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Docket: ATSDR-2016-0002
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ

Comment On: ATSDR-2016-0002-0003
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill ATSDR-2016-0002

Document: ATSDR-2016-0002-0010
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ Comment on FR Doc # 2016-03305

Submitter Information

Name: Lori Gill-Pazaris
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Email: lpazaris@comcast.net

General Comment

The announcement of this study states "Limited studies have not shown an elevated health risk from playing on fields with tire crumb, but the existing studies do not comprehensively evaluate the concerns..." This raises the question, "How will new studies be more comprehensive than the old?" The objectives of the Federal plan include: determining key knowledge gaps, identifying and characterizing chemicals, characterizing how people are exposed to the chemicals, and identifying follow-up activities. But the details of the plan remain to be seen, and only some studies will be open for public comment. For those of us with a medical research background, there are many unanswered questions.

First, will the studies address toxicity by age group? There is no dispute that young children are more sensitive to the negative effects of toxins. The children's product safety rules established by the CPSC for children age 12 and under call for testing for substances such as lead, phthalates, and plasticizers in products ranging from pacifiers to mattresses, toys, and articles of clothing but exclude testing crumb rubber surfaces for use by young children. The reason lies in the CPSC's definition of a children's product, but the logical decision should have been to ban sales of crumb rubber product into the children's market, unless tested. Instead, the industry has been allowed to sell product for children.

Will the studies expand the number of substances tested? Many new studies have been

conducted over the years which show the presence of carcinogens and other human health toxins. Researchers at Yale have identified over 20 new chemicals in crumb rubber, bringing the total number to 96. No health screening has been conducted for almost half of these, and only incomplete screening for the rest. Of chemicals partially tested, 20 percent are probable carcinogens and 40 percent can cause problems for breathing, skin, or eyes. Some are neurotoxins and may cause learning disabilities.

Also, what studies will be carried out to address recent findings that suggest that 59% of environmental chemicals cause harm at low doses and that, through long-term, cumulative exposure / action on a variety of organs and tissues, even non-carcinogenic chemicals may work in unison to cause disease? To address these findings, a robust process, equivalent to that required for the testing of pharmaceutical products, is needed. Testing methodologies should include testing in biological systems and multi-variate analyses using statistical techniques such as Dupont's 'Design of Experiments'.

The routes of exposure for the multitude of chemicals in crumb rubber are similar to routes of administration of medicines. Toxicology testing, applied in past studies, has focused on short-term tests, e.g. leachates, vapors. These have provided limited information.

And what about our environment? Use of synthetic substances kills the soil ecosystems that allow the earth to act as a giant sponge for torrential, flood-producing rains and interferes with the soils absorption of CO2 from the atmosphere. Research shows that soils treated with synthetic chemicals and managed under convene tonal farming techniques, have lost 50-70% of their original carbon stocks. And remember, plants produce life-sustaining oxygen.

Finally, I question the value of including extensive "testimonials" by the industry, coaches, parents, etc. in answering these important questions. We need studies that seeks to elucidate what "is" and not what is "believed". Additionally, the content of tire crumb has been examined in recent studies and should be considered in deciding the degree of additional characterization needed.

Lori Gill-Pazaris, Ph.D

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Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ

Comment On: ATSDR-2016-0002-0003
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill ATSDR-2016-0002

Document: ATSDR-2016-0002-0018
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ Comment on FR Doc # 2016-03305

Submitter Information

Name: LEE FLECK
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General Comment

In the state of Georgia there is a limited analysis underway to attempt to grasp the unusually high level of youth asthma possibly associated with preschool children playing on playgrounds incorporating CRI over the last several years, the same time frame as the increased use of crumb rubber.

The term "athletic asthma" is becoming far to commonly used by physicians in the Southeast to explain away this increase.

The Southeast has been ignored in the sampling process and must be included due to the higher temperature ranges and longer periods experienced in this geographic area.

The parties funding this study must be identified to insure that the results are at arms length from special interests (i.e. manufacturers and contractors). I would recommend that the Federal government provide funding for local research to be conducted by institutes of higher learning to insure a more neutral analysis.

Finally, the federal agencies involved in the current studies do not have the authority to make any final determination because state environmental agencies (i.e. EPD) have the sole authority

with regard to recycling of tires and their derivatives. How will any recommendation by the federal agencies involved in this study be executed with these state restrictions in mind.

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Docket: ATSDR-2016-0002
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ

Comment On: ATSDR-2016-0002-0003
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill ATSDR-2016-0002

Document: ATSDR-2016-0002-0024
Comment on FR Doc # 2016-03305

Submitter Information

Name: Jerome Silbert M.D.
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General Comment

I am a physician trained in pathology with boards in anatomic pathology, clinical pathology and blood banking. I have been following the controversy over tire crumb rubber for several years and have reviewed a number of the published studies on this matter.

I congratulate the governmental agencies for taking up this important matter to establish whether ground up tires used on artificial grass fields in the form of crumb rubber is a suitable for children to play on.

After reviewing a number of studies I must conclude that, thus far, the studies are totally inadequate to establish the safety of tire crumb rubber for artificial grass playing fields.

Background:

A recent study at Yale University was done on shredded tires and tire crumb rubber by Gaboury Benoit, Professor of Environmental Chemistry, Professor of Environmental Engineering, Co-Director of the Hixon Center for Urban Ecology, Director of the Center for Coastal and Watershed Systems.

Crumb rubber from tires is a very heterogeneous material coming from tires that have many different chemical compositions so it is legitimate to include shredded tires that are used on

playgrounds as well as crumb rubber that is used in artificial grass to see to what chemicals children will be exposed. Professor Gaboury's findings were quite shocking.

96 chemicals were found in 14 samples analyzed. Half of those chemicals had no government testing on them - so we have no idea whether they are safe or harmful to health! Of those chemicals found that have had some government testing done on them, there were 12 carcinogens, and 20 irritants.

There is no dispute over the fact that there are carcinogens and toxic compounds in tires and products made from tires. The claims of safety rely upon assumptions about whether exposure to these chemicals (and metals) are within levels recognized as safe.

There are number of reasons why I believe the studies thus far are totally inadequate.

1) When the determination is made that the exposure to toxins and irritants is within safe levels it is based on studies of the toxicity of each individual chemical. If all the chemicals are shown to be within safe levels of exposure the conclusion is made that there is minimal if any risk.

This conclusion is totally unjustified because it does not take into account that the exposure is to many of these chemicals simultaneously. It is well established that when toxic chemical substances are combined together (termed the combination effect) they can cause adverse effects to human health, even if the individual chemical substances are within levels considered safe. It is my hope that you will take this into account when you do your safety assessments.

2) To my knowledge, there have been no in vivo studies regarding frequent and close contact with tire crumb rubber. There is a requirement for these kinds of studies for pharmaceuticals and for pesticides. But apparently not for tire crumb rubber. Instead of assuming that exposure levels are safe, Particularly when the exposure is to a complex mixture of toxic agents and irritants, it only makes sense to do toxicity studies with living systems that are actually exposed to the complex mixture to which children will be exposed.

I find it a serious flaw even in pesticide testing that only the active agent in the pesticide is tested for in vivo toxicity when, in actuality, the way the pesticide is used is in combination with a mixture of chemicals designed to enhance the pesticides toxic effect and, in many cases in combination with other pesticides.

When such studies are conducted, it should be kept in mind that crumb rubber fields can reach very high temperatures in the sun and give off larger amounts of volatile organic compounds.

In there is to be any confidence in your study, in vivo toxicity testing needs to be done with the crumb rubber to which children and athletes are actually exposed.

3) Amy Griffin a goalkeeper for the U.S. National team has been informally tracking American soccer players with cancer since 2009, when she noticed a number of young athletes who'd played soccer on artificial fields were getting sick.

In 2014 Griffin, had heard from 38 soccer players who'd been diagnosed with cancer (mainly non-Hodgkin's lymphoma). That tally has climbed to 220 athletes - 166 of them soccer players. Of the soccer players, 102 were former goalkeepers who spent more time on the ground and

were more exposed to crumb rubber than their teammates.

This points to the need of a epidemiological study to see if there is indeed an abnormal increase in cancers among athletes that play regularly on artificial turf with crumb rubber infill. Important to note is that lymphomas often have a long lag time between exposure and manifestation of the disease.

Thank you for this opportunity to comment.

Respectfully,

Jerome A. Silbert, M.D.

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Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ

Comment On: ATSDR-2016-0002-0003
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill ATSDR-2016-0002

Document: ATSDR-2016-0002-0030
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ Comment on FR Doc # 2016-03305

Submitter Information

Name: Kathryn Vallance
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General Comment

1. Will you address nano-particles, nano tubes and carbon black which are all known components of tire manufacturing?
2. Will you consider that families playing on crumb rubber have "continual exposure" to the material as it gets on the bodies, in the sports bags, the cars, homes, laundry, air vents of everyone at the games.
3. Will you include pregnant women, and toddlers in your study as they are also exposed?
4. Will you review regulatory levels of chemical exposure at tire plants that have been set as acceptable and have still produced groups of workers with elevated levels of cancer and heart disease?
5. Will you have cooperation of any tire manufactured to determine what chemicals have gone into making tired over the last 30 years focusing on the era of the tire that is most likely to be used in the crumb rubber on the fields today?
6. Will you consider the vulnerability of children, their growing bodies, increased breathing rate and their expisure to the field because they are smaller?
7. Will you consider that regular exposure to a variety of carcinogenic chemicals on a regular basis may in fact be as harmful to a child's body as the rare exposure to a moderate - highly toxic chemical?

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Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ

Comment On: ATSDR-2016-0002-0003
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill ATSDR-2016-0002

Document: ATSDR-2016-0002-0033
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ Comment on FR Doc # 2016-03305

Submitter Information

Name: Kevin McKeon

General Comment

Lacking conclusive scientific evidence regarding crumb rubber, we must accept that the growing discussion is about RISK assessment, RISK mitigation, and RISK level acceptance. These risks include heat stresses and injuries and, according to a recent Yale study, exposure to 99 chemicals variously listed as irritating, harmful, and suspected/known carcinogens. Government Exposure Limits are not health-based, they are risk-based...a compromise of many factors: environmental, scientific, financial, political, and business-friendly issues. All credible studies prove the presence and probable exposure to these chemicals. Turf manufacturers and installers recognize this and require users to release them from health and safety liability claims.

Studies and satellite imagery prove the creation of "heat islands" on and over crumb rubber fields. The surface is monitored and watered when overly hot. Vigorous play in these conditions results in burns, dehydration, heat stress, or heat stroke. Kids bodies, being closer to the heat source, with a higher surface-area/body-mass ratio, producing more body heat per unit mass, and sweating less than adults, are particularly susceptible to heat stresses.

Over time, crumb rubber reacts with light, heat, air, seasonal temperature fluctuations, mechanical agitation from play and maintenance operations, etc., becoming hard, brittle, cracked, discolored, and powdered; this hardening and cracking can be noticed on old sneakers. The CDC's 2008 advisory says that as turf ages and weathers, "lead is released in dust that could then be ingested or inhaled." This rubber erosion happens down to the molecular level, resulting in a persistent atmospheric chemical contamination over the playing fields and their

immediate areas. (More on this later).

The most dangerous item of this disintegration process could prove to be carbon nanotubes. About 30% of a tire is composed of carbon black; puff out a candle...that black, wispy stuff is carbon black. Engineered carbon nanotubes (and other engineered nanoparticles...zinc, titanium, etc.) are made in specific shapes to give strength and durability to tires. It is the long thin nature of engineered carbon nanotubes that has scientists comparing them with asbestos; studies suggest that inhaling carbon nanotubes could lead to the same cancer and breathing problems that prompted a ban on asbestos, and carbon nanotube exposure tests on mice result in the formation of lesions known as granulomas. From Dr. Kathleen Michels, Neuroscientist, Administrator, National Institute of Health: "...it has the potential to wreck everything in its path. First, it has been declared a possible carcinogen by the US government and by the World Health Organization. Then, carbon black used in tires consists of the purest, smallest (ultra-fine) nanoparticles giving them a unique potential toxicity throughout the body. ...when you pulverize tires for use in children's playing fields, they become more available to interact with the environment and people with weathering and the impact of each child's footfall and body...When children's life-long health is at stake, the precautionary principle should apply." Toxicologist Dr. David Brown, Emeritus, (Public Health Toxicologist and Director of Public Health Toxicology for Environment and Human Health, Inc.) says that tire crumb off-gases 24 harmful materials, and that the amount of off-gassing increases as the tire crumb heats. Carbon black, which makes up 30% of black tires, is carcinogenic and breaks down into very small particles called nano-particles. Those small carbon black particles attach onto the surface of the gases, which then penetrate into the deep lung as the child breathes. These gas/particle mixtures are 10-20 times more toxic than the materials alone. We know from air pollution studies that looked at these mixtures that they cause serious disease." These nanoparticles are known to pass the blood/brain barrier, attacking at the molecular level; some scientists state the need for studying the effects of nanotubes on DNA function.

During heat mitigation operations, water is sprayed over the field causing evaporative cooling. The rising water vapor picks up these nanotubes and atmospheric contamination mentioned earlier, causing an unseen but dangerous "fog of chemicals" within which the kids are playing. The resultant risk to our kids safety and health is intuitively obvious, and as part of their decision process, the decision makers should apply The Precautionary Principle: "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically." Examples of the essence of the Precautionary Principe are: "an ounce of prevention is worth a pound of cure", "better safe than sorry", "look before you leap", and the well known medical oath "First, Do No Harm".

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Comment On: ATSDR-2016-0002-0003
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill ATSDR-2016-0002

Document: ATSDR-2016-0002-0034
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ Comment on FR Doc # 2016-03305

Submitter Information

Name: Joanna Brown
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Email: Joannabr@comcast.net

General Comment

Dear researchers,
I comment as a citizen who is concerned about the possible health effects of a crumb rubber infill artificial turf field that is currently being installed in my town of South Hadley, MA.

Background for my comments: I saw a film on espnw.com entitled Turf Wars (Google "Turf Wars Julie Foudy" to get the link to that program). That TV program raised many concerns for me about crumb rubber infill and possible links to cancer in 200 student athletes. The lists of cancer cases among student athletes were collected by Amy Griffin, assistant soccer coach at University of Washington. I urge you to contact her (search her name on the University of Washington website to find her email address) to see the lists of student athletes who played on crumb rubber and who developed cancer, showing the types of sports played and types of cancer, if you have not already done so.

I am grateful that you are undertaking this study, and I look forward to seeing the results of it.

Below are my comments regarding the study:

In the description of the first study, the wording says: "Also, these may be asked to supply samples from their synthetic turf fields with crumb rubber infill..." Why is the word "may"

used, rather than "will"? Why would you not want to collect samples from all fields in the study? If not all of the fields will be sampled, what is the percentage that will be sampled? In my local experience, the athletic staff are completely in favor of artificial turf crumb rubber field. Thus, they might not want to give a sample in order to prevent you--and the public-- from finding out the chemical and heavy metal composition of the crumb rubber.

In the description of the second study, which will be of "persons who use synthetic turf..." , there is the following wording: "Furthermore, if time and resources allow, we will conduct a full exposure characterization sub-study among..." Why is there not a firm commitment up-front to undertake this sub-study? "If time and resources allow" indicates to me that a commitment has not been made to fully understand the actual effects on crumb rubber field users, and this is the heart of the matter--finding out if student athletes are harmed by use of the crumb rubber fields.

The description goes to say: "It is likely that some of the collection items will not be analyzed in the current project time frame but will be archived for future analysis." I can fully understand the desire to create an archive that is properly maintained for reference in a possible longitudinal study. If there are negative health effects, they may take years to materialize, and having sampls availaible from prior years from athletes would be useful. However, I do not understand why all samples could not be analyzed within the current project time frame. Would it not be possible to split samples and analyze them now and also save part of the sample for reference at a later date?

Finally, I offer two URLS from a non-profit research organization that may be useful to you:

Www.ehhi.org/turf/findings0815.shtml

Www.ehhi.org/reports/turf/turf_report07.pdf. (This is the 37 page report that EHHI produced on crumb rubber infill)

The stakes are very high regarding possible health risks to student athletes. Your study will provide important information on which possible future installations of crumb rubber infill fields we be decided. Moreover, the results could also inform future studies regarding the use of crumb rubber for playgrounds for children.

Again, I thank you for proposing this study and soliciting public comment.

P.S. Please note that there are several companies now making alternative infill materials out of wood and polymers. Will you also be comparing the samples of alternative infill materials to show the difference in chemical and metal composition?

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Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ

Comment On: ATSDR-2016-0002-0003
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill ATSDR-2016-0002

Document: ATSDR-2016-0002-0065
Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ Comment on FR Doc # 2016-03305

Submitter Information

Name: Erik Glavich
Organization: National Association of Manufacturers

General Comment

See attached comments on behalf of the following organizations:

American Chemistry Council
Halloween Industry Association
Institute of Scrap Recycling Industries, Inc.
Juvenile Products Manufacturers Association
National Association of Manufacturers
National Retail Federation
Retail Leaders Industry Association

Attachments

Comments_CrumbRubber_2016-05-02_final

May 2, 2016

Mr. Leroy A. Richardson
Information Collection Review Office
Centers for Disease Control and Prevention
1600 Clifton Road, N.E., MS-D74
Atlanta, Georgia 30329

Re: Notice with Comment Period: Information Collection Related to Synthetic Turf Fields with Crumb Rubber Infill (Docket No. ATSDR-2016-0002)

The undersigned organizations provide these comments in response to the notice requesting public comment on "Collections Related to Synthetic Turf Fields with Crumb Rubber Infill." Specifically the notice seeks input on proposed and/or continued information collections that will assist the Agency for Toxic Substances and Disease Registry ("ATSDR") within the Centers for Disease Control and Prevention ("CDC") and the Environmental Protection Agency ("EPA") to "conduct two studies to investigate the chemical composition and use of crumb rubber infill in synthetic turf and the potential for exposure to environmental constituents that may result from contact with crumb rubber infill." We represent manufacturers, their suppliers and other key stakeholders that would be impacted by the action sought through the information collection request. Our collective members are committed to providing safe products, and we appreciate the opportunity to provide these comments.

Since the industries in which our members belong are much broader than those directly related to the synthetic turf and playground industries, it is vital that the most effective safety regime be based on the highest quality information available, sound science and objective risk assessments. Any effort to respond to possible risks associated with the use of crumb rubber should involve robust analysis that focuses on the actual use in specific products and involves a cooperative engagement with stakeholders.

I. Introduction

The recycled rubber used in synthetic turf and playgrounds is used in a multitude of products throughout the economy, so the research to be conducted could have broad and significant implications. Therefore, although the information collection request does not specifically reference the *Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields* ("Federal Research Action Plan"), the notice does request information intended to implement the plan, including specifically comments on the necessity of the proposed collection and ways to enhance the quality, utility and clarity of the collected information.

These comments express our urging that the agencies conducting research as outlined in the Federal Research Action Plan engage in a comprehensive and thoroughly objective analysis of all available peer-reviewed research concerning crumb rubber and its composition. The agencies must apply sound scientific methodologies to their research, including proper sampling controls. Moreover, the research and analysis should be applied in proper context so that constituents found in recycled rubber and their exposure to users of synthetic turf fields are properly represented (e.g., trace amounts of a chemical compound that pose no potential health hazard should be represented properly). Implementing the suggestions within our comments will help assure that the research is defensible and credible and actually addresses the concerns that prompted it in the first place.

II. The Federal Research Action Plan Should Provide Detail on the Planned Actions of the U.S. Consumer Product Safety Commission

The Federal Research Action Plan provides an overview of the research to be conducted by ATSDR, the EPA and the U.S. Consumer Product Safety Commission ("CPSC"). However in the supporting materials provided by the CDC's Information Collection Review Office, it is unclear as to what specific action the CPSC will engage and how the CPSC has guided or will influence the activities of and research conducted by ATSDR and the EPA. For example, the supporting statement indicates that ATSDR and the EPA "consulted directly with the White House Council of Environmental Quality and the Consumer Product Safety Council (CPSC) to obtain their views on the public health issue/concern surrounding crumb rubber infill in synthetic turf."[1] However, there is no discussion in the supporting materials of what those views are and how they will affect the research to be conducted.

Moreover, the supporting statement describes that ATSDR and the EPA will conduct two studies "in collaboration with the CPSC." This statement implies that the CPSC will be actively engaged throughout the research project for which the information collection request applies. The statement also mentions that the "CPSC has indicated its own plans to conduct a limited study of playground material with recycled tire material," but asserts that there will be no duplication of efforts because the studies to be conducted by ATSDR and the EPA do not incorporate playground material.[2] However without detailed information on the planned activities of the CPSC, the scope of the CPSC's research is unclear and there is not sufficient support for the assertion by ATSDR and the EPA that the information collection request avoids unnecessary duplication. The Federal Research Action Plan indicates that the CPSC will "convene discussions with members of the public and organizations with an interest in studying tire crumb" including athletes, parents and coaches; government agencies; and industry representatives. The CPSC will reportedly explore "conducting a survey of parents to get first-hand perspectives on potential exposures from playground surface materials" and will "conduct additional work on the safety of playgrounds."

We request that the materials supporting the information collection request include additional information on the activities on which the CPSC has engaged and will engage. We also encourage ATSDR, the EPA and the CPSC to provide more detailed information on the CPSC's planned activities in the Federal Research Action Plan. To our knowledge, the CPSC has not issued publicly any detailed information on its activities. Therefore, it is difficult for the public to ascertain that the three agencies are indeed avoiding unnecessary duplication or requesting information that is necessary for determining the health effects of crumb rubber in playing fields and other environments.

III. The Agencies Must Objectively Analyze All Available Peer-Reviewed Research

Similar to our concerns over the lack of transparency on the activities of federal agencies like the CPSC, the agencies conducting research must engage in a comprehensive and thoroughly objective analysis of all available peer-reviewed research concerning crumb rubber and its composition, including studies on exposure. There has been much research on the issue, and it is vital that the agencies avoid selection bias when determining key knowledge gaps, which is one of the specific objectives indicated in the Federal Research Action Plan. To avoid unnecessary duplication, the agencies must properly consider all available peer-reviewed

[1] See "Supporting Statement Part B—Collection."
[2] *Ibid.*

research so that the findings developed through the current project are thorough, objective and a true representation of the potential risks associated with crumb rubber exposure.

IV. Researchers Must Incorporate Proper Scientific Controls and Other Sound Scientific Methodologies in the Sampling of Recycled Rubber

We have concerns that proper scientific controls (e.g., sampling from grass fields and other areas surrounding synthetic turf fields) have not been contemplated by the agencies as they embark on this research. Without parallel sampling from soil and air near synthetic turf fields, the researchers would compromise the reliability of their findings. Scientific controls not only provide a reference point for the sample results that are the focus of the research, they also provide context. For example, a chemical compound found in crumb rubber may be found naturally in the surrounding soil. Without this information, researchers could draw incorrect assumptions that would bias their results. In fact, the failure to provide information on surrounding areas could actually misinform the public if the agencies only report on the recycled rubber used in synthetic turf fields or playgrounds.

Furthermore, the analytical test methodologies and other processes used by the researchers should be in accordance with accepted guidelines and/or protocols as established by federal guidelines, international standards and/or voluntary consensus standards. The agencies should not rely on published research projects that were not reproducible or properly vetted. It is vital that the researchers employ sound scientific methodologies.

V. Researchers Must Report Findings in Proper Context

Importantly, the identification of chemical compounds in recycled rubber must include context, which should include a baseline below which the presence of those constituents has already been determined to present no known health hazards. Simply reporting the presence of chemical compounds without regard to whether the levels found present any cause for concern, including the bioavailability of those chemicals, ignores sound science and would needlessly misinform the users of the facilities. At the very least, if the presence of chemicals found at low levels is reported, the agencies must provide context to that report by noting (if so) that the chemical compounds are present only at levels below that at which there is any health concern.

VI. Agencies Must Establish a Scientific Review Panel

To improve coordination among the federal agencies conducting research and the state-led research that has been and will be conducted, we strongly urge the agencies to establish a scientific review panel to oversee the project. This panel should be comprised of subject matter experts from industry, academia and the research community and would help minimize any duplication of efforts by the agencies. Importantly, the scientific review panel should provide comments on agencies' efforts. Finally, the panel should ensure that all research activity conducted by the agencies is thorough and objective and that the agencies comply with all applicable laws, regulations and guidance for scientific research.

VII. Conclusion

As ATSDR, the EPA and the CPSC move forward in implementing the Federal Research Action Plan, we encourage the agencies to employ sound scientific principles, including a thorough and objective analysis of all available peer-reviewed research. The researchers also

must incorporate proper scientific controls and provide proper context for their findings. Finally, we strongly urge the agencies to commit to conducting their research in an open and transparent manner in accordance with Office of Management and Budget and agency-specific guidelines for information quality and peer review. The agencies must place the highest priority on ensuring that information, data and methodologies are sound and subject to public review and input. Thank you for your time and consideration.

Sincerely,

American Chemistry Council
Halloween Industry Association
Institute of Scrap Recycling Industries, Inc.
Juvenile Products Manufacturers Association
National Association of Manufacturers
National Retail Federation
Retail Leaders Industry Association

PUBLIC SUBMISSION

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Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ

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Collections Related to Synthetic Turf Fields with Crumb Rubber Infill ATSDR-2016-0002

Document: ATSDR-2016-0002-0066
Comment on FR Doc # 2016-03305

Submitter Information

Name: Rockwood Turf
Email: rockwoodturf@gmail.com

General Comment

Studies with Conflicts of Interest and Other Recommendations for Studies and Data.

Attached please find comments regarding studies with conflicts of interest in addition to recommendations for other studies pertaining to crumb rubber used on playgrounds and synthetic turf fields, and synthetic turf fields in general.

Comments reference EPA's own "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015" located at https://www.epa.gov/chemical-research/tire-crumb-and-synthetic-turf-field-literature-and-report-list-nov-2015 to be used as part of the new February 2016 federal study: Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds.

Thank you for your consideration of this important matter. Our children thank you!

Attachments

Conflicts-of-Interest-and-Recs-for-EPA-CR-Lit-Report-List-20160502

Comments: "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"

Please see table below referencing EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015" posted at https://www.epa.gov/chemical-research/tire-crumb-and-synthetic-turf-field-literature-and-report-list-nov-2015. Conflicts of interest are identified in the studies conducted on shredded waste tires in crumb rubber infill and playground rubber mulch. Because conflicts of interest affect a study's conclusions, determining them is important. EPA should be aware of studies funded or conducted by industry, if the group/company makes a profit from the product, or if the mission of the group interferes with safety, such as promoting use of recycled tires. This explains why time has been taken to study this issue. Provided comments are not a review of whether the studies have data gaps or are well done, although a few notes have been given in this regard.

Comments presented here include:

- Identification of conflicts of interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015" (pp. 1-28)
- Recommendations for studies to be added (pp. 29-43)
- Other data for consideration (pp. 44-56)

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"

	Study	Author(s)	Group(s)	Conflict of Interest?	Reason for Conflict of Interest	Notes
1.	Leaching of DOC, DN and Inorganic Constituents from Scrap Tires	Selbes M., Yilmaz O., Khan A.A., Karanfil T. (2015). Chemosphere. 139:617-23. (Selbes M[1], Yilmaz O[1], Khan AA[2], Karanfil T[3].)	[1]Department of Environmental Engineering and Earth Sciences, Clemson University, Anderson, South Carolina. [2]Department of Civil Engineering, Clemson University, Clemson, South Carolina. [3]Department of Environmental Engineering and Earth Sciences, Clemson University, Anderson, South Carolina. tkaranf@clemson.edu	N	N/A	

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
2.	Environmental and Health Impacts of Artificial Turf: A Review	Cheng H.[1], Hu Y., Reinhard M. (2014). Environ Sci Technol. 48(4):2114-29.	[1]State Key Laboratory of Organic Geochemistry Guangzhou Institute of Geochemistry, Chinese Academy of Sciences Guangzhou 510640, China.	N	N/A	Not a study; a literature review only.
3.	Environmental Sanitary Risk Analysis Procedure Applied to Artificial Turf Sports Fields	Ruffino et al. (2013). Environ Sci Pollut Res Int. (Ruffino B[1], Fiore S, Zanetti MC.)	[1]DIATI-Department of Environment, Land and Infrastructure Engineering, Politecnico di Torino, Corso Duca degli Abruzzi, 24 10129 Torino, Italy. barbara.ruffino@polito.it	Y	Promotes recycling used tires (see notes).	"Management of the huge quantity of end-of-life tires (ELTs) collected every year leads to several options among which the preferable ones seem to be recycling and reuse, that allow the high quality of component materials to be fully exploited…" http://www.ucprc.ucdavis.edu/P-LCA2014/media/pdf/Papers/LCA14_Crumb%20Rubber%20Pavements.pdf "Management of end-of-life tyres (ELTs) has become a critical problem worldwide… Since landfill disposal has been banned in most Countries, alternative final destinations have been sought, with a major effort being placed in trying to exploit in the most efficient manner the high energy potential of ELTs. Nevertheless, due to the fact that rubber employed in tyre fabrication is the result of specialized materials' selection, recycling and reuse seem to be preferable options for such a high-quality waste material (Santagata and Zanetti, 2012)." http://opensample.info/order/ad6145a12f3aa43693b0e51dee50a107761f3af0

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
4.	New Approach to the Ecotoxicological Risk Assessment of Artificial Outdoor Sporting Grounds	Krüger O.[1], Kalbe U., Richter E., Egeler P., Römbke J., Berger W. (2013). Environ Pollut. 175:69-74.	[1]BAM Federal Institute for Materials Research and Testing, Division 4.4 Thermochemical Residues Treatment and Resource Recovery, Unter den Eichen 87, 12205 Berlin, Germany. oliver.krueger@bam.de	N	N/A	
5.	Artificial Turf Football Fields: Environmental and Mutagenicity Assessment	Schilirò T.[1], Traversi D., Degan R., Pignata C., Alessandria L., Scozia D., Bono R., Gilli G. (2013). Arch Environ Contam Toxicol. 64(1):1-11.	[1]Department of Public Health and Microbiology, University of Torino, Via Santena, 5bis, 10126, Torino, Italy. tiziana.schiliro@unito.it	N	N/A	This study was financed by the Department of Sport and Recreation of the city of Torino, Italy.
6.	Bioaccessibility and Risk Exposure to Metals and SVOCs in Artificial Turf Field Fill Materials and Fibers	Pavilonis B.T.[1], Weisel C.P., Buckley B., Lioy P.J. (2013). Risk Anal.	Environmental and Occupational Health Sciences Institute, Robert Wood Johnson Medical School.	Y	Promotes recycling used tires (see note).	The study was supported by contract #SHW10-004 from the NJ Department of Environmental Protection, Recycling Program and Planning. This study found lead and other toxins in both the plastic rug and tire crumb infill. Lead was also was found in simulated body fluids meaning there is little or no protection of any kind against the lead getting out of the material into the body. "Since it is possible that children may be exposed to potentially high concentrations of lead while using artificial turf fields we recommend, at a minimum, all infill and fibers should be certified for low or no lead content prior to purchase and installation."

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						The main outcomes of concern: • The finding of lead and chromium in both the tire crumb and the plastic rug and body fluids at sometimes extremely high levels EVEN IN NEW FIELD CARPETS. • Benzothiazole derivatives and 4-(tert-octyl) phenol were also found. Both are probable carcinogens. "Lead was detected in almost all field samples for digestive, sweat, and total extraction fluids with digestive fluid extract of one field sample as high as 260 mg/kg. Metal concentrations were not markedly different across the three different sample types (new infill, new turf fiber, tire crumb field sample). However, one of the new turf fiber samples contained relatively large concentrations of chromium (820 mg/kg) and lead (4,400 mg/kg) compared to the other samples tested…the variability of lead contained in the infill material is large and can span more than two orders of magnitude. One field [tire crumb] sample did contain a high lead level (260 mg/kg) which was on the same order of magnitude as the NJ DEP cleanup value (400 mg/kg)." Lead-free is the only acceptable level for child products (and indeed for people in general.). There is NO safe level of lead for children. And yet many of our children are playing often, if not daily, on fields that may contain lead and certainly do contain many other toxic substances. Finding ANY lead in any play area for children of any age is unacceptable. Every effort should be made to eliminate ALL unnecessary sources of lead in the environment, especially a child's environment. Lead in artificial turf is not only totally unnecessary but dangerous to health.

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						The levels of bioaccessibility would have been greatly underestimated; this study did not use biologically relevant crumb rubber particle sizes or incubation times when determining the bioaccessibility of SVOCs and metals in simulated lung fluids. Tire crumbs do not float in the air. Athletes are inhaling particulate matter often only a few microns in diameter. Further, the particulate matter may stay lodged in the lungs for months, not 24 hours. Surface area is a key factor in determining bioavailability. The toxicants in dust are far more bioavailable than those in crumbs, which in turn are more bioavailable than those in whole tires.
7.	Review of the Human Health & Ecological Safety of Exposure to Recycled Tire Rubber Found at Playgrounds and Synthetic Turf Fields	Cardno Chem Risk. (2013).	Prepared for: Rubber Manufacturers Association, Washington, DC.	Y	Prepared for Rubber Manufacturers Association	
8.	Health Risk Assessment of Lead Ingestion Exposure by Particle Sizes in Crumb Rubber on Artificial Turf Considering Bioavailability	Kim S.[1], Yan J.Y., Kim H.H., Yeo I.Y., Shin D.C., Lim Y.W. (2012). Environ Health Toxicol. 27:e2012005.	[1]Institute for Environmental Research, Yonsei University, Seoul, Korea.	N	N/A	The authors have no conflict of interest to declare on this study.

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
9.	Zinc Leaching from Tire Crumb Rubber	Rhodes E.P.[1], Ren Z., Mays D.C. (2012). Environ Sci Technol. 46(23):12856-63.	[1]Department of Civil Engineering, University of Colorado Denver, Campus Box 113, PO Box 173364, Denver, Colorado.	N	N/A	
10.	Comparison of Batch and Column Tests for the Elution of Artificial Turf System Components	Krüger O.[1], Kalbe U., Berger W., Nordhauβ K., Christoph G., Walzel H.P. (2012). Environ Sci Technol. 46(24):13085-92	[1]BAM Federal Institute for Materials Research and Testing , Unter den Eichen 87, 12205 Berlin, Germany. oliver.krueger@bam.de	N	N/A	Faulty testing method: sand is routinely used to filter pollutants out of stormwater. Krueger's method included filter sand at the top and bottom of the column to "disperse the flow." The filter sand may also have reduced the levels of leachates that were measured. Addition of extraneous filtering media into a system does not yield a realistic model.
11.	Design of a New Test Chamber for Evaluation of the Toxicity of Rubber Infill	Gomes JF [1], Mota HI, Bordado JC, Baião M, Sarmento GM, Fernandes J, Pampulim VM, Custódio ML, Veloso I. (2011). Toxicol Mech Methods. 21(8):622-7	[1]IBB/Centre for Chemical and Biological Engineering, Instituto Superior Técnico-UTL , Lisboa , Portugal. jgomes@deq.isel.ipl.pt	N	N/A	
12.	An Evaluation of Potential Exposure to Lead and Other Metals as the Result of Aerosolized Particulate Matter from Artificial Turf Playing Fields	Shalat, S.L. (2011).	Division of Environmental Health. Submitted to the New Jersey Department of Environmental Protection.	N	N/A	This study examined the levels of PM 100 and respirable lead dust measured by a stationary air monitor, a mobile air monitor on a robot remotely controlled by a computer, and by a personal breathing space air monitor on a child running soccer drills. Total inhalable particles and inhalable lead levels were lowest when measured by the stationary air monitor. The study found lead in the field dust in the respirable air space of a robot and real player; highly variable but

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						sometimes very high (note most facilities would NOT allow testing). The concerns about lead exposure have taken on a new urgency following the release in June 2012 of a study completed for the New Jersey DEP which found artificial fields made of tire crumb can contain highly elevated levels of lead much greater than the allowed levels for children: • It reports concerns with regard to potential hazards that may exist for individuals, and in particular, children, who engage in sports activities on artificial fields • Inhalable lead present in artificial turf fields can be resuspended by even minimal activity on the playing surface.
13.	Artificial-Turf Playing Fields: Contents of Metals, PAHs, PCBs, PCDDs and PCDFs, Inhalation Exposure to PAHs and Related Preliminary Risk Assessment	Menichini et al. (2011). Sci Total Environ. 409(23):4950-7. (Edoardo Menichini[a], Vittorio Abate[a], Leonello Attias[b], Silvia De Luca[a], Alessandro di Domenico[a], Igor Fochi [a], Giovanni Forte[a], Nicola Iacovella[a], Anna Laura Iamiceli[a], Paolo Izzo[b], Franco Merli[a], Beatrice Bocca[a])	[a]Department of Environment and Primary Prevention, Istituto Superiore di Sanità, Viale Regina Elena 299, 00161 Rome, Italy. [b]National Centre for Chemical Substances, Istituto Superiore di Sanità, Viale Regina Elena 299, 00161 Rome, Italy.	N	N/A	

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14.	Human Health Risk Assessment of Synthetic Turf Fields Based Upon Investigation of Five Fields in Connecticut	Ginsberg[1] et al. (2011). J Toxicol Environ Health A. 74(17):1150-74.	[1]Connecticut Dept of Public Health, Hartford, Connecticut. gary.ginsberg@ct.gov	N	N/A	Faulty testing method, faulty risk assessment method. The authors excluded benzene from the risk assessment based on results from personal air monitor samples taken from a grass field approximately 15 months after the original sampling was taken. It is not plausible to suggest that air samples taken more than a year later, in a different season, can serve as an adequate background control. The authors failed to mention the second round of sampling in this report although it was discussed in a separate report generated by this research project. The addition of implausible post hoc control data and the lack of transparency in this article violate good scientific practices. **Thirteen compounds** were included in the cancer risk assessment. Cancer unit risks were obtained from standard toxicology databases for four of those, **two of those included human epidemiologic data**. Unit risk estimates for the other nine carcinogens were estimated, assumed or obtained from nonstandard sources. Of the dozens of chemicals known to be contained in crumb rubber, twenty-seven chemicals of potential concern were identified by the CT DPH for the risk assessment portion of the "Connecticut Study." (A total of five documents comprise the Connecticut Study.) Thirteen chemicals were identified as carcinogens and included in the cancer risk assessment. The study authors were only able to identify unit risk estimates from standard governmental databases for four of the thirteen carcinogens in the cancer risk assessment. Unit risk estimates for the other nine carcinogens were assumed or obtained from nonstandard sources. This study demonstrates both the lack of necessary toxicity information to do a quantitative risk assessment and the inappropriate risk assessment methodology.

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						The Connecticut study used a component-based risk assessment method in which the risks posed by the individual chemicals were simply summed, ignoring any possible interaction effects. However, the Connecticut risk assessment relied on an inappropriate methodology and both approaches relied on extremely incomplete toxicity databases. There are too many possible synergistic or antagonistic interactions between combinations of chemicals to predict the overall toxicity of the mixture with any confidence. Other issues with study methods: **1.** The study inappropriately used component-based risk assessment methods. **2.** The study did not include a legitimate estimate of the risk from respirable rubber dust and carbon black. The 2010 study done by the University of Connecticut Health Center (UCHC) had used stationary air monitors to measure PM 10 levels on the turf fields near simulated games using 3-4 players and up wind of turf fields (Simcox, Bracker, & John, 2010). However, as noted earlier, the Norwegian study found increased levels of PM 2.5, not PM 10. PM 2.5 is also considered to be more of a health threat than PM 10. Although personal air monitors were used in other parts of the study, they were not used to measure PM 10, PM 2.5 or carbon black. As indicated by the Shalat study, this may have led to a significant underestimation of the levels of respirable particles that players were exposed to. No good explanation exists for this oversight.

