

# A multi-site recycled tire crumb rubber characterization study: recruitment strategy and field sampling approach

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## Introduction

Public concerns have been raised about the safety of recycled tire crumb rubber used as infill in synthetic turf fields. In response, the 2016 Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds (FRAP) was developed to examine key environmental and human health questions resulting from the use of tire crumb rubber. One specific goal of the FRAP was to characterize the chemicals, potential emissions, and bioaccessibility associated with tire crumb rubber. In order to address this goal, CDC/ATSDR and EPA initiated a tire crumb characterization study.

The objective of the tire crumb characterization study was to analyze tire crumb rubber for a variety of chemicals and to characterize field use patterns and maintenance procedures using a structured questionnaire. The goal was to recruit and sample 40 synthetic turf fields with tire crumb rubber infill, ten fields in each U.S. census region, including both outdoor and indoor facilities.

## Methods

### Recruitment:

The target population for the community fields was defined as synthetic turf fields with recycled tire crumb rubber infill. There were no restrictions on field age, “grass blade” composition or color, or field type (i.e., soccer, baseball). Researchers requested field size information, but that was not a specific exclusion criterion. The study team excluded synthetic turf fields with encapsulated or colored or painted crumb rubber and limited participation to two outdoor fields per facility; however, in order to include 2 fields at one facility, the fields must meet one of two criteria: the fields must be of different ages, or the fields must be installed by different manufacturers. Researchers allowed two fields from the same facility of the same age if one was an Indoor field and one an outdoor field.

ATSDR/EPA used a convenience sampling approach for the recruitment of facilities with synthetic turf fields. Researchers found prospective facilities using online search engines and the following key search terms: “recreational fields,” “sports training facilities,” “sports training,” “sport fields,” “sporting fields,” “soccer fields,” “baseball fields,” “football fields,” and “parks and recreation.” The researchers followed these key search terms by the state or area of focus. Additionally, potential facilities/fields were allowed to self-identify if interested in participation. For inclusion in the study, agency researchers required agreement to recycled tire crumb rubber sample collection and answering a questionnaire on field maintenance procedures and field use. The researchers contacted the facilities verbally agreeing to participate on a weekly basis until obtaining written consent, the maximum number of facilities consented for census region, or the project recruitment period ended.

Researchers also collaborated with the U.S. Army Public Health Center to identify and collect samples from synthetic turf fields at military installations across the U.S.

### Field Sampling:

Tire crumb rubber samples were collected on synthetic turf fields to support characterization of chemical constituents. Individual samples were collected from seven locations at each field for each type of analysis including semi-volatile organic compounds (SVOCs) analysis, metals analysis, and particle size characterization.

For SVOC samples, a small handheld metal rake or spatula was used to collect rubber, with a collection depth no more than 3 cm from the surface. Collected tire crumb rubber was placed into certified pre-cleaned 250-mL amber glass wide-mouth containers with Teflon-lined lids. For metals and particle samples, a small handheld plastic rake or spatula was used and rubber placed into certified pre-cleaned 250-mL polyethylene wide-mouth containers. Samples were shipped overnight to a central processing laboratory.

For the microbiome analysis, individual samples were collected from each field at all seven sampling sites. Nitrile gloves and a clean disposable lab coat were worn, and samples were collected with a sterile spatula. The tire crumb rubber was added to a sterile 50 mL polypropylene container with volumetric lines to the 25 mL line. Samples were immediately placed in a cooler with ice packs and shipped the same day.

### Questionnaire:

At the time of sampling, a hard copy of the questionnaire was given to each field owner. Then, the questionnaire was administered to the owner/manager over the phone and entered directly into the computer using Epi Info.

## Field Information

Table 1. Community field recruitment efforts

Region	Contacted <sup>a</sup>	Ineligible	Refused <sup>b</sup>	Participating Community Fields	Participating Army Fields
Northeast	118	22	20	4	5
Midwest	96	10	9	8	0
South	40	11	13	5	8
West	52	8	9	4	6
Total	306	51	51	21	19

<sup>a</sup>Facilities with more than one field were only counted as n=1.

<sup>b</sup>Facilities that did not return phone calls or other attempts (i.e., email) at recruiting were not included in the number of refusals.

Table 2. Outdoor and indoor syntheticturf field final sampling status

Region	Outdoor Fields	Indoor Fields	Total Fields Sampled
Northeast	5	4	9
Midwest	2	6	8
South	11	2	13
West	7	3	10
Total	25	15	40

