



# SYNTHETIC TURF STUDY: OVERVIEW OF THE STUDY ELEMENTS

## Synthetic Turf

**Synthetic or Artificial Turf** is increasingly used in athletic fields.

Synthetic turf is composed of two parts:

- **Crumb rubber infill**
  - ◊ is made of chopped-up waste tires
  - ◊ supports synthetic grass blades
  - ◊ cushions falls
- **Synthetic grass blades**
  - ◊ soften the play surface
  - ◊ look like natural grass

Tire rubber is a complex material made of natural rubber and synthetic materials.

The types and levels of chemicals released from tire rubber depend on the source of material, weather, age of field, and other factors.

## Study Purpose and Scope

**What:** OEHHA will conduct a health study on synthetic turf

**Why:** To further our understanding of:

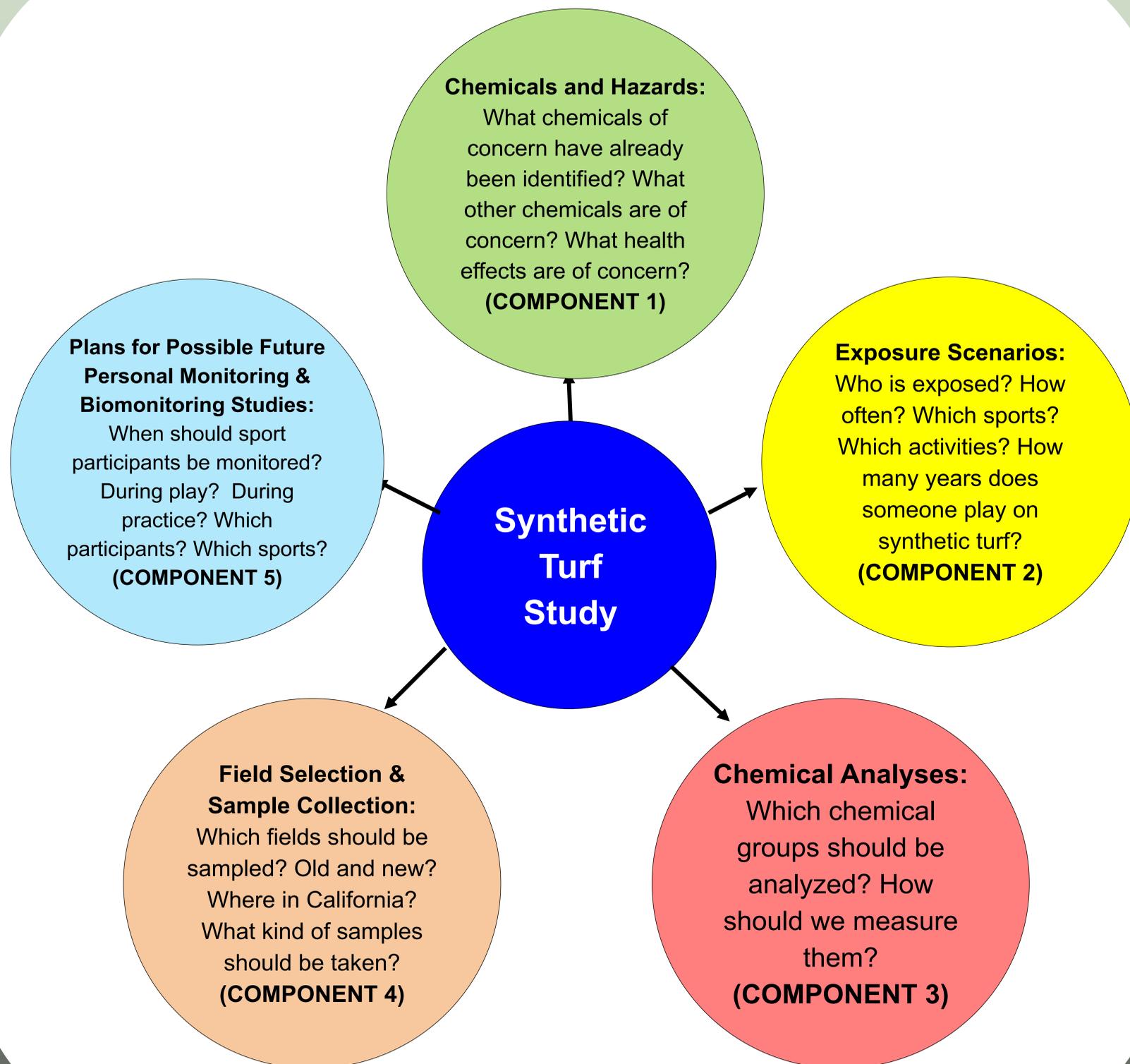
- chemicals that can be released from synthetic turf
- human exposures to these chemicals
- potential adverse health effects of these chemicals

