Environmental Health Study on Synthetic Turf

Emily Wang

Department of Resources Recycling and Recovery

2007 Study

- Playground and track surfaces

2007 Study

- Playground and track surfaces

- Ingestion toxicity
- Skin sensitization
- Groundwater
- Evaluation of injury from falls

2007 Study

- Playground and track surfaces

- **Ingestion toxicity** – below de minimus levels
- **Skin sensitization** - none
- **Groundwater** – minimal risk
- **Evaluation of injury from falls** – many surfaces too thin

2010 Study

- Artificial Turf Fields

2010 Study

- Artificial Turf Fields

- Inhalation risks
- Skin infection risks

2010 Study

- Artificial Turf Fields

- **Inhalation risks** - low
- **Skin infection risks** – less bacteria, more abrasions

Other Studies

- Washington State
- Penn State University
- Connecticut
- Chinese Academy of Sciences
- France
- Norway
- Netherlands

Other Ongoing Studies

- US EPA
- US National Toxicity Program
- E.U.

Knowledge Gaps

- Chemicals found in tire rubber
- Bioaccessibility data
- Biomonitoring

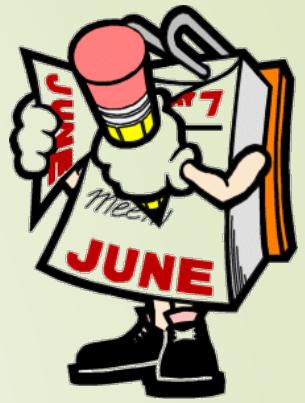
Project Goal: Conduct a human health risk assessment – Is it safe to play on synthetic turf?

Toxicity (Task 4)	X	Exposure (Task 3)	à	Risk & Hazard (Tasks 6&7) "putting the puzzle together"

Study Tasks (July 2015 – Mid 2019)

1. Expert, public, and interagency consultation and input
2. Hazard Identification
3. Exposure Scenario Development
4. Sampling and Analysis of New and In-field Synthetic Turf
5. Personal Monitoring and Biomonitoring Study Protocol Development
6 & 7. Health Assessment from playing on synthetic turf fields and playground mats

