



Artificial Turf Fact Sheet

Artificial turf is a multi-layered fossil fuel-based plastic product which can include hundreds of hazardous chemicals in the plastic carpet as well as in most cushioning or infill materials. Here we present some of the scientifically documented concerns for young athletes. To read the published, peer-reviewed scientific studies which support these statements, please visit our webpage on artificial turf: grassrootsinfo.org/artificial-turf.

High temperatures. A comprehensive study by Brigham Young University found surface temperatures as high as 200° F on a 98° F day. Even on cooler days, field temperatures of 120° F to 174° F were recorded. In general, the surface temperature of the artificial turf was 37° F higher than asphalt and 86.5° F hotter than natural grass. Water cannons or other irrigation systems can cool down a field for about 20 minutes, interrupting play numerous times on particularly hot days. Serious heat-related health problems are associated with playing on hot surfaces, including dehydration, heat stroke and heat exhaustion. There are also many reports of serious burns on the soles of the feet of players (through socks and shoes) when the temperatures on the turf are dangerously high.

Injuries. There is compelling data indicating that joint injuries (especially ankles and knees) are more common on artificial turf surfaces. The G-max rating - the ability to absorb impact - changes as the surfaces are compacted, often resulting in a harder surface that makes concussions and other injuries more likely and more severe. The Hospital for Special Surgery in New York notes that despite progress by artificial turf manufacturers in making their fields feel more “natural,” players still suffer from debilitating turf toe (sprain of the main joint of the big toe) which is unique to artificial playing surfaces. Most NFL players agree that playing on artificial turf increases soreness and fatigue.

Crumb rubber health concerns. As many as 40,000 used vehicle tires shredded into crumb rubber pellets are used as cushioning material for a single artificial turf field. Tires contain a toxic brew of chemicals, many of which are known carcinogens or endocrine disruptors. Government regulations allow these toxic materials to be used on artificial turf fields, but that does not imply or assure safety.

- The exact chemical composition of tires is largely determined by the intended use for the tire and the manufacturing location. Typical tire rubber contains 40-60% rubber polymer, 20-35% reinforcing agents, up to 28% aromatic extender oil, vulcanization additives, antioxidants, antiozonants, and processing aids (plasticizers and softeners).

- Examples of chemicals of concern in the above categories and their potential health effects:

1,3 Butadiene – human carcinogen
4-(t-octyl) phenol – corrosive to mucous membranes
Arsenic – human carcinogen
Benzene – human carcinogen, developmental and reproductive toxicant
Benzothiazole – acutely toxic, respiratory and eye irritant, dermal sensitizer
Butylated Hydroxyanisole – human carcinogen, suspected endocrine and immune system toxicant
Cadmium – human carcinogen
Carbon Black – human carcinogen (makes up to 40% of rubber tires)
Fluoranthene – human carcinogen
Latex – allergic reactions in susceptible individuals
Lead – neurotoxin
Manganese – neurotoxin
Mercury – neurotoxin
N-hexadecane – eye, skin and respiratory system irritant
Octylphenol – endocrine disruptor
Per- and polyfluoroalkyl substances (PFAS) - carcinogen, endocrine disruptor, liver toxicant, thyroid disease
Phthalates – endocrine disruptors, developmental and reproductive toxicants
Polycyclic Aromatic Hydrocarbons (PAHs) – reproductive and respiratory toxicants, liver toxicants, suspected blood or cardiovascular toxicants
Styrene – human carcinogen and mutagen
Toluidine – human carcinogen
Trichloroethylene – human carcinogen

- Crumb rubber pieces can become lodged in mouths, ears and noses, and crumb rubber dust can be easily inhaled as it becomes disturbed during play. Also, many of the above listed chemicals are volatiles (chemicals which outgas), which means that they will create inhalation exposures, especially in warmer temperatures. Given the number of different sources for ground up rubber tires and the unique chemical components of each individual field, an absolute determination of safety is impossible. And since many of these chemicals are toxic at any level of exposure, the presence of even one of these chemicals on fields where children play should trigger a public health concern.

- There have been reports of higher than usual cases of lymphoma and leukemia among athletes using artificial turf fields, especially soccer goalies. While no studies to date have confirmed a link, common sense tells us that chemicals in tires that are known to cause cancer should be avoided wherever possible.

