# Safer Snuggles

## A White Paper on Materials Used for Baby and Toddler Blankets and Stuffed Animals

**A hazard-based evaluation of materials for babies and toddlers**
**Final Report - October 29, 2026**

*This research was independently conducted by MADEWORKS Intelligence and underwritten by Naturepedic.*

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# Executive Summary

Blankets and stuffed animals (“soft goods”) are among the most intimate items in a baby or toddler’s world. They often rest against their face during use, ride in strollers and car seats, and often become frequently mouthed objects in the home. That combination—skin and mouth contact, high frequency-of-use, and a large surface area—can make the chemistry of these products more relevant than many parents realize.[1]

MADEWORKS Intelligence™ conducted a hazard-based materials evaluation of fabrics, fills, finishes, and common components used in baby and toddler blankets and stuffed animals. The review emphasizes both human health and environmental considerations such as persistence, migration potential, and microfiber pollution. It is designed to translate technical evidence into practical guidance without sensationalizing risk or implying that any single product is solely responsible for a health outcome.

Because infants and toddlers have unique exposure patterns—especially frequent hand-to-mouth and object-to-mouth behavior—soft goods can represent a recurring pathway for transfer of residues, fibers, and dust. This paper focuses on common, plausible exposure pathways and prioritizes interventions that are high-impact and feasible for families.[2,3]

It is also our hope that manufacturers, upon reading this, will be motivated to produce safer baby products.

# High-Level Findings

• **Best choices** are typically simple constructions made from certified organic natural fibers with minimal finishes (e.g., Global Organic Textile Standard (GOTS)-certified organic cotton), plus plush designs with embroidered features and full materials disclosure.

• **Performance finishes** (e.g., “stain resistant,” “water repellent,” “antimicrobial,” or “wrinkle resistant”) are meaningful “chemistry clues.” These claims can be associated with chemical classes that persist, migrate, or are difficult to fully characterize—such as

per- and polyfluoroalkyl substances (PFAS), certain antimicrobials, formaldehyde-based resins, or additive flame retardants.

• **Synthetics can be compatible with safer products** when they avoid chemical add-ons and are supported by credible transparency and testing—yet they raise environmental considerations due to microfiber pollution.[4,5,6]

• **Certification can simplify shopping**. Third-party certifications may help simplify shopping by providing additional screening, testing, or transparency standards.

• **Most products disclose almost nothing about their chemical inputs.** Fiber content labels identify the base material but say nothing about dye systems, finish chemistry, fill additives, or adhesive composition. Performance marketing claims ("stain resistant," "antimicrobial") are more useful as red flags than as assurances: they signal that a chemical treatment was applied, but not which one, at what level, or whether it has been tested for infant safety.

In simple terms: the safest soft goods for babies and toddlers tend to be the simplest—fewer materials, fewer finishes, and more transparency about what's inside.

# Purpose and Scope

This paper evaluates materials commonly found in the market for baby and toddler blankets and stuffed animals, including lovies and comfort items. It does not assess individual brands and does not attempt to calculate a child's individualized risk. Instead, it uses a hazard-based approach consistent with the MADE SAFE screening framework: identifying materials and finishes with known or suspected human health concerns, environmental persistence, or significant data gaps.

Scope includes: (1) outer fabrics; (2) fill/padding and internal structures; (3) finishes and features that create performance claims; and (4) components such as plastic eyes, prints, waterproof backings, adhesives, and decorative add-ons. Supporting evidence is collected via review of peer-reviewed literature and authoritative public-health and regulatory sources on relevant hazards and exposure pathways.

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A brief note on terminology: throughout this paper, “hazard” refers to the inherent ability of a substance to cause harm; “exposure” refers to how much, how often, and by what route a child contacts a substance; and “risk” is a function of both. This paper focuses on hazard identification alongside realistic exposure pathways—in plain terms: which chemicals are plausibly present in these products, and how might a baby actually encounter them?

# Market Basket of Case Studies

To ground the discussion in real-world products, we examined a market basket of widely available baby and toddler blankets and stuffed animals drawn from major national retailers. Products were selected based on sales rank, consumer review volume, and broad retail availability, and represent construction profiles that are common in the mass market. Material composition, care instructions, and safety warnings are drawn from publicly available product listings as of February 2026.

**Stuffed Animals**

Three of the four stuffed animals in this market basket share a common construction profile: polyester plush outer fabric, polyester fiberfill, and at least one non-textile component.

