

# The State of the Science: Recycled Rubber Safety

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Public Health Advisory Committee (PHAC) Meeting

Minneapolis, MN

October 25, 2016

## Context/Example: Recycled Rubber vs. Natural Soil

Chemical	Recycled Rubber (mg/kg)	Natural Soil (mg/kg)
Arsenic	0.3-4.0	0.1-97
Lead	0.02-389	10-700
Carcinogenic PAHs	1.31-3.13	0.93-4.60

Data are only a subset of chemicals found in crumb rubber/soil.

Crumb rubber data (and c-PAH data) are from literature review; data from chemical composition studies, and do not consider bioaccessibility.

Natural soil data are from MADEP, 2002 (90<sup>th</sup> percentiles) and USGS, 1984 (ranges).

# Current Scientific Literature

- Artificial turf reports from 17 different organizations
  - US EPA, Connecticut DPH, Massachusetts DPH, CalOEHHA, CPSC, New Jersey DEP, New York City, New York State
  - Some discussion related to data gaps or limitations
- 24+ peer-reviewed studies
- Overall: studies that evaluate chemical risk (not simply presence!) do not identify concerns

# Limitations

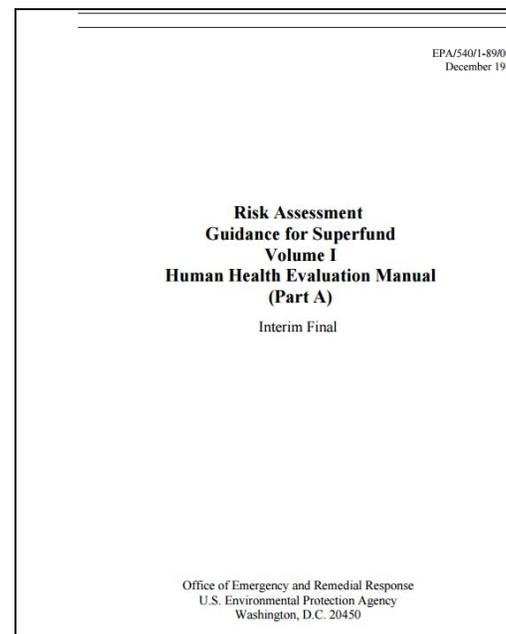
- Yes, there are limitations (as with ALL scientific inquiries)
- However, studies have:
  - Evaluated ingestion, dermal contact, inhalation
  - Evaluated ~90 chemicals
  - Evaluated the impact of hot surfaces
  - Taken samples of air above crumb rubber
  - Evaluated the bioavailability of chemicals in crumb rubber
  - Evaluated the mutagenic potential of crumb rubber

# New Study: A Comprehensive Multi-pathway Human Health Risk Assessment

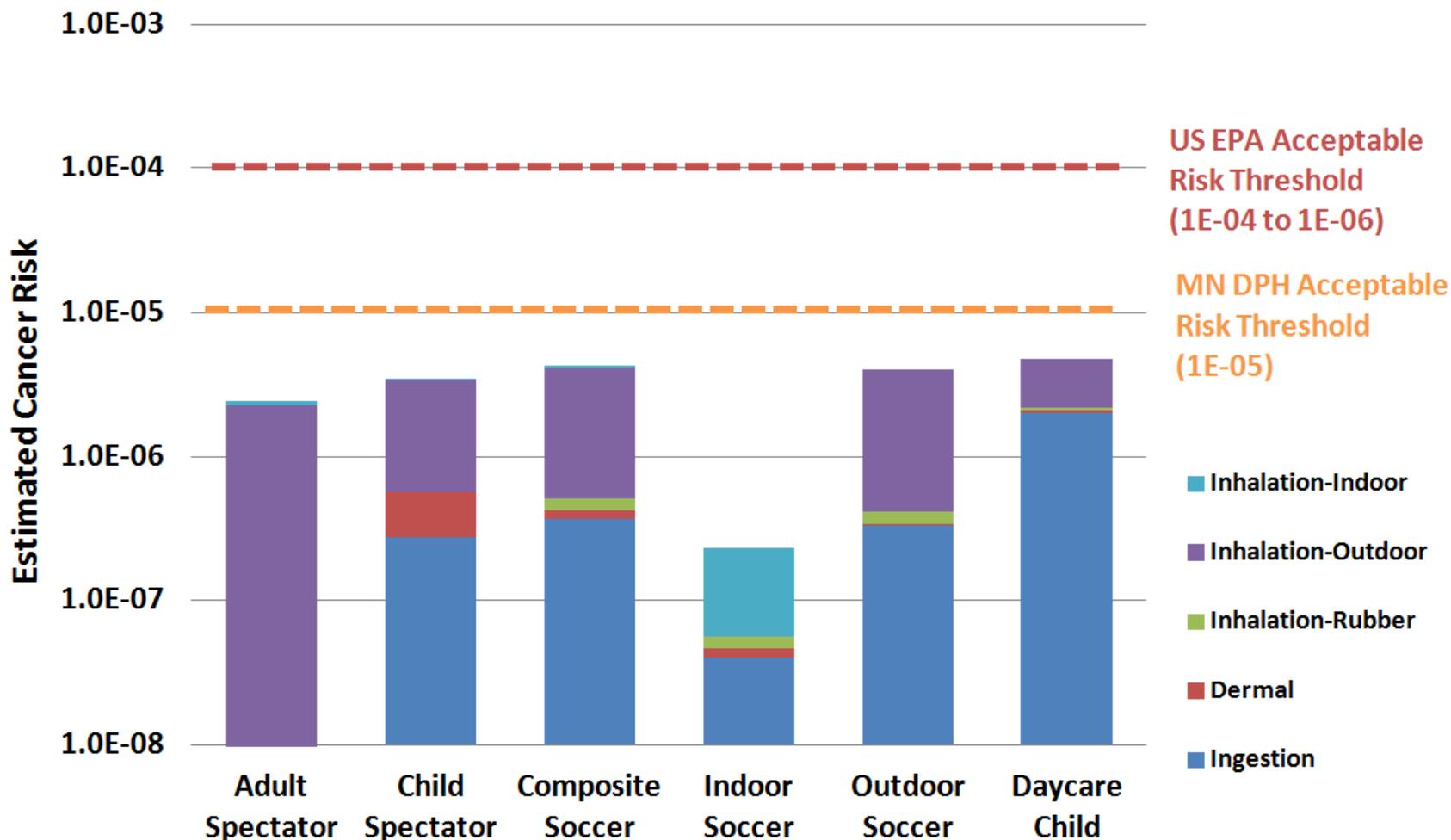
- Collected all available data in the literature
- Evaluated dermal, inhalation, and ingestion exposure
- Evaluated multiple exposure scenarios
  - Indoor and outdoor soccer players
  - Year round (indoor and outdoor) soccer player
  - Spectators (adult and child)
  - Daycare child
- Close to 200 recycled rubber samples
- Over 100 air samples
- Over 100 different chemicals evaluated

# Risk Assessment

- Government provides guidance on appropriate methods
- In general:
  - Take chemical data (concentrations in crumb rubber or in air above fields);
  - Combine with exposure assumptions (how long do players use fields, how much touches skin, body weight, inhalation rate);
  - Calculate doses (how much gets into body);
  - Compare to doses that are considered to be safe (US EPA reference doses); even for sensitive subpopulations

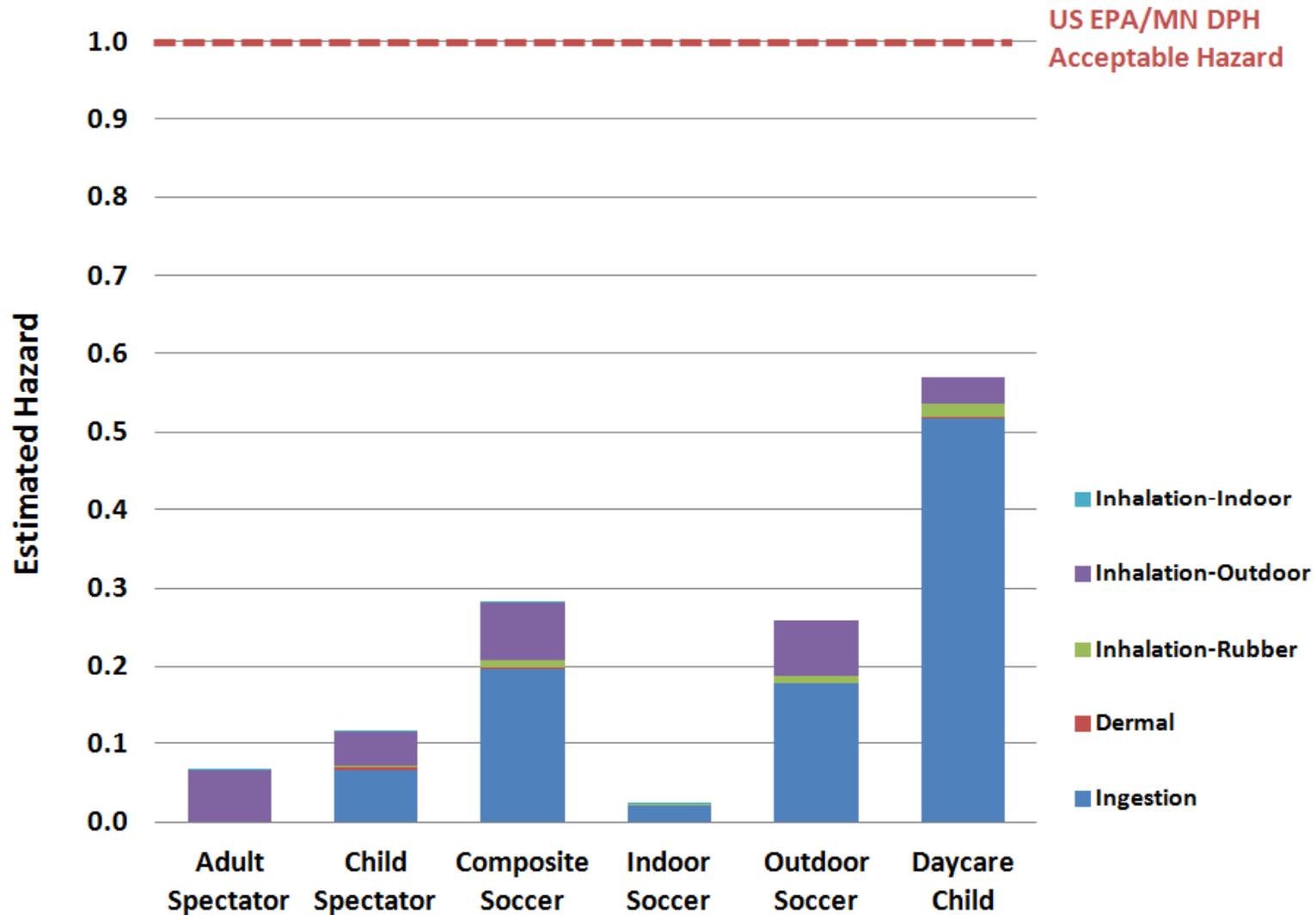


# New Study Results: Cancer Risks



Note log scale on y-axis; exposure route-specific bars are not proportionate  
 MN acceptable risk level: MAR 4717.8000 to MAR 4717.8600  
 US EPA acceptable risk level: US EPA, 1990, 1991; Rodricks and Rieth, 1998

# New Study Results: Non-Cancer Hazards



## New Study Conclusions

- All exposure scenarios within US EPA and MN DPH acceptable risk limits
- Even though:
  - Maximum or 95% UCL concentrations
  - 100% bioavailability
  - All spectators and players assumed to play 100% of games/practices on synthetic turf
  - No comparison to background levels to eliminate chemicals
  - All chemicals assumed to impact same organ/system

# What About Contrary Studies?

- Do Not Consider Risk; Only Measure Concentrations
  - Yale Study; Llompart et al., 2013
- Italian Study (Marsili et al., 2014)
  - Used 3 methods to evaluate risk—2 of the 3 found risks were below regulatory limits
  - Other method:
    - "It must be underlined that this preliminary hazard assessment overestimates the PAH contribution of the field because the input from the wide variety of anthropogenic and crustal sources were not considered and then, this theoretical approach must be considered as an extreme worst case screening."
- No contrary study considers bioavailability!

# Context: Coach Griffin's Cancer List

- Actual list is not public!
  - 209 athletes: 137 soccer players; 97 goalies; 45 Washington residents (137 both recreationally and year-round)
- What about background cancer?
  - 3,000,000 US youth soccer players • 100,000 in WA
  - Expected background cancer: 100 cases per 100,000/yr
- In other words, over 15 years we would expect there to be:
  - 21,735 US soccer cancer cases (8,820 leukemia, 12,915 lymphoma)

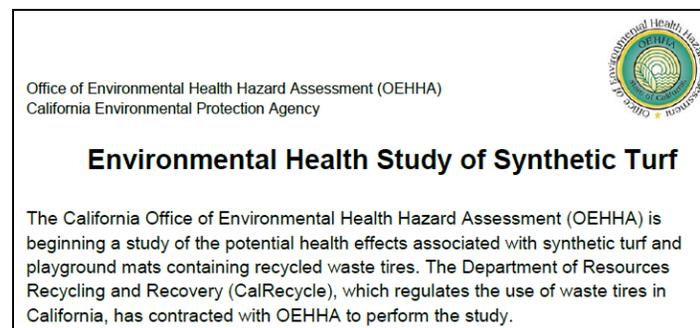
OVERSIMPLIFICATION

# Context: Coach Griffin's Cancer List

- Actual list is not public!
  - 209 athletes; 160 soccer players; 97 goalies; 45 Washington residents who played both recreationally and year-round
- What about background rates?
  - 3,000,000 US youth soccer players; 100,000 in WA
  - Expected background cancer rate: 48.7 per 100,000/yr
- In other words, over 15 years we would expect there to be:
  - 21,735 US soccer cancer cases (8,820 leukemia/lymphoma)

# Ongoing Research

- US EPA/CPSC/ATSDR
  - Limited study this year; primarily identifying data gaps and research needs
  - Presumably might expand after this year
- California OEHHA
  - Four year study
  - Very comprehensive



# Questions?

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## Information Sheet: Recycled Rubber Cancer Cases

**The Concern:** Amy Griffin, associate head coach for the University of Washington women's soccer team, "has been informally tracking American soccer players with cancer since 2009" (1). She has identified 220 cases to date, 166 of them soccer players. The two most frequent cancer diagnoses are lymphoma and leukemia. The diagnoses date back to 1994, with the ages 5-24 specifically mentioned (2). The concern is that exposure to chemicals in recycled rubber has caused the identified cancer cases.

The number of cancer cases assembled by Ms. Griffin can appear alarming, especially to those who would expect there to be zero or very few cases of children and young adult soccer players with cancer.

**Interpreting the Cases:** Coach Griffin acknowledges that her ascertainment of cases was not scientific, but rather is anecdotal (1). In order to understand whether there may be a causal relationship between exposure to recycled rubber and cancer, it would be necessary to calculate whether the number of cases is more than expected. Information on background cancer rates, taking into account normal occurrences, is readily available to help answer that question (3,4). Without further detail on the cases, however, we do not know the specific size and characteristics of the population the cases are drawn from. Information such as the geographical boundaries of the cases is critical to understanding the expected number of cases.

**Context:** Leukemias and lymphomas are among the most common childhood cancers (5). To provide some context, we can calculate the expected number of cancer cases among the approximately 3,000,000 registered US Youth Soccer players aged 5-19 over the past 15 years (6). Based on age-specific cancer rates in the US (3), we would expect to see 21,735 total cancer cases, including 8,820 lymphomas and leukemias. These numbers would be even greater for the age range 5-24.

In light of the 21,735 cancer cases expected in US youth soccer players, the finding of 220 cases by Coach Griffin should not necessarily be considered unusual.

It has been suggested that Coach Griffin's cases, which include more lymphomas than leukemias, is inconsistent with background rates showing greater rates of leukemias than lymphomas (1). As shown in the table below, however, this presumption is dependent on the age range selected. The age range of Coach Griffin's cases (5-24) is consistent with there being more lymphomas than leukemias (2).

Data	Age Range	Lymphomas <sup>a</sup>	Leukemias <sup>a</sup>	
US (3)	5-19	9.0	10.6	← More leukemias
	5-24	15.9	13.2	← More lymphomas
Washington State (4)	5-19	8.7	10	← More leukemias
	5-24	16.2	12.4	← More lymphomas

(a) Numbers of incident cases expected per 100,000 individuals of the specified age range.

**Summary:** It is important to use caution instead of rushing to conclusions regarding the anecdotal evidence gathered by Coach Griffin. A scientific approach to assembling and evaluating available data is instrumental in answering the key questions associated with this concern. To date, there is no evidence to support that recreating on recycled rubber increases the risk of cancer.

## Citations

(1) Huffington Post, April 14, 2016. "Worries mount over potential link between artificial turf and cancer."

[http://www.huffingtonpost.com/entry/cancer-artificial-turf-crumb-rubber\\_us\\_570960a3e4b0142232493441](http://www.huffingtonpost.com/entry/cancer-artificial-turf-crumb-rubber_us_570960a3e4b0142232493441)

(2) Herald Net, February 5, 2016. "State studies crumb-rubber in athletic fields, cancer cases."

<http://www.heraldnet.com/article/20160205/NEWS01/160209578>

(3) National Cancer Institute SEER Cancer Statistics Review

### **Total Cancers**

[http://seer.cancer.gov/archive/csr/1975\\_2012/browse\\_csr.php?sectionSEL=2&pageSEL=sect\\_02\\_table.07.html](http://seer.cancer.gov/archive/csr/1975_2012/browse_csr.php?sectionSEL=2&pageSEL=sect_02_table.07.html)

### **Non-Hodgkin Lymphoma**

[http://seer.cancer.gov/archive/csr/1975\\_2012/browse\\_csr.php?sectionSEL=19&pageSEL=sect\\_19\\_table.07.html](http://seer.cancer.gov/archive/csr/1975_2012/browse_csr.php?sectionSEL=19&pageSEL=sect_19_table.07.html)

### **Hodgkin Lymphoma**

[http://seer.cancer.gov/archive/csr/1975\\_2012/browse\\_csr.php?sectionSEL=9&pageSEL=sect\\_09\\_table.07.html](http://seer.cancer.gov/archive/csr/1975_2012/browse_csr.php?sectionSEL=9&pageSEL=sect_09_table.07.html)

### **Leukemia**

[http://seer.cancer.gov/archive/csr/1975\\_2012/browse\\_csr.php?sectionSEL=13&pageSEL=sect\\_13\\_table.11.htm](http://seer.cancer.gov/archive/csr/1975_2012/browse_csr.php?sectionSEL=13&pageSEL=sect_13_table.11.htm)

The cumulative cancer annual cancer incidence for leukemias and lymphomas for the age range 5-19 (all sexes, all races) is 19.6/100,000.

(4) Washington State Department of Health. "Washington State Cancer Registry."

<https://fortress.wa.gov/doh/wscr/WSCR/Query.mvc/Query>

(5) American Cancer Society. "What are the most common types of childhood cancers?"

<http://www.cancer.org/cancer/cancerinchildren/detailedguide/cancer-in-children-types-of-childhood-cancers>

(6) US Youth Soccer

[http://www.usyouthsoccer.org/media\\_kit/keystatistics/](http://www.usyouthsoccer.org/media_kit/keystatistics/)

19.6/100,000 (annual incidence rate) × 3,000,000 US Youth Soccer registrants per year × 15 years = 8,820 cases expected