

URL: http://www.precaution.org/lib/08/lead_in_synthetic_turf.081001.htm

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TOXIC LEAD IN SYNTHETIC TURF

[Rachel's introduction: More and more, artificial turf is replacing grass on kids' ball fields and playgrounds. Now new information suggests that these synthetic playing surfaces may be contaminated with, among other things, toxic lead.]

By William Crain*

Synthetic turf playing fields are expanding at a rapid pace, but concerns about their health risks are growing as well. In recent months, the concerns have focused on the possibility that the turf contains toxic lead (Pb), which can have especially harmful effects on the cognitive functioning of children. When absorbed, lead can lower children's IQs and cause attention deficits. [1]

Questions about lead have risen with respect to both the old style AstroTurf and the "new generation" turf. The old style turf is basically a carpet with nylon grass fibers. It lacks the springiness of the new generation turf, which typically uses polyethylene fibers and includes a rubber granule infill. Advertisers say that playing on the new turf is more like playing on natural grass.

Artificial Grass Fibers in Old Style Turf

The current concerns began with a routine state inspection. In the summer of 2007, the New Jersey Department of Health and Senior Services (DHSS) was investigating potential toxicants in a scrap metal yard in the city of Newark and decided to examine the adjacent, old style turf field as well. Laboratory tests revealed high levels of lead in the nylon turf fibers and in the dust resulting from the fibers' deterioration. [2] The New Jersey DHSS concluded that the lead didn't come from the scrap metal yard, but from the field itself. [3]

In follow up studies, the New Jersey DHSS also found high lead levels in two other old-style turf fields in the state, one in the city of Ewing and the other in the city of Hoboken. [4] The findings prompted the federal Centers for Disease Control and Prevention (CDC) to issue a June 18, 2008, health advisory, recommending precautions such as washing hands after playing on synthetic grass fields. [5]

The New Jersey DHSS also initiated laboratory simulations to evaluate the effects of ingesting the fibers or the fiber dust. The results suggested that a significant portion of the lead in the fibers and dust is dissolved in digestive fluids. Once dissolved, some of the lead might enter the blood and affect the central nervous system. [6]

The Synthetic Turf Council, which represents the synthetic turf industry, questioned the actual risk, but the findings were worrisome. [7]

Fibers in New Generation Turf

When the New Jersey findings were reported in the press, I was a consultant to a task force considering the installation of synthetic turf in Battery Park City in Manhattan. Some of the task force members had read about the New Jersey findings, but they weren't concerned. Their fields would be the new generation turf, which tends to use polyethylene grass fibers -- not nylon -- and the New Jersey DHSS hadn't found high levels of lead in the polyethylene fibers it tested. [4]

Subsequently, the U.S. Consumer Product Safety Commission (CPSC) detected moderate concentrations of lead in a small number of samples

of new generation turf fibers. These results pertained to green fibers, which are the most prevalent in synthetic turf products. But manufacturers use various colors to mark field boundaries, and the CPSC found extremely high concentrations of lead in yellow fibers. Guive Mirfendereski, who operates the website SynTurf.org{1}, also had fibers tested and obtained similar results. [8] It is likely that the lead in the fibers primarily comes from the pigments.

Nevertheless, the CPSC also evaluated the risk of ingesting the lead in the fibers and gave the fields a clean bill of health. Specifically, the CPSC concluded that hand contact with the fibers, followed by hand-to-mouth contact, was unlikely to pose a danger. On July 30, 2008, it issued a press release titled, "CPSC Staff Finds Synthetic Turf Fields OK to install, OK to play on." [9]

As Consumer Reports recently observed, the CPSC's conclusion is premature. [10] For one thing, the CPSC didn't consider alternative exposure routes such as direct swallowing or dust inhalation. In addition, the CPSC often relied on speculation instead of collecting relevant data. For example, it didn't gather data on the fraction of lead in polyethylene fibers that is dissolved in the digestive tract and might enter the blood. Finally, the CPSC used safety standards that are probably too lax.

