BATTELLE 2025 SEDIMENTS CONFERENCE

Bench-Scale Treatability Study for Washing Soils Contaminated with PCBs Up to Hazardous Waste Levels and Co-Occurring Dioxin/Furans

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Port of Seattle

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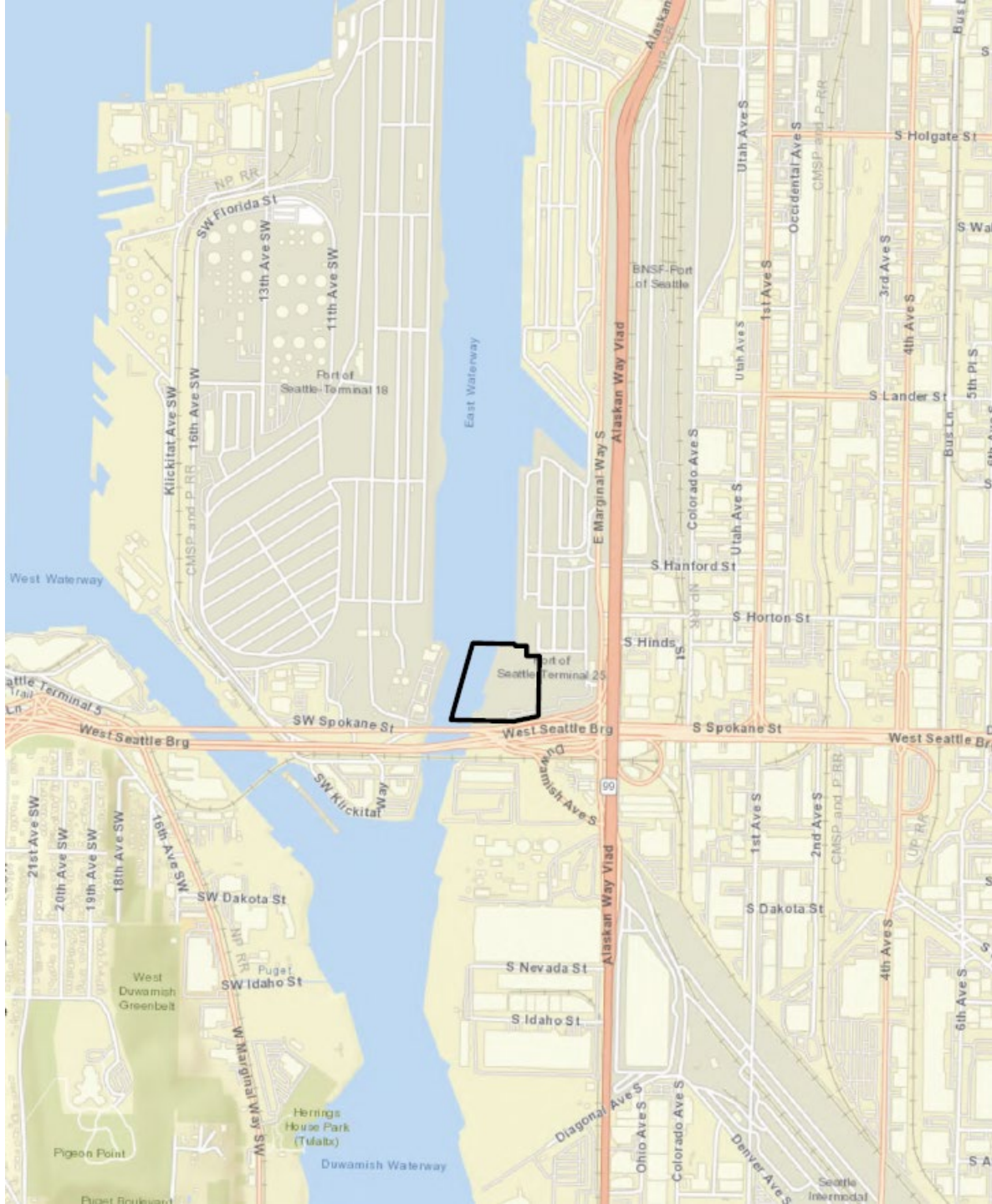
PROJECT BACKGROUND

