

US EPA ARCHIVE DOCUMENT

## Additional Information Regarding American Electric Power's Philip Sporn Power Plant in New Haven, West Virginia

Today, EPA is posting certain materials related to the draft coal ash site assessment conducted by EPA's contractor at the American Electric Power (AEP) Philip Sporn Power Plant in New Haven, West Virginia. EPA worked with State officials and AEP to address issues raised in the draft report to provide the basis for further action. Specifically:

- **Draft EPA Site Assessment Report:** On October 9, 2009, EPA's engineering contractor, Dewberry and Davis, notified EPA that a condition rating of "poor" might be warranted for the two coal ash impoundments at this facility. Dewberry concluded that there was no threat of imminent failure at either of these units, but recommended that AEP conduct liquefaction, slope stability and vibration studies. On October 16, 2009, Dewberry transmitted to EPA the draft assessment report that gave these units a preliminary condition rating of "poor," primarily due to the lack of adequate studies to insure long term safe operation.
- **AEP's Reports/Studies in Response to EPA's Draft Site Assessment Report:** EPA provided AEP and officials from the State of West Virginia Dewberry's draft report and has been in contact with AEP and West Virginia dam safety officials to exchange additional information and discuss further actions. On November 2 and 9, AEP provided EPA with the following reports:
  - AEP's Initial Response to the primary recommendations contained in EPA's Draft Assessment Report;
  - AEP's Liquefaction Studies;
  - AEP's proposed action plan in response to downstream sloughing, erosion, and surface irregularities;
  - AEP's Slope Stability Analysis in support of proposed slope improvement work;
  - AEP's White Paper on factors at AEP's Sporn Ash Disposal Facilities as compared to those at TVA's Kingston facility.

AEP indicated that they are willing to conduct the slope stability and vibration studies, but believed that additional liquefaction tests would not be necessary based on the fact that AEP had already conducted "generic" liquefaction studies that showed that the impoundments at Philip Sporn would be structurally sound over the long term.

- **Dewberry and Davis' Analysis of AEP's Report/Studies:** EPA directed Dewberry and Davis to review the AEP materials noted above and submit a memorandum discussing whether the requested studies noted in the draft report were still needed. Dewberry concluded that the impoundments did not pose an imminent threat, but continued to believe that a liquefaction study should be conducted for the two impoundments.

- **Information Request Letter:** The final item EPA is posting is a formal information request letter which EPA has sent to AEP on November 13, 2009 requesting it to conduct liquefaction, stability and vibration studies. This request, issued under the authority of the Clean Water Act, sets specific requirements for these studies and establishes due dates.

Finally, EPA has directed another of its engineering contractors to conduct a peer review of the Dewberry draft report on the Philip Sporn facility, as well as a review of the conclusions reached in Dewberry's November 10, 2009 memorandum. This peer review will be completed the week of November 16, 2009, and will be posted on the website once it has been received and reviewed by EPA.



## **Supplemental Information to Address Liquefaction Analysis Philip Sporn Plant Draft Dam Assessment Report**

**- November 6, 2009 -**

During the conference call held on Monday, November 2, 2009 between American Electric Power (AEP), U.S. EPA, and Dewberry, AEP presented information that describes the work that had been previously performed to address the question of liquefaction in the context of ash pond dike construction. In 2005, a study was conducted for AEP by The Ohio State University regarding the liquefaction of fly ash which utilized samples of ash from different AEP power plants. Ashes were selected from a representative number of plants, with the fly ash from AEP's Mitchell Plant being determined by the investigators to be the most representative. During the call, the question was raised regarding the applicability of that study to the specific conditions at the Philip Sporn Plant, since fly ash from Sporn was not specifically subjected to the laboratory tests used in that study. Today's submittal addresses that question and confirms that the study results are clearly valid for any review of the potential for liquefaction of ash at Sporn.

