

HELLO!

I am Hunter Nelson

I am here because I love to give presentations on
environmental chemistry.

You can find me at hunter.nelson@deq.ok.gov



PRESENTER

Hunter Nelson, ODEQ Environmental Chemical
Lab Scientist

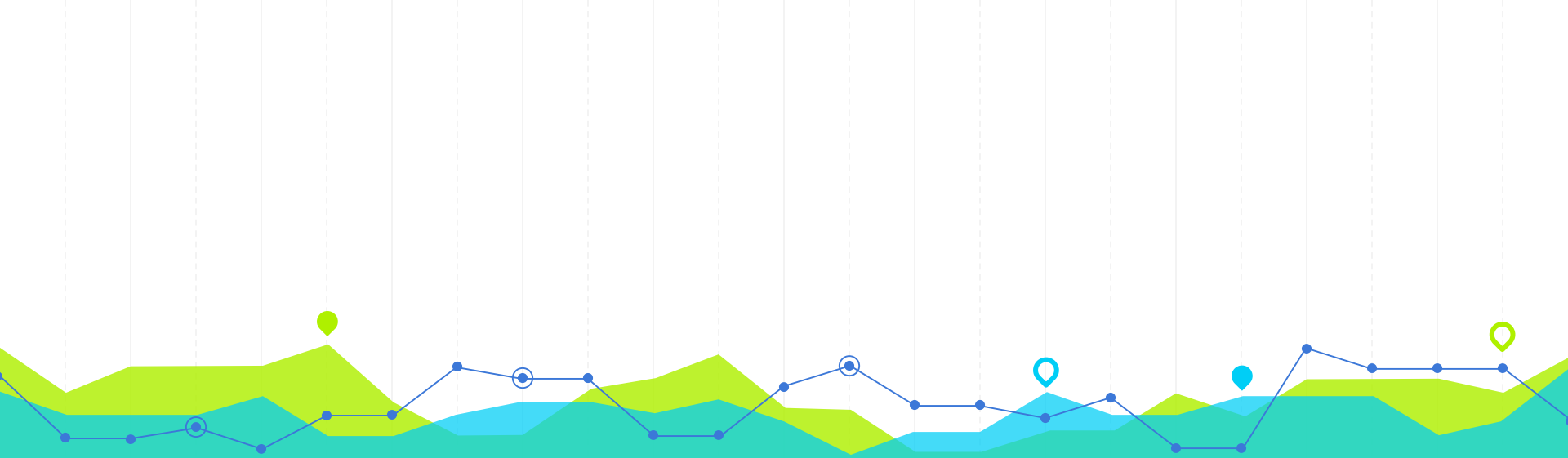
CONTRIBUTORS

Candace Brooks, ODEQ Environmental Program
Manager, General Chemistry

Erin Vorderlandwehr, ODEQ Environmental
Program Manager, Sample and Data
Management