Terminal 25 South

- 5 acres of upland and 5 acres of intertidal/subtidal
- Early action area for Harbor Island Superfund Site East Waterway Operable Unit (in-water portion)
- Estuarine and marine transition area that is important for juvenile salmon



Current Conditions

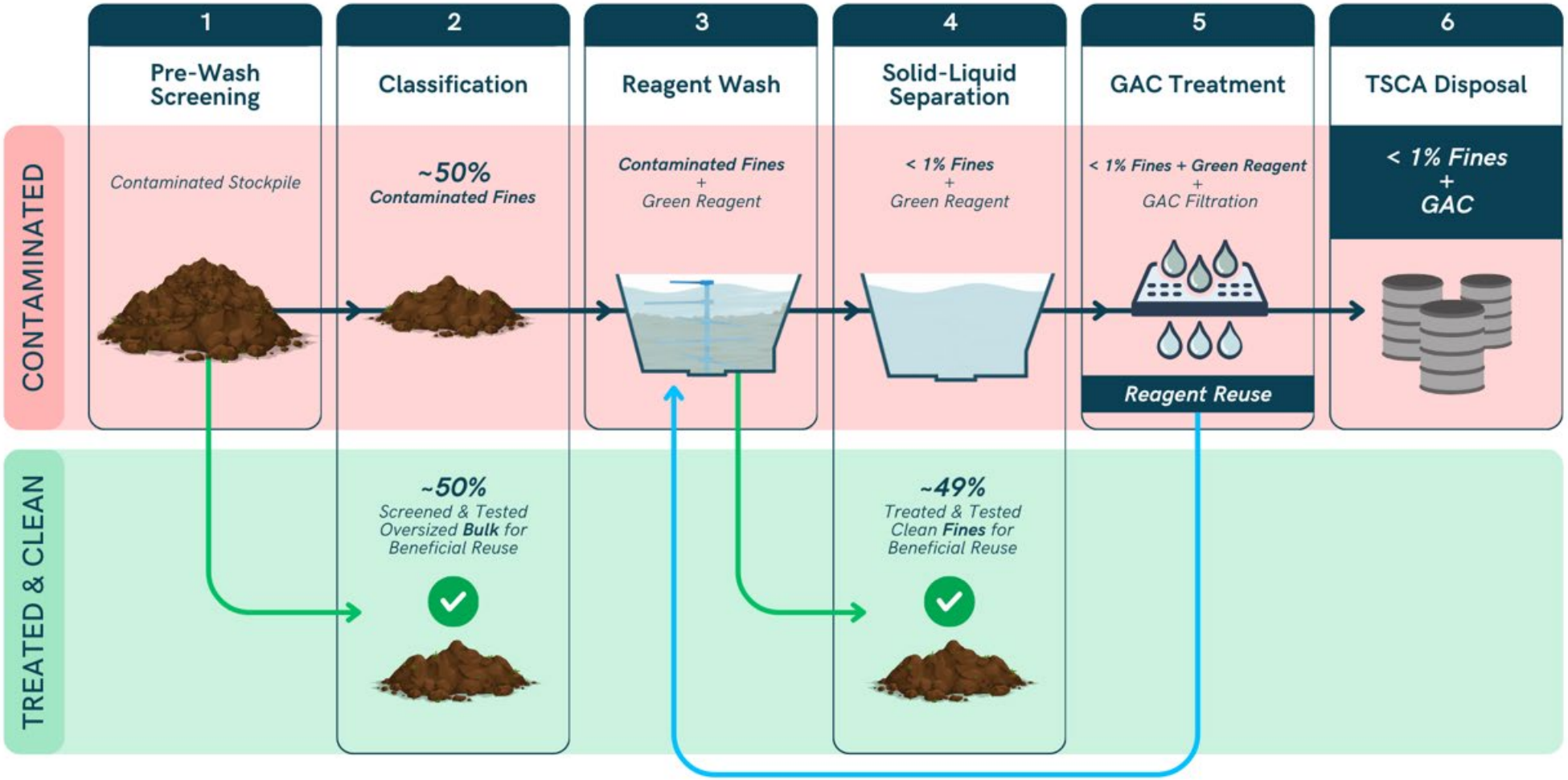
Rendering of Restoration Concept

CHALLENGE

How can we reduce the costs and environmental impact of managing contaminated soil?

