

From the Lab to the Field, a Pathway to Success for Bioremediation Field Testing Techniques

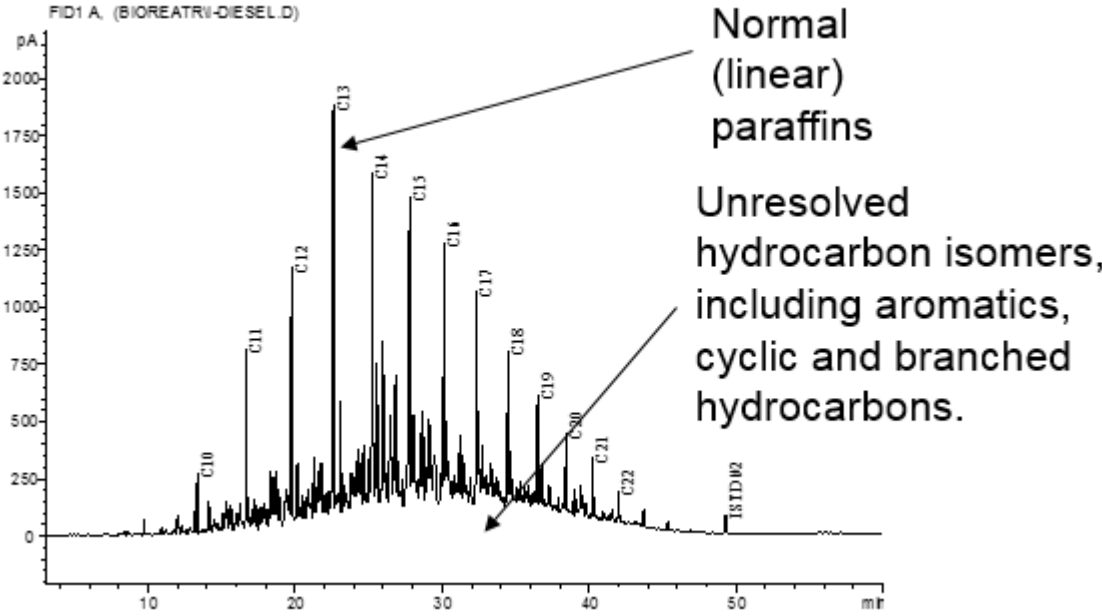
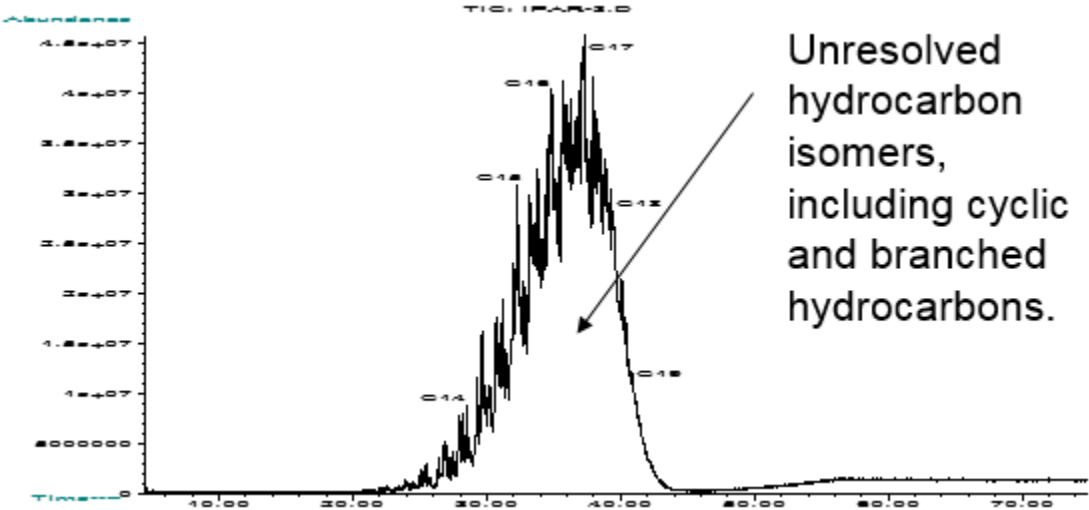
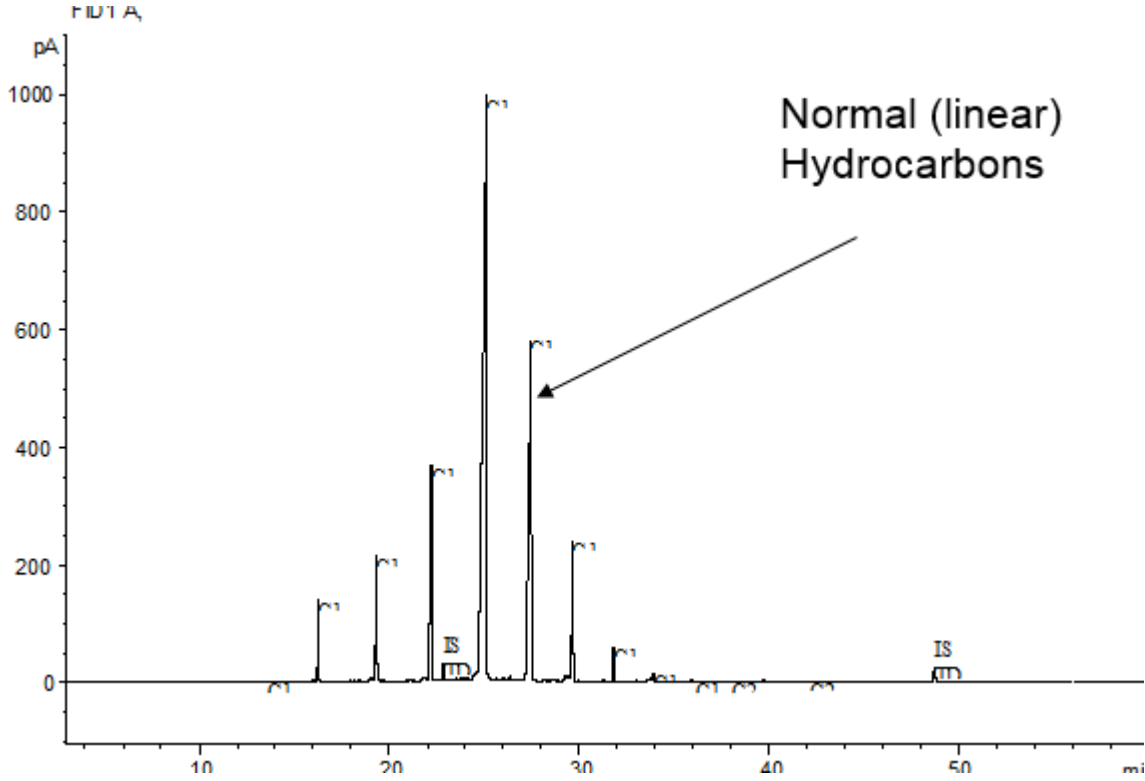
John Candler, Patrick Tyczynski
M-I SWACO, a Schlumberger company



