HPS Evidence Assessment on the Potential Health Impacts of Tyre Crumb used in Artificial Ground Surfaces

Health Protection Scotland

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Potential Health Impacts of Tyre Crumb used in Artificial Ground Surfaces

1. Background

Artificial ground surfaces (pitches) containing recycled rubber tyre crumb have been used for a range of sports and other recreational uses for several decades. However, concern has been raised over the potential link between the use of these artificial pitches and a range of adverse health outcomes, particularly cancers. Much of the concern relates to chemical substances potentially contained within the rubber granulate infill.

A number of reviews have been conducted of the potential health impacts of tyre crumb in sports pitches (Norwegian Institute of Public Health and the Radium Hospital 2006, New York State Department of Health 2009, Washington State Department of Health 2017). Two of the most significant and recent reviews of the chemical risks posed by rubber infill to human health have been published by the European Chemicals Agency (ECHA, 2017) and the National Institute for Public Health in the Netherlands (RIVM, 2017).

Health Protection Scotland (HPS) has considered the findings of these reviews in order to assess the evidence on the potential health impacts of rubber tyre crumb used in artificial ground surfaces.

2. Findings of Recent International Research

2.1. European Chemicals Agency (ECHA), 2017

An interim report on the potential health impacts of tyre crumb used in artificial pitches was published by the European Chemicals Agency (ECHA) on behalf of the European Commission in February 2017 (ECHA, 2017). ECHA described their findings as preliminary, and noted that their assessment will be reviewed when the conclusions from ongoing studies become available, particularly citing the study by the United States Environmental Protection Agency (US EPA), due to report in late 2017 (US EPA, 2016).

The report examined the chemical risks to both the general public (children and adults) and workers installing or maintaining pitches, as well as reviewing previously published evidence.

ECHA approached their risk evaluation using the recognised source-pathway-receptor model and evaluated evidence relating to exposure via the dermal, ingestion and inhalation pathways. In order to identify the potential hazards posed by recycled rubber granules, the authors identified a number of hazardous substances that could be present in the granules (identified from literature review and recent study findings), and could, therefore, potentially pose a risk to health via the identified pathways of exposure. Chemical substances of potential concern identified in the report included polycyclic aromatic hydrocarbons (PAHs), metals, phthalates, volatile organic hydrocarbons (VOCs) and semi-volatile organic hydrocarbons (SVOCs).

The following is an extract from ECHA's conclusions and recommendations in their summary of interim findings (ECHA, 2017a):

"Based on the information available, ECHA concludes that there is, at most, a very low level of concern from exposure to recycled rubber granules:

- *The concern for lifetime cancer risk is very low given the concentrations of PAHs typically measured in European sports grounds.*

- *The concern from metals is negligible given that the data indicated that the levels are below the limits allowed in the current toys legislation.*
- *No concerns were identified from the concentrations of phthalates, benzothiazole and methyl isobutyl ketone as these are below the concentrations that would lead to health problems.*
- *It has been reported that volatile organic compounds emitted from rubber granules in indoor halls might cause irritation to the eyes and skin.*

In the studies that ECHA evaluated, which are listed in the report, the concentrations of PAHs in recycled rubber granules were well below the limits set for carcinogenic, mutagenic and reprotoxic (CMR) substances for consumers in REACH[1].

ECHA has also highlighted several uncertainties in its evaluation. Therefore, ECHA suggests the following action to be taken:

1. *Consider changes to the REACH Regulation to ensure that rubber granules are only supplied with very low concentrations of PAHs and any other relevant hazardous substances.*
2. *Owners and operators of existing (outdoor and indoor) fields should measure the concentrations of PAHs and other substances in the rubber granules used in their fields and make this information available to interested parties in an understandable manner.*
3. *Producers of rubber granules and their interest organisations should develop guidance to help all manufacturers and importers of (recycled) rubber infill test their material.*
4. *European sports and football associations and clubs should work with the relevant producers to ensure that information related to the safety of rubber granules in synthetic turfs is communicated in a manner understandable to the players and the general public.*
5. *Owners and operators of existing indoor fields with rubber granule infills should ensure adequate ventilation.*

In addition, ECHA recommends that players using the synthetic pitches should take basic hygiene measures after playing on artificial turf containing recycled rubber granules."

2.2. National Institute for Public Health and the Environment (RIVM, Netherlands), 2017

In October 2016, the Dutch Minister of Health, Welfare and Sport commissioned the National Institute for Public Health (RIVM) to carry out research on the potential health risks from playing sports on synthetic turf pitches with rubber granulate infill. The report was published in March 2017.

