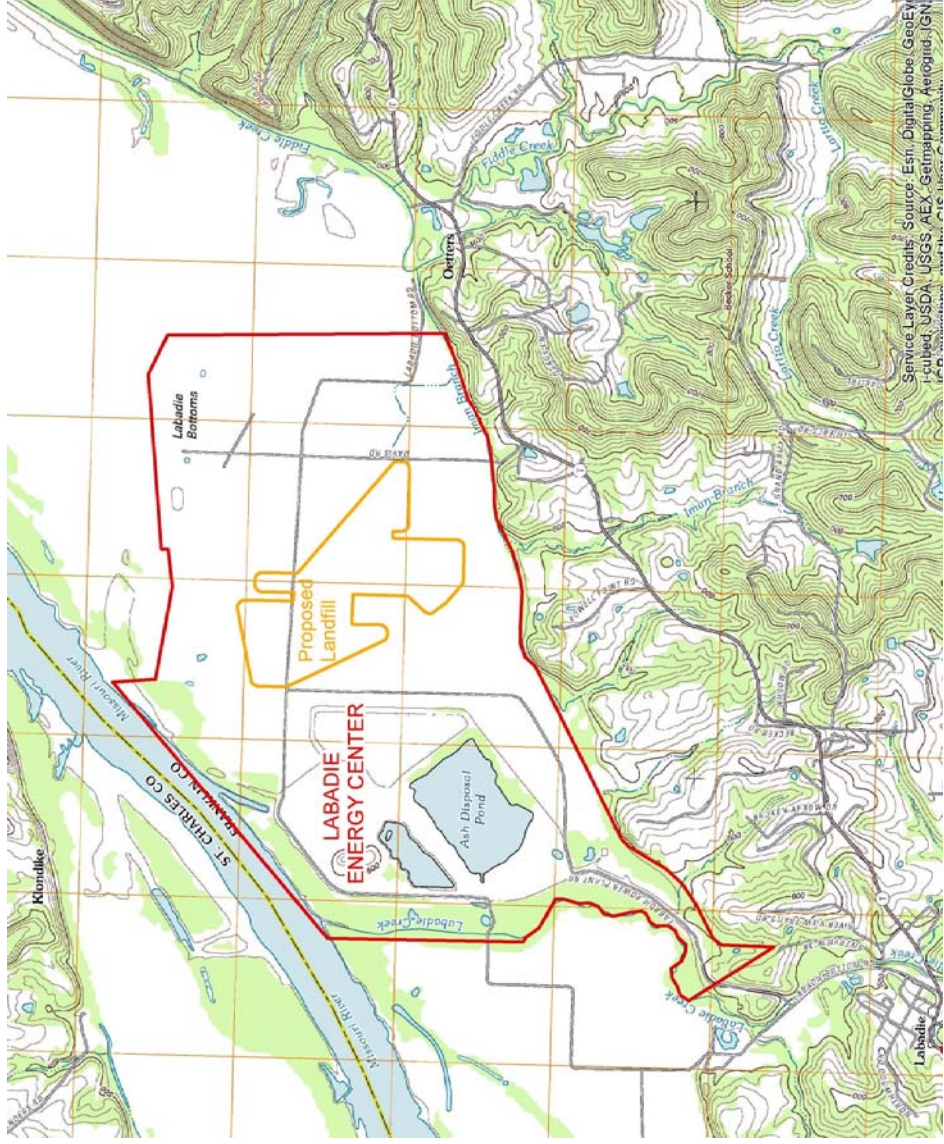
Citizen and environmental groups have voiced concerns about the potential impact that coal ash management practices at coal-fired power plants may have on the environment.

Where allegations of such impact are made, they are not accompanied by supporting data.