The GUND Baby Flappy the Elephant Musical Plush is an interactive toy with an electronic sound-and-motion module; it is marketed for ages 0+ but carries a surface-wash-only care restriction, which limits the ability to reduce accumulated residues through laundering.[7]

The Itzy Ritzy Sweetie Snuggles Plush Stuffed Animal (Goose) features a multi-texture polyester construction with attached ribbon elements and is marketed with embroidered features as a safety-conscious design choice.[8]

The Melissa & Doug Burrow Bunny Rabbit 9″ Stuffed Animal is marketed for newborn and up and includes plastic components, with machine-wash guidance provided but no materials disclosure beyond “polyester.”[9]

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The fourth stuffed animal, the Ty Beanie Baby (classic bear), illustrates a construction category warranting specific attention: pellet-filled plush. Beanie Babies are filled with polyethylene (PE) plastic pellets—the material that gives them their characteristic malleability—in addition to polyester fiberfill. The product carries an age warning ("not suitable for children under 3 years") due to the choking hazard posed by pellet release if seams fail, and is surface-wash only. From a materials perspective, PE pellets represent a plastic component embedded throughout the interior of a mouthed and handled item. While PE itself has a relatively favorable hazard profile compared to polyvinyl chloride (PVC) (which was used in earlier-generation Beanie Babies), any pellet-containing toy introduces a mechanical hazard pathway and limits cleaning options. The product is widely available and frequently marketed to young children despite the age restriction.[10]

The Manhattan Toy Baby Stella doll exemplifies a different construction concern: a soft-bodied polyester plush item (approximately 95% polyester by composition) that is marketed specifically as a first baby doll and sleep companion, including for infants. The product is machine-washable, which is a meaningful advantage for reducing accumulated residues; however, the polyester-dominant construction means it will shed microfibers during laundering. Baby Stella also includes small iron magnets and thermoplastic PE components for shaping- internal additives that are not independently disclosed on the product label.[11]

**Blankets and Comfort Items**

All three blankets in the market basket are constructed entirely or predominantly from polyester. The Parent's Choice Plush Baby Blanket (Walmart) is a low-cost ultra-soft fleece blanket ranked as a "popular pick" with high purchase volume; its construction is undisclosed beyond a generic fiber content label, and no finishes or treatments are identified.[12] The Modern Moments by Gerber Reversible Plush Blanket is 100% polyester in a plush/thermal construction and carries an explicit suffocation warning advising against use for infants under 12 months, a meaningful safe-sleep signal that parents may not notice at the point of purchase.[13] The Peanutshell Newborn Swaddles are 100% cotton with hook-and-loop fasteners, making them the simplest construction in the blanket group from a chemical-complexity standpoint; the cotton fiber content and absence of performance claims represent a comparatively lower-concern profile among the examples reviewed.[14]

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Taken together, these examples illustrate a pattern consistent with broader market trends: the construction features most likely to increase chemical complexity are rarely the base fiber alone. Performance claims (stain resistance, water repellency, antimicrobial treatment, wrinkle resistance), non-textile components (plastic eyes, electronic modules, internal pellets, embedded magnets), and limited or absent materials disclosure are the strongest markers that a product may carry an avoidable chemical burden or offer limited verification options for families.[15]

From a MADE SAFE screening perspective, none of the stuffed animals in this basket would qualify as best-in-class, primarily because synthetic plush, added plastic components, and a lack of certified-standard verification increase uncertainty about the full additive and finish profile. Products with electronic modules, pellet fills, or embedded hardware present the highest material complexity. In practice, these items also experience heavy handling and frequent laundering, contributing to microfiber shedding and the accumulation and redistribution of indoor dust on product surfaces. The goal is not to discourage use of comforting toys, but to explain why simpler constructions paired with verified standards are more likely to align with MADE SAFE Certification principles.

The blanket examples similarly illustrate why “soft” can work against “simple.” Plush polyester blankets are the dominant format at mass-market price points,[16] but because they’re synthetic, they can shed microfibers with wear and washing.[5,17] The Gerber blanket’s explicit suffocation warning[13] is also a useful reminder that infant safe-sleep guidance recommends keeping blankets and soft objects out of a baby’s sleep area entirely;[18,19] blanket products should be treated as supervised comfort items, not sleep accessories, for infants under 12 months.