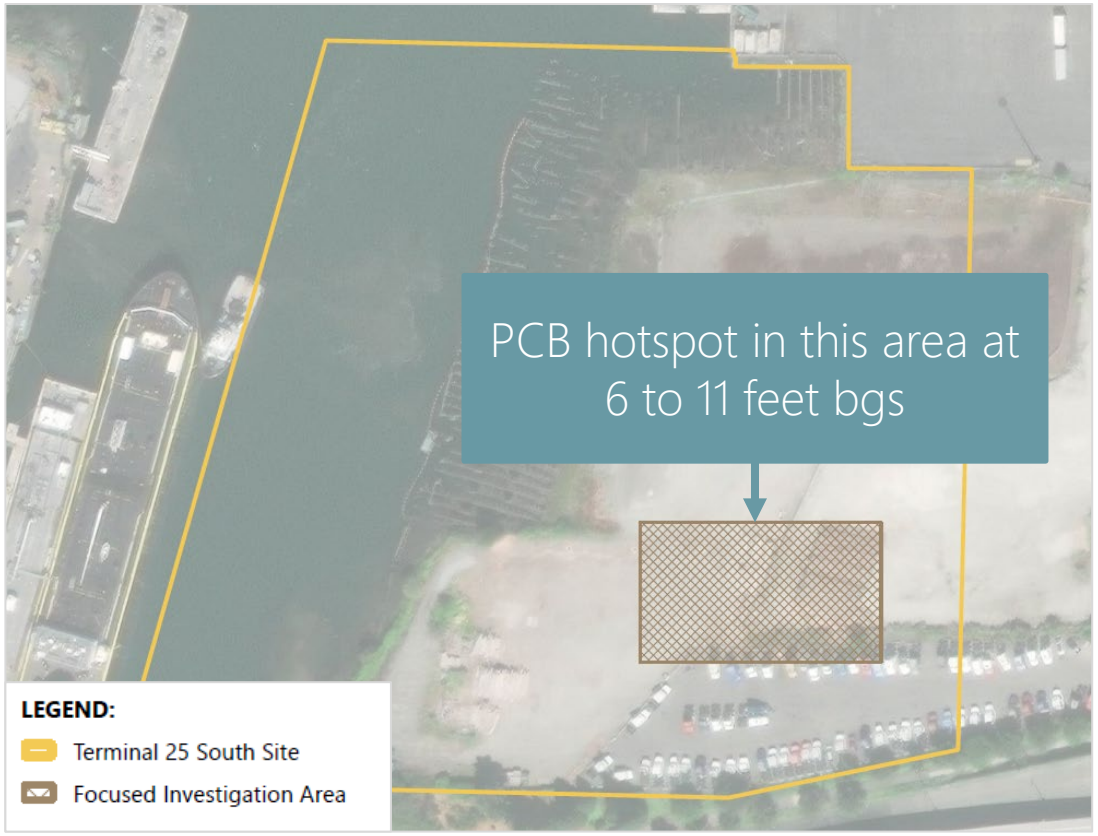
CHALLENGE

ecoĀINA Ex Situ Soil Washing Technology



Study Objective 1

- Reduce PCB concentrations to allow for disposal at a non-TSCA landfill (<50 ppm)
  - DU-1: Soils with the highest concentrations of PCBs (n=8)



Study Objective 2

- Reduce moderate D/Fs and PCBs below thresholds for industrial land use
  - DU-2: Soils with D/F and PCB concentrations exceeding project cleanup levels, but not the PCB TSCA threshold (n=6)