Overview – When Have You Met Regulatory Limits?



Overview – Hydrocarbons

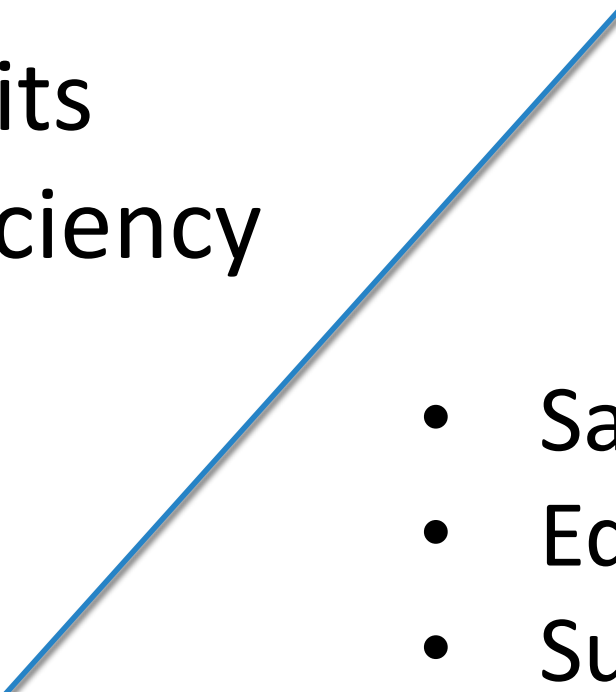


Instruments

- Relationship Between the Lab and the Field
- Optimal treatment to reach target
- Variables with potential to extend process



Results – Comparison

- Detection Limits
 - Extraction Efficiency
 - Correlation
- 
- Sampling
 - Equipment and Techniques
 - Substrate
 - Calibration