Study Timeline



Today

2. Hazard Identification

3. Exposure Study

4. Chemical Analysis, Field Study

5. Biomonitoring/Personal Monitoring Protocol Development

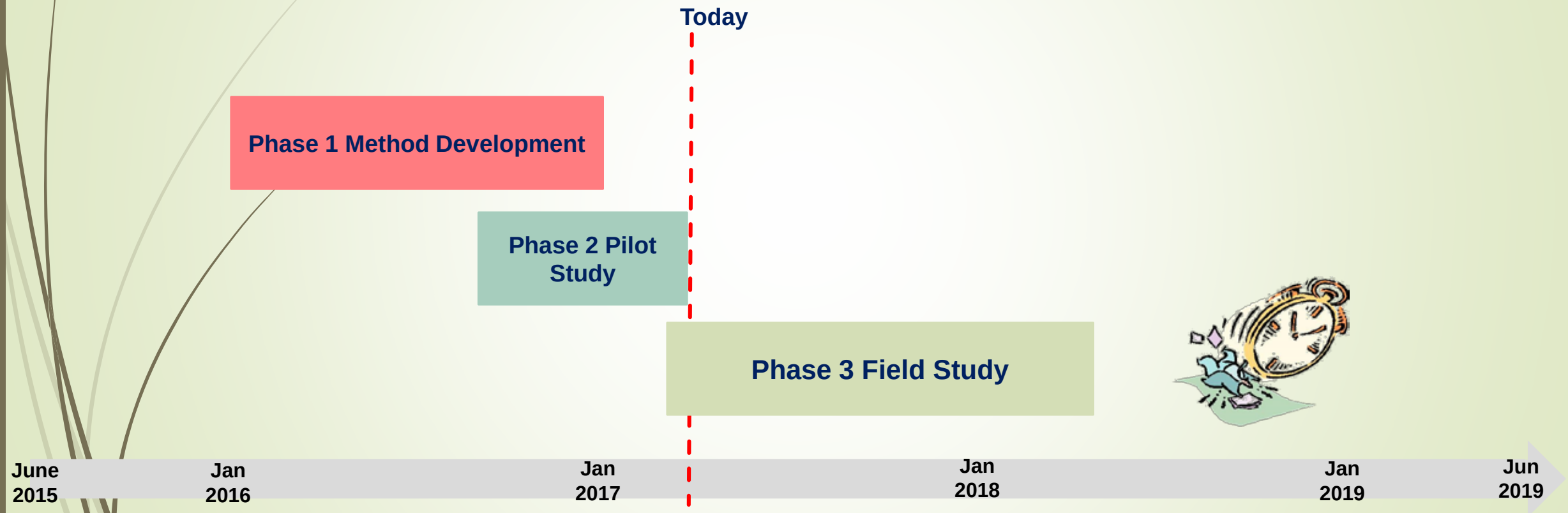
