Chemicals of Concern in Children’s products

A Case Study on Children’s Car Seats

Jeff Gearhart

HEALTHY STUFF
Researching toxic chemicals in everyday products
Research and Policy Projects

Toys & Other Children’s Products
Carpet
Resilient Flooring
Insulation
Food
Food Packaging
Food Processing Equipment
Mattresses
Screening Studies
12 years of children’s car seat studies

<table>
<thead>
<tr>
<th>Year of study</th>
<th>Number of seats tested</th>
<th>What we tested for</th>
<th>Analytical methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>131</td>
<td>• Bromine</td>
<td>XRF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chlorine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Heavy metals</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>153</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>15</td>
<td>• Multiple specific flame retardants</td>
<td>XRF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Heavy metals</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bromine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chlorine</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Phosphorus</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>15</td>
<td></td>
<td>XRF GC/MS FTIR (starting in 2016)</td>
</tr>
<tr>
<td>2018</td>
<td>17</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Case Study:**
Britax, a popular car seat company, worked with Healthy Stuff to develop a strong chemicals policy and to remove halogenated FRs from all their car seats.
Changes in BFR usage over time

- BFRs appear to have increased in fabric since 2013.
- BFRs detected in PU foam and fabrics 2014 and 2016 include: tris(2,3-dibromopropyl)isocyanurate, brominated polystyrenes, and others unidentified.
- BFRs (identified as HBCD in 2014 and 2016) are still used in rigid foam but have become less common since 2006. In part this reflects increasing use of expanded polypropylene (EPP) in place of expanded polystyrene (EPS)--see next panel.
Increase in phosphorus-based FR usage

P-containing FRs detected in 2016 and 2018

- Triethyl phosphate
- Tri(butoxyethyl)phosphate
- Triphenyl phosphates
- Cyclic phosphonate esters (Amgard CU, Amsgard 1045)
- Ammonium polyphosphate

Other
- Melamine

Cyclic phosphonate ester (Amsgard CU, Amsgard 1045)
Formerly called AntiBlaze 19 or 1045
Study Design

• Tested 18 seats
• All seats purchased in 2018
  • All seats manufactured in 2017 or 2018
• 12 brands tested: Baby Trend, Britax, Chicco, Clek, Cosco, Eddie Bauer, Evenflo, Graco, Maxi-Cosi, Nuna, Safety 1st and UPPAbaby
• Dorel owns 3 brands: Cosco, Maxi-Cosi, Safety 1st. Eddie Bauer no longer made.
• Tested 2 seats each from 6 brands: Britax, Clek, Evenflo, Graco, Nuna, UPPAbaby
Study Design

For each seat, we tested between 9 and 31 components

Test methods included

• In House: XRF and FTIR
• 3rd Party Labs
  • Indiana University-Marta Venier (tested for FRs): Gas chromatography and liquid chromatography coupled to mass spectrometry (GC/MS and LC/MS)
  • University of Notre Dame-Graham Peaslee (PFAS): Particle-Induced Gamma Ray Emission (PIGE) spectroscopy
Highlights from the 2018 study

• Newly launched FR-free seats
• Most child car seats still contain hazardous flame retardants: 83% (15 of 18) of seats studied still contain FRs that may be hazardous.
• Toxic PBDEs and chlorinated tris are out
• 50% of seats contained PFAS
• **Design changes can eliminate both added FRs & PFAS**
• The federal government must change FR regulations
3 categories: Low Concern, Moderate Concern, High Concern

<table>
<thead>
<tr>
<th>descriptive ranking scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flame retardant (FR) profile:</strong></td>
</tr>
<tr>
<td>1 - No halogens, no detected FR.</td>
</tr>
<tr>
<td>2- Contains phosphorus-based FRs. Contains up to one major component with bromine.</td>
</tr>
<tr>
<td>3 - Contains phosphorus-based FRs. Contains bromine in at least two major components.</td>
</tr>
<tr>
<td>One seat (Eddie Bauer) also contains PVC.</td>
</tr>
</tbody>
</table>
LOW CONCERN

