Soil Treatability Studies: Soil Partitioning

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Soil Treatability Study
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Overview of Presentation

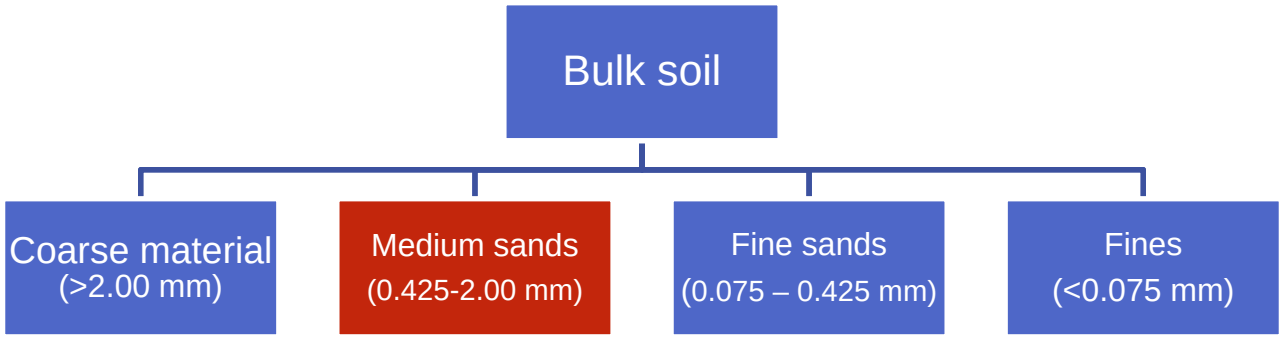
- Soil Partitioning Study (SPS)
  - Purpose of the study
  - Description of soil partitioning analysis
  - Soil partitioning categories
    - Soil particle size (this study)
    - Contaminant-soil binding characteristics (future study?)
  - Sample locations
- Results
  - Contaminant partitioning by size fraction
  - Variations between sample locations
  - Comparison to prior soil characterization testing
- Summary

What is Soil Partitioning Analysis?

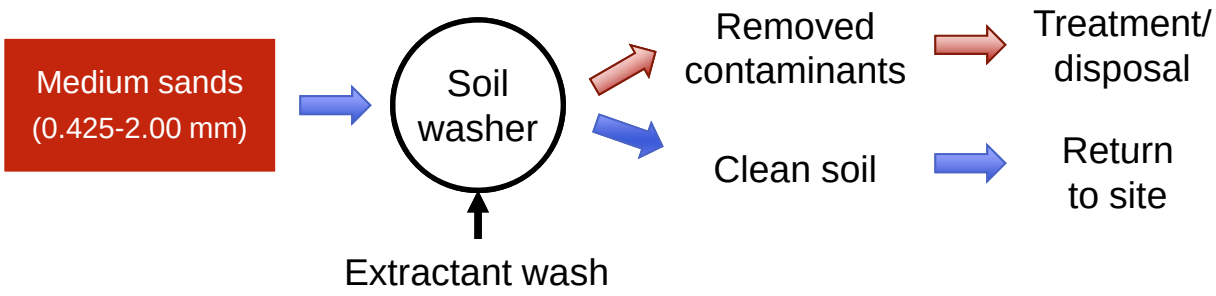
- Primary Purpose:
  - Determine where the contaminants are within a contaminated soil by depth and soil size fractions.
- Secondary Purpose:
  - Determine how tightly the contaminants are held within the contaminated portions of the soil.

SPS Goals

- Sandia 2012 Soil Treatability Study Recommendations
  - Recommendation 1 Contaminant Partitioning/Separation in the Soil
    - Potential reduction of soil volume to be removed from site