# Why Babies and Toddlers Are Uniquely Vulnerable

Infants and toddlers are not simply smaller adults. Pound for pound, they breathe more air and ingest more dust than adults do, and their developing bodies are more vulnerable to the effects of chemical exposure during this period than they will be at any later point in life.[20] Their behavior amplifies this further: babies explore the world

through touch and mouthing, and a well-loved stuffed animal or blanket may spend hours each day pressed against a child's face, clutched in a fist, or chewed on during teething.[21]

In children's environmental health, this supports a straightforward precautionary principle: when a plausible exposure pathway exists and safer alternatives are available, reducing that exposure makes sense, especially during the years when it matters most.[2]

# Why Soft Goods Are High-Exposure Items

Soft goods are designed for closeness. They contact thin facial skin for long periods, can be mouthed directly during soothing—meaning residues, leachate, and particles can transfer directly into the mouth, and can trap and re-release indoor dust.[3] A process-oriented infant exposure assessment published in the *Journal of Exposure Science & Environmental Epidemiology* asserts that repeated, normal behaviors (hand-to-mouth, object-to-mouth, floor contact) create frequent opportunities for transfer from indoor environments to the mouth.[3]

# Exposure Pathways

**Ingestion** (hand-to-mouth and mouthing): Babies and toddlers routinely mouth comfort items, and they also transfer settled indoor dust from hands and surfaces to the mouth. When blankets or plush toys contact floors, car seats, or other indoor surfaces, dust and residues can accumulate on the textile surface and be ingested during normal use.

**Dermal contact** (skin absorption and prolonged contact): Prolonged contact can increase the opportunity for semi-volatile chemicals (substances that can slowly migrate out of treated materials) associated with finishes or residues to transfer from a textile surface onto skin, especially when skin is warm and covered. Infants' physiology and rapid development make this pathway more relevant than for adults, even when absolute transfer rates are small.

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**Inhalation** (airborne emissions, dust, and fibers): Textiles may emit volatile and semi-volatile chemicals (VOCs and SVOCs) to indoor air, and physical wear and laundering can release fibers that become part of household dust. Infants and toddlers breathe at approximately twice the rate of adults relative to their body weight, meaning they inhale more air—and more of any airborne particles or emissions—than adults in the same environment. Because babies also breathe closer to the floor and spend long periods with their face near soft goods, even low-level emissions or dust-associated additives can be more relevant in early life.[21]

The same logic explains why sleep environments receive special attention in children's health research: long duration, close proximity to the airway, and repeated daily exposure.[22] Major public-health guidance for infant sleep recommends keeping blankets and soft objects out of a baby's sleep area; from an exposure-reduction perspective, this also reduces contact with dust-associated chemicals and airborne fibers during the longest period of daily use.[18,19]

What this means for parents: items your child holds, sleeps with, or chews on regularly matter more than occasional-use products. The closer and more frequent the contact, the more material choices matter.[21]

# Key Chemical Classes of Concern in Baby Soft Goods

Not every chemical used in textiles is equally relevant for babies. The classes below are prioritized because they combine (a) credible hazard concerns, (b) plausible early-life exposure pathways through soft goods, and (c) a track record of appearing in consumer products via finishes, additives, or plastic components.

### PFAS in Stain and Water Repellency

Per- and polyfluoroalkyl substances (PFAS) have been used to create durable stain and water repellency on textiles. Many PFAS are persistent and mobile, and PFAS presence is difficult to infer from labels or marketing language alone.[23,24] Because baby blankets and plush toys rarely require durable repellency for function, PFAS are a high-priority

“banned” class under the MADE Ecosystem Approach, which considers potential impacts on human health and the environment across a product’s life cycle.

Parents may encounter PFAS indirectly via claims like “stain resistant,” “water repellent,” “easy clean,” or “soil release.” Some brands now use “PFAS-free” language, but without testing, these claims may be hard to verify. A peer-reviewed label evaluation conducted by Rodgers *et al.* found that labeling did not consistently indicate PFAS presence in children’s items; therefore, transparency and testing are key.[23]

PFAS concerns are not only about child exposure; they are also an environmental problem. Persistent chemicals used at scale in textiles can enter wastewater and persist in ecosystems. Avoiding PFAS finishes in baby items is therefore aligned with both human health and ecosystem health goals.[24]

### Phthalates in Flexible Plastics and Prints

Phthalates are a class of chemicals used primarily as plasticizers in flexible plastics and sometimes in ink systems or coated materials. They are widely discussed as endocrine disruptors (chemicals that can interfere with hormones) and are restricted in certain children’s products in the United States above specified limits.[25,26,27,28]

In the context of blankets and plush toys, phthalate relevance is highest when products include flexible plastic parts (e.g., coated fabrics, vinyl backings, plastic accessories) or certain print/coating systems. Plush toys that are frequently mouthed make plastic components a higher-priority concern than they would be in adult textile items.[27]

A practical mitigation strategy is design-based: prefer embroidered details and uncoated fabrics, reducing the need to make assumptions about plasticizer chemistry. For products that do include plastics, brands should provide phthalate compliance documentation and—ideally—testing.[27,28]

