United States Environmental Protection Agency

Quantitative Non-Targeted Analysis: From Data to Decisions

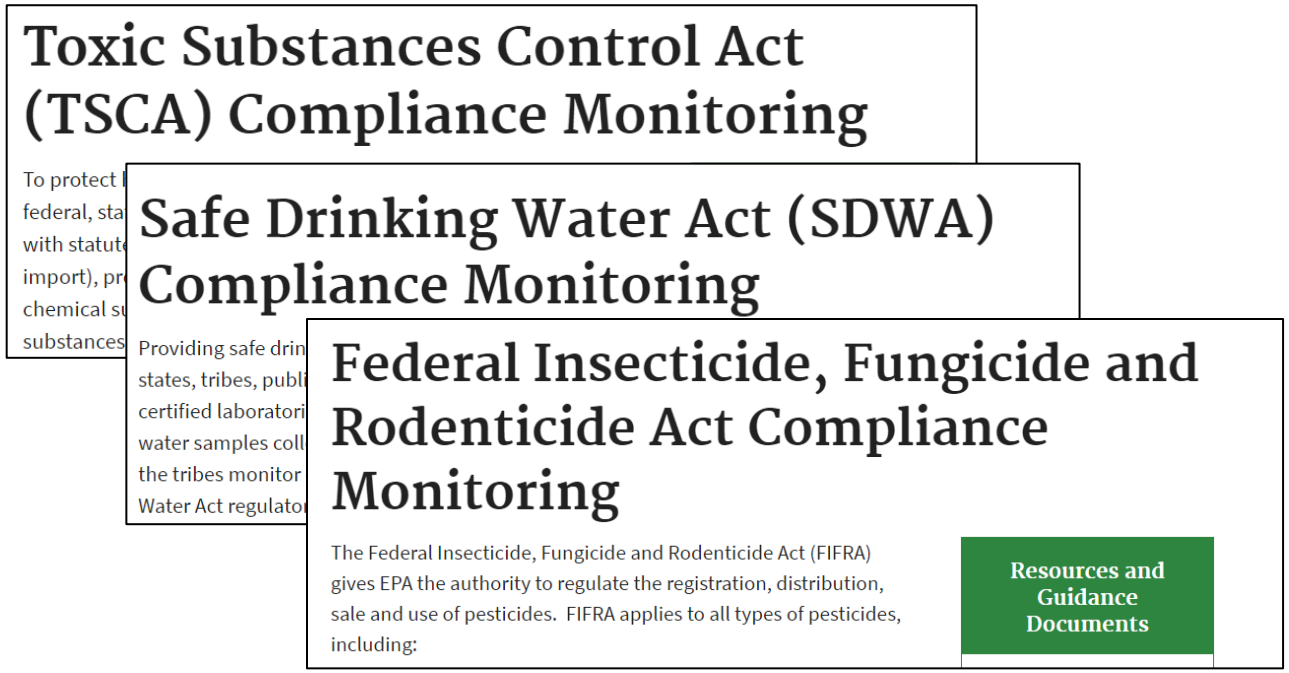
Jon R. Sobus, Louis C. Groff II, James P. McCord

