THE SMART GUIDE TO SYNTHETIC SPORTS FIELDS RUBBER INFILL

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Acknowledgements

Smart Connection Consultancy is extremely grateful to the sport peak bodies, valued suppliers and manufacturers who have provided information, photographs and case studies for this Smart Guide to Synthetic Sports Fields Rubber Infill.

Without their support, we would not be able to achieve our goal to enhance the knowledge of the industry on sports turf fields. We would also like to thank the colleagues, clients and organisations that we have completed work for in the sports industry. It is your appetite for change and progress that makes our job so rewarding.

ISBN: TBC

Disclaimer

Smart Connection Consultancy do not accept any liability for the accuracy of the information provided. All material and information that is provided from the third parties is done so in good faith to assist organisations understand the key issues around the infill used in synthetic sports fields. We will continually update the Smart Guide to attempt to keep the industry updated.

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He clearly understands strategic and the political environment of sport, whilst also providing tactical and innovative solutions. Martin is an international speaker whose expertise is recognised for aligning synthetic surfaces and facility development, with player pathways, supply and demand forecasting and participation strategies.

Photo 1: Martin Sheppard receiving the PLA (Vic/Tas) Award for the 2015 Research Project for the Smart Guide to Synthetic Sports Surfaces.

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Welcome and Purpose

The popularity of synthetic sports surfaces used by many sports, local governments and within the education sector in Australia has significantly grown in the last two decades to complement the natural turf fields. This enables the local community to participate in sport when the demand on natural fields cannot be accommodated.

There are some community groups who have concerns about aspects of the synthetic sports field systems having a negative impact on the players, the environment and the community. Media raised these concerns yet a gap in their coverage are the lack of facts.

The aim of this Smart Guide is to address this gap and provide objective evidence from around the globe to assist organisations with their decisions to embrace the technology to supplement their natural turf fields. It is anticipated that this should guide community groups in appreciating the benefits and use of such investments.

Smart Connection Consultancy is passionate about working with organisations that are keen to encourage their community to be more active. Sport is one of the vehicles to achieve this and provides many physical, community and health benefits.

Smart Connection Consultancy has embraced the use of sports field technology, whether that be natural, hybrid, synthetic or alternative sports surfaces to complement natural fields, as a vehicle to promote and provide the community with opportunities to be more active more often.

Introduction

The growth of the Australian population over the past 20 years has seen an increase of over five million[1] (31.36%), and the expected population in the next 15+ years will rise to be over 31 million[2] (Approx. 40% increase).

The ability to cater for the growing demand of natural playing fields is causing concern to many inner city local governments. These natural turf fields are under greater capacity pressure and this results in increased stress levels to the natural turf. Many local governments are embracing the synthetic sports turf technology to complement natural turf and satisfy community need.

Photo 2: NSW Council field in typical mid-season condition for their natural turf field

The benefits of synthetic sports turf technology caters for increased playing capacity, often more than 60 hours a week, and offering a consistency that is not detrimentally impacted by drought or excessive rain. Most football codes in Australia benefit from this technology and the growth in synthetics fields for Soccer, Rugby (Union and League), AFL and multi-sports fields, continues to increase.

At times, there has been media coverage that has raised concern about the perceived health risks of adopting the technology. The key health risk perceptions are based on:

- Truck and car rubber tyres which are recycled for the football field infill and commonly known as Styrene Butadiene Rubber (SBR) or crumb rubber. These may have chemicals or heavy metals within the rubber that may be carcinogenic if released or exposed to users or the environment; and
- The safety to players is compromised by playing on synthetic fields.

Photo 3: NSW Field after synthetic field installed

This Smart Guide addresses key issues in each section including:

- The purpose and types of infill
- Health issues – Frequently asked questions
- Environmental concerns - Frequently asked questions
- Global considerations and regulations - Frequently asked questions
- Conclusion and suggestions on how to reduce risk when purchasing synthetic fields with infill

[1] ABS, Australian Demographic Statistics (cat. no. 3101.0), Data extracted on 21st December 2016 http://abs.gov.au/ausstats/abs%40.nsf/94713ad445ff1425ca25682000192af2/1647509ef7e25faaca2568a900154b63?OpenDocument

[2] ABS, http://www.abs.gov.au/AUSSTATS/abs@.nsf/mf/3222.0

The Purpose and Types of Infill

The infill within the 3G long grass synthetic turf system aims to provide a consistency between the ball, player, and surface interaction that allows the synthetic system to perform to the required standards.

There are several aspects that need to be considered when choosing the most appropriate infill for a sports field including the:

- Type of infill for the surface;
- Depth and height of the infill compared to the yarn; and
- Amount of infill.

Purpose of Infill

The infill, or lack of it, is needed to assist the performance of the whole grass system, which ensures that the yarn plays a similar role as the soil in natural grass fields. The different types of grass surfaces and infill considerations commonly categorised are:

1) Unfilled

Although the first nylon pitches in the 1960's were unfilled, today the pitch systems are far more sophisticated. Water is used; predominantly for hockey's premium standard - global. Water is applied through an irrigation system immediately prior to play, increasing the speed of the ball interaction with the surface. Technology is now looking for unfilled fields that have similar playing conditions as traditional water based pitches. However, many are sand-dressed.