### Flame Retardants and Foam-Associated Additives

Flame retardants can be added to materials to slow ignition or burning. While many baby blankets and plush toys are not intended to contain chemical flame retardants, foam-containing designs and certain supply chains can correlate with additive flame retardant use. National Institute of Environmental Health Sciences (NIEHS) resources

emphasize that some flame retardants can migrate from products into indoor dust, creating a relevant exposure pathway for infants and toddlers.[29]

A 2025 study published in *Environmental Science & Technology* assessing children's mattresses illustrates how close-contact soft materials can be sources of plasticizers and flame retardants in the sleep environment.[22] The same migration principle applies to other foam-containing soft goods; long time-of-use near the airway and high dust contact can amplify relevance. Evidence from other indoor soft furnishings also suggests that material substitutions can reduce exposure pathways. In a study of upholstered furniture, Rodgers et al. found that replacing older furniture or foam with options expected to be free of added flame retardants significantly reduced measured flame retardant concentrations in household dust. Although this study did not examine baby blankets or plush toys, it demonstrates that changing a source material can reduce chemical contamination in the indoor environment.[30]

Similarly, Young et al. examined a healthier-materials intervention involving furniture and carpeting and found lower concentrations of several PFAS and flame retardants in indoor dust following the changes. This provides additional evidence that modifying material sources can reduce indoor chemical contamination, although the study did not directly evaluate baby blankets or stuffed animals.[31]

### Formaldehyde and Wrinkle-Resistant Finishes

Formaldehyde-based resins can be used to create wrinkle resistance and dimensional stability. Formaldehyde can off-gas or remain as residues in treated textiles.[15] A study by Herrero et al. published in *Toxics* assessing early-life exposure through clothing underscores that textiles can contribute to infant exposure depending on finishing chemistry.[32]

For baby items, avoiding wrinkle-resistant claims and relying on baby-class residue limits (e.g., OEKO-TEX Product Class I) are practical mitigation approaches.

### Antimicrobial Treatments

Antimicrobial treatments can be marketed for odor control and perceived hygiene. For routine home use of blankets and plush toys, these treatments rarely provide meaningful benefits and can introduce biocides with their own hazard profiles. Examples include nanosilver coatings and quaternary ammonium compound

(QAC)-based treatments; triclosan is another biocide that appears in some applications and is regulated as a pesticide ingredient in the US.[33,34,35]

Because babies mouth soft goods, antimicrobial treatments add a plausible oral exposure pathway without clear necessity. MADE SAFE recommends avoiding antimicrobial claims unless the chemistry is fully disclosed, justified, and supported by robust safety evidence for infant close-contact use.

**Dyes, Colorants, and Optical Brighteners**

The bright, appealing colors of mass-market stuffed animals and baby blankets are achieved through dye and print systems that can introduce their own chemical concerns—yet dye chemistry is rarely discussed in consumer-facing materials safety content.

Azo dyes are widely used in textile dyeing and can, under certain conditions, break down to release aromatic amines, a class of compounds that includes several known carcinogens. In the European Union, specific Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulations restrict azo dyes that can release any of 22 specified aromatic amines in textiles and leather intended for prolonged skin contact, with limits set specifically for children's articles.[36,37] In the US, some of these aromatic amines are restricted or banned, but there is no comparable, explicit federal restriction on azo dyes themselves. This means that azo-dye-containing textiles that could not be sold in the EU can be legally sold in baby products here.[38]

Reactive dyes, disperse dyes (commonly used on polyester), and pigment systems used in screen printing and surface coatings can also contain or produce hazardous substances. Disperse dyes in particular are associated with contact sensitization; several are restricted under OEKO-TEX STANDARD 100 and REACH.[36,39]
Screen-printed graphics, heat-transfer decals, and plastisol-based prints may use PVC binders and contain phthalates or heavy metal pigments depending on the ink system.

Optical brighteners, added to make whites appear whiter and colors appear more vibrant, are fluorescent compounds that absorb ultraviolet (UV) light and re-emit it as visible blue light. Some optical brighteners are associated with skin sensitization and aquatic toxicity; OEKO-TEX STANDARD 100 restricts certain optical brighteners in baby-class products. Products described as "extra white," "bright white," or featuring

unusually vivid colors without natural fiber certification may warrant additional scrutiny.[39]

The practical guidance is simple: prefer certified organic natural fibers (where dye chemistry is restricted by the certifying standard) or items with disclosed, certified colorant systems. Avoid heavily printed or dyed synthetic items without credible third-party certification, particularly for products that will be mouthed or pressed against facial skin.

# What the Law Covers—and What It Doesn't

Understanding what federal regulations do and do not require is important context for this paper. Existing rules protect children in some areas but leave significant gaps that parents and manufacturers should be aware of.

