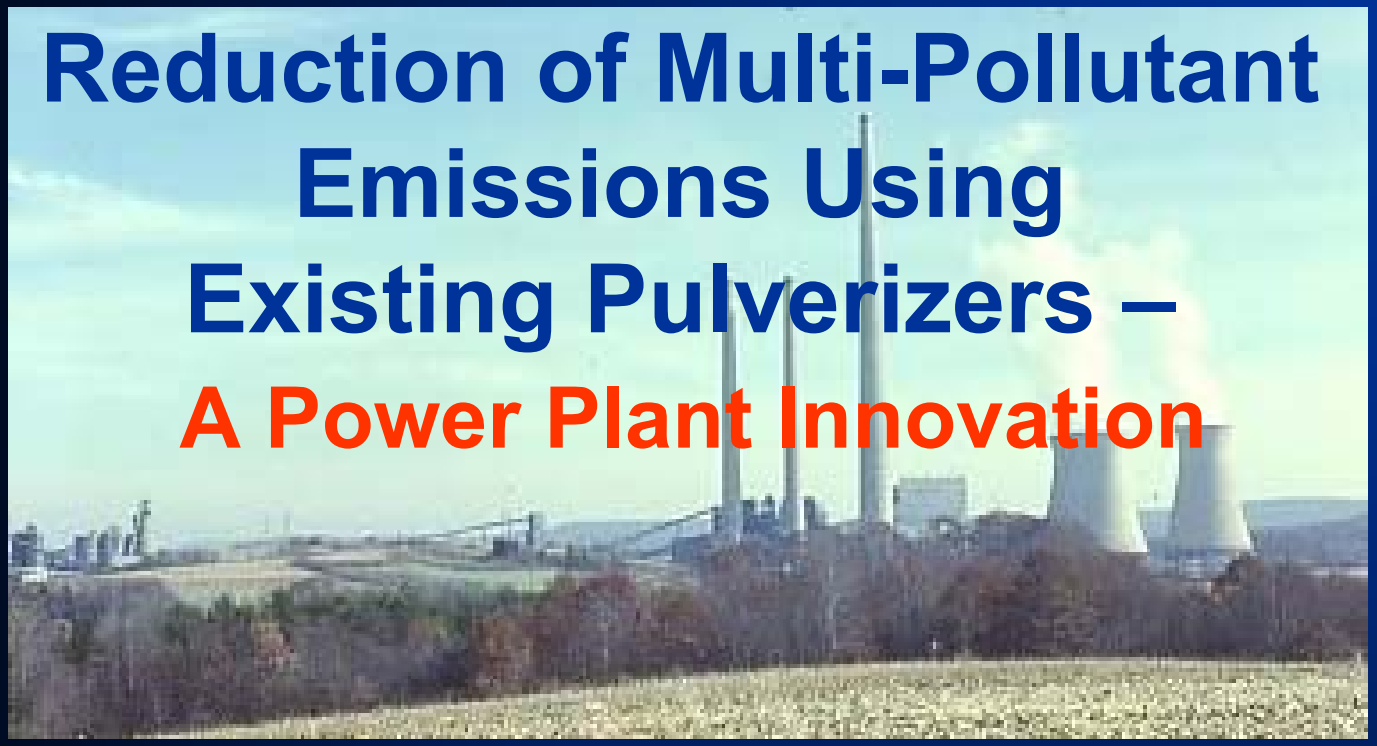
Reduction of Multi-Pollutant Emissions Using Existing Pulverizers – A Power Plant Innovation