SETAC NonTarget 2022

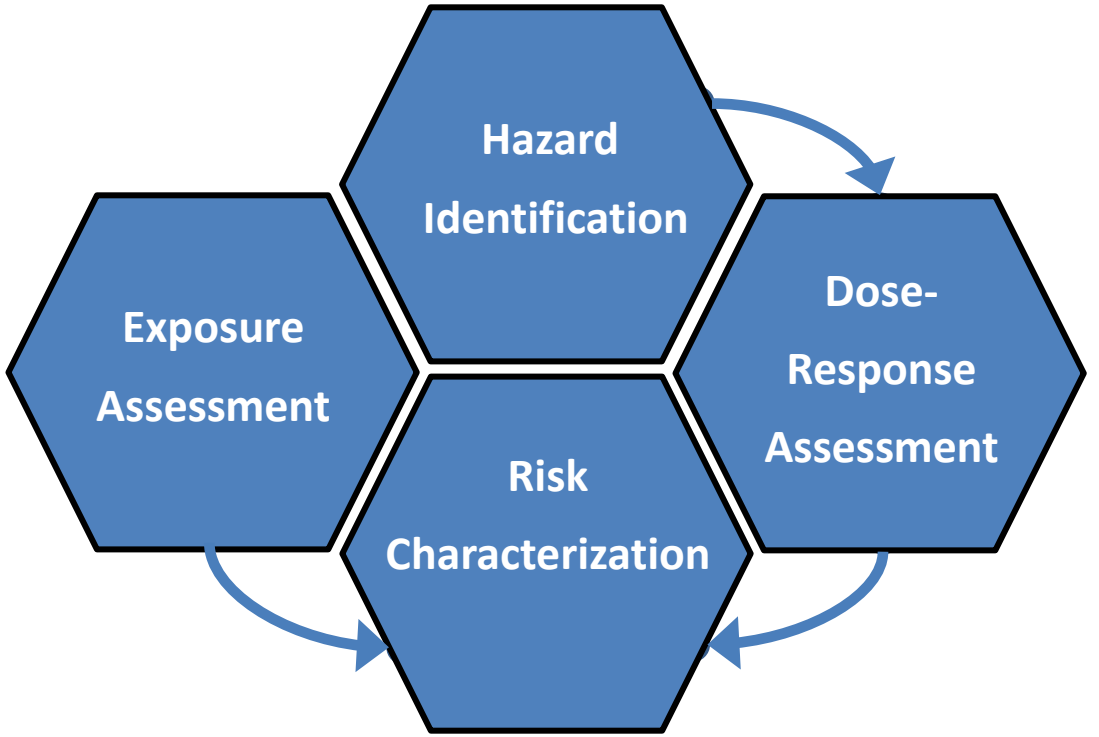
May 23, 2022

Why Does EPA Need Measurement Data?

- **Measurement data needed to ensure chemical safety**
  - Characterize risk
  - Regulate use & disposal
  - Manage human & ecological exposures
  - Ensure compliance under federal statutes