First, the 2005 study used fly ash samples from AEP's Mitchell Plant. As mentioned in the conference call, the Mitchell Plant ash is very similar in nature to the ash from Sporn. As follow-up to the call, AEP's engineering department has conducted an in-depth review of the coal sources and the processes that create fly ash at both facilities. That review is documented in Attachment 1 and concludes that the design and operating characteristics of the two plants and their coal sources confirms that engineering characteristics of the fly ash collected at the Mitchell Plant in May of 2005 and used in the 2005 liquefaction study at The Ohio State University are virtually the same as the characteristics of the fly ash from the Sporn Plant.

Additionally, we have inquired with William E. Wolfe, Ph.D., P.E, who was the lead investigator of the 2005 liquefaction study, regarding the applicability of the study results to the evaluation of liquefaction at the Sporn Plant. Dr. Wolfe's response is included here as Attachment 2. In his letter, Dr. Wolfe states that the similarity in physical characteristics between the Sporn and Mitchell ashes would result in similar liquefaction characteristics. Further, Dr. Wolfe explains that they conducted laboratory tests at cyclic stresses exceeding seismic levels credible for the Sporn site and that those tests indicate that liquefaction of the Sporn fly ash is not likely. On this basis, it is believed that the use of the 2005 liquefaction study to support our earlier conclusion, that the conditions

necessary for the fly ash to liquefy at the Sporn site are not present because of its geological and seismic setting, is well founded and in accordance with generally accepted geotechnical engineering practice.

For reference, we direct the reader's attention to data regarding the physical characteristics of fly ash from both Mitchell and Sporn Plants. A summary of the relevant physical characteristics of the fly ash collected in May 2005 at the Mitchell Plant is also included here as Attachment 3. The physical characteristics of the fly ash encountered in the foundation of the eastern dam of the Unit 5 fly ash pond at the Sporn Plant were determined in samples collected in 1996. These samples were collected during the field work conducted as part of the 1998 engineering report that was prepared in support of the, then proposed, modifications to the pond dikes. Those modifications were completed in 2002 and resulted in the current geometry of the site. For reference the logs of the borings can be found in sheet numbers: AEPSPP-000613, AEPSPP-000615, and AEPSPP-000619, and the summary of the tests is found in sheet numbers: AEPSPP-000692, AEPSPP-000699, AEPSPP-000712, and AEPSPP-000713. These documents were previously submitted by AEP to Dewberry as part of their initial site assessment.

In conclusion, the information provided herein clearly substantiates AEP's position that the existing liquefaction analysis is directly applicable to the Sporn Plant and that conditions necessary to liquefy the fly ash at Sporn are not present.

## American Electric Power Comparison of Sporn Plant and Mitchell Plant Coal and Fly Ash Characteristics

### **Purpose:**

Compare Sporn Plant and Mitchell Plant coal and fly ash characteristics. Comparison will include general plant information, coal type consumed, boiler type, coal combustion process, fly ash characteristics and a coal and fly ash comparison summary.

### **General Plant Information:**

#### **Sporn Plant:**

The plant is comprised of a total of five (5) coal-fired electric generating units. Units 1-4 are sub-critical type each rated at 150 Mw electric output and Unit 5 is a super-critical type (once-through) rated at 475 Mw electrical output. All Sporn units burn the same delivered coal. The boilers or furnaces for these units are suspension fired (pulverized coal – PC type) and dry bottom. From a combustion process the units are very similar including the pulverized coal fineness that is delivered to the respective boiler or furnace combined with necessary quantity of air to support the combustion process.

All units are equipped with Electrostatic Precipitator (ESP) for particulate or ash removal/control. Units 3 and 4 are also equipped with Selective Non Catalytic Reduction (SNCR) for NOx removal/control. Respective of the ESP and ash removal for all units, the plant coordinates with the state to conduct particulate emission testing to demonstrate compliance, as required by their air permit.

#### **Mitchell Plant:**

The plant is comprised of a total of two (2) coal-fired electric generating units. Units 1-2 are super-critical type each rated at 800 Mw electric output. Both Mitchell units burn the same delivered coal. The boilers or furnaces for these units are suspension fired (PC type) and dry bottom. From a combustion process the units are very similar to the Sporn units including the pulverized coal fineness that is delivered to the respective boiler or furnace combined with necessary quantity of air to support the combustion process.