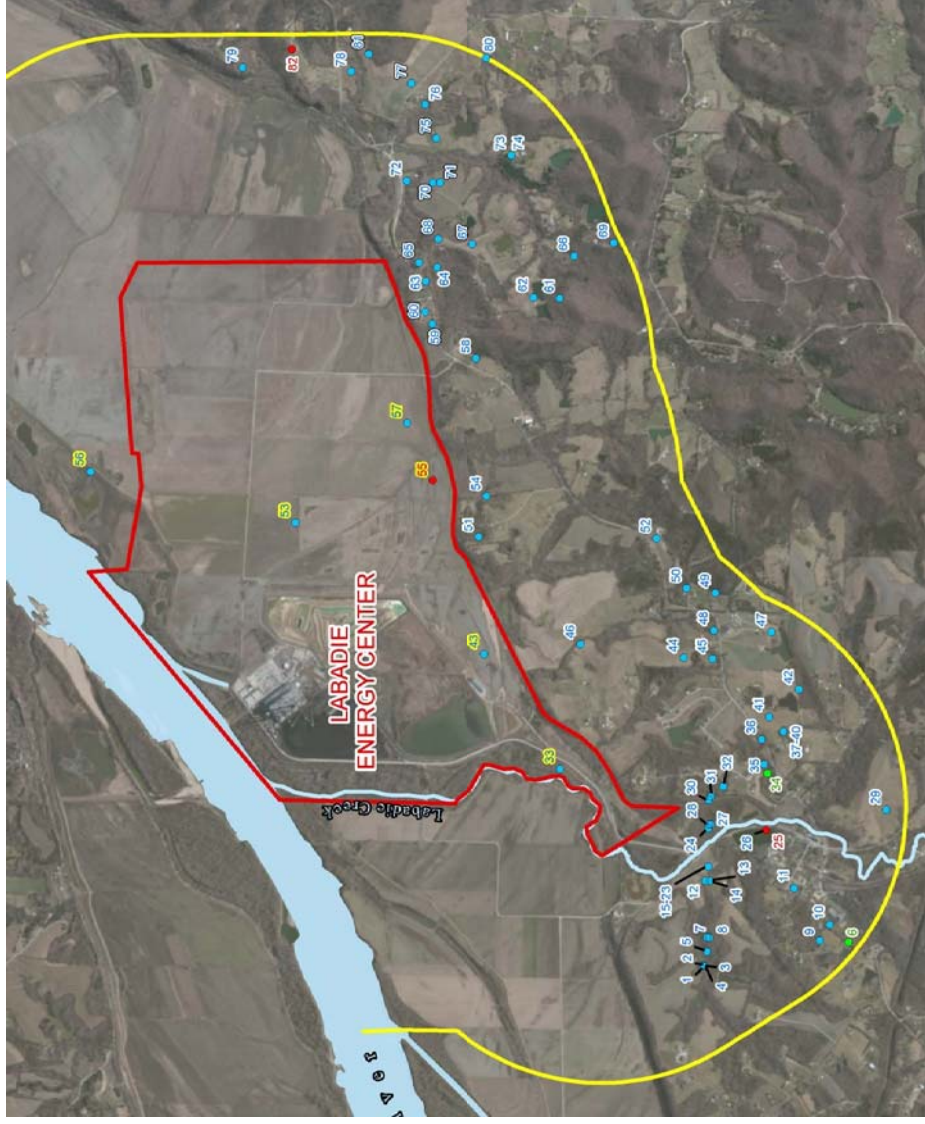
To address such concerns and allegations, the impact to the environment of the coal ash management practices were evaluated using a risk-based conceptual site model approach.

The Labadie Energy Center is used here as the example.

