



# 2021 AEMA-ARRA-ISSA Annual Meeting

February 15-18





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## An Attempt at Predicting Asphalt Emulsion Performance from Chemistry

Stormy Brewster, Senior Asphalt Technologist  
Marathon Petroleum Company

# Agenda



- Field issues
- Experimental
- Results
- Takeaways
- Path Forward



# Variations in Field Viscosity



- Reported from industry - Viscosity, demulsibility, float issues
  - Chemistries changing based on binder supply
  - Time consuming if not prepared
  - Are there one or two binder tests that can predict viscosity in the field?



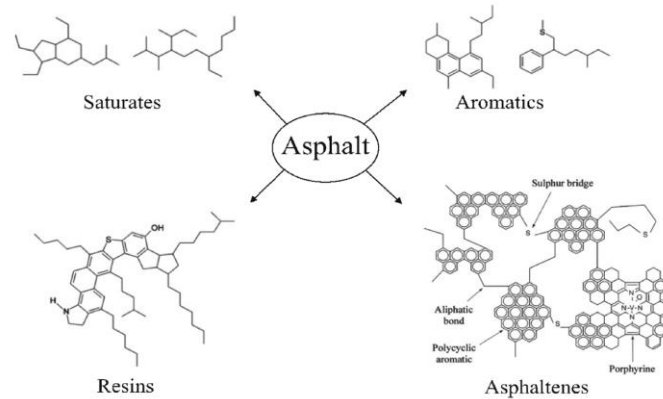
- 20 asphalts
  - Blending to an emulsion base, no PG grades
  - Majority of samples were 150-200dmm materials, common RS base for Midwest



# Asphalt Testing



- Total Acid Number
- Salt in Crude
- High Temperature Simulated Distillation
- X-ray fluorescence
- SARA
- Metals