Both units are equipped with Electrostatic Precipitator (ESP) for particulate or ash removal/control, Selective Catalytic Reduction (SCR) for NOx removal/control and Flue Gas Desulfurization (FGD) for SO2 removal/control. In addition, both Mitchell units are equipped with Trona Injection for SO3 removal/control. Respective of the ESP and ash removal for both units, the plant coordinates with the state to conduct particulate emission testing to demonstrate compliance, as required by their air permit.

### **Coal:**

Reference attached EPRI diagram labeled “Coal Producing Regions” that defines various regions and coal types. Additionally, reference attached spreadsheet labeled “AEP Sporn Plant and Mitchell Plant Coal Mines” as a general guideline to the various mines that supply coal to both plants. The spreadsheet includes mine source information for the 2004 to 2008 timeframe and this information is representative of the historic coal supply for both plants. It is important to mention that the Mitchell Plant units had both an FGD and SCR installed in 2006 and the coal supply has changed somewhat since that time but is not relevant to a more historic comparison of the coal consumed at Mitchell Plant and associated coal combustion products. As a result there is no 2006 to 2008 coal mine data for Mitchell Plant included in the spreadsheet.

All of the coal consumed currently (and historically) at the Sporn Plant is from the Appalachian Region and more specifically from Central Appalachia. Approximately 95% of all the coal consumed historically at the Mitchell Plant is also from the Appalachian Region and from Central Appalachia the same as Sporn Plant. The remaining 5% of coal consumed at the plant is also from the Appalachian region and is from Northern Appalachia.

Of the Central Appalachia region coal, no particular seam is a dominant supply. In fact, nearly all of these mines produce a blend of Central Appalachia coal from this area. Based on the mines and short proximate analysis, the coals are considered to be the same in terms of all characteristics.

### **Boiler Type & Coal Combustion Process:**

For both Mitchell Plant and Sporn Plant, the boilers are suspension fired pulverized coal (PC) dry bottom type. From a coal combustion process the units are very similar. All the Mitchell Plant units and Sporn Plant units incorporate coal pulverizers that crush the coal into very fine particles. The coal is sized to a fineness of 70% passing 200 mesh and 99.5% passing 50 mesh, which results in coal particles sized nominally at 50 microns. These very small fine coal particles burnout very quickly (i.e., about 1 second) and achieve a temperature of around 2600 to 2700 degrees F within the boiler. During the combustion process, the ash is heated to the resulting furnace bulk temperature. Dependant upon the temperature, some of the elements in the ash will melt and other elements will vaporize.

All Sporn Plant and Mitchell Plant units are dry bottom boilers. In a dry bottom unit, 70% to 80% of the ash is fly ash. The remaining 20% to 30% that settles in the furnace because it is too large and heavy to be suspended in the gas stream or is knocked off of the heat transfer surfaces and falls to the bottom of the boiler as a dry material. The hopper is at the bottom of the furnace and provides the collection of the dense, sintered bottom ash.

### **Fly Ash Characteristics:**

Physical characteristics of fly ash including size, shape, density or weight and chemical composition are determined by the coal rank (i.e., bituminous ...), boiler type, combustion process and the environment in which the combustion takes place. Reference attached AEP slide labeled "Coal Combustion Products" that includes photos of typical coal combustion products including fly ash, bottom ash, boiler slag and FGD 'scrubber' product to show the coal ash product variation for general information. The temperature to which the ash is exposed to is largely related to the combustion process (i.e., PC, cyclone...). Fly ash is ash that is entrained in the flue gas. Nearly all (99.4+%) of the fly ash in the flue gas exiting the unit is collected in the respective unit ESP before exiting the stack to meet particulate emission compliance.

