



# WHEELING JESUIT UNIVERSITY

Biology Department

March 9, 2009

Senator C. Randy White  
Natural Resource Committee  
212 River Drive  
Webster Springs, West Virginia

Dear Senator White,

Attached please find the preliminary summary and database of selected metal results from the Underground Injection Control Study as compiled by Dr. Ben Stout and Mary Ellen Cassidy of Wheeling Jesuit University.

In a meeting with OSM and WVDEP on February 17<sup>th</sup>, there was some confusion as to which standards apply to injected slurry. We have used Primary Drinking Water Standards in our analysis based on information found in WVDEP reports, one being WVDEP's use of Primary Drinking water standards for the Southern Minerals UIC report and another being a statement from "History and Status of Mining Underground Injection Control at the WVDEP Division of Water and Waste Management" presented at the 2008 West Virginia Surface Mine Task Force Symposium - "In fact, if an existing mine pool is being used as a potable water source for even one person, no permit will be issued for injection into it, notwithstanding the requirement that all UIC injection must meet Federal Safe Drinking Water Standards, also called Primary Drinking Water Maximum Contaminant Levels, or MCLs, at the point of injection."

Based on Primary Drinking Water standards the following metals were present in the liquid fraction of the UIC slurry samples in concentrations above the Primary Drinking Water Standards: antimony, arsenic, lead, barium, cadmium, and chromium.

Antimony exceeded Primary Drinking Water Standards at all but one (Power Mountain) of the six sites with as high as 3x the standard at the Southern Minerals site. Lead exceeded Primary Drinking Water Standards at two of the six sites (Marfork and Panther) with values at 5x the standard at the Panther site and over 300 x the standard at the Marfork site. Barium, cadmium, and chromium also far exceeded the drinking water standards at the Marfork site with concentrations 100x, 24x, and 55x the accepted levels respectively.

Exceptionally high concentrations of metals were found in the solid fraction of the slurry at all six locations. For example the solids from Marfork had concentrations of arsenic at 159 000 ppb. Although solids are not regulated under Drinking Water Standards metal concentrations are relevant due to the fact that changes in pH, redox potential and other unknown underground conditions can mobilize metals from the solid to the liquid fraction of the slurry.

WJU analyzed samples for selected metals only (inorganic constituents). However, WVDEP tested for other parameters including organic compounds. In their organic analysis section of the Southern Minerals UIC report, WVDEP notes that "Total Petroleum Hydrocarbon (TPH) values should not exceed the threshold limit

(100 mg/L) set by the WVDEP's Division of Solid Waste Management for their Special Waste designation... The TPH issue should be corrected since this slurry is being injected into the groundwater of the state of West Virginia". Based on this concern, it should be noted that all but one (Power Mountain) of the UIC sites show TPH values above these threshold limits. Especially high concentrations were recorded at the Coresco site with TPH levels above 700 mg/L. According to the WVDEP, "Coal Slurry containing TPH values above 100 mg/L should not be injected into groundwater aquifers in West Virginia. This practice may be in violation of the WVDEP Division of Solid Waste policy, unless an exclusion or exemption has been granted by the WVDEP." (West Virginia Coal Slurry Study: Southern Minerals/Welch Sample Results Discussion).

The attached database was sent to WVDEP for review. Upon receipt of comments a comprehensive final report will be compiled by WJU. There are questions as to identity of comparable samples and discrepancies between WVDEP and WJU findings that are still unresolved (see attached documents). Therefore, without review and comment from the WVDEP, the remarks included in this letter along with the attached analysis are preliminary findings and are not yet considered verified and reliable. Please feel free to contact us with any further questions you may have.

Sincerely,

  


Mary Ellen Cassidy  
Dr. Ben Stout  
Wheeling Jesuit University  
316 Washington Avenue  
Wheeling, West Virginia  
304-232-2316  
[mcassidy@wju.edu](mailto:mcassidy@wju.edu)  
[bens@wju.edu](mailto:bens@wju.edu)

# West Virginia Department of Environmental Protection and Wheeling Jesuit University Underground Injection Control Collaborative Study.

Based on citizens' request, WVDEP agreed to send split samples from six underground injection control sites to Wheeling Jesuit University along with the WVDEP lab results to compare with the WJU lab results.