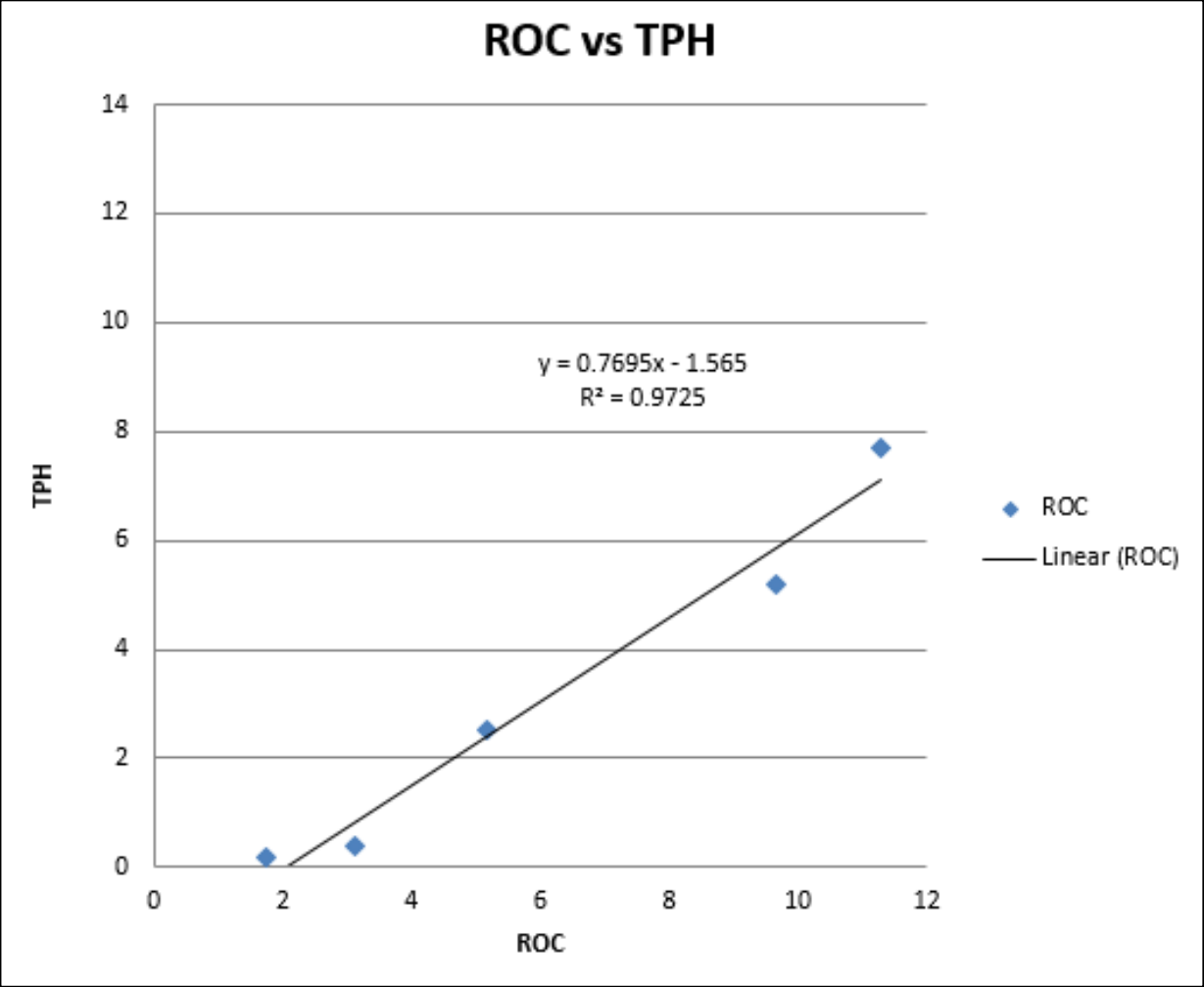
Results – Comparison

Day	ROC (Retort)	TPH (INFRACAL)	DRO (3rd Party)
0	11.29	7.7	8.97
7	9.66	5.21	
14	5.18	2.51	
20	3.13	0.41	0.392
27	1.74	0.2	0.32

Results – Comparison

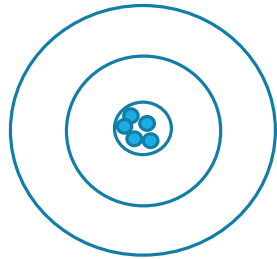
Client Sample ID: LIMS20180036							Lab Sample ID: 600-166552-1			
Date Collected: 05/25/18 13:30							Matrix: Solid			
Date Received: 05/25/18 15:31							Percent Solids: 67.4			
Method: 8015B - Diesel Range Organics (DRO) (GC) - DL										
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac	
Diesel Range Organics [C10-C28]	3200		1230	254	mg/Kg	☉	05/30/18 10:37	05/31/18 02:13	100	
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac	
<i>o</i> -Terphenyl	0	X	60 - 140				05/30/18 10:37	05/31/18 02:13	100	
Method: TX 1005 - Texas - Total Petroleum Hydrocarbon (GC)										
Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac	
C6-C12	51.1		14.8	5.63	mg/Kg	☉	05/30/18 12:46	05/31/18 10:45	1	
>C12-C28	589		14.8	6.02	mg/Kg	☉	05/30/18 12:46	05/31/18 10:45	1	
>C28-C35	102		14.8	6.02	mg/Kg	☉	05/30/18 12:46	05/31/18 10:45	1	
C6-C35	742		14.8	5.63	mg/Kg	☉	05/30/18 12:46	05/31/18 10:45	1	
Surrogate	%Recovery	Qualifier	Limits				Prepared	Analyzed	Dil Fac	
<i>o</i> -Terphenyl	81		70 - 130				05/30/18 12:46	05/31/18 10:45	1	

Results – Correlation

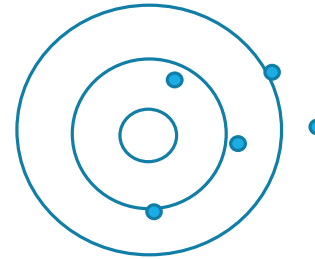


Results – Correlation

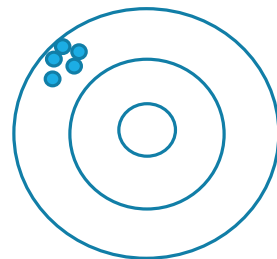
- Understanding the difference between precision and accuracy



