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Coal Combustion Residuals Impoundment Closure Dewatering Wastewater Characterization and Treatment Evaluation

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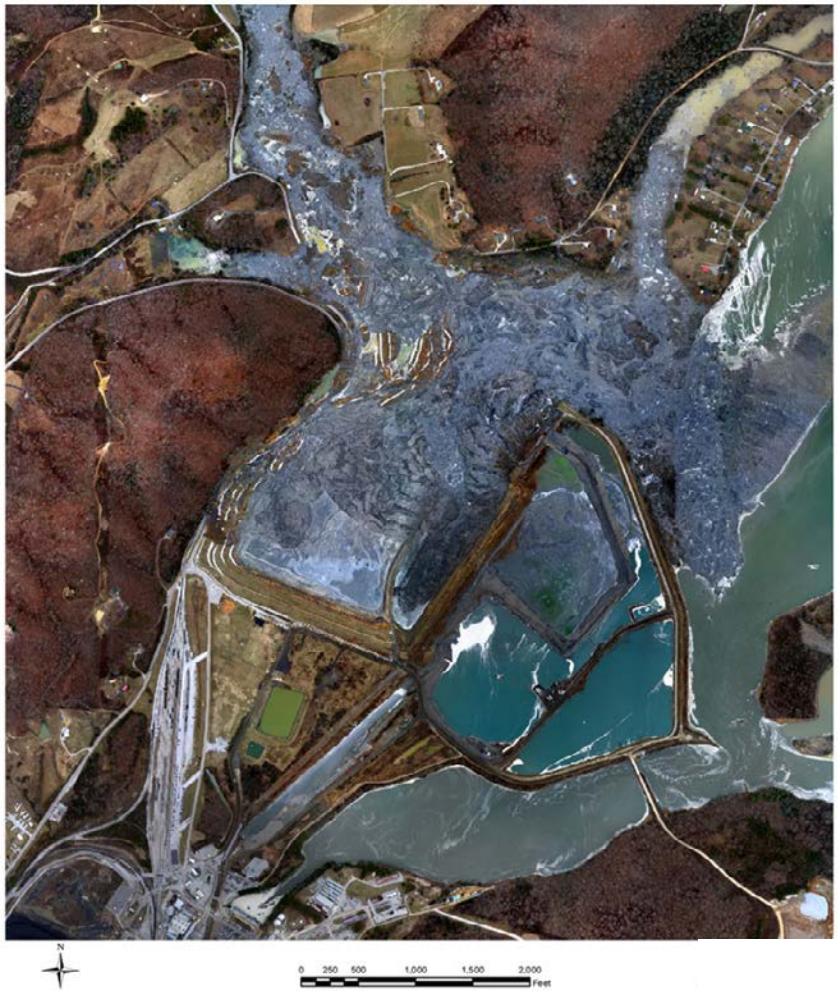
AECOM

Aerial Image Of Kingston Ash Slide 12/23/08



Coal Combustion Residuals (CCR) Rule Development Timeline

- ***June 2010***
  - Proposed Regulation Issued
- ***April 17, 2015***
  - Final Rule Published in the Federal Register
- ***October 2015***
  - Final Rule Effective Date
    - 6 months following Federal Register Publication

CCR Presentation Overview

- What are CCRs?
  - How have they been managed?
  - Future management under the CCR Rule
- CCR impoundment closure dewatering
  - Wastewater discharge/compliance implications
- Characterization of CCR closure wastewater discharges
  - Free water
  - Interstitial (ash entrained) water
- Summary guidance
  - Impoundment closure wastewater management

What Are CCRs

- Fuel byproducts produced from the combustion of coal (from the steam generation of electric power)

- ***Fly Ash (light airborne particulate)***

- ***Bottom Ash (heavy solids)***

- ***FGD Solids (SO_2 air pollution control system solids)***

Historical/Current Management of CCRs

- ***Wet sluiced ash to surface impoundments***
- ***Dewatered material to landfills***
- ***Beneficial reuse as product raw material***