2) Sand-Dressed

Dressed synthetics surfaces aim to add weight to the carpet to keep the denier pile upright while also maintaining the playing standards for hockey. Some football (soccer) 5-a-side/futsal courts use this type of system as it seems to provide a more durable solution to people using flat training shoes.

Photo 4: Example of a mixed profile of sand and rubber infill

3) Filled Fields

The aim of the filling is to replicate soil in a natural pitch where the grass/synthetic yarn is held upright. The filling can be compiled from rubber, plastics, sand or organic infills. The amount of fill is normally determined by the manufacturer, when they consider the length of grass yarn, the performance outcomes, the shock pad and purpose of the field. For instance, rugby union is to be at least 60mm, whilst hockey can be around 11mm.

Type of Infill

Depending on the manufacturers' systems, there will always be a choice for the purchaser depending upon the affordability and philosophical standing. Some local governments do not like the idea of using recycled types (SBR) due to community perceptions, although these perceptions have been proved unfounded. In essence, there are five types of infill, offering slightly different options, but with the same outcome, namely the performance standards stipulated by the sport(s). The key options are:

1) Crumbed Rubber (Recycled SBR)

The most popular infill in the Asia Pacific region, historically due to the cost-effective price point. Derived from recycled truck tyres that are ground up and recycled. The recycled rubber is metal free, and according to the United States Synthetic Turf Council's (STC) Guidelines, which represents the manufacturers and suppliers of synthetic sports

turf in the USA, the crumb rubber infill should not contain liberated fibre in the amount that exceeds 0.01 percent of total weight of crumbed rubber.

Recycled and shredded rubber is normally 0.5 - 2mm in size, is the least expensive and still provides the necessary sliding and shock absorbing qualities. The shredding of the rubber is normally completed mechanically. Sifting technology is used to ensure that the dimensions are correct. The benefits are it is recycled, economical, UV stable and has a long-life span.

The black rubber has been, according to the UK's Sport and Play Construction Association's (SAPCA) independent Consultant polymer chemist, Dr Bryon Willoughby, "selected to offer optimum performance in a demanding application which requires strength, fatigue and abrasion resistance".[3]

The ambient and cryogenically shredded rubber can be coated with obscurants, sealers or anti-microbial substance if required. This approach provides a great aesthetic appeal but the additional cost may not be justifiable for many Local Government Authorities (LGA's).

The recycled SBR infill is the most economically viable proposition compared to a premium virgin rubber or organic infill, adding another $100,000 to a typical rectangular football field. Over the past two years in Australia, there has been a move for purchasers to invest more in the infill and select a virgin rubber or organic option.

2) Sands

Silica sand is the preference for sports fields due to the rounding of each particle, as opposed to the sharpness of natural sand, found on the beach. This sand is chemically stable, fracture resistant, non-toxic and is rounded.

Photo 5: Silica Sand (Source: www.flexsand.com)

It can be used by itself, or in combination with rubber or organic infills. It is important that the Silica sand has a high purity of grains of more than 90 percent as recommended by the STC. This sand can also be coated with either a firm or flexible coating which is normally elastomeric or acrylic, forming a coating that allows for different sizes depending on the system's needs. It is normal for these coatings over time to wear off during the life of the carpet.

3) TPE (Thermo Plastic Elastomer)

This is a new material, which is heated and compressed into grains or various shapes for performance. Once cooled, it retains its new shape, is elastic in nature and can also be recycled. It has a long life and shows durability according to various manufacturers.

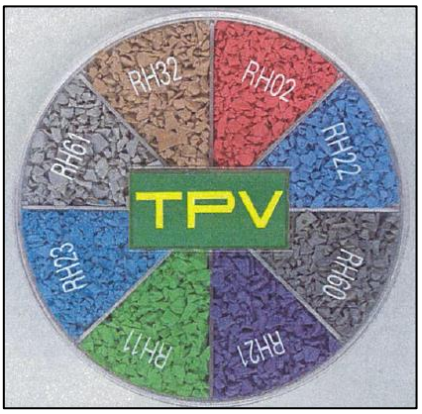

Photo 6: TPV Granules provide a greater colour range and less UV degradation (Source: Surface Designs)

This 'virgin plastic' infill is non-toxic, chemically stable, resits fading and is long lasting. It can also

[3] Twenty Questions on Rubber Granulate: SAPCA: 2007 – Dr Bryon Willoughby - http://www.murfittsindustries.com/wp-content/uploads/New-copy-of-20-questions.pdf

provide the benefit of being recycled at the end of the "grasses life". Providing a wide range of colours, TPE or similar sister products such as TPV, EVA etc., which are often used in playgrounds, athletic tracks and for field infills. It has elastic properties, uniform shape and its virgin rubber and filling provide a high-performance infill option. There has been some concern that cheaper made Thermo Plastic products may be more likely to melt in fields at higher temperatures, which would compromise the performance of the synthetic system.

4) EPDM Infill (Ethylene Propylene Terpolymer)

This type of infill is produced from a polymer recovered from three monomers: ethylene, propylene and diene. Common colours are red, green and brown and it is odourless and offers consistent quality. It is often used for playgrounds, on athletic tracks as well as for synthetic field infill.

