Waste Coal to CFB Ash
"What Can a Watershed Group Do"

Prepared for:
2006 Pennsylvania Statewide Conference on Abandoned Mine Reclamation
August 25, 2006
State College, PA

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Why We Are All Here Today?

Pennsylvania bears the scars of decades of coal mining before stringent laws and regulations were passed to protect the environment.

Waste Coal piles (gob, boney, culm) are major sources of AMD that degrade hundreds of miles of the state's watersheds.

A Solution – one of many but maybe the best?

One of the ways to eliminate the watershed pollution is to eliminate the sources of AMD by consuming the acid-producing coal waste in the production of electricity at CFB boiler power plants.

Partnerships between watershed groups and private industry is a great way to accomplish what may seem like insurmountable tasks!

Does this guy know what he's talking about?

Robindale Energy Services, Inc. (RES) was formed in 1997 to expand upon the capabilities of RNS Services, Inc. for providing coal waste supply, beneficial use CFB ash handling and reclamation services.

Since 1991, RNS has reclaimed and transported approximately 16 million tons of waste coal and over 12 million tons of CFB ash.

RES currently supplies the coal waste fuel supply, limestone requirements and CFB ash handling services for Seward Power Station, Cambria Cogeneration Company, Ebensburg Power Company and Scrubgrass Generating Company.

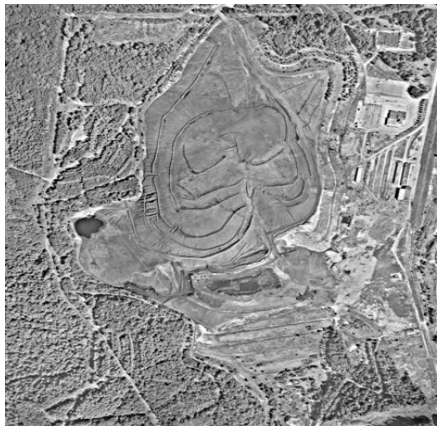
RES has contracts and facilities in place to supply over 5 million tons of coal waste, 700,000 tons of limestone and to beneficially use over 4 million tons of CFB ash in 2006 making it what we feel is the largest coal waste and CFB handling specialty company in the world.

RES/RNS ENVIRONMENTAL RECORD

- The company has been in business in Pennsylvania since 1987 and has never received a DEP violation which resulted in a fine.
- Permitted acreage exceeds 1,500 with additional reclamation contracts on another 125 acres.
- Operating 5 active AMD plants and constructed 5 passive water treatment facilities.
- Collecting and reporting almost 100 stream sampling points. Pumping, monitoring and reporting close to 50 wells.
- Constructed more than 20 acres of mitigated wetlands.
- Total past and present acreage RES/RNS has or had under permit with California, Ebensburg, Greensburg District Offices totals 2333.7 acres.

WASTE COAL RESERVES

RES has evaluated over 100 coal refuse sites in west central Pennsylvania and owns or controls over 64 million tons of waste coal reserves throughout a six-county region.



What the Heck is a CFB boiler?

(Circulating Fluidized Bed)

Low quality coal waste can be successfully burned in a CFB boiler

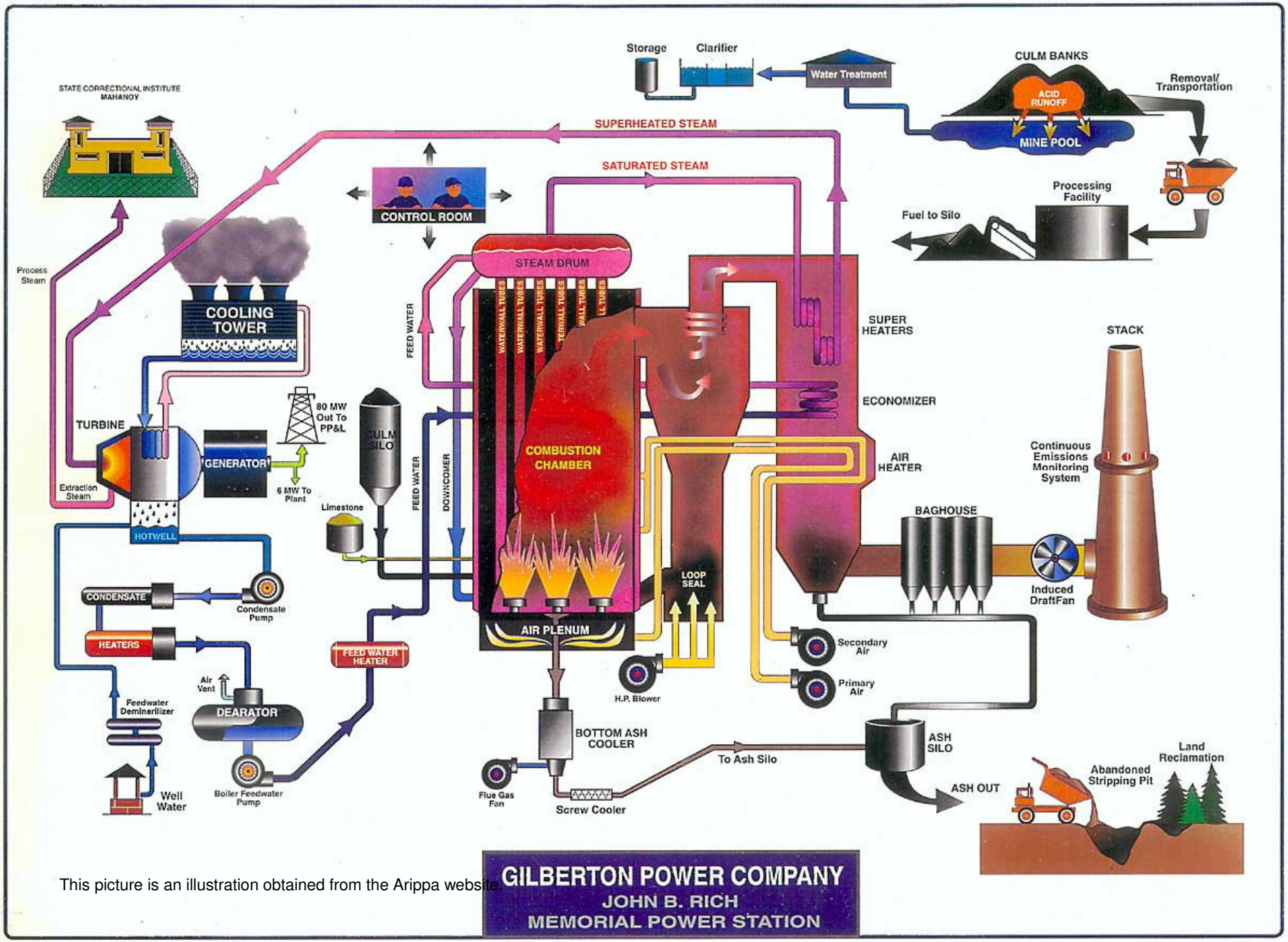
-CFB boilers operate at lower firing temperatures than conventional pulverized coal plants so high ash content fuels can be burned without slagging issues.