GOT TO KEEP IT LOW: Laboratory Limits Explained



Definitions

Laboratory Limits

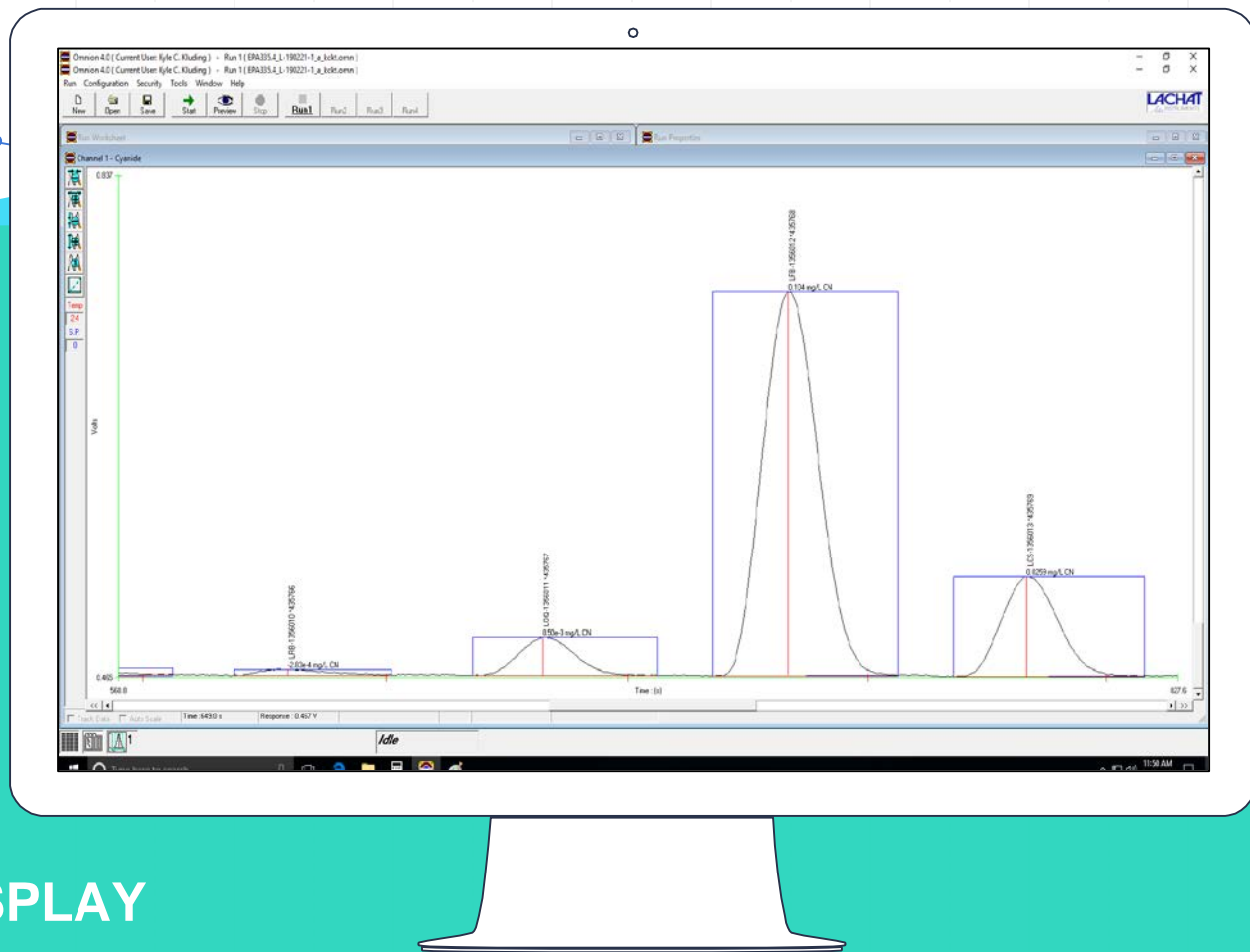
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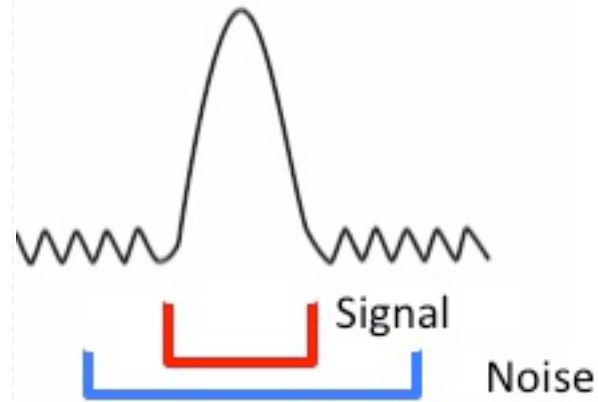
Clarke's Second Law: The only way of discovering the limits of the possible is to venture a little way past them into the impossible.