METHODS AND APPROACH

Experimental Process

Composite Sieving and Sub-Sampling

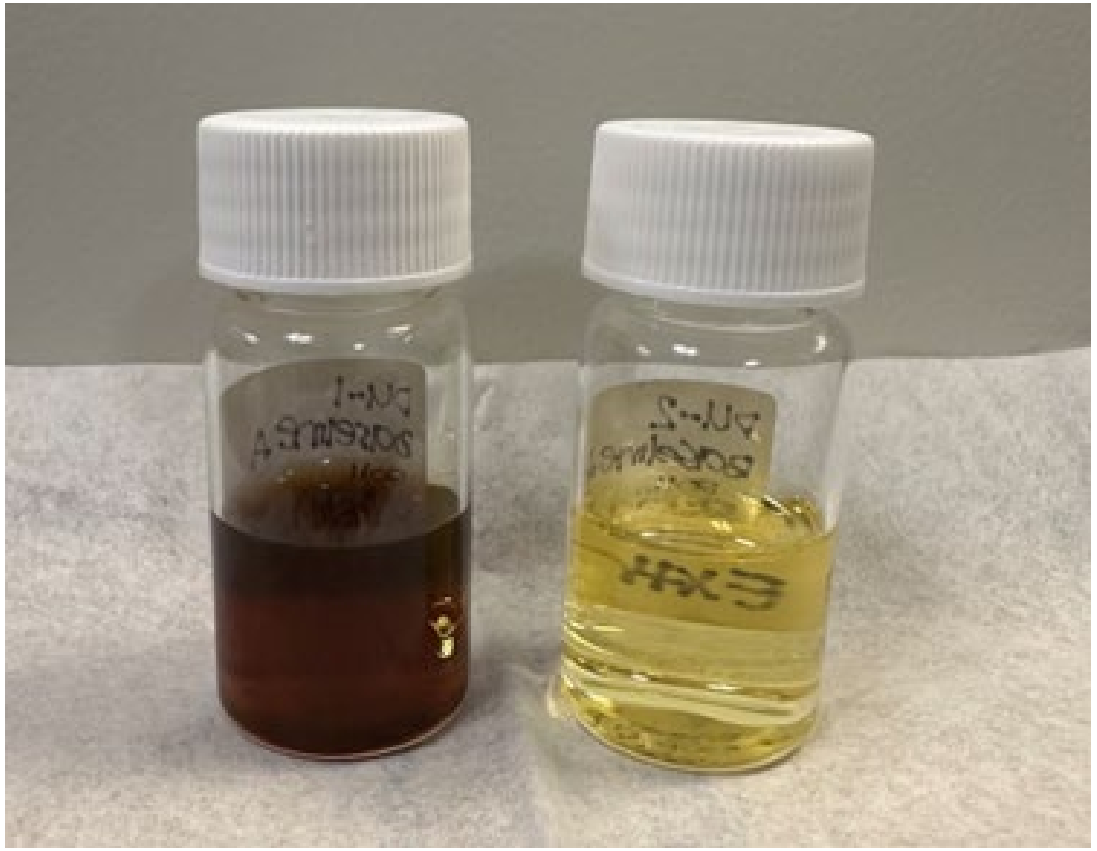
Sieving of composite using .025-inch mesh screen

Sampling of composite using multi-incremental sampling

Examples of DU-1 composite (left) and DU-2 composite (right)

Baseline Concentrations

Composite	Analyte	Target Range for Composite	Average Composite Concentration
DU-1	PCBs (ppm)	>50	212
DU-2	PCBs (ppm)	>0.94	1.4
	D/F TEQ (pptr)	>22	190



Baseline extracts for DU-1 (left) and DU-2 (right)