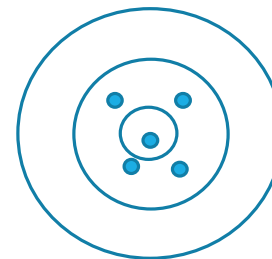
Good Precision
Good Accuracy



Poor Precision
Poor Accuracy



Good Precision
Poor Accuracy

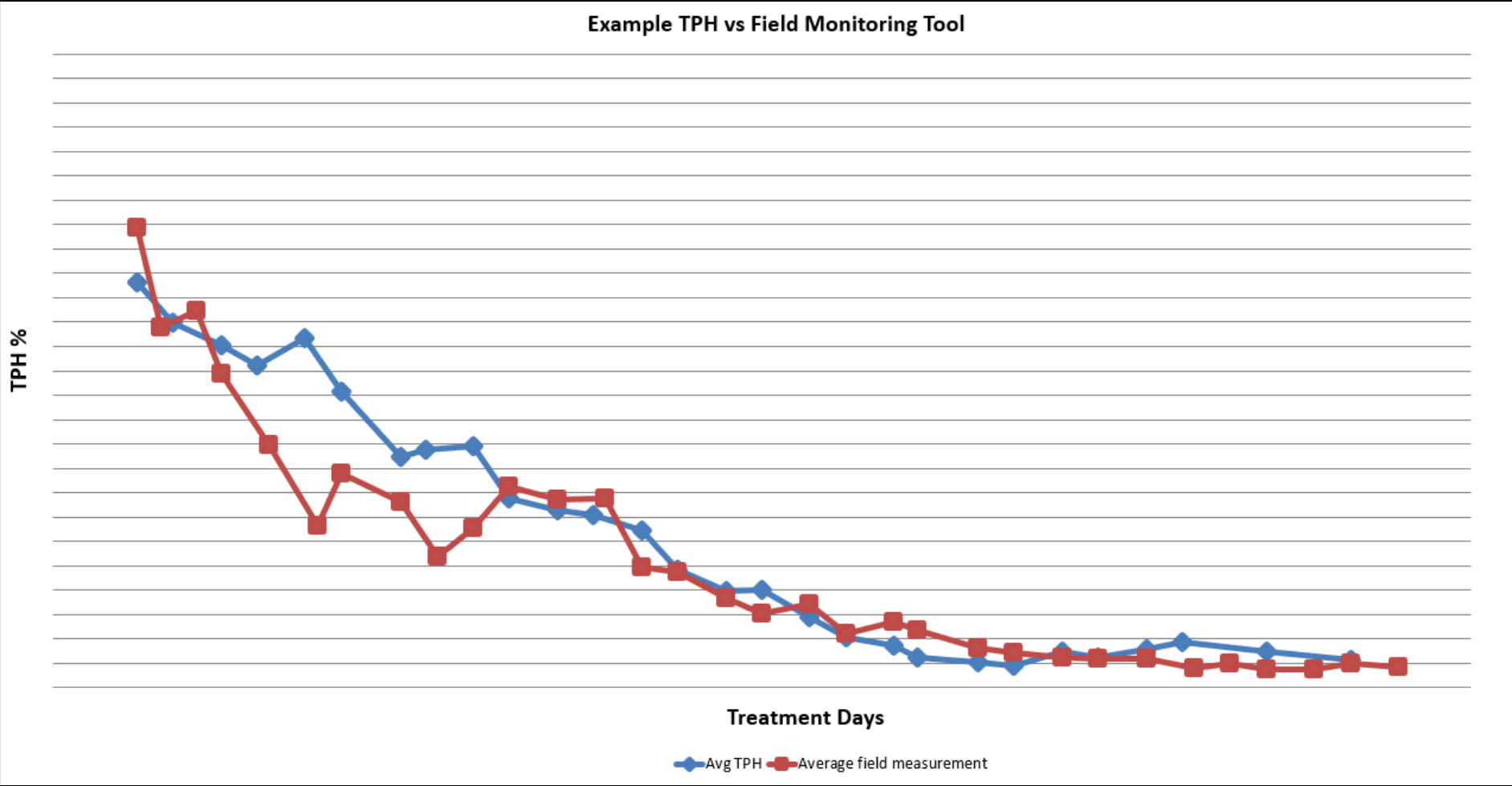


Poor Precision