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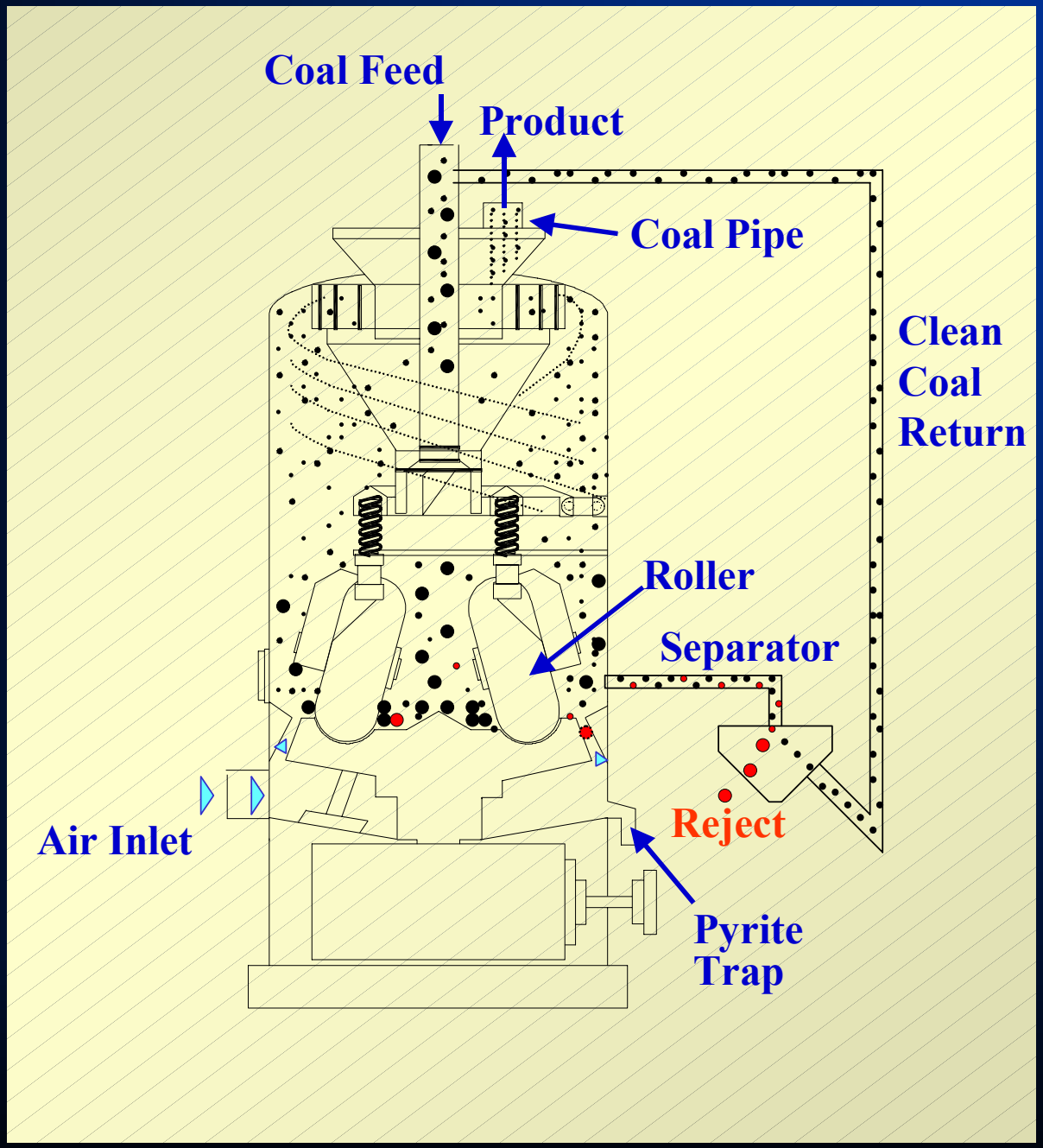

Coal Feed
Product
Coal Pipe
Clean
Coal
Return
Roller
Separator
Air Inlet
Reject
Pyrite
Trap