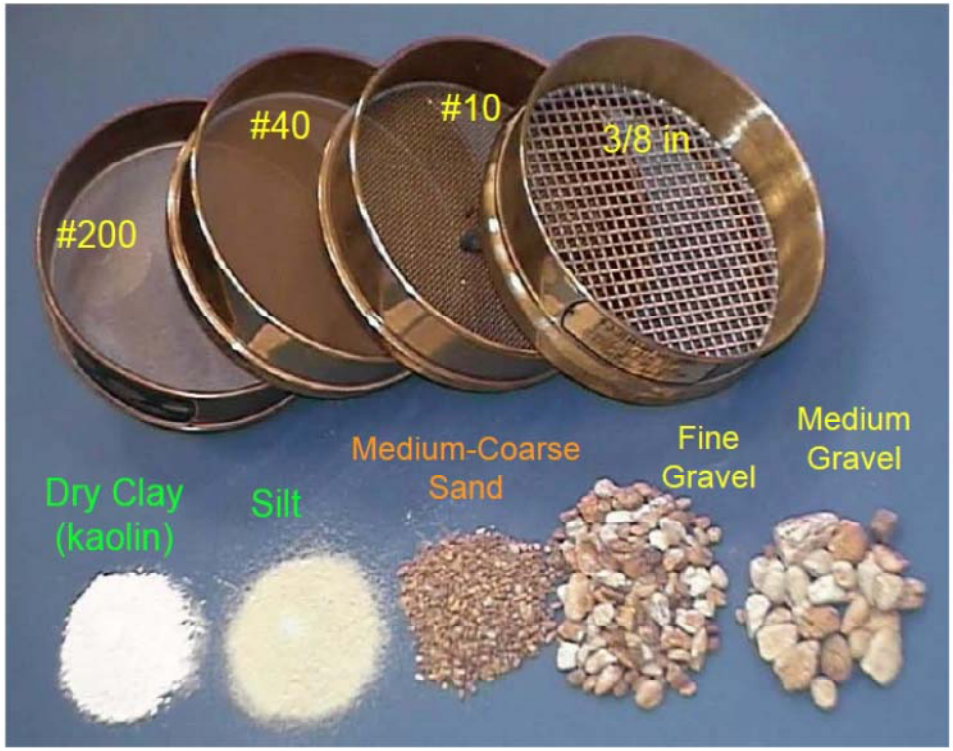


    - Soil washing potential if contaminant only partially separate by soil size



Soil Size Analysis

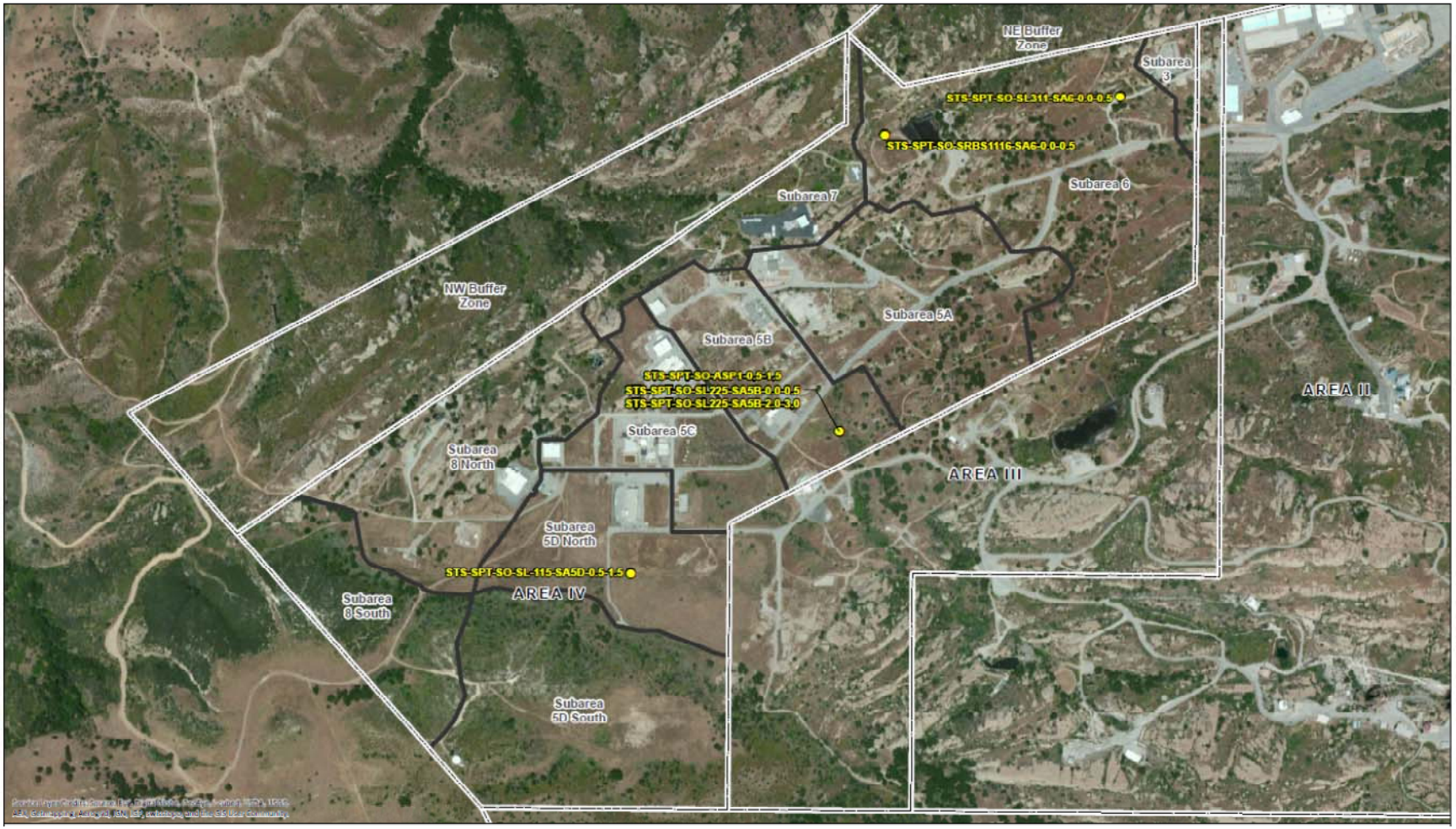
Size Fractions



Source: FHWA NH1-01-031

Description	Size (mm)
Gravel	>2.0
Coarse Sand	0.50 – 2.0
Medium/Fine Sand	0.075 – 0.50
Silt & Clays (Fines)	<0.075

SPS Sampling Locations



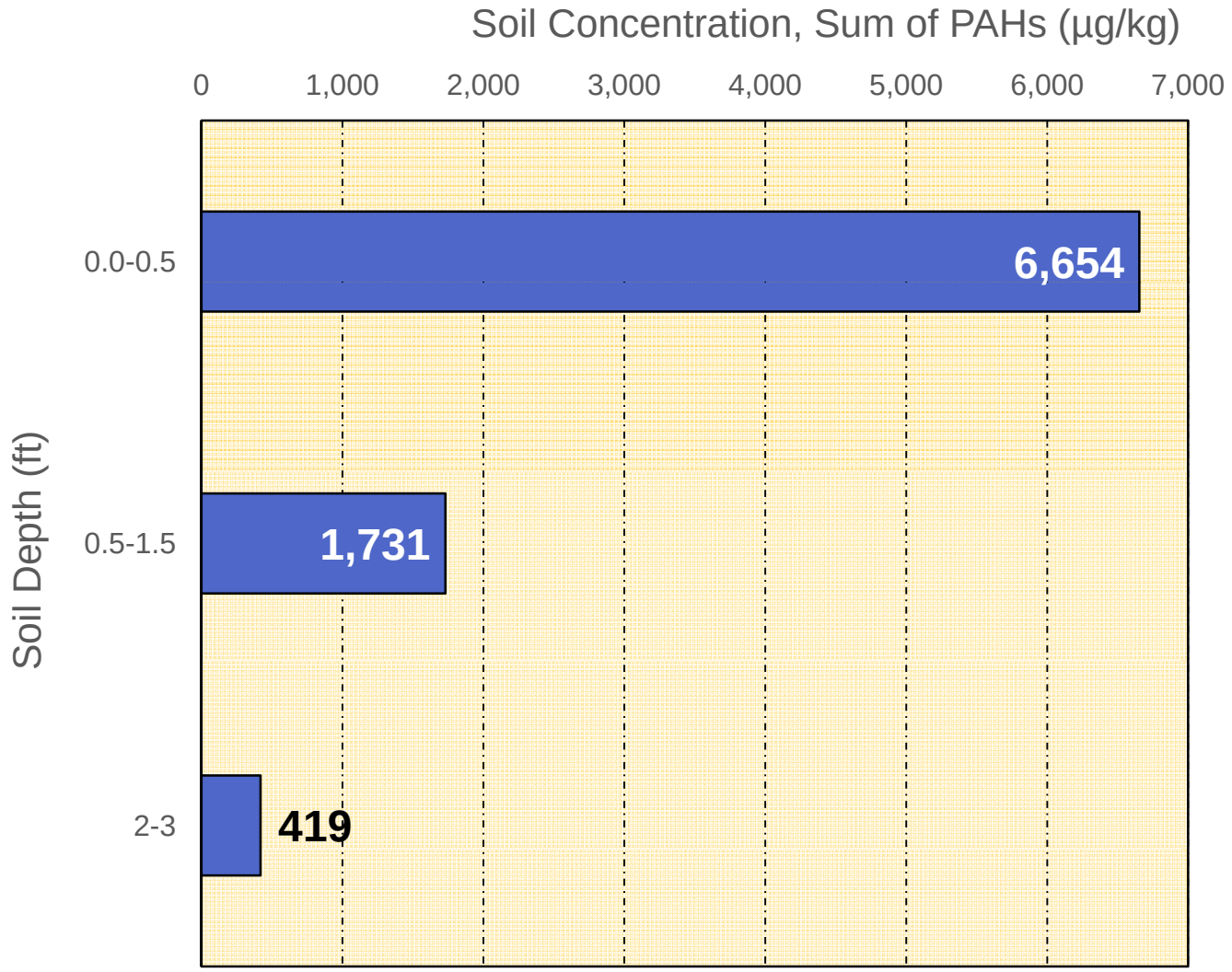
Soil Volume Reduction

- By depth (remove only contaminated soil layers)
- Separate contaminated soil size fractions