**Where Regulation Provides Some Coverage**

Phthalates are restricted in children's toys and child care articles under the Consumer Product Safety Improvement Act (CPSIA), which prohibits concentrations above 0.1% for the eight most hazardous phthalates. However, "child care article" has a specific legal definition: it covers items designed for use by children under 3 for sleeping, feeding, sucking, or teething. Many soft goods, including stuffed animals marketed for older toddlers or "all ages", may fall outside this definition even when they are actively used by infants.[25]

Lead is restricted in surface coatings and substrates of children's products under CPSIA, and ASTM F963, the US toy safety standard, provides additional physical, mechanical, and chemical requirements for items marketed as toys.[1] These standards are meaningful but were designed primarily for hard-goods and play-oriented products rather than textile-dominant comfort items.

**Where Regulation Leaves Significant Gaps**

As of this writing, the US does not have a comprehensive federal restriction on PFAS in children’s textiles; however, roughly a dozen states have enacted PFAS-related laws that apply to textiles and/or children’s products. The US lags behind the EU, which

restricts PFAS in food-contact textiles and is actively expanding restrictions under the REACH regulation.[36,40] A parent purchasing a "stain-resistant" baby blanket has no regulatory assurance that the repellency finish is PFAS-free.

Flame retardants in textiles are addressed primarily through flammability standards (16 CFR Parts 1610 and 1611 for general apparel; 16 CFR Part 1615/1616 for children's sleepwear), which set performance requirements but do not specify which chemistries may be used to achieve them.[29,41] While some states have restrictions on flame retardants in certain children's products, there is no federal ban on additive flame retardants in stuffed animals or blankets.[42] As a result, chemical flame retardants can be—and in some cases are—used without being disclosed on product labels.

Formaldehyde, antimicrobial treatments, azo dye systems, adhesives, and most other finishing chemistries are largely unregulated in US consumer textiles. There is no federal requirement that manufacturers disclose the finish chemistry applied to a baby blanket or the colorant system used in a plush toy's dyes.[43] This transparency gap is precisely why hazard-based certification frameworks and third-party testing exist: they fill the space that regulation has not yet reached.

The practical implication for parents: regulatory compliance is a floor, not a ceiling. A product can be fully compliant with all applicable US regulations and still contain chemical classes—PFAS finishes, formaldehyde-based wrinkle treatments, certain flame retardants, or undisclosed dye system— that a precautionary approach would seek to avoid in items used for close infant contact.

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# Materials and Features Commonly Found in the Market

Soft goods can be understood as an “outer layer” (fabric), an “inner layer” (fill/structure), and “added features” (finishes and components). Added features are often what transform a simple textile into a more chemically complex product.

| Category | Common examples | Why it matters |
|---|---|---|
| Outer fabrics | Polyester fleece/minky; cotton; bamboo viscose; blends | Fiber influences microfiber shedding, dye systems, and likelihood of performance finishes. |
| Fill/structure | Polyester fiberfill; foam pieces; beads; mixed materials | Some fills correlate with SVOCs (such as flame retardants and plasticizers) and dust retention. |
| Finishes/”claims” | Stain/water resistant; antimicrobial; wrinkle resistant | Claims can signal PFAS, biocides, or formaldehyde resins. |
| Components | Plastic eyes/noses; vinyl coatings; screen prints; glitter | Adds plastics, plasticizers, pigments; increases complexity. |

*Table 1. Market snapshot of common material categories in baby/toddler blankets and stuffed animals.*

Mass-market baby blankets and plush toys are often designed to be extremely soft, brightly colored, and easy-care.[44] To achieve these performance and aesthetic goals at scale, products commonly use combinations of synthetic fibers, multi-material constructions, and surface treatments that can increase uncertainty around chemical inputs and potential exposure pathways.

### Synthetic Outer Fabrics

A common marketplace pattern is the use of synthetic plush textiles—including polyester plush/minky/fleece, often paired with polyester or nylon satin trims and, in some products, blends that include nylon/polyamide or acrylic for specific textures or

decorative effects. Outer fabric selection matters because it influences (1) the likelihood of fiber shedding over time, (2) the type and intensity of dye/print systems used to achieve bright colors and patterns, and (3) whether the textile is more likely to be paired with performance finishes (e.g., odor control or easy-clean claims).[5] These considerations are especially relevant for baby/toddler items that are held close to the face, mouthed, or used for cuddling, where prolonged contact can increase the relevance of dust- and surface-mediated exposure pathways.

