

# RECYCLED RUBBER INFORMATION PACKET



December 2017

Know the Facts About Recycled Rubber Infill

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# Recycled Rubber Information Packet

## KNOW THE FACTS ABOUT RECYCLED RUBBER INFILL

### OVERVIEW

#### Recycled Rubber and its Uses

- Recycled rubber is rubber that has been derived from scrap materials such as used tires.
- Since 2007, an estimated 4.5 billion square feet of synthetic turf have been installed around the world, including 800 million square feet in the U.S. Recycled rubber infill is used in over 98% of the 12,000+ synthetic turf sports fields.
- Recycled rubber infill benefits sustainability efforts.
  - The use of this infill helps by conserving water, reducing fertilizers, pesticides and herbicides, and diverting millions of tires from landfills.

#### Recycled Rubber Infill is Safe

**To date, over 90 studies have been published that determined there is negligible or very low human health risk from exposure to recycled rubber infill.**

- Since 1990, there have been over 90 technical studies and reports, conducted by leading universities, toxicologists, and government agencies, that have delved into various health and human safety questions relating to the use of recycled rubber as an aftermarket product, including its use as infill in synthetic turf sports fields.
- These existing studies have evaluated many aspects of safety; they have looked a multitude of chemicals, at all major exposure pathways—ingestion, inhalation, skin contact—and have used many methods.
  - These studies and reports have failed to find any link between recycled rubber infill and cancer or any other human health risk.

#### Recent Studies on Recycled Rubber

- In 2016, President Barack Obama pushed for a comprehensive look at the health risks and the Centers for Disease Control and Prevention and the U.S. Consumer Product Safety Commission, announced they would look into the issue and conduct their own research. This is despite the fact that the EPA had previously looked into the issue and had not raised concerns.
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- The federal study was to last one year and industry cooperated with EPA because we believed it was to our benefit to help them accomplish the study. However, after 11 months of data collection, EPA has now determined that it needs another two years to complete its work. It has now asked for permission to extend its study into 2019 and collect more data.
- There has also been an abundance of additional reputable scientific research made publicly available since February 2016 that support the safety of recycled rubber. These studies include:
  - A study by the Washington Department of Health, that while limited in its scope, found the premise of reports of soccer players with cancer—a key driver of attention to the issue—to be false.
  - A Dutch government (RIVM) risk assessment that concluded, "...because the substances are more or less 'enclosed' in the granulate, which means that the effect of these substances on human health is virtually negligible."
  - A European Chemicals Agency (ECHA) study of the health effects of playing on recycled rubber infill fields including exposure to metals, PAH's and volatiles through skin contact, inhalation and ingestion—which concluded there is a very low level of concern and found no reason to advise against playing on fields using recycled rubber infill.
- Dr. Archie Bleyer, an expert in pediatric oncology with over a decade of experience and the former chair of the Children's Cancer Group, published a peer-reviewed commentary in *Sports Medicine*, saying that the available science does not support the hypothesis that recycled rubber is unsafe, and, in fact, promotes a healthier lifestyles through physical activity.
- The Cal Ripken Sr. Foundation commissioned a study of the chemical and physical properties of recycled rubber infill and found that cancer risks were "at or below one in a million."
- Dr. Michel D'Hooghe, Chairman of the International Federation of Football Associations (FIFA) Medical Committee, wrote the following in a public letter to FIFA members: "A large number of studies have further confirmed that the effect of SBR rubber are as negligible as the effect of ingesting grilled foods or exposure to tyre wear on roads in everyday life."

Recycled rubber is rubber that has been derived from scrap materials such as used tires.
- Michael Peterson, a toxicologist, published a peer-reviewed study in *Environmental Research*. His multipathway risk assessment of chemicals found within recycled rubber infill found no elevated public health risk from playing on this material.
- The Tire Industry Project conducted extensive ambient air testing and found the presence of tire and road-wear particles (TRWP) to be below all human health and regulatory thresholds. The report states that "based on a comprehensive risk assessment, the studies demonstrated that TRWP are considered safe for human health and the environment."

## ONLINE RESOURCES



**Safe Fields Alliance**

<http://www.safefieldsalliance.com/>



**ISRI**

Institute of  
Scrap Recycling  
Industries, Inc.

*Voice of the Recycling Industry*

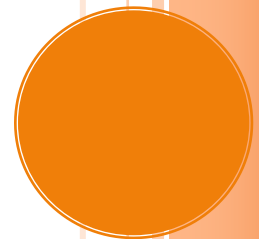
<http://www.recycledrubberfacts.org/>



**Synthetic Turf**  
COUNCIL

<http://www.syntheticurfCouncil.org/>

# SELECTED RECENT RESEARCH



# Peer-Reviewed Risk Assessment in *Environmental Research* (October 2017)

To read the full study, click here:

<https://www.sciencedirect.com/science/article/pii/S0013935117303936>



Contents lists available at ScienceDirect

Environmental Research

journal homepage: [www.elsevier.com/locate/envres](http://www.elsevier.com/locate/envres)



## Comprehensive multipathway risk assessment of chemicals associated with recycled ("crumb") rubber in synthetic turf fields



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### ARTICLE INFO

#### Keywords

Risk assessment  
Recycled rubber  
Crumb rubber  
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### ABSTRACT

**Background:** Thousands of synthetic turf fields in the US are regularly used by millions of individuals (particularly children and adolescents). Although many safety assessments have concluded that there are low or negligible risks related to exposure to chemicals found in the recycled rubber used to make these fields, concerns remain about the safety of this product. Existing studies of recycled rubber's potential health risks have limitations such as small sample sizes and limited evaluation of relevant exposure pathways and scenarios.

**Objective:** Conduct a comprehensive multipathway human health risk assessment (HHRA) of exposure to chemicals found in recycled rubber.

**Methods:** All available North American data on the chemical composition of recycled rubber, as well as air sampling data collected on or near synthetic turf fields, were identified via a literature search. Ingestion, dermal contact, and inhalation pathways were evaluated according to US Environmental Protection Agency (US EPA) guidance, and exposure scenarios for adults, adolescents, and children were considered.

**Results:** Estimated non-cancer hazards and cancer risks for all the evaluated scenarios were within US EPA guidelines. In addition, cancer risk levels for users of synthetic turf field were comparable to or lower than those associated with natural soil fields.

**Conclusions:** This HHRA's results add to the growing body of literature that suggests recycled rubber infill in synthetic turf poses negligible risks to human health. This comprehensive assessment provides data that allow stakeholders to make informed decisions about installing and using these fields.

### 1. Introduction

Synthetic turf fields containing recycled rubber (also called "crumb rubber") infill have been in use for decades. These fields typically consist of bottom backing layers composed of polypropylene, polyurethane, or latex, with polyethylene, nylon, or polypropylene blades woven into the material (Synthetic Turf Council, 2011). After the field is laid down, infill is added to soften the field and allow the individual turf blades to stand up (Fig. 1). One of the most common types of infill

is recycled rubber, often mixed with sand (Synthetic Turf Council, 2011). Recycled rubber infill is typically made from recycled automobile and light truck tires, which are ground, shredded, and sorted into uniformly sized pieces (Synthetic Turf Council, 2011).

