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Report: Use of Crumb Rubber for Artificial Turf Fields in Burlington, MA

To: The Conservation Commission, Burlington, MA
From: Nesra Engineering, LLC
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Introduction

As communities, including Burlington, consider alternatives to natural grass fields, it is essential to understand the extensive research that has been conducted on the safety of crumb rubber turf fields, both from an environmental and human health perspective. This report aims to provide factual evidence on the safety of crumb rubber turf fields, citing key studies and findings from trusted institutions, while also addressing recent concerns raised about the presence of 6PPD-quinone, a chemical associated with tire wear particles.

Environmental Safety of Crumb Rubber Turf

The environmental impact of crumb rubber has been thoroughly studied by the U.S. Environmental Protection Agency (EPA) in collaboration with the Centers for Disease Control and Prevention (CDC). The EPA's research found that while tire crumb rubber contains a mixture of chemicals, the levels of chemicals released into the environment from crumb rubber turf fields are minimal and well below levels that would pose significant environmental risks.

1. **Air Quality**: Studies conducted by the EPA and CDC show that the air concentrations of most chemicals emitted from crumb rubber are similar to background levels found in the general environment. For example, emissions of polycyclic aromatic hydrocarbons (PAHs), which are associated with the burning of organic materials, were found to be at concentrations comparable to those found in natural surroundings, such as in urban areas. These levels were not deemed to be harmful to air quality or the environment (EPA, 2021).

2. **Water and Soil Safety**: Research into the potential for chemical leaching from crumb rubber has shown that very small amounts of metals and chemicals are released into simulated biological fluids or soil. These releases are minimal and are not expected to significantly affect soil or water quality. According to the EPA's findings, the bioavailability (the extent to which chemicals can be absorbed by living organisms) of these substances is extremely low (EPA, 2021).

3. **Overall Environmental Impact**: The potential environmental risks of crumb rubber are limited, and studies from both the EPA and independent bodies such as the European Chemicals Agency have concluded that synthetic turf fields with crumb rubber do not pose significant environmental threats (European Chemicals Agency, 2020).

Addressing 6PPD-Quinone Concerns

Recent scientific research has identified 6PPD-quinone (6PPD-q), a transformation product of 6PPD found in tires, as a compound of concern due to its acute toxicity to certain aquatic species, particularly coho salmon. It is important to note, however, that the majority of environmental detections of 6PPD-q are associated with urban roadway runoff, where tire wear particles are continuously deposited and washed directly into stormwater systems.

The primary source linking 6PPD-quinone to environmental toxicity is a 2021 study published in *Science* by Tian et al., which investigated unexplained mortality events in coho salmon. The study traced the cause to 6PPD-quinone found in **urban roadway runoff**, particularly from high-traffic areas, due to the degradation of tire rubber additives. Notably, synthetic turf fields were **not evaluated** as a source of this chemical in the study.

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The proposed synthetic turf field utilizes recycled crumb rubber infill, which does contain residual 6PPD. However, the potential for release of 6PPD-q from this application is significantly lower than from roadways, due to the controlled nature of the installation and the use of engineered stormwater mitigation systems.

To further reduce the potential for chemical migration into adjacent resource areas, this project incorporates the following protective measures:

- Perimeter bioretention areas to filter runoff before it reaches sensitive wetlands.
- Stone diaphragms and a blended stone base to promote infiltration and particle settling.
- Geotextile filter fabric layers, which provide an additional barrier for fine particles.
- A field design that maximizes infiltration and onsite treatment, minimizing overland flow to wetland boundaries.

Current research, including the U.S. EPA's 2021 multi-agency study on crumb rubber, has not found significant evidence of risk to human health or the broader environment under typical field-use scenarios. Furthermore, no regulatory body, including the Massachusetts Department of Environmental Protection (MassDEP), has issued guidance prohibiting the use of crumb rubber turf systems based on 6PPD-q concerns.