Photo 7: EPDM 'Bionic' infill (Source MILOS)

5) Organic Infill

There has been experimentation using organic or natural infill's by a small number of companies. The basic offerings are:

i. Cork infill – allowing cork to be stripped from trees (every nine years) then used as a top. The marketing rationale from a key supplier states that it has 12 million air cells per cubic cm. A few fields are being installed in Australia currently and much interest is being shown on how they perform in the hot dry weather in Australia.

ii. Cork/organic infill – allowing less cork with other plant/organic compounds such as coconut husk etc. There seems to be more concerns about this combination due to:
   - The plant/organic compound breaking down quickly from the typical level of use that Australian LGA's programme their pitches (e.g. 40-60 hours).
   - Additional cost of maintenance due to compaction and possible organic growth with plant substance.
   - Additional cost of continual replacement and top-up.
   - This option, in Australia's climate also needs to be watered regularly as it will turn to dust with the breakdown of the natural fibres, which may indicate that a hybrid stabilised turf/grass solution should also be considered.

Photo 8: Organic Infill (Source: Limonta)

Amount of Infill

The amount of infill used in a field will depend on how the manufactured systems work and against what sports performance standards are chosen. If a shock pad is used, then for the same football codes the yarn length may be as little as 43mm. In Europe, the mix of silica sand and rubber infill is being used with a yarn of 50mm allowing 15-20mm for the fibre to be left above the infill.

The import aspects to consider are the structure of infill or square meter and the thickness of the yarn fibres to allow the yarn to stay upright.

Photo 9: EPDM (Virgin Rubber) Infill allowing around 20mm of grass above the infill

FAQ 1: Is there a difference in the component make up of virgin rubber and recycled SBR rubber?

A: Synthetic rubber has been made for decades using chemicals that reflect the properties of natural rubber, to provide a robust and flexible surface. The synthetic rubber or plastic is made from bringing together various chemicals and curing the 'ingredients' to make polymers into rubber latex and plastics. This may in some cases include the use of Styrene (liquid) and Butadiene (gas) to form a liquid latex which is prepared into rubber for purposes e.g., shoes, toys and other products handled and used daily, as well as commercial products including rubber matting and vehicle tyres.

For vehicle tyres, there are also other compounds added to increase the durability for the needs on the roads. This adds a significant added benefit to the crumb rubber in synthetic fields as the infill is extremely durable.

Although Styrene and Butadiene are identified carcinogens in their natural state, when combined they, with other chemicals, form polymers which result in these chemicals being locked within the polymer chain. The latest independent research from the Dutch Government states *"…the effect of these substances on human health is virtually negligible."* [4]

Recycled SBR rubber, or crumb rubber as it is commonly known, predominantly sourced from vehicle tyres is used as the performance infill. After the tyres are stripped of the metal rims the rubber is recycled by shredding into crumbs.

Photo 10: Australia's Institute of Sport has embraced the sports turf technology and invested in EPDM infill as opposed to recycled SBR

[4] National Institute for Public Health and the Environment (RIVM) Ministry of Health, Welfare and Sport, Netherlands, report on 'Playing sports on synthetic turf fields with rubber granules' 20-12-2016 OomenAG, de Groot GM (RIVM Summary Report 2016 – 0202) accessed on 22nd December 2016: http://www.rivm.nl/en/Documents_and_publications/Common_and_Present/Newsmessages/2016/Playing_sports_on_synthetic_turf_fields_with_rubber_granulate_is_safe

Health Issues - Frequently Asked Questions

FAQ 2: Does research identify that recycled SBR infill is harmful to users?

A: Concern from of the community gaps focuses on the Polymer base chemicals locked in the Polymer chain within the recycled SBR. The concern is there may be a danger of these components breaking down and the raw components being ingested, or reacting against player's skin, or inhaled into their lungs. Thus, increasing the likelihood of players being exposed to higher health risks.

Photo 11: Rubber granular infill for a synthetic surface

The Synthetic Turf Council (STC), has acknowledged community concern around the use of synthetic rubber and synthetic grasses. In response to this concern they have invested significantly to highlight the independent research by government agencies, chemical engineers, toxicologists, epidemiologists, chemists, biologists and other medical professionals.

The STC reviewed related research on inhalation toxicity (34 articles); ingestion toxicity (45 articles); and dermal toxicity (27 articles); links to cancer (11 articles). The findings were STC '*unequivocally failed to find any link between recycled rubber infill and cancer or any other human health risk'*.[5]

In February 2016, the STC produced a video explaining the infills, titled "The Truth About Artificial Turf and Crumb Rubber" (https://www.youtube.com/watch?time_continue=9&v=pVZSVhyMv-A)

In March 2016, the STC issued a statement on the 'Available Recycled Rubber Research'[6]. This was in response to the increased public interest in potential health effects of recycled rubber in sports fields.

Other independent European research in 2013[7] involved a Tier 2 environmental – sanitary risk analysis, on five synthetic sports turf fields in Italy, Turin. It explored the exposure to adults and children from the projected three opportunities of exposure to any harmful components of the recycled rubber: direct contact; rain water soaking; and inhalation of dust and gases. The results of the research for all exposure opportunities, was based on the cumulative risk proved to be lower than one in a million.

