

Impact of High Volatile Content on Coal Grind Size and Combustion in Power Plants



Rajive Ganguli, PhD, PE
Sukumar Bandopadhyay, PhD, PE
University of Alaska Fairbanks



Project Team

- University of Alaska Fairbanks
 - Rajive Ganguli, Ph.D., P.E.
 - Sukumar Bandopadhyay, Ph.D. ,P.E.
 - Students
- Golden Valley Electric Association
 - Dave Hoffman, Plant Superintendent
- Usibelli Coal Mine
 - Alan Renshaw , P.E. Chief Engineer
 - Fred Wallis, P.E.
- Sponsor
 - Arctic Energy Technology Development Lab, University of Alaska Fairbanks
 - Cost Share by GVEA and UCM



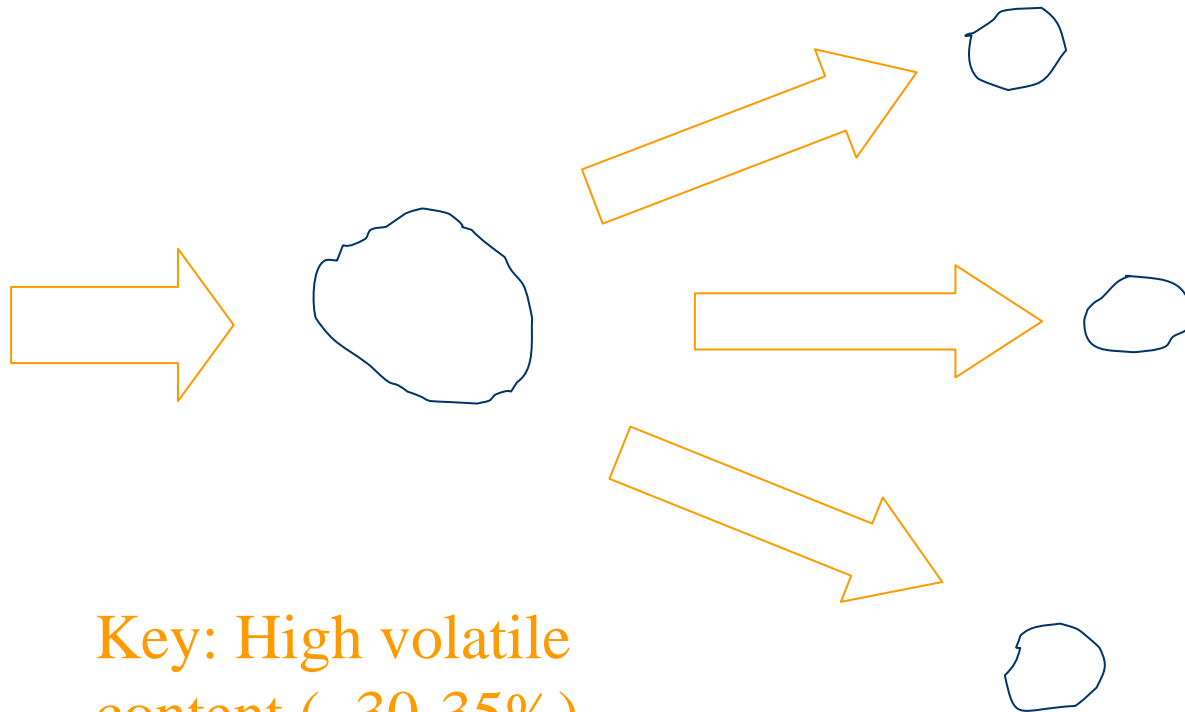
Project Background

- Currently mined Alaska coal is hard to grind
 - An issue when marketing Alaska coal

- But, since Alaska coal is also high in volatile content, can we burn the coal at a coarser grind?



Why is burning coarse possible?