-The lower combustion temperature also allows plants to meet latest EPA/DEP air quality standards

- Lower combustion temps create less NOX
- In-situ SO2 and mercury capture can be accomplished with dry limestone injection

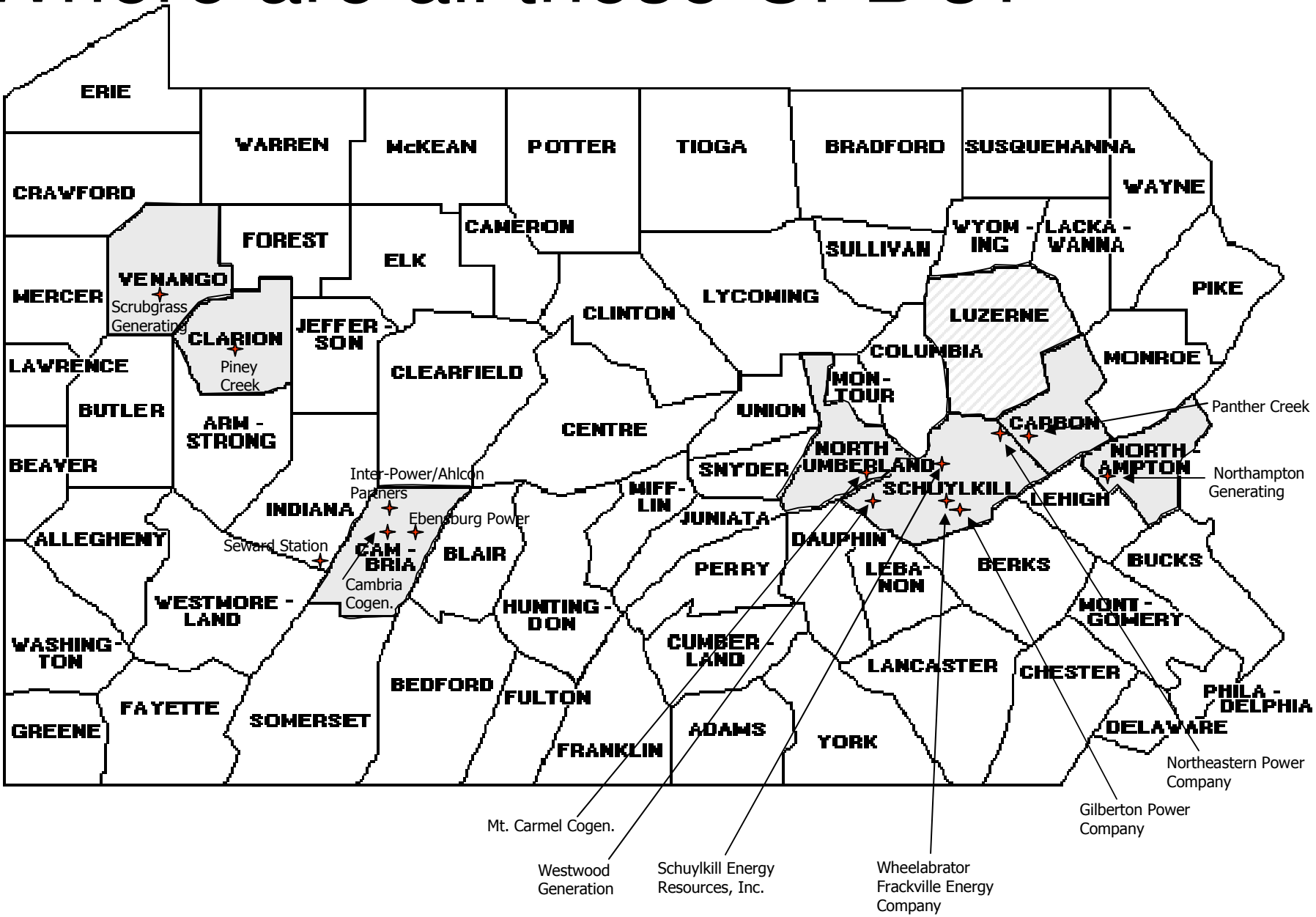
Limestone injection creates an alkaline ash stream due to unreacted calcium oxide and gypsum.

This ash has physical and chemical properties that make it ideally suited for mine land reclamation projects



This picture is an illustration obtained from the Arippa website.

Where are all these CFB's?



So how does my watershed group get something started?

- The #1 Hurdle to Overcome?
  - Most of these plants already have all the fuel they need for the next 10 -20 years!
  - Your waste coal would have to have better all in economics than what they already have in fuel plan to get your foot in the door.
  - Sometimes you might have to pay them?

What do they look for to rank piles?

