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Assessment of Environmental Footprints for Per- and Polyfluoroalkyl Substances (PFAS) Treatment Technologies for Liquids and Solids

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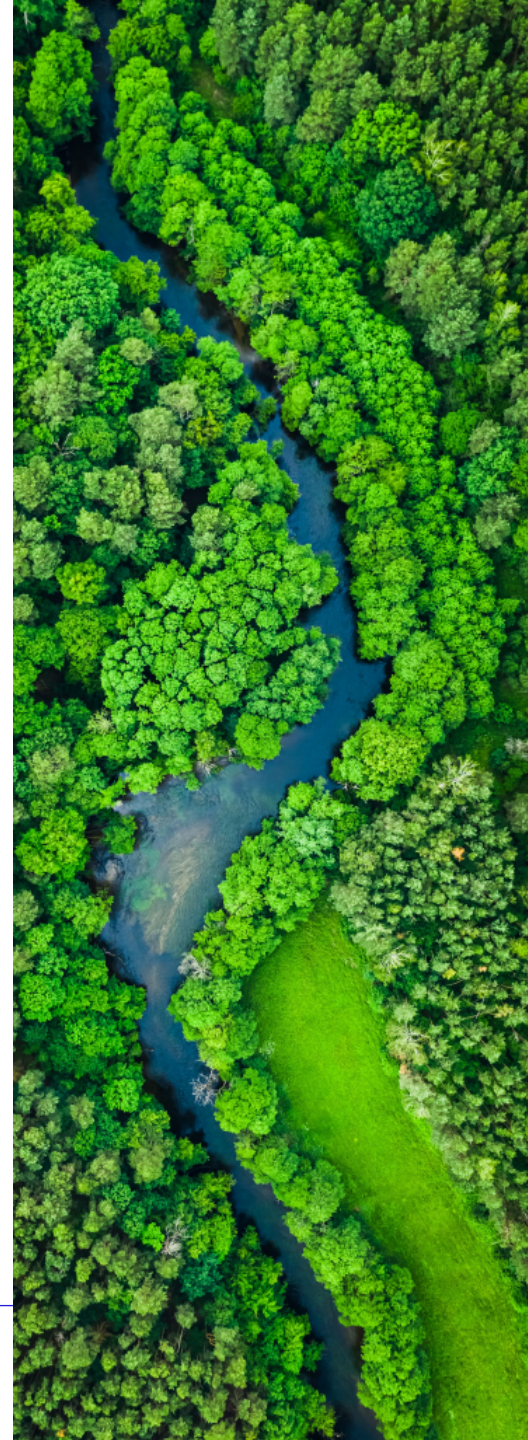
Agenda

- Why consider the environmental footprint of PFAS treatment?
- Methodology
  - Develop Scenarios
  - Gather Data
  - Calculate Environmental Footprint
- Results
  - Liquid Scenarios
  - Solid Scenarios
- Conclusions and Opportunities



Why consider the environmental footprint of PFAS treatment?

- Remediation ≠ Sustainability
- PFAS cleanup levels are low
- Long term operations are required
- There will be an environmental impact

⟶ How will we reduce that impact?

https://pfas-1.itrcweb.org/

Methodology

	Volume	Initial Concentration (PFOA+PFOS)	Target Concentration (PFOA+PFOS)
Liquid Scenario 1	1,000 gallons	50,000 ng/L	10 ng/L
Liquid Scenario 2	50,000,000 gallons	500 ng/L	10 ng/L
Solid Scenario 1	Five 55-gallon drums	10,000 µg/kg	1 µg/kg
Solid Scenario 2	10,000 cubic yards	10,000 µg/kg	1 µg/kg

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High concentration, low volume sources: monitoring well IDW, thermal treatment condensate, soil washing waste streams, IX regenerant liquids, etc.

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High volume, low concentration sources: potential pump and treat groundwater hydraulic containment system, contaminated site dewatering system, etc.

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Low volume: potential IDW or drill cuttings from environmental investigation