Key: High volatile content (~30-35%)



Project

- Conduct tests at Healy Unit #1 (GVEA) at various particle size distributions (PSD)
- Compare plant efficiencies for the various PSD's



Concept Testing

- Initially, a simple test was done to test the concept.
 - Coal was burned at two different PSD's
 - Plant efficiency examined to see if there is a difference.

	Finer Grind **	Coarser Grind*
Eff.	0.23	0.23
MW Genrtd.	28.15	28.37

* 42% passing 200 mesh

** 49% passing 200 mesh

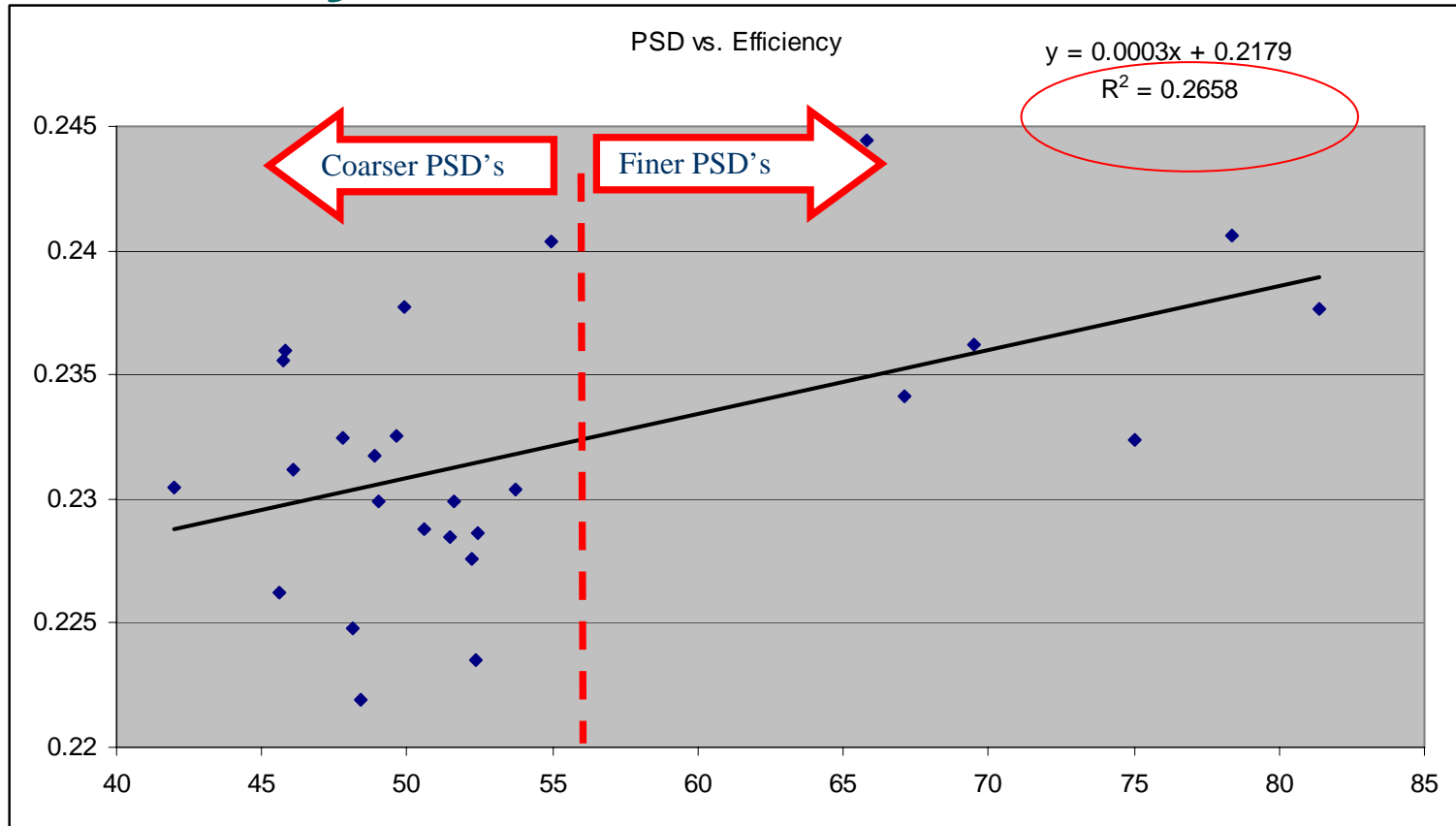


Extended Testing

- Following proof of concept, testing was expanded
 - The power plant was run at various PSD's
 - Data collected on plant efficiency, quality of combustion and emissions
 - Results for tests to data presented next.



Efficiency



Coal Quality Difference

	Average		t-stat	Significant* difference?
	Coarser	Finer		
Ash	14.15	14.98	1.28	No
Volatile Content	38.43	38.22	0.37	No
Volatile Content^{RC}	32.5	31.5	1.66	No
Moisture	15.2	17.35	N/A	N/A
Moisture^{RC}	27.1	30.6	MWT	Yes
Heat Val, kJ/kg (BTU)	19337 (8320)	18774 (8078)	4.1	Yes
Fixed Carbon Content	32.3	29.5	N/A	N/A
HGI	34	37.8	3.8	Yes

