



# CCR -- ELG



## **Proposed EPA Regulations Changing the Coal Power Generation Industry**

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





## Disadvantages of Wet (lean) Slurry and “Dry” Ash Management

### Traditional Lean Slurry Cons

### Traditional Dry Management Cons

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



## What is Circumix Dense Slurry Technology?

- Intense Mixing that Maximizes Availability of Reactive Ions
- Mixes Wastewater with Fly Ash, & Other Combustion Residuals
- 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





## Dense Slurry System Installations

**Rovinari In Operation Since 2009**  
**Scale: 4 X 270 m<sup>3</sup> / Hour (E. Europe)**



**Jacksonville Unit, 2003**  
**2 X 62.5 Ton/Hour Units**

# Circumix Dense Slurry Technology



## Past, Current and Future Dense Slurry Technology Use

Plant	Country	Year	MW	BA -PH	FA -PH	Slurry m <sup>3</sup>
Pannon Hőerőmű	Hungary	1991-2000	200	38.8	155.2	6,480,000
Tatabányai Erőmű	Hungary	1993-2000	30	-	20	840,000
AES Borsodi	Hungary	1996-2000	200	24	156	2,400,000
Matra	Hungary	1998-	836	80 *	640	23,040,000
SC Colterm SA	Romania	2000-	50	3	20	1,050,000
Jacksonville JEA	USA	2003-	600	63 *	63	6,720,000
SC Colterm SA	Romania	2002-	50	3	17	840,000
Rovinari	Romania	2010-	1 720	120 *	508	1,140,000
Craiova II.	Romania	2010-	300	18.4 *	204	760,000
Isalnita	Romania	2010-	630	28 *	220.8	466,600
Spectrum	India	Const.	50	15.6	36.4	-
Turceni	Romania	Commis.	1320	120 *	440	-

\* Highlighted Figures Indicate Ash Stabilized with FGD Water



## Who Developed and Who Offers the Technology?



**Largest Third-Party O&M Company**

**O&M Track Record of 230 Facilities and 67 GW**

**2,700 Employees, \$400+ Million in Revenues**

**Currently Operating 35 GW of Power Facilities (114 plants)**

**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**

**GEA EGI Developed Dense Slurry**

**Provides Heller® Type Dry Cooling & BoP Systems for the Power Industry**

**GEA Group: \$7.4 Billion Revenues  
GEA EGI \$130 Million Revenues**

**GEA EGI is a Member of HX segment Within the GEA Group**



## Dense Slurry Advantages Pursuant to CCR Proposed Rule

### Features & Advantages

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**Solid, Non-Dusting Product**

**Significantly Reduced Fugitive Emissions**

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**Cured Strength Typically 600-2000 psi**

**Eliminates Risk of Liquefaction & Spills**

**Simplifies Impoundment Design**

**Reduced Inspection Requirements**

**Increased Ash Storage in Existing Space**

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**Low Hydraulic Conductivity ( $10^{-4} - 10^{-10}$ )**