*The following is not an attempt to present a detailed final analysis paper but rather to provide a requested first summary of the preliminary results.*

## **Discussion**

WJU was not permitted to take samples. WVDEP collected all the samples and provided splits to WJU. WVDEP and WJU did not synchronize sampling or analysis protocol. The samples were sent to different independent labs. WVDEP sent samples to Reich in Beaver, WV and WJU to the National Center for Water Quality Research in Tiffin, OH.

WJU has received the Reich lab results from WVDEP for all six locations. WJU has received the split samples from Loadout, LLC, Panther, and Power Mountain. WJU has provided metals analysis for both Loadout and Panther. The WJU results for Power Mountain are not yet available. As of this date the additional three split samples (Marfork, Coresco, Southern Minerals) have not yet been received for WJU analysis.

Initially there was some confusion regarding the identity of the slurry sample on the Reich reports. This was later clarified by WVDEP providing WJU with additional reports.

Samples identified as WJU Supernatant represent the liquid poured directly from the settled slurry samples. Samples identified as WJU Reconstituted Samples refer to slurry samples where the solids were well mixed with 250 mL deionized water and left to settle. After 37 days the supernatant (l) was decanted and sent for analysis along with the recovered solid (s) fraction.

The slurry sample database provided in this summary was emailed to WVDEP for comment on March 5, 2009. WJU will forward these comments when received.

## **Results:**

The attached database includes analysis of selected metals (not organic compounds) in slurry samples only. Based upon use of Primary Drinking water standards in both the Southern Minerals UIC report and the WVDEP paper "History and Status of Mining Underground Injection Control at the WVDEP Division of Water and Waste Management" - liquid slurry fraction exceedences are based on the limits set by the Primary Safe Drinking Water Act.

### **Metals exceeding Primary Drinking Water Standards (DWS):**

#### **Antimony (Sb) was found in exceedence of 6 ppb DWS at four of the six sites**

Loadout (Total = 11.32 ppb reported by WJU)

Panther (Total = 16.00 ppb; Soluble = 14.60 ppb reported by WVDEP)

Southern Minerals (Total = 21.5 ppb; Soluble = 22.0 ppb reported by WVDEP ).

Coresco (Slurry Liquid 7.1 ppb reported by WVDEP)

#### **Arsenic (As) was found in exceedence of 10 ppb DWS at one of the six sites**

Panther (Total = 16.00 ppb; Soluble = 14.60 ppb reported by WVDEP)

#### **Lead (Pb) was found in exceedence of 15 ppb DWS at two of the six sites**

Panther (Total = 77.50ppb; Soluble = 76.20 ppb reported by WVDEP)

(Total = 27.88 ppb; Soluble = 29.23 ppb reported by WJU)

Marfork (Slurry = 5860 ppb reported by WVDEP).

**Barium (Ba) was found in exceedence of 2000 ppb DWS at one of the six sites.**

Marfork (Slurry = 304 000 ppb reported by WVDEP)

**Cadmium (Cd) was found in exceedence of 5 ppb DWS at one of the six sites.**

Marfork (Slurry = 123 ppb reported by WVDEP)

**Chromium (Cr) was found in exceedence of 100 ppb DWS at one of the six sites.**

Marfork (Slurry = 5 550 ppb reported by WVDEP)

According to WVDEP reports Power Mountain shows no primary water standard exceedence for metals tested. (WJU analysis not yet available)

In general, both WVDEP and WJU results showed high metal concentrations in the solid faction. The potential solubility and mobility of these metals from the solid to liquid faction depends on the stability of several parameters such as pH, redox and surrounding chemistry.

Attached Database: Notes of Interest

In several instances, there were discrepancies between WVDEP results compared to WJU results with no clear pattern of consistently higher results from either. (For instance, for the split samples from Loadout, the total liquid antimony (Sb) concentration is given as 11.32 ppb by WJU compared to 5.90 ppb by WVDEP. In contrast, for the split samples from Panther, the total liquid arsenic (As) concentration is given as 4.26 ppb by WJU compared to 11.30 ppb from WVDEP.)

In several instances WJU reconstituted samples showed higher concentrations than the WJU original supernatants. For example, for Panther, the total liquid antimony (Sb) concentration for slurry supernatant was 1.35 ppb while the reconstituted (diluted) sample is 1.95 ppb.

