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Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields: Tire Crumb Rubber Characterization and Exposure Characterization Study Overview

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Editor's Note:

As part of our continued effort to highlight innovative approaches to improve the health and environment of communities, the Journal is pleased to publish a bimonthly column from the Agency for Toxic Substances and Disease Registry (ATSDR) at the Centers for Disease Control and Prevention (CDC). ATSDR serves the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. The purpose of this column is to inform readers of ATSDR's activities and initiatives to better understand the relationship between exposure to hazardous substances in the environment, its impact on human health, and how to protect public health.

The conclusions of this column are those of the author(s) and do not necessarily represent the official position of ATSDR or CDC.

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Background

Introduced in the 1960s, synthetic turf fields are commonly installed at numerous venues including municipal and county parks, schools, colleges, professional team stadiums, practice fields, and military installations. In the U.S., there are between 12,000–13,000 synthetic turf fields and approximately 1,200–1,500 new installations each year (Synthetic Turf Council, Safe Fields Alliance, Recycled Rubber Council, & Institute of Scrap Recycling Industries, communication, 2016). Millions of people are estimated to use these

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fields, including professional, college, and youth athletes; coaches; fans; recreational users; and military personnel.

In an estimated 95% of existing turf fields in North America, recycled tire crumb rubber material, produced from waste automobile and truck tires, is used as infill, either exclusively or in a mixture with sand or alternative infills, while the remaining 5% contain only alternative infills (Synthetic Turf Council et al., communication, 2016). Outdoor synthetic turf fields with tire crumb rubber infill are more common than indoor fields, with some sources reporting that indoor fields make up approximately 5–15% of the market (D. Gill, FieldTurf, personal communication, May 5, 2016; R. Reddy & B. Cheskin, Sprinturf, personal communication, May 2, 2016).

In recent years, concerns have been raised about the safety of recycled tire crumb rubber used as infill for playing fields and playgrounds. The public has expressed concerns that the use of these fields could potentially be related to certain health effects. Although studies to date have not shown an elevated health risk from playing on fields with tire crumb rubber, they have limitations and do not comprehensively evaluate the concerns about health risks. Additional research is needed to fill important data gaps that will address key environmental and human health questions regarding the use of recycled tire crumb rubber.

Study Overview

In 2016, the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (CDC/ATSDR), U.S. Environmental Protection Agency (U.S. EPA), and U.S. Consumer Products and Safety Commission (CPSC) launched the Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds (FRAP) (U.S. EPA, 2017). The research activities specific for playing fields were conducted by ATSDR and U.S. EPA under the approval of the Office of Management and Budget's Information Collection Request review process. The purpose of FRAP is to study key questions concerning the potential for human exposure resulting from the use of recycled tire crumb rubber in playing fields and playgrounds. There are four major components of FRAP that include a literature review and data gaps analysis, a tire crumb rubber characterization study, an exposure characterization study, and a playground study. The research activity involving playgrounds is being conducted by CPSC.

The aim of the tire crumb rubber characterization study was to collect tire crumb rubber material from tire recycling plants and synthetic turf fields around the U.S. and analyze the material for a wide range of metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), particle size, moisture, sand content, and microbial characterizations. A convenience sampling approach was used to recruit up to 40 facilities with synthetic turf fields across the four U.S. census regions. The geographic extent of the recruitment was intended to provide a range of material weathering conditions for outdoor fields and potential differences in tire crumb rubber source material.

The study design also accounted for facility type (i.e., indoor or outdoor fields) in the facility identification and recruitment stage. Fields were recruited across a range of synthetic turf

ages to allow potential differences in chemical content and particle size distribution to be assessed with age. For inclusion in the study, facility owners/managers were required to provide written agreement for sample collection and answer a questionnaire that included information on general facility operations, turf history and maintenance, and public use at the facilities. Samples were collected from seven set locations at each field to allow for analysis of between-field and within-field variations (Figure 1).

The second research activity under FRAP, the exposure characterization study, was a pilot-scale effort to collect information on synthetic turf field users and to conduct a human exposure measurement substudy. Several different age groups were included, specifically adults (≥18 years old), adolescents (13–17 years old), youth (10–12 years old), and children (7–9 years old). Questionnaires included queries on the frequency and duration of field use, as well as contact rates with field materials. A subset of participants were videotaped engaging in a physical activity on a synthetic turf field. Personal and biological samples were collected from a subset of the participants. Urine and blood samples were collected before and after practice. Personal samples included passive air and dermal wipe sampling. Field environmental samples were also collected, including ambient air monitoring, surface wipes, and dust samples. These samples were analyzed for metal, VOC, and SVOC analytes. A subset of VOC and SVOC samples were analyzed for suspect screening and nontargeted analysis.