- Energy content of gob material … the higher the btu/lb the better (~4500 minimum)
- The sulfur content of the material determines how much limestone the plant needs to meet SO2 capture requirements … the lower the better with about 8 lb/mmbtu max.
- Transportation costs determined by distance from the pile to receiving plant
  - Can ash be backhauled to the site … figures into overall transportation costs
  - Accessibility to the pile … road bonds or improvements, bridge weights etc.
- Site Operating Costs need to be as low as possible
  - Permitting issues and costs
  - Moisture and clay content to determine if handling issues exist
  - Landowner access fees
- Any time constraints associated with project

ALL THESE THINGS WIILL DETERMINE ALL-IN-COSTS TO CUSTOMER AND IT HAS TO BE LESS THAN OR EQUAL TO EXISITNG RESERVES TO MAKE THE CUT!

How do I get a power plant interested in working with us?

- Go to the plants with an already developed plan and ask for help in specific areas
  - Identify some of the issues mentioned on the last slide
  - Mileage for TRUCK routes already determined
  - A written background on the pile and any direction that DEP may have given on permitting process
  - Any support letters for project from local community
  - Is there a chance for any form of subsidy such as including the refuse removal as part of the workscope in creating a passive treatment system under growing greener or others
  - DON'T WASTE YOUR TIME AND MONEY SAMPLING THE MATERIAL!!!
- To consult or not to consult – that is the question?

Ernest Wetland B Project

BCWA – Wehrum Project

NO
TRESPASSING

DEELCO

CAUTION

402
404
H19

Lancashire #15 Waste Coal Pile – 1994 prior to reclamation

Lancashire #15

- Contained 650,000 tons of refuse coal spread over 11 acres.
- Average sulfur quality was over 5%.
- Reclaimed over a seven year period from 1995 through 2001.

Lancashire #15 Reclamation Process

- Hauled black coal waste to the #25 site for disposal or to a power plant for combustion
- The remaining coal waste “red dog” which averaged 10 foot thickness was excavated to original ground, mixed with CFB ash at about a ratio of 1 part ash to 4 parts red dog.
- A three foot bed of CFB ash was placed on original ground and the mixed material was replaced on top of this bed.

Mine #15 Downgradient Monitoring Well

MONITORING WELL (DW-1) BELOW WASTE COAL PILE REMOVAL / ASH ADDITION AND RECLAMATION							
	ph	cond	alk	acid	iron	mang	sulfate
Before Reclamation	4.78	2329.00	2.99	397.26	214.19	42.89	1529.72
During Reclamation	6.72	969.29	16.75	74.31	35.51	9.48	553.27
After Reclamation	8.68	298.67	23.17	0.00	6.21	0.33	104.27

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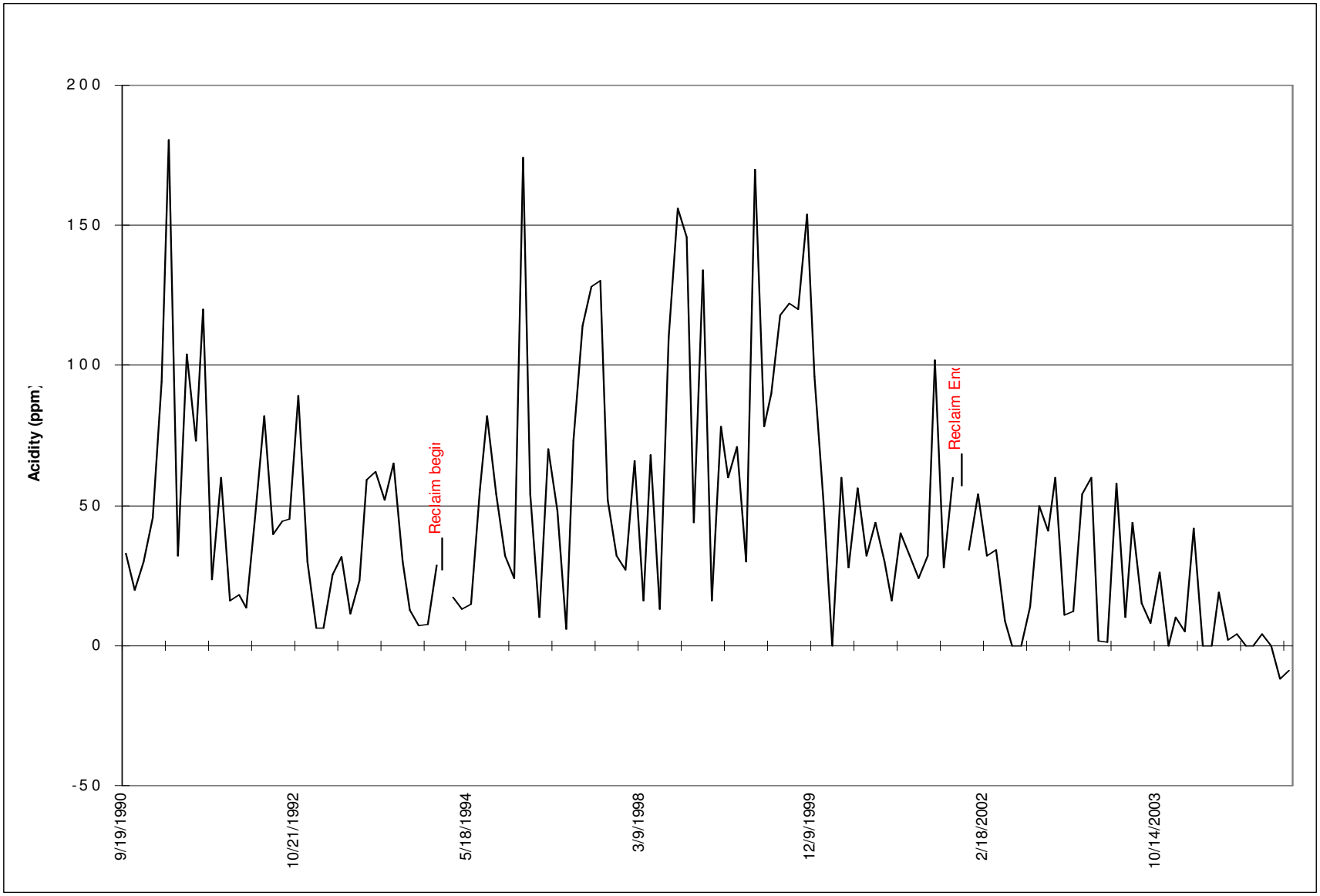
Susquehanna River Improvements