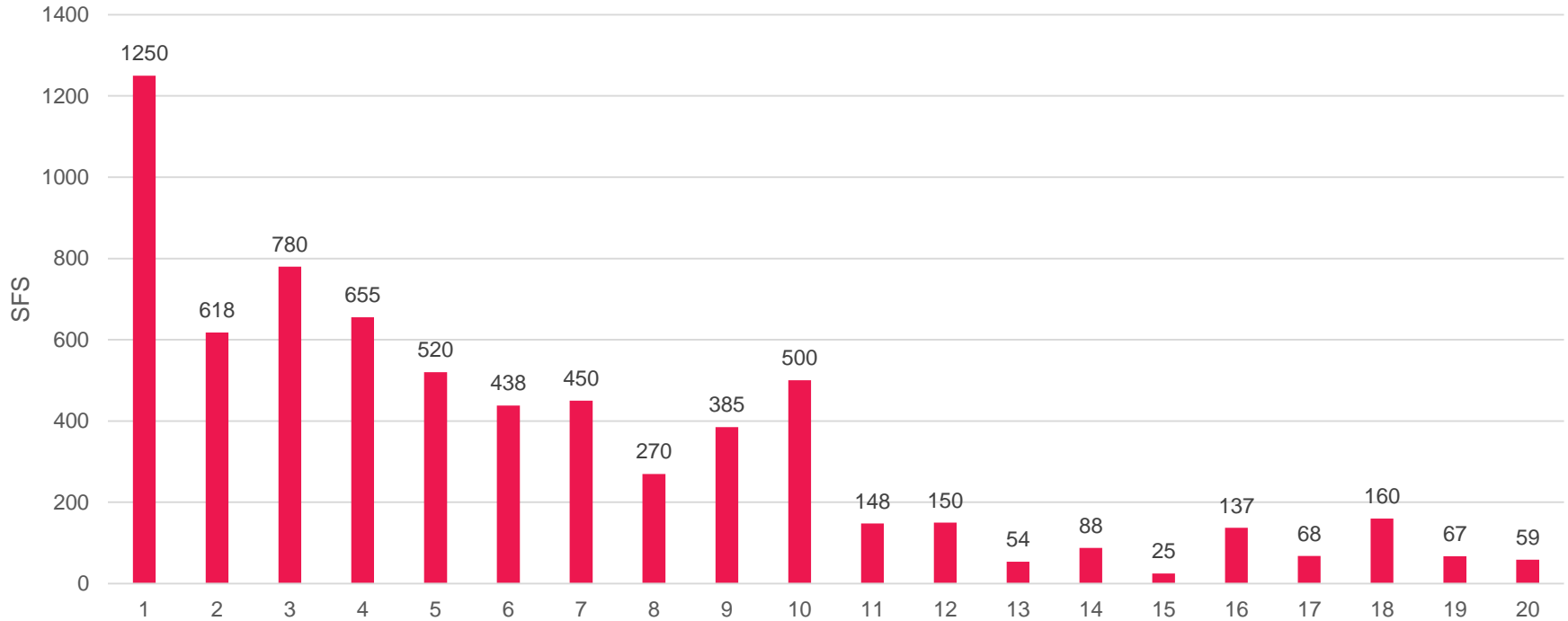
# Emulsion Prep and Testing



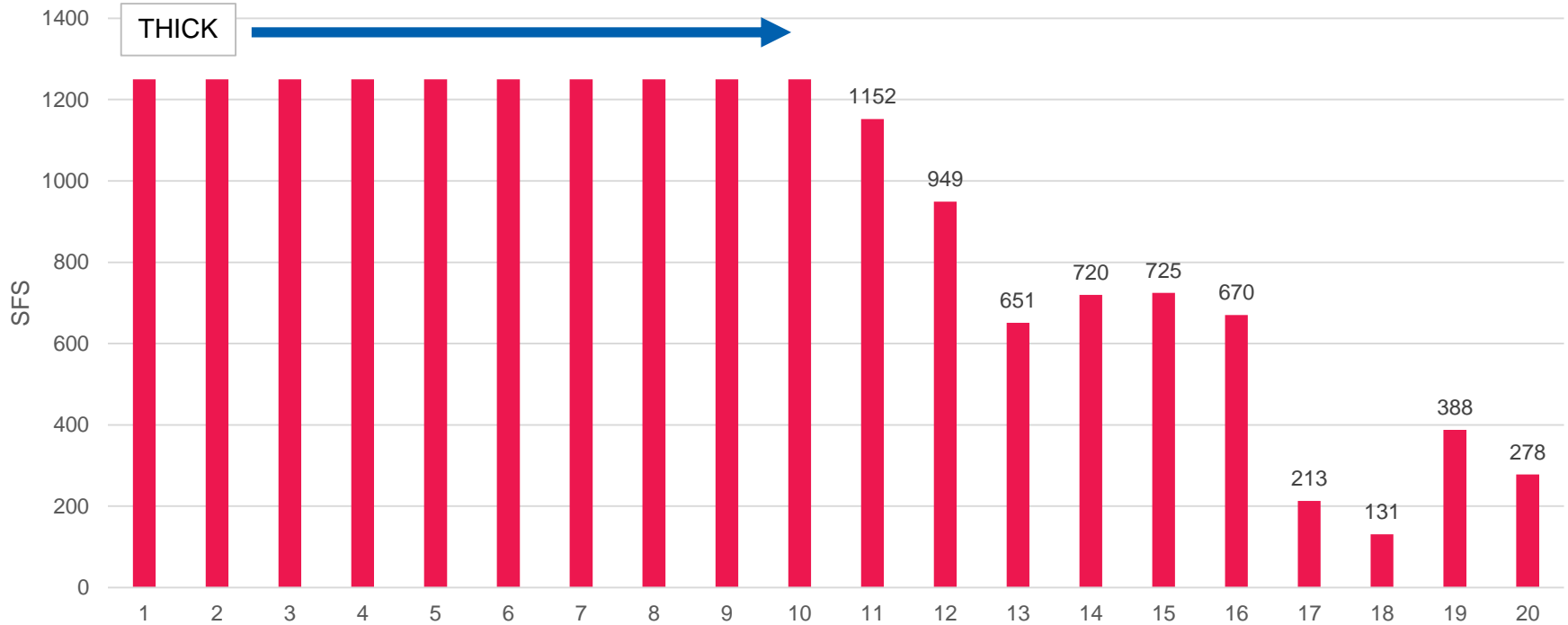
- All asphalts run for CRS-2 and HFRS-2
- Emulsifiers used:
  - Indulin AA-86
  - Indulin 533/Indulin 206
- Emulsion Testing:
  - Viscosity day 1 and day 3
  - Demulsibility
  - Float
  - Particle size
  - Penetration from distillation