In the mid-2000s, a US Environmental Protection Agency (US EPA)<sup>1</sup> investigation identified the presence of lead in a synthetic turf field in New Jersey, and it was eventually determined that the source of the lead was a yellow pigment used on the synthetic turf's blades (US EPA, 2017a). This finding resulted in the initiation of multiple regulatory

# Synthetic Turf Fields, Crumb Rubber, and Alleged Cancer Risk

Archie Bleyer<sup>1,2,3</sup> 

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**Abstract** Most synthetic turf fields have crumb rubber interspersed among the simulated grass fibers to reduce athletic injuries by allowing users to turn and slide more readily as they play sports or exercise on the fields. Recently, the crumbs have been implicated in causing cancer in adolescents and young adults who use the fields, particularly lymphoma and primarily in soccer goalkeepers. This concern has led to the initiation of large-scale studies by local and federal governments that are expected to take years to complete. Meanwhile, should the existing synthetic turf fields with crumb rubber be avoided? What should parents, players, coaches, school administrators, and playground developers do? What should sports medicine specialists and other health professionals recommend? Use grass fields when weather and field conditions permit? Exercise indoors? Three basic premises regarding the nature of the reported cancers, the latency of exposure to environmental causes of cancer to the development of clinically detectable cancer, and the rarity of environmental causation of cancer in children, adolescents, and young adults suggest otherwise.

## Key Points

In 2014, crumb rubber in synthetic turf fields was hypothesized to cause cancer in adolescents and young adults who used the fields, particularly lymphoma and primarily in soccer goalkeepers.

The concern has induced some school systems and park departments to abandon plans to install synthetic turf fields and governments to initiate major toxicology studies, the results of which are expected to take years to obtain.

Meanwhile, the state of the science of adolescent and young adult cancer causation does not support the hypothesis.

On the contrary, the potential for decreasing exercise by reducing access to playgrounds and sports fields may increase the rate of cancer occurrence in later life.

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## 1 Background

A hypothesis that synthetic turf fields can cause cancer was publicized after a soccer coach at the University of Washington collected a list of young adult soccer players, particularly goalkeepers, who had been diagnosed with lymphoma and other cancers [1]. Because crumb rubber infill, the shock absorption layer within synthetic turf derived from recycled automotive tires, contains some potentially carcinogenic chemicals, the turf has been



implicated. As goalkeepers are more likely than outfield players to ingest or inhale the crumb or absorb crumb constituents via their skin, the hypothesis gained credence. As a result, some school systems and park departments have abandoned plans to install synthetic turf fields, and some states have introduced bills to ban such installations [2]. In 2015, the California Office of Environmental Health Hazard Assessment began an Environmental Health Study of Synthetic Turf, and in early 2016, three US federal agencies launched the Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields [3–5]. Millions of dollars have been earmarked for these studies [6] that are expected to take years to complete.

## 2 State of Science

Several studies of human cancer and/or non-cancer risk using data from direct measurements or data reported in the literature have been reported [7–14]. Other studies have focused directly or indirectly on the toxicity of one or more constituents of crumb rubber [14–23]. None of these studies have identified a significant human carcinogenic risk from exposure to crumb rubber at synthetic turf fields. Menichini and co-investigators [22] estimated that 0.4 ng/m<sup>3</sup> of benzo(a)pyrene at an indoor facility had a potential for an excess lifetime cancer risk of 1 in a million athletes after an intense 30-year activity level. Marsili and coauthors [24] considered the hazard indices and cumulative excess risk values for cancer to be below levels of concern for measured chemicals; they reasoned that polycyclic aromatic amines in the crumb rubber could potentially increase cancer risk after long-term frequent exposures at fields under very hot conditions (60 °C). Polycyclic aromatic amines have been implicated in some studies as an occupational lymphomagen, but the most recent systematic review and meta-analysis of cohort studies refuted the association [25]. Kim and colleagues [18] proposed a potential risk for children with pica behavior through ingestion of crumb rubber material at playgrounds. The most recent review published in a peer-reviewed journal concluded that users of artificial turf fields, even professional athletes, are not exposed to elevated risks [26]. Since this review, the most detailed studies of potential carcinogenicity conducted to date, by the Washington State Department of Health in USA and the Dutch National Institute for Public Health and the Environment, did not find an association between the fields and an increased incidence of cancer in the susceptible age group [27, 28].

Meanwhile, what should parents, players, coaches, school administrators, and playground developers do and physicians recommend? Avoid synthetic turf fields and use

grass fields when weather and field conditions permit? Three basic premises suggest otherwise.

### 2.1 The Cancers Cited in Media Reports About Soccer Players are Precisely those Cancers that are Expected to Occur in the Age Group of Concern

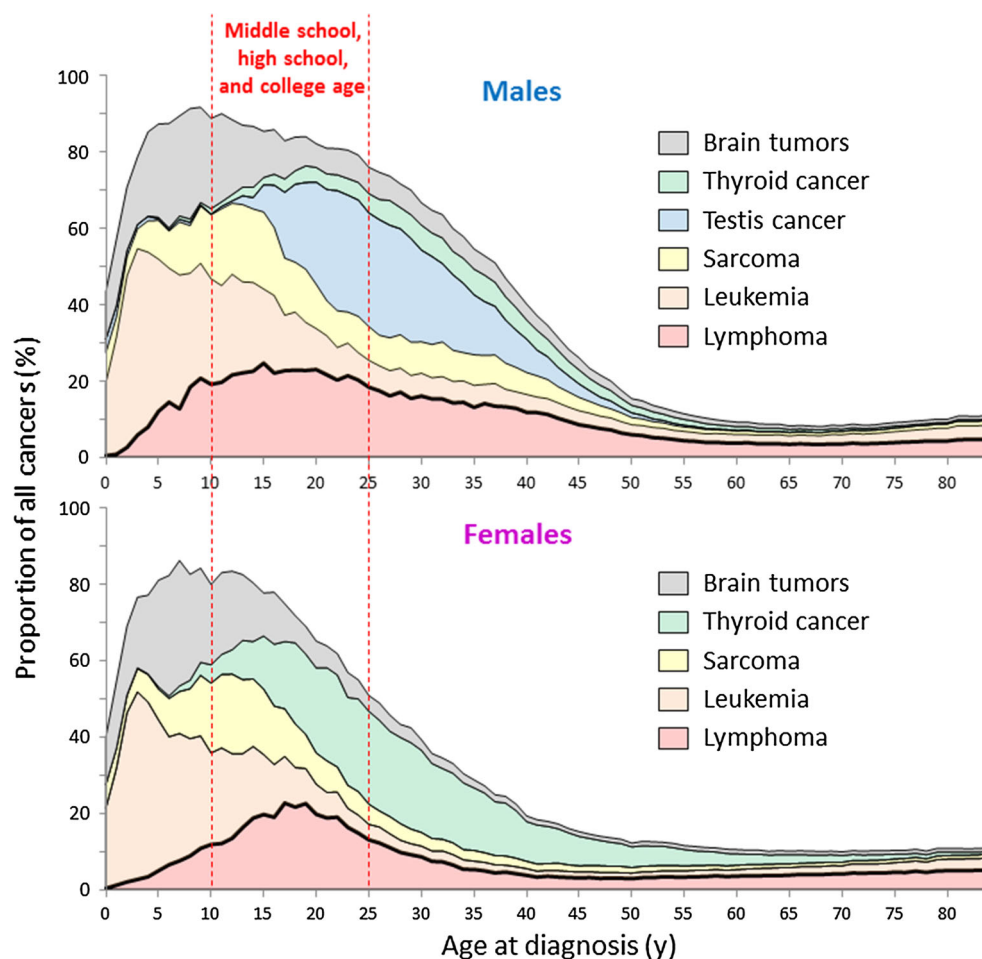
Not only is lymphoma the most common cancer in high-school and college-age persons, the other cases in the reported cohort—leukemia, sarcoma, testis cancer, thyroid cancer, and brain tumors—are the next most common cancers in the age group. Together with lymphoma, these cancers account for 80–90% of the cancers in male individuals of middle-school, high-school, and college age and 50–80% of female individuals in the age group (Fig. 1) [29]. In other words, the suspect cancers are precisely those expected without having to invoke exogenous factors.