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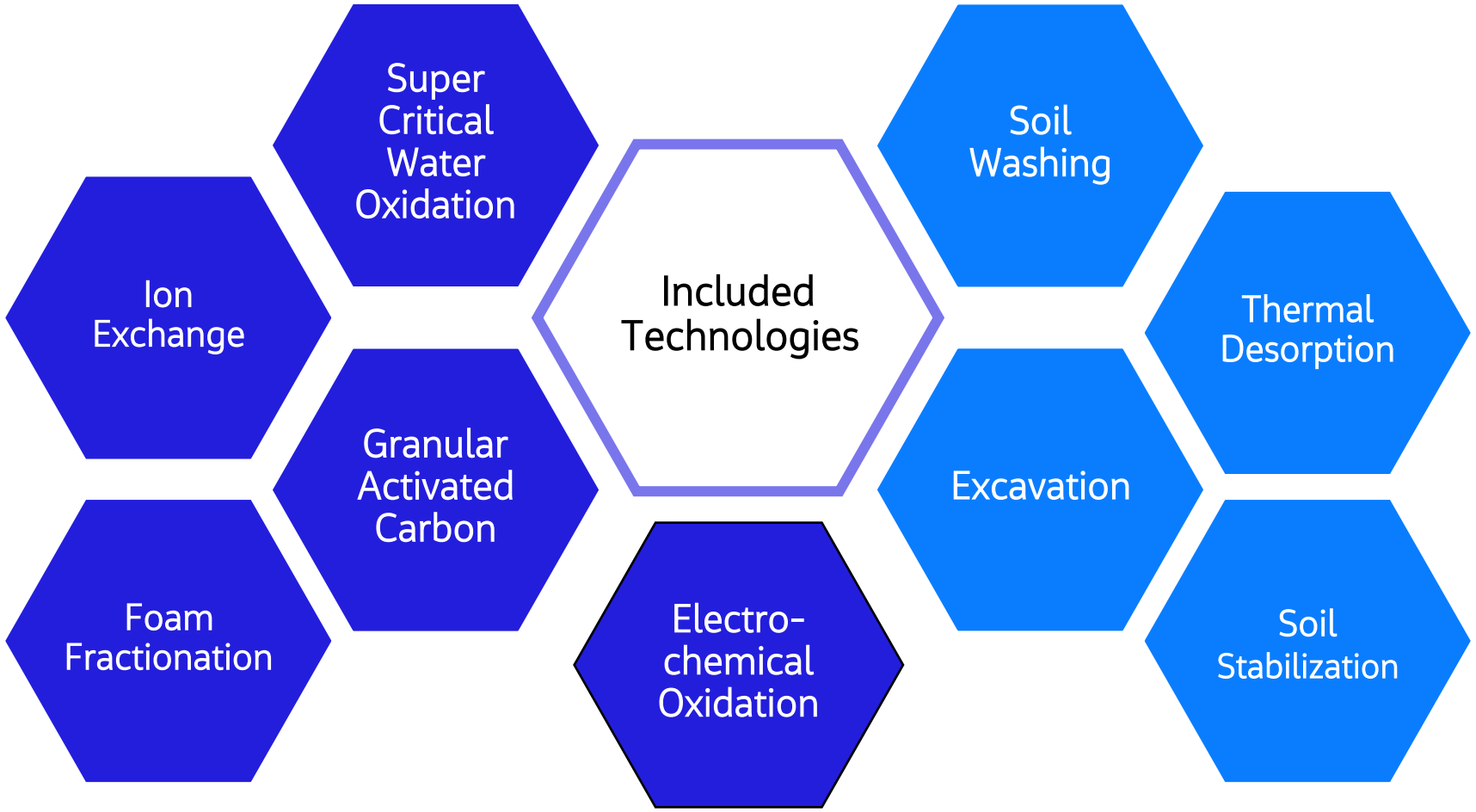
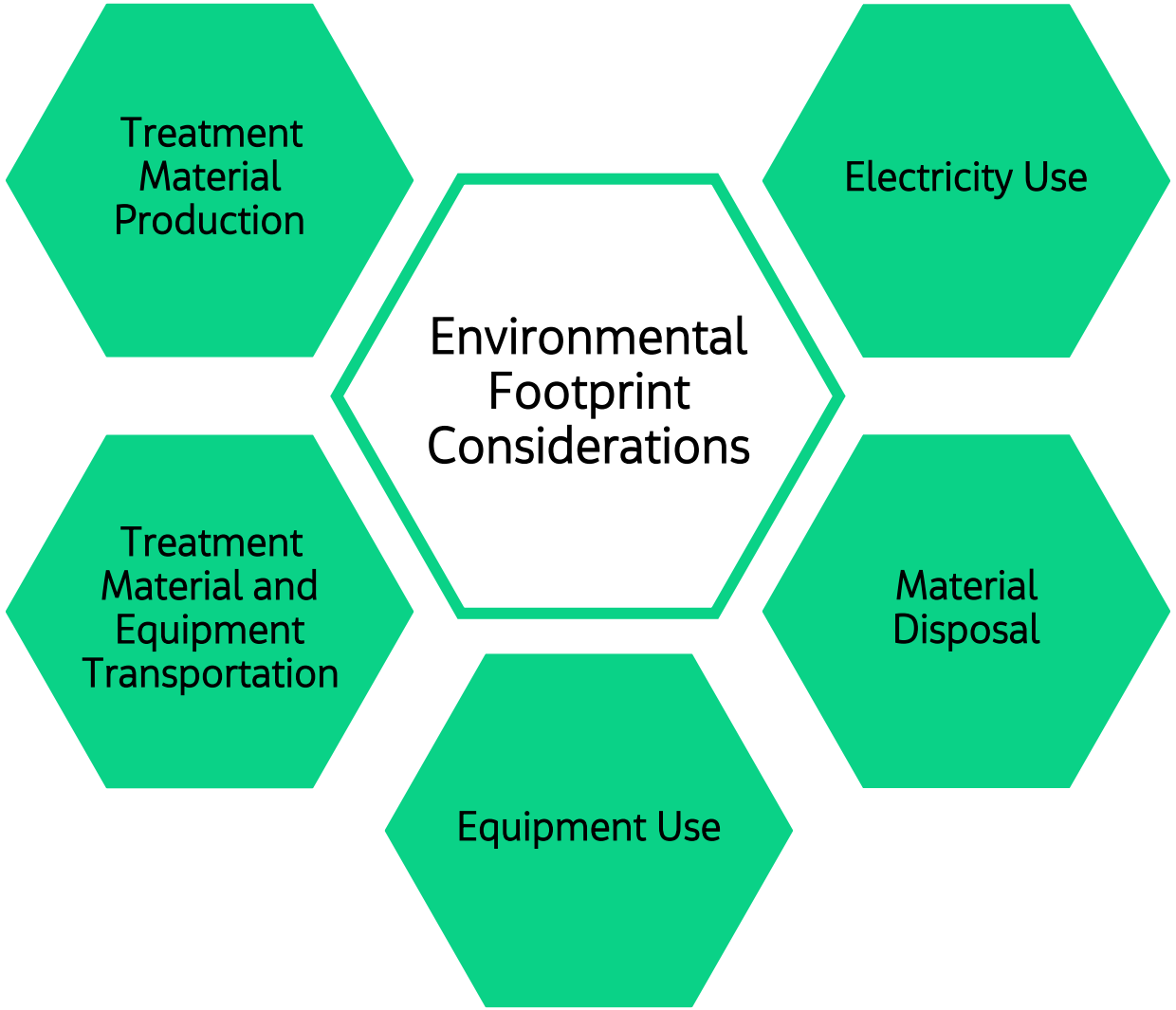
Solid Scenario 2	10,000 cubic yards	10,000 µg/kg	1 µg/kg