The table below includes a more detailed description of the metal concentrations. The last column indicates whether the values are from WJU or WVDEP reports. Secondary Drinking water contaminants are listed. Contaminant Candidate Listed (CCL) metals are also listed below with respective Drinking Water Equivalency Limits (DWEL). However, both Secondary and CCL metals although assigned suggested limits are not enforceable standards.

## LOADOUT, LLC.

### Metals Exceeding EPA Primary Drinking Water Standards

Metal	Sample	EPA STD	Concentrations (ppb)	Report
Sb	Slurry Supernatant Total (2008)	6 ppb	<del>11.32</del>	WJU
	Reconstituted Slurry Liquid Total (2008)	Primary	1.04	WJU
	LL-Slurry-Liquids Total		5.90	WVDEP

### Metals Exceeding EPA Secondary Drinking Water Standards

Metal	Sample	EPA STD	Concentrations (ppb)	Report
Al	Reconstituted Slurry Liquid Total (2008)	200 ppb	<del>2477.77</del>	WJU
	Slurry Supernatant Total (2008)		10.86	WJU
	LL-Slurry-Liquids Total		<del>2370.00</del>	WVDEP
Fe	Reconstituted Slurry Liquid Total (2008)	300 ppb	<del>1881.11</del>	WJU
	Slurry Supernatant Total (2008)		141.99	WJU
	LL-Slurry-Liquids Total		<del>828.00</del>	WVDEP
	Slurry Supernatant Soluble (2007)		<del>318.57</del>	WJU
	LL Slurry Liquid Dissolved		ND	WVDEP
	Slurry Supernatant soluble (2008)		131.53	WJU
Mn	Reconstituted Slurry Liquid Soluble (2008)	50 ppb	87.05	WJU
	Slurry Supernatant Total (2008)		BDL	WJU
	Reconstituted Slurry Liquid Total (2008)		21.24	WJU
	LL-Slurry-Liquids Total		<del>97.00</del>	WVDEP
	Slurry Supernatant Soluble (2007)		<del>86.92</del>	WJU
LL Slurry Liquid Dissolved	<del>86.00</del>	WVDEP		

### Metals on the Contaminant Candidate List – not regulated

Metal	Sample	DWEL *	Concentrations (ppm)	Report
Na	Slurry Supernatant Total (2008)	20 ppm	<del>117.53</del>	WJU
	LL-Slurry-Liquids Total		<del>267.00</del>	WVDEP
	Reconstituted Slurry Liquid Total (2008)		<del>62.23</del>	WJU
	LL Slurry Liquid Dissolved		<del>265.00</del>	DEP
	Slurry Supernatant soluble (2008)		<del>287.49</del>	WJU
	Reconstituted Slurry Liquid Soluble (2008)		<del>78.78</del>	WJU
	Slurry Supernatant Soluble (2007)		BDL	WJU

\* DWEL = Drinking Water Equivalency Level According the EPA website: " This low level of concern is compounded by the legitimate criticisms of EPA's 20 milligrams per liter (mg/l) Drinking Water Equivalency Level (DWEL or guidance level) for sodium. EPA believes this guidance level for sodium needs updating, and is probably low. If a health benchmark for drinking water were established using current information and current drinking water health assessment procedures, it would likely be higher. This revision could establish a new level at which sodium occurrence would not meet the criteria for inclusion on the CCL as a drinking water contaminant of concern. There was insufficient time to complete a reassessment of the sodium guidance in advance of the CCL issuance."

WJU Reconstituted Samples = Slurry samples were well mixed and allowed to settle for 37 days. Then 100 mL supernatant was decanted and diluted with 250 mL deionized water.