-Sir Author Charles Clarke

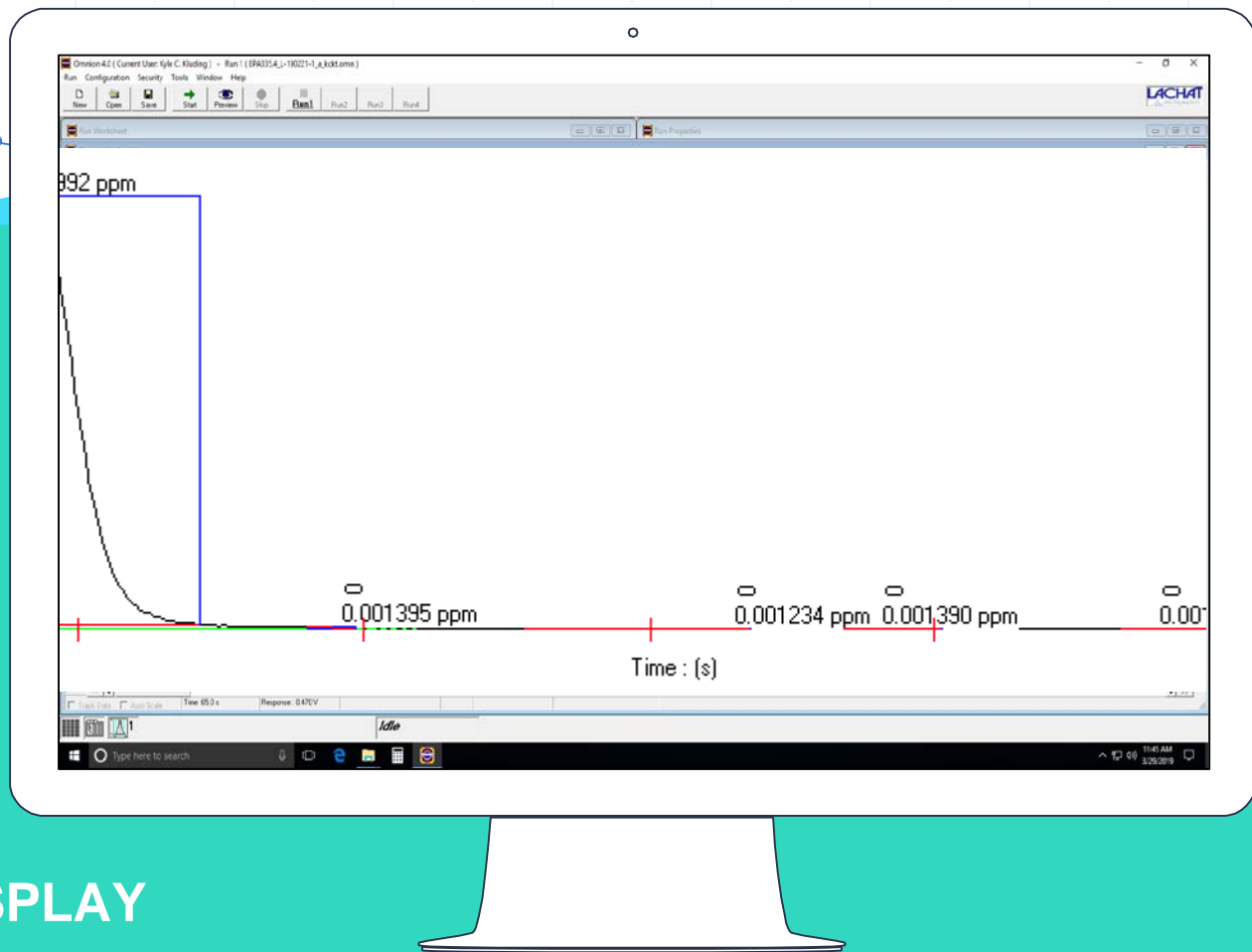
LABORATORY INSTRUMENT DISPLAY



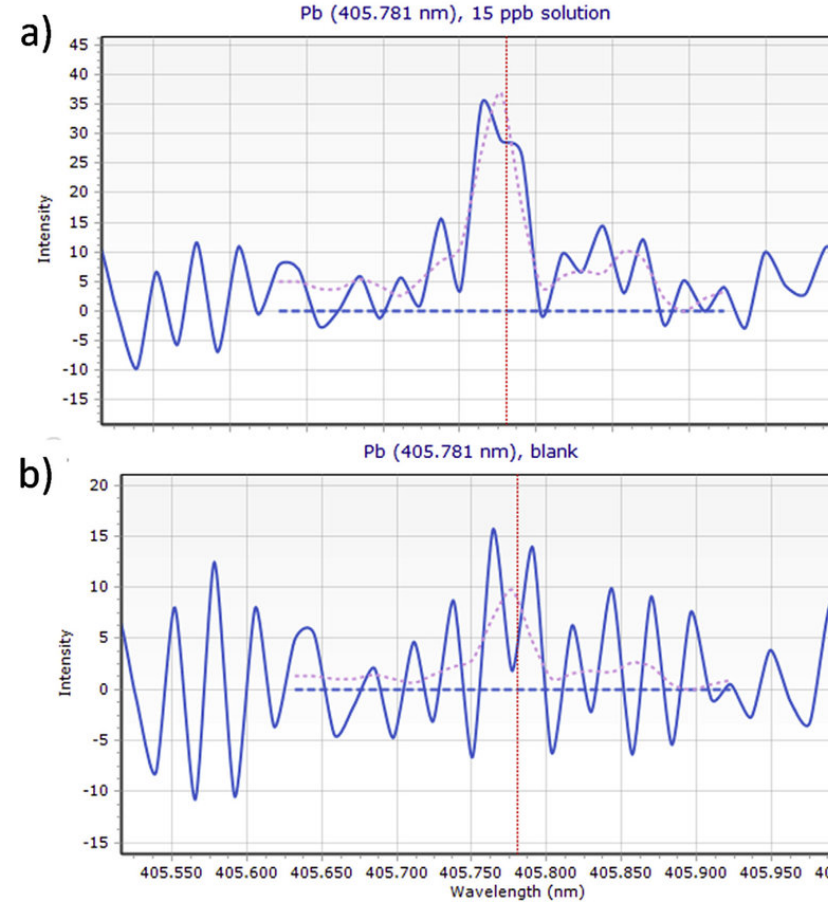
- ◉ Signal- carries information about the analyte
- ◉ Noise- extraneous information that degrades accuracy and precision



