


CCR -- ELG


Proposed EPA Regulations
Changing the Coal Power Generation Industry

How Dense Slurry Ash and Wastewater Management Technology can Solve Challenges Resulting from Proposed Regulations

CCR: Coal Combustion Residuals
40 CFR 257 Subpart D

Proposed EPA Rules for Regulating :

Fly Ash, Bottom Ash and Gypsum in Surface Impoundments Including Impoundment Design/Operations, Fugitive Dust, Ground Water Protection

ELG: Effluent Limitations Guidelines
40 CFR Part 423

Proposed EPA Rules for Regulating:

FGD Wastewater, Fly Ash Transport Water, Flue Gas Mercury Control (FGMC) Water Bottom Ash Transport Water, Gasification Wastewater, Coal Pile Runoff Leachate, Metal Cleaning Wastewater




Pending Rule Changes Driving Transition Away from Traditional Wet Slurry

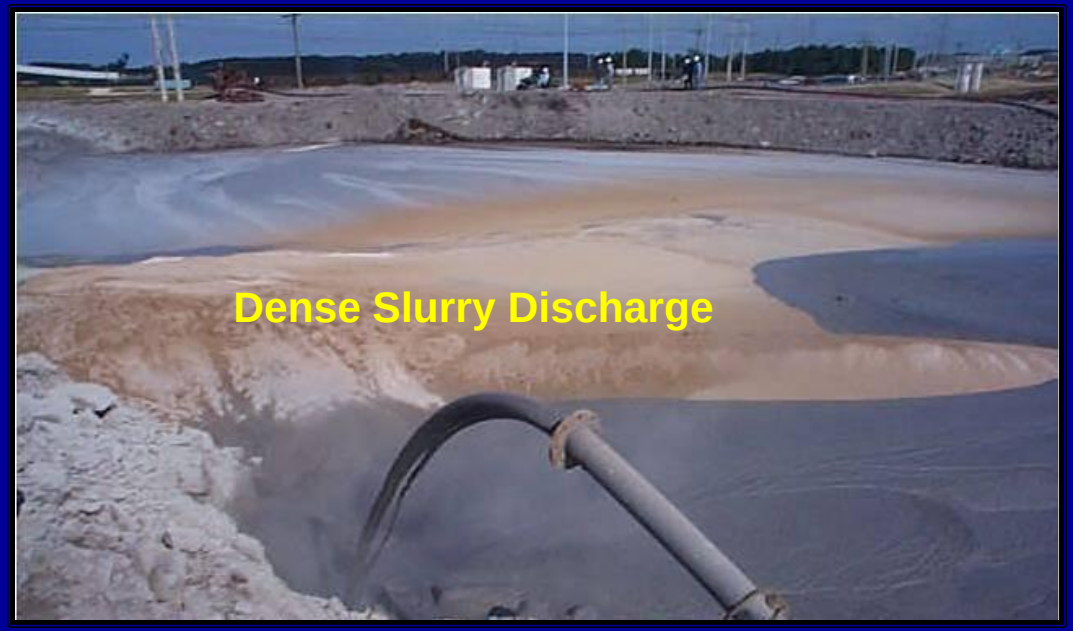
- Plants Closing Impoundments or Converting Away from Traditional Wet Slurry Systems
- Traditional Wet & Dry Systems Have Disadvantages
- Need For Better Ash Management & Storage
- Circumix Dense Slurry Technology Offers Advantages over Wet and Dry Systems

Lean Slurry Ash Impoundment




What is Circumix Dense Slurry Technology?

- Intense Mixing that Maximizes Availability of Reactive Ions
- Mixes Wastewater with Fly Ash, Bottom Ash and/or Gypsum
- Additives Not Required
- Water to Solids Ratio ~1:1
- Slurry Pumpable 10 km +
- Slurry Sets in 24 – 72 Hours
- Product Exhibits:
  - Low Hydraulic Conductivity
  - High Compressional Strength
  - Zero Discharge of Transport Water
  - Enhanced Metals Sequestration






Who Developed and Who Offers the Technology?

NAES

GEA

GEA EGI Co.Ltd.