## PANTHER

### Metals Exceeding EPA Primary Drinking Water Standards

Metal	Sample	EPA STD	Concentrations (ppb)	Report
Sb	PL-Slurry Liquids Total	6 ppb	16.00	WVDEP
	Slurry Supernatant Total (2008)		1.36	WJU
	Reconstituted Slurry Liquid Total (2008))		1.95	WJU
	PL-Slurry Liquids dissolved metals		14.60	WVDEP
	Slurry Supernatant Soluble (2008)		1.37	WJU
	Reconstituted Slurry Liquid Soluble (2008)		2.24	WJU
As	PL-Slurry Liquids Total	10 ppb	11.30	WVDEP
	Slurry Supernatant Total (2008)		4.26	WJU
	Reconstituted Slurry Liquid Total (2008))		2.91	WJU
	Slurry Supernatant Soluble (2008)		4.62	WJU
	Reconstituted Slurry Liquid Soluble (2008)		3.58	WJU
	PL-Slurry Liquids Dissolved Metals		10.40	WVDEP
Pb	Slurry Supernatant Total (2008)	15 ppb	27.88	WJU
	PL-Slurry Liquids total		77.50	WVDEP
	Reconstituted Slurry Liquid Total (2008)		6.58	WJU
	Reconstituted Slurry Liquid Soluble (2008)		5.13	WJU
	Slurry Supernatant Soluble (2008)		29.23	WJU
	PL-Slurry Liquids dissolved metals		76.20	WVDEP

### Metals Exceeding EPA Secondary Drinking Water Standards

Metal	Sample	EPA STD	Concentrations (ppb)	Report
Al	Reconstituted Slurry Liquid Total (2008))	200 ppb	1988.29	WJU
	Slurry Supernatant Total (2008)		20.15	WJU
	PL-Slurry Liquids total		46.00	WVDEP
Fe	Slurry Supernatant Total (2008)	300 ppb	46.95	WJU
	PL-Slurry Liquids total		89.00	WVDEP
	Reconstituted Slurry Liquid Total (2008))		935.94	WJU
	Slurry Supernatant Soluble (2008)		28.48	WJU
	PL-Slurry Liquids dissolved		68.00	WVDEP
	Reconstituted Slurry Liquid Soluble (2008)		322.17	WJU

### Metals on the Contaminant Candidate List – not regulated

Metal	Sample	DWEL *	Concentrations (ppm)	Report
Na	Slurry Supernatant Total (2008)	20 ppm	942.42	WJU
	PL-Slurry Liquids total		341.00	WVDEP
	Reconstituted Slurry Liquid Total (2008))		243.93	WJU
	Slurry Supernatant Soluble (2008)		1023.07	WJU
	PL-Slurry Liquids dissolved		266.00	WVDEP
	Reconstituted Slurry Liquid Soluble (2008)		268.37	WJU

\* DWEL = Drinking Water Equivalency Level According the EPA website: " This low level of concern is compounded by the legitimate criticisms of EPA's 20 milligrams per liter (mg/l) Drinking Water Equivalency Level (DWEL or guidance level) for sodium. EPA believes this guidance level for sodium needs updating, and is probably low. If a health benchmark for drinking water were established using current information and current drinking water health assessment procedures, it would likely be higher. This revision could establish a new level at which sodium occurrence would not meet the criteria for inclusion on the CCL as a drinking water contaminant of concern. There was insufficient time to complete a reassessment of the sodium guidance in advance of the CCL issuance."

WJU Reconstituted Samples = Slurry samples were well mixed and allowed to settle for 37 days. Then 100 mL supernatant was decanted and diluted with 250 mL deionized water.

The following data for Southern Minerals, Marfork, Coresco and Power Mountain represents WVDEP results only.

### SOUTHERN MINERALS

#### Metals Exceeding EPA Primary Drinking Water Standards

Metal	Sample	EPA STD	Concentrations (ppb)	Report
Sb	SM-Slurry Liquids Dissolved	6 ppb	22.0 ppm	WVDEP
	SM-Slurry Liquids Total		21.5 ppm	WVDEP

#### Metals Exceeding EPA Secondary Drinking Water Standards

Metal	Sample	EPA STD	Concentrations (ppb)	Report
Al	SM-Slurry Liquids	200 ppb	651	WVDEP
Fe	SM-Slurry Liquids	300 ppb	910	WVDEP

#### Metals on the Contaminant Candidate List – not regulated

Metal	Sample	DWEL *	Concentrations (ppm)	Report
Na	SM-Slurry Liquid Dissolved	20 ppm	58.8	WVDEP
	SM-Slurry Liquid Total		55.5	WVDEP

\* DWEL = Drinking Water Equivalency Level According the EPA website: " This low level of concern is compounded by the legitimate criticisms of EPA's 20 milligrams per liter (mg/l) Drinking Water Equivalency Level (DWEL or guidance level) for sodium. EPA believes this guidance level for sodium needs updating, and is probably low. If a health benchmark for drinking water were established using current information and current drinking water health assessment procedures, it would likely be higher. This revision could establish a new level at which sodium occurrence would not meet the criteria for inclusion on the CCL as a drinking water contaminant of concern. There was insufficient time to complete a reassessment of the sodium guidance in advance of the CCL issuance."