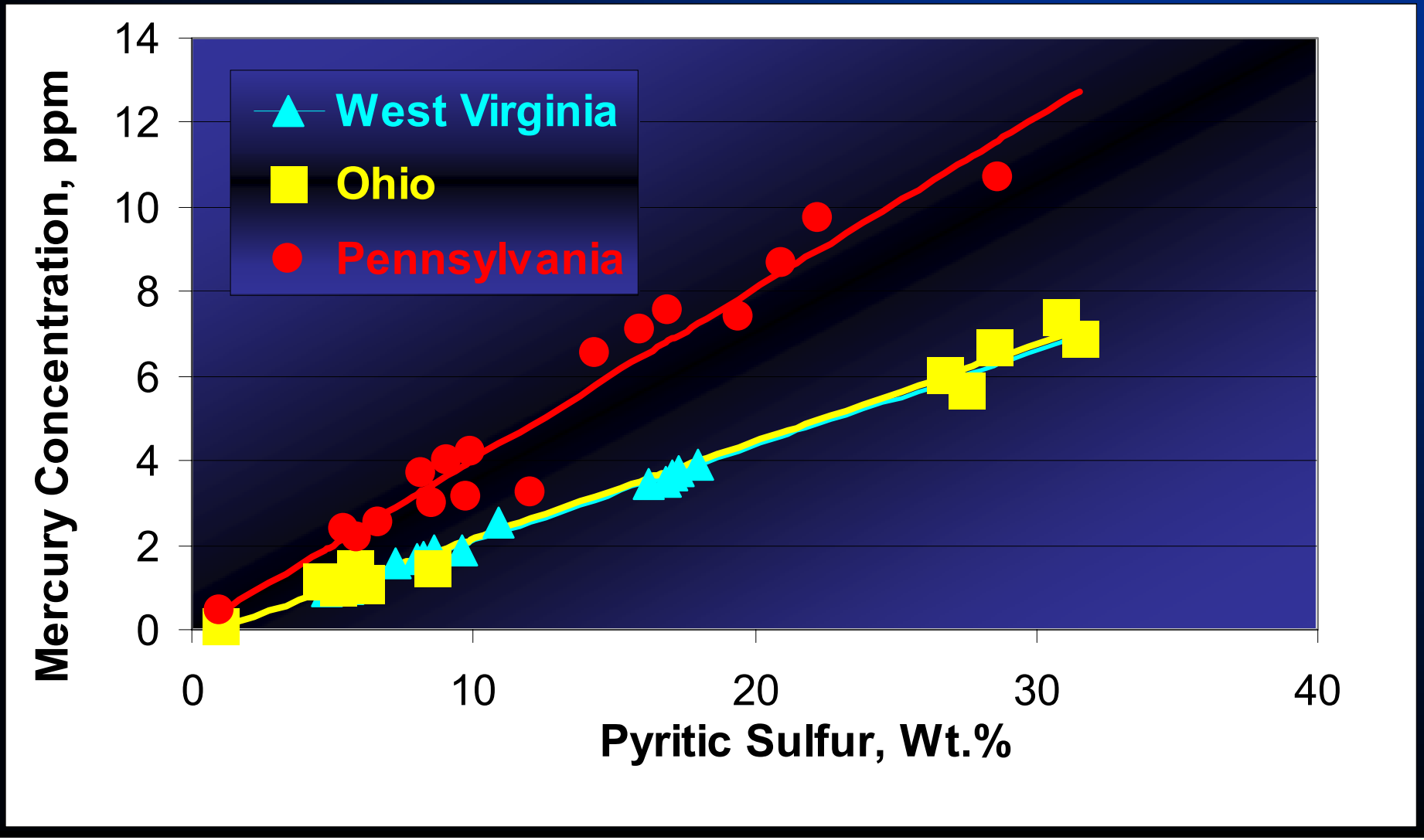
Pulverizers Tested

Company	Location	Pulverizer
Allegheny Energy	PA	D-8 Ball Mill
	PA	723 Table Mill
	WV	823 Bowl Mill
	WV	MPS 89 Roller Mill
Ameren/CIPS	IL	633 Bowl Mill
FirstEnergy	OH	MPS 89K Roller Mill
Reliant	PA	633 Bowl Mill
Bradley Pulverizer Co.	PA	1½ ton per hour Ring/Roller

