



# FACT SHEET

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December 2015

## The CT DPH Risk Assessment of Artificial Turf Fields



### Background

A study of artificial turf fields containing crumb rubber infill was completed in 2010 through a joint agreement between the CT Department of Environmental Protection (DEP), the University of Connecticut Health Center (UCHC), the CT Agricultural Experiment Station (CAES) and the CT Department of Public Health (DPH). The table below shows the main areas of responsibility for each of these participating agencies. This fact sheet focuses upon the risk assessment performed by DPH which draws upon the UCHC findings from five fields tested in Connecticut in July 2009. The overall report containing each of the individual agency reports can be obtained at [www.ct.gov/dph/artificialturf](http://www.ct.gov/dph/artificialturf). The Connecticut Academy of Science and Engineering (CASE) reviewed a draft of these reports and their comments were incorporated into the final reports.

### Components of the State of Connecticut Artificial Turf Study

Agency	Activity	Methods
DPH	Human health risk assessment	Convert air concentrations measured by UCHC to the level of health risk to users of the fields from inhaling emitted chemicals
UCHC	Human exposure field investigation	Measured air concentrations of approximately 200 chemicals at 5 fields during active play
DEP	Environmental field investigation	Measured leaching of metals from fields during rain events
CAES	Laboratory study	Measured offgasing and leaching of chemicals from crumb rubber under defined laboratory conditions
CASE	Document review	Assembled 9 member expert panel to review all aspects of the State of CT reports on artificial turf fields

### Why This Study

Some Connecticut municipalities have opted for, or are considering artificial turf fields, to replace natural grass fields. The most common type of field to date uses recycled rubber from tires as a crumb rubber infill to cushion the playing surface. Advantages over natural grass fields are reduced watering and maintenance, avoiding the need for pesticides, reduced injuries, and ability to play on the fields in a wider variety of

weather conditions.

Questions have been raised regarding health, safety and environmental aspects of the rubber infill material. Rubber contains a variety of industrial chemicals that, in small quantities, can be released into the air on warm days and from sports activities on the fields. Previous studies in Europe and the United States have tested a limited number of fields for the release of chemicals of potential concern (COPCs). The Connecticut study was designed to evaluate outdoor and indoor fields in Connecticut for airborne chemicals that are emitted from the crumb rubber under summertime active play conditions. The artificial grass blades were also tested for lead content due to concerns raised in New Jersey that the plastic blades can contain lead. Connecticut's study enhances the database on crumb rubber fields by increasing the number of fields tested, by evaluating an indoor field, something that has not previously been done in the United States, by using personal monitoring techniques to better assess the exposure of players on the fields, and by expanding the risk assessment by focusing on acute health risks in general and benzothiazole, in particular. Benzothiazole is the main chemical that vaporizes from the crumb rubber.



## What Was Done

### A. The Field Investigation

UCHC sent a team of researchers to four outdoor fields and one indoor field spread across Connecticut. Sampling occurred on warm, sunny and low wind days in July 2009. Sampling equipment was set up on the field as well as at upwind background locations to determine what was coming off the field. Three soccer players at each field were equipped with personal monitoring devices and these results together with the stationary samplers (on field and background) were used to characterize the possible exposures. Overall, approximately 200 chemicals were tested for at each field including 60 volatile organic chemicals (VOCs), 22 polycyclic aromatic hydrocarbons (PAHs), 7 nitrosamines, 5 specially targeted rubber-related chemicals, 93 miscellaneous air pollutants, lead and particulate matter (PM<sub>10</sub>). The samples were sent to a laboratory in Wisconsin that is capable of detecting even very small amounts of chemicals in air samples. In addition, bulk samples of crumb rubber and turf fibers were analyzed for lead by a laboratory in Connecticut.

### B. The Risk Assessment

DPH reviewed the UCHC data to identify chemicals that were coming from the field rather than from background sources of air pollution. Any chemical found to be 25% higher on the field than upwind was considered to be field-related. A total of 27 COPCs were identified on this basis and run through the human

health risk assessment. The table below shows the four hypothetical exposure scenarios evaluated. The outdoor fields were combined into one assessment by using the highest concentration of each chemical found at any of the outdoor fields to represent what is possible regardless of where it was found. The indoor field was analyzed separately because conditions indoors and outdoors were considerably different. Two different groups were analyzed, children aged 6-18 and adults. The greater breathing rate associated with active sports was incorporated into exposure equations for children and adults.