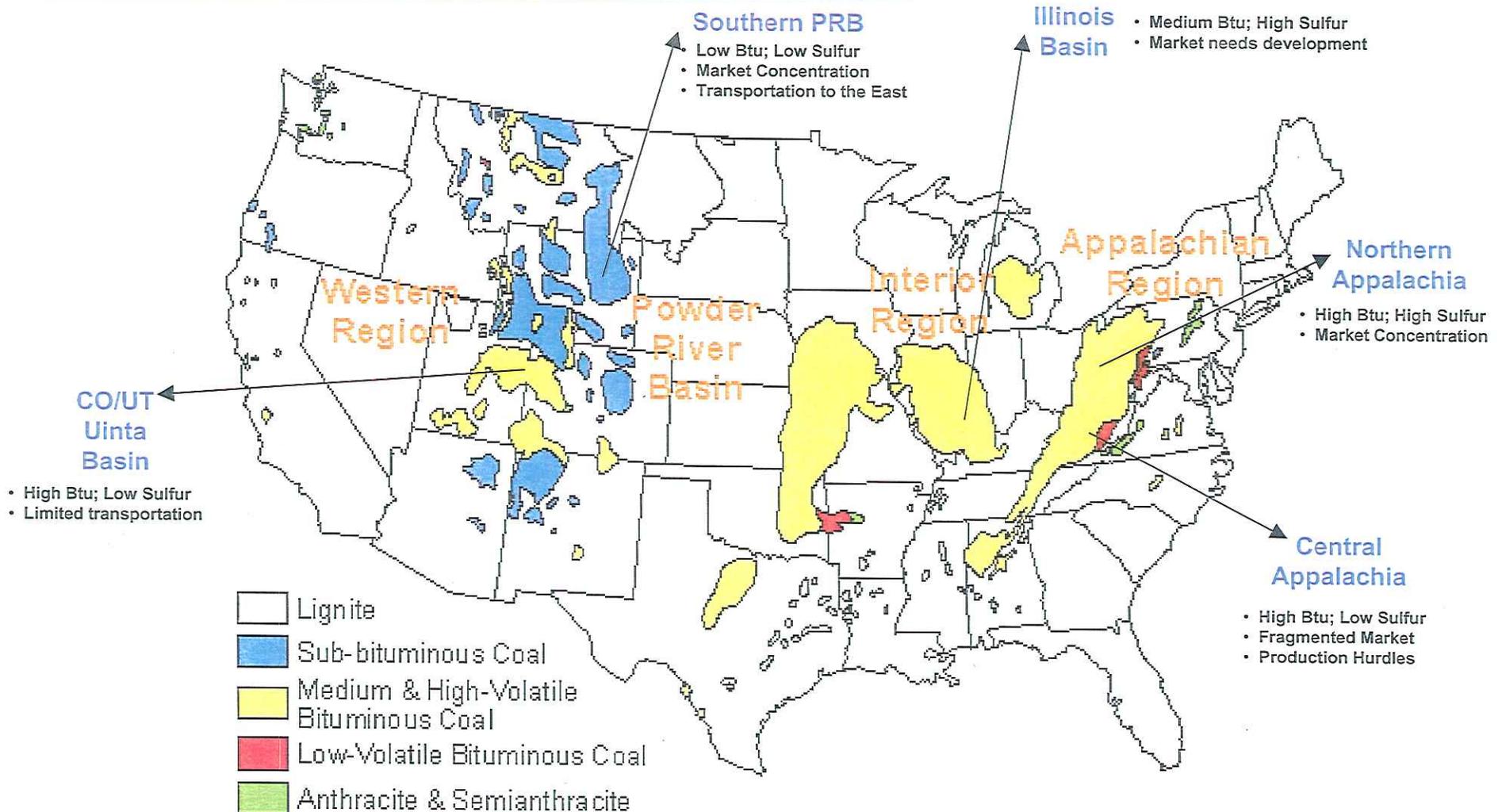
Eastern coal primarily from the Appalachian Region has ash that contains more iron, alumina and silica than Western coal types (i.e., Power River Basin). Because of these elements, Eastern coal ash is considered more erosive than the Western coal ash. The Central Appalachia coal, in eastern Kentucky and lower West Virginia, contains coal that has a high melting temperature (>2700 Degrees F) and is low in sulfur. The Northern Appalachia coals have more iron and sulfur and tend to melt at a lower temperature (~2400 Degrees F).

### **Coal and Fly Ash Characteristic - Comparison Summary:**

From the above information a clear comparison of the coal and ash products from Sporn Plant and Mitchell Plant indicates that fly ash and bottom ash physical characteristics from these plants exhibit virtually the same qualities.