**Enhanced Metals Sequestration**

**Reduced Leachate Generation**

**Reduced Risk of Groundwater Contamination**

**Lower Post-Closure Risks**

### Superior Environmental Properties





## Advantages Pursuant to ELG Proposed Rule

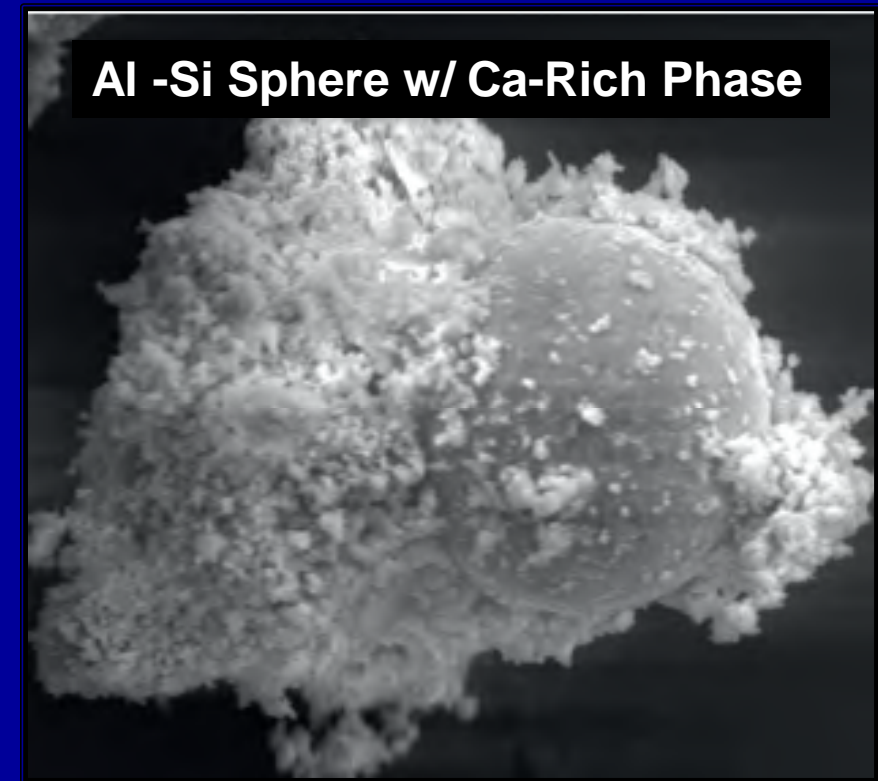
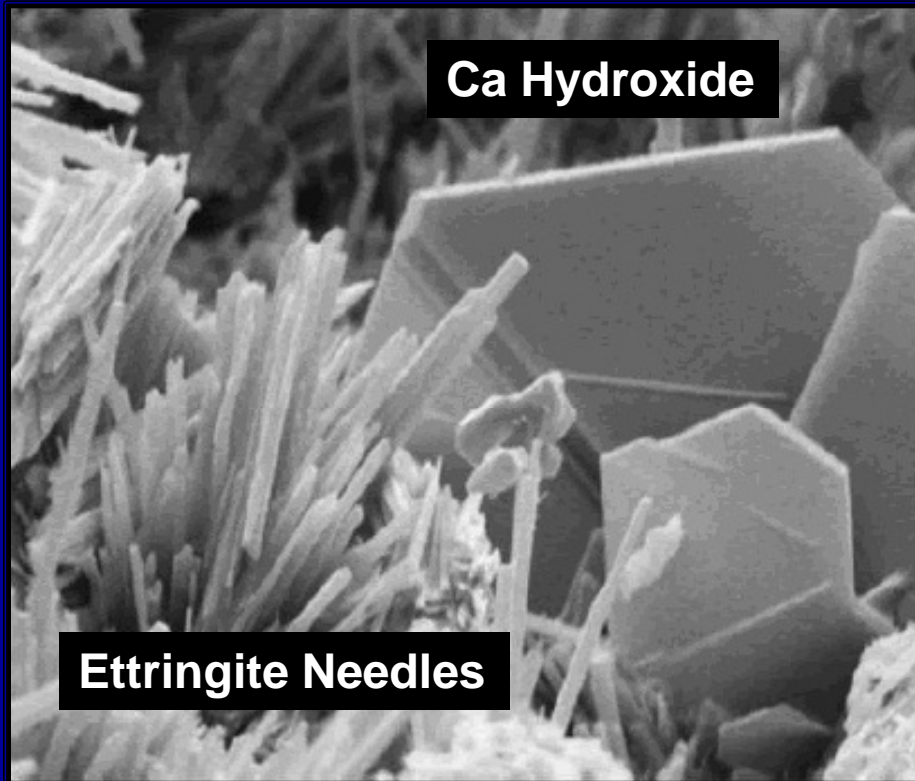
- **Effective Combined Stabilization of Ash & Wastewater**
- **80%-90% Reduction of Water Use for Ash Management**
- **Zero Discharge of Transport Water**
- **Leachate can be Reprocessed = Zero Discharge Impoundment**
- **Reduction of Plant-Wide Wastewater Generation**
- **Low Hydraulic Conductivity = Low Leachate Volumes & Greater Protection of Ground Water**
- **BAT: Proven Technology, Low Complexity, Low Life-Cycle Cost, Ability to Utilize Existing Infrastructure ,Energy Efficient, Can Achieve Effluent Standards**