Largest Third-Party O&M Company	GEA EGI Developed Dense Slurry
O&M Track Record of 195 Facilities and 57 GW	Provides Heller® Type Dry Cooling & BoP Systems for the Power Industry
2,700 Employees, $400+ Million in Revenues	GEA Group: $7.4 Billion Revenues GEA EGI $130 Million Revenues
Currently Operating 35 GW of Power Facilities (114 plants)	GEA EGI is a Member of HX segment Within the GEA Group

NAES and GEA have Teamed to Deploy Circumix Dense Slurry Technology and for NAES to be the Exclusive Provider of this Technology in North America




Past, Current and Future Dense Slurry Technology Use

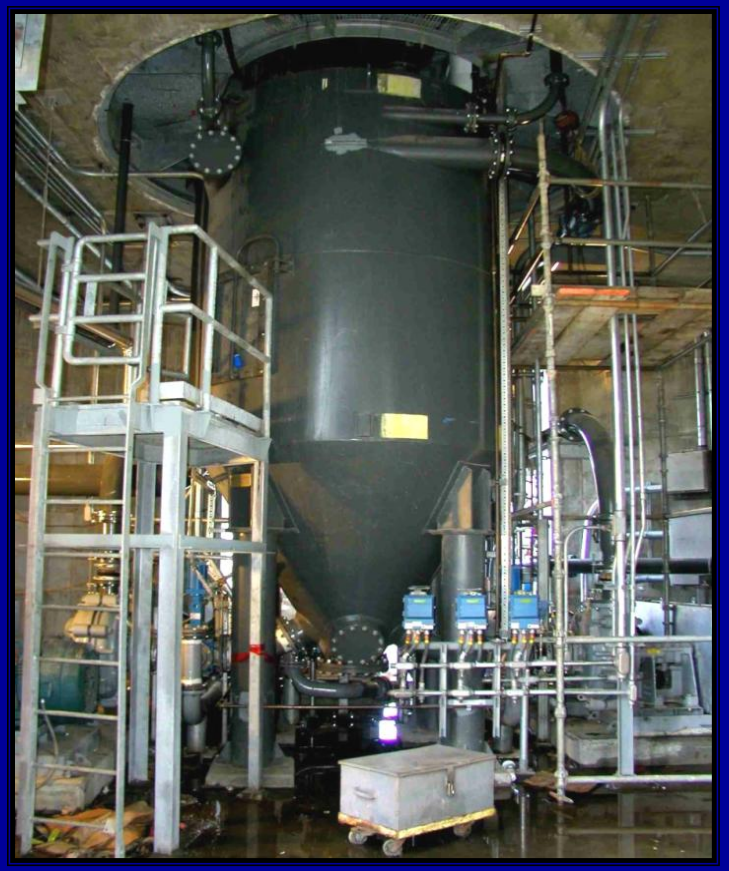
Plant	Country	Ops. Year	Capacity MW	BA TPH	FA TPH	Total Slurry m^3
Pannon Hőerőmű Zrt.	Hungary	1991-2000	200	38.8	155.2	6,480,000
Tatabányai Erőmű Kft.	Hungary	1993-2000	30	-	20	840,000
AES Borsodi Energetikai Kft.	Hungary	1996-2000	200	24	156	2,400,000
Matra	Hungary	1998-	836	80 (FGD)	640	23,040,000
SC Collterm SA	Romania	2000-	50	3	20	1,050,000
Jacksonville Northside Generating Station	USA	2003-	600	63 (FGD)	63	6,720,000
SC Collterm SA	Romania	2002-	50	3	17	840,000
Rovinari Power Plant	Romania	2010-	1 720	120 (FGD)	508	1,140,000
Craiova II. Power Plant	Romania	2010-	300	18.4 (FGD)	204	760,000
Isalnita Power Plant	Romania	2010-	630	28 (FGD)	220.8	466,600
Spectrum Coal and Power	India	Under Const.	50	15.6	36.4	-
Turceni	Romania	Under Commis.	1320	120 (FGD)	440	-




Dense Slurry System Installations

In Operation Since 1991

Scale: 4 X 190 Tons/Hour (E. Europe)



Jacksonville Unit, 2003
2 X 62.5 Ton/Hour Units




Disadvantages of Wet (lean) Slurry and "Dry" Ash Management

Traditional Lean Slurry Cons	Traditional Dry Management Cons
High Water Use	Relatively High Capital/Operating Cost
Waste Water Management	High Risk of Fugitive Dust
Risk of Flow if Released	Multiple Handling for Transport
Stringent Dike Inspection & Maintenance	Increased Safety Risk from Trucks
Risk of Ground Water Contamination	Impoundment Heavy Equipment Required
Will Become Airborne if Dry	Relatively High Hydraulic Conductivity
Process Water Leachate	High Storm Water Leachate Volumes
Variable Hydraulic Conductivity	Ground Water Risks
Complex Closure Requirements	High Labor Costs (dust supp. fuel mgt., security, lighting, etc.)