**When:** 2015-2018

## Contact Information

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## Study Approach



# CHEMICALS AND HAZARDS:



## WHAT CHEMICALS OF CONCERN HAVE ALREADY BEEN IDENTIFIED?

## WHAT OTHER CHEMICALS ARE OF CONCERN? WHAT HEALTH EFFECTS ARE OF CONCERN?

### Adverse Health Effects

- Effects can be caused by short-term or long-term exposure to chemicals
- Different chemicals or chemical classes may cause different types of adverse health effects
- Some chemicals can cause more than one type of adverse health effect
- Age, sex, race, and family background, etc., can change a person's response to chemicals

### Questions

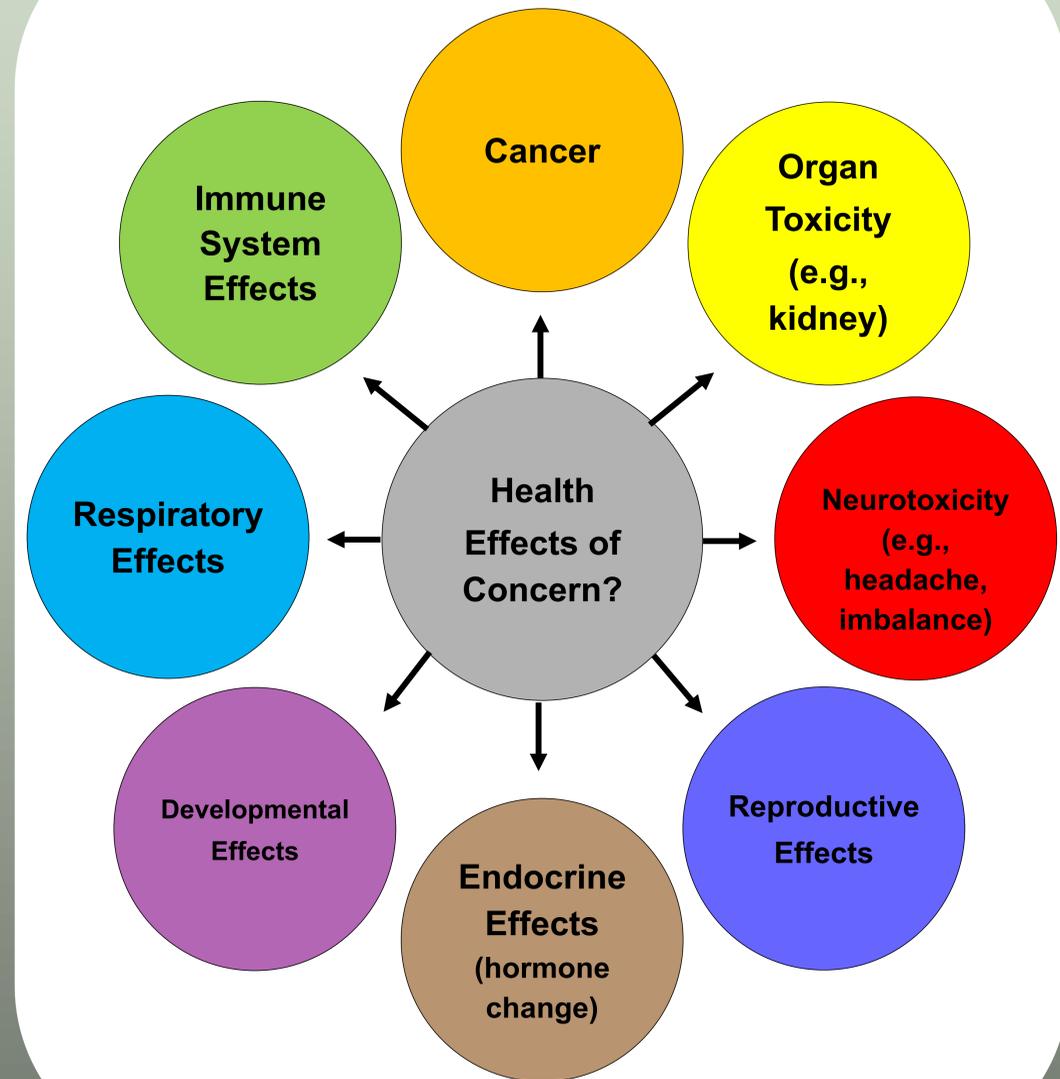
- What health effects are you concerned about?
- Do you notice any health issues that you think might be associated with playing on synthetic turf or playground mats?
- Do you know of any studies we have missed?