The issue then is whether the absolute frequency is more than expected. An ecologic investigation applied to the state with the largest number of synthetic fields, California, and to 17 other regions of USA, did not indicate that the incidence is greater in counties and regions with synthetic fields or that the incidence is proportional to the prevalence of such fields when race/ethnicity and socioeconomic status of those who have access to synthetic fields are included in the analyses [30]. The method used did not, however, directly measure the incidence in soccer players per se and could miss an increase of lymphoma in them, particularly if only a small percentage of cases have exposure to synthetic turf fields. In the State of Washington, about 25% of 15-year-old individuals have been estimated to play soccer at some point in their lives [27]. The proportion is likely to be higher in California, given the more conducive weather and the greater Hispanic population. If so, the ecologically derived data are more meaningful in assessing the risk than the face value of the results. A more complete ecologic study of all 58 counties in California is in progress.

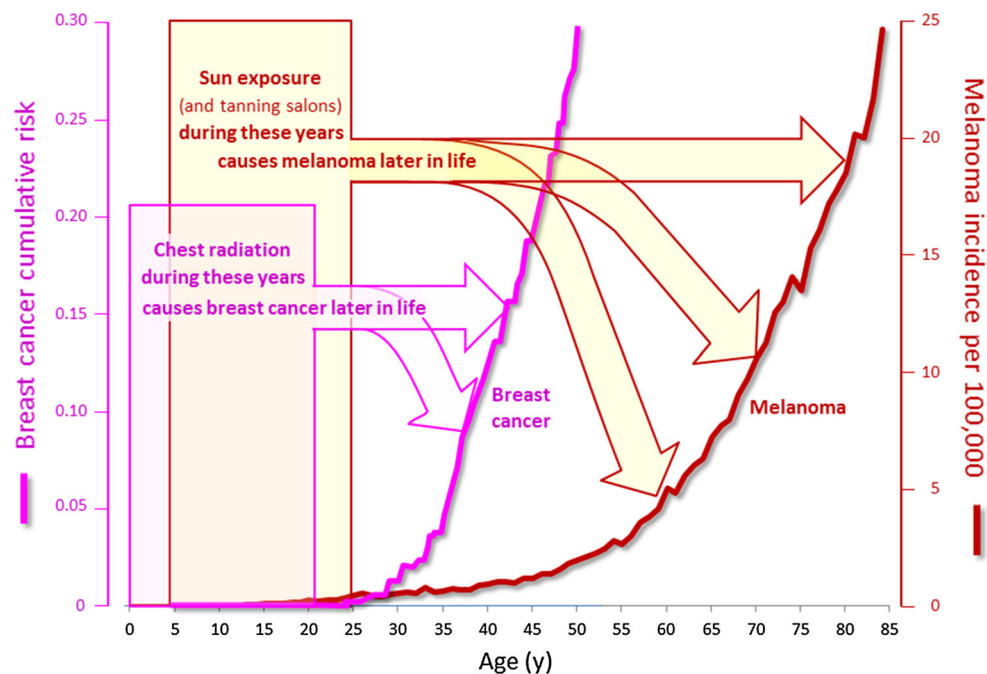
### 2.2 Exposure to Environmental Causes of Cancer During Childhood, Adolescence, and Early Adulthood Results in Cancer Later in Life

Figure 2 shows two established causes of cancer resulting from exposures during childhood and adolescent: melanoma after ultraviolet radiation and breast cancer after chest radiation. The type of melanoma caused by ultraviolet rays is rarely diagnosed before the age of 35 years (Fig. 2, brown curve) and breast cancer caused by chest radiation for cancer has a median latency of 14 years [31] and rarely occurs before 30 years of age (Fig. 2, pink curve). When melanoma occurs in younger persons, it is

**Fig. 1** Prevalence of the suspect cancers of all cancers by age and sex. Source: US National Cancer Institute Surveillance, Epidemiology, and End Results Program, SEER 18 Regions, 2000–2013 [29]



**Fig. 2** Incidence of melanoma in sun-exposed areas of skin (face, lips, ears) and, in female individuals, breast cancer after chest radiation during childhood or adolescence, and latency to clinical manifestation. Source: the melanoma data are from the US National Cancer Institute Surveillance, Epidemiology, and End Results Program SEER 18 Regions, 2000–2013 [29] and the breast cancer data are from Moskowitz et al. [31]



nearly always not related to external exposure. If crumb rubber causes cancer in young athletes, it would be expected to become clinically detectable at an older age than during adolescence or early adult years.

### 2.3 Environmental Causation of Cancer in Children, Adolescents, and Young Adults is Rare

During the 1990s, the world's largest pediatric cancer research organization, the Children's Cancer Group, was awarded millions of dollars of research grants to determine what caused cancer in the young. None of those studies, nationally and in multistate surveys, within homes and with environmental sampling, of childhood and prenatal exposures, and a host of other variables, uncovered evidence for an environmental factor that "might explain more than a small fraction of the observed cases" [32]. The conclusion was that, with few exceptions, cancer during childhood, adolescence, and early adulthood is a mistake of nature—spontaneous mutation to malignancy—and not the result of exogenous causes [33].

### 3 Conclusion

All the prior studies and the perspectives expressed here cannot completely exculpate crumb rubber as a cause of cancer. Even the Washington State study of the very soccer players whose cancer raised the concern is not without significant limitations, as fully expressed by the investigators [27] and critiqued by others [34]. The concern of parents, coaches, school administrators, sports medicine specialists, other healthcare professionals, and the players themselves is reasonable, especially when, if the hypothesis were true, the adverse outcome is potentially preventable. After all, cancer is one of the most feared diseases [35] and to have it happen in the young could not be worse.

It is also human nature to blame. Blaming autism on vaccines is a recurrent quintessential example. It also illustrates another human behavior: refusal to believe objective scientific irrefutable evidence [36] and this anti-science attitude appears to be increasing in our society [37, 38]. This human need and attendant denial causes unnecessary alarm, especially when cancer is the fear and especially in the United States. When American adults were asked which of five major diseases they were most afraid, 41% said cancer, 31% said Alzheimer's disease and only 6–8% named heart disease, stroke or diabetes [39].

