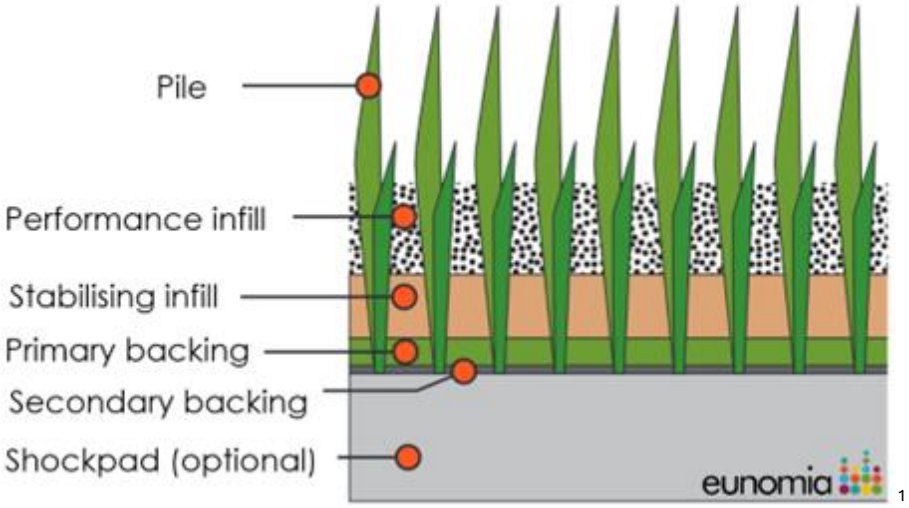
What is Artificial Turf?



[1]

Artificial Turf consists of three main components[2]:

1. Pile is the green plastic blades –100% polyethylene or polypropylene or nylon (polymers derived from fossil fuels).
2. Infill material - crumb rubber, silica sand, cork or zeolite.
3. Plastic two-layer backing
    a. primary backing – multi-layered woven polyethylene
    b. secondary backing – often proprietary such as Envylock® (no chemical composition provided)

Environmental Concerns with Artificial Turf

On April 24, 2019, Ottawa City Council declared a climate emergency and by January 2020 the council had approved the Climate Change Master Plan[3]. One priority action is to develop a climate resiliency strategy to handle hotter and wetter weather.

"... Ottawa will continue to get much warmer, with a significant increase in extreme heat events, ... and wetter springs and winters."

Given our climate emergency, the Glebe Community Association Environment Committee has the following concerns with artificial turf being used on local school playgrounds. Following these

[1] https://www.fidra.org.uk/chemicals-pollution/pfas-in-artificial-turf-the-grass-isnt-greener-on-the-artificial-side/ (graphic credit: Eunomia, accessed 2024-11-29).
[2] https://ottawaartificialgrass.com/products/envyplay/ (accessed 2024-11-28).
[3] https://documents.ottawa.ca/sites/default/files/climate_change_mplan_en.pdf (accessed 2024-11-28).

environmental concerns, the Glebe Community Association Health, Housing & Social Services Committee has outlined the health risks that might be posed to residents playing on artificial turf[4].

1) Artificial turf contributes to rising temperatures within our neighbourhood:

The urban heat island effect occurs when built-up areas are hotter than surrounding areas[5].

"Between the mid-1940s and the mid-2010s the average temperature in Ottawa increased by 1.3 degrees Celsius. This trend will continue in the future."

"Buildings with dark roofs, ... parking lots and artificial turf show up as hotter areas that absorb and retain heat."

2) Artificial turf contributes to increased stormwater entering our neighbourhood drains:

The City of Ottawa is working on flood mitigation efforts which include improved planning and infrastructure design. Artificial turf has been shown to reduce the amount of rainwater that soaks into the ground after a storm[6].

"...artificial grass displayed greater volumes and proportion of runoff than living grass... Living grass was also significantly better at retaining water and delaying drainage compared to both artificial grasses ..."

3) Artificial turf contributes to micro- and macro-plastics pollution in our neighbourhood:

A 2024 University of Toronto framework[7] for estimating plastic pollution placed artificial turf as the biggest contributor to microplastics over a one-year period for the City of Toronto.

"...artificial turf was responsible for the most emissions of microplastics — particles less than five millimetres in diameter — at 237 tonnes."

Researchers from Spain quantified fibres from artificial turf polluting the aquatic environment.[8]

"..., accounting for up to 15% of the macro-plastics ... found floating in the aquatic environment ..."

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[4] https://www.fidra.org.uk/chemicals-pollution/pfas-in-artificial-turf-the-grass-isnt-greener-on-the-artificial-side/ (accessed 2024-11-29).
[5] https://engage.ottawa.ca/climate-resiliency/news_feed/extreme-heat (accessed 2024-11-28).
[6] https://www.sciencedirect.com/science/article/abs/pii/S1618866721002570?via%3Dihub%20 (accessed 2024-11-28).
[7] https://www.artsci.utoronto.ca/news/scientists-develop-framework-measure-plastic-emissions-and-bolster-un-efforts-reduce-pollution (accessed 2024-11-28).
[8] https://www.newscientist.com/article/2383869-huge-amounts-of-plastic-from-artificial-grass-end-up-in-the-sea/ (accessed 2024-11-29).