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						Since the UCHC study found no significant difference between the upwind and the on-field levels of PM 10, the DPH study authors concluded that particulate matter posed zero risk for the purposes of their health risk assessment. **3.** The study assumed that the levels of VOCs and SVOCs measured on sunny days when the temperatures were generally in the low 80's would be a suitable average of levels of these chemicals for the four warmest months of the year, and that no VOCs or SVOCs would be emitted the other four months of the year when the fields were used. However, the rate at which VOCs and SVOCs off gas increases exponentially as temperatures increase. Exposures at a 100° F day and a 60° F do not equal the exposure from two 80 °F days. Further, it cannot be argued that these exposure levels could be applied to areas with higher temperatures, such as Texas, Southern California, or even Eastern Washington. Eastern Washington had far too many days last summer with the temperature in the 90's for these exposure levels to be relevant. **4.** No model of inhalation by soccer goalies and younger people who spend much time on or close to the surface has been conducted. **5.** Three carcinogens that were identified as Contaminants of Possible Concern were excluded from the cancer health risk assessment without explanation. **a. Ethylbenzene:** It is unclear why this carcinogen was not included in the risk assessment. Ethylbenzene would have made a significant contribution to the overall risk.

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						Ethylbenzene has been considered a carcinogen by California's OEHHA since 2004. A cancer unit risk value was established by OEHHA in 2007. **b. Methyl isobutyl ketone:** The risk assessment also did not include methyl isobutyl ketone. Methyl isobutyl ketone was declared to be a carcinogen by OEHHA in 2011, but no unit risk was established. Given the lengths the authors went to in order to obtain unit risk estimates for chemicals that are still not considered to be carcinogens, it is odd that this chemical was excluded from the risk analysis with no discussion or indication as to why. **c. Styrene:** In the study, the authors state that the data on styrene is limited and conflicting but that styrene has positive mutagenicity data and that its main metabolite, styrene oxide, is a known carcinogen. Because they considered styrene a potential carcinogen, they added an additional uncertainty factor to styrene's RFC when calculating its hazard index in a separate part of the study. Nonetheless, styrene was omitted from the cancer health risk assessment. California's OEHHA declared styrene to be a carcinogen in 2010.An updated cancer risk assessment was published by the Connecticut Department of Public Health in 2011, after additional measurements were taken in October of 2010. This risk assessment also did not include styrene (Simcox N. J., et al., 2011).

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						OEHHA currently estimates the unit risk for styrene oxide to be 4.6 x10^{-5}. Had styrene been included in the risk estimate with this as a conservative estimate of its unit risk, styrene would have been the largest contributor of risk. **6.** The limitations of the toxicity data were not fully discussed, thus giving readers an overly optimistic view of the accuracy and precision of the estimates. Although the authors noted how they obtained their cancer unit risk, reference concentration, and acute target level for each chemical in a table, the body of the report does not indicate that most of the table is filled in based on assumptions of toxic equivalency or estimated relative potencies. There was no discussion of the limitations of drawing conclusions about human health effects based on animal studies. A discussion of the chemicals involved in Connecticut's study, and the nature of the toxicology data for each chemical is provided below. The Connecticut study drew data from the Environmental Protection Agency's (EPA) Integrated Risk Information System (IRIS) database, California's Office of Environment Health Hazard Assessment (OEHHA) Toxicity Criteria Database, as well as other standard government sources. The information below contains information from the above referenced sources as well as the International Agency for Research on Cancer (IARC), and the National Toxicology Program (NTP). The first four chemicals have sufficient data to have established cancer unit risks in one or more standard toxicology databases. **Benzene** – Adequate animal studies and human epidemiological data are available. The OEHHA cancer unit risk estimate was at least 3.7 times greater than the EPA IRIS

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						unit risk estimate. The authors of the Connecticut study decided that neither either estimate was demonstrably more accurate, so the study authors averaged the two unit risk estimates to create a new unit risk estimate for use in their study (Ginsburg & Toal, 2010). **Methylene Chloride** – Adequate animal studies and human epidemiological data are available. The study used the EPA IRIS cancer unit risk. **Naphthalene** – The unit risk was from OEHHA's database and was based on studies conducted in rodents. There are a couple of cancer case series in humans, but the EPA and IARC consider these to be insufficient evidence of carcinogenicity in humans. **Benzo(a)pyrene** – The unit risk was from OEHHA's database and was derived from a few studies on hamsters. While OEHHA staff felt that the studies on benzo(a)pyrene were not ideal for calculating a cancer unit risk, the toxicology data on other PAHs were even less complete (Office of Environment Health Hazard Assessment, 2011). **Benz(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene** The next four chemicals, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene are all polycyclic aromatic hydrocarbons (PAHs). The U.S. EPA determined that these are probable carcinogens but lacked information sufficient to allow for direct estimation of cancer unit risks. However, the EPA did publish, "EPA Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons." In this document, the relative potencies of seven PAHs were estimated based on the effects of dermal exposures to the

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						PAHs in mice. These potencies were rounded to a single order of magnitude. The authors of the Connecticut study assumed that the relative potencies of the PAHs derived from dermal exposures in mice were equivalent to the relative potencies for inhalation exposures in humans, thus allowing for the derivation of unit risks for these chemicals. There is uncertainty from using mice to model human toxicity. Uncertainty from using dermal studies to model inhalation risk. Uncertainty from computing relative potencies to estimate unit risks rather than computing unit risks directly from sufficient data. Rounding error. Uncertainty from using hamsters to model human toxicity. Uncertainty from exposing hamsters to inhalation of benzo(a)pyrene in a particle bound form or dissolved in a medium to estimate response to exposure to the gas. Uncertainty was multiplied by uncertainty which was multiplied by rounding error, and the result was represented as a scientifically supported risk calculation accurate to two significant digits. **Chloromethane:** The study authors stated that the cancer unit risk for chloromethane (methyl chloride) was obtained from documentation for California's Proposition 65. However, no citation was given and the source was unable to be identified. Chloromethane is not considered by California or the EPA to a carcinogen. There is some evidence from a mouse study that chloromethane may cause renal tumors, but the relevance of this study to humans is questionable due to differences in rodent and human physiology. **1-Methylnaphthalene 2-Methylnaphthalene 2,6 Dimethylnaphthalene** Three chemicals, 1-methylnaphthalene, 2-methylnaphthalene, and 2,6 dimethylnaphthalene are not

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						classified by the EPA or California as carcinogens. , 1-Methylnaphthalene and 2,6 dimethylnaphthalene do not even appear in the EPA's IRIS or OEHHA's toxicity criteria database. 2-Methylnaphthalene is listed in IRIS as unclassifiable as to carcinogenicity due to insufficient data. The limited animal studies thus far on the methylnaphthalenes have not yielded clear evidence of oncogenetic effects for these chemicals (Lin, Wheelock, Morin, Baldwin, & al, 2009). **Benzothiazole**: The risk estimate for benzothiazole must be considered speculative, at best. It is also not considered to be a carcinogen in the EPA IRIS or the OEHHA database. There was not enough information on benzothiazole to estimate a unit risk directly from studies on the chemical itself. Rather, a related chemical 2-MBT (2-mercaptobenzothiazole) was used. In a study for the National Toxicology Program, rats and mice were orally exposed to 2-MBT dissolved in corn oil and the animals displayed elevated rates of cancers at various sites. A researcher attempting to assess the risk of 2-MBT in water calculated cancer unit risks based on the study's data. The author's calculations underestimated the total cancer risk because the calculations only considered the risk for renal cancer, even though the rodents developed multiple types of cancer. The authors of the Connecticut study converted the unit risk for an oral dose of 2-MBT to a unit risk for inhalation. Thus, the study authors used an underestimate the unit risk of orally administered 2-MBT in rodents as an estimate of the unit risk for inhaled benzothiazole in humans.

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15.	Synthetic Turf Field Investigation in Connecticut	Simcox et al. (2011). J Toxicol Environ Health A. 74(17):1133-49.	[1]University of Connecticut Health Center, Farmington, Connecticut. simcox@uchc.edu	Y	Promotes recycling used tires (see note).	Funding for this project was provided by the Connecticut Department of Environmental Protection. The addition of post hoc 'control' data from personal air monitor samples violates generally accepted rules of scientific methodology. Control and test groups should have been declared and created at the beginning of the study. Further, background air pollution levels vary from day to day and from season to season. Thus it is implausible to suggest that an air sample gathered over a year later, during a different season, could serve as a control.
16.	Benzothiazole Toxicity Assessment in Support of Synthetic Turf Field Human Health Risk Assessment	Ginsberg et al. (2011). J Toxicol Environ Health A. 74(17):1175-83. (Gary Ginsberg[a*], Brian Toal[a] & Tara Kurland[b])	[a]Connecticut Dept of Public Health , Hartford, Connecticut. [b]Clark University , Worcester, Massachusetts.	N	N/A	Not a study; it is a literature review only. The Connecticut study used a component-based risk assessment method in which the risks posed by the individual chemicals were simply summed, ignoring any possible interaction effects. However, the Connecticut risk assessment relied on an inappropriate methodology and both approaches relied on extremely incomplete toxicity databases. There are too many possible synergistic or antagonistic interactions between combinations of chemicals to predict the overall toxicity of the mixture with any confidence. This article gives the justification for the toxicity estimates for benzothiazole (BZT) used in the synthetic turf risk assessments performed by the Connecticut Department of Public Health (DPH). BZT was slightly more acutely toxic than 2-mercaptobenzothiazol (2-MBZT) in tests on laboratory animals, and showed genetic toxicity in one strain of salmonella while 2-MBZT did not show genetic toxicity in any strains. Given the chemical structure of BZT, and the positive

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						genetic toxicity test result, the authors chose to estimate the cancer risk from BZT based on the chemical 2-MBZT. While 2-MBZT did appear to be slightly less toxic than BZT in several tests, the authors' approach seems reasonable, and is far preferable to leaving the risk from BZT out of the health risk assessment entirely.
17.	Hydroxypyrene in Urine of Football Players After Playing on Artificial Sports Fields with Tire Crumb Infill	Van Rooij[1] and Jongeneelen. (2010). Int Arch Occup Environ Health. 83(1):105-10.	[1]IndusTox Consult, PO Box 31070, 6503 CB, Nijmegen, The Netherlands. joost.vanrooij@industox.nl	Y	Promotes recycling used tires (see note).	This study is funded by the following organizations in the Netherlands: KNVB, NOC*NSF, WG Materialen, VACO, DSM, RecyBem and Ten Cate. **"Old tires, great agreements** RecyBEM B.V. and the Association Tire and Environment come together in the execution of the Decision Management Car Tires. As a member of the Association Tire and Environment, Yde van der Veen has been made responsible for processing used car tires in an environmentally-friendly way by virtue of the decree. The RecyBEM B.V. was founded as an execution organization for the Decision Management Car Tires to ensure that all used car tires on the Dutch market are collected structurally and are reprocessed in an environmentally-friendly way. RecyBEM B.V. exercises supervision on the collection companies contracted by RecyBEM B.V. You can also recognize BEM-certified collection companies, such as Yde van der Veen by the use of the uniform tire recycling receipt of RecyBEM B.V. and the Association Tire and Environment." http://www.ydevanderveen.nl/en/recybem-en Exposure was only measured for one day, at 2.5 hrs. All players were age 20 or older; no children were included in study.

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
18.	Risk Assessment of Artificial Turf Fields	Connecticut Department of Energy & Environmental Protection. (2010). Connecticut Departments of Public Health and Environmental Protection and the Connecticut Agricultural Research Station.	Connecticut Department of Energy & Environmental Protection. (2010). Connecticut Departments of Public Health and Environmental Protection and the Connecticut Agricultural Research Station.	Y	This study relies on data collected by Synthetic Turf Field Investigation in Connecticut by Simcox et al. (2011). J Toxicol Environ Health A. 74(17):1133-49, which also has a conflict of interest.	Failure to disclose the use of a post hoc control group. The Connecticut study used a component-based risk assessment method in which the risks posed by the individual chemicals were simply summed, ignoring any possible interaction effects. However, the Connecticut risk assessment relied on an inappropriate methodology and both approaches relied on extremely incomplete toxicity databases. There are too many possible synergistic or antagonistic interactions between combinations of chemicals to predict the overall toxicity of the mixture with any confidence. --- "Their "headline" conclusion, however, reflects none of that concern: 'Results indicate cancer risks slightly above de minimis levels for all scenarios evaluated …' The conclusion fails to indicate that such risks are highly improbable, reflecting a series of systematic overestimates of exposure and risk, and including a contaminant that is almost certainly not actually off-gassing from the crumb rubber. The CASE Peer Review Committee strongly urges DPH to revise its risk assessment and then present its findings with appropriate cautions. At the least, the various assumptions underlying the risk assessment should be compiled and presented in a manner so that they can be understood by non-scientists (e.g., parents and journalists) reading the report." http://www.ct.gov/deep/lib/deep/artificialturf/case_artificial_turf_review_report.pdf

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
19.	Toxicological Assessment of Coated Versus Uncoated Rubber Granulates Obtained from Used Tires for Use in Sport Facilities	Gomes et al. (2010). J Air Waste Manag Assoc. 60(6):741-6. (Gomes J[1], Mota H, Bordado J, Cadete M, Sarmento G, Ribeiro A, Baiao M, Fernandes J, Pampulim V, Custódio M, Veloso I.)	[1]IBB/Center for Chemical and Biological Engineering, Instituto Superior Técnico, and Chemical Engineering Department, Instituto Superior de Engenharia de Lisboa, Lisboa, Portugal. jgomes@deq.isel.ipl.pt	N	N/A	
20.	Characterization of Substances Released from Crumb Rubber Material Used on Artificial Turf Fields	Li et al. (2010). Chemosphere. 80(3):279-85. (Li X[1], Berger W, Musante C, Mattina MI.)	The Connecticut Agricultural Experiment Station.	N	N/A	
21.	Evaluating and Regulating Lead in Synthetic Turf	Gregory Van Ulirsch, Kevin Gleason, Shawn Gerstenberger, Daphne B. Moffett, Glenn Pulliam, Tariq Ahmed, Jerald Fagliano. (2010). Environ Health Perspect. 118(10): 1345–1349. (Gregory Van Ulirsch[1], Kevin Gleason[2], Shawn Gerstenberger[3], Daphne B. Moffett[1], Glenn Pulliam[4], Tariq Ahmed[4], Jerald Fagliano[4])	[1]Agency for Toxic Substances and Disease Registry, Atlanta, Georgia. [2]New York State Department of Health, Troy, New York. [3]Department of Environmental and Occupational Health, University of Nevada Las Vegas, Las Vegas, Nevada. [4]New Jersey Department of Health and Senior Services, Trenton, New Jersey.	N	N/A	Not a study; literature review only.

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
22.	Safety Study of Artificial Turf Containing Crumb Rubber Infill Made from Recycled Tires: Measurements of Chemicals and Particulates in the Air, Bacteria in the Turf, and Skin Abrasions Caused by Contact with the Surface	California Office of Environmental Health Hazard Assessment. (2010). Prepared for the California Department of Resources Recycling and Recovery.	California Office of Environmental Health Hazard Assessment. (2010). Prepared for the California Department of Resources Recycling and Recovery.	Y	Prepared for the California Department of Resources Recycling and Recovery. CalRecycle, as part of OEHHA, promotes recycling used tires.	This study examined the temperature at four artificial turf fields. It measured the VOCs in the air above the air at the four fields. Air for the VOC samples was collected from stationary monitors placed beneath galvanized steel garbage cans for 45 minutes. PM 2.5 samples were also collected from three fields, however, the results from two fields were below the limit of detection. The results from the third field were inconsistent. The study also looked at MRSA risk. While artificial turf has not been shown to harbor or transmit the MRSA virus, its abrasiveness significantly increases the risk of epidermal injuries that could result in a MRSA infection.
23.	An Assessment of Chemical Leaching, Releases to Air and Temperature at Crumb-Rubber Infilled Synthetic Turf Fields	Lim L., Walker R. (2009).	New York State Department of Environmental Conservation, New York State Department of Health.	Y	Promotes recycling used tires (New York State Department of Environmental Conservation).	This report only involved two artificial turf fields, both of which were located in downtown New York City, making it very difficult to separate out signal from noise when attempting to measure possible off-gassing from the fields. PM 10 and PM 2.5 were measured, but the measurements at Thomas Jefferson Field were deemed unreliable due to the implausible relationship between the PM 2.5 and PM 10 readings. The temperature readings on the fields clearly demonstrated that once the ambient temperature reached the 80's, the fields could become hot enough to significantly increase the risk of heat-related illness.

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
24.	A Scoping-Level Field Monitoring Study of Synthetic Turf Fields and Playgrounds	Highsmith R., Thomas K.W., Williams R.W. (2009). EPA/600/R-09/135.	National Exposure Research Laboratory, U.S. Environmental Protection Agency.	N	N/A	"This report was prepared for the U.S. Environmental Protection Agency (EPA) Tire Crumb Committee, a cross-Agency workgroup." This study examined airborne PM 10 and VOCs at four outdoor fields and one outdoor playground. Additionally the extractable heavy metals from surface wipes, the crumb rubber and the turf blades from each location were also measured. Bioaccessibility of the lead in the crumb rubber was estimated using the protocols for assessing the bioaccessibility of lead in soil.
25.	Air Quality Survey of Synthetic Turf Fields Containing Crumb Rubber Infill	Vetrano, K.M., Ritter G. (2009).	Prepared by TRC for the New York City Department of Mental Health and Hygiene, New York, New York.	N	N/A	
26.	New Jersey Investigation of Artificial Turf and Human Health Concerns	New Jersey Department of Health and Senior Services. (2008). Fact Sheet. Consumer and Environmental Health Services. Epidemiology, Environmental and Occupational Health. Trenton, New Jersey.	New Jersey Department of Health and Senior Services. (2008). Fact Sheet. Consumer and Environmental Health Services. Epidemiology, Environmental and Occupational Health. Trenton, New Jersey.	N	N/A	

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
27.	A Review of the Potential Health and Safety Risks from Synthetic Turf Fields Containing Crumb Rubber Infill	Denly E., Rutkowski K., Vetrano K.M. (2008).	Prepared by TRC for the New York City Department of Mental Health and Hygiene, New York, New York.	N	N/A	Not a study; it's a literature review only. This report is a review of the literature on crumb rubber and artificial turf safety. It also provides information on the manufacture of tires and the chemicals contained in tires. "In a letter dated May 14 of that year [2008], Landrigan and two other doctors at the center advised the Health Department to not release the 'deeply flawed' report, calling it 'superficial and one-sided.' City Limits obtained the damning five-page letter through another Freedom of Information Law request. The literature review 'does not present a fair and balanced assessment of the issues surrounding the potential health hazards of synthetic turf,' the letter read. 'It is not up to the high standard of work that we have come to expect from the New York City Department of Health and Mental Hygiene in this administration.' The letter went on to identify four 'proven and potential' hazards of synthetic turf made from recycled tires. The first and 'best established' was exposure to 'excessive heat,' with such medical consequences as 'foot burns, dehydration and heat exhaustion.' The doctors warned that watering the fields to cool them down could actually do more harm than good: 'That can set the stage for skin infections,' because 'residual water droplets may act as bacterial incubators.' This observation led to a more in-depth discussion of the second risk: MRSA, the antibiotic-resistant staph infection that can be acquired through turf burns. MRSA clusters from turf burns had been reported in The New England Journal of Medicine, the doctors noted, and in the CDC's Morbidity and Mortality Weekly Report.

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
						Lastly, the letter raised the risk of chemical exposures, acknowledging that the scientific literature was 'much less well developed' on these hazards than on the dangers from heat and MRSA. 'Several credible studies' had found the crumb rubber contained 'known human carcinogens' and 'neurotoxic chemicals,' as well as lead, chromium and arsenic. The city's literature review relied on reports of human exposure to toxic chemicals from poured- or hard-rubber products, 'very different from the particulate rubber infill found in synthetic turf fields' and therefore 'only remotely relevant' to its topic. The letter was blunt in its criticism: 'Overall the draft report from [TRC Companies] on the health hazards of synthetic turf is incomplete, it relies on irrelevant data sources, it uses a deeply flawed approach to risk assessment, it glosses over glaring gaps in the data, and it far too readily dismisses proven risks to human health. It does not take into account the unique exposures and the special vulnerabilities of young children. It concludes quite inappropriately that absence of evidence of risk is evidence of no risk.'" http://citylimits.org/2010/08/24/it-wont-taste-great/
28.	Synthetic Turf: Health Debate Takes Root	Claudio L. (2008). Environ Health Perspect 116(3): A116–A122.	Mount Sinai School of Medicine, New York, New York.	N	N/A	Not a study; opinion piece only
29.	Artificial Turf: Safe or Out on Ball Fields Around the World	Lioy P., Weisel C. (2008). Editorial. J of Expos Anal Environ Epidem. 18:533-534	Exposure Science Division, Environmental and Occupational Health Sciences Institute of Robert Wood Johnson Medical School.	N	N/A	Not a study; it is an editorial providing an opinion only.

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
30.	Hazardous Chemicals in Synthetic Turf Materials and their Bioaccessibility in Digestive Fluids	Zhang et al. (2008). J Expo Sci Environ Epidemiol. 18(6):600-7. (Zhang JJ[1], Han IK, Zhang L, Crain W.)	[1]School of Public Health, University of Medicine and Dentistry of New Jersey. jjzhang@eohsi.rutgers.edu	N	N/A	
31.	Mapping, Emissions and Environmental and Health Assessment of Chemical Substances in Artificial Turf	Nilsson N.H., Malmgren-Hansen B., Thomsen U.S. (2008).	Danish Ministry of the Environment, Environmental Protection Agency.	Y	Promotes recycling used tires (see note).	Study financed by Danish EPA. **"3.2 Tyres (Waste strategy 2005-2008)** Landfilling of used tyres has been banned as of 16 July 2001 according to the Statutory Order No 648 of 29 June 2001 on the revision of Statutory Order No 619 of 27 June 2000 on Waste. Collection and recovery of tyres is regulated by the Statutory Order on a Fee on Tyres and a Recovery Subsidy No 111 of 5 February 2000. …An intermediary goal was that at least 80% of all discarded tyres from private cars, vans, and motorbikes will be collected and recycled or incinerated before 1997. According to the agreement, 80% of all discarded tyres must be recycled or incinerated before 2000. Since 2001, the collection rate has been close to 100%. Goals for 2008: • 90% reuse or recycling of all discarded tyres On 20 February 1995, the Minister for Environment and Energy entered into an agreement with the tyre and motor trade associations, the Association of Danish Recycling Industries and municipal associations on a take-back scheme for discarded tyres. Through the agreement it is ensured that discarded tyres are collected and recycled or incinerated, thus avoiding landfilling and ensuring resource utilisation of waste tyres…" http://scp.eionet.europa.eu/facts/factsheets_waste/2006_edition/Denmark

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
32.	Evaluation of Health Effects of Recycled Waste Tires in Playgrounds and Track Products	California Office of Environmental Health Hazard Assessment. (2007). Prepared for the California Integrated Waste Management Board.	California Office of Environmental Health Hazard Assessment. (2007). Prepared for the California Integrated Waste Management Board.	Y	CalRecycle, as part of COEHHA, promotes recycling used tires.	Not a study; a literature review only. Reviews numerous related studies on shredded and poured in place recycled tire products. It also contains an original study of oral toxicity based on gastric digestion simulation of tire shreds.
33.	Examination of Crumb Rubber Produced from Recycled Tires	Incorvia Mattina M.J., Isleyen M., Berger W., Ozdemir S. (2007). The Connecticut Agricultural Research Station, New Haven, CT.	The Connecticut Agricultural Research Station, New Haven, Connecticut.	N	N/A	
34.	Artificial Turf: Exposures to Ground-Up Rubber Tires - Athletic Fields - Playgrounds - Gardening Mulch	Brown, D., Alderman, N., Addiss, S., Bradley, J.	Environment and Human Health, Inc. (2007).	N	N/A	Non-profit organization Study referenced in this source is Examination of Crumb Rubber Produced from Recycled Tires, Incorvia Mattina M.J., Isleyen M., Berger W., Ozdemir S. (2007). The Connecticut Agricultural Research Station, New Haven, CT.
35.	Environmental and Health Evaluation of the Use of Elastomer Granulates (Virgin and from Used Tyres) as Filling in Third-Generation Artificial Turf	Moretto. (2007). France.	ALIAPUR in partnership with Fieldturf Tarkett and the ADEME (Environmental French Agency).	Y	ALIAPUR in partnership with Fieldturf Tarkett	

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
36.	Preliminary Assessment of the Toxicity from Exposure to Crumb Rubber: Its Use in Playgrounds and Artificial Turf Playing Fields	LeDoux T. (2007).	Division of Science, Research and Technology. New Jersey Department of Environmental Protection.	N	N/A	Not a study; literature review only.
37.	A Case Study of Tire Crumb Use on Playgrounds: Risk Analysis and Communication When Major Clinical Knowledge Gaps Exists	Anderson et al. (2006). Environ Health Perspect.114(1):1-3. (Mark E. Anderson,[1,2] Katherine H. Kirkland,[3] Tee L. Guidotti,[4] and Cecile Rose[5])	[1]Department of Community Health Services, Denver Health, Denver, Colorado. [2]Department of Pediatrics, Univ. of Colorado Health Science Center, Denver, Colorado. [3]Association of Occupational and Environmental Clinics, Washington, DC. [4]Department of Environmental and Occupational Health, Mid-Atlantic Center for Child Health and the Environment, School of Public Health and Health Sciences, George Washington Univ. Medical Center, Washington, DC. [5]Departments of Medicine/ Preventive Medicine and Biometrics, National Jewish Medical and Research Center, Denver, Colorado.	N	N/A	Not a study; it's a commentary only. The authors declare they have no competing financial interests.

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
38.	A Survey of Microbial Populations in Infilled Synthetic Turf Fields	McNitt A.S., Petrunak D., Serensits T. (2006).	Penn State University, College of Agricultural Sciences, Department of Plant Science.	Y	This study was funded by the Synthetic Turf Council. In addition, Penn State has a partnership with FieldTurf. http://www.syntheticturfcouncil.org/?page=Research	This study does not address tire crumb. It is a study about the possible risk of Staph and MRSA infections on ST. Compare with Weber State study Determination of Microbial Populations in a Synthetic Turf System **Sample Size of Infill Material Being Tested** •Penn State-.075 Grams •Weber State-10 Grams **Collection Time Frame of Samples** •Penn State-15 days, June only. •Weber State-Once a week for 14 weeks. Very controlled samples. **Location of Samples** •Penn State-"High Use" and "Low Use" areas. •Weber State-1) Sideline, 2) 50 Yard Line and 3) end of field. 3 locations and same locations on both new and old field being sampled. **Time of Study** •Penn State-Height of Summer when field temperatures were at the peak. •Weber State-Height of the Actual Football Season when the fields were in use. **Technical Issues of reasons why the Penn St study did not find Pathogens (Staph)** •Penn State-Shortened agitation times for the samples (shortened time means less chance for full discovery of Pathogens, technical please read study) •Penn State-Failed to Isolate S. Aureus (Staph) on samples

Identification of Conflicts of Interest – EPA's "Tire Crumb and Synthetic Turf Field Literature and Report List as of Nov. 2015"						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
39.	Artificial Turf Pitches: An Assessment of Health Risks for Football Players and the Environment	Norwegian Institute of Public Health and the Radium Hospital. (2006). Norwegian Institute of Public Health and the Radium Hospital, Oslo, Norway.	Norwegian Institute of Public Health and the Radium Hospital. (2006). Norwegian Institute of Public Health and the Radium Hospital, Oslo, Norway.	N	N/A	Demonstrated elevated Particulate Matter (PM) 2.5 and carbon black levels in indoor turf arenas that used crumb rubber infills.
40.	Measurement of Air Pollution in Indoor Artificial Turf Halls	Dye C., Bjerke A, Schmidbauer N., Mano S. (2006).	Norwegian Pollution Control Authority/Norwegian Institute for Air Research, State Programme for Pollution Monitoring.	N	N/A	This study clearly demonstrated that crumb rubber infill in indoor turf halls generated significant amounts of fine respirable dust in the form of rubber particles and carbon black. (Crumb rubber in outdoor fields would obviously also generate significant amounts of fine respirable dust.) As the American Lung Association article explained, fine respirable dust in general, and carbon black in particular, are associated with numerous adverse health outcomes. There are no studies of fine respirable dust or carbon black exposure in the breathing space of field users during active field use conditions on indoor or outdoor fields. There are also no studies of the potential exposures to people living or attending class in buildings adjacent to artificial turf fields.
41.	Toxicological Evaluation for the Hazard Assessment of Tire Crumb for Use in Public Playgrounds	Birkholz[1] et al. (2003). J Air Waste Manag, 53:903-07.	[1]Enviro-Test Laboratories, Edmonton, Alberta, Canada.	Y	Promotes recycling used tires (see note).	"The Tire Recycling Management Association of Alberta provided funding through the Alberta Centre for Injury Control and Prevention. Harold Hoffman reviewed the initial proposal and provided comments." http://www.synturf.org/images/birkholz_crumb_safety_paper.pdf

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
Crumb Rubber Components						
42.	News Release: Many carcinogens found in Yale analysis of crumb rubber infill and playground mulch surfacing	Benoit, G. (2015)	Yale University for Environment and Human Health, Inc.	N	N/A	EHHI is a non-profit organization. Yale researchers document that no toxicological information exists for approximately half of the 96 identified chemicals in crumb rubber; inadequate information is available on many other chemicals. http://seas.yale.edu/news-events/news/study-led-gaboury-benoit-looks-chemicals-synthetic-playing-surfaces-0 http://www.ehhi.org/turf/findings0815.shtml http://www.ehhi.org/turf/metal_analysis2016.shtml
43.	Pilot study: characterizes chemical components of artificial turf, potential inhalation and dermal exposure to these chemicals	Harari, H. (Underway as of 2015)	Children's Environmental Health Center at Mount Sinai Hospital	N	N/A	http://www.slideshare.net/KatherineSouthwick1/cehc2015annualreport
44.	Scrap Tire Mulch on Duluth Public Schools' Playgrounds	North Shore Analytical for Duluth Parents for Healthy Playgrounds (2015).	North Shore Analytical for Duluth Parents for Healthy Playgrounds	N	N/A	Kirsling raised funds through a GoFundMe website

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
45.	Identification of Benzothiazole Derivatives and Polycyclic Aromatic Hydrocarbons as Aryl Hydrocarbon Receptor Agonists Present in Tire Extracts	He G[1], Zhao B, Denison MS. Environ Toxicol Chem. 2011 August ; 30(8): 1915–1925. doi:10.1002/etc.581	[1]Department of Environmental Toxicology, University of California, Davis, California	N	N/A	"Leachate from rubber tire material contains a complex mixture of chemicals previously shown to produce toxic and biological effects in aquatic organisms. The ability of these leachates to induce Ah receptor (AhR)-dependent cytochrome P4501A1 expression in fish indicated the presence of AhR active chemicals, but the responsible chemicals and their direct interaction with the AhR signaling pathway were not examined. Using a combination of AhR-based bioassays, we have demonstrated the ability of tire extract to stimulate both AhR DNA binding and AhR-dependent gene expression and confirmed that the responsible chemicals were metabolically labile. The application of CALUX (chemical-activated luciferase gene expression) cell bioassay-driven toxicant identification evaluation not only revealed that tire extract contained a variety of known AhR-active polycyclic aromatic hydrocarbons but also identified 2-methylthiobenzothiazole and 2-mercaptobenzothiazole as AhR agonists. Analysis of a structurally diverse series of benzothiazoles identified many that could directly stimulate AhR DNA binding and transiently activate the AhR signaling pathway and identified benzothiazoles as a new class of AhR agonists. In addition to these compounds, the relatively high AhR agonist activity of a large number of fractions strongly suggests that tire extract contains a large number of physiochemically diverse AhR agonists whose identities and toxicological/biological significances are unknown."

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
46.	Release of Polycyclic Aromatic Hydrocarbons and Heavy Metals from Rubber Crumb in Synthetic Turf Fields: Preliminary Hazard Assessment for Athletes	Marsili L, Coppola D, Bianchi N, Maltese S, Bianchi M (2015) J Environ Anal Toxicol 5: 265. doi:10.4172/2161-0525.1000265	[1]Department of Physical Sciences, Earth and Environment, Siena University, Via Mattioli 4, 53100 Siena, Italy. [2]Department of Political Science and International, Siena University, Via Mattioli 10, 53100 Siena, Italy.	N	N/A	"Synthetic turf, made with an infill of rubber crumb from used tyres or virgin rubber, is now common in many sporting facilities. It is known that it contains compounds such as polycyclic aromatic hydrocarbons (PAHs) and heavy metals. We evaluated in nine samples of rubber crumb the total content of some heavy metals (Zn, Cd, Pb, Cu, Cr, Ni, Fe) normally found in tyres by microwave mineralization and the levels of the 14 US EPA priority PAHs by Soxhlet extraction and HPLC analysis. The results showed high levels of PAHs and zinc in all rubber crumb samples compared to rubber granulate limits set by Italian National Amateur League (LND). Following the precautionary principle, a risk assessment at 25°C was done, using the Average Daily Dose (ADD) assumed by athletes, expressed in terms of mass of contaminant per unit of body weight per day (mg/kg day), and the Lifetime Average Daily Dose (LADD) and then evaluating the Hazard Index (HI) and the Cumulative Excess Cancer Risk (∑ECR). In the different rubber granulates samples the HI ranges from a minimum of 8.94×10-7 to a maximum of 1.16×10-6, while the ∑ECR ranges from a minimum of 4.91×10-9 to a maximum of 1.10×10-8. Finally, the aim of this study was to estimate the "hazard" for athletes inhaling PAHs released at the high temperatures this synthetic turf may reach. Then a sequence of proofs was carried out at 60°C, a temperature that this rubber crumb can easily reach in sporting installations, to see whether PAH release occurs. The toxicity equivalent (TEQ) of evaporates from rubber crumb is not negligible and represents a major contribution to the total daily intake of PAHs by different routes."

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
47.	Hazardous organic chemicals in rubber recycled tire playgrounds and pavers	Llompart, M.[a], Sanchez-Prado, L.[a], Lamas, J. P.[a], Garcia-Jares C.[a], Roca, E.[b], Dagnac, T.[c] (2013). Chemosphere, 423-431.	[a]Departamento de Quimica Analitica, Nutricion y Bromatologia, Facultad de Quimica, Universidad de Santiago de Compostela, Santiago de Compostela 15782, Spain. [b]Departamento de Ingeniería Química, Escuela de Ingenieria, Universidad de Santiago de Compostela, Santiago de Compostela 15782, Spain. [c]INGACAL (Galician Institute for Food Quality)–CIAM (Agrarian and Agronomic Research Centre), Laboratory of Food/Feed Safety and Organic Contaminants, Apartado 10, E-15080 A Coruña, Spain. *Corresponding author. Tel.: +34 881814225. E-mail address: maria.llompart@usc.es (M. Llompart)	N	N/A	"In this study, the presence of hazardous organic chemicals in surfaces containing recycled rubber tires is investigated. Direct material analyses using solvent extraction, as well as SPME analysis of the vapour phase above the sample, were carried out. Twenty-one rubber mulch samples were collected from nine different playgrounds. In addition, seven commercial samples of recycled rubber pavers were acquired in a local store of a multinational company. All samples were extracted by ultrasound energy, followed by analysis of the extract by GC–MS. The analysis confirmed the presence of a large number of hazardous substances including PAHs, phthalates, antioxidants (e.g. BHT, phenols), benzothiazole and derivatives, among other chemicals. The study evidences the high content of toxic chemicals in these recycled materials. The concentration of PAHs in the commercial pavers was extremely high, reaching values up to 1%. In addition, SPME studies of the vapour phase above the samples confirm the volatilisation of many of those organic compounds. Uses of recycled rubber tires, especially those targeting play areas and other facilities for children, should be a matter of regulatory concern."

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
48.	Empire State Consumer Project 2015 Children's Products Safety Report	Chittenden, C., Muir, E. (2015). (Artificial Turf pp. 18-20, Artificial Mulch pp.21-22, Attachments pp. 32-33.)	Empire State Consumer Project, Inc.	N	N/A	Non-profit organization "The attached table (last page of attached) lists results obtained on materials used in rubber mulch. Rubber mulch is made of ground recycled tires like those used for making artificial turf fields. The mulch is advertised as a garden and playground mulch. Some products are marked "Playground safety tested." There are no government standards for testing the safety of rubber mulch for playground use or for garden use. The East Rochester, New York school district is using Nike Grind for the infill on its artificial turf field. Among other health effects caused by arsenic and cadmium, both are known to be human carcinogens (cancer classification NTP). Zinc is known to cause respiratory and digestive health effects, and pancreatic and kidney damage http://www.atsdr.cdc.gov/substances/index.asp. Inhalation, ingestion, and dermal exposure to toxic chemicals are all concerns where children play. Where foods are grown for human consumption, toxic chemicals potentially leaching into plants is also a concern that warrants study. **We have included only chemicals that show levels higher than current acceptable limits. The 'limits' are NYS DEC soil cleanup guidelines for brownfields. These are minimum requirements and do not imply safety. Limits must be adjusted downward when multiple chemicals are found together.** US EPA limits for groundwater and wildlife exposure have not been included. Although some chemicals show values below equipment detection limits, in some cases, detection limits may be higher than DEC limits; these chemicals warrant further analysis."

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
Particulate Matter (PM)						
49.	American Lung Association, non-profit: State of the Air 2015: Particle Pollution	American Lung Association. (2015).	American Lung Association (2015)	N	N/A	This article explains health risks associated with respirable dust, or the PM 10 and PM 2.5 and carbon black that you have been hearing about. (PM size 10 microns, or 2.5 microns and smaller, is abbreviated as PM 10 and PM 2.5.) Short-term exposure risks include increased severity of asthma attacks in children; increased hospitalizations for asthma in children; death from respiratory and cardiovascular disease, including stroke; and increased numbers of heart attacks.
Toxicity						
50.	Carbon nanotubes introduced into the abdominal cavity of mice show asbestos-like pathogenicity in a pilot study	Poland Craig A, et al. Nature Nanotechnology 2008. 3: 423-428.		N	N/A	
51.	Supplementary Guidance for Conducting Health Risk Assessment of Chemical Mixtures	EPA Risk Assessment Forum Technical Panel. (2000). Washington DC.	U.S. Environmental Protection Agency			**Thus far, risk assessments on crumb rubber, a complex chemical mixture, have not been conducted in a manner consistent with these guidelines.** The guidelines define a complex mixture thus: "A mixture containing so many components that any estimation of its toxicity based on its components' toxicities contains too much uncertainty and error to be useful…Risk assessments of complex mixtures are preferably based on toxicity and exposure data on the complete mixture..." Appendix B p.2

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
52.	Assessing the carcinogenic potential of low-dose exposures to chemical mixtures in the environment: the challenge ahead	Goodson, W. H., Lowe, L., & al, e. (2015). Carcinogenesis, S254-S296.	(Over 141 affiliations; see hyperlink.)	N	N/A	This paper reports that the World Health Organization and the International Agency for Research on Cancer (IARC) suggest that the fraction of cancers attributable to toxic environmental exposures is between 7% and 19% of all cancers; other sources suggest the proportion of cancers due to unknown causes may be much higher. Supported by over 500 references, this paper presents evidence of physiologic mechanisms that predict/explain how chemicals that are not carcinogens when acting alone (heavy metals, endocrine disruptors, and others) can collectively work through different pathways (such as immune suppression) at different points in time to ultimately induce cancer. Note: Other articles in the supplement would also prove relevant.
53.	Toxicity and metabolism of methylnaphthalenes: Comparison with naphthalene and 1-nitronaphthalene	Lin, C. Y., Wheelock, A. M., Morin, D., Baldwin, R. M., & al, e. (2009). Toxicology, 16-27.		N	N/A	
54.	Automobile Tires a Potential Source of Highly Carcinogenic Dibenzopyrenes to the Environment	Ioannis Sadiktsis, et al. Environ. Sci. Technol. Feb 21, 2012, 46, 3326−3334.		N	N/A	"…Through the release of PAHs from stockpiled scrap tires, PAH emissions from pyrolysis of scrap tires or leaching of PAHs from recycled tire rubber material, tires are a source of environmental pollution of PAHs throughout their entire lifecycle."