High volume: potential source area contamination on a site

Liquid Technologies
Solid Technologies



Develop Scenarios → Gather Data → Calculate Environmental Footprint



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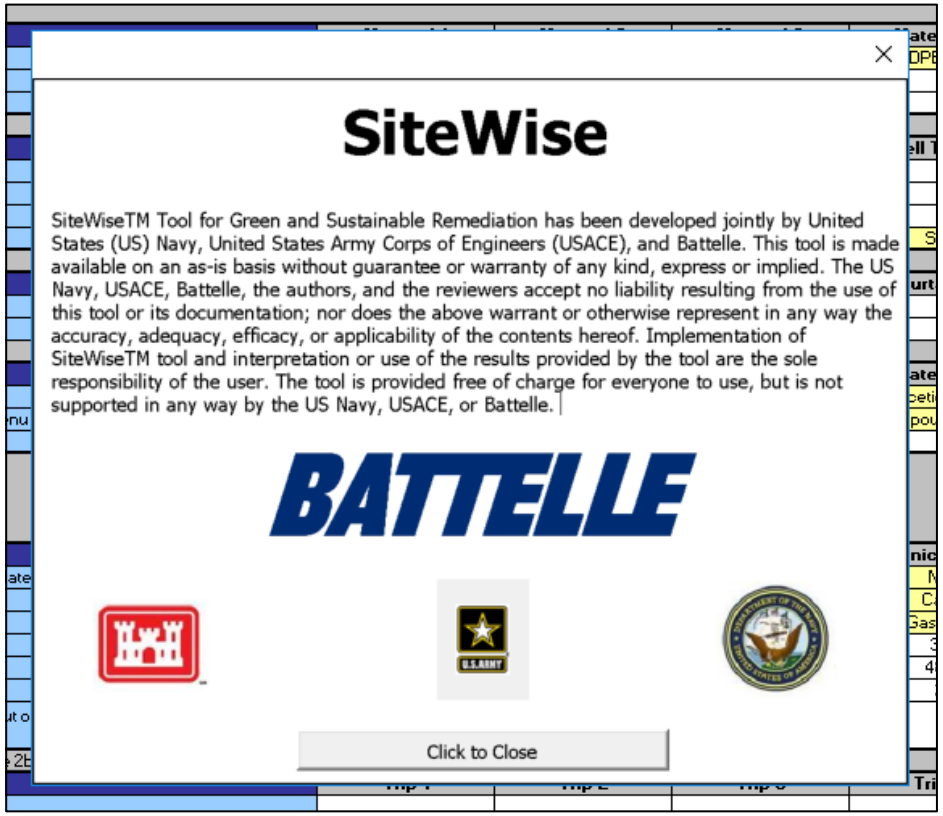


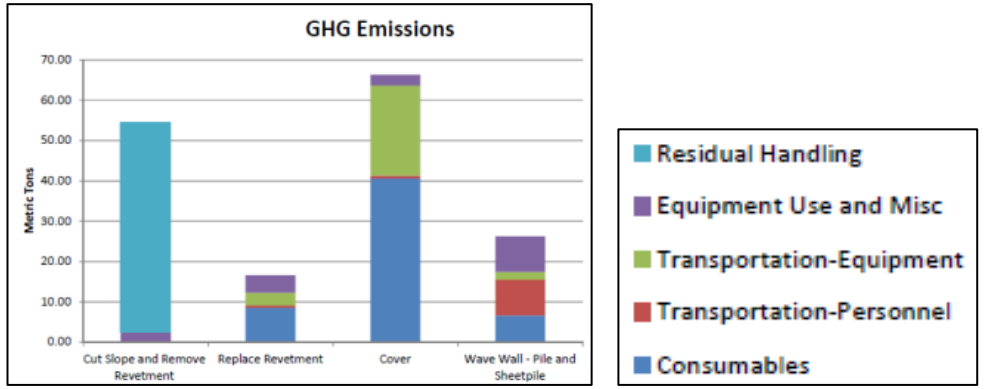
Inputs

BULK MATERIAL QUANTITIES	Material 1	Material 2
Choose material from drop down menu	Bentonite	Virgin GAC
Choose units of material quantity from drop down menu	pounds	pounds
Input material quantity	165,000	300

DRILLING	Event 1	Event 2
Input number of drilling locations	5	25
Choose drilling method from drop down menu	Sonic Drilling	Direct Push
Input time spent drilling at each location (hr)	5.00	5.00
Choose fuel type from drop down menu	Diesel	Diesel

RESIDUE DISPOSAL/RECYCLING	Soil Residue	Residual Water
Will DIESEL-run vehicles be retrofitted with a particulate reduction technology?	No	No
Input weight of the waste transported to landfill or recycling per trip (tons)	20.0	16.0
Choose fuel used from drop down menu	Diesel	Gasoline
Input total number of trips	4.0	2.0
Input number of miles per trip	100.0	300.0