**Attachments:** EPRI diagram: "Coal Producing Regions", 2008 Electric Power Research Institute (EPRI); AEP document: "AEP Sporn Plant and Mitchell Plant Coal Mines" and AEP slide: "Coal Combustion Products".

# Coal Producing Regions



AEP Sporn Plant and Mitchell Plant - Coal Mines						
Mitchell Plant coal mines - 2004	Mitchell Plant coal mines - 2005	Sporn Plant coal mines - 2004	Sporn Plant coal mines - 2005	Sporn Plant coal mines - 2006	Sporn Plant coal mines - 2007	Sporn Plant coal mines - 2008
DTE/IndyCoke	Blacksville No.1-WV	Elk Run - Boone, WV	Cannelton No.140 - K	Deep Water Resources	Deep Water Resources	Coalburg #2, WV
Elk Run - Boone, WV	Blacksville No.2 - M	EQUESTRIAN PARK	Elk Run - Boone, WV	Elk Run - Boone, WV	Elk Run - Boone, WV	Crooked Run Mine- WV
Evergreen	DTE/IndyCoke	Island Fork Const-WV	Little Elk Mine- KY	Feats, WV Logan	Feats, WV Logan	Elk Run - Boone, WV
Feats, WV Logan	Evergreen	Lens Creek No.1 - WV	Panther Creek - WV	Gun Hill Mine	Fork Creek No.1 - WV	Kanawha Eagle- WV
Fork Creek No.1 - WV	Feats, WV Logan	Omar No 1 - WV	Rosebud Mine	Homer III Mine- WV	Independence - WV	Kiah Creek - WV
Independence - WV	Homer III Mine- WV	Panther Creek - WV	Rum Creek Prep (Band	Jean Mine - PA	Kingston No. 1 - WV	Mammoth Mine
LibertyProcessMne,WV	Independence - WV	Rush Creek Surf - WV	Rush Creek Surf - WV	Landmark No.2, KY	Lese No. 1 Mine - WV	Motts Branch Mine,KY
Lick, WV	LibertyProcessMne,WV	Sandy River Synfuel	Sandy River Synfuel	Lese No. 1 Mine - WV	Little Elk Mine- KY	NicholasEnergyMine-WV
McElroy Mine - WV	Loveridge Prep - WV	Var,KY&WV-Boone/Pike	Stirrat Prep - WV	Little Elk Mine- KY	Mammoth Mine	Panther Creek - WV
Prenter LO, WV	McElroy Mine - WV	Var,WV-Kanawha-S100%	Toms Fork LO - WV	Mammoth Mine	NicholasEnergyMine-WV	Republic Energy Mine
Rock Lick Prep - WV	Prenter LO, WV	Var,WV-KnwahaRvr-Bne	Var,KY&WV-Boone/Pike	Panther Creek - WV	Omar No 1 - WV	Rush Creek Surf - WV
Rum Creek Prep (Band	Robinson Run#95 - WV	Various KY	Var,KY&WV-Wayne/Pike	Republic Energy Mine	Panther Creek - WV	Var,KY&WV-Boone/Pike
Wells Prep, WV	Rock Lick Prep - WV	Various WV	Var,WV Kan/Fay	Rum Creek Prep (Band	Performance/Edwight	Var,KY&WV-Wayne/Pike
#N/A	Rum Creek Prep (Band	Various,KY & WV	Var,WV-Fayette(S,U)	Rush Creek Surf - WV	Republic Energy Mine	Var,WV Kan/Fay
#N/A	Stirrat Prep - WV	Various,KY-Pike	Var,WV-Kanawha-S100%	Stirrat Prep - WV	Rush Creek Surf - WV	Var,WV-KnwahaRvr-Bne
#N/A	Wells Prep, WV	Various,WV-Boone(S)	Var,WV-KnwahaRvr-Bne	Var,KY&WV-Boone/Pike	Stirrat Prep - WV	Various- Kanawha, WV
#N/A	#N/A	Various,WV-Boone(U)	Various- Kanawha, WV	Var,KY&WV-Wayne/Pike	Var,KY&WV-Boone/Pike	Various,KY-Floyd
#N/A	#N/A	Various,WV-Logan	Various,KY & WV	Various,KY-Floyd	Var,WV Kan/Fay	Various,WV-Wayne
#N/A	#N/A	Various,WV	Various,KY-Pike	Various,WV- Marshall	Various,WV-Boone(U)	#N/A
#N/A	#N/A	#N/A	Various,WV-Boone(S)	Various,WV-Boone(U)	#N/A	#N/A
#N/A	#N/A	#N/A	Various,WV-Boone(U)	Various,WV-Wayne	#N/A	#N/A
#N/A	#N/A	#N/A	Various,WV-Wayne	#N/A	#N/A	#N/A
#N/A	#N/A	#N/A	Wills Mine	#N/A	#N/A	#N/A