Regular physical activity during adolescence and early adulthood helps prevent cancer later in life [40]. Restricting the use or availability of all-weather year-round

synthetic fields and thereby potentially reducing exercise could, in the long run, actually increase cancer incidence, as well as cardiovascular disease and other chronic illnesses [41]. That the Washington State study found a much lower incidence of cancer in their soccer players than expected from their general population [27] supports the concern that restricting access to such fields and playgrounds may lead to the opposite of what was intended.

#### Compliance with ethical standards

**Funding** No sources of funding were used to assist in the preparation of this article.

**Conflict of interest** Archie Bleyer has no conflicts of interest directly relevant to the content of this article.

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National Institute for Public Health  
and the Environment  
*Ministry of Health, Welfare and Sport*

## **Dutch National Institute for Public Health and the Environment**

### **Playing sports on synthetic turf fields with rubber granulate is safe**

*Publication date: 20 December 2016*

*Modification date: 07 March 2017*

New research by the Dutch National Institute for Public Health and the Environment (RIVM) shows it is safe for people to play sports on synthetic turf fields with an infill of rubber granulate. Rubber granulate contains numerous substances which were found to be released from the granulate in very low quantities. This is because the substances are more or less 'enclosed' in the granulate, which means that the effect of these substances on human health is virtually negligible.

#### **Playing sports on synthetic turf fields**

Rubber granulate contains numerous substances, such as polycyclic aromatic hydrocarbons (PAHs), metals, plasticisers (phthalates) and bisphenol A (BPA). There is little variation in the concentrations of substances between fields and between the measurement points per field. Therefore, the results properly reflect all fields with SBR rubber granulate in the Netherlands.

#### **No link with leukaemia**

No indications were found in the available literature of a link between playing sports on synthetic turf fields with an infill of rubber granulate and the incidence of leukaemia and lymph node cancer. Moreover, it is clear from the composition of the rubber granulate that the chemical substances that are capable of causing leukaemia or lymph node cancer are either not present (benzene and 1,3-butadiene) or are present in a very low quantity (2-mercaptobenzothiazole). Since the 1980s, a slight rise has been observed in the number of people aged between 10 and 29 who get leukaemia. This trend has not changed since synthetic turf fields were first used in the Netherlands in 2001.

#### **Recommendation for adjusting the standard**

RIVM recommends adjusting the standard for rubber granulate to one that is closer to the standard applicable to consumer products. Rubber granulate is required to satisfy the legal requirements for 'mixtures'. The standard for consumer products is far more stringent: it allows far lower quantities of PAHs (100 to 1000 times lower) compared with the standard for mixtures. The quantity of PAH in rubber granulate is slightly higher than the standard for consumer products. The European Chemicals Agency (ECHA) is currently conducting research to determine a suitable standard for rubber granulate.

RIVM also completed a study on the consumer product standard for rubber shock absorbing tiles.





## **European Chemicals Agency**

### **Recycled Rubber Infill Causes a Very Low Level of Concern**

*ECHA has evaluated the risk of substances in recycled rubber that is used on artificial sports pitches. Based on the evidence, ECHA has concluded that the concern for players on these pitches, including children, and for workers who install and maintain them is very low. ECHA will update its evaluation as and when new information becomes available.*

Helsinki, 28 February 2017 – In June 2016, the European Commission asked ECHA to evaluate the risk to the general population, including children, professional players and workers installing or maintaining the pitches.

A number of hazardous substances are present in recycled rubber granules, including polycyclic aromatic hydrocarbons (PAHs), metals, phthalates, volatile organic hydrocarbons (VOCs) and semi-volatile organic hydrocarbons (SVOCs). Exposure to these substances through skin contact, ingestion and inhalation was considered.

Based on the information available, ECHA concludes that there is, at most, a very low level of concern from exposure to recycled rubber granules:

- The concern for lifetime cancer risk is very low given the concentrations of PAHs typically measured in European sports grounds.
- The concern from metals is negligible given that the data indicated that the levels are below the limits allowed in the current toys legislation.
- No concerns were identified from the concentrations of phthalates, benzothiazole and methyl isobutyl ketone as these are below the concentrations that would lead to health problems.
- It has been reported that volatile organic compounds emitted from rubber granules in indoor halls might cause irritation to the eyes and skin.

In the studies that ECHA evaluated, which are listed in the report, the concentrations of PAHs in recycled rubber granules were well below the limits set for carcinogenic, mutagenic and reprotoxic (CMR) substances for consumers in REACH.

ECHA has also highlighted several uncertainties in its evaluation. Therefore, ECHA suggests the following action to be taken:

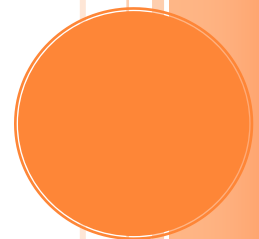
1. Consider changes to the REACH Regulation to ensure that rubber granules are only supplied with very low concentrations of PAHs and any other relevant hazardous substances.
2. Owners and operators of existing (outdoor and indoor) fields should measure the concentrations of PAHs and other substances in the rubber granules used in their fields and make this information available to interested parties in an understandable manner.
3. Producers of rubber granules and their interest organisations should develop guidance to help all manufacturers and importers of (recycled) rubber infill test their material.
4. European sports and football associations and clubs should work with the relevant producers to ensure that information related to the safety of rubber granules in synthetic turfs is communicated in a manner understandable to the players and the general public.

5. Owners and operators of existing indoor fields with rubber granule infills should ensure adequate ventilation.

In addition, ECHA recommends that players using the synthetic pitches should take basic hygiene measures after playing on artificial turf containing recycled rubber granules.

ECHA's evaluation has been sent to the European Commission. The findings are preliminary and will be updated when new information becomes available.

# STATE AGENCY AND REGULATORY BODY CONCLUSIONS







## **Washington State Department of Health**

### **Synthetic Turf and Crumb Rubber**

#### *Investigation of Reported Cancer among Soccer Players in Washington State*

In 2009, the University of Washington Women's Associate Head Soccer Coach, Amy Griffin, became concerned that several soccer goalies had developed blood cancers at around the same time. By 2014, the coach had compiled a list of soccer players with cancer. The initial information included 30 current or former Washington residents who played soccer and developed a variety of cancer types between the mid-1990s and 2015. By 2016, the number on the coach's list had grown to 53 people.

In light of this, public health officials at the Department of Health and researchers at the University of Washington School of Public Health formed a project team to investigate issues related to soccer playing and cancer. The overall purpose of the investigation was to explore whether the information from Coach Griffin's list warranted further public health response. The primary goals of the investigation were to:

- Determine whether the number of cancer diagnoses among the soccer players on Coach Griffin's list was higher than would be expected if rates of cancer among these soccer players were similar to rates among all Washington residents of the same ages.
- Describe individuals on the list in terms of their demographics, factors related to cancer and history of playing soccer and other sports.

Note: The investigation was not designed to determine if soccer players in general were at increased risk of cancer due to exposures from crumb rubber in artificial turf.

### **Frequently Asked Questions**

#### **Can you explain the type of study conducted? What did it consist of?**

We conducted a cluster investigation of reported soccer players with cancer in Washington. Generally, cancer cluster investigations are within a geographic area, and look at whether that area has an increased rate of a specific cancer compared to the rest of Washington. This investigation wasn't only geographically defined, but also defined by those who had played soccer in Washington. In that way, it's more similar to an investigation among a particular occupation group. The concern was that too many cancer diagnoses were being seen among soccer players on Coach Griffin's list so we looked to see whether the number of cancers on her list was higher than we would expect based on Washington state rates.