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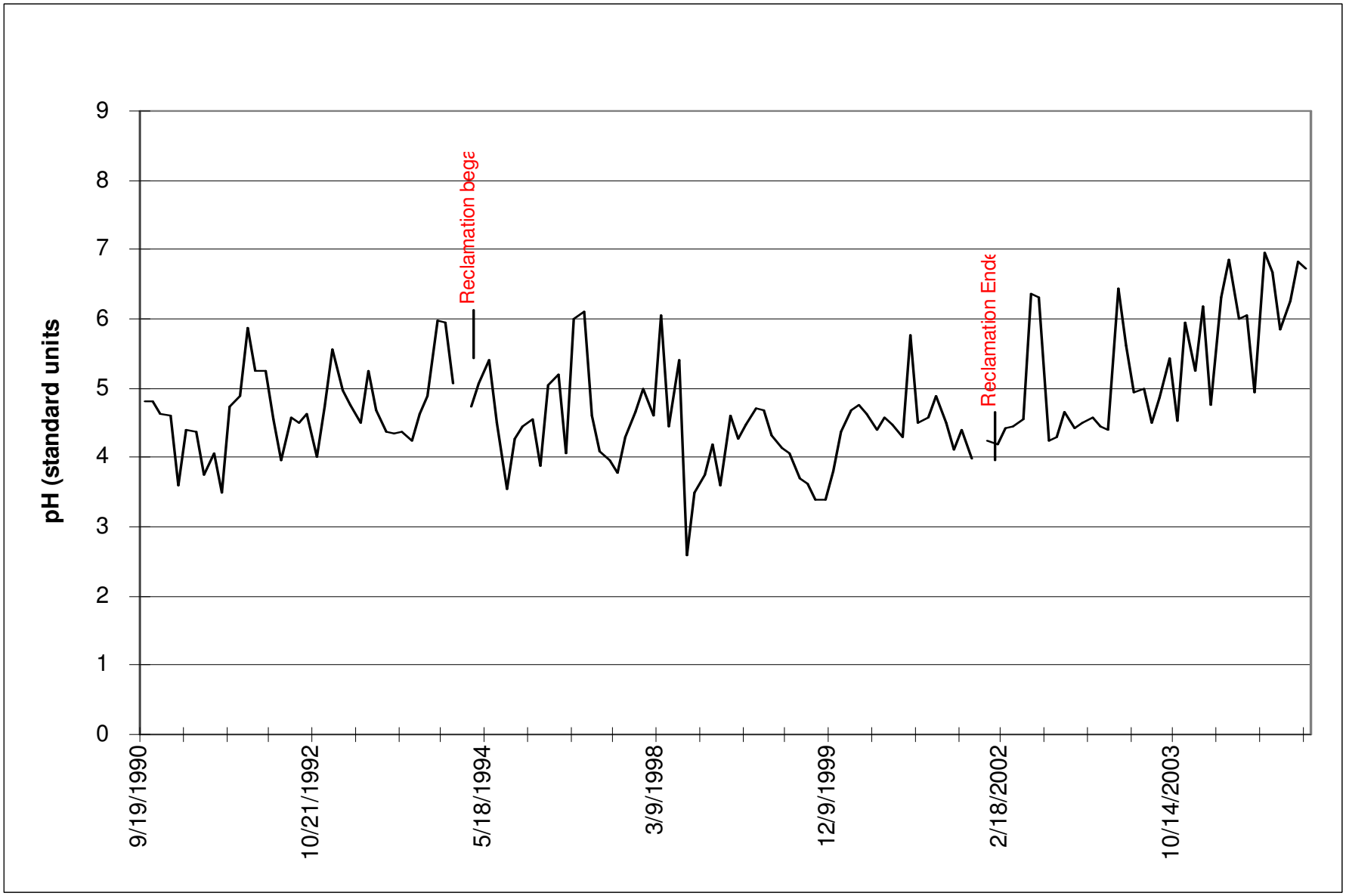


Ongoing Barnes-Watkins Remediation

The pile is estimated to contain 1,172,000 cubic yards of waste coal with an average quality 8.4% sulfur with individual samples approaching 14%.

Barnes-Watkins Project

The waste coal in this pile falls into two categories;

1) A portion of the pile is useable as fuel for electricity production in a modern circulating fluidized bed boiler

2) The balance of the pile is being remediated in the adjacent CRDP #11743703, or remediated insitu by mixing with CFB ash at a 1:1 ratio.