Dense Slurry Advantages Pursuant to CCR Proposed Rule

Features & Advantages

Solid, Non-Dusting Product

Significantly Reduced Fugitive Emissions

Cured Comp. Strength Typically 600-2000 psi

Eliminates Risk of Liquefaction & Spills
Simplifies Impoundment Design
Reduced Inspection Requirements
Increased Ash Storage in Existing Space

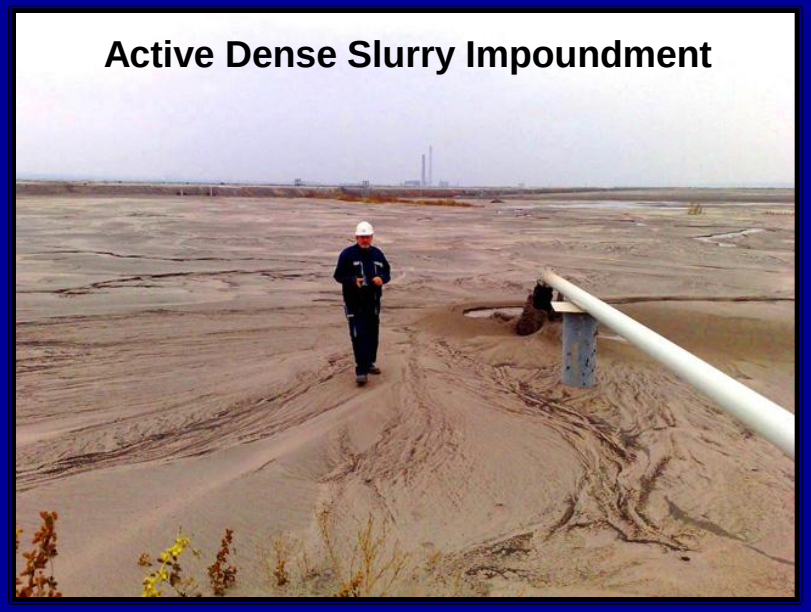
Low Hydraulic Conductivity (10^{-4} – 10^{-10})

Enhanced Metals Sequestration
Reduced Leachate Generation
Reduced Risk of Groundwater Contamination
Lower Post-Closure Risks




Advantages Pursuant to ELG Proposed Rule

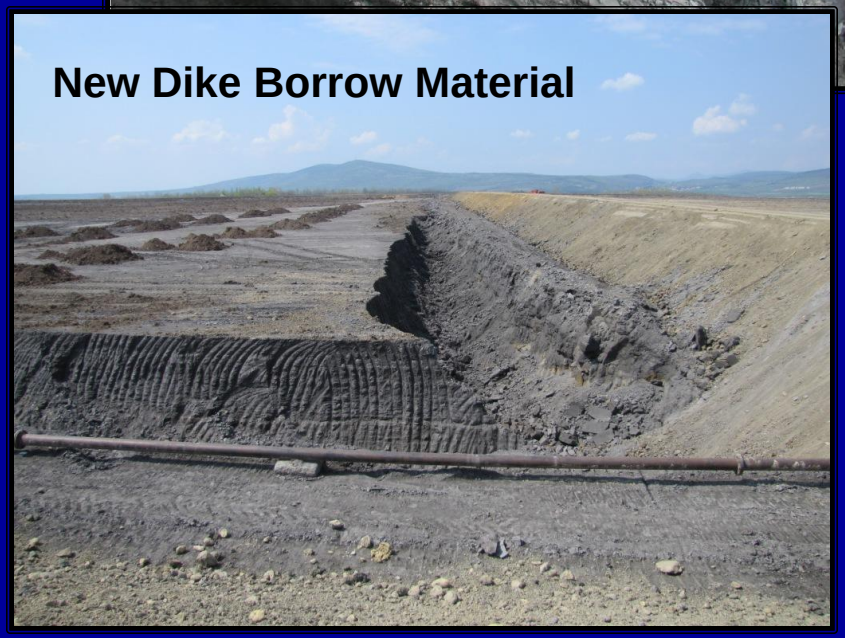
- Effective Combined Stabilization of Ash & Wastewater
- 80%-90% Reduction of Water Use for Ash Management
- Zero Discharge of Transport Water
- Leachate can be Reprocessed = Zero Discharge Impoundment
- Reduction of Plant-Wide Wastewater Generation
- Enhanced Protection of Ground Water from Low Hydraulic Conductivity
- Low Hydraulic Conductivity = Low Leachate Volumes