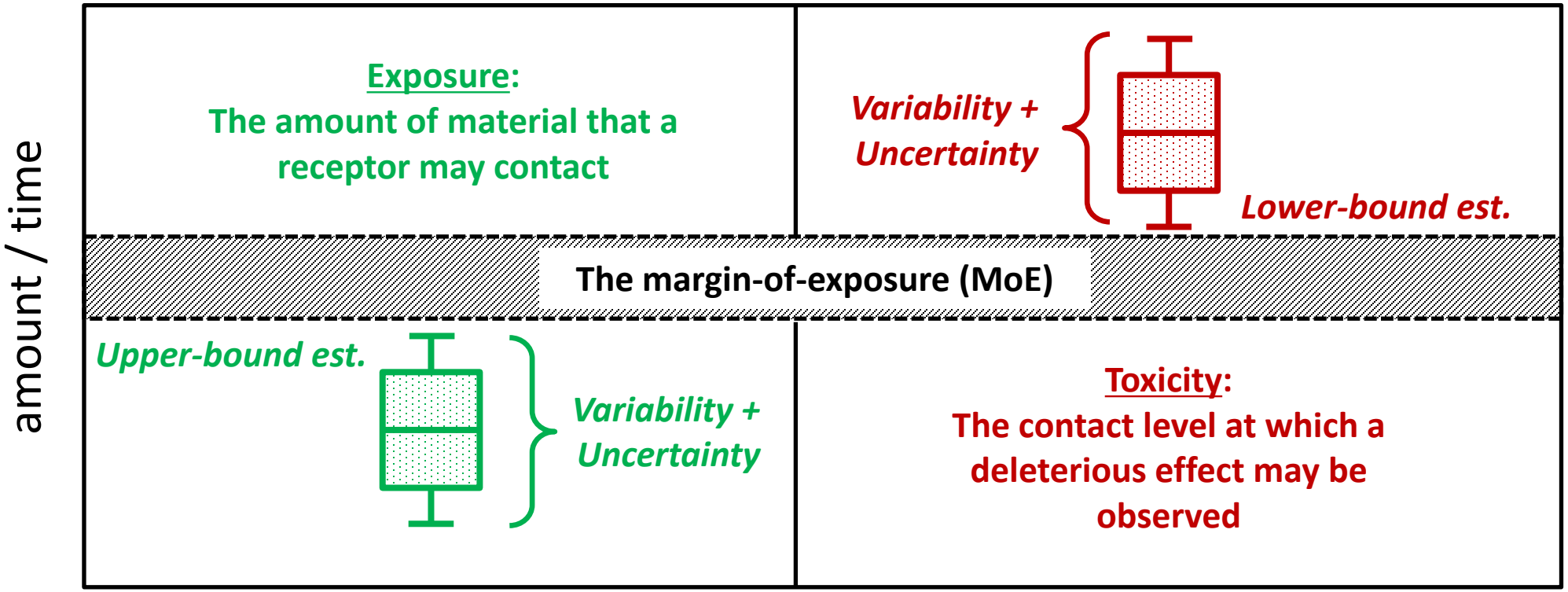
Chemical Monitoring Needs



Challenges

- High-quality monitoring data are unavailable for most chemicals
- Measurement data traditionally generated using “targeted” methods
- Targeted analytical methods:
  - Require *a priori* knowledge of chemicals of interest
  - Produce data for few selected analytes (10s-100s)
  - Require standards for method development & compound quantitation
  - Are blind to emerging contaminants
  - Can’t keep pace with the needs of 21st century risk characterizations
- Quantitative NTA (qNTA) methods must be developed to support provisional risk characterization for emerging contaminants