Photo 12: Virgin rubber being used more in synthetic sports fields

Although dust and gases were found to be the main rate of exposure, the results assessed the impact on the inhalation pathway when compared to risk assessment conducted on citizens

[5] Synthetic Turf Council , Executive Summary Catalogue of Available Recycled Rubber Research (march 3, 2016) http://c.ymcdn.com/sites/www.syntheticturfcouncil.org/resource/resmgr/docs/stc_cri_execsummary2016-0303.pdf

[6] STC Executive Survey Catalog of Available Recycled Rubber Research (March 3, 2016) http://c.ymcdn.com/sites/www.syntheticturfcouncil.org/resource/resmgr/docs/stc_cri_execsummary2016-0303.pdf

[7] Ruffino, B., Fiore, S., & Zanetti, M.C., (2013). Environmental-sanitary risk analysis procedure applied to artificial turf sports fields. *Environ Sci Pollut Res Int. 20*(7):4980-92. doi: 10.1007/s11356-012-1390-2)

breathing gases and dusts from traffic emissions every day in Turin.

For adults and children, the conclusion of the report states: *"the inhalation of atmospheric dusts and gases from vehicular traffic gave risk values of one order of magnitude higher than those due to playing soccer on an artificial field".*[8]

Additional independent research conducted between 2009-2013 have found similar results[9] [10] [11].

- Over a 12-year period, Simon[12] reviewed impacts of crumb rubber in artificial turf. Results showed: "*ingestion of a significant quality of type shared did not elevate a child's risk of developing cancer, relative to the overall cancer rates of the population[13]".*
- *Cardno Chemrisk found: "regular exposure (e.g. regular play on ground rubber infilled fields) to ground rubber for the length of one's childhood does not increase risk of cancer above levels considered by the state of California to be de minimus (i.e. lifetime excess cancer risk of 1 in a million")[14].*

FAQ 3: Is there a link with rubber infills and Leukaemia or other cancers?

A: According to recent research in 2015 and 2016 the following summary can be provided.

In response to significant community concern during 2016 in the Netherlands the Dutch Governments' research states:

"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 leukemia and lymph node cancer. Moreover, it is clear from the composition of the rubber granulate that the chemical substances that are capable of causing leukemia 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 1980's, a slight rise has been observed in the number of people aged between 10 and 29 who get leukemia. This trend has not changed since synthetic turf fields were first used in the Netherlands in 2001" [15].

In response to community interest in the USA leading toxicologist Dr Laura Green, pragmatically considered and addressed a series of concerns raised by a Principal of Jonesport Elementary School in Main (USA). This response is potentially the most detailed explanation of the perceived links of recycled SBR tyres to cancer, found by the author of this FAQ Fact Sheet. In brief her conclusion states:

"Overall, then, the evidence on crumb rubber and rubber mulch does not suggest, let alone demonstrate, that rubber poses a significant risk to the health of children and others. As such, I believe that Principal Lay can rest assured that the mulch in her playgrounds has not put her students at risk of developing cancer." [16]

[8] Ruffino, B., Fiore, S., & Zanetti, M.C., (2013). Environmental-sanitary risk analysis procedure applied to artificial turf sports fields. *Environ Sci Pollut Res Int. 20*(7):4980-92. doi: 10.1007/s11356-012-1390-2) Abstract Summary - http://link.springer.com/article/10.1007/s11356-012-1390-2

[9] Krüger, O., Kalbe, U., Richter, E., Egeler, P., Römbke J, & Berger, W. (2013). New approach to the ecotoxicological risk assessment of artificial outdoor sporting grounds. Environ Pollut. Apr;175:69-74. doi: 10.1016/j.envpol.2012.12.024.

[10] **Sunduk, K., Ji-Yeon, Y., Ho-Hyun, K., In-Young, Y., Dong-Chun, S., & Young-Wook, Lim. (2012). Health Risk Assessment of Lead Ingestion Exposure by Particle Sizes in Crumb Rubber on Artificial Turf Considering Bioavailability. Environ Health Toxicol. 2012; 27: e2012005. doi: 10.5620/eht.2012.27.e2012005**

[11] Menichini, E., Abate, V., Attias, L., De Luca, S., di Domenico, A., Fochi, I., Forte, G., Iacovella, N., Iamiceli, AL., Izzo, P., Merli, F., & Bocca, B. (2011). Artificial-turf playing fields: contents of metals, PAHs, PCBs, PCDDs and PCDFs, inhalation exposure to PAHs and related preliminary risk assessment.Sci Total Environ. 409(23):4950-7. doi: 10.1016/j.scitotenv.2011.07.042

[12] Simon, R. (Feb. 2010). Review of the Impacts of Crumb Rubber in Artificial Turf Applications. UNIVERSITY OF CALIFORNIA, BERKELEY LABORATORY FOR MANUFACTURING AND SUSTAINABILITY

[13] Rachel Simon, University of California, Buheberg, Review of Impacts of Crumb Rubber in Artificial Turf Applications (Feb 2010) p31

[14] Review of the human Health and ecological safety of exposure to recycled tire rubber found at playgrounds and synthetic turf fields. Prepared by Cardno ChemRisk, Pittsburgh, PA (Aug 2013) http://c.ymcdn.com/sites/www.syntheticturfcouncil.org/resource/resmgr/files/rma_chemrisk_update-_8-1-13.pdf

