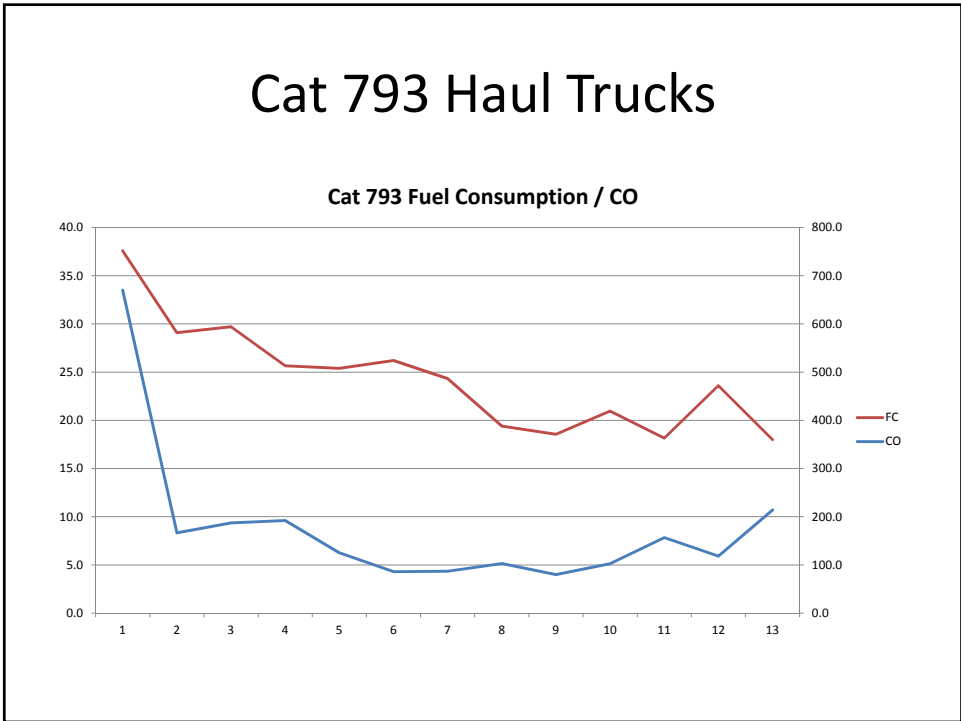


Emissions Based Maintenance For Fuel Consumption Reduction

Steve Forbush (Arch Coal)