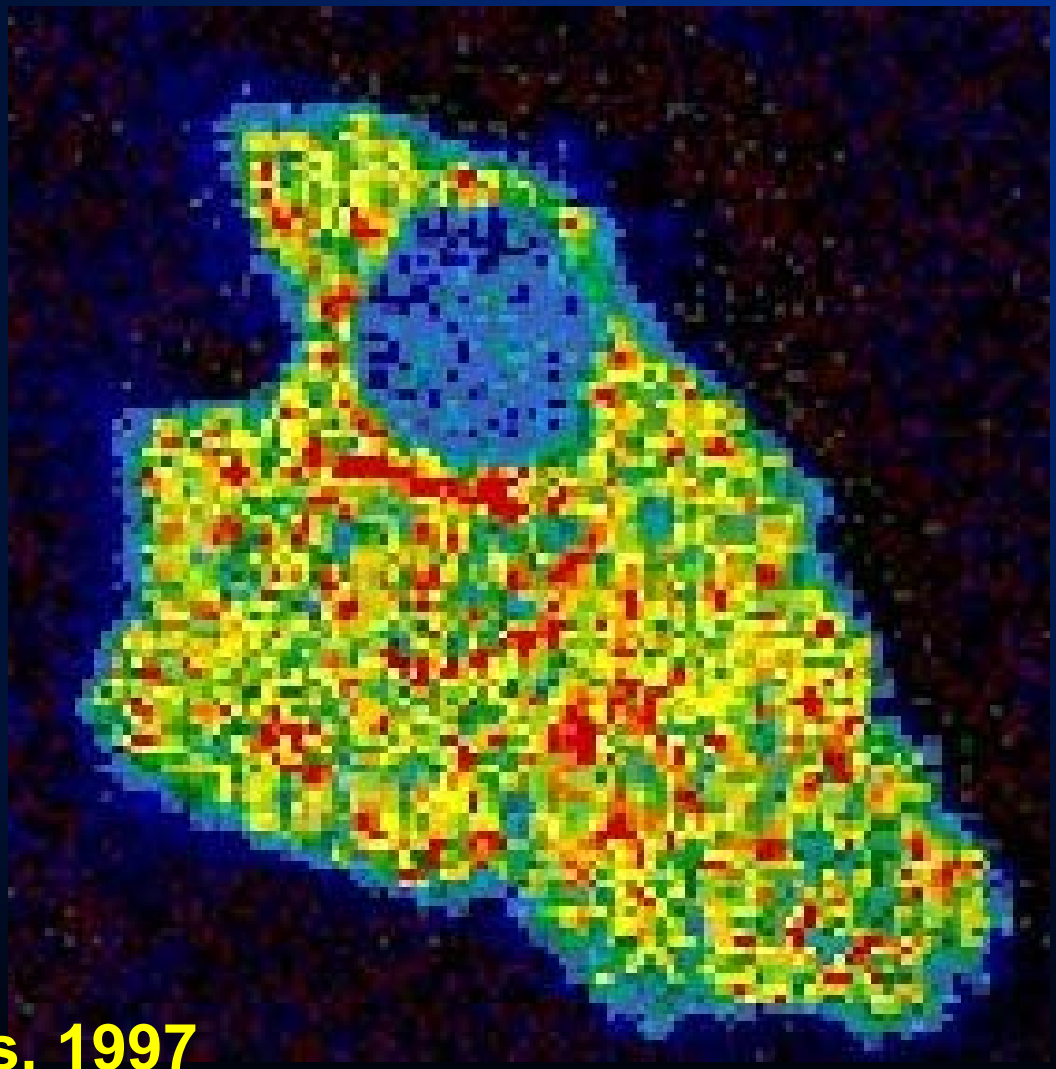
Power Plant Samples

	Ash	Sulfur	Pyritic Sulfur	HGI	Hg	As	Se
	Wt.%				(ppm)		
CE Raymond 633, Lower Kittanning Raw Coal							
Feed	14	2	1		0.1	27	4
MCS	32	11	9		4	142	13
MS Reject	56	19	17		8	169	18
B&W MPS 89K, Cleaned Pittsburgh Seam							
Feed	8	2	1		0.1	3	1
MCS	21	11	9		2	27	10
MS Reject	53	40	29		7	58	23
B&W MPS 89K, Blend of Raw & Cleaned Pittsburgh Seam							
Feed	8	2	1	53	<0.1	3	1
MCS	28	10	8	51	2	29	15
MS Reject	62	20	17	44	3	58	29

Hg Concentration vs. Pyritic Sulfur
Power Plant Samples



Mercury & Arsenic Associations with Pyrite Particle*



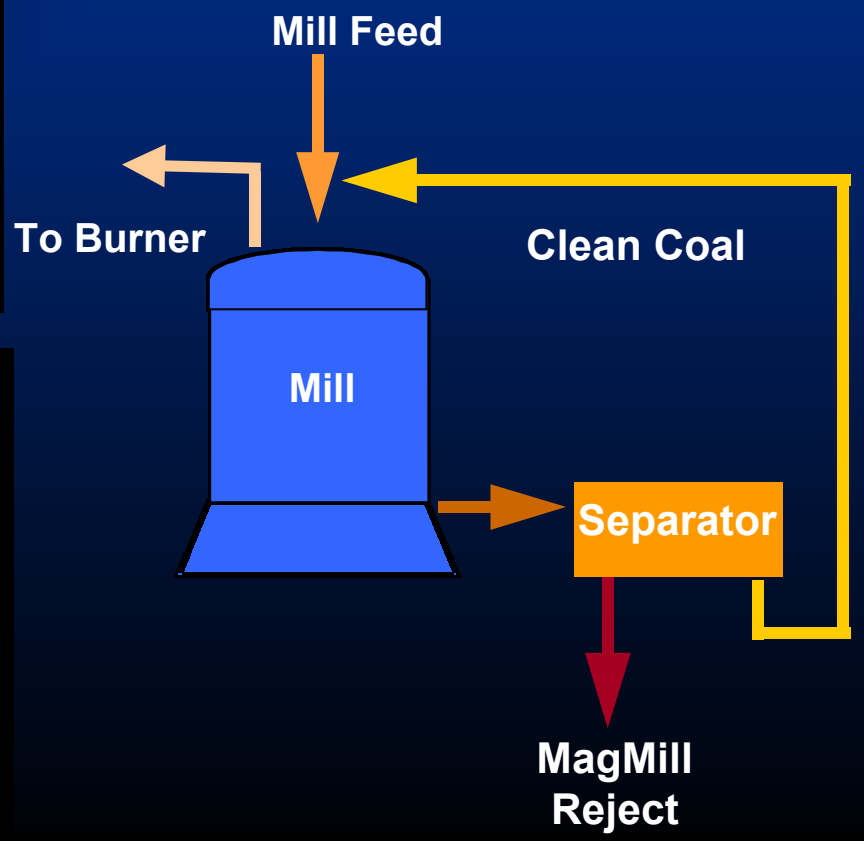
*D. J. Akers, 1997

MagMill™ Technology

- Beta prototype
  - 25 HP Hercules air-swept ring/roller mill
  - 3 ½ MW equivalent
- Results for Lower Kittanning and Upper Freeport raw coals

