

FieldShield, Inc.

Play it safe!

ASSESSMENT OF MILONE & MACBROOM REPORT ENTITLED “Evaluation of the Environmental Effects of Synthetic turf Athletic Fields”

Since the release of the subject report, on Dec.1 2008, many entities, both public and private, have offered it as argument that artificial turf, as typically constructed, is environmentally and ecologically safe. In deference to Milone & MacBroom (M&M), the report does not make such an expansive claim, however, it purports to answer three questions regarding excessive heat; air quality; and effects of metal leaching on water quality and implies the results of the study are applicable to other synthetic fields installed in the northeast.

To insure that this study does not carry disproportional weight in the ongoing debate over the health and ecological safety of artificial turf, we highlight, below, errors in methodology and scope which invalidate the study.

THERMAL EFFECTS ASSOCIATED WITH CRUMB RUBBER:

A significant error in methodology was committed when M&M chose to measure the surface temperature of the polyethylene fibers with an infrared thermometer but inexplicably chose a probe (pen) thermometer to measure the temperature within the depth of the sand/rubber infill instead of the surface temperature of the rubber. As can be discerned from the photos provided with the study, the top layer of the infill material is composed, almost entirely, of rubber particulate. This rubber infill is a poor conductor and in combination with the air spaces, inherent in its granular configuration, serves as an excellent insulator for the below layers of infill material, which contain an increasing proportion of sand as the probe measures temperatures deeper into the infill. It is well-known that the upper layers of an infill will depress and moderate the temperature of the deeper portion of the infill. Consequently, this sub-surface measurement is not the temperature of interest and the sub-surface sand is not the material of interest.

Just as M&M measured the surface temperature of the PE fibers with an infrared thermometer they should have measured the surface temperature of the rubber with the same instrument. Since the albedo of the black rubber is considerably lower than that of the green PE fiber, it is axiomatic that the surface temperature of the crumb rubber, measured with the same instrument, would have been significantly higher than the 156⁰F measured on the fiber surface. If the study was to answer “the question concerning the effect of solar heating on the fields and in particular the crumb rubber” as it postulates, the effect of insolation (solar radiation energy received) on the surface temperature of the rubber must be considered. Such rubber surface temperatures, which have exceeded 180⁰F in other studies (where, as in this instance, the sparsity of grass fibers in the tested turf design exposes black rubber to the sun over more than 50% of the surface area), have multiple effects including: accelerated leaching of unbound constituent chemicals; heat irritation of skin from contact; foot irritation from overheating of footwear; and re- radiation of heat.

Neither the fiber nor the crumb rubber has enough mass to store solar energy and neither are good conductors. Therefore, when the solar radiation is obscured by clouds, both the fiber and the rubber cool rapidly, as noted (for only the fiber) in the study. This is indicative of materials that rapidly re-radiate absorbed energy.

M&M made a second conceptual error in ignoring the radiant heating of objects (players) by this re-radiated energy. It is this component of radiant heat – the radiant heat emanating from the super-heated fiber and rubber surfaces - that is the major contributor to the “excessive heating” that affects players on artificial turf – not the heating of the ambient air.

EFFECTS OF INFILL MATERIAL ON AIR QUALITY:

The second question the M&M study purports to answer is: “does the crumb rubber infill material have an effect on air quality”. The study does not answer this question due to the extremely limited scope of the investigation.

First, only two fields were tested. As Dr. David Brown of EHHI has often warned, recycled-tire rubber varies significantly, in its content (and, therefore, potential effluents) depending on the source recipe of the original car tire. This means that no meaningful conclusions can be generalized to the greater population of fields from testing any one artificial turf installation, until the source of the original tires can be identified and compared for content vs. other tested fields.

Second, the study focused on just two (*4-(tert-octyl) phenol* and *benzothiazole*) of many potentially toxic compounds (including, *butylated hydroxyanisole* - a carcinogen; *n-hexadecane* - a severe irritant; *phthalates* - endocrine and reproductive toxicant and suspected developmental toxicant; and *respirable crystalline silica particulate* – a carcinogen) contained in tire rubber and sand.

Third, the fields tested were no more than one year old. Environmental effects are thought to increase leaching and availability of certain compounds over time, so if results are to be extrapolated to a greater population of fields, older fields need to be included in the testing samples.

Fourth, measurement of gaseous contaminants in the ambient air is difficult. Variability of wind speed, wind direction and temperature, as well as exposure of the crumb rubber and the age of the installation, all have an effect upon the results.

