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Title: Evaluating Reductions in Modeled Flux as a Metric for Demonstrating Regulatory Compliance for Coal Combustion Residual (CCR) Surface Impoundments following Closure

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Key Topic: Modeling

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Client Name: Confidential

Project Name: Confidential

Project Location: Confidential

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ABSTRACT

Background/Objectives:

Closure and groundwater corrective action at coal combustion residual (CCR) surface impoundments requires assessment of potential remedial alternatives that address both the source of impacts (CCR in the surface impoundment) and impacted groundwater. Groundwater flow and transport modeling is a useful tool for comparing the effectiveness of remedial alternatives, estimating time to reach applicable groundwater standards, and evaluating post-closure performance. Modeling may also be a requirement. For example, Illinois Part 845 regulations, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (promulgated in 2021), require results of groundwater contaminant transport modeling and calculations showing how compliance with the applicable groundwater standards will be met for corrective action and closure permit applications. Part 845 regulations also require closure plans which include Closure in Place (CIP) must demonstrate that CIP will control, minimize, or eliminate as much as feasible "post-closure infiltration of liquids" and releases of CCR, leachate, or contaminated runoff. Groundwater models were used to demonstrate compliance with Part 845 requirements by quantifying modeled reduction in hydraulic flux into and out of CCR remaining in place.

Approach/Activities:

Groundwater models were used to demonstrate reductions in infiltration into CCR and reduction of hydraulic flux out of the CCR compared to pre-closure conditions. Evaluations of post-closure water flux through the consolidated and covered CCR were completed using data obtained from the CIP prediction models when simulated post-closure heads in the groundwater monitoring wells were predicted to stabilize (approximate hydraulic steady state). The post-closure movement of water in and out of the CCR at approximate hydraulic steady state were compared to pre-closure conditions to determine the reduction in hydraulic flux following closure construction activities.

Results/Lessons Learned:

The pre-closure (calibration model) and post-closure CIP prediction model simulated hydraulic flux values were provided in appendices, tabulated, and illustrated in figures presented in the Groundwater Modeling Reports submitted to the agency in support of CIP designs and compliance with Part 845. Data export files (data extracted from the models using the computer code) used for flux evaluations were included along with electronic model files in Groundwater Modeling Report appendices submitted to the agency. In each case CIP was predicted to reduce both total flux in and out of the CCR when simulated post-construction heads in the groundwater monitoring wells are predicted to stabilize (approximate hydraulic steady state), thus demonstrating CIP will control, minimize, or eliminate as much as feasible "post-closure infiltration of liquids" and releases of CCR, leachate, or contaminated runoff in compliance with Part 845. Future work includes incorporating mass flux along with hydraulic

flux estimates. Feedback received thus far from industry contacts indicates we are way out in front of other owner/operators with CCR management units.

Aspect of Work that Relates to Sustainability:

Groundwater models can be used to demonstrate CIP is an effective closure and corrective action alternative, which also has the following sustainable benefits over other alternatives like landfilling: for example; less traffic congestion is expected, as compared to the off-site landfill option; accidents, noise, traffic, air pollution to nearby residents and communities would be less because of reduced off-site vehicle travel; short-term impacts of noise, visual disturbances, construction on scenic and recreational values will be smaller, due to shorter duration of construction; less impacts on greenhouse gas emissions and energy consumption. Risk assessments completed for each site also demonstrated that no risks to either human or ecological receptors will be present post-closure. CIP activities pose only short-term impacts on recreational use of neighboring surface water bodies and the terrestrial species located near the impoundments during construction activities (which are shorter than other alternatives).