

State of California: Office of Environmental Health Hazard Assessment
Safety Study of Artificial Turf Containing Crumb Rubber Infill Made From Recycled Tires: Measurements of Chemicals and Particulates in the Air, Bacteria in the Turf, and Skin Abrasions Caused by Contact with the Surface (October, 2010)

Results and Conclusions

“Inhalation hazard

- a. PM_{2.5} and associated elements (including lead and other heavy metals) were either below the level of detection or at similar concentrations above artificial turf athletic fields and upwind of the fields. No public health concern was identified.
- b. The large majority of air samples collected from above artificial turf had VOC concentrations that were below the limit of detection. Those VOCs that were detected were usually present in only one or two samples out of the eight samples collected per field. There was also little consistency among the four artificial turf fields with regards to the VOCs detected. Nevertheless, seven VOCs detected above artificial turf were evaluated in a screening-level estimate of health risks for both chronic and acute inhalation exposure scenarios. All exposures were below health-based screening levels, suggesting that adverse health effects were unlikely to occur in persons using artificial turf.
- c. There was no correlation between the concentrations or types of VOCs detected above artificial turf and the surface temperature.

Skin infection hazard

- a. Fewer bacteria were detected on artificial turf compared to natural turf. This was true for MRSA and other *Staphylococci* capable of infecting humans. This would tend to decrease the risk of skin infection in athletes using artificial turf relative to athletes using natural turf.
- b. The rate of skin abrasions due to contact with the turf was two- to three-fold higher for college soccer players competing on artificial turf compared to natural turf. This was observed for both female and male teams. Skin abrasion seriousness was similar on the two surfaces. The higher skin abrasion rate would tend to increase the risk of skin infection in athletes using artificial turf relative to athletes using natural turf.
- c. The sum of these effects on the skin infection rate for artificial turf relative to natural turf cannot be predicted from these data alone. Measuring the skin infection rates in athletes competing on artificial and natural turf might determine if there is a significant difference. “

Connecticut Department of Public Health

Human Health Risk Assessment of Artificial Turf Fields Based Upon Results from Five Fields in Connecticut (July, 2010)

Executive Summary:

“In spite of the conservative nature of the assessment, cancer risks were only slightly above de minimis levels for all scenarios evaluated including children playing at the indoor facility, the scenario with the highest exposure. The calculated risks are well within typical risk levels in the community from ambient pollution sources and are below target risks associated with many air toxics regulatory programs. Further, the main risk driver, benzene, was only above background in personal monitoring samples and so may be more related to the sampling equipment or host than being field-related. Chronic non-cancer risks were not elevated above a Hazard Index of 1. The Hazard Index for acute risk was also not elevated above 1 but was close to 1 for children playing at the indoor field. The main contributor to this Hazard Index was benzothiazole, a rubber-related SVOC. This presents an uncertainty regarding the potential for

playing indoors. Based upon these findings, the use of outdoor and indoor artificial turf fields is not associated with elevated health risks. However, it would be prudent for building operators to provide adequate ventilation to prevent a buildup of rubber-related VOCs and SVOCs at indoor fields. The current study did not evaluate new fields under hot weather conditions and so the potential for acute risks under this circumstance is another uncertainty. The current results are generally consistent with the findings from studies conducted by New York City, New York State, the USEPA and Norway which tested different kinds of fields and under a variety of weather conditions. Thus, it appears that the current results are reasonably representative of conditions that can be encountered at indoor and outdoor crumb rubber fields, although this tentative conclusion could benefit from the testing of additional fields.”

The United State Environmental Protection Agency

A Scoping-Level Field Monitoring Study of Synthetic Turf Fields and Playgrounds (November, 2009)

Key findings are summarized below.

- (1) The study protocol and many of the methods were found to be reliable and could be implemented in the field. Several limitations are noted below.
 - a. Collecting integrated air samples provided a high burden in terms of time and equipment.
 - b. Semivolatile organic compounds were not measured.
 - c. At any single site, there can be substantial variability in the materials used and the concentrations of contaminants measured. More work is needed to determine where to collect samples and how many samples to collect to fully characterize a given site.
 - d. It was difficult to obtain access and permission to sample at playgrounds and synthetic turf fields. More work is needed to increase public and private owner participation if additional monitoring studies are conducted.
- (2) Methods used to measure air concentrations of PM₁₀ and metals were found to be reliable.
 - a. Concentrations of PM₁₀ and metals (including lead) measured in air above the turf fields were similar to background concentrations.
 - b. Concentrations of PM₁₀ and metals at the playground site with high play activity were higher than background levels.
 - c. All PM₁₀ air concentrations were well below the National Ambient Air Quality Standards (NAAQS) for PM₁₀ (150 µg/m³). All air concentrations for lead were well below the NAAQS for lead (150 ng/m³).
- (3) Methods used to measure VOCs in air were found to be reliable.
 - a. All VOCs were measured at extremely low concentrations that are typical of ambient air concentrations.
 - b. One VOC associated with tire crumb materials (methyl isobutyl ketone) was detected in the samples collected on one synthetic turf field but was not detected in the corresponding background sample.
- (4) Methods used to measure extractable metals from turf field blades, tire crumb materials, and turf field wipe samples were found to be reliable. However, the aggressive acid extraction procedure likely will overestimate the concentration of metals that are readily available for human uptake. Since understanding uptake is a key component in understanding risk, methods to determine bioavailable metal concentrations still are needed.
 - a. Total extractable metal concentrations from the infill, turf blade samples and tire crumb material were variable in the samples collected at a given site and between sites.
 - b. The average extractable lead concentrations for turf blade, tire crumb infill, and tire crumb rubber were low. Although there are no standards for lead in recycled tire material or synthetic

Although there are no directly comparable standards, average concentrations were well below the EPA standard for lead in residential floor dust (40 µg/ft²).

- (5) On average, concentrations of components monitored in this study were below levels of concern; however, given the very limited nature of this study (i.e., limited number of components monitored, samples sites, and samples taken at each site) and the wide diversity of tire crumb material, it is not possible to reach any more comprehensive conclusions without the consideration of additional data.

UNIVERSITY OF CALIFORNIA, BERKELEY

Review of the Impacts of Crumb Rubber in Artificial Turf Applications

“3.0 CONCLUSIONS

This report explored the various aspects of crumb rubber and addressed some of the claims made by various researchers. A look into the existing literature and data supported many of the assertions made about crumb rubber. Crumb rubber and synthetic turf have many traits that make it a beneficial choice for athletic surfaces. Some of the findings that were found indicated that synthetic turf has:” ...

“Generally Safe Application – Extensive research has pointed to the conclusion that these fields result in little, if any, exposure to toxic substances. A review of existing literature points to the relative safety of crumb rubber fill playground and athletic field surfaces. Generally, these surfaces, though containing numerous elements potentially toxic to humans, do not provide the opportunity in ordinary circumstances for exposure at levels that are actually dangerous. Numerous studies have been carried out on this material and have addressed numerous different aspects of the issue. For the most part, the studies have vindicated defenders of crumb rubber, identifying it as a safe, cost-effective, and responsible use for tire rubber.”