Contaminant Depth Profile - PAHs

SL-225-SA5B

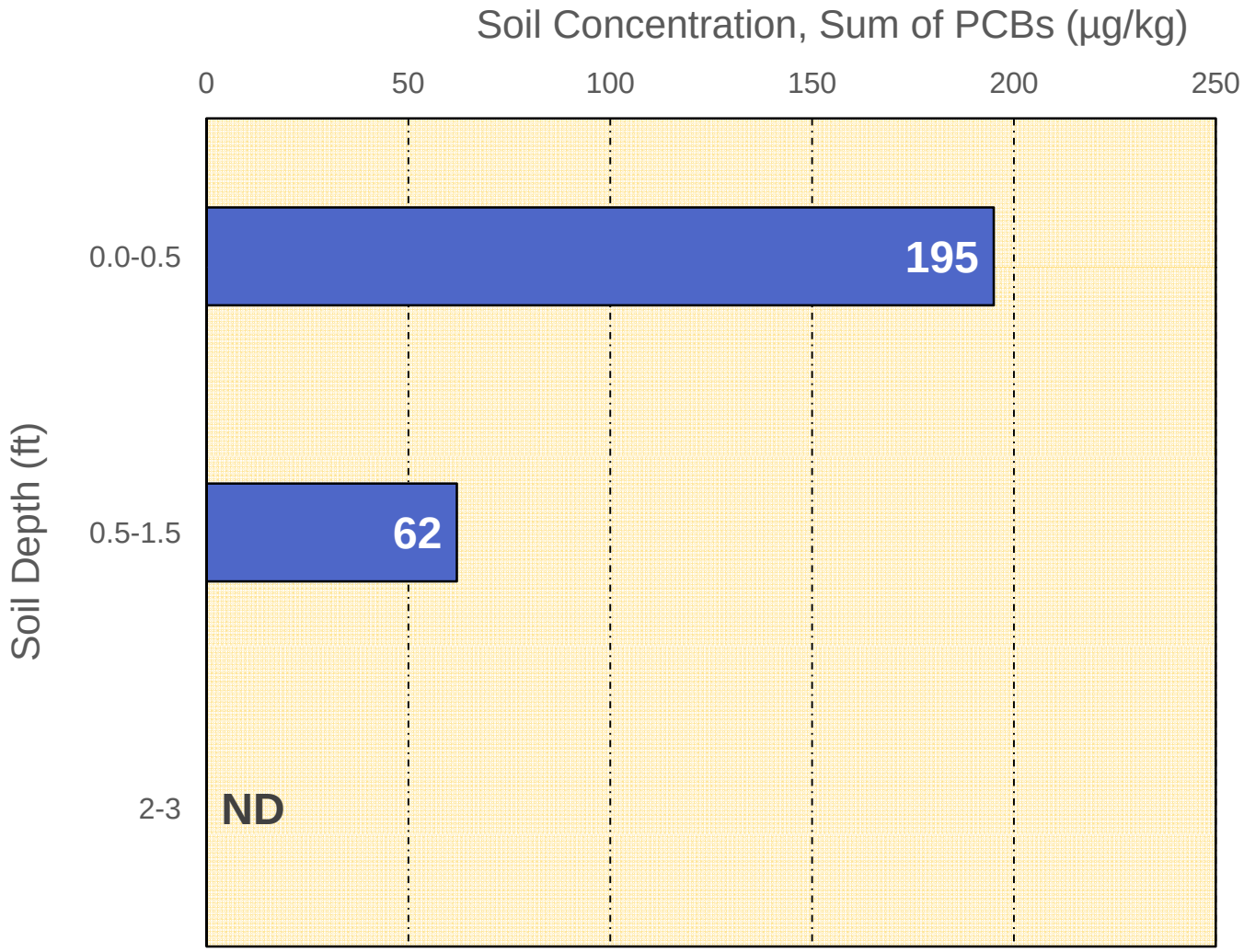
- Acenaphthene
- Acenaphthylene
- Anthracene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- Chrysene
- Dibenzo(a,h)anthracene
- Fluoranthene
- Fluorene
- Indeno(1,2,3-CD)Pyrene
- Naphthalene
- Phenanthrene
- Pyrene
- 1-Methylnaphthalene
- 2-Methylnaphthalene



Contaminant Depth Profile - PCBs

SL-225-SA5B

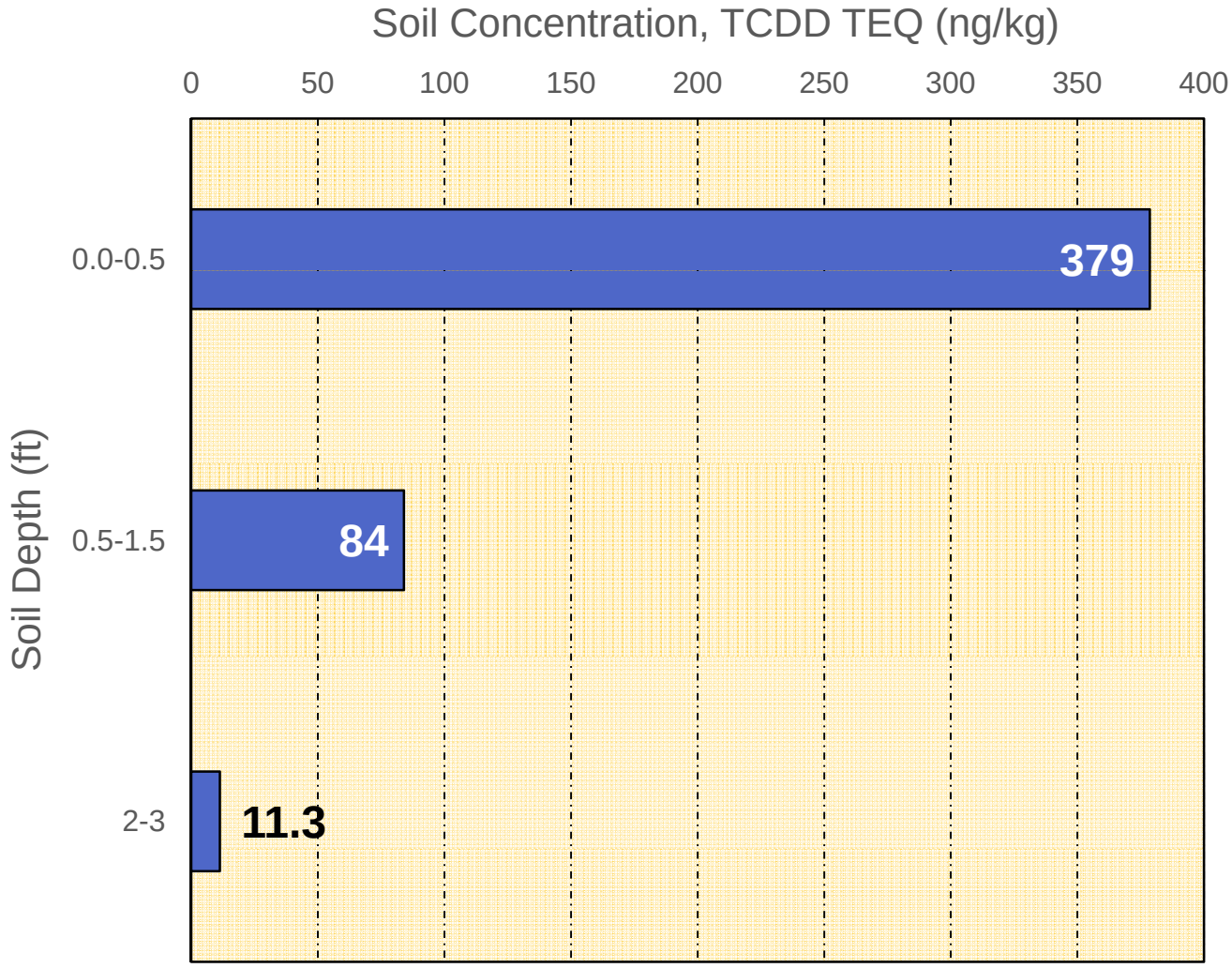
- Aroclor 1016
- Aroclor 1221
- Aroclor 1232
- Aroclor 1242
- Aroclor 1248
- Aroclor 1254
- Aroclor 1260
- Aroclor 1262
- Aroclor 1268
- Aroclor 5432
- Aroclor 5442
- Aroclor 5460