Risk Characterization Involves Variability and Uncertainty

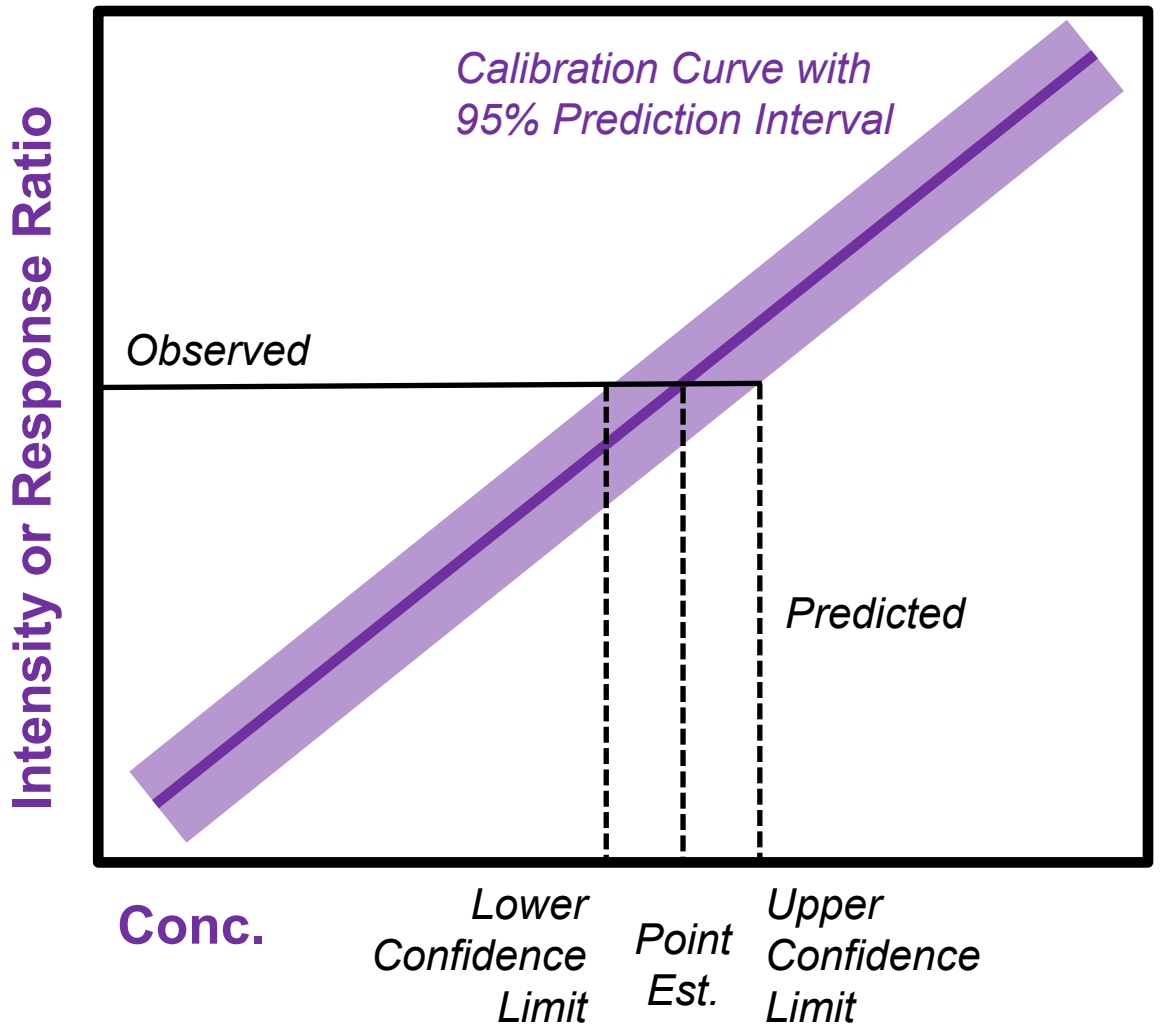


Variability = inherent heterogeneity of phenomena; cannot be reduced, only characterized

Uncertainty = incomplete understanding of phenomena; can be reduced with better methods

Analytical chemistry data help estimate exposure and toxicity, and are both variable and uncertain

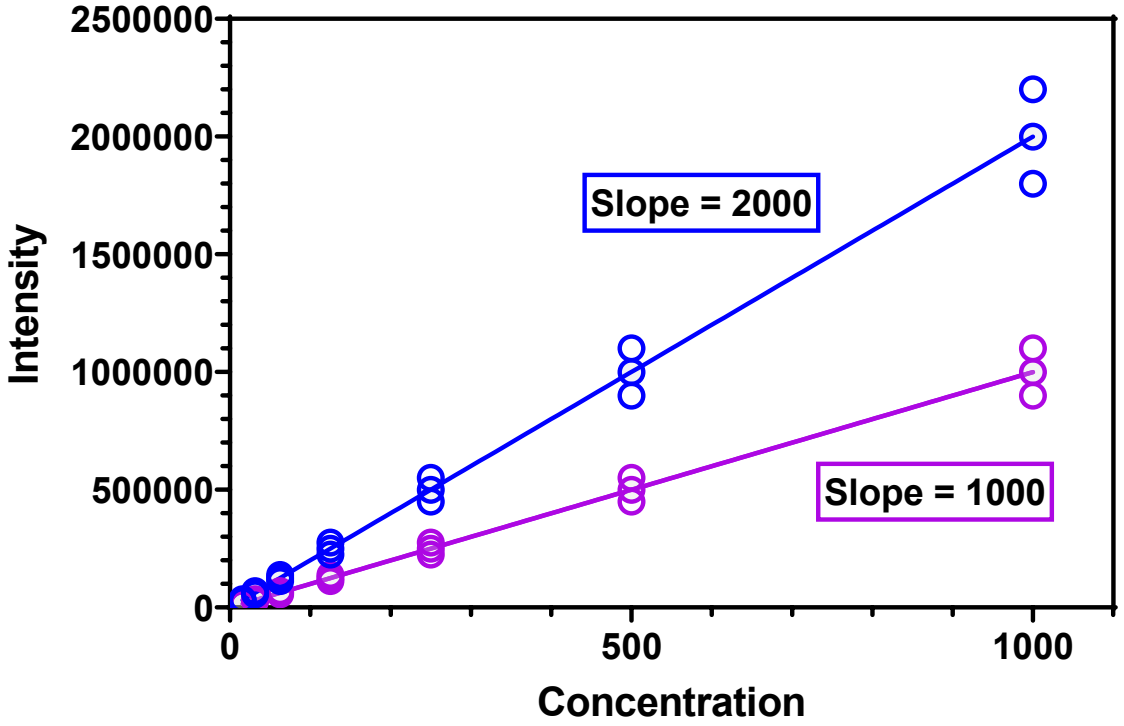
Review of Fundamental Quantitative Method Used with Targeted Analysis