The question of safety standards is particularly vexing. Growing research indicates that even low levels of lead can cause neurocognitive damage in children. [11] It appears that no level of lead can be considered "safe" in children's blood. But public health agencies such as the CPSC and CDC have not adjusted their safety standard in light of this finding. (For a fascinating account of the CDC's refusal to adjust its standards, see Peter Montague's article in the July 26, 2007{2} issue of Rachel's Democracy and Health News (#917).)

In September, 2008, the California attorney general joined legal actions by the Center for Environmental Health{3} (Oakland, Calif) against several synthetic turf companies. The plaintiffs have argued that their test results reveal high lead levels in some turf fields, although they haven't made details of their results public. [12]

Rubber Granules in New Generation Turf

Most brands of synthetic turf include tons of tiny (0.5 to 3 mm) rubber granules that lie between the artificial grass fibers. The rubber granules, which are usually made from scrap tires, contribute to the spring one feels when running on the turf. This springiness is very popular, but the rubber granules, like the artificial grass fibers, might also contain lead and other toxic chemicals that can be absorbed into the body through exposure routes such as ingestion.

When considering ingestion -- whether it's the ingestion of fibers or rubber granules -- I worry most about the infants and toddlers who play on the turf while their caretakers watch the games from the sidelines. Children this age are of special concern because they try to put almost everything they can pick up into their mouths. And while they might pick up some of the fibers that come loose as a field ages, the possibility of picking up rubber granules is greater. As soon as a new field is ready for play, the granules are loose and abundant. What's more, the granules stick to athletes' clothes and get into their shoes, often spilling onto the floor when they take off their shoes at home. So infants and toddlers are exposed to the granules when they play on the floor at home, too.

Several research groups, including the Rochesterians Against the Misuse of Pesticides and Jim Zhang's team at Rutgers University, have gained information on the concentrations of lead in the rubber granules. The results have been very consistent; concentrations seem to range from about 3 to 67 mg/kg [milligrams per kilogram] lead. [13-16] Although these values are below the conventional 400 mg/kg safety standard for humans in residential environments, we should bear in mind that even low concentrations of lead can cause neurocognitive damage in children.

Bioaccessibility

A key question at this point is, if new generation fibers or rubber granules are ingested, what fraction of the lead in them is bioaccessible? That is, what fraction of the lead dissolves in human digestive fluids, making it available for transport out of the digestive tract into to the blood and the rest of the body?

A recent small-scale study by Jim Zhang, I-K Han, Lin Zhang and W. Crain [16] simulated digestive tract absorption of lead in a sample of polyethylene fibers. Mimicking the digestive process, the study examined absorption in synthetic saliva, synthetic gastric (stomach) fluid, and synthetic intestinal fluid, in that order. No lead dissolved in the saliva, but 34.6% and 54.0% of the lead dissolved in the gastric and intestinal fluids, respectively. These are sizeable fractions. If replicated, the results suggest that ingestion of fiber material can have significant consequences.

The study also examined the bioaccessibility of lead in rubber granules. In the two samples tested, 24.7% and 44.2% of the lead dissolved in synthetic gastric fluids. The researchers didn't find additional dissolution of lead in synthetic intestinal fluids, but the fractions in the gastric fluids are substantial.

Summary

After high levels of lead were detected in an old synthetic turf field in Newark, New Jersey, further research suggested that high levels of lead were present in other old style artificial turf fields. Researchers have sometimes found lead in new generation turf fibers as well. These concentrations have been extremely high in yellow fibers that mark field boundaries, but lead has sometimes showed up in the more common green fibers, too. In addition, low-to-moderate levels of lead have consistently been detected in the new generation turf's rubber granules.

Because even low levels of lead can harm children's neurocognitive development, it's important to know the lead's bioaccessibility -- the fractions of lead in turf materials that can be dissolved in digestive fluids. Initial studies suggest that the lead in the old style turf fibers, as well as the lead in the new generation turf fibers and rubber granules, does dissolve in synthetic digestive fluids. The results suggest that researchers take a closer look at the possibility that children and athletes might ingest synthetic turf materials and that the lead in the materials is absorbed in the digestive tract and enters the blood.

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