In the conclusion of the M&M report this difficult question is summarized by the following paragraph:

-- The study determined that under favorable conditions for vapor generation, no detectable concentrations of volatile nitrosamines or 4-(tert-octyl) phenol existed in the air column at a height of four feet above the tested synthetic playing surfaces or in the air either upwind or downwind of the fields. The study did not evaluate if any of these two compounds were off-gassed from the fields, but simply that if they did, sufficient dilution within the air column existed to render them undetectable using methods based upon accepted OSHA and NIOSH procedures. The study also determined that benzothiazole, a common compound used in the manufacturing of rubber and plastics, was present at a very low concentration directly above one of the two fields sampled. This compound was not detected at the second of the two fields sampled nor was it detected in any of the upwind or downwind locations at either field. --

The field on which a reportable concentration of benzothiazole was found had recently been groomed so that more crumb rubber was exposed to the air. However, as noted in the study the effort of the sampling was not directed towards detecting the presence of the contaminants tested but rather to determine if they were present at detectable concentration levels.

The key word is concentration. If you were sampling just to ascertain if pollutants are present you would extract the collected contaminant from the adsorbent tube and report the results in micrograms or milligrams, as the case may be. However, in all cases the results of the M&M study were reported as concentrations, that is, micrograms per cubic liter. The weight of the total sample collected is divided by the total volume of the air pulled through the adsorbent tube. That result can then be converted to parts per billion on a volume basis. Therefore, detectable quantities of chemicals collected can be reduced to insignificant concentrations of the chemical by dividing the quantity by the volume of air.

Also, since the study has concluded that detectable concentrations of pollutants were collected because a field has been groomed, it is reasonable to assume that similar conditions of exposure of the infill and thus detectable concentrations would be generated when the field is heavily played upon.

It should also be noted that this testing was not conducted at the higher temperatures that prevailed during the heat study. However, it is significant that the air temperature and crumb rubber temperature were more elevated on the field at which the detectable concentrations of benzothiazole were found. The immediate question which should have been considered is whether the levels would be higher at higher temperatures. Because of the uncontrolled variables and the extremely limited scope of the testing, no conclusions can be generalized to other sites with regard to effects on air quality.

Finally, rather than considering the effects on air quality of only two randomly selected volatiles, it would be more instructive to consider the potentially more significant problem of respirable particulate matter generated from the agitation, impacting and particulate break-down of sand and rubber infill, as this may be the primary hazard associated with inhalation on athletic fields. (This respirable particulate hazard is exacerbated with regard to athletic fields because young lungs and lungs weakened by asthma and other pulmonary diseases are significantly more vulnerable to the danger of respirable particulate, especially given the exaggerated, deep respiration triggered by competitive athletic activity). Testing for respirable particulate should be performed immediately after athletic events or grooming, when the infill is dry.

EFFECTS OF CRUMB RUBBER INFILL LEACHATE ON WATER QUALITY:

Again, the methodology and scope of this part of the M&M study are problematic. The three fields chosen had an installed age of approximately one year, or less. The limited number of fields and the limited age do not allow generalization of the results to the greater population of fields. Also, the study considered only metals, to the exclusion of other toxicants, such as the recently banned phthalates (known to be contained in virtually all tire rubber), some of which carry an EPA limit in drinking water of only 6 parts

per billion. Likewise, free urethane (a known carcinogen), contained in the polyurethane coating of the turf backing was not investigated, though it is known to easily leach into run-off.

The water samples tested, all passed through and, therefore, were filtered by the 8" basaltic stone base. The metals are leached by and dissolved in the acidic rainwater, however, as the study documents; the basaltic stone base raises the pH of the water, causing the metals to precipitate into the base materials. For this reason, it would be surprising if anything more than trace amounts of metals were able to circumvent the filtering of the stone base. Therefore, given the short life of the fields, direct testing of the stone base would provide a better quantification of actual leaching.

More importantly, the chosen methodology mistakenly assumes that all the rainwater will pass through the rock base. In actuality, during rain events of high one-hour storm intensity, greater than 50% of the water flows laterally through the infill, above the turf backing, following the field slope to the sideline collector drains. This water is not filtered by the stone base and is likely to contain much higher levels of leachate. Furthermore, anecdotal evidence indicates that particulate break-down and siltation of sand in the chosen infill matrix design will cause the percentage of water that is laterally drained to increase over time.

The purpose of the foregoing assessment is to limit the unintended use of the M&M study, by some, as an argument for the environmental, health and ecological safety of artificial turf. The scope of the study was too limited and the methodologies too questionable to allow any extrapolation of results beyond the tested fields and the limited application of the erroneously chosen test protocols.

Given the potential environmental, ecological and health risks now associated with artificial turf, the *Precautionary Principle* demands that; artificial turf manufacturers, purveyors, and design professionals prudently embrace new technologies, designs and products, which eliminate these risks - rather than reflexively defend the old technologies, designs or products, which perpetuate and exaggerate the perception of artificial turf as harmful, thus rendering the efforts of the defenders, self-defeating.

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