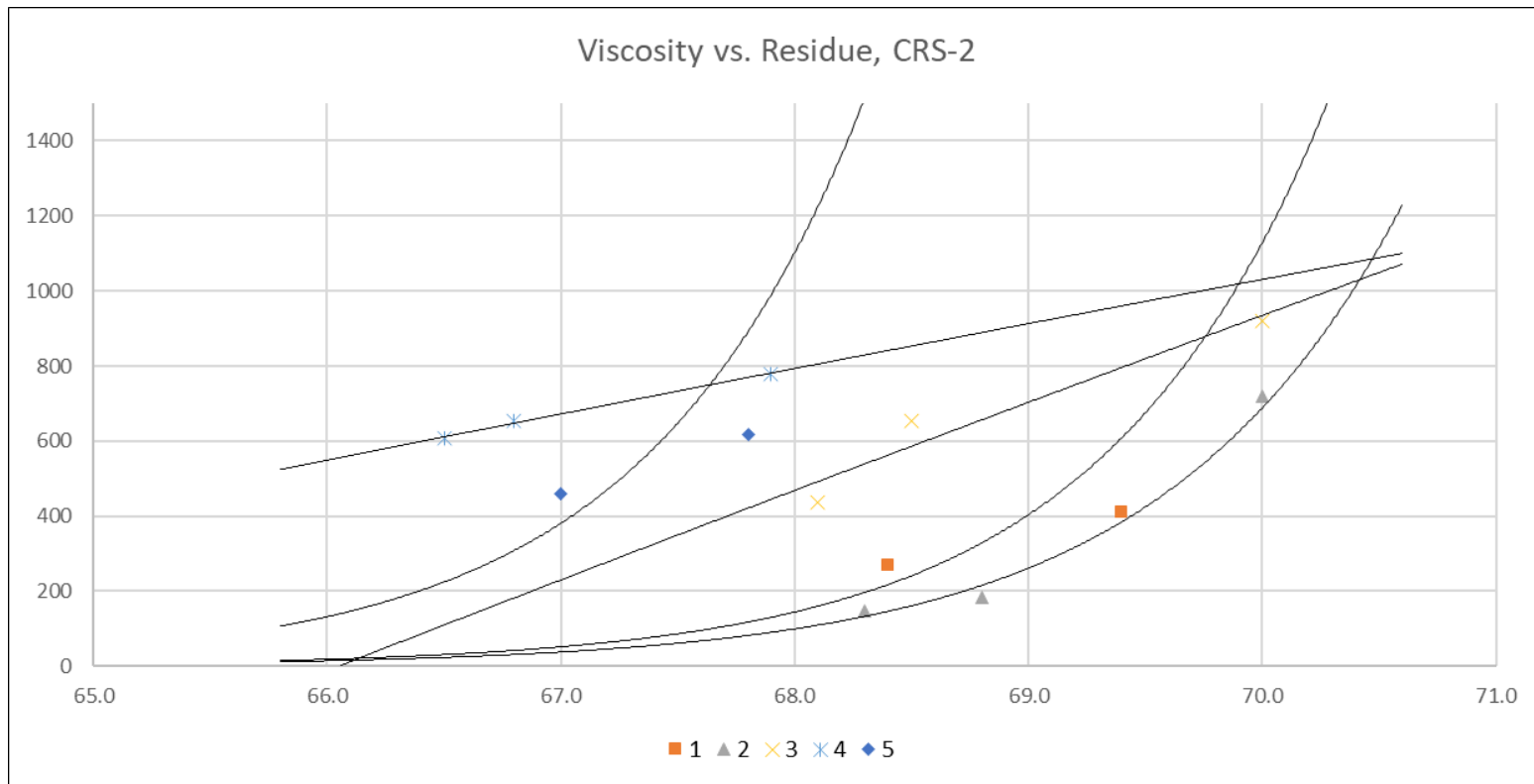


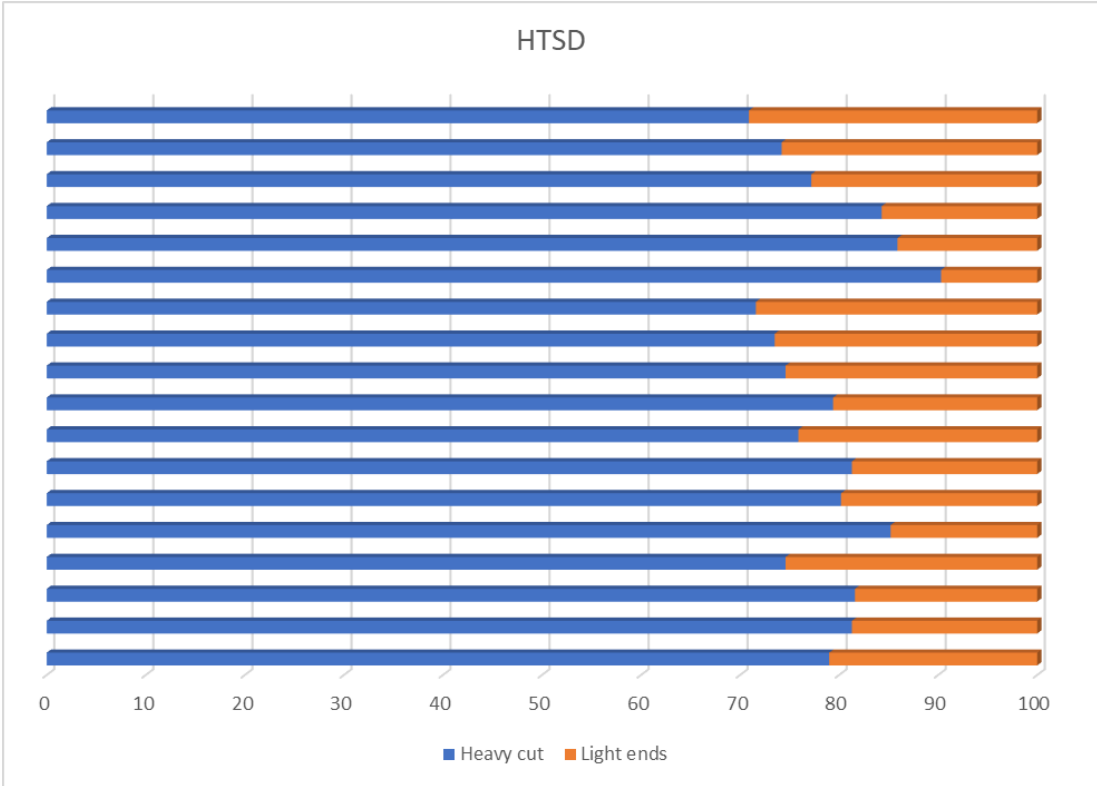
## CRS-2 Viscosity @ 68% Residue



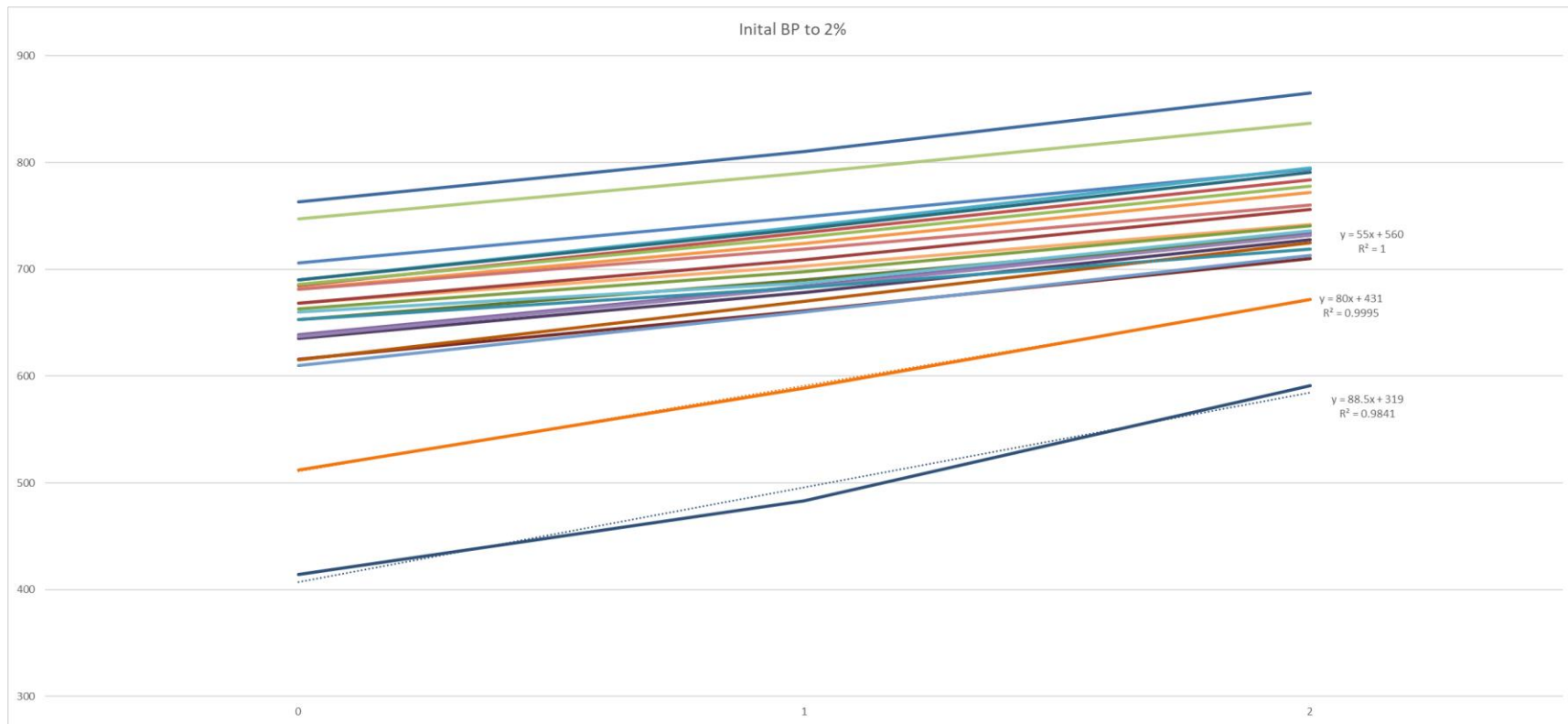
## HFRS-2 Viscosity @65.5-67% Residue

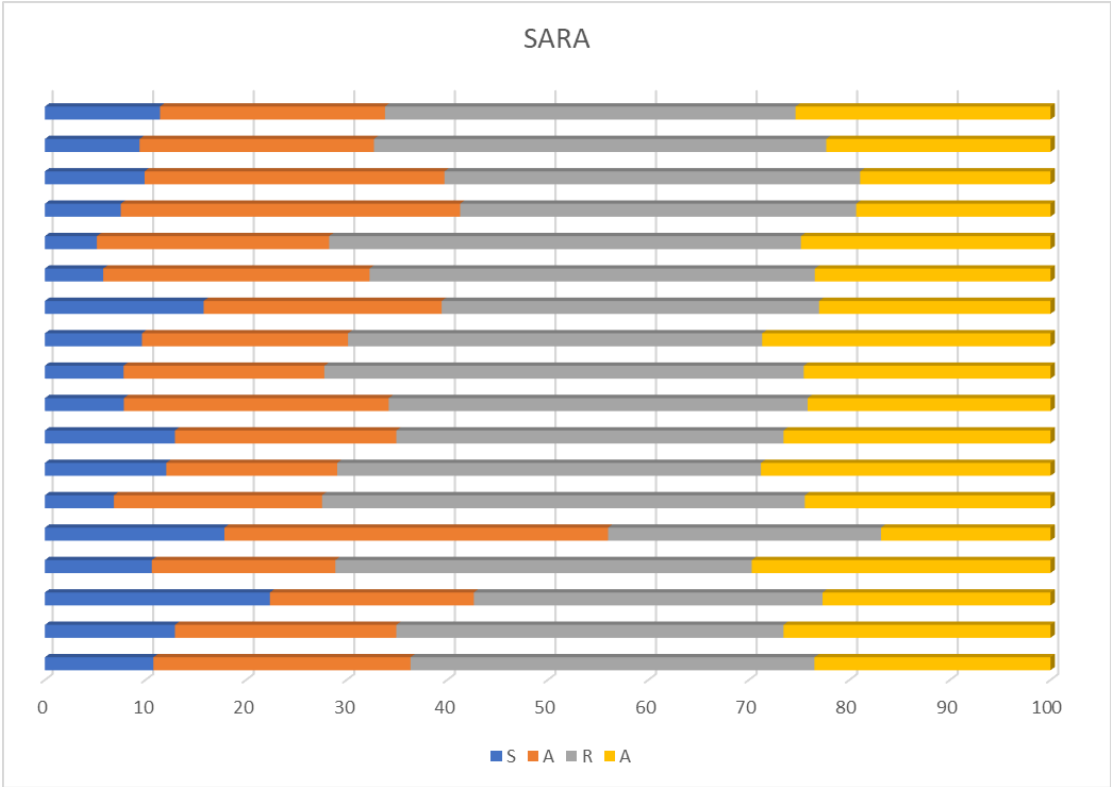