The authors investigated the chemical composition of rubber granulate from 100 pitches considered representative of synthetic pitches in the Netherlands. Migration studies were conducted to evaluate the extent to which substances from rubber granulate could enter the human body via dermal contact (based on dissolution of rubber granulate components in artificial sweat over two hours at 37°C), ingestion (based on release of substances into a simulated gastrointestinal system), and inhalation (by measuring evaporation of rubber granulate components at 60°C). This research was complimented with a review of the published scientific literature on substances in rubber granulate and their potential impacts on health, as well as a specific review of the scientific evidence on the link between playing sports on synthetic turf pitches with an infill of rubber granulate and the incidence of leukaemia or lymphoma.

[1] REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) is a European Union regulation that aims to improve the protection of human health and the environment from the risks that can be posed by chemicals in the EU (EU, 2016).

In terms of the risks posed to human health by chemical substances leaching from rubber granulate, RIVM concluded:

"Rubber granulate contains numerous substances, such as polycyclic aromatic hydrocarbons (PAHs), metals, plasticisers (phthalates) and bisphenol A (BPA). These substances were found to be released from the granulate in very low amounts. This is because the substances are more or less 'enclosed' in the granulate, which means that the effect of these substances on human health is virtually negligible."

In terms of the potential link between playing sports on synthetic pitches and developing leukaemia or lymphoma, RIVM concluded:

"No indications were found in the available literature of a link between playing sports on synthetic turf pitches with an infill of rubber granulate and the incidence of leukaemia and lymphoma. No international research has demonstrated this connection. Moreover, it is clear from the composition of the rubber granulate that the chemical substances that are capable of causing leukaemia or lymphoma are either not present (benzene, styrene and 1,3-butadiene) or are present in a very low amount (2-mercaptobenzothiazole)."

The overall conclusion drawn by RIVM was that:

"The results of this research indicate that playing sports on synthetic turf pitches with rubber granulate is safe. The health risk from playing sports on these synthetic turf pitches is virtually negligible. While rubber granulate contains hazardous substances, these substances are only released from the rubber granulate to a limited extent after ingestion, contact with the skin or evaporation in hot weather."

However, the authors also recommended the following:

"RIVM recommends adjusting the concentration limit for rubber granulate to one that is closer to the concentration limit for consumer products. In view of the use of synthetic turf pitches, even by young children, there is a need for sound health-based limits for rubber granulate. At this time, there is a big difference (factor 100 to 1,000) between the concentration limit for PAHs in rubber consumer products (such as rubber shock-absorbing tiles) and the concentration limit for rubber granulate, for which the concentration limit for mixtures applies. When we compare the use of rubber tiles at playgrounds with playing sports on pitches with rubber granulate infill, this major difference between these concentration limits does not appear to be well justified."

3. International Research in Progress

Health Protection Scotland is also aware of a number of significant research studies currently underway in the United States.

In February 2016, the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (CDC/ATSDR) and the US EPA , in collaboration with the Consumer Product Safety Commission (CPSC), produced a Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds (US EPA, 2016). The Action Plan is aimed at studying key questions concerning the potential for human exposure resulting from the use of tyre crumb rubber in playing fields and playgrounds. It is anticipated that the findings of this research will be available towards the end of 2017.

The California Office of Environmental Health Hazard Assessment (OEHHA), under a four-year contract with the California Department of Resources Recycling and Recovery (CalRecycle), is conducting a study of the potential health effects associated with the chemicals that can be released from synthetic turf and playground mats containing recycled waste tires. The study has recently been expanded include *"methods to extract as many chemicals as possible from crumb rubber samples for identification, the use of more suitable artificial bio-fluids (such as fluids that mimic human sweat) to evaluate the chemicals that enter the body, and measurements of crumb rubber particle size to understand if inhalation of small particles occurs"*, which has led to an extension to the original reporting date. The investigation is likely to be completed by mid-2019.

4. Discussion and Conclusions

Within the last year (2017), there have been two significant reviews of the evidence on health impacts associated with tyre crumb used in artificial sports/play pitches. Neither review has identified evidence to confirm a significant association between exposure to the tyre crumb via use of artificial pitches and adverse human health outcomes. These reviews support previous research drawing the same conclusion.

Health Protection Scotland has, therefore, concluded that there is a clear consensus in the findings from evidence published to date, which does not support the hypothesis that exposure to tyre crumb used in artificial surfaces poses a significant risk to human health.

Health Protection Scotland will, however, continue to monitor findings from new studies as they are published, and assess the potential impact of new evidence on the current understanding of health risk.

5. References

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