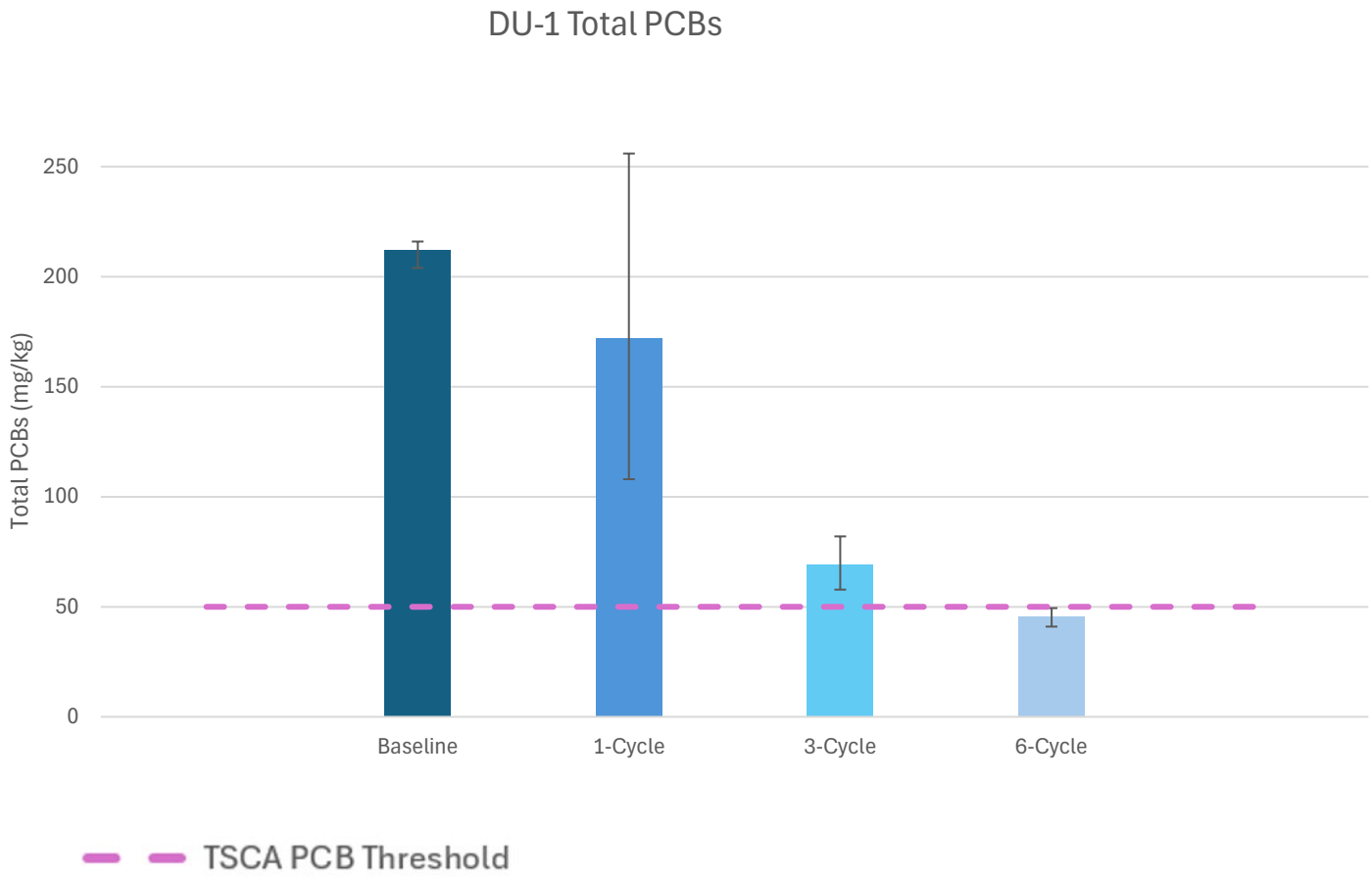
Soil Washing and Reagent Extraction

- Soils washed with reagent in 1:1 ratio (1 cycle)
  - e.g., 200 grams soil and 200 grams reagent
- Reagent extracted from soil
- Process repeated for 3 and 6 cycles using fresh reagent