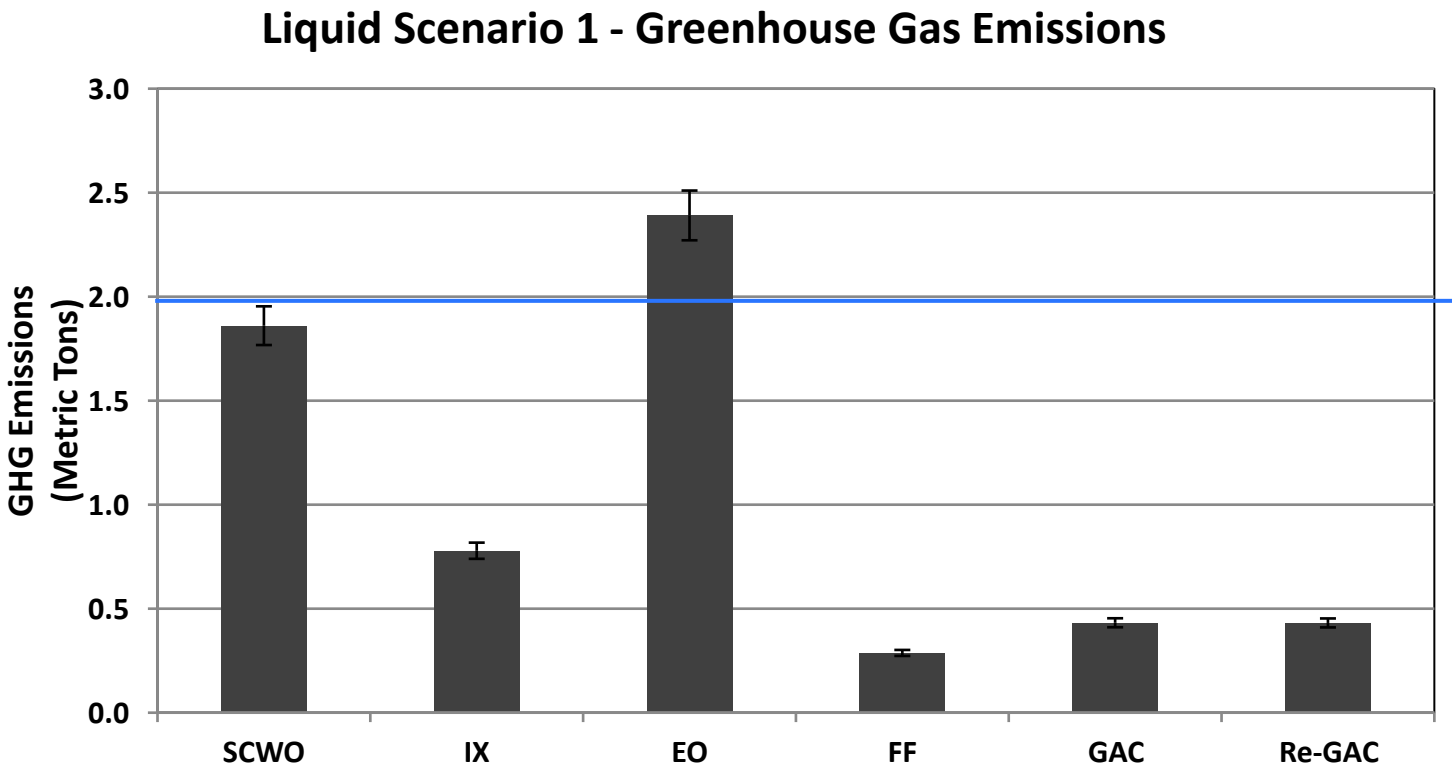
Outputs



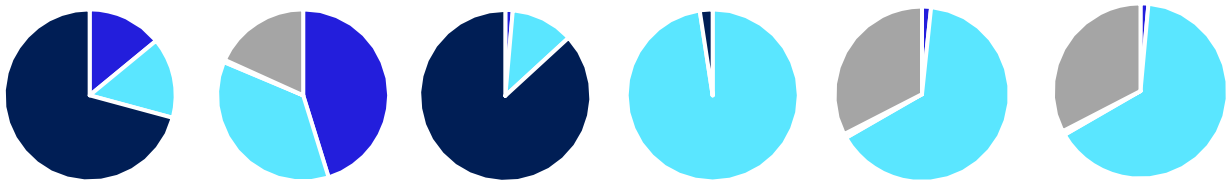
Remedial Alternatives	GHG Emissions	Energy Usage	Water Usage	Electricity Usage	Onsite NOx Emissions	Onsite SOx Emissions
Alternative 1	High	High	Low	High	Medium	Medium
Alternative 2	Medium	Medium	Low	Low	High	High
Alternative 3	Medium	Medium	High	Low	High	High

Develop Scenarios → Gather Data → Calculate Environmental Footprint

Results



Equivalent to ~5,000 miles driven by an average gasoline powered passenger vehicle

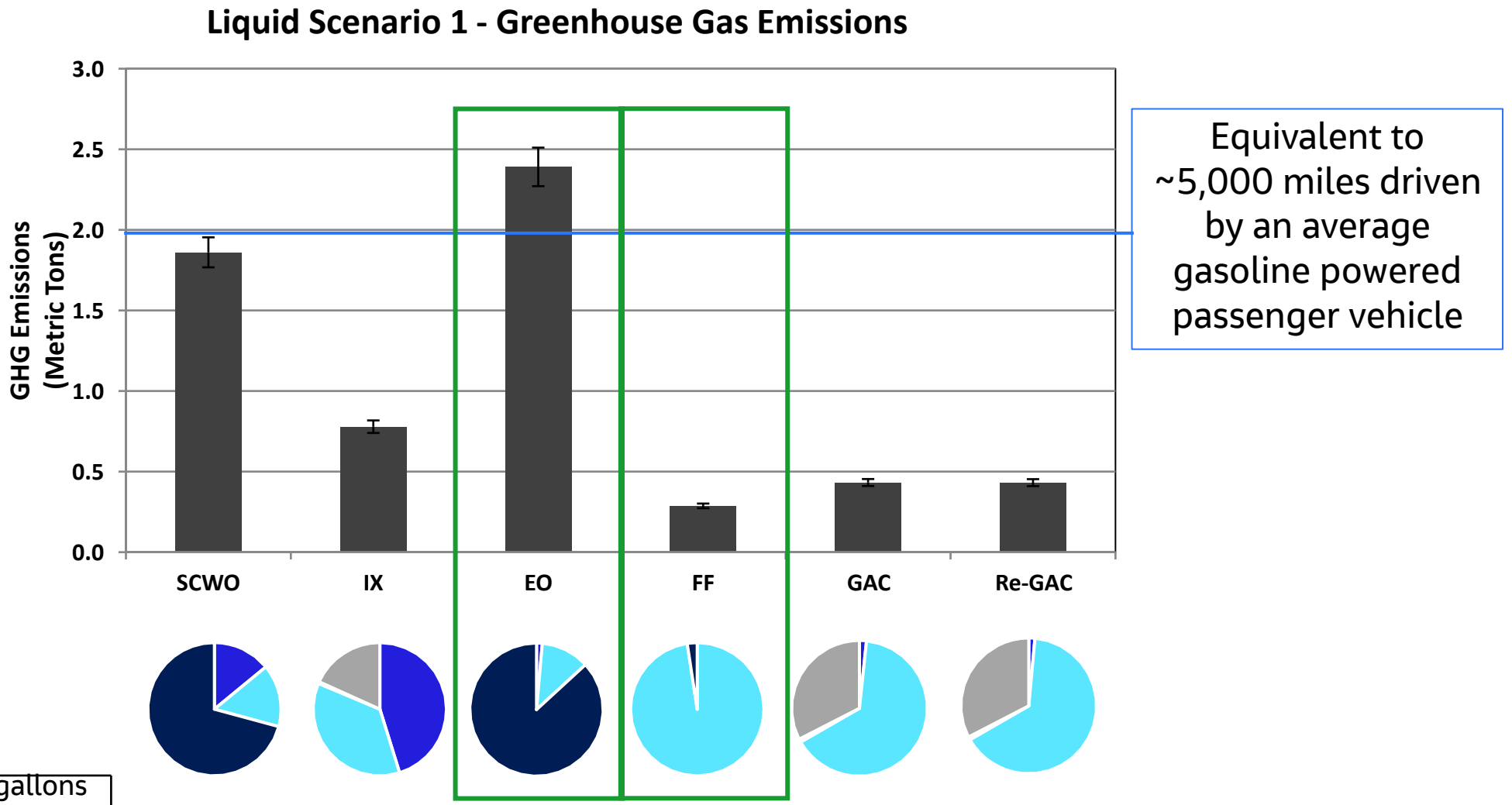


Volume	1,000 gallons
Initial Concentration (PFOA+PFOS)	50,000 ng/L
Target Concentration (PFOA+PFOS)	10 ng/L