### Synthetic Stuffing and Structural Foams

For internal fill and structure, the market most commonly relies on polyester fiberfill, and in some designs, structural polyurethane foam (e.g., to create shape in certain plush formats or "pillow-like" constructions). Some products also use polystyrene beads/pellets or other weighted inserts to create sensory/weighted features. These material choices matter because internal components can correlate with higher chemical complexity (e.g., additive packages used in certain foams/plastics), and they may contribute to dust retention or migration of additives into indoor environments over time. Beads/pellets also introduce a non-chemical but important consideration: if seams fail, they can create mechanical safety hazards (including choking risks), particularly in high-wear, high-handling children's items.

### Finishes and Treatments

In addition to base fibers, many products are differentiated through finishes and functional claims. Common examples include stain-resistant/water-resistant/waterproof coatings (which may signal persistent water-repellent chemistries), antimicrobial/anti-odor treatments (biocidal finishes), wrinkle-resistant systems, and the use of optical brighteners to create an "extra white" appearance. These finishes often contribute more to overall concern than the fiber itself because they can add persistent or biologically active chemistries without providing meaningful benefits for most baby/toddler use cases (especially for comfort items that can be routinely washed and do not require antimicrobial performance). The presence of these claims is therefore a useful "red flag" when assessing whether a product is likely to contain avoidable chemical complexity.

### Trims, Decorations, and Add-ons

Finally, blankets and stuffed animals frequently include add-on components that are not obvious from a simple "fabric content" label. Common examples include plastic

safety eyes/noses, PVC/vinyl decorations or coated badges, screen prints and decals, glitter/sequins, and glued-on shapes or appliqués. Even care labels/tags can be a high-contact detail when they are coated, stiffened, or treated, because they sit directly against skin and are often handled or mouthed.[1] These components matter because they can introduce unknown polymer additives, pigments, adhesives, and coatings, and they are often the least transparent aspects of a finished product. They can also create durability and safety concerns if small parts detach or coatings degrade with washing and wear.

### Adhesives and Bonding Agents

A less-visible category of chemical concern in stuffed animals and blankets is adhesive chemistry. Glued-on eyes, fused appliqués, laminated backings, and, in some cases, heat-bonded trims, rely on adhesive systems that are almost never disclosed on product labels. Common adhesive types include hot-melt adhesives (which may contain plasticizers and tackifying resins), solvent-based adhesives (which can carry residual solvents), and reactive adhesives including isocyanate-based systems used in some foam bonding and lamination applications. Formaldehyde-releasing compounds also appear in some textile bonding and stiffening agents.[1,32]

Because adhesives are applied to surfaces that may be mouthed or handled frequently, and because adhesive bonds can degrade with repeated washing, this is a category where transparency is especially important. Parents should treat glued-on components, particularly plastic eyes or noses that are adhesive-bonded rather than safety-constructed, as both a chemical and a mechanical concern.

# Common Materials

### Natural Fibers

Natural fibers can be excellent options—especially when certified organic and minimally finished. The biggest determinants of concern are not the fibers themselves but the chemical inputs used in growing, dyeing, finishing, and functional treatment. However, natural origin alone does not establish that a material is safe. Natural fibers can contain contaminants or undergo chemical processing, dyeing, and finishing, so

their safety depends on the specific material, chemical inputs, and available verification.

### Regenerated Cellulose (Rayon/Viscose, Bamboo, Lyocell)

Regenerated cellulose fibers can feel soft and breathable, but supply chain transparency is essential. Viscose/rayon production can involve hazardous solvents and emission concerns if not controlled.[45] Lyocell is often positioned as a more controlled process; still, dyes and finishes matter.[46]

### Synthetics (Polyester, Nylon, Acrylic)

Synthetics are common for softness and durability. The key issues are microfiber shedding (environmental and indoor dust relevance), and the frequent pairing of synthetics with performance finishes.[5]

### Fills and Structure

Fill materials are among the most chemically significant components of stuffed animals and lovies, yet they are the least visible to consumers and are almost never disclosed on product labels. Polyester fiberfill (polyfill) is a petroleum-derived, synthetic material that is widely used as stuffing in plush toys. Polyester textiles are well documented to shed microplastic fibers during washing and abrasion, raising microfiber pollution concerns over a product's life cycle.[4,6,47,48] Additionally, it may carry processing additives, and may be treated with flame retardants to meet flammability standards.[29,44]

Polyurethane (PU) foam appears in products designed to hold a specific shape, such as pillow-style lovies and structured plush heads; PU foam is produced through a complex chemical reaction and is commonly treated with additive flame retardants, some of which are known or suspected endocrine disruptors that can migrate into household dust over time.[22] Polystyrene beads and pellets are used in weighted or sensory toys; beyond the mechanical hazard if seams fail, polystyrene plastic can carry residual styrene and other processing chemicals, and the beads themselves are a microplastic source.

