Soil Sampling, Risk Mapping & Exposure Prevention

Second Session of a Three Part Series on Soil Quality / Health

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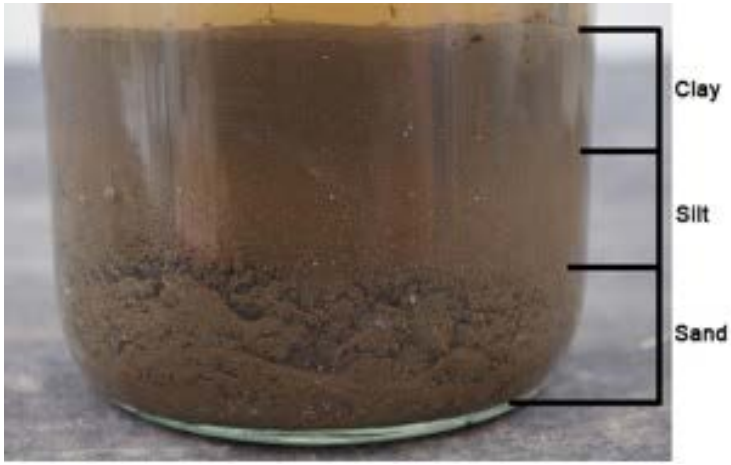
Goal:

Understand Soil Quality to Assess Site-Risk & Manage Soils to Grow Food & Family Safely

Objective:

Provide Soil Testing & Best Practice Guidance to ↑ Informed Decision Making that ↓ Risk of Soil Contaminant Exposure

Why should you care about your soil?



Soil Quality

→ How Your Crops Grow!!!

Some Soils Are Easy To Improve:

Plants Grow Best With Proper Nutrients/Structure/Composition/pH

Dont Guess! Test!!

Some Soils are Harder to Improve: If have Contaminants…

Soil Quality Affects Human/Plant Health

→Risk Management: (even in testing)

Home Tests versus Lab Test Results

DIY Home Tests → Basic Info

vs. Lab Tests → Reliability & Precision

Where are Soil Contaminants a Concern?

- Agricultural Lands - Historical Contaminants can Inhibit Plant Growth/Affect Human Health
- Residential Properties - Contaminants could be > Allowable for Human or Plant Health
- Urban Ag/Community Garden Sites –

  Based on Site History/Possibly Several Risks

Common Soil Contaminant Sources

Source:	Contaminant
Paint (before 1978):	lead
High traffic areas:	lead, zinc, PAHs
Treated lumber:	arsenic, chromium, copper
Burning wastes:	PAHs, dioxins
Manures:	copper, zinc
Coal ash:	molybdenum, sulfur
Sewage sludge:	cadmium, copper, zinc, lead, PBTs
Petroleum spills:	PAHs, benzene, toluene, xylene
Commercial / industrial	PAHs, petroleum products, solvents, lead,
site use:	other heavy metals
Pesticides:	lead, arsenic, mercury (historical use),
	chlordane and other chlorinated pesticides

Why are soil contaminants a concern in urban areas?

Contaminants Can:

-Inhibit Plant Growth

-Affect Human Health!

-Persist in Soils Long Term

-Persist without Us Knowing

Sources of Heavy Metal/Lead Exposure

- **Lead paint hazards**

  → lead **dust** in homes; from exterior prep work

  & friction of windows

- **Bare soil** in yards with lead contamination from house paint or previous use of leaded gasoline

- **Take-home** lead dust from construction work or other occupations

How do we get lead into our body while growing food?