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
Health Effects						
55.	Determination of Microbial Populations in a Synthetic Turf System	Bass, Jason J. and Hintze, David W. (2013)	Weber State University	N	N/A	**Sample Size of Infill Material Being Tested** •Penn State-.075 Grams •Weber State-10 Grams **Collection Time Frame of Samples** •Penn State-15 days, June only. •Weber State-Once a week for 14 weeks. Very controlled samples. **Location of Samples** •Penn State-"High Use" and "Low Use" areas. •Weber State-1) Sideline, 2) 50 Yard Line and 3) end of field. 3 locations and same locations on both new and old field being sampled. **Time of Study** •Penn State-Height of Summer when field temperatures were at the peak. •Weber State-Height of the Actual Football Season when the fields were in use. **Technical Issues of reasons why the Penn St study did not find Pathogens (Staph)** •Penn State-Shortened agitation times for the samples (shortened time means less chance for full discovery of Pathogens, technical please read study) •Penn State-Failed to Isolate S. Aureus (Staph) on samples

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
56.	A High-Morbidity Outbreak of Methicillin-Resistant Staphylococcus aureus among Players on a College Football Team, Facilitated by Cosmetic Body Shaving and Turf Burns	Elizabeth M. Begier[1,4], Kasia Frenette[1], Nancy L. Barrett[1,2], Pat Mshar[1], Susan Petit[1,2], Dave J. Boxrud[5], Kellie Watkins-Colwell[3], Sheila Wheeler[3], Elizabeth A. Cebelinski[5], Anita Glennen[5], Dao Nguyen[4,6], James L. Hadler[1], The Connecticut Bioterrorism Field Epidemiology Response Team[a]	[1]Infectious Diseases Division, Hartford [2]Connecticut Active Bacterial Core Surveillance Project, Connecticut Department of Public Health, Hartford [3]Student Health Services of Sacred Heart University, Fairfield, Connecticut [4]Epidemic Intelligence Service Program, Centers for Disease Control and Prevention, Atlanta, Georgia [5]Division of Public Health Laboratories, Minnesota Department of Public Health, Minneapolis, Minnesota [6]Los Angeles County Department of Health Services, Los Angeles, California	N	N/A	"Potential conflicts of interest. All authors: No conflict." "Players who sustained turf burns had a risk of infection that was 7 times higher than that for players without turf burns… MRSA was likely spread predominantly during practice play, with skin breaks facilitating infection. Measures to minimize skin breaks among athletes should be considered, including prevention of turf burns and education regarding the risks of cosmetic body shaving. MRSA-contaminated pool water may have contributed to infections at covered sites, but small numbers limit the strength of this conclusion. Nevertheless, appropriate whirlpool disinfection methods should be promoted among athletic trainers."
57.	Synthetic Turf Heat Evaluation – Progress Report	Penn State's Center for Sports Surface Research. (January 2012).	Penn State's Center for Sports Research	Y	Penn State has a partnership with FieldTurf.	Lowest temp in a test of synthetic fields on an average 76 degree air temp day…154. See pp. 12-14 for outdoor testing."No product in this test substantially reduced surface temperature compared to the traditional system of green fibers filled with black rubber in both the indoor and outdoor test. Reductions of five or even ten degrees offer little advantage when temperatures still exceed 150 °F. Until temperatures can be reduced by at least twenty or thirty degrees for an extended period of time, surface temperature will remain a major issue on synthetic turf fields."

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
58.	Synthetic Surface Heat Studies	Williams, C.F., and Pulley, G.E. (2002)	Brigham Young University	N	N/A	
59.	Associations between health effects and particulate matter and black carbon in subjects with respiratory disease	Jansen Karen L., et al. Environ Health Perspect. 2005. 113:12: 1741–1746.		N	N/A	
60.	Acute respiratory inflammation in children and black carbon in ambient air before and during the 2008 Beijing Olympics	Lin W., et al. Environ Health Perspect. 2011 Oct;119:10:1507-12.		N	N/A	
61.	Association of black carbon with cognition among children in a prospective British cohort study	Sugilia S. Franco, et al. American Journal of Epidemiology 2007, 167:3:280-286.		N	N/A	
62.	Does traffic exhaust contribute to the development of asthma and allergic sensitization in children: findings from recent cohort studies	Lennart, B. Bertil, F. Environmental Health 2009, 8:17.		N	N/A	

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
63.	Occupational Exposure in the Rubber Manufacturing Industry	IARC Monographs Volume 100F, Supplementary Web Tables, Section 2, Cancer in Humans. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans.	World Health Organization (WHO), International Agency for Research on Cancer (IARC	N	N/A	These web tables formed part of the original submission and have been peer reviewed. They are posted as supplied by the Working Group. Readers are requested to report any errors to: edit-vol100F@iarc.fr.
64.	Tire-Derived Flooring Chemical Emissions Study and Indoor Reference Exposure Levels (iRELs)	Office of Environment Health Hazard Assessment's (OEHHA), CalRecycle, California Department of Public Health's (CDPH). 2011.	Office of Environment Health Hazard Assessment's (OEHHA), CalRecycle, California Department of Public Health's (CDPH)	Y	CalRecycle, as part of OEHHA, promotes recycling used tires.	
65.	Dermal exposure to chemicals in the workplace: just how important is skin absorption?	Semple, S. Department of Environmental & Occupational Medicine, University of Aberdeen, Foresterhill, Aberdeen AB25 2ZD, UK. Occup Environ Med 2004;61:376-382 doi:10.1136/oem.2003.010645.	Department of Environmental & Occupational Medicine, University of Aberdeen	N	N/A	

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
66.	Nanotechnology: Toxicologic Pathology	Ann F. Hubbs,[1] Linda M. Sargent,[1] Dale W. Porter,[1] Tina M. Sager,[1] Bean T. Chen,[1] David G. Frazer,[1] Vincent Castranova,[1] Krishnan Sriram,[1] Timothy R. Nurkiewicz,[2] Steven H. Reynolds,[1] Lori A. Battelli,[1] Diane Schwegler-Berry,[1] Walter McKinney,[1] Kara L. Fluharty,[1] and Robert R. Mercer[1] Toxicol Pathol. Author manuscript; available in PMC 2015 Dec 1. Published in final edited form as: Toxicol Pathol. 2013 Feb; 41(2): 395–409. Published online 2013 Feb 6. doi: 10.1177/0192623312467403 PMCID: PMC4665093 NIHMSID: NIHMS723787	[1]Health Effects Laboratory Division, National Institute for Occupational Safety and Health, Morgantown, West Virginia [2]Center for Cardiovascular and Respiratory Sciences, West Virginia University School of Medicine, Morgantown, West Virginia Address correspondence to: Ann F. Hubbs, Health Effects Laboratory Division, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 1095 Willowdale Rd, Morgantown, WV 26505; Email: vog.cdc@sbbuha	N	N/A	

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
67.	nanoCOLT - Long-term effect of modified carbon black nanoparticles on healthy and damaged lungs	Prof. Dr. Bernd Müller, Philipps-University of Marburg, Marburg (DE) Press Release (16.10.2014, in GERMAN only). *Biowissenschaftler erforschen Auswirkungen von Nanopartikeln - Marburger Lungenspezialist leitet bundesweiten Forschungsverbund* (uni-marburg.de)	FB 20 Medizin und Universitätsklinikum - Klinik für Innere Medizin - Pneumologie, Philipps-University of Marburg, Marburg (DE), Institut für Anatomie - AG Barriere-Organe, University Lübeck, Lübeck (DE), Fraunhofer Institute for Toxicology and Experimental Medicine (ITEM), Hannover (DE), Engler-Bunte-Institute - Division of Combustion Technology (EBI vbt), Karlsruhe Institute of Technology (KIT), Karlsruhe (DE), Experimental Pneumology, Research Center Borstel - Leibniz-Center for Medicine and Biosciences, Borstel (DE)	N	N/A	
68.	Toxicological Profile for Synthetic Vitreous Fibers	Syracuse Research Corporation for U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. 2004.	Syracuse Research Corporation for U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry.	N	N/A	

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
69.	International Agency for Research on Cancer (IARC) - Summaries & Evaluations: The Rubber Industry (Group 1)	International Agency for Research on Cancer (IARC).	International Agency for Research on Cancer (IARC).	N	N/A	
70.	Work Environments and Exposure to Hazardous Substances in Korean Tire Manufacturing	Naroo Lee[1] Byung-kyu Lee,[2] Sijeong Jeong,[2] Gwang Yong Yi,[1] and Jungah Shin[1] Saf Health Work. 2012 Jun; 3(2): 130–139. Published online 2012 Jun 8. doi: 10.5491/SHAW.2012.3.2.130 PMCID: PMC3440462.	[1]Occupational Safety and Health Research Institute, Incheon, Korea. [2]Korea Occupational Safety and Health Agency, Incheon, Korea. Corresponding author. Correspondence to: Naroo LEE. Occupational Safety and Health Research Institute, Korea Occupational Safety and Health Agency, 478, Munemi-ro, Bupyeong-gu, Incheon 403-711, Korea. Tel: +82-32-510-0802, Fax: +82-32-518-0864, Email: ten.ahsok@eelooran	N	N/A	

Recommendations for Studies to be Added						
	Study	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
71.	Urban Airborne Particulate Matter: Origin, Chemistry, Fate and Health Impacts	Springer-Verlag Berlin Heidelberg. Edited by Fathi Zereini, Clare L. S. Wiseman. 2010.	Institute for Atmospheric and Environmental Sciences. Department of Environmental Analytical Chemistry, J.W. Goethe-University. Adaptation and Impacts Research Group. Institute for Environmental Studies. University of Toronto.	N	N/A	
72.	Effects of Chemical Co-exposures at Doses Relevant for Human Safety Assessments	European Centre for Ecotoxicology and Toxicology of Chemical (ECETOC). Technical Report No. 115. ISSN-0773-8072-115 (print). ISSN -2079-1526-115 (online). Brussels, July 2012.	European Centre for Ecotoxicology and Toxicology of Chemical (ECETOC)	N	N/A	
73.	Leaching of Phenols from Tire Shreds in a Noise Barrier	Håøya, A.O.[1], Aabøe, R.[2], Edeskär, T.[3].	[1]RAMBØLL. [2]Norwegian Public Roads Authorities, (NPRA) Norway. [3]Luleå University of Technology, Sweden.	N	N/A	

Other Data for Consideration						
	Title	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
News Reports/Video						
74.	Field Turf admits lead is in their [artificial turf] product but opposes signs to inform the public	YouTube posted (April 7, 2016).	SF Parks	N	N/A	Video "March 11, 2016 testimony by Field Turf Mid-Atlantic Sales representative to the Ways and Means Committee of the Maryland General Assembly in a hearing on HB883 seeking to require informational signs at the entrance to artificial turf fields regarding precautions recommended by the CDC to safeguard children from exposures to lead. When asked by Delegate Mary Washington (D43, Baltimore City) about the status of a law suit against Field Turf regarding lead content, and whether Field Turf's artificial turf products contain lead, the response was 'Yes, there is lead in our product.'" Yet Field Turf opposes HB883."
75.	NBC News - How Safe is the Artificial Turf on Your Child's Sports Field ? (cancer)	Gosk, S.	NBC News	N	N/A	Video
76.	Is Rubber Mulch a Safe Surface for Your Child's Playground?	Rappleye, H., Gosk, S., Monahan, K., Alba, M.	NBC News	N	N/A	Video
77.	E:60 Sports Matter: Turf Wars: How Safe Are The Fields Where We Play?	Foudy, J. (November 24, 2015).	ESPN	N	N/A	Video

Other Data for Consideration						
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78.	Children and synthetic turf	Forman, J., Landrigan, P., Brown, D., Michels, K., Alderman, N.	Mount Sinai School of Medicine, Children's Environmental Health Center at Mount Sinai Hospital, Environment and Human Health, Inc.	N	N/A	Video includes pediatricians, toxicologists and others discussing plastic turf in addition to other toxins.
79.	The Health Hazards of Artificial Turf Crumb Rubber Playing Fields	Landrigan, P.	Children's Environmental Health Center at Mount Sinai Hospital	N	N/A	Video
80.	Are we treating women athletes like guinea pigs?	International News Review	International News Review	N	N/A	Video
81.	Playground Hazards: Are Rubber Chips Toxic?	Enninga, H.	WDIO-TV, LLC	N	N/A	Video "'He would come home with a black dust on him,' Kirsling said. 'It would be all over his legs. I mean, his legs would be black if he wore shorts.' Then one day this May, Kirsling said he realized those playground drawbacks might be more serious. '(Jack) would come home and he would blow his nose, and it would be gray from the dust,' Kirsling said. He would say, 'I have a headache. I have a scratchy throat.' After Kirsling spoke to other parents who had also noticed similar symptoms, his initial endearment turned to alarm. 'It seems very odd that more than one child is coming home and saying the same things,' Kirsling said. 'Something doesn't seem right here.'" See: Scrap Tire Mulch on Duluth Public Schools' Playgrounds

Other Data for Consideration						
	Title	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
82.	Student suffers severe injuries during punishment	Smith, M.	ABC 7 KVIA	N	N/A	Video "It took less than 200 yards for Brandon Chacon, 15, to bruise and blister his hands beyond recognition Tuesday. Chacon, taking part in a football drill known as "bear crawls," is now unable to play football all because of a punishment administered by an assistant coach… On Tuesday the temperature was around 96 degrees... Studies done by Penn State University show that turf, like the kind on El Dorado's new football field, can see temperatures 35-55 degrees hotter than normal grass. Previous studies done by Texas A&M show turf can reach temperature above 160 degrees in the state of Texas."
83.	Football player burns hand on hot turf after coach's practice punishment	Newton, J.	News 8 WTNH	N	N/A	Video "…players at Stratford High, forced to crawl on the artificial turf with their bare hands during the September heat wave. Pictures…showing one student-athlete's hand with a huge blister covering most of his palm. Apparently caused by the extreme temperature of the turf, against his bare skin. 'Ridiculous. That was insane. That can cause an infection,' said Felicia Murray, who has a daughter at the school. Our own thermometer showed temperatures of the artificial grass hovering around 150 degrees."

Other Data for Consideration						
	Title	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
Other Testimonial						
84.	Life After Crumb Rubber	Lindstrum, A. Playground Underlayment Committee.	Playground Underlayment Committee	N	N/A	"The Crumb Rubber underlayment was unacceptable to many parents for a variety of reasons. It off-gassed heavily year-round, though it was much stronger in hot weather. The smell had a strong chemical quality to it, similar to industrial solvents and tires. A number of adults and children reacted strongly to the Crumb Rubber after being on the playground for only minutes. Some had allergic reactions and had to get medical attention. Others got headaches and nausea. Enough people reacted strongly enough that the school had an unusually difficult time scheduling volunteers for playground duty during recess…"
Overviews						
85.	Written Testimony before the Connecticut General Assembly on Children	Wright, R., Evans, S. (2016).	Children's Environmental Health Center at Mount Sinai Hospital	N	N/A	Testimony in Support of Raised Bill 5139, An Act Concerning the Use of Recycled Tire Rubber at Municipal and Public School Playgrounds. "Given the hazards associated with recycled tire rubber, it is our recommendation that these products never be used as surfaces where children play."
86.	Dr. Landrigan Answers Back-to-School Questions	Landrigan, P.	Children's Environmental Health Center at Mount Sinai Hospital	N	N/A	
87.	Reducing Environmental Cancer Risk: What We Can Do Now	President's Cancer Panel. (2010). Bethesda: U.S. Department of Health and Human Services.		N	N/A	

Other Data for Consideration						
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88.	Substantial contribution of extrinsic risk factors to cancer development	Wu, S., Powers, S., Wei, Z., & Hannun, Y. A. (2016). Nature, 43-47.		N	N/A	
89.	Artificial Turf: Exposures to Ground Up Rubber Tires on Athletic Fields and Playgrounds	Environment and Human Health, Inc. (EHHI)	Environment and Human Health, Inc. (EHHI)	N	N/A	Non-profit organization
90.	Overview of the Risks of Synthetic Turf Fields	Brown, D.	Environment and Human Health, Inc. (EHHI). (April 4, 2015).	N	N/A	Non-profit organization Dr. David Brown, among other qualifications, is a former Deputy Director of The Public Health Practice Group of ATSDR at the CDC. In this article, he details weaknesses in scientific studies and holes in the "collective database" to date. This overview outlines why children are specifically at higher risk to toxins, and why he and many other epidemiologists, toxicologists, and public health officials are concerned about crumb rubber. Instead of conducting research proactively, prior to health effects, Dr. Brown asserts that "a natural experiment is being conducted in which thousands of children are being exposed on playing fields to rubber 1) known to contain carcinogens and 2) documented to produce cancer in workers in the tire manufacturing plants."
91.	Fact Sheet: CPSC, EPA & CDC on Artificial Turf Safety & Precautions	Safe Healthy Playing Fields Coalition. (July, 2015).	Safe Healthy Playing Fields Coalition	N	N/A	Non-profit organization The Consumer Product Safety Commission (CPSC) and the Environmental Protection Agency (EPA) have retracted prior assurances regarding artificial turf, in acknowledgement of multiple concerns raised by the scientific community and the public. The Centers for Disease Control and Prevention (CDC) identifies artificial turf as one of seven sources of lead exposure for children.

Other Data for Consideration						
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92.	Crumb Rubber	Gilbert, S.	Toxipedia	N	N/A	Provides thorough overview of crumb rubber.
93.	Tire Crumb Synthetic Turf Study Reference Materials		QWERTY Media Resources	N	N/A	"This resource is being posted and maintained for educational, journalistic, and reference purposes. The content continues to be vetted and updated for factual accuracy." Provides thorough overview of synthetic turf including history.
News Articles						
94.	Texas Football Succumbs to Virulent Staph Infection From Turf	Epstein, V. Bloomberg. (December 21, 2007).	Bloomberg L.P.	N	N/A	Player suffers from MRSA recurrence via turf burn/Texas has 16x higher player MRSA infection rate than national avg. "'Mom, I can't move my arms or legs.'" Boone, 16, wide receiver, 'was suffering from a recurrence of…MRSA, which his doctor said he got through an abrasion from playing on artificial turf,' Baker said. Texas has artificial turf at 18 percent of its high school football stadiums, according to Web site Texasbob.com. It also has an MRSA infection rate among players that is 16 times higher than the estimated national average, according to three studies by the Texas Department of State Health Services."
95.	DCR removes tire mulch from local playgrounds	Oliveira, R. Jamaica Plain Gazette. (December 3, 2010).	Jamaica Plain Gazette	N	N/A	"The JP Moms group's efforts to get rid of the rubber mulch were based on fears that regular exposure to volatile organic compounds in the tires might have long-term negative health impacts. Some also said that exposure to the tires caused them to have respiratory issues, and complained that the light-weight material is easily spread throughout the park and carried home in children's' clothes."

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96.	Feds promote artificial turf as safe despite health concerns	Frank, T. USA Today. (March 16, 2015).	USA Today.	N	N/A	The article describes how the Synthetic Turf Council has mischaracterized the results of some studies on artificial turf fields and has ignored scientists' warnings about children possibly ingesting lead in turf and tire crumbs. The article describes the differing opinions of different health departments, and how the EPA ignored internal warnings from its scientists. It also discusses how the CPSC pronounced artificial turf, 'safe to play on,' whereas the CDC listed artificial turf as one of the top sources of lead exposure, along with paint and costume jewelry, for children.
97.	Critics say EPA played dual role in recycled tire controversy	Gutierrez, M. San Francisco Chronicle. (February 21, 2015).	San Francisco Chronicle.	N	N/A	This article discusses the EPA's role in promoting the use of crumb rubber and how it ignored its own scientist's concerns about the safety of using crumb rubber in children's play areas. It also discusses the apparent link between crumb rubber and increased lymphoma and leukemia incidence in soccer players.
98.	Combinations of 'safe' chemicals may increase cancer risk, study suggests	Harris-Lovett, S. Los Angeles Times. (July 1, 2015).	Los Angeles Times	N	N/A	"…it's plausible that consuming mixtures of these chemicals is riskier than consuming any one individually. 'To me, it's not a surprise,' said Birnbaum (Director of the National Institute of Environmental Health Sciences, NIEHS, of the NIH). Scientists know that small effects from many chemicals can add up to cause other diseases, she said. For instance, chemicals known as endocrine disruptors can lead to neurological, immune system and reproductive problems, among others. Considering the safety of individual chemicals is a lot like looking at the trees, but missing the forest, Birnbaum said.

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						When doing research to determine chemical safety, 'we've got to start thinking more about what reality is,' she said. This could mean sweeping changes in rules about the levels of chemicals considered safe in drinking water, food, and air. 'I'd like to see regulators and policy makers start looking at the totality of the exposure instead of one chemical at a time,'" she said.
Other Miscellaneous						
99.	Bioavailability Study Models	N/A	N/A	N	N/A	When reading the details of all the bioavailability studies, shreds and crumbs are used even when modeling bioavailability in simulated lung fluid. Athletes are not inhaling crumbs because the crumbs aren't floating in the air! They are inhaling PM 2.5 and PM 10 which remain in the lungs for days to months, not 24 hours. Similarly, ingestion is crumbs and dust via hand to mouth behavior. A half inch long shred is not a good model.
10(	Human Rights Tribunal of Ontario between Players on National Teams Participating in the FIFA Women's World Cup Canada and Canadian Soccer Association, Fédération Internationale de Football Association	Boies, Schiller & Flexner LLP Ryder, Wright, Blair & Holmes LLP Osler, Hoskin & Harcourt LLP (September 23, 2014).	Boies, Schiller & Flexner LLP Ryder, Wright, Blair & Holmes LLP Osler, Hoskin & Harcourt LLP	N	N/A	Synthetic turf named "inferior, dangerous and discriminatory." Suit filed against FIFA January 2015: discrimination for forcing to play on synthetic turf, World Cup 2015. The women dropped it, due to FIFA's lack of response, and some players said FIFA was going to retaliate against them personally. After what the women experienced this year, FIFA will NEVER again hold ANY World Cup on synthetic. "1) by forcing them to compete on a surface that fundamentally alters the way the game is played, (2) by

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						subjecting them to unique and serious risks of injury, and (3) by devaluing their dignity, state of mind and self-respect as a result of requiring them to play on a second-class surface before tens of thousands of stadium spectators and a global broadcast audience." "No soccer player prefers FieldTurf. It pales in comparison to a well-manicured grass pitch and takes some getting used to." "Turf exposes players to injuries that do not exist on natural grass, such as skin lesions, abrasions and lacerations." "In addition, artificial turf is uniquely vulnerable to degradation upon installation as a result of the effects of weathering, brushing and painting. CSA's site choice for the finals is particularly susceptible to such adverse effects as it is in use more than 200 days a year according to a report published in 2013. This type of use makes artificial turf an even more dangerous and difficult surface on which to play." "force the top female soccer players in the world to play their preeminent event under inferior, dangerous and discriminatory conditions." Also see p. 7 - turf burn, other dangers of synthetic turf.
10	Public Health Statement for Lead	ATSDR. (August 2007). CAS# 7439-92-1	ATSDR	N	N/A	Synthetic turf is known to give players horrible turf burns frequently. It opens them up to more infection and apparently, more lead exposure. "More lead can pass through skin that has been damaged (for example, by scrapes, scratches, and wounds)."

Other Data for Consideration

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102	Surface Temperature of Synthetic Turf	Penn State Center for Sports Surface Research. The Sportsturf Scoop: Surface Temperature of Synthetic Turf	Penn State Center for Sports Surface Research	Y	Penn State has a partnership with FieldTurf.	"Children less able to adapt to changes in temperature...How does high surface temperature affect field users?...Greater chance of heat-related issues. Discomfort, dehydration, heat stroke." Some believe that the crumb rubber infill is to blame for high temperatures. However, no matter what type of infill is used, "Fibers are a major contributor to high surface temperatures."
103	Miscellaneous Extreme Temperature Information	N/A	N/A	N	N/A	**Sample Temperatures 2015 WWC** **Air** / **Synthetic Turf** 82 °F / 150 °F / From 86 °F to over 122 °F within 5 minutes. 77 °F / 131 °F 64 °F / 129 °F 77 °F / 109 °F 78 °F / 120 °F *Sources:* *https://en.m.wikipedia.org/wiki/2015_FIFA_Women%27s_World_Cup* *http://news.nationalpost.com/sports/soccer/womens-world-cup-offence-is-hot-and-the-fields-are-hotter-renewing-complaints-over-artificial-turf* *http://t.thestar.com/#/article/sports/soccer/2015/06/08/womens-world-cup-heats-up-as-pitch-level-mercury-soars.html*

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						• **Kansas City, Missouri, Stanley-Durwood Soccer Stadium**
						  ○ 95 °F air, 159 °F synthetic turf http://www.sportingnews.com/soccer/story/2014-08-23/alex-morgan-nwsl-portland-thorns-hot-turf-field-uswnt
						• **On a 98 °F (37 °C) day, MU's Faurot Field had a surface temperature of 173 °F (78 °C)**. The temperature of the nearby natural grass was only 105 °F (41 °C). Even at head-level, the temperature over the artificial turf was 138 °F (59 °C).[13]
						  ○ Dr. Brad Fresenburg, turfgrass specialist from the University's Division of Plant Sciences, explains the danger of artificial turf is that the rubber and plastic materials used absorb more of sunlight's heat energy than natural grass, causing extraordinarily high temperatures. http://plasticfieldsfornever.org/ArtificialTurfBooklet.pdf "Synthetic Turf Playing Fields Present Unique Dangers," *Applied Turfgrass Science,* November 3, 2005.
						• **Columbia, Missouri: Professor says "the fibers in a synthetic field control the heat**."
						According to a news report in the *Columbia Missourian* (6 September 2013), the Faurot Field at the University of Missouri's Memorial Stadium registered a high of 151 degrees during the school's football season opener on

Other Data for Consideration						
	Title	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
						Saturday 31 August. “A team of turf experts used an infrared thermometer to measure the heat coming off of the field in Memorial Stadium.” “The National Weather Service in St. Louis [had] reported Saturday'' high temperature in Columbia as 100 degrees, but that reading was on a natural grass surface about 6 feet above the ground.” The service’s hydrologist, Mark Fuchs, said “on an artificial-turf surface, the temperatures jump.” The Division of Plant Sciences professor Brad Fresenburg had this to say about the heating of the artificial turf fields: sunlight plays a vital role in turf temperature. “If we’ve got the sun in the air and there’s a clear blue sky, we’re easily going to be in the 150s. It could even be in the 160s.” “We know that the fibers in a synthetic field control the heat.” “Artificial fields are made of petroleum-based fibers that absorb heat as weather conditions change. Mid- to late afternoon, when direct sunlight has had its greatest effect on temperature, is usually when turf fields reach high temperatures. Much like vinyl in cars, the fibers capture and hold heat until the field has time to cool. Often, the fields get so hot that the heat can be felt through the soles of shoes.” “Temperature readings vary depending on the kind of surface, amount of cloud cover, humidity, wind speed and thermometer height during the time of the reading. A slight breeze, for instance, can change temperatures by 20 or 30 degrees.” “The clarity of the sky and the time of day — that makes a huge difference in what reflects off of that field as far as heat. The sky, if it’s more clear blue, that’s going to allow the field to absorb more heat.” Source: Beth Castle, “Artificial turf turns up the heat on Faurot Field,” in the *Columbia Missourian*, 5

Other Data for Consideration						
	Title	**Author(s)**	**Group(s)**	**Conflict of Interest?**	**Reason for Conflict of Interest**	**Notes**
						September 2013, at http://www.columbiamissourian.com/a/165243/artificial-turf-turns-up-the-heat-on-faurot-field/ . See pdf here. • **Cooling the synthetic field only lasts 5 minutes** Irrigation of the synthetic turf had a significant result cooling the surface from 174 °F to 85 °F but after five minutes the temperature rebounded to 120 °F. The temperature rebuilt to 164 °F after only twenty minutes. http://plasticfieldsfornever.org/ArtificialTurfBooklet.pdf

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Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ Comment on FR Doc # 2016-03305

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General Comment

Attached are my comments regarding Collections Related to Synthetic Turf Fields with Crumb Rubber Infill 0923-16PJ
FR Doc # 2016-03305

Thank you for your consideration.

Jean B Barish, Esq., MS

Attachments

FR Doc # 2016-03305

JEAN B BARISH, Esq., MS
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May 2, 2016

Leroy A. Richardson
Information Collection Review Office
Centers for Disease Control and Prevention
1600 Clifton Road NE, MSD-74
Atlanta, GA 30329

Re: Docket No. 2016-03305

Dear Mr. Richardson:

Thank you for this opportunity to comment on the proposed Federal research on the toxicity of synthetic turf athletic fields with rubber tire crumb infill. I have worked as a research scientist, a consumer advocate, and an attorney specializing in health care law. I am also affiliated with several environmental organizations that have been concerned about this issue. One of these organizations, *Action for Nature*, recognized Claire Dworsky as an AFN Eco-Hero for her study on the toxicity impact of synthetic turf with rubber tire crumb. (http://actionfornature.org/2011_winners.aspx; http://www.scgh.com/featured/success-stories/4th-graders-research-reveals-dangers-of-artificial-turf/nggallery/image/image-463)

Rubber tires are a complex blend of materials and chemicals, many of which are carcinogenic, neurotoxic, eye and throat irritants, and toxic to many organ systems. These chemicals include but are not limited to polynuclear aromatic hydrocarbons (PAHs); phthalates; volatile organic compounds (VOCs); heavy metals including lead, zinc, iron, manganese, and mercury; nanoparticles such as carbon black; and dioxin. Additionally, a great deal of dust and particulate matter, including nanoparticles, are created during play on an artificial turf field. All of this harmful material can enter the body by inhalation, ingestion, dermal contact and eye contact. Other health and safety concerns include sports injuries; infections from methicillin-resistant Staphylococcus aureus (MRSA); overheating of the fields; and; disposal problems. Finally, the use of artificial turf with rubber tire crumb also raises environmental concerns.

Many cities and school districts have chosen not to install turf with rubber tire crumb after considering the health and environmental risks. For example, the City of New York Parks and Recreation and Department has not used rubber tire crumb infill since 2008. And in 2009 the Los Angeles Unified School District served manufacturers of artificial turf with Proposition 65 Notices claiming that artificial turf with SBR infill contains unacceptable levels of lead and carbon black. LAUSD no longer uses turf with rubber tire crumb. Several school districts in Sonoma County in Norther California have also decided not to use rubber tire crumb infill, and the San Francisco Recreation and Parks Department is planning to replace worn out fields with safer, organic infill. These are just a few examples of schools and municipalities throughout the country that no longer use synthetic turf with rubber tire crumb.

In view of the growing concern about the health and environmental hazards of these fields, your research should be done rigorously and thoroughly. To assure the studies will provide meaningful information, please consider the following recommendations:

Study Recommendations

It is important that samples of rubber tire crumb are taken from an adequate number of fields throughout the country. There are many variables that must be considered to assure adequate sampling, including but not limited to the following: age of the fields; weather conditions to which the fields are exposed such as temperature, humidity, precipitation; use of the fields; age of the fields; source of the tire crumb; location on the field from which the samples are taken. Rubber tire crumb comes from a huge variety of tires that have been manufactured all over the world. This lack of homogeneity of the rubber tire crumb must be accounted for in your research.

Numerous studies have identified several categories of chemicals found in rubber tire crumb, including but not limited to: polyaromatic hydrocarbons; phthalates; dioxins; semivolatile compounds; nitrosamines, and; heavy metals. These should all be measured.

Rubber tires contain nanotubules. These should be measured.

There is also off-gassing of volatile compounds on synthetic turf fields, as well as the dispersal of particulates into the air. These volatiles and particulates should also be measured on indoor and outdoor fields under various ambient and play conditions when the fields are in use.

There is growing concern about the health risks of exposure to nanoparticles and carbon black. These particles are able to cross biological membranes such as the blood-brain barrier and access cells, tissues and organs. The risk of exposure to nanoparticles and carbon black should be studied. (Nanoparticles – known and unknown health risks. Peter HM Hoet, Irene Brüske-Hohlfeld and Oleg V Salata. *Journal of Nanobiotechnology* 20042:12. http://jnanobiotechnology.biomedcentral.com/articles/10.1186/1477-3155-2-12). See also: "Understanding the mechanism of toxicity of carbon nanoparticles in humans in the new millennium: A systemic review," Mukesh Sharma. *Indian Journal of Occupational and Environmental Medicine,* vol. 14(1), 2010, web publication June 24, 2010, abstract available at http://www.ijoem.com/article.asp?issn=0019-5278;year=2010;volume=14;issue=1;spage=3;epage=5;aulast=Sharma ; Peter Gehr "Nanoparticles can penetrate brain tissue," on the website of the Federal Office for the Environment (FOEN) (also BAFU in German), March 2010, available at http://www.bafu.admin.ch/dokumentation/umwelt/10649/10659/index.html?lang=en ; "Toxic Potential of Materials at the Nanolevel," Mädler,and Ning Li, *Science*, 3 February 2006: 622- 627, abstract at http://www.sciencemag.org/cgi/content/abstract/311/5761/622.

In addition to surveying field representatives to determine facility use and characteristics, please survey players, coaches, and spectators. This will provide more reliable information regarding field uses and conditions.

In addition to air monitoring, dermal sampling, and urinalysis, mucous membranes such as the oral cavity, nasal passages, and conjunctiva of players should also be sampled. Dermal sampling should include all exposed areas of the body, including the face and scalp.

Exposure characterization should also include contact with clothing and shoes, and the impact that has on the spread of material off-site. This is especially important since many people report that rubber tire crumb is tracked into cars and homes, and that players' clothing is covered with black dust after a game.

The risk of increased skin, muscular and joint injury caused by synthetic turf versus natural turf should be studied.

All impact studies should account for demographic variations in users of the fields, including age, gender, and race.

One of the adverse health impacts of artificial turf fields is related to the fact that the fields get much hotter than natural grass fields. Synthetic surface undesirably absorbs, retains and emanates heat at temperatures and rates that can be dangerous. (https://www.pitchcare.com/magazine/concerns-over-heat-stress-on-3g-surfaces.html) The health hazards of playing on these hot fields should be studied.

Analysis of the health hazards of rubber tire crumb must also analyze the cumulative risk of exposure to the synthetic turf with rubber tire crumb, defined in the US EPA document "Framework for Cumulative Risk Assessment" as "the combined risks from aggregate exposure (i.e., including all relevant routes) to multiple agents or stressors." (U.S. EPA 2003. Framework for Cumulative Risk Assessment. PA/630/P-02/001A. Washington, DC)

Please review the Material Safety Data Sheets (MSDS) for the manufacturer of rubber tire crumb and evaluate these for information about health and safety hazards.

In addition to an analysis of the constituents of rubber tire crumb and exposure levels, the synthetic turf fibers also contain chemicals of concern, including but not limited to phthalates, quaternary ammonium bocides, BPA, acetone, elastomers, and heavy metals. A chemical analysis of a representative sample of turf fibers should be done.

Other Considerations

The following comments are also submitted for your consideration:

Epidemiological Studies

There is a growing data base of soccer players exposed to fields with rubber tire crumb that have developed cancer. Notably, there is a disproportionate number of young people lymphomas in this population. (http://www.ehhi.org/turf/cancer_patterns_1114.shtml) Epidemiological research is necessary to more accurately assess the health impacts of playing on artificial fields with rubber tire crumb. This research should study the incidence of cancer, as well as allergies, asthma and other respiratory disorders, gastrointestinal disorders, autoimmune diseases, neurological conditions, skin conditions, and the like. There is already a great deal of information about the components of rubber tire crumb. Epidemiological research is the next step that should be taken to determine whether exposure to these toxins on the playing field increases the risk of cancer and other health problems.

The testing your agency proposes will never capture what is really going in the real life exposures of a generation of young people. A national agency such as NCI or CDC has the resources to do the necessary epidemiological research. It should begin as soon as possible in order to protect a the young people who are now playing on these fields.

Animal Studies

Several experts I have spoken to have recommended that your research includes animal studies in order to better assess exposure risks. Please include animal studies in this project or explain why you do not plan to include it.

Environmental Impacts

Rubber tire crumb can also impact the environment, especially if the field is built above an aquifer. Chemicals from rubber tire crumb can leach into this underlying aquifer, as well as spill into waste water, poisoning drinking water and impacting aquatic life. Additionally, synthetic turf fields with rubber tire crumb can impact the ecosystems where they are installed. Accordingly, please address the following issues in your research:

Include consideration of the impact of these fields on rainwater and other waters that flow through the turf that will pick up particulates that could then enter the public water system or adjoining waterways.

Include consideration of the impact of these fields on all animal species in the surrounding ecosystems.

Disposal

The environmental impact of disposal of the fields and the rubber tire crumb infill should also be studied. It is important to understand the regulatory control of the disposal of these fields. Do they end up in landfills? Can they be recycled? What is the impact of the particulates on the environment when they must be removed at the end of their lifespan or the repurposing of the fields?

Precautionary Principle

The Precautionary Principle stands for the proposition that when an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. (http://unesdoc.unesco.org/images/0013/001395/139578e.pdf) Much has been written about the Precautionary Principle, but in its simplest terms it means that there is a social responsibility to protect the public from exposure to harm when scientific investigation has found a plausible risk. These protections can be relaxed only if further scientific findings emerge that provide sound evidence that no harm will result.

You are encouraged to apply the Precautionary Principle in analyzing the data from your studies.

Thank you for your consideration of these comments.

Sincerely,

Jean B Barish, Esq., MS

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General Comment

See attached file(s)

Attachments

Comments on ASTDR 2016-0002

Comments on ASTDR 2016-0002-0003

Federal Research Action Plan on

Recycled Tire Crumbs Used on Playing Fields and Playgrounds

Submitted to Federal Register May 2, 2016

Washington Alliance for Non-Toxic Play and Athletic Fields

The overarching public health question surrounding crumb rubber is, "Is crumb rubber safe to use on play fields and playgrounds?" Not only has it been established that the carcinogens and other toxicants from crumb rubber off-gas into the air, but research has also proven that they leach into water and simulated body fluids as well (1) (2) (3) (4) (5) (6). Coach Amy Griffin has already compiled a self-reported list of hundreds of athletes whose cancers may be related to crumb rubber exposure (7), and millions of children and young adults are currently exposed to crumb rubber on a daily basis. Therefore, a timely, accurate, and reliable estimate of the risks associated with crumb rubber exposure is of utmost importance.

Given the current state of relevant toxicity data, the planned exposure study is insufficient to provide reliable, timely estimates of the health risks associated with the use of crumb rubber. In the April 14, 2016 webinar for this study, one of the presenters stated that study researchers intended to combine exposure data from the federal study with existing toxicology data to predict health risks and make recommendations. There are no toxicity studies on crumb rubber as a complete mixture. Further, even if EPA guidelines didn't clearly state that component-based methods were useless for estimating the toxicity of complex mixtures, the toxicity information on the components of crumb rubber is too incomplete to be usable (8). For example, the recent EHHI/Yale study identified 96 chemicals in crumb rubber, almost half of which had not undergone any government toxicity testing (9). Until there is a reliable, scientifically defensible estimate of the carcinogenicity of crumb rubber, there can be no reliable health risk assessment.

It is not even clear that an estimate of the carcinogenicity of crumb rubber is technically feasible because crumb rubber is not a standardized product. It is a waste product. The chemical composition of the waste stream used to produce it is highly heterogeneous, may contain chemical hot spots, and may change at any time in significant and unpredictable ways with no notice, ever.

Predicting the health risks posed by crumb rubber is a formidable challenge. However, measuring any harm already caused should be relatively straightforward.

Prior formal studies on crumb rubber have provided the scientific basis to ascertain not only that crumb rubber may cause cancer, but also predict what types of cancer it would be likely to cause on the basis of its chemical components. However, it is the list of athletes who have contracted cancer compiled by Coach Amy Griffin that gives research on the safety of crumb rubber urgency. Crumb rubber has only

been commonly used in playgrounds and playfields for about 15 years, but there is already a self-reported list of hundreds of suspected cancer cases in young people. The list is remarkable not only for the age of the cancer patients, but also for how quickly cancers related to crumb rubber exposure seem to be appearing. Cancer is typically slow to develop, often only appearing decades after exposure. Further, parents have been repeatedly reassured that any carcinogens in crumb rubber are present at minute doses that pose virtually no risk. If cancers are appearing in unexpectedly large numbers now, then either exposures are much higher than believed or crumb rubber may be a potent carcinogen and the long-term cancer risk may be far greater than originally thought.

