



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 8

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Ref: 8P-P3T

MEMORANDUM

SUBJECT: Potential Risks of Tire Crumb

FROM: Stephen S. Tuber, Assistant Regional Administrator  
Office of Partnerships and Regulatory Assistance

/s/ Stephen S. Tuber

TO: Charles M. Auer, Director,  
Office of Pollution Prevention & Toxic Substances

Donna DeLeone, Acting Director,  
Office of Children's Health Protection

Matt Hale, Director  
Office of Solid Waste

Region 8 has received a number of questions over the last several years from citizens and public health officials regarding risks to children from shredded tire crumb products used as playground surfaces. My staff has reviewed the published research on the safety of tire crumb, and has found information suggesting that children's chronic, repeated exposure to tire crumb could present health hazards. However, sufficient data to quantify toxicological risks from tire crumb exposure are not available.

As you know, EPA recommends the use of recycled tire crumb for various applications, including playground surfaces. (See attachment.) Region 8 recognizes that resilient playground surfaces reduce impact injury to children. Region 8 also supports uses of recycled tires when they do not present disproportionate hazards to children, such as asphalt-rubber road surfaces. However, the growing interest and concern about possible toxicological risks of certain crumb rubber applications suggests that it would be prudent for EPA to look further into its safety and make sure that there is a scientific basis for EPA's promotion of certain uses of the product.

Therefore, I propose that OPPT, OSWER, OCHP and Region 8 work together to identify data that can be used to assess toxicological risks of tire crumb in situations where children are exposed. If the information that addresses these concerns is not available, I recommend that the Offices involved consider revising EPA's listing of crumb rubber in the Comprehensive Guidelines for

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Procurement of Products Containing Recovered Materials (by adopting a more neutral stance) pending further investigations into the toxicological safety of the product for the applications in question. I further recommend that our Offices work together to ensure completion of research needed to fill key data gaps with regard to tire crumb.

Details of our research and recommendations follow. In summary, it appears that there are valid reasons to take a broader perspective of all potential risks associated with crumb rubber, yet there are insufficient data to assess the full spectrum of those risks. I recommend that appropriate data be obtained and a formal risk assessment be conducted.

I appreciate the technical support and coordination that members of your staff have given my staff over the past several months during our inquiries into this question, and we will look forward to working with you to appropriately address the concerns that have been raised. If you have any questions or need further assistance from Region 8, please contact me or John M. Brink, Chief of the Pollution Prevention and Toxics Unit at 303-312-6498, or [brink.john@epa.gov](mailto:brink.john@epa.gov).

Attachment

cc: Patti Tyler, Region 8 Science Advisor  
Liz Blackburn, Outreach Coordinator, OCHP  
Michael Firestone, OCHP  
Greg Schweer, Chief, Chemical Information & Testing Branch, Chemical Control Division (OPPTS)  
Tab Tesnau, OSW

## Region 8 Crumb Rubber Research and Recommendations

### Background and Research

Executive Order 13045 (FR 62:19883; 1997) directs EPA to identify and assess environmental health and safety risks that may disproportionately affect children and to ensure that its policies, program activities and standards address such risks.

Since 1991 EPA has recommended the use of recycled tire crumb instead of other materials for playground surfaces (see for example, Markets for Scrap Tires EPA/530-SW-90-074A; Comprehensive Guideline for Procurement of Products Containing Recovered Materials, Final Rule, FR 60: 21370, May 1, 1995; Comprehensive Procurement Guidelines for Playground surfaces at <http://www.epa.gov/epaoswer/non-hw/procure/products/playgrnd.htm>; Buy Recycled Series Park & Recreation Products at <http://www.epa.gov/epaoswer/non-hw/procure/pdf/parks.pdf>; OSW Tire Scrap Workgroup website (<http://www.epa.gov/epaoswer/non-hw/muncpl/tires/workgroup.htm>).

Use of tire crumb is significant. In 2005, 13 million tires (11 million pounds) were recycled into ground rubber, comprising 12% of scrap tire disposition. There is now a growing market for homeowners to purchase ground rubber for personal use. (Scrap Tire Markets in the United States, Rubber Manufacturer's Association, November 2006).