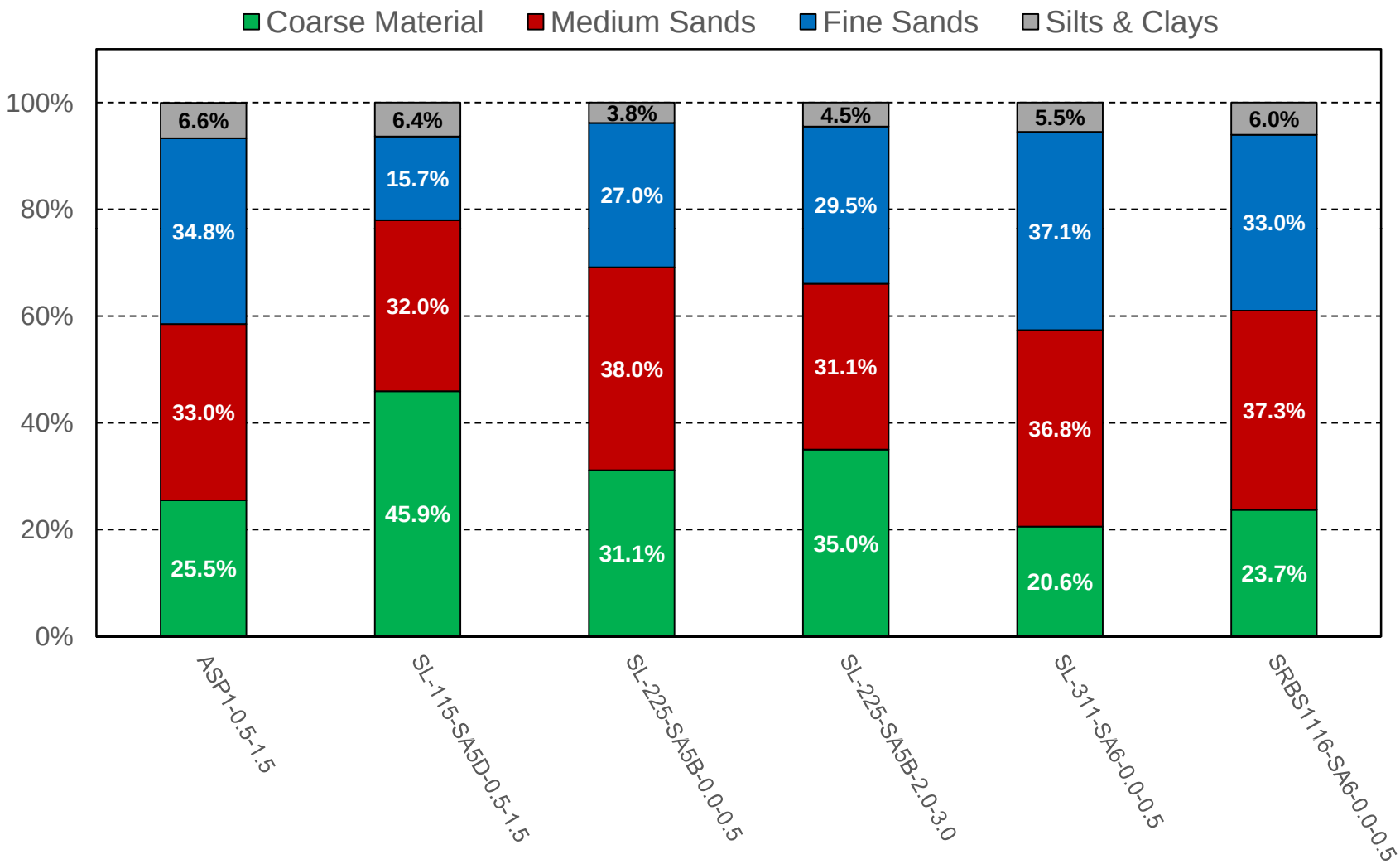
Contaminant Depth Profile – Dioxins/Furans