SWCO = supercritical water oxidation
IX = ion exchange
EO = electrochemical oxidation
FF = foam fractionation
GAC = granular activated carbon
Re-GAC = regenerated granular activated carbon

- Treatment Material Production
- Treatment Material and Equipment Transportation
- Equipment and Electricity Use
- Material Disposal

Results



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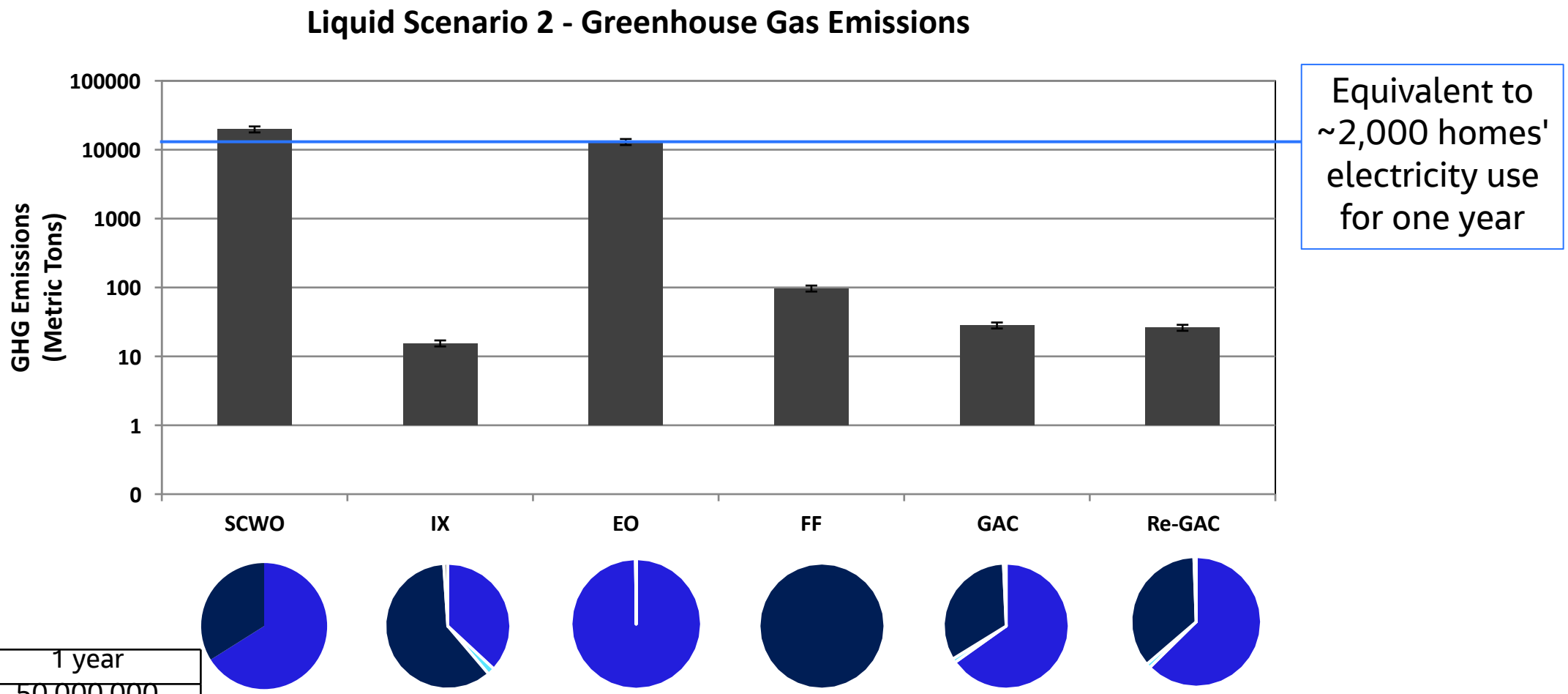