6&7. Human Health Risk Assessment

Jun 2015 | Jan 2016 | Jan 2017 | Jan 2018 | Jan 2019 | Jun 2019

Toxicity

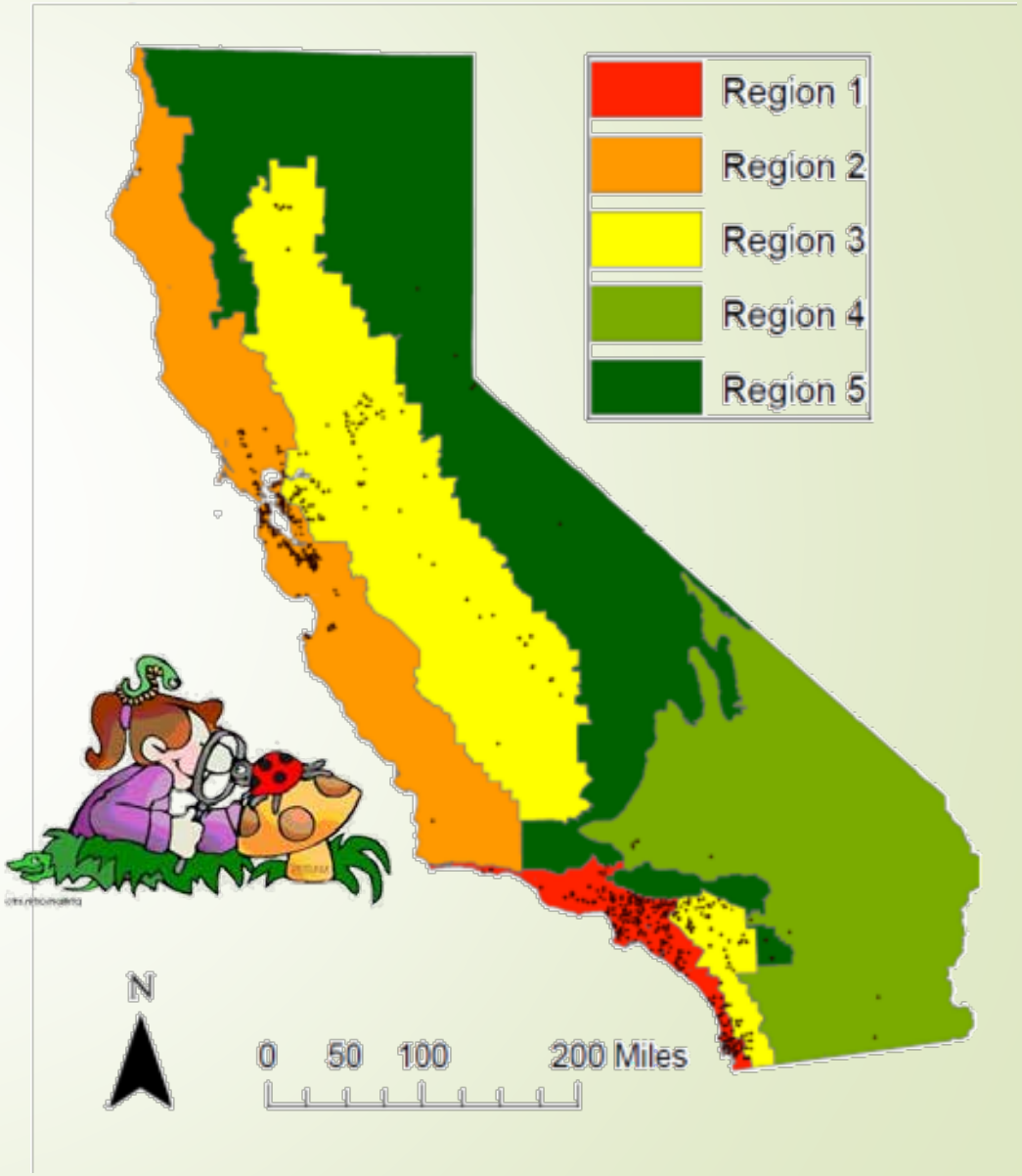
- Field Work, Chemical Analyses and more…