SL-225-SA5B

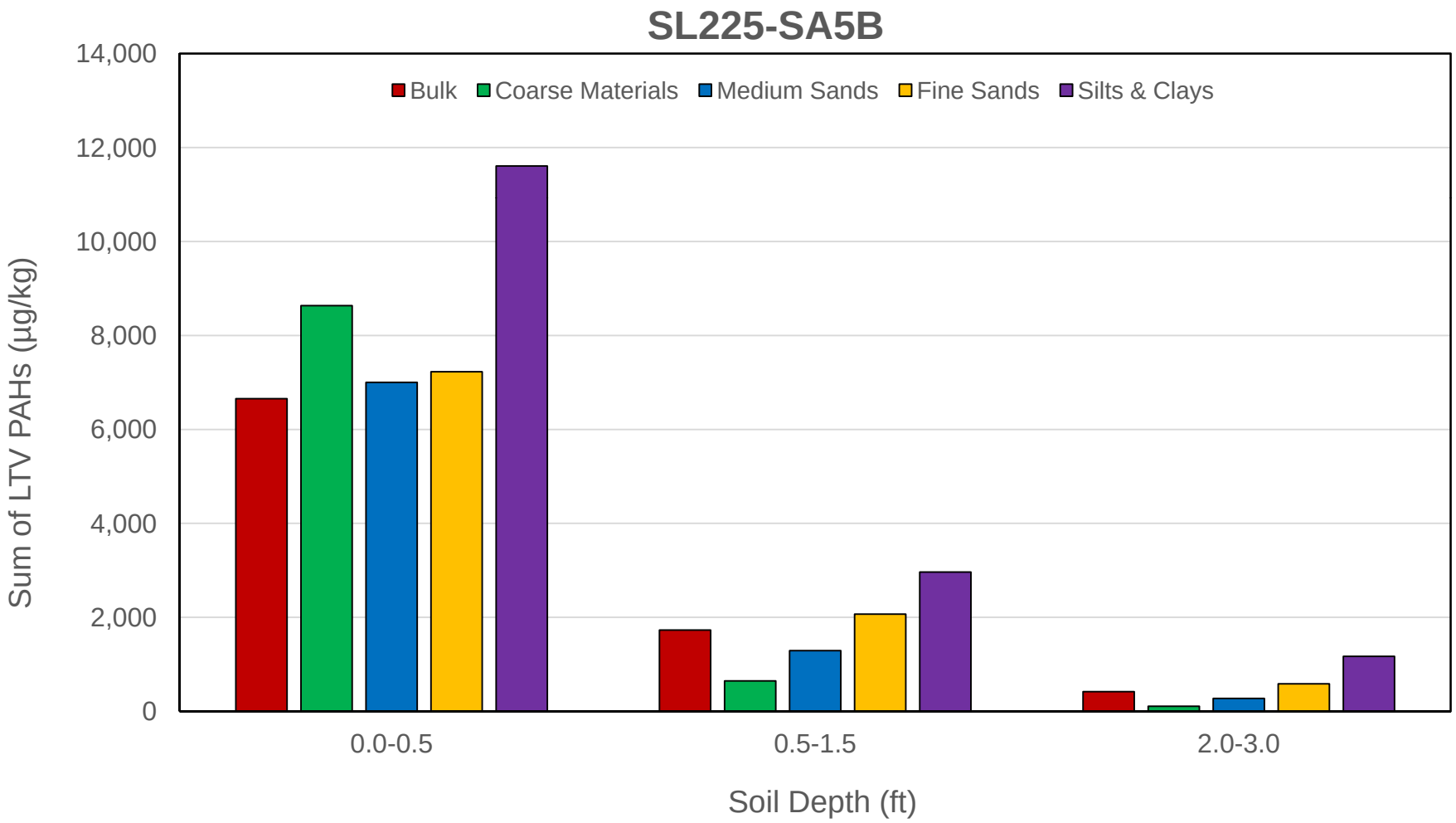
1,2,3,4,6,7,8-HpCDD
1,2,3,4,6,7,8-HpCDF
1,2,3,4,7,8,9-HpCDF
1,2,3,4,7,8-HxCDD
1,2,3,4,7,8-HxCDF
1,2,3,6,7,8-HxCDD
1,2,3,6,7,8-HxCDF
1,2,3,7,8,9-HxCDD
1,2,3,7,8,9-HxCDF
1,2,3,7,8-PeCDD
1,2,3,7,8-PeCDF
2,3,4,6,7,8-HxCDF
2,3,4,7,8-PeCDF
2,3,7,8-TCDD
2,3,7,8-TCDF
OCDD
OCDF