Good Accuracy

Importance of Onsite Testing

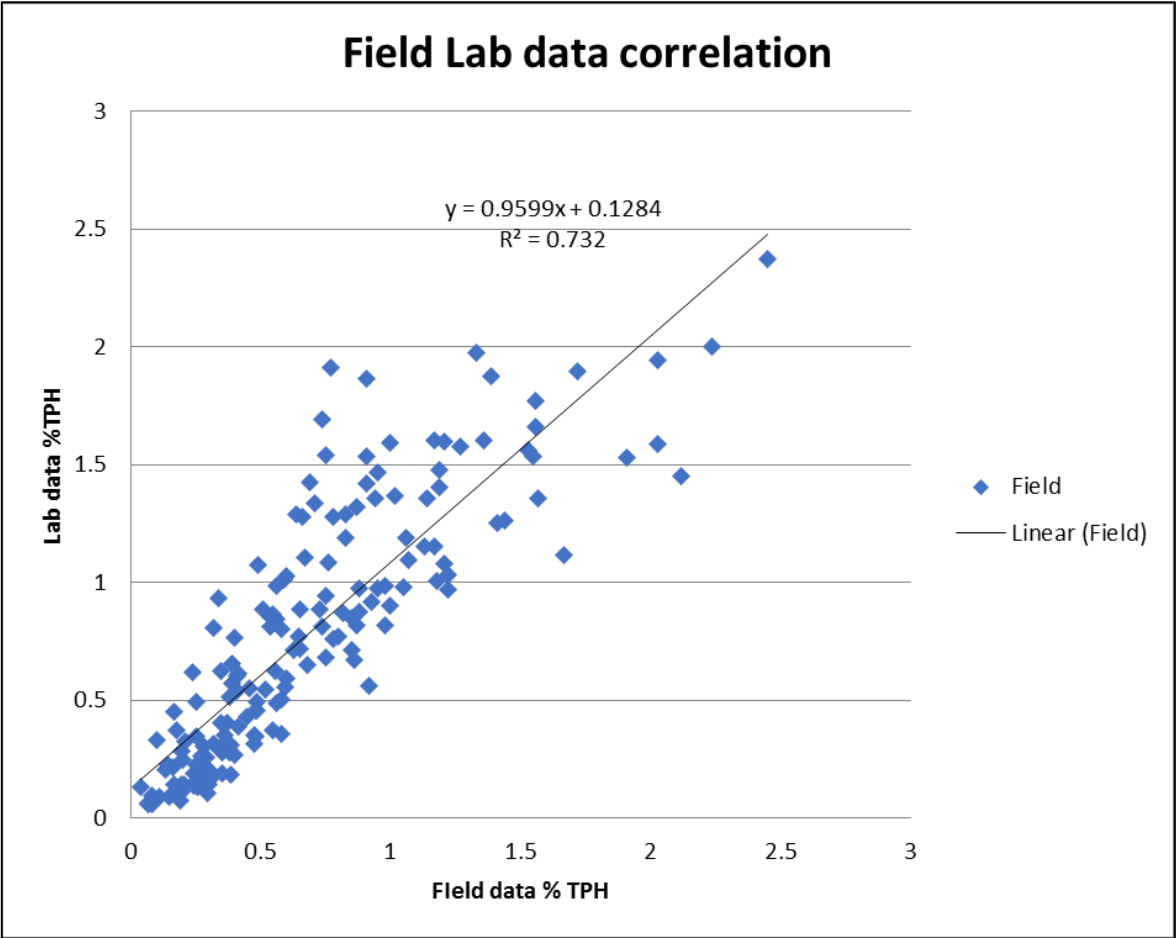


Optimization



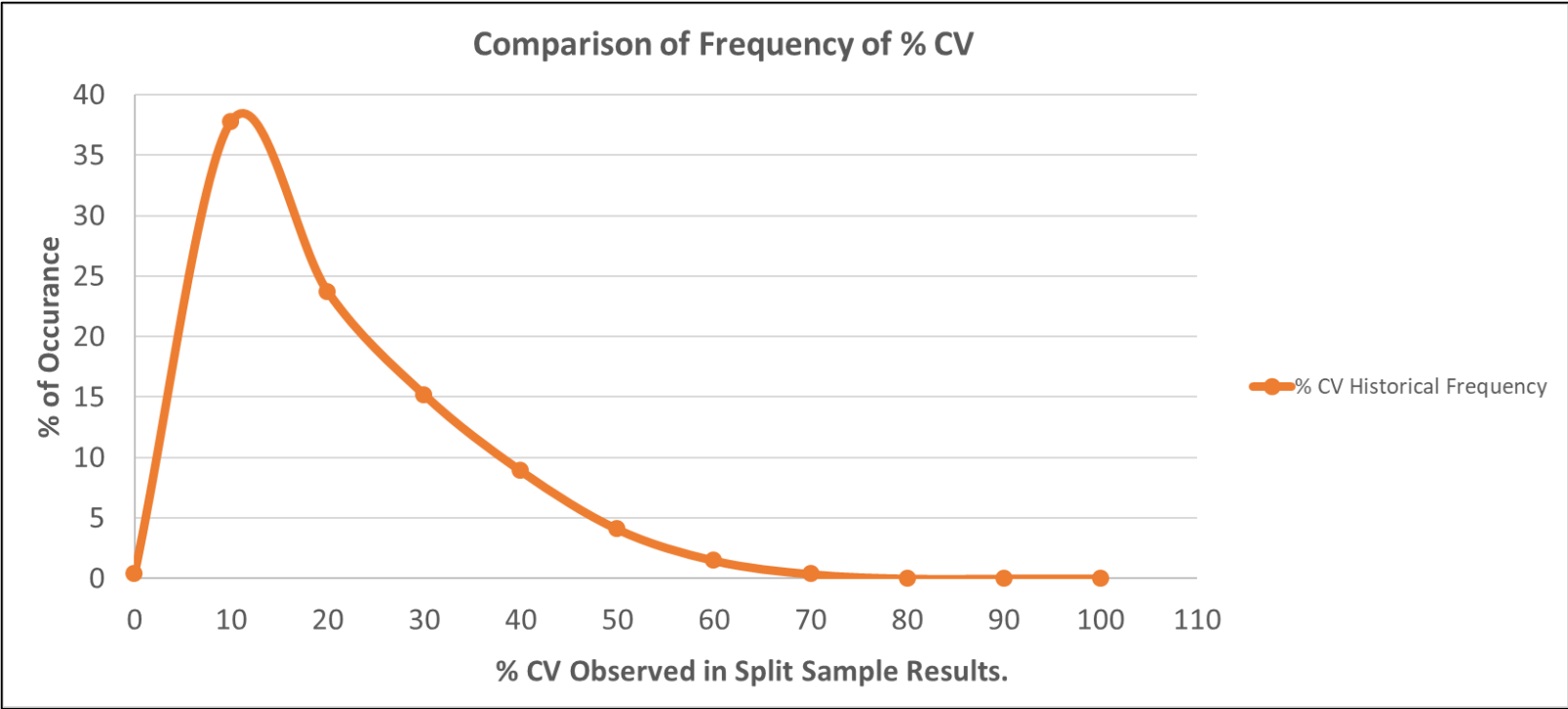
- Field collected data and lab data from a certified lab