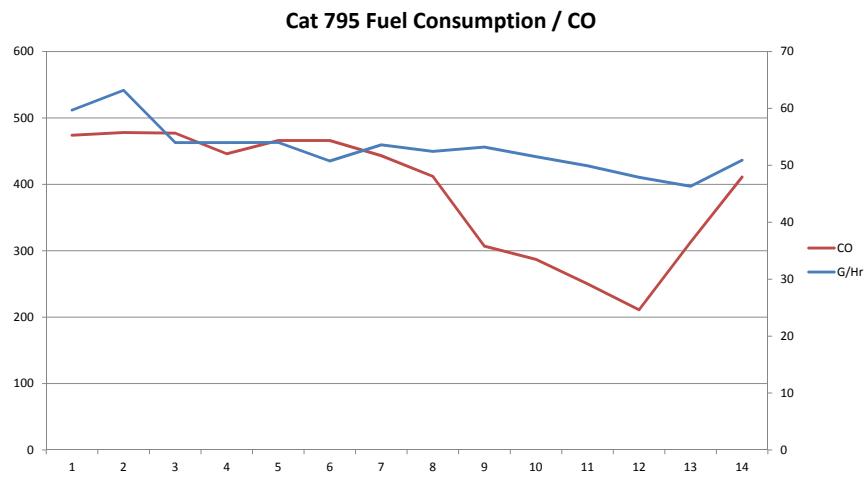
MDEC Conference 2015

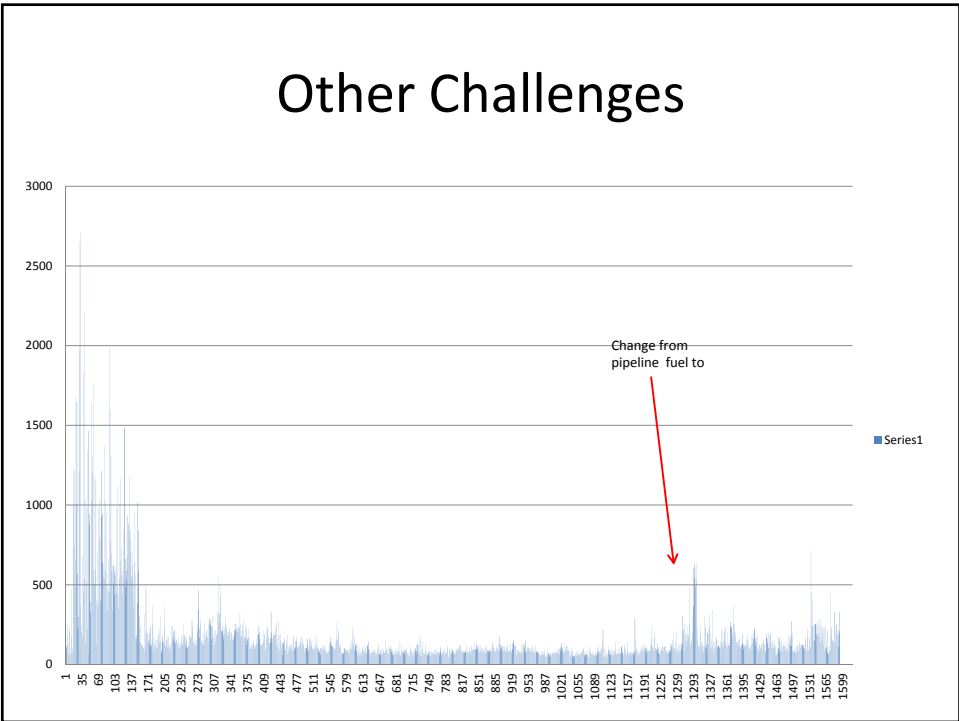
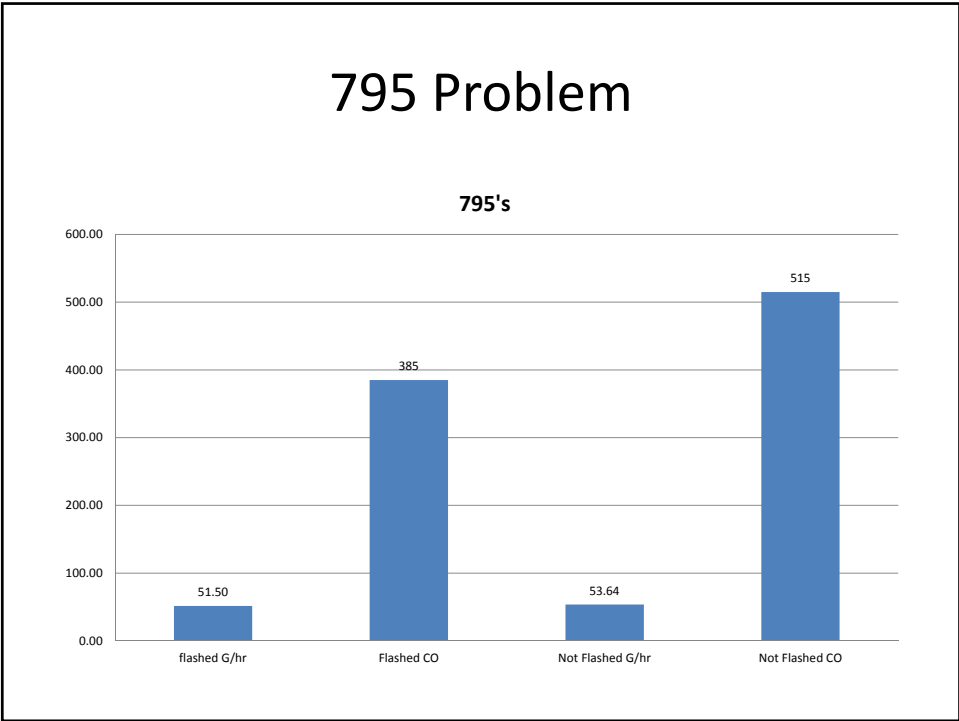