Amy Griffin's List

While the list of athletes diagnosed with cancer collected by Coach Amy Griffin does not constitute an epidemiologic study, what the list reveals is as instructive as it is frightening. The distribution of cancers by type on the list does not reflect the distribution in the general population for individuals aged 5-29. There is an excess rate of leukemia, lymphoma, and lung cancer relative to thyroid, brain, and testicular cancer on the list. Further, the risk may be concentrated in certain areas or with certain teams.

If a self-reported cancer list is just the product of public fears, then the reported cancers should display a distribution that reflects the distribution of cancer in the underlying population. A failure to display this pattern either reflects a significant reporting bias or an underlying difference in cancer rates in the reference population, or both. Standard population cancer incidence rates are easily available from the SEER dataset as shown in Table 1 below (10).

Table 1. Age-Specific SEER Incidence Rates By Cancer Site, All Ages, All Races, Both Sexes, 2004-2013

Cancer Site Age at Diagnosis

	5-9	10-14	15-19	20-24	25-29
Leukemia	4.18	3.22	3.08	2.66	2.74
Lymphoma	1.50	2.52	4.82	6.89	7.54
Thyroid	0.15	0.65	2.36	5.24	9.25
Brain and Other Nervous System	3.41	2.61	2.20	2.26	2.82
Lung and Bronchus	--	0.05	0.12	0.32	0.60
Testis*	0.04	0.11	1.88	5.13	7.20

Rates are per 100,000 persons. *Rates for testicular cancer are for 100,000 persons assuming 50,000 males.

An age 5-29 age adjusted cancer rate for each of the cancers can be calculated using the standard 2000 US population distribution (not shown) from the SEER database. The age adjusted cancer rates are shown in Table 2.

At last report, the individuals on Amy's list range in age from 5 to 29 years and were diagnosed at least as far back as 2007. The list contains data through March of 2016, so it covers at least 9.25 years (11). The numbers included in Table 2 only include individuals that self-reported as playing soccer. Sixteen cases of sarcomas and 9 cases of other rare cancers in soccer players are not included in Table 2. Sarcomas were not included in the list because the SEER database breaks down cancers by site, not

type. Fifty-four individuals that only reported playing sports other than soccer are on Amy's list but are not included in Table 2.

While the numbers on Amy Griffin's list do not represent the cases for a defined population, they could be assumed to do so for purposes of illustration. Assume the actual cancer cases in Table 2 represent cases from a defined population of unknown size x. If it is assumed that the rate of thyroid cancer in the theoretical population is the same as the rate in the U.S. population, then the size of the theoretical population can be calculated as 12*100,000/(3.37*9.25)= 38,548 individuals. Given a population of 38,548 individuals at risk for 9.25 years, it is possible to calculate the expected number of cases for each of the other cancers on Amy's list. Then the ratio of actual to expected cases can be calculated. As can be seen in Table 2, the number of leukemia, lymphoma and lung cancer cases are elevated relative to thyroid, brain and testicular cancer.

Table 2. Expected Number of Cancer Cases Versus Actual Number on Amy Griffin's List

	Age-adjusted incidence in 5-29 year olds	Expected number of cases	Actual number of soccer players	Ratio Actual to Expected Cases
Leukemia	3.19	11.39	41	3.60
Lymphoma	4.55	16.21	64	3.95
Thyroid	3.37	12	12	1
Brain and Other Nervous System	2.66	9.49	11	1.16
Lung and Bronchus	0.21	0.74	4	5.41
Testis	2.73	9.73	9	0.92

The incidence of lymphoma cases in soccer goalkeepers in Washington State was investigated based on Amy Griffin's list. Washington was selected because the author and Ms. Griffin live in Washington and a significant percentage of the names on the list are from Washington. Goalkeepers were examined because of their elevated exposure and high rates of appearance on the list. Lymphoma was examined because many of the carcinogens in crumb rubber are believed to cause blood cancers and because of the number of lymphoma cases on the list as a whole.

Based on private communications with Amy Griffin, her list includes 7 goalkeepers from Washington State, aged 12-24 who were diagnosed with lymphoma between 2008 and 2015. By estimating the number of goalkeepers in this age group, it is possible to estimate incidence.

There are approximately 1,552 boys and girls high school soccer teams in Washington State. Per Amy Griffin, approximately an additional 10% of high school age soccer players play on select teams instead of high school teams. This yields a total estimate of 1,707 teams of high school age players, and an estimated 3,414 14-17 year old goalkeepers. Assuming goalkeepers are spread equally over the age range, this yields 854 goalkeepers per age, or 4,268 goalkeepers per 5 year age spread. Although athletes may stop playing after graduation from high school, their exposure during their youth can never be erased. Thus, they remain in the risk pool. Additionally, goalkeeper is such a specialized position that it is highly unlikely that a player who was not a goalkeeper in high school would become one after

high school. Thus, once a cohort completes high school, the number of people in that cohort who are exposed to crumb rubber while playing goalkeeper should remain stable over time.

Estimating the number of goalkeepers in the 12-13 age range is difficult. There are likely more 12-13 year old children playing soccer, but 12-13 year olds are less likely to be set in the position they play at that age. Therefore, to provide a conservative estimate, it is assumed that there are twice as many goalkeepers per age for 12-13 year olds as there are for 14-24 year olds. The estimate of the at-risk population is a back of the envelope estimate, and there are additional unstated assumptions in play. However, it provides a useful, reasonably conservative, estimate of the at-risk population.

Based on the estimated numbers of goalkeepers and age-specific rates for lymphoma for individuals aged 10-14, 15-19, and 20-24 years, there should have been approximately 5.6 lymphomas in goalkeepers between the ages of 12 and 24 in Washington between 2007 and 2015. There are 8 on Amy's list, approximately 43% more than expected. It is a disturbing finding given that Amy's list is entirely self-reported and should only represent a fraction of the actual number of cases. This provides support to the theory that soccer players are at an elevated risk of leukemia, lymphoma, and lung cancer and the proportions of cancers on Amy's list are due to elevated risks of certain cancers in soccer players and not reporting bias.

Amy Griffin testified before the Washington State House Environment Committee on January 26, 2016 that her list contained five different groups of two or more players with cancer from the same team (7). Thus, at least 5% of the names on Amy Griffin's list come from mini clusters. Some clustering of cancer cases will occur by random chance, but the proportion of the cases on Amy's list that come from individual teams is clearly excessive. Either players from teams with multiple cases are more likely to self-report, or something is placing players on certain teams at elevated risk, or both. Given the concerns about crumb rubber, it is entirely possible that players on teams with high levels of exposure to crumb rubber, either due to extended seasons, or practicing on indoor fields, are at elevated risk. It is also possible that certain fields pose much higher risk than other fields.

The data on Amy's list raise grave concerns. Many of these concerns can be answered by a thorough epidemiologic study. Fortunately, the necessary data exist, and the CDC has epidemiologists that are fully capable of doing the type of research that is necessary to protect the health of our children.

Epidemiology

It should be fairly straightforward to design an epidemiologic study that would at least be able to determine if soccer players, or goalkeepers in particular, are at an elevated risk of developing certain cancers such as Hodgkin's lymphoma or lung cancer.

For example, epidemiologists could model the incidence of selected specific cancers for all athletes who played NCAA soccer between 2000 and 2013.

Cancer registries are already in place. The NCAA should have a list of all college athletes complete with basic demographic data as well as information on sports and positions played. Hopefully, the NCAA will be willing to cooperate in the name of public health and athlete health. While there are always concerns about privacy, the NCAA would not necessarily need to reveal any information that isn't

already publicly available. Further, cooperation in a government study designed to protect athlete health could be portrayed as positive and proactive. Failure to cooperate could be publicly portrayed as a sign that the association has something to hide or that it does not put the well-being of its student athletes first.

If the NCAA is unwilling to cooperate, it is likely that the necessary information will be available from big data brokers. Failing that, there are always sites such as TopDrawerSoccer.com that display the name, college, home town, and position of 69,802 college soccer players in the US right now (12). Sites such as this likely have archives of data from previous years as well.

Without a measure of athlete exposure to crumb rubber, a comparison of cancer incidence rates in soccer players to rates in the general population can underestimate the risks associated with crumb rubber. When soccer players are mixed together in the same data set with nothing to indicate exposure level, the resulting risk estimate is a function of both the risk associated with exposure to crumb rubber and the average level of exposure. However, the average level of exposure remains unknown, and if it is assumed that all practices and games are spent on artificial turf, then the risk associated with crumb rubber will be greatly underestimated.

However, adding proxy measures of exposure could improve estimates of any increased cancer risk associated with exposure to crumb rubber and provide an estimate of any potential dose response. NCAA data should include both the location of the athletes' colleges and their home towns or high schools. The average high temperatures in the summer and fall months might be one proxy measure of exposure since the outgassing of toxic chemicals increases exponentially with temperature.

Adding annual US crumb rubber market penetration data to the model would increase the precision of the model. Obviously, if exposure to crumb rubber causes cancer, then cancer rates should increase as market penetration increases and as the number of years athletes are exposed to it increases. College athletes in 2005 were exposed to crumb rubber for a relatively short period of time and a much smaller percentage were exposed. College athletes in 2013 may have played on it for 13 years, and a relatively large percentage probably played on it since high school.

Adding annual market penetration to the model for each athlete's home town/ home state would increase the precision of the model. Adding in the type of field present at each athlete's college or annual market penetration of crumb rubber in each athlete's college town / state would also increase the precision of the model.

Although the EPA no longer participates in the Scrap Tire Workgroup, it may have historical market penetration data. Otherwise, the Synthetic Turf Council, or major turf retailors such as FieldTurf, may have the data. Since this study has explicitly stated that it will include representatives from the synthetic turf industry in this research, it is only reasonable to expect basic cooperation from the stakeholders. If the STC or major retailors choose not to cooperate with an investigation on the safety of crumb rubber, partial, if not complete, data may be available elsewhere. For example, states that have given subsidies for the construction of synthetic turf fields and may have market data for their state. (A failure of the synthetic turf industry to cooperate with the study could be interpreted as a tacit admission that the industry believes that there are significant health risks associated with crumb rubber use. This could provide further justification for an immediate moratorium on the use of crumb rubber.)

A multivariate regression model with proxy variables and other basic explanatory variables such as age, gender, and position, as well as all necessary interaction terms could be created. Determination of the exact type of statistical model to be used should obviously be left up to biostatisticians / epidemiologists who regularly model cancer epidemiological data. A list of the types of cancer to investigate can be compiled from the list of cancer cases maintained by Coach Amy Griffin, and by consultation with toxicologists on the cancers expected from the carcinogens in crumb rubber. In addition, the Washington State Department of Health is validating the Washington State cancer cases on Amy's list and expects to publish some descriptive statistics concerning the list in the summer of 2016 (13). The DOH plans to determine if the cases represented on Amy's list represent an excessive rate of cancer cases among soccer players / goalkeepers in Washington (14). However, there is no plan to independently identify other cases of cancer in soccer players in Washington.

The main weakness of an epidemiologic study is that it has no ability to predict long-term effects. Crumb rubber has been widely used for around 15 years. The full effects of a carcinogen on human health typically take 30-50 years to appear. If the epidemiologic studies do not reveal any current cancer excesses, animal experimentation could help rule out any long-term risks. However animal experimentation is expensive, time-consuming, and should be avoided whenever possible for ethical reasons. If there is a current excess of cancer cases, then crumb rubber is unsafe and should not be used. Animal studies would not be necessary to determine whether or not to ban it.

Specific Comments on Exposure Study Design

Bioavailability

Any bioavailability studies should mimic real world exposure scenarios, including using realistic particle sizes and exposure periods as much as possible. Thus, gastric studies should include crumb rubber dust as well as crumbs. While some children engage in pica, and soccer goalies get crumbs in their mouths when diving for balls, much of the oral exposure of children is via hand to mouth behavior. Thus, children are ingesting dust, not tire shreds or crumbs. Toxins on particles 10 to 250 micrometers in diameter are likely to be much more bioavailable than toxins encased in shreds half an inch in length. The Kim study examined the effects of particle size on the bioavailability of lead in EPDM based on acid extraction and simulated digestive fluid extraction (15). The study found that lead was more than five times more bioavailable in particles less than 250 microns in diameter than it was in larger particles.

The bioavailability of toxins in 1-2 mm diameter crumbs in simulated lung fluid is not biologically relevant because humans are breathing in airborne particles, not large crumbs (4). Further, the smaller particles, those just a few microns in diameter, can pass through the lung tissue, into the bloodstream, and from there into various organs and tissues. At that point, the bioavailability of the toxicants in blood or tissue becomes relevant. Similarly, the estimated bioavailability of PAHs on PM 2.5 that are estimated to stay in the lungs for 3 months is very different than the estimated bioavailability of PAHs on a 1 mm crumb that is estimated to stay in the lungs for 24 hours.

Collection Procedures

Samples of crumb rubber should not be washed as washing removes the smaller dust particles.

Samples of new crumb rubber should be taken from the top, middle and the bottom of the bag because of granular convection, also known as the 'Brazil-nut effect." Different sized crumbs will have different surface areas relative to their mass. Hence the toxicants contained in them will have different levels of bioaccessibility. Different sizes of crumb rubber particles may also be chemically different. A tire is not composed of a uniform piece of rubber. Different portions of the tire have different formulations, some of which may be more likely to crumble than others. Different tire parts have been exposed to different microenvironments containing different contaminants. This affects how the rubber ages and breaks down. The outer layer of the tread that was most exposed to roadway contaminants could be the most brittle and likely to crumble into dust. Conversely, inner layers of rubber that were more protected from the elements and contaminants may remain as larger crumbs. Washing the dust off of the crumbs could mean washing away relevant contaminants from the sample.

Similarly, when collecting crumb rubber samples from fields and playgrounds, care must be taken to collect the dust and respirable particulate matter as well. Care must be taken not to re-suspend particulate matter that has settled from the air. Sweeping samples into a collector risks loss of dust and settled particulates. Vacuuming up the crumb may be the best way of capturing all of the crumb rubber in a given area. It is important to know all of what is actually on the fields, not just what is in the large crumbs on the fields.

Legislation or administrative action compelling institutions that receive federal funding, such as most public schools, to participate upon request should be considered. In 2011, Dr. Stuart Shalat noted that only 5 of the 50 schools and towns he contacted gave him permission to test their fields due to liability concerns (16). That was before Coach Amy Griffin's list of athletes who have developed cancer started raising public concern. Field owners might be much less cooperative today. Given previous difficulties in obtaining permissions to test fields, collecting 40 samples from fields, stratified by field type, age and census region may mean contacting hundreds of towns or schools. Alternatively, it might help to publicize the school districts and cities that refuse to allow their fields to be tested. At the same time, a policy of not releasing any individual results, unless hazardous levels of a toxicant are identified (such as lead > 400 ppm in crumbs), could shield participants from unintended negative consequences. Thus, those who refuse to help look like they have something to hide or like they aren't concerned about the health of their field users, while those that participate get to look like they are taking steps to protect public health.

All air monitoring should include personal air monitoring of VOCs, SVOCs, PM 2.5, and carbon black. Proper off-field, up wind controls should be taken concurrently. On-field sampling should be done during actual games, scrimmages or practices. Referees may wear the monitoring equipment if it is not feasible to have players wear monitors. Stationary monitors on the side of the field do little to reveal what players on the field are exposed to due to atmospheric mixing and the settling of dusts. Players actively churn the crumb re-suspending dust and PM 2.5, and opening up pockets of trapped gasses (16).

Measurements of PM 2.5 and carbon black from personal air monitors would be new information. Personal air monitors have been used for VOCs and SVOCs but not PM 2.5 (17). Even though carbon

black constitutes roughly 30% of crumb rubber, no measurements of ambient carbon black levels at synthetic turf fields in the U.S. using any type of monitor were located. The estimates of airborne carbon black from crumb rubber typically come from a study of indoor turf fields conducted in Norway (18).

Estimating exposures goal keepers receive, especially during practice diving drills may be difficult. It may not be safe for either the player or the equipment for goal keepers to dive into the turf while wearing the monitors. It may be more practical to have engineers study films of goalies diving after balls, and then design ways to mimic the spray of crumbs and dust particles they receive each time they dive into the turf.

It is encouraging that the CDC, CPSC and EPA are examining the toxic exposures that children and athletes receive when using playgrounds and athletic fields that use artificial turf. However, given the number of citizens that are exposed to crumb rubber on a daily basis, and the evidence that crumb rubber is already responsible for excess cancer cases in the country's youth, a more aggressive research program, including a large epidemiological study, is needed.

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Submitter Information

Name: Jonathan Damm
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General Comment

Dear Federal Agencies:

I am a concerned parent with a background in environmental law and a lacrosse player and coach. Because of my education, I understand and appreciate the dangers inherent with repeated exposure to toxins. Since I am a coach and player, I have also spent many hours on tire crumb fields. I have witnessed how children are exposed to the fine particulate. After reading all the available literature, my wife and I concluded the risks far outweigh any benefits of using fields with tire crumb. Regardless of your final conclusions, it is clear that tire crumb is beyond our capacity to thoroughly investigate - as I will discuss below. So we will never let our three young children play on tire crumb. A generation of young Americans relies on you for similar protection.

Later this year, when the federal government issue its preliminary statement regarding the safety of tire crumb on synthetic turf fields, the most important messages to communicate to concerned parents are: 1) Tire Crumb is a "Moving Target" - tire manufacturers frequently change tire ingredients. So any formal study conclusion only speaks to existing fields. Any field installed after a study, or any field not studies, may contain chemicals that were not examined in past studies - including any federal study. So for all the millions of dollars of resources the federal government is about to spend on this study, any conclusions can only speak to actual

fields that were studied. A study can only be backwards looking by its very nature since there can be zero confidence that manufacturers will not change tire ingredients. This must be clearly communicated. 2) Compound based risk assessment can only be done on chemicals and compounds that have regulatory risk frameworks. Tire crumb contains numerous chemicals and compounds with no regulatory risk frameworks. Therefore, any formal study will necessarily contain significant data gaps. 3) Given that tire crumb contains multiple chemicals and compounds with no risk frameworks, epidemiological studies and animal studies are the only available methods of study to overcome this intrinsic problem. If there are no significant epidemiological studies undertaken or planned, this must be communicated. If there are no animal studies planned, this must be communicated.

If the three points of focus above were communicated clearly and prominently, it would help educated field users to truly understand that sometimes, a problem is beyond our ability and present capacity to accurately make predictions or draw conclusions regarding safely. If the federal government was realistic in this endeavor, it would recognize this from the very start. And given what we know about the multiple carcinogens, mutagens and reprotoxins in this material, the government should conclude from the start that tire crumb is simply too risky to use in such close proximity to children.

Sweden Concluded that Tires should Not be Used

Such a position would not be novel or unprecedented. The Swedish agency tasked with reviewing tire crumb on synthetic fields recommended that tires should not be used as material on synthetic turf fields for exactly these reasons. Sweden wisely concluded that given the complexity and the inherent unknowns regarding tire crumb use on turf fields, they simply should not be used.

"Tyres contain substances of very high concern

Tyres contain several substances that are substances of very high concern. These substances maypersist in the environment, they may be bioaccumulative, carcinogenic, reprotoxic, or mutagenic. This is true of, for example, polycyclic aromatic hydrocarbons (PAHs), phthalates and certain metals. These substances should not be released into the environment and thus waste tyres should not be used for synthetic turf surfaces.

KemI's Recommendations:

Do not select synthetic turf that contains substances of very high concern when laying new surfaces
Material that contains substances of very high concern should not be used, as specified by the environmental objectives of the Swedish parliament. This means that granulate formed from recycled rubber should not be used when laying new surfaces of synthetic turf. The Norwegian authorities have issued a similar recommendation."

http://www.wellesleyma.gov/pages/WellesleyMA_SpragueResources/Swedish%20Study.doc

In addition to Sweden and Norway, whole countries that have recommended that tires not be used on turf fields, municipalities like as New York City have has banned tire crumb since 2009 for their schools and parks.

Similarly in 2009, the L.A. Unified School district has banned tire crumb. The list grows larger by the week. In early 2015, Montgomery County, Maryland's most populous, banned tire crumb by a unanimous vote of the council.

Please honor the precautionary principal and recommend a complete ban on the use of tire crumb on turf fields and playgrounds. See attached for full comments.

Regards,

Jonathan Damm

Attachments

Comments on ASTDR 2016-0002 by Jonathan Damm

Comments on ASTDR 2016-0002-0003

Federal Research Action Plan on

Recycled Tire Crumbs Used on Playing Fields and Playgrounds

Submitted to Federal Register May 2, 2016

By Jonathan R. Damm

Dear Federal Agencies:

I am a concerned parent with a background in environmental law and a lacrosse player and coach. Because of my education, I understand and appreciate the dangers inherent with repeated exposure to toxins. Since I am a coach and player, I have also spent many hours on tire crumb fields. I have witnessed how children are exposed to the fine particulate. After reading all the available literature, my wife and I concluded the risks far outweigh any benefits of using fields with tire crumb. Regardless of your final conclusions, it is clear that tire crumb is beyond our capacity to thoroughly investigate – as I will discuss below. So we will never let our three young children play on tire crumb. **A generation of young Americans relies on you for similar protection.**

Later this year, when the federal government issue its preliminary statement regarding the safety of tire crumb on synthetic turf fields, the most important messages to communicate to concerned parents are: 1) Tire Crumb is a "**Moving Target**" – tire manufacturers frequently change tire ingredients. So any formal study conclusion only speaks to existing fields. Any field installed after a study, or any field not studies, may contain chemicals that were not examined in past studies – including any federal study. So for all the millions of dollars of resources the federal government is about to spend on this study, any conclusions can only speak to actual fields that were studied. A study can only be backwards looking by its very nature since there can be zero confidence that manufacturers will not change tire ingredients. This must be clearly communicated. 2) **Compound based risk assessment can only be done on chemicals and compounds that have regulatory risk frameworks. Tire crumb contains numerous chemicals and compounds with no regulatory risk frameworks.** Therefore, any formal study will necessarily contain significant data gaps. 3) Given that tire crumb contains multiple chemicals and compounds with no risk frameworks, epidemiological studies and animal studies are the only available methods of study to overcome this intrinsic problem**. If there are no significant epidemiological studies undertaken or planned, this must be communicated. If there are no animal studies planned, this must be communicated.**

If the three points of focus above were communicated clearly and prominently, it would help educated field users to truly understand that sometimes, a problem is beyond our ability and present capacity to accurately make predictions or draw conclusions regarding safely. If the federal government was realistic in this endeavor, it would recognize this from the very start. And given what we know about the multiple carcinogens, mutagens and reprotoxins in this material, the government should

conclude from the start that tire crumb is simply too risky to use in such close proximity to children. The following links provide examples of chemicals of concern in tire crumb.
http://www.albany.edu/ihe/Synthetic_Turf_Chemicals.php
http://www.ncbi.nlm.nih.gov/m/pubmed/22352997/
http://www.ehhi.org/turf/new_study_jun2015.shtml http://southlakesturf.org/wp-content/uploads/2015/02/Pg-31.jpg
http://southlakesturf.org/wp-content/uploads/2015/02/Attachment-1-Crumb-Rubber-Chemicals.pdf

Sweden Concluded that Tires should Not be Used

Such a position would not be novel or unprecedented. The Swedish agency tasked with reviewing tire crumb on synthetic fields recommended that tires should not be used as material on synthetic turf fields for exactly these reasons. Sweden wisely concluded that given the complexity and the inherent unknowns regarding tire crumb use on turf fields, they simply should not be used.

> ***Tyres contain substances of very high concern***
> Tyres contain several substances that are substances of very high concern. These substances maypersist in the environment, they may be **bioaccumulative, carcinogenic, reprotoxic, or mutagenic.** This is true of, for example, polycyclic aromatic hydrocarbons (PAHs), phthalates and certain metals. These substances should not be released into the environment and thus waste tyres should not be used for synthetic turf surfaces.
>
> ***Keml's Recommendations:***
> ***Do not select synthetic turf that contains substances of very high concern when laying new surfaces***
> Material that contains substances of very high concern should not be used, as specified by the environmental objectives of the Swedish parliament. This means that granulate formed from recycled rubber should not be used when laying new surfaces of synthetic turf. **The Norwegian authorities have issued a similar recommendation.**
> **http://www.wellesleyma.gov/pages/WellesleyMA_SpragueResources/Swedish%20Study.doc**

In addition to Sweden and Norway, whole countries that have recommended that tires not be used on turf fields, municipalities like as New York City have has banned tire crumb since 2009 for their schools and parks. http://www.nydailynews.com/new-york/city-yields-ground-crumb-rubber-turf-wars-article-1.389543
Similarly in 2009, the L.A. Unified School district has banned tire crumb.
http://usatoday30.usatoday.com/sports/2009-06-10-artificial-turf_N.htm
The list grows larger by the week. In early 2015, Montgomery County, Maryland's most populous, banned tire crumb by a unanimous vote of the council.
http://www.mymcmedia.org/councilmember-berliner-applauds-council-turning-the-page-

on-artificial-turf/ Recently, the city of Hartford, CT banned Tire Crumb as well. http://ctmirror.org/2016/02/12/a-shifting-ground-for-artificial-turf-in-connecticut/

There are many other communities taking similar action. A Google search will provide you with plenty of evidence. Industry lobbyists and representatives will likely tell you that these are just reactionary measures because of sensational headlines of anecdotal news about goalies with cancer. I will discuss the goalies with cancer below. First, Sweden and Norway took their precautionary measures in 2006, well before the news about goalies with cancer in 2014. It was enough for them to understand what is in tire crumb. They didn't need to conduct a generation long experiment to decide if it is safe. They erred on the side of caution, which is a reasonable measure given the multiple chemicals of concern, carcinogens, PAHs, VOCs, phthalates, heavy metals and endocrine disruptors. All these things are in tire crumb. There is no debate about that.

Over the last ten to twenty years, parents have been increasingly aware that they should take reasonable steps to protect their kids from having toxins bioaccumlate in their kids' bodies. So countries and municipalities that are avoiding tire crumb are not simply acting because they are scared, they are taking prudent and reasonable measures to minimize exposure to dangerous toxins. BPA and phthalates are good examples. These chemicals are not banned by EPA and really not heavily regulated as far as I understand.

Exposure

But the science is pretty clear at this point that we should protect children from unnecessary exposure to endocrine disruptors. When developing kids are on a tire crumb field, they often ingest tire crumb. They either ingest actual particles or they ingest micro particles that get mixed into their sweat as it runs over their skin and into their mouth. The attached document from the safe healthy playing fields coalition illustrates how small particles actually are. The picture below is from the attachment. But look at how small the dust is. The larger black spot is a highly magnified piece of tire crumb. The specs are microscopic dust. The picture of the woman illustrates how easily the dust can be transferred from a field to a sweaty person and into their mouth.

They inhale fine tire crumb dust. They inhale VOCs. They absorb chemicals and oils from tire plasticizers either directly through their skin or in open wounds. It gets in their noses. It gets in their eyes. There are multiple exposure routes.

Bioavailability

Based on limited study, industry representatives like to assert that the chemicals in tire crumb are somehow not bioavailable. But there are studies that contradict that. For example, there is a study from South Korea that concludes that lead in EPDM rubber particulate is indeed bioavailable. It should not be any different for metals in particulate and dust like tire crumb. **"Conclusions - Results of this study confirm that the exposure of lead ingestion and risk level increases as the particle size of crumb rubber gets smaller."** http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278598/

So it is reasonable for parents to take precautions in their daily lives to protect their children from toxins. People wash fruit, they off-gas products, they avoid flame retardants, and they avoid endocrine disruptors and PAHs in their children's products. The list goes on. So when municipalities ban tire crumb, they are simply acting in the same reasonable and cautious way that their populations act every day. **Why would parents want to take reasonable steps to protect their children from harmful toxins in their daily lives, then turn around and expose their kids to all the same chemicals of concern and even worse? It does not make sense to take one step forward and two steps back.**

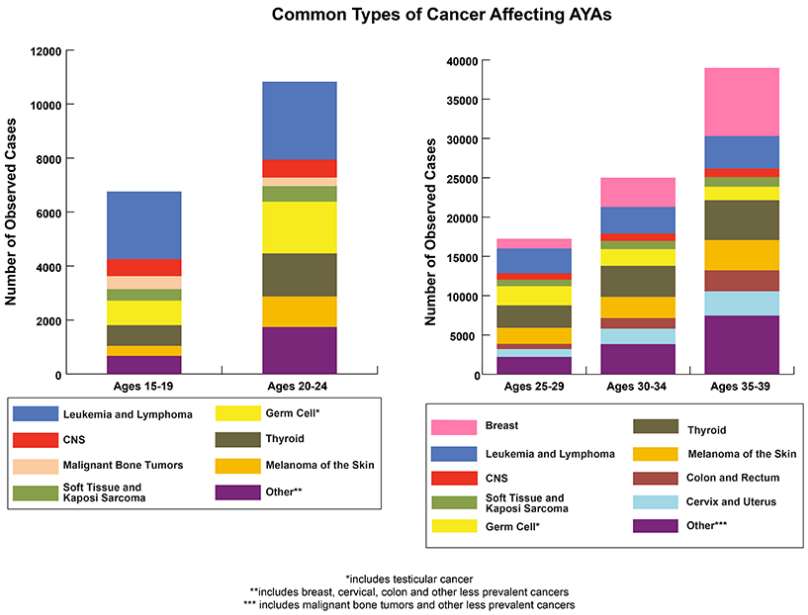
Avoiding tire crumb is not a reactionary measure to sensational news; it is wisdom and common sense. Using tire crumb where kids play is reckless and out of step with a growing population of educated American's approach to toxins around children. It is truly mind boggling that there are individuals in the federal government that consider this even remotely as a good idea.

Every day, we learn how toxins bioacumulate in the body. Folks take careful steps to protect their families. By even pretending that somehow a field full of all the same chemicals of concern could be tolerable under any circumstance is just plainly behind the times. The only reason there has not already been a mass revolt is that there has not been an opportunity to educate the millions of people that need the education. But if the same people who avoid BPA and phthalates in their childrens' products actually learned in detail just how full of toxins their kids' fields are, they would put it all together.

So please don't pretend that somehow different rules apply just because kids are running around an exercising. It is illogical to think that exercising somehow mitigates the harms and risks. If anything, it makes it worse.

Goalies with Cancer – Only 5000 blood Cancers a Year

What about those soccer goalies with cancer? Anything short of a serious statistical analysis would be too bad. It appears that there are only around 5000 blood cancers a year under the age of 24. There are now over 100 goalies on Amy Griffin's list. Most have blood cancers. Given so few kids with blood cancers in a given year, it seems very unlikely that one person would be able to put together a list of so many people with two things in common 1) plays one particular position (goalie), and 2) plays mostly on one particular kind of field (tire crumb). And there are still not that many tire crumb fields nationally – around 12,000. So Amy Griffins list should be taken very seriously.



http://www.cancer.gov/research/progress/snapshots/adolescent-young-adult

Carbon Black

Any investigation must also look closely at carbon black. Carbon black makes up about 1/3 of a tire. That means about 1/3 of a tire crumb field is also carbon black. Carbon black is a known animal carcinogen and a possible human carcinogen. Nanoparticles in carbon black have been theorized to present asbestos like concerns. http://www.turfandrec.com/index.php?option=com_content&task=view&id=2986 If this is not looked at very closely, it would be a monumental oversight. Will the study look closely at carbon black exposure?

Carbon Nanotubes

"**Inhaling carbon nanotubes could be as harmful as breathing in asbestos**, and its use should be regulated lest it lead to the same cancer and breathing problems that prompted a ban on the use of asbestos as insulation in buildings, according a new study

posted online . . . by *Nature Nanotechnology*."
http://www.scientificamerican.com/article/carbon-nanotube-danger/

"[Ti]res enhanced with CNT (carbon nanotubes) appear to have improved mechanical properties, such as tensile strength, tear strength and hardness of the composites, by almost 600%, 250% and 70% respectively, comparing with those of the pure SBR composites (styrene-butadiene rubber)." http://www.iosrjournals.org/iosr-jmce/papers/vol11-issue4/Version-1/B011410711.pdf

This concern with carbon nanotubes goes back to the "Moving Target" concern I discussed in the first page of this document. Tires are waste products that are not designed for use, ingestion, inhalation and absorption by children. Any slew of potentially carcinogenic material could make their way into the next generation of tires, and probably will. This should be unacceptable from the start.

Past studies have been negligent in how they collect data. They underestimate exposure. The 2008 EPA study set up a particle collector and had kids run by periodically. The particle collector was surrounded by a small 3 foot fence. That is not realistic exposure replication. In order to replicate a goalies exposure, you would literally have to kick the tire crumb fly-out into the collector again and again for hours and hours.

Past studies also use simulated body fluids that do not accurately extract all the chemicals in tire crumb. The Yale study found 12 carcinogens. http://www.ehhi.org/turf/findings0815.shtml Industry critics claim that Yale used to harsh an extraction method. But there is no debate that the carcinogens were present. One can make an argument that prior extraction methods based on simulated body fluids were not stringent enough.

I am attaching the written testimony of Dr. Wright from the Mount Sinai Children's Environmental Health Center.

https://dl.dropboxusercontent.com/u/101177270/CEHC%20RB%205139%20Testimony%20Feb%2016%202016.pdf

It says it all. In short:

1. "Given the hazards associated with recycled tire rubber, it is our recommendation that these products never be used as surfaces where children play."
2. "[W]e found significant gaps in the evidence supporting the safety of recycled rubber turf products."
3. "Children are uniquely vulnerable to harmful exposures from recycled rubber surfaces."
4. "In the absence of convincing evidence of safety, we recommend that children not play on recycled rubber surfaces that contain known carcinogens and neurotoxins and support a ban on the use of these products."

I hope the federal government takes the same reasonable position. Even if you do not, a large portion of the population will continue to act prudently and will avoid using fields with tire crumb. You might as well act responsibly and protect those that do not have the fortune to be as educated on the dangers of bioaccumulated toxic exposure.

Heat - 120 degrees

A few comments on heat - I read that the fields would be tested at two temperatures. One would be at room temperature or average outdoor temp. The other would be at a higher temperature to mimic a hot day. I hope you paid attention to the temperatures at the women's soccer world cup. The temperatures of the turf were not just hot, they were astonishingly hot. It was measured at 120 degrees! So please measure it at that temperature. Anything else would be a sham.
https://www.washingtonpost.com/news/early-lead/wp/2015/06/06/the-artificial-turf-at-the-womens-world-cup-was-reportedly-120-degrees-at-kick-off/

Industry MSDS

The Synthetic Turf Council has a MSDS that makes clear there are certain precautions that their installer should take. They include washing frequently, wearing a respirator, and wearing eye protection to name a few (see next page). But importantly, this is the industries own material. How can they be asserting on the one hand that children are safe to play on tire crumb and then at the same time, warning their installers to take very deliberate and thorough measures to protect themselves from tire crumb as they install it?

It is very puzzling to try to understand how this material is safe for players who get the same if not more exposure than installers. Kids who roll in tire crumb, eat tire crumb, drink tire crumb in sweat, inhale tire crumb, absorb tire crumb, and grow up on tire crumb are getting absolutely no warnings like the installers. It is a terrible injustice and wildly hypocritical.

Standard Format MSDS *(continued)*

PRECAUTIONS FOR SAFE HANDLING AND USE	
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED	Sweep up or vacuum into disposal containers
WASTE DISPOSAL METHOD	Product not defined as hazardous waste. Dispose of in accordance with federal, state, and local regulation.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE	Do not store near flame or ignition source. Do not store hot material in tubs or containers where spontaneous ignition could occur.
OTHER PRECAUTIONS	If material burns, an oily residue will result. This residue must be disposed of in accordance with federal, state and local regulations.
RESPIRATORY PROTECTION (Specify Type)	Use any dust and mist respirator noted for up to 10 mg/m^3.

CONTROL MEASURES	
VENTILATION: Yes	LOCAL EXHAUST: Yes, if dusty conditions occur.
SPECIAL: None	MECHANICAL (General): Dust collector and
PROTECTIVE GLOVES: Recommended	EYE PROTECTION: Use safety goggles to prevent dust entry.
OTHER PROTECTIVE CLOTHING OR EQUIPMENT	Enough fresh air should flow past the user to prevent exposure to airborne fibers and particles.
WORK/HYGENE PRACTICES	Good personal hygiene; frequent washing with soap and water of exposed areas; remove and clean solid clothing.

The information contained in this MSDS is consistent with the U.S. Department of Labor OSHA Form OMB 1218-0072. Consult OSHA Hazard Communication Standard 29 CFR 1910.1200 for additional information. To fully understand the use of any material, the user should avail themselves of reference material and expert consultation in the fields of fire prevention, ventilation and toxicology.

https://www.dropbox.com/s/yvszy6bgtsis39a/STC%20MSDS.pdf?dl=0

Why should kids not receive the same warnings when they get even more exposure than installers? When parents are educated on this seeming hypocrisy, they see right through industry assertions that the material is safe. If you conclude that tire crumb is safe as well, you will have to explain why installers receive special warnings about wearing respirators and washing.

There should be signs on every field that provide the same warnings to parents and players.

These are just some thoughts that hopefully provide some insight as to why you should categorically conclude that tire crumb is too risky to use where children play. Please do the right thing and recommend that there be a moratorium on the use of tire crumb on synthetic turf fields and playgrounds.

Please consider attachments 1 and 2 as a fully incorporated part of this document and part of my formal comments as well.

Regards,

Jonathan R. Damm
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Vermont Law School, JD, MSEL ‘99

Attachment 1

Icahn School of Medicine at Mount Sinai

Children's Environmental Health Center
Department of Preventive Medicine
Icahn School of Medicine at Mount Sinai
One Gustave L. Levy Place, Box 1217
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Written Testimony before the Connecticut General Assembly Committee on Children
February 16, 2016

Testimony in Support of:
Raised Bill 5139, An Act Concerning the Use of Recycled Tire Rubber at Municipal and Public School Playgrounds.

To Senator Bartolomeo, Representative Urban, and honorable members of the Committee on Children:

We, the Children's Environmental Health Center of the Icahn School of Medicine at Mount Sinai, strongly support *Raised Bill 5139, An Act Concerning the Use of Recycled Tire Rubber at Municipal and Public School Playgrounds.* **Given the hazards associated with recycled tire rubber, it is our recommendation that these products never be used as surfaces where children play.**

As pediatricians, epidemiologists, and laboratory scientists at the Children's Environmental Health Center of the Icahn School of Medicine at Mount Sinai, which hosts one of 10 nationally funded Pediatric Environmental Health Specialty Units, we have received numerous phone calls from concerned parents and physicians regarding the wide scale use of recycled rubber surfaces on school grounds and in park properties. This led us to conduct a review of the risks and benefits of artificial playing surfaces, during which we found **significant gaps in the evidence supporting the safety of recycled rubber turf products**. Our findings are summarized below and discussed in detail in the attached documents: "Artificial Turf: A Health-Based Consumer Guide" and "Position Statement on the use of Recycled Tires in Artificial Turf Surfaces".

Children are uniquely vulnerable to harmful exposures from recycled rubber surfaces. Public playgrounds are typically utilized by children age 6 months to 12 years, a population exquisitely vulnerable to the health effects of toxic environmental exposures. This vulnerability is due to a number of factors including, but not limited to, their unique physiology and behaviors, rapidly developing organ systems, and immature detoxification mechanisms[1]. Additionally, because of their young age, children have more future years of life and therefore more time to develop chronic diseases.

[1] Bearer, CF. Neurotoxicology 21:925-934, 2000.