Optimization



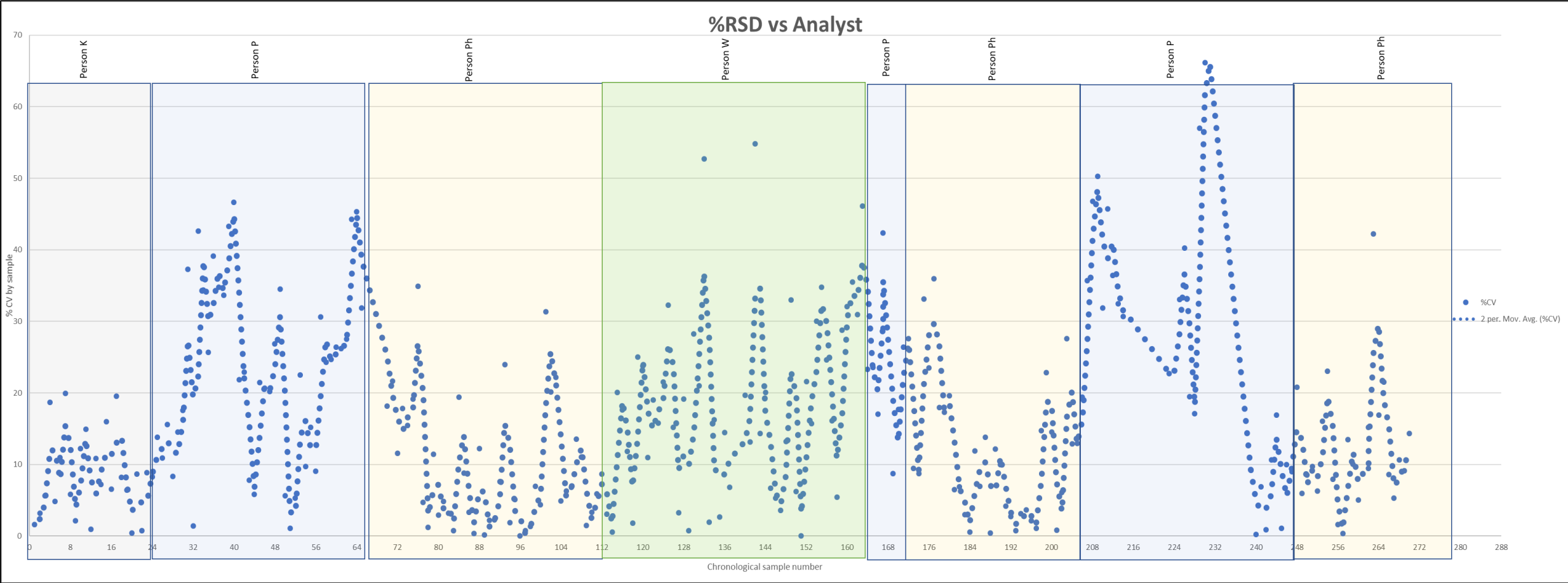
- Degree of correlation between the two methods may be operator dependent