Vacuum filtration to extract reagent

CONCLUSION

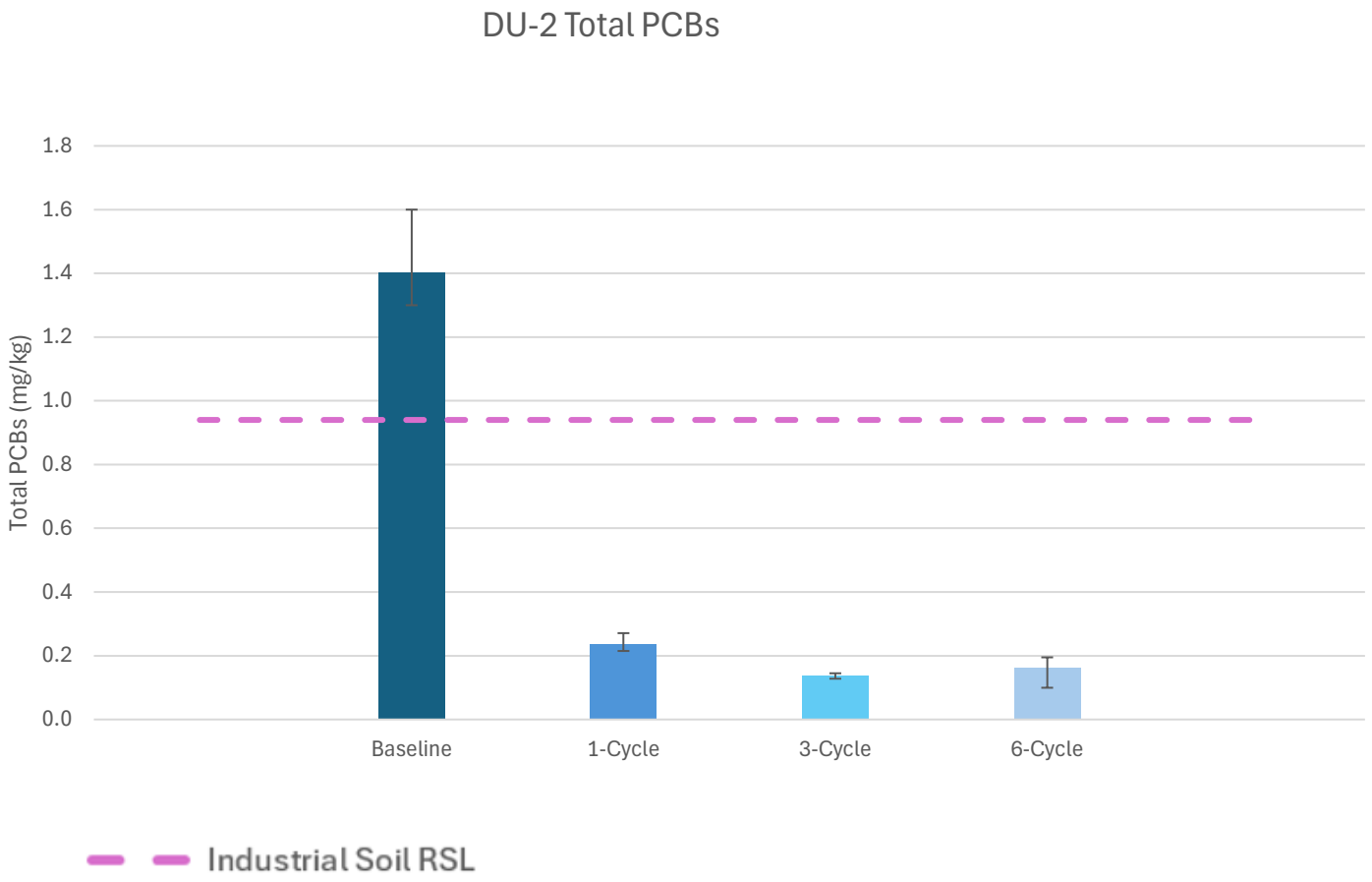
TSCA-Level PCBs Reduced to Below Threshold