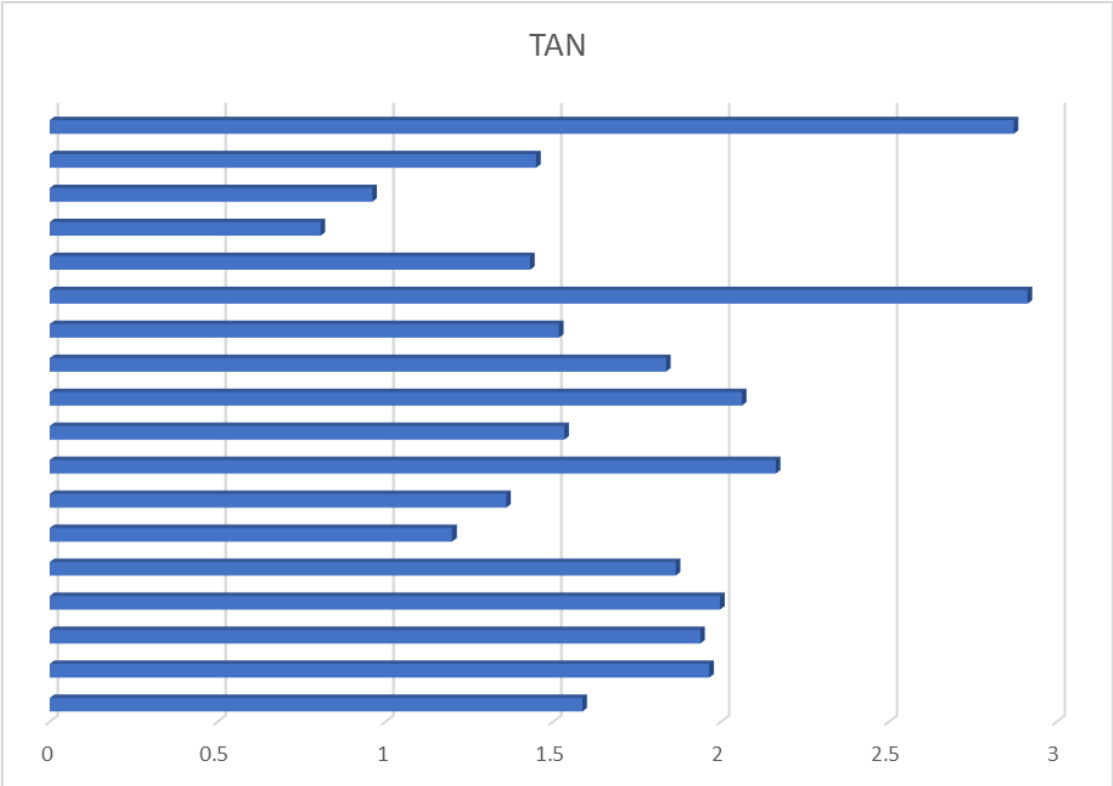


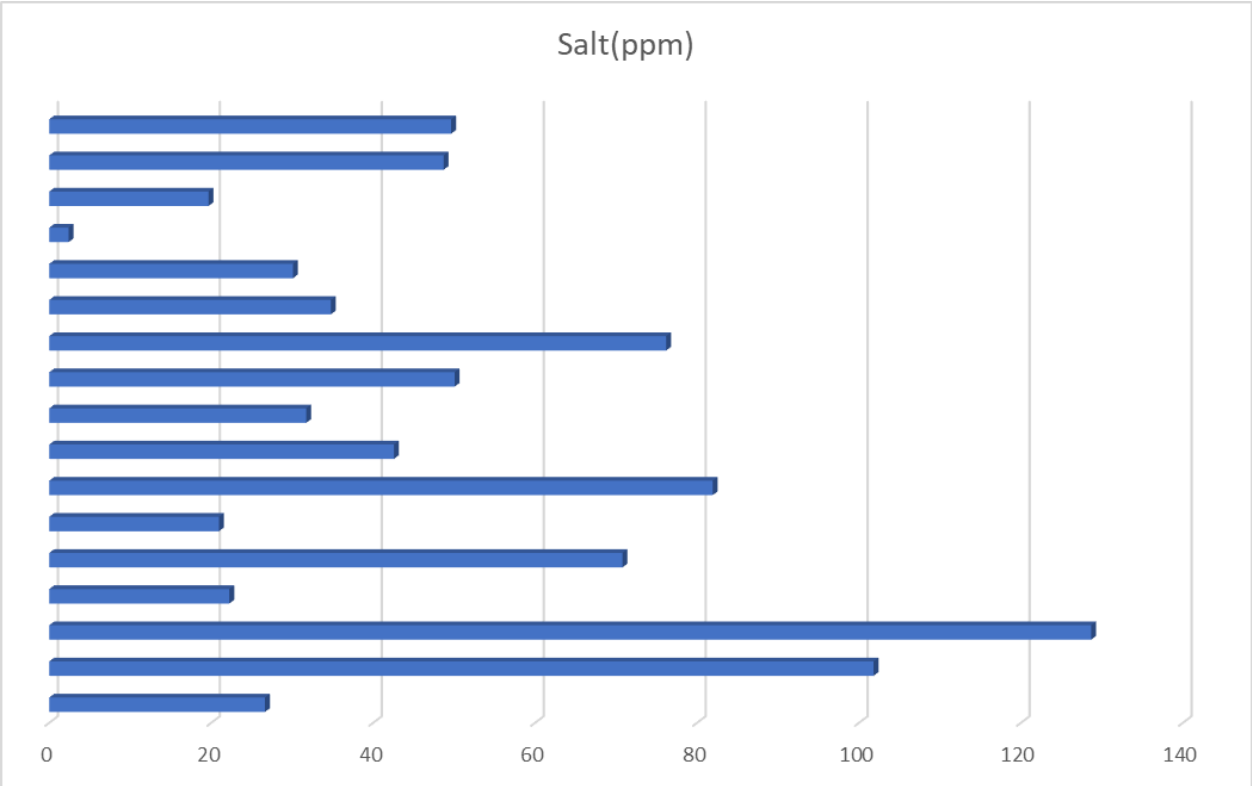


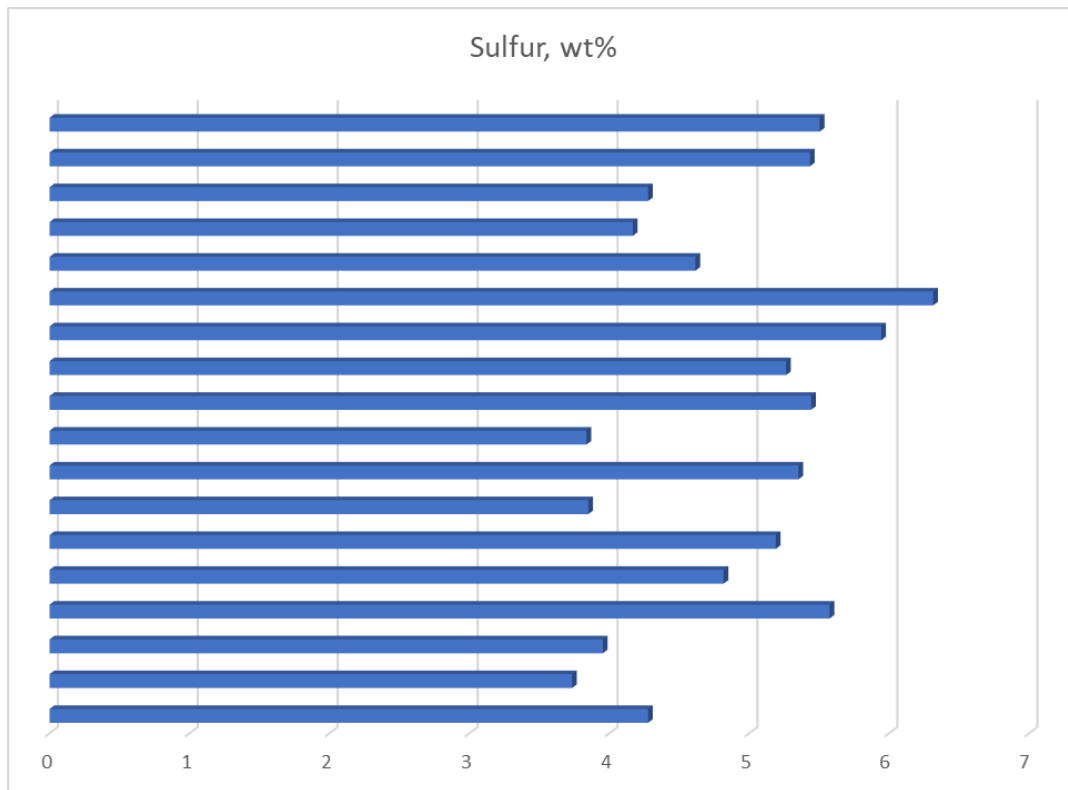
# Results











## Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	8	799416	99927	0.90	0.560
S	1	6758	6758	0.06	0.812