Topographic Setting

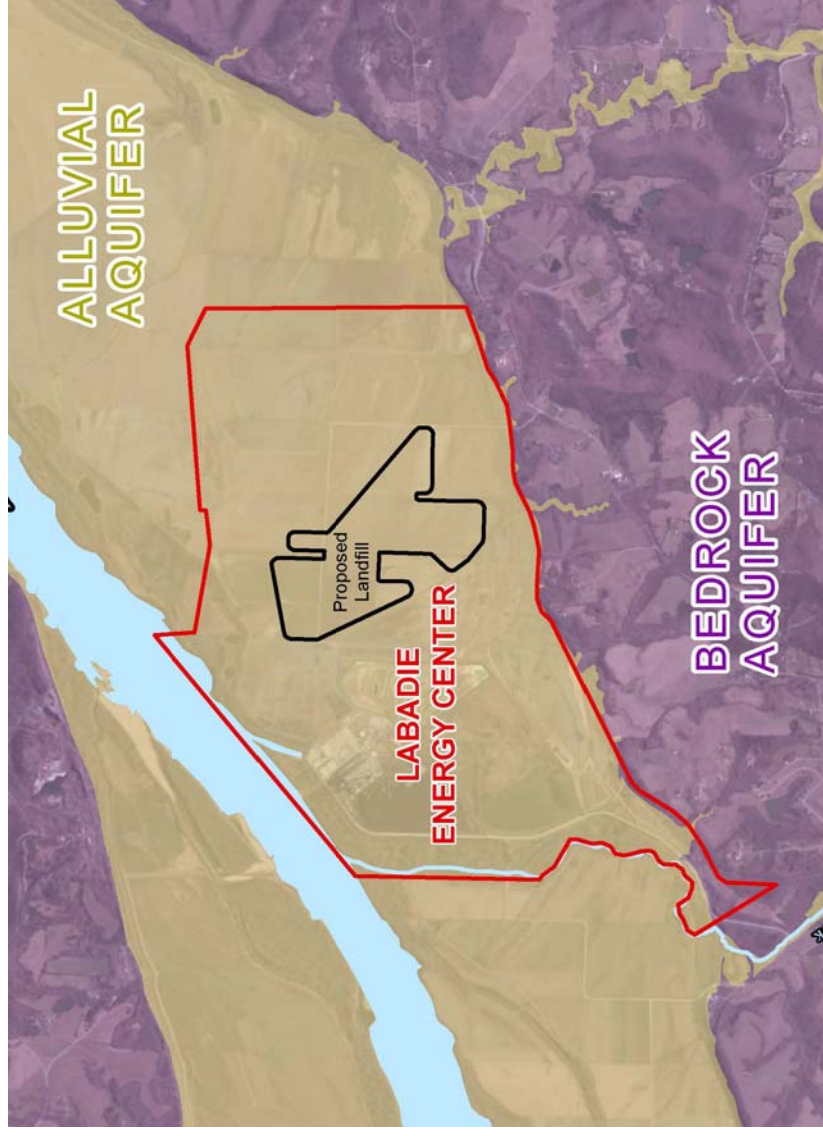


Private Well Search Results



- Wells are located south of the facility
- Private wells are located in an upland area