Tire crumb is a heterogeneous product because tire ingredients vary with tire type, date of manufacture and source. Tires may contain metals such as arsenic, cadmium, chromium, manganese, mercury and lead; aliphatic and aromatic organic compounds such as acetone, methyl ethyl ketone, chloroethane, polycyclic aromatic hydrocarbons, benzene and halogenated fire retardants; nylon and polyester fibers; dyes and latex (see for example, Evaluation of Health Effects of Recycled Waste Tires in Playground and Track Products, California Office Environmental Health and Hazard Assessment, January, 2007).

Volatile organics and respirable particulate matter have been identified in scrap-tire shredding facilities (Assessment of occupational hazards in scrap-tire shredding facilities, Sci. Total Environ. 309: Issues 1-3, p. 35-46, June, 2003). Recent analysis by the State of Connecticut demonstrates that VOCs volatilize from tire crumb, and that heavy metals leach from tire crumb under relatively mild conditions of temperature and leaching solvent (Mattina et al., Examination of crumb rubber produced from recycled tires, Connecticut Agricultural Experiment Station, Fact Sheet AC005, 8/07). Large numbers of VOCs were identified in the air above artificial turf in indoor sports arenas (Measurement of air pollution in indoor artificial turf sports halls, Norwegian Institute for Air Research, TA-2148/2006).

In addition, recent news reports indicate that, like discarded tires themselves, tire crumb is flammable (for a report of an August, 2007 playground fire in Canandaigua, N.Y. see <http://www.mpnnow.com/homepage/x748940067>).

Region 8 has identified the following potential health hazards to children playing on surfaces made of tire crumb:

- Pulmonary toxicity due to respirable particulates and fibers
- Systemic toxicity due to inhalation of volatile organic compounds
- Systemic toxicity due to ingestion of heavy metals and dyes
- Pulmonary sensitization to latex

Region 8 is not alone in recognizing these potential hazards. See for example Hazardous Chemicals in Synthetic Turf: Follow-up Analyses, Rachel's Democracy and Health News #992, 4/12/07; *ibid*, #873; A Study of Tire Crumb Use on Playgrounds; Risk Analysis and Communication: When Major Clinical Knowledge Gaps Exist, *Env. Health Persp.* 114: 1-3, 2006; and Artificial Turf: Exposures to ground-up rubber tires: Athletic fields, playgrounds and gardening mulch, D. Brown, Environment and Health, Inc., August 29, 2007. Dr. Phillip Landrigan, nationally recognized expert in children's health and Chair of the Department of Community and Preventive Medicine at Mt. Sinai School of Medicine, has raised the issue (*The New York Times*, October 28, 2007; *The Stamford Advocate*, October 16, 2007). Region 5 has communicated to us that they, too have received, but have been unable to address questions about risks to children from exposure to tire crumb.

Region 8 has been unable to identify data that adequately address our concerns. For example:

- o Agency recommendations for the use of tire crumb as playground surfaces are based on the benefits of recycling and preventing impact injuries (see for example, Mack, M.G., Sacks J.J., and Thompson D., Testing the impact attenuation of loose fill playground surfaces, *Injury Prevention* 6:141-4, 2000).
- o EPA's Final Rule: Comprehensive Guideline for Procurement of Products Containing Recovered Materials (EPA/530-Z-95-006 at docket number EPA- HQ- RCRA-1995-0059) indicates that research to support the Rule did not include an analysis of potential systemic toxicity or allergenicity to children from contact with tire crumb.
- o The Consumer Product Safety Commission (*Handbook for Public Playground Safety* (<http://www.cpsc.gov/cpscpub/pubs/325.pdf>) recommends the use of shredded rubber for playground surfaces based solely on reduction in impact injuries, and contains inaccurate or unsubstantiated statements regarding toxicity (e.g., "tire crumb does not contain chemicals with high vapor pressures; thus exposure via inhalation is deemed inconsequential").
- o The California Integrated Waste Management Board's report, Evaluation of Health Effects of Recycled Waste Tires in Playground and Track Products, (<http://www.ciwmb.ca.gov/Publications/default.asp?pubid=1206>) is based on estimated tire chemical composition. It found minimal risk from ingestion of zinc, and four PAHs. It found no evidence to support skin sensitization from latex; however, it failed to evaluate pulmonary sensitization from latex, pulmonary toxicity from

particulate matter, or systemic toxicity from inhalation of organic compounds. However, it did identify an elevated cancer risk from ingestion of chrysene.