Duration	1 year
Volume	50,000,000 gallons
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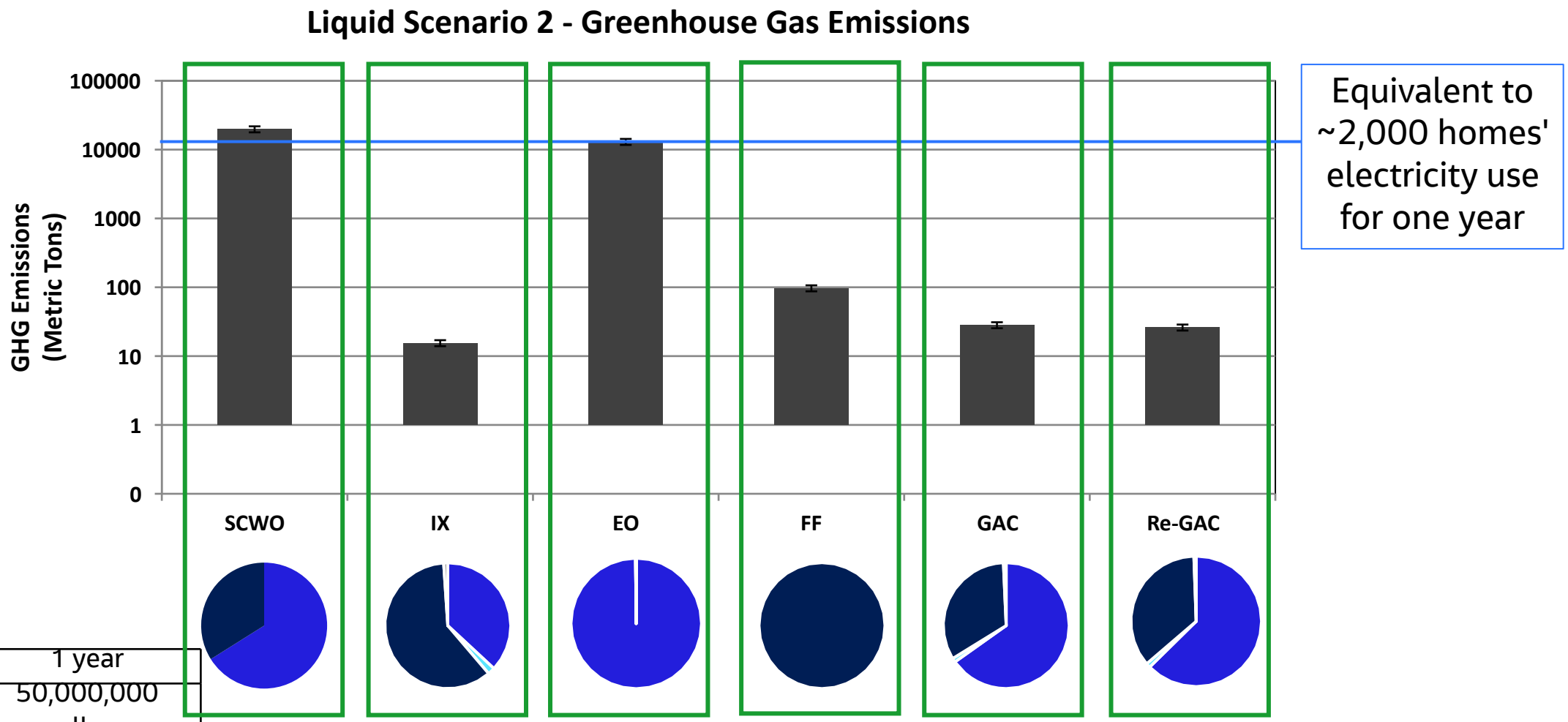

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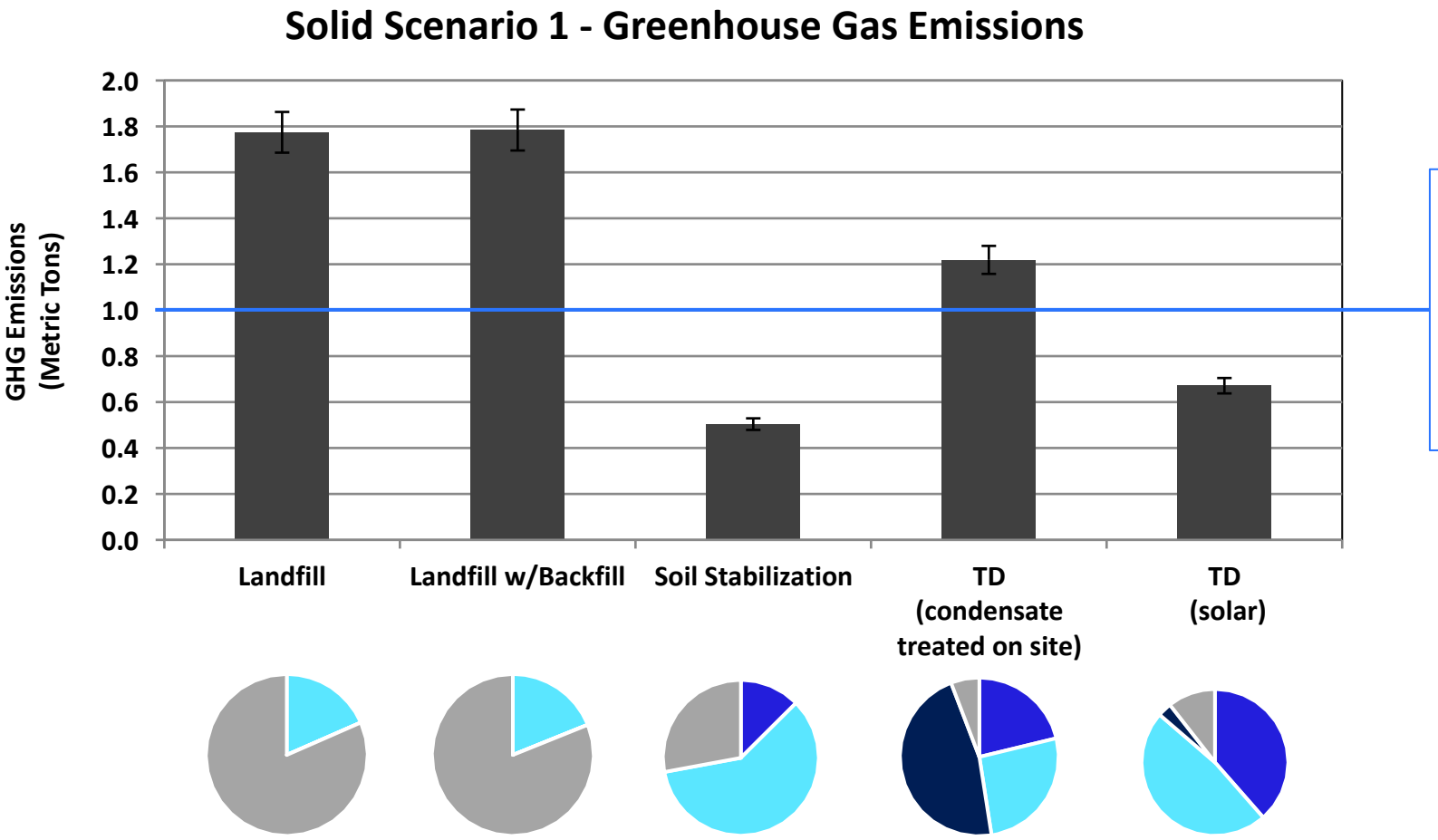

Equivalent to ~2,500 miles driven by an average gasoline powered passenger vehicle