European Union banned the use of granular infill material used on artificial sport surfaces as it is the largest source of intentional microplastics in the environment.[9]

4) Artificial turf increases the volume of greenhouse gases emitted in our neighbourhood:

Ottawa's greenhouse gas reduction target for community emissions is 43% by 2025 and 100% by 2050. The carbon footprint of natural grass includes emissions associated with growth, transportation, and maintenance. The carbon footprint of artificial turf includes emissions associated with manufacture, transportation, and disposal of fossil fuel-derived compounds.

Although the production of natural turf is not devoid of emissions it is significantly lower compared to the production of polyethylene-based artificial turf. According to the US Government's Environmental Protection Agency, one kilogram of carbon dioxide is emitted for each kilogram of polyethylene produced[10].

In addition, artificial turf is a source of greenhouse gases which it produces as it degrades, whereas natural grass is a carbon sink as it absorbs atmospheric carbon dioxide[11].

5) Artificial turf contributes waste to the Ottawa landfill sites:

On September 30, 2024, the City of Ottawa announced a 3-bag limit for residential garbage to help reduce unnecessary waste going to the landfill[12].

> *"...the Trail Road Waste Facility Landfill is expected to reach capacity in 13 to 15 years."*

In this context, it is imperative to consider the lifecycle of artificial turf. The City of Ottawa's Waste Explorer webpage indicates that polyethylene should be "placed in your regular garbage" and that rubber is "a prohibited material and cannot be disposed of in the regular garbage" [13]. Artificial turf is made from rubber, polyethylene, plastic backing, and sand – only the sand appears to be recyclable, even if the product could be separated. Unfortunately, Ottawa lacks the specialized facilities to separate the components of artificial turf. We conclude that it is highly likely that artificial turf will end up in landfill at the end of its 10-year lifespan[14].

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[9] https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4581 (accessed 2024-12-12).
[10] https://stanfordmag.org/contents/the-link-between-plastic-use-and-climate-change-nitty-gritty#:~:text=According%20to%20the%20EPA%2C%20approximately%20one%20ounce%20of%20carbon%20dioxide%20is%20emitted%20for%20each%20ounce%20of%20polyethylene%20(PET)%20produced (accessed 2024-1-28).
[11] https://carbonliteracy.com/the-carbon-cost-of-lawns/ (accessed 2024-11-28).
[12] https://ottawa.ca/en/garbage-and-recycling/garbage#section-0bc074ce-05c5-44d2-ae12-66dbff6d316f (accessed 2024-11-29).
[13] https://ottawa.ca/en/garbage-and-recycling/recycling/waste-explorer (accessed 2024-11-28).
[14] https://www.youtube.com/watch?v=Y5o3J7uy4Tk (accessed 2024-11-29).

6) Artificial Turf does not support biodiversity within our neighbourhood:

Artificial turf eradicates natural habitat for insects and birds, destroying the essential biodiversity of local ecosystems.

7) Artificial Turf leaches toxic materials in the form of crumb rubber into our neighbourhood:

A 2019 report[15] from the Environmental Protection Agency states

"The same target analytes were measured in the tire crumb rubber collected at tire recycling plants and synthetic turf fields."

The recycling of tires into artificial turf seemed helpful but instead has been harmful.[16]

"The tire crumb from artificial turf washes away into nearby grass and waterways, and when the fields are replaced after approximately 8 years, the plastic and the rubber all end up in landfills."

Crumb rubber has been shown to sometimes contain harmful metals, polyaromatic hydrocarbons (PAHs), phthalates, and benzothiazole[17] which can impact human health.

[15] https://www.epa.gov/sites/default/files/2019-08/documents/synthetic_turf_field_recycled_tire_crumb_rubber_research_under_the_federal_research_action_plan_final_report_part_1_volume_1.pdf (accessed 2024-12-12).
[16] https://www.center4research.org/children-athletes-play-toxic-turf-playgrounds/ (accessed 2024-12-12).
[17] https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0216156 (accessed 2024-12-12).

The Glebe Community Association Health, Housing and Social Services Committee has the following concerns with artificial turf being used on local school playgrounds.

1) Artificial turf contains a variety of chemicals that are known carcinogens, neurotoxicants, mutagens and endocrine disruptors[18]:

These include hazardous chemicals such as "*… polycyclic aromatic hydrocarbons (PAHs)[19], phthalates[20] and per- and polyfluoroalkyl substances (PFAS)[21].*" In addition, volatile organic compounds (VOCs)[22], metals[23] as well as rubber curatives, antioxidants/ antiozonants and biocide products have been found in crumb rubber.[24]

"*A recent study evaluated the potential carcinogenicity of 306 chemicals found in tire crumb and found that 197 of them met certain carcinogenicity criteria, while 58 were actually listed as carcinogens by a government agency."*[25] There have been numerous anecdotal reports of increased cancer rates among sport players on artificial turf.[26] Studies are ongoing to try to understand the link.[27]

2) Micro-plastics are recognized as a health hazard of artificial turf:

Infill, whether crumb rubber or other polymeric materials, is a loose component with a diameter less than 5 mm, meeting the definition of microplastics. Studies have confirmed "*… the presence of hazardous substances in the recycled crumb rubber samples collected all around the world… Microplastics are considered contaminants of emerging concern since they do not biodegrade and*

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[18] Murphy M, Warner GR. Health Impacts of Artificial Turf: Toxicity Studies, Challenges and Future Directions. Environ Pollut. 2022;310:119841.
[19] PAHs found in artificial turf include anthracene, benz(a)anthracene, fluoroanthene, naphthalene, phenanthrene and pyrene.
[20] Phthalates found in artificial turf include benzyl butyl phthalate, bis(2-ethylexyl) phthalate.
[21] PFAs found in artificial turf include 6:2-fluorotelomer sulfonic acid and perfluorooctane sulfonate https://www.turi.org/publications/per-and-poly-fluoroalkyl-substances-pfas-in-artificial-turf-carpet/ (accessed 2024-12-19).
[22] VOCs found in artificial turf include benzene, benzothiazole, hexane, naphthalene, styrene, toluene and xylenes.
[23] Examples of metals found in artificial turf include including aluminium, arsenic, barium, cadmium, chromium, copper, lead, nickel & zinc.
[24] Massey R, Onasch J, Pollard L. Athletic Playing Fields: Choosing Safer options for Health and the Environment. TURI Report #2018-002. 2019 April.
[25] Perkins AN, Inayat-Hussain SH, Deziel NC, Johnson CH, Ferguson SS, Garcia-Milian R, Thompson DC, Vasiliou V. Evaluation of potential carcinogenicity of organic chemicals in synthetic turf crumb rubber. Environ Res. 2019 Feb;169:163-172.
[26] https://www.theguardian.com/society/2023/mar/10/phillies-ball-players-cancer-artifical-turf (accessed 2024-12-19).
[27] Bleyer A. Synthetic Turf Fields, Crumb Rubber, and Alleged Cancer Risk. Sport Med. 2017;47(12):2437–2441.

remain in the environment for a long time."[28] Infill can wash off fields into the environment, collect in players' clothes, or be accidentally ingested during athletics or by babies and toddlers, resulting in additional sources of exposure.[29]

"Microplastics have been detected in food consumed by humans or in the air. Therefore, they may affect human health through food consumption or inhalation. Ingested or inhaled microplastics may accumulate in the body and trigger an immune response or cause local particle toxicity. In addition, chronic exposure may cause more problems through accumulation in the body."[30]

3) Artificial turf is substantially hotter than natural turf on warm days which can lead to dehydration, heatstroke and burns:

"Since grass leaves release water vapor (or transpire) and the evaporation of that water vapor leads to cooling, grass fields rarely get above 100° F. Turf fields, in comparison, regularly rise well above 100° F. Penn State University's Center for Sports Surface Research conducted studies comparing surface temperatures of synthetic turfs composed of various fiber and infill colors/materials and found that the maximum surface temperatures during hot, sunny conditions averaged from 140° F to 170° F."[31]

4) Due to possible risks on Artificial turf, the US Consumer Product Safety Commission has recommended the following[32]:

1.Avoid mouth contact with playground surfacing materials, including mouthing, chewing or swallowing playground rubber. This may pose a choking hazard, regardless of chemical exposure.

2. avoid eating food or drinking beverages while directly on playground surfaces, and wash hands before handling food.

3. Limit the time at a playground on extremely hot days.

4. Clean hands and other areas of exposed skin after visiting the playground and consider changing clothes if evidence of tire materials is visible on fabrics.

5. Clean any toys that were used on a playground after the visit.

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[28] Armada, D. *et al*. Global evaluation of the chemical hazard of recycled tire crumb employed on worldwide synthetic turf football pitches. Sci Total Environ. Mar 2022;812:152542.
[29] Lopez-Galvez *et al*. Quantification and Analysis of Exposure to Recycled Tire on Turf and Playgrounds. Int J Environ Res Public Health. 2022;19(4):2-6.
[30] Lee, Y et al. Health effects of Microplastic Exposures: Current Issues and Perspectives in South Korea. Yonsei Med J. 2023;64(5).
[31] Myrick, S. Synthetic Sports Fields and the Heat Island Effect, Parks & Recreation Magazine, National Recreation and Parks Association, May 8, 2019. https://www.nrpa.org/parks-recreation-magazine/2019/may/synthetic-sports-fields-and-the-heat-island-effect/ (accessed 2024-12-19).
[32] https://www.cpsc.gov/Safety-Education/Safety-Education-Centers/Crumb-Rubber-Safety-Information-Center (accessed 2024-12-19).