### Potential Health Effects from Exposure

Chemical	Known Effects	Detected in Turf/Mat Samples	Study
<b>Benzene</b>	Cancer: leukemia; neurotoxicity	Air, surface wipe, crumb rubber and artificial grass blade samples from indoor and outdoor synthetic turf fields and playground mats; athletic tracks; shredded tires	US EPA 2009, Simcox 2010, Simcox et al 2011, Ginsberg et al. 2011, Ginsberg et al. 2010, NIPHRH 2006, Chang et al. 1999, Lim 2008, OEHHA 2010, OEHHA 2007
<b>Toluene</b>	Developmental effect & neurotoxicity	Air, surface wipe, crumb rubber and artificial grass blade samples from indoor and outdoor synthetic turf fields and playground mats; shredded tires; athletic tracks	US EPA 2009, Simcox 2010, Simcox et al 2011, Ginsberg et al. 2011, Ginsberg et al. 2010, NIPHRH 2006, Chang et al. 1999, Lim 2008, OEHHA 2010, OEHHA 2007
<b>Mercury</b>	Developmental effect & neurotoxicity	Rubber granulate; artificial turf fields and crumb rubber; air samples above synthetic turf fields	Keml 2006, Menichini et al. 2011, Bocca et al. 2009, Lim 2008, Lim 2009, OEHHA 2007
<b>Manganese</b>	Reproductive & respiratory effect, neurotoxicity	Air, surface wipe, crumb rubber and artificial grass blade samples from synthetic turf fields and playground mats	US EPA 2009, Menichini et al. 2011, Ruffino et al. 2013, Bocca et al. 2009, Lim 2009
<b>Hexane</b>	Neurotoxicity & respiratory effects	Air, surface wipe, crumb rubber and artificial grass blade samples from indoor and outdoor synthetic turf fields and playground mats; athletic tracks	US EPA 2009, Simcox 2010, Simcox et al 2011, Ginsberg et al. 2011, Ginsberg et al. 2010, Chang et al. 1999, OEHHA 2010
<b>Zinc</b>	Skin, eyes, nose, & throat irritations	Air, surface wipe, crumb rubber and artificial grass blade samples from synthetic turf fields and playground mats; crumb rubber leachate; shredded tires	Zhang et al. 2008, US EPA 2009, Mattina et al. 2007, Keml 2006, Menichini et al. 2011, Ruffino et al. 2013, Bocca et al. 2009, Lim 2008, Lim 2009, OEHHA 2007

Select chemicals and their known health effects

### Potential Health Effects of Concern



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# EXPOSURE SCENARIOS:

## WHO IS EXPOSED? HOW OFTEN? WHICH SPORTS? WHICH ACTIVITIES?

## HOW MANY YEARS DOES SOMEONE PLAY ON SYNTHETIC TURF?

### Data Collection and Exposure Modeling

- Input from the public - parents, coaches, etc.
- Advice from scientific experts
- Review of literature

### Possible Sensitive and Highly Exposed Groups

- Young children
- Youth sport participants

### Regional Climate and Activity Patterns

Regional climates influence activity patterns.