793 Problem

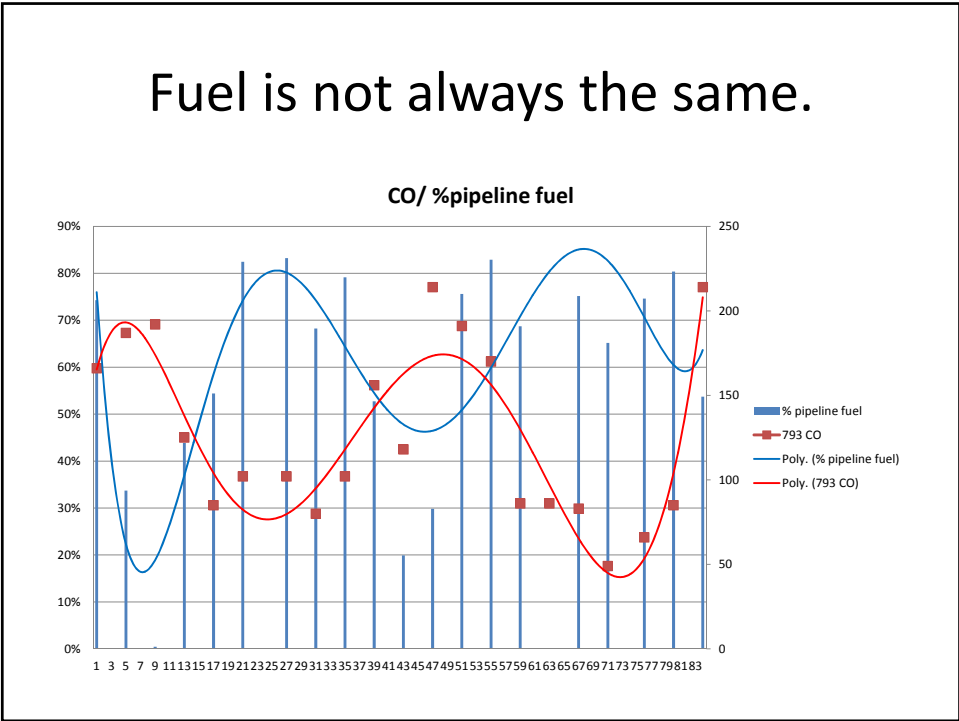


Cat 795 Haul Trucks

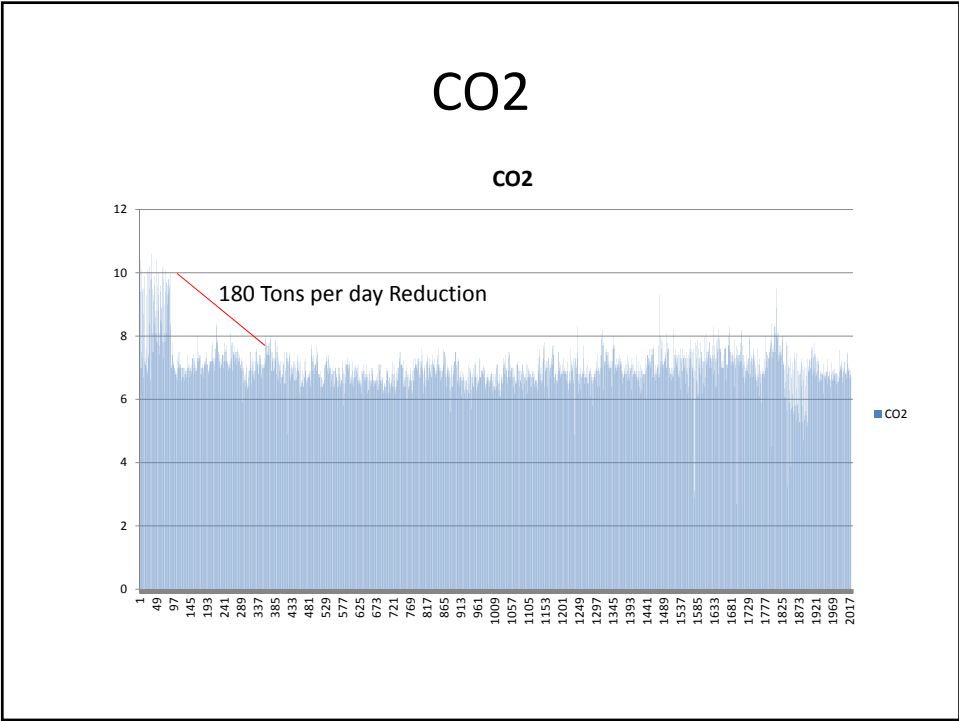




Fuel is not always the same.