## Coresco

### Metals Exceeding EPA Primary Drinking Water Standards

Metal	Sample	EPA STD	Concentrations (ppb)	Report
Sb	CL-Slurry Liquid	6 ppb	71	WVDEP

### Metals Exceeding EPA Secondary Drinking Water Standards

Metal	Sample	EPA STD	Concentrations (ppb)	Report
Al	CL-Slurry Liquid	200 ppb	644	WVDEP
Mn	CL-Slurry Liquid	50 ppb	138	WVDEP

### Metals on the Contaminant Candidate List – not regulated

Metal	Sample	DWEL *	Concentrations (ppm)	Report
Na	CL-Slurry Liquid	20 ppm	279	WVDEP

\* DWEL = Drinking Water Equivalency Level According the EPA website: " This low level of concern is compounded by the legitimate criticisms of EPA's 20 milligrams per liter (mg/l) Drinking Water Equivalency Level (DWEL or guidance level) for sodium. EPA believes this guidance level for sodium needs updating, and is probably low. If a health benchmark for drinking water were established using current information and current drinking water health assessment procedures, it would likely be higher. This revision could establish a new level at which sodium occurrence would not meet the criteria for inclusion on the CCL as a drinking water contaminant of concern. There was insufficient time to complete a reassessment of the sodium guidance in advance of the CCL issuance."

## Marfork

### Metals Exceeding EPA Primary Drinking Water Standards

Metal	Sample	EPA STD	Concentrations (ppb)	Report
Ba	MF-Slurry metals	2000 ppb	304 000	WVDEP
Cd	MF-Slurry metals	5 ppb	123	WVDEP
Cr	MF-Slurry metals	100 ppb	5 550	WVDEP
Pb	MF-Slurry metals	15 ppb	5860	WVDEP

### Metals Exceeding EPA Secondary Drinking Water Standards

Metal	Sample	EPA STD	Concentrations (ppb)	Report
Al	MF-Slurry metals	200 ppb	3 130 000	WVDEP
Cu	MF-Slurry metals	1300 ppb	10 800	WVDEP
Fe	MF-Slurry metals	300 ppb	7 000 000	WVDEP
Mn	MF-Slurry metals	50 ppb	72 900	WVDEP
Zn	MF-Slurry metals	5 000 ppb	18 700	WVDEP

### Metals on the Contaminant Candidate List – not regulated

Metal	Sample	DWEL *	Concentrations (ppm)	Report
Na	MF-Slurry metals	20 ppm	315	WVDEP
Ni	MF-Slurry metals	100 ppm	7 680	WVDEP

\* DWEL = Drinking Water Equivalency Level According the EPA website: " This low level of concern is compounded by the legitimate criticisms of EPA's 20 milligrams per liter (mg/l) Drinking Water Equivalency Level (DWEL or guidance level) for sodium. EPA believes this guidance level for sodium needs updating, and is probably low. If a health benchmark for drinking water were established using current information and current drinking water health assessment procedures, it would likely be higher. This revision could establish a new level at which sodium occurrence would not meet the criteria for inclusion on the CCL as a drinking water contaminant of concern. There was insufficient time to complete a reassessment of the sodium guidance in advance of the CCL issuance."

## Power Mountain

**According to WVDEP Reports, there are no metals exceeding Primary Drinking Water Standards for Power Mountain.**

### Metals Exceeding EPA Secondary Drinking Water Standards

<b>Metal</b>	<b>Sample</b>	<b>EPA STD</b>	<b>Concentrations (ppb)</b>	<b>Report</b>
Al	PM – Slurry Liquid PM- Slurry Liquid Lab Filtered	200 ppb	564 509	WVDEP
Mn	PM – Slurry Liquid PM- Slurry Liquid Lab Filtered	50 ppb	921 921	WVDEP

### Metals on the Contaminant Candidate List – not regulated

<b>Metal</b>	<b>Sample</b>	<b>DWEL *</b>	<b>Concentrations (ppm)</b>	<b>Report</b>
Na	PM – Slurry Liquid PM- Slurry Liquid Lab Filtered	20 ppm	237 236	WVDEP

\* DWEL = Drinking Water Equivalency Level According the EPA website: " This low level of concern is compounded by the legitimate criticisms of EPA's 20 milligrams per liter (mg/l) Drinking Water Equivalency Level (DWEL or guidance level) for sodium, EPA believes this guidance level for sodium needs updating, and is probably low. If a health benchmark for drinking water were established using current information and current drinking water health assessment procedures, it would likely be higher. This revision could establish a new level at which sodium occurrence would not meet the criteria for inclusion on the CCL as a drinking water contaminant of concern. There was insufficient time to complete a reassessment of the sodium guidance in advance of the CCL issuance."