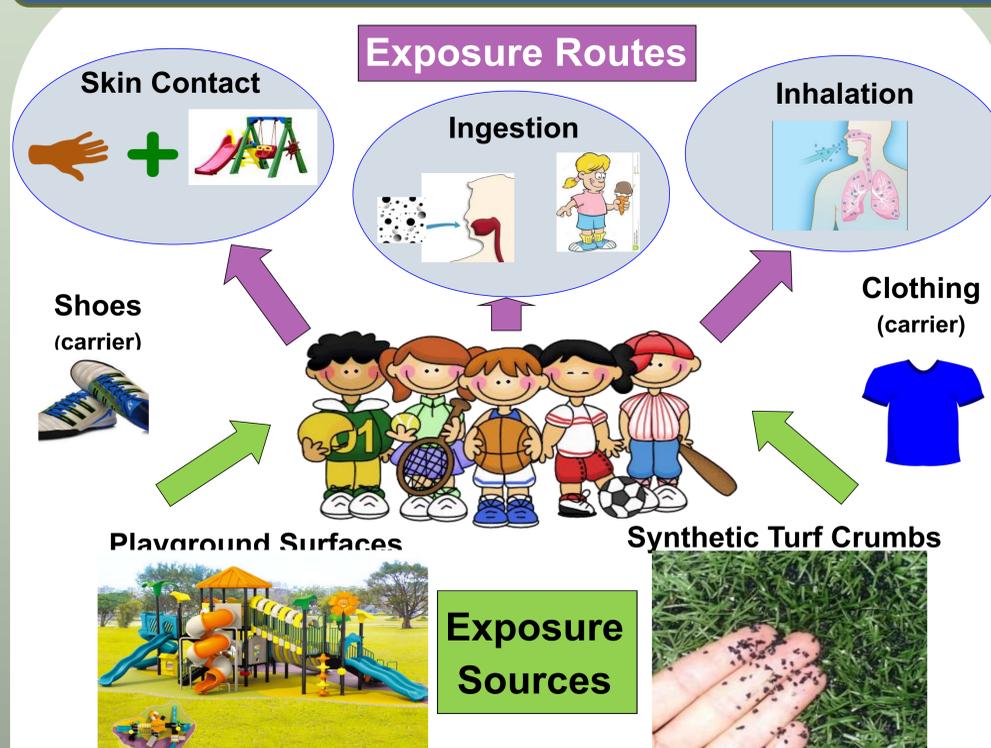
#### Warmer and less rainy areas:

- longer outdoor seasons
- higher temperatures enhance the release of certain chemicals

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### Exposure Routes and Factors



### Exposure Factors



### Key Points to Consider

#### Young Children/Youth Sport Participants

- Exposed early in life
- Hand-to-mouth activity
- Combined exposure (multiple locations & routes)
- Seasonal or year-round
- Frequency and location
- Exposure patterns associated with type of sports
- Starting age and length of participation
- Exposure at home from "carried" turf crumbs

#### Coaches, Referees & Parents

- Seasonal or year-round
- Frequency and location
- Starting age and length of participation

### Questions

- Do you have concerns for specific groups or activities?
- Do you have information on sport participants' ages, activity patterns, and other related information you want to share with us?
- How much crumb rubber does an athlete "carry" home after a game or practice?
- What sports should be studied?
- Have we captured all the kinds of exposures?
- Do you know of any good studies of exposure characterization?

# FIELD SELECTION AND SAMPLE COLLECTION:

## WHICH FIELDS SHOULD BE SAMPLED? OLD AND NEW? WHERE IN CALIFORNIA?

## WHAT KINDS OF SAMPLES SHOULD BE TAKEN?



### Sampling

#### Sample Types:

- New crumb rubber, artificial grass blades, and playground mats
- In-field crumb rubber and artificial grass blades
- Air—gas and particulates
- Surface wipe — particles and chemicals adhered to gloves and balls after a game



#### Field Selection:

- Age of field
- Climate region, altitude

### Air Sampling

- Chemical vapors and particulates
- Collect samples upwind (background) & on-field

#### Sampling Height:

- Breathing zone for kids  
—3 feet above ground
- Near ground surface



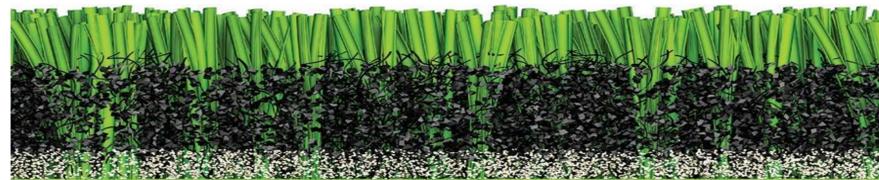
### New Synthetic Turf

Analyze new, uninstalled crumb rubber, artificial grass blades, and playground mats from several major manufacturers to:

- provide background information on chemicals that can be released from synthetic turf products
- develop and standardize methods for in-field sample analysis

Analyze materials, treated under processes mimicking aging of the turf, to:

- understand chemical break-down in field aging
- guide specific plans for field sample collection
- modify analytical methods to identify and quantify break-down chemicals



### Synthetic Turf Fields: Indoor and Outdoor

#### Samples Collected:

- Crumb rubber
- Artificial grass blades
- Air—on-field and upwind
- Surface wipe—fields & balls



#### Fields Selected:

- Several regions of CA (outdoor only)
- Fields of different ages



### Playground Mats: Indoor and Outdoor

#### Samples Collected:

- Air—upwind of mats (outdoor only) and on mats
- Surface wipe

#### Mats Selected:

- Several regions of CA (outdoor only)
- Mats of different ages



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### Questions

Do you know of any fields or playground mats that could be considered for field sampling?

Are there certain regions of the state and times of the year when field sampling would be especially important?

Of the different kinds of samples described in this poster, are there certain kinds that you feel are particularly important?

Is it better to sample many fields with fewer samples, or fewer fields with more samples?

# CHEMICAL ANALYSES:

## WHICH CHEMICAL GROUPS SHOULD BE ANALYZED?

## HOW SHOULD WE MEASURE THEM?

### Chemical Analyses

Identification and quantification of chemicals released from crumb rubber and artificial grass blades

**Steps:** (1) Extraction and (2) Analysis

### Extraction

#### Artificial Biofluids:

1. Saliva
2. Stomach fluid
3. Intestinal fluid
4. Sweat
5. Lung fluid

### Chemical Groups

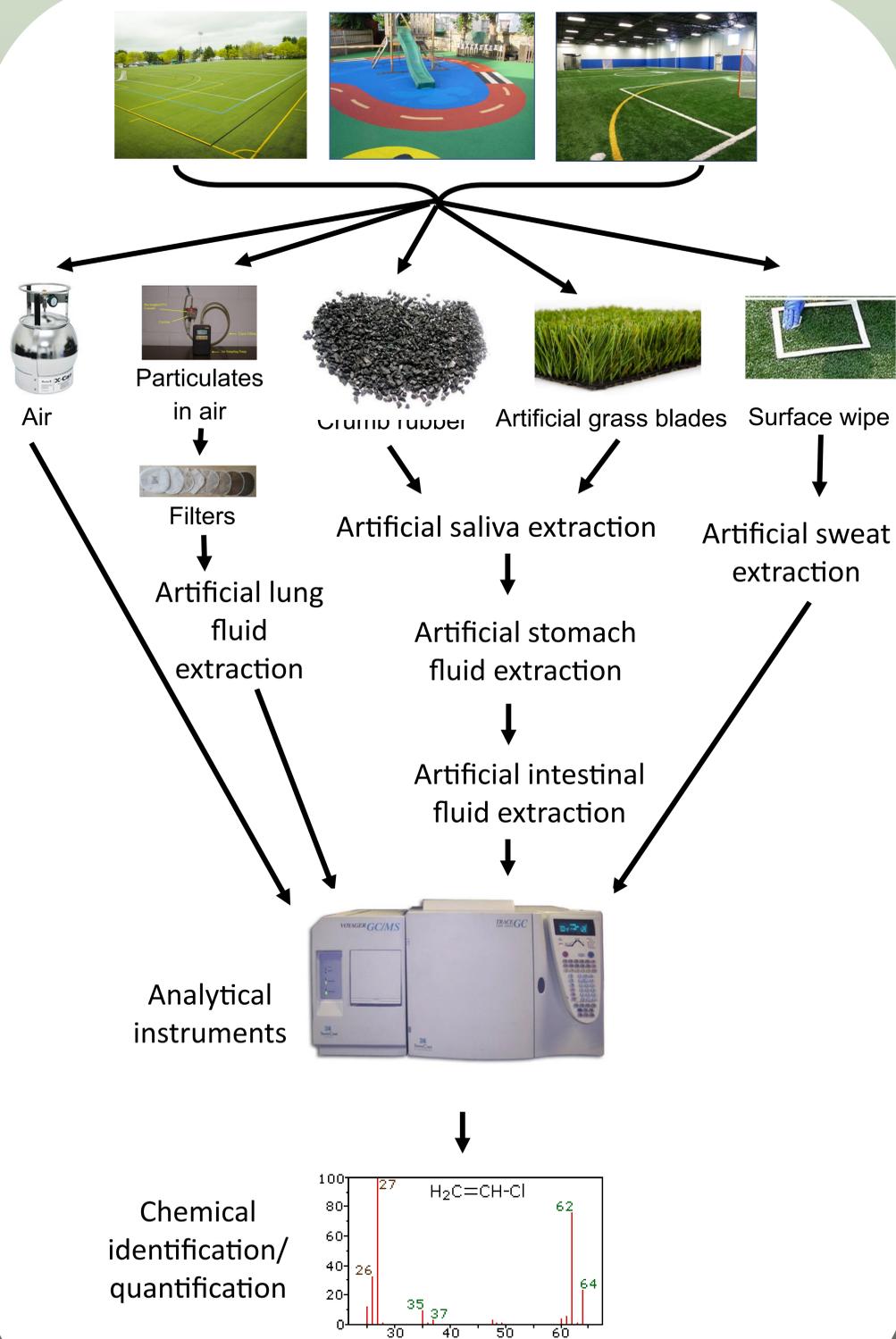
#### Organics:

- Volatile organic compounds—chemicals that are easily released into the air
- Semi-volatile organic compounds—chemicals that are released into the air to some degree
- Polycyclic aromatic hydrocarbons—most are not volatile; complex chemicals found in tars and petroleum

#### Metals:

- Zinc
- Lead
- Chromium

### Exposure Routes Modeled



### Sample Treatments & Analyses

Type of Samples and Treatments	Possible Analyses
<b>New</b> (synthetic turf and playground mats) <ul style="list-style-type: none"> <li>• Crumb rubber, artificial grass blades, playground mats</li> <li>• Exposure chamber (e.g., study effects of weathering)</li> <li>• Biofluid extraction</li> </ul>	<ul style="list-style-type: none"> <li>• Standard chemical analyses</li> <li>• Unknown identification</li> </ul>
<b>In-field</b> (indoor and outdoor synthetic turf fields, and playground mats) <ul style="list-style-type: none"> <li>• Crumb rubber, grass blades, playground mats, air, and particulates</li> <li>• Biofluid extraction</li> </ul>	<ul style="list-style-type: none"> <li>• Standard chemical analyses</li> <li>• Unknown identification</li> </ul>

### Questions

Are there other methods we should consider?  
Are there other measurements we should consider?

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# PLANS FOR POSSIBLE FUTURE PERSONAL MONITORING AND BIOMONITORING STUDIES:

## WHEN SHOULD SPORT PARTICIPANTS BE MONITORED? DURING PLAY? DURING PRACTICE?

## WHICH PARTICIPANTS? WHICH SPORTS?



### Plan to Study Human Subjects

Results from the new study will provide data and information on planning:

- the chemicals and health effects to be monitored
- the types of bio-sample to be collected and analyzed

Developing a plan to study human subjects and a legally required review by Institutional Review Board could take at least 2 to 3 years.

### Biomonitoring

**Biomonitoring** measures the amount of chemicals in a person's body.

**Biomonitoring** may tell us:

- if people have been exposed to certain chemicals
- if their exposure level and/or pattern changes over time
- if exposure is different between different groups
  - men and women
  - children and adults
  - sport participants and spectators



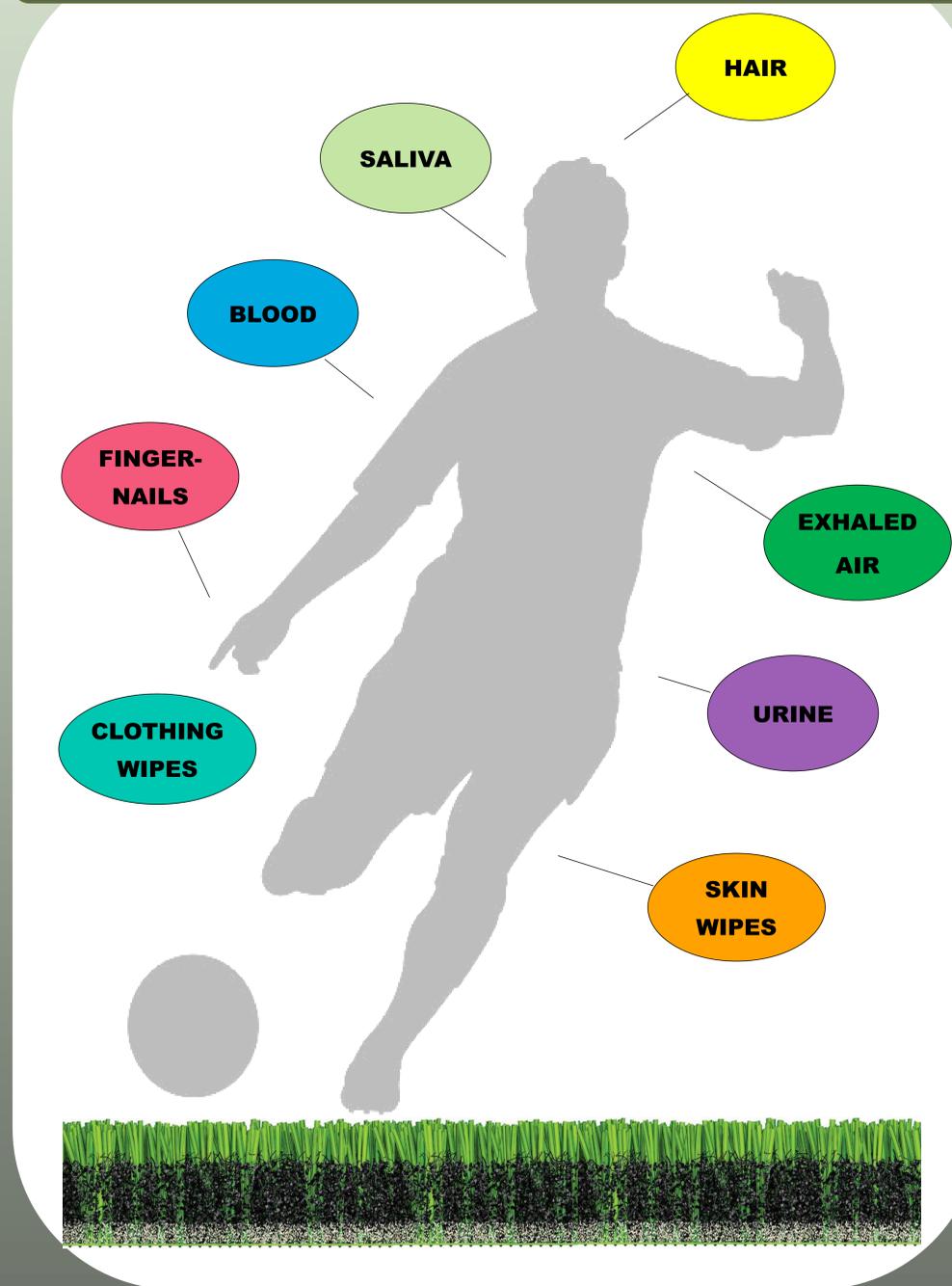
### Personal Monitoring

**Personal monitoring** measures the type and amount of chemicals a person is exposed to while on or near synthetic turf.

**Personal monitoring samples** can be collected in many ways:

- Personal air monitors worn during sports/games to measure chemicals in the air
- Special clothing and gloves worn during sports/games to measure chemicals that are transferred onto skin from synthetic turf

### Types of Samples



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### Sensitive Groups

- Young sport participants
- Family members of sport participants

### Potentially Exposed Individuals

- **Sport Participants:** close contact with synthetic turf and ingestion of crumb rubber
- **Coaches and Referees:** many years of exposure



### Samples Collected

Participants provide **biomonitoring samples** after playing on or around synthetic turf.

- Some samples, such as exhaled air and skin surface wipes, may provide information about the type and amount of chemicals a person is exposed to.
- Other samples, such as blood or urine, may provide information about the type and amount of chemicals that have entered a person's body.
- These and other samples may provide information about the risk of developing diseases such as cancer

### Questions

- Do you prefer biomonitoring or personal monitoring?
- Who should be sampled?
- When should they be monitored, during game or practice?
- What should be the exposure duration studied? A game, over many weeks, or over a season?