



Synthetic Turf Fields Fact Sheet

Background Information

- 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.
- There is a considerable effort to find uses for recycled rubber tires. Historically they have been used as fuel in the paper and cement industries, as road construction materials and in construction of drainage fields for septic systems, among other industrial applications. But with the growing number of used tires and prohibitions for their disposal in landfills, new markets for this hazardous waste product are actively being sought.
- A relatively recent use of ground up used rubber tires, also known as “crumb rubber,” is to cushion or infill synthetic turf fields or create playground surfaces. Approximately 40,000 tires can be recycled into crumb rubber pellets to use as infill material for a single field.
- The Resource Conservation and Recovery Act (RCRA) of 1976, our nation’s primary law governing disposal of solid and hazardous waste, 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 synthetic turf crumb rubber infill or recycled rubber playground surfaces.

Chemical Composition of Crumb Rubber

- 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
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 Health Concerns

- 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 synthetic 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 synthetic turf** - A comprehensive study on the temperature of synthetic 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 synthetic 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 synthetic 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 synthetic 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 synthetic turf versus natural grass fields, there is compelling data indicating that joint injuries (especially ankles and knees) are more common on synthetic turf surfaces. The Hospital for Special Surgery in New York notes that despite progress by synthetic 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 synthetic turf increases soreness and fatigue.

- **Turf burns or abrasions and infections** – Skin abrasions (turf burns) are more common on plastic synthetic 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 synthetic turf carpets and grass blades.

- **Chemical flame retardants** – One of the more recent developments in the controversy over synthetic 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 synthetic 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.

- **Toxic PFAS chemicals used to facilitate the manufacture of plastic grass blades raise new concerns about synthetic turf's safety.** A recent discovery that the plastic grass blades on turf fields contain PFAS chemicals (per- and polyfluoroalkyl substances) is yet another issue to be addressed when considering replacing natural grass with synthetic turf. Dr. Linda Birnbaum, former Director of the National Institute of Environmental Health Sciences concluded that a “safe” level of PFOA (the chemical found in the plastic blades) would need to be lowered to 0.1 parts per trillion, 700 times lower than the current EPA standard. 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. PFAS chemicals in synthetic turf will add to the cost, both in terms of human health and the bottom line for schools and municipalities.

- **Few toxicological and risk assessment studies exist for alternative infill materials.** The health concerns of recycled tire crumb rubber infill have forced many schools and municipalities to look at alternative materials for cushioning synthetic turf fields, 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 synthetic turf infill materials is not yet known, but the extreme heat effects and contact injuries are similar to crumb rubber infill. Natural cork and coconut hulls (corkonut) alternative infills have the fewest health concerns.

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