In contrast, natural fills such as organic cotton batting, organic wool, and kapok can reduce chemical complexity due to the absence of a synthetic plastic polymer matrix. Wool is also intrinsically flame resistant, reducing reliance on added flame-retardant treatments.[49] While natural fibers can still shed during use and washing, they avoid

persistent plastic microfibers, which are a key environmental concern for synthetic textiles.[6] When sourced to certified organic or equivalent standards, these materials represent the most straightforward path to a lower-concern fill. The key practical guidance is simple: opt for stuffed animals and lovies where the fill is disclosed and is a natural fiber, and treat any foam- or bead-filled product as higher concern, particularly for infants who mouth and sleep with these items.

# Environmental Considerations

The chemistry of baby soft goods is not only a human health question. The same synthetic materials and chemical finishes that raise infant exposure concerns also have consequences that extend into the broader environment, often long after a product is washed, worn out, or discarded.[4,44,46] For the MADE Ecosystem Approach, these environmental dimensions are part of the same evaluative framework.

### Microfiber Pollution

Every time a synthetic textile—polyester fleece, minky plush, nylon trim—is washed, it releases microscopic plastic fibers into wastewater.[5,17,48] Research published in *Marine Pollution Bulletin* found that a single domestic wash load of synthetic fabric can release hundreds of thousands of microfibers;[50] fleece fabrics shed particularly heavily.[47] These fibers pass through most wastewater treatment systems and accumulate in rivers, lakes, and ocean environments, where they have been detected in drinking water sources, marine organisms, and human tissue.[4,6,51,52,53]

For parents, this means that the regular laundering needed to reduce chemical residues on a synthetic plush toy also sends microplastic pollution downstream. Washing bags designed to capture microfibers can reduce, though not eliminate, this release.[17] The more fundamental mitigation is material choice: organic cotton, organic wool, and kapok fill do not shed synthetic microplastic fibers.[6] Choosing natural fiber soft goods where possible is therefore both an infant health decision and an environmental one.

### Persistent Chemical Finishes

PFAS finishes are persistent by design. Molecules engineered to repel water and stains do not degrade meaningfully in the environment—hence the designation "forever

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chemicals."[40] When PFAS-treated textiles are washed, worn, or landfilled, PFAS compounds enter soil, groundwater, and water systems, where they accumulate in wildlife and human populations. Detectable PFAS are now found in drinking water sources, rainfall, and human breast milk globally.[24,54,55]

Because baby blankets and stuffed animals have no functional need for durable water or stain repellency, as they are comfort items, not outdoor gear, any PFAS use in this product category is avoidable. Eliminating intentionally-added PFAS from baby soft goods is therefore one of the most straightforward environmental improvements available to manufacturers, with direct co-benefits for infant health.

**Longevity, Durability, and the Lifecycle Question**

A durable, well-made soft good that accompanies a child throughout early childhood has a lower environmental footprint than a cheaply constructed item that is discarded after a few months of shedding, pilling, or seam failure. However, durability should not be achieved through chemical means: adding antimicrobial treatments to prevent odor, or PFAS coatings to prevent staining, extends a product's apparent usability while introducing the chemical concerns described elsewhere in this paper. Safer durability comes from fiber quality, construction, and design—and from certifications that address both.

For the same reason, buying fewer, better-made products—organic cotton lovies that last years, rather than three synthetic plush animals replaced annually—is environmentally preferable in both materials use and chemical load.

# How the Ecosystem Approach Evaluates Materials

The MADE Ecosystem Approach is designed to identify materials and finished products that do not contain known or suspected harmful chemicals. Rather than relying on regulatory compliance alone—which, as noted above, leaves significant gaps—the Ecosystem Approach applies a comprehensive hazard-based screening that considers human health and environmental endpoints simultaneously.

Screening criteria include, among others: carcinogenicity; reproductive and developmental toxicity; endocrine disruption; neurotoxicity; persistence and bioaccumulation potential; aquatic and terrestrial toxicity; heavy metals and other environmental contaminants; and problematic volatile organic compounds and solvent residues. For baby and toddler products designed for prolonged close contact, the Ecosystem Approach applies a precautionary standard: the simplest material systems are typically easiest to verify, require the least chemical manipulation, and are most likely to be both safer and more sustainable by design.

