College of Engineering
CAL POLY

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Phytoremediation Soil Treatability Study

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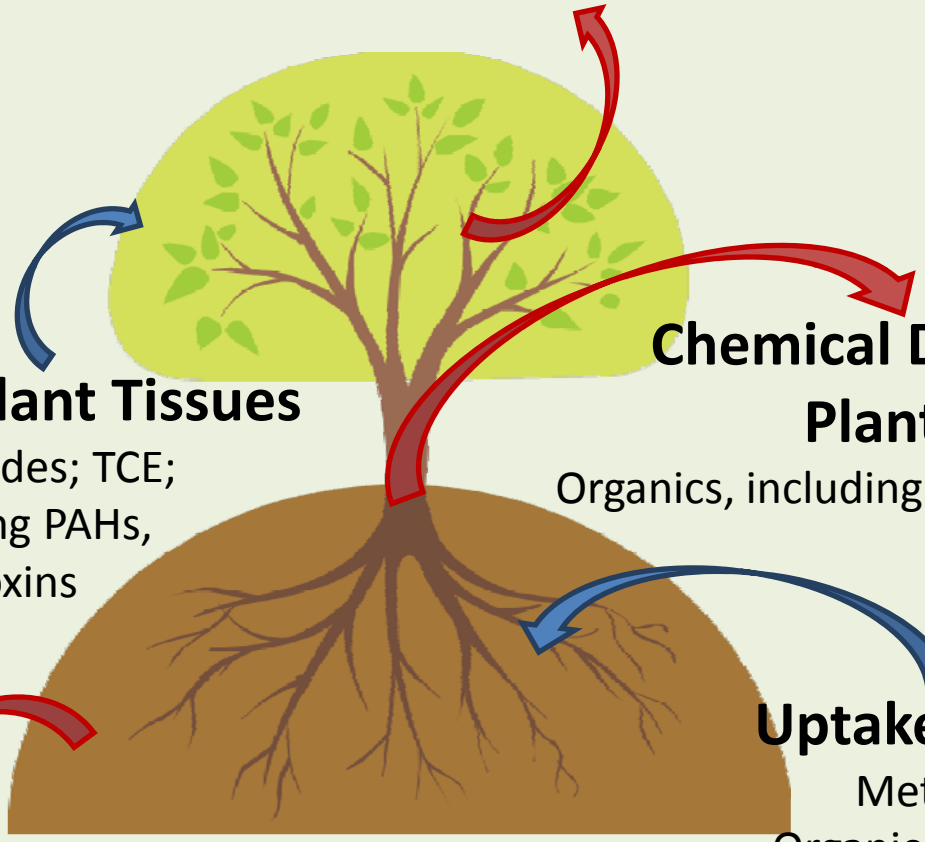
How Does Phytoremediation Work?

Volatilization and Transpiration into the Atmosphere

Mercury; TCE; Organics, possibly including PAHS, PCBs, and dioxins



Accumulation in Plant Tissues

Metals; Radionuclides; TCE; Organics, including PAHs, PCBs, and dioxins

Chemical Degradation in Plant Tissues

Organics, including PAHs, PCBs, and dioxins

Uptake in the Root Zone

Metals; Radionuclides; Organics, including PAHs, PCBs, and dioxins

Chemical Degradation in the Root Zone: Microbial Degradation

Organics, including PAHs, PCBs, and dioxins

Phytoremediation Objectives

Phase I: Field Study

- Identify & Select Potential Plant Species

→ Collect plants from field site
& analyze for contaminant uptake

Phase II: Controlled-Growth Study

- Determine Mechanism(s) of Phytoremediation
- Estimate Remediation Rates

→ Grow candidate plants in controlled experiments
& measure uptake/volatilization/degradation

Phytoremediation Research Plan

Phase I: Identify Suitable Plant Species

- **Collect plant tissue samples from plants currently growing at Area IV to ascertain contaminant uptake**