Location

# WVDEP UIC STUDY First Draft Lab Results

Report

Sb As Ba Be Cd Cr Pb Hg Se Tl Al Cu Fe

ppb ppb ppb ppb ppb ppb ppb ppb ppb ppb ppb ppb ppb

Loadout: both: (WJU) (WVDEP) Results

Slurry Supernatant Total (2008)	WJU	11.32	BDL	25.13	BDL	BDL	BDL	BDL	BDL	4.02	BDL	10.86	BDL	141.99
LI-Slurry-Liquids Total Recover ICP Lab ID 0709F34 and	DEP	5.90	4.70	133.00	ND	ND	ND	1.60	ND	27.80	0.40	2370.00	3.40	828.00
Reconstituted Slurry Liquid Total (2008))	WJU	1.04	1.14	95.68	BDL	BDL	2.71	5.54	BDL	5.66	BDL	2477.77	9.40	1881.11
Slurry Supernatant Soluble (2007)	WJU	5.24	3.72	49.46	BDL	BDL	BDL	BDL	BDL	22.85	BDL	168.21	2.54	318.57
LI Slurry Liquid Dissolved ICP Lab ID 0709F34 and	DEP	5.70	4.20	97.40	ND	ND	ND	ND	ND	26.80	0.30	150.00	1.60	ND
Slurry Supernatant soluble (2008)	WJU	11.93	BDL	25.27	BDL	BDL	BDL	BDL	BDL	2.10	BDL	6.71	1.35	131.53
Reconstituted Slurry Liquid Soluble (2008)	WJU	1.19	BDL	62.59	BDL	BDL	BDL	BDL	BDL	6.38	BDL	18.65	2.19	87.05
Slurry Solids (2007)	WJU	BDL	6941.00	104181.00	1624.00	BDL	12102.50	18414.50	BDL	3335.50	BDL	3681632.50	29232.00	7405295.00
LI-Slurry Solids Lab ID 0709F34	DEP	ND	ND	638.00	ND	ND	ND	ND	ND	ND	ND	36100.00	ND	29700.00
Reconstituted Slurry Solids (2008)	WJU	BDL	5350.39	113407.15	1658.19	BDL	12404.88	19601.42	BDL	3427.19	BDL	3316696.33	29494.08	6282672.33

Panther LLC: both: (WJU) (WVDEP) Results

Slurry Supernatant Total (2008)	WJU	1.36	4.26	53.76	BDL	BDL	BDL	27.88	BDL	1.01	6.80	20.15	120.84	46.95
PL-Slurry Liquids total recoverable ICP Lab ID 0801C	DEP	16.00	11.30	269.00	ND	1.10	34.20	77.50	BDL	25.50	ND	46.00	27.80	89.00
Reconstituted Slurry Liquid Total (2008))	WJU	1.95	2.91	132.46	BDL	BDL	2.30	6.58	BDL	7.02	BDL	1988.29	34.46	935.94
Slurry Supernatant Soluble (2008)	WJU	1.37	4.62	54.63	BDL	BDL	BDL	29.23	BDL	4.52	BDL	8.82	129.91	28.48
PL-Slurry Liquids dissolved metals ICP Lab ID 0801C90-	DEP	14.60	10.40	243.00	ND	ND	27.20	76.20	BDL	22.40	ND	29.00	24.80	68.00
Reconstituted Slurry Liquid Soluble (2008)	WJU	2.24	3.58	97.26	BDL	BDL	BDL	5.13	BDL	8.27	BDL	383.68	39.06	322.17
Reconstituted Slurry Solids Total (2008)	WJU	BDL	BDL	153184.20	1150.37	BDL	11777.75	13529.52	BDL	BDL	BDL	5825292.50	18351.71	8292354.00
PL-Slurry Solids Lab ID 0801C90-01S	DEP	ND	ND	52300.00	385.00	80.90	4820.00	4790.00	ND total	ND	ND	3600000.00	7540.00	6 080 000
Reconstituted Slurry Thickener Total (2008)	WJU	60.55	7.13	93.69	BDL	BDL	2.83	94.77	BDL	2.57	29.73	1057.82	49.05	1118.18
Reconstituted Slurry Thickener Soluble (2008)	WJU	63.09	7.40	59.57	BDL	BDL	BDL	82.63	BDL	25.86	BDL	23.47	45.77	41.99

