

Interplay of Congeners and Total PCBs in Risk Assessment and Remedial Decisions

Rick Fox, Jeff Ramey, Denise Kay, and John Kern – OBG, Part of Ramboll

ABSTRACT

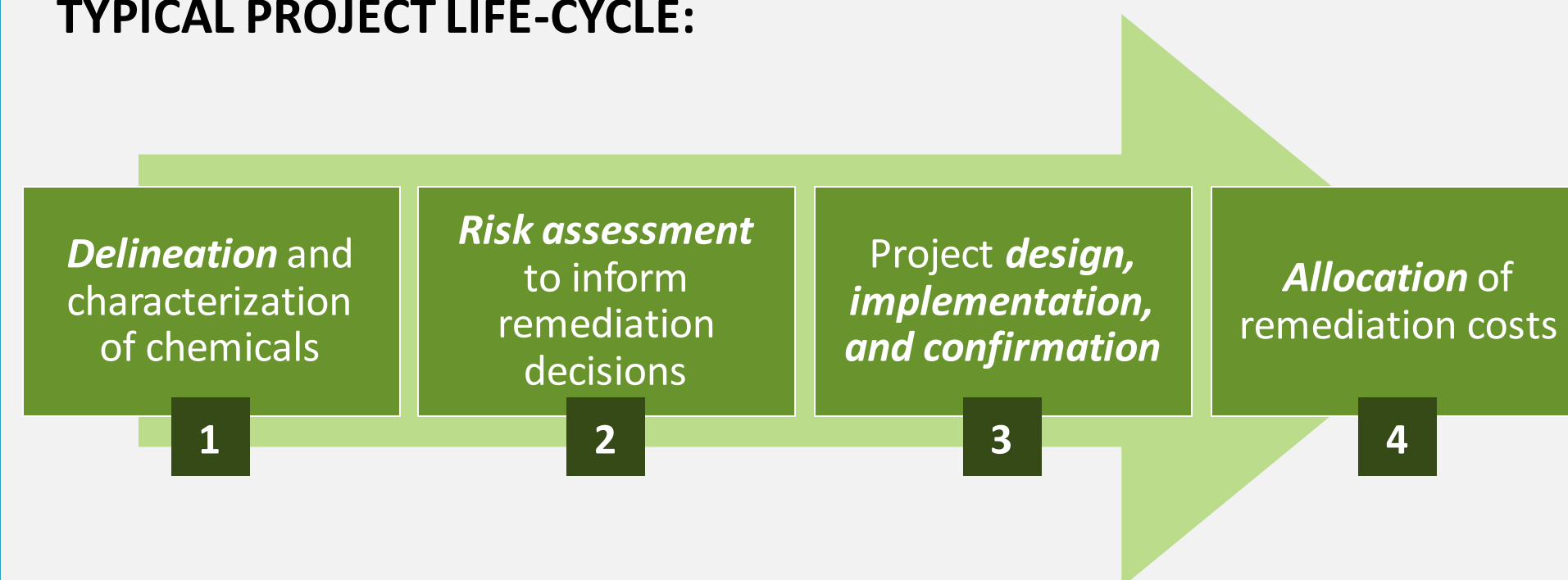
Project Managers (PMs) at PCB contaminated sites are continuously evaluating the worth of congener-specific versus Aroclor sample analysis. As the project progresses, the available information and decision-making parameters change. Frequently at later stages of a project a PM wishes he/she would have done something different for analysis in the initial stages.

Key Messages

- ✓ Different project stages can be adequately informed by different PCB quantification methods.
- ✓ Delineation and confirmation can be based on less specific analysis such as Aroclors summed total PCBs.
- ✓ Risk and allocation are best informed by congener analysis.
- ✓ There are means to translate between Aroclors and congeners given certain assumptions and uncertainties.

INTRODUCTION

TYPICAL PROJECT LIFE-CYCLE:



A PM has opportunities to consider PCB Aroclors v. congeners during each of these project phases. Decisions revolve around schedule, budget, and anticipated complexity to site resolution.