- Proven Technology, Low Complexity, Low Life-Cycle Cost, Ability to Utilize Existing Infrastructure ,Energy Efficient, Can Achieve Effluent Standards




Dense Slurry System Final Ash Disposal



No Incidents of Slope Failure, Seepage or Liquefaction




Stabilized Ash Performance

Example of Slurry Composition, Total Metals and Leach Performance

Slurry Make-Up		Total Metals and Leach Performance (mg/L)			
Components	Wt %	Metal	Total	Leach	pH Adjust
Fly Ash	35.1	As	36.9	0.14	0.069
Coarse FA	10.5	Ba	71.6	0.06	0.4
Economizer Ash	2.5	Ca	55770	587	2017
Bottom Ash	4.3	Cd	0.138	0.0004	0.009
Water	37.1	Cr	13.17	<0.05	0.089
FGD Water	2.1	Cu	23.63	<0.02	0.57
Lime Pre-Treat (ion exchange) Water	8.4	Hg	0.093	<0.001	<0.001
		Mn	336	<0.02	8.88
Slurry Density	1.33 g/cm^3	Pb	6.06	<0.005	<0.005
		V	48.8	<0.008	<0.005




Examples of Physical Properties of Cured Dense Slurry Product

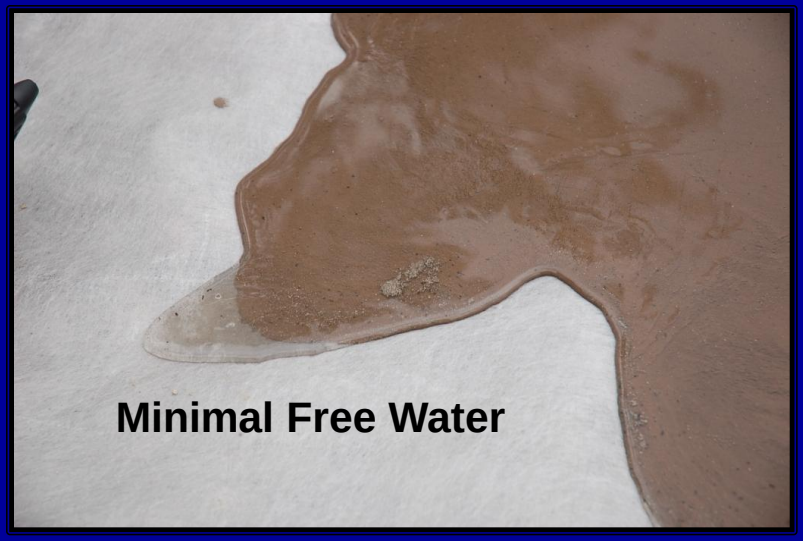
Sample	Water	Cure Time Days	Water-Ash Ratio	Hydraulic Cond. cm/sec	Wet Density	Comp. Strength lb/ft^3
1	Indust. Water	90	1.3:1	6.8E-9	1.61	25,396
2	80% FGD	90	1:1	1.0E-10	1.51	31,014
3	Indust. Water	90	0.8:1	2.1E-9	1.76	166,391
4	100% FGD	90	0.8:1	1.0E-10	1.71	147,720
5	80% FGD	90	0.8:1	1.0E-10	1.76	147,970
6	100% FGD	90	0.9:1	1.3E-05	1.56	13,387
7	80% FGD	90	0.9:1	4.2E-06	1.61	27,004
8	80% FGD	30	1.3:1	6.0E-07	--	--
9	80% FGD	60	1.3:1	4.8E-07	--	--
10	Indust. Water	90	1.3:1	1.2E-07	1.42	13,889
11	Indust. Water	90	1.3:1	1.1E-07	--	--
12	100% FGD	90	1.3:1	3.5E-09	1.52	24,331
13	80% FGD	90	1.3:1	1.9E-08	1.50	22,639
14	80% FGD	60	1.3:1	1.2E-08	--	--
15	80% FGD	30	1.3:1	1.1E-07	--	--