- **Hands contaminated with leaded soil**

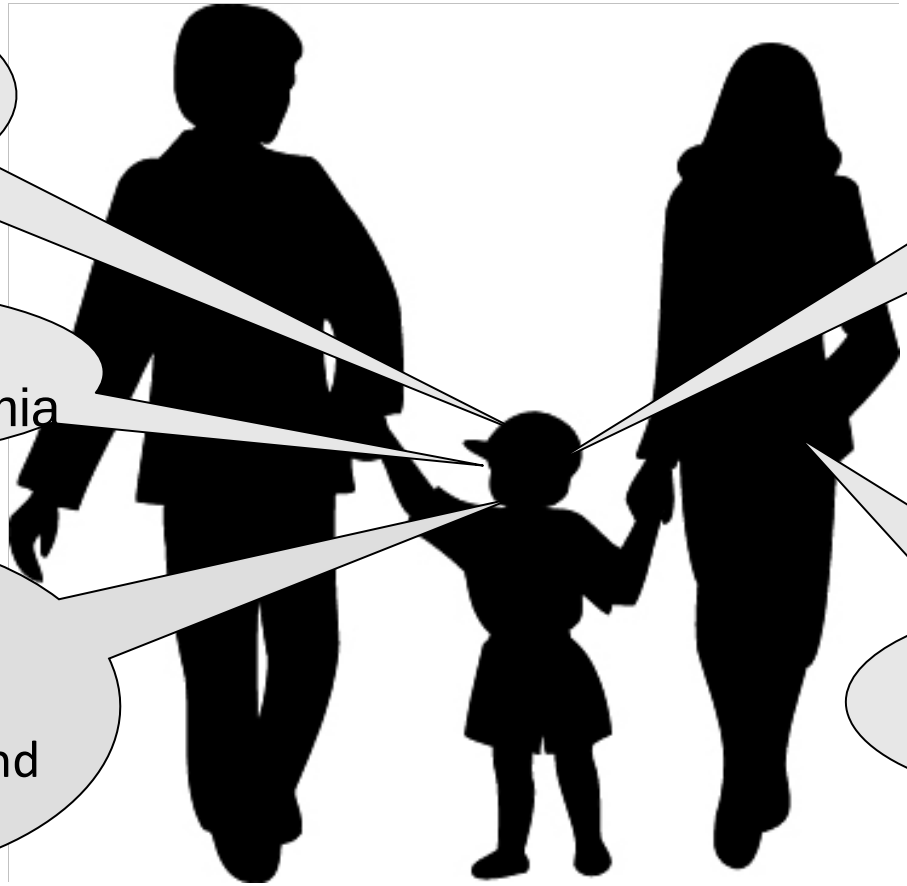
  Contaminated hands touch mouth, food, drink container, cigarette

- **Hands contaminated with leaded paint**

  Hands touch damaged lead paint and its dust. Then hands touch mouth, food, drink container, cigarette, etc.

- **Eating lead-containing soil or paint dust on unwashed produce, or eating produce that has lead uptake**

How Lead Toxicity Affects Health



Children at most risk- their brains & bodies are still developing (& fetus, because lead easily crosses placenta).

Human Exposure Pathways:

→Soils/Dust Ingestion,

→Skin/Eye Contact, Inhalation

→Bare Feet from Garden to Home

Who is impacted?

-Humans/Children/Seniors -Pets

~ Based on Contaminant Concentrations

Plant/Crop-Contaminant Exposure Pathways

Through Plants Roots → Plant Root Uptake

(In Plants=Lab tests) (Plant-Internal/Now what?)

On Plants' Parts/Leaves →Topical

(ALL Plant/Leaf Surfaces (Plant-External/Wash)

=Lab Tests/Not Visible to Naked Eye)

If contamination found, how manage soils?

Use Best management practices based on case.

Best Practices: Recognize Potential Contamination → Know Risks

- **Test Soils: Dont Guess! Research! Investigate! Do Soil Tests!!**

- **Buy Organic Materials Review Institute (OMRI)**
- **Test soils to confirm lead is < 80 ppm**

- **Wear Gloves & Practice Good Hygiene/Boots**
- **Don’t Let Kids Garden/Play in > 80 ppm Soils**

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Best Practices:

Raise Beds	→	Import Clean Soils/Make & Use Compost
Amend with Compost/OM	→	-to Bind Soil Contaminants With Phoshorous & Dilute Contaminants
Mulch	→	-to Prevent Airborne Soil Dust & Prevent Upsplash
Sub-Surface Irrigate	→	-to Prevent Upsplash/Spreading Particles

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Best Practices:

Adjust pH	→	Neutral pH → Optimal Growth/Nutrition
Promote Good Drainage	→	-Soil Contaminants Concentrate @ Slopes-Bottoms/Allow H20 Infiltration
Post-Harvest	→	-Soak in Vinegar/Wash Produce & Peel Root Crops
Manage Inputs	→	-Avoid Waste-Derived Fertilizers

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Where to start?