### **Is it safe for my kids to play on synthetic fields made with crumb rubber?**

Based on what we know today, the Washington State Department of Health recommends that people who enjoy soccer continue to play regardless of the type of field surface. Our recommendation is based on our investigation and the available research on crumb rubber which currently does not suggest it poses a significant public health risk. Assurances of the safety of artificial turf with crumb rubber are limited by the lack of adequate information on potential toxicity and exposure.

### **What about carcinogens or substances in the crumb rubber that are known to cause cancer? Should parents be concerned?**

Parents should be aware, but not concerned. We know that crumb rubber is made from tires that contain chemicals that have been shown to cause cancer. However, what is critical to consider are the routes of exposure and potential dose someone receives. The available research suggests exposures from crumb rubber are very low and will not cause cancer among soccer players. The Washington State Department of Health recommends that people who enjoy soccer continue to play regardless of the type of field surface.

### **How can I continue to reduce my kid's exposure to chemicals in crumb rubber?**

While the available research does not indicate a significant health risk, there are several ways to minimize any potential exposures to chemicals from synthetic turf fields.

- Always wash hands after playing on the field and before eating.
- Take off shoes/cleats, sports equipment and soiled uniforms outside or in the garage to prevent tracking crumb rubber into the house.
- Shower after play, and quickly clean any cuts or scrapes to help prevent infection.
- Athletes who accidentally get crumb rubber in their mouths should spit it out; don't swallow it.
- Will my child get cancer if he/she plays on these crumb rubber fields?

With very few exceptions, no one knows if someone will develop cancer in their lifetime. That being said, our investigation did not find the number of cancers on Coach Griffin's list to be concerning, and the available research does not suggest that playing soccer on artificial turf causes cancer.

### **Can you rule out, with 100 percent certainty, that there is nothing in the synthetic turf that can cause cancer?**

No, synthetic turf fields made with crumb rubber infill do contain chemicals that have been shown to cause cancer. However, what is critical to consider are the routes of exposure and potential dose someone receives. The available research suggests exposures from crumb rubber are very low and will not cause cancer among soccer players. The Washington State Department of Health

recommends that people who enjoy soccer continue to play regardless of the type of field surface.

### **Who did you interview for this study?**

For this study, we interviewed people or parents of people on Coach Griffin's list to obtain information on demographics, cancer-related factors, and history of playing soccer and other sports.

### **Why did you only look at soccer players?**

We focused on soccer players, because this was the original group of concern, and most of the individuals on Coach Griffin's list played soccer. A relatively small number of people played a variety of other field sports. Because cancer takes time to develop and be diagnosed, we also required a time lapse of about five months (0.4 years) between first playing soccer and diagnosis.

### **What would you tell communities who are considering installing a synthetic field? Or deciding not to install a synthetic field?**

It is important for Washington communities to build and support environments that make it easier for adults and youth to be physically active. Physical activity can slow the increase in the proportion of adults who are obese, reduce rates of chronic disease, and improve the quality of life. The currently available research does not suggest that crumb rubber presents a significant public health risk.

### **How many soccer fields did you include in your study?**

We did not do any testing of soccer fields. We did interview people on Coach Griffin's list reported to us as having cancer and having played soccer. The interviews revealed that the 35 people interviewed had practiced on about 110 soccer fields in Washington.

### **How does Washington compare with the other states regarding rates of cancer in ages five through 24?**

During 2009–2013, the age-adjusted cancer incidence rate for all types of cancer combined among people ages five to 24 years was statistically significantly higher in Washington than in the United States (23.6 and 22.4 per 100,000 people, respectively), so our age adjusted rate has about 1.2 more cancers per 100,000 than nationally.

### **Why did you limit the time period for people meeting the case definition to 2002–2015?**

We limited the time period for people meeting the case definition to 2002–2015 because reports of people with cancer on the coach's list were more likely to be complete during this time period than in earlier time periods. The only person who was diagnosed with cancer before 2002

was diagnosed in the mid-1990s before artificial turf fields with crumb rubber fields were installed in Washington.

**Why did you limit the case definition to people who were ages six to 24 years?**

We limited the case definition to people who were ages six to 24 years when diagnosed because processes leading to the development of cancer are often different for children and adults. Most cancer investigations and research focus on children and adults separately, with children defined as under ages 15 or 20 years old. We opted to include people diagnosed up to age 24 years because we wanted to include as many people as possible in the case definition without becoming so inclusive that it would lessen the potential to find a problem if one existed. This age group included about 70 percent of people reported to our team.

**Did you find that any one position, e.g., goalies, had an increased number of cancer diagnoses?**

Our investigation explored whether there was an increased number of cancer diagnoses among soccer players on Coach Griffin's list compared to what we would expect if soccer players experienced the same cancer rates as Washington residents of the same ages. We were able to look at all people on the list with a history of playing soccer, as well as goalkeepers on the list and neither group had an increased number of cancer diagnoses.

**Why didn't you look at expected cancers among players on crumb rubber turf fields?**

To be able to look at the expected cancers among players on crumb rubber turf fields, we would have had to be able to identify who the soccer players were overall who had played on turf fields. We had no way to assess this. We did look at select and premier players on Coach Griffin's list to see if they had an increased number of cancer diagnoses compared to what we would expect, but they did not. We hypothesized that they likely had longer playing experience and would have greater exposure to crumb rubber.

# STATE OF CONNECTICUT

## DEPARTMENT OF PUBLIC HEALTH

Jewel Mullen, M.D., M.P.H., M.P.A.  
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**EHS Circular Letter #2015-02**  
**(Follow up to Circular Letter #2014-26a)**

DATE: January 20, 2015

TO: Local Health Departments and Districts

FROM: Brian Toal, Gary Ginsberg  
Environmental and Occupational Health Assessment

RE: Recent News Concerning Artificial Turf Fields

**Brief Video Clip for Local Health Departments – *Click Here* →**



This letter and video clip are being sent to update you regarding the news story that has circulated since last spring regarding potential cancer risks at artificial turf fields. Various media outlets have continued to run this story and a number of local health departments have inquired as to its validity. Since many Connecticut towns have installed or are considering artificial turf fields an elevated cancer risk would be an important consideration. However, this news story is still based upon very preliminary information and does not change CTDPH's position that outdoor artificial turf fields do not represent an elevated health risk.

The Connecticut Department of Public Health has evaluated the potential exposures and risks from athletic use of artificial turf fields. Our study of 5 fields in Connecticut in 2010-2011 was a comprehensive investigation of releases from the fields during active play. This study was conducted as a joint project with the CT DEEP and the University of CT Health Center and was peer-reviewed by the Connecticut Academy of Science and Engineering. Our study did not find a large amount of vapor or particle release from the fields confirming prior reports from Europe and the US. We put these exposures into a public health context by performing a risk assessment. Our risk assessment did not find elevated cancer risk. These results have been published as a set of 3 articles in a peer review journal and are available on the DPH artificial turf webpage (<http://www.ct.gov/dph/cwp/view.asp?a=3140&q=464068> ).