[15] National Institute for Public Health and the Environment (RIVM) Ministry of Health, Welfare and Sport, Netherlands, report on 'Playing sports on synthetic turf fields with rubber granules' 20-12-2016 OomenAG, de Groot GM (RIVM Summary Report 2016 – 0202) accessed on 22nd December 2016: http://www.rivm.nl/en/Documents_and_publications/Common_and_Present/Newsmessages/2016/Playing_sports_on_synthetic_turf_fields_with_rubber_granulate_is_safe

[16] Dr Laura Green Memorandum, June 29, 2015 Re: Comments on CPSC Report #20150608-22F81-2147431268 Assessment of the risk of cancer posed by rubber mulch used in playgrounds http://c.ymcdn.com/sites/www.syntheticturfcouncil.org/resource/resmgr/Files/Rubberecycle_-_Dr._Green_let.pdf

In 2006, the Norwegian Institute of Public Health published their report,[17] the investigators noted; *"Worse case calculation based on air measurements carried out..... does not cause any increased risk of leukaemia as a result of benzene exposure or any elevated risk as a result of exposure to Polycyclic Aromatic Hydrocarbons (PAH's).*

FAQ 4: Can the community be sure of what chemicals and components are in the recycled rubber?

A: To ensure quality recycled SBR is used in sports field infill, it is important to appreciate the region of the globe where infill is sourced and the regions' regulations regarding the components makeup of the tyres.

Photo 13: Synthetic fields are being used for both full-side games and the intensity of training on small areas that natural turf could not accommodate

America and Europe have strict regulations on the safety of the chemicals and components used to make vehicle tyres. The US has a voluntary code[18] and Europe has very strict compulsory legislation[19] which has placed restrictions on the use of substances that may be cacogenic in their raw form in any product being brought into Europe for sale.

This has resulted in the identification of eight key Polycyclic Aromatic Hydrocarbons (PAH's) that are deemed to be harmful and no product, including car tyres can be provided in Europe without being certified on the sum of all the PAH's being less than 10mg/kg.

In summary, as long as the tyres can demonstrate that they have been certified to the American Code and European regulations there is a strong likelihood that they will not contain any harmful levels of PAH's.

Presently, Australia does not have a similar code.

[17] Dye, C.; Bjerke, A.; Schmidbauer, N.; Mano, S. Measurement of Air Pollution in Indoor Artificial Turf Halls, Report NILU OR 03/2006. Norwegian Institute for Air Research: Kjeller, Norway, 2006.

[18] ASTM D5603 - 01(2015): Standard Classification for Rubber Compounding Materials—Recycled Vulcanizate Particulate Rubber. https://www.astm.org/Standards/D5603.htm

[19] EU REACH ANNEX XVII: RESTRICTIONS ON THE MANUFACTURE, PLACING ON THE MARKET AND USE OF CERTAIN DANGEROUS SUBSTANCES, PREPARATIONS AND ARTICLES (Source: http://www.reachonline.eu/REACH/EN/REACH_EN/articleXVII.html)

Environmental Issues - Frequently Asked Questions

FAQ 5: Is recycled SBR infill safe to the environment?

A: There has been significant research globally on the impact of recycled SBR on local ecosystems. These research projects[20] [21] including those representing the California Environmental Protection Agency, the Norwegian Institute of Public Health, the French National Institute of Environment and Risk, and Auckland Council, all have similar conclusions.

Photo 14: Organic infills are now being embraced in certain parts of the world

The conclusions are best summarised by the Swiss Study[22] by the Ministry of Environment, Traffic, Energy and Communications. The study was on the Environmental Compatibility of Synthetic Sports Surfaces which explored the secretion of synthetic surfaces from disintegration by UV radiation, mechanical destruction by abrasion, and diffusion of ingredients and washing off by rain water.

The testing was in a controlled environment with rain washing through the synthetic and natural turf systems over a two-year period then collected and measured for the secreted substances. The report summarises there is no risk for the environment from Poly Aromatic Hydrocarbons (PAH's) or heavy metals including Mercury, Lead, Cadmium, Chromium, Zinc, and Tin, which were all lower than the required European safety levels.

Photo 15: Swiss Study collecting rain water through various synthetic sports surface systems

FAQ 6: Are there heavy metals in the infill or yarn?

A: Historically Lead Chromate was used for pigment colouring in yarn, and after research was conducted in 2008 the use of Lead Chromate as a pigment for the grass was stopped in 2009[23] for all sports turf.

The use of heavy metals is not common in the infill, although some cheaper virgin rubbers may use lead as colouring.

The European standards including the Swiss and German Regulation DIN 18035 parts 6 and 7 and ESM105, state the requirements of metals need to be less than:

- Mercury ≤ 0.01 mg/l,
- Lead ≤ 0.04 mg/l,
- Cadmium ≤ 0.005 mg/l,
- Chromium ≤ 0.008 mg/l,
- Zinc ≤ 3.0 mg/l, and
- Tin ≤ 0.05 mg/l.

[20] Humphrey, C., & Katz, L., (2000). Water-Quality effects of tire shreds placed above the water table: Five-year field study. Transportation Research Record: Journal of the Transportation Research Board, 1714, 18-24. DOI: http://dx.doi.org/10.3141/1714-03http://dx.doi.org/10.3141/1714-03

[21] Hofstra, U. (March, 2009). Zinc in drainage water under artificial turf fields with SBR. Summary ITRON Report. http://c.ymcdn.com/sites/syntheticturfcouncil.site-ym.com/resource/resmgr/Docs/Zinc_in_Drainage_Water_-_200.pdf

[22] Muller, E. (2007). Results of a Field Study on Environmental Compatibility of Synthetic Sports Surfaces. Swiss Ministry of Environment, Traffic, Energy and Communication Authority of Environment Section Water.