Understand/Interpret:

- Site History
- Soil Test
- Remediation versus

  Best Management Practices

Observe Plant Growth/Soil Orgs/Debris

- **Dig test, Soil Structure Tests.**

Site History→ What to Look For:

- Public Access Maps (Sanborn)
- Walk around, ask neighbors/property owners, identify other homes in neighborhood that show similar potential hazards
  - Parking lots, auto repair, junkyards, machine shops, dry cleaners, gas stations, concrete plants, illegal dumping sites!!

Every site is different, Soils vary too…

Ask Yourself….:

Are there plants currently growing?

- **Is the soil easy to dig into?**
- **Are you finding any micro organisms in the soil? (worms, insects, larvae)**
- **Do you come across any debris or trash?**
- **Consider a Bean Test: plant in testing site soil, and compare growth with potting soil.**

Mapping Your Food Growing Site

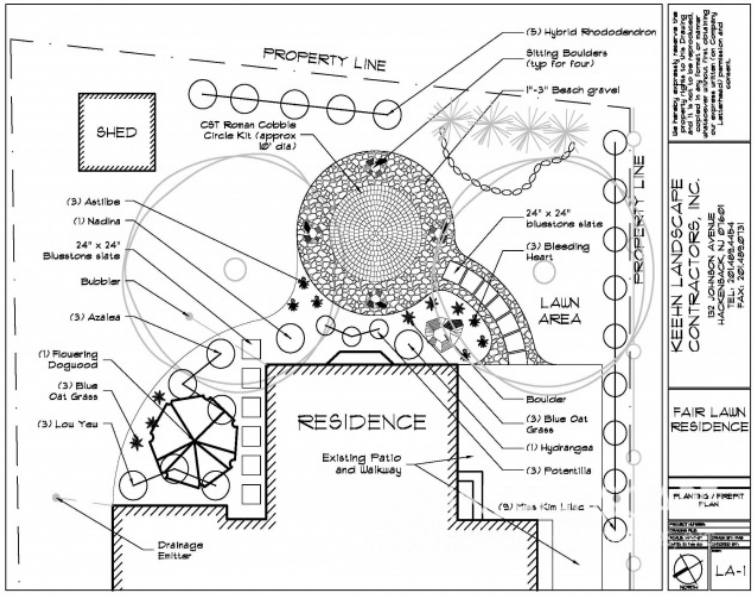
- Areas that show differences in plant growth should be sampled separately
  - Peeling paint, evidence of contamination
- 5-6 samples per area (top 4-6 inches of soil)
  - Decomposing foliage should not be included
  - Keep accurate notations per site-area
  - Each distinct area should be sampled