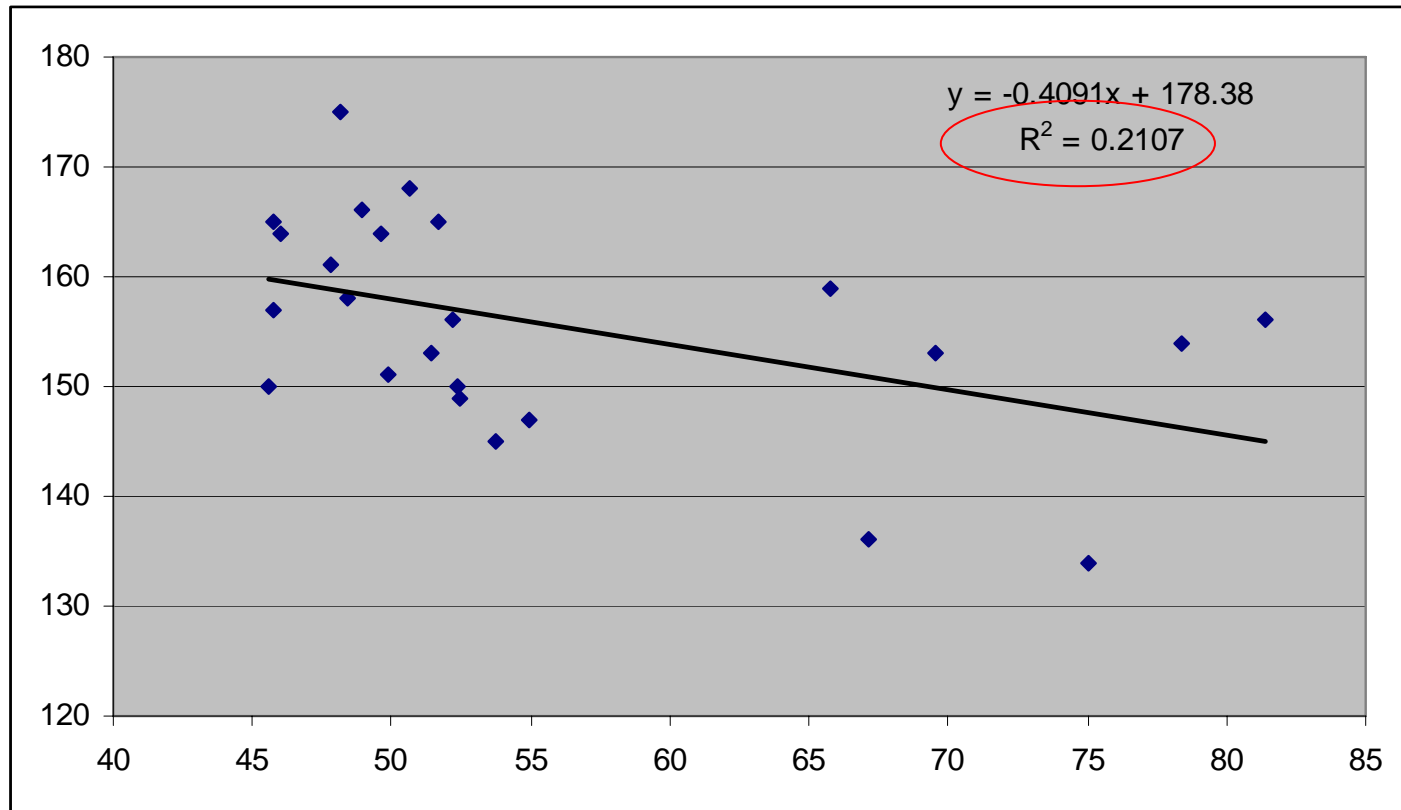
* at 95% confidence

RC: Raw Coal

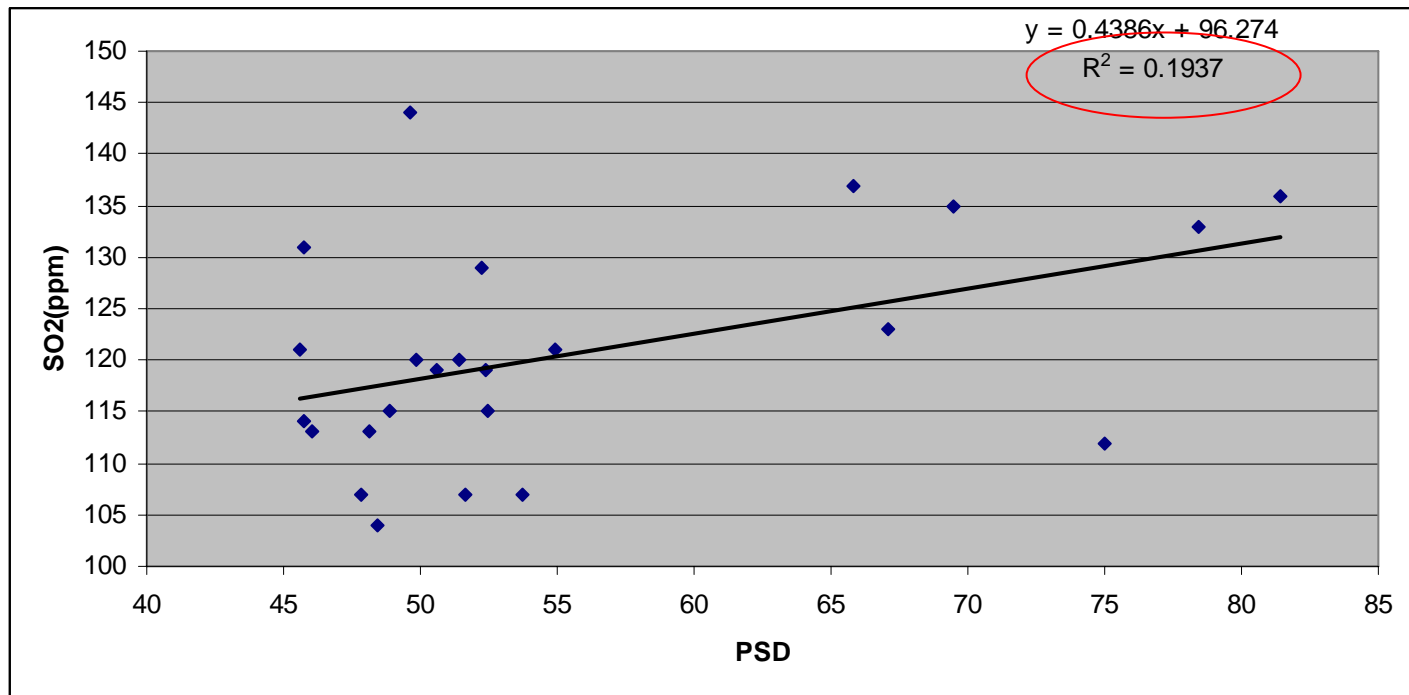