[23] STC: Lead Chromate in Synthetic Turf, Though Safe for kids per CPSC, was discontinued in 2009 (20/3/2015 - STC Website)

Synthetic systems purchased, should therefore meet these standards or the alternative standard, European Standard EN71-3 (2013) Table 2 Category III, which is the standard for Safety of Toys – Part 3 Migration of certain elements, and Category III (Scraped-off materials). In the US, the equivalent is the ASTM F3188 – 16.

Both the European and US alternative standards measures the possible heavy metal migration of material that may be hazardous if ingested.

FAQ 7: Does the introduction of synthetic turf using rubber infill impact on carbon sequestration?

A: Significant global research has been completed about the comparisons, including:

- A 9,000m^2 synthetic facility over 10 years, recorded a total CO^2 emission of 55.6 tonne and the tree planting offset requirements was approximately 900 trees[24].
- Natural grass helps remove carbon dioxide (carbon sequestration) from the atmosphere via photosynthesis and stores it as organic carbon in soil, depending on factors such as land practices and climatic conditions. Therefore, grass contributes to soil organic matter, mainly through its root system, which makes it an important carbon sink. A carbon sink can store some carbon-containing compound for a period of time. A typical lawn of 232m^2, converts enough carbon dioxide from the atmosphere to provide adequate oxygen for a family of four[25].
- Growing forests produce a net gain of oxygen because they store carbon in wood in the trees themselves. Whereas grass stores carbon in the form of sugars, starches and cellulose. However, the important point is that natural grass is often cut - particularly on a playing field - which releases the carbon as it breaks down and rots, plus the reduction in blade length reduces the amount of absorption. This is compared with trees, which drop leaves while the wood components are more likely to stay intact. It should be noted that plants continue to release carbon dioxide and water into the atmosphere through the process of cellular respiration. Therefore, the net production oxygen in grass is very small in comparison to trees and bushes.
- Greenhouse gas emissions from natural turf production and maintenance is greater than the amount of carbon that can be stored in the grass. This study found that athletic sports fields do not store as much carbon as ornamental grass due to soil disruption by tilling and resodding. However, this methodology of research has since been reviewed and modified to suggest that it is a net sequester or carbon dioxide. Essentially, the difference is to do with the ability to counter balance emissions through the carbon sink[26].
- In 2010, the BASF Corporation Eco-Efficiency Analysis[27] compared synthetic fields with professionally installed and maintained grass fields. It concluded that the use of synthetics can lower consumption of energy and raw materials and the generation of solid waste, depending on field usage. BASF also found that the average life cycle over 20 years of natural grass fields are 15 per cent higher than the synthetic alternatives.

FAQ 8: Does the high UV in Australia impact on virgin rubber infills?

A: Due to the intensity of UV over Australia, the infill and yarn is tested using the Extended Test Method. This has been adopted by the majority of

[24] Meil, J and Bushi L, 2007. 'Estimating the Required Global Warming Offsets to Achieve a Carbon Neutral Synthetic Field Turf System Installation'. Athena Institute, Merrickville, Ontario, Canada.
[25] TurfGrass Producers International, 2010. "Natural Grass and Artificial Turf: Separating Myths and Facts' published by Turf Grass Resource Centre, www.TurfResourceCentre.org viewed August 2011.
[26] TurfGrass Producers International, 2010. "Natural Grass and Artificial Turf: Separating Myths and Facts' published by Turf Grass Resource Centre, www.TurfResourceCentre.org viewed August 2011.
[27] Submission for Verification of Eco-efficiency Analysis Under NSF Protocol P352, Part B Synthetic Turf, Eco-Efficiency Analysis Final Report – August 2010. BASF Corporation, NJ.

International Federations to at least 5,000 hours as some infills have been found under the Australian heat and UV, to lose its performance properties.

The AFL introduced this UV standard in 2009 as part of its Quality Manual for synthetic turf being used for community Australian Rules Football fields[28]. FIFA has followed in recognising this level in the 2015 Quality Manual for the football turf performance standards[29].

Photo 16: Synthetic fields are allowing young people continue to play the chosen games, by allowing the fields to be trained on for longer each week in a manner that the latest natural grass technology could not cope with

[28] AFL and Cricket Australia Handbook for Testing of Synthetic Turf (2013) page 21: http://www.aflvic.com.au/wp-content/uploads/2013/10/AFL-CA-Testing-Manual_September-2013.pdf

[29] FIFA Quality Program for Football Turf, Handbook of Requirements (Oct 2015) http://quality.fifa.com/globalassets/fqp-handbook-of-requirements-2015.pdf

Global Considerations and Regulations – Frequently Asked Questions

FAQ 9: Is recycled SBR currently being investigated globally?

A: Concerns have been raised in the Netherlands and the USA about the safety of recycled tyre crumb used in playing fields and playgrounds.

