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Determining the effectiveness of Risk Management Measures to minimize infill migration from synthetic turf sports fields

Executive Summary

The benefits of synthetic turf

The use of synthetic turf sports fields has grown significantly throughout Europe since the development of long pile, rubber infill surfaces in the early 2000s. The fields are used due to their ability to sustain far greater levels of use and in a much wider range of climatic conditions than natural grass.

Due to the huge popularity of football, this sport is the principle users of synthetic turf sports fields. Other sports that use these types of surface include rugby, American football, Gaelic games, and hockey. Synthetic turf fields are now used at the professional levels of sport in some countries and at the community level in all countries.

Synthetic turf design and use of infill that is defined as a microplastic

The sports surface is made of synthetic turf carpet with a plastic pile that is designed to replicate the appearance and playing characteristics of real grass. The pile of the carpet is partly infilled with infill. Most fields use an elastic (performance) infill made of rubber or thermo-plastics granulate that improves player performance, ensure adequate comfort, and provides protection to players when they fall.

Synthetic turf surfaces are typically designed to be used for around 10 years and are used through the wide range of climatic regions experienced across Europe.

The infill is a granulate usually in the range of 0.5 mm to 3.0 mm, and when this is a polymeric material it falls under the definition of a microplastics developed by the European Chemical Agency (ECHA).

The use of this infill in synthetic turf fields has caused concern due to the risk of it spreading to the environment. To minimize this risk the ECHA are proposing that the use of these infills is either banned or fields are required to use Risk management measures (RMM) that will contain the infill on the fields and prevent its loss to the environment.

To describe RMM of synthetic turf sports fields it is divided into three zones:

- The synthetic turf field (playing area and run-offs) where the infill is meant to be,
- Areas such as surrounding paving, storage compounds for maintenance equipment, shoe cleaning stations and storm water drains where the infill can accumulate but is still controlled as it is contained.
- Areas where any infill entering them is uncontrolled and this may lead to the infill contaminating the environment.

Activities during use and maintenance lead to transportation of infill, these include relocation on the fields and infill being carried off the fields mainly by shoes/clothes, maintenance equipment, or by water.

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Aim of Study

The aim of this study was to use the latest research showing the magnitude of infill transportation from synthetic turf fields, and to present a way to monitor the effectiveness of infill containment or RMMs used by the synthetic turf industry and those operating synthetic turf sports fields. The study's objectives were specified as:

- Define what are the typical conditions for the use of synthetic turf fields
- Describe the typical ways infill is transported from synthetic turf fields and the effectiveness of infill containment, in quantitative terms, can be to reduce this under typical conditions
- Develop and describe a methodology for monitoring the effectiveness of infill containment

Methodology

Literature was reviewed to describe the infills function and its properties and to gather data from field measurements of infill transported by maintenance equipment, surface water runoff, players etc. and used to quantify the extent of infill migration due to common activities on turf fields.

Methodologies for quantifying microplastics spreading from synthetic turf fields were reviewed. Data from estimations and on-site measurements of infill spread were collected.

A risk management method was developed and used for sorting and prioritizing activities and events that may cause infill transportation.

Literature was also reviewed to identifying infill containment measures and to determine how to monitor infill containment efficiency.

Quantifying infill loss

Activities during use and maintenance of a field can lead to transportation of infill. This includes relocation of infill within the field (migration from high use areas to the sides) and infill being carried off the field into the surrounding environment.

Activities during use can also result in infill compaction. This reduces the total infill layer thickness, and results in reduced playability, lower player safety and compromises the durability of the synthetic turf pile. To compensation for compaction refilling or topdressing is undertaken, i.e. adding more infill to the carpet. Refilling can require up to 1 ton to 2 tons per year. Early studies assumed that this quantity of infill refilling was to compensate for infill lost through transportation, etc.

Due to large differences in how turfs are managed and maintained in Europe, it is difficult to quantify a mean infill loss from synthetic turf fields.

In this study it is estimated that full size football fields subjected to careless management and not including containment measures could potentially suffer a loss of about 500 kg infill / year. Additionally, if a field is subjected to inappropriate snow clearance (i.e. uncontrolled disposal of snow containing infill) the loss could increase to about 900 kg/ year.

Measures to prevent infill spreading

Risk Management Measures (RMM), aiming to contain the infill, have been developed in several countries were communities have expressed concerns about infill migration. These techniques and measures have subsequently been reviewed and formalized in a technical report published by the European Standards Committee (CEN Technical Report TR 17519).

In this study a risk management methodology has been developed in this report to increase infill containment efficiency. Activities and events that may cause infill loss during the life cycle of synthetic turf fields have been identified. The severity (quantity) of infill loss from each activity/ event is

evaluated. Containment measure effectiveness, and the responsibility for monitoring measures (maintenance personal, players, etc.) have been identified and described for each event.

The risk management approach shows that for many events that may lead to infill loss, the risks can be reduced or eliminated, e.g. appropriate field boundary barriers, filters in surface water drains, correct storage and handling of infill bags, and appropriate handling and storage of maintenance equipment.

Other events such as infill being carried on players' shoes and clothes cannot be eliminated but can be minimized using shoe cleaning stations.

The report recommends that existing and new fields incorporate the risk management measures detailed in CEN TR 17519.

Infill containment efficiency can be up to 97 %

Based on reported measurements an assessment has been made of the efficiency of the containment measures described in the CEN Report.

The results show that despite the site-specific variety of maintenance practices undertaken on synthetic turf fields throughout Europe, infill containment up to 97 % is possible; meaning the amount of infill that may spread from the fields can be reduced to below the 50 kg/year [7g/m^2] proposed by ECHA's SEAC committee.

These reductions can be achieved with relatively easy measures such as using containment zones, barriers, good maintenance routines and improving player hygiene. Infill can be contained to the field with measures such as:

1. Designated snow storage compounds.
2. Containment board around the boundaries of fields
3. Use of site specific maintenance equipment, or cleaning of equipment to remove infill before leaving a site
4. Ensuring clothes/shoes are brushed off before leaving the site
5. Fitting filters in drain catchment pits

The Study has shown that by introducing measures 1-5, infill loss can be reduced to about 15 kg/year [2 g/m^2].

Conclusion

Despite the site specific variety of maintenance practices seen at European synthetic turf fields, it is estimated that infill migration into uncontrolled zones on fields in common use in the EU can be controlled by up to 97 %. This means that uncontrolled infill migration can be limited with relatively simple, cost effective measures, as detailed in the CEN Technical Report TR17519. Resulting in uncontrolled infill transportation that is below the 7g/m^2 proposed by ECHA's SEAC committee.

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