- **Analyze plant tissues for metals, dioxins, PAHs, PCBs/PCTs, and TPH**

Sampling of both native & naturalized species

Phytoremediation using best native or naturalized remediators

Restoration later using local natives only

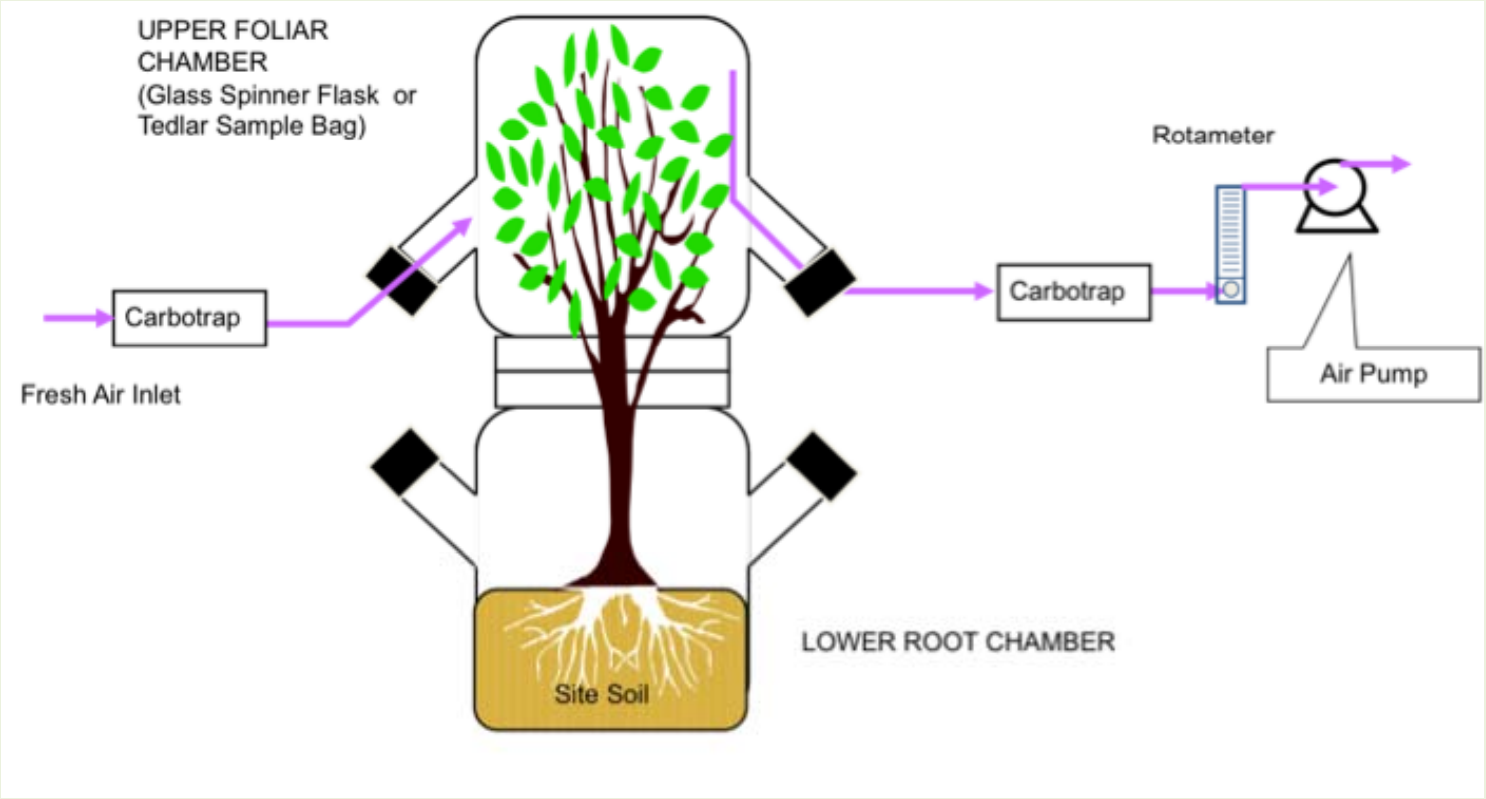
Potential SSFL Plant Species for Phytoremediation

Species	Metals	Dioxins	PAHs	PCBs	PCTs	Petroleum
Mustards	●					
Legumes			●	●	●	●
Sunflowers	●					
Cottonwoods		●				
Willows				●	●	
Grasses *Barley*	●					
Brome	●					
Fescue	*?*		●	●	●	●
Wildrye	*?*		●	●	●	●
Needlegrass	*?*		*?*	*?*	*?*	*?*

Proposed Analytical Methods

Analyte	Analytical Method	
	Soil matrix	**Plant tissue matrix**
Dioxin/PCB	EPA 1613B	EPA 1613B/1668C
TPH (DRO and GRO)	EPA 8015B/C/D	GC/FID
Metals	EPA 6010C/6020A/7471A	ICP/HRMS
Mercury	Cold Vapor AA	Cold Vapor AA
PAHs	EPA 8270C/D SIM	GC/HRMS
PCBs	EPA 8082A	EPA 8082A

