BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	R 2020-019
STANDARDS FOR THE DISPOSAL OF	)	
COAL COMBUSTION RESIDUALS IN	)	(Rulemaking – Water)
SURFACE IMPOUNDMENTS:	)	
PROPOSED NEW 35 ILL. ADM.	)	
CODE 845	)	

NOTICE OF FILING

To: Service List

PLEASE TAKE NOTICE that I have today electronically filed with the Office of the Clerk of the Pollution Control Board Midwest Generation, LLC's Pre-Filed Testimony of David E. Nielson, P.E., a copy of which is herewith served upon you.

Dated: August 27, 2020

MIDWEST GENERATION, LLC

By: ___/s/Kristen L. Gale ___________

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CERTIFICATE OF SERVICE

The undersigned, an attorney, certifies that a true copy of the foregoing Notice of Filing, and Midwest Generation, LLC's Pre-Filed Testimony of David E. Nielson, P.E. was electronically filed on August 27, 2020 with the following:

Don Brown, Clerk of the Board
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and that copies were sent via e-mail on August 27, 2020 to the parties on the service list.

Dated: August 27, 2020 /s/Kristen L. Gale ____________

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STANDARDS FOR THE DISPOSAL	)	
OF COAL COMBUSTION RESIDUALS	)	R 2020-019
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PRE-FILED TESTIMONY OF DAVID E. NIELSON, P.E.

Introduction

My name is David E. Nielson I am a Sr. Consultant and Sr. Manager with Sargent & Lundy (S&L). S&L is an Illinois-based engineering firm with over 125 years of history focused on the design of electric power generation and transmission systems. I have over 30 years of professional experience as a geotechnical and civil engineer. I have been a licensed professional engineer (civil) in the state of Illinois in good standing since 1993. My professional career has included services associated with coal combustion residuals (CCR), industrial waste surface impoundments, industrial waste landfills, and municipal solid waste (MSW) landfills in numerous states and regulatory environments since 1990. My curriculum vitae is attached.

I have been retained on behalf of Midwest Generation to review and comment on the Illinois Environmental Protection Agency's (IEPA) proposed Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Reference 1, which is referred to herein as the "Proposed Illinois CCR Rule").

My testimony will focus on the following sections of the Proposed Illinois CCR Rule:

- Section 845.420: Leachate Collection and Removal System
- Section 845.770: Retrofitting

COMMENTS ON SECTION 845.420
LEACHATE COLLECTION AND REMOVAL SYSTEM

Leachate Collection & Removal System Requirements

The IEPA has incorporated a leachate collection requirement for new and retrofitted CCR surface impoundments in Section 845.420 of the Proposed Illinois CCR Rule. This essentially requires a drainage layer at the base of new and retrofitted CCR surface impoundments with the purpose of reducing the hydraulic head on the impoundment's composite liner system. Per the IEPA:

> "A new CCR surface impoundment must be designed, constructed, operated and maintained with a leachate collection and removal system. The purpose of this Section is to minimize the amount of head on the liner system which will decrease the potential for the movement of fluids through the liner. The system is similar to leachate collection systems required for solid waste landfills." (Reference 1, Statement of Reason, Part IV [1] ("Regulatory Proposal: Language"), Section 845.420: Leachate Collection and Removal System)

Section 845.420 of the Proposed Illinois CCR Rule details the requirements for leachate collection systems for new and retrofitted CCR surface impoundments. For this testimony, I am focusing on the following excerpts from the Proposed Illinois CCR Rule (paragraph numbering from the rule is preserved for clarity):

a) The leachate collection and removal system must:

1) be placed above the liner required by Section 845.400 or Section 845.410;

