UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE SECRETARY

In the Matter of

Callaway Plant Unit 2 — Docket No. 52-037

Combined Construction and License Application

DECLARATION BY DR. ROBERT E. CRISS IN SUPPORT OF HIS CRITIQUE OF AMERENUE'S ENVIRONMENTAL REPORT, SECTION 2.3, "WATER"

I, Dr. Robert E. Criss, under penalty of perjury, declare as follows:

1. I am Professor of Earth and Planetary Sciences at Washington University in St. Louis. I hold a Ph.D. in Geochemistry from California Institute of Technology, 1981, and a M.S. in Geology from California Institute of Technology, 1974. My full curriculum vita and a publications list are attached.

2. I have published extensively on the Missouri River and studied its chemistry, temperature variations, flow variations, and flooding. I have studied caves, springs and stream flows in Missouri.

3. I have reviewed Section 2.3 (Water) of the Environmental Report submitted by AmerenUE in this proceeding, specifically as it relates to groundwater and wetlands. Based on this review I supplied the following report:

Basis for Contention: Deficiencies in ER Section 2.3 "Water"

Executive Summary: The ER Section 2.3 description of the relevant aquifers in the Callaway Plant vicinity understates their hydraulic conductivity, denies their connectivity with the Earth's surface, and thereby denies the probable impacts of the large anticipated increases in groundwater pumping on proximal wetlands, springs, surface streams, and water levels in private and public wells.

Details

The shallow "Graydon Chert aquifer" beneath the Callaway power block is mischaracterized as a "confined" "artesian" aquifer (pp. 2-54; 2-57, 2-89). Abundant contrary evidence includes the situation of the aquifer on an isolated hilltop, from which surface streams radiate in all directions, so there is no distal, higher elevation direction from which the aquifer could receive artesian pressure. Figures 2.3-28–2.3-31 (pp. 2-194–197) show a close relationship between the potentiometric surface and the topographic surface, as occurs in unconfined aquifers. These figures and Figure 2.3-24 (p. 2-190) document seasonal variation of the potentiometric surface, indicating substantial communication between the aquifer and the Earth's surface, as typical for unconfined systems. The report contradicts itself with the preposterous statement on page 2-55 that "It is believed that on-site ponds not present during the Callaway Plant Unit 1 investigation likely provide enhanced groundwater recharge and hydraulic head to the underlying materials, thus explaining the artesian conditions." In fact, the page 2-55 statement that "The primary change to the Callaway Plant Unit 1 conceptual model is that the shallow aquifer is under confined conditions...." indicates that the earlier site investigation did not reach this implausible conclusion.

The upper part of the Cotter-Jefferson City aquifer (hereafter, "CJC") is likewise mischaracterized as a "confined" "artesian" aquifer (pp. 2-54, 2-89). Figures 2.3-28–2.3-31 (pp. 2-194–197) show a close relationship between the potentiometric surface and the local topographic surface, as is typical for unconfined aquifers. These figures also document seasonal variation of the potentiometric surface, indicating communication between the aquifer and the Earth's surface. We contest the statement of page 2-89 that "Regionally, the CJC aquifer is considered to be a minor aquifer and represents the top of the Cambrian-Ordovician aquifer system;" for example, see Imes (1988). Moreover, the proffered hydrologic calculations utilize assumptions of homogeneous permeability and porosity that are inappropriate for karst, as case histories demonstrate that standard methods can underestimate actual flow and transport velocities in such systems by 100 times or more (e.g., see Goldschieder et al. 2007).

A related misnomer is the description of the 250 to 290 ft-thick section immediately beneath the Graydon Chert as an "aquitard" (see pp. 2-53 top; 2-60). This geologic section is inconsistently described on these pages to include the Burlington limestone, the Bushberg sandstone, Snyder Creek formation, Callaway Limestone, the St. Peter Sandstone, and the upper CJC Dolostone. This "demarcation" thus divides the CJC Formations into an upper "aquitard" part and a lower "aquifer" part, and in effect claims that all rock units above the level of the Missouri River are "confined" and mostly "aquitards" (e.g., see Fig. 2.3-21 on p. 2-187). A significant oversight is that this "aquitard" includes the St. Peter sandstone, an important aquifer in many parts of Missouri that is inexplicably not mentioned elsewhere in ER Section 2.3; note that this rock unit crops out in lower Auxvasse and Logan Creeks to the south of the power block, as shown on the Geologic Map of Missouri (Anderson et al. 1979). In fact, outcrops of the St. Peter sandstone occur within 5 miles of the Callaway power block to the southeast, south, southwest and northwest; this unit cannot crop out to the north and northeast of the power block simply because the topographic elevations are everywhere too high. Saltpeter Cave, a well-known feature with 200 feet of mapped passage shown on the Morrison USGS topographic quadrangle, occurs in the St. Peter sandstone only 3 miles southeast of the power block (Deicke, 1959). In fact, the entire CJC formation and the overlying St Peter sandstone and several other units such as the Callaway limestone are included as part of the Ozark aquifer in the basic geologic literature for Missouri (e.g., Homyk et al., 1967, p. 282; Imes, 1988; Criss and Osburn, 2009).