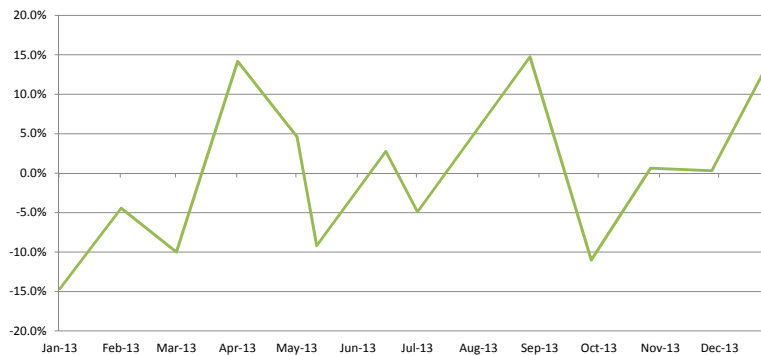
CO2

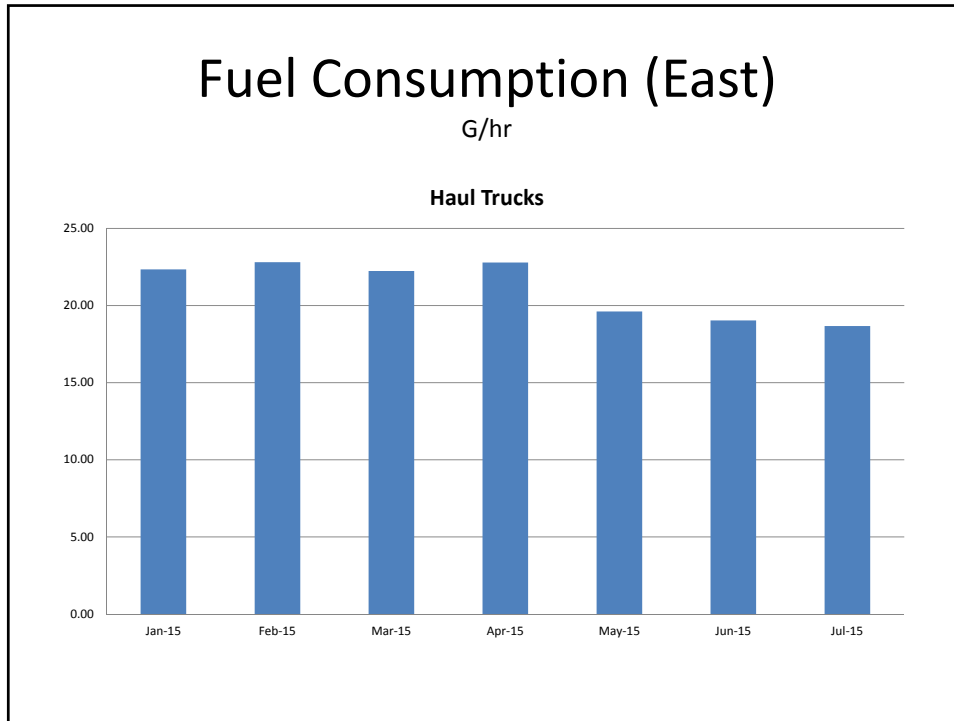


Fuel Analysis (West)

