

IN HARM'S WAY:

Lack Of Federal Coal Ash Regulations Endangers Americans And Their Environment



Environmental Integrity Project, Earthjustice and Sierra Club

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Entity/Company - Location

Union Electric Company/Ameren Energy d/b/a AmerenUE - Venice Power Station Ash Ponds

701 Main St

Venice, IL 62090

St. Clair and Madison Counties

Latitude: 38.653694 Longitude: -90.172728

Across
river from St. Louis

Determination

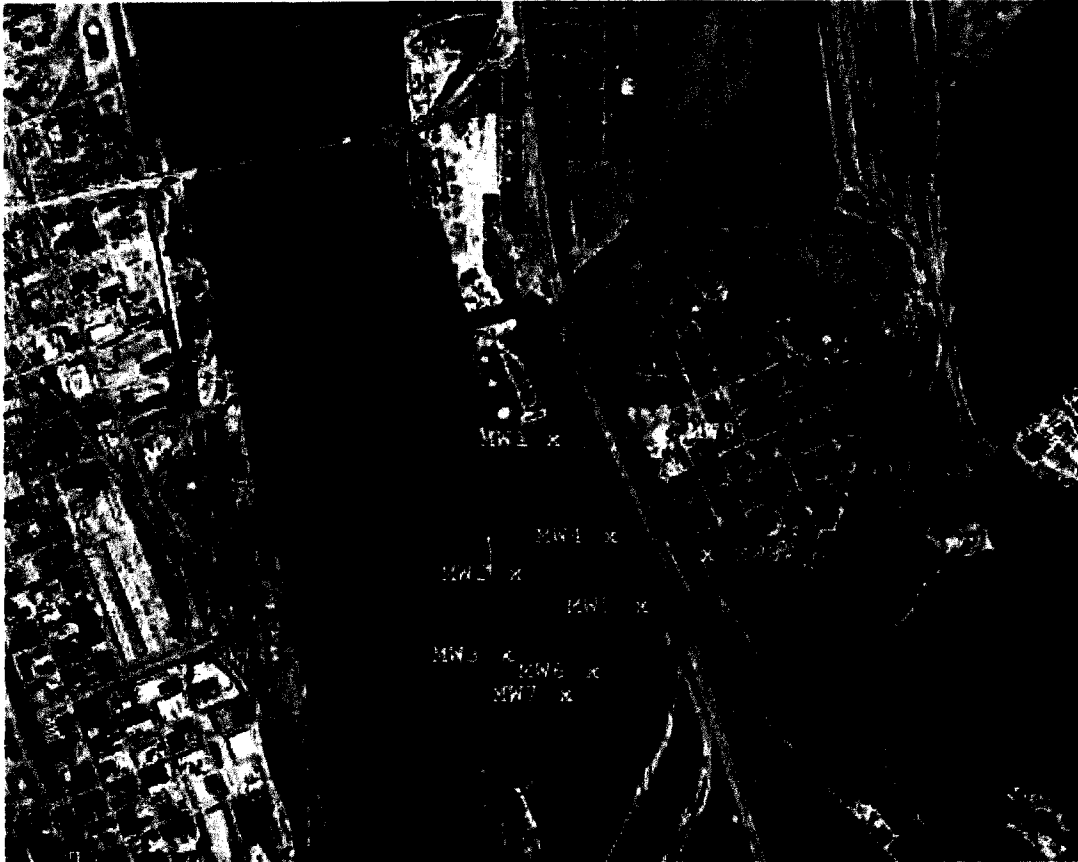
Demonstrated damage to groundwater off-site (400 feet east of ash ponds & beyond property line)

Probable Cause(s)

Leaching of coal combustion waste (CCW) contaminants from unlined CCW ponds

Summary

Inactive and unlined coal ash ponds at the AmerenUE Venice power plant on the east side of the Mississippi River created a contaminant plume of boron that exceeds Illinois Class I (potable) groundwater standards, extending 475 feet south of the ponds. A contaminant plume of arsenic that exceeds Class I standards extends beyond the boron plume and contains concentrations as high as 38 times the federal MCL, 400 feet beyond the ash ponds. The ash ponds stopped receiving CCW in 1977 when the plant switched from burning coal to oil. The contaminant plumes were discovered in the late 1990s when groundwater monitoring was required as part of a permit to resume operation of the Venice Plant in 1995. AmerenUE has proposed a state "Groundwater Management Zone" (outlined in red on the map below) to contain contaminant plumes within the property.