PROCESS

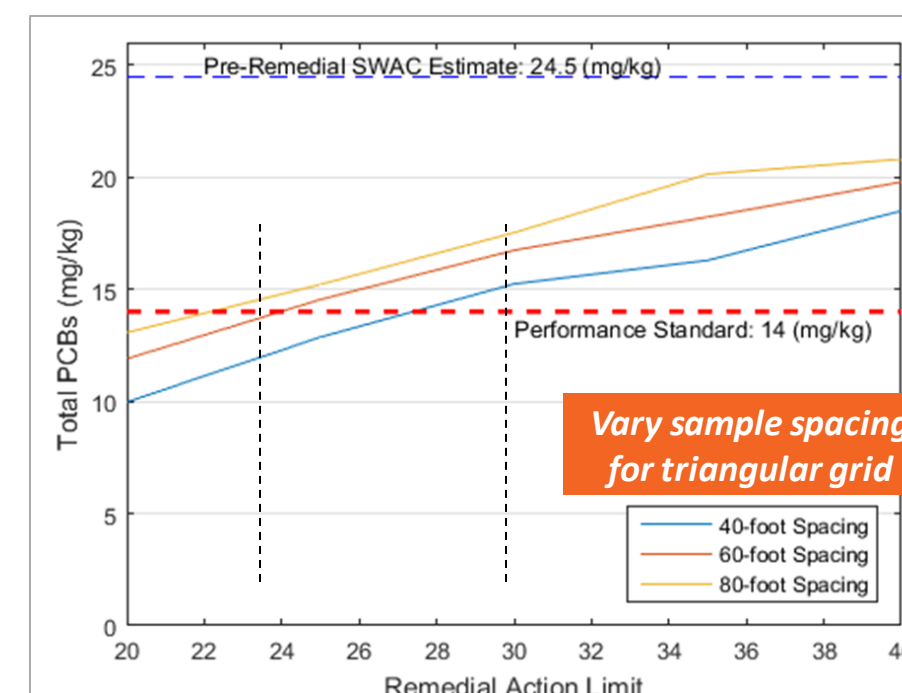
- 1** **Delineation** and characterization of chemicals
Found PCBs? → Aroclors are fine for delineation. Consider also analyzing a subset of samples for congeners if risk assessment will be needed.
- 2** **Risk assessment** to inform remediation decisions
Congeners = fewer assumptions = less uncertainty in risk potential which may reduce overall project cost.
- 3** **Project design, implementation, and confirmation**
Aroclor-based total PCBs are sufficient for remediation activities, but how many samples?
- 4** **Allocation** of remediation costs
Congener data supports risk-based allocation and source fingerprinting.

OPTIMIZING SPEND:



Aroclor is the typical analysis	Congener analysis done less frequently
Aroclors can be summed to get Total PCBs	Congeners can be summed to get Total PCBs
Limits the understanding of toxicity	Better basis for toxicity evaluation and source fingerprinting

STATS OPTIMIZE SAMPLING DURING PDI:



Increasing density from 80 foot to 40 foot spacing increased the RAL from 22 to 28 mg/kg while maintaining 95% confidence to meet the goals

Statistical analyses can be performed to understand decision errors associated with differing sample densities.