Photo 17: Synthetic football field in NSW used by a university, schools and local community

The Dutch Governments' (RIVM – Dec 2016) main recommendation states:

"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." [30]

The US Federal government has requested their Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (ATSDR), and the U.S. Consumer Product Safety Commission (CPSC), to investigate key community concerns around environmental and human health.[31] The video explaining the research can be seen on https://www.youtube.com/watch?v=O5Gk_bP39LQ. The investigation is transparent and has an informative website. (http://www.epa.gov/TireCrumb), and the report is due early 2017. An interim report was published in December 2016 providing the results of the peer review and consultation process to date but does not identify any findings, conclusions or recommendations[32].

The government's website refers to further research completed in the USA by their Environmental Protection Agency[33].

The California Office of Environmental Health Hazard Assessment is currently conducting an in-depth SBR infill study. This study includes a series of scientific studies to determine if chemicals in recycled SBR can potentially be released under various environmental conditions and what, if any, exposures or health risks these potential releases may pose to players who frequently play on artificial fields constructed with SBR.

It will also expand understanding on if chemicals can be released from the SBR infill when a person encounters the infill. For example, when recycled SBR comes in contact with sweat on the skin or are accidentally ingested by athletes playing on turf fields.

[30] RVIM Website English Summary (accessed Dec 2016) http://www.rivm.nl/en/Documents_and_publications/Common_and_Present/Newsmessages/2016/Playing_sports_on_synthetic_turf_fields_with_rubber_granulate_is_safe

[31] Lead Chromate in Synthetic Turf, Though Safe for Kids per CPSC, Was Discontinued in 2009 (Posted by Terrie Ward, STC Marketing and Education Director, March 20, 2015: https://syntheticturfcouncil.site-ym.com/news/222483/Lead-Chromate-in-Synthetic-Turf-Though-Safe-for-Kids-per-CPSC-was-Discontinued-in-2009.htm

[32] December 2016 Status Report: Federal Research Action Plan on Recycled Tire Crumb: (Source: https://www.epa.gov/chemical-research/federal-research-recycled-tire-crumb-used-playing-fields)

[33] Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015 (Source: https://www.epa.gov/chemical-research/tire-crumb-and-synthetic-turf-field-literature-and-report-list-nov-2015.)

The European Chemical Agency is also conducting a similar review process[34] and has had discussions with their US counterparts.

FAQ 10: Are there any regulations addressing what can be used as infills?

A: The performance regulations for the sports fields are established by each sports International Federation, such as World Rugby, FIFA or Australia's AFL/Cricket Australia etc. It is understood the international body for Hockey (FIH) will be issuing guidance on how and what infills are used for their fields in early 2017.

There is no peak body in Australia responsible for the environmental and toxicological parameters, thus the need to explore global initiatives and apply them here.

In Europe, there are comprehensive regulations known as Registration, Evaluation, Authorisation and restriction of Chemicals (REACH) addressing the chemical industry and anything made from chemicals.

In the European Synthetic Turf Organisation (ESTO) Crumb Rubber (SBR) infill FAQ Sheet[35], it states that REACH:

"Applies to all individual chemical substances on their own, in preparations or in products. All car and truck tyres sold in the EU since 2012 have had to satisfy the relevant requirements of REACH. In March 2016, the Competent Authorities for REACH also stated that rubber crumb used as infill in synthetic turf pitches should be classified as a mixture and it needs to comply with entry 28 of annex XVII to the REACH regulations. This entry establishes a limit on the presence of substances which are carcinogenic and are placed on the market, or used by themselves, or in mixtures, for supply to the general public"

The ESTO FAQ Sheet also explains:

"In view of recent media and public concern, the European Commission has asked the European Chemicals Agency (ECHA) to determine whether certain hazardous substances contained in rubber crumb infill present any unacceptable risk to human health and, if so, to advise which risk management measures it needs to take. The ECHA is expected to report to the Commission in early 2017."

Smart Connection Consultancy will keep this FAQ sheet updated with recommendations produced. In addition, as a company responsible for facilitating the procurement of approximately 80% of the full-size sports fields in Australia, we will ask for preferences for infill to be sourced from organisations that can demonstrate they have a Quality Assurance system that meets the REACH Annex XVII – Entry 28 standards for infill.

FAQ 11: What safeguards are there for virgin rubber infills?

A: To explore the key safeguards for rubber infills the following should be considered:

- *For Heavy Metal Concerns* – Ensure the infills have been tested against EN 71.3 (2013) Table 2 Category III, which is the standard for Safety of Toys – Part 3 Migration of certain elements, and Category III (Scraped-off materials). In the US, the equivalent is the ASTM F3188 – 16. In addition, the European Standard DIN 1803.5 parts 6 & 7 / ESM105 are advised. These tests are harder to achieve in the recycled rubber as the source is not always known.
- *For PAH Concerns* – ensure that the sourced tyres have been certified to the European REACH regulation Annex XVII. This can also be used for the virgin rubber infills.

[34] ECHA Preliminary Evaluation if recycled Rubber Granules are a risk to human health. https://echa.europa.eu/addressing-chemicals-of-concern/restriction/previous-calls-for-comments-and-evidence/-/substance-rev/15331/term

[35] ESTO Crumb Rubber Infill FAQ Sheet (source: http://www.theesto.com/images/ESTO-Publications/Crumb%20Rubber%20infill%20-%20Frequently%20Asked%20Questions.pdf)

- *For UV Concerns* – the infill should be tested using the Extended Test Method for FIFA Quality Manual (2015) or the AFL Community Facility Manual for UV test of 5,000 hours.