- o The article by Birkholtz et. al., Toxicological Evaluation for the Hazard Assessment of Tire Crumb for Use in Public Playgrounds (JAWMA 53: 903-907, 2003, <http://www.shercomindustries.com/industries/birkholzcrumb%20safety%20paper.pdf>) found tire crumb negative for genotoxicity, and acutely toxic to aquatic organisms. Although it presented no data relating to pulmonary toxicity or allergenicity, it nevertheless concluded that tire crumb presents “no adverse risk to children playing in facilities where it is deployed.”

- o A recent review of the toxicity literature on tire crumb (A case Study of Tire Crumb Use on Playgrounds: Risk Analysis and Communication When major Clinical Knowledge Gaps Exist, Env. Health Perspectives 114: 1-3, 2006) concludes that “crumb rubber tire as a surface amendment on playgrounds is “a model case where the published literature did not contain the needed answers” regarding safety, and “the question regarding hazards posed to children playing on the amended playgrounds is left unanswered.” Nor has the author been able to identify new data that might answer the questions posed in this article (personal communication, Dr. Mark Anderson).

- o The November 2007 document: Artificial Turf: Exposures to ground-up rubber tires, by Environment and Human Health, Inc., evaluates the information known about the potential health and environmental risks from exposure to crumb rubber made from recycled tires. In commenting on the inadequacy of prior studies (including those mentioned above) it states: “The potential risk from human and environmental chemical exposures is unknown. In its place are general reports with nonspecific data ...such as that from the Consumer Product Safety Commission... Both the Norwegian study and the California report describe attempts to assess the overall risk. In both cases, the lack of reliable exposure measures and the absence of relevant toxicological tests restrict the quantitative determination of the actual health hazards...Neither the Norwegian study nor the OEHHA [California] study is sufficient to determine health risks to humans.” Among its conclusions:

- o “Gaps in the available information make it difficult to determine whether the proposed use of recycled tire crumbs in playing fields or playgrounds can be deemed safe.”

- o “Exposures to already installed synthetic turf fields that contain rubber tire crumbs should be limited pending the development of more definitive information.

- o “People who are allergic to latex should be careful when using these fields because rubber tire crumbs might contain excessive amounts of latex.”

Among the Environment and Human Health, Inc. recommendations: "There is enough information now concerning the potential health effects from chemicals emanating from rubber tire crumbs to place a moratorium on installing any new fields or playgrounds that use ground-up rubber tires until additional research is undertaken."

Region 8 has also polled, but has not located additional relevant data from the following internal Agency sources:

- OPPTS Emerging Chemicals Workgroup
- ORD's National Health and Environmental Effects Research Lab
- EPA's Science Inventory (<http://cfpub.epa.gov/si/>)
- Office of Children's Health Protection

### **Recommendations**

To ensure that the Agency has a scientific basis for recommendations regarding the use of tire crumb for playground surfaces or other applications that expose children, Region 8 recommends that EPA undertake a formal risk assessment of risks to children playing on tire crumb surfaces. In order to conduct this assessment EPA should obtain the following data:

1. Analysis of the physical and chemical composition of tire crumb from a representative range of commercial sources from different U.S. markets;
2. Analysis of representative tire crumb samples for: metals, VOCs, semi-volatile and non-volatile organic compounds; dyes and latex;
3. Analysis of representative tire crumb samples for particle size distribution, and length-to-diameter ratio of any respirable particles; and
4. Inhalation and ingestion exposure estimates for children playing on representative playground tire crumb surfaces.

After obtaining these data and further assessing the potential risks associated with these uses of tire crumb, EPA will be in a position to address public concerns with greater confidence than we have now.