Optimization



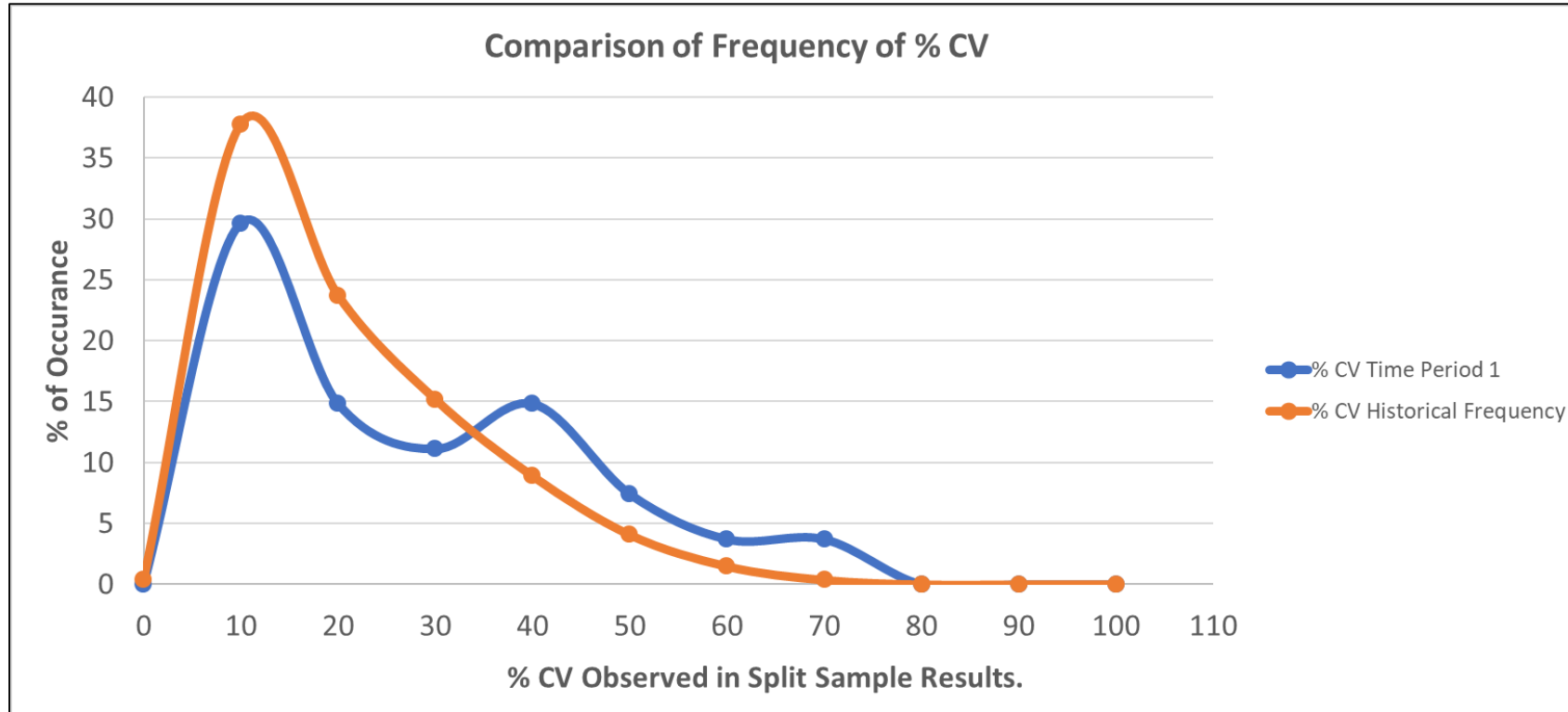
- Degree of correlation between the two methods may be operator dependent

Optimization



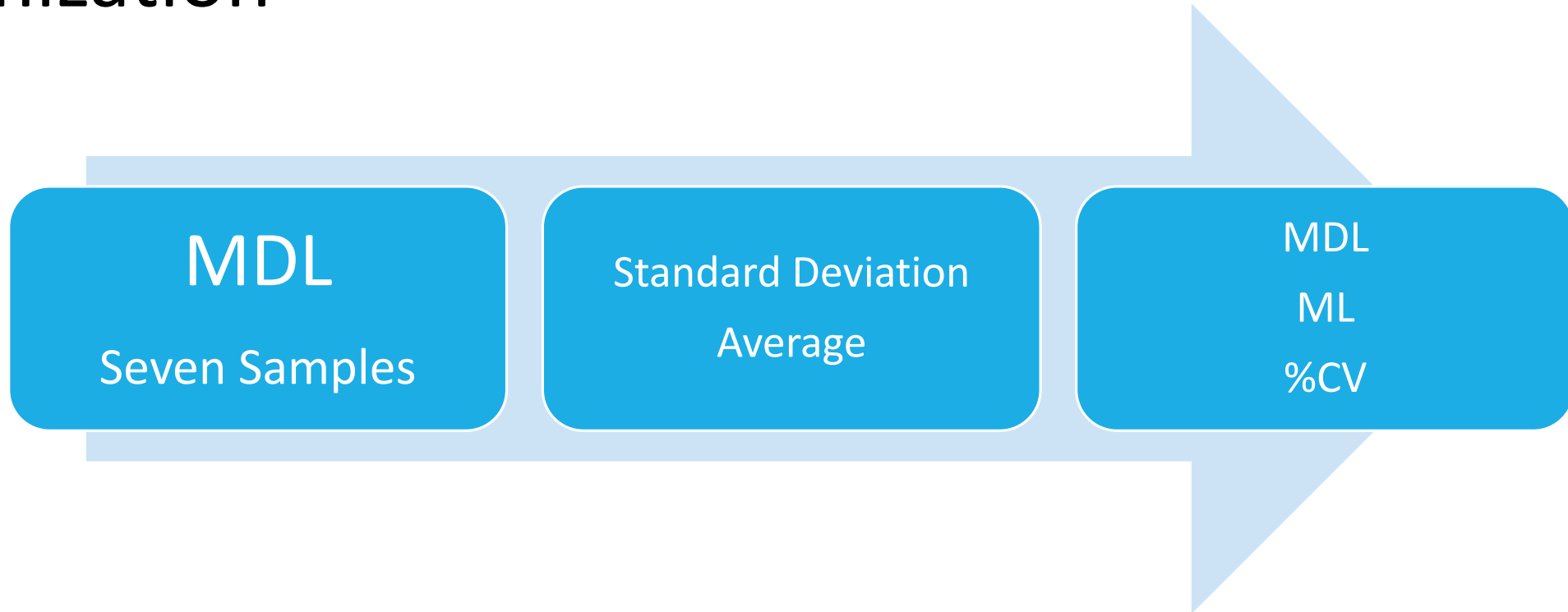
- Degree of correlation between the two methods may be operator dependent