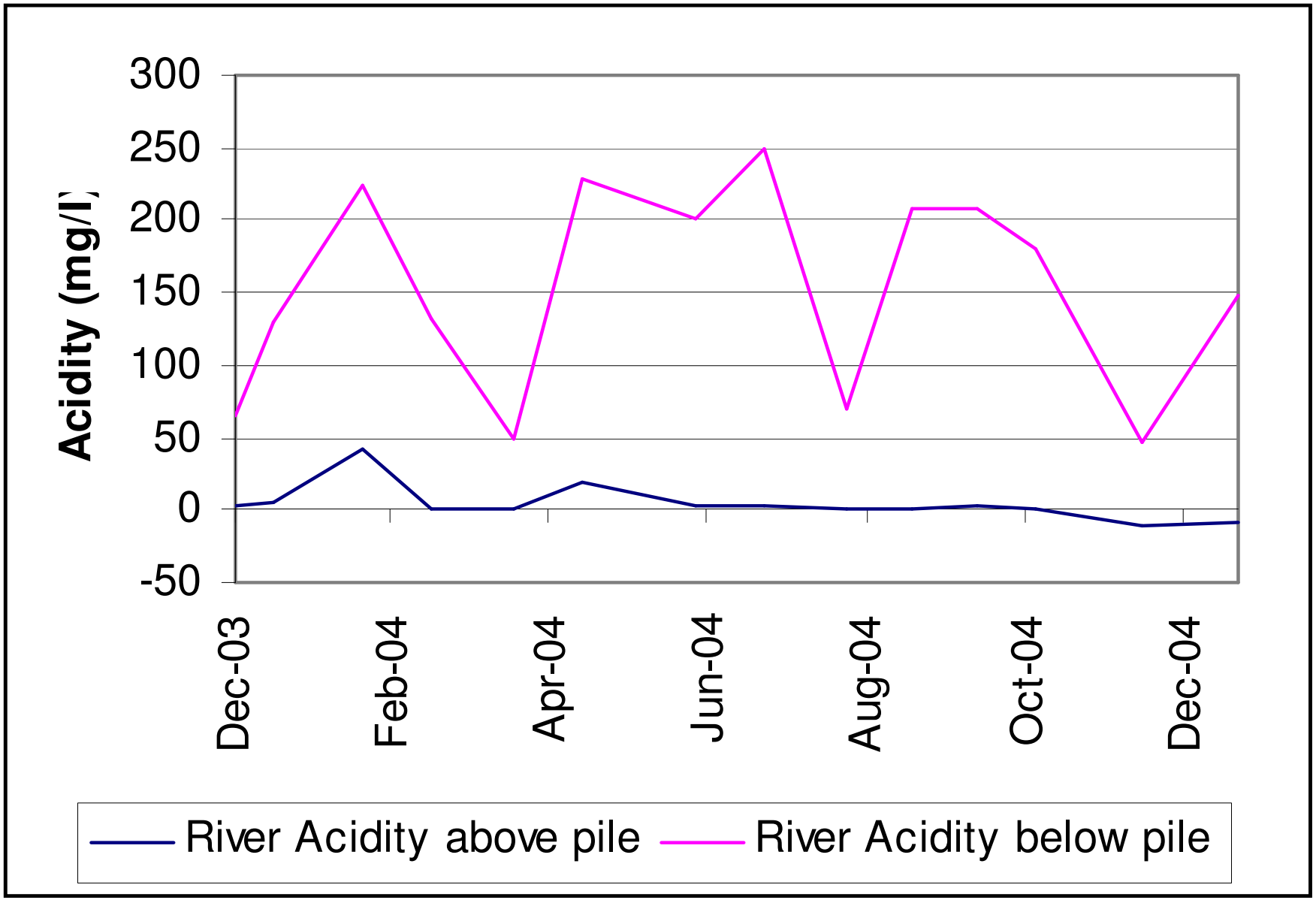
Barnes-Watkins Project

The Project is partially subsidized by Growing Greener and Watershed Protection Grants from the Pennsylvania DEP Protection which total $4,396,333.