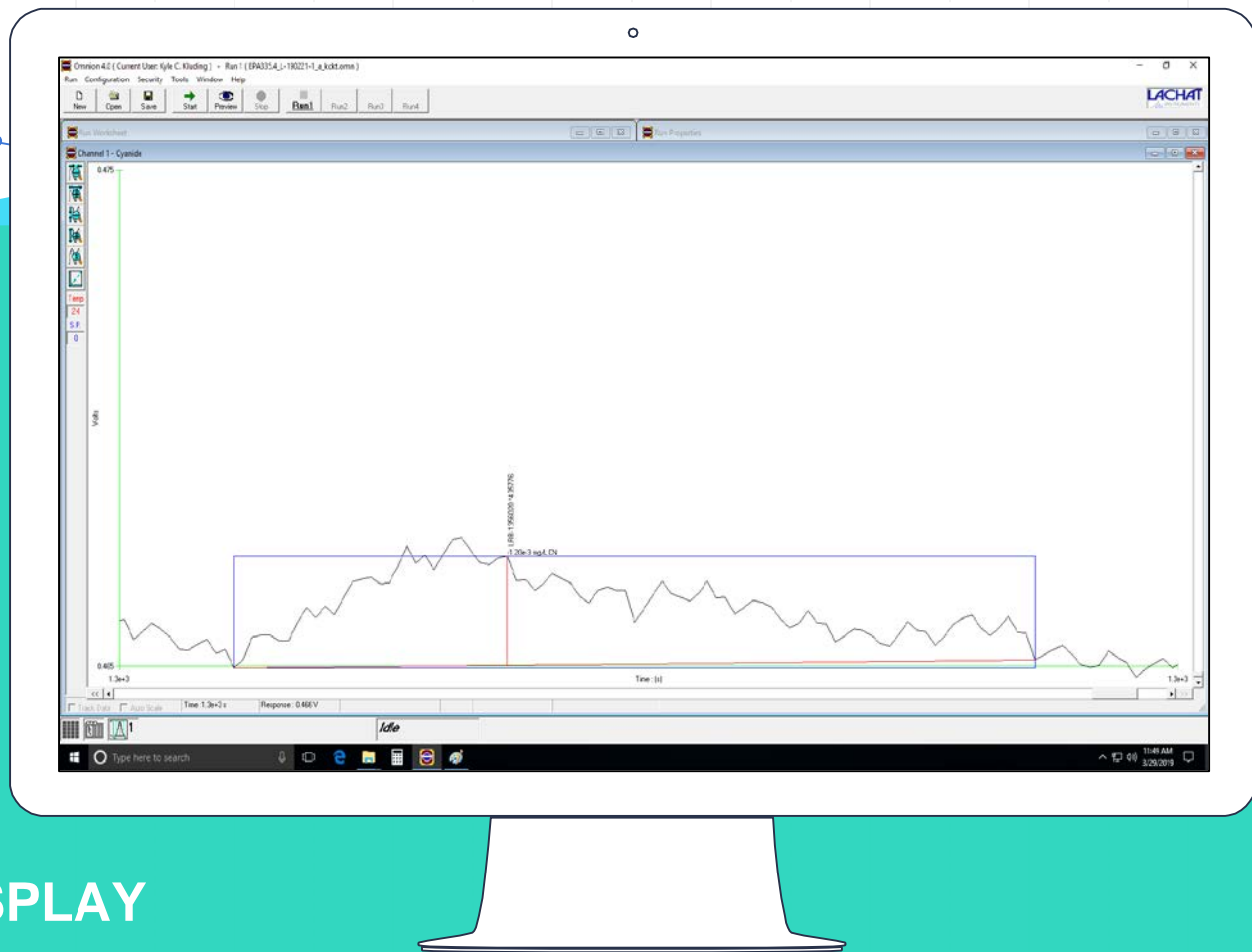
LABORATORY INSTRUMENT DISPLAY



- Instrument Detection Limit (IDL)-
Lowest concentration that can be detected by an instrument.
Determined and generally defined as three to five times the standard deviation of the mean instrument noise level. *Does not account for matrix or sample preparation.*