Human Health and Safety

Health concerns related to crumb rubber turf primarily focus on the potential for exposure to toxic chemicals. However, numerous studies have found no evidence of significant health risks to humans from playing on these fields.

1. **Chemical Exposure**: The EPA's 2021 study on tire crumb rubber fields indicates that the levels of exposure to chemicals—such as metals, PAHs, and volatile organic compounds (VOCs)—are similar to or even lower than those found in everyday environmental exposure. For instance, metal concentrations in blood samples from people playing on crumb rubber turf were comparable to those in the general population (EPA, 2021).
2. **Toxicity and Carcinogenic Risks**: Despite concerns about carcinogenic substances, studies have shown that the risks associated with exposure to chemicals in crumb rubber are minimal. The National Institute for Health and the Environment (Rijksinstituut voor Volksgezondheid en Milieu) in the Netherlands has stated that the risk of cancer from playing on synthetic turf fields made with recycled rubber is virtually negligible (Rijksinstituut voor Volksgezondheid en Milieu, 2018).
3. **Independent Reviews**: In addition to the EPA and CDC's findings, independent reviews by organizations such as the World Health Organization and the European Chemicals Agency have consistently concluded that there is no need for health warnings related to playing on crumb rubber turf fields. Furthermore, ongoing studies continue to support the conclusion that these fields are safe for both athletes and the general public (European Chemicals Agency, 2020).

Advantages of Crumb Rubber Turf Fields

Crumb rubber turf offers numerous benefits that make it an ideal choice for many communities, including Burlington:

1. **Durability and Cost-Effectiveness**: Crumb rubber turf fields require less maintenance than natural grass fields, which can be expensive to maintain, particularly in regions with variable climates. The long lifespan of synthetic turf fields, often lasting 8 to 10 years, provides a cost-effective solution over time. This durability is particularly valuable in areas with heavy sports usage or in communities that experience harsh weather conditions.

2. **Environmental Benefits of Recycling**: Crumb rubber is made from recycled tires, which otherwise would end up in landfills or incinerators. The use of crumb rubber in turf fields helps reduce waste and provides an environmentally responsible alternative for tire disposal. This contributes to a circular economy by repurposing waste materials for a beneficial use.

3. **Increased Accessibility**: Synthetic turf fields provide a consistent, durable surface that is usable year-round, regardless of weather conditions. This increases the accessibility of fields for sports and recreational activities, especially during wet seasons when natural grass fields may be unusable.

4. **Safety:** A comprehensive 15-season study published in the *Orthopaedic Journal of Sports Medicine* analyzed over 9,000 collegiate football injuries across 39 NCAA Division I programs to assess the safety of heavyweight artificial turf compared to natural grass. The findings showed that athletes competing on artificial turf experienced significantly fewer post-injury imaging procedures (including X-rays, CTs, and MRIs) and required fewer surgical interventions than those playing on natural grass. Notably, injuries such as syndesmosis sprains and Lisfranc fractures were less frequent on turf. Contrary to common concerns, the study concluded that artificial turf is not only comparable to natural grass in terms of safety but, in many respects, offers a lower risk of serious or surgical-level injuries (Meyers et al., 2024).

Conclusion

Based on extensive research by reputable institutions such as the EPA, CDC, and the European Chemicals Agency, there is compelling evidence that crumb rubber turf fields are both environmentally safe and pose minimal risks to human health. While concerns about 6PPD-quinone, a compound that may leach from crumb rubber, are valid, mitigating strategies such as improved stormwater management can significantly reduce environmental impacts. The use of crumb rubber in synthetic turf fields is a responsible choice that balances environmental considerations with the need for durable and accessible recreational spaces.

As a civil engineering firm, we base our recommendations on current EPA guidelines, client needs, and budgetary constraints. While we are not chemists or toxicologists, this report reflects our understanding of the best-available data and our commitment to responsible engineering design.

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