Task 4: Field Study Timeline



Group the Fields

Region	Climate Zones Covered	No. of Fields
1	6 -9: southern coastal areas	376
2	1 - 5: northern and central coastal areas	272
3	10 – 13: southern interior valleys and northern Central Valley	233
4	14 -15: southern high and low deserts	14
5	16: mountainous area	10

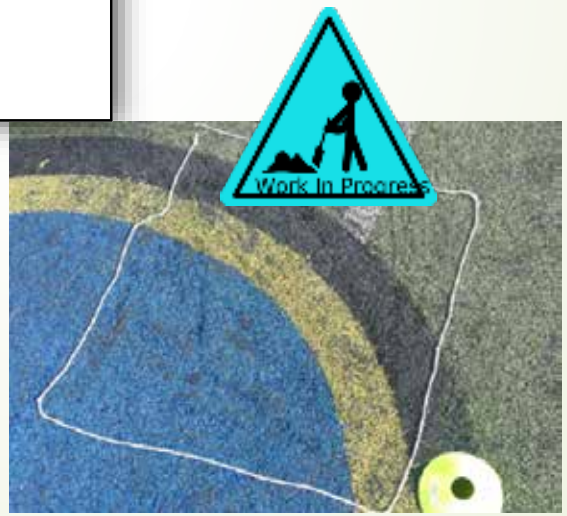


Study the Fields - Pilot

Collect air and particles

Agitate field surface

Collect crumb rubber

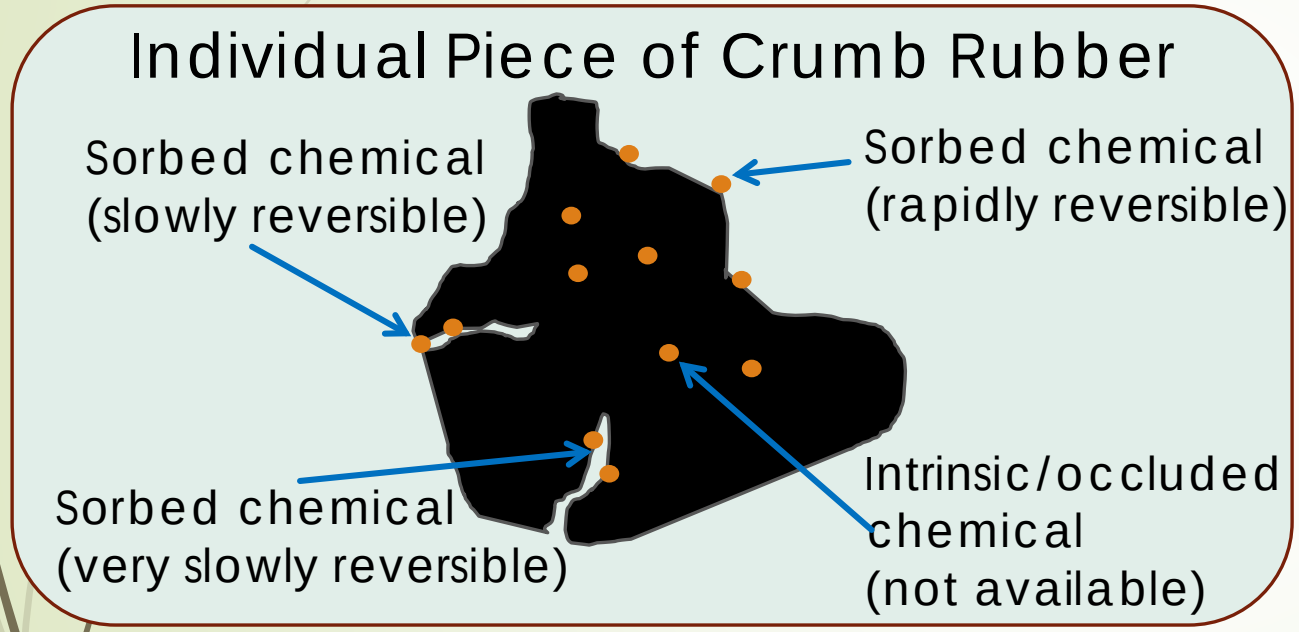


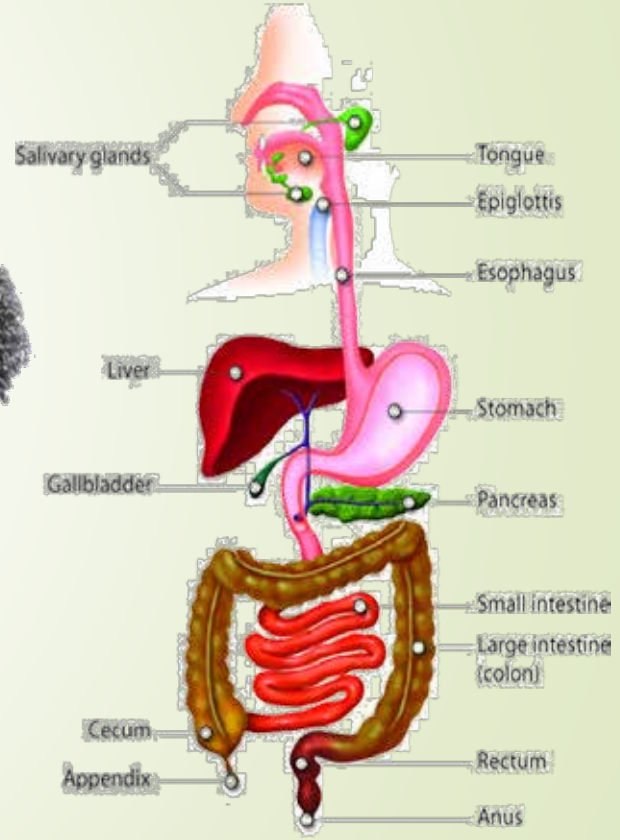
Analyze the Chemicals

1. **Emission Chamber**
   - standard temperature and humidity
   - 41 chemicals detected (VOCs)
2. **Thermal Extraction**
   - 150 and 300 °C
   - identified 53 chemicals (23 new)
   - VOCs and SVOCs
3. **Solvent Extraction**
4. **Biofluid Extraction**
   - 10% methanol/water
   - 1 hr. at room temperature
   - 72 chemicals identified