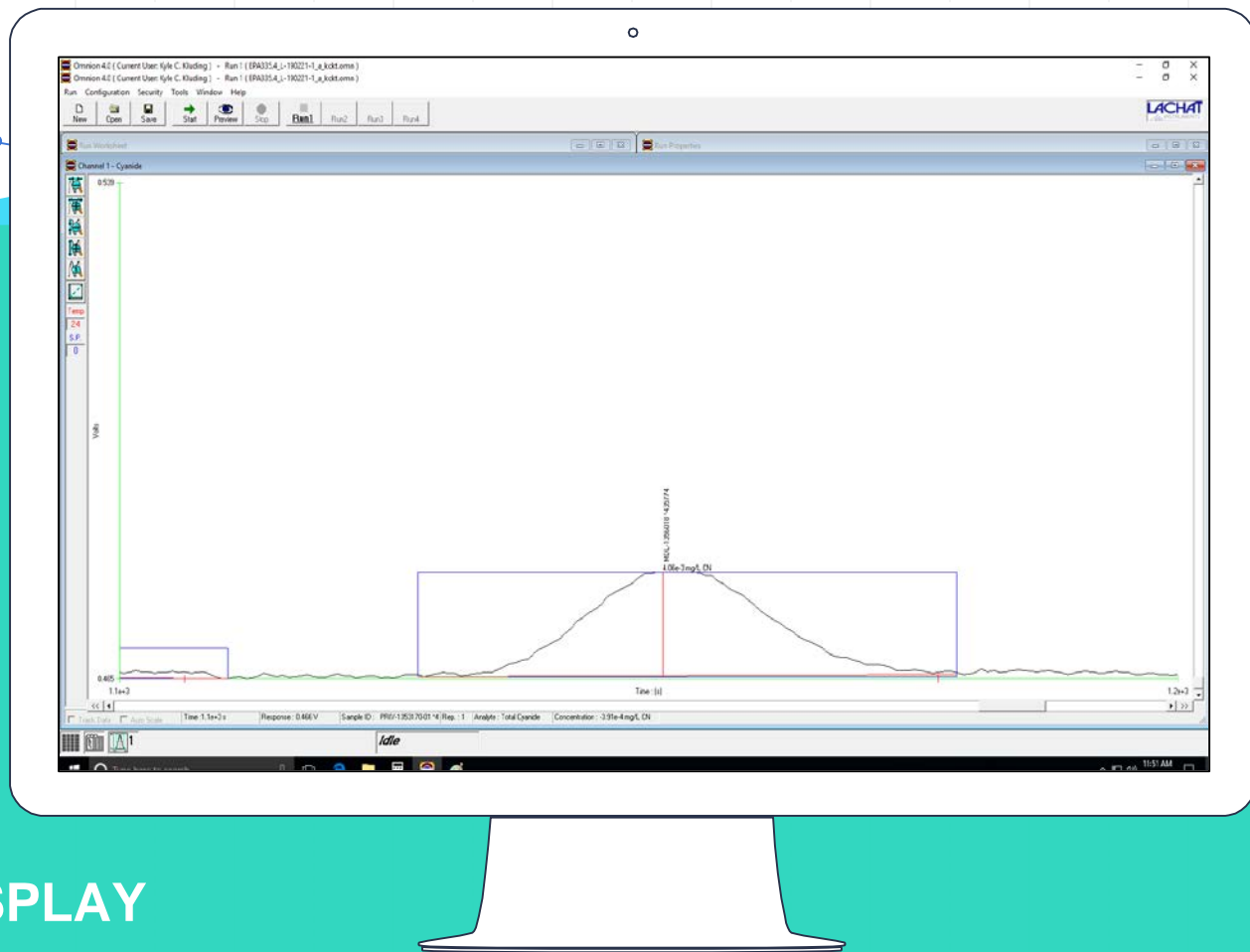
LABORATORY INSTRUMENT DISPLAY



- Method Detection Limit (MDL)- Lowest concentration that can be detected by an instrument with correction for the effects of sample matrix and sample preparation. They are defined as three times the standard deviation of replicate spiked analyses.



LABORATORY INSTRUMENT DISPLAY



- ◉ Detection Limit - Detection limits refer to a minimum concentration of an analyte that can be measured above the instrument background noise.
- ◉ Quantitation Limit - Quantitation limit refers to a minimum concentration of an analyte that can be measured within specified limits of precision and accuracy. They are generally 5-10 times the detection limit.