Material Balance
Lower Kittanning
Raw Coal
Run #4

		Base Case	Run #4
Mill Feed	Lb/hr	2,623	3,434
Ash	wt%	20.3	20.5
Btu/Lb	wt%	12,081	11,989
LbSO2/MBtu	wt%	8.5	9.2
Hg	ppm		0.40
Mill Product	Lb/hr	2,623	2,948
Wt. Recovery	wt%	100	87
Btu Recovery	%	100	94
Ash	wt%	20.3	15.4
Btu/Lb	wt%	12,081	12,949
LbSO2/MBtu	wt%	8.5	6.2
Hg	ppm		0.22
Mill Reject	Lb/hr	0	486
Wt. Recovery	wt%	0	12.9
Btu Recovery	%	0	6.0
Ash	wt%	0	54.9
Btu/Lb	wt%	0	5,525
LbSO2/MBtu	wt%	0	57.3
Hg	ppm		1.6



Trace Metal Measurements
Beta Prototype MagMill™
Raw Coals

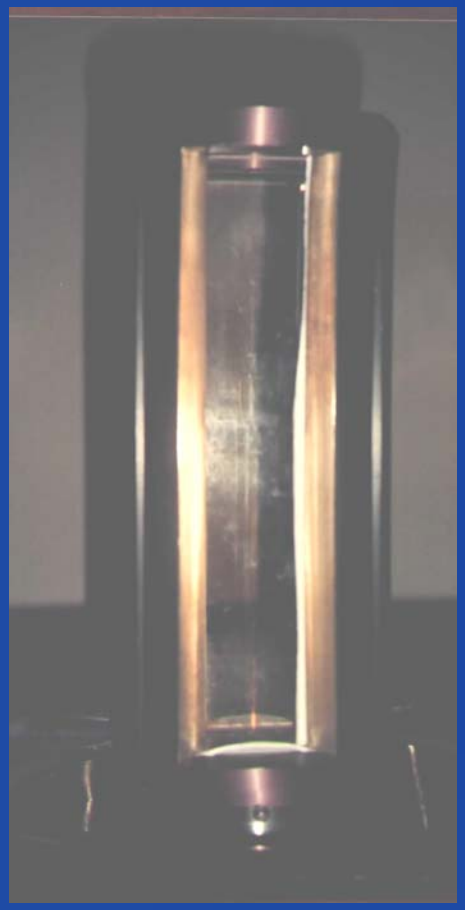
	Lower Kittanning Run #4				Upper Freeport Run #6			
	Concentration Lb/TeraBtu*			Reduction %	Concentration Lb/TeraBtu*			Reduction %
	Feed	Product	Reject		Feed	Product	Reject	
Arsenic	624	356	4,644	43	4,074	1,331	32,160	67
Lead	850	550	5358	35	912	340	6,770	63
Mercury	34	17	286	50	33	13	237	60
Nickel	946	558	6,787	41	1,394	687	8632	51
Thallium	72	32	679	56	117	35	965	70