Sample	Average % Reduction
Baseline	--
1-Cycle	19%
3-Cycle	67%
6-Cycle	79%

CONCLUSION

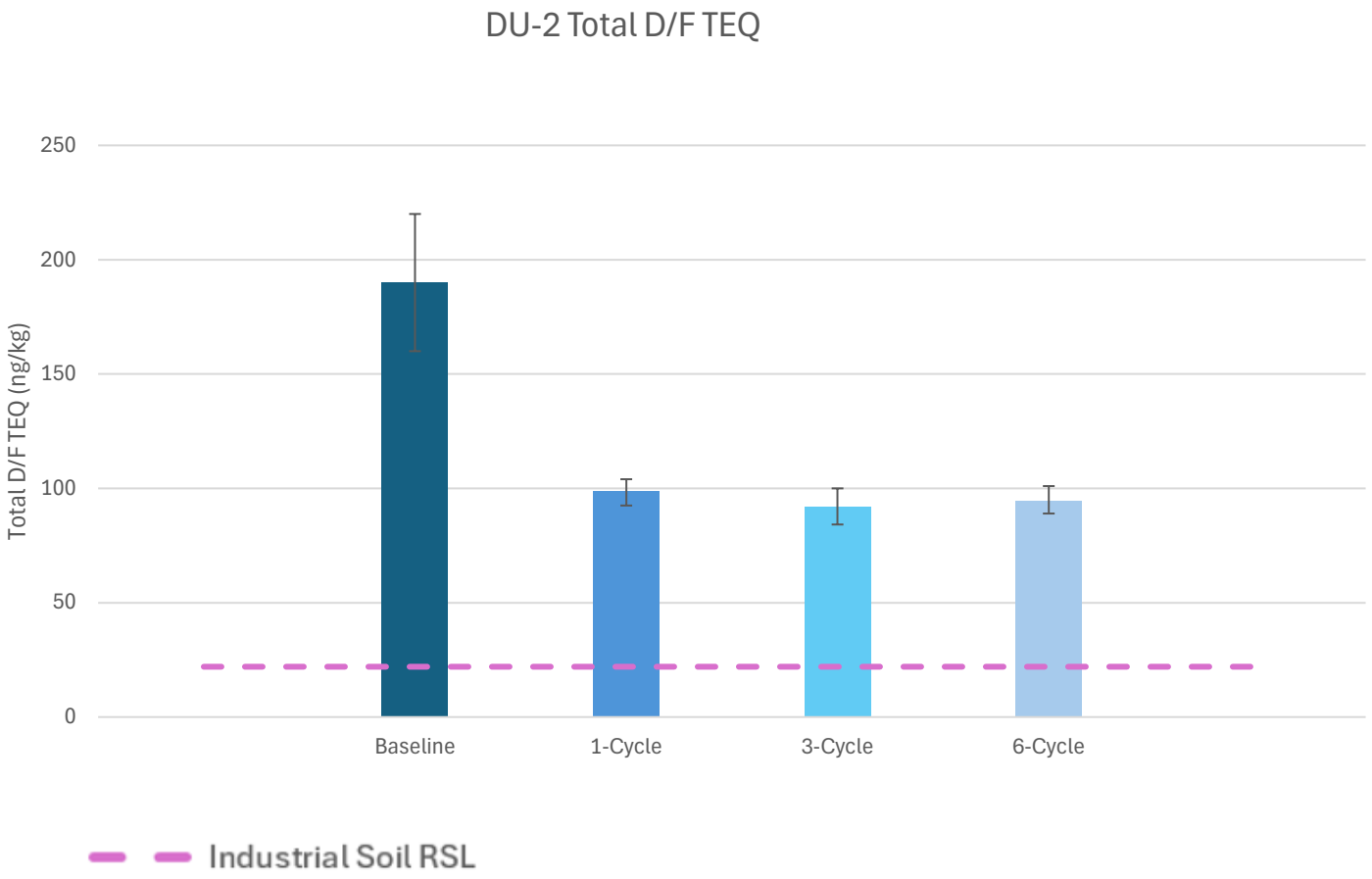
Similar Percent Reduction for Lower-Level PCBs



Sample	Average % Reduction
Baseline	--
1-Cycle	83%
3-Cycle	90%
6-Cycle	88%

CONCLUSION

Co-Occurring D/F TEQ Reduced by 50%



Sample	Average % Reduction
Baseline	--
1-Cycle	48%
3-Cycle	52%
6-Cycle	50%

CONCLUSION

Soil Characteristics Impact Treatability

- Wood particles – higher absorption of reagent
- Grain size – material >0.25 inches managed separately

Wood particles in soil for DU-1 (left) vs. DU-2 (right)

Considerations for Implementability

- Space requirements
  - Stockpile area with engineering controls
  - ecoAINA unit(s) and production rate
- Costs
  - Confirmation testing
  - GAC disposal
- Co-contaminants (e.g., metals) limiting reuse

Conclusions

- ecoĀINA reduced PCBs by 80% to 90% and D/F TEQ by 50%
- For higher concentrations of PCBs (DU-1), 6 cycles of soil washing was required
  - In field, may run unit longer, not necessarily use more reagent
- Lower PCB concentrations (DU-2) only required a single cycle
- Modifications to bench-scale study may allow for greater reduction

REFERENCES

Aminzadegan, S., M. Shahriari, F. Mehranfar, B. Abramovic, 2022. *Factors affecting the emission of pollutants in different types of transportation: A literature review.* Energy Reports. Volume 8. November 2022.

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