The news story suggests soccer players and especially goalies may have an elevated cancer risk from playing on artificial turf fields. This is based upon anecdotal observations of a university soccer coach (<http://www.komoneews.com/news/local/Soccer-coach-Could-field-turf-be-causing-cancer-259895701.html> ). Reportedly the coach is developing a list of soccer players who have contracted cancer. However, the types of cancer are undocumented and so it is impossible to say whether they



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represent a common effect and there has been no reporting on how long the goalies played on artificial turf fields to see if there was plausible exposure and latency. There are many reasons why someone collecting a list of cancer cases may appear to find a cluster including the fact that when you have a single-minded focus on finding cases you do not capture all the non-cases that would tend to disprove the cluster. Documentation of an increased rate in soccer players would require an epidemiological study in which the total number who play on turf fields in a given region was also known so that a cancer rate could be established and compared to those that do not play on artificial turf fields. The current news report does not constitute epidemiological evidence and thus is very preliminary.

Our risk assessment did cover carcinogens that are known to be in recycled tires and the crumb rubber used to cushion fields. Once again, we found there to be very little exposure of any substances, carcinogenic or not, in the vapors and dust that these fields generate under active use, summer conditions. Background levels of chemicals in urban and suburban air from heating sources and automobile traffic are much more significant sources of airborne carcinogens. The fact that we sampled 5 fields (4 outdoor and 1 indoor) of different ages and composition suggests that the results can be generalized to other fields, a conclusion supported by the fact that results were similar to what was found in California, USEPA and European studies. Our study did not evaluate ingestion of the crumb rubber itself as players are unlikely to ingest an entire rubber pellet. However, two studies, one in California and one at Rutgers University did evaluate the cancer risk if children ingested a mouthable chunk of playground rubber (10 gram), using laboratory extraction methods to estimate the amount of chemicals that might become available in the stomach and absorbed into the body. Both studies found very low cancer risk from this scenario (Cal OEHHA 2007; Pavilonis et al. 2014). Thus, CT DPH finds no scientific support for a finding of elevated cancer risk from inhalation or ingestion of chemicals derived from recycled tires used on artificial turf fields. US EPA has a similar position: "At this point, EPA does not believe that the field monitoring data collected provides evidence of an elevated health risk resulting from the use of recycled tire crumb in playgrounds or in synthetic turf athletic fields."

(<http://www.epa.gov/epawaste/conservation/materials/tires/health.htm>)

In summary, federal and state authorities have taken seriously the concerns that artificial turf fields may present a health risk due to contaminants in recycled rubber. The best way to investigate these concerns is via an exposure investigation. Studies conducted in Connecticut and elsewhere have shown a very low exposure potential, less than from typical outdoor sources of air pollution. The current news reports of a list of soccer players with cancer does not constitute a correlation or causality and thus raises a concern that currently lacks scientific support. Thus, the CT DPH position expressed in 2011 at the conclusion of the Connecticut study, that outdoor artificial turf fields do not represent an elevated health risk, remains unchanged. For further information please contact Brian Toal or Gary Ginsberg at 860-509-7740.

## References

California OEHHA 2007. Evaluation of Health Effects of Recycled Waste Tires in Playground and Track Products. Prepared for the California Waste Management Board, January, 2007.

Pavilonis BT, Weisel CP, Buckley B, Lioy PJ. 2014. Bio accessibility and Risk of Exposure to Metals and SVOCs in Artificial Turf Field Fill Materials and Fibers. *Risk Anal.* 34: 44-55.

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March 23, 2015

Stephanie Bacon, Health Agent  
Office of Board of Health  
155 Village Street  
Medway, MA 02053

Dear Ms. Bacon:

Thank you for your letter of February 24, 2015, in which you requested that the Massachusetts Department of Public Health, Bureau of Environmental Health (MDPH/BEH), evaluate health concerns related to the use of crumb rubber infill material for artificial turf fields in Medway, Massachusetts. As you are likely aware, our office had previously evaluated this issue in a series of letters to the Town of Needham Board of Health in 2008, 2011, and 2013.

In response, MDPH/BEH staff have evaluated more recent information on potential exposure opportunities to artificial turf components, including crumb rubber infill, and evaluated health concerns, including cancer, in relation to exposure to such turf. Recent media reports on soccer players, particularly goalies that have played on artificial turf, and the incidence of some cancers have been expressed. These reports raised concerns about the possible association between playing on crumb rubber fields and the development of cancers, notably, non-Hodgkin's lymphoma, Hodgkin Lymphoma, and osteosarcoma. We also evaluated information you provided on the content of the specific products used in Medway. Our review is summarized below.

Updated Literature Review

Our previous evaluations noted that crumb rubber infill has been found to contain chemicals, including polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds (VOCs), and metals. We further stated that although these chemicals are in the material itself, information available at that time did not suggest significant exposure opportunities to the chemicals in the materials such that we would expect health effects. We noted that the most relevant study on this topic at the time was a study conducted by the California Office of Environmental Health Hazard Assessment (CA OEHHA).

Since that time, the CA OEHHA conducted additional evaluations of chemical concentrations in air above crumb rubber turf fields under active use (CA OEHHA 2010). Air samples were taken above fields and analyzed for VOCs and metals. Results suggested that adverse health effects were unlikely to occur from inhalation of VOCs or metals in particulates above these fields. To assess the potential for skin infections due to bacteria or to skin abrasions on these fields, tests for bacterial contamination were performed and the frequency of skin abrasions was assessed. Researchers found fewer bacteria detected on the artificial turf compared to natural turf, suggesting that the risk of infection to athletes using these fields was actually lower. However, more skin abrasions were observed in athletes using artificial turf fields than natural turf fields, and the study authors made various recommendations to help prevent skin abrasions (e.g., protective equipment or clothing) and prompt treatment of skin abrasions.

In another study, the state of Connecticut conducted air sampling at four outdoor artificial turf fields with crumb rubber infills (most relevant to Medway) under summer conditions (Simcox et al. 2011). Air measurements were taken using stationary air sampling monitoring devices as well as personal samplers (placed on people using the fields). They concluded that exposure opportunities to turf contaminants were not associated with elevated health risks and suggested that their findings were consistent with other studies available at the time. A letter prepared by the Connecticut Department of Public Health reiterates these conclusions (CTDPH 2015).

A 2014 study by researchers at the Rutgers Robert Wood Johnson Medical School in New Jersey evaluated opportunities for exposures to PAHs, semivolatile organic compounds (SVOCs), and heavy metals from exposures to artificial turf fibers and crumb rubber infills by measuring these constituents in simulated body fluids (digestive fluids, lung fluids, sweat) that represented different routes of exposure (ingestion, inhalation, dermal). This bioaccessibility study aimed to provide a better measure of the actual amount of these contaminants that might be absorbed into the body after exposure. The researchers found that PAHs were routinely below the limit of detection and SVOCs that have environmental regulatory limits to use for comparison were identified at levels too low to quantify. Some metals were detected but at concentrations at which health risks were low, with the exception of lead from the field sample collected. That sample indicated lead at levels in the simulated digestive fluids that the authors reported could result in blood lead levels above the current U.S. Centers for Disease Control and Prevention (CDC) reference value for blood lead in children (5 ug/dL). It should be noted that the lead concentration of the materials used in this study included a sample of turf fiber with a lead concentration of 4,400 mg/kg. This level contrasts with information on the Medway artificial turf components, which reportedly either contained lead at 39 mg/kg (crumb rubber infill) or had no lead (turf fibers) (see discussion later in this letter). Based on the lead result from this one field sample, the authors suggested that components of artificial turf fields should be certified for low or no lead content prior to use. Overall, however, the authors concluded that opportunities



for exposure to constituents in these fluids presented very low risk among all populations that would use artificial turf fields (Pavilonis et al. 2014).

