Artificial Turf & Children's Health

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Acknowledgments

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Institute for Climate Change, Environmental Health, and Exposomics

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Chronic diseases are on the rise

Your lifetime risk has doubled or tripled for many common diseases in the past 20 years

1 in 10

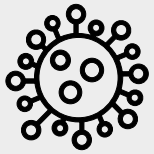
Alzheimer's Disease

1 in 12

Asthma

1 in 36

Autism



1 in 3 / 2

Cancer in Women/Men

1 in 12

Cardiovascular Disease

1 in 6

Developmental Disabilities

1 in 10

Diabetes

1 in 10

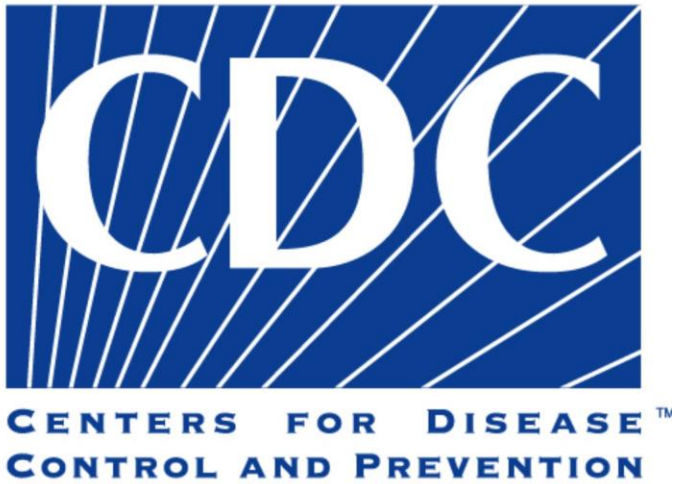
Food Allergy

1 in 10

Infertility in Couples

Exposomics: The Future of Medicine

Our Chemical Body Burden

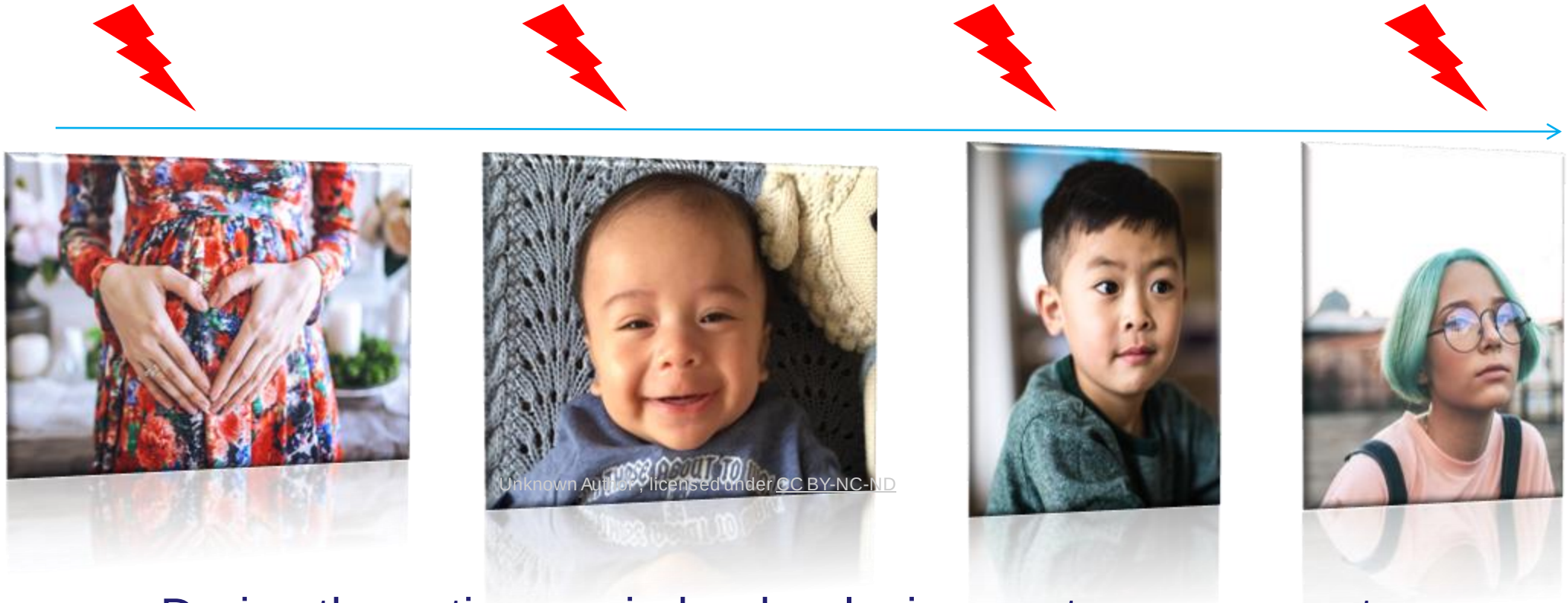


- 200+ chemicals
- Some exposures higher in children
- Higher exposures in Black and Hispanic participants
- Chronic, low-dose, cumulative, mixtures
- No clinical threshold

https://www.cdc.gov/nchs/nhanes/

Children are not little adults

Windows of Susceptibility
Not just *what*, but *when*



During these time periods, developing systems are most sensitive to certain environmental toxins.

Health impacts of turf chemicals

Carcinogens

- Benzene
- PAHs
- Styrene
- Cadmium
- Arsenic
- PFAS
- VOCs

Neurotoxicants

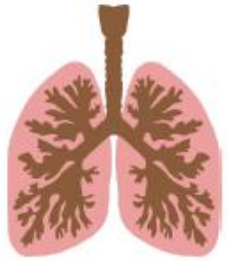
- Lead
- Zinc
- Phthalates
- VOCs

Reproductive Toxicants

- Phthalates
- Plasticizers

Respiratory Irritants

- VOCs
- Particulate matter
- Silica

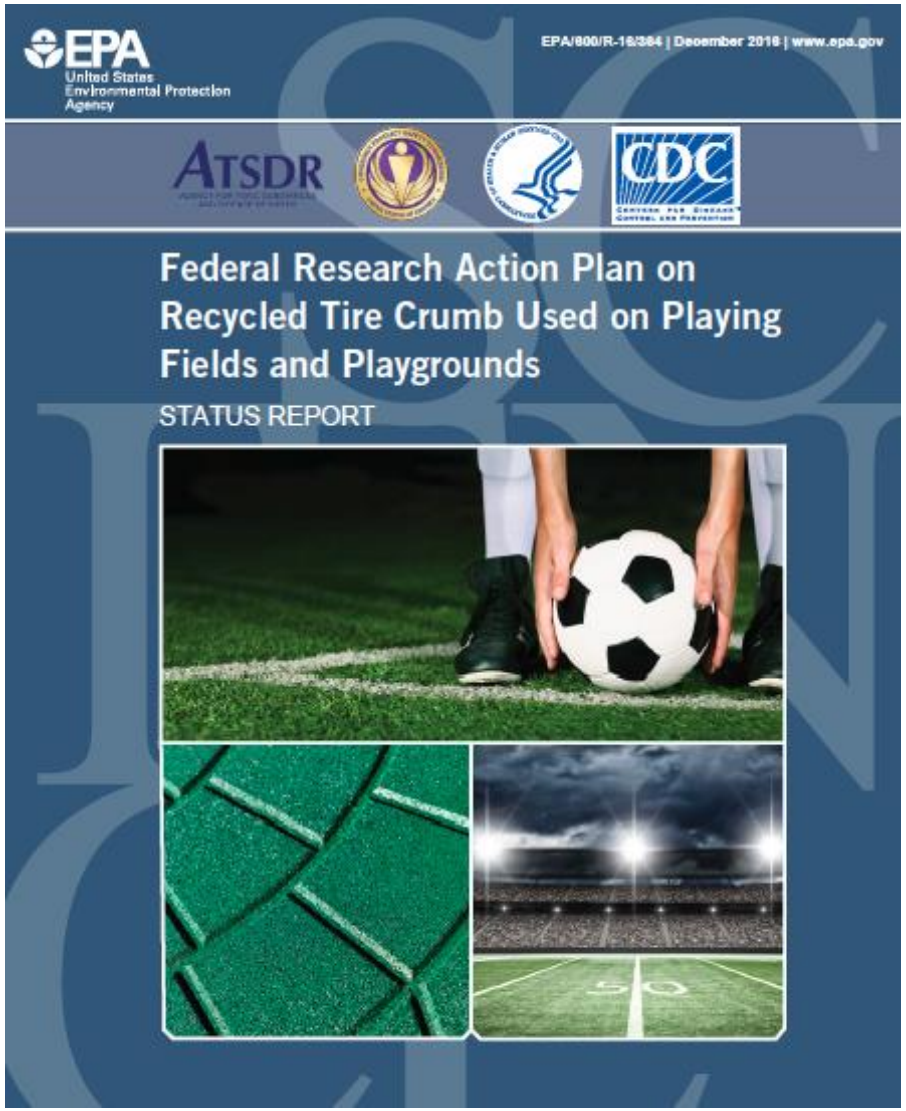


Inhalation of chemicals and particles

Dermal contact and absorption through the skin or open wounds

Ingestion of turf infill particles

Federal Turf Study



"Studies to date…have limitations and do not comprehensively evaluate the concerns about health risks from exposure to tire crumb rubber."

1. Literature Review/Gap Analysis
   - 350 chemicals
   - No epidemiological studies
   - Very few dermal & ingestion studies
   - Very few playground studies
2. Recycled Tire Crumb Characterization
   - Confirmed presence of metals, VOCs, carcinogens
   - Toxicity data for half of 355 chemicals
   - Not a risk assessment
3. Exposure Characterization Study
4. Playground Study

Alternative Infills Contain Chemicals of Concern

Table 1. Comparing Tire Crumb With Alternative Infills: Selected Categories of Chemicals of Concern.[a]

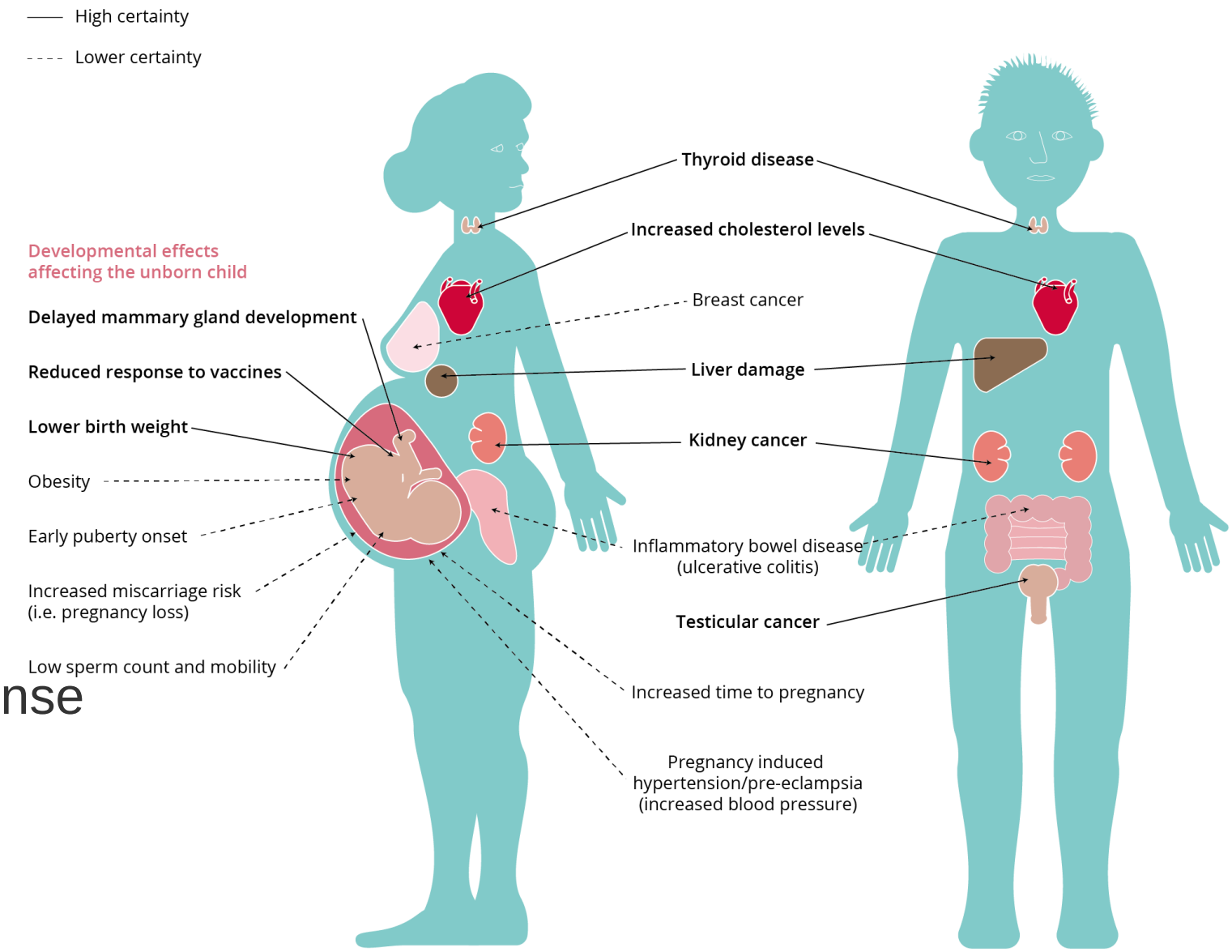
Category	Tire crumb	EPDM	Shoe materials[b]	TPE	Acrylic-coated sand	Mineral- or plant-based
VOCs	Present[c]	Present; lower in some cases, higher in others[d]	Expected to be present but subject to RSL	Present, lower[e]	Expected to be low or absent	Expected to be low or absent[f]
PAHs	Present[c]	Present, lower[d]	May be present but subject to RSL	Present, lower[e]	Below detection limit[g]	Expected to be low or absent[f]
PAHs (TURI sample)[h]	Present, highest	Present, lower[L1]	Present, lower[L1]	Present, lowest[L2]	Present, lowest[L2]	Present, lowest[L2]
Phthalate esters	Present[c]	Present, lower[d]	May be present but subject to RSL	Present[e]	Expected to be absent	Expected to be absent
Vulcanization compounds[i]	Present[c]	Expected to be present	Expected to be present	Expected to be absent	Expected to be absent	Expected to be absent
Vulcanization compounds: benzothiazole only (TURI sample)[h]	Present, highest	Present, lowest detected[L3]	Present, lower[L1]	Not detected	Not tested	Not tested
Lead[j]	Present, wide range of values documented in the literature[c]	Present, lower in some cases, higher in others[d,j]	Present	Present	Below detection limit[g]	Below detection limit in some cases
Other metals[j]	Present	Present	Present	Present	Present[g]	Present in some cases
Fungi, allergens, or other biologically active dusts	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present	May be present in some plant-based materials
Pulmonary fibrogenic dusts (crystalline silica or respirable fibers)	Not known to be present	Not known to be present	Not known to be present	Not known to be present	Not known to be present	May be present in some mineral-based materials[k]

Massey et al. Artificial Turf Infill: A Comparative Assessment of Chemical Contents. *NEW SOLUTIONS: A Journal of Environmental and Occupational Health Policy*. 2020, Vol. 30(1) 10–26.

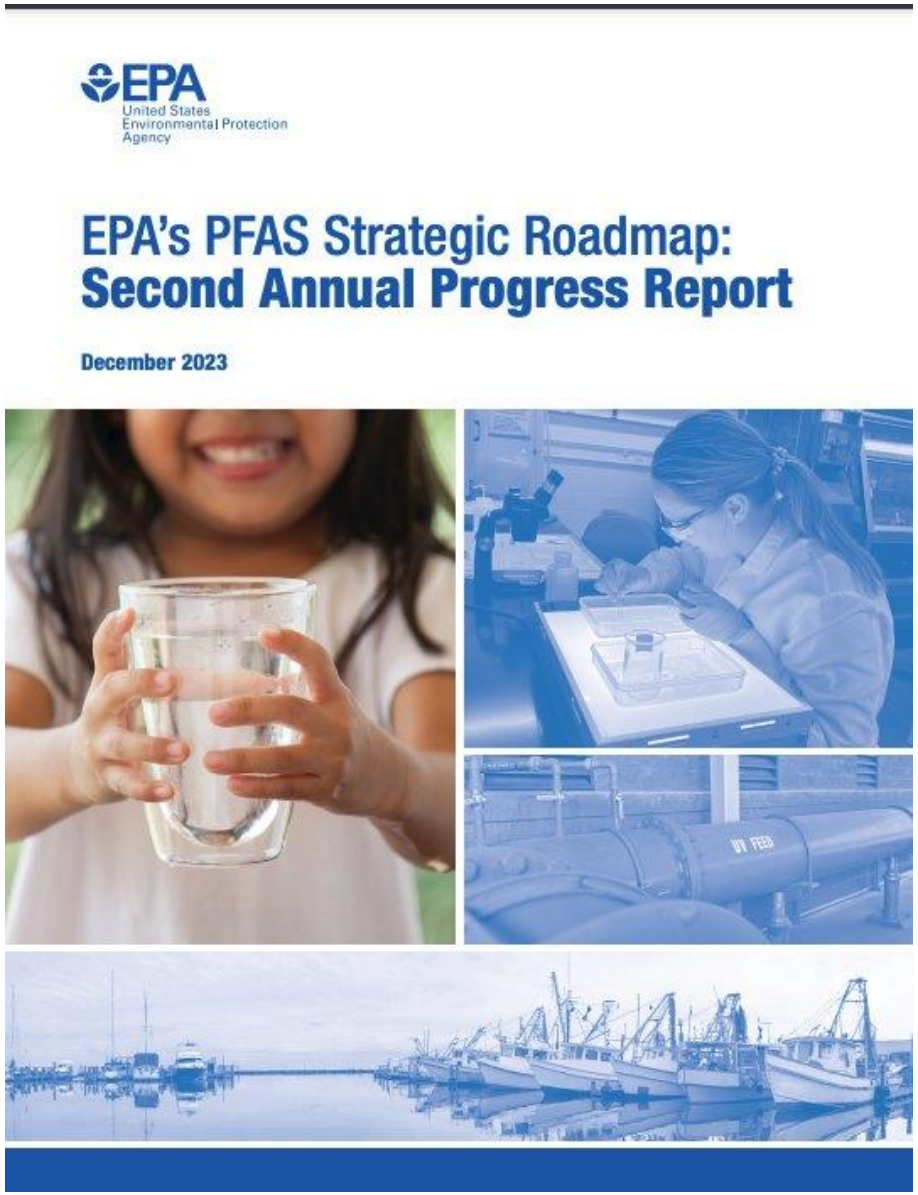
See also Armada et al. Global evaluation of the chemical hazard of recycled tire crumb rubber employed on worldwide synthetic turf football pitches. *Science of the Total Environment* 812 (2022) 152542.

Non-infill exposures: PFAS

- High cholesterol
- Thyroid disease
- Ulcerative colitis
- Cancer
  - Kidney
  - Testicular
- COVID-19 severity
- Immune dysfuntion
  - Decreased vaccine response
- Impaired neurodevelopment
- Infertility
- Pregnancy outcomes



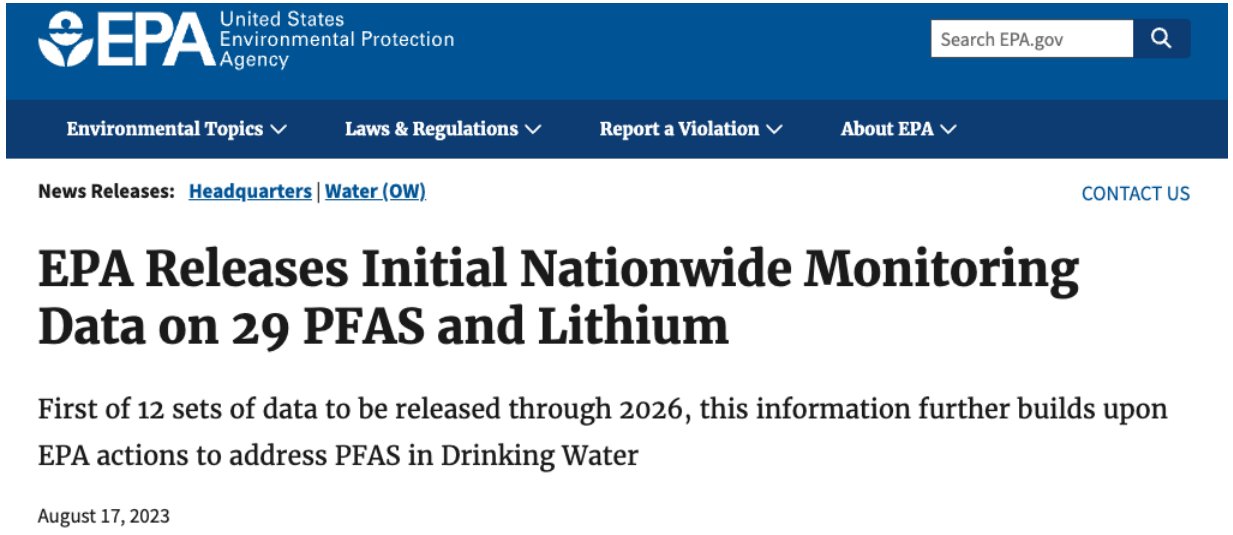
https://www.eea.europa.eu/publications/emerging-chemical-risks-in-europe



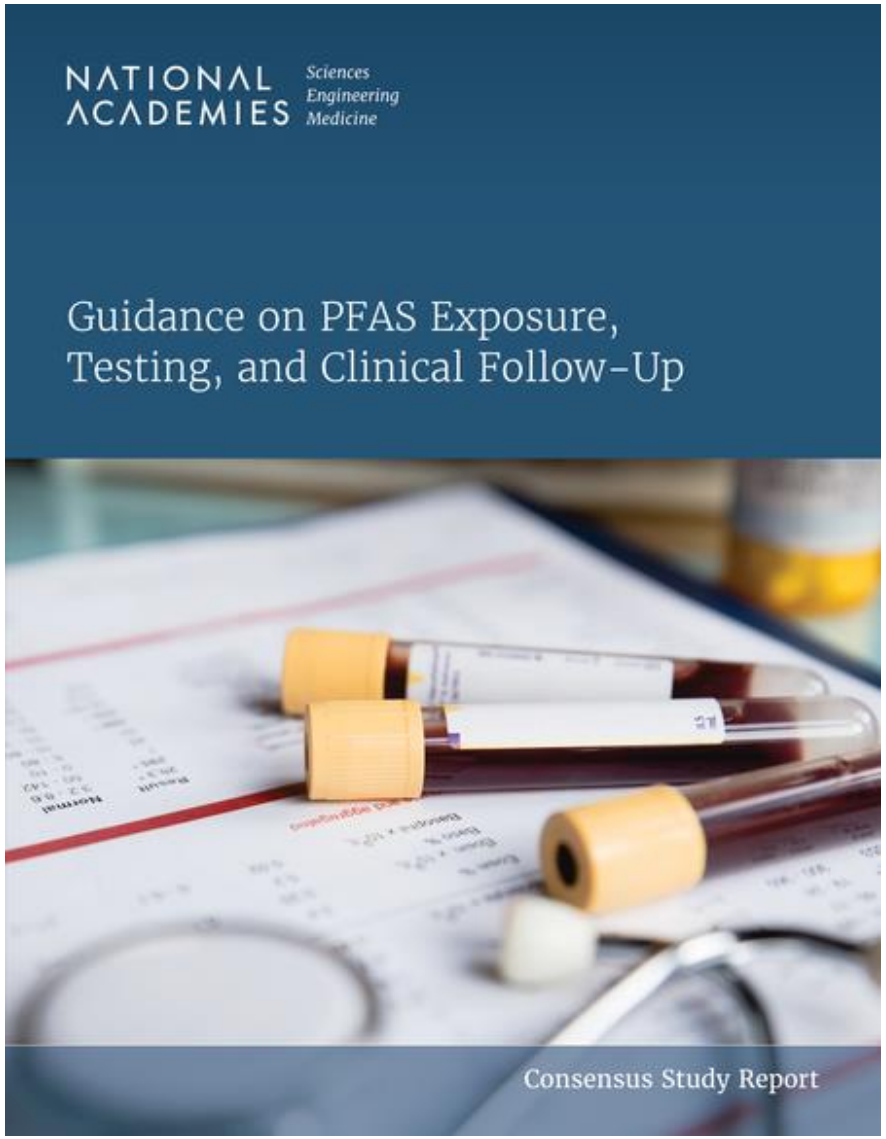
"PFAS, the common term used for per- and polyfluoroalkyl substances, are an urgent threat to public health and the environment. Communities across the nation are discovering them in their air, land, and water. The science is clear: exposure to certain PFAS poses significant risks to human health, including cancer, even at very low levels."

USEPA, December 2023

PFAS: Research to Action

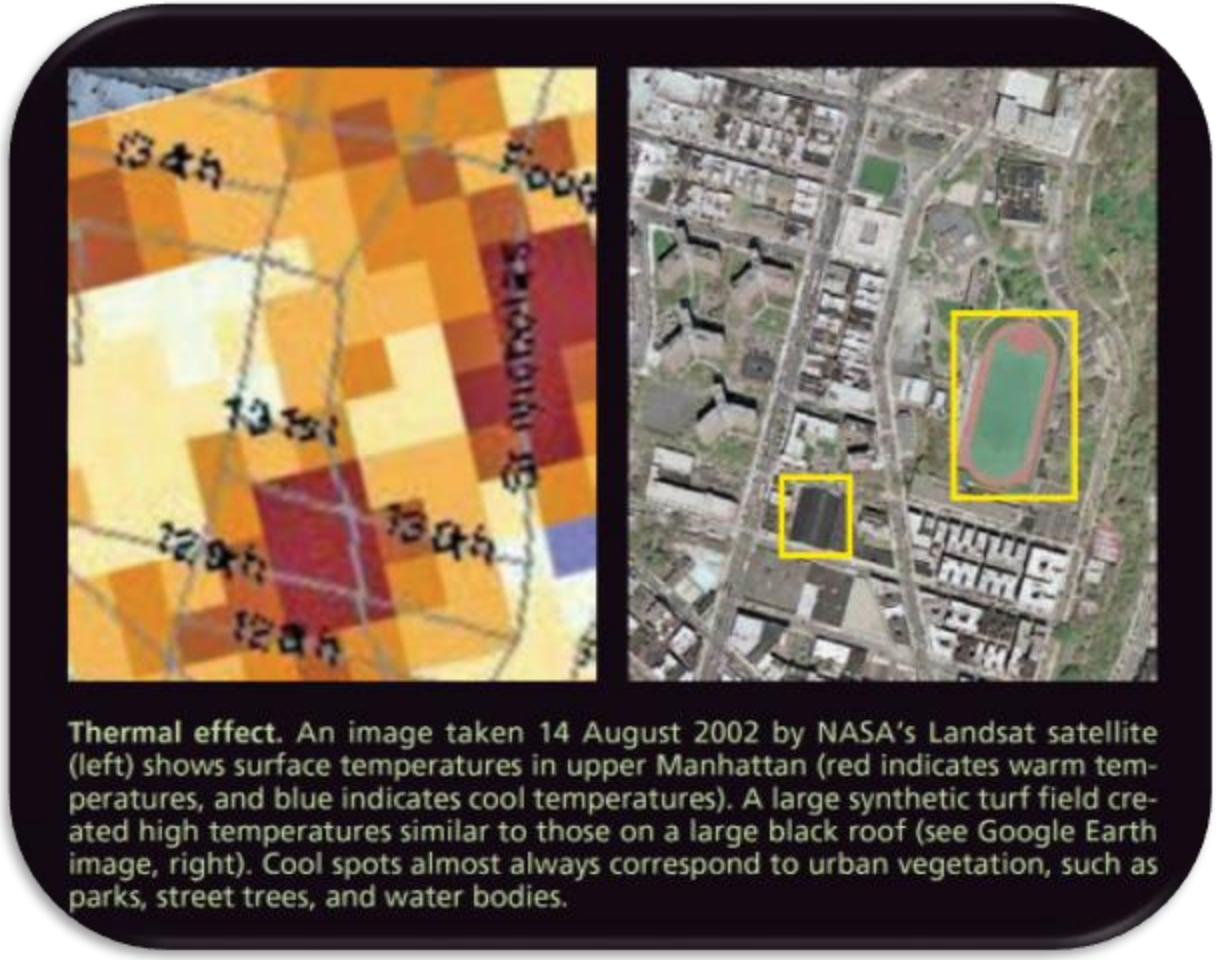


Clinical Guidance: PFAS testing



PFAS blood level (sum of 7 common PFAS)	Clinical Action
<2ng/mL	• No follow up
2-<20ng/mL	• Reduce PFAS exposures • Test cholesterol at 9-11 and 17-21 years • Test hypertension in pregnancy
>20ng/mL	• Reduce PFAS exposures • Test cholesterol at 9-11 and 17-21 years • Thyroid function test at 18+years • Assess for testicular & kidney cancer and ulcerative colitis at well visits at 15+ years

Heat effects of turf



Thermal effect. An image taken 14 August 2002 by NASA's Landsat satellite (left) shows surface temperatures in upper Manhattan (red indicates warm temperatures, and blue indicates cool temperatures). A large synthetic turf field created high temperatures similar to those on a large black roof (see Google Earth image, right). Cool spots almost always correspond to urban vegetation, such as parks, street trees, and water bodies.

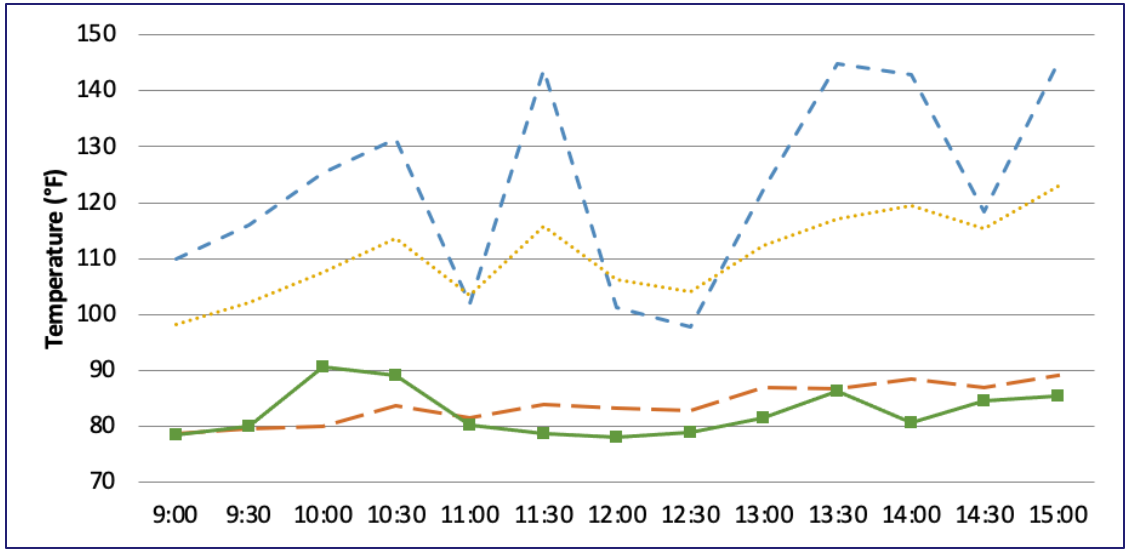
- Surface temperatures up to 200ºF
- 50ºF higher than natural grass
- 70ºF hotter than air temp
- Increased air temperature at head height
- Watering provides limited cooling

Luz Claudio, Environmental Health Perspectives Vol 116 No. 3 March 2008

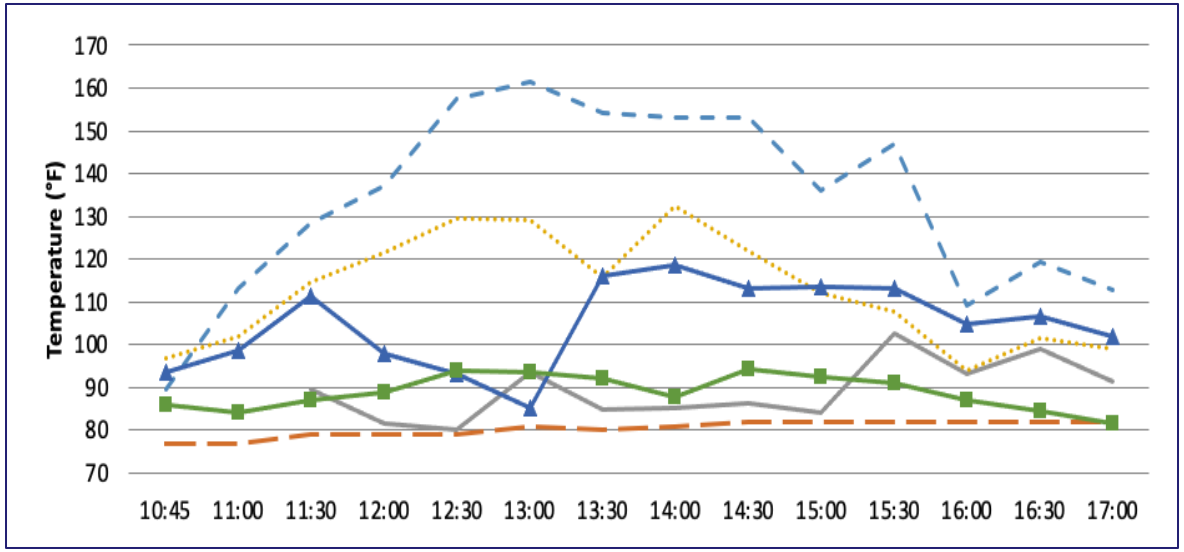
See also https://plantscience.psu.edu/research/centers/ssrc/research/synthetic-turf-surface-temperature

Dangerous surface temperatures on artificial fields and playgrounds, NYC

Crumb rubber turf field



PIP Playground



Rubber surface
Sand
Wood Mulch
Ambient Temperature
Asphalt
Grass

Courtesy: Dr. Homero Harari, Mount Sinai

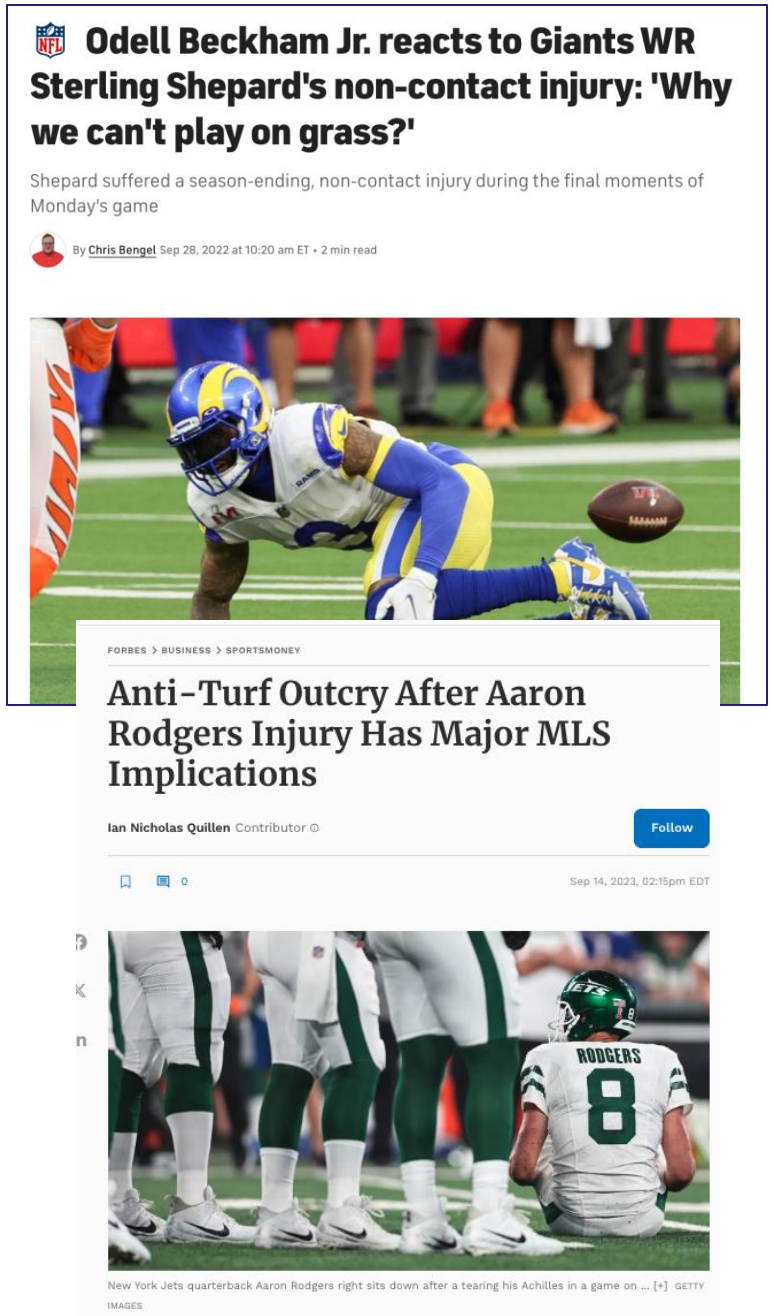
Health effects of hot turf

- Heat illness
  - #1 cause of death and disability in high school athletes
  - Football players most impacted
  - Marching bands also at risk
- Skin burns
  - 1st degree: 118ºF
  - 2nd degree: 131ºF
- Game & practice cancellations/restrictions
  - No play when surface temp >120ºF
  - Precautions and restrictions when air temp >82ºF

https://www.montgomeryschoolsmd.org/departments/athletics/programs/default/542923/
https://www.burlingtonpublicschools.org/district/district_policies/utilizing_artificial_turf_in_the_heat

Injuries and Abrasions

- Knee injuries
  - ACL, PCL
- Concussion
  - Temperature and maintenance are key
- “Turf burn”
  - Skin abrasion
  - May increase risk of chemical exposures
  - Increases risk of infection including MRSA



Concussions

Aging artificial turf fields may carry risk of head injuries

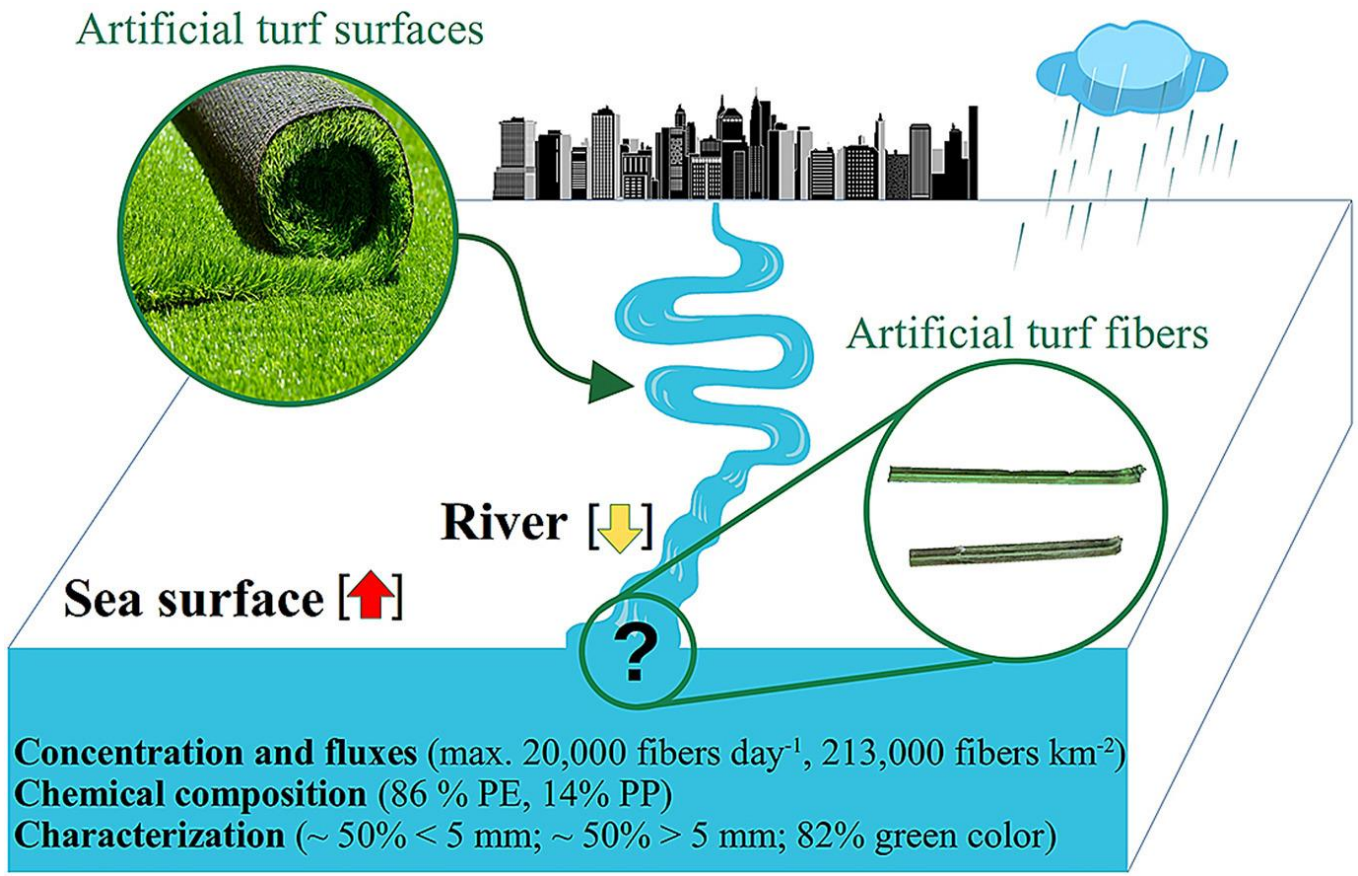
A Charlestown mother sounded the alarm after a popular athletic field repeatedly failed shock absorption tests.

By Kay Lazar Globe Staff, Updated September 24, 2022, 7:32 p.m.

Johanna Hynes dragged her foot over the artificial turf at Charlestown High School that has repeatedly failed shock absorption tests. JIM DAVIS/GLOBE STAFF

- 1 in 6 sports concussions due to surface impact
- NFL: Concussion risk is increased by play on artificial turf and in colder temperatures (Smoliga 2022)
- Hardness (G-max) should be measured 1-2x per year in multiple field locations and depends greatly on:
  - -Proper maintenance
  - -Age of field
  - -Frequency of play
  - -Padding
  - -Infill distribution
  - -Temperature

Emerging Concern: Microplastics

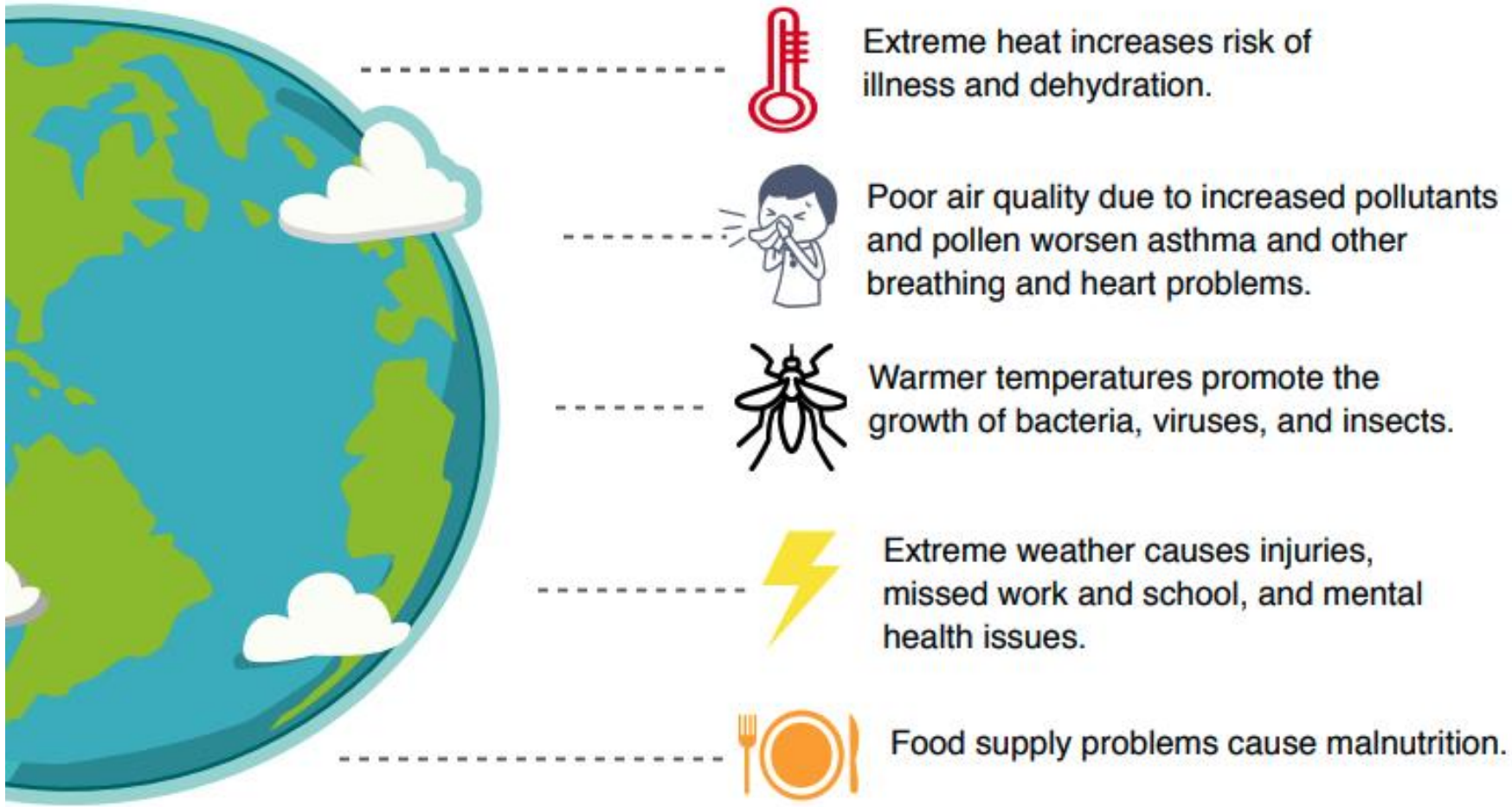


de Haan et al 2023 Env. Poll. Vol 334, 122094

- Indoor & outdoor air
- Tap and bottled water
- Seafood
- Inhale and ingest 5g/week
- Lung, blood, placenta
- Health effects may include:
  - Inflammation
  - GI problems
  - Obesity/metabolic disorders
  - Respiratory problems
  - Immune dysruption
  - Endocrine disruption
- EU Ban on microplastics includes artificial turf

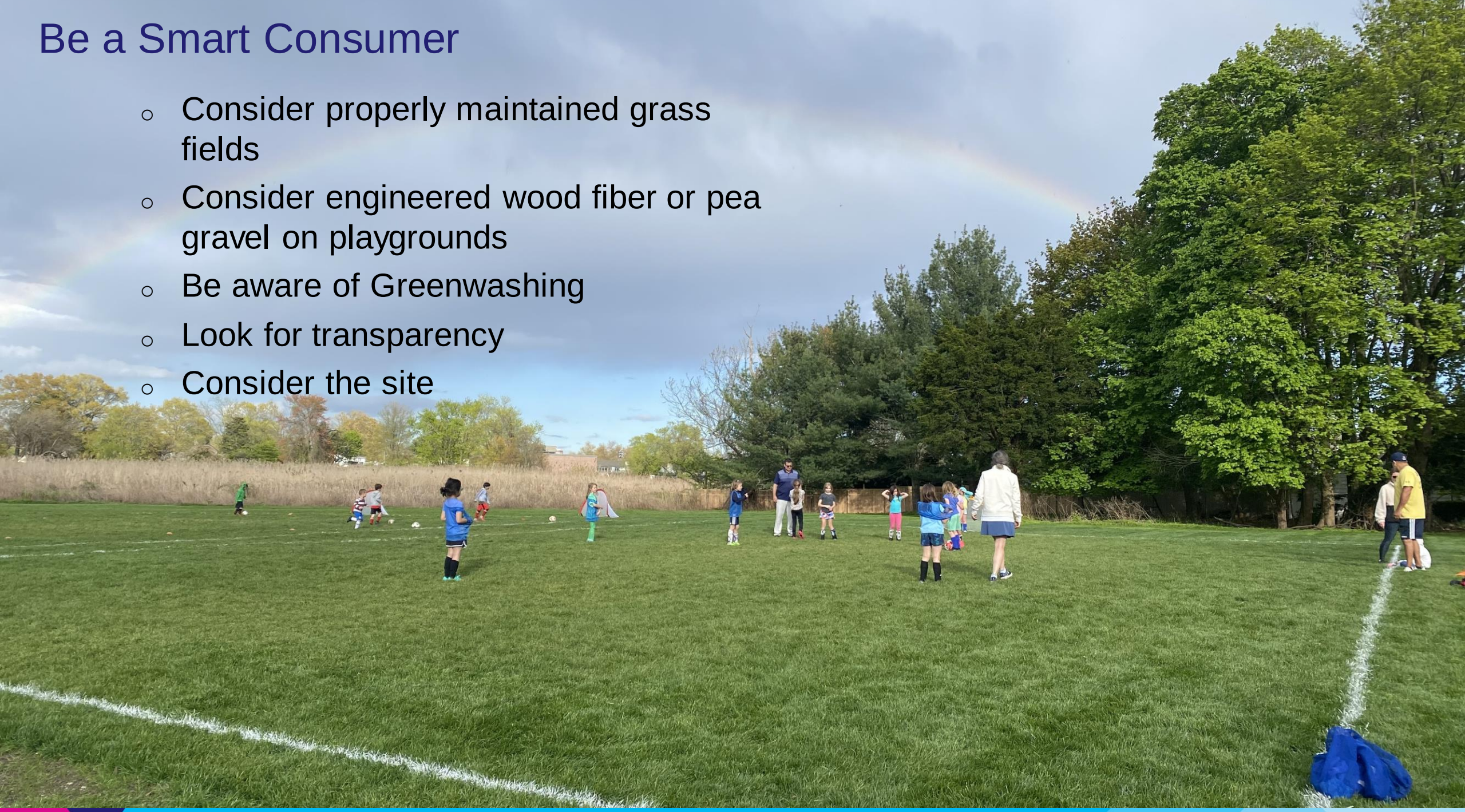
Indirect health effects: climate change

- Petroleum-based
- Heat islands
- Flooding
- Greenhouse gas emissions

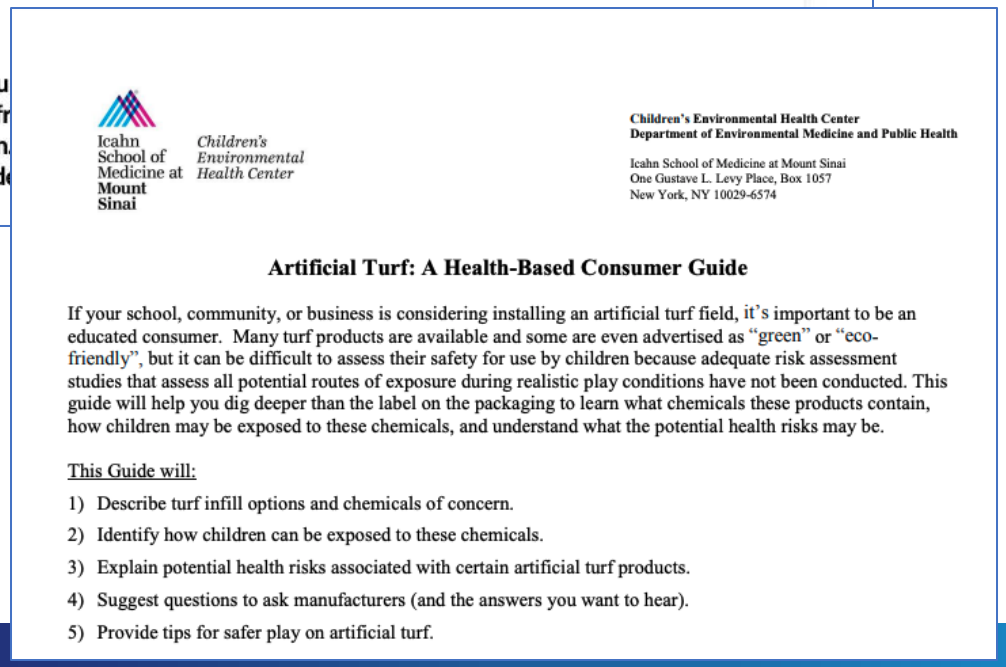


Be a Smart Consumer

- Consider properly maintained grass fields
- Consider engineered wood fiber or pea gravel on playgrounds
- Be aware of Greenwashing
- Look for transparency
- Consider the site



Learn More



Icahn School of Medicine at Mount Sinai *Children's Environmental Health Center*

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Artificial Turf: A Health-Based Consumer Guide

If your school, community, or business is considering installing an artificial turf field, it's important to be an educated consumer. Many turf products are available and some are even advertised as "green" or "eco-friendly", but it can be difficult to assess their safety for use by children because adequate risk assessment studies that assess all potential routes of exposure during realistic play conditions have not been conducted. This guide will help you dig deeper than the label on the packaging to learn what chemicals these products contain, how children may be exposed to these chemicals, and understand what the potential health risks may be.

This Guide will:

1) Describe turf infill options and chemicals of concern.
2) Identify how children can be exposed to these chemicals.
3) Explain potential health risks associated with certain artificial turf products.
4) Suggest questions to ask manufacturers (and the answers you want to hear).
5) Provide tips for safer play on artificial turf.

https://mountsinaiexposomics.org/learning-hub/turf-sports/

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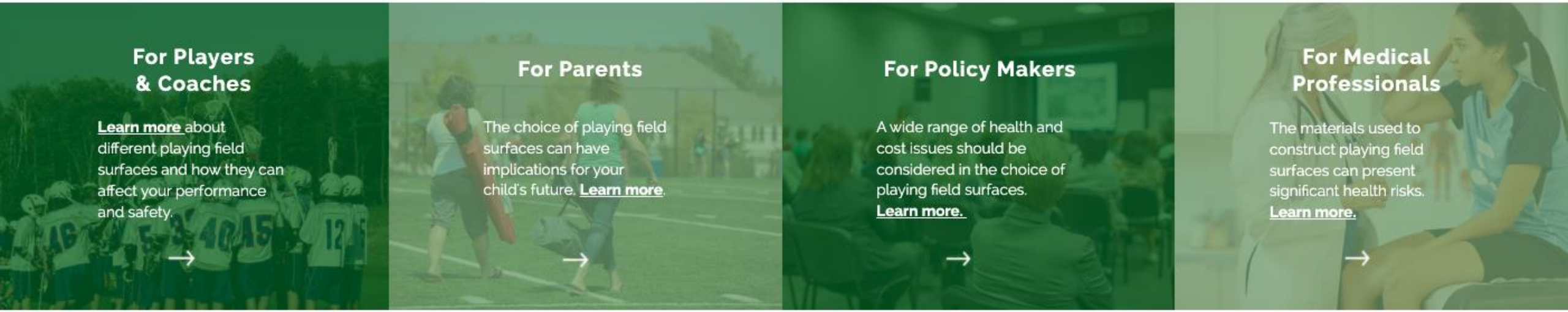
The Partnership for Healthy Playing Surfaces

Home | Chemicals | Health | Environment | Science | Comparisons



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https://www.healthyplayingsurfaces.org/

Thank you

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