Phase II: Assessment of Remediation Potential using Controlled-Growth Experiments

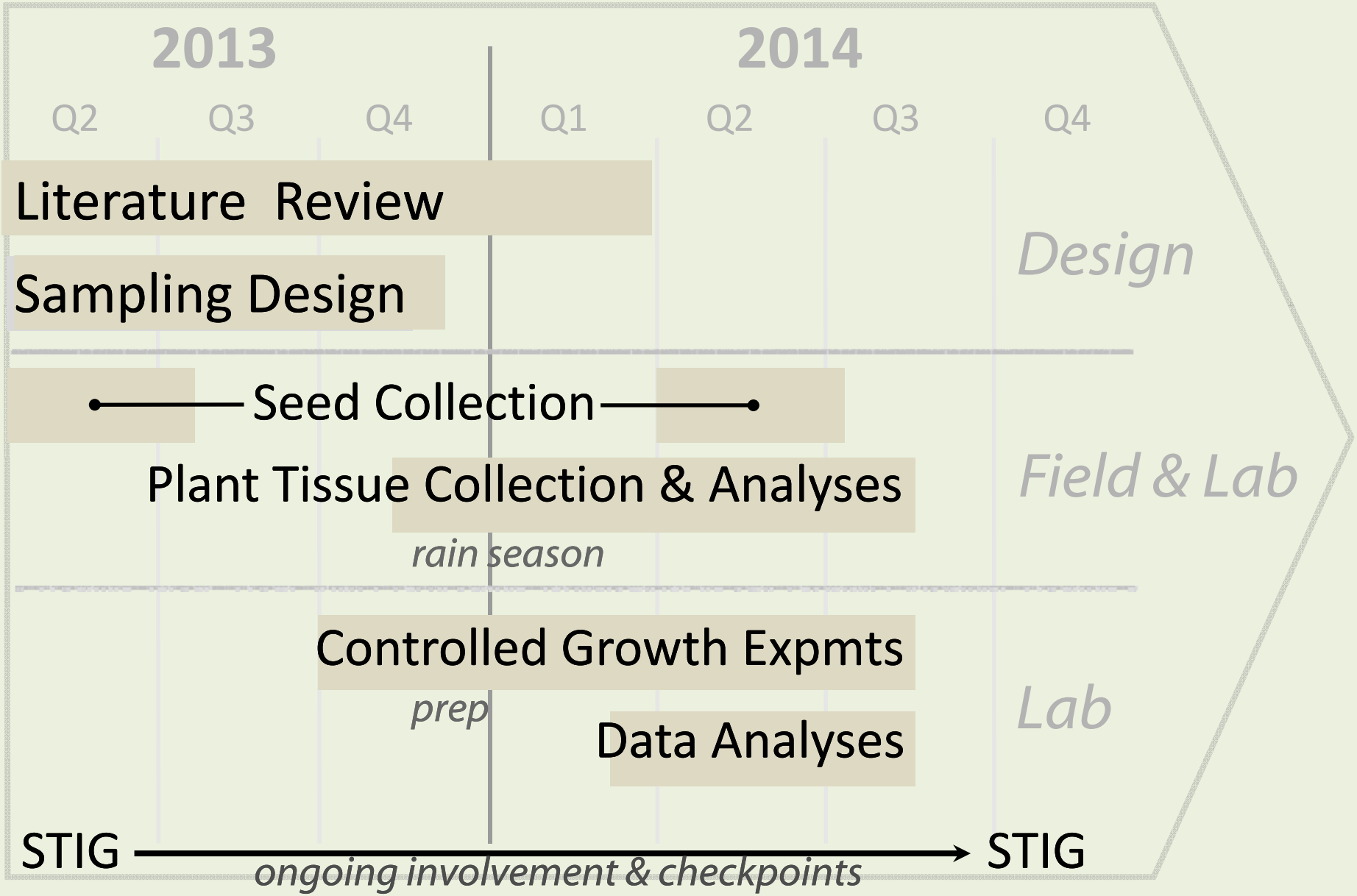


Controlled-Growth Experiments

1. **Determine the Mechanism of Phytoremediation**
   - Measure potential volatilization of contaminants
   - Measure soil contaminant concentration changes
   - Run controls with soil bacteria/fungi killed
   - Examine mercury conversion?

2. **Determine Remediation Rates**
   - Estimate from change in soil contaminant concentrations
   - Can nutrients/additives stimulate/increase phytoremediation rates?

SSFL Phytoremediation Timeline



Questions?