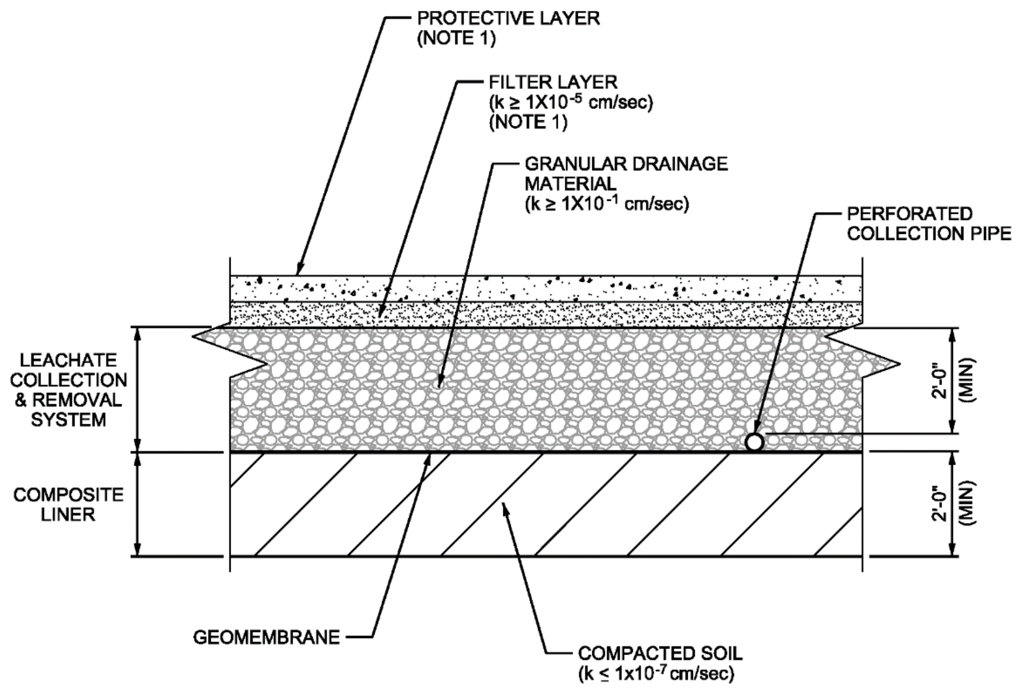
2) have placed above it a filter layer that has a hydraulic conductivity of no less than 1 $x10^{-5}$ cm/sec;

4) be constructed of drainage materials with a hydraulic conductivity of 1 x 10^{-1} cm/sec or more and a thickness of 24 inches or more above the crown of the collection pipe; or constructed of synthetic drainage materials with a transmissivity of 6 x 10^{-4} m^2/sec or more;

7) have collection pipes

A) designed such that leachate is collected at a sump and is pumped or flows out of the CCR surface impoundment;

These requirements are graphically depicted in Figure 1. When a new or retrofitted CCR surface impoundment is operating, the CCR transport water (leachate) will be directly above the protective layer, which would likely be gravel or crushed limestone.



MINIMUM REQUIREMENTS PROPOSED BY ILLINOIS EPA FOR
CCR SURFACE IMPOUNDMENT LINER & LEACHATE COLLECTION & REMOVAL SYSTEM

FIGURE 1

NOTE 1: PROPOSED 35 ILL. ADM. CODE 845.420 DOES NOT SPECIFY THICKNESS REQUIREMENTS FOR THE PROTECTIVE AND FILTER LAYERS.

The Federal CCR Rule (Reference 2) does not require leachate collection and removal systems for the transport water in CCR surface impoundments. During the rulemaking phase of these federal CCR disposal standards, the US EPA evaluated if a leachate collection and removal system should be required for new and retrofitted CCR surface impoundments. In the 2010 proposed rule (Reference 3), the US EPA proposed a leachate collection and removal system be installed between the flexible membrane liner (FML, i.e., geomembrane) and low-permeability soil components of the impoundment's composite liner system. This was a modification of the double liner system required by the US EPA for hazardous waste land disposal units, which was justified by the US EPA's initial CCR risk assessment in which the agency concluded that "composite liners effectively reduce risks from all constituents to below the risk criteria for both landfills and surface impoundments" (Reference 3, p. 35174). The US EPA continued, "[T]he Agency believes a composite liner system would be adequately protective of human health and the environment and a double liner system would be unnecessarily burdensome" (Reference 3, p. 35174).

Following several years of additional research and review of comments on the 2010 proposed rule, in 2015 the US EPA finalized the Federal CCR Rule, in which the agency concluded that it was counterproductive and erroneous to require a leachate collection and removal system between the two component's of a CCR surface impoundment's composite liner system (Reference 2, p. 21369). The agency stated:

> "The proposed requirement for CCR surface impoundments to construct a leachate collection system between the FML and soil components would prevent the direct and uniform contact of the upper and lower components and, therefore, compromise the integrity of the composite liner. For this reason, EPA is not requiring a leachate collection and removal system for new surface impoundments or any lateral expansion of a CCR surface impoundment." (Reference 2, p. 21369)

It is notable that the US EPA did not require a leachate collection and removal system for CCR surface impoundments. The agency could have required the leachate collection and removal system be installed above the impoundment's composite liner system (as the Proposed Illinois CCR Rule), which would maintain the integrity of the liner. However, after performing an exhaustive risk assessment, which included modeling of and reviewing the available data on both proven and potential damage cases , the agency determined that a leachate collection and removal system was not necessary for CCR surface impoundments to be protective of human health and the environment.