NOTES:  
1. Color coding of specific mines indicates same mine for both Mitchell Plant and Sporn Plant as a general reference.  
2. Mitchell Plant units had both an FGD and SCR installed in 2006 therefore coal mine information is not relevant to a more historic comparison of the coal consumed at Mitchell Plant.



# Coal Combustion Products





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November 6, 2009

Phone (614) 292-2771  
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Mr. Pedro J. Amaya, P.E.  
American Electric Power  
1 Riverside Plaza  
Columbus, OH 43215

Dear Mr. Amaya,

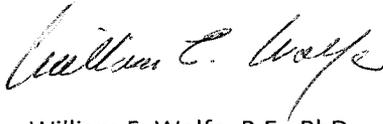
I have reviewed the liquefaction data generated in my laboratory when we performed a series of cyclic triaxial tests on fly ash samples in 2005. I also reviewed the seismic wave propagation analyses performed at the same time. The laboratory tests were conducted on samples of compacted fly ash received from the Mitchell Plant. The Mitchell plant fly ash was chosen for testing because it was considered representative of the fly ashes we investigated. We made that determination by comparing physical characteristics of the ashes we had obtained from other AEP plants. Based on the similarity of grain size distribution and specific gravity, the fly ash from the Philip Sporn plant would exhibit liquefaction characteristics similar to those measured during the 2005 testing program.

In those 2005 tests, we observed the resistance to liquefaction of the fly ash samples was a function primarily of ash density and confining stress. Although we found no other experimental data on the resistance to liquefaction of fly ash, over the past 40 years there have been numerous studies characterizing the liquefaction behavior of other particulate materials and our data are consistent with the general behavior of those materials. We also found that, in addition to the physical properties of the ash, liquefaction potential was strongly dependent on the level of imposed cyclic stress and the number of cycles of applied stress. This too is consistent with the cyclic behavior of other particulate materials.