Alternative infill materials. Alternative materials for cushioning artificial turf fields are now available, but more research is needed to confirm their safety. Plastic coatings on crumb rubber as well as other plastic infill alternatives (EPDM, TPE) often contain toxic flame-retardant chemicals, and may also contain styrene and butadiene, classified by the World Health Organization (WHO) as carcinogens. While infill from natural cork or coconut hulls may possibly reduce heat

exposure, there is insufficient data concerning potential chemical exposures, leaching and off-gassing.

Body fluid contamination. There is always potential for body fluid contamination on a playing field during normal sports activities, including blood, saliva, sweat and vomit. Natural grass fields have the advantage of soil microbes to help break down pathogens, but plastic surfaces on artificial turf need to be disinfected with chemical pesticides to ensure safety, adding an additional concern for the health and safety of players.

Turf burns and infections. Turf burns (skin abrasions) are more common on artificial turf fields than natural grass fields and are typically larger in size, providing more opportunity for infection. Research on the causes of MRSA (Methicillin-resistant Staphylococcus aureus) outbreaks in sports teams is ongoing, but there appears to be an association with traumatized skin, as seen in turf burns, and this serious antibiotic-resistant staph infection. Medical experts have found that staphylococci and other bacteria can survive for more than 3 months on polyethylene, the type of plastic material used in the manufacture of artificial turf.

Toxic PFAS chemicals. Research has confirmed that plastic grass blades, crumb rubber infill, underpadding and other materials and components of artificial turf fields may contain per- and polyfluoroalkyl substances (PFAS). Exposure to these "forever chemicals" has been linked to cancer, liver damage, decreased fertility, asthma and thyroid disease. PFAS chemicals take a very long time to degrade, accumulating in the environment and living organisms and threatening water sources if they are not disposed of as hazardous waste. PFAS chemicals also volatilize, especially on hot, sunny days, and the amount of PFAS that young athletes inhale has yet to be quantified.

Lead. The pigment used in older artificial turf fields may contain lead. As the fields age and the elements fade and break down the plastic, it begins to powder, making the lead more accessible. The crumb rubber may also contain lead from tire balancing weights and lead paint residue picked up from road surfaces. Lead is a potent neurotoxin and even tiny amounts can affect the brain, especially in young children. There is no safe lead exposure level for children.

Chemical flame retardants. These chemicals (polybrominated diphenyl ethers, or PBDEs) are being added to some artificial turf fields to deter vandals from setting them on fire, but the chemicals are hazardous to humans. PBDEs persist in the environment and accumulate in fatty tissue and breast milk through bio-magnification and bio-accumulation. PBDEs are linked to endocrine disruption (especially thyroid function) and neurological impacts and are considered possible human carcinogens.

Micro- and nanoplastics. As the plastic material breaks down into tiny plastic particles due to friction from field use, exposure to UV radiation from the sun and other sources of degradation, micro- and nanoplastics (MNPs) are shed into the surrounding environment, contaminating soil, air and water sources. An average 80,000 square foot field contains 40,000 pounds of plastic carpeting and 400,000 pounds of infill. Depending on age, type of use and maintenance of the field, annual plastic fiber loss on a single field has been estimated at .5% and 10% annually. Emerging research is finding these MNPs and their chemical components in human blood and organs. Players on

artificial turf are subject to all pathways of exposure to MNPs, including inhalation, skin absorption and accidental ingestion.

Heat island effect. Artificial turf fields contribute to a warming planet. They retain heat due to the plastic and infill components and become significantly hotter than natural grass, contributing to the "heat island effect." In fact, thermal images generated from NASA satellite mapping show artificial turf fields as hot spots, or areas of concentrated heat. In addition, unlike natural grass fields, these fields are unable to convert carbon dioxide into oxygen or store carbon in their biomass.

Environmental Pollution. Used artificial turf fields cannot be easily or economically recycled. The toxic chemicals from plastic, crumb rubber, pesticides, flame retardants and other materials will continue to pollute the surrounding environment for generations, contaminating ground and surface waters. The tons of plastic carpet will eventually degrade into tiny particles and be released into air and water, carrying with them their hazardous components and threatening public health.

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Main office: 184 Main Street, Port Washington, New York 11050

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