Risk Evaluation of CCR Surface Impoundments Without Leachate Collection and Removal Systems

The US EPA performed an exhaustive risk assessment during the development of the Federal CCR Rule. This EPA risk assessment used mathematical models to determine the rate at which chemical constituents may be released from different CCR waste management units, to predict the fate and transport of these constituents through the environment, and to estimate the resulting risks to human and ecological receptors. In addition to extensive sensitivity analysis and as a further method of validation, EPA compared the results of the sensitivity and uncertainty analyses with proven and potential damage cases. Together these analyses and comparisons show that there is a high degree of confidence in the principal findings of the probabilistic analysis.

The findings from this analysis are presented in a detailed public report (Reference 4). The stated purpose of this study was:

> "…to characterize the risks that may result from the current disposal practices for coal combustion residuals (CCRs) and provide a scientific basis for the development of regulations necessary to protect human health and the environment under the Resource Conservation and Recovery Act (RCRA)." (Reference 4, p. ES-1)

One of the conclusions of this risk analysis was:

> "**Composite liners** were the only liner type modeled that **effectively reduced risks** from all pathways and constituents **far below human health and ecological criteria** in every sensitivity analysis conducted." (Bolding added for emphasis) (Reference 4, p. ES-7)

To validate the modeling, the study also compared the results to proven and potential damage cases. This comparison was summarized:

> "Due to the differing nature of these two sources of information, a direct comparison would not be relevant. However, general characteristics and conclusions from the damage cases are relevant to support the findings of the risk assessment, and are discussed below. …**No damage cases were identified for composite-lined units**. This agrees well with the results of the sensitivity analyses, which showed … … that **risks for composite-lined units were far below all cancer and noncancer criteria**." (Bolding added for emphasis) (Reference 4, p. 5-47)

Based on the conclusions made in US EPA's Risk Assessment (Reference 4) and the lack of damage cases for composite-lined CCR surface impoundments, I agree with the US EPA's determination that a leachate collection and removal system is not necessary for CCR surface impoundments to be protective of human health and the environment.

In written questions regarding the US EPA's Risk Assessment (Reference 4) the IEPA was asked, "Has IEPA reviewed that risk assessment?" The IEPA response was "No. The Agency is aware this document exists." (Reference 5, Page 37, Agency's response to Q 3.a). When asked "Did IEPA rely upon U.S. EPA's risk assessment to support its Part 845 proposal?" the agency responded, "Only to the extent that USEPA's risk assessment was used by USEPA to develop the requirements of Part 257." (Reference 5, Page 37, Q 3.b).

As a licensed professional engineer, I believe that valid scientific studies, similar to the US EPA's Risk Assessment, should be the primary basis for environmental regulation, which does not appear to be the case for the leachate collection and removal system requirements in the Proposed Illinois CCR Rule. Understanding that the IEPA and the Illinois Pollution Control Board are on a very short deadline pursuant to the new Section 22.59 of the Illinois Environmental Protection Act, both agencies should look to the thorough study and analysis conducted by the US EPA when they developed the Federal CCR Rule, as well as the recommendations against leachate collection systems in impoundments. Following a thorough review of this information by the IEPA and the Pollution Control Board, I suggest that the Pollution Control Board should not require a leachate collection and removal system for new and retrofitted CCR surface impoundments in Illinois.

Operational Implications of Leachate Collection and Removal from Impoundments

The collection and removal of leachate from MSW landfills is a well-established requirement and an industry standard. However, removing CCR transport water (leachate) from surface impoundments is not an industry standard because it is not practical given the inherent operation of a surface impoundment. In fact, calling the transport water "leachate" is a bit of a misnomer. Leachate from an MSW landfill is very different than transport water used to move CCR from a power station; the volume and purpose of liquid is vastly different. MSW landfill leachate is the combination of precipitation that falls on open cells that percolates through the waste to the leachate collection system and the liquid generated as the solid waste degrades and compresses in the landfill. The flow rate of leachate collected in an MSW landfill is typically less than 1/10th of the typical flow rate of CCR transport water system, which are usually about 3,000 to 5,000 gpm. One additional significant difference in MSW landfill leachate and transport water is that while MSW leachate is a waste product, the transport water is a vital part of the operation of a power plant to cool and move the CCR from a power station to waste treatment unit such as a CCR surface impoundment.