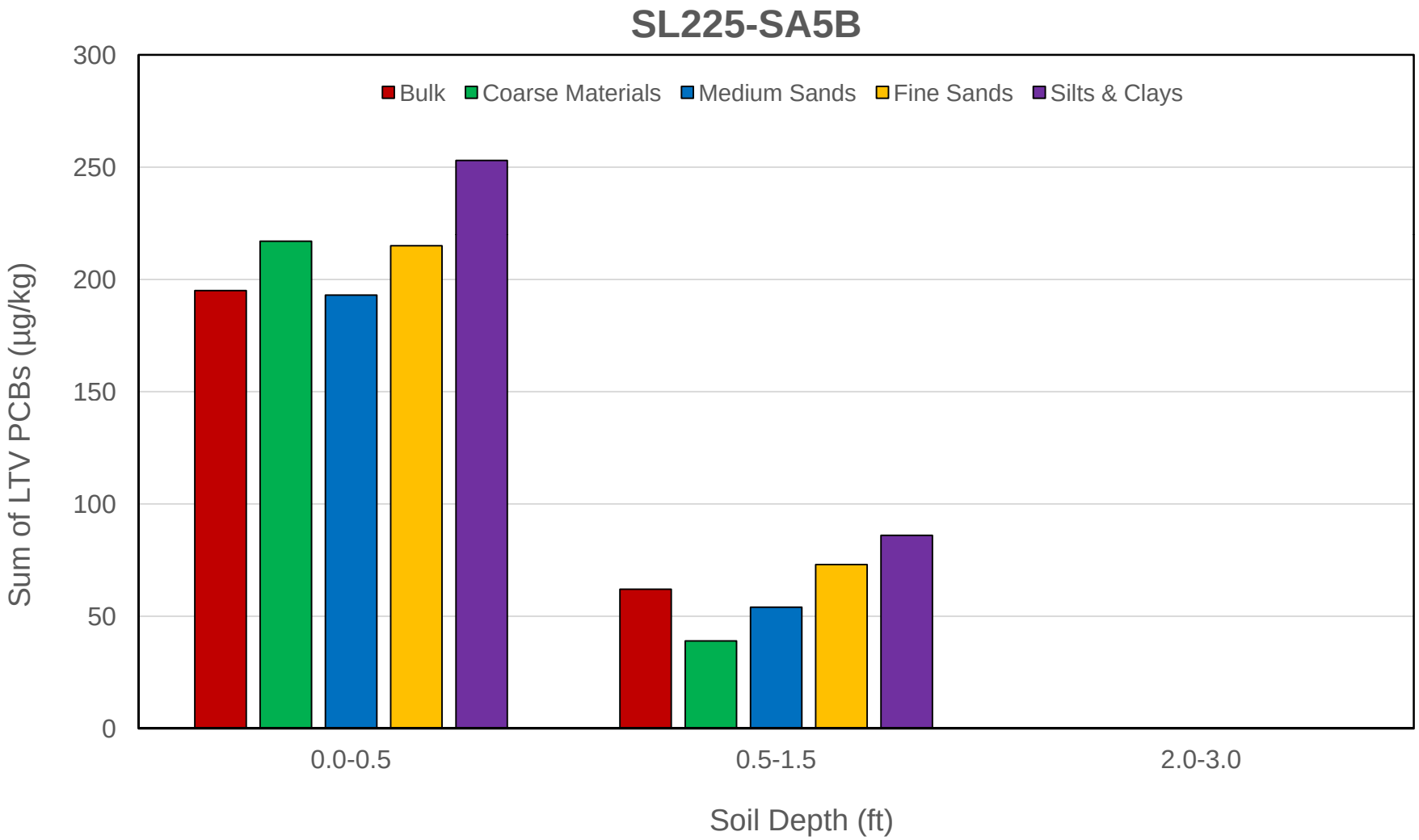
Soil Particle Size Distribution



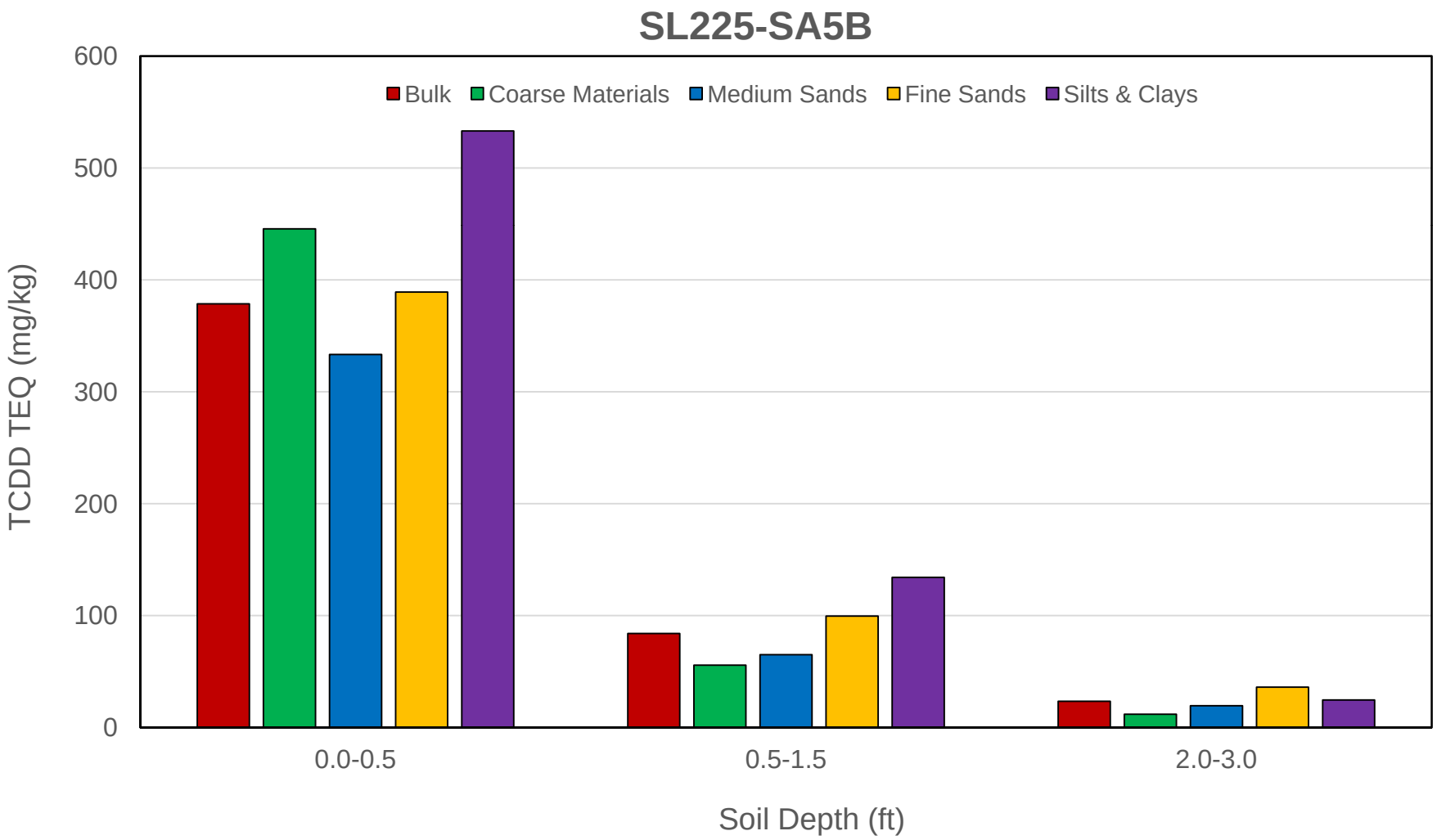
Particle Size Variations - PAHs



Particle Size Variations - PCBs



Particle Size Variations – TCDD TEQ



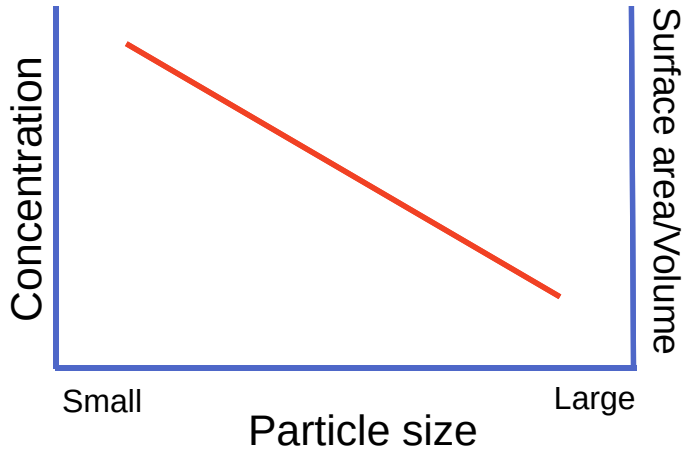
Assessment*

- Elevated Contaminants of Concern (exceed LUT Values)
  - Metals in surface soils at a few locations
    - Mercury (SL-115-SA5D, SL-225-SA5B, SL-1116-SA6)
    - Silver (SL-225-SA5B, SL-311-SA6)
    - Zinc (SL-225-SA5B)
  - PAHs – all locations (varies by depth)
  - PCBs – all locations, surface soils only (data for SL-115-SA5D-0.5-1.5 missing)
  - Dioxins – all locations

*Based on STS soil sampling only

Assessment*

- Soil Type
  - Dominated by coarse material, sands
    - Coarse materials (>2.0 mm) – 25 to 45%
    - Medium sands (0.425-2.0 mm) – 30 to 40%
    - Fine sands (0.075- 0.425 mm) – 20 to 40%
    - Silts and clays (<0.075 mm) – <7%
  - Concentration increases with decreasing particle size



*Based on STS soil sampling only

Assessment*

- Volume Reduction Potential
  - Reducing the removal depth of contaminated soil for offsite disposal or onsite treatment may be possible. Contaminant concentration decreases with depth.
  - Potential for volume reduction via size separation is minimal. Elevated contaminants (>LUT Values) are found in almost all soil size fractions.
- Onsite Treatment - Ex Situ Soil Washing
  - Potentially applicable due to dominance of coarse material and sands, but requires extractant wash testing to assess.
  - Plans to conduct extractant testing were developed, but not implemented.
  - Positive bioremediation/phytoremediation are indicative of desorption potential.