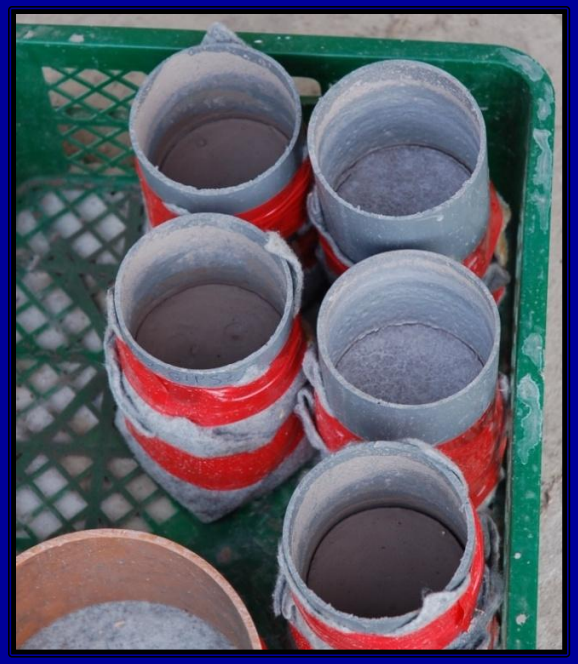


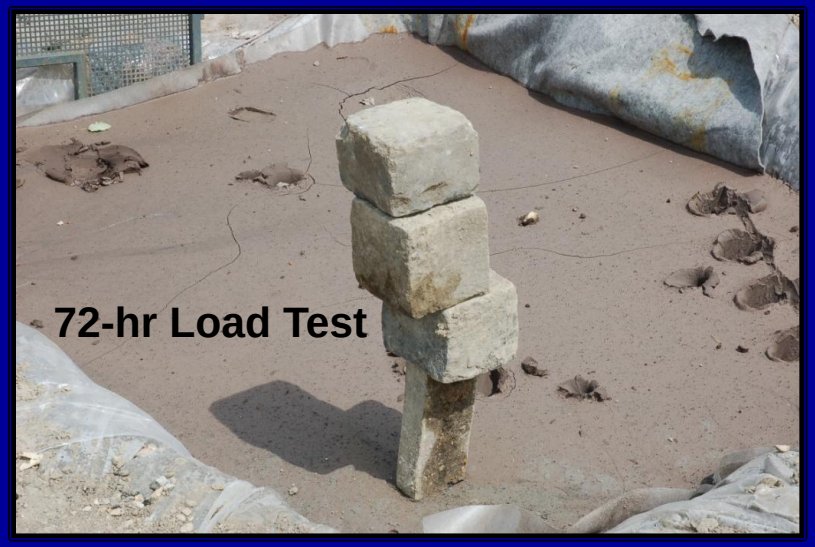

Dense Slurry System Ash Testing

Treatability Testing Performed

- Particle Size Distribution
- Porosity - Hydraulic Conductivity
- Chemical Composition
- Rheology – Flow Dynamics
- Compressional Strength
- Leach Resistance
- Water Stoichiometry










Dense Slurry System Ash Testing

- Ash/Wastewater Testing Programs can be Performed On Site
- Ash & Wastewater can be Shipped and Tested Remotely
- Testing is Performed on Several "Recipes" to Establish Optimum Mix
- Test Scale of 1.5 tons/hr Facilitates Accurate Scale-Up Cost Analysis
- Testing Facility is Skid-Mounted and Contained in One 20-ft. Shipping Container
- Test System is Autonomous of Plant Support and Stand-Alone

Modular Test Unit




Summary

Circumix Dense Slurry Technology Effectively Addresses all of the Challenges Presented by the Proposed CCR and ELG Rules for a Cost that is Less than Traditional Dry Ash Management

Contact Information




Thank You for Your Time

For More Information, Please Contact NAES

NAES

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