A study conducted in 2010 in the Netherlands assessed the exposure of soccer players to PAHs after playing sports on a rubber crumb field. Urine testing in participants indicated that uptake of PAHs by the participants following exposure to artificial turf with rubber crumb infill was minimal. If there is any exposure, the authors reported, uptake is minimal and within the normal range of uptake of PAHs from environmental sources and/or diet observed in healthy individuals (van Rooij and Jongeneelen 2010).

It is probably worthwhile to also note that MDPH/BEH reviewed testing data for artificial turf for the Town of Needham, as reported in our letters of 2011 and 2013 to the Needham Board of Health. The Town of Needham contracted with an environmental testing firm to conduct environmental tests including, air measurements of volatile organic compounds taken in the laboratory and heavy metals (arsenic, cadmium, chromium, lead, mercury, selenium, zinc) content of crumb rubber materials. Our review and conclusions for that testing, did not indicate exposures of health concern.

#### Material in Medway

MDPH/BEH reviewed available information provided by the Medway Board of Health regarding the specific materials used in the Medway fields. These included the APT Gridiron turf system and Liberty Tire Recycling 10+20 BM Rubber Crumb Brantford, ON. Among the materials provided for these products were statements or test results for various constituents in these products.

APT submitted a written statement dated October 29, 2014, that reported that the APT Gridiron turf systems (essentially the grass fibers of the artificial turf) are manufactured and installed without the use of any lead or heavy metals. They reported that this included all materials used for the turf fibers and backings. No other documentation about this product, including any testing results, was provided to support this statement.

With respect to the 10+20 BM Crumb Rubber infill product, laboratory testing results were provided for this product, although it is not clear whether the testing was for the materials specifically used in turf applied in Medway. Testing was conducted for metals content as well as emissions of volatile organic compounds (VOCs). It appears that testing included the following: (1) testing for VOCs emitted into a confined air space in the laboratory after heating the product to 73 degrees F; and (2) content testing for eight heavy metals, including lead. The laboratory compared results to criteria established by the Greenguard certification program, part of Underwriters Laboratory, that uses among its criteria for certification health-based levels derived by the CA OEHHA.

Testing results for metals content of the product indicated a lead concentration of 39 mg/kg, which is less than the current Consumer Product Safety Improvement Act (CPSIA) limit of 100 mg/kg for lead in children's products (Ulirsch et al. 2010). No other metals were detected.

Test results measuring emissions off-gassing from heated material were provided in measurements that cannot be compared to any health-based standards or guidelines and thus, MDPH/BEH did not further evaluate this information. Typically, when certain products raise health concerns, health agencies review Material Safety Data Sheets (MSDS). An MSDS provides information on health risks associated with use of the product. An industry group, Synthetic Turf Council, provides a sample template MSDS for crumb rubber infill material (Synthetic Turf Council 2014). Although this sample MSDS is not specific to any particular product, it appears to be applicable to crumb rubber infill in general. In the section under "Hazardous Ingredients," the MSDS notes that the product can contain fine fibers that may cause irritation symptoms (e.g., itching, irritation of mucous membranes, eye irritation). The MSDS notes that the crumb rubber material is generally thought to be a nuisance dust.

### Concerns About Cancer Among Soccer Players

As noted earlier in this letter, some recent news reports suggested that the incidence of cancers among soccer players, particularly goaltenders exposed to artificial turf, might be atypical. These reports included many cancer types, but some focused specifically on NHL, Hodgkin Lymphoma, and osteosarcoma in three individuals. We thought it would be helpful to provide additional information on cancers in general and known risk factors for NHL, Hodgkin Lymphoma, and osteosarcoma.

### Cancer in General

Understanding that cancer is not one disease, but a group of diseases, is very important. Research has shown that there are more than 100 different types of cancer, each with separate causes, risk factors, characteristics and patterns of survival. A risk factor is anything that increases a person's chance of developing cancer and can include hereditary conditions, medical conditions or treatments, infections, lifestyle factors, or environmental exposures. Although risk factors can influence the development of cancer, most do not directly cause cancer. An individual's risk for developing cancer may change over time due to many factors and it is likely that multiple risk factors influence the development of most cancers. In addition, an individual's risk may depend on a complex interaction between their genetic make-up and exposure to environmental agents, including infectious agents and/or chemicals. This may explain why some individuals have a fairly low risk of developing a particular type of cancer as a result of an environmental exposure, while others are more vulnerable.

Cancers in general have long latency or development periods that can range from 10 to 30 years in adults, particularly for solid tumors. In some cases, the latency period may be more than 40 to 50 years. It is important to note, however, that latency periods for children and adolescents are significantly shorter than for adults.

## Hodgkin Lymphoma

Hodgkin Lymphoma is most common in young adults between the ages of 15 and 40, especially in individuals in their 20s. Among adolescents, it is the most common type of cancer.

Hodgkin Lymphoma occurs specifically in a type of B lymphocyte (or white blood cell) called the Reed-Sternberg cell while other lymphomas (non-Hodgkin's types) occur in different cells.

Established risk factors for Hodgkin Lymphoma include: exposure to the Epstein-Barr virus (EBV); a previous diagnosis of mononucleosis (mono is caused by the EBV); family history; and certain hereditary conditions (such as ataxia telangiectasia) associated with a weakened immune system. The Epstein-Barr virus is very prevalent in the general population. Even though most of us have been exposed to the virus (which remains latent in our bodies), most people do not develop mononucleosis or Hodgkin Lymphoma. EBV is thought to account for about 20% or 25% of the diagnoses of classical Hodgkin's in the US.

Higher socioeconomic status is also a possible risk factor. This is thought to be due to delayed infectious exposures in childhood.

Occupational exposures as risk factors have been studied extensively and none have emerged as established risk factors. Likewise, there is very little evidence linking the risk of Hodgkin Lymphoma to an environmental exposure, other than the EBV.

## Non-Hodgkin Lymphoma (NHL)

NHL refers to a diverse group of cancers that are characterized by an increase in malignant cells of the immune system. Each subtype of NHL may have different risk factors associated with its development. The specific cause of NHL in most individuals is unknown.

Although some types of NHL are among the more common childhood cancers, more than 95% of diagnoses occur in adults. Incidence generally increases with age, and most diagnoses occur in people in their 60s or older.

Established risk factors for NHL include a weakened immune system, associated with various medical conditions, and exposure to various viruses. An increased risk is faced by individuals taking immunosuppressant drugs following organ transplants; individuals with autoimmune disorders, such as rheumatoid arthritis and lupus; and individuals who have taken certain chemotherapy drugs for other cancers. Several viruses have been shown to play a role in the development of NHL, including the human immunodeficiency virus (HIV), the human T-cell leukemia/lymphoma virus (HTLV-1), and the Epstein-Barr virus.