*Based on STS soil sampling only

SPS Summary*

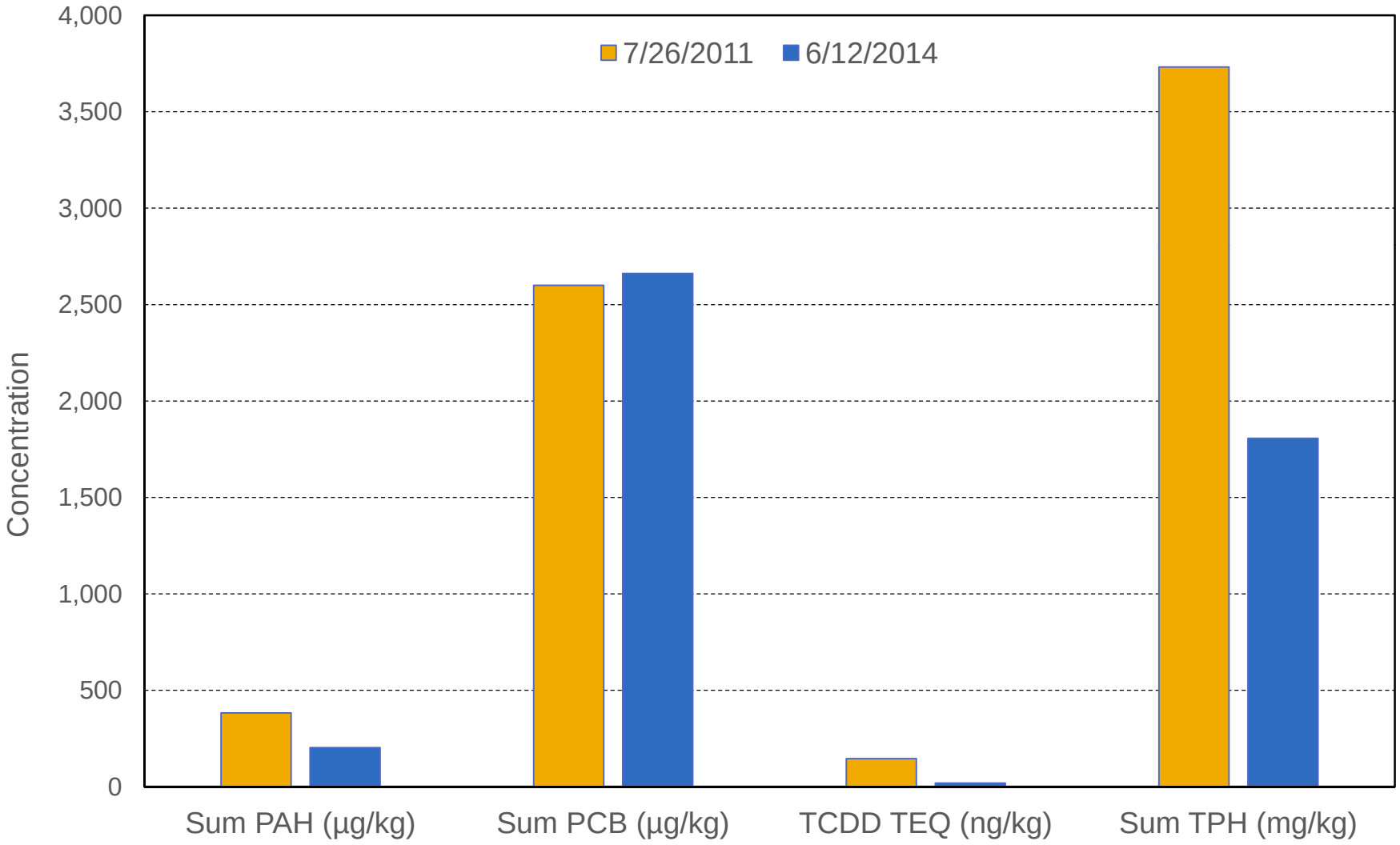
- Dominant contaminants exceeding LUT Values are PAHs, PCBs, and dioxins/furans with a few metals.
- Contaminant concentrations are highest at the surface and decrease with depth below ground surface.
- Soil volumes excavated for ex situ treatment/disposal may be limited to upper surface soil layers.
- Soil size partitioning will not yield any appreciable additional volume reduction for ex situ treatment/disposal.
- Soil washing onsite may be an alternative to offsite hauling. Additional study is required to assess the potential.