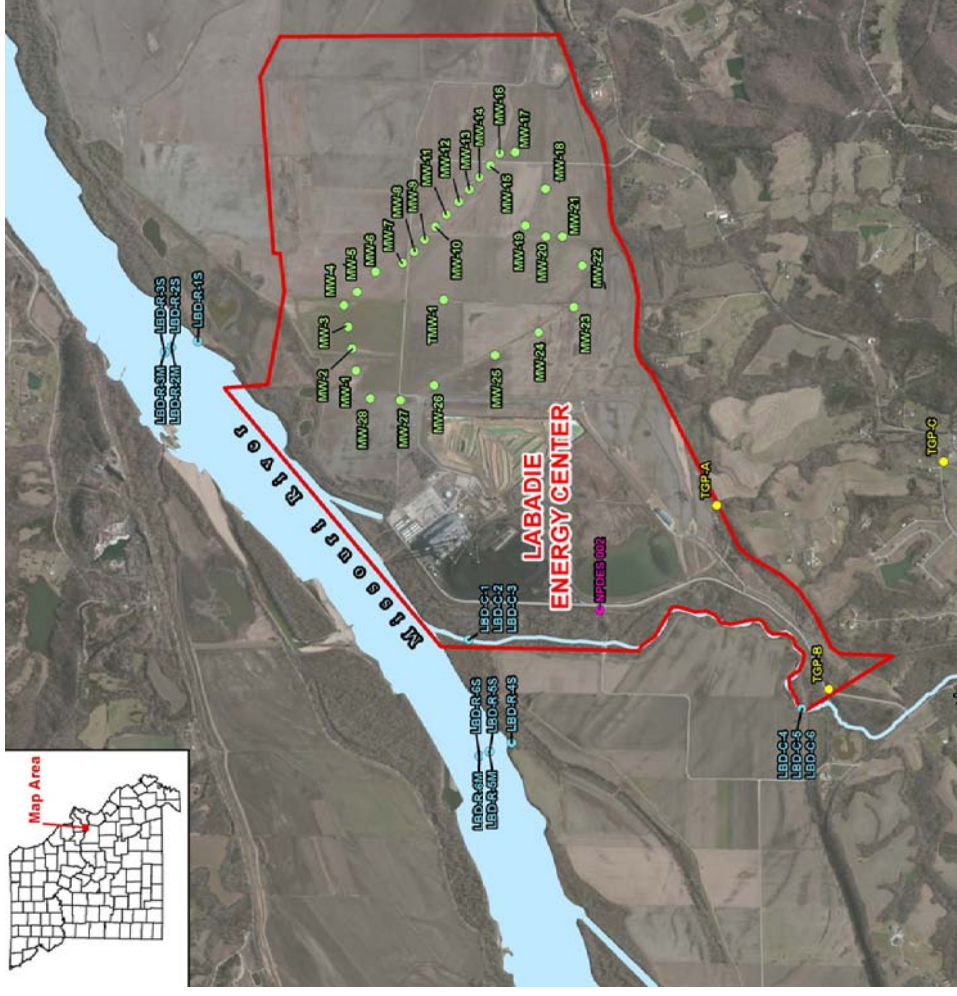
Groundwater Setting



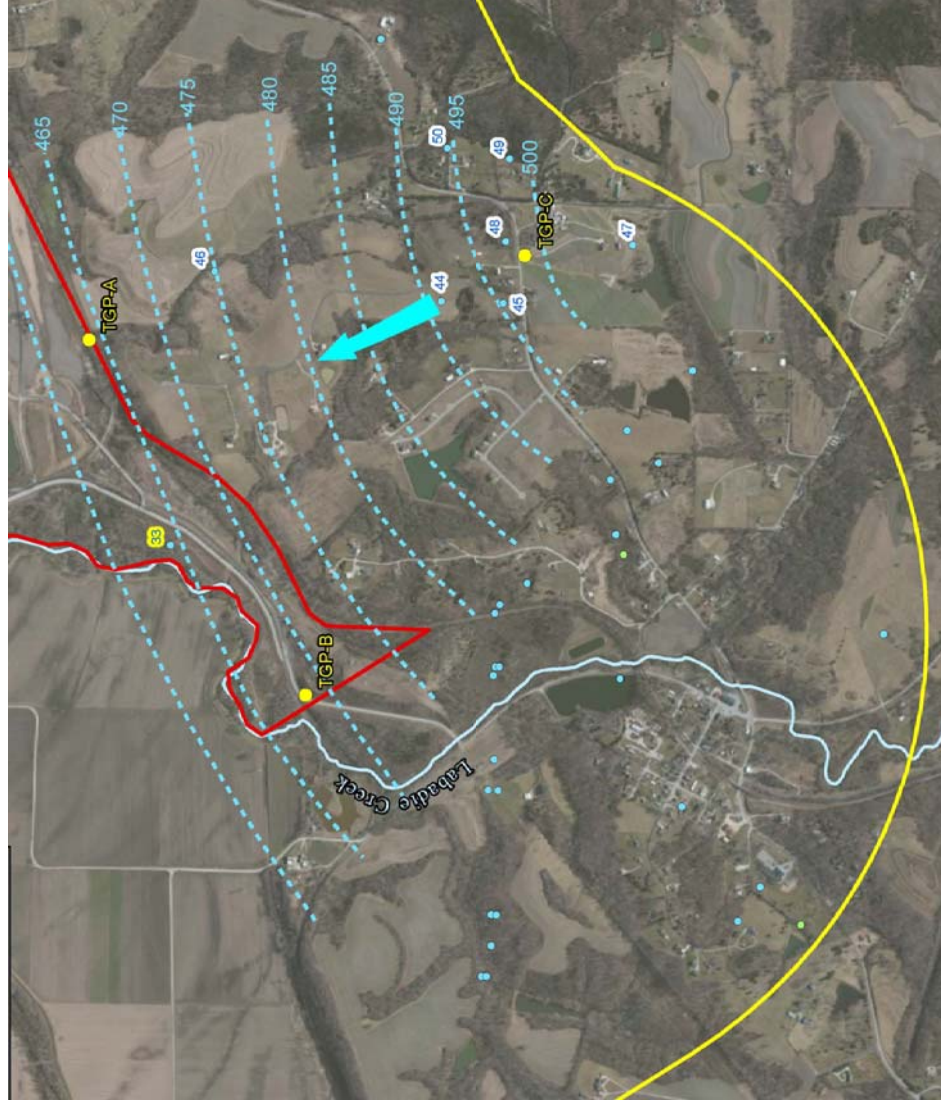
- A bedrock aquifer is present in the upland area
- This is overlain by a shallow alluvial aquifer in the river bottoms

Investigation Approach – Conceptual Site Model

- Comprehensive Investigation:
 - **Blue** – surface water samples;
 - **Yellow** – bedrock groundwater samples
 - **Green** – shallow alluvial aquifer samples
 - **Purple** – NPDES Outfall