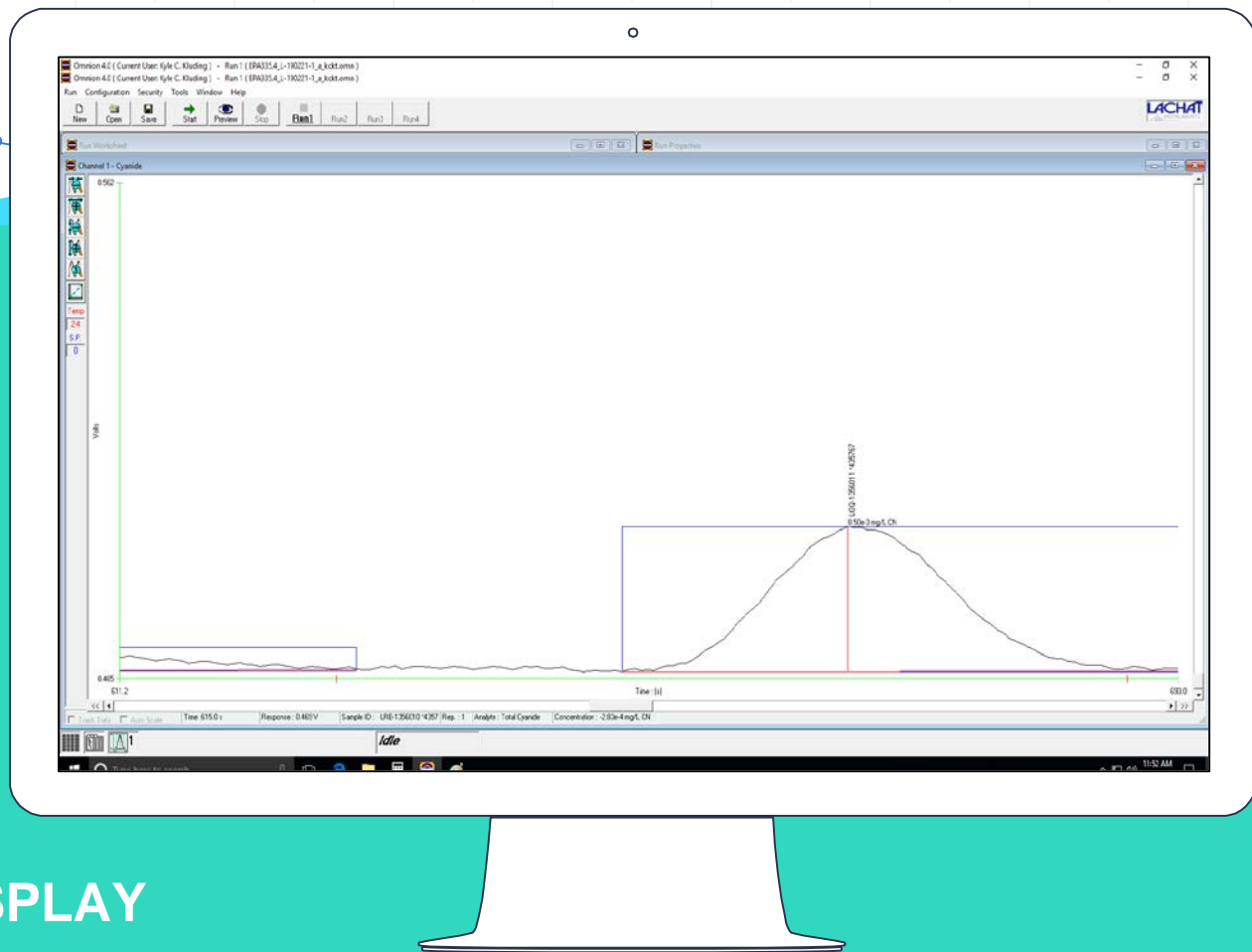


- ◉ Reporting Limit (RL)- Lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. RLs normally are arbitrarily set rather than explicitly determined. Also known as Method Reporting Limit (MRL), Practical Quantitation Limit (PQL) and Minimum Quantification Limit (MQL).

And that's not all, but all that we will cover.



LABORATORY INSTRUMENT DISPLAY





Examples 2

Laboratory Limits

Analogy

Sailboat



NOISE



INSTRUMENT DETECTION LIMIT





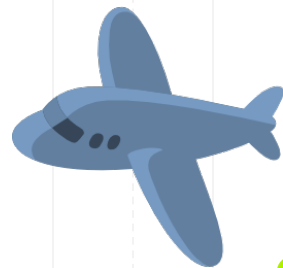
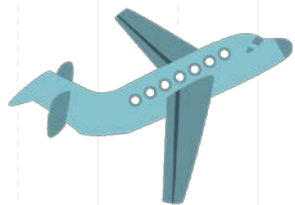
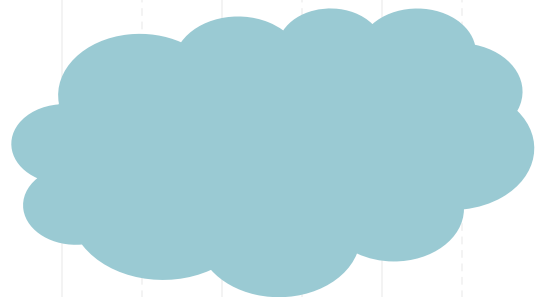
METHOD DETECTION LIMIT

QUANTIFICATION LIMIT



Analogy


Jet Engine



BACKGROUND NOISE



LIMIT OF DETECTION

A photograph of two male technicians in blue work uniforms and white hard hats standing in front of a large, silver jet engine. The engine is mounted on a red scissor lift. The technicians are looking at a clipboard. A speech bubble is overlaid on the right side of the image, containing text.

I know you are
talking Fred, but I
have no idea what
you are saying.