Future Management of CCRs/ Impoundments Under the CCR Rule

- Existing/New CCR impoundments to comply with:
  - Sighting/location requirements
  - Operational and inspection requirements
  - Structural integrity requirements
  - Groundwater monitoring
  - Impoundment closure and post closure care requirements

CCR Final Rule/Compliance details (See Final Rule and Rule Summary Documents on EPA website:

https://www.epa.gov/coalash/coal-ash-rule

Future Management of CCRs/ Impoundments Under the CCR Rule

- Existing CCR impoundments non-compliant with CCR Rule:
  - Closure of existing impoundment
  - Construction of new CCR impoundment meeting requirements of CCR Rule *OR*

    Convert wet ash sluicing to dry ash handling systems
  - Reroute non-ash handling plant wastewaters to alternate waste management system(s)

Characterization of Free and Interstitial Waters

- Physical/Conventional Chemical Parameters:
  - pH
  - Total Dissolved Solids (TDS)
  - Total Suspended Solids (TSS)
  - Oil & Grease
  - Turbidity

Characterization of Free and Interstitial Waters (Continued)

- Metals (Total and Dissolved):
  - Arsenic (As)
  - Selenium (Se)
  - Mercury (Hg)
  - Copper (Cu)
  - Iron (Fe)
- Nutrients:
  - Nitrate (NO_3)
  - Nitrite (NO_2)
  - Total Kjeldahl Nitrogen (TKN)
  - Phosphorus

Characterization of Free and Interstitial Waters (Continued)

- Collect samples at various depth in free water and accumulated ash
- Perform metals and TSS analyses on raw (unfiltered) samples and on serial filtrations of samples (i.e., 20µ and 10µ and 0.45µ)
- Speciation of As and Se
- Whole Effluent Toxicity testing

Total Suspended Solids

	Permit Limits (mg/l)		Impoundment I-1 (mg/l)				Impoundment I-2 (mg/l)			
Free Water TSS (mg/l)	*Monthly Avg.*	*Daily Max*	*I-1 (1ft)*	*I-1 (4ft)*	*I-1 (8ft)*		*I-2 (1ft)*	*I-2 (4ft)*	*I-2 (8ft)*	
	23	75	2.5	2.5	2.5		2.5	2.5	2.5	
Interstitial Water TSS (mg/l)	*Monthly Avg.*	*Daily Max*	*PZ-1*	*PZ-1 (20µ)*	*PZ-1 (10µ)*		*PZ-2*	*PZ-2 (20µ)*	*PZ-2 (10µ)*	
	23	75	2000	96	5		5700	680	66	

Arsenic

	Permit Limits (µg/l)		Impoundment I-1 (µg/l)				Impoundment I-2 (µg/l)			
Free Water As (µg/l)	*Monthly Avg.*	*Daily Max*	*I-1 (1ft)*	*I-1 (4ft)*	*I-1 (8ft)*		*I-2 (1ft)*	*I-2 (4ft)*	*I-2 (8ft)*	
	52.5	72.5	3.05	3.28	3.32		38		38.5	
Interstitial Water As (µg/l)	*Monthly Avg.*	*Daily Max*	*PZ-1*	*PZ-1 (20µ)*	*PZ-1 (10µ)*	*PZ-1 (0.45µ)*	*PZ-2*	*PZ-2 (20µ)*	*PZ-2 (10µ)*	*Z-1 (0.45µ)*
	10.5	14.5	656	386	375	378	71	10.7	1.61	

Selenium

	Permit Limits (µg/l)		Impoundment I-1 (µg/l)				Impoundment I-2 (µg/l)			
Free Water Se (µg/l)	*Monthly Avg.*	*Daily Max*	*I-1 (1ft)*	*I-1 (4ft)*	*I-1 (8ft)*		*I-2 (1ft)*	*I-2 (4ft)*	*I-2 (8ft)*	
	68	127.5	1.96	2.07	1.81		46.9		48.6	
Interstitial Water Se (µg/l)	*Monthly Avg.*	*Daily Max*	*PZ-1*	*PZ-1 (20µ)*	*PZ-1 (10µ)*	*PZ-1 (0.45µ)*	*PZ-2*	*PZ-2 (20µ)*	*PZ-2 (10µ)*	*Z-1 (0.45µ)*
	13.6	25.5	55.7	2.47	1.36	1.53	426	239	229	