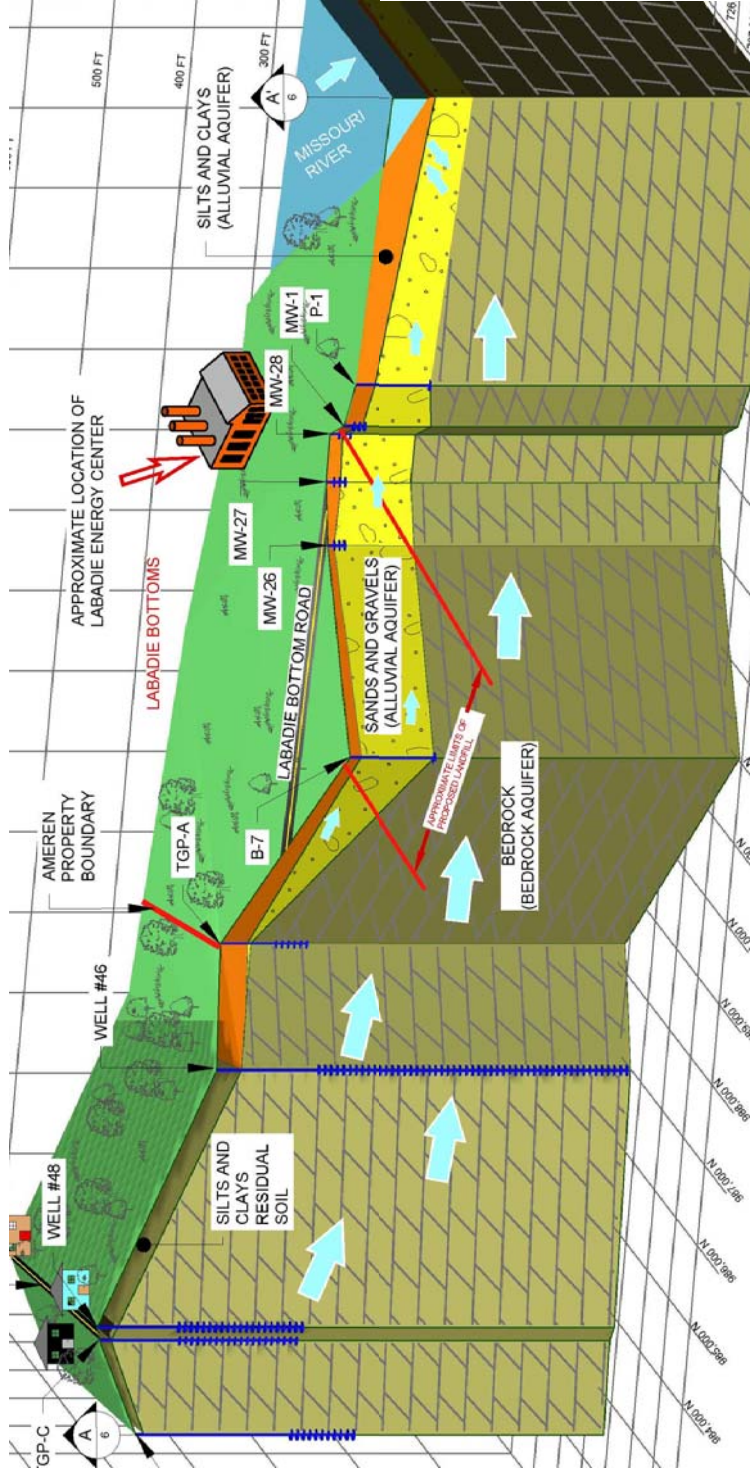


Bedrock Groundwater Flow Direction



- Groundwater flows from the upland area towards the river and towards the facility

Groundwater CSM



Bedrock aquifer that serves as a drinking water source flows from the upland area where private wells are located towards the river and towards the facility

Any impact in the shallow alluvial aquifer cannot be transported to the bedrock groundwater serving the private well area

Risk-Based Evaluation

Aluminum	Copper	Nitrite/Nitrate as N
Antimony	Cyanide	Selenium
Arsenic	Fluoride	Silver
Barium	Iron	Sulfate
Beryllium	Lead	Thallium
Boron	Magnesium	Tin
Cadmium	Manganese	Titanium
Calcium	Mercury	Zinc
Chloride	Molybdenum	Hardness
Chromium	Nickel	pH (std)
Cobalt	Nitrate	Total Dissolved Solids
	Nitrite	[Not Lithium or Radium-226/228]

Constituents

- More than 23 inorganic constituents were analyzed in all samples

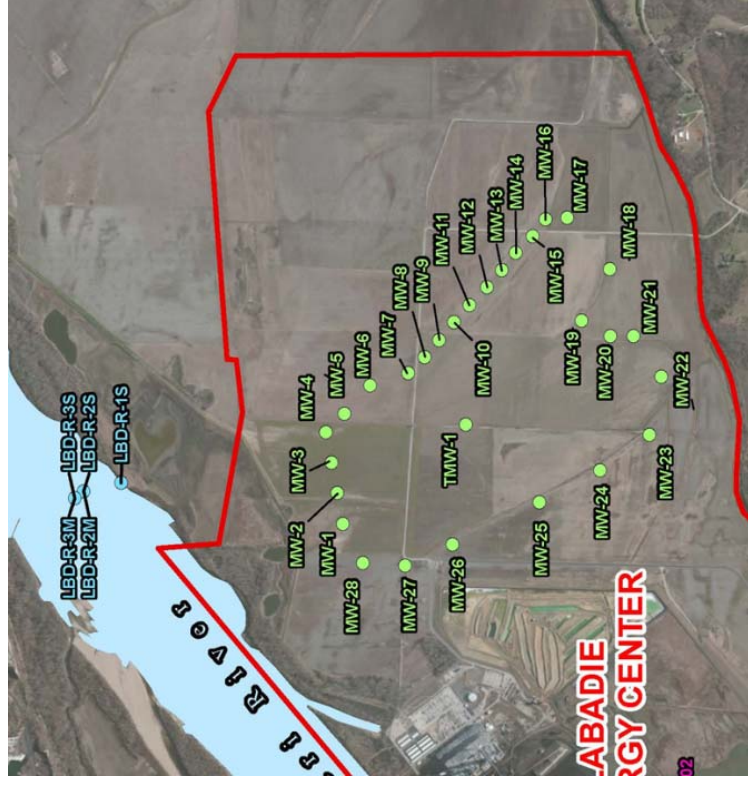
- **B and SO₄ as indicators of releases**