Volume	Five 55-gallon drums
Initial Concentration (PFOA+PFOS)	10,000 µg/kg
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TD = thermal desorption

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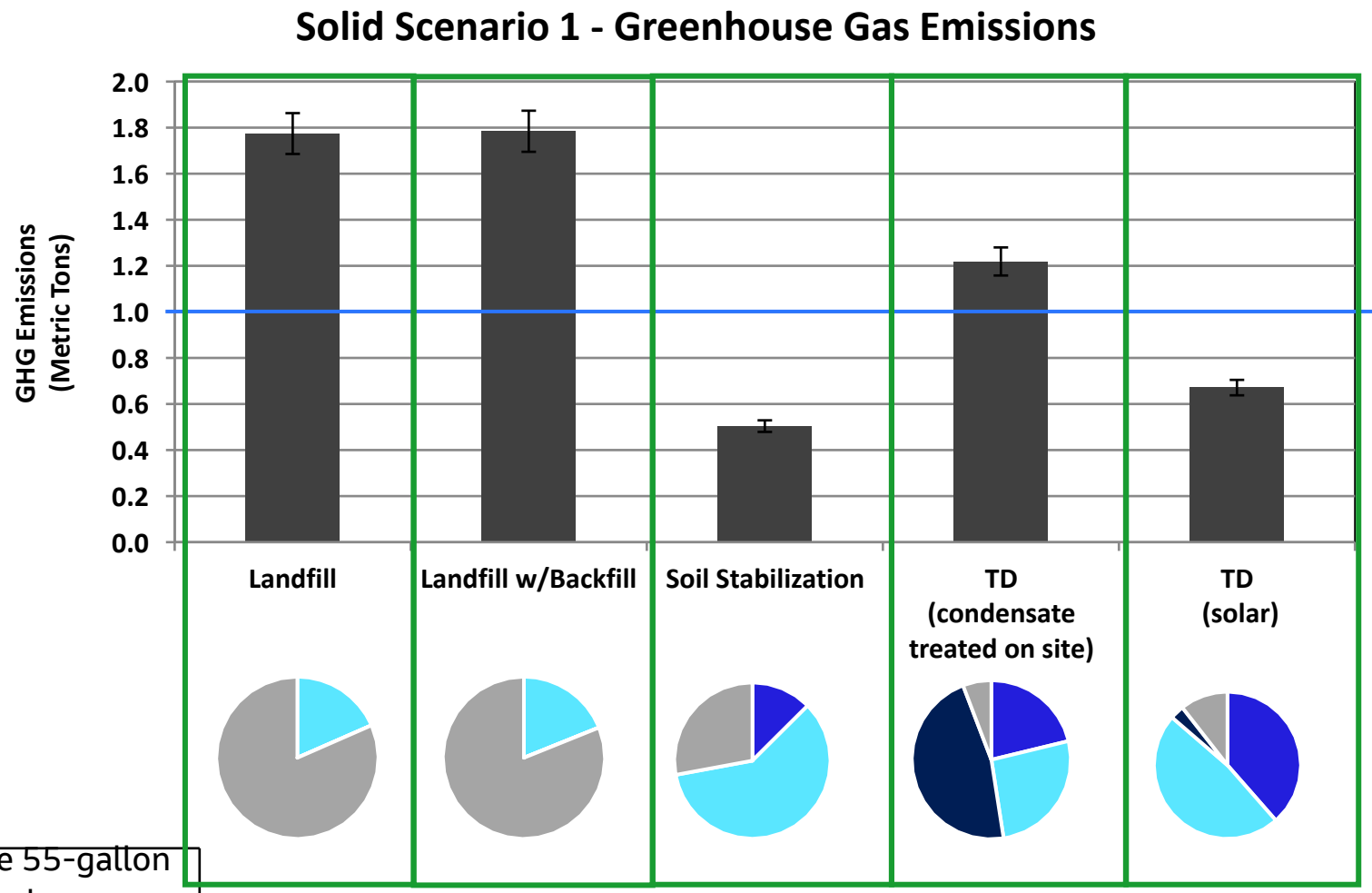

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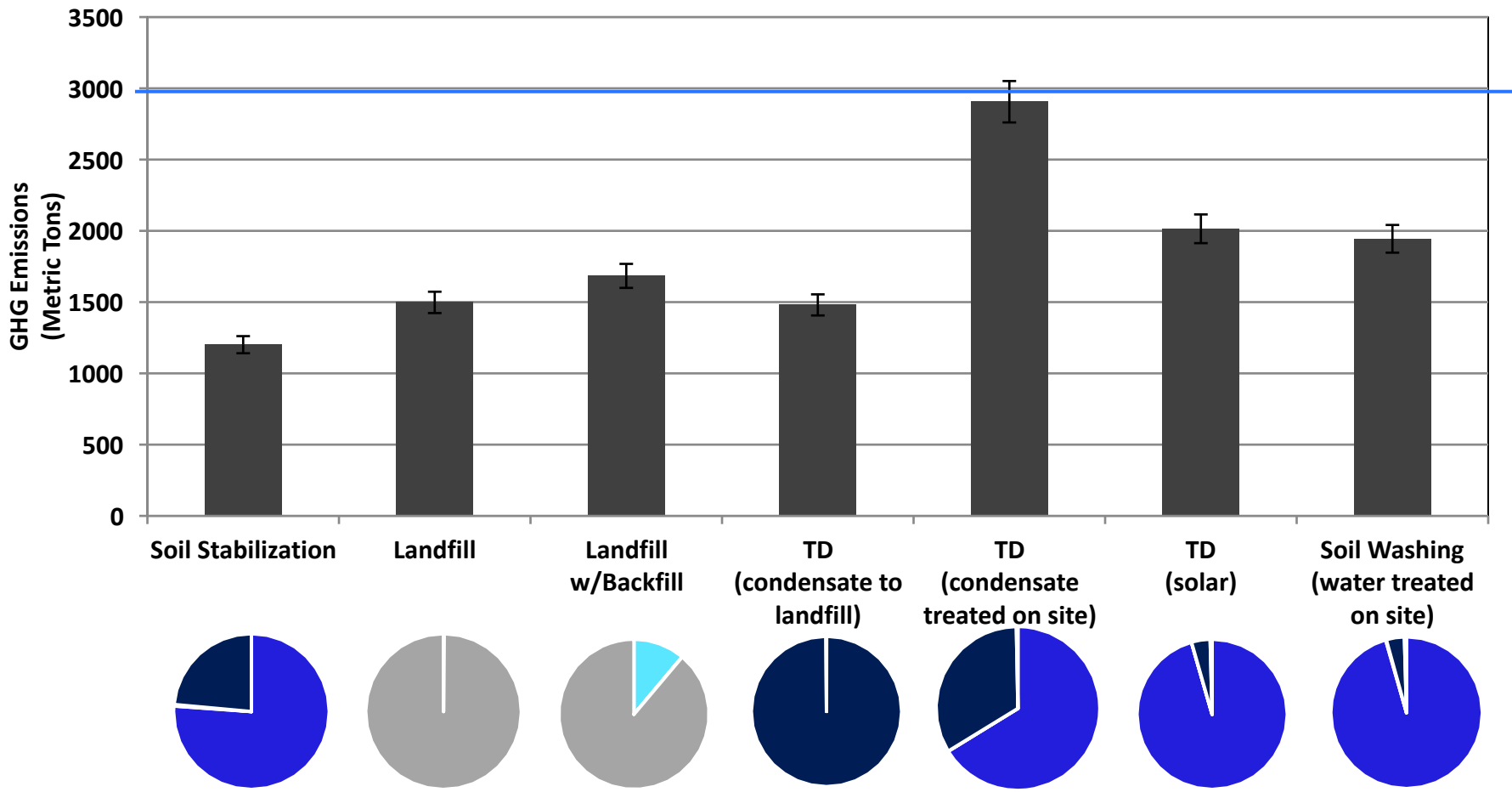