The IEPA's basis for requiring a leachate collection and removal system is to reduce the hydraulic head on an impoundment's liner as a proactive means of protecting groundwater (Reference 1, p. 19). However, the Proposed Illinois CCR Rule does not mandate the removal of leachate or the maximum hydraulic head level on a pond liner system. Moreover, during the August 12, 2020 Hearing, Ms. Gale asked, "So are you saying that under these rules the head should be limited to 30 centimeters?" and Mr. Buscher of the IEPA responded "… no, I don't think that can be done because it's an operational consideration of the CCR impoundment. I think that that might not allow the owner or operator of a CCR impoundment the flexibility they would need to properly operate the impoundment." (Reference 6, p. 141. l. 15 – 24). I concur with Mr. Buscher's opinion regarding mandating a maximum water level above the liner of CCR impoundments in Illinois. In my opinion, the decision whether to install a leachate collection and removal system that will be operated as determined by the Owner/Operator should be made by the Owner/Operator.

Installing a leachate collection and removal system in a CCR surface impoundment is not practical because, if the system was to operate, the pond would likely be dry, causing negative consequences such as fugitive dust emissions.

To better understand the implications of collection and removal of leachate from a pond floor, consider the following hypothetical scenario. The flow rate through the filter layer, which is the most restrictive layer above the leachate collection system, as required by the Proposed Illinois CCR Rule, for a hypothetical 20-acre CCR surface impoundment is calculated using Darcy's Law for flow through porous media. The flow per unit area (Q/A) is:

$Q/A = k \times ((h/t) + 1)$, (Reference 2, p. 21474)

where:

Q = flow rate (cubic feet/second);
A = surface area of the area considered (square feet);
k = hydraulic conductivity of the filter layer (feet/second);
Assume $k = 1 \times 10^{-5}$ cm/sec = 3.28×10^{-7} ft/sec
h = hydraulic head above the filter layer (feet); Assume impoundment water is 20 ft deep; and
t = thickness of the filter layer (feet); Although not specified, assume 6 inches or 0.5 ft..

$Q/A = 3.28 \times 10^{-7}$ ft/sec x ((20/.5) + 1) = 1.3×10^{-5} ft/sec = 0.048 ft/hr

Assuming the hydraulic conductivity of the filter layer is the minimum permitted by the Proposed Illinois CCR rule (1×10^{-5} cm/sec =3.28×10^{-7} cm/sec), the water in the pond is 20-feet deep, and the filter layer is 6-in. thick (it is noted that no minimum thickness is specified by the Proposed Illinois CCR Rule), the total flow per hour in the 20-acre pond is:

Q = 20 ac x 43,560 ft^2/ac x 0.048 ft/hr = 42,000 ft^3/hr = 5,300 gpm = 7.5 million gal/day

Since the hydraulic conductivity used in this example was the lowest permeability allowed by the Proposed Illinois CCR Rule, and since the filter layer thickness was assumed to be six inches, the calculated flow could be significantly higher with more permeable or thinner filter materials. It is noted that in my experience with CCR sluice systems, the flow rate into the pond is typically on the order of 3,000 to 5,000 gpm. Thus, this hypothetical CCR surface impoundment would not be able to contain significant free water since the flow rate into the leachate collection and removal system would be effectively equal to the flow rate of CCR into the impoundment. Consequently, this hypothetical pond would generally be dry, which would result in a higher likelihood of fugitive dust risks to the environment.

The IEPA clarified that water collected by a leachate collection and removal system could be returned to the impoundment (Reference 5, p. 16, Agency's Answer to Question 36.a). But that creates other issues, including the impracticality of having one pump system designed to remove water from the leachate collection system and return it to the pond, and a second pump system to reuse the water that is typically impounded as the source for the CCR sluicing system, which is the typical process flow for sluice water system. If these two systems are operated simultaneously, they would require “tank like” water storage for the sluice water return system to operate. Additionally, when the sluice system is not operational, the leachate collection and removal system is not really what its name suggests; instead it is a filtration system that constantly circulates the transport water without serving any other purpose.