MWT: Mann-Whitney Test



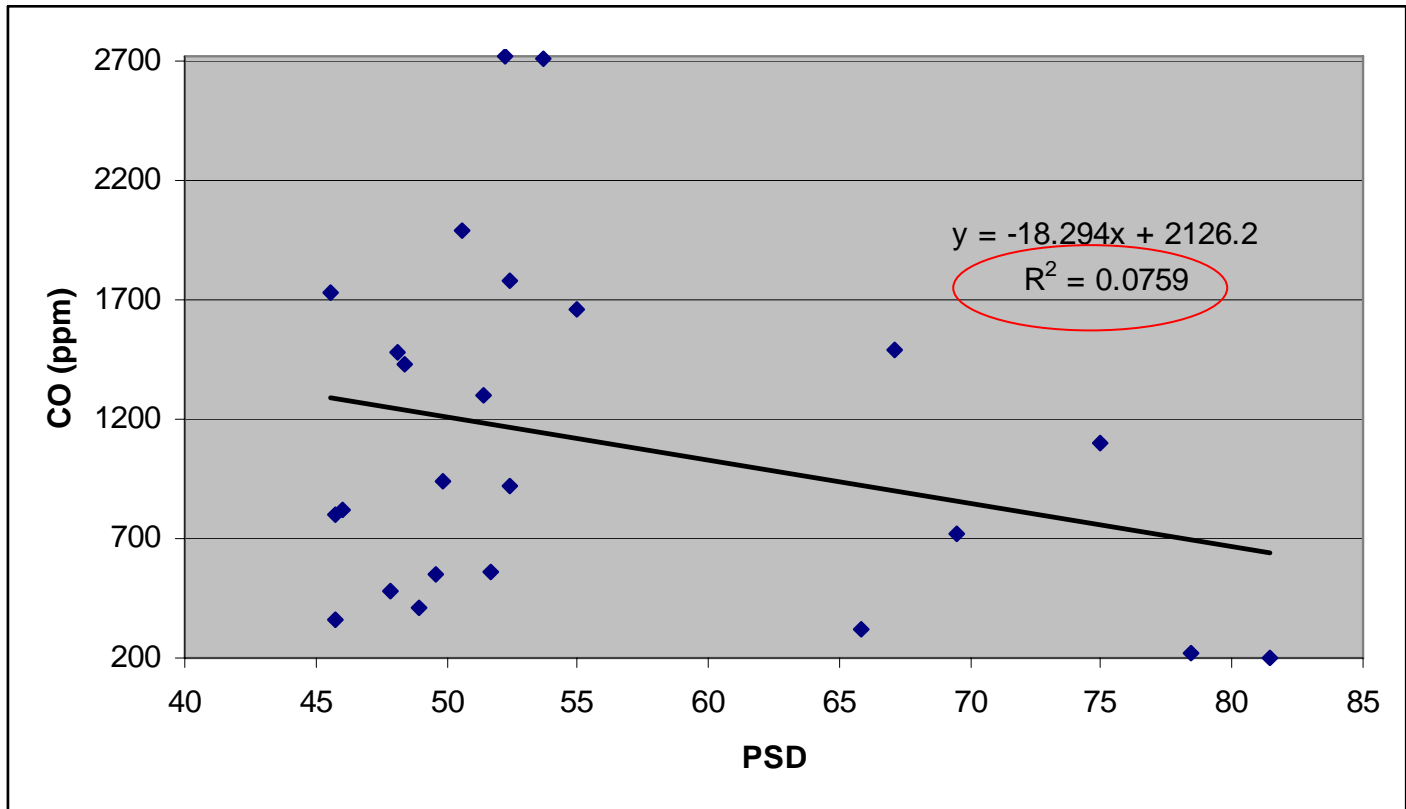
Emissions PSD vs. NO_x



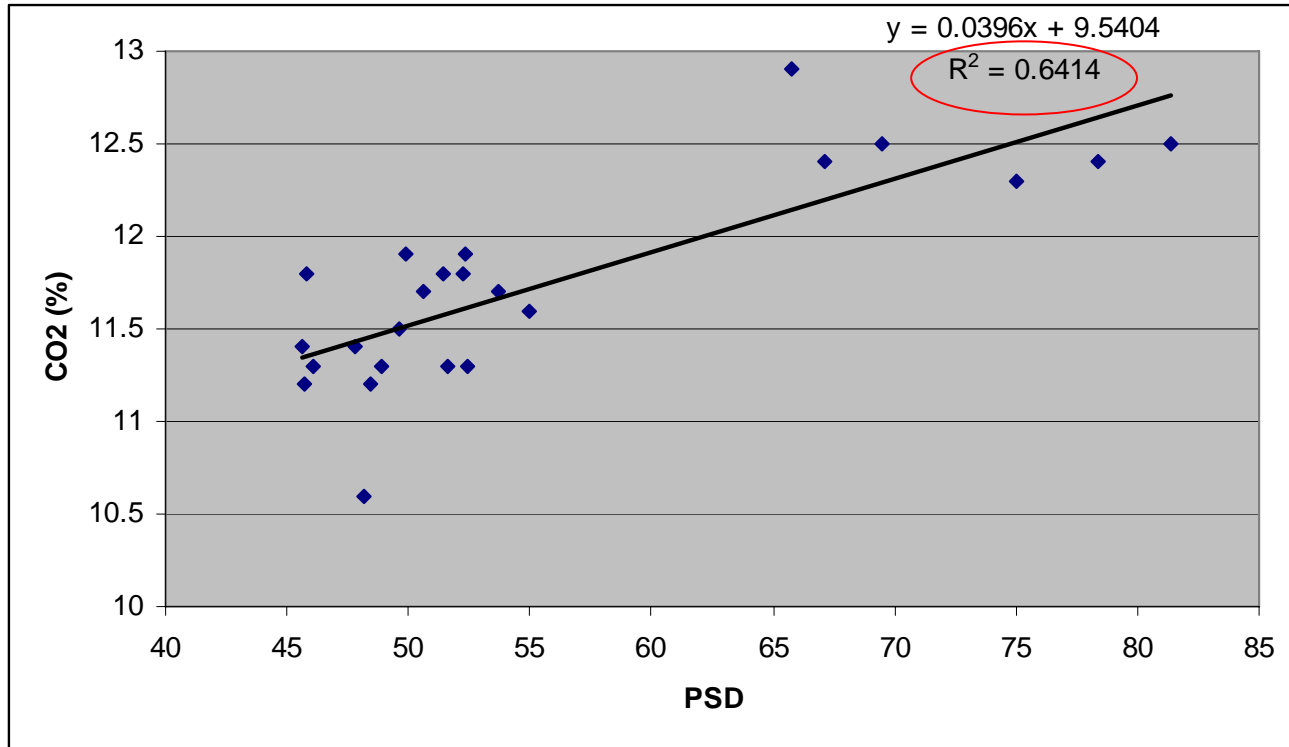