Test of Proof

A review of groundwater monitoring data submitted by AmerenUE to the Illinois Environmental Protection Agency (IEPA) from 1996 to 2009 found the following:

- **Arsenic.** The Illinois Class I groundwater standard for arsenic is 0.05 mg/L, five times higher than the federal Maximum Contaminant Level (MCL) of 0.01 mg/L. The average concentration of arsenic exceeded the Illinois standard in MW5 (0.054 mg/L) and MW6 (0.077 mg/L) on the north and south edges of the ash ponds, respectively. MW7, set 200 feet south of the edge of the ash ponds, had even higher average arsenic concentrations (0.086 mg/L, 8.6 times the MCL, with a maximum of 0.215 mg/L, 21 times the MCL). Other monitoring wells where average concentrations exceeded the MCL included MW1 on the north edge of the ash pond (0.026 mg/L) and MW4 on the east edge (0.024 mg/L). Arsenic concentrations in monitoring wells west of the ash ponds and east of the river were lower, suggesting that the dominant flow of groundwater is to the east away from the river (MW2 exceeded the MCL in 3 out of 30 samples, with a maximum of 0.24 mg/L, and MW3 exceeded the MCL in 2 out of 24 samples, with a maximum of 0.26 mg/L). A dominant flow to the east away from river is also suggested by common, and in some cases substantive, exceedances of the arsenic MCL in MW8 (7 out of 39 samples, maximum of 0.31 mg/L) and MW9 (11 out of 39 samples, maximum of 0.38 mg/L, 38 times the MCL). Both MW8 and MW9 are off-site about 400 feet east of the CCW ponds, and, as discussed below, concentrations of contaminants are affected by seasonal changes in flow direction.
- **Boron.** The standard for boron in Illinois for Class I (potable) water is 2.0 mg/L. The average concentration of boron exceeded the state standard in all monitoring wells set at the northern (MW1, 22.5 mg/L, more than 10 times the MCL), eastern (MW4, 19.2 mg/L and MW5 5.2 mg/L) and southern (MW6, 3.8 mg/L) edges of the ash ponds. MW7, set 200 feet south of the edge of the ash ponds, had a somewhat lower average boron concentration (2.6 mg/L). MW2, west of the ash ponds, also had a high boron concentration (5.4 mg/L). Wells MW3 (west) and off-site MW8/MW9 (east) had one or zero exceedances of the state standard since monitoring began, although these wells show concentrations of boron above what would be expected natural background levels. As discussed later, elevated boron both east and west of the ash pond system can be explained by seasonal variations in groundwater flow direction.
- **Cadmium.** The MCL for cadmium (0.005 mg/L) was exceeded three times in early sampling of MW1, but has not been exceeded since April 1999. There were no other MCL exceedances for cadmium in other wells.
- **Iron.** The Illinois Class I groundwater standard for Iron is 5.0 mg/L. Iron concentrations have exceeded this standard at MW6 (maximum of 27.5 mg/L), MW7 (maximum of 17.8 mg/L) and MW9 (maximum of 23.3 mg/L).
- **Manganese.** The Illinois Class I groundwater standard for manganese is 0.015 mg/L. Manganese concentrations have exceeded this standard in all wells. Wells with exceptionally high manganese concentration (more than 1.5 mg/L, 100 times the standard) include: MW1 (maximum of 4.82 mg/L), MW4 (maximum of 4.25 mg/L), MW6 (maximum of 3.56 mg/L), and MW7 (maximum of 5.59 mg/L).
- **Total Dissolved Solids (TDS).** The Illinois Class I groundwater standard for TDS is 1,200 mg/L, more than twice as high as the Secondary MCL (SMCL) of 500 mg/L. The Illinois standard for TDS was consistently exceeded in MW1 (maximum of 2,656 mg/L), and regularly exceeded in MW4 (maximum of 2090 mg/L). These exceedances are more than five and four times the federal SMCL, respectively.