Alternatively, the Proposed Illinois CCR Rule could suggest that the leachate collection and removal system would not operate until the closure of the CCR surface impoundment. However, I do not believe the Illinois CCR Rule should require installation of a leachate control and removal system that would be idle until closure, since other dewatering options are available. The installation of a leachate collection and removal system in the hypothetical 20-acre surface impoundment presented earlier is expected to require the mining, transportation, and placement of over 70,000 cubic yards (3,500 to 4,500 truckloads) of free-draining gravel, which may not be considered to be a prudent use of natural resources, given the US EPAs position on the adequacy of composite liners without leachate collection.

Approved State CCR Rules and Leachate Collection & Removal Systems for CCR Surface Impoundments

To date, two states (Oklahoma and Georgia) have obtained US EPA approval of their CCR programs. Neither of these states have a requirement to install a leachate collection and removal system in a CCR surface impoundment. Also, I am not aware of any other state requiring (or proposing to require) a leachate collection and removal system in a CCR surface impoundment

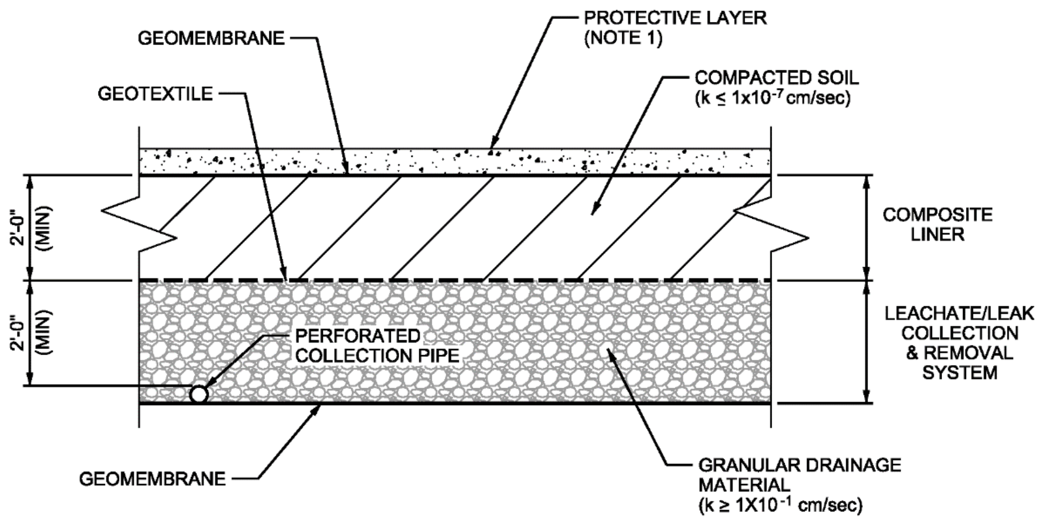
Groundwater Protection

Since the IEPA’s stated reason for this leachate collection and removal system is to “minimize the amount of head on the liner system which will decrease the potential for the movement of fluids through the liner,” protection of the groundwater is further considered. The Federal CCR Rule and the Proposed Illinois CCR Rule both require a system of groundwater monitoring wells near the waste boundary of a CCR surface impoundment (Reference 1, Section 845.630.a.2), which is effectively an early leak detection system and thus allow any required remedial actions to be implemented before offsite groundwater impacts.

Alternate Leachate Collection System

Based on the preceding discussions, I do not believe that a leachate collection and removal system is necessary in a CCR surface impoundment to protect human health and the environment. Further, I do not agree that the one design as mandated by IEPA should be to only acceptable "one size fits all option" in the event leachate collection remains within this rule.

I recognize that the IEPA is seeking a more proactive measure in protecting groundwater than the protection provided by the composite liner system and regular groundwater monitoring. Given my concerns with the system described in the Proposed Illinois CCR Rule, I suggest the Illinois Pollution Control Board should allow an alternative method of leachate collection that is at least as protective as the system required by the Proposed Illinois CCR Rule. For example, a collection system similar to that shown in Figure 2 would provide a proactive means of protecting groundwater since the lower geomembrane liner would impede the flow of any leakage from the primary composite liner and direct the flow to the leachate pumping system. The leachate collection and removal system in this case would effectively act as a leak detection system, which would provide immediate notice to the owner or operator that the surface impoundment's liner is leaking. Conversely, leaks through the CCR surface impoundment design specified in the Proposed Illinois CCR Rule would not be detected until the next groundwater monitoring well sampling event. Finally, this alternative system also has the advantage of requiring less energy to operate relative to the system proposed by the IEPA since the composite liner would significantly limit the flow into the leachate collection and removal system.