- Clek Flo - Convertible - Mammoth
- Nuna Pipa Lite - Infant - Fog
- UPPAbaby MESA - Infant - Jordan

MODERATE CONCERN

- Britax Advocate Clicktight - Convertible - Circa
- Britax Roundabout - Convertible - Charcoal Black
- Clek Foonf - Convertible - Thunder
- Cosco Scenera NEXT - Convertible - Moon Mist Grey
- Maxi-Cosi Mico 30 - Infant - Bright Rose
- Safety 1st Grow & Go 3-in-1 - Convertible - Shadow
- UPPAbaby MESA - Infant - Taylor

HIGH CONCERN

- Baby Trend EZ Flex-Loc - Infant - Morning Mist
- Chicco KeyFit 30 - Infant - Regatta
- Eddie Bauer XRS 65 - Convertible - Viewpoint
- Evenflo Nurture - Infant - Max
- Evenflo SureRide DLX - Convertible - Paxton
- Graco Contender 65 - Convertible - Piedmont
- Graco Snugride Click Connect 30 - Infant - Kyte
- Nuna Pipa - Infant - Graphite

*Level of concern was evaluated by assessing the presence and hazard of flame retardants in seats. Ratings are based on the exact model and fabric color tested.*

*F* Contains fluorinated substances

View complete 2018 Children’s Car Seat Report at healthystuff.org
<table>
<thead>
<tr>
<th>Seat name</th>
<th>PFAS on fabric*</th>
<th>Results Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clek fllo with Mammoth wool fabric</td>
<td>No</td>
<td>No bromine; no FR detected. Fabric is wool.</td>
</tr>
<tr>
<td>Nuna Pipa Lite - Fog</td>
<td>No</td>
<td>No bromine; no FR detected. Fabric is polyester.</td>
</tr>
<tr>
<td>UPPAbaby Mesa Infant Car Seat - Jordan</td>
<td>No</td>
<td>No bromine; no FR detected. Seat fabric is wool-polyester; canopy is polyester.</td>
</tr>
<tr>
<td>Britax Advocate Clicktight ARB</td>
<td>No</td>
<td>No bromine; fabrics with TBEP, foam with TBEP, TEP.</td>
</tr>
<tr>
<td>Britax Roundabout - Charcoal Black</td>
<td>Yes</td>
<td>No bromine; some fabric with TBEP, TPHP and RDP.</td>
</tr>
<tr>
<td>Clek foonf with Thunder fabric</td>
<td>Yes</td>
<td>No bromine; foam with unidentified phosphorus compound. Fabric is polyester.</td>
</tr>
<tr>
<td>UPPAbaby Mesa Infant Car Seat - Taylor</td>
<td>No</td>
<td>No bromine; fabrics with cyclic phosphonate ester and TEP.</td>
</tr>
<tr>
<td>Maxi-Cosi Mico 30 - Bright Rose</td>
<td>Yes</td>
<td>1 component with bromine (warning label); fabric with cyclic phosphonate ester</td>
</tr>
<tr>
<td>Cosco Scenera Next - Moon Mist Grey</td>
<td>No</td>
<td>1 fabric with bromine; foam with TBEP and TEP.</td>
</tr>
<tr>
<td>Safety 1st Grow and Go 3-in-1 - Shadow</td>
<td>No</td>
<td>Upholstery fabric w/bromine. Foams &amp; fabrics with TEP and TBEP.</td>
</tr>
<tr>
<td>Model</td>
<td>Supplier</td>
<td>Bromination</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td>Chicco KeyFit 30 - Regatta</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Eddie Bauer XRS 65 - Viewpoint</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Evenflo Nurture - Blake</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Evenflo Sureride DLX - Paxton</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Baby Trend EZ Flex Loc - Morning Mist</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Nuna Pipa- Graphite</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
Children’s Car Seats Contain Legacy and Novel Flame Retardants

