Location Restrictions
MCPA, MCPB and MCPC
Meramec Energy Center

Contents

LOCATION RESTRICTIONS - MERAMEC ENERGY CENTER

I. Introduction

Ameren Missouri has evaluated the Meramec Energy Center's ("Meramec") MCPA, MCPB and MCPC active surface impoundments in accordance with location restrictions set forth below:

§257.60, Placement Above the Uppermost Aquifer;
§257.61, Wetlands;
§257.62, Fault Areas;
§257.63, Seismic Impact Zones; and
§257.64, Unstable Areas.

II. Background

A. Active Surface Impoundments

The Meramec Energy Center (Meramec) is located at the southernmost point in St. Louis County, Missouri at the confluence of the Mississippi and Meramec Rivers, approximately 3 miles southeast of the City of Arnold. Meramec has four active surface impoundments used to manage coal combustion residuals (CCR) produced at the facility. The active CCR surface impoundments are designated as MCPA (Bottom Ash Pond 492), MCPB (Bottom Ash Pond 493), and MCPC (Bottom Ash Pond 496), and MCPD (Fly Ash Pond 494).

MCPA, MCPB and MCPC were constructed in the 1950s, and are interconnected. The embankment separating MCPA and MCPC has been removed so that these two ponds currently act as a single incised impoundment with a combined surface area of 12 acres. MCPB is partially incised and bounded on the north by a short section of the perimeter embankment. The surface area of MCPB is approximately 7 acres.

III. Location Restrictions

A. Placement Above the Uppermost Aquifer – 40 CFR §257.60

Existing CCR surface impoundments must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.

Meramec is located on the northern side of the confluence of the Meramec and Mississippi rivers in an alluvial setting of water-deposited soils. The stratigraphy at the site is comprised of alluvium over Mississippian-aged limestone bedrock of the Middle Warsaw formation. The natural alluvium

consists of high plastic clays, silty clays and clayey silts, silty sands, and sands for a thickness of approximately 100 feet. The stratification of the alluvium is heterogeneous with discontinuous deposits of soft, high plastic clay in lenses. A layer of sand and gravel is intermittently encountered overlying the bedrock. During prior geotechnical investigations, the top of limestone bedrock was encountered at elevations ranging from 306 to 310 feet.

The Meramec Energy Center sits on fill that was borrowed from the incised portion of the surface impoundments constructed in the early 1950's. The fill is generally high plastic clay or silty clay. Construction activities have removed a significant portion of the uppermost fine-grained flood basin deposits at the locations of the CCR units.

Groundwater levels at the Meramec Energy Center closely follow the stage of the adjacent Mississippi River, which controls the level of the rivers at the confluence.

The base of MCPA, MCPB, and MCPC are not 5 feet above the upper limit of the uppermost aquifer and do not meet the requirements of 40 CFR §257.60.

1. Engineering Certification – Placement Above the Uppermost Aquifer

The existing CCR surface impoundments MCPA, MCPB and MCPC at the Meramec Energy Center were evaluated to determine if they were constructed with a base that is located no less than 5 feet above the upper limit of the uppermost aquifer, or if it can be demonstrated that there will not be intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR units and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table) to meet the requirements of 40 CFR §257.60, Placement Above the Uppermost Aquifer for Existing CCR Surface Impoundments.

CCR Unit	Meets requirements of 40 CFR §257.60
MCPA, MCPB and MCPC (Bottom Ash Pond)	No

Engineer's Seal

Jeff Bertel, P.E.
License: PE-2010025265, MO

B. **Wetlands – 40 CFR §257.61**

Existing CCR surface impoundments must not be located in wetlands as defined in §232.2, unless the owner or operator demonstrates that the CCR unit meets the requirements of §257.61(a)(1) through (5).

The existing CCR units at Meramec where evaluated to determine whether jurisdictional wetlands were located in proximity to each CCR unit and that the operation of the CCR Unit will not cause or contribute to significant wetland degradation. Engineering and biological assessments performed in 2016 and 2018, along with weekly inspections and effluent limitations contained in the facility's water operating permit confirm that CCR Units at Meramec are not causing or contributing to significant degradation of the wetlands adjacent to the CCR units.

The proximity of wetlands to the MCPA, MCPB and MCPC has been identified on aerial imagery by the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory[1] (NWI) Mapper. The NWI identifies wetlands to the north of the MCPA, MCPB and MCPC. The wetlands are defined as a riverine system that includes wetlands and deepwater habitat within a channel.