Exposure to high-dose radiation (for example, by survivors of atomic bombs and nuclear reactor accidents and possibly by patients who have received radiation therapy for a previous cancer) may pose an increased risk. Some studies have also suggested that exposure to chemicals such as benzene and certain herbicides and insecticides may be linked with an increased risk of NHL. Smoking has been associated in some studies with certain types of NHL.

### Osteosarcoma

Osteosarcoma is a type of malignant bone cancer which accounts for about 2% of childhood cancers in the United States. It is the most common type of cancer that develops in bone and comprises about 66% of malignant bone tumors in children in Massachusetts. Most osteosarcomas occur in children and young adults between the ages of 10 and 30. Teenagers comprise the most commonly affected age group and are at the highest risk during their growth spurt. However, osteosarcoma can occur in people of any age, with about 10% of all osteosarcomas occurring in people over the age of 60.

Established risk factors for osteosarcoma include certain inherited syndromes (such as retinoblastoma, the Li-Fraumeni syndrome, and others) and certain bone diseases (such as Paget disease of the bone and hereditary multiple osteochondromas). Individuals with these syndromes and bone diseases have an increased risk of developing osteosarcoma. People who have received radiation treatment for a previous cancer may have a higher risk of later developing osteosarcoma in the area that was treated. Being treated at a younger age and with higher doses of radiation both increase the risk. Because the risk of osteosarcoma is highest between the ages of 10 and 30, especially during the teenage growth spurt, experts believe that there may be a link between rapid bone growth and the risk of a bone tumor. Children with osteosarcoma are often tall for their age, which supports the link with rapid bone growth. Other than radiation, there are no known lifestyle or environmental risk factors associated with osteosarcoma. Besides from these risk factors, the causes of most osteosarcomas are unknown.

### Summary

In summary, the scientific literature continues to suggest that exposure opportunities to artificial turf fields are not generally expected to result in health effects. Testing results on the crumb rubber infill indicated lead content less than CPSIA statutory limits established for children's products. For the turf fibers, APT provided a statement that this material did not have lead used in its manufacture, but no additional documentation was provided.

With respect to cancer concerns reported in media stories, it is important to note that the reports of cancers were of a wide variety of different types, each with its own set of risk factors. In addition, our staff reviewed cancer incidence data for the Town of Medway. The Massachusetts Cancer Registry (MCR) is a population-based surveillance

system that began collecting information in 1982 on Massachusetts residents diagnosed with cancer in the state. All newly diagnosed cancer cases among Massachusetts residents are required by law to be reported to the MCR within six months of the date of diagnosis (MGL, c.111, s.111B). This information is kept in a confidential database and reviewed for accuracy and completeness.

Available information on the occurrence of cancers in children living in Medway indicates no diagnoses of Hodgkin Lymphoma, NHL, or osteosarcoma have been reported to the MCR in a search of their files from 2006 to the present. Although it is possible that a very recent diagnosis may not yet have been reported to the MCR, the fact that there are no reports of such cancers is reassuring.

Although available resources cannot support MDPH conducting environmental testing of this material, we would be happy to assist the Town of Medway in developing a sampling and analysis plan as well as provide technical support in interpreting results, similar to the assistance that we provided to the Town of Needham.

As we stated in our letters to Needham officials, while available information does not indicate exposure opportunities of health concern, MDPH/BEH continues to recommend common sense ways to minimize any potential exposure to chemicals that may be contained in synthetic turf fields made of crumb rubber. MDPH/BEH suggests washing hands after playing on the field and before eating, particularly for younger children with frequent hand-to-mouth activity, and taking off shoes before entering the house to prevent tracking in any crumb rubber particles. Also, there are studies that indicate heat levels on artificial turf fields may rise as outdoor temperatures increase (New York State 2009). Thus, for protection of the players, MDPH/BEH recommends increasing hydration, taking frequent breaks, and watering down the field to cool it on hot days to prevent the potential for burns or heat stress. Finally, based on recent work in California, MDPH/BEH recommends that steps be taken to minimize the potential for skin abrasions (e.g., protective equipment) and that skin abrasions be treated promptly to prevent potential infections.

We hope this information is helpful to you and Medway residents. If you have any questions, please feel free to contact us at 617-624-5757.

Sincerely,

A handwritten signature in black ink, appearing to read 'Suzanne K. Condon', with a long, sweeping horizontal line extending to the right.

Suzanne K. Condon, Associate Commissioner  
Director, Bureau of Environmental Health

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## **To the members of FIFA**

Zurich, April 2017  
MDH/awe

### **A statement on potential cancer risks from exposure to SBR in artificial turf fields**

Dear Sir or Madam,

During the recent FIFA Medical Committee meeting on the 13 March 2017, the issue of potential cancer risks from exposure to SBR on artificial turf fields was discussed and we are very pleased to share this information with you.

FIFA first responded to media coverage of the topic in 2006 when an open letter was published following several high profile articles that stipulated that there may be a link between the crumb rubber particles known as SBR (Styrene Butadiene Rubber) in artificial turf fields and the occurrence of cancer in players exposed to these surfaces. Studies dating until 2006 from various scientific disciplines found no evidence that contact with SBR was linked with the emergence of cancer. FIFA reiterated this position ahead of the FIFA Women's World Cup 2015 in Canada that was played on artificial turf surfaces based on published studies up until that date.

In light of increased public interest in the topic in 2016 and further studies carried out in the past months, FIFA would like to clarify its position on the use of artificial turf fields containing SBR infill.

FIFA has taken note of ECHA/PR/17/04 in which the European Chemicals Agency has found "at most, a very low level of concern from exposure to recycled rubber granules". Regulating authorities are conscious of the presence of potentially carcinogenic components in the compounds used for the production of tyres, the main source of SBR rubber and have labelled these products accordingly. In particular the presence of polycyclic aromatic hydrocarbons (PAH's) is undisputed but equally there is no scientific evidence of these being bioavailable in their application as car tyres and infill for artificial turf fields thereafter. The newest findings by Van Rooj and Jongeneelen (2010) concluded that "If there is any exposure, then the uptake is very limited and within the range of uptake of PAH from environmental sources and/or diet". A further study from New Jersey's State Medical School indicated that health risks to children and adults from extensive contact with crumb rubber ranged from none to negligible (Pavilonis et al. 2014).

Looking at specific issues such as ingestion or air pollution, a number of studies has investigated the intake of PAH from artificial turf and found less or comparable exposure than for grilled food products, smoked salmon or log burning. As a result, Dye et al concluded in 2006 that "on the basis of environmental monitoring, artificial turf football fields present no more exposure risks than the rest of the city".

While it will never be possible to exclude risk completely or prove this negative, the newer studies have confirmed the previous findings that there is no evidence of link between contracting cancer



and playing on artificial turf with SBR infill. A large number of studies have further confirmed that the effect of SBR rubber are as negligible as the effect of ingesting grilled foods or exposure to tyre wear on roads in everyday life.

As with all aspects relating to player safety, FIFA will continue to monitor the developments within the scientific debate and consider any future findings.

Yours faithfully,

FÉDÉRATION INTERNATIONALE  
DE FOOTBALL ASSOCIATION



Dr Michel D'Hooghe  
Chairman FIFA Medical Committee  
Member of the FIFA Council

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