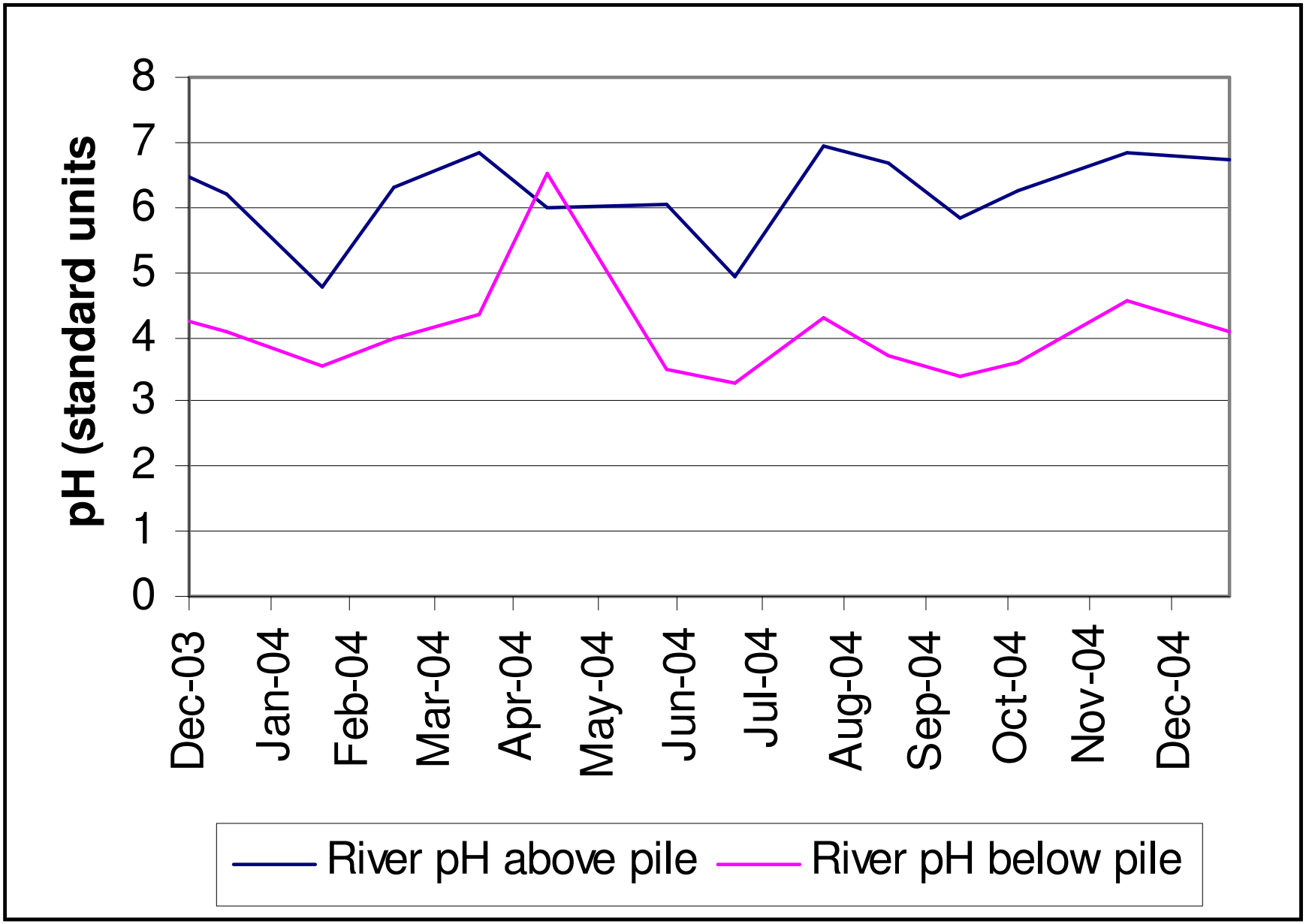
Barnes-Watkins Project

The concept for this project and the required leachate testing done to validate it during the mid-1990's formed the basis for Robindale's proposal to handle the Seward Refuse Pile Remediation Project.

Susquehanna River Quality above & below B-W pile



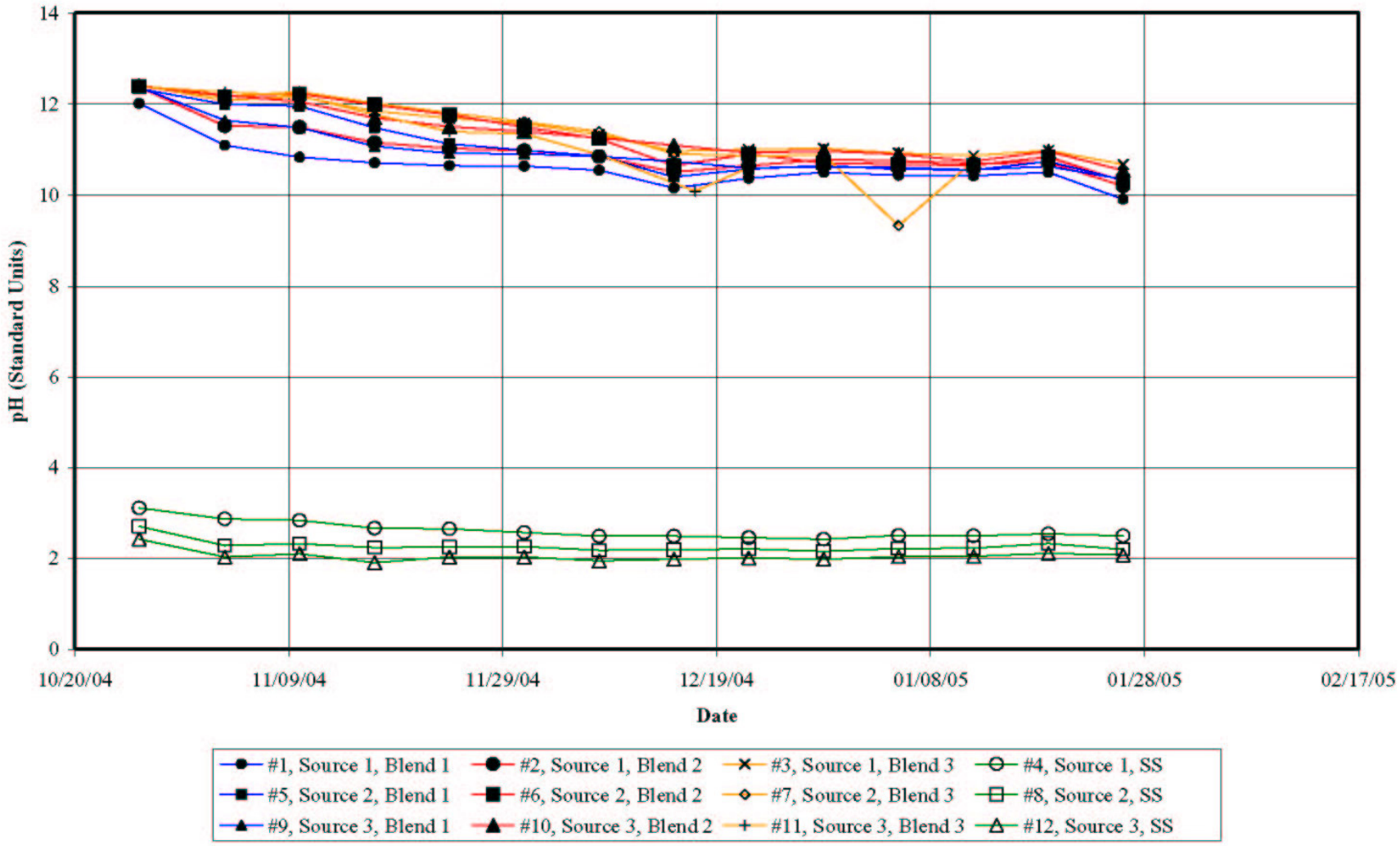
Susquehanna River Quality above & below B-W pile



Seward Remediation

- Based on the above testing results, the PADEP approved a program for mixing the large pile of pyritic refuse with alkaline ash at a 1:1 ratio (by weight). This was an approved solution to a Consent Order that Reliant Energy had with Water Quality.
- The results of the Seward project are being monitored with several wells. The wells adjacent to the earliest part of the pile show a considerably lower acidity, indicating that the accumulated acid water in the alluvium on which the piles were built is being neutralized and replaced by alkaline water from the pile of mixed ash and rock.
- The entire 1.2 million tons of refuse coal were mixed with CFB ash and placed in compacted layers to establish a firm base for the material handling area of the new Seward plant