## Crystal Growth During Curing Reduces Hydraulic Conductivity



**Interstitial Crystal Growth Reduces Pore Size, Inhibits Fluid Flow, Increases Capillary Forces, Increases Tortuosity and Minimizes Hydraulic Conductivity**





## Dense Slurry System Final Ash Disposal

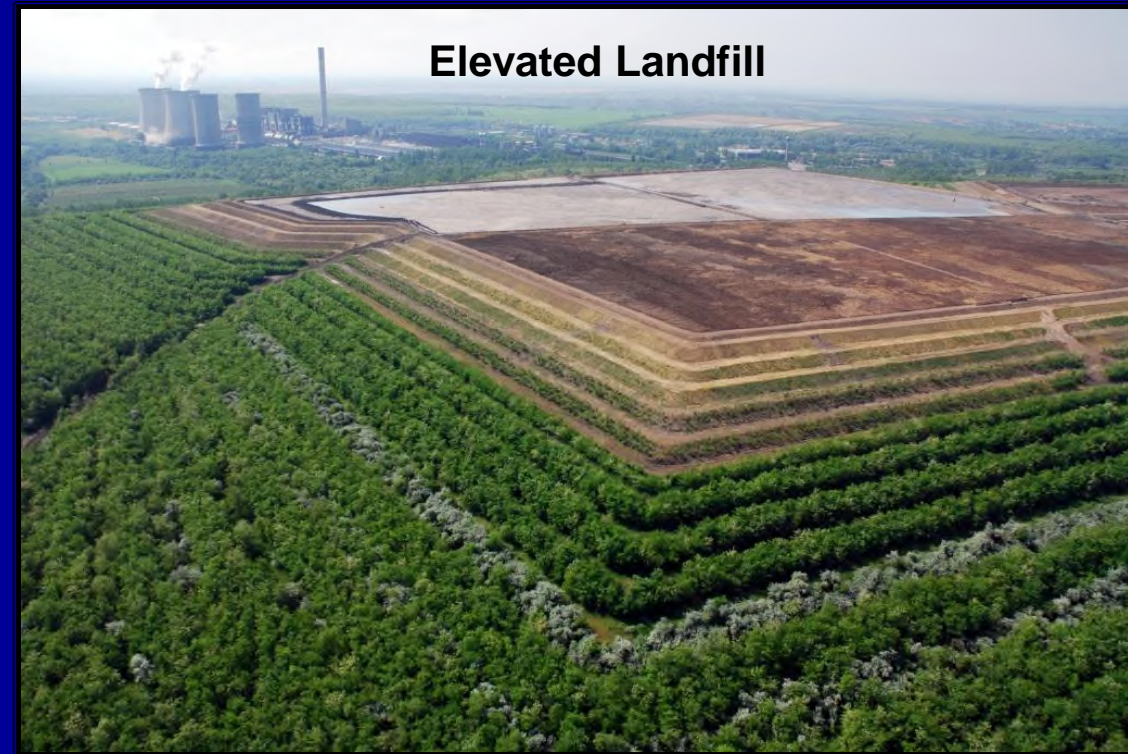
**Solidified Product**



**New Dike Borrow Material**



**Elevated Landfill**



**No Incidents of Slope Failure, Seepage or Liquefaction**



## Dense Slurry System Ash & Wastewater Testing

- Testing Programs can be Performed at the Plant
- Testing can be Conducted Remotely
- Several “Recipes” are Tested to Establish Optimum Mix
- Test Scale of 1.5 tons/hr Facilitates Improved Scale-Up Cost Analysis
- Unit 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**





Thank You for Your Time

For More Information, Please Contact NAES



*Energy People Making Energy Facilities Work - Better* \_\_\_\_\_

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