LIMIT OF QUANTITATION

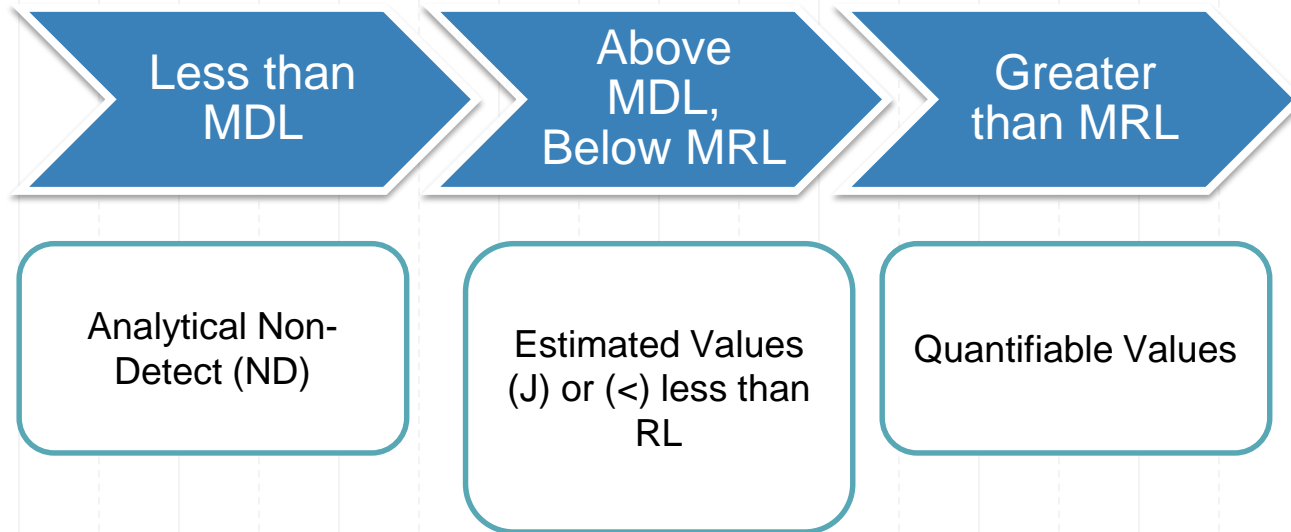


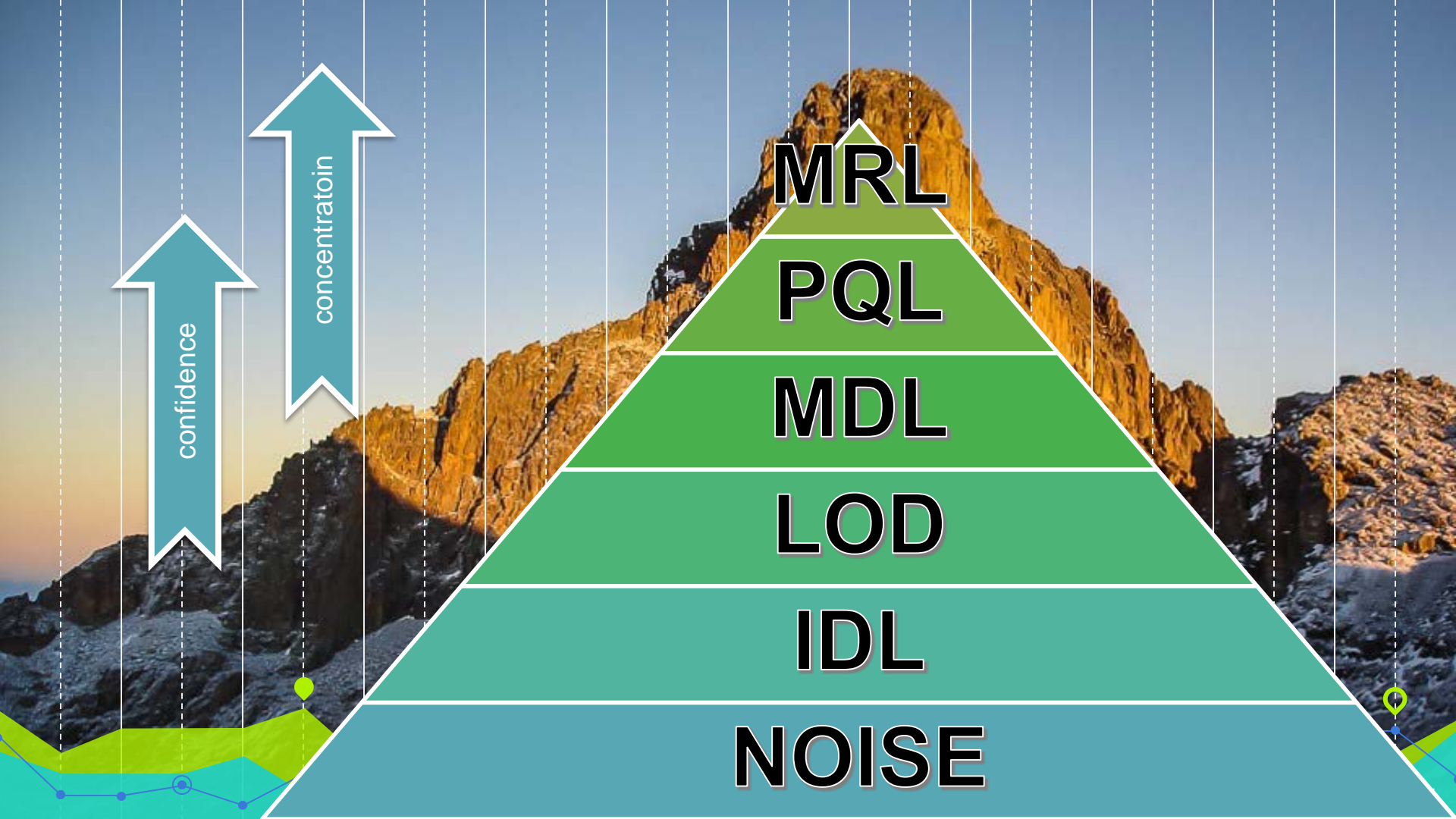


Relationships

Laboratory Limits

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LET'S REVIEW SOME CONCEPTS



IDLs

Can vary over time. Age of the instrument, technology, production vs intermittent use, maintenance, etc. affect the capability of the instrument's detection limit. Not static!