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We have identified several potential dangers that playing on recycled rubber playing surfaces pose to children. These include:

1. **Extreme heat.** On hot summer days, temperatures of over 160 degrees Fahrenheit have been recorded on recycled rubber play surfaces[2]. Vigorous play in these conditions conveys a very real risk of burns, dehydration, heat stress, or heat stroke. Children are less able to regulate their body temperature than adults, making them particularly susceptible to conditions of extreme heat[3]. In addition, children have a higher surface area to body mass ratio, produce more body heat per unit mass, and sweat less than adults, all factors that increase susceptibility to heat injury[4].

2. **Inhalation and ingestion of toxic and carcinogenic chemicals.** Children are particularly vulnerable to chemical exposures from playground surfaces due to their developmentally appropriate hand to mouth behaviors. In addition, their close proximity to the ground and higher respiratory rates compared with adults increase the likelihood of inhalational exposures. Thus, there is a potential for toxins to be inhaled, absorbed through the skin and even swallowed by children who play on recycled rubber surfaces.

   The major chemical components of recycled rubber are styrene and butadiene, the principal ingredients of the synthetic rubber used for tires in the United States[5]. Styrene is neurotoxic and reasonably anticipated to be a human carcinogen[6]. Butadiene is a proven human carcinogen that has been shown to

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[2] Devitt, D.A., M.H. Young, M. Baghzouz, and B.M. Bird. 2007. Surface temperature, heat loading and spectral reflectance of artificial turfgrass. Journal of Turfgrass and Sports Surface Science 83:68-82

[3] https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/Children-and-Disasters/Pages/Extreme-Temperatures-Heat-and-Cold.aspx

[4] Falk B, Dotan R. *Appl Physiol Nutr Metab.* 2008 Apr;33(2):420-7. doi: 10.1139/H07-185.

[5] Denly *et al* A Review of the Potential Health and Safety Risks from Synthetic Turf Fields Containing Crumb Rubber Infill. May 2008. http://www.nyc.gov/html/doh/downloads/pdf/eode/turf_report_05-08.pdf

[6] ATSDR Toxicological Profile for Styrene, November 2010. http://www.atsdr.cdc.gov/toxprofiles/tp53.pdf.

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cause leukemia and lymphoma[7]. Shredded and crumb rubber also contain lead, cadmium, and other metals known to damage the developing nervous system[8,9]. Some of these metals are included in tires during manufacture, and others picked up by tires as they roll down the nation's streets and highways. Children may also inhale potentially harmful chemicals that have been detected in the air above rubber turf such as benzathiazole and polycyclic aromatic hydrocarbons (PAHs), both of which are linked to cancer[10].

It is important to note that risk of harm due to exposures from recycled rubber turf has been assessed only for single chemicals, yet children are exposed to numerous harmful chemicals in aggregate during play on these surfaces. It is widely recognized that carcinogens and other environmental toxins act in an additive or multiplicative fashion, making risk assessment of the chemical mixtures present in recycled rubber critical for a comprehensive safety assessement[11]. Because tire rubber composition varies by manufacturer, it is impossible to know the full contents of chemicals contained within a recycled rubber playing surface. For a more comprehensive description of the harmful chemicals contained within recycled rubber products, please see the attached Consumer Guide.

4. **Transportation home of rubber pellets.** Recycled rubber materials used in play surfaces break down into smaller pieces over time that may be picked up on children's shoes, clothing and skin. The rubber is then tracked into children's homes and cars, and carried into the places where children live, play, eat and sleep. Thus exposure can continue for many hours beyond the time that a child spends in the play area.

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[7] International Agency for Research on Cancer, 2008. http://monographs.iarc.fr/ENG/Monographs/vol100F/mono100F-26.pdf

[8] Timothy Ciesielski *et al.* Cadmium Exposure and Neurodevelopmental Outcomes in U.S. Children. *Environ Health Perspect*. 2012 May; 120(5): 758–763. 27. doi: 10.1289/ehp.1104152

[9] CDC (2012) Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention. http://www.cdc.gov/nceh/lead/acclpp/final_document_010412.pdf

[10] Connecticut Department of Public Health (2010) Human Health Risk Assessment of Artificial Turf Fields Based Upon Results from Five Fields in Connecticut. http://www.ct.gov/deep/lib/deep/artificialturf/dph_artificial_turf_report.pdf

[11] Goodson WH *et al* 2015. Assessing the carcinogenic potential of low-dose exposures to chemical mixtures in the environment: the challenge ahead. Carcinogenesis 36(Suppl 1):S254–S296.

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5. **Escape of chemical hazards from rubber surfaces to the environment.** A number of the toxic and chemical components of the recycled rubber that is installed on playgrounds are soluble in water. When rain and snow fall on synthetic fields, these materials can leach from the surface to contaminate ground water and soil[12]. In addition, chemicals in turf can be released into the air and inhaled, particularly on hot days.

Disposal of recycled rubber surfaces. A further unresolved issue is what to do with the toxic components of recycled rubber play surfaces 10 years from now when they reach the end of their usable life-span and need to be dismantled. The costly process of separating, reclaiming, reusing, recycling, or disposing of the various components of a turf field are often overlooked at the time of installation. What will disposal cost? Who will pay? Often, these questions have not been factored into the overall cost.

Safe alternatives to recycled rubber playground surfaces exist. Daily outdoor play and physical activity are essential components of a healthy childhood. Thus safe play areas are critical to any school environment. While it is important to minimize playground injuries, the Consumer Product Safety Commission Public Playground Safety Handbook[13] contains several additional safe and affordable alternatives such as wood mulch, which does not carry the same risks of chemical and heat exposure outlined above.

The potential long-term consequences of exposures to synthetic rubber play surfaces have not been carefully assessed by independent third parties prior to their installation throughout the country. For this reason, Senator Richard Blumenthal called upon the federal government to conduct comprehensive studies to verify the safety of recycled rubber for use in areas where children play – including playgrounds[14]. Subsequently, on February 12, 2016, the United States Environmental Protection Agency announced the launch of an investigation into the safety of crumb rubber in partnership with the Centers for Disease Control and Prevention and the Consumer Product Safety

[12] Connecticut Department of Environmental Protection (2010) Artificial Turf Study: Leachate and Stormwater Characteristics. http://www.ct.gov/deep/lib/deep/artificialturf/dep_artificial_turf_report.pdf

[13] US Consumer Product Safety Commision. *Public Playground Safety Handbook*. #365, November 2010. https://www.cpsc.gov//PageFiles/122149/325.pdf

[14] http://www.nhregister.com/article/NH/20151106/NEWS/151109637

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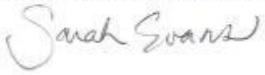
Commission, stating "existing studies do not comprehensively evaluate the concerns about health risks from exposure to tire crumb"[15]. **In the absence of convincing evidence of safety, we recommend that children not play on recycled rubber surfaces that contain known carcinogens and neurotoxins and support a ban on the use of these products.**

We urge your support of HB 5139 in order to protect the health of the children of Connecticut. Thank you for the opportunity to provide you with our professional opinion. We would be more than happy to answer any questions that you might have.

Kind Regards,

Robert Wright, MD, MPH
Director, Mount Sinai Children's Environmental Health Center



Sarah Evans, PhD, MPH
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[15] http://www.epa.gov/sites/production/files/2016-02/documents/us_federal_research_action_plan_tirecrumb_final_0.pdf

Attachment 2

Comments on ASTDR 2016-0002-0003

Federal Research Action Plan on

Recycled Tire Crumbs Used on Playing Fields and Playgrounds

Submitted to Federal Register May 2, 2016

SAFE AND HEALTHY PLAYING FIELDS COALITION www.safehealthyplayingfields.org

A grass roots coalition working for healthier alternatives for children and communities

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INTRODUCTION

On behalf of the millions of children, parents and athletes who play field sports in the US at schools, parks, athletic facilities and playgrounds, thank you for agreeing to study the potential harm caused by playing on or being near athletic fields with surfaces made waste tires. There are more than 12,000 of these playfields in place (15,000 according to the website of a large company that installs them), and they are being installed at a rate we estimate to be about 3000 a year. By our calculations, 12,000 fields currently present 2,380,000 tons or 4,760,000,000 pounds of loose, unencapsulated tire crumb on their field surface. (See our Table of Runoff and Material Volumes attached.) Tens of thousands of students and young athletes play on those fields, many more thousands have direct or indirect contact with the material. It is a public health issue of substantial importance.

The following lists our comments on the proposed study. We argue that the fields present known carcinogenic, pathogenic, and mutagenic material in a high surface area, pulverized form that is more toxic than whole tires, and should never have been allowed near children, or adults, because of risk of ingestion and inhalation exposure to all the ingredients in tires. On warm, sunny days the surface temperature routinely reaches over 150F, which presents direct, well-known heat injury risks to children. The heat increases off-gassing of the tire components, increasing the likelihood of pulmonary

exposures, and creates a complex dynamic in the children's exposure zone immediately above a field that has not been correctly modeled or studied yet. The material lacks uniformity, or any regulatory or exposure controls. We assert that it is impossible to assure even a single tire crumb field is free of inhalation and ingestion risk of dangerous particulate and gases inherent in tires, tire crumb, and add-in composites; and that dangerous and unwanted exposures from lead, benzothiazoles, 12 carcinogens, phthalates, carbon black and other materials, can happen with every use. The data gaps are enormous, and we hope CDC/CPSC/EPA will recognize there is no way the tire crumb industry can protect any player, on any field, from the potential for dangerous exposures with normal use. We argue that not enough scrutiny was placed on this material.

NOTE: The Safe and Healthy Playing Fields Coalition is a grass roots group of scientists, public health professionals, toxicologists, neurobiologist, educators, plastics engineers, medical doctors, waste management and remediation professionals, coaches, researchers, and parents who donate their own time and skills towards helping communities and individuals assess risks to their communities from tire crumb field use. We do not have a lobbying firm, law firm, hired laboratory, consultant, or revenue-generating source (such as tire crumb), and rely solely on the skill of researchers who donate time to compile our comments. That said, we have found compelling data that refutes almost all claims of safety, and when we asked for additional time to compile the information, we were given two weeks, but denied additional time. Hence, we are working at a disadvantage, and hope that during this study year, we will have time and opportunity to substantiate our concerns, and share our research with the study officials. One of our comments below explains our requests for a conference or virtual meeting that allows more disclosure and discussion.

Our comments are listed in numerically and organized into: 1. General Comments, 2. Characterization and methodology comments; 3.Summary List of requests, and a number of supporting documents are also submitted as part of our comments.

PART I: GENERAL COMMENTS:

1. CPSC/CDC/EPA should use their existing authority to immediately reclassify tire crumb athletic fields as a children's product, since thousands of fields have been installed in schools that serve hundreds of thousands of children.

2. We have grave concerns about their safety to human health and the environment, since **known carcinogenic and pathogenic components in the field material yield into both air and water pathways, and provide ample opportunity for both chronic low dose exposures with every use of the field to lead, chromium, mercury, zinc, PAH, VOC, carbon black, styrenes, benzothiazoles, and plastics; and more intermittent, but dangerous high dose exposures from "HOTSPOTS" of component material.** (See comments on Characterization). Each of the fields has material that is known to cause cancer, illnesses, and injury in humans; and leachate from runoff causes several negative impacts on the aquatic ecosystems. We believe that the potential for human illness (including several cancers) from both low dose and high dose exposures to the ingredients in tires is staggering. Basic logic favors our position. Based on the known potential for exposures to children, and the finding of a group of 200 soccer players with cancer (the group represents the reach of a single charismatic soccer coach), an immediate moratorium on new construction of the fields should be put in place with the existing authority of CDC/CPSC/EPA, until the tire crumb fields can be shown to be safe to inhale and ingest.

3. **The tire crumb recycling industry, which appears "green" in its efforts to sell millions of used tires in "repurposed" shredded form, in fact enables a direct transfer of the contamination burden of waste tires from landfills/collection sites (in the US and abroad) to the play surfaces of 12,000 schools and sports centers, where tens of thousands of children and adults have direct contact with the toxins in tire crumb materials on the field surface, and *these exposures could happen with every single contac*t.**

4. For the most part, the **schools and sports centers do not have resources to conduct toxicity due diligence;** meaning, they do not have access to a toxicologist who reads the industry studies with their health as the only priority. Purchasers rely on the tire crumb recycling industry statements, industry studies, and industry funded websites that claim toxicology assessment and public health guidance. The sales material can be striking, and the studies appear convincing on the surface, but our study groups have found significantly misleading information about the safety and actual risk of harm from the tire

crumb fields to all users, particularly children. They are likely unaware that claims that the fields are "SAFE TO INSTALL; SAFE TO PLAY" have been repealed.

5. **PEER Filings**. Public Employees for Environmental Responsibility have filed a number of complaints and documents that argue for a repeal of endorsements of tire crumb safety from EPA/CPSC, and those statements were in fact repealed; but most schools and potential purchasers are unaware of the removal of endorsements and claims of safety. The PEER filings are an excellent source for telling the toxicity story and regulatory story of this product. We respectfully request that the entire file of complaints and responses to the complaints, and other supporting material be entered into the record for ASTDR 2016-0002-0003.

The full list of documents for the ASTDR 2016-002-0003 collection and record can be found here: http://www.peer.org/campaigns/public-health/artificial-turf/news-releases.html. Please include all in that list, and all supporting materials.

6. Formal legal requests have been made to classify the tire crumb fields as a children's product since children use them, and sales and marketing material are very clear about tire crumb fields are for children. **CDC/CPSC/EPA should use their existing authority to explicitly label the fields as children's products.** (Please refer to PEER filings for details and supporting arguments: **http://www.peer.org/campaigns/public-health/artificial-turf/news-releases.html)**

7. CLASSIC CANCER CLUSTER APPEARANCE: SOCCER PLAYERS

Parents and schools may have trusted the "Safe to Play" statements, **but the parents of the 200 young women and men, who played intense soccer and were stricken with cancer do not trust those claims anymore.**

The case of over 200 young soccer players who used tire crumb fields and contracted cancer, strongly indicates a classic cancer cluster, though the cases have not undergone the formal validation process, not yet. That is because a process for the collection of this information, does not exist yet for either cancer victims, or for other illnesses, head injuries, and heat injuries/illness from the fields.

8. We respectfully request that an official study of the soccer player cancer cluster be initiated by CDC immediately.

Through our activist network, we learned about these cases, which were reported to the NBC news link, or directly to a single, trusted concerned soccer coach. EHHI reported as follows:

_____

"New Cancer Numbers Among Soccer Players on Synthetic Turf,

April 2016

It is important to remember that the only people counted in the numbers below are those who have known to call Amy Griffin. There is still no government agency tracking the cancers among the athletes who have played on synthetic turf. We know the actual numbers of athletes who have played on synthetic turf and contracted cancer have to be much greater than those who have known to report their illness to Amy Griffin.

In January of 2016, there were 159 cancers reported among soccer players; now (April 2016) there are 166. Ninety-seven of those in January were goalkeepers; now there are 102. Sixty-one percent of the soccer players with cancer are goalkeepers. As of this writing, 220 athletes of various sports who have played on synthetic turf have cancer; 166 soccer players who have played on synthetic turf also have cancer.

166 Soccer Players who have played on synthetic turf and have cancer

- 102 are goalkeepers (61% are goalkeepers)
- 64 soccer players with lymphomas, 39 are goalkeepers (61%—over half are goalkeepers)
- 10 soccer players with Non-Hodgkin lymphoma, 7 are goalkeepers (70%—over half)

- 54 soccer players with Hodgkin lymphoma, 32 are goalkeepers (60%—over half)
- 41 total leukemias, 24 are goalkeepers (59%—over half)
- 16 total sarcomas, 7 are goalkeepers (44%)
- 12 thyroid, 9 are goalkeepers (75%—over half)
- 11 brain—5 are goalkeepers (45%)
- 9 testicular—6 are goalkeepers (67%—over half)
- 4 lung—3 are goalkeepers (almost all are goalkeepers)

Remaining are OTHER rare cancers."

Source: Various; Victim parent volunteers, EHHI primary collection; 4/2016 (ongoing)

All the victims were frequent users of turf fields, spending multiple hours a week in close contact with the material in the fields. All were in their mid-twenties or younger.

9. The self-reporting to a trusted coach, is also an indication that the actual illness rates are not yet being properly assessed or managed by any hospital, medical system, or group; there is no "home" for this information, yet. The 200+ cancer victim count is likely the reach of a single coach with the help of a link in broadcast media, and a fraction of the actual count of victims of cancer or other serious illnesses. Better investigation and creating a "safe" place to report serious and intermittent illness will uncover many more victims, and provide needed perspective on the accuracy of risk assessment for this product.

10. The CDC and appropriate agencies should issue a directive asking for adequate screening for injury and disease. That US hospital and medical systems are not yet set up to collect this data is a contributing factor; and concurrently, screening for synthetic field use should be part of a responsible screening protocol. To our utter dismay, we learned from pediatric oncologists in our group that at least some oncologist are prohibited from screening victims/patients for tire crumb field use; the screening must be part of the approved protocol, and tire crumb product is not yet included..

11. In fact, the number of **all injuries from tire crumb fields should be collected and analyzed to include, but not be limited to: head injury and concussion; joint injuries (multiple); heat injury; blood cancer; lymphomas; testicular cancer; pulmonary illness; neurological impairment; kidney disease; diabetes; brain disease and cancers. These findings need to be documented, and the children who suffer from them should be screened for tire crumb field use and proximity.** No doctor or oncologist should be prevented from asking questions, screening for, or questioning the safety of this product or contact with this product. We believe there are many more heat related illnesses, head injuries, and endocrine system disruptions directly resulting from exposure to the fields than what is being reported.

12. REQUEST MORE INVESTIGATION INTO EXISTING AND POTENTIAL CANCER CLUSTER: We ask that the multiagency group takes steps to expedite the process of collecting epidemiological data and verification of the current soccer player cluster, and other potential clusters, to include field maintenance workers who rake the fields, field installers who pour the millions of pounds of material onto field surfaces, school custodians, high contact users of any kind, and school children in buildings adjacent to the fields. Residences near the fields should be considered in the scope of the study or subsequent studies. **In our own informal assessment, and using SEER database and known levels of cancer victims, we found the potential for 7-11 cancer clusters.** We respectfully ask the CDC experts to look into this possibility and take the necessary steps to prevent additional injury and cancers.

13. NEED FOR EXPLICIT PROTECTION FROM RETRIBUTION: Sadly, the families, coaches, and school leaders who have reported illnesses do so with concern for **retribution from the tire crumb industry, school boards, university administrations, and even sports league administrators, and may need explicit protection and remedy against retribution.** Researchers who study the potential for harm tell us that they do not have protection from retribution from tire crumb field industry proponents. Even in our own group, public health and medical professionals must make statements of concern anonymously to protect themselves from retribution—professionally and personally from industry proponents. Adequate protections need to be established to protect the professionals and parents who speak out.

14. **PROTECTION FOR CHILDREN IS NOT A COST-BENEFIT ANALYSIS.** Children have a unique vulnerability to toxic exposures—both intermittent high exposures—and to low dose exposures, and if we are aware of a carcinogenic presence, then we are responsible for using a precautionary principle, and removing that exposure risk. With due respect, this is not a cost-benefit analysis that will show a

percentage of children will get sick (cost) vs. tournaments played or jobs created (benefit). It is a decision made by a civil society that upholds protection for children's health above all other industry priorities, and a recognition that tens of thousands of children, if not hundreds of thousands, are already being exposed to material with known carcinogenic, and harmful materials on school turf fields.

15. The CDC/CPSC/EPA should recognize that the fields serve children, acknowledge that there are zero safety controls on the material and the potential exposures, and immediately acknowledge tire crumb fields as children's products, and use your existing authority to regulate them as children's products. **Therefore, we emphatically REQUEST THAT THE CPSC/EPA/CDC USE EXISTING AUTHORITY TO IMMEDIATELY CLASSIFY ARTIFICIAL TURF AS A CHILDREN'S PRODUCT, SINCE THOUSANDS OF CHILDREN ALREADY USE THE FIELDS, IN THOUSANDS OF SCHOOLS.**

Since children and adults are already being exposed on tire crumb fields to the materials in tires, we ask for an **immediate moratorium on further construction of tire crumb based or recycled rubber based artificial turf fields** until adequate assurances that tire crumb particulate, off-gassing, and combinations are safe for children to inhale and safe for children to ingest.

Your three agencies do not need to conduct a study to know with absolute certainty that tires were not designed to be inhaled by children, and we should protect children, at any length, from chronic or lose dose carcinogenic exposures.

Even if we cannot model or know (or will we ever know) the exposures to each child, each day (and we will never know), we do know with certainty that:

1. Carcinogens are in tires.
2. Shredded, pulverized tire crumb contains everything in tires, and more ingredients, including: carbon black, phthalates, VOCs, PAHs, benzothiazoles, lead, chromium, zinc, nanoparticle additives, proprietary additives, 12 known carcinogens, 90 materials known to be harmful to human and environmental health, (EHHI)
3. The material can be inhaled when playing and ingested with contact, or intermittent adjacent contact.

4. Every single direct or indirect use has the potential for exposure to hotspots and low dose chronic exposures to multiple scenarios of these materials.
5. The exposures could impact children, school buildings, and surrounding areas; contamination travels to cars, homes, and even children's bedrooms.
6. It is both within the authority and the responsibility of your three agencies to take immediate action to protect the public, especially children, from known carcinogenic, pathogenic exposures.

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Only a complete moratorium on their use will protect the millions of children, athletes and bystanders from inhalation and ingestion of the materials that yield from tire crumb synthetic turf fields.

16. It is also evident that tire crumb will never be safe unless ALL tire ingredients, all "recipes", the manufacturing of tires, and then preparation of materials for fields are controlled from a toxicity perspective. This level of voluntary cooperation from the tire manufacturing industry will, of course, never happen.

17. ONLY UNIFORM MATERIAL SAFE TO INHALE AND INGEST IS APPROPRIATE FOR SCHOOL FIELDS ; UNTIL THEN, A MORATORIUM. When the play surface material is uniform, consistent, and controlled, when it is tested by an adequate study with pediatric toxicology assessments to be safe for ingestion and inhalation, and results are peer reviewed following IRB standards, then we may consider a synthetic turf field might be safe. Until then, tire crumb should be rejected from any casual or unnecessary contact with children or adults.

18. RECONSIDERATION: A reconsideration of the moratorium could occur when the industry can demonstrate a uniform, non-carcinogenic, non-inhalable, non-ingestible alternative that does not present PAH, VOCs, phthalates, lead, chromium, mercury, 1,3-benzothiazoles, butadiene, styrenes, carbon black (in particulate, gaseous form, or any form to children); and the product undergoes strict, peer-reviewed study by independent qualified toxicologists who have a mandate to protect children's health and the health of the environment above the interests of industry. The hypothetical product should be subject to regular reviews and quality control determinations to ensure safety over the life of the synthetic field. Safety Data Sheets should be provided and accessible for every user. If waste tires

are used, the controls requested above will never be possible, since the tire material, by definition, is a composite of many toxins in unknown quantities and with unknown impacts.

PART TWO: CHARACTERIZATION OF TIRE CRUMB COMMENTS

1. SCALE AND SCOPE: Tire crumb potential to individuals, buildings, surrounding areas and stormwater for contamination is enormous.

2. PUBLIC HEALTH ISSUE: SCALE AND SCOPE CONCEPTS

The potential for contamination from tire crumb is a growing public health issue, in terms of the relative size of the product and its mass; the total number of potential fields; and their basic contact with students, athletes, school personnel, buildings, communities, and streams/storm water.

To give an idea of the existing volumes of material, the field runoff and children affected or who may be affected, we have developed reference tables, and the summary is attached to this filing These tables indicate the scope and scale, and demonstrate that these are not isolated fields, nor tiny exposure potentials. The quantities of material are enormous. The source and reasoning is explained, but the tables are designed for your model development and quick reference.

3. ENORMOUS QUANTITIES ON EACH FIELD SURFACE .

To give an idea of the scale, a modest soccer field uses 30,000 waste tires. According to a randomly selected company selling packaged tire crumb infill for original or replacement treatments, 30,000 tires makes about 396,667 pounds of lbs of material. According to our calculations, the volume for 2" thick field is about 525 cubic yards, However, a large football field, three times the size of a small soccer field, could use 1,000,000 pounds of tire crumb material.

4. The tires are shredded, pulverized into crumb of various sizes, and the shredded material is poured on top of a plastic "grass" carpet. Importantly, the material is loose, unencapsulated and can loft into the air when struck by a ball or foot, or body. We estimate that, depending on the school, each field has

regular, daily contact with at least 1000 athletes and students. At sports events, busy tournaments, or with active use, a field can have contact with many, many more.

5. No fields we found have mandated capture of the leachate or particulate at the field.

6. TOTAL FIELD VOLUMES POTENTIAL:. The universe of potential tire crumb playfields is approximately 200,000 - 220,000 schools and athletic facilities in the US, based on number of schools. The potential reach of exposure from use of these fields is in the millions of children, millions of adults, hundreds of thousands of exposed buildings and adjacent soils, and hundreds of thousands of public easements and storm water access points (we estimate 1:1 ratio for field to point source drainage).

7. TABLE RUNOFF AND VOLUMES: SUMMARY OF KEY METRICS

For reference, we analysed fields by sport type, by Metropolitan Service Area, and calculated the volumes for rainfall (by city), and for amount of tire crumb material on a field surface.

Key metrics are the following:

- Estimated tire crumb per 85,000 sq feet field and 2" deep tire crumb infill is 525 cubic yards, 396,667 pounds, or 198 tons per field.

- **The total amount of tire crumb material on surface of 12,000 fields is estimated to be 6,296,296 cubic yards, or 4,760,000,000 pounds or 2,380,000 tons** that are currently in sports centers and schools in April 2016..

- **Runoff is calculated by city and field size, but the total runoff for fields in the top 50 MSAs is 15,006,99,787 gallons.**

- **Total Runoff for** 12,000 fields based on number of fields per MSA, accounting for rainfall in that MSA, and added together for 2016 is: **23,370,639,827 gallons**… for a single year.

The calculations were made to illustrate the scale and scope of this product, and to characterize the reach of exposures from the field surface into the airway, and into the water pathway.

8. INGREDIENTS IN TIRE CRUMB: Lack Of Uniformity, High Variation, Multiple Toxins

Tire crumb appears to be a composite material, heterogenous with multiple known carcinogens, pathogens, and mutagens. The material is not uniform, comes from multiple sources and lots, and can be mixed with plastics and materials of unknown origin. The material can have anticlumping agents, flame retardant additives, paint, and strengthening or characteristic enhancing additives. Shredding of tires can cause small pieces of steel or metals to be included in the material from steel belted tires. Some tire crumb is from newer depositories from recalled tires, some from landfills, and some have been subjected to a variety of weather and conditions. Leachate and off gassing could be variable, with the expectation that newly installed/poured material off-gassing is higher than from an older field, but we expect those rates would vary with the age of the tires from which the tire crumb was made.

9. HETEROGENEOUS, MULTIPLE TOXINS, UNKNOWN ORIGIN: To say that tire crumb infill comes from multiple sources, is an understatement: dispensaries, landfills in the US, landfills abroad, collection centers, factory waste from China, factory waste from the US and abroad. Some of the newer marketed blends included multi colored sport shoe waste, shoe factory waste, and many unidentified synthetic materials. Just as tire companies may add anything to their "recipe" for a tire, an infill provider may offer materials that could have anything added into the blend. Tire plugs, tire polishes, tire coatings, and materials picked up on the roads should be considered. And even if it is known that there are only tires in the blend, there is a broad variation in the ingredients based on the use of the tire, and the manufacturer. Those tires may look the same, but from a toxicity standpoint their variation and the unknowns in the "recipe" create a margin of uncertainty that makes any claim of known safety for inhalation or ingestion impossible. If a vendor says he or she knows what is in a lot of tire crumb, and that is known to be safe, then they ignored the materials in the product. Since we never know what is

in any field for sure, and if we know that they have tire crumb, they cannot be demonstrated safe for children to inhale, ingest, nor play upon.

10. What Is In Tires? SOME GROUPS WENT LOOKING

Since it was difficult from MSDS or any other source to identify the components in tires or tire crumb, some groups studied them directly.

11. Environment and Human Health Inc, and Yale University Study

EHHI, Inc. in cooperation with Yale University studied samples of rubber mulch, and new tire crumb with the intent of characterizing their ingredients.

The summary text of their characterization study is found here:

http://www.ehhi.org/turf/metal_analysis2016.shtml

http://www.ehhi.org/turf/findings0815.shtml

The EHHI/Yale Study list of components found is explained this way:

The shredded rubber tire playground mulch samples tested were provided by the manufacturer and were purchased in new bags of rubber mulch for use in gardens and playgrounds. The rubber tire infill for synthetic turf fields was obtained as new infill material from installers of synthetic turf fields. There were 5 samples of infill from 5 different installers of fields and 9 different samples of rubber mulch taken from 9 different unopened bags of playground mulch.

RESULTS There were 96 chemicals found in 14 samples analyzed. Half of those chemicals had no government testing on them - so we have no idea whether they are safe or harmful to health. Of

those chemicals found that have had some government testing done on them these are the findings with their health effects.

TWELVE (12) KNOWN CARCINOGENS

2-Mercaptobenzothiazole/ **Carcinogen**, toxic to aquatic life

9,10-Dimethylanthracene/ **Carcinogen**, respiratory irritant and can cause asthma

Bis(2-ethylhexyl) phthalate/ **Carcinogen**, may cause damage to fetuses

Fluoranthene / **Carcinogen**, Fluoranthene is one of the US EPA's 16 priority pollutant, A PAH.

Heptadecane/ **Carcinogen**

2-mercaptobenzothiazole / **Carcinogen**

Phenol, 4-(1,1,3,3-tetramethylbutyl)/**Carcinogen**

Phenanthrene/ **Carcinogen** - A PAH

Phthalimide/ **Carcinogen**, skin, eye and lung irritan. A Fungicide

Pyrene, 1-methyl- /**Carcinogen**

Tetratriacontane /**Carcinogen**, eye and skin irritant. Can cause systemic damage to central nervous system.

Pyrene/ **Carcinogen,** toxic to liver and Kidneys, a PAH

Carbon Black/ **Carcinogen**

Carbon Black makes up to 20% to 30 % of every tire. It is used as a

reinforcing filler. Carbon Black is listed as a carcinogen by the International Agency for Research on Cancer (IARC).

Carbon Black, as such, was not analyzed by the Yale Study because Carbon Black is made up of a

number of chemicals – some of which were found in the Yale study.

Carbon Black is not one chemical -- it is made up of many chemicals - often of petroleum products. Furthermore, carbon black has no fixed composition, even of the many compounds it contains. Carbon black from different sources will have

differing compositions. In our method, carbon black will register as

a series of substances extracted from it. There is no carbon black

molecule, it is a mixture.

TWENTY (20) KNOWN IRRITANTS

1,4-Benzenediamine, N-(1,3-dimethylbutyl)-N'-phenyl-

Irritant - causes skin and eye irritation, toxic to aquatic life

1,4-Benzenediamine, N-(1-methylethyl)-N'-phenyl-

Irritant - causes skin and eye irritation, toxic to aquatic life

2(3H)-Benzothiazolone

Irritant - causes skin and lung irritantation

2-Dodecen-1-yl(-)succinic anhydride

Irritant - causes eyes, skin and lungs irritation

3,5-di-tert-Butyl-4-hydroxybenzaldehyde

Irritant - causes irritation to eyes, skin and lungs.

Anthracene

Irritant - causes skin, eye and respiratory irritation. Breathing it can irritate the nose, throat and lungs causing coughing and wheezing.

Benzenamine, 4-octyl-N-(4-octylphenyl)-

Irritant - causes eye and skin irritation

Benzenesulfonanilide

Considered hazardous, very little testing has been done on it.

Benzothiazole, 2-(methylthio)-

Irritant - causes Skin and eye irritation.

Dehydroabietic acid

Toxic to aquatic organisms

Docosane

Irritant - causes Skin irritation

Hexadecanoic acid, butyl ester

Irritant - causes eye, skin and lung irritant. Can cause reproductive effects.

Methyl stearate

Irritant - causes eye, skin and lung irritation.

Octadecane

Irritant - causes kin, eye and respiratory irritation

Octadecanoic acid also known as Stearic acid

Irritant - causes skin, eye and respiratory irritation

Oleic Acid

Irritant - causes skin and eye irritation

Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-ethyl-

Irritant - causes skin, eye and respiratory irritation

Tetradecanoic acid

Toxic to aquatic organisms. Skin and eye irritant.

Anthracene, 2-methyl-

Acute aquatic toxicity, Not much data available - what there is shows it to be an eye, skin and lung irritant

Anthracene, 9-methyl-

Acute aquatic toxicity, serious eye irritant

13. Carbon Black

Carbon black plays an extraordinary role in tires, and in their toxicity and potential for harm from exposures. Well known from decades of air pollution studies, urban epidemiological studies, carbon black causes lung cancer, brain cancer, kidney cancer, heart disease, neurological disorders, and cognitive degenerative disease.

A known carcinogen (WHO), we have found variations in percentages of the amount of carbon black in a tire, from 30%-68%. (EHHI/Yale Study; NY STUDY, .pdf, pp19-20.) Carbon black breaks down into many sized particles, including PM10/PM2.5. That size particle was shown to cause several types of cancer, including brain cancer, kidney cancer, kidney disease, bladder cancer, and neurological disease and cognitive impairment disorders. (CITE; Harvard Mexico Studies and Urban Cohort Studies) We know for sure that carbon black is in tires, in part from simple observation of color.

14. THE NY STUDY CHARACTERIZES TIRE CRUMB THIS WAY:

"The components of Firestone's and Dow Chemical Company's rubber are summarized in technical specification documents. Although they are only two of many different rubber manufacturers, a similarity between the two vendors is readily apparent, even between three different types of rubber, solution-SBR, cold polymerized emulsion SBR, and high cis2-4 polybutadiene rubber. In general, the following similarities were observed between the two manufacturers for the compounds used to produce the rubber:

• The polymer used to produce solution-SBR contained approximately 18-40% bound styrene.

• The oil content in the polymer ranged from 27.3-32.5% in solution-SBR and cold polymerized emulsion SBR. Oils used include aromatic oil, high viscosity naphthenic oil, and treated distillate aromatic extract oil.

• Besides the polymer used, the other components of the rubber were similar between manufacturers and the relative proportions (parts by weight) of these other components ranged as follows:

o Carbon black: 50.00 – 68.75

o Zinc oxide: 3.00

o Stearic acid: 1.00 – 2.00

o Sulfur: 1.5 – 1.75

o N-tert-butyl benzothiazole sulfonamide (TBBS): 0.9 – 1.50

o Naphthenic or aromatic oil: 5.00 – 15.0

The components summarized above are the principal components of the major type of rubber (SBR) used for the manufacturing of crumb rubber and therefore have the potential to have a significant presence in crumb rubber. As discussed in subsequent sections of this report, some of these components have been found to be prevalent in crumb rubber, including **zinc (from the zinc oxide), benzothiazole compounds** (from TBBS), and **PAHs** (possibly from the oils used). These compounds may be attributed to the SBR used in the manufacturing of crumb rubber."

15. Phthalates are a regulated toxin, and PEER filings covered some of the toxicity and regulatory discussion. Please refer to http://www.peer.org/campaigns/public-health/artificial-turf/news-releases.html

16. ZINC

Coastal Marine Resource Center Study, found fatal levels of zinc in leachate from tire crumb fields. This amount would cause fatal impacts to aquatic ecosystem within 48 hours. This is a notable amount, and though was assessed in terms of environmental health, indicates presence.

Menichini and Abate Study: "Zn concentrations (1 to 19 g/kg) and BaP concentrations (0.02 to 11 mg/kg) in granulates largely exceeded the pertinent standards, up to two orders of magnitude". "Zinc and BaP concentrations are high in rubber largely exceeding the Italian soil standards".

17. METALS: MERCURY, CHROMIUM, ARSENIC

The highest median values were found for Zn (10,229 mg/kg), Al (755 mg/kg), Mg (456 mg/kg), Fe (305 mg/kg), followed by Pb, Ba, Co, Cu and Sr. The other elements were present at few units of mg/kg. The highest leaching was observed for Zn (2300 µg/l) and Mg (2500 µg/l), followed by Fe, Sr, Al, Mn and

Ba. Little As, Cd, Co, Cr, Cu, Li, Mo, Ni, Pb, Rb, Sb and V leached, and Be, Hg, Se, Sn, Tl and W were below quantification limits. Data obtained were compared with the maximum tolerable amounts reported for similar materials, and only the concentration of Zn (total and leached) exceeded the expected values.

18. LEAD, POLITICS and CHILDREN

The problem is synthetic turf is NOT REGULATED as a children's product by the CPSC thwarting the ability to apply lead regulations that CPSC could enforce.

Lead was identified in synthetic turf fields as early as 2008 but was not addressed in any systemic way due to lack of standards or required testing (although the CPSC could have required the testing mandated for children's products since 2008). The CPSC has chosen not to mandate this children's product testing for synturf and in fact advised the industry about not having it designated as a children's product < http://parentscoalitionmc.blogspot.com/2009/03/artificial-turf-tale-of-lead-levels.html> .

This has led to a "buyer beware" situation especially after the CPSC tested synthetic turf carpets, found lead at varying levels depending on sample age, and astoundingly concluded the whole synthetic turf system was, always and everywhere, safe not just for adults but for children. The assumptions were based on inappropriate modelling for blood lead levels from a meager sampling and the troubling finding presupposes that there is, a safe level of blood lead, which most pediatricians and lead experts agree there is not safe level.

To this day the synthetic turf industry cites the still CPSC-posted "OK to Install, OK to Play on" press release which should never have been posted to begin with, has been disavowed, in front of US Congress, by CPSC commissioner Kaye and is an embarrassment to government science, policy and public health <http://www.cpsc.gov/en/Newsroom/News-Releases/2008/CPSC-Staff-Finds-Synthetic-Turf-Fields-OK-to-Install-OK-to-Play-On/ >

19. By contrast, The Centers for Disease Control (CDC) in contrast warned and continues to warn the " there is no safe level of lead" to expose children.

http://www.cdc.gov/nceh/lead/>

http://www.cdc.gov/nceh/information/healthy_homes_lead.htm.

"**No safe blood lead level in children has been identified.** Lead exposure can affect nearly every system in the body. Because lead exposure often occurs with no obvious symptoms, it frequently goes unrecognized"

In 2010 Van Ulirsch et al (Environ Health Perspect. 2010 Oct;118(10):1345-9 <http://www.ncbi.nlm.nih.gov/pubmed/20884393

20. Evaluating and regulating lead in synthetic turf.

Division of Health Assessment and Consultation, Agency for Toxic Substances and Disease Registry gulirsch@cdc.gov) concluded that: "Synthetic turf can deteriorate to form dust containing lead at levels that may pose a risk to children. Given elevated lead levels in turf and dust on recreational fields and in child care settings, it **is *imperative that a consistent, nationwide approach for sampling, assessment, and action be developed*.** In the absence of a standardized approach, we offer an interim approach to assess potential lead hazards when evaluating synthetic turf."

21. *But no such approach has ever been instituted. Indeed as reported in USA today this year: "The CDC in 2008 said communities should test recreational areas with turf fibers made from nylon, and they should bar children younger than 6 from the areas if the lead level exceeded the federal limit for lead in soil in children's play areas. But some communities have refused to test their fields, fearing that a high

lead level would generate lawsuits or force them to replace and remove a field, which costs about $1million, according to a 2011 New Jersey state report . Forty-five of 50 New Jersey schools and towns contacted in 2009 by epidemiologist Stuart Shalat would not let him test their turf-and-rubber fields, Shalat's report states. The EPA also found, in 2009, that "it was difficult to obtain access and permission to sample at playgrounds and synthetic turf fields."<http://www.usatoday.com/story/news/2015/03/15/artificial-turf-health-safety-studies/24727111/ >

22. And for the past 2 years the company FieldTurf has, with impunity, noted its synturf fields contain lead during testimony on various bills in the Maryland State House.