Water from these CCR units is discharged into the retention basin which ultimately discharges on the north side of these CCR units through Outfall 003 of Ameren's Missouri State Operating and National Pollutant Discharge Elimination System (NPDES) permit (MO-0000361) for Meramec. The NPDES permit is administered by the Missouri Department of Natural Resources (MDNR). Discharges through Outfall 003 are monitored and subject to the effluent limitations stipulated in the NPDES permit.

Meramec also has a Dust Control Plan to minimize CCR from becoming airborne and potentially causing or contributing to significant degradation of surrounding wetlands. The Dust Control Plan includes controls for managing fugitive dusts originating from CCR units, roads and other CCR management and material handling activities from becoming airborne. The primary controls used to minimize fugitive dust include system design, maintenance programs, traffic control, watering, and covering and handling procedures for the CCR materials.

[1] *The National Wetland Inventory is not dispositive on whether regulated wetlands exist at any particular location. According to Corps of Engineers' Guidance: "Since not all delineated areas on NWI maps are wetlands under Department of Army jurisdiction, NWI maps should not be used as the sole basis for determining whether wetland vegetation is present." 1987 Manual, at page 48. The Corps later states: "The optimum use of NWI maps is to plan field review (i.e., how wet, big, or diverse is the area?) and to assist during field review, particularly by showing the approximate areal extent of the wetland and its association with other communities." Id.*

MCPA, MCPB and MCPC are incised with an earthen embankment on the perimeter of the CCR units. In 2016, Reitz & Jens performed a Structural Integrity Criteria & Hydrologic/Hydraulic Capacity Assessment of Meramec and determined that MCPA, MCPB and MCPC meet or exceed the minimum stability factors of safety specified in 40 CFR §257.73(e)(1), Safety Factor Assessment. The perimeter embankment is also maintained with riprap or vegetative slopes to prevent erosion of exterior embankment material. The perimeter embankment is designed and maintained to prevent catastrophic release, migration of CCR, and/or erosion of embankment material from potentially causing or contributing to significant degradation of surrounding wetlands. In the remote chance that the earthen embankment circling the perimeter of the MCPA, MCPB and MCPC were to fail it could impact adjacent wetlands. However, the associated environmental impacts would be minimal.

Ameren also completed a comprehensive evaluation of surface and groundwater data that demonstrates that there are no adverse impacts resulting from coal ash management practices at Meramec on human health or the environment[2].

[2] Haley and Aldrich, Inc. (2018). "Human Health and Ecological Assessment of the Meramec Energy Center, Ameren Missouri." File No. 130182-002, Boston, MA.

1. Engineering Certification – Wetlands

Existing CCR surface impoundments must not be located in wetlands as defined in §232.2, unless the owner or operator demonstrates that the CCR unit meets the requirements of §257.61(a)(1) through (5). An assessment of the active CCR surface impoundments MCPA, MCPB, and MCPC at the Meramec Energy Center was conducted and used to prepare a demonstration that these CCR units meet the requirements of 40 CFR §257.61.

CCR Unit	Meets requirements of 40 CFR §257.61
MCPA, MCPB and MCPC (Bottom Ash Pond)	Yes

Engineer's Seal

Jeff Bertel, P.E.
License: PE-2010025265, MO

C. **Fault Areas – 40 CFR §257.62**

Existing CCR surface impoundments must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit. A fault is defined in §257.53 as a fracture or zone of fractures which strata on one side have been displaced with respect to the other side.

The Meramec CCR surface impoundments are not located within 200 feet of the outermost damage zone of a mapped fault that has had displacement in Holocene time. The closest mapped fault is the Maxville monocline and fault, which is about 1.9 miles south of Meramec. This fault is believed to be an extension of the Valmeyer anticline from Illinois that is part of a large family of structure in western Illinois and Missouri that all exhibit northwest trend, strong asymmetry, and commonly faulting on the steep limb. The Valmeyer anticline predates the Mississippian age St. Louis Limestone[3].

[3] Denny, F.B., R.J. Jacobson, and W.J. Nelson. (2009). "Bedrock Geology of Valmeyer Quadrangle, Monroe, County, Illinois." Illinois State Geologic Survey, Institute of Natural Resource Sustainability.