Regarding the unconfined stream valley aquifers, no evidence is presented that supports the geologically improbable statement (p. 2-45) that "in most places, they are separated from the bedrock aquifers by low permeability beds of clay or shale.

The documentation of Ameren's own monitoring wells in Table 2.3-30 (e.g., p. 152-3) is insufficient. How can data from these wells support the proffered hydrogeologic analysis when basic and critical information is reported as unavailable (NA or NR) in relevant tables? The missing information in these tables includes the collar elevations of these wells, their total depths, their distance to the power block, their casing intervals, etc.

The report claims (p. 2-58, bottom) that "field personnel looked for evidence of groundwater discharge around the perimeter of the plateau and upper portions of the drainages down to approximately 700 ft msl." They found that the drainages are "consistently dry", though one "seep" was noted, and unspecified "evidence of a spring" is mentioned on p. 2-62. Further, page 2-67 asserts the "there was no evidence to suggest that the shallow aquifer is providing significant discharge to these drainages." Available evidence suggests that the aforementioned "site reconnaissance" was insufficient. For example, a prominent topographic feature called "Spring Hollow", a tributary of Mud Creek, is located at elevations above 700 feet in Sec 23, T46N, Range 8 W, only 1 mile due south of the power block (see the Mokane East USGS topographic quadrangle; this otherwise unmentioned feature can also be found by careful examination of Fig. 2.3-1 on p. 167). Interestingly, only the last six letters "ollow" of "Spring Hollow" appear on the detailed maps such as 2.3-28–2.3-31 (p. 2-194 to 2-197) in ER Sec. 2.3. Moreover, drill cores establish the presence of the Bushberg sandstone at an elevation of about 770 ft. MSL in the area of the power block, so this unit clearly would crop out in upper Spring Hollow. Many perennial springs and small caves are associated with the contact between the Bushberg Sandstone and adjacent carbonate strata in St. Louis County, and several of these are deep, vertical pits that would not likely be intersected by drilling (Criss et al., 2007).

The anticipated production of nearly 100 MGD of groundwater from two huge collector wells (caissons) in the Missouri alluvial aquifer is colossal, nearly 500 times larger than other nearby groundwater use in southern Callaway County. The seemingly innocuous statement (p. 2-87, bottom) that 15% of the pumped water "will be derived from upgradient sources of groundwater" actually represents a serious threat to existing groundwater users, because 15% of a huge number is also a huge number. Impacts to private and public wells located nearby, such as the private wells along CR 457 (see Fig. 2.3-63 on p. 2-229) can therefore be expected, as considerable groundwater will be produced from storage. Such impacts could be severe if the recharge rates to these aquifers are as low as Section 2.3 insists. Computer calculations are meaningless if inappropriate aquifer characteristics are used as parameter inputs. The potential for groundwater level drop in the Missouri floodplain should be further studied because proximal wetlands, riparian vegetation, and stream flow in the lower reaches of proximal tributary creeks, including Auxvasse, Logan and Mud Creeks, will very likely be adversely affected.

References:

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Goldscheider, N., Drew, D. and Worthington, S. (2007) Introduction, in Methods of Karst Hydrogeology, Goldscheider, N. and Drew, D., eds., Taylor and Francis, NY, p. 1-7.

Homyk, A., Harvey, E.J., and Jeffreys, H.G. (1967) Water Resources, in Mineral and Water Resources of Missouri, Report of the Missouri Division of Geological Survey and Water Resources and the US Geological Survey, v. 43, p. 258-399.

Imes, JL (1988) Geohydrology and hydrochemistry of the Ozark plateaus aquifer system, in Regional Aquifer Systems of the United States, Aquifers of the Midwestern Area. AWRA Monograph Series no. 13, p. 165-178.

The facts presented in this declaration and in the contention in the Petition to Intervene are true and correct to the best of my knowledge, and the opinions expressed in this declaration and in the contention, which I have reviewed, are based on my best professional judgment.

[signature]

April 3, 2009