POSSIBLE ALTERNATE LINER FOR CCR SURFACE IMPOUNDMENTS WITH PROACTIVE LEAK COLLECTION SYSTEM IN LIEU OF LEACHATE COLLECTION SYSTEM

FIGURE 2

NOTE 1: PROPOSED 35 ILL. ADM. CODE 845.420 DOES NOT SPECIFY THICKNESS REQUIREMENTS FOR THE PROTECTIVE LAYER.

Conclusions

The Federal CCR Rule was based on an exhaustive risk analysis performed by the US EPA, and it does not require leachate collection and removal systems for CCR surface impoundments. This risk assessment notes that CCR surface impoundments with composite liners, as required by the Federal CCR Rule as well as the Proposed Illinois CCR Rule (without leachate collection system) provide a level of protection “that effectively [reduce] risks from all pathways and constituents far below human health and ecological criteria in every sensitivity analysis.” Moreover, when evaluating proven and potential damage cases, the US EPA’s analysis concluded, “No damage cases were identified for composite-lined units.” Thus, I conclude that the use of composite liners in CCR surface impoundments, without leachate collection, is appropriately protective of human health and the environment. As a licensed professional engineer, I believe that valid scientific studies should be the basis for environmental regulation, which does not appear to be the case for the leachate collection and removal requirements in the Proposed Illinois CCR Rule.

If the proposal to require a leachate collection and removal system for a new or retrofitted CCR surface impoundment is not modified, any operation of the system, will result in very large flow rates and significant water management challenges for Illinois power plants. Any proposed requirement to attempt to reduce the hydrostatic pressure on a liner system through operation of a leachate collection and removal system is burdensome and, based on the US EPA risk assessment, provides no material long term benefit to the protection of human health or the environment relative to the burden placed on Illinois power plants.

A properly designed and monitored system of groundwater monitoring wells can identify future failures in a CCR surface impoundment's composite liner system. When identified early (i.e., when impacted water is at the edge of waste), a remedial program can be implemented to protect the offsite groundwater quality.

I encourage the Pollution Control Board to implement pond design requirements that are identical to those in the Federal CCR Rule. The Federal CCR Rule is the result of many thousands of hours of thoughtful work by scientists, engineers, and regulators of the US EPA and other interested parties, which in my opinion, is an appropriate regulation for the protection of human health and the environment. Specifically, I encourage the Illinois Pollution Control Board to remove Section 845.420 of the Proposed Illinois CCR Rule along with any references to leachate collection and removal systems.

Alternatively, if the Board concludes that more proactive measures are required for protecting groundwater than those prescribed by the Federal CCR Rule, I suggest that the Board include language in 845.420 that would allow an entity to install an alternative leachate collection system that is at least as protective as the system required in 845.420(a).

COMMENTS ON SECTION 845.770
RETROFITTING

Background

The Federal CCR Rule uses the term retrofit as the process of removing CCR and contaminated soils and sediments from the CCR surface impoundments to allow relining in accordance with the current regulation. Thus, retrofitting is a method to allow existing impoundments to be improved to allow ongoing use of the CCR surface impoundment. The Proposed Illinois CCR Rule, Section 845.120 (Reference 1) defines retrofit as:

> "Retrofit" means to remove all CCR and contaminated soils and sediments from the CCR surface impoundment, and to ensure the surface impoundment complies with the requirements in Section 845.410."

Although the Illinois definition of retrofit essentially matches the Federal CCR Rule, Section 845.770(a)(1) of the Proposed Illinois CCR Rule (Reference 1) requires that any liners be removed when an impoundment is retrofitted.

Evaluation

The Proposed Illinois CCR Rule does not clearly define the type of liners that would require removal. This testimony is based on responses provided by the IEPA in the August 25 Hearing that the IEPA intends for any existing geomembrane liners to be removed as well as any clay liners.

In answer to why the Agency required removal of a liner, "The Agency would consider the liner system to be contaminated with CCR" (Reference 5, p. 32, Agency's Answer to Question 84), yet gave no other explanation. The responses provided by the IEPA in the August 25, 2020 Hearing indicate that the Agency believes that all liners are considered contaminated.