Leached pH Concentration Through Time

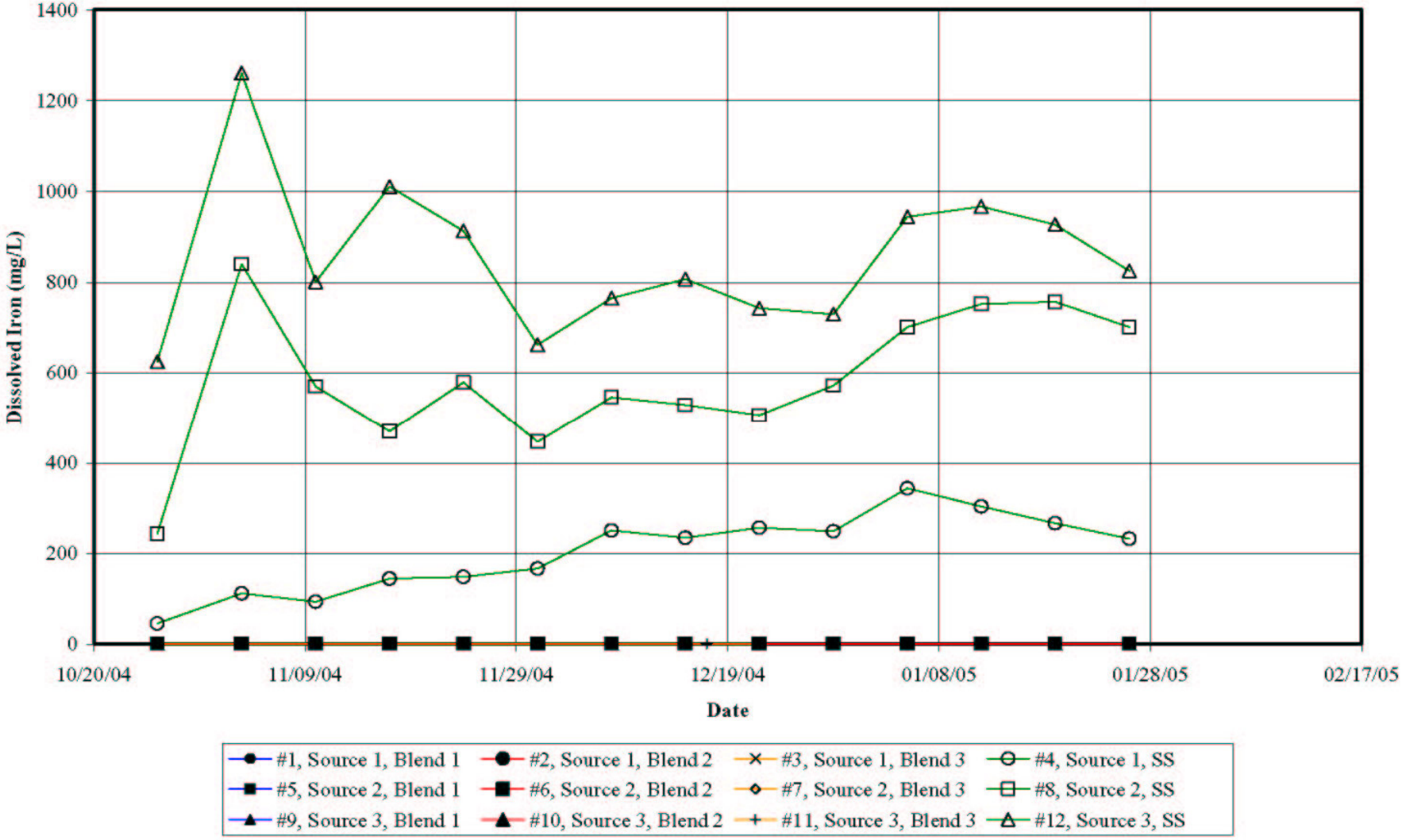


C:\Projects\Robindale\Robindale-99\2Flush Data.xls-pH Chart

Prepared by *Meiser and Earl, Inc.*

2/7/2005

Leached Dissolved Iron Concentration Through Time



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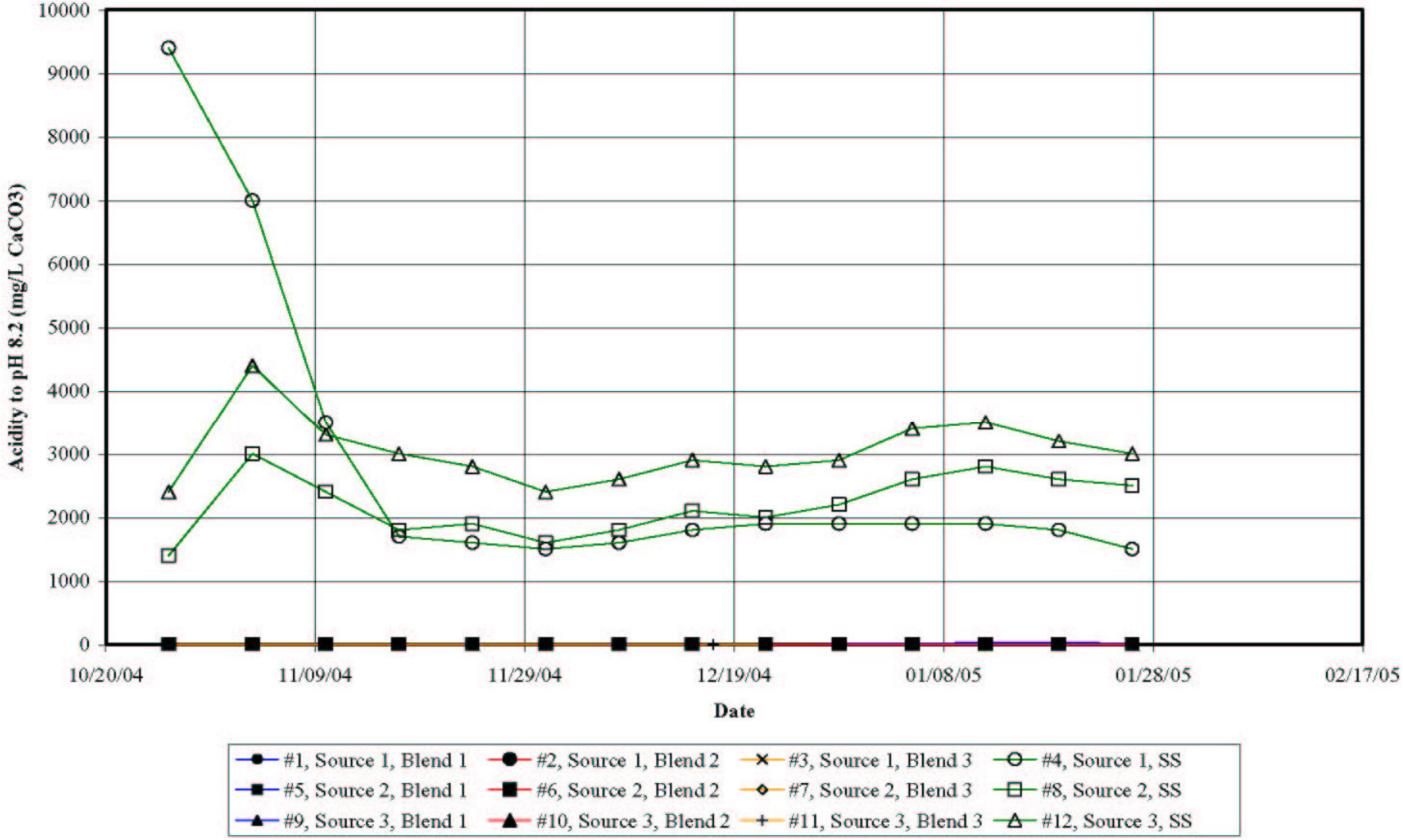
Prepared by *Meiser and Earl, Inc.*