Southern Minerals (WVDEP) Results only

SM-Slurry Liquids Lab ID 0707930-12A dissolved metals	DEP	22.0	3.91	80.9	0.21	ND	1.31	ND	8.2	ND	ND	3130.00	10.800	7 000 000
SM-Slurry Liquids Lab ID 0707930-12A total recover	DEP	21.5	4.31	114	0.41	ND	1.61	0.81	ND	8.2	0.21	651	1.81	910
SM-Slurry Solids Lab ID 0707930-12B	DEP	5501	12001	99200	425	ND	2770	29501	ND	ND	ND	1910000	4590	2 060 000

Marfork (WVDEP) Results only

MF-Slurry metals ICP Lab ID 0807680-01A	DEP	ND	ND	304 000	ND	123	5 550	5 860	ND	ND	ND	3 130 000	10 800	7 000 000
MF-Coal leachate metals ICP Lab ID 0807680-02L at	DEP	1.1	24.6	695	2	ND	5.4	21.7	ND	4	0.4	1 190	24.8	13 200
MF-Coal Solid Lab ID 0807680-02A	DEP	ND	159 000	152 000	ND	445	13 900	16 200	254	1 170	ND	8 720 000	27 400	28 200 000

Coresco(WVDEP) Results only

CL-Slurry-Liquid ICP Lab ID 0806J41-01A and ICP-M	DEP	7.1	ND	71.3	ND	ND	ND	ND	ND	2.4	0.2	644	2.1	174
CL-Slurry-Solid ICP Lab ID 0806J41-01S	DEP	ND	4 630	38 800	525	145	7 470	4 090	34	617	ND	1 420 000	7980	8 160 000
CL-Coal-Solid ICP Lab ID 0806J41-02A	DEP	ND	10 600	34 900	1 400	312	10 700	8 060	158	ND	ND	1 820 000	10 500	19 900 000

Power Mountain (WVDEP) WJU has split sample bu

PM-Slurry-Liquid Lab ID 0807583-01	DEP	0.5	ND	63.4	ND	ND	ND	0.4	ND	5.9	0.3	564	1.6	195
PM-Slurry-Liquid Lab Filtered ID 0807583-01B	DEP	0.4	ND	52.3	ND	ND	ND	ND	ND	5.7	0.2	509	1.5	30
PM-Slurry-Solid Lab ID 0807583-01S	DEP	ND	2110	170000	289	149	4330	4890	112	ND	ND	1040000	6160	9890000