The latest admission documented on video: <http://wtop.com/montgomery-county/2016/03/md-lawmakers-seem-information-artificial-turf-schools/>

> "....asked point-blank by one delegate, “Is there lead in your products? The executive answered, “There’s lead in a lot of things in this world.”.... “**Yes, there’s lead in our products**." In spite of this admission and the fact that the legislation in question was meant to post the CDC prescribed warnings about minimizing lead and other toxin exposures from the synturf and tire waste products, and in spite of the fact that the legislation had strong and broad input and support, the legislation was not even allowed to come up for a vote in committee by the committee chair.

23. Public Employees for Environmental Responsibility compiled the literature as of early 2012 on lead

see: <http://www.peer.org/campaigns/public-health/artificial-turf/news-releases.html > and specifically: 2012-07-12 lead-limits-needed-on-tire-crumb-playgrounds (*NOTE if you go to PEER.ORG news releases: click on public health and "artificial turf" to find the actual filings with many links}*

Unfortunately for the children, fields with high lead remain. But those responsible for protecting children are kept in the dark. NO ONE IS MONITORING OR REGULATING ARTIFICIAL TURF FOR LEAD OR OTHER TOXINS in either old or new fields, including the Consumer Product Safety Commission (CPSC) (see <http://www.peer.org/news/news-releases/cpsc-drops-artificial-turf-playground-safety-review.html Even though the Chairman of the CPSC, recently admitted to congress that its soothing conclusions of safety after finding lead in synthetic turf were NOT correct.

Tested fields keep showing up with lead in them both old AND NEW. Some tested fields have little or no lead , some high levels and some have both within the same field. There is no way of knowing if any of the components of a field contain lead, and how much without stringent and thorough testing of each field.

This problem highlights the need for application of the designation as a children's product for testing and regulation : 1) stringent testing of all the colors and of the backing of the carpet for total lead content (chromium and cadmium should also be tested for) AND 2) Testing many samples of the infill which is an ever-changing â€˜witches brewâ€™ of chemicals- so undetectable, low and very high levels can all be found in the same field. In addition to having testimony both last year and this year in the MD state chambers from Field Turf that their product DOES indeed contain lead (as you heard in the recent committee testimony on MD house Bill 883 , and in addition to those referenced in the PEER review, other studies on lead also exist.

24. For a comprehensive media article on Lead in artificial turf which cites scientists and studies that the synturf industry avoids please go to: <http://www.usatoday.com/story/news/2015/03/15/artificial-turf-health-safety-studies/24727111/

>

For example as reported in that article:

Dr. Shalat's New Jersey State Study (2012) on artificial turf found lead in the field dust in the respirable

air space of a robot and real player- highly variable but sometimes very high (note most facilities would NOT LET THEM TEST).

<http://www.nj.gov/dep/dsr/publications/artificial-turf-report.pdf

25. PEER writes: The concerns about lead exposure have taken on a new urgency following the release in June of 2012 of a study done for the New Jersey Department of Environmental Protection which found artificial fields made of tire crumb can contain highly elevated levels of lead much greater than the allowed levels for children:

a)· It reports "concerns with regard to potential hazards that may exist for individuals and in particular children who engage in sports activities on artificial fields"; and

b) *"In**halable lead present in artificial turf fields can be resuspended by even minimal activity on the playing surface**."*

26. Dr. Lioy of Rutgers who is quoted in the USA Today article recently participated as the senior author in a study which found lead and other toxins in the BOTH the plastic rug (supplied to them by the industry) and tire crumb infill. LEAD was also was found in simulated body fluids meaning there is little or no protection of any kind against the lead getting out of the material into the body .

27. Pavilonis Study found lead.

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4038666/pdf/nihms565643.pdf > 2014

" **Bio-accessibility and Risk of Exposure to Metals and SVOCs in Artificial Turf Field Fill Materials and Fibers**" , Brian T. Pavilonis1,Clifford P. Weisel1, Brian Buckley1, and Paul J. Lioy1

QUOTE from Pavilonis et al:**."Since it is possible that children may be exposed to potentially high concentrations of lead while using artificial turf fields we recommend, at a minimum, all infill and**

fibers should be certified for low or no lead content prior to purchase and installation."

*<u>The main out-comes of concern from Pavilonis et al</u>**<u>:</u>**

a) the finding of **lead, and chromium** in **both** the **tire crumb** and **the plastic rug** and simulated **body fluids** at sometimes extremely high levels ***EVEN IN NEW FIELD CARPETS**.*

b) **Benzothiazole** derivatives and **4-(tert-octyl) phenol** were also found in in the simulated body fluids. Both are probable carcinogens (the subject of another fact sheet).

QUOTE: "**Lead was detected in almost all field samples** for digestive, sweat, and total extraction fluids with digestive fluid extract of one field sample as high as 260 mg/kg. Metal concentrations were not markedly different across the three different sample types (new infill, new turf fiber, tire crumb field sample). However, one of the ***new*** turf fiber samples contained relatively large concentrations of **chromium (820 mg/kg) and lead (4400 mg/kg)** compared to the other samples tested…the variability of lead contained in the infill material is large and can span more than two orders of magnitude* . One field [tire crumb] sample did contain a high lead level (260 mg/kg) which was on the s**ame order of magnitude as the NJ DEP cleanup value** (400 mg/kg)."

In summary: Lead-free is the only acceptable level for child products (and indeed for people in general). T**here is NO safe level of lead for children.** And yet many of our children are playing often, if not daily, on fields that may contain lead and certainly do contain many other toxic substances. Finding ANY lead in any play area for children of any age is unacceptable. As the CDC notes: Every effort should be made to eliminate ALL unnecessary sources of lead in the environment, especially a child's environment. ***Lead in artificial turf is not only totally unnecessary but dangerous to health AT ANY LEVEL*.**

28. Other sources of information on Lead in tire crumb fields:

www.ehhi.org/turf/<http://www.ehhi.org/turf/>

www.safehealthyplayingfields.org<http://www.safehealthyplayingfields.org>

www.synturf.org<http://www.synturf.org>

[FOOTNOTE SYN TURF]Where on the Synturf page on lead you can find:

No. 36] Mayo Clinics tips to protect children from lead in artificial turf. April 2015.

No. 35] Durham, New Hampshire: Lead scare at UNH, s Memorial Field. November 2012.

No. 34] Beware of lead content in exotic color artificial turf fields! September 2012.

No. 33] Odessa, Texas: Eager fans will not be given pieces of the artificial turf field. September 2012.

No. 32] U.S. Federal panel increases child protection against lead. February 2012.

No. 31] UNLV researcher spreads word about the need to test artificial turf fields. December 2010.

No. 30] Environmental Health Sciences study (2010): Deteriorating synthetic turf dust containing lead may pose a risk to children. October 2010.

No. 29] Concord, Mass.: Town replaces fake grass fields, officials insist nothing is wrong with the lead levels! July 2012

28. TWELVE (12) CARCINOGENS found and HOW DO THEY INTERACT:

The Yale Study identified the presence of so many carcinogenic materials in a single material that it raises many more questions about interaction of PAHs with metals, and combination impacts. The

interaction of the PAHs and benzothiazoles with other materials in the fields needs to be characterized and addressed

29. Strengthening Additives: Nanoparticles

We would also ask for information and clarity about tire strengthening additives of any kind that were built into the material anytime in the past 30 years, these would have been added to tires. [http://nice.asu.edu/nano/carbon-black-and-amorphous-silica-tires]

Similarly, we request that the tire manufacturing industry explain their use of nanoparticle products, of any kind, including the type and size, source company and source country, and ask for an explanation about how:

a. they can be quantified in the product, and
b. how can they be cleaned up if they are released when the tire crumb and or plastic “grass” carpet degrades?
c. We would also like to understand what material characterization of their behavior in tires performance,
d. And or their behavior once they are released into the environment.
e. We ask for any epidemiological due diligence that was conducted by any tire company on nanoparticle use prior to using them in a commercial product.
f. Plans for continued use and safety precautions tire companies will impose upon themselves
g. Epidemiological studies conducted on these particles in tires

30. Plastics, Microplastic Fibers, Microbeads, and Small Particulate Plastics

Assessment of microfiber particulate and small particulate plastics needs to be assessed in characterization studies.

31. Flame Retardants

Flame retardants can be added to a tire in production, or applied post production in a shipping setting or possibly as tire crumb. Since flame retardants are known carcinogens with health issues of concern, and will be on the surface of the waste tire crumb, tire infill providers need to know if they are present, and purchasers need to know that the material contains flame retardants prior to purchase.

32. Tires and Tire Crumb Additives

Myriad products exist to clean, protect, condition, and color tires. We wonder if they are components of tire crumb?

33. Road Waste Picked Up By Tires

Tires spend their lives on roadways, of course, and can pick up many materials in their travels. Debris, hydrocarbons, ….

34 CARINOGENIC, PATHOGENIC, and MUTAGENIC ingredients in tires cannot be removed by shredding tires into tire crumb and must be assumed to be accessible.

35. Tire crumb and repurposed rubber appear to be the same thing, with interchangeable use… but are they the same? We would like clarification.

We would like clarification about the distinction between the tire crumb, repurposed crumb rubber, and crumb rubber. Specifically if using the term “repurposed rubber crumb” implies uniformity of ingredients? Does that term imply tires are not used? If so, what are the ingredients in repurposed rubber crumb and how do they differ from tire crumb?

36. **We would also like access to all MSDS/SDS of tire crumb manufacturers and tire companies,** and the ability to ask questions about how and where they were made, variations on lots, source and composite addendums. It is difficult to locate them.

37. EXEMPTION ON LISTING HAZARDOUS MATERIALS: We would like to understand why tire companies have an exemption on their need to list ingredients under Section 2: Hazardous Materials of an MSDS/SDS. We were unable to find the source of that exemption, if it has a deadline, and whether your study group thinks it is an obstacle to understanding and characterizing risk of exposure from tires and tire crumb.

38. Of those MSDS that we located, several, like this Michelin North America Material Safety Data Sheet for Michelin, Uniroyal, BF Goodrich, says in **"Section 2 HAZARDOUS INGREDIENTS: Note: Tires meet the definition of article as defined by the OSHA Hazard Communication Standard (29 CFR 1910.1200) and are exempt from MSDS requirements."**

There was clearly no mention of 1,3 butadiene, carbon black, POHs, VOCs, benzothiazoles, or any plasticizers, nor metals, styrene, sulphur, known irritants, or well… anything. Since that section also outlines corrosive, combustible and waste treatment, it is important for more than this issue. We explicitly ask CDC/CPSC/EPA if they can use their existing authority to require tire crumb companies and tire companies to provide ingredient information.

39. SOURCE MATERIAL UNKNOWN: MSDS/SDS CANNOT REPRESENT WHOLE FIELD. Tire crumb comes from many tires, and many sources. Since not a single tire crumb field can accurately list or track which tires were source materials, or what other mixed in components, and there is no accountability from tire crumb recycling industry for the shredded product, then MSDS/SDS cannot be accurate for a whole field due to variability. Therefore, the burden of "proof" of risk lays squarely on the ability of the purchaser (schools, sports directors, booster clubs) to assess risk… of a very very complex product. So,

if the exemption stays in place, we will know for sure that we cannot know what is in a tire crumb based field.

40. TREATMENT TO SHOW NO PARTICULATE OR BREAKDOWN: SHOW US.

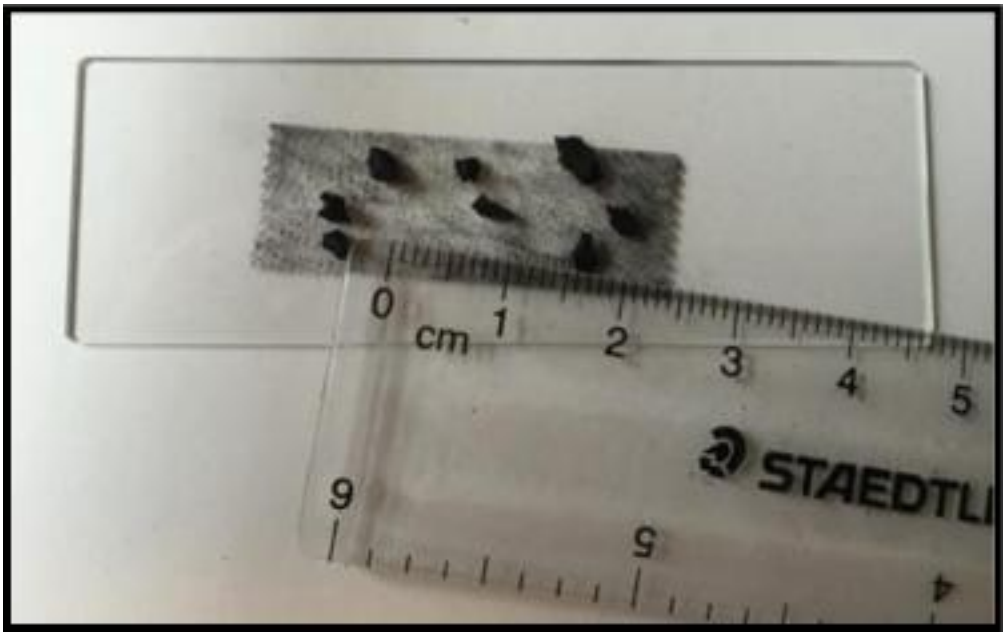
As for studies that claim that their product has been treated (such as cryogenic treatment) to not break down into dangerous particulate, we are deeply skeptical, and would ask for proof. We also ask for assay testing over a period of at least several summer weeks. We ask for the researchers to simulate the pounding over 10 years and assess the particulate characteristics and particle size. That testing in fact is being done right now… in thousands of children across the country. Simple observation on a player body, on the sideline benches, or under a microscope shows consistent breakdown into particulate.

41. SHREDDED, PULVERIZED, HIGH SURFACE AREA FORM OF TIRES and ADD INS is LIKELY MORE TOXIC THAN WHOLE TIRES.

Unfortunately, because it is shredded, pulverized, and in loose and unencapsulated form, tire crumb has exponentially more surface area than whole tires (Thomas, Gupta study;) and we are concerned the material is very likely more toxic—possibly many times more toxic—in the school field form than whole tire form, since the increased surface area provides more opportunity for molecules to escape. We know for sure that the increased amount of surface area in tire crumb makes the material in tire crumb more available to the breathing and exposure zones, and to runoff.

42. CRUMB IS SURROUNDED BY DUST PARTICULATE:

Accurate characterization technique must include a study of the particulate that surrounds tire crumbs, and steps must be taken to make sure that the sampling process does not inadvertently remove that dust and particles. We found several examples of the samples being washed, some in unbuffered water, prior to their analyses being done. Of course, that removes the particulate that concerns us the most. Distribution of the particulate size and type is important. Those particulate can become aerosolized by numerous gases and we ask that attempts are made to properly model this dynamic under high heat conditions, primarily.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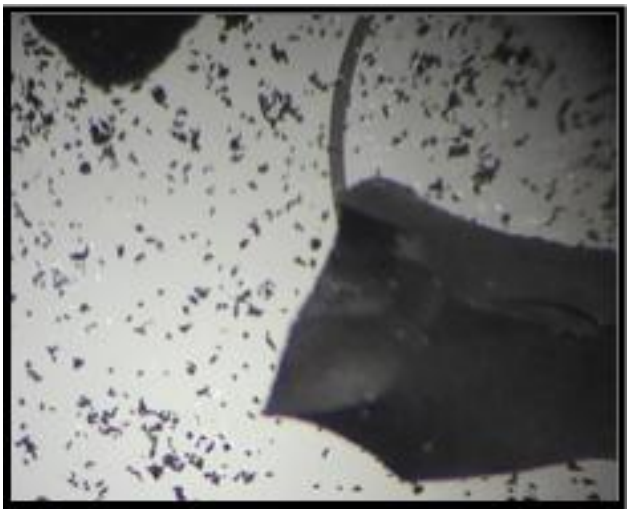

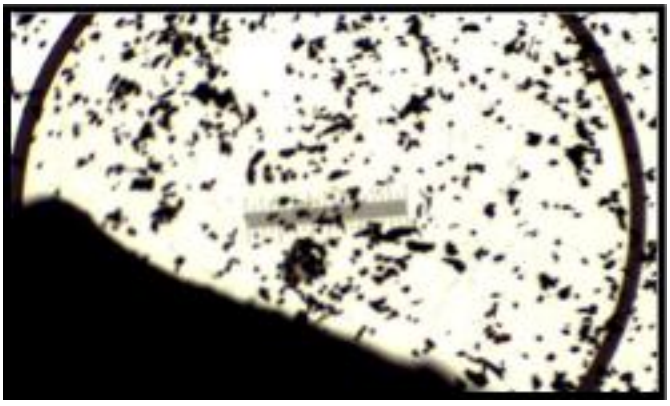

43. VERY COMPLEX PICTURE From TOXICOLOGY PERSPECTIVE: Tire crumb material is complex from a toxicology perspective, largely due to the chemical complexity presented by multiple known toxic components and variation. It has been described as a "toxic soup" of ingredients for which we have no consistent data on proportions or levels. Characterization of ingredients' margin of error is unknown.. Testing must be done at the field levels using accepted sampling plans that have been statistically shown to be valid. Not fields have been tested in sufficient detail to determine or rule out any exposures or risks. A look at testing protocols for lead in urban soil sites illustrate the level of attention required and show the degree that current testing has fallen short of that needed for decision making for children's health.

44. CONTACT PATTERNS, FIELD USE and ADJACENT BUILDING CONTAMINATION

Exposure is likely determined by ingredients in surface, activity, and number of children or users on field. Each school or community field has high use and high contact patterns, such as hosting contact sports, like football, lacrosse, soccer, and baseball, athletic camps, workshops and practices. In those sports, children dive into the field materials. As a child runs or skids or slide tackles, a column of material rises up, as does the dust and particulate that surround the tire crumbs themselves.

Testing for exposure need to list weather conditions including humidity, wind speed, and precipitation, temperature on field surface and ambient air temperature. Number of children on field, and activity level of that play needs to be recorded, video would be most interesting.

Children of all ages use the fields for multiple sports, recreation and school events. Artificial turf tire crumb fields abound in elementary schools and at indoor and outdoor sports centers where children of all ages and all stages of development play soccer, lacrosse, football, track, cheerleading, band, and use the field for general recreational school activities. In the fields with which we are familiar, families with members of all ages use the fields; and the community holds events, picnics, special fairs, and activities. Some fields are immediately adjacent to a school building.). That there are many uses, and probably many levels of contact and exposure is an important part of characterizing exposures, but both low dose exposures AND high contact exposure scenarios and use need to be examined, with appropriate epidemiological process.

45.. SCHOOL BUILDINGS AND SURROUNDING AREAS ARE CONTAMINATED with a great deal of tire crumbs. The fields appear to lose from 1-30 tons of material over their 8-10 year life, and some of it goes directly into buildings, cars, and then homes. This impact needs to be studied as an inadvertent consequence.

46. CANNOT ARGUE NO INHALATION OR INGESTION RISK or SAFETY FOR EVEN A SINGLE FIELD. We argue that given the unique characteristic of nonuniformity, known carcinogenic materials, breakdown into particulate/dust, no known source of origin, and no accurate studies on complex interactivity of those components in the children's exposure zone, in the tire crumb as it is installed today in 12, 000 fields, not a single field installer, nor material provider can demonstrate that the material is safe from inhalation and ingestion during normal use, active use, and on hot days.

47. EVERY USE COULD POSE A TOXIC EXPOSURE and it would be irrational to argue otherwise. We argue that due to the high variability of toxins in the tire crumb substrate (from tires, unknown additives, and factory waste add-ins), and lack of any control of the material, well-known sampling techniques will NOT accurately predict risks to human health.

48. CHILDREN CANNOT AVOID THE EXPOSURES: Since school children cannot self-advocate and take responsibility for staying off a field if directed to be there by coaches or school officials or parents, we must assume that children cannot avoid the exposures when they play on those fields.

49. CANNOT CLAIM THAT EXPOSURES WILL NOT OCCUR. Absolutely no way to responsibly claim that ingestion and inhalation of particulate from the material will NOT occur to those children.

50. HOTSPOTS of intermittent dangerous exposures are possible, and should be expected and searched for in every field.

We must assume that tires have different "recipes" based on their type of use. Therefore, knowing the type of tire used in tire crumb, and each tire "recipe" would be helpful in assessing characterization of

ingredients. However, there is no way to ever know what tires, or what material is in any field, and therefore, an MSDS/SDS cannot be representative of any field, or even any meaningful part of a field. Alarmingly, the high variability in the ingredients presents worrisome "hotspots" potential, where the hotspots might be missed in sampling but even a single exposure could have very serious impacts for a child who has the unfortunate luck to dive into that hotspot. PAH's may be more prevalent, and present dangerous levels for installation period of the field, and for some unknown period of time afterwards, and considered a "hotspot", then the consistent release of PAHs in the subsequent years could mean low dose, chronic exposures. Both need to be examined.

51. Lead, chromium, mercury and arsenic could be hotspot sources, based on which tires were used, and how they were treated prior to being placed in the field.

52. For example, when we asked about the source of lead in tire crumb fields, an infill vendor explained to us that a) lead could be in any field as an ingredient of the tires, of the treatment of tires, and b) once, they were aware of a shipment of tires that was treated with an anticlumping material that contained lead and the whole lot had lead, and c) that some lots had flame retardants added as well. They would never really know, but "most purchasers never ask", according to the infill material vendor. If an MSDS was required, an additional charge was to be imposed, since MSDS were not available from the materials they acquired from China or other countries. We have collected many more examples of the worrisome unknown ingredients in our fields and can share with the study teams, if requested. While this information is anecdotal, that is the point: we have no idea what is in any field, for sure.

53. Another example, but this is not anecdotal: in a primary study field exposures in CT, a researcher found that the children's monitors showed benzene. Since there is no safe level of exposure for benzene, and in fact, tires are not expected to have benzene, the field was sampled more closely, until that "hotspot" was located. The original source of that benzene was not determined, but it was next to a busy parking lot where cars' exhaust may have been a source as they turned the corner, or possibly the tire crumb material had been previously stored in an area with benzene in surrounding environment, or perhaps it was picked up from contact on roads. We will never know. That finding suggests that the carbon black in the tires can adsorb additional toxins present near tires or tire crumb, and could release that material as the fields are pounded with running feet, or possibly on a hot day.

The proper characterization of this material needs to account for adsorption characteristics of carbon black, and other interactions

54. The point is, that it is impossible to locate hotspots for all toxins in every field, and incorrect to extrapolate the risk for a whole field from a single sample or even multiple samples, since every sample is unique. So, while hotspots can easily be missed in a field, the unfortunate child that dives into that particular part of a field has an exposure that can actually be life threatening, but missed in its entirety in the sampling based risk assessment.

55. In fact, since the tire crumb creates multi sized "dust" particles, and off gases, it is impossible to prove that even a single field is safe from inhalation or ingestion exposures from tire dust particulate, off-gassing components, multiple toxins and combinations of toxins, and heat.

56. Importance of the Heat Factor: Source of direct injury and chemical catalyst

HOT HOT HOT HOT EXTREMELY HOT FIELDS

Grass playfields remain close to the temperature of ambient air, and are often much cooler. Asphalt playgrounds used to have a use limit of 141F and many schools remove children from playgrounds when temperatures get hot. With tire crumb based turf fields, surface temperatures can soar on even mild sunny days.

Tire crumb fields "superheat" to levels that are routinely over 150F on a sunny spring day, and in a recent study conducted on a sunny day Utah, found to be close to boiling point, 190F, according to the Penn State Field Turf Heat Study. The study found that tire crumb field surfaces are hotter than ambient air, and increase in heat in a non-linear function with each additional degree Kelvin of heat, hence the designation "superheating". To draw an example, on a Labor Day Weekend in DC area, with ambient temps of 82F, the field surface temperature hit 164F by noon on several fields used in a busy, tournament for about 1000 children, both boys and girls, ages 8-15. Those levels are known to melt plastic cleats, require tubs of water on the sidelines to cool down shoes, and create heat-related injury

including heat stroke, nausea, heat exhaustion, and dehydration in children and all users. It is not unusual for children players to vomit, faint, and suffer dehydration from hot conditions on the fields.

57. Marketing and sales for these fields tout their usability in all conditions as a benefit (more practice and play hours), but in fact, the heat build up on fields makes them very uncomfortable during many days and conditions. In DC, there are over 100 days of sunshine each year, and most are during the spring, summer and fall, making the fields uncomfortably hot and possibly dangerously hot for a third of a year. A calculus should be made on the percentage of safe days to play based on field yield risk, and heat.

58. Tire crumb fields do not have any protection from heat, and so they are irrigated to be cooled down, but the effect is temporary.

59. To our knowledge, there has been no well known place for doctors nor parents to report heat injury, though they are commonplace. (This author specifically remembers a hot, poor air quality day in August in 2014 in Washington DC when during a single practice, 4 soccer players vomited, another child was taken to the hospital after passing out, and another sidelined himself against the coach's wishes, due to extreme dizziness and nausea.)

60. **Reluctance to Report?** Yet, it is curiously uncommon for school teachers, coaches and parents to remove the children from the fields, due to temperature. We cannot explain that in rational terms.

We have also noted another curious effect: as football, soccer and lacrosse increase in popularity and competition in the US, competition for spots on high performance teams is fierce. There is a perception from strong sales and marketing of the fields, that the turf fields present a competitive edge for a school, a club or even a teenager trying to get into college, and are worth the high price paid. As psychologist Dr. Wendy Miller, explains, " it is a culture where high performance parents, players and schools might be willing to overlook these injuries, thinking that to complain would jeopardize their child's access to a competitive team. This thinking could easily lead to the silencing of reporting of injuries."

Heat injury reporting needs to be included in the survey questionnaires, and victims of heat injury and illnesses need to have a place to report, with impunity.

61. HEAT MAKES THE CHEMICAL DYNAMICS ABOVE A FIELD VERY COMPLEX

In addition to the serious issue of direct injury from hot playfields to young children, or anyone, the super hot fields present a very challenging chemical situation.

Dr. David Brown, ShD, toxicologist, professor and former Deputy Director of Public Health Practice Group at ATSDR/ CDC explains that, "the unintended, and largely unstudied chemical consequences of what comes off such an enormous quantity of high surface area material, in amounts and sequence that is scientifically accurate is very difficult to predict and model. Since the chemicals in the area above the field could change instantaneously, the conditions are critically important (number of players, temperature, time from last rainfall, etc.), as is the sampling methodology. But no one has been able to come close to modeling the actual yield, we only know the materials by characterization with samples, and that variation in samples is so broad as to almost be meaningless, since it could be easy to miss harmful exposures."

62. Analyzing the field yield on a hot day is very complex, and challenging to even trained toxicologists. The superheating of the fields makes gases yield at faster rates as temperatures on the tire crumb surface increases. So, as a day heats up, it is very likely that the yield increases directly with temperature increase; a hot day creates more gases. Based on well understood scientific laws, we presume that the gas yield from the field at surface temperature of 50F (a cloudy day in January in DC) would be considerably less than a field surface temperature of 158F measured last week. If more gases are escaping the surface, then there are more "opportunities" for particulate to adsorb onto the surface of the gases, creating very dynamic series of compounds, none of which would be recommended to inhale.. The changes in the chemical composition over the fields as their temperatures rise is very difficult to test and model. These changes happen in an instant… as a threshold is reached… and the exposures can increase sharply. It is a very sophisticated and difficult challenge to model. But what is the most important is not only that the 24 gases that escape tire crumb (Norway Study) create dangerous mixtures but those gas/particulate mixtures, (and air) create a vector for deep lung exposures of all the

materials in the tire crumb field. So, on poor air quality days, when there are many children on the field and a lot of stirring up of the material, the fields could present enormous risk.

63. We are concerned about the range of yield levels, but, we are most concerned about the intermittent risk to children during those hot periods (a hot, poor air quality summer day during children's soccer camp week in Washington DC, for example) when the fields are likely yielding more gas, and therefore particulate has more "carriage" into lungs, respiration rates are higher, skin is exposed, and perspiration is highest. All these are likely factors in exposure. It is during those days when exposures are probably highest, and high enough overwhelm a developing immune system.

64. Exposure Study Needs To Focus On Worst Case Conditions

We acknowledge that the level of yield from the fields might vary widely with material variation, and will also vary with outdoor weather (temperature, wind, humidity and sun) conditions. Taking averages from fields across the country will be meaningless, and will only help the industry to expand its message of "found no harm". An analogy might be to determine the health of a forest taking 4 samples from 40 locations, evenly spaced, but the sampling might easily miss a blazing forest fire. That one day might destroy living material exponentially, but it could easily be missed. Dangerous exposures can be unpredictable in this material due to the scope and scale, the toxic character, and the superheating characteristic.

65. A better approach is to carefully detect high yield days, and look THAT DAY for exposures in a child's body during those periods. Since the exposures might attenuate, the work would have to be done expeditiously. The harmful exposures may or may not be detectable a day or a month later in a child. Monitor both genders, for patterns that might lead to that awful air quality soccer camp in the city on a tire crumb field, on days when vomiting and melting shoes are commonplace. A focus on the impacts from the high end of those yields we believe will present exposures that are clearly, and unequivocally harmful from both heat injury perspective and toxicity exposure potential. We do not know for sure if the carcinogenic exposures from low dose regular exposures or from high dose "events" are more dangerous, but both need to be studied as separate situations, not as an average.

66. We urge your team to focus the study resources on primary measurements made in high use scenarios on hot days, and refrain from the approach used in earlier studies that look at chemical compositions during winter or rain conditions on limited number of fields.

67. The only reliable way to assess the risk to children from a particular field, or groups of fields, is to look at their direct exposures, and importantly look at bloodlevels of the known substances. Cooperation from both high use athletes and those exposed to chronic levels of materials will be important.

68. The Study Needs To Focus Also On Low Dose Exposure Risks

Trained immunotoxicologists look at the impacts of chronic low dose exposures to metals, PAHs, VOCs and many other materials in tire crumb. Their input is crucial to understanding risk of exposure in a developing child.

69. Characterization Mistakes

Studies look convincing, but miss the forest for the trees.

Tire recycling and tire crumb industry reports are quick to point out that when they find harmful materials in their samples, they are under the known safety limits. There are two interesting fallacies in that reasoning.

First, since the samples in several studies are few and not uniform, they fail to acknowledge the statistical significance of finding known regulated toxic material in 2 million pounds of powdered tires… if one finds the needle, is it luck, or is it because needles are more prevalent than expected?

Proof of presence is meaningful! For example, in the NY Study, PAHs were found, as were metals, benzothiazoles, and many substances. Their presence indicates a risk.

In a child's product, since many materials are not known how they affect children, just knowing they are there is enough to use a precautionary principle and prevent the exposure. Arguing that the materials

appear under a limit (especially if that quantity is an average of multiple samples), or there is no established limit (because it has not been studied), are not as meaningful as the proof of their presence.

Second, though the conclusions of the industry reports may be of no harm found/safety, a close look at the data itself on PAHs, lead, cobalt, chromium, etc. is useful, since a) it proves presence, and b) at levels that suggest risk for **chronic exposure**. Chronic exposure risk is the subject of a great deal of new cancer research, and we care about all the materials, including those which are potentially toxic.

70. ARGUMENT FOR MORATORIUM BASED ON KNOWN CHARACTERIZATION FOR TIRE CRUMB

Because of the:

a. known loss of 1-30 tons of material from the fields during the 8-10 year "life of the field" into air and water
b. ingredients list: over 50% of its components are known carcinogens and pathogens, [cite Yale Study]
c. massive scope and scale of this product, (the amount of material and surface area of these fields is enormous; scale/millions of pounds in each installation),
d. inability to control the levels of toxic exposure to children, or even properly characterize them due to immense variation and chemical complexity of what happens on a hot day over a field, and around children. We cannot suggest mitigation strategies for the danger, because the material is inconsistent,
e. Even if we did know for sure what was in each field, and suggest mitigation techniques and protections…. All the tire company has to do is change their recipe, or many recipes, as they do continually, and the study is worthless. Children are still being exposed to whatever is in the tire, the lot or that particular field..

71. Moving Target Analogy

Even if the study were completely successful, and the tire crumb material categorized properly, the trouble is, tire manufacturers could change the “recipe” for tires… and in fact they do this regularly… and the study results will be useless, or at best, diminish in usefulness.

Any attempt to study tire crumb safety on turf fields is analogous to trying to hit a moving target. Tire crumb is a waste product. Tires are not designed or intended to be used as infill for turf fields.

Ingestion, inhalation and absorption of fine particulate by children is not a consideration of tire manufacturers as they choose chemicals and compounds for their tires. Nor are they bound to maintain any safety considerations for such use by children.

So any study of present day tire crumb is a futile endeavor, because such study tells us nothing about a field that gets installed immediately after the study. Tire manufacturers often change the chemical composition of tires and will likely do so again.

Even if a field passed safely concerns in a present day study, a new field could easily fail a hypothetical study conducted the day after the present study. So unless every field was tested using the exact same methodology after every installation, there is absolutely no way to assure the user that their new field is safe. Those new fields could easily have an entirely different chemical composition simply because tire manufacturers changed their tire ingredients.

So the present Federal Study is only a backwards looking study, not forward looking. Any conclusion must be transparent and clear on that issue - upfront and center. Otherwise the public is being misled into a false sense of security.

72. **Sampling: Not Appropriate For Tire Crumb**

The core pediatric toxicology problem in industry based safety studies, is that there appears to be an assumption that tire crumb is a uniform material, and behaves uniformly. It does not. There also appears to be an assumption that sampling will be an accurate method for studying tire crumb risk to children, and it is not. **Sampling will not be accurate to assess a nonuniform, heterogeneous material with multiple known toxic ingredients, high direct contact (dermal, hand to mouth, breathing zone) for pediatric use**. **Sampling cannot produce a single sample that is representative of the whole field, or even a part of the field, other than the sample itself.**

73. Methodology needs to study PERFECT STORM exposure conditions, and be able to calculate exposures during those relatively dangerous days.

Nor can sampling in the way it is proposed (samples from 40 fields across the US), illustrate impacts from a perfect storm of exposure conditions on a particular field, say, during an intense soccer camp in in summer in Washington, DC with high ambient and field surface temperatures (ie 160F), bad air quality, no wind, when working athletes are breathing in particulate with high VOC, PAH, benzothiazoles, and carbon black… and many more compounds, on a particularly high yield day. Averages cannot be relied upon in sampling for this type of product, since they will further obscure the risk from exposures to hot spots of high risk material that are on fields. Averaging the results from a national distribution in various weather conditions simply obscures the acute risks further; it is useless for risk analysis. In layman's terms, it is like studying a forest using "x" number samples, but missing the forest fire that is blazing away at a nearby area of the park. For a child, it means that she plays on a field that was called "SAFE TO PLAY", after sampling, but in fact she might easily have been covered with multiple materials known to cause cancer, and in fact, that might be a regular event. The uncertainty of exposure frequency makes the risk higher, not less.

74. The core of the methodology used in the 50 studies asserted by the tire recycling industry were based on simple characterization of a single sample, but not on realistic, combined, nor worst case (the most important) use scenarios.

75. Multiple carcinogen and multiple pathogen combined effects need to be measured. Single material measurements could be only a fraction of the exposures, since the material exposures are likely to be from combinations of materials.

76. BIOMONITORING FRONT AND CENTER

Because sampling presents inconclusive results, a methodology that relies on biomontioring will be more meaningful. We suggest that more sophisticated approach be considered. Personal sampling monitors attached to children, dermal, urine, breathing analyses, and particularly, blood and tissue samples from frequent users, players on "Perfect Storm Days" and those expected to have chronic low dose exposures. We understand that biomonitoring raises more issues, but absent a good model, empirical data is the most reliable way to accumulate actual evidence of exposures and to be able to establish a reliable causal link to the cancers and diseases we predict from exposures.

77. IMMUNOTOXICOLOGY SUPPORT: RECRUIT THE BEST PEDIATRIC IMMUNOTOXICOLOGISTS AND RESEARCHERS. Some researchers and epidemiological professionals are already on the trail of better ways to identify actual exposures, and can create biomarker groups as indicators of presence of illness or exposures. These researchers have background in immunological toxicology, and can track subtle changes in an immune system that might be precursors to serious disease, like cancer, kidney disease, brain changes, and lung disease. It is possible to create biomarker group to prove tire crumb exposures in users and we believe that the preliminary proof of concept step could be accomplished in less than 6 months with cooperative athletes, and study volunteers, and modest budget. While we will not list them here, for protection of their privacy and frankly, for fear of industry retribution, we will nonetheless let you know that we have found multiple professionals who are capable and willing to work on this task, provided a protective forum and IRB standards are in place.

78. Immunotoxicology support: look carefully at the ages those immune system markers in all children who are using these fields, understanding that some metabolic types, and ages may be more

vulnerable than others. In fact, there are early indications that certain age groups, such as prepubescent females (age 8-11), may be more vulnerable to exposures to benzothiazoles, plastics, phthalates, and endocrine disruptors in general, and therefore might be at higher risk to contract cancer or disease from low dose particulate exposures from tirecrumb, and the plastic "grass" carpet particulate. We need to establish the datum from players to study this. We still do not know, but some indications exist. For that reason, we respectfully request that the study team include toxicologists and epidemiologists that are trained to keep these concepts front and center.

79. LOW DOSE EXPOSURE CONCEPTS and CONCERNS

Based on what we know now about low dose exposures to VOCs, PAHs, benzothaizoles, styrenes, carbon black, plastics, plasticizers, and metals, even at low, sub acute exposures, the fields could be very dangerous. That possibility was not considered in the CPSC study, EPA study, nor in mulitiple industry studies. These need to be assessed:

- Chronic exposure to metals, plastics and plasticizers
- Chronic exposure to carbon black mimics air pollution exposures
- Immune system reactions
- Endocrine disruption exposures from plasticizers and phthalates,
- Exposures from multiple low doses and chronic exposures

80. The study should calculate yield of material that leaves the fields, and how it leaves the fields. How much in the air , water pathways, and with users (in shoes, cars, etc.) Interviews with schools and vendors need to establish the replacement quantities of these fields, and how often new material is put into place, since it would affect exposures, and give an indication of gross yields. We estimate that the fields lose from 1-30 tons (estimated) of material, so exposures and impacts need to be measured in adjacent buildings, soils, and stormwater systems. With 12,000 existing facilities, this may need to be the subject of additional studies conducted to also assess if the fields shall be regulated as point source contamination under Clean Water Act and Clean Air Act. It is a very important metric, and a perfect opportunity to include it, with little incremental cost, in your study.

81. INTEGRITY STANDARDS. To track the history of the emergence of this product is to track effective lobbying for regulation changes that favored the tire industry, and the tire recycling industry. This industry took advantage of an enormous quantity of recalled and used tire stockpiles, and heavily sold and marketed the materials to schools, and sports centers where millions of children play. Central to the steps that catapulted this industry forward was the removal of the designation of artificial turf fields as children's products, based on the rationale that adults played on them, too. Yet the fields continue to be sold to elementary schools and to sports centers brimming with elementary, middle and high school players. The sales oriented industry was willing to submit children, schools and communities to the materials in tires in enormous amounts, and call them safe. As this claim is deeply questioned now, we also urge you to NOT allow the sampling or data collection to be conducted by an interested party, including schools, sports centers, athletic group personnel or administrators, field installers or laboratories or consultants hired by those groups, and establish peer reviewed standards for testing.

82. Any group or individual who does participate in the study, including regulatory staff, needs to sign an affidavit certifying that she or he, and her/his group has not received compensation or benefits in any form, including but not limited to sales commissions, direct payment, compensation, bonuses, grass to artificial turf grant, field financing, water savings rebates (State of California and possibly others), or physical benefits including but not limited to uniforms, facility enhancements (restrooms, concession stands, parking lots, storage facilities, etc.), stadium components, or field equipment of any sort, from the field installers or tire crumb field industry and its assigns, and has no financial conflict of interest. The document should be filed with an appropriate agency and made public.