Geomembrane liners are flexible membranes that are manufactured of resins such as polyethylene (HDPE, LLDPE, LDPE) and polyvinyl chloride (PVC), which are energy intensive to manufacture and very low permeability. ASTM International defines geomembrane "an essentially impermeable geosynthetic composed of one or more synthetic sheets." (Reference 7, p. 3)

I assume the Agency believes that a geomembrane liner would become saturated with CCR constituents such that it would allow these constituents to migrate into the environment. While this may be true of clay liners, there is no basis to conclude that it is true of geomembrane liners, such as

HDPE. In fact, I am not aware of a study that shows that polymer liners become saturated with CCR constituents. Accordingly, there is no basis to conclude that a geomembrane liner would be saturated with CCR constituents such that the only method of decontamination is removal.

It is recognized that the existing geomembrane liner cannot be considered as a component of a new compliant composite liner system. Although not incorporated into the composite liner system, it is my opinion that allowing existing, effective liners to stay in place could add an additional level of protection of the environment. It is certainly a better alternative than requiring removal of a decontaminated liner and transporting it to a solid waste landfill, which in my opinion is not in compliance the reuse and energy conservation concepts that are fundamental to environmental stewardship.

Conclusion

I recommend that the language of section 845.770 be modified to allow existing geomembrane liners to be decontaminated, similar to the Federal CCR Rule requirements. The decontamination could include cleaning with high-pressure water washes, visual inspections for any damage, repair if damage was a result of the removal of CCR, and reuse as a supplemental layer below a new composite liner as suggested in Figure 2.

REFERENCES

1. IEPA, 2020 – Proposed New 35 ILL. ADM. CODE 845, "Standards For The Disposal of Coal Combustion Residuals in Surface Impoundments", as published March 2020 (referred to as the "Proposed Illinois CCR Rule")
2. US EPA, 2015 – 40 CFR Part 257 Subpart D, "Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments", as published April 17, 2015 (herein referred to as "Federal CCR Rule")
3. US EPA, 2010 – "Hazardous and Solid Waste Management System; Identification and Listing of Special Wastes; Disposal of Coal Combustion Residuals From Electric Utilities," 75 Fed. Reg. 35128, June 21, 2010.
4. US EPA 2014 – "Human and Ecological Risk Assessment of Coal Combustion Residuals", December 2014, Regulation Identifier Number: 2050-AE81
5. IEPA, 2020 – "FIRST SUPPLEMENT TO IEPA'S PRE-FILED ANSWER" filed with the Clerk's Office August 5, 2020 by Christine Zeivel.
6. Illinois Pollution Control Board, 2020 – "REPORT OF THE PROCEEDINGS … … before Hearing Officer Vanessa Horton, called by the Illinois Pollution Control Board, taken by Steven Brickey, CSR, RMR, for the State of Illinois … … on the 12th day of August 2020, commencing at the hour of 8:01 a.m."
7. ASTM International Standard Terminology for Geosynthetics, ASTM D4439 - 20, January 2020

Thank you, this concludes my pre-filed testimony .

David E. Nielson, P.E.

August 27, 2020

DAVID E. NIELSON

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EDUCATION

Utah State University – B.S. Civil and Environmental Engineering - 1988

REGISTRATIONS

Professional Engineer – Illinois, Indiana, Michigan, Washington, Nevada

Previously Licensed Water Well Driller – Indiana, Tennessee and Louisiana

PROFICIENCIES

- Design of embankments, dikes and containment structures
- Evaluation of existing conditions of dams, dikes, landfills & other earthen structures
- Design and evaluation of production and monitoring well systems
- Selection of design parameters for foundation and earthen structures
- Design of shallow and deep foundation systems
- Design of pavement systems
- Reinforced earth structure design
- Geosynthetics applications in geotechnical and geo-environmental areas
- Geotechnical field and laboratory instrumentation, field testing and data acquisition
- Construction material field and laboratory instrumentation, field testing and data acquisition
- Forensic evaluation of concrete structures and earthen structures

RESPONSIBILITIES

Mr. Nielson is the process owner of geotechnical and groundwater well process in the S&L quality program. He is responsible for the selection of geotechnical design parameters, design and construction monitoring of foundation systems for projects at fossil and nuclear powered electric generating stations. Mr. Nielson performs and reviews examinations of dikes, dams and landfills at both nuclear and coal fired power plants. Additionally, Mr. Nielson actively participates in engineering geology evaluation of potential plant sites and plant structure foundations. Mr. Nielson serves as a committee member on the DFI Auger Cast Pile subcommittee.