*Based on STS soil sampling only

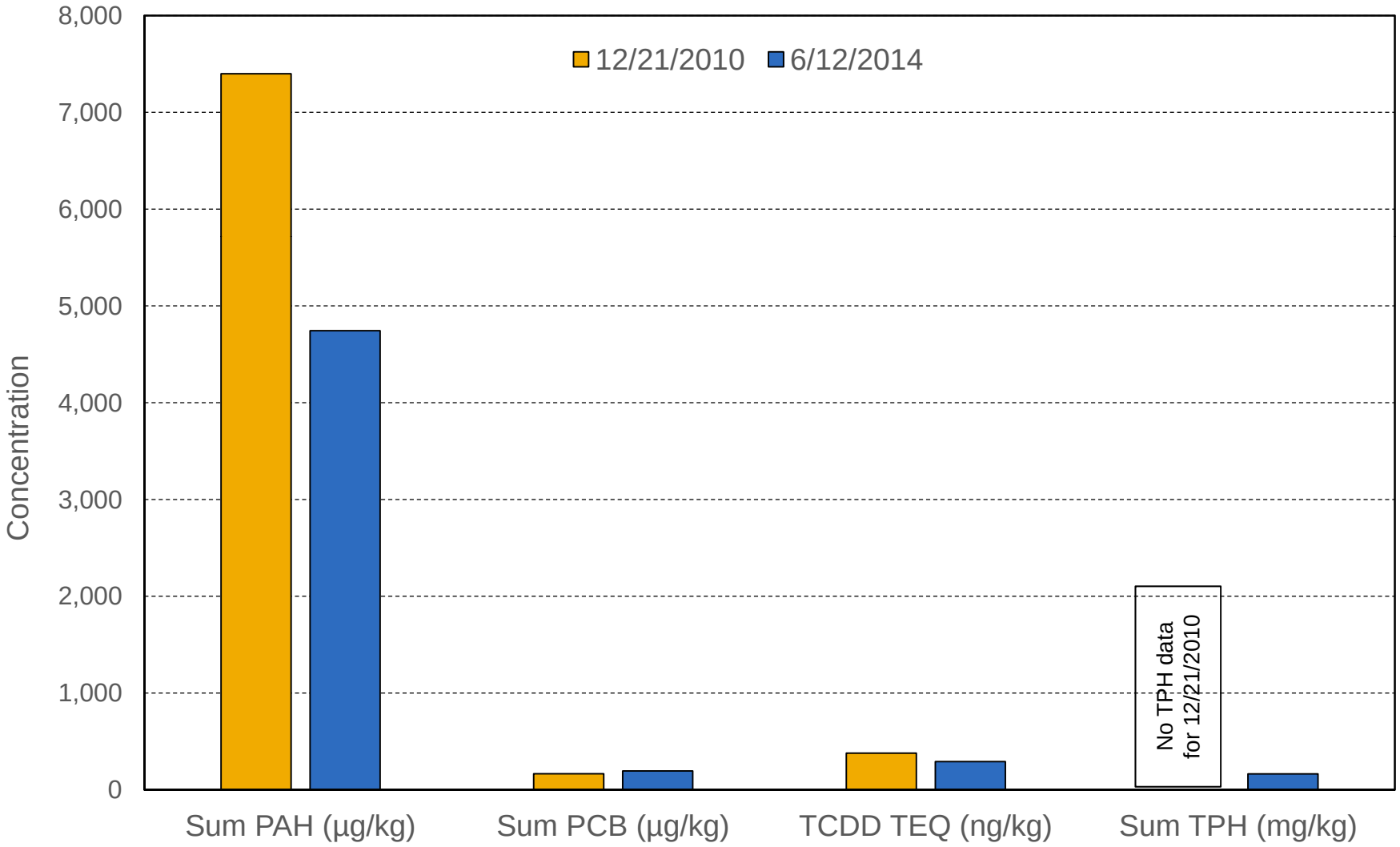
Observed Changes with Time

- Three sampling locations and depths for the soil partitioning study collected in coincide with the same sampling locations used for the chemical survey study.
- The time difference between sampling is 3 to 3.5 years.
  - SL-311-SA6-0.0-0.5 (July 26, 2011 and June 12, 2014)
  - SL-225-SA5B-0.0-0.5 (December 21, 2010 and June 12, 2014)
  - SL-225-SA5B-2.0-3.0 (March 9, 2011 and June 12, 2014)

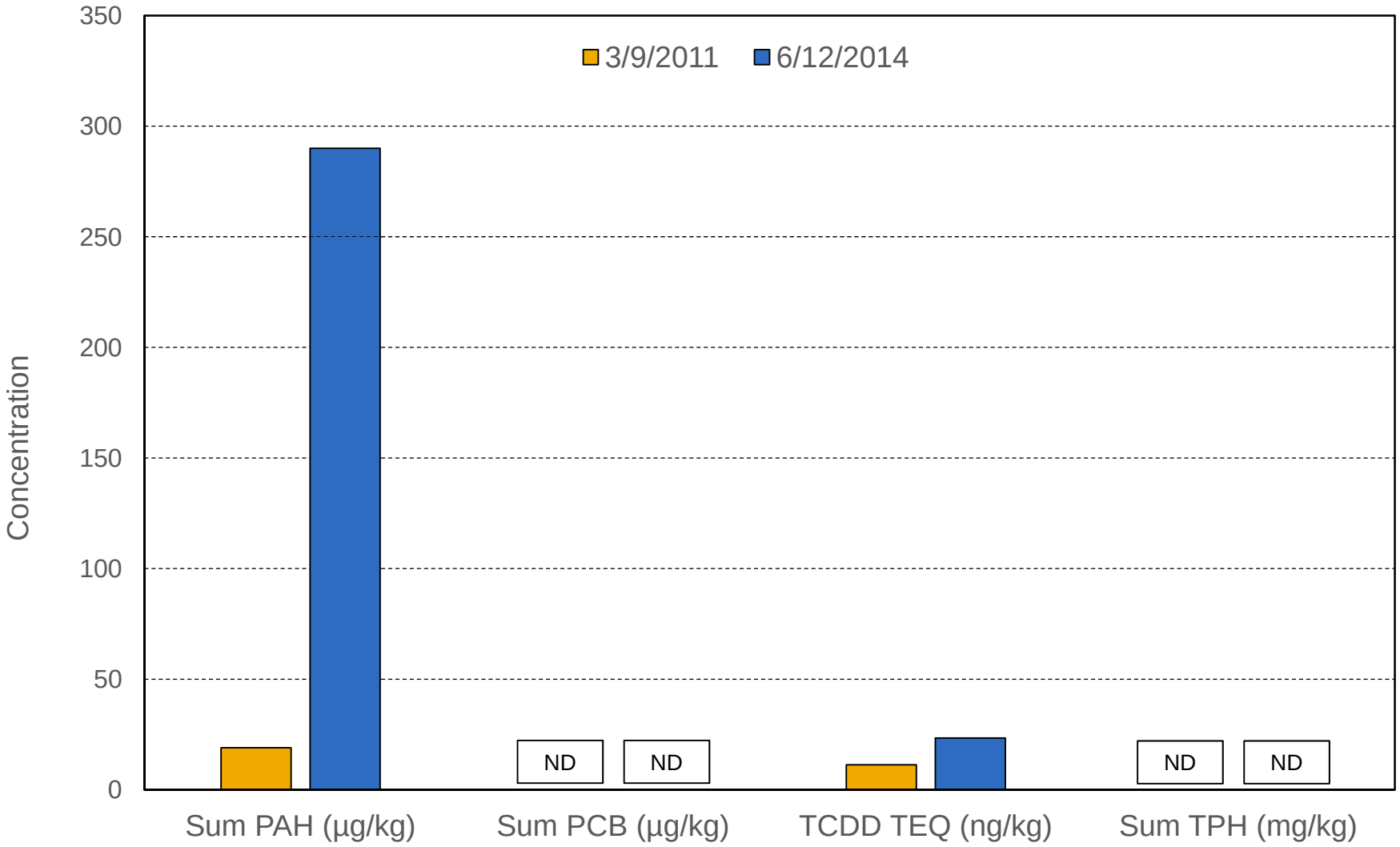
SL-311-SA6, 0.0 to 0.5 ft



SL-225-SA5B, 0.0 to 0.5 ft



SL-225-SA5B, 2.0 to 3.0 ft



Concentration Changes With Time

- Surface soil layer (0.0 to 0.5 ft)
  - PAHs, dioxins/furans, and petroleum hydrocarbons have decreased.
  - PCBs have remained steady over time in the surface soil layers.
- Subsurface soil layer (2.0 to 3.0 ft)
  - PAHs and dioxins/furans have increased.
  - PCBs and petroleum hydrocarbons remain below the detection limits.
- Speculation
  - Biological degradation or other degradative processes may be occurring in surface layers.
  - Transport of contaminants towards the groundwater may be occurring due to natural weathering.

Thank you.

Questions