Optimization



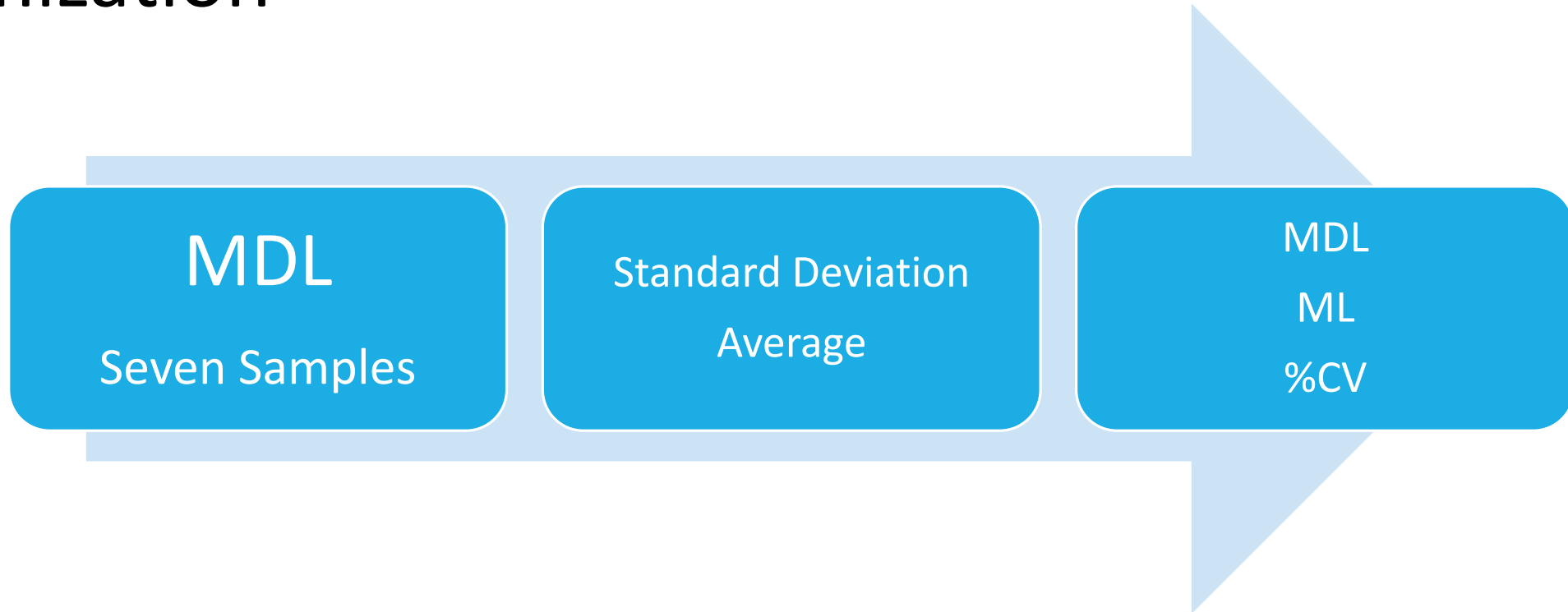
- Normalized to a % of occurrence, the recent and historical data variability is similar.
- Additional procedure modifications and training may make it possible to achieve 10 % CV even with low TPH concentrations

Optimization



- MDL is the lowest concentration that the method can detect at a 99% confidence interval while ML is the lowest number that can be calibrated with the method
- MDL calculated by preparing a set of at least seven replicates equal to 1 to 5 times the estimated detection limits and using the standard deviation of this set of samples for the calculations

Optimization



- Procedure modifications and training are enhanced through the incorporation of the Method Detection Limit evaluation for all operators
- Spiking native soil with base oil at a concentration of 1000 mg/kg as the starting point.
- Evaluate the coefficient of variation to evaluate reproducibility of results

Field Optimization

- Real time field technique calibration



Training



- Training on procedures using the MDL
- Adjusting to field scenarios

Optimization