### **Exposure Scenarios Analyzed in DPH's Risk Assessment**

<b>Field Type</b>	<b>Exposure Group</b>	<b>Exposure Frequency</b>
Outdoor	Child 6-18 yr old	3 hr/day, 138 day/year, 12 yr
Outdoor	Adult	3 hr/day, 138 day/year, 30 yr
Indoor	Child 6-18 yr old	3 hr/day, 138 day/year, 12 yr
Indoor	Adult	3 hr/day, 138 day/year, 30 yr

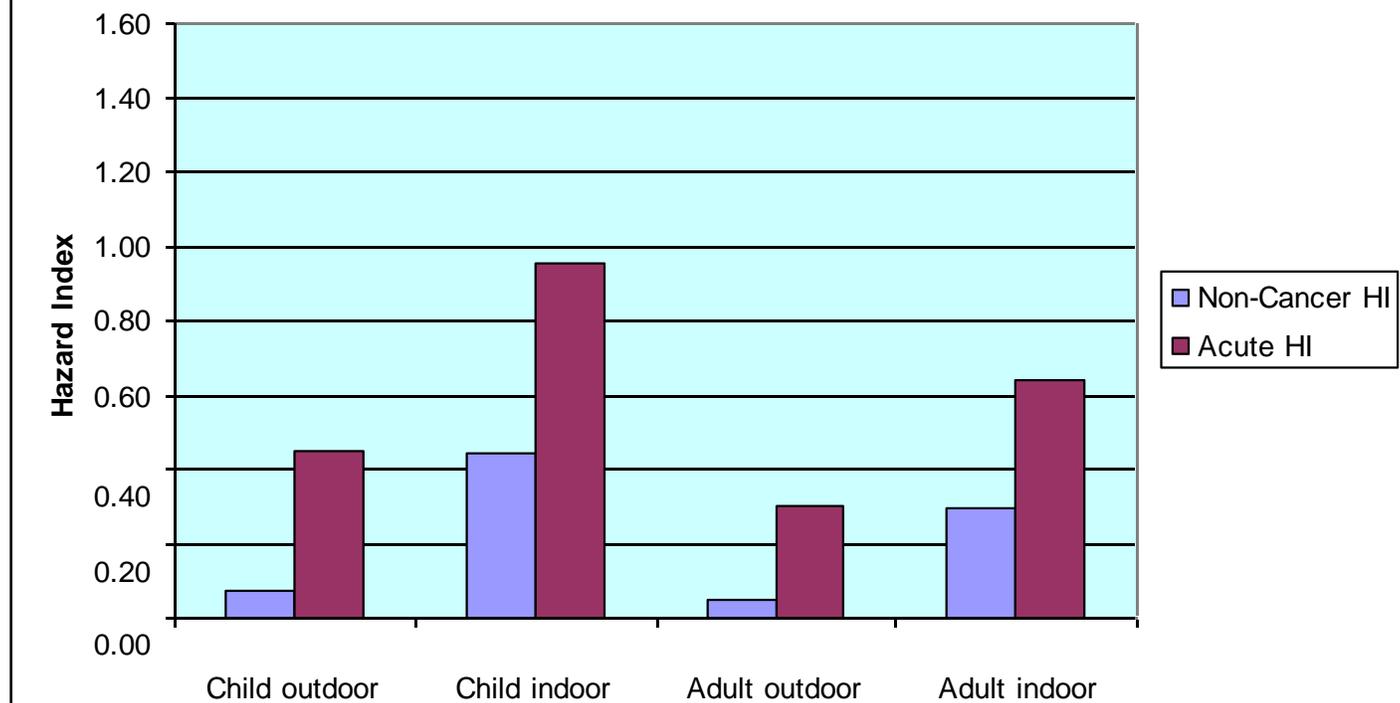
The DPH risk assessment represents a screening analysis in which high end assumptions were used for the amount of exposure possible from playing on the fields. Our worst case approach included the use of the maximum detection found at any field across all chemicals, assessing risks for benzene and methylene chloride even though they were only detected in the personal monitors and thus may not be coming from the fields, and the use of sunny low wind conditions to represent every day of playing. A screening level risk assessment is used to determine whether there is the potential for elevated risks when using worst case assumptions. If this is not the case, no further analysis is needed.

