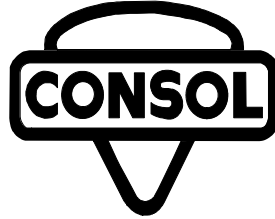


AGGREGATE PRODUCTION FROM WET LIMESTONE FGD SLUDGE



**M. M. Wu, R. A. Winschel, F. W. Theodore
CONSOL Inc.
Research & Development
4000 Brownsville Road
Library, PA 15129**

**Charles Ostrander
Illinois Concrete Products Assoc.
1480 Renaissance Drive
Suite 401
Park Ridge, IL 60068**

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BACKGROUND

- **Wet Limestone Scrubbing is the Prevailing FGD Technology in Illinois**
- **Waste Disposal is Expensive**
- **Only ~7% of Wet FGD Sludge is Utilized**
- **Aggregate Production is a High-volume Utilization Option**
- **Utilization Could Reduce the Cost of FGD and Promote Illinois Coal Use**
- **CONSOL has Produced Synthetic Aggregates from Dry FGD By-Products (FBC and Spray Dryer)**

AGGREGATE PRODUCTION FROM WET LIMESTONE FGD SLUDGE

OBJECTIVES

- **Determine the Process Feasibility**
- **Evaluate Aggregate Properties vs ASTM or AASHTO Specifications.**
- **Determine the Cost of Aggregate Production.**

AGGREGATE PRODUCTION FROM WET LIMESTONE FGD SLUDGE

PROJECT ELEMENTS AND STATUS

Task 1 - Sample Collection and Characterization

Completed

Task 2 - Baseline Pelletization

Completed

Task 3 - Improved Product Development

Completed

Task 4 - Preliminary Cost Evaluation

In Progress

TASK 1 - SAMPLE COLLECTION AND CHARACTERIZATION

FGD Sludge, Fly Ash

- **City Water, Light & Power (CWL&P) Dallman Station**
- **Public Service Indiana (PSI) Gibson Station**

CONCRETE AGGREGATES FROM CWL&P DALLMAN FGD GYPSUM

	Test No. ICCI-SU-13	Test No. ICCI-SU-14	ASTM C-33 Specs for Concrete Aggregate
Fly Ash/Wet FGD Sludge/Hydrated Lime	51.9/35.3/12.8	39.4/48.1/12.5	
LA abrasion index, wt %	45	47	50 (max)
Soundness index, wt %	3.1	1.3	12 (max)
Grain size	coarse	coarse	coarse
Clay lumps, wt %	0.85	0.79	2 to 10 (max)*
Material finer than 75 μm	0	0	1.0 (max)
Coal and lignite	0	0	0.5 to 1.5
Crush strength, lb	76	62	no spec.
Unit weight, lb/ft³	75	75	no spec.

*Depending on application

ROAD AGGREGATES FROM PSI GIBSON FGD SLUDGE

	TEST No. ICCI-SU-12	Test No. ICCI-SU-7	Test No. ICCI-SU-8	AASHTO M-283 Specs for Class A Aggregate
Fly Ash/Wet FGD Sludge/ Hydrated Lime	52.3/36.1/ 11.6	55.5/38.3/ 6.2	42.3/52.0/ 5.7	
LA abrasion index, wt %	30	32	36	40 (max)
Soundness index, wt %	87	82	84	12 (max)
Grain size	coarse	coarse	coarse	coarse
Unit weight, lb/ft³	73	74	75	70 (min)
Crush strength, lb	148	138	95	no spec

ROAD AGGREGATES FROM PSI GIBSON FGD SLUDGE

	Test No. ICCI-SU-23	AASHTO M-283 Specs for Class A Aggregate
Fly Ash/Wet FGD Sludge/Hydrated Lime/Cement	36.7/43.8/6.0/13. 5	
LA Abrasion Index, wt %	26	40 (max)
Soundness Index, wt %	10 (a)/18 (b)	12 (max)
Grain Size	coarse	coarse
Unit Weight, lb/ft³	78	70 (min)
Crush Strength, lb	333	---

- (a) Sizes from 3/4" to 4 mesh (uncrushed)
- (b) Sizes from 3/8" to 4 mesh (crushed)

LIGHTWEIGHT AGGREGATES FROM PSI GIBSON FGD SLUDGE

	Test No. ICCI-SU-29	ASTM C-331 Specifications for Lightweight Aggregate
Fly Ash/Wet FGD Sludge/ Hydrated Lime	43.9/50.3/ 5.8	
<u>Unit Weight, lb/ft³</u>		
as-is	65	N/A
dry	55	55 (max)
Clay Lumps, wt %	1	2 (max)
Grain Size	Coarse	Coarse
Loss on Ignition, wt %	5	12 (a) (max)
Staining	None	None

(a) For end products of coal combustion

COMPOSITIONS AND PROPERTIES OF CWL&P DALLMAN STATION AND PSI GIBSON STATION FLY ASH AND FGD SLUDGE

	CWL&P Dallman Station		PSI Gibson Station	
	Fly Ash	FGD Sludge	Fly Ash	FGD Sludge
Specific Gravity	2.35(a)	2.25(b)	2.34(a)	2.39(b)
<u>Sulfur Forms, wt % of S</u>				
Sulfate sulfur	N/A	100	N/A	28.5
Sulfite sulfur	N/A	0	N/A	71.5
Loss on Ignition, wt%	2.31	N/A	8.25	N/A

(a) Oven dry at 110 EC

(b) Oven dry at 55 EC

(c) N/A - Not Applicable

SUMMARY

- **Feasible to Produce Aggregates from Limestone Wet FGD Sulfite Sludge and Gypsum.**
 - **Concrete Aggregate Meeting ASTM Specifications Produced from CWL&P FGD Gypsum, Fly Ash, and Hydrated Lime.**
 - **Class A Aggregate Meeting AASHTO Specifications Produced from PSI Gibson FGD Sulfite Sludge, Fly Ash, Hydrated Lime, and Cement.**
 - **Lightweight Aggregate Meeting ASTM Specifications Produced from PSI Gibson FGD Sulfite Sludge and CWL&P FGD Gypsum, High LOI Fly Ash, and Hydrated Lime.**
- **Economic Evaluation Being Conducted.**
- **Field Demonstration Required.**