A	1	4971	4971	0.04	0.838
Light ends	1	83744	83744	0.76	0.413
Sulfur	1	311316	311316	2.81	0.137
TAN	1	24404	24404	0.22	0.653
Salt	1	108546	108546	0.98	0.355
R	1	8526	8526	0.08	0.789
Really Light Ends	1	4208	4208	0.04	0.851
Error	7	774913	110702		
Total	15	1574329			

## Model Summary

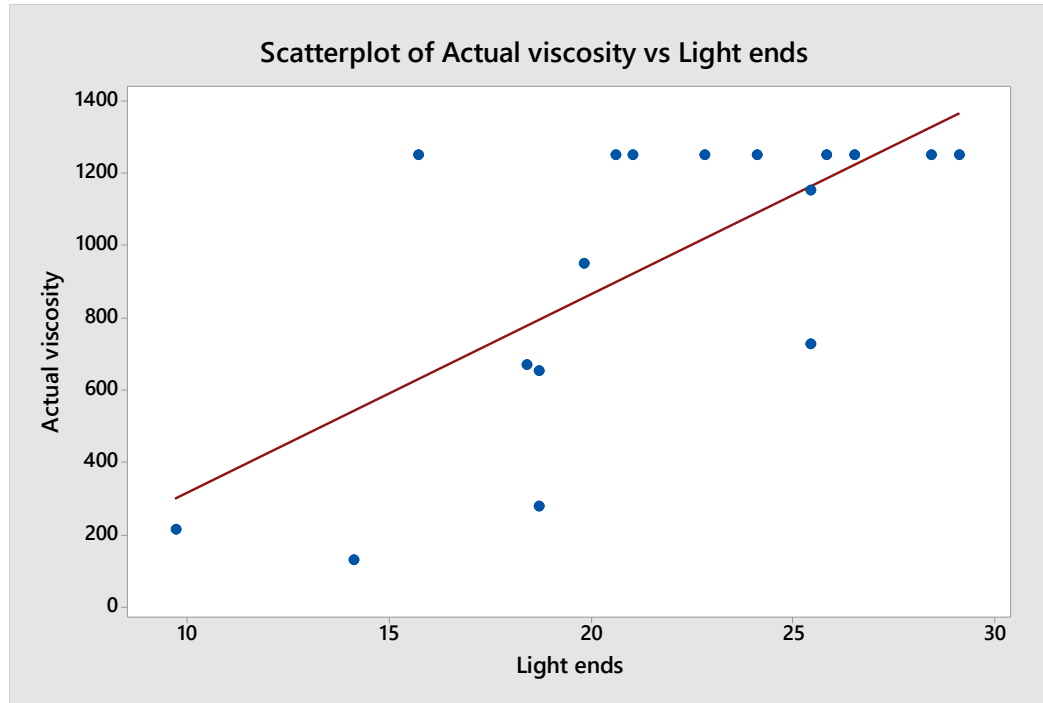
S	R-sq	R-sq(adj)	R-sq(pred)
332.719	50.78%	0.00%	0.00%

## Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Regression	8	1762010	220251	6.54	0.017
S	1	112473	112473	3.34	0.117
A	1	832	832	0.02	0.880
Light ends	1	919060	919060	27.31	0.002
Sulfur	1	43345	43345	1.29	0.300
TAN	1	265	265	0.01	0.932
Salt	1	148085	148085	4.40	0.081
R	1	161721	161721	4.81	0.071
Really Light Ends	1	58728	58728	1.74	0.235
Error	6	201938	33656		
Total	14	1963948			