Mapping your Site for Soil Tests

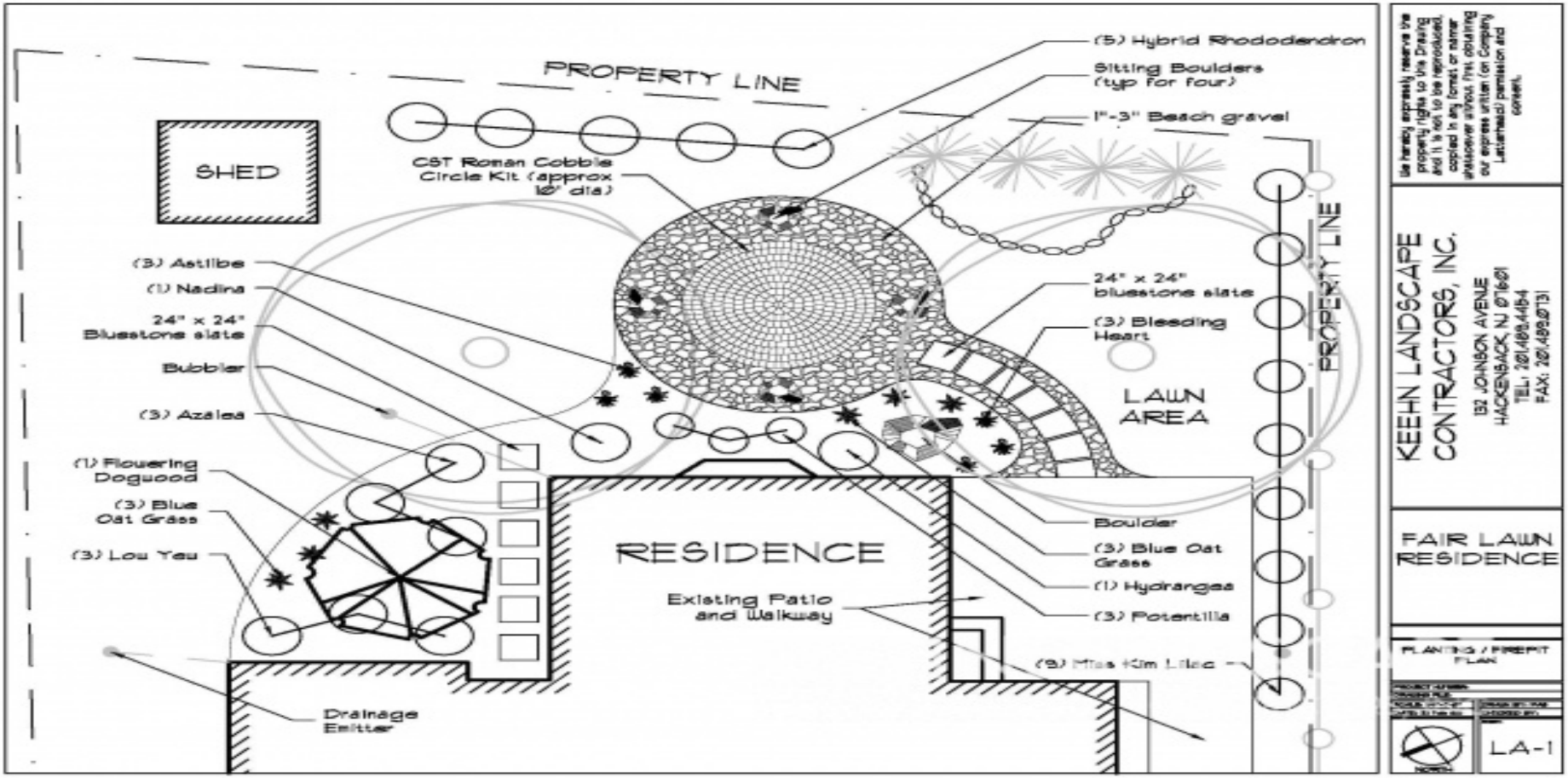
Make Maps with Notes for Different Sample-Site Locations

Ex: Front/Back/Side Yard Sample Maps

Map your Garden Based on Planting Areas (Exs: veggies, native perennials, fruit trees, etc…)