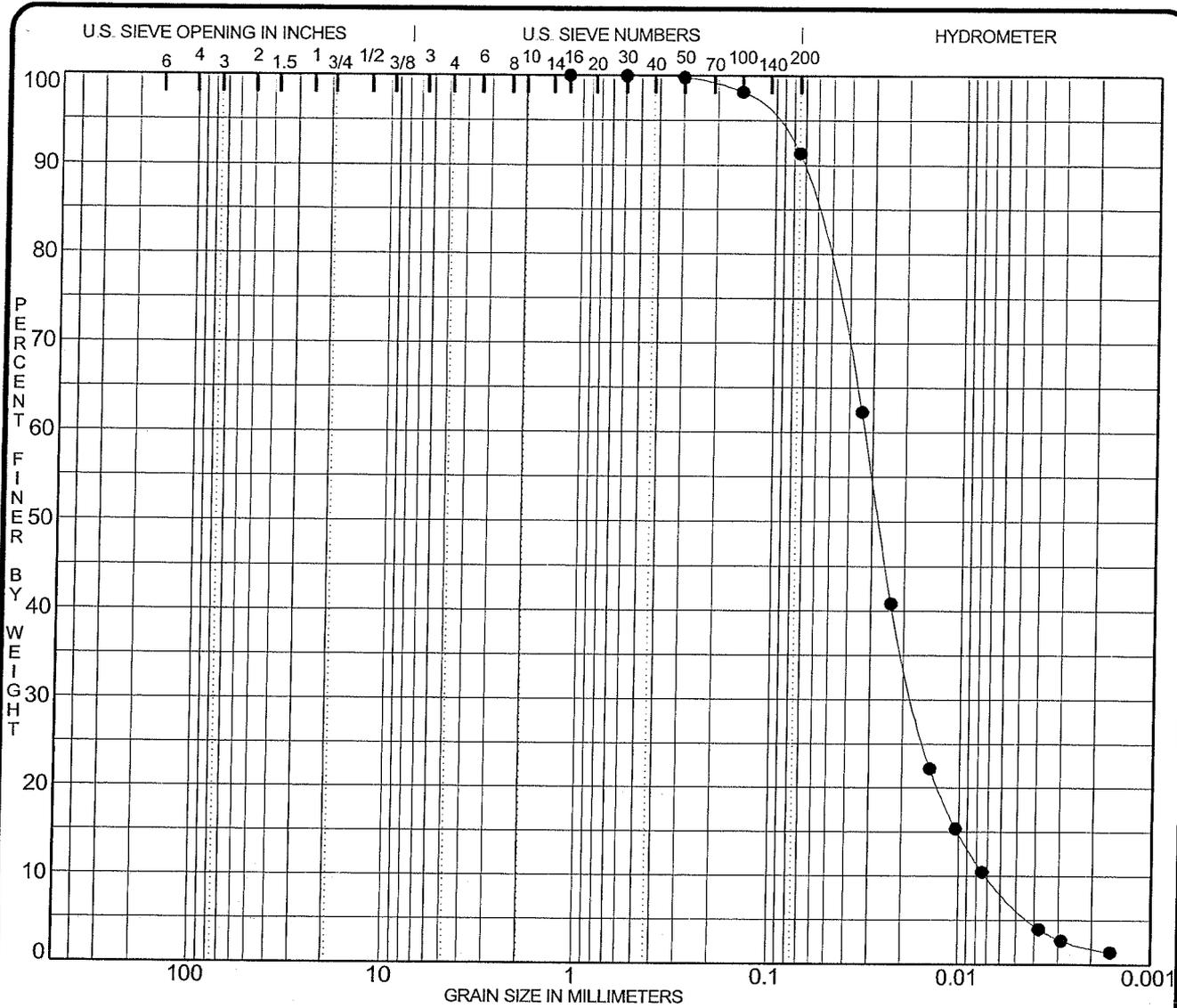
Our laboratory tests were conducted at cyclic stress levels designed to approximate horizontal seismic shaking levels of 0.08g and 0.15g. These levels were selected because, based on the non-fly ash results available in the literature, they should be large enough to induce liquefaction in compacted samples.—We found that for the fly ash samples tested, cyclic stress levels corresponding to a seismic event of 0.08g were insufficient to induce liquefaction. The level of seismic shaking deemed credible is site specific and for the Sporn site the best estimate of shaking corresponds to 0.06g, well below the threshold we determined for liquefaction.

The analytical tool we used to determine the levels of shaking at specific locations within the fly ash, given a credible earthquake event was a one dimensional wave propagation program that has been used in seismic design for many years. This method, because it is based on elastic properties, is well suited to design but does not fully account for all the energy dissipation likely in layered particulate strata. Largely for that reason I expect the actual level of shaking necessary to initiate and sustain liquefaction is greater than the levels we reported, providing an even greater factor of safety. For these several reasons our tests and our analyses strongly indicate that liquefaction of the Sporn fly ash is not likely.

Sincerely,

A handwritten signature in cursive script, appearing to read "William E. Wolfe".

William E. Wolfe, P.E., PhD  
Professor



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification	MC%	LL	PL	PI	Sp.Gr.
● S-9612 0.0						2.27
<b>MITCHELL PONDED FLY ASH - Sampled May 2005</b>						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Fines	%<.002
● S-9612 0.0	1.180	0.033	0.018	0.007	0.0	8.7	91.3	1.9

PROJECT FLY ASH TESTING - JOB NO. \_\_\_\_\_ DATE 11/4/09