Emissions PSD vs. SO₂



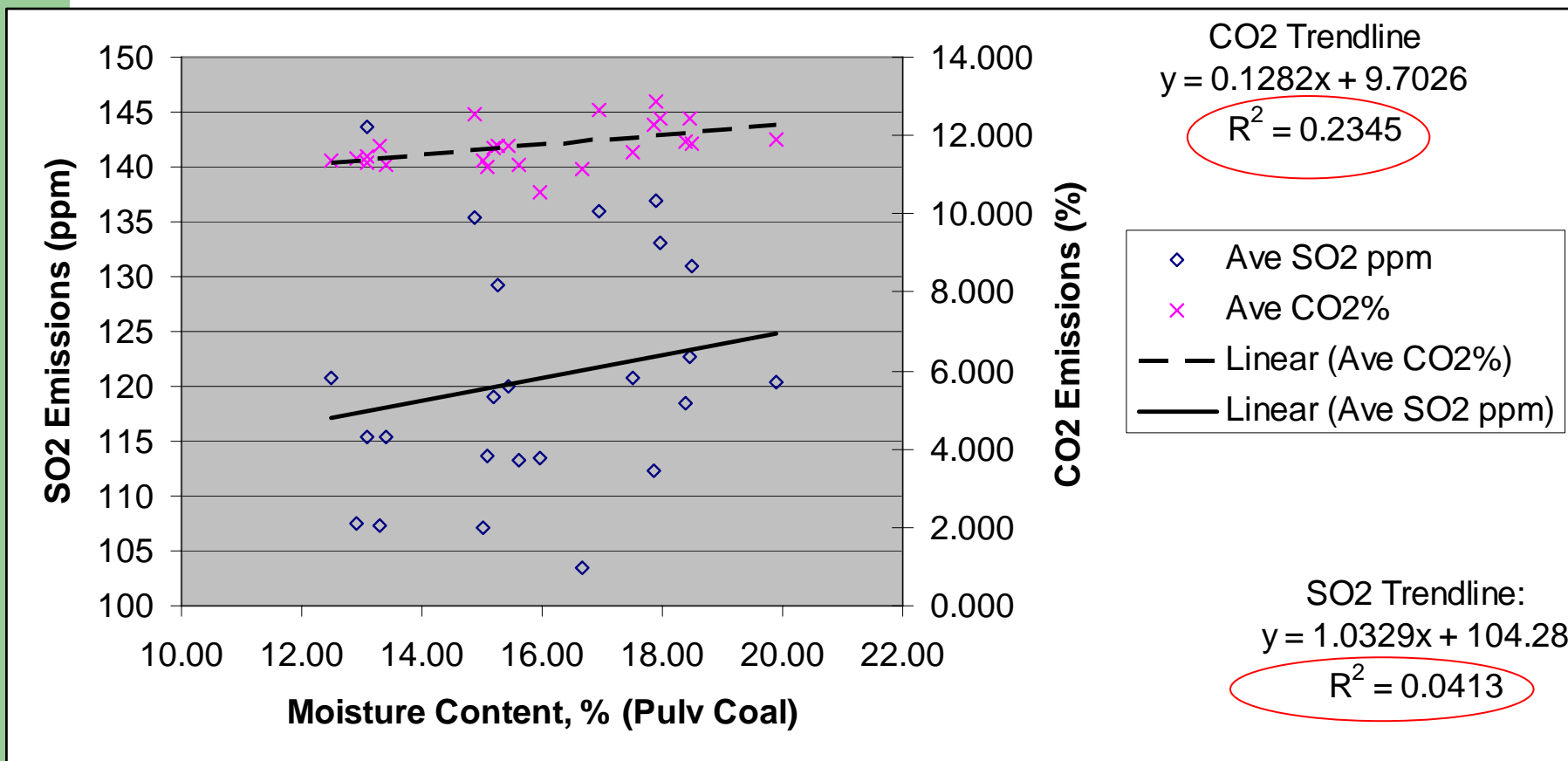
Emissions PSD vs. CO



Emissions PSD vs. CO₂



Role of moisture



Conclusions

- Tests to date have indicated that
 - High volatile content Alaska coal can be burned at coarser grinds
 - Emissions do not worsen
 - Coarse grinds lead to tangible savings in costs