Study Accomplishments

As part of the tire crumb rubber characterization study, CDC/ATSDR and U.S. EPA contacted seven companies operating tire recycling plants that produce tire crumb rubber for synthetic turf infill. The agencies reached agreements with six Companies to collect samples at nine recycling plants that were located across all four U.S. census regions. Researchers collected samples from three separate lots at each facility for SVOC analyses, metals analyses, and particle characterization.

From August–November 2016, ATSDR researchers contacted a total of 306 community field owners and obtained participation agreements to sample at 21 community synthetic turf fields with tire crumb rubber infill. Researchers also collaborated with the U.S. Army Public Health Center to identify synthetic turf fields with crumb rubber infill installed at military installations across the U.S, which resulted in the inclusion of 19 additional U.S. Army fields. Tire crumb rubber infill samples were collected from a total of 40 synthetic turf fields to characterize chemical constituents and particle size, as well as examine microbial species (Figure 2). Questionnaires were administered to facility owners or field managers to obtain information on types and numbers of field users and maintenance practices.

Due to scheduling and availability issues that reduced the number of fields and participants available for recruitment during the field study implementation window, the target sample size of 6 fields and 60 participants was not reached during the study period. Overall, the research team recruited 32 participants at 3 field locations.

On December 30, 2016, the agencies released a status report on FRAP that included the final peer-reviewed literature review report and described the progress on other research activities (U.S. EPA, 2016). The collection and laboratory analyses of samples have been completed for both the tire crumb rubber and exposure characterization parts of the study. The tire crumb rubber characterization study will be released in 2019. Currently, CDC/ATSDR is initiating a biomonitoring study to investigate potential exposure to constituents in tire crumb rubber infill. The information from the biomonitoring study will be released, along with information collected as part of the FRAP exposure characterization study, at a later date. The results and information from this effort will fill specific data gaps about the potential for human exposure to chemical constituents found in recycled tire crumb rubber infill material.

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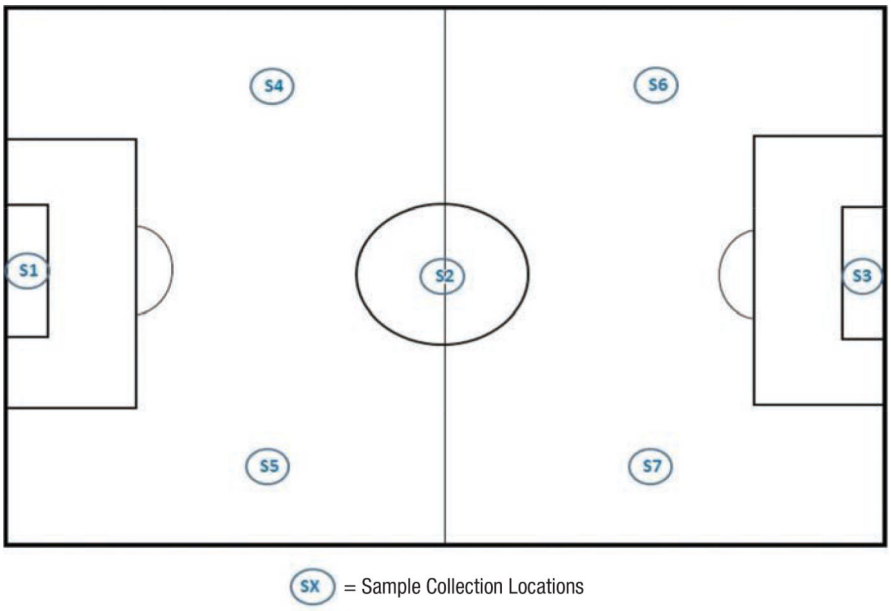

FIGURE 1.
Tire Crumb Rubber Collection Sites on a Synthetic Turf Field

FIGURE 2. Sample Collection Methods to Remove Tire Crumb Rubber From a Synthetic Turf Field Surface

Note. Combs were used to sample for organics and metals and particles. Spatulas were used to sample for microbes. Samples was taken from approximately the top 3 cm of the synthetic turf field surface.