

## National Toxicology Program Synthetic Turf/Recycled Tire Crumb Rubber Research Program

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Public health concern for playing on synthetic turf fields has recently increased due to media reports that young adult soccer players, particularly goalies, are being diagnosed with blood cancers. Over 12,000 synthetic turf fields exist in the United States, and approximately 1,200 are being added annually. In addition to being installed in professional sports stadiums, synthetic turf is increasingly found at public parks and school athletic fields. Several federal<sup>1</sup>, state<sup>2</sup>, and international<sup>3</sup> efforts are ongoing to address this public health concern.

In response to a request from the California Office of Environmental Health Hazard Assessment (OEHHA), NTP conducted studies on tire crumb rubber (TCR) to enhance understanding of potential health impacts of exposure to chemicals released from TCR. The focus of the NTP studies was to evaluate (1) utility of different experimental models for characterizing toxicity, (2) routes of exposure that may result in systemic exposure, and (3) bioaccessibility of TCR constituents.

Multiple lots of fresh recycled TCR were received from OEHHA and combined into one test lot for use in these studies. The lot was characterized using microscopy, elemental composition, metal analysis, as well as liquid (LC-MS) or gas chromatography coupled with mass spectrometry.

In vitro studies were conducted with human-derived skin, lung, small intestinal and liver cell lines using TCR-conditioned media (TCR-CM). Cytotoxicity was evaluated at multiple time points, and untargeted LC-MS was used to characterize the chemical composition of TCR-CM.

Studies without animals were used to determine the feasibility of conducting in vivo studies with crumb rubber by various routes of exposure. Based on feasibility work, 14-day studies in female B6C3F1/N mice were performed by administering size-fractionated TCR by oral gavage, dosed-feed, or by housing on TCR mixed-bedding. Traditional measures of toxicology testing were evaluated (body weight, clinical observations, food consumption, organ weights, hematology, bone marrow cytology and histopathology), and using an LC-MS metabolomics analysis approach, urine and plasma were evaluated for evidence of exposure.

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<sup>1</sup> Federal Research Action Plan: <https://www.epa.gov/chemical-research/federal-research-recycled-tire-crumb-used-playing-fields>

<sup>2</sup> California Office of Environmental Health Hazard Assessment: <http://oehha.ca.gov/risk-assessment/synthetic-turf-studies>

<sup>3</sup> Netherlands National Institute for Public Health and the Environment: [https://www.rivm.nl/en/Topics/R/Rubber\\_granulate/Research\\_into\\_rubber\\_granulate\\_on\\_turf\\_fields\\_in\\_2016](https://www.rivm.nl/en/Topics/R/Rubber_granulate/Research_into_rubber_granulate_on_turf_fields_in_2016) ; European Chemicals Agency: <https://echa.europa.eu/-/recycled-rubber-infill-causes-a-very-low-level-of-concern>

The results of the NTP studies were presented at the Society of Toxicology 2018 annual meeting, and the posters can be found on the NTP website<sup>4</sup>.

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<sup>4</sup> NTP Studies on Synthetic Turf/Tire Crumb Rubber: <https://ntp.niehs.nih.gov/go/820989>