Method	Test	Units	Requirements per ASTM D975, No. 2-D 515		Result				
			Min	Max	CL13-8988 - CL13-4991	CL13-5066	CL13-5067	CL13-5068	CL13-5069
D4052	Density 15°C	g/ml	NR	NR	0.8498	0.8430	0.8476	0.8313	0.8354
D9281	Carbon Hydrogen Content	mass %	NR	NR	C 86.77, H 12.98	C 86.85, H 13.09	C 87.05, H 12.91	C 86.24, H 13.61	C 86.21, H 13.54
D86	Distillation, 90%	°C	282	338	325.1	330.0	318.0	313.3	316.3
D93	Flash Point	°C	52	---	63.5	51.5	59.5	62.5	65.5
D1319	Aromatics	vol %	---	35	35.5	34.2	37.2	24.1	33.6
D2822	Sulfur Content	ppm	---	15	8.2	6.7	8.3	4.9	5.3
EN14078	Biodiesel FAME Content	vol %	NR	NR	0.4	<0.1	<0.1	0.6	1.0
D4009	Net Heat of Combustion	BTU/lb	NR	NR	18,469	18,312	18,347	18,508	18,589
D6304	Water Content	ppm	NR	NR	56	60	59	8	60
D976	Calculated Cetane Index		40	NR	46.5	47.7	44.2	52.1	51.2

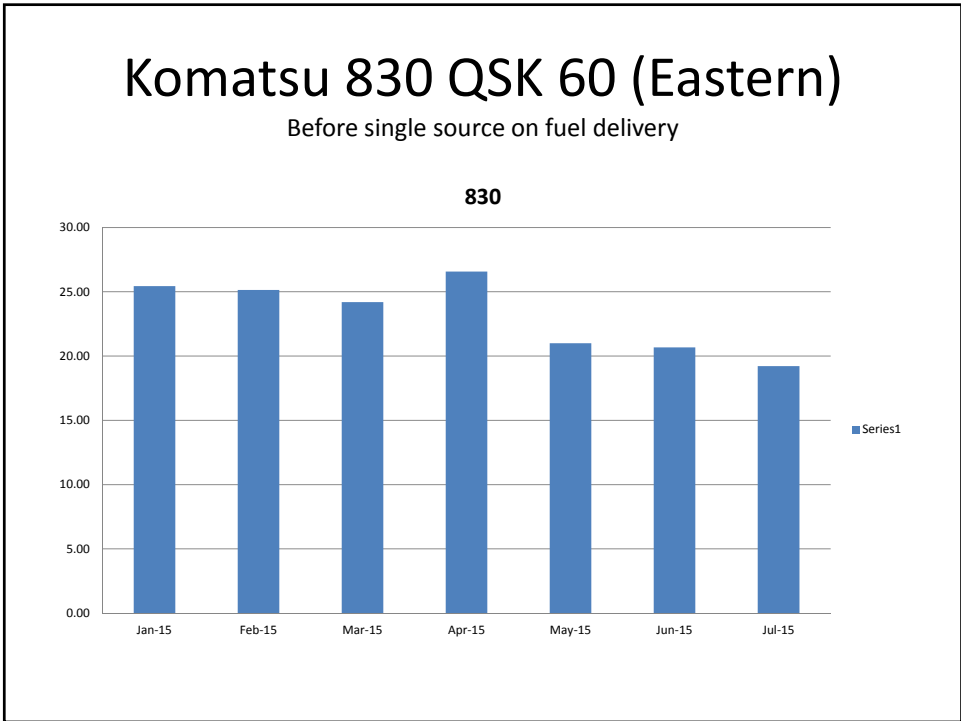
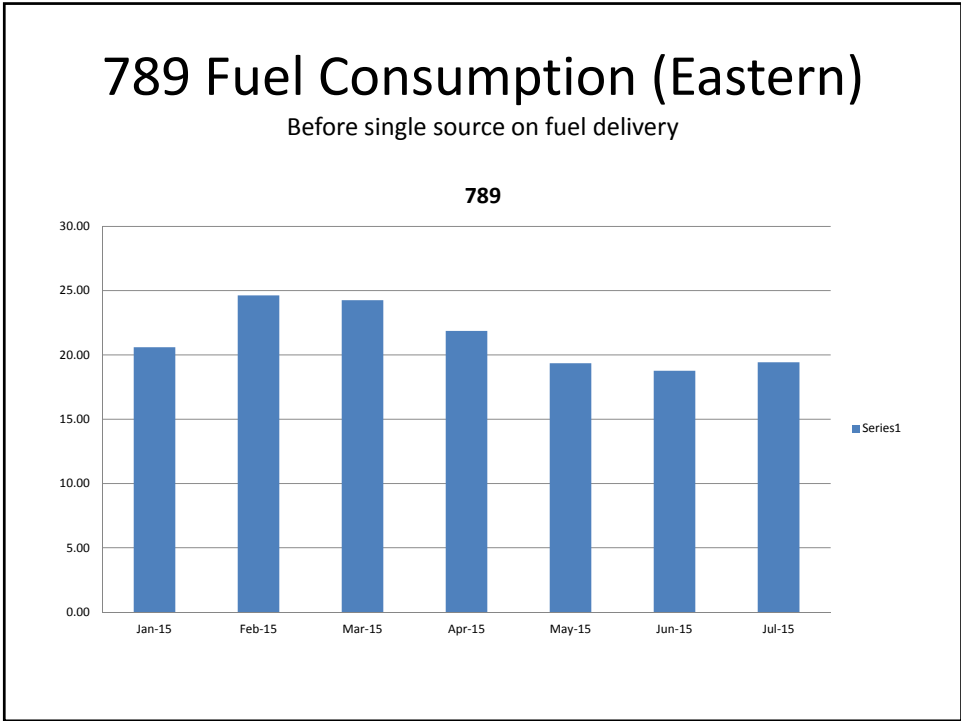
795 Fuel Consumption (Western)