83. We ask for full transparency on all parts of the study process for parents, interested parties, and schools.

OUR REQUESTS TO ASTDR/CDC/CPSC/EPA	
Request	Background
1. Regulate tire crumb and rubber mulch as children's product	PEER filed formal request; 12,000 fields x 30,000 tires is the amount of existing material in children's use; see table A for details on volumes and surface area sizes, children/schools. Known carcinogenic material and known

	contact.
2. Remove "safe to play, safe to install" or any other references that imply safety from all EPA, CPSC and CDC websites and public information sources	PEER Formal Request; agencies must remove all endorsements of safety.
3. Place all PEER artificial turf filings in Federal Record	**http://www.peer.org/campaigns/public-health/artificial-turf/news-releases.html**
4. Issue a directive to public health agencies to disseminate warnings regarding unknown risks from lead exposure from AT fields, as well as exposures to carbon black, known carcinogens, PAH, VOCs into air and water pathways; direct hospital systems and medical systems to screen for tire crumb field use, and report results	For parents, schools, athletic groups, and communities; conduct parent outreach webinars
5. Use only independent lab or consultants unassociated with tirecrumb industry, adhering to high ethics guidelines; transparent process for review; affidavit of no conflict of interest	
6. Commission a primary study, conducted by independent, peer reviewed group such as CDC to examine existing cancers AND illness in tire crumb field users and maintenance workers of tire crumb fields	
7. Mandate Cal Recycle Study corrections to methodology; mandate methodology peer review; and mandate to impose Prop 65 rule based on OEHHA's own findings on carcinogenic exposure	
8. Convene a conference for presentation of risks and concerns from parent groups, cancer survivors to Federal Research Team	Needs participation from CDC/CPSC/EPA staff so parents and public can have direct contact
9. Convene series of webinars and open comment opportunities	
10. Allow public health and environmental advocacy groups in Federal Research Team with complete transparency	
11. Establish a collection point for recording experience of victims and those who may have suffered injury from use of the fields, including heat injury, concussion or head trauma, cognitive disorder, illness, and cancer for study and documentation; victim hotline; for both child and adult contact with fields	
12. Funding to identify potential biomarkers of exposure; conclusive marker study in users	
13. Conduct blood monitoring and studies on existing cancer survivors.	
14. Conduct cancer cluster study on soccer player cluster, and identify additional clusters such as maintenance workers and installers	
15. Provide full transparency with all interested parties	
16. Conduct full epidemiological study of tire crumb on playfields existing and predictive	
17. Study forms and questionnaires should include data collection on what is released from fields into air, adjacent areas, water pathways, and quantified. Replacement quantities for tire crumb fields should be quantified and examined as a metric that indicates yield.	
18. Based on release/yield figures, and other inputs, tire crumb fields should be evaluated for compliance with Clean Water Act and Clean Air Act, and regulated accordingly.	
19. We request that OEHHA study methodology be peer reviewed by your agencies before it begins, taking into account the comments received in this proceeding.	
20. OEHHA Study Process and Methodology Concerns: How will those be considered?	
21. Consider explicit protection from retribution steps be put in place to protect researchers, players, and concerned parents from retribution	

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Submitter Information

Name: Amy Stephan
Organization: Safe and Healthy Playing Fields Coalition

General Comment

Thank you for the opportunity to comment on this important proceeding on behalf of the Safe and Healthy Playing Fields Coalition we respectfully submit our comment and supporting material in the attached document. We hope to have the opportunity to provide additional comments and participate directly in this important study.

Attachments

SHPFC FINAL ASTDR 2016-0002-0003Comments

Comments on ASTDR 2016-0002-0003
Federal Research Action Plan on
Recycled Tire Crumbs Used on Playing Fields and Playgrounds
Submitted to Federal Register May 2, 2016

SAFE AND HEALTHY PLAYING FIELDS COALITION
www.safehealthyplayingfields.org
A grass roots coalition working for healthier alternatives for children and communities

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INTRODUCTION

On behalf of the millions of children, parents and athletes who play field sports in the US at schools, parks, athletic facilities and playgrounds, thank you for agreeing to study the potential harm caused by playing on or being near athletic fields with surfaces made waste tires. There are more than 12,000 of these playfields in place (15,000 according to the website of a large company that installs them), and they are being installed at a rate we estimate to be about 3000 a year. By our calculations, 12,000 fields currently present 2,380,000 tons or 4,760,000,000 pounds of loose, unencapsulated tire crumb on their field surface. (See our Table of Runoff and Material Volumes attached.) Tens of thousands of students and young athletes play on those fields, many more thousands have direct or indirect contact with the material. It is a public health issue of substantial importance.

The following lists our comments on the proposed study. We argue that the fields present known carcinogenic, neurotoxic, and endocrine disrupting material in a high surface area, pulverized form that is more toxic than whole tires, and should never have been allowed near children, or adults,

because of risk of ingestion and inhalation exposure to all the ingredients in tires. On warm, sunny days the surface temperature routinely reaches over 150 F, which presents direct, well-known heat injury risks to children. The heat increases off-gassing of the tire components, increasing the likelihood of pulmonary exposures, and creates a complex dynamic in the children's exposure zone immediately above a field that has not been correctly modeled or studied yet. The material lacks uniformity, or any regulatory or exposure controls. We assert that it is impossible to assure even a single tire crumb field is free of inhalation and ingestion risk of dangerous particulate and gases inherent in tires, tire crumb, and add-in composites; and that dangerous and unwanted exposures from lead, benzothiazoles, carcinogens, phthalates, carbon black and other harmful substances, can happen with every use. The data gaps are enormous, and we hope CDC/CPSC/EPA will recognize there is no way the tire crumb industry can protect any player, on any field, from the potential for dangerous exposures with normal use. We argue that not enough scrutiny was placed on this material.

NOTE: The Safe and Healthy Playing Fields Coalition is a grass roots group of parents, coaches, scientists, public health professionals, toxicologists, neurobiologists, educators, researchers, plastics engineers, medical doctors, waste management and remediation professionals who donate their own time and skills towards helping communities and individuals assess risks to their communities from tire crumb field use. We do not have a lobbying firm, law firm, hired laboratory, consultant, or revenue-generating source (such as tire crumb), and rely solely on the skill of researchers who donate time to compile our comments. That said, we have found compelling data that refutes almost all claims of safety, and when we asked for additional time to compile the information, we were given two weeks, but denied additional time. Hence, we are working at a

disadvantage, and hope that during this study year, we will have time and opportunity to substantiate our concerns, and share our research with the study officials. One of our comments below explains our requests for a conference or virtual meeting that allows more disclosure and discussion.

Our comments are listed numerically and organized into: 1. General Comments, 2. Characterization and methodology comments; 3.Summary List of requests. A number of supporting documents are also submitted as part of our comments.

PART I: GENERAL COMMENTS:

1. CPSC/CDC/EPA should use their existing authority to immediately enforce regulations on tire crumb playgrounds and athletic fields as a children's product, since thousands of fields have been installed in child-care facilities and schools that serve hundreds of thousands of children.

2. We have grave concerns about their safety to human health and the environment, since **known harmful components in the field material are released into both air and water pathways, and provide ample opportunity for both acute and chronic low to high dose exposures with every use of the field to known toxics such as lead, chromium, mercury, zinc, PAH, VOC, carbon black, styrene, benzothiazoles, and plasticizers. Intermittent 'Hotspots' of high levels of toxins such as lead are of particular concern for exposure.** (See comments on Characterization). Every tire crumb playground and synthetic turf field has material that is known to cause cancer, illnesses, and injury in humans; and leachate from runoff causes several negative impacts on the aquatic ecosystems. We believe that the potential for human illness (including

several cancers) from both low dose and high dose exposures to the ingredients in tires is staggering. Based on the known potential for exposures to children, and the finding of a group of now over 200 soccer players with cancer (the group represents the reach of a single soccer coach, implying that this group may be the 'tip of an iceberg' of affected individuals), an immediate moratorium on new construction of the fields should be put in place with the existing authority of CDC/CPSC/EPA, until the tire crumb fields can be shown to be safe to inhale and ingest.

3. **The tire crumb recycling industry, which appears "green" in its efforts to sell millions of used tires in "repurposed" shredded form, in fact enables a direct transfer of the contamination burden of waste tires from landfills/collection sites (in the US and abroad) to the play surfaces of 12,000 schools and sports centers, where tens of thousands of children and adults have direct contact with the toxins in tire crumb materials on the field surface, and *these exposures could happen with every single contac*t.**

4. For the most part, the **schools and sports centers do not have resources to conduct toxicity due diligence;** meaning, they do not have access to a toxicologist who reads the industry studies with their health as the only priority. Purchasers rely on the tire crumb recycling industry statements, industry studies, and industry funded websites that claim toxicology assessment and public health guidance. The sales material can be striking, and the studies appear convincing on the surface, but our study groups have found significantly misleading information about the safety and actual risk of harm from the tire crumb fields to all users, particularly children. They are likely unaware that the previous CPSC claims that the fields are "SAFE TO INSTALL; SAFE TO PLAY ON" have been repealed.

5. **PEER Filings**. Public Employees for Environmental Responsibility have filed a number of complaints and documents that argue for a repeal of endorsements of tire crumb safety from EPA/CPSC, and those statements were in fact repealed; but most schools and potential purchasers are unaware of the removal of endorsements and claims of safety. The PEER filings are an excellent source for telling the toxicity story and regulatory story of this product. We respectfully request that the entire file of complaints and responses to the complaints, and other supporting material be entered into the record for ASTDR 2016-0002-0003.

The full list of documents for the ASTDR 2016-002-0003 collection and record can be found here: http://www.peer.org/campaigns/public-health/artificial-turf/news-releases.html. Please include all in that list, and all supporting materials.

6. Formal legal requests have been made to classify the tire crumb fields as a children's product since children use them, and sales and marketing material are very clear about tire crumb fields are for children. **CDC/CPSC/EPA should use their existing authority to explicitly label the fields as children's products.** (Please refer to PEER filings for details and supporting arguments: **http://www.peer.org/campaigns/public-health/artificial-turf/news-releases.html)**

7. CLASSIC CANCER CLUSTER APPEARANCE: SOCCER PLAYERS

Parents and schools may have trusted the "Safe to Play" statements, **but the parents of the 200 young women and men, who played intense soccer and were stricken with cancer do not trust those claims anymore.**

The case of over 200 young soccer players who used tire crumb fields and contracted cancer, strongly indicates a classic cancer cluster, though the cases have not undergone the formal validation process yet. That is because a process for the collection of this information, does not exist yet for either cancer victims, or for other illnesses, head injuries, and heat injuries/illness from the fields.

8. We respectfully request that an official study of the soccer player cancer cluster be initiated by CDC immediately.

Through our activist network, we learned about these cases, which were reported to the NBC news link, or directly to a single, trusted concerned soccer coach. EHHI reported as follows:

_____

"New Cancer Numbers Among Soccer Players on Synthetic Turf,
April 2016

It is important to remember that the only people counted in the numbers below are those who have known to call Amy Griffin. There is still no government agency tracking the cancers among the athletes who have played on synthetic turf. We know the actual numbers of athletes who have played on synthetic turf and contracted cancer have to be much greater than those who have known to report their illness to Amy Griffin.

In January of 2016, there were 159 cancers reported among soccer players; now (April 2016) there are 166. Ninety-seven of those in January were goalkeepers; now there are 102. Sixty-one percent of the soccer players with cancer are goalkeepers. As of this writing, 220 athletes of various sports who have played on synthetic turf have cancer; 166 soccer

players who have played on synthetic turf also have cancer.

166 Soccer Players who have played on synthetic turf and have cancer

- 102 are goalkeepers (61% are goalkeepers)
- 64 soccer players with lymphomas, 39 are goalkeepers (61%––over half are goalkeepers)
- 10 soccer players with Non-Hodgkin lymphoma, 7 are goalkeepers (70%––over half)
- 54 soccer players with Hodgkin lymphoma, 32 are goalkeepers (60%––over half)
- 41 total leukemias, 24 are goalkeepers (59%––over half)
- 16 total sarcomas, 7 are goalkeepers (44%)
- 12 thyroid, 9 are goalkeepers (75%––over half)
- 11 brain––5 are goalkeepers (45%)
- 9 testicular––6 are goalkeepers (67%––over half)
- 4 lung––3 are goalkeepers (almost all are goalkeepers)

Remaining are OTHER rare cancers."

Source: Various; Victim parent volunteers, EHHI primary collection; 4/2016 (ongoing) _____

All the victims were frequent users of turf fields, spending multiple hours a week in close contact with the material in the fields. All were in their mid-twenties or younger.

9. The self-reporting to a trusted coach, is also an indication that the actual illness rates are not yet being properly assessed or managed by any hospital, medical system, or group; there is no "home" for this information, yet. The 200+ cancer victim count is likely the reach of a single coach with the help of a link in broadcast media, and a fraction of the

actual count of victims of cancer or other serious illnesses. Better investigation and creating a "safe" place to report serious and intermittent illness will uncover many more victims, and provide needed perspective on the accuracy of risk assessment for this product.

10. The CDC and appropriate agencies should issue a directive asking for adequate screening for injury and disease. That US hospital and medical systems are not yet set up to collect this data is a contributing factor; and concurrently, screening for synthetic field use should be part of a responsible screening protocol. To our utter dismay, we learned from pediatric oncologists in our group that at least some oncologist are prohibited from screening victims/patients for tire crumb field use; the screening must be part of the approved protocol, and tire crumb product is not yet included..

11. In fact, the number of **all injuries from tire crumb fields should be collected and analyzed to include, but not be limited to: head injury and concussion; joint injuries (multiple); heat injury; blood cancer; lymphomas; testicular cancer; pulmonary illness; neurological impairment; kidney disease; diabetes; brain disease and cancers. These findings need to be documented, and the children who suffer from them should be screened for tire crumb field use and proximity.** No doctor or oncologist should be prevented from asking questions, screening for, or questioning the safety of this product or contact with this product. We believe there are many more heat related illnesses, head injuries, and endocrine system disruptions directly resulting from exposure to the fields than what is being reported.

12. REQUEST MORE INVESTIGATION INTO EXISTING AND POTENTIAL CANCER CLUSTER: We ask that the multiagency group takes steps to

expedite the process of collecting epidemiological data and verification of the current soccer player cluster, and other potential clusters, to include field maintenance workers who rake the fields, field installers who pour the millions of pounds of material onto field surfaces, school custodians, high contact users of any kind, and school children in buildings adjacent to the fields. Residences near the fields should be considered in the scope of the study or subsequent studies. **In our own informal assessment, and using the SEER database and known levels of cancer victims, we found the potential for 7-11 cancer clusters.** We respectfully ask the CDC experts to look into this possibility and take the necessary steps to prevent additional injury and cancers.

13. NEED FOR EXPLICIT PROTECTION FROM RETRIBUTION: Sadly, the families, coaches, and school leaders who have reported illnesses do so with concern for **retribution from the tire crumb industry, school boards, university administrations, and even sports league administrators, and may need explicit protection and remedy against retribution.** Researchers who study the potential for harm tell us that they do not have protection from retribution from tire crumb field industry proponents. Public health and medical professionals sometimes make statements of concern anonymously to protect themselves from retribution––professionally and personally from industry proponents. Adequate protections need to be established to protect the professionals and parents who speak out.

14. PROTECTION FOR CHILDREN IS NOT A COST-BENEFIT ANALYSIS. Children have a unique vulnerability to toxic exposures––both intermittent high exposures––and to low dose exposures, and if we are aware of a carcinogenic presence, then we are responsible for using a precautionary principle, and removing that exposure risk. With due respect, this is not a

cost-benefit analysis that will show a percentage of children will get sick (cost) vs. tournaments played or jobs created (benefit). It is a decision made by a civil society that upholds protection for children's health above all other industry priorities, and a recognition that tens of thousands of children, if not hundreds of thousands, are already being exposed to material with known carcinogenic, and harmful materials on school turf fields.

15. The CDC/CPSC/EPA should recognize that the fields serve children, acknowledge that there are zero safety controls on the material and the potential exposures, and immediately acknowledge tire crumb fields as children's products, and use your existing authority to regulate them as children's products. **Therefore, we emphatically REQUEST THAT THE CPSC/EPA/CDC USE EXISTING AUTHORITY TO IMMEDIATELY CLASSIFY ARTIFICIAL TURF AS A CHILDREN'S PRODUCT, SINCE THOUSANDS OF CHILDREN ALREADY USE THE FIELDS, IN THOUSANDS OF SCHOOLS.**

Since children and adults are already being exposed on tire crumb fields to the materials in tires, we ask for an **immediate moratorium on further construction of tire crumb based or recycled rubber based artificial turf fields** until adequate assurances that tire crumb particulate, off-gassing, and combinations are safe for children to inhale and safe for children to ingest.

Your three agencies do not need to conduct a study to know with absolute certainty that tires were not designed to be inhaled by children, and we should protect children, at any length, from chronic or lose dose carcinogenic exposures.

Even if we cannot model or know (or will we ever know) the exposures to each child, each day (and we will never know), we do know with certainty that:

1. Carcinogens are in tires.
2. Shredded, pulverized tire crumb contains everything in tires, and more ingredients, including: carbon black, phthalates, VOCs, PAHs, benzothiazoles, lead, chromium, zinc, nanoparticle additives, proprietary additives, 12 known carcinogens, 90 materials known to be harmful to human and environmental health, (EHHI)
3. The material can be inhaled when playing and ingested with contact, or intermittent adjacent contact.
4. Every single direct or indirect use has the potential for exposure to hotspots and low dose chronic exposures to multiple scenarios of these materials.
5. The exposures could impact children, school buildings, and surrounding areas; contamination travels to cars, homes, and even children's bedrooms.
6. It is both within the authority and the responsibility of your three agencies to take immediate action to protect the public, especially children, from known carcinogenic, pathogenic exposures.

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Only a complete moratorium on their use will protect the millions of children, athletes and bystanders from inhalation and ingestion of the materials that yield from tire crumb synthetic turf fields.

16. It is also evident that tire crumb will never be safe unless ALL tire ingredients, all "recipes", the manufacturing of tires, and then preparation of materials for fields are controlled from a toxicity perspective. This level of voluntary cooperation from the tire manufacturing industry will, of course, never happen.

17. ONLY UNIFORM MATERIAL SAFE TO INHALE AND INGEST IS APPROPRIATE FOR SCHOOL FIELDS ; UNTIL THEN, A MORATORIUM. When the play surface material is uniform, consistent, and controlled, when it is tested by an adequate study with pediatric toxicology assessments to be safe for ingestion and inhalation, and results are peer reviewed following IRB standards, then we may consider a synthetic turf field might be safe. Until then, tire crumb should be rejected from any casual or unnecessary contact with children or adults.

18. RECONSIDERATION: A reconsideration of the moratorium could occur when the industry can demonstrate a uniform, non-carcinogenic, non-inhalable, non-ingestible alternative that does not present PAH, VOCs, phthalates, lead, chromium, mercury, 1,3-benzothiazoles, butadiene, styrenes, carbon black (in particulate, gaseous form, or any form to children); and the product undergoes strict, peer-reviewed study by independent qualified toxicologists who have a mandate to protect children's health and the health of the environment above the interests of industry. The hypothetical product should be subject to regular reviews and quality control determinations to ensure safety over the life of the synthetic field. Safety Data Sheets should be provided and accessible for every user. If waste tires are used, the controls requested above will never be possible, since the tire material, by definition, is a composite of many toxins in unknown quantities and with unknown impacts.

PART TWO: CHARACTERIZATION OF TIRE CRUMB COMMENTS

1. SCALE AND SCOPE: Tire crumb potential to individuals, buildings, surrounding areas and stormwater for contamination is enormous.

2. PUBLIC HEALTH ISSUE: SCALE AND SCOPE CONCEPTS

The potential for contamination from tire crumb is a growing public health issue, in terms of the relative size of the product and its mass; the total number of potential fields; and their basic contact with students, athletes, school personnel, buildings, communities, and streams/storm water.

To give an idea of the existing volumes of material, the field runoff and children affected or who may be affected, we have developed reference tables, and the summary is attached to this filing These tables indicate the scope and scale, and demonstrate that these are not isolated fields, nor tiny exposure potentials. The quantities of material are enormous. The source and reasoning is explained, but the tables are designed for your model development and quick reference.

3. ENORMOUS QUANTITIES ON EACH FIELD SURFACE .

To give an idea of the scale, a modest soccer field uses 30,000 waste tires. According to a randomly selected company selling packaged tire crumb infill for original or replacement treatments, 30,000 tires makes about 396,667 pounds of lbs of material. According to our calculations, the volume for 2" thick field is about 525 cubic yards, However, a large football field, three times the size of a small soccer field, could use 1,000,000 pounds of tire crumb material.

4. The tires are shredded, pulverized into crumb of various sizes, and the shredded material is poured on top of a plastic "grass" carpet. Importantly, the material is loose, unencapsulated and can loft into the air when struck by a ball or foot, or body. We estimate that, depending on the school, each field has regular, daily contact with at least 1000 athletes and students. At

sports events, busy tournaments, or with active use, a field can have contact with many, many more.

5. No fields we found have mandated capture of the leachate or particulate at the field.

6. TOTAL FIELD VOLUMES POTENTIAL:. The universe of potential tire crumb playfields is approximately 200,000 - 220,000 schools and athletic facilities in the US, based on number of schools. The potential reach of exposure from use of these fields is in the millions of children, millions of adults, hundreds of thousands of exposed buildings and adjacent soils, and hundreds of thousands of public easements and storm water access points (we estimate 1:1 ratio for field to point source drainage).

7. TABLE RUNOFF AND VOLUMES: SUMMARY OF KEY METRICS

For reference, we analysed fields by sport type, by Metropolitan Service Area, and calculated the volumes for rainfall (by city), and for amount of tire crumb material on a field surface.

Key metrics are the following:

- Estimated tire crumb per 85,000 sq feet field and 2" deep tire crumb infill is 525 cubic yards, 396,667 pounds, or 198 tons per field.

- **The total amount of tire crumb material on surface of 12,000 fields is estimated to be 6,296,296 cubic yards, or 4,760,000,000 pounds or 2,380,000 tons** that are currently in sports centers and schools in April 2016..

- **Runoff is calculated by city and field size, but the total runoff for fields in the top 50 MSAs is 15,006,99,787 gallons.**

- **Total Runoff for** 12,000 fields based on number of fields per MSA, accounting for rainfall in that MSA, and added together for 2016 is: **23,370,639,827 gallons**… for a single year.

The calculations were made to illustrate the scale and scope of this product, and to characterize the reach of exposures from the field surface into the airway, and into the water pathway.

8. INGREDIENTS IN TIRE CRUMB: Lack Of Uniformity, High Variation, Multiple Toxins

Tire crumb appears to be a composite material, heterogenous with multiple known carcinogens, pathogens, and mutagens. The material is not uniform, comes from multiple sources and lots, and can be mixed with plastics and materials of unknown origin. The material can have anticlumping agents, flame retardant additives, paint, and strengthening or characteristic enhancing additives. Shredding of tires can cause small pieces of steel or metals to be included in the material from steel belted tires. Some tire crumb is from newer depositories from recalled tires, some from landfills, and some have been subjected to a variety of weather and conditions. Leachate and off gassing could be variable, with the expectation that newly installed/poured material off-gassing is higher than from an older field, but we expect those rates would vary with the age of the tires from which the tire crumb was made.

9. HETEROGENEOUS, MULTIPLE TOXINS, UNKNOWN ORIGIN: To say that tire crumb infill comes from multiple sources, is an understatement: dispensaries, landfills in the US, landfills abroad, collection centers, factory waste from China, factory waste from the US and abroad. Some of the newer marketed blends included multi colored sport shoe waste, shoe factory waste, and many unidentified synthetic materials. Just as tire companies may add anything to their "recipe" for a tire, an infill provider may offer materials that could have anything added into the blend. Tire plugs, tire polishes, tire coatings, and materials picked up on the roads should be considered. And even if it is known that there are only tires in the blend, there is a broad variation in the ingredients based on the use of the tire, and the manufacturer. Those tires may look the same, but from a toxicity standpoint their variation and the unknowns in the "recipe" create a margin of uncertainty that makes any claim of known safety for inhalation or ingestion impossible. If a vendor says he or she knows what is in a lot of tire crumb, and that is known to be safe, then they ignored the materials in the product. Since we never know what is in any field for sure, and if we know that they have tire crumb, they cannot be demonstrated safe for children to inhale, ingest, nor play upon.

10. What Is In Tires? SOME GROUPS WENT LOOKING

Since it was difficult from MSDS or any other source to identify the components in tires or tire crumb, some groups studied them directly.

11. Environment and Human Health Inc, and Yale University Study

EHHI, Inc. in cooperation with Yale University studied samples of rubber mulch, and new tire crumb with the intent of characterizing their ingredients.

The summary text of their characterization study is found here:

http://www.ehhi.org/turf/metal_analysis2016.shtml
http://www.ehhi.org/turf/findings0815.shtml

The EHHI/Yale Study list of components found is explained this way:

The shredded rubber tire playground mulch samples tested were provided by the manufacturer and were purchased in new bags of rubber mulch for use in gardens and playgrounds. The rubber tire infill for synthetic turf fields was obtained as new infill material from installers of synthetic turf fields. There were 5 samples of infill from 5 different installers of fields and 9 different samples of rubber mulch taken from 9 different unopened bags of playground mulch.

RESULTS There were 96 chemicals found in 14 samples analyzed. Half of those chemicals had no government testing on them - so we have no idea whether they are safe or harmful to health. Of those chemicals found that have had some government testing done on them these are the findings with their health effects.

TWELVE (12) KNOWN CARCINOGENS

2-Mercaptobenzothiazole/ **Carcinogen**, toxic to aquatic life

9,10-Dimethylanthracene/ **Carcinogen**, respiratory irritant and can cause asthma

Bis(2-ethylhexyl) phthalate/ **Carcinogen**, may cause damage to fetuses

Fluoranthene / **Carcinogen**, Fluoranthene is one of the US EPA's 16 priority pollutant, A PAH.

Heptadecane/ **Carcinogen**

2-mercaptobenzothiazole / **Carcinogen**

Phenol, 4-(1,1,3,3-tetramethylbutyl)/**Carcinogen**

Phenanthrene/ **Carcinogen** - A PAH

Phthalimide/ **Carcinogen**, skin, eye and lung irritan. A Fungicide

Pyrene, 1-methyl- /**Carcinogen**

Tetratriacontane /**Carcinogen**, eye and skin irritant. Can cause systemic damage to central nervous system.

Pyrene/ **Carcinogen,** toxic to liver and Kidneys, a PAH

Carbon Black/ **Carcinogen**

Carbon Black makes up to 20% to 30 % of every tire. It is used as a reinforcing filler. Carbon Black is listed as a carcinogen by the International Agency for Research on Cancer (IARC).

Carbon Black, as such, was not analyzed by the Yale Study because Carbon Black is made up of a number of chemicals – some of which were found in the Yale study.
Carbon Black is not one chemical -- it is made up of many chemicals - often of petroleum products. Furthermore, carbon black has no fixed composition, even of the many compounds it contains. Carbon black from different sources will have
differing compositions. In our method, carbon black will register as a series of substances extracted from it. There is no carbon black molecule, it is a mixture.

TWENTY (20) KNOWN IRRITANTS

1,4-Benzenediamine, N-(1,3-dimethylbutyl)-N'-phenyl-

Irritant - causes skin and eye irritation, toxic to aquatic life

1,4-Benzenediamine, N-(1-methylethyl)-N'-phenyl-

Irritant - causes skin and eye irritation, toxic to aquatic life

2(3H)-Benzothiazolone

Irritant - causes skin and lung irritantation

2-Dodecen-1-yl(-)succinic anhydride

Irritant - causes eyes, skin and lungs irritation

3,5-di-tert-Butyl-4-hydroxybenzaldehyde

Irritant - causes irritation to eyes, skin and lungs.

Anthracene

Irritant - causes skin, eye and respiratory irritation. Breathing it can irritate the nose, throat and lungs causing coughing and wheezing.

Benzenamine, 4-octyl-N-(4-octylphenyl)-

Irritant - causes eye and skin irritation

Benzenesulfonanilide

Considered hazardous, very little testing has been done on it.

Benzothiazole, 2-(methylthio)-

Irritant - causes Skin and eye irritation.

Dehydroabietic acid

Toxic to aquatic organisms

Docosane

Irritant - causes Skin irritation

Hexadecanoic acid, butyl ester

Irritant - causes eye, skin and lung irritant. Can cause reproductive effects.

Methyl stearate

Irritant - causes eye, skin and lung irritation.

Octadecane

Irritant - causes kin, eye and respiratory irritation

Octadecanoic acid also known as Stearic acid

Irritant - causes skin, eye and respiratory irritation

Oleic Acid

Irritant - causes skin and eye irritation

Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-ethyl-

Irritant - causes skin, eye and respiratory irritation

Tetradecanoic acid

Toxic to aquatic organisms. Skin and eye irritant.

Anthracene, 2-methyl-

Acute aquatic toxicity, Not much data available - what there is shows it to be an eye, skin and lung irritant

Anthracene, 9-methyl-
Acute aquatic toxicity, serious eye irritant

13. Carbon Black

Carbon black plays an extraordinary role in tires, and in their toxicity and potential for harm from exposures. Well known from decades of air pollution studies, urban epidemiological studies, airborne carbon black causes lung cancer, brain cancer, kidney cancer, heart disease, neurological disorders, and cognitive degenerative disease.

A known carcinogen (WHO), we have found variations in percentages of the amount of carbon black in a tire, from 30%-68%. (EHHI/Yale Study; NY STUDY, .pdf, pp19-20.) Carbon black breaks down into many sized particles, including PM10/PM2.5 and potentially smaller. That size particle was shown to cause several types of cancer, including brain cancer, kidney cancer, kidney disease, bladder cancer, and neurological disease and cognitive impairment disorders. (CITE; Harvard Mexico Studies and Urban Cohort Studies).

14. THE NY STUDY CHARACTERIZES TIRE CRUMB THIS WAY:

"The components of Firestone's and Dow Chemical Company's rubber are summarized in technical specification documents. Although they are only two of many different rubber manufacturers, a similarity between the two vendors is readily apparent, even between three different types of rubber, solution-SBR, cold polymerized emulsion SBR, and high cis2-4 polybutadiene rubber. In general, the following similarities were observed between the two manufacturers for the compounds used to produce the rubber:

• The polymer used to produce solution-SBR contained approximately 18-40% bound styrene.

• The oil content in the polymer ranged from 27.3-32.5% in solution-SBR and cold polymerized emulsion SBR. Oils used include aromatic oil, high viscosity naphthenic oil, and treated distillate aromatic extract oil.

• Besides the polymer used, the other components of the rubber were similar between manufacturers and the relative proportions (parts by weight) of these other components ranged as follows:

o Carbon black: 50.00 – 68.75
o Zinc oxide: 3.00
o Stearic acid: 1.00 – 2.00
o Sulfur: 1.5 – 1.75
o N-tert-butyl benzothiazole sulfonamide (TBBS): 0.9 – 1.50
o Naphthenic or aromatic oil: 5.00 – 15.0

The components summarized above are the principal components of the major type of rubber (SBR) used for the manufacturing of crumb rubber and therefore have the potential to have a significant presence in crumb rubber. As discussed in subsequent sections of this report, some of these components have been found to be prevalent in crumb rubber, including **zinc (from the zinc oxide), benzothiazole compounds** (from TBBS), and **PAHs** (possibly from the oils used). These compounds may be attributed to the SBR used in the manufacturing of crumb rubber."

15. Phthalates are a regulated toxin, and PEER filings covered some of the toxicity and regulatory discussion. Please refer to http://www.peer.org/campaigns/public-health/artificial-turf/news-releases.html

16. ZINC

Coastal Marine Resource Center Study, found levels of zinc in leachate from tire crumb fields with fatal impacts to an aquatic ecosystem within 48 hours.

Menichini and Abate Study: “Zn concentrations (1 to 19 g/kg) and BaP concentrations (0.02 to 11 mg/kg) in granulates largely exceeded the pertinent standards, up to two orders of magnitude”. “Zinc and BaP concentrations are high in rubber largely exceeding the Italian soil standards”.

17. METALS: MERCURY, CHROMIUM, ARSENIC

The highest median values were found for Zn (10,229 mg/kg), Al (755 mg/kg), Mg (456 mg/kg), Fe (305 mg/kg), followed by Pb, Ba, Co, Cu and Sr. The other elements were present at few units of mg/kg. The highest leaching was observed for Zn (2300 µg/l) and Mg (2500 µg/l), followed by Fe, Sr, Al, Mn and Ba. Little As, Cd, Co, Cr, Cu, Li, Mo, Ni, Pb, Rb, Sb and V leached, and Be, Hg, Se, Sn, Tl and W were below quantification limits. Data obtained were compared with the maximum tolerable amounts reported for similar materials, and only the concentration of Zn (total and leached) exceeded the expected values.

18. LEAD, POLITICS and CHILDREN

The problem is synthetic turf is NOT REGULATED as a children's product by the CPSC thwarting the ability to apply lead regulations that CPSC could enforce.

Lead was identified in synthetic turf fields as early as 2008 but was not

addressed in any systemic way due to lack of standards or required testing (although the CPSC could have required the testing mandated for children's products since 2008). The CPSC has chosen not to mandate this children's product testing for synturf and in fact advised the industry about not having it designated as a children's product < http://parentscoalitionmc.blogspot.com/2009/03/artificial-turf-tale-of-lead-levels.html> .

This has led to a "buyer beware" situation especially after the CPSC tested synthetic turf carpets, found lead at varying levels depending on sample age, and astoundingly concluded the whole synthetic turf system was, always and everywhere, safe not just for adults but for children. The assumptions were based on inappropriate modelling for blood lead levels from a meager sampling and the troubling finding presupposes that there is, a safe level of blood lead, which most pediatricians and lead experts agree there is not safe level.

To this day the synthetic turf industry cites the still CPSC-posted "OK to Install, OK to Play on" press release which should never have been posted to begin with, has been disavowed, in front of US Congress, by CPSC commissioner Kaye and is an embarrassment to government science, policy and public health <http://www.cpsc.gov/en/Newsroom/News-Releases/2008/CPSC-Staff-Finds-Synthetic-Turf-Fields-OK-to-Install-OK-to-Play-On/ >

19. The Centers for Disease Control (CDC) in contrast warned and continues to warn that" there is no safe level of lead" to expose children to.

http://www.cdc.gov/nceh/lead/>

http://www.cdc.gov/nceh/information/healthy_homes_lead.htm.

"**No safe blood lead level in children has been identified.** Lead exposure can affect nearly every system in the body. Because lead exposure often occurs with no obvious symptoms, it frequently goes unrecognized"

In 2010 Van Ulirsch et al (Environ Health Perspect. 2010 Oct;118(10):1345-9 <http://www.ncbi.nlm.nih.gov/pubmed/20884393

20. Evaluating and regulating lead in synthetic turf.

Division of Health Assessment and Consultation, Agency for Toxic Substances and Disease Registry gulirsch@cdc.gov) concluded that: "Synthetic turf can deteriorate to form dust containing lead at levels that may pose a risk to children. Given elevated lead levels in turf and dust on recreational fields and in child care settings, it **is *imperative that a consistent, nationwide approach for sampling, assessment, and action be developed*.** In the absence of a standardized approach, we offer an interim approach to assess potential lead hazards when evaluating synthetic turf."

21. *But no such approach has ever been instituted. Indeed as reported in USA today this year: "The CDC in 2008 said communities should test recreational areas with turf fibers made from nylon, and they should bar children younger than 6 from the areas if the lead level exceeded the federal limit for lead in soil in children's play areas. But some communities have refused to test their fields, fearing that a high lead level would generate lawsuits or force them to replace and remove a field, which costs about $1million, according to a 2011 New Jersey state report . Forty-five of 50 New Jersey schools and towns contacted in 2009 by epidemiologist Stuart Shalat would not let him test their turf-and-rubber

fields, Shalat's report states. The EPA also found, in 2009, that "it was difficult to obtain access and permission to sample at playgrounds and synthetic turf fields."<http://www.usatoday.com/story/news/2015/03/15/artificial-turf-health-safety-studies/24727111/ >

22. And for the past 2 years the company FieldTurf has, with impunity, noted its synturf fields contain lead during testimony on various bills in the Maryland State House.

The latest admission documented on video: <http://wtop.com/montgomery-county/2016/03/md-lawmakers-seem-information-artificial-turf-schools/>

> "....asked point-blank by one delegate, “Is there lead in your products? The executive answered, “There’s lead in a lot of things in this world.”.... “**Yes, there’s lead in our products**." In spite of this admission and the fact that the legislation in question was meant to post the CDC prescribed warnings about minimizing lead and other toxin exposures from the synturf and tire waste products, and in spite of the fact that the legislation had strong and broad input and support, the legislation was not even allowed to come up for a vote in committee by the committee chair.

23. Public Employees for Environmental Responsibility compiled the literature as of early 2012 on lead

see: <http://www.peer.org/campaigns/public-health/artificial-turf/news-releases.html > and specifically: 2012-07-12 lead-limits-needed-on-tire-crumb-playgrounds (*NOTE if you go to PEER.ORG news releases: click on public health and "artificial turf" to find the actual filings with many links}*

Unfortunately for the children, fields with high lead remain. But those responsible for protecting children are kept in the dark. NO ONE IS MONITORING OR REGULATING ARTIFICIAL TURF FOR LEAD OR OTHER TOXINS in either old or new fields, including the Consumer Product Safety Commission (CPSC) (see <http://www.peer.org/news/news-releases/cpsc-drops-artificial-turf-playground-safety-review.html Even though the Chairman of the CPSC, recently admitted to congress that its soothing conclusions of safety after finding lead in synthetic turf were NOT correct.

Tested fields keep showing up with lead in them both old AND NEW. Some tested fields have little or no lead , some high levels and some have both within the same field. There is no way of knowing if any of the components of a field contain lead, and how much without stringent and thorough testing of each field.

This problem highlights the need for application of the designation as a children's product for testing and regulation : 1) stringent testing of all the colors and of the backing of the carpet for total lead content (chromium and cadmium should also be tested for) AND 2) Testing many samples of the infill which is an ever-changing witch's brew of chemicals- so undetectable, low and very high levels can all be found in the same field. In addition to having testimony both last year and this year in the MD state chambers from Field Turf that their product DOES indeed contain lead (as heard in the recent committee testimony on MD house Bill 883) , and in addition to those referenced in the PEER review, other studies on lead also exist.

24. For a helpful media article on Lead in artificial turf which cites scientists and studies that the synturf industry avoids please go to:

<http://www.usatoday.com/story/news/2015/03/15/artificial-turf-health-safety-studies/24727111/

>

For example as reported in that article:

Dr. Shalat's New Jersey State Study (2012) on artificial turf found lead in the field dust in the respirable air space of a robot and real player- highly variable but sometimes very high (note most facilities would NOT LET THEM TEST).

<http://www.nj.gov/dep/dsr/publications/artificial-turf-report.pdf

25. PEER writes: The concerns about lead exposure have taken on a new urgency following the release in June of 2012 of a study done for the New Jersey Department of Environmental Protection which found artificial fields made of tire crumb can contain highly elevated levels of lead much greater than the allowed levels for children:

a)· It reports "concerns with regard to potential hazards that may exist for individuals and in particular children who engage in sports activities on artificial fields"; and

b) *"In**halable lead present in artificial turf fields can be resuspended by even minimal activity on the playing surface**."*

26. Dr. Lioy of Rutgers who is quoted in the USA Today article recently participated as the senior author in a study which found lead and other toxins in the BOTH the plastic rug (supplied to them by the industry) and tire crumb infill. LEAD was also was found in simulated body fluids meaning there is little or no protection of any kind against the lead getting

out of the material into the body .

27. Pavilonis Study found lead.

http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4038666/pdf/nihms565643.pdf > 2014

" **Bio-accessibility and Risk of Exposure to Metals and SVOCs in Artificial Turf Field Fill Materials and Fibers**" , Brian T. Pavilonis1,Clifford P. Weisel1, Brian Buckley1, and Paul J. Lioy1

QUOTE from Pavilonis et al:**."Since it is possible that children may be exposed to potentially high concentrations of lead while using artificial turf fields we recommend, at a minimum, all infill and fibers should be certified for low or no lead content prior to purchase and installation."**

*The main out-comes of concern from Pavilonis et al**:**

a) the finding of **lead, and chromium** in **both** the **tire crumb** and **the plastic rug** and simulated **body fluids** at sometimes extremely high levels ***EVEN IN NEW FIELD CARPETS**.*

b) **Benzothiazole** derivatives and **4-(tert-octyl) phenol** were also found in in the simulated body fluids. Both are probable carcinogens (the subject of another fact sheet).

