



# SYNTHETIC TURF AND CRUMB RUBBER INFILL

A Summary of the Current State

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## **Executive Summary**

Synthetic turf is used on thousands of athletic fields and children’s playgrounds around the world. With a growing trend toward green and sustainability initiatives, a push towards conducting more thorough research and filling the gaps in data is currently being conducted. The goal of this research is to reveal the health effects, if any, related to exposure of the materials which comprise synthetic turf. The center of the discussion is related to polycyclic aromatic hydrocarbon (PAHs) concentration, volatile organic compound (VOCs) concentration, and heavy metal concentration in the synthetic fibers of the turf; as well as the recycled rubber infill (crumb rubber) used to provide a cushioned layer for those using the fields, as well as assist in maintaining the integrity of the turf itself. Human carcinogens have been identified through crumb rubber infill sampling and analysis, but there is currently a data gap in the evaluation of the exposure to individuals playing on these synthetic surfaces.

In the last decade studies have been conducted to assess the association between synthetic turf, crumb rubber use, and the onset of cancer. These studies were sparked by a report written by the Washington State Health Department as they analyzed cancer trends and risks among athletes aged 6 and 24 who were diagnosed with cancer between 2002 and 2015. This report has shown that individuals who participate in activities on synthetic turf fields with crumb rubber infills do not have higher cancer rates in comparison to individuals who do not actively participate in activities on synthetic turf with crumb rubber infills.<sup>6</sup>

## **Background**

Beginning in 1965, artificial turf began making appearances in professional athletic venues across the country. As an alternative to natural grass, artificial turf allowed for continuous use with minimal maintenance. Originating as the commonly known term “AstroTurf”, because of its installation in Houston at the newly built Astrodome. Popularity quickly spread into outdoor college football venues as well as throughout the professional ranks. In the 1970’s a second generation synthetic turf began to make its appearance throughout the country, with a new material made up of polypropylene fibers which had a much more natural appearance in comparison to the original AstroTurf. This new rendition was used until the mid-1990’s in which the current synthetic turf, made from polyethylene grass blades, was introduced. This new turf was revolutionary, as this new turf incorporated for the first time a crumb rubber infill made up of recycled tires. The purpose of this crumb rubber infill was to allow for a more natural grass like feel, a cushioned layer, as well as added traction for athletes as they run across the playing surface<sup>5</sup>.



## **Risks**

The Washington State Department of Health published a report in 2017 analyzing the information brought forward by the University of Washington’s Assistant Women’s Soccer Coach Amy Griffin. Coach Griffin comprised a list of soccer players around the country aged 6 to 24 who were diagnosed with cancer between 2002 and 2015. This list was used to compare the number of cancer diagnoses associated with soccer players to the number of soccer players expected to have cancer if their cancer

rates were equivalent to that of the general population in that geographic region. It was determined that there was not enough sufficient evidence to suggest a correlation, and that the State Health Department did not have reason to warrant a further public health response. From peer-reviewed scientific literature, it was determined that the concentrations of chemicals known to be toxic to the human body which are often found in the crumb rubber infill, is very low. On the contrary this does not provide a completed picture of the exposures, as chemical concentrations differ on each playing surface, and the mechanism of exposures for each individual who utilizes the crumb rubber infilled playing surface differs (i.e. body weight, amount of crumb rubber infill ingested or taken in through dermal contact and inhalation).



A study in 2012, Kim et al., described how the ingestion of crumb rubber infill resulted in increased exposure to lead in young individuals who are actively utilizing synthetic turf fields. This study describes how particle size directly impacts the concentration of exposure to individuals. As the particles become smaller, down to the scale of dust, there is an increased likelihood of ingestion and inhalation. For individuals who are lower to the ground or are often spending time diving into the synthetic turf there is an additional increased

susceptibility to inhaling dust containing lead from the crumb rubber infill.

Research has been done to help classify the potential exposure to lead for individual's playing on synthetic turf surfaces with crumb rubber infill. Lead is a heavy metal, and probable human carcinogen, which has a long latency period within the body. When lead is absorbed by the body it negatively affects the efficiency of absorption of other compounds such as calcium, which is essential for a young body to continue to develop. There is a direct correlation between the amount of lead absorbed by the body in children compared to grown adults. Children's bodies, in general, have faster metabolisms which allows for more rapid absorption of materials through ingestion and inhalation<sup>4</sup>.

In addition to lead, studies have found that other heavy metals, PAHs, and VOCs make up a significant part of the hazardous profile of crumb rubber infill, finding elevated levels of toxic substances such as<sup>1</sup>:

- Benzo(a)pyrene
- Benzo(e)pyrene
- Benzo(a)anthracene
- Butylated Hydroxyanisole
- Phthalates
- Carbon Nano-Tubes
- Cadmium
- Chromium
- Zinc



Of the compounds listed above, multiple are known or suspected carcinogens. An unpublished study by Rutgers University analyzed crumb rubber infill from fields in New York State. Six separate PAHs which are "highly likely" to be carcinogenic to humans were identified.<sup>2</sup>

To minimize potential exposure to crumb rubber infill, it is recommended that when an individual is actively using these fields for a prolonged period (i.e. as part of an athletic team or for daily recess on a campus) that individuals should implement the following practices:

- Practice good hygiene.
- Wash hands when leaving the field of play.
- Prior to entering the individual's residence; remove shoes, cleats, and all sporting equipment that may have come into contact with crumb rubber infill. This is done in an effort to limit the tracking of crumb rubber infill into places of residency.
- Shower after practices and games to remove any crumb rubber infill pellets or crumb rubber infill dust from the body.
- If crumb rubber infill gets into the mouth, spit out pellets and wash out mouth immediately to limit the concentration of ingested crumb rubber infill.

Additionally, heat poses a significant risk to individuals partaking in activities on synthetic turf. During the warmer months, it is not uncommon for ground level temperatures to read in excess of 140°Fahrenheit when the ambient temperature is 90° Fahrenheit. These severe temperatures, elevated due to the heat absorbed by the synthetic turf materials and the crumb rubber infill, can lead to elevated risk of heat related illness, burns, and a breaking down of the components of the field turf itself.

### **Alternatives**

Many different options have arisen as alternatives to filling synthetic turf with the recycled tire crumb rubber infill. One of the more popular options is known as "Nike Grind", in which the rubber soles of donated/recycled shoes are ground up and used as the infill on the turf. This is different than the tire rubber in that it is tested and known to not exceed hazardous levels of known concerning compounds found in the traditional tire rubber that has been used for the past 20 years.



Another option is a non-toxic thermoplastic elastomer (TPE). This product is made of a plastic material which mimics the feel of rubber infill allowing for adequate cushion and safety of the athletes.

A third option is an organic infill, such as coconut fibers, cork, or recycled nutshells. Using an organic infill mimics the feel of a natural grass field, while allowing for maximum cushion, traction, and playability.<sup>7</sup>

### **Conclusion**

While research is still ongoing, and there is currently no definitive data stating that traditional crumb rubber infill has negative health effects to athletes playing on it, it is recommended that alternatives be considered. Using more environmentally safe and friendly alternatives as infill will minimize the potential for hazardous exposures to athletes for years to come.

## Sources

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