Fuel Analysis (East)

Test		January	February	March	June	July	August
Flash Point	°C	65.5	67.5	66.5	64.5	63.5	59.5
Ignition Delay	--	3.908	4.304	4.355	4.145	4.032	3.884
Derived Cetane	--	52.21	47.82	47.31	49.48	50.74	52.51
Total Aromatics	mass%	18.4	24.6	26.4	29.9	28.8	26.7
"Lubricity" Wear Scar Diameter	um	271	365	318	319	333	304
Density (15°C)	kg/m³	828.5	838.7	839.2	843.4	842.2	839.9
Heat of Combustion	kJ/kg	18405	18331	18555	18273	18246	18284
Total Sulfur Content	ppmm	2.1	3.6	3.2	7.1	8	16.3
Carbon	%	85.84	86.07	85.76	85.61	85.99	85.33
Hydrogen	%	13.71	13.3	13.25	12.94	12.96	13.13
FAME Content (IR)	% volume	4.8	5	4.9	5	5	4.2



Black Fuel Filter (Western)



Black Fuel Filter (Eastern)



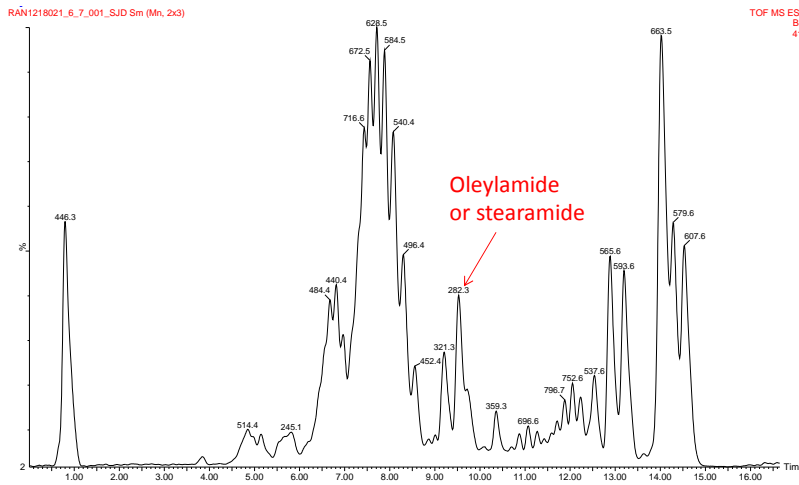
Pipelines in USA



Injector Failure on Dodge Trucks

Mine Site	Injectors	# Trucks
West Elk	99	45
Sufco	8	58
Skyline	1	43
Dugout	5	39

What we found to be the Cause.



Fuel inside injector



Injectors with same hours.



Injector Seating area.



“The spectra are consistent with deposition from corrosion inhibitor or lubricity enhancer amide-based type fuel additives.”