In practice, for soft goods in this product category, materials that qualify unconditionally under the Ecosystem Approach include certified organic natural fibers, including organic cotton, organic wool, organic alpaca, organic silk, kapok, and hemp, as well as Tencel/lyocell produced through closed-loop processes. Synthetic flame retardants, PFAS, PVC/vinyl, polyurethane foam, acrylic, and standard rayon are not eligible. Many other materials, including polyester, are permitted only under narrow use-case restrictions (such as crib mattress ticking to prevent suffocation) and are not considered qualifying choices for stuffed animals and blankets.

**Illustrative Example: A Simpler Material Construction Approach**

Some products currently on the market illustrate what a lower-complexity soft good designed around these principles can look like, including products that use simplified constructions, greater material transparency, minimal finishes, and certified or more fully disclosed material inputs. Made with GOTS-certified organic cotton,[56] these products are made without polyester fiberfill, plastic accessories (such as eyes or nose) and stain-resistant, antimicrobial, or wrinkle-resistant finishes. The result is a simplified material construction that reduces the number of synthetic inputs, finishes, and undisclosed components in areas designed for prolonged close contact, including against the face and in the mouth.

This type of construction demonstrates what is possible given available materials while also reducing several of the concerns discussed throughout this paper, including synthetic microfiber shedding, uncertainty around fill materials and additive systems, the use of plastic hardware in close-contact areas, and limited transparency around finishes and material inputs. For parents seeking a practical reference point, products that incorporate certified organic materials, simplified construction methods, and third-party screening or certification can help illustrate how these principles may be applied in commercially available soft goods.

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# Shopping Guidance

A practical way to shop is to combine: (1) a safe default material choice, (2) a quick scan for performance claims, and (3) reliance on credible standards or certification, like MADE SAFE, when available.

**Safe Defaults:**

- Sleep and soothing items (blankets/lovies): certified organic natural fibers with minimal finishes.
- Stuffed animals: embroidered features; fewer plastic parts.

If synthetics are preferred for softness or price, favor simpler constructions without performance finishes and look for transparent documentation or credible testing where available.

Cost and availability can make safer material alternatives difficult to access. Stuffed animals made with certified organic natural fibers and disclosed natural fills may be more expensive and harder to find than widely available polyester plush toys, and identifying them can require extra time and research. Families should not have to navigate these barriers alone; making simpler, more transparent material choices affordable and widely available should also be a priority for manufacturers and retailers.

The materials framework below is intended to be usable for consumers (parents/caregivers) as well as product designers and manufacturers. In this framework, “Best” reflects materials that tend to have both lower inherent hazard potential and clearer transparency/verification pathways (for example, certified organic natural fibers with minimal finishes).

“Better/Acceptable” reflects materials that can be compatible with lower-hazard use but may carry a higher probability of processing chemicals or additives depending on supply chain controls and finishing chemistry. “Avoid” reflects materials and features strongly associated with high-concern chemical classes (e.g., PFAS repellents, antimicrobial treatments, or foam/plastic bead fills) or that introduce avoidable exposure uncertainty for items intended for close contact.

Because product labels rarely disclose finishing chemistry in a standardized way, this framework is intentionally conservative: if a product advertises a performance claim

that commonly indicates a durable chemical treatment, parents should either seek verification (certification, test results, or supplier documentation) or choose a simpler alternative where those treatments are not needed.

**Best: Prioritize When Possible**

Look for the simplest chemistry, fewer finishes, verified safer inputs, and fewer add-on components. In practice, this most often means certified organic natural fibers for outer fabrics and (where feasible) fills, minimal dyes and prints with disclosure, and simple construction (for example, embroidered features instead of plastic components and fewer coatings).

**Better/Acceptable: Reasonable Options When "Best" Isn't Available**

The goal is to reduce complexity and avoid high-risk features, even if not every input is verified to the highest standard. Examples can include conventional cotton/wool/linen without performance finishes (prefer finished-product testing appropriate for infant use), lyocell without performance finishes, and selected synthetic shells (polyester/nylon) when they are not paired with PFAS-type repellents or antimicrobial treatments and are supported by credible documentation or testing. Plastic or metal components should be limited, well-documented, and kept away from chew zones whenever possible.

**Avoid: Higher-Concern Materials/Features for Snuggle Items**

Avoid persistent coatings, biocides, unnecessary performance finishes, and plastics/foams with known concerns. This includes PFAS-signaling finishes (stain/waterproof), flame-resistant treated textiles where chemical treatments are used, antimicrobial finishes (e.g., silver- or QAC-based), heavy printing and optical brighteners, PVC/vinyl decorations and unknown waterproof backings, polyurethane foam inserts/padding, plastic bead fillers, and complex glitter/sequin add-ons for mouthed items.[33,34]

**Performance-Claim Red Flags (Ask Questions):**

The claim: Stain/water resistant; antimicrobial/anti-odor; wrinