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[Home](#) » Position Statement on the Use of Artificial Turf Surfaces

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The Children's Environmental Health Center Recommendations

The Mount Sinai Children's Environmental Health Center at the Institute for Climate Change, Environmental Health, and Exposomics recommends against the installation of artificial turf playing surfaces and fields due to the uncertainties surrounding the safety of these products and the potential for dangerous heat and chemical exposures.

This position is supported by the following:

- **Studies to assess the safety of artificial turf are ongoing and inconclusive.** The preponderance of existing data on artificial turf pertains to recycled tire infill, or "crumb rubber", which contains known carcinogens and neurotoxins. Concerns about the safety of recycled rubber playing surfaces have been raised by the federal government, based on a lack of comprehensive studies. In 2016, the United States Environmental Protection Agency (USEPA) announced the launch of an investigation into the safety of crumb rubber in partnership with the Centers for Disease Control and Prevention and the Consumer Product Safety Commission, stating "**existing studies do not comprehensively evaluate the concerns about health risks from exposure to tire crumb**".^[1] In July 2019, USEPA published a portion of their findings from these studies, which confirmed the presence of chemicals linked to cancer, nervous system toxicity, and impaired reproductive development such as polycyclic aromatic hydrocarbons, benzene, lead, and phthalates.^[2] The authors

emphasize that the reported findings **do not constitute a risk assessment** and cannot be interpreted as evidence of safety.

Adequate safety assessment requires biomonitoring to determine chemical exposures under realistic play conditions. Importantly, no studies have addressed children's exposure to chemicals from artificial turf surfaces via oral and dermal routes, the two most likely ways that turf chemicals enter the body during play. These studies are underway at USEPA; until findings are available and conclusively demonstrate the safety of artificial surfaces, we recommend a moratorium on the use of these materials where children play.

- **Questions remain about the safety of alternatives to crumb rubber.** Extremely few studies have examined the composition and safety of alternative infills including those purported to be “natural”. A 2016 USEPA report found research supporting the safety of alternative infills such as EPDM, TPE, and plant-based infills “lacking or limited”. [3] Recent studies including one conducted by Mount Sinai and the Toxic Use Reduction Institute (TURI) found the **presence of known carcinogens and neurotoxins including polycyclic aromatic hydrocarbons (PAHs), lead, zinc, and black carbon in almost all alternative infill materials examined.** [4],[5]
- **Undisclosed chemicals of concern are present in plastic grass blades and turf pads and matting.** A recent study identified per- and poly-fluoroalkyl substances (PFAS, aka “Teflon chemicals”), a class of more than 5000 chemicals linked to numerous health problems including cancer, nervous system toxicity, immune dysfunction, thyroid, and cardiovascular disease in the plastic grass blades and backing used on artificial turf fields and in adjacent bodies of water. [6],[7],[8],[9] PFAS are considered “forever chemicals” because they persist in the body and the environment and are widespread drinking water contaminants. These findings raise concerns about PFAS groundwater and environmental contamination from turf field run off and emphasize the need for further examination of exposures that may occur from turf components other than infill.

Recent actions by the USEPA highlight increasing recognition that there is no safe level of PFAS exposure. On March 14, 2023, USEPA proposed National Primary Drinking Water Regulations for six PFAS, dramatically lowering the recommended levels of PFOA and PFOS and citing **scientific evidence of health impacts at drinking water levels close to zero.** [10] These guidelines also include advisories for newer PFAS chemicals PFNA, GenX, PFBS, and PFHxS. In addition to

drinking water regulations, steps have been taken to designate PFAS hazardous substances and restrict their use in certain products both at the federal and state level.^{[11],[12],[13],[14],[15],[16]} **To allow the installation of PFAS-containing surfaces would be extremely short-sighted as further restrictions and regulations on these chemicals are likely to come.**

- **Risk of heat injury is elevated on artificial turf.** On hot summer days, temperatures of over 160 degrees Fahrenheit have been recorded on recycled rubber play surfaces.^[17] All artificial turf surfaces examined have been shown to have higher surface temperature and air temperature at head height compared with natural grass, regardless of infill type.^[18] Vigorous play in these conditions conveys a very real risk of burns, dehydration, heat stress, or heat stroke. Children are less able to regulate their body temperature than adults, making them particularly susceptible to conditions of extreme heat.^{[19],[20]}

High temperatures and risk of heat illness lead to a loss of field usage even on hot days, which have become increasingly common due to climate change. Like asphalt, artificial turf fields contribute to the “heat island effect”, in which communities close to the fields become hotter than surrounding areas.^[21] Artificial turf contributes to the climate crisis throughout its lifecycle, requiring fossil fuels during production and emitting greenhouse gases during use and disposal.^[22]

- **Children are uniquely vulnerable to harmful exposures from artificial turf surfaces** because of their unique physiology and behaviors, rapidly developing organ systems, and immature detoxification mechanisms.^[23] Children may be exposed to artificial turf chemicals through ingestion, inhalation, skin absorption, and open wounds or broken skin. Children and young athletes breathe faster than adults, putting them at greater risk for inhalation of chemicals that off-gas from turf fields. Small children put their hands and other objects in their mouths, increasing the risk of exposure via ingestion. In addition, youth have a higher surface area to body mass ratio, produce more body heat per unit mass, and sweat less than adults, all factors that increase susceptibility to heat injuries that have been observed on artificial turf fields.¹⁴ Vulnerability to turf chemicals persists through the teen years as the reproductive and nervous systems continue to develop beyond the first two decades of life. Lastly, children have more future years of life over which chronic diseases linked to the chemicals in turf develop.

- **Chemical hazards escape from artificial turf surfaces to the environment.** A number of

the chemical components of artificial turf surfaces are soluble in water. When rain and snow fall on synthetic fields, these materials can leach from the surface to contaminate ground water and soil.^[24] Recent studies find PFAS in wetlands adjacent to artificial turf suggesting that these chemicals may migrate from field components to contaminate the environment.⁷ Runoff from turf fields also has the potential to release microplastics into the environment. Microplastic contamination is found in drinking water and wildlife throughout the globe and in human blood, lungs, and placenta.^{[25],[26],[27]}

- **Turf materials are transported home.** Over time, play surfaces break down into smaller pieces and fine particles that may be picked up on children's shoes, clothing, and skin. Infill and grass blades accumulate in shoes and stick to bodies of players, bringing these materials into cars and homes. Thus, exposure can continue for many hours beyond the time that a child spends in the play area.

Daily outdoor play and physical activity are essential components of a healthy childhood. Safe play areas are an essential component of any school environment. While it is important to maximize safe play time, we caution against the use of materials which carry risks of chemical and heat exposure and have not been comprehensively tested for safety.

For the reasons outlined above, the Children's Environmental Health Center recommends natural grass fields and playing surfaces as the safest option for areas where children play.

Corresponding Faculty

Sarah F. Evans, PhD, MPH, Assistant Professor, Department of Environmental Medicine and Climate Science, Icahn School of Medicine at Mount Sinai. Dr. Evans regularly speaks to community groups and policy makers about the health hazards of artificial turf and the alternatives solutions. To invite Dr. Evans for a presentation, **please contact us**.

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