EMERGING ISSUES WITH THE USE OF SYNTHETIC GRASS:
BOB CAMPBELL OVAL GREENWICH

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Executive Summary

Lane Cove Council's proposal to convert Bob Campbell from a grass to synthetic playing field arouses concerns on environmental, human health grounds and community interests.

The work proposed will deprive Greenwich of its ONLY large expanse of grassed open space, an area that the community has shared successfully for years. There is a large body of evidence about the benefits to mental health and well-being of visiting and connecting with green space / nature and this has been emphasised during COVID 19.

In the light of emerging research, it is our recommendation that the precautionary principle be applied and the conversion of the grass oval to synthetic grass does not occur. This would be in keeping with the Lane Cove Sustainability Action Plan quadruple bottom line and particularly:

Goal 1: Enhance and value our open space, waterways and bushland (see p12)

The following submission highlights

- Concerns exist for the impact of the chemicals in tyre crumb on human health and environmental contamination. We draw Council's attention to US Environmental Protection Agency EPA and Center for Disease Control CSC ongoing review of research in this area, the gaps in knowledge and to the possibility of Council liability in future (see A below).
- An Australian study on the performance, safety and playing facility requirements for sports, including environmental considerations, (see B below). The substitution of synthetic grass for natural grass removes the 'natural' and 'living' elements of the environment; predominant community desires in the LGA Sustainability Action Plan. Grass fixes carbon, in the plants and soil, and provides other heat and sound absorbing benefits. Synthetic grass requires fossil fuel use for the preparation of materials and application; thereby contributing to CHG emissions and climate change. Maintenance of synthetic grass is required, including applying water and surfactants, and machinery to redistribute the rubber in the field.
- Personal injury law cases because synthetic fields can get up to more than twice the surface temperature of natural turf on a hot day. This dramatic increase in temperature can increase the risk of severe dehydration, burn-related injuries including blisters and skin burns, particularly among young children. (See part C)
- Synthetic grass is a plastic, which can migrate from the field on footwear, clothes and in the machinery used to service the field. The field is very close to a creek and estuary, and at times can flood. Plastic pollution of water and ocean is a social and environmental concern. Plastic breaks down into small particles to form micro plastics, which are ubiquitous throughout the environment. These micro and macro

plastic particles are ingested by wildlife and micro-organisms and become concentrated in the food chain. There is evidence of microplastics attracting pollutants from aqueous environments. University of Newcastle and Macquarie University are researching the toxicology of ingesting microplastics and associated contaminants.

REPORT

The following outlines findings of ongoing research efforts.

A Research Under the Federal Research Action Plan Final Report Part 1 Volume 2 – Tire Crumb Rubber Characterization July 25, 2019.

Background

Concerns have been raised by the public about the potential health risks from playing on synthetic turf fields in the U.S. containing tire crumb rubber. Studies to date have not shown an elevated health risk from playing on fields with tire crumb rubber, but the existing studies have been limited.

To help address these concerns, the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (CDC/ATSDR) and the U.S. Environmental Protection Agency (EPA), in collaboration with the Consumer Product Safety Commission (CPSC), launched a multi-agency research effort in February 2016.

This multi-agency research effort, known as the Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds (FRAP), is focused on assessing potential human exposure, which includes conducting research activities to characterize the chemicals associated with tire crumb rubber and to identify the ways in which people may be exposed to those chemicals based on their activities on synthetic turf fields. Also, the FRAP includes characterizing emissions and bioaccessibility to differentiate what is present in the tire crumb rubber from what people may actually be exposed to from tire crumb rubber.

This is the first comprehensive investigation internationally into exposure and synthetic turf.