Bedrock groundwater results

- All results meet State and Federal MCLs
- Concentrations of B and SO₄ are low in all bedrock groundwater samples

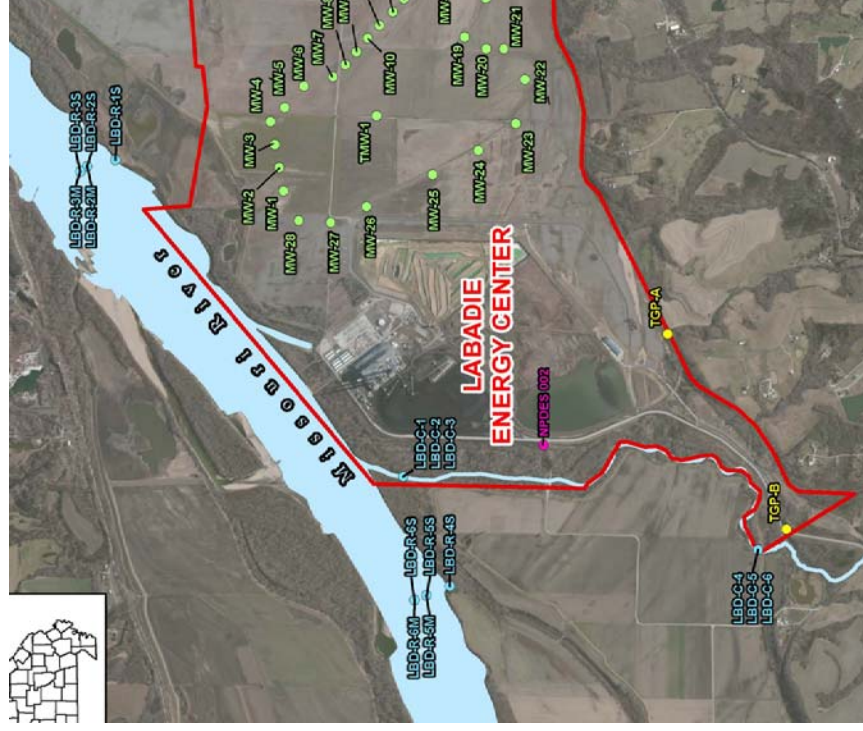


Alluvial Groundwater Results



- Fe and Mn concentrations are elevated and above SMCLs in almost all locations, consistent with a reducing environment in a river bottoms area
- As is present above MCLs where Fe concentrations are the highest
- This generally occurs at locations furthest from the ash ponds, not in the proximal locations
- B and SO₄ indicator parameter concentrations are low in all locations
- Demonstrates the importance of groundwater geochemistry and including more than Appendix III and IV constituents in analytical programs