QUOTE: "**Lead was detected in almost all field samples** for digestive, sweat, and total extraction fluids with digestive fluid extract of one field sample as high as 260 mg/kg. Metal concentrations were not markedly different across the three different sample types (new infill, new turf fiber, tire crumb field sample). However, one of the ***new*** turf fiber samples contained

relatively large concentrations of **chromium (820 mg/kg) and lead (4400 mg/kg)** compared to the other samples tested…the variability of lead contained in the infill material is large and can span more than two orders of magnitude* . One field [tire crumb] sample did contain a high lead level (260 mg/kg) which was on the s**ame order of magnitude as the NJ DEP cleanup value** (400 mg/kg)."

In summary: Lead-free is the only acceptable level for child products (and indeed for people in general). T**here is NO safe level of lead for children.** And yet many of our children are playing often, if not daily, on fields that may contain lead and certainly do contain many other toxic substances. Finding ANY lead in any play area for children of any age is unacceptable. As the CDC notes: Every effort should be made to eliminate ALL unnecessary sources of lead in the environment, especially a child's environment. ***Lead in artificial turf is not only totally unnecessary but dangerous to health AT ANY LEVEL*.**

28. Other sources of information on Lead in tire crumb fields:

www.ehhi.org/turf/<http://www.ehhi.org/turf/>
www.safehealthyplayingfields.org<http://www.safehealthyplayingfields.org>
www.synturf.org<http://www.synturf.org>

At www.synturf.org , a sampling of findings of lead on fields is available on the page on lead:

No. 36] Mayo Clinics tips to protect children from lead in artificial turf. April 2015.

No. 35] Durham, New Hampshire: Lead scare at UNH, s Memorial Field.

November 2012.

No. 34] Beware of lead content in exotic color artificial turf fields! September 2012.

No. 33] Odessa, Texas: Eager fans will not be given pieces of the artificial turf field. September 2012.

No. 32] U.S. Federal panel increases child protection against lead. February 2012.

No. 31] UNLV researcher spreads word about the need to test artificial turf fields. December 2010.

No. 30] Environmental Health Sciences study (2010): Deteriorating synthetic turf dust containing lead may pose a risk to children. October 2010.

No. 29] Concord, Mass.: Town replaces fake grass fields, officials insist nothing is wrong with the lead levels! July 2012

28. TWELVE (12) CARCINOGENS found and HOW DO THEY INTERACT:

The Yale Study identified the presence of so many carcinogenic materials in a single material that it raises many more questions about interaction of PAHs with metals, and combination impacts. The interaction of the PAHs and benzothiazoles with other materials in the fields needs to be characterized and addressed

29. Strengthening Additives: Nanoparticles

We would also ask for information and clarity about tire strengthening additives of any kind that were built into the material anytime in the past 30 years, these would have been added to tires.

[http://nice.asu.edu/nano/carbon-black-and-amorphous-silica-tires]

Similarly, we request that the tire manufacturing industry explain their use of nanoparticle products, of any kind, including the type and size, source company and source country, and ask for an explanation about how:

a. they can be quantified in the product, and
b. how can they be cleaned up if they are released when the tire crumb and or plastic "grass" carpet degrades?
c. We would also like to understand what material characterization of their behavior in tires performance,
d. And or their behavior once they are released into the environment.
e. We ask for any epidemiological due diligence that was conducted by any tire company on nanoparticle use prior to using them in a commercial product.
f. Plans for continued use and safety precautions tire companies will impose upon themselves
g. Epidemiological studies conducted on these particles in tires

30. Plastics, Microplastic Fibers, Microbeads, and Small Particulate Plastics

Assessment of microfiber particulate and small particulate plastics needs to be assessed in characterization studies.

31. Flame Retardants

Flame retardants can be added to a tire in production, or applied post production in a shipping setting or possibly as tire crumb. Since flame retardants are known carcinogens with health issues of concern, and will be on the surface of the waste tire crumb, tire infill providers need to know

if they are present, and purchasers need to know that the material contains flame retardants prior to purchase.

32. Tires and Tire Crumb Additives

Myriad products exist to clean, protect, condition, and color tires. We wonder if they are components of tire crumb?

33. Road Waste Picked Up By Tires

Tires spend their lives on roadways, of course, and can pick up many materials in their travels. Debris, hydrocarbons, ….

34 CARCINOGENIC, PATHOGENIC, Endocrine disrupting and other harmful ingredients in tires cannot be removed by shredding tires into tire crumb and must be assumed to be accessible.

35. Tire crumb and repurposed rubber appear to be the same thing, with interchangeable use… but are they the same? We would like clarification.

We would like clarification about the distinction between the tire crumb, repurposed crumb rubber, and crumb rubber. Specifically if using the term "repurposed rubber crumb" implies uniformity of ingredients? Does that term imply tires are not used? If so, what are the ingredients in repurposed rubber crumb and how do they differ from tire crumb?

36. **We would also like access to all MSDS/SDS of tire crumb manufacturers and tire companies,** and the ability to ask questions about how and where they were made, variations on lots, source and composite addendums. It is difficult to locate them.

37. EXEMPTION ON LISTING HAZARDOUS MATERIALS: We would like to understand why tire companies have an exemption on their need to list ingredients under Section 2: Hazardous Materials of an MSDS/SDS. We were unable to find the source of that exemption, if it has a deadline, and whether your study group thinks it is an obstacle to understanding and characterizing risk of exposure from tires and tire crumb.

38. Of those MSDS that we located, several, like this Michelin North America Material Safety Data Sheet for Michelin, Uniroyal, BF Goodrich, says in **"Section 2 HAZARDOUS INGREDIENTS: Note: Tires meet the definition of article as defined by the OSHA Hazard Communication Standard (29 CFR 1910.1200) and are exempt from MSDS requirements."**

There was clearly no mention of 1,3 butadiene, carbon black, POHs, VOCs, benzothiazoles, or any plasticizers, nor metals, styrene, sulphur, known irritants, or well… anything. Since that section also outlines corrosive, combustible and waste treatment, it is important for more than this issue. We explicitly ask CDC/CPSC/EPA if they can use their existing authority to require tire crumb companies and tire companies to provide ingredient information.

39. SOURCE MATERIAL UNKNOWN: MSDS/SDS CANNOT REPRESENT WHOLE FIELD. Tire crumb comes from many tires, and many sources. Since not a single tire crumb field can accurately list or track which tires were source materials, or what other mixed in components, and there is no accountability from tire crumb recycling industry for the shredded product, then MSDS/SDS cannot be accurate for a whole field due to variability. Therefore, the burden of "proof" of risk lays squarely on the ability of the purchaser (schools, sports directors, booster clubs) to assess risk… of a

very very complex product. So, if the exemption stays in place, we will know for sure that we cannot know what is in a tire crumb based field.

40. TREATMENT TO SHOW NO PARTICULATE OR BREAKDOWN: SHOW US.

As for studies that claim that their product has been treated (such as cryogenic treatment) to not break down into dangerous particulate, we are deeply skeptical, and would ask for proof. We also ask for assay testing over a period of at least several summer weeks. We ask for the researchers to simulate the pounding over 10 years and assess the particulate characteristics and particle size. That testing in fact is being done right now… in thousands of children across the country. Simple observation on a player body, on the sideline benches, or under a microscope shows consistent breakdown into particulate.

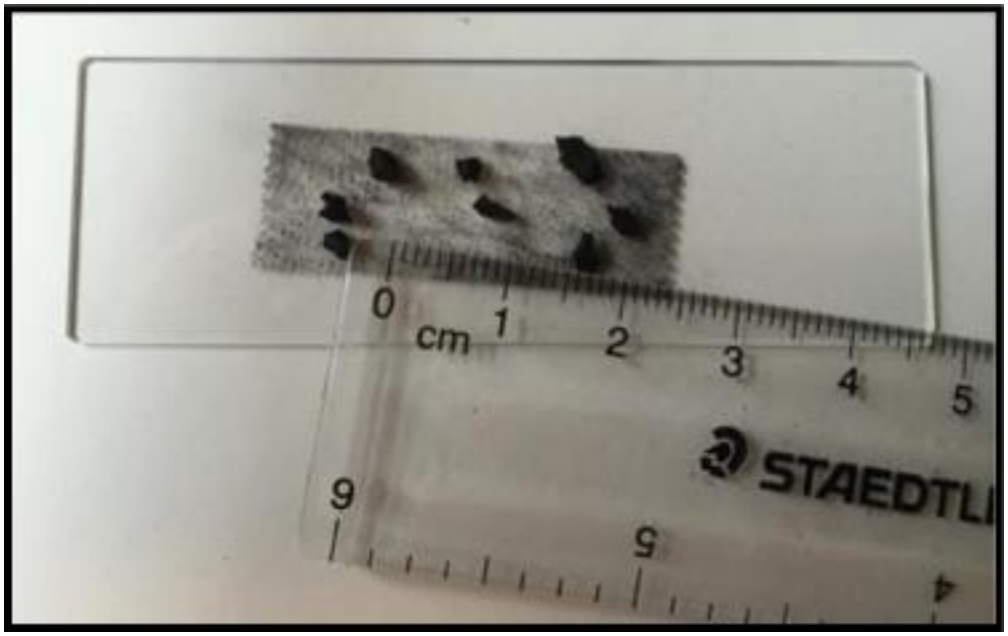
41. SHREDDED, PULVERIZED, HIGH SURFACE AREA FORM OF TIRES and ADD INS is LIKELY MORE TOXIC THAN WHOLE TIRES.

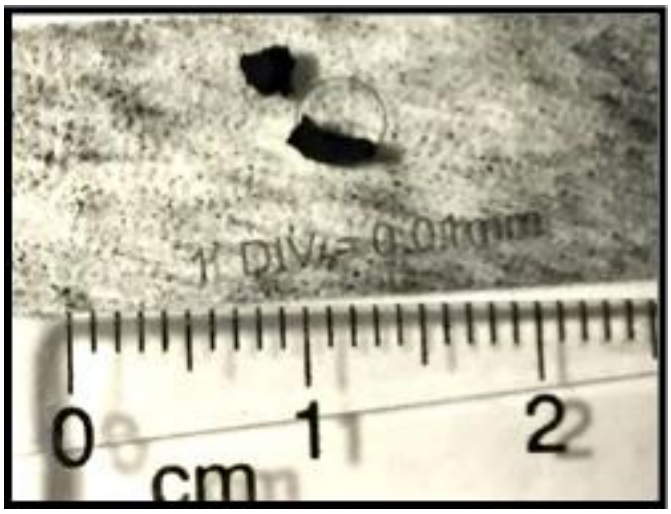
Unfortunately, because it is shredded, pulverized, and in loose and unencapsulated form, tire crumb has exponentially more surface area than whole tires (Thomas, Gupta study;) and we are concerned the material is very likely more toxic––possibly many times more toxic––in the school field form than whole tire form, since the increased surface area provides more opportunity for molecules to escape. We know for sure that the increased amount of surface area in tire crumb makes the material in tire crumb more available to the breathing and exposure zones, and to runoff.

42. CRUMB IS SURROUNDED BY DUST PARTICULATE:

Accurate characterization technique must include a study of the particulate that surrounds tire crumbs, and steps must be taken to make sure that the

sampling process does not inadvertently remove that dust and particles. We found several examples of the samples being washed, some in unbuffered water, prior to their analyses being done. Of course, that removes the particulate that concerns us the most. Distribution of the particulate size and type is important. Those particulate can become aerosolized by numerous gases and we ask that attempts are made to properly model this dynamic under high heat conditions, primarily.

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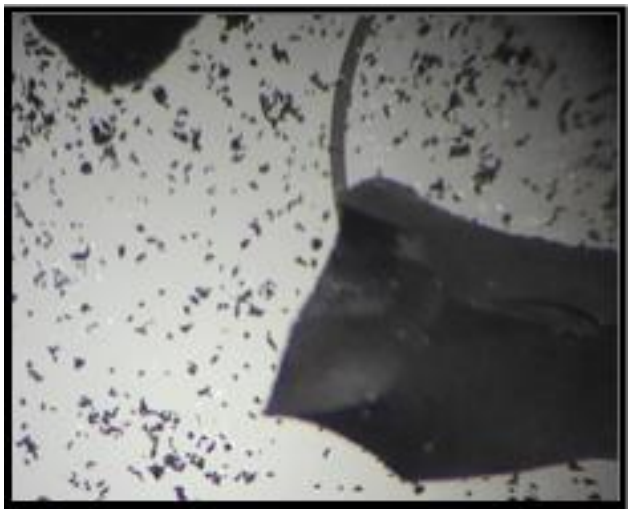

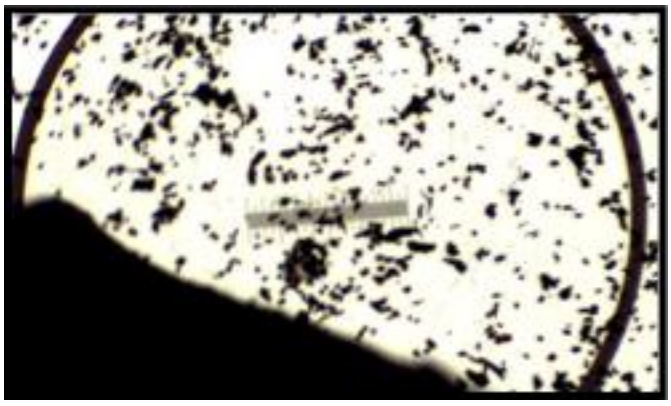

43. VERY COMPLEX PICTURE From TOXICOLOGY PERSPECTIVE: Tire crumb material is complex from a toxicology perspective, largely due to the chemical complexity presented by multiple known toxic components and variation. It has been described as a "toxic soup" of ingredients for which we have no consistent data on proportions or levels. Characterization of ingredients' margin of error is unknown..

Testing must be done at the field levels using accepted sampling plans that have been statistically shown to be valid. Not fields have been tested in sufficient detail to determine or rule out any exposures or risks. A look at testing protocols for lead in urban soil sites illustrate the level of attention required and show the degree that current testing has fallen short of that needed for decision making for children's health.

44. CONTACT PATTERNS, FIELD USE and ADJACENT BUILDING CONTAMINATION

Exposure is likely determined by ingredients in surface, activity, and number of children or users on field. Each school or community field has high use and high contact patterns, such as hosting contact sports, like football, lacrosse, soccer, and baseball, athletic camps, workshops and practices. In those sports, children dive into the field materials. As a child runs or skids or slide tackles, a column of material rises up, as does the dust and particulate that surround the tire crumbs themselves.

Testing for exposure need to list weather conditions including humidity, wind speed, and precipitation, temperature on field surface and ambient air temperature. Number of children on field, and activity level of that play needs to be recorded, video would be most interesting.

Children of all ages use the fields for multiple sports, recreation and school events. Artificial turf tire crumb fields abound in elementary schools and at

indoor and outdoor sports centers where children of all ages and all stages of development play soccer, lacrosse, football, track, cheerleading, band, and use the field for general recreational school activities. In the fields with which we are familiar, families with members of all ages use the fields; and the community holds events, picnics, special fairs, and activities. Some fields are immediately adjacent to a school building.). That there are many uses, and probably many levels of contact and exposure is an important part of characterizing exposures, but both low dose exposures AND high contact exposure scenarios and use need to be examined, with appropriate epidemiological process.

45.. SCHOOL BUILDINGS AND SURROUNDING AREAS ARE CONTAMINATED with a great deal of tire crumbs. The fields appear to lose from 1-30 tons of material over their 8-10 year life, and some of it goes directly into buildings, cars, and then homes. This impact needs to be studied as an inadvertent consequence.

46. CANNOT ARGUE NO INHALATION OR INGESTION RISK or SAFETY FOR EVEN A SINGLE FIELD. We argue that given the unique characteristic of nonuniformity, known carcinogenic materials, breakdown into particulate/dust, no known source of origin, and no accurate studies on complex interactivity of those components in the children's exposure zone, in the tire crumb as it is installed today in 12, 000 fields, not a single field installer, nor material provider can demonstrate that the material is safe from inhalation and ingestion during normal use, active use, and on hot days.

47. EVERY USE COULD POSE A TOXIC EXPOSURE and it would be irrational to argue otherwise. We argue that due to the high variability of toxins in the tire crumb substrate (from tires, unknown additives, and

factory waste add-ins), and lack of any control of the material, well-known sampling techniques will NOT accurately predict risks to human health.

48. CHILDREN CANNOT AVOID THE EXPOSURES: Since school children cannot self-advocate and take responsibility for staying off a field if directed to be there by coaches or school officials or parents, we must assume that children cannot avoid the exposures when they play on those fields.

49. CANNOT CLAIM THAT EXPOSURES WILL NOT OCCUR. Absolutely no way to responsibly claim that ingestion and inhalation of particulate from the material will NOT occur to those children.

50. HOTSPOTS of intermittent dangerous exposures are possible, and should be expected and searched for in every field.

We must assume that tires have different "recipes" based on their type of use. Therefore, knowing the type of tire used in tire crumb, and each tire "recipe" would be helpful in assessing characterization of ingredients. However, there is no way to ever know what tires, or what material is in any field, and therefore, an MSDS/SDS cannot be representative of any field, or even any meaningful part of a field. Alarmingly, the high variability in the ingredients presents worrisome "hotspots" potential, where the hotspots might be missed in sampling but even a single exposure could have very serious impacts for a child who has the unfortunate luck to dive into that hotspot. PAH's may be more prevalent, and present dangerous levels for installation period of the field, and for some unknown period of time afterwards, and considered a "hotspot", then the consistent release of PAHs in the subsequent years could mean low dose, chronic exposures. Both need to be examined.

51. Lead, chromium, mercury and arsenic could be present in hotspots, based on which tires were used, and how they were treated prior to being placed in the field.

52. For example, when we asked about the source of lead in tire crumb fields, an infill vendor explained to us that a) lead could be in any field as an ingredient of the tires, of the treatment of tires, and b) once, they were aware of a shipment of tires that was treated with an anticlumping material that contained lead and the whole lot had lead, and c) that some lots had flame retardants added as well. They would never really know, but "most purchasers never ask", according to the infill material vendor. If an MSDS was required, an additional charge was to be imposed, since MSDS were not available from the materials they acquired from China or other countries. We have collected many more examples of the worrisome unknown ingredients in our fields and can share with the study teams, if requested. While this information is anecdotal, that is the point: we have no idea what is in any field, for sure.

53. Another example, but this is not anecdotal: in a primary study field exposures in CT, a researcher found that the children's monitors showed benzene. Since there is no safe level of exposure for benzene, and in fact, tires are not expected to have benzene, the field was sampled more closely, until that "hotspot" was located. The original source of that benzene was not determined, but it was next to a busy parking lot where cars' exhaust may have been a source as they turned the corner, or possibly the tire crumb material had been previously stored in an area with benzene in surrounding environment, or perhaps it was picked up from contact on roads. We will never know. That finding suggests that the carbon black in the tires can adsorb additional toxins present near tires or tire crumb, and

could release that material as the fields are pounded with running feet, or possibly on a hot day. The proper characterization of this material needs to account for adsorption characteristics of carbon black, and other interactions

54. The point is, that it is impossible to locate hotspots for all toxins in every field, and incorrect to extrapolate the risk for a whole field from a single sample or even multiple samples, since every sample is unique. So, while hotspots can easily be missed in a field, the unfortunate child that dives into that particular part of a field has an exposure that can actually be life threatening, but missed in its entirety in the sampling based risk assessment.

55. In fact, since the tire crumb creates multi sized "dust" particles, and off gases, it is impossible to prove that even a single field is safe from inhalation or ingestion exposures from tire dust particulate, off-gassing components, multiple toxins and combinations of toxins, and heat.

56. Importance of the Heat Factor: Source of direct injury and chemical catalyst

HOT HOT HOT HOT EXTREMELY HOT FIELDS

Grass playfields remain close to the temperature of ambient air, and are often much cooler. Asphalt playgrounds used to have a use limit of 141F and many schools remove children from playgrounds when temperatures get hot. With tire crumb based turf fields, surface temperatures can soar on even mild sunny days.

Tire crumb fields "superheat" to levels that are routinely over 150F on a sunny spring day, and in a recent study conducted on a sunny day Utah, found to be close to boiling point, 190F, according to the Penn State Field Turf Heat Study. The study found that tire crumb field surfaces are hotter than ambient air, and increase in heat in a non-linear function with each additional degree Kelvin of heat, hence the designation "superheating". To draw an example, on a Labor Day Weekend in DC area, with ambient temps of 82F, the field surface temperature hit 164F by noon on several fields used in a busy, tournament for about 1000 children, both boys and girls, ages 8-15. Those levels are known to melt plastic cleats, require tubs of water on the sidelines to cool down shoes, and create heat-related injury including heat stroke, nausea, heat exhaustion, and dehydration in children and all users. It is not unusual for children players to vomit, faint, and suffer dehydration from hot conditions on the fields.

57. Marketing and sales for these fields tout their usability in all conditions as a benefit (more practice and play hours), but in fact, the heat build up on fields makes them very uncomfortable during many days and conditions. In DC, there are over 100 days of sunshine each year, and most are during the spring, summer and fall, making the fields uncomfortably hot and possibly dangerously hot for a third of a year. A calculus should be made on the percentage of safe days to play based on field yield risk, and heat.

58. Tire crumb fields do not have any protection from heat, and so they are irrigated to be cooled down, but the effect is temporary.

59. To our knowledge, there has been no well known place for doctors nor parents to report heat injury, though they are commonplace. (This author

specifically remembers a hot, poor air quality day in August in 2014 in Washington DC when during a single practice, 4 soccer players vomited, another child was taken to the hospital after passing out, and another sidelined himself against the coach's wishes, due to extreme dizziness and nausea.)

60. **Reluctance to Report?** Yet, it is curiously uncommon for school teachers, coaches and parents to remove the children from the fields, due to temperature. We cannot explain that in rational terms.

We have also noted another curious effect: as football, soccer and lacrosse increase in popularity and competition in the US, competition for spots on high performance teams is fierce. There is a perception from strong sales and marketing of the fields, that the turf fields present a competitive edge for a school, a club or even a teenager trying to get into college, and are worth the high price paid. As psychologist Dr. Wendy Miller, explains, " it is a culture where high performance parents, players and schools might be willing to overlook these injuries, thinking that to complain would jeopardize their child's access to a competitive team. This thinking could easily lead to the silencing of reporting of injuries."

Heat injury reporting needs to be included in the survey questionnaires, and victims of heat injury and illnesses need to have a place to report, with impunity.

61. HEAT MAKES THE CHEMICAL DYNAMICS ABOVE A FIELD VERY COMPLEX

In addition to the serious issue of direct injury from hot playfields to young children, or anyone, the super hot fields present a very challenging chemical situation.

Dr. David Brown, ShD, toxicologist, professor and former Deputy Director of Public Health Practice Group at ATSDR/ CDC explains that, "the unintended, and largely unstudied chemical consequences of what comes off such an enormous quantity of high surface area material, in amounts and sequence that is scientifically accurate is very difficult to predict and model. Since the chemicals in the area above the field could change instantaneously, the conditions are critically important (number of players, temperature, time from last rainfall, etc.), as is the sampling methodology. But no one has been able to come close to modeling the actual yield, we only know the materials by characterization with samples, and that variation in samples is so broad as to almost be meaningless, since it could be easy to miss harmful exposures."

62. Analyzing the field yield on a hot day is very complex, and challenging to even trained toxicologists. The superheating of the fields makes gases yield at faster rates as temperatures on the tire crumb surface increases. So, as a day heats up, it is very likely that the yield increases directly with temperature increase; a hot day creates more gases. Based on well understood scientific laws, we presume that the gas yield from the field at surface temperature of 50F (a cloudy day in January in DC) would be considerably less than a field surface temperature of 158F measured last week. If more gases are escaping the surface, then there are more "opportunities" for particulate to adsorb onto the surface of the gases, creating very dynamic series of compounds, none of which would be recommended to inhale.. The changes in the chemical composition over the fields as their temperatures rise is very difficult to test and model. These changes happen in an instant… as a threshold is reached… and the

exposures can increase sharply. It is a very sophisticated and difficult challenge to model. But what is the most important is not only that the 24 gases that escape tire crumb (Norway Study) create dangerous mixtures but those gas/particulate mixtures, (and air) create a vector for deep lung exposures of all the materials in the tire crumb field. So, on poor air quality days, when there are many children on the field and a lot of stirring up of the material, the fields could present enormous risk.

63. We are concerned about the range of yield levels, but, we are most concerned about the intermittent risk to children during those hot periods (a hot, poor air quality summer day during children's soccer camp week in Washington DC, for example) when the fields are likely yielding more gas, and therefore particulate has more "carriage" into lungs, respiration rates are higher, skin is exposed, and perspiration is highest. All these are likely factors in exposure. It is during those days when exposures are probably highest, and high enough overwhelm a developing immune system.

64. Exposure Study Needs To Focus On Worst Case Conditions

We acknowledge that the level of yield from the fields might vary widely with material variation, and will also vary with outdoor weather (temperature, wind, humidity and sun) conditions. Taking averages from fields across the country will be meaningless, and will only help the industry to expand its message of "found no harm". An analogy might be to determine the health of a forest taking 4 samples from 40 locations, evenly spaced, but the sampling might easily miss a blazing forest fire. That one day might destroy living material exponentially, but it could easily be missed. Dangerous exposures can be unpredictable in this material due to the scope and scale, the toxic character, and the superheating characteristic.

65. A better approach is to carefully detect high yield days, and look THAT DAY for exposures in a child's body during those periods. Since the exposures might attenuate, the work would have to be done expeditiously. The harmful exposures may or may not be detectable a day or a month later in a child. Monitor both genders, for patterns that might lead to that awful air quality soccer camp in the city on a tire crumb field, on days when vomiting and melting shoes are commonplace. A focus on the impacts from the high end of those yields we believe will present exposures that are clearly, and unequivocally harmful from both heat injury perspective and toxicity exposure potential. We do not know for sure if the carcinogenic exposures from low dose regular exposures or from high dose "events" are more dangerous, but both need to be studied as separate situations, not as an average.

66. We urge your team to focus the study resources on primary measurements made in high use scenarios on hot days, and refrain from the approach used in earlier studies that look at chemical compositions during winter or rain conditions on limited number of fields.

67. The only reliable way to assess the risk to children from a particular field, or groups of fields, is to look at their direct exposures, and importantly look at bloodlevels of the known substances. Cooperation from both high use athletes and those exposed to chronic levels of materials will be important.

68. The Study Needs To Focus Also On Low Dose Exposure Risks

Trained immunotoxicologists look at the impacts of chronic low dose exposures to metals, PAHs, VOCs and many other materials in tire

crumb. Their input is crucial to understanding risk of exposure in a developing child.

69. Characterization Mistakes

Studies look convincing, but miss the forest for the trees.
Tire recycling and tire crumb industry reports are quick to point out that when they find harmful materials in their samples, they are under the known safety limits. There are two interesting fallacies in that reasoning.

First, since the samples in several studies are few and not uniform, they fail to acknowledge the statistical significance of finding known regulated toxic material in 2 million pounds of powdered tires… if one finds the needle, is it luck, or is it because needles are more prevalent than expected?

Proof of presence is meaningful! For example, in the NY Study, PAHs were found, as were metals, benzothiazoles, and many substances. Their presence indicates a risk.

In a child's product, since many materials are not known how they affect children, just knowing they are there is enough to use a precautionary principle and prevent the exposure. Arguing that the materials appear under a limit (especially if that quantity is an average of multiple samples), or there is no established limit (because it has not been studied), are not as meaningful as the proof of their presence.

Second, though the conclusions of the industry reports may be of no harm found/safety, a close look at the data itself on PAHs, lead, cobalt, chromium, etc. is useful, since a) it proves presence, and b) at levels that suggest risk for **chronic exposure**. Chronic exposure risk is the subject of

a great deal of new cancer research, and we care about all the materials, including those which are potentially toxic.

70. ARGUMENT FOR MORATORIUM BASED ON KNOWN CHARACTERIZATION FOR TIRE CRUMB

Because of the:

a. known loss of 1-30 tons of material from the fields during the 8-10 year "life of the field" into air and water
b. ingredients list: over 50% of its components are known carcinogens and pathogens, [cite Yale Study]
c. massive scope and scale of this product, (the amount of material and surface area of these fields is enormous; scale/millions of pounds in each installation),
d. inability to control the levels of toxic exposure to children, or even properly characterize them due to immense variation and chemical complexity of what happens on a hot day over a field, and around children. We cannot suggest mitigation strategies for the danger, because the material is inconsistent,
e. Even if we did know for sure what was in each field, and suggest mitigation techniques and protections…. All the tire company has to do is change their recipe, or many recipes, as they do continually, and the study is worthless. Children are still being exposed to whatever is in the tire, the lot or that particular field..

71. Moving Target Analogy

Even if the study were completely successful, and the tire crumb material categorized properly, the trouble is, tire manufacturers could change the "recipe" for tires… and in fact they do this regularly… and the study results will be useless, or at best, diminish in usefulness.

Any attempt to study tire crumb safety on turf fields is analogous to trying to hit a moving target. Tire crumb is a waste product. Tires are not designed or intended to be used as infill for turf fields.

Ingestion, inhalation and absorption of fine particulate by children is not a consideration of tire manufacturers as they choose chemicals and compounds for their tires. Nor are they bound to maintain any safety considerations for such use by children.

So any study of present day tire crumb is a futile endeavor, because such study tells us nothing about a field that gets installed immediately after the study. Tire manufacturers often change the chemical composition of tires and will likely do so again.

Even if a field passed safely concerns in a present day study, a new field could easily fail a hypothetical study conducted the day after the present study. So unless every field was tested using the exact same methodology after every installation, there is absolutely no way to assure the user that their new field is safe. Those new fields could easily have an entirely different chemical composition simply because tire manufacturers changed their tire ingredients.

So the present Federal Study is only a backwards looking study, not forward looking. Any conclusion must be transparent and clear on that issue - upfront and center. Otherwise the public is being misled into a false sense of security.

72. **Sampling: Not Appropriate For Tire Crumb**

The core pediatric toxicology problem in industry based safety studies, is that there appears to be an assumption that tire crumb is a uniform material, and behaves uniformly. It does not. There also appears to be an assumption that sampling will be an accurate method for studying tire crumb risk to children, and it is not. **Sampling will not be accurate to assess a non-uniform, heterogeneous material with multiple known toxic ingredients, high direct contact (dermal, hand to mouth, breathing zone) for pediatric use**. **Sampling cannot produce a single sample that is representative of the whole field, or even a part of the field, other than the sample itself.**

73. Methodology needs to study PERFECT STORM exposure conditions, and be able to calculate exposures during those relatively dangerous days.

Nor can sampling in the way it is proposed (samples from 40 fields across the US), illustrate impacts from a perfect storm of exposure conditions on a particular field, say, during an intense soccer camp in in summer in Washington, DC with high ambient and field surface temperatures (ie 160F), bad air quality, no wind, when working athletes are breathing in particulate with high VOC, PAH, benzothiazoles, and carbon black… and many more compounds, on a particularly high yield day. Averages cannot be relied upon in sampling for this type of product, since they will further obscure the risk from exposures to hot spots of high risk material that are on fields. Averaging the results from a national distribution in various weather conditions simply obscures the acute risks further; it is useless for risk analysis. In layman's terms, it is like studying a forest using "x" number samples, but missing the forest fire that is blazing away at a nearby area of the park. For a child, it means that she plays on a field that was called "SAFE TO PLAY", after sampling, but in fact she might easily have

been covered with multiple materials known to cause cancer, and in fact, that might be a regular event. The uncertainty of exposure frequency makes the risk higher, not less.

74. The core of the methodology used in the 50 studies asserted by the tire recycling industry were based on simple characterization of a single sample, but not on realistic, combined, nor worst case (the most important) use scenarios.

75. Multiple carcinogen and multiple pathogen combined effects need to be measured. Single material measurements could be only a fraction of the exposures, since the material exposures are likely to be from combinations of materials.

76. BIOMONITORING FRONT AND CENTER

Because sampling presents inconclusive results, a methodology that relies on biomonitoring will be more meaningful. We suggest that more sophisticated approach be considered. Personal sampling monitors attached to children, dermal, urine, breathing analyses, and particularly, blood and tissue samples from frequent users, players on "Perfect Storm Days" and those expected to have chronic low dose exposures. We understand that biomonitoring raises more issues, but absent a good model, empirical data is the most reliable way to accumulate actual evidence of exposures and to be able to establish a reliable causal link to the cancers and diseases we predict from exposures.

77. IMMUNOTOXICOLOGY SUPPORT: RECRUIT THE BEST PEDIATRIC IMMUNOTOXICOLOGISTS AND RESEARCHERS. Some researchers and epidemiological professionals are already on the trail of better ways to

identify actual exposures, and can create biomarker groups as indicators of presence of illness or exposures. These researchers have background in immunological toxicology, and can track subtle changes in an immune system that might be precursors to serious disease, like cancer, kidney disease, brain changes, and lung disease. It is possible to create biomarker group to prove tire crumb exposures in users and we believe that the preliminary proof of concept step could be accomplished in less than 6 months with cooperative athletes, and study volunteers, and modest budget. While we will not list them here, for protection of their privacy and frankly, for fear of industry retribution, we will nonetheless let you know that we have found multiple professionals who are capable and willing to work on this task, provided a protective forum and IRB standards are in place.

78. Immunotoxicology support: look carefully at the ages those immune system markers in all children who are using these fields, understanding that some metabolic types, and ages may be more vulnerable than others. In fact, there are early indications that certain age groups, such as prepubescent females (age 8-11), may be more vulnerable to exposures to benzothiazoles, plastics, phthalates, and endocrine disruptors in general, and therefore might be at higher risk to contract cancer or disease from low dose particulate exposures from tirecrumb, and the plastic "grass" carpet particulate. We need to establish the datum from players to study this. We still do not know, but some indications exist. For that reason, we respectfully request that the study team include toxicologists and epidemiologists that are trained to keep these concepts front and center.

79. LOW DOSE EXPOSURE CONCEPTS and CONCERNS

Based on what we know now about low dose exposures to VOCs, PAHs, benzothaizoles, styrenes, carbon black, plastics, plasticizers, and metals, even at low, sub-acute exposures, the fields could be very dangerous. That possibility was not considered in the CPSC study, EPA study, nor in mulitiple industry studies. These need to be assessed:

- Chronic exposure to metals, plastics and plasticizers
- Chronic exposure to carbon black mimics air pollution exposures
- Immune system reactions
- Endocrine disruption exposures from plasticizers and phthalates,
- Exposures from multiple low doses and chronic exposures

80. The study should calculate yield of material that leaves the fields, and how it leaves the fields. How much in the air , water pathways, and with users (in shoes, cars, etc.) Interviews with schools and vendors need to establish the replacement quantities of these fields, and how often new material is put into place, since it would affect exposures, and give an indication of gross yields. We estimate that the fields lose from 1-30 tons (estimated) of material, so exposures and impacts need to be measured in adjacent buildings, soils, and stormwater systems. With 12,000 existing facilities, this may need to be the subject of additional studies conducted to also assess if the fields shall be regulated as point source contamination under Clean Water Act and Clean Air Act. It is a very important metric, and a perfect opportunity to include it, with little incremental cost, in your study.

81. INTEGRITY STANDARDS. To track the history of the emergence of this product is to track effective lobbying for regulation changes that favored the tire industry, and the tire recycling industry. This industry took

advantage of an enormous quantity of recalled and used tire stockpiles, and heavily sold and marketed the materials to schools, and sports centers where millions of children play. Central to the steps that catapulted this industry forward was the removal of the designation of artificial turf fields as children's products, based on the rationale that adults played on them, too. Yet the fields continue to be sold to elementary schools and to sports centers brimming with elementary, middle and high school players. The sales oriented industry was willing to submit children, schools and communities to the materials in tires in enormous amounts, and call them safe. As this claim is deeply questioned now, we also urge you to NOT allow the sampling or data collection to be conducted by an interested party, including schools, sports centers, athletic group personnel or administrators, field installers or laboratories or consultants hired by those groups, and establish peer reviewed standards for testing.

82. Any group or individual who does participate in the study, including regulatory staff, needs to sign an affidavit certifying that she or he, and her/his group has not received compensation or benefits in any form, including but not limited to sales commissions, direct payment, compensation, bonuses, grass to artificial turf grant, field financing, water savings rebates (State of California and possibly others), or physical benefits including but not limited to uniforms, facility enhancements (restrooms, concession stands, parking lots, storage facilities, etc.), stadium components, or field equipment of any sort, from the field installers or tire crumb field industry and its assigns, and has no financial conflict of interest. The document should be filed with an appropriate agency and made public.

83. We ask for full transparency on all parts of the study process for parents, interested parties, and schools.

OUR REQUESTS TO ASTDR/CDC/CPSC/EPA	
Request	Background
1. Regulate tire crumb and rubber mulch as children's product	PEER filed formal request; 12,000 fields x 30,000 tires is the amount of existing material in children's use; see table A for details on volumes and surface area sizes, children/schools. Known

	carcinogenic material and known contact.
2. Remove "safe to play, safe to install" or any other references that imply safety from all EPA, CPSC and CDC websites and public information sources	PEER Formal Request; agencies must remove all endorsements of safety.
3. Place all PEER artificial turf filings in Federal Record	**http://www.peer.org/campaigns/public-health/artificial-turf/news-releases.html**
4. Issue a directive to public health agencies to disseminate warnings regarding unknown risks from lead exposure from AT fields, as well as exposures to carbon black, known carcinogens, PAH, VOCs into air and water pathways; direct hospital systems and medical systems to screen for tire crumb field use, and report results	For parents, schools, athletic groups and communities; conduct parent outreach webinars
5. Use only independent lab or consultants unassociated with tirecrumb industry, adhering to high ethics guidelines; transparent process for review; affidavit of no conflict of interest	
6. Commission a primary study, conducted by independent, peer reviewed group such as CDC to examine existing cancers AND illness in tire crumb field users and maintenance workers of tire crumb fields	
7. Mandate Cal Recycle Study corrections to methodology; mandate methodology peer review; and mandate to impose Prop 65 rule based on OEHHA's own findings on carcinogenic exposure	
8. Convene a conference for presentation of risks and concerns from parent groups, cancer survivors to Federal Research Team	Needs participation from CDC/CPSC/EPA staff so parents and public can have direct contact
9. Convene series of webinars and open comment opportunities	
10. Allow public health and environmental advocacy groups in Federal Research Team with complete transparency	
11. Establish a collection point for recording experience of victims and those who may have suffered injury from use of the fields, including heat injury, concussion or head trauma, cognitive disorder, illness, and cancer for study and documentation; victim hotline; for both child and adult contact with fields	
12. Funding to identify potential biomarkers of exposure; conclusive marker study in users	
13. Conduct blood monitoring and studies on existing cancer survivors.	
14. Conduct cancer cluster study on soccer player cluster, and identify additional clusters such as maintenance workers and installers	
15. Provide full transparency with all interested parties	
16. Conduct full epidemiological study of tire crumb on playfields existing and predictive	
17. Study forms and questionnaires should include data collection on what is released from fields into air, adjacent areas, water pathways, and quantified. Replacement quantities for tire crumb fields should be quantified and examined as a metric that indicates yield.	
18. Based on release/yield figures, and other inputs, tire crumb fields should be evaluated for compliance with Clean Water Act and Clean Air Act, and regulated accordingly.	
19. We request that OEHHA study methodology be peer reviewed by your agencies before it begins, taking into account the comments received in this proceeding.	
20. OEHHA Study Process and Methodology Concerns: How will those be considered?	
21. Consider explicit protection from retribution steps be put in place to protect researchers, players, and concerned parents from retribution	