Literature Review and Gaps Analysis Summary

To comprehensively understand the current state-of-the science and data gaps associated with the toxicity of and human exposure to constituents in tire crumb rubber, the USA CDC/ATSDR, EPA and CPSC undertook a collaborative effort to review the scientific literature and analyze data gaps. Details of the literature review methods are in the footnote.[1]

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[1] *Objectives of the Literature Review/Gaps Analysis (LRGA) collaboration*

1. *To identify the existing body of literature related specifically to human exposure to tire crumb rubber through the use of synthetic turf athletic fields and playgrounds.*
2. *To characterize and summarize the relevant data from the scientific literature.*
3. *To review the summary information and identify data gaps to build on the current understanding of the state-of-the-science and inform the development of specific research efforts that would be most impactful in the near-term.*

Results

As part of the effort, greater than 350 discrete chemical compounds were identified in the literature and a list of potential chemical constituents was compiled to inform further research efforts. The studies that were identified covered a wide range of topics and locations, but some topic areas received greater coverage than others:

- Information on chemical leaching and offgassing and volatilizing from tire crumb rubber was found in 36 and 25 studies, respectively;
- less information was available on microbiological, bioavailability, and biomonitoring aspects of tire crumb rubber exposures (i.e., seven, five, and three studies, respectively).
- No epidemiological studies were identified in the literature search.
- Studies on occupational exposures from turf and playground installations were also limited.
- Metal constituents of tire crumb rubber, such as lead and zinc, have been frequently identified in the literature as constituents of concern, but research on exposures to these metals by field and playground users is limited.
- While a number of volatile and semivolatile organic chemicals (especially polycyclic aromatic hydrocarbons) have been measured in some studies, research on other organic chemical constituents identified by the LRGA is more limited.
- Other important data gaps include the lack of more in-depth characterizing of dermal and ingestion exposure pathways, identifying constituents and scenarios resulting in the highest exposures, developing and applying biomonitoring for constituents of concern, and assessing the feasibility and approaches for epidemiological investigations. Several important data gaps for assessing exposures and risks of tire crumb rubber at synthetic fields and playgrounds are summarized in the report.

The very clear message in this comprehensive report relates to the identification of gaps in the literature. Two tables on pages 26 and 27 provide a summary of these gaps.

Methods: Federal researchers examined a wide variety of information sources to build a list of relevant citations. The literature search included the following databases: PubMed Medline (OVID); Embase (OVID); Scopus; Primo (Stephen B. Thacker CDC Library); ProQuest Environmental Science Collection; Web of Science; ScienceDirect and Google Scholar. The LRGA focused on scientific publications that addressed tire crumb rubber use, physical characteristics and chemical composition, potential pathways of exposures, bioavailability, and component toxicity and risk assessment. It included studies that examined occupational exposures at tire recycling plants, human exposures related to field and playground installations, and subsequent exposures involved with use of synthetic turf and playground facilities.

It did not include studies on automotive tire manufacturing processes and related exposures and risks. In determining whether or not to include a publication found in the course of the literature search, a set of relevance criteria was developed. The LRGA identified 88 relevant references published through August 2016. Each reference that was reviewed was categorized according to 20 general information categories (e.g., study topic, geographic location, sample type, conditions, populations studied) and more than 100 sub-categories (e.g., for the study topic sub-categories included: site characterisation, production process, leaching, off-gassing, microbial analysis, and human risk).

Conclusions: This report concludes that the study activities completed as part of this multi-agency research effort were not designed, and are not sufficient by themselves, to directly answer questions about potential health risks.

We recognize that communities, parents, and state and local officials are concerned about tire crumb used in synthetic turf fields.

Risk is a function of both hazard (toxicity) and exposure; therefore, understanding what is present in the material (Part 1 of the report, describing tire crumb rubber characterisation) and how individuals are potentially exposed (Part 2 of the report, describing exposure characterisation, to be released at a future date) is critical to understanding potential risk.

While this short-term study will not provide all the answers, characterizing the chemicals in recycled tire crumb rubber and identifying the ways in which people may be exposed to those chemicals based on their activities on synthetic turf fields, will contribute to future risk assessments.