Creek and River Surface Water Results

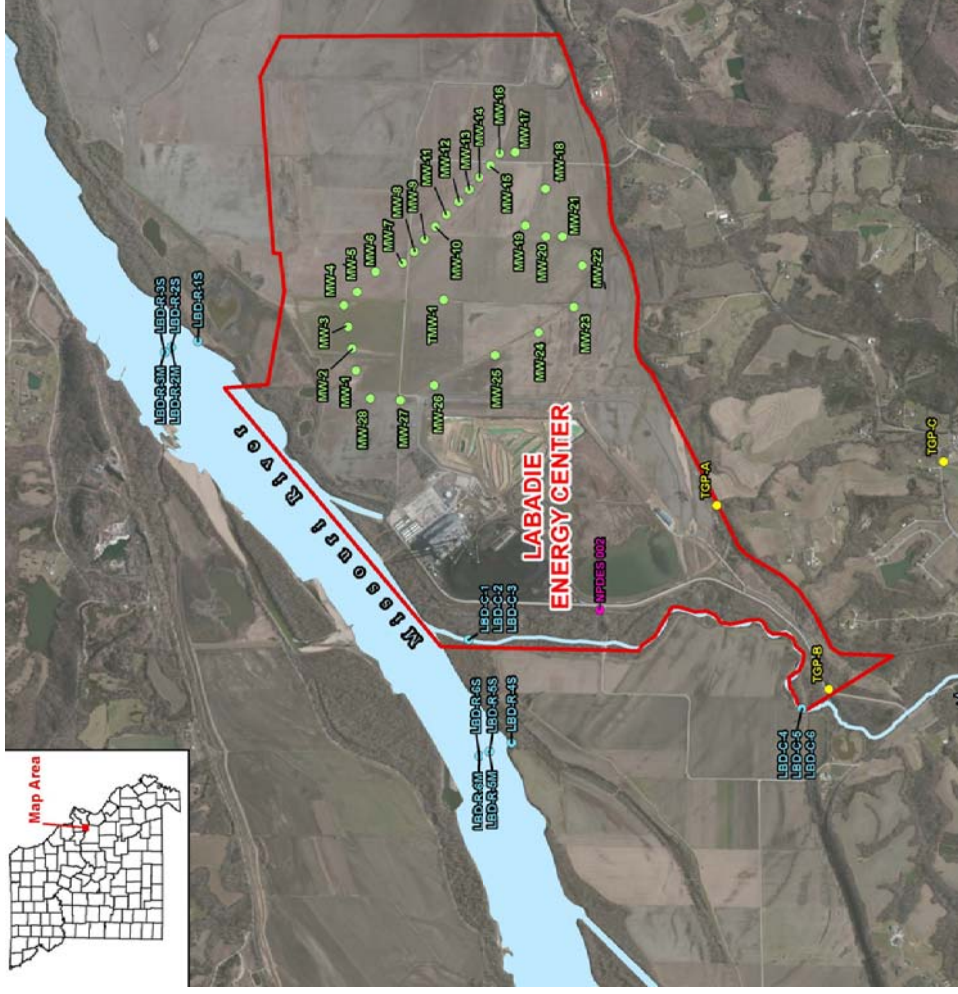


- Five upstream and five downstream river samples were collected - the ash ponds are located ~0.5 miles from the river
- Three upstream and three downstream creek samples were collected - the ash ponds are located ~560-580 feet from the creek
- Constituent concentrations are similar upstream and downstream
- No results are above MCLs
- B and SO₄ indicator parameter concentrations are low

CSM Conclusions - 1

- **The results indicate no adverse impacts on human health and the environment for either surface water or groundwater uses as a result of coal ash management practices at the facility**
- All bedrock groundwater results from the upland area near private drinking water wells meet State and Federal MCLs
- Concentrations of B and SO₄, indicators of releases to groundwater from coal ash management areas, are low in all samples
- Fe and Mn can be indicators of natural reducing conditions

CSM Conclusions - 2



- Focus on whether or not potentially complete exposure pathways are present
- Sample where exposure could occur
- Power of the CSM

Thank you!

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