Understand Bioaccessibility of the Chemicals

Amount of chemical (in e.g. crumb rubber) available for absorption



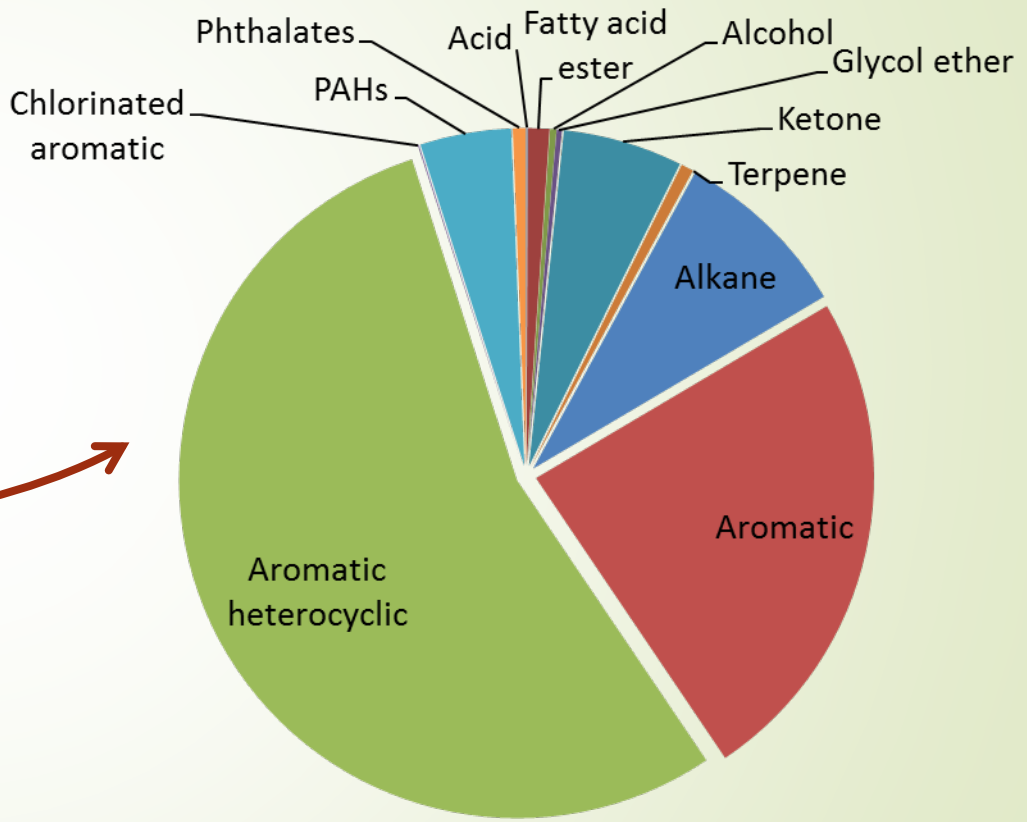


(Semple, Kirk T., et al. "Defining bioavailability and bioaccessibility of contaminated soil and sediment is complicated." *Environmental Science & Technology* 38.12 (2004): 228A-231A.

Simulate Biological Extraction – Pilot Test

1g crumb in 30 mL
10% methanol/water

GC/MS



72 chemicals grouped by class and normalized to area of GC instrument response.

Exposure

- Where, Who, How…?

Understand Exposure

How?

Who?

Where?

Eating

Breathing

Touching

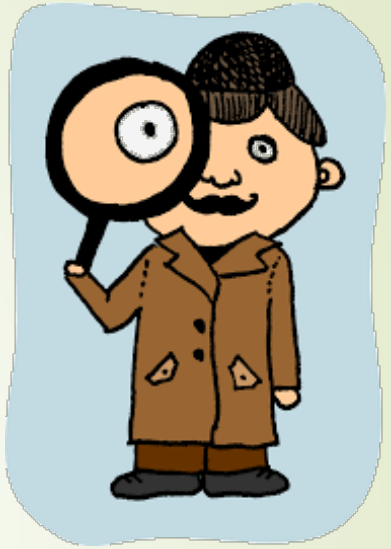
Playground Surfaces

Shoes (carrier)

Clothing (carrier)

Synthetic Turf Fields

Study the Behavioral Patterns



1. Observe players and bystanders
   - Sport and Non-sport activities

2. Videotape players
   - Code video for activity data

Videotape Soccer Players

Design:

- 4 players per game/practice

Position:

- Goal Keeper
- Defender
- Midfielder
- Forward

Conduct a Human Health Risk Assessment

Toxicity (Task 4)	X	Exposure (Task 3)	à	Risk & Hazard (Tasks 6&7) "putting the puzzle together"