The Supplemental Hydrogeological Assessment of the site performed by a consultant for AmerenUE states that there is little correlation between arsenic and boron concentrations in groundwater samples collected at the site, and uses this evidence, along with the fact that arsenic concentrations in field leachate samples collected at the ash ponds are a factor of 4 to 5 lower than observed in groundwater, to argue that the main source of the arsenic is not from the coal ash ponds (NRT, 2010). The Supplemental Hydrogeological Assessment for the site also identifies MW8 and MW9 east of the ash ponds as "upgradient" wells, apparently on the assumption that the dominant direction of groundwater flow is west toward the river (NRT, 2010).

However, several lines of evidence suggest that the ash ponds are the main source of arsenic, and that off-site MW8 and MW9 are not truly upgradient and are affected by contaminants from the ash ponds:

- Boron tends not to interact with aquifer solids and serves as a good indicator of the zone of influence of ash leachate on groundwater. Arsenic, on the other hand, is sensitive to redox conditions in the ash pore waters and aquifer, so a correlation between arsenic and boron in the same sample would not necessarily be expected.
- In Pleistocene aquifers, groundwater containing boron concentrations greater than 0.5 mg/L can be considered affected by leachate (Schleyer et al., 1992). In MW8, the average concentration of boron in samples taken from 1999 to 2009 was 0.68 mg/L and more recent sampling in MW8P averaged 1.48 mg/L, suggesting that this well, 400 feet "upgradient," has been affected by the ash ponds.
- This influence can be explained by the fact that when the Mississippi River is high, the groundwater gradient to the east is much steeper (river 8.34 feet higher than MW8 on July 26, 2008) than when the river is at normal flow (river 3.93 feet lower than MW8 on September 26, 2008), making it entirely possible for contaminants to reach these wells and farther east before the lower westward gradient is reestablished.
- The interpretation that the dominant direction of the flow of contaminants is to the east rather than the west is confirmed by the fact that the monitoring wells set between the ash ponds and the river (MW2 and MW3) have lower average concentrations of arsenic and boron than the wells east of the ash ponds (MW4 and MW5).

Although the consultant raises the possibility that there may be some contribution of arsenic from another source, none has been identified.

The boron contaminant plume with concentrations up to 2.0 mg/L extends a maximum of 475 feet south of the ponds. A contaminant plume of arsenic that exceeds Illinois Class I standards extends a bit beyond the boron plume. The "Groundwater Management Zone" (GMZ) proposed by AmerenUE extends somewhat beyond the boundaries of the contaminant plume and is located within the property boundaries of the power plant.

Constituents Involved

Arsenic, boron, cadmium, iron, manganese, total dissolved solids

At Risk Population

A potable well survey conducted within a 2,500-foot radius of the ash pond system boundaries has been performed (NRT 2009a). The map showing the locations of these wells was withheld by IEPA when it responded to the Freedom of Information Act (FOIA) request for information about the site, so the results of this survey cannot be reported here. AmerenUE (2010) notes that the City of Venice and Village of Brooklyn have enacted ordinances prohibiting the use of groundwater as a potable water supply, because the presence of industrial facilities in the area since the early 1900s has created multiple potential sources for groundwater contamination. However, the analysis presented here suggests that most, if not all, contaminants are being detected in monitoring wells associated with the ash pond system and come from the unlined ash ponds. Private and public well data for the state of Illinois is maintained on a county by county basis via an online database operated by the Illinois State Water Survey. Wells locations fall in a one- to five-mile area arranged by section, township, and range. It is not possible to plot well locations or distinguish which wells are downgradient of the site.

Incident and Date Damage Occurred / Identified

Arsenic and boron exceeded MCLs and SMCLs in the first round of groundwater sampling on July 27, 1996. When MW4, MW5, and MW6 were added to the network in December 1997, arsenic and boron also exceeded Illinois Class I groundwater standards in all three wells.