yellow highlights indicate above drinking water standards

Primary Drinking Water Standards

Secondary Drinking Water Standards

ND = Non Detect

BDL = Below Detection Limits

ppm = parts per million

ppb = parts per billion

Mn	Ag	Zn	Na	Ni	Ca	Mg	K	Mo	V	Co	Sr	Ti	Sn	U	Si
ppb	ppb	ppb	ppm	ppb	ppm	ppm	ppm	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppm
BDL	BDL	BDL	117.53	BDL	28.26	8.54	6.01	65.46	BDL	BDL	BDL	5.34	BDL	BDL	1.36
97.00	ND	8.00	267.00	7.30	63.70	20.60	14.30	46.60	2.50	1.60	1470.00	5.34	BDL	BDL	8.54
21.24	1.34	13.71	62.33	5.17	36.94	7.90	8.46	23.69	4.32	2.19	BDL	23.14	BDL	3.22	5.17
86.92	BDL	4.39	BDL	3.95	BDL	BDL	BDL	48.95	BDL	1.14	N/A	9.63	BDL	8.93	2.30
86.00	ND	ND	266.00	6.70	62.10	19.80	13.90	44.70	1.30	ND	1440.00	4.75	BDL	1.16	3.10
BDL	BDL	3.16	287.49	2.11	57.00	20.67	13.79	65.79	BDL	BDL	1.32	4.75	BDL	1.16	3.10
BDL	BDL	4.41	78.78	1.47	34.61	8.17	7.98	26.60	BDL	BDL	BDL	1.50	BDL	2.55	1.46
98297.50	BDL	37206.50	16493.00	16493.00	84.10	26.20	43.30	1211.00	16981.00	8126.00	N/A	99223.50	BDL	1180.00	32.30
498.00	ND	2700.00	217.00	ND	84.10	26.20	43.30	ND	ND	ND	1570.00	88710.07	BDL	1195.35	1079.19
93944.76	BDL	31753.46	1009.10	16652.44	2113.19	2098.96	2559.09	BDL	16898.13	7976.31	2033.09	88710.07	BDL	1195.35	1079.19
13.39	BDL	121.88	924.42	60.82	5.12	2.64	16.37	187.90	BDL	23.36	BDL	5.19	BDL	5.48	2.17
28.00	ND	14.00	341.00	43.20	3.51	0.77	7.05	217.00	13.10	16.10	632.00	5.19	BDL	5.48	2.17
11.35	1.26	27.98	243.93	17.95	2.29	BDL	7.81	53.00	3.44	7.43	7.45	9.67	BDL	BDL	4.46
13.09	BDL	134.69	1023.07	64.75	3.49	3.23	18.19	190.25	BDL	26.84	BDL	2.85	BDL	5.56	2.30
21.00	ND	19.00	266.00	38.60	2.83	0.59	5.38	198.00	10.30	14.20	571.00	2.85	BDL	5.56	2.30
2.27	BDL	29.32	268.37	19.65	BDL	1.02	7.48	57.79	BDL	7.53	7.75	2.49	BDL	BDL	2.02
135328.90	BDL	43979.33	1761.75	12933.01	3276.03	2906.37	3924.66	BDL	15766.70	5315.99	1972.44	26791.69	BDL	BDL	1917.88
51900.00	ND	17400.00	754.00	5060.00	1220.00	908.00	1210.00	ND	6610.00	2310.00	13600.00	26791.69	BDL	BDL	46.30
115.98	3.54	71.52	528.67	64.00	4.82	1.44	9.45	233.96	2.88	22.60	BDL	18.05	BDL	7.39	1.63
3.13	1.45	65.05	1422.15	61.36	5.87	3.66	22.67	185.29	BDL	21.51	BDL	4.31	BDL	6.85	2.50
14.1	ND	ND	58.8	4.3J	51.4	20.80	6.90	17.6	1.8J	2.1J	1160	3.3	BDL	BDL	3.3
17.7	ND	27J	55.5	5.2J	51.7	21.00	7.07	17.8	2.1J	2.4J	1170	3.76	BDL	BDL	3.76
22500	ND	8600	44.3	4340	424	620	931	395J	3140	1990J	16800	4.53	BDL	BDL	4.53
72.900	ND	18.700	315	7.680	719	1.260	1.280	ND	8.220	3.810	34.600	3.17	BDL	BDL	3.17
142	ND	38	6.67	11	1.26	2.210	0.925	2.1	6.7	135	71	71	BDL	BDL	71
183.000	ND	49.100	593	21.500	951	2.680	2.180	1.620	16.800	11.200	61.400	321	BDL	BDL	321
138	ND	ND	279	7.4	115	40	5.16	29.7	ND	2.9	3.270	3.91	BDL	BDL	3.91
48.700	ND	20.300	394	7.930	3.940	584	381	876	11.000	3.660	84.000/ND?	70.8	BDL	BDL	70.8
85.700	ND	23.900	415	11.100	2540	704	555	765	16.500	6.340	84.600	174	BDL	BDL	174
921	0.6	41	237	9.6	123	82.3	15.5	2.4	ND	3.9	1740	5.31	BDL	BDL	5.31
921	0.6	32	236	9.2	124	81.4	15.5	2.3	ND	3.7	1630	3.27	BDL	BDL	3.27
34300	ND	10300	85.7	6100	371	324	422	408	25600	3020	14400	250	BDL	BDL	250
50	100	5000	20	100											

Unregulated for Drinking Water. Sodium and Nickel have suggested limits