1. Engineering Certification – Fault Areas

Existing CCR surface impoundments must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit. An assessment of the active CCR surface impoundments MCPA, MCPB, and MCPC at the Meramec Energy Center was conducted to prepare a demonstration that these CCR units meet the requirements of 40 CFR §257.62.

CCR Unit	Meets requirements of 40 CFR §257.62
MCPA, MCPB and MCPC (Bottom Ash Pond)	Yes

Engineer's Seal

Jeff Bertel, P.E.
License: PE-2010025265, MO

D. **Seismic Impact Zones – 40 CFR §257.63**

Existing CCR surface impoundments must not be located in seismic impact zones unless the owner or operator demonstrates that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

The seismic acceleration determined for MCPA, MCPB and MCPC was based upon the USGS 2014 seismic hazard maps for a Peak Horizontal Ground Acceleration (PHGA) for seismic loading event with a 2% probability of exceedance in 50 years. The PHGA was factored for the seismic site class in accordance with ASCE 7 Minimum Design Loads for Buildings and Other Structures, International Building Code to obtain a site specific PHGA of 0.342g. Based on this finding, Meramec is located in a seismic impact zone.

MCPA, MCPB and MCPC were evaluated under seismic loading to determine if these CCR units design is adequate to prevent harmful release of CCR, leachate, and contaminants both during and after the design seismic event. In order to demonstrate the adequacy of the design we evaluated both liquefaction potential and slope stability.

Our analyses determined that there is an acceptable factor of safety for the post-earthquake load case and estimated probable maximum deformations as the result of seismic acceleration or liquefaction induced settlement. The magnitude of deformation has the potential to require immediate response as detailed in these CCR units' Operation & Maintenance Manual. However, it is not expected that these deformations will cause a catastrophic release of CCR. The MCPA, MCPB and MCPC designs are adequate to prevent harmful release of CCR, leachate, and contaminants both during and after the design seismic event.

1. Engineering Certification – Seismic Impact Zones

Existing CCR surface impoundments must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site. An assessment of the active CCR surface impoundments MCPA, MCPB, and MCPC at the Meramec Energy Center was conducted to prepare a demonstration that these CCR units meet the requirements of 40 CFR §257.63.

CCR Unit	Meets requirements of 40 CFR §257.63
MCPA, MCPB and MCPC (Bottom Ash Pond)	Yes

Engineer's Seal

Jeff Bertel, P.E.
License: PE-2010025265, MO

E. **Unstable Areas - 40 CFR §257.64**

Existing CCR surface impoundments must not be located in an unstable area unless the owner or operator demonstrates that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.

Meramec is located in an alluvial plain just north of the confluence of the Mississippi and Meramec Rivers. The stratigraphy at the site is comprised of alluvium over Mississippian-aged limestone bedrock of the Middle Warsaw formation. The natural alluvium consists of high plastic clays, silty clays and clayey silts, silty sands, and sands for a thickness of approximately 100 feet. The stratification of the alluvium is heterogeneous with discontinuous deposits of soft, high plastic clay in lenses. A layer of sand and gravel is intermittently encountered overlying the bedrock. During prior geotechnical investigations, the top of limestone bedrock was encountered at elevations ranging from 306 to 310 feet.

MCPA, MCPB, and MCPC at Meramec were evaluated to determine if they were located in an unstable area using data from existing geotechnical investigations and relevant information including maps showing regional bedrock geology, karst features, mines and other potential unstable features. There are no known springs, caves, sinkholes or rock outcrops within the alluvial plain. No other potentially significant geologic or geomorphic features have been identified at Meramec. No significant on-site or local human-made features or events, either surface or subsurface are in evidence at Meramec within the footprints of the CCR units.

The global stability and settlement of the CCR units were evaluated during design or after construction based on the as-built conditions. These evaluations show that the MCPA, MCPB, and MCPC are not susceptible to significant differential settling or mass movement.

1. Engineer's Certification – Unstable Areas

Existing CCR surface impoundments must not be located in an unstable area unless the owner or operator demonstrates that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted. An assessment of active CCR surface impoundments MCPA, MCPB, and MCPC at the Meramec Energy Center was conducted to prepare a demonstration that these CCR units meet the requirements of 40 CFR §257.64.

CCR Unit	Meets requirements of 40 CFR §257.64
MCPA, MCPB and MCPC (Bottom Ash Pond)	Yes

Engineer's Seal

Jeff Bertel, P.E.
License: PE-2010025265, MO