EXPERIENCE

Mr. Nielson has over 30 years of experience in geotechnical engineering and construction material testing services. He has successfully performed shallow and deep foundation design for projects in virtually all geologic settings and directed construction material quality control services in over 30 states and over 10 countries. Additionally, he has specified, directed, and performed over one-thousand subsurface exploration programs.

In addition to the design and consultation services on earthen embankments, ponds, lakes and landfills, he supervises and performs annual examination of eight dams, which are up to 8 miles in length with residential properties within 1/8 mile of the dam toe.

He has designed numerous production wells, monitoring well programs, and structure under-drain/dewatering systems to mitigate the effects of groundwater seepage in several construction projects. Moreover, he has provided design and construction recommendations for tunnels under and bridges over Midwestern rivers.

He has served as an expert witness for construction defect litigation in the areas of soil and concrete.

He provides our clients with an unusual perspective and experience. In addition to his design experience, he has worked as a construction laborer on the construction of a large coal fired power plant in Utah, geotechnical driller and geotechnical engineer with design work and quality control services in many of the major physiographic regions of the U.S.

Mr. Nielson's relevant experience with Sargent & Lundy LLC (since 2008) includes:

- **Hydroelectric Dam – Peruvian Andes**
  Before visiting the site, Mr. Nielson reviewed the prior design documents, prior reports, studies and repair designs to aid in our evaluation of the repair of a vertical crack and the general integrity of the confidential hydroelectric dam. The existing dam is an arched concrete gravity structure with an 88-meter maximum height and a crest length of 274 m. Our evaluation of the structure included recommendations for physical repairs of an abutment to improve stability and supplemental monitoring equipment to provide insight into the structure's response to loading (2018).

- **Power Stations – Wyoming**
  Performing conceptual and detailed design of several new impoundments to serve as evaporation and disposal ponds for Coal Combustion Residual waste streams. Dam heights will range up to 50 feet and the total impoundment area will exceed 400 acres. (2017 - 2020)

- **Two Power Stations – Texas**
  The two stations represent over 4400 megawatts of coal fired generating capacity. Served as Owner's Engineer to develop closure plans, hazard classifications, structural stability and annual inspections of coal ash ponds and landfills (2015 - 2018).

- **Power Station – Indiana**
  Performed emergency dam inspection to evaluate damage and recommend repair alternatives for a sand filled dam which experienced significant erosion during beyond design basis storm event. (2012)

- **Power Station – Pennsylvania**
  Formulated of design parameters for shallow spread, drilled piers and deep micropile foundation systems for SCR system constructed above existing precipitators and other plant features (2010-2012).

- **Power Station – Pennsylvania**
  Developed of geotechnical exploration specifications and formulated ACIP foundation design details, specifications, and performance criteria (2009).

- **Power Station – Nebraska**
  Developed specification for geotechnical exploration and formulated design criteria for foundation systems for major emission control project (2008).

- **Generation Project – Upper Midwest**
  Prepared a study of groundwater availability for a new combined cycle generating station (2016).

Mr. Nielson's relevant experience with other firms (1988 - 2008) includes:

- **Elkhart County Jail – Elkhart, Indiana**
  Determination of engineering design parameters for shallow foundations and utility tunnels for 1000-bed, seven building correctional campus. This work included monitoring and designing repairs to control seepage into a major utility tunnel that was constructed with inferior concrete (2004 - 2008).

- **Elkhart County Landfill/Jail – Elkhart, Indiana**
  Mr. Nielson designed extraction, compression and transmission system to remove landfill gas and transport it for beneficial use at the 1000 bed jail (2006 - 2008).

- **Earth Movers Landfill – Elkhart County, Indiana**
  Directed Construction Quality Control and Assurance (CQA/CQC) services to assure state regulators the clay and membrane liners were constructed in accordance with the permit requirements (2007).

- **Prairie View Landfill – St. Joseph County, Indiana**
  Directed Construction Quality Control and Assurance (CQA/CQC) services to assure state regulators the clay and membrane liners were constructed in accordance with the permit requirements (2006).

MEMBERSHIP

Deep Foundation Institute