Location Restrictions
LCPB
Labadie Energy Center

Contents

LOCATION RESTRICTIONS - LABADIE ENERGY CENTER

I. Introduction

Ameren Missouri has evaluated the Labadie Energy Center's ("Labadie") LCPB active surface impoundment 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 Labadie Energy Center (Labadie) is located in northeastern Franklin County, Missouri. The plant is approximately 3 miles north of the Town of Labadie on the south bank of the Missouri River at river mile 57.5. Labadie has two active surface impoundments that are designated as LCPA (Bottom Ash Pond) and LCPB (Fly Ash Pond), and one active landfill designated as LCL1 (Landfill Cell 1). The surface impoundments are used to manage process waters along with fly and bottom ash. The surface impoundments are formed by single stage industrial embankment dams that impound approximately 243-acres. Decant water from LCPB flows via submerged pumps into the LCPA before being discharged, through an MDNR NPDES Outfall, into a manmade channel located at the western edge of the property. This channel runs parallel to Labadie Creek before discharging into the Missouri River.

LCPB was built in the 1990s and is located east of LCPA and south of the plant. LCPB occupies an area of approximately 79 acres and is used to manage fly ash only. A section of the earthen embankment that encircles LCPA, also forms the western edge of LCPB.

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.

Labadie is located within an extensive area of alluvial deposits largely derived from the Missouri River, which bounds the site to the north. The alluvial soils vary both with depth and in horizontal extent. The near-surface soils are generally clays and silty clays with scattered seams and layers of low plastic silt, underlain by silts. There is not an overall pattern to the stratification of the near-surface soils, except for the presence of clayey sandy silt at the surface near the southern end of the site. Sandy silts, silty fine sands, and fine sands underlie the near-surface soils. These soils are underlain by poorly-graded sands with some silty sands and gravelly sands at greater depths. Recent geologic mapping of the Labadie area by DGLS[1] indicate that the bedrock underlying the alluvium is most likely the Jefferson City-Cotter limestone formation.

Monthly measurements made over the 12-consecutive month time period from December 2009 through November 2010 as part of the Detailed Site Investigation for the Labadie UWL. This data showed the water table in the alluvial aquifer fluctuated during routine monthly measurements. When topographic differences across the site are considered, the water table depth below ground surface typically varied during a given month. Groundwater levels were relatively uniform across the site during any given monitoring event and are primarily controlled by the Missouri River levels.

The base of LCPB is not 5 feet above the upper limit of the uppermost aquifer and does not meet the requirements of 40 CFR §257.60.

[1] Starbuck, E. (2010), "Bedrock Geologic Map of the Labadie 7.5' Quadrangle, Franklin and St. Charles County, Missouri", Missouri Department of Natural Resources, Division of Geology and Land Survey, Open File Map OFM-10-556-GS.

1. Engineering Certification – Placement Above the Uppermost Aquifer

The existing CCR surface impoundment LCPB at the Labadie Energy Center was evaluated to determine if it was 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 unit 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
LCPB (Fly 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 Labadie where evaluated to determine the location of jurisdictional wetlands in proximity to each CCR unit and to confirm 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 Labadie are not causing or contributing to significant degradation of the wetlands adjacent to the CCR units. CCR Units LCPA and LCPB are scheduled to undergo closure once a wastewater treatment facility has been constructed and placed into service.

The proximity of wetlands to the LCPB has been identified on aerial imagery by the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory[2] (NWI) Mapper. The NWI identifies wetlands to the west and south of the LCPB.

The interior of the LCPB is lined with 60 MIL HDPE on the interior slopes, and 40 MIL HDPE on the pond bottom. LCPB receives process water used to sluice fly ash and discharges into LCPA. LCPB does not have an NPDES permitted discharge.

Labadie 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.

[2] *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.*

LCPB is incised with an earthen embankment circling the perimeter of the CCR unit. In 2016, Reitz & Jens performed a Structural Integrity Criteria & Hydrologic/Hydraulic Capacity Assessment of Labadie determined that LCPB meets or exceeds the minimum stability factors of safety specified in 40 CFR §257.73(e)(1), Safety Factor Assessment. The perimeter embankment is also maintained with 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 LCPB 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 Labadie on human health or the environment[3].

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 impoundment LCPB (Bottom Ash Pond) at the Labadie Energy Center was conducted and used to prepare a demonstration that the CCR unit meets the requirements of 40 CFR §257.61.

CCR Unit	Meets requirements of 40 CFR §257.61
LCPB (Fly Ash Pond)	Yes

Engineer's Seal

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

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

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.

LCPB is not located within 200 feet of the outermost damage zone of a fault known to exist that has had displacement in Holocene time. Recent geologic mapping of the Labadie area by Starbuck (2010) shows the existence of a structural feature termed the "Klondike Monocline" on the river bluffs north and east of the site. This feature has a strike of approximately N. 45° W. and dips to the northeast, toward the Eureka-House Springs Anticline which is approximately 5 to 6 miles northeast of the site. These features were formed as a result of periods of uplift in the Ozarks. There is no literature indicating that these faults are currently active or have been active during Holocene time.

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 impoundment LCPB (Fly Ash Pond) at the Labadie Energy Center was conducted to prepare a demonstration that the CCR unit meets the requirements of 40 CFR §257.62.

CCR Unit	Meets requirements of 40 CFR §257.62
LCPB (Fly 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 the LCPB 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 0.259g. Based on this finding, Labadie is located in a seismic impact zone.

The LCPB was evaluated under seismic loading to determine if the CCR unit 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. This magnitude of deformation has the potential to require immediate response as detailed in this CCR unit's Operation & Maintenance Manual. However, it is not expected that these deformations will cause a catastrophic release of CCR. The LCPB design is 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 impoundment LCPB (Fly Ash Pond) at the Labadie Energy Center was conducted to prepare a demonstration that the CCR unit meets the requirements of 40 CFR §257.63.

CCR Unit	Meets requirements of 40 CFR §257.63
LCPB (Fly 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.

Labadie is located within an extensive area of alluvial deposits largely derived from the Missouri River, which bounds the site to the north. The alluvial soils vary both with depth and in horizontal extent. The near-surface soils are generally clays and silty clays with scattered seams and layers of low plastic silt underlain by silts. There is not an overall pattern to the stratification of the near-surface soils, except for the presence of clayey sandy silt at the surface near the southern end of the site. Sandy silts, silty fine sands, and fine sands underlie the near-surface soils. These soils are underlain by poorly-graded sands with some silty sands and gravelly sands at greater depths. Recent geologic mapping of the Labadie area by DGLS (Starbuck, 2010) indicate that the bedrock underlying the alluvium is most likely the Jefferson City-Cotter limestone formation.

The CCR units at Labadie 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 Labadie. No significant on-site or local human-made features or events, either surface or subsurface are in evidence at Labadie 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 CCR units 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 impoundment LCPB (Fly Ash Pond) at the Labadie Energy Center was conducted to prepare a demonstration that the CCR unit meets the requirements of 40 CFR §257.64.

CCR Unit	Meets requirements of 40 CFR §257.64
LCPB (Fly Ash Pond)	Yes

Engineer's Seal

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