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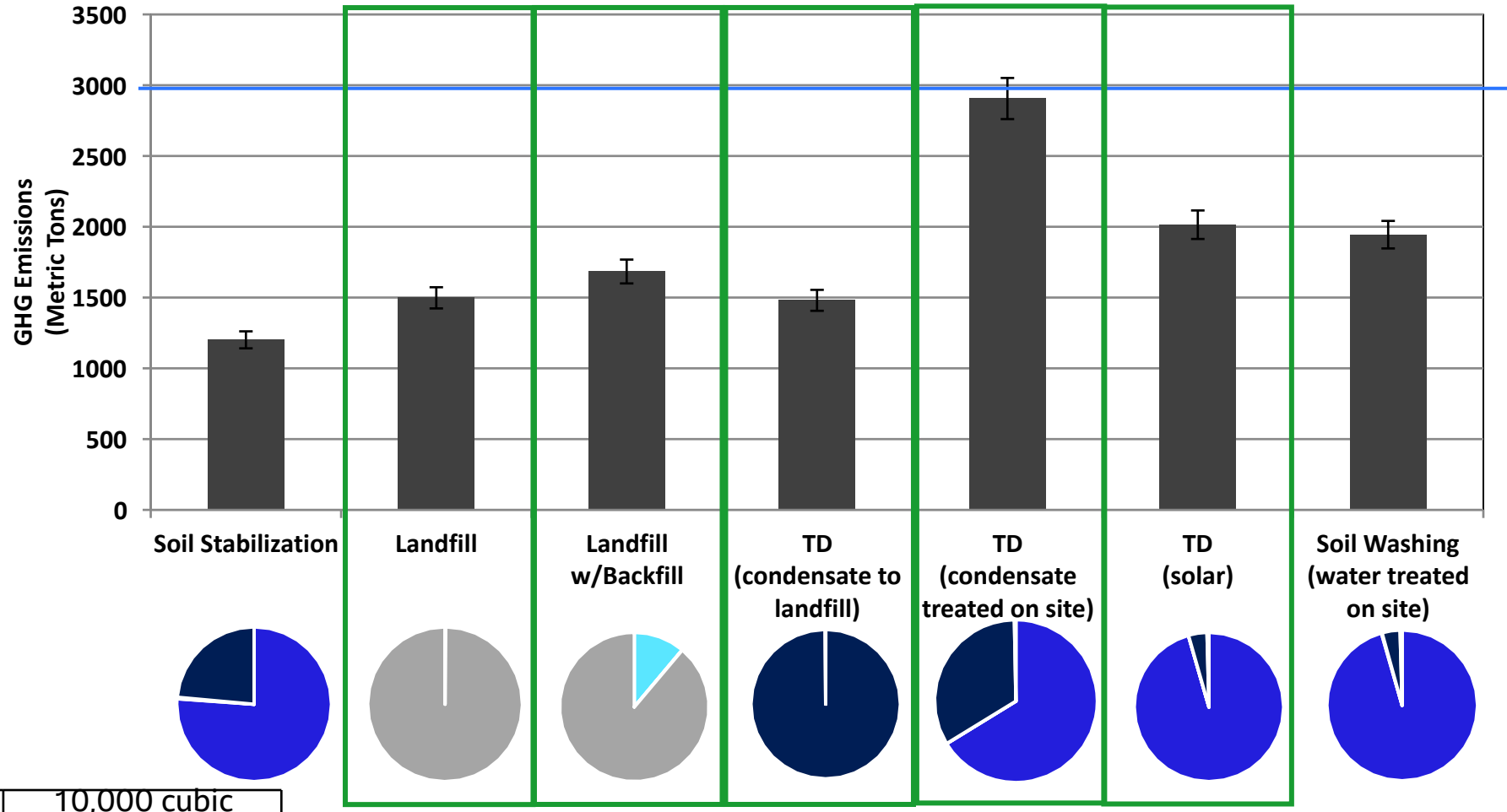

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Considerations and Opportunities

- Long-term resiliency
  - Risk mitigation vs. destruction of PFAS
- Main contributors: electricity use and transportation
  - Solar panels
  - Higher percentages of renewables
  - Electric vehicles
- Treatment Trains
  - Combine technology types
  - Create efficiencies, reduce overall environmental footprint
- Consideration of additional sustainability factors in future evaluations
- PFAS treatment will have an impact, consider opportunities for reductions

Thank you!

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