Mercury

	Permit Limits (ng/l)		Impoundment I-1 (ng/l)				Impoundment I-2 (ng/l)			
Free Water Hg (ng/l)	*Monthly Avg.*	*Daily Max*	*I-1 (1ft)*	*I-1 (4ft)*	*I-1 (8ft)*		*I-2 (1ft)*	*I-2 (4ft)*	*I-2 (8ft)*	
	47	47	0.25	0.25	0.25		0.941	1.03	0.987	
Interstitial Water Hg (ng/l)	*Monthly Avg.*	*Daily Max*	*PZ-1*	*PZ-1 (20µ)*	*PZ-1 (10µ)*	*PZ-1 (0.45µ)*	*PZ-2*	*PZ-2 (20µ)*	*PZ-2 (10µ)*	*Z-1 (0.45µ)*
	47	47	40.6	16.5	3		76.7	33.2	12.9	

Nitrate-Nitrite

	Permit Limits (mg/l)		Impoundment I-1 (mg/l)				Impoundment I-2 (mg/l)			
Free Water NO_3-NO_2 (mg/l)	*Monthly Avg.*	*Daily Max*	*I-1 (1ft)*	*I-1 (4ft)*	*I-1 (8ft)*		*I-2 (1ft)*	*I-2 (4ft)*	*I-2 (8ft)*	
	0.65	0.85	0.005	0.028	0.018		0.005		0.01	
Interstitial Water NO_3-NO_2 (mg/l)	*Monthly Avg.*	*Daily Max*	*PZ-1*	*PZ-1 (20µ)*	*PZ-1 (10µ)*	*PZ-1 (0.45µ)*	*PZ-2*	*PZ-2 (20µ)*	*PZ-2 (10µ)*	*Z-1 (0.45µ)*
	0.13	0.17	0.005	0.01	0.023	0.016	0.005	0.333	0.317	

Phosphorus

	Permit Limits (mg/l)		Impoundment I-1 (mg/l)				Impoundment I-2 (mg/l)			
Free Water P (mg/l)	*Monthly Avg.*	*Daily Max*	*I-1 (1ft)*	*I-1 (4ft)*	*I-1 (8ft)*		*I-2 (1ft)*	*I-2 (4ft)*	*I-2 (8ft)*	
	Monitor Only		0.01	0.01	0.01		0.01	0.01	0.01	
Interstitial Water P (mg/l)	*Monthly Avg.*	*Daily Max*	*PZ-1*	*PZ-1 (20µ)*	*PZ-1 (10µ)*	*PZ-1 (0.45µ)*	*PZ-2*	*PZ-2 (20µ)*	*PZ-2 (10µ)*	*Z-1 (0.45µ)*
	Monitor Only		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Free Water and Interstitial Water pH

- General observations:
  - Neutral to slightly alkaline across all project portfolio impoundments (meeting discharge requirement of pH = 6.0 to 9.0)
  - Exception site/interstitial water pH at 5.2 to 5.8 (requiring pH neutralization for discharge)

Wastewater Characterization Treatment Implications

- TSS Treatment of Free Water
  - Not required but implemented as contingency
- TSS Treatment of Interstitial Water
  - Required with likely chemical coagulation
- As and Se
  - Filtration (with/without chemical enhancement, in particulate form)
  - Where in dissolved anionic form
    - Biological (anaerobic) metal reduction
    - Zero Valent Iron media

Wastewater Characterization Treatment Implications (Continued)

- Mercury Treatment of Free Water/Interstitial Water
  - Not required for Free Water
  - Interstitial water/dewatering phase treatment by filtration
- Nitrate-Nitrite
  - Treatment not required
- Phosphorus
  - Treatment not required

Conclusions/Recommendations

- Engage environmental regulators early in the CCR impoundment closure planning process
- Prepare comprehensive free water and interstitial water characterizations including:
  - Analyses on serial filtrations (particularly interstitial water)
  - As and Se speciation
  - Whole Effluent Toxicity Testing
- Treatability testing

Questions