### **What Did We Find?**

Risk estimates were not elevated into a range of health concern for cancer or non-cancer endpoints for children or adults at the outdoor fields. Risk levels were somewhat higher indoors because the concentrations of benzothiazole and naphthalene were greater indoors. These risks were still below a health concern (see Figure below) but the acute risk to children playing indoors is borderline (Hazard Index almost 1) resulting in a greater amount of uncertainty over whether an adverse effect is possible. The theoretical concern is an acute irritation response from benzothiazole and other volatile compounds released from crumb rubber indoors. The indoor field tested had no ventilation which presents a worst case condition.

Regarding the potential concern raised in New Jersey over lead in the crumb rubber or blades of artificial grass, the UCHC results showed that lead levels were low and not a health concern at the five fields tested.

## Hazard Indices for Non-Cancer and Acute Risk at Artificial Turf Fields



(The Hazard Index is the ratio between actual exposure and the safe exposure level; an index below 1 signifies no increase in risk)

Another area of uncertainty is that this study did not evaluate newly installed fields under peak summer heat conditions. UCHC tested a range of newer (less than 2 years old) and older fields. However, the CAES data demonstrate that crumb rubber rapidly ages and emits much lower levels of chemicals after several weeks of being outdoors. Thus it is possible that greater exposures on outdoor fields are possible if the rubber infill is brand new during the summer months. Since this exact scenario was not tested, its health implications are unknown although if there was a risk, it would be short lived.

### CASE Review

The main areas of CASE comments were that 1) the cancer risks calculated by DPH may have been overestimates because of the inclusion of benzene detections that are likely not coming from the playing field but from the players themselves; 2) the uncertainty with respect to the benzothiazole risk assessment since so little toxicology data are available for benzothiazole; and 3) the potential for allergic reactions to occur due to the presence of latex antigen in natural rubber. To address these comments, the risk assessment

describes the issues and finds that they do not change the overall conclusions and are unlikely to present added risk. For example, the public is commonly exposed to rubber particles in street dust without obvious reactions to the latex in these particles, so this does not appear to be a major risk at crumb rubber fields. Nevertheless, those who think they are experiencing an allergic reaction to the fields (skin rash, breathing difficulty) should report this to their doctor and to local health officials.

## **What Does It All Mean?**

Outdoor Fields: DPH's assessment found no health concern from inhaling chemicals at outdoor crumb rubber fields tested as part of this study. It is important to note that these fields are typically hotter than natural grass fields and users of these fields should take added precautions to avoid heat exhaustion (more frequent rest breaks, hydration). Further, it would be best to install new crumb rubber in cooler months to avoid the peak exposure that might occur with fresh rubber in hot weather.

Indoor Fields: DPH's assessment found that exposures can be considerably greater indoors than out and this creates an uncertainty in terms of the potential for acute risks for children playing indoors. It is prudent for building operators to ventilate the indoor fields to decrease these exposures. The level of ventilation needed will vary from field to field. New indoor fields should consider alternatives to crumb rubber infill as a cushioning agent.

While allergic reactions on the skin or in the lungs are not anticipated from outdoor or indoor fields, anyone experiencing such reactions should report the incident to their doctor and the local health department.

## **Limitations and Relationship to Other Studies**

The 2010 risk assessment of five artificial turf fields in Connecticut does not provide conclusive evidence about the safety of artificial turf fields. There is still uncertainty and additional investigation is warranted. Like all scientific studies, our evaluation of artificial turf fields has limitations. It did not specifically evaluate the risks from dermal exposure or ingestion of the crumb rubber, two pathways which are expected to be of lower concern and have received some attention in previous studies. The data are still from a small number of fields and days of sampling. Finding VOCs such as benzene only in personal monitoring samples raises questions about the utility of those data that could not be resolved in the current study. The default

approach was to include the questionable data for this screening level risk assessment. The potential for allergic reactions at these fields was not a focus and in general is difficult to analyze.

While there are still uncertainties with crumb rubber fields, they have been tested more than many other products. Neither the testing done here in Connecticut nor that done by New York City, New York State, California, USEPA or the Norwegian government have found data supporting a health concern, especially at outdoor fields where exposures are generally lower than what has been found at indoor fields.

DPH will continue to monitor the latest science on artificial turf fields. In the meantime, DPH does not endorse or recommend the installation of a certain type of field. We encourage researchers, policymakers, and the public to review our findings as well as other available resources.

### For More Information:

- Please visit [ct.gov/dph/artificialturf](http://ct.gov/dph/artificialturf)
- For health questions call DPH at 860-509-7740.
- For questions about the UCHC study call UCHC at 860-679-4643.
- For questions about the environmental aspects of artificial turf fields call DEEP at 860-424-3867.