Important Statistical Considerations

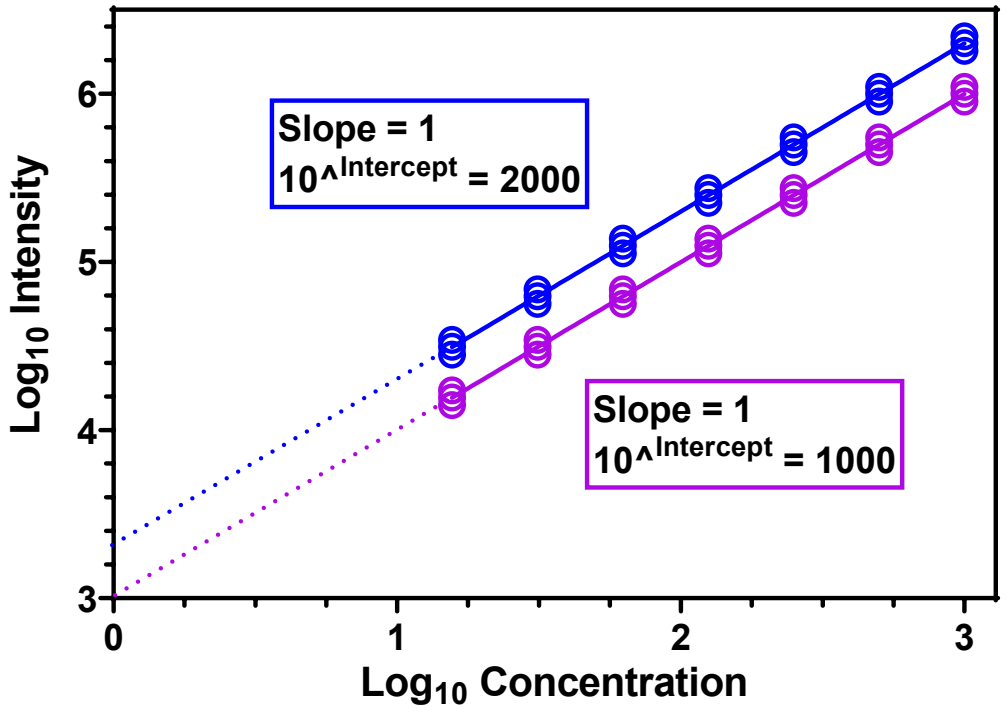
Common Calibration Scenario:

- Unequally spaced dilutions
- Non-uniform measurement variance
- Response Factor (RF) = Intensity/Conc.
- RF = cal. curve slope