Yan Wu, Gillian Z. Miller, Jeff Gearhart, Kevin Romanak, Viorica Lopez-Avila, and Marta Venier

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Ecology Center, Ann Arbor, Michigan 48104, United States
Agilent Technologies, Santa Clara, California 95051, United States

Supporting Information

ABSTRACT: Brominated and phosphorus-based flame retardants (PFRs) were measured in foam and fabric samples from 18 newly marketed children’s car seats. The concentrations of two cyclic phosphonates [PMMPFs, 5-ethyl-2-methyl-2-oxido-1,3,2-dioxaphosphinan-5-yl)methyl methyl methylphosphonate and bis(5-ethyl-2-methyl-1,3,2-dioxaphosphinan-5-yl)methyl] methyl phosphate] were quantitatively measured for the first time in the North American environment and were much higher than those of other flame retardants. Median PMMP concentrations were 73.6 µg/g, accounting on average for 52% of the total FR concentrations, indicating an intentional addition of PMMPFs during the manufacturing process of these car seats. Two other emerging PFRs [tris(2,4-di-tert-butylphenyl) phosphate (TDBP)] and resorcinol bis(diphenyl phosphate) (RDP)] were detected for the first time in baby products at median levels of 1.11 and 6.15 µg/g, respectively. Other frequently detected PFRs included triethyl phosphate (TEP), triphenyl phosphate (TPHP), and tris(2-butoxyethyl) phosphate (TBOEP). Among the brominated flame retardants monitored, decabromodiphenyl ethane (DBDPE), with a median concentration of 128 µg/g, was the only halogenated FR measured at levels suggesting intentional use. Other brominated FRs such as hexabromobenzene (HBB) and 2,3-dibromo 2,4,6-tribromophenyl ether (TBBPE) were sporadically detected with median concentrations of 0.23 and 0.18 µg/g, respectively. Despite being phased out in the United States starting in 2013, polybrominated diphenyl ethers (PBDEs) were still observed in 75% of our samples, although at modest levels (median total PBDE levels of 0.24 µg/g). Trace PBDE levels suggest background contamination rather than intentional use. The high levels of FRs measured in these children’s car seats together with the negative health effects associated with some of these compounds are a cause for concern for children’s health.
Call to Action

• Calling on NHTSA to update their flammability standards
  • exempt car seat from the FMVSS 302 test; or
  • allow them to comply with an alternative standard more appropriate to children’s products.
  • Sing-on letter co-signed by 17 organizations, including Sierra Club, US PIRG.

• Ongoing dialogue with national NGO’s and NHTSA
Nuna Pipa
Chemically flame retarded textiles contain TBEP, PMMMP, DBDPE
$299.95
https://www.nuna.eu/pipa

Nuna Pipa Lite
Flame retardants free FMVSS 302 compliance achieved through fabric design
$349.95
https://www.nuna.eu/usa/pipa-lite
Wool & polyester/wool blends

• In comparison with other natural and manmade fibers, wool is an inherently low flammability natural fiber that self-extinguishes when exposed to a flame.
  • High nitrogen (16%) and
  • Sulphur (3-4%) contents
• Results in high ignition temperature (570-600ºC), low heat of combustion (27kJ/g) and relatively high loss of ignition (LOI) (25-27%).
Fabric Structure & Flammability

• Fabric weight, air permeability, and cover factor (density of the weave) cause changes in the flame retardancy characteristics of fabrics

• Thread density and weave factor strongly influence fabric’s flammability. When the overall density and weave density increase the flammability decreases.
Influence of Woven Fabrics Structure upon Flammability Properties:

Fig. 3. Correlation between fabric ignition time and its crack time

Fig. 5. Dependence of fabric crack time on weave factor
Acknowledgements

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**Ecology Center:** Gillian Miller, Lauren Olson