



**RUN-ON AND RUN-OFF
CONTROL SYSTEM PLAN
LABADIE ENERGY CENTER
LCL1**

*Labadie Energy Center
226 Labadie Power Plant Road
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I. Introduction

Ameren Missouri has evaluated the Labadie Energy Center's ("Labadie") CCR landfill LCL1 in accordance with operating and design criteria requirements set forth below:

§257.81, Run-on and Run-off Controls for CCR Landfills.

For this initial assessment, Ameren Missouri retained the engineering firm Reitz & Jens, Inc. to evaluate Labadie's Run-on and Run-off Control System Plan for the permitted Ameren Missouri Labadie Utility Waste Landfill (UWL). The objective of this assessment is to determine if the existing plan meets the requirements of §257.81. These requirements state that a CCR landfill must be designed, constructed, operated and maintained with a run-on control system to prevent flow onto the active portion of the CCR unit during the peak discharge from a 24-hour, 25-year storm, and a run-off control system from the active portion of the CCR unit to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

II. Background

Labadie UWL is a permitted utility waste landfill in northeastern Franklin County, Missouri. The UWL is permitted by the Missouri Department of Natural Resources (MDNR) Solid Waste Management Program (SWMP) under State of Missouri Solid Waste Disposal Area Construction Permit Number 0907101. The permitted footprint for disposal of utility waste covers approximately 166.5 acres and will be developed in four phases. Phase I consists of the development of LCL1, which has a disposal area of approximately 31.4 acres, and a 5.7-acre stormwater pond. LCL1 is currently under construction, with completion schedule for fall 2016.

III. Run-on and Run-off Control System Plan

LCL1 contains a perimeter berm constructed around the entire disposal area that will function as a flood protection dike. The top of the perimeter berm will be at elevation 488.0 feet, approximately 4 feet higher than the current Base Flood Elevation at the UWL site and 0.5 feet above the 500-year flood level. Run-on to LCL1 will consist of precipitation falling within the perimeter berm.

Stormwater management requirements will change throughout the operating life and closure of UWL Phases 1, 2, 3 and 4. Ameren Missouri's objective to contain and reuse as much stormwater falling within the footprint of the UWL as possible is the primary factor in the design of the stormwater controls that will result in 'no discharge' from the UWL. Other factors that add or subtract significant water quantities from the UWL include: infiltration of direct precipitation; evaporation and evapotranspiration; and water re-used on-site for CCR moisture conditioning and dust control.

Routine wastewaters generated from the leachate collection system and direct precipitation on the UWL area will be managed as a closed loop system. Precipitation will be collected and routed to the stormwater pond. The pond will collect stormwater runoff from the perimeter ditches around the UWL cell and, with the leachate collection system, will form a water management system that will contain, temporarily store and process all waters within the active UWL for reuse or proper management. Leachate and stormwater will either be used for dust control within the UWL area, conditioning to achieve appropriate moisture content for CCR materials prior to placement, and/or makeup water for future scrubber additions to the plant. To the extent wastewater quantities exceed these management options, discharges from the leachate and stormwater systems may be pumped to the Labadie Energy Center for management if the existing NPDES permit is revised, or may be disposed at an off-site treatment facility.

A. Stormwater Runoff Controls

The drainage structures included in the UWL are designed to collect and control at least the water volume resulting from a 24-hour, 25-year storm¹. Stormwater in active disposal areas will be controlled by a system of perimeter berms, let down channels, side slope bench drainage ways and perimeter ditches; all ultimately conveying runoff to the on-site stormwater holding pond. Some of the stormwater falling into active disposal areas that infiltrates into the CCRs will ultimately drain to the leachate sumps in the bottom of each cell where it will be removed by pumping to above ground tanks for temporary storage. Landfill operations will maintain slopes on active landfill areas to minimize ponding.

During the initial, active operation of disposal cells, stormwater runoff may temporarily pond on the CCRs within the UWL. Temporary collection basins will be located within the active disposal cell and temporary pumps used to pump accumulated runoff to the perimeter ditch or directly to the adjacent stormwater holding pond to minimize the amount of stormwater that infiltrates into the waste. After the elevation of in-place CCR exceeds the bottom of the perimeter ditch, the CCRs will be graded to maintain slopes on active landfill areas to avoid ponding, except in temporary collection basins. Ultimately, the perimeter ditch will convey stormwater from the side slopes, let down structures, and side slope benches to the on-site stormwater holding ponds. These structures are described below, starting at the top of the UWL.

Small perimeter berms on top of the UWL near the slope break line will be maintained to direct stormwater runoff from the top of the UWL to designated let down structures located around the UWL top perimeter. The letdown structures will convey the runoff in a controlled manner from the top of the UWL to the perimeter ditch or surrounding ground surface. Letdown structures have been sized to minimize the number of drainage channels that must be constructed and maintained around the perimeter of the UWL.

¹ Huff, F.A. and J.R. Angel. (1992). "Rainfall Frequency Atlas of the Midwest." Bulletin 71, Midwestern Climate Center and Illinois State Water Survey.

Side slope benches and letdown structures are designed to carry stormwater from the upper portion of the UWL slopes to the perimeter ditch and, ultimately, after closure to the surrounding ground surface around the completed UWL.

During operations, the active disposal area may have both closed areas and active areas. Temporary structures consisting of ditches or berms are used to control flows during the on-going landfill operations. All stormwater that comes in contact with CCRs in the active areas will be managed within the active disposal area as described above and conveyed to the on-site stormwater holding pond. Stormwater collected in the pond will be re-used or treated; there is no discharge to the environment.

Management of surface water runoff after closure is addressed by dividing the closed UWL into distinct drainage areas to control runoff quantities and velocities from the final UWL surface. Stormwater falling on closed UWL sections will be conveyed to the outside toe of the perimeter berm where it will be discharged. The side slope benches and letdown structures define individual drainage areas for the final contours of the landfill.

Surface water structures are designed to manage flow rates, quantities and velocities resulting from the 25-year, 24-hour rainfall event. Runoff volumes were calculated using the Rational Method. Stormwater diversion structures, capacities and velocities were calculated using Manning's Equation for open channel flow. The perimeter ditch used to convey stormwater to the pump station or stormwater holding pond is modeled using both Bernoulli's Equation and Manning's Equation.

Erosion of the final cover, side slope benches, stormwater letdown structures, and perimeter ditches were evaluated using North American Green's Version 4.31 Erosion Control Materials design software. The software uses the Revised Universal Soil Loss Equation to conservatively evaluate the amount of erosion that will occur on a slope. The software conservatively evaluates channel erosion using the maximum shear strength method outlined in the Federal Highway Administration's HEC #15 and the United States Agricultural Department's Ag Handbook #667. All drainage structures will be protected from erosion using one of several possible materials: an erosion control mat, limestone riprap, or other manufactured erosion control product.

Engineering support for the Run-on and Run-off Control System Plan is contained in the facilities operating record and in the application for the MDNR SWMP State of Missouri Solid Waste Disposal Area Construction Permit Number 0907101.

1. Engineering Certification – Run-on and Run-off Control System Plan

The 2016 Run-on and Run-off Control System Plan was evaluated for the new CCR landfill LCL1 at the Labadie Energy Center. The initial Run-on and Run-off Control system Plan meets or exceeds the requirements of 40 CFR 257.81. The engineering support for this certification has been placed in the operating record.

CCR Unit	Run-on and Run-off Control System Plan meets or exceeds the requirements of 40 CFR 257.81.
LCL1	Yes

Engineer's Seal



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