2/7/2005

Leached Acidity Concentration Through Time



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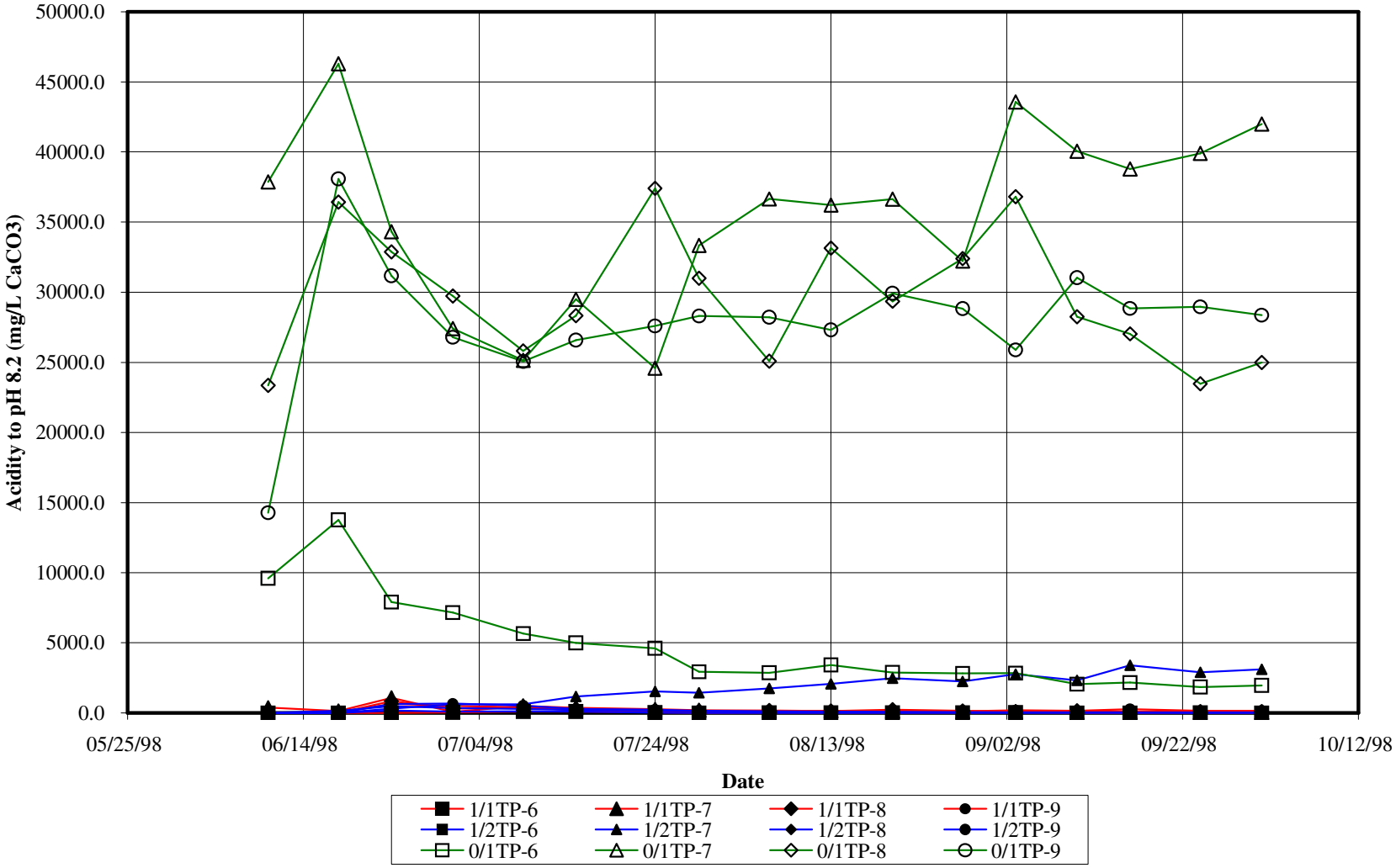
Prepared by *Meiser and Earl, Inc.*

2/7/2005

FIGURE D-3

GPU Seward Refuse Pile Remediation (1998)

Leached Acidity Concentration through Time



The new Seward Power Plant is the world's largest waste coal plant, and a portion of the plant is constructed on a mixture of coal refuse and CFB ash

Summary

- Aligning yourselves with the Waste Coal CFB's is a great way to remediate AMD sources in watersheds by tackling problems that require more resources than a watershed group can bring to the table.