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**ANALYSIS OF TURF ALTERNATIVES ON HUMAN HEALTH
DRAFT FINAL REPORT
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Rutgers Center for Green Building

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EXECUTIVE SUMMARY

The Rutgers Center for Green Building (hereafter: the Center, or RCGB), at the request of the Township of Maplewood, NJ, has undertaken a literature review and the development of a risk analysis framework for alternative turf types. The information presented in this report is expected to serve, first and foremost, as a decision-making tool to assist the Township in weighing the evidence and potential impacts of different options. Ultimately, the Township's choice is necessarily a subjective one, based also on the community's sense of risk and control over each of the available alternatives. This document provides a flexible framework within which the community can work toward building consensus among stakeholders. Accordingly, this report does not issue recommendations regarding the absolute safety of any products; however, it does suggest some actions that may be useful when considering turf alternatives.

The risk analysis framework is drawn from the New Jersey Comparative Risk Project (NJDEP, 2003), and comprises a four-step process that identifies: 1) the Source of an (ecological, health or socioeconomic) stressor; 2) the Stressor; 3) Exposure Routes; and 4) Human Health Impact. The New Jersey Comparative Risk Project (NJCRP) represents a collaborative effort of about 100 experts in various fields to provide a qualitative analysis of the relative human health, ecological, and socioeconomic risk resulting from various anthropogenic and natural activities. It is a particularly useful approach in situations wherein quantitative analysis is difficult owing to deficiencies in data such as lack of independent or complete research and agreement about metrics. As such, it serves as an organizing framework through which to interpret various claims regarding the negative human health impacts of artificial and natural turf (the Sources).

The categories of stressor chemicals most frequently cited in reports regarding artificial turf are polyaromatic hydrocarbons (PAHs), heavy metals, and phthalates. The exposure pathways that are consistently identified in the reports are ingestion, inhalation (of both gases and particulate matter) and dermal contact. Of these, inhalation is the easiest of the chemical exposure pathways to examine, dermal contact is a concern for non-cancer exposures (allergy), and toxicity by ingestion is subject to the bioavailability of chemicals in the gastrointestinal system, which is relatively uncertain/understudied. The general impacts of each category are carcinogenesis, human health disability, and human reproductive disability, respectively. Additional effects that are typically discussed include sports injuries of various types, stemming from both contact and non-contact sports.

In order to determine relative risk, it is necessary to consider at each of the four stages how much evidence exists and to make an assessment of the quality of this evidence. The assessment can then be employed in an evaluation of potential human health impacts of specific products (sources), resulting in a series of 'cause-and-effect' diagrams for each source. The diagrams offer a visual classification system for whether an impact is unlikely, less likely or more likely to be significant across the various combinations of stressor, pathways, and impacts.

Based on this methodology, the key findings are as follows:

- Natural Turf: Sports injuries are the only significant (less likely) health impact identified, although there is also a possibility of other health impacts if soils at a particular site are contaminated. All other health impacts are unlikely.
- Styrene-Butadiene Rubber Infill (FieldTurf): Contains PAHs, heavy metals and phthalates, but likelihood of significant health impacts is low (less likely and unlikely). Exposure routes of greatest concern are ingestion and inhalation. Latex allergies a concern. Not much evidence regarding relative incidence of sports injuries.
- Recyclable Thermoplastic Infill (EcoFill): May contain PAHs, heavy metals, and phthalates but likelihood of significant health impacts is low (less likely and unlikely). Exposure routes of greatest concern are ingestion and inhalation. Not much evidence regarding relative incidence of sports injuries.
- Synthetic Organic Blend Infill (GeoSafePlay): Contains heavy metals but likelihood of significant health impacts is low (less likely and unlikely). May contain PAHs and phthalates. Exposure routes of greatest concern are ingestion and inhalation. Not much evidence regarding relative incidence of sports injuries.
- Sneaker Grind Infill (Nike Grind): Contains heavy metals, and phthalates but likelihood of significant health impacts is low (less likely and unlikely). May contain PAHs. Exposure routes of greatest concern are ingestion and inhalation. Latex allergies a concern. Not much evidence regarding relative incidence of sports injuries.

In summary, a review of the literature, utilizing comparative risk assessment methodologies, suggests some avenues for concern and identifies significant gaps in our knowledge of the relative risks associated with turf alternatives. However, uncertainty does not imply inaction. There are several ways in which Maplewood can proactively reduce or manage the uncertainty regarding health risks, while still meeting the community's recreational needs. Some of these may already be in practice, such as encouraging athletes to wash hands after participation in activities, regardless of field type. Others would be more specific to an artificial turf field. Regardless, the community should determine which of these actions may be appropriate for the option selected, and should include stakeholders in the decision-making process of deciding which actions will meet their needs. Illustratively, Maplewood could undertake actions like the following:

- Perform an audit of use and maintenance patterns of existing natural grass fields and make any required improvements that may allow increased use.
- Diversify the municipality's portfolio of playing fields by maintaining some in natural turf and constructing others using artificial turf from various manufacturers; this ensures that Maplewood residents will still have access to playing fields regardless of future scientific findings.
- Stay apprised of state or federal agency guidance on the safety of turf alternatives.

- Include a risk assessment requirement (or at least provision of toxicity information) in the RFP and or contract document for artificial turf playing fields.¹
- Include a requirement in an RFP and or contract document that suppliers provide existing health data and research to communities for artificial turf playing fields.
- Require pre- and post- season testing of artificial surfaces each season, either by the municipality or by the supplier as part of the RFP/contract requirements.
- Consider age and playing time when scheduling different age groups for use of artificial and natural turf fields to reduce potential exposure of populations that may be more sensitive.
- Keep records of users (league rosters, tournament programs, etc.) for an extended period of time to enable follow-up health monitoring, (if necessary).
- Explore dust suppression techniques, including watering down the field before and after use (or any suitable alternative method).²
- Encourage individuals who use any field (including natural turf which may have been treated with chemicals) to wash exposed skin before resuming daily activities (especially eating).
- Recommend that clothes worn on any field (including natural turf which may have been treated with chemicals) be separated from regular laundry when washing and potential for contact with other clothes by taking off clothing (worn while participating on any fields) inside out.⁶

The Center believes that many of these suggestions will resonate with stakeholders consulted during this project. Whereas some stakeholders believe that the presence of any unknown (untested) component in the turf is unacceptable and others do not hold this view, a general belief that manufacturers should be responsible for proving the safety of their products was expressed. In our experience, recent publicity has made most manufacturers more open to discussion of what is in their product at a time when legislation may be drafted to require it. Further to this point, it seems likely that the State of New Jersey has not issued its last word on the safety of artificial turf materials. Accordingly, the Center has agreed to follow this topic and to provide periodic updates to Maplewood Township over the next two months.

Additional documents are appended to this report and include: an annotated bibliography compiled by the Center; a log of correspondences³, both by the Center and between stakeholders (to the extent that they have been forwarded to the Center); comparison of laboratory results between different artificial turf alternatives, as well as a listing of state regulatory standards for the chemicals tested; and NJCRP, ASTDR, and IRIS reports for chemicals of interest to this analysis.

¹ The Center is has initiated contact with agencies that may be drafting RFPs or construction specifications that may require product testing and/or alternative infill products. The expectation is to either forward documents or contact information to Maplewood Township.

² Adapted from New Jersey Department of Health and Senior Services “New Jersey Investigation of Artificial Turf and Human Health Concerns”, April 2008

³ Administrative tasks (such as arranging meetings or phone calls) have been omitted.