Smart Connection Consultancy recommend all rubber infills are subject to the European Standard EN71-3 (2013) Table 2 Category III, which is the standard for Safety of Toys – Part 3 Migration of certain elements, and Category III (Scraped-off materials). In the US, the equivalent is the ASTM F3188 – 16. They both measure the possible heavy metal migration of material and may be hazardous if ingested.

FAQ 12: What should be specified when buying a synthetic football field?

A: Smart Connection Consultancy when providing advice, continually research the latest global trends and research. Based on the findings our recommendations are updated accordingly. Presently the following advice in regard to procuring synthetic field infills is provided:

- Infill – request two options as part of the procurement process – one should be a recycled SBR, the other a non-recycled infill;
- If economics will influence the choice between a non-recycled infill (virgin rubber such as EPDM/TPE/TPV/EVA or organic) and the economical option (SBR), the SBR needs to ensure it has minimum heavy metals as specified in EN71.3 Table 2 Category III;
- UV standards are achieved; and
- REACH standards are adopted for any recycled tyres used.

Useful Contact Details:

- Smart Connection Consultancy
www.smartconnection.net.au

Global Peak Bodies for Synthetic Turf

- Synthetic Turf Council
www.syntheticturfcouncil.org

- European Synthetic Turf Organisation
www.theesto.com

- Sport and Play Industry Association (Aus)
www.sapia.org.au

- Sports and Play Contractors Association (UK)
http://www.sapca.org.uk/

International Sports Federation

- FIFA Quality Program for Football Turf
http://quality.fifa.com/en/About-the-programme/

- World Rugby - Rugby Turf Program
http://playerwelfare.worldrugby.org/rugbyturf

- FIH Quality Program for Hockey Turf
http://www.fih.ch/inside-fih/fih-quality-programme-for-hockey-turf/

Conclusion

To date, independent studies have shown there is limited health risk, if any, of playing on surfaces with recycled rubber (SBR).

There has been no health issue linked to field users, objectively proven to be linked to the SBR infill used in sports fields.

That said, by taking proactive steps, government, education, and sports purchasers of synthetic sports fields with infill have a number of options to ensure quality standards, including:

1. If resources allow, investing in a virgin rubber technology that has been tested to the latest European standards for 'Toy Ingestion';
2. Explore if organic infills are appropriate for the climate and use the field will have;
3. If the recycled SBR is the most economic option, explore if the tyres have been sourced from a supplier that can demonstrate key health and safety processes around:-
    a. Reduced heavy metals that may be in the tyres which have been tested against EN71.3 Table 2 Category III
    b. PAH reduction to acceptable levels in the source tyres which have been tested against the REACH Annex XVII – Entry 28 regulations

These options should alleviate this perceived concern from the community.

About Smart Connection Consultancy

Smart Connection Consultancy offers an innovative approach that delivers outcomes to enhance the experience of participation in physical activity, recreation and sport in local communities.

We specialise in the planning, development, management and procurement of synthetic sports surface technology. We see this technology as complementing natural grass and encouraging more people to be active, play and achieve success in sport because of its extended durability.

By embracing the skills sets and knowledge of our collaborative consultants, we can provide an integrated and holistic approach to our client's projects.

Smart Connection Consultancy is the Technical Consultants for FFA, the NRL, and the Australian Rugby Union for Synthetic Surfaces.

Field of Expertise

In collaboration with industry experts, we provide our clients with high level quality service that is offered for a very affordable investment.

Commitment to Knowledge Building

We are committed to providing leading edge advice and knowledge so that the industry and our clients can appreciate how synthetic sports turf can complement their natural turf options.

Our Services Include:

Feasibility and Funding Advice and Solutions

Completing a Business Case to justify the need of a synthetic surface can be streamlined by using our *Smart Whole of Life Costing Model.* We support clients in developing financial strategies, funding applications and where applicable offer funding packages with major financial institutes.

Masterplanning and Design Solutions

We will work with you in exploring the site parameters and constraints together with the opportunities to ascertain the best design and management options for your park or venue.

Procurement and Project Management Support

Over 20 years' experience in procurement and in collaboration with SportEng, we provide the detailed civil engineering hold points to ensure that every step of the installation meets the appropriate civil and performance standards.

Our Clients

We have successfully completed a significant number of sports performance standards reviews, sports strategies, master plans, feasibility studies, business cases and procurement projects. Our client base includes:

- International Federations (FIH, FIFA, World Rugby)
- National and State Sports Organisations (FFA, NRL, ARU, AFL (NSW/ACT), Golf Australia, ASC, Hockey ACT etc.)
- Local Governments – More than 100 local governments with fields worth over Au $150m in most States/Territories.

"Over the last four years the relationship the City has built with Smart Connection Consultancy has become integral to the development of our public open space planning, most notably the Ellenbrook District Open Space, which includes four synthetic playing fields.

Smart Connection Consultancy has contributed in many ways including various studies, reports and research tours that we continue to use today. The work has been outstanding: on time, on budget and most importantly of a very high quality.

Martin has been very accommodating in its approach to our requirements and continues to go out of their way to help us where necessary – always going that extra mile."

Wayne Stuart, Facilities Planning Coordinator, Asset Management – City of Swan

SPORT INSPIRES A NATION

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