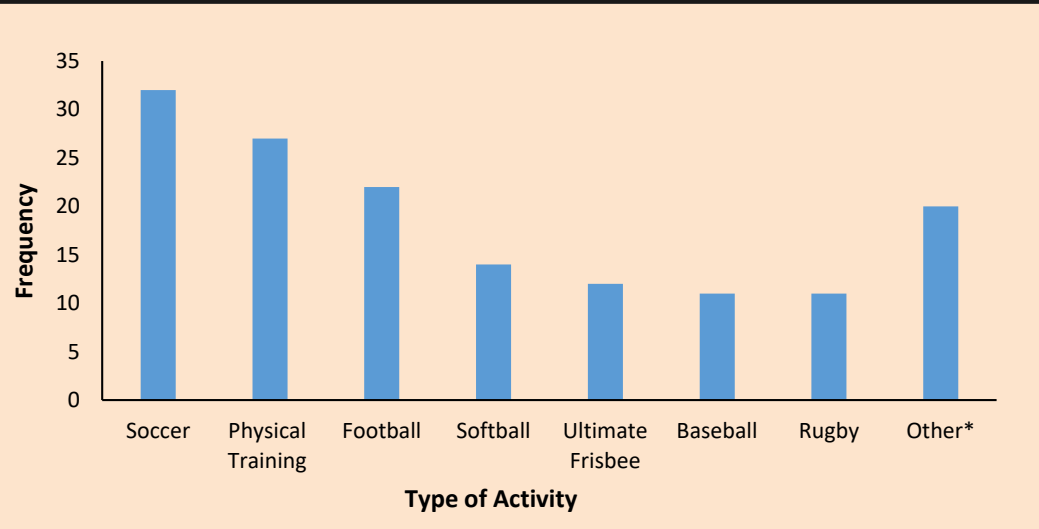


Figure 1. Types of activities frequently performed on synthetic turf fields  
\*Facilities reported other activities that were not listed in the questionnaire.

## Questionnaire Items

Table 3. Fields that have refreshed or replaced tire crumb infill on the syntheticturf field(s)

	Indoor Fields (15)		Outdoor Fields (24) <sup>a</sup>	
	Frequency	Percentage	Frequency	Percentage
Refresh Tire Crumb	9	60.0%	11	45.8%
Replace Tire Crumb	1	6.7%	1	4.2%

<sup>a</sup>Missing responses from one outdoor field.

Table 4. Synthetic field(s) treated anytime with cleaners, biocides, herbicides, insecticides, fungicides, or other agents

Response	Indoor Fields (14) <sup>a</sup>		Outdoor Fields (24) <sup>a</sup>	
	Frequency	Percentage	Frequency	Percentage
Yes	7	50.0%	4	16.7%
No	5	35.7%	19	79.2%
Don't Know	1	7.1%	1	4.2%
Refused	1	7.1%	--	--
Total	14	100.0%	24	100.0%

<sup>a</sup>Missing responses from one indoor and one outdoor field.

Table 5. Types of field maintenance activities

Activities	Indoor Fields (15)		Outdoor Fields (25)	
	Frequency	Percentage	Frequency	Percentage
Brushing	9	60%	14	56%
Leveling	6	40%	13	52%
Deep Cleaning	5	33.3%	5	20%
Magnet	4	26.7%	8	32%
Aerating	2	13.3%	7	28%
Other	2	13.3%	5	20%

## Results

- A total of 306 community fields were contacted, with recruitment of 21 community fields (Table 1). Also, the US Army recruited an additional 19 fields.
- The final field count, included 25 outdoor fields and 15 indoor fields (Table 2).
- Soccer was reported as the most common activity (80%) on both indoor and outdoor fields, followed by physical training (67.5%) and football (55%). Other sports included softball (35%), ultimate frisbee (30%), baseball (27.5%) and rugby (27.5%) (Figure 1).
- Other sports (flag football, lacrosse, track and field, golf, and kickball) not listed in the questionnaire (50%) were also reported being played on the turf (Figure 1).
- Fields tended to refresh tire crumb rubber more often than replacing tire crumb rubber (Table 3).
- Indoor fields were more likely to report refreshing or adding crumb rubber than outdoor fields, 60% compared to 45.8% (Table 3).
- Indoor fields were more likely to report ever being treated with cleaners, biocides, herbicides, insecticides, fungicides, or other agents than outdoor fields, 50% to 16.67% respectively (Table 4).
- The most commonly reported field maintenance activities were brushing and leveling for both indoor and outdoor fields (Table 5). A common response included in the other category was sanitization with UV light.

## Challenges

### Recruitment:

- For those immediately declining participation in the study, three main issues were documented including liability, confidentiality, and facility owners declining participation at this time.
- Concerns of liability included potential actions that would need to be taken based on the outcome of this study.
- Even though individual names of facilities will not be released, some facility owners expressed concerns over confidentiality.
- Other field owners were interested in the outcome of this study but did not want to participate at this time.

### Sampling:

- Handheld metal and plastic rakes did not work on every field, specifically for fields with thick synthetic grass blades. Instead, researchers used sterile spatulas to collect the crumb rubber and noted these protocol changes.
- For outdoor fields, weather was an important factor for sampling and also prompted researchers to perform a moisture analyses on all samples.
- Sampling needed to be performed when the field was not in use.

### Questionnaire:

- Some respondents were not able to provide all of the requested information in the questionnaire.

## Limitations

- This study includes a limited number of fields, and the fields sampled are not a representative sample of fields across the U.S.
- Additionally, this study does not have the capability to determine the potential health risks and completely assess the safety of recycled tire crumb in playgrounds or in synthetic turf athletic fields.
- Only fields with tire crumb rubber infill were included for this study, which excludes others types of fields including natural grass, synthetic fields with natural product infill, and synthetic fields with EPDM or TPE infill.

## Conclusions

- Soccer and physical training were the most common reported activities occurring on synthetic turf fields.
- Most fields reported some maintenance efforts, like refreshing tire crumb and performing brushing.
- Indoor fields were more likely to report being treated with chemicals or other agents.

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