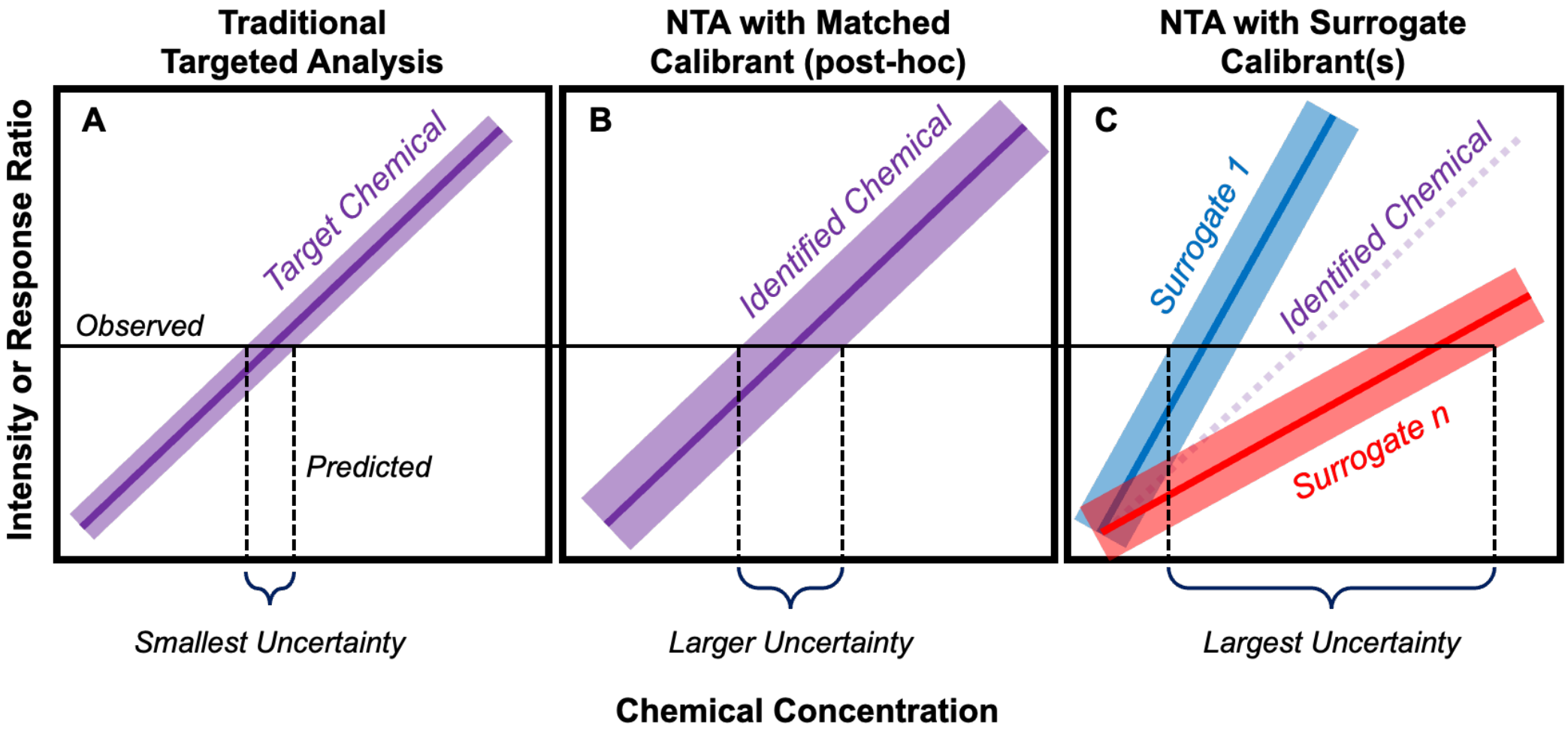
1 Simple Solution → Data Transformation:

- Equally spaced dilutions
- Uniform measurement variance
- Slope ≈ 1 when within linear dynamic range
- RF = 10^ cal. curve intercept