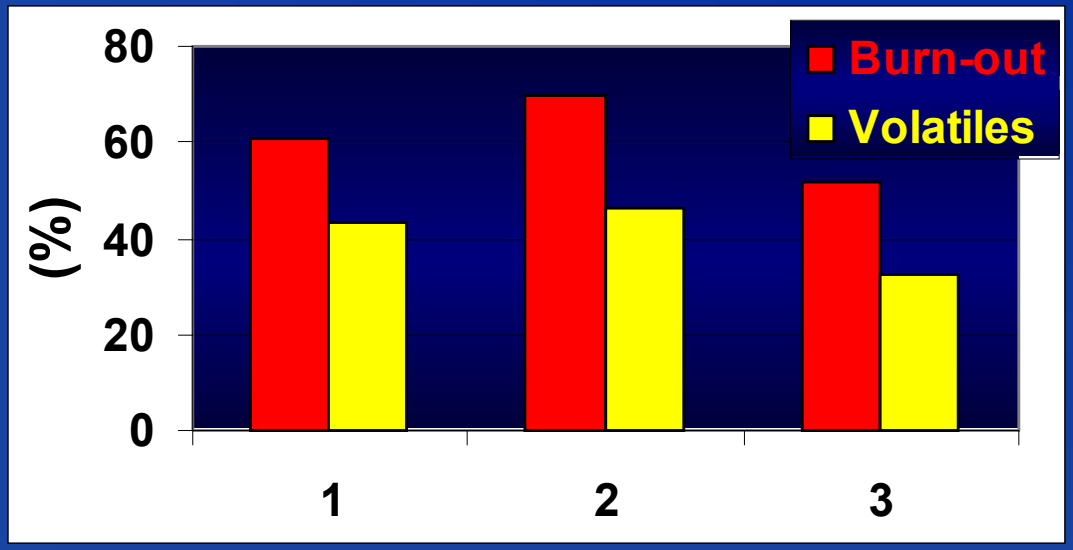
*Tera/Btu = 10^{12} = million million

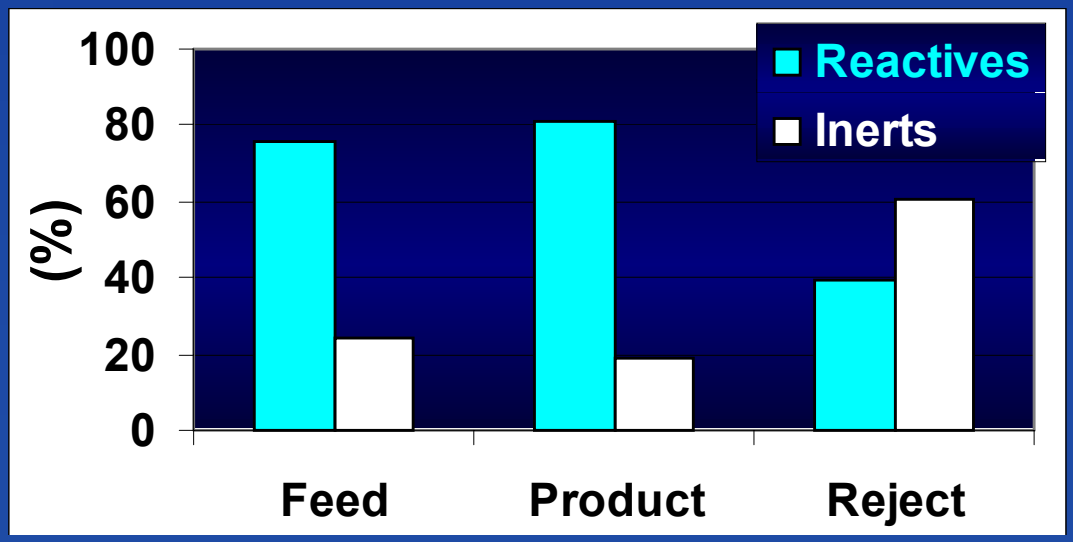
Ash Fusion Temperatures
Upper Freeport Raw Coal

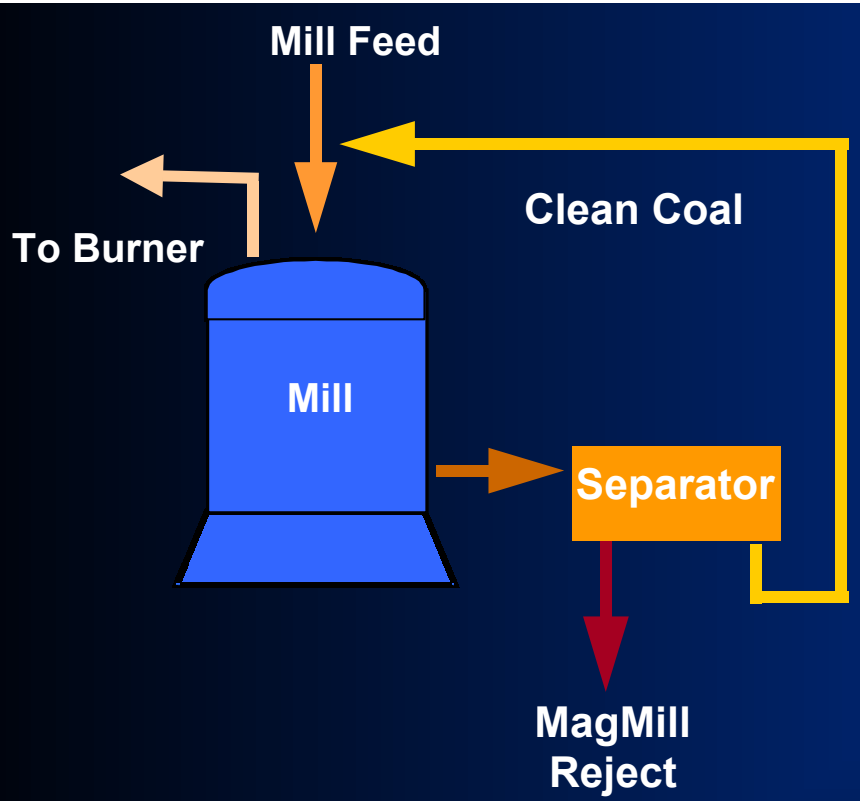
	Temperature, Deg. F		
	Feed	Product	Reject
Initial Deformation	2228	2599	2092
Softening	2400	2692	2215
Hemispherical	2510	2700+	2376
Fluid	2579	2700+	2489
	Ratios		
Base/Acid*	0.29	0.22	0.34
Silica/Alumina *	2.2	2.0	2.3
Iron/Calcium	5.9	2.9	14.4
Iron/Dolomite	4.2	2.2	8.3
Dolomite %	16.1	26.1	9.6
Total Alkalies	4	3	3