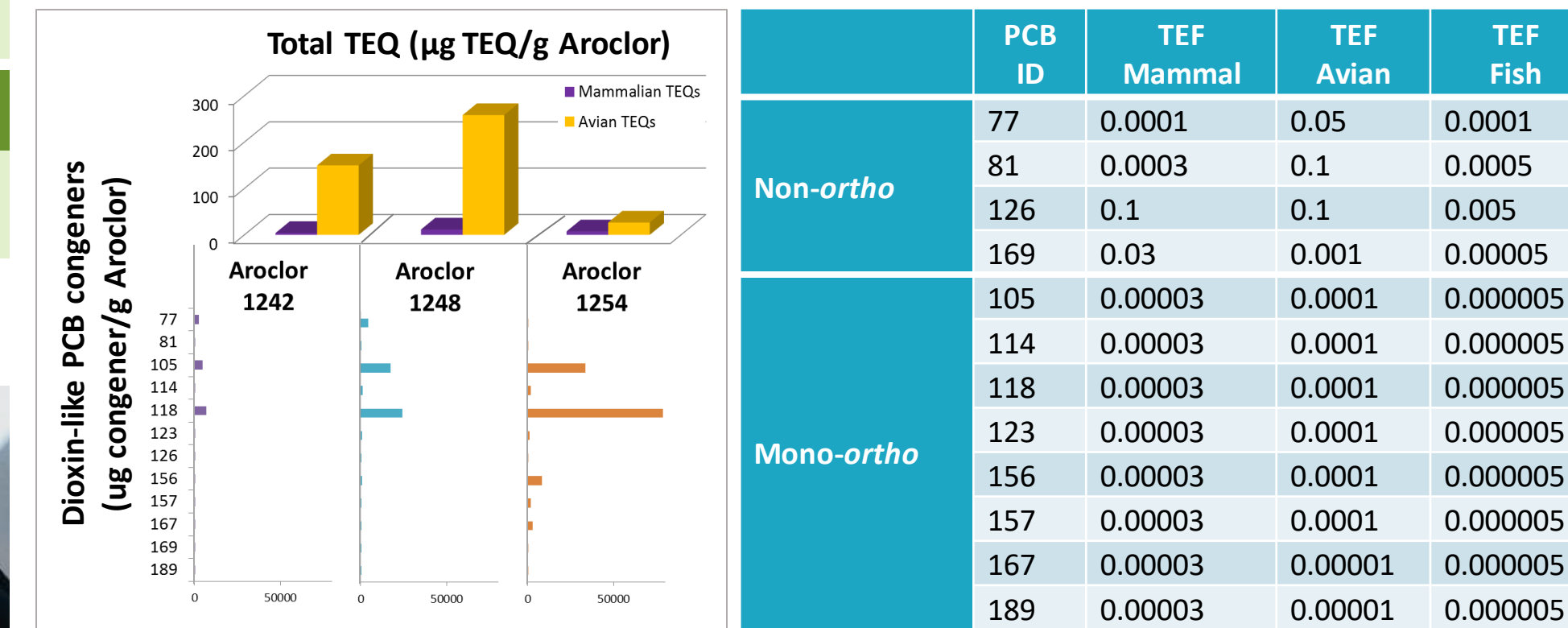
RESULTS

RISK DETERMINATION

CONGENER ANALYSIS INFORMS RISK:

- PCB congener toxicity due to “dioxin-like” mode of action
- 12 of 209 congeners are dioxin-like
- Potency of congeners varies
- WHO developed system for expressing toxicity of a mixture of congeners as a single number – the toxic equivalency (TEQ)

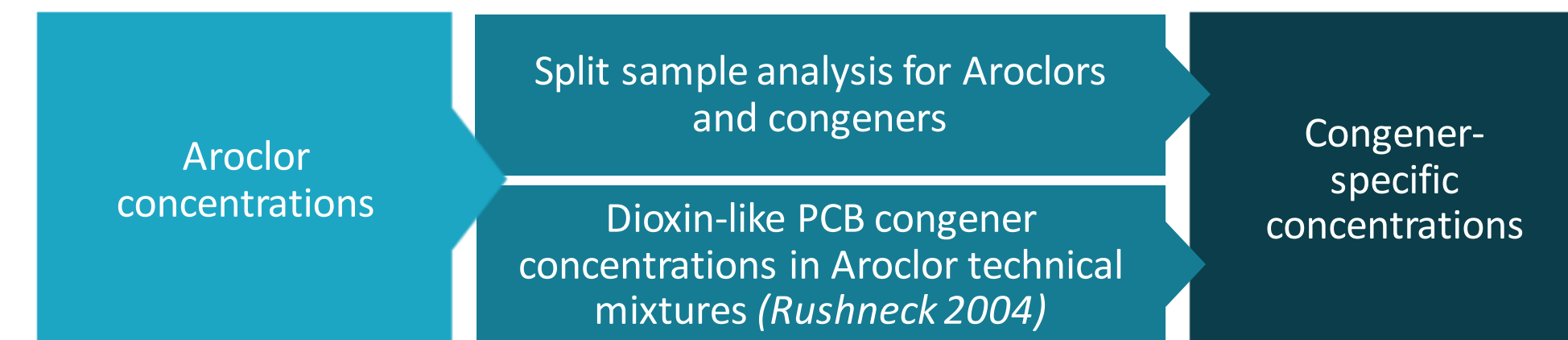
MASS AND TOXICITY ARE NOT EQUIVALENT:



Congener concentrations in Aroclor mixtures as reported by Rushneck et al. 2004

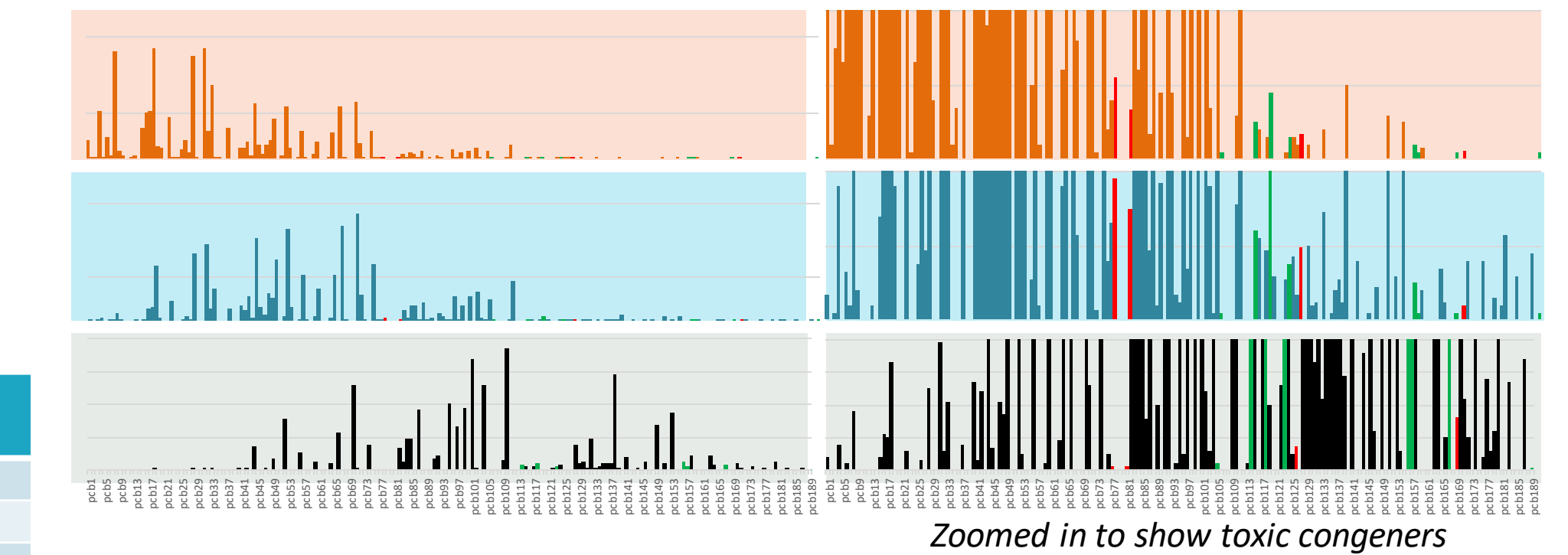
Reminder: TEFs, and hence TEQs, differ for mammals, birds, and fish.

GETTING FROM AROCLOR TO TOXICITY:



ALLOCATION

CONGENER DATA SUPPORTS TOXICITY-BASED ALLOCATION:



Total PCB mass (Aroclors)	Human toxicity (congeners)	Bird toxicity (congeners)
33%	18%	28%
33%	51%	62%
33%	30%	9%

- Allocation can be mass or toxicity based
- Congener concentrations are needed to calculate dioxin-like toxicity
- Congener analysis is best source of concentrations
- Aroclor analysis can be translated to congener concentrations

CONCLUSIONS

DELINEATION RECOMMENDATION

Plan ahead during delineation to avoid data analysis do over!

- Aroclor analysis for delineation
- Selective split sample congener analysis when complex risk assessment or allocation is anticipated, especially at locations where different sources are suspected

RISK ASSESSMENT RECOMMENDATION

Use early risk calculations to inform opportunity to optimize project spend.

- Use limited congener analysis from delineation to do calculations to frame risk potential
- Expand split sampling and congener analysis if warranted (may include biota sampling)

DESIGN AND CONFIRMATION RECOMMENDATION

Total cost of remediation plus sampling and analysis can be optimized.

- High data density can be costly, but rarely costs more than errors in remedy decisions
- Use statistics to optimize sample numbers
- Limit cost by using Aroclor analysis

ALLOCATION RECOMMENDATION

Congener-specific analysis supports risk-based allocation (and remedial decisions) with the least uncertainty.

- Spend on congener analysis will have best value return when:
- Remediation project is large or complex
 - There are multiple RPs with distinguishable sources