Regulatory Action

When the Venice Plant resumed operations in 1995, a condition for the operating permit was that hydrogeologic investigations be initiated to evaluate the impact of the ash pond system on groundwater. These investigations

were initiated in 1996 with the installation of three monitoring wells, and the monitoring well network was eventually expanded to include 17 monitoring wells at varying depths and locations in and around the ash pond system. As discussed above, contaminant plumes containing arsenic and boron at levels that exceed ILEPA Class I groundwater standards and federal MCLs have been defined within the boundaries of the Venice Plant facility.

In March 2010, as part of the plan for final closure of the ash ponds, AmerenUE proposed final capping and establishment within their property boundaries of a Groundwater Management Zone (GMZ) for containing the contaminant plumes.

Wastes Present

Coal ash and other CCW from boilers, wastewaters from the boilers and water treatment plant, and various other process waters plus storm water runoff

Type(s) of Waste Management Unit(s)

A series of unlined ponds, referred to as Ash Pond Nos. 2 and 3 and collectively as the "ash pond system," was constructed in the 1950s to receive wet-slucied coal ash and other CCW from boilers, wastewaters from the boilers, water treatment plant, and various other process waters plus storm water runoff. When the plant stopped burning coal in 1977, the ash pond system contained about 1,425,500 cubic yards of waste. The ash pond system continued to receive process wastewater and storm water runoff until a new water treatment facility and outfall was constructed in 2005. The ash pond system has been out of service since 2005 (AmerenUE, 2010).

Active or Inactive Waste Management Unit

Inactive

Hydrogeologic Conditions

The ash pond system is underlain by about 80 feet of alluvial deposits associated with the Mississippi River. The upper 20 to 30 feet of alluvium contain alternating layers of silt, sand, and clay. The lower 60 to 50 feet consist primarily of sand and gravel. Groundwater flow in the region is controlled by the Mississippi River. During normal river stage, which lasts the majority of the year, groundwater flows west and discharges into the river. During high river stage, groundwater flow is reversed, flowing east, with the river recharging the aquifer. There is also a perched water table that is influenced by infiltration of precipitation that tends to dilute the concentrations of contaminants from the ash pond system in the shallower wells. As discussed above in the Test of Proof section, even though the seasonal eastward flow inland from the Mississippi River is of shorter duration than the westward flow toward the river, the higher gradient of the eastward flow has carried contaminants farther inland (400 feet to MW8 and MW9) than has been acknowledged by AmerenUE's consultants (Hanson Engineering, 2000).

Additional Narrative

The 500-MW Venice plant burned coal until it was converted to an oil-burning facility in the late 1970s. The plant's capacity dropped off in the 1980s, but it was reconditioned and reopened in 1995. AmerenUE was formed in 1998 with the merger of Union Electric and Illinois Public Service. A catastrophic fire in 2003 resulted in abandonment of the original power plant building and associated generating equipment. Beginning in 2004, three additional single-cycle combustion turbine generators (Units 3, 4, and 5) were installed north of the ash pond system, and the plant was reopened in 2005. The plant now operates only intermittently as a peaking facility.

Sources

AmerenUE. 2010. Memorandum from AmerenUE to Bill Buscher, Groundwater Protection, Division of Water Pollution Control, Illinois Environmental Protection Agency, Re: Ash Pond Closures at AmerenUE's Venice Plant (Mar. 25, 2010).

Hanson Engineering. 2000. Hanson Engineering, Hydrogeologic Investigation, Former Ash Disposal Pond System, AmerenUE Venice Power Plant (Appendix A to Venice Ash Pond Closure Memorandum, AmerenUE, 2010).

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NRT. 2009. NRT, Potable Well Survey, Hydrogeological Assessment, and Modifications to the Groundwater Monitoring Program, Technical Memorandum No. 1 (Sept. 17, 2009) (Appendix B to Venice Ash Pond Closure Memorandum, AmerenUE, 2010).

Schleyer, Ruprecht, Helmut Kerndorff, and Gerald Milde. 1992. Detection and Evaluation of Groundwater Contamination Caused by Waste Sites, in Suzanne Lesage and Richard E. Jackson (eds.), Groundwater Contamination and Analysis at Hazardous Waste Sites, CRC Press 273–91.