



## Artificial Turf Fields Fact Sheet

### ***Crumb Rubber Health Concerns***

- As many as 40,000 used vehicle tires are recycled into crumb rubber pellets to use as infill or cushioning material for a single artificial turf field.
- Used or “scrap” rubber tires present significant problems in solid waste management as their sheer numbers, flammability and indestructible nature makes them persist in the environment. When disposed of in landfills, they take up massive amounts of space, leach toxic chemicals and collect water that creates a fertile breeding ground for disease- transmitting mosquitoes.
- The Resource Conservation and Recovery Act (RCRA) of 1976 gives the EPA the authority to control hazardous waste from “cradle-to-grave,” including used rubber tires. But it also states that the recycling of a hazardous waste product into a useable consumer product automatically exempts it from RCRA requirements, even if the end product it creates is more toxic than other similar products on the market. This loophole means that no monitoring follows the new products that have been manufactured from recycled hazardous waste, such as artificial turf crumb rubber infill or recycled rubber playground surfaces.
- 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)
  - Flouranthene – 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.

### ***Other Health Concerns***

- **High temperatures on artificial turf** - A comprehensive study on the temperature of artificial turf fields was conducted by Brigham Young University. The researchers found that the amount of light (electromagnetic radiation) had the greater impact on heating of the fields than air temperature. The hottest surface temperature recorded was 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 canons or other irrigation systems can cool down a field for only about 20 minutes, interrupting the game numerous times on particularly hot days.

Serious heat-related health problems are associated with playing on artificial turf fields, including dehydration, heat stroke and heat exhaustion. More frequent water breaks are a necessity and many players concur that the heat issue impacts their ability to perform their best. 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.

- **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 after games to ensure safety. However, in practice, this is rarely done, if ever, and the use of chemical disinfectants (pesticides) adds an additional concern for the health and safety of players.

- **Injuries** – Although there is not enough research comparing injuries incurred on artificial turf versus natural grass fields, there is compelling data indicating that joint injuries (especially ankles and knees) are more common on artificial turf surfaces. 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. Almost 75% of NFL players feel that playing on artificial turf increases soreness and fatigue.

- **Turf burns or abrasions and infections** – Skin abrasions (turf burns) are more common on plastic 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 plastic, the material used in the manufacture of artificial turf carpets and grass blades.

- **Chemical flame retardants** – One of the more recent developments in the controversy over artificial turf has been the vandalizing of fields by setting them on fire. Rubber tires (and tire crumbs) burn for long periods of time, releasing highly toxic smoke, which could be hazardous for those living in close proximity to a school or park where a field is located. Because of this, manufacturers of artificial turf are now treating the fields with chemical flame retardants. Polybrominated diphenyl ethers, or PBDEs, are commonly used flame retardant chemicals that belong to a broader class of chemicals called polyhalogenated aromatic hydrocarbons, or PHAHs. PBDEs are intrinsically hazardous because they are persistent in the environment, accumulating in the fatty tissue and especially breast milk of humans through bio-magnification and bio-accumulation. They are linked to endocrine disruption (especially thyroid function) and neurological impacts. They are considered possible human carcinogens.

- **Micro - and nanoplastics (MNPs)** Artificial turf is a multi-layered fossil fuel-based plastic product which includes hundreds of hazardous chemicals in the plastic carpet and blades as well as in the infill material. 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 and it is estimated that as much as 3,000 pounds of plastic is shed annually. Emerging research is finding these MNPs and their chemical components in our blood and organs. Players on artificial turf are subject to all pathways of exposure to MNPs, including inhalation, skin absorption and accidental ingestion.

- **Toxic PFAS chemicals in plastic grass blades.** Recent studies are showing that the plastic grass blades on turf fields contain per- and polyfluoroalkyl substances (PFAS). PFAS exposure has been linked to cancer, liver damage, decreased fertility, asthma and thyroid disease. PFAS chemicals are also known as “forever” chemicals, meaning they 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 can also volatilize, especially on hot, sunny days, and the amount of PFAS that young athletes inhale has yet to be quantified.

- **Few toxicological and risk assessment studies exist for alternative infill materials.**

Alternative materials for cushioning artificial turf fields are now available, but more research needs to be done before any conclusions as to their safety can be drawn. Plastic coatings on crumb rubber as well as other plastic infill alternatives (EPDM, TPE) often contain flame retardant chemicals and are composed of chemicals like styrene and butadiene, which are classified by the World Health Organization (WHO) as carcinogens. The human health impacts from exposure to these plastic substances in artificial turf infill materials is not yet known, but the extreme heat effects and contact injuries are similar to crumb rubber infill. While infill from natural cork or coconut hulls may possibly reduce heat exposure, there is insufficient data concerning potential chemical exposures, leaching and offgassing.

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Rev. 9/24 dw