## Model Summary

S	R-sq	R-sq(adj)	R-sq(pred)
183.456	89.72%	76.01%	0.00%



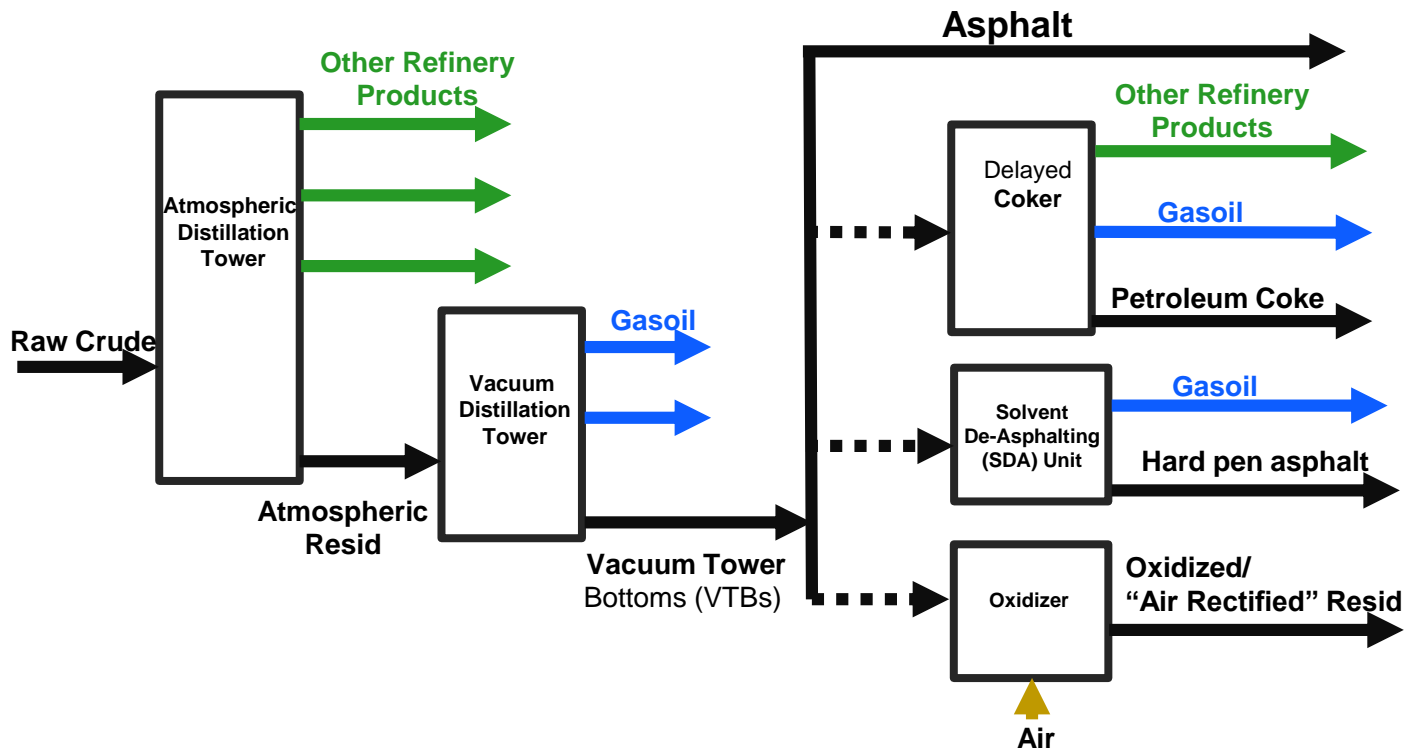
- Clear difference in asphalt chemistry and viscosity performance
- Nothing exciting in demulsibility or float data
- None of the bases were “bad”
  - No sieve, storage stable, no demulsibility or float issues
- Not one change in chemistry and eventually the bases would have passed by managing residue
- Same sourced asphalts had repeatable viscosities



Something in  
the light ends,  
or crude?

But, what is  
actually feeding  
the asphalt  
towers.....

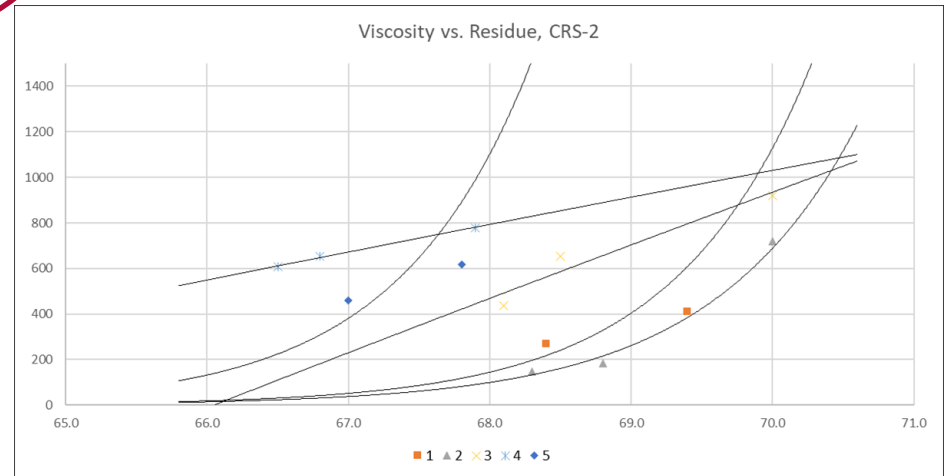
# General Refinery Flow Diagram (Asphalt Focus)



# Takeaways



- It is not all about a certain residue %



# Path Forward



- Continue to evaluate the data for more than one interaction.
- Take low viscosity producers and blend to alter the composition.
- Run viscosities on paddle viscometer to further separate.
- Grab high viscosity and low viscosity bases as they come up.