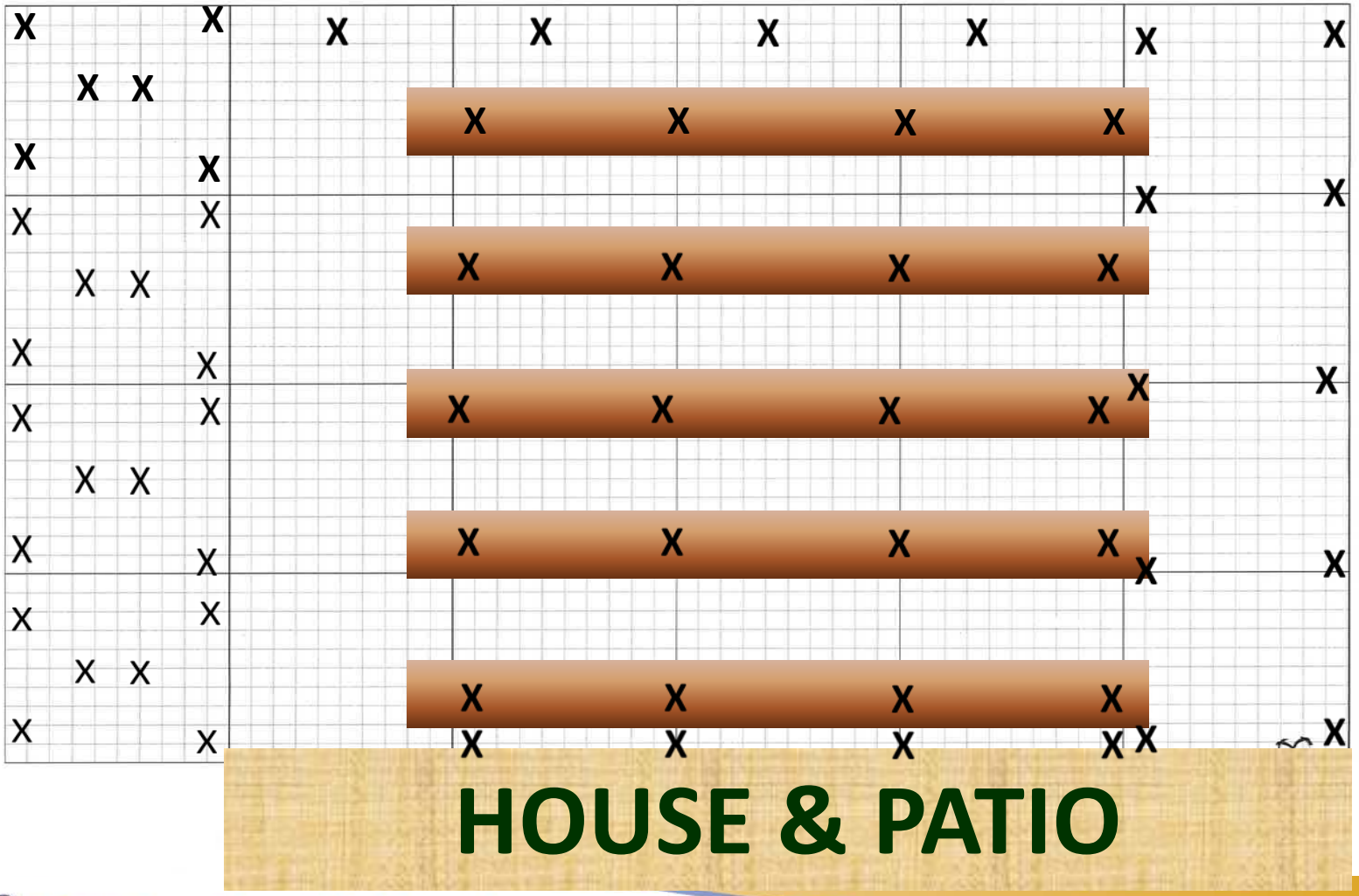


Map Your Growing Site



GAS STATION or DRY CLEANERS

Example of Soils Sampling Map



Soil Testing

See UCCE Contra Costa/Alameda Master Gardeners

Growing Your Own Food Web Page(s)

for Analytical Laboratories for Soil Testing

EPA Suggests Urban Garden Soils should Be Tested for: -pH -% organic matter

-Nutrients -Heavy Metals/Petro-/Dioxins (based on site history including lead)

How Should Samples Be Collected?

Sampling Strategy ~ Site Conditions

- **Sampling Soil Surface? Top 2”**
- **Sampling Food Growing Site? Top 6-12”**
- **For Both, <u>Make a Composite Sample.</u>**
- **<u>Mix/Remove Sub-Sampled for Testing.</u>**

Sample Preparation

- Map Sample Spots
- Collect/Mix Composite Sample
- Dry
- Sift
- Remove and Bag Test Sample
- Send/Deliver

Sampling Your Soil

- Use clean equipment!
- If toxins found, test sub-samples by sample area

  AGAIN!!!

- Sample depth based on plant material
  - Veggies 1-12 inches
  - Turf 1-6 inches
  - Shrubs, roses 1-12 inches
  - Small Trees 6-18 inches
  - Deep rooted trees 6 to 24-36 inches

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Soil Sampling

- Do not sample under wet conditions/bad for soil structure
- Depending on case, may discard top inch of subsamples
- Remove non-soil materials/Rocks
- Mix subsamples, Send sample in plastic zip-type bag (6-8 cups)
- Label completely! Date, time, weather, slope, vegetation, GPS

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