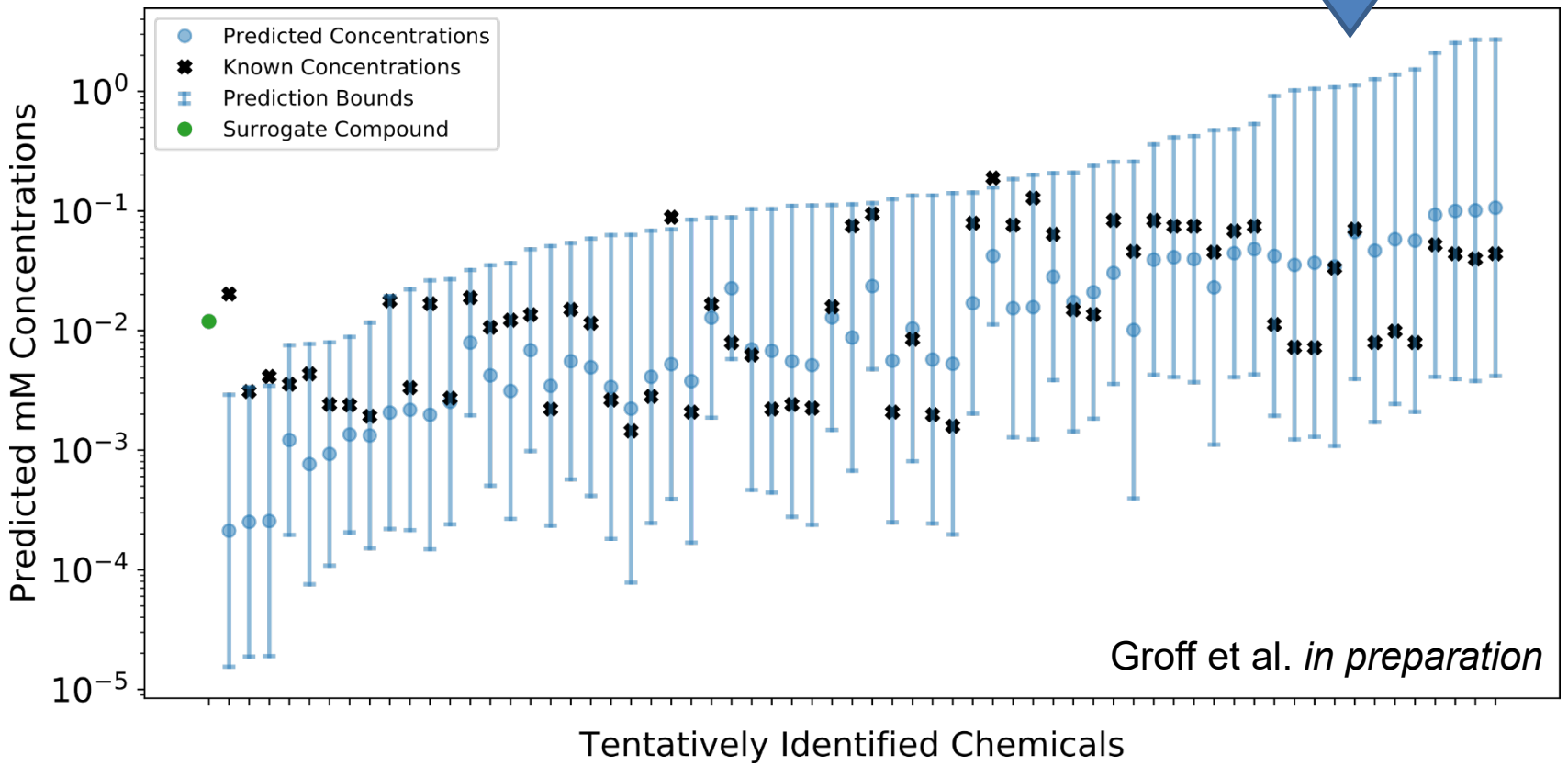
Groff et al. *Anal. Bioanal. Chem.* accepted

Extension of Fundamental Methods to qNTA



Fisher and Peter et al. *Anal. Bioanal. Chem.* submitted

qNTA Proof-of-Concept



- Analysis of Brita filter extracts via GC-HRMS.
- Concentration estimates can be above or below true value.
- Confidence intervals used to bound concentration estimates.
- 95% confidence intervals shown; Can use 99%, 99.9%, etc.
- Tentatively identified compounds ranked by upper-bound estimates.
- Upper-bound estimates compared to level-of-interest to set priorities.
- Priority compounds further examined using targeted methods (when standards can be procured).

The Future of NTA and Chemical Risk Assessment

- The number of labs performing NTA will increase dramatically!

- We're expecting a wealth of NTA data for known (but data-poor) chemicals
  - These data cannot be interpreted using traditional performance metrics
    - **How will risk assessors use new NTA data to support decisions?**

- We're expecting a steady stream of NTA data for newly discovered chemicals
  - Chemical standards won't be readily available (via purchase or synthesis)
    - **How will risk assessors rapidly evaluate the safety of these CECs?**

- **Please visit my poster if you wish to learn more about the development and application of qNTA methods!**

qNTA Research Contributors

The views expressed in this presentation are those of the author(s) and do not necessarily represent the views or policies of the US EPA.

EPA Office of Research and Development

Alex Chao
Louis Groff*
Jarod Grossman*
Dustin Kapraun
Hannah Liberatore
Charles Lowe
James McCord
Jeff Minucci
Seth Newton
Dimitri Abrahamsson*
Katherine Phillips
Tom Purucker
Caroline Ring
Randolph Singh*
Antony Williams

* = ORISE/ORAU

Stockholm University

Anneli Kruve

Questions?

sobus.jon@epa.gov

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