Further the report identifies two very recent research articles that raise the issue of exposure risk:

1. *"Evaluation of organic and inorganic compounds extractable by multiple methods from commercially available crumb rubber mulch"* (Benoit & Demars, 2018).
   The article describes characterisation of metals and organic chemicals associated with tire crumb rubber infill and shredded tire material sold for home use. Laboratory experiments were also performed to assess leaching with simulated acid rain and emissions from passive degassing.

   Their findings and conclusions include:

   > "*Solvent extraction yielded 92 separate compounds, of which only about half have been tested for human health effects. Of these, nine are known carcinogens and another 20 are recognized irritants, including respiratory irritants that may complicate asthma. Strong acid extraction released measurable amounts of Pb and Cd and relatively large amounts of Zn. These three metals were specifically targeted for analysis, and others may be present as well, but were unmeasured.*
   >
   > *Simulated acid rain extracted only Zn in significant quantities. Passive volatilisation yielded detectable amounts of 11 compounds. Results demonstrate that recycled tire materials contain and can release a wide variety of substances known to be toxic, and caution would argue against their use where human exposure is likely*."

2. *"Release of particles, organic compounds, and metals from crumb rubber used in synthetic turf under chemical and physical stress"* (Canepari, 2018).

   The research characterized the chemical and morphological characteristics of materials released under chemical and physical stress for tire crumb rubber, natural rubber, and thermoplastic elastomer. Headspace analysis was performed for materials heated to 70ºC, the release of metals under slightly acidic conditions was measured, and the formation of particles under mechanical and thermal stress was examined.

   Findings and conclusions include:

- *The headspace solid-phase micro-extraction GC-MS analysis evidenced that at 70 ºC natural rubber and thermoplastic elastomer release amounts of organic species much higher than recycled scrap tires. In particular, the desorption of mineral oils, with a prevalence of toxicologically relevant low viscosity alkanes in the range C17–C22, and plasticizers (diisobutyl phthalate) was clearly evidenced.*

- *The new generation thermoplastic elastomer material also releases butylated hydroxytoluene. In slightly acidic conditions, quite high amounts of bioaccessible Zn, Cu, and Co are released from recycled scrap tires, while natural rubber releases mainly Se and Tl. In contrast, the thermoplastic elastomer does not contain significant concentrations of leachable heavy metals. The formation of small particles, also in the inhalable fraction, was evidenced by electron microscopy after mechanical or thermal treatment of natural rubber. The chemical and morphological characterisation of the considered crumb rubber materials put into evidence how potential risks for health and environment can arise from the exposition of rubbers to chemical and physical agents.*

- *The use of natural rubber and of not-recycled thermoplastic materials, which are progressively replacing recycled tire scraps as synthetic turf fillers, does not seem to be adequately safe for human health, particularly when considering that children are the most exposed bracket of population. Exposure risks arising from the use of these materials deserve to be further deepened."*

B The West Australian Natural Grass vs Synthetic Turf Study Report July 2019

This is the only recent published Australian report that covers the factors that contribute to the choice of playing surface, in terms of performance, safety and playing facility requirements for sports. It specifically covers environmental considerations:

1. Soil regeneration and dust stabilisation qualities
Topsoil takes thousands of years to develop. It is lost quickly by wind and water erosion. Natural grass sends many fine rootlets into crevices of the soil where they grow and, as they decay, add organic matter to the soil. Natural grass is the most effective plant in conditioning the soil. Natural grass roots are continually developing, dying, decomposing and redeveloping. By leaving clippings on the lawn and by allowing them to decay, the equivalent of three applications of lawn fertiliser is made. This process builds humus, keeps soils microbiologically active and, over time, improves soils both physically and chemically. Natural grass improves the soil by stimulating biological life and by creating a more favourable soil structure.

On the other hand, before installing synthetic turf it is recommended that all soil be heavily compacted. This damages soil structure, soil microbes and soil life. It can also significantly damage any tree roots in the vicinity.

Healthy, well maintained natural grass helps with dust stabilisation and soil erosion control. Healthy grass surfaces capture dirt and dust from the atmosphere.