Combustion Testing
Upper Freeport Raw Coal





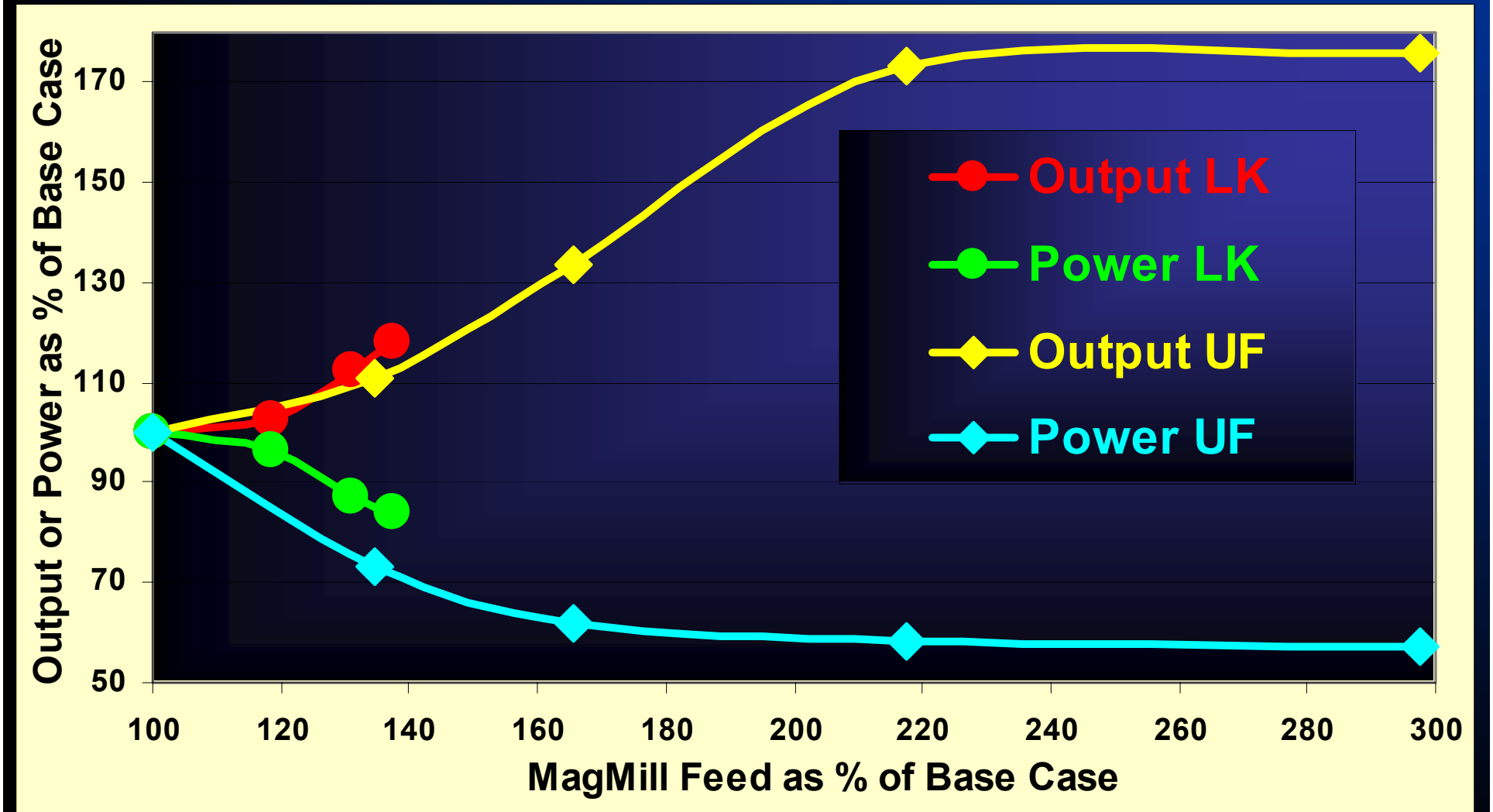




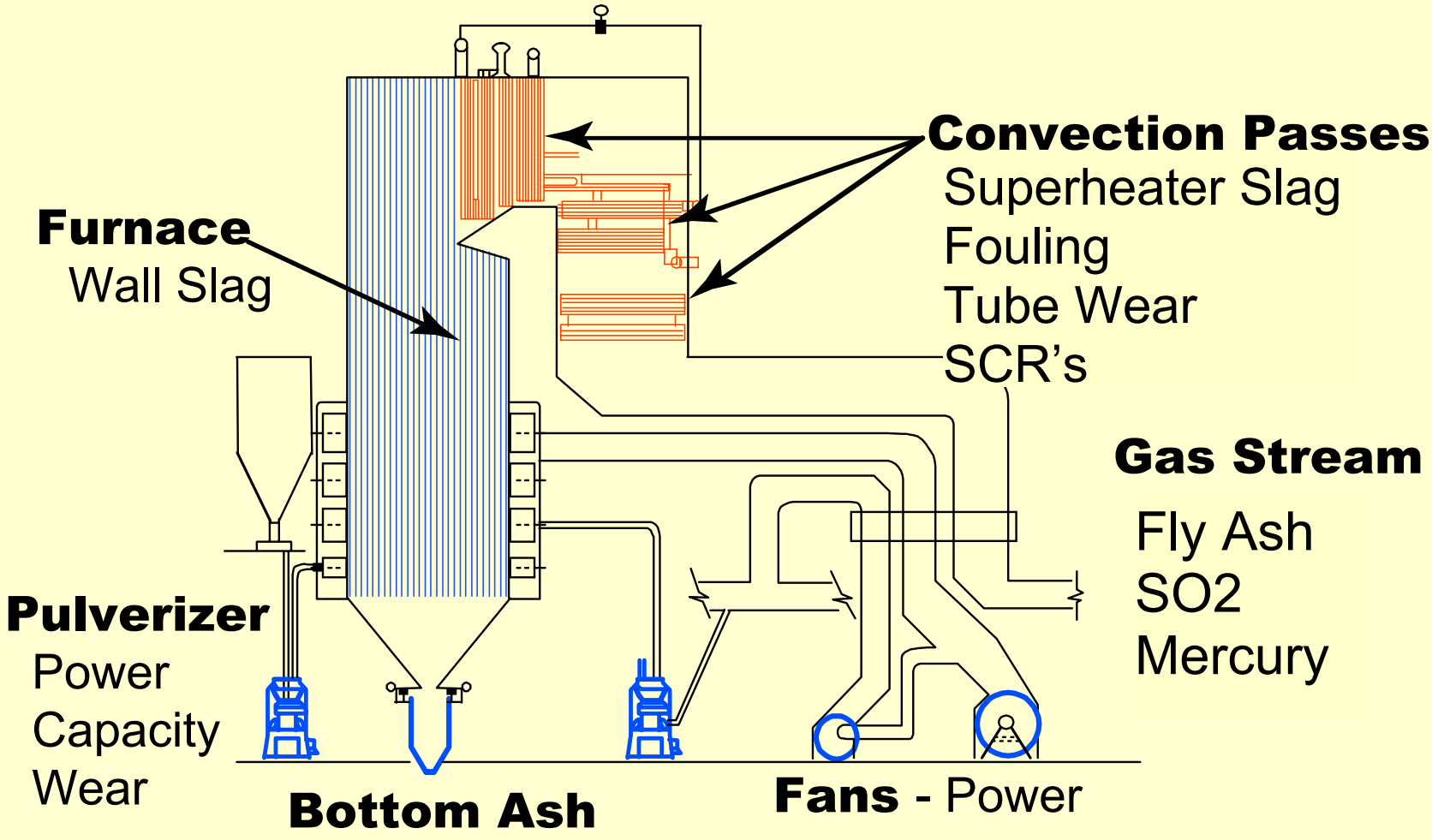
Beta Prototype Mass Balance Lower Kittanning Run #4

Run #		Base Case	MagMill #4
Mill feed	Lb/hr	2,623	3,434
Mill product	Lb/hr	2,623	2,948
Magnet feed	Lb/hr	0	1,114
Mill reject	Lb/hr	0	486
Mill power	kW-hr/T	16.6	14.4

Effect of MagMill™ on Pulverizer Output & Power Draw



Coal Quality Impacts*



*J.K. Alderman, 2005


SLY
PleatJet II