MDLs

Can vary over time. Factors affecting the IDL plus analyst and sampler error, sample matrix, sample preparation, laboratory environment, analytical technique, etc. affect the detection limit of the method. Not static!



MRLs

Are set by laboratories based on MDL values (3-5x) but can vary in confidence. Can be set at LOQ/PQL levels or above. Typically static but can be changed at lab discretion.



IDLs

Analyzed for new instrumentation and to estimate appropriate MDL levels or when changes occur within the instrument.



MDLs

Specific to lab, matrix, method, analyte and instrument. Nitrate for EPA 353.2 \neq Nitrate for EPA 300.0 \neq Nitrate for SM 4500 NO₃-F

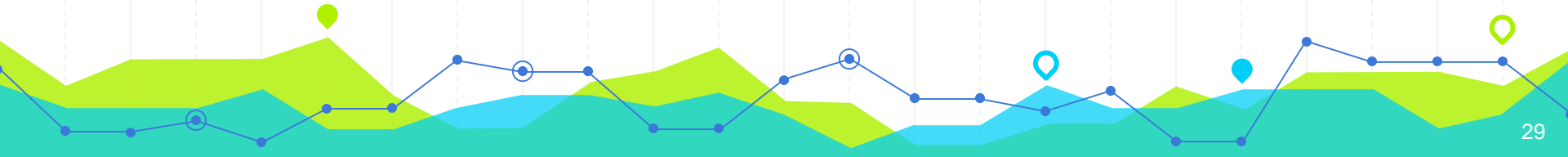


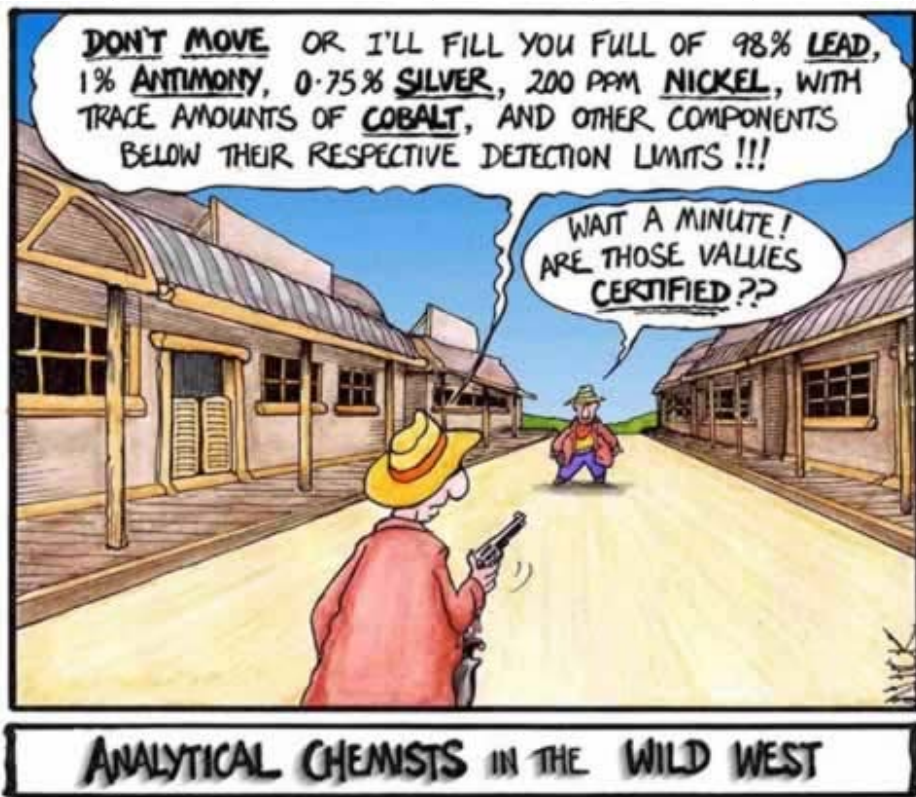
Measurement Certainty

Just because a compound or analyte of interest can be quantified, doesn't mean that number is absolute. There are ranges on accuracy and precision that vary at different concentration levels.

THANKS!

Any questions?





CREDITS

Special thanks to all the people who made and released these awesome resources for free:

- Presentation template by [SlidesCarnival](#)
- Environmental Protection Magazine, 10, 37-41, (May, 1999)