During severe drought periods and tight water restrictions, natural grass can deteriorate and loss of natural grass can create 'dust bowls'. During prolonged periods of drought synthetic turf has an advantage in this area.

2. Heat dissipation
Most synthetic turf surfaces absorb rather than reflect sunlight, causing the emission of heat. These high temperatures not only impact the surrounding environment, but they can also affect the health and safety of athletes and children who use the synthetic turf grounds. They can become an uncomfortable playing surface very quickly, especially for summer sports like cricket, tennis and lawn bowls. (Refer to section 9 for more information on the health impacts of heat related issues).

Recent local research for the AFL and CA, suggests that in hot conditions, an artificial grass sporting area can be up to 40% hotter than a natural field, although this increased heat dissipates quickly on a windy day.

Natural grass plays an important role in controlling climate. Natural grass is one of the best exterior solar radiation control ground covers, because it absorbs radiation and converts it to food for growth through photosynthesis. Natural grass surfaces reduce temperature extremes by absorbing the sun's heat during the day and releasing it slowly in the evening (Simon, 2010).

The replacement of natural grass with synthetic turf has the opposite effect and can contribute to rising temperatures in urban settings, known as the urban heat island effect. Urban heat islands are created when natural grass and trees are replaced by impervious surfaces which absorb heat. Urban heat islands increase demand for energy (particularly air conditioning), intensify air pollution, and increase heat-related health problems.

Not only does removing natural grass exacerbate the urban heat island effect – most synthetic turf fields absorb rather than reflect sunlight, causing them to emit heat.

3. Noise and glare reduction
Natural grass provides greater noise abatement and glare reduction when compared with synthetic turf. Natural grass plants have the ability to absorb sound. Noise levels are affected by the softness or hardness of the surface over which sound travels. Because grassed areas present such an irregular soft surface, they are very effective at reducing noise levels.

C Personal Injury Lawyers are now focusing on injuries due to Synthetic Turf: Why artificial turf could increase our risk of serious injury.
https://lawpartners.com.au/blog/why-artificial-turf-could-increase-our-risk-of-serious-injury

In addition to being all-weather friendly, these synthetic fields also require less maintenance and are significantly more durable – capable of coping with more than 60 hours of play per week as opposed to less than 20 hours for natural turf. So, what's not to love about artificial fields? Well, how about a potential increased risk for serious injury and illness.

It may not be well publicised but synthetic fields can get up to more than twice the surface temperature of natural turf on a hot day. It's recommended that these fields are constantly watered throughout the day during use, but on days exceeding 30 degrees, the surface temperature of the field can reach as much as 75 degrees. As you can imagine this dramatic

increase in temperature can increase the risk of severe dehydration, burn-related injuries including blisters and skin burns, particularly among young children.

While the emergence of synthetic turf is relatively new here in Australia, America has more than 12,000 nationwide and have conducted a number of studies that highlight the potential risks of regularly playing on the surface.

Burns, abrasions and even the increased potential to contract cancer have all been flagged in studies that looked at the negative effects of synthetic fields.

The biggest area of concern is the exposure to potential cancer-causing materials. The majority of synthetic fields around the world use rubber pellets to give the surface a bouncy feel similar to watered soil. These pellets are sourced from different scrap tires which have been broken down to small pieces and laid over the surface.

A chemical analysis study conducted by Yale University in 2015 found that 12 of the 96 chemicals found in rubber pellets were registered carcinogens (substance capable of causing cancer), and up to 48 other chemicals hadn't been tested by the government.

D Other Relevant Recent Literature

Determination of priority and other hazardous substances in football fields of synthetic turf by gas chromatography-mass spectrometry: A health and environmental concern (Celeiro et al, 2018).

This study reveals the presence of priority organic compounds such as PAHs, and other hazardous substances including phthalates, adipates, vulcanizing agents and antioxidants in synthetic turf football fields.

The leaching of these chemicals from these synthetic play surfaces to the runoff water and their direct transfer to the air above the crumb rubber has also been demonstrated.

It should be also noted that high concentrations of heavy metals such as Cd, Pb and Cr, were found in two crumb rubber samples.

A miniaturized UAE procedure followed by GC-MS analysis, was successfully employed to analyse the crumb rubber from 15 football field surfaces.

The results showed the presence of 24 of the 40 target compounds, including 14 of the 16 EPA PAHs, with total concentration up to 50 mg g1. The SPME conditions were optimized to achieve the highest extraction efficiency of the compounds from the runoff water. Target compounds, including 8 PAHs, BTZ and some phthalates, were detected at mg L1 level. These compounds were also detected after performing SPME analysis of the air above the playing surfaces, underlining the inhalation risk, especially to children.

Therefore, PAHs and other organic substances were proved to quickly transfer into the air and water, suggesting that they could easily reach different environmental compartments.

The environmental and health risks derived from the use of these surfaces have to be considered and some regulations should be adopted

E The European Chemicals Agency (ECHA) possible recommendation that the EU ban synthetic granules used as infill material for synthetic turf pitches

The European Chemicals Agency (ECHA) is most likely to recommend that the EU ban synthetic granules used as infill material for synthetic turf pitches, with a six-year transition period. The EU decision is not expected before 2021 at the earliest.

ECHA has been running a public consultation on the use of microplastics intentionally added to products such as cleaners. As infill granulates for synthetic turf pitches would fall within the definition of "intentionally added microplastics" being considered by ECHA, the agency also asked for input on these granulates as part of the consultation. The information is to be used to assess the need to exempt the use of rubber and plastic infill in sports fields from a future ban or restrictions on microplastics. Infill is an important application for rubber from end-of-life tyre (ELT) recycling.

https://www.dw.com/en/possible-eu-ban-on-plastic-granules-has-amateur-football-clubs-in-an-uproar/a-49730305

CONCLUSION

It is impossible for there to be scientific evidence that confirms what is now emerging with the potential health risks posed by synthetic turf as it takes many years for this kind of confirmatory data to emerge. But the warning lights are there just like they were with smoking and also asbestos. For these reasons, we advocate for the precautionary principle of sustainability.

The rhetoric of those companies selling this product is there is no evidence of any adverse health impacts..... just like we had when the connection was made between cancer and asbestos or cancer and smoking.....it took many years for the scientific connection to be proven. In the meantime, people died.

Additionally, there will also most likely be evidence of the adverse environment effects of leeching of unstable rubber and plastic particles into the environment.

Gore Creek at Bob Campbell Oval and the mudflats into which the creek discharges is an extremely environmentally sensitive area that needs to be protected from contaminants and consistent with the Sustainability Action Plan.

As our community becomes aware that personal injury lawyers in Australia are now focusing on this issue, personal injury claims will no doubt rise. The use of synthetic turf therefore creates a significant risk to local councils who replace natural grass playing fields and other outdoor recreational areas with synthetic grass.

While living turf requires mowing and watering, to adapt to climate change, funds from the grant, could be used to provide storm water collection/storage tanks to provide water for maintaining the turf, soil improvement and planting with a diverse range of more climate resilient grasses.

There is an assumption that the St Leonards south precinct development requires an industrial solution to Bob Campbell Oval to absorb this future communities' interests or that of outside competitive organised sport.

There is already a synthetic oval on Pacific Highway near North Shore Hospital that can carry a heavier load of organised sports from the St Leonards South development. It is not in the interests of existing Greenwich community to lose their natural grass area and the diversity of uses that residents make of this area.

Finally, three young teenage Greenwich Sports Club members in their club clothes response to their parent being asked if they would sign the Greenwich Community Association petition responded "Can we sign it……Synthetic turf is just way too hot to play on….we want to play on natural grass!" Perhaps we should listen to the young people who train on this oval and their parents

RECOMMENDATION

It is recommended the Bob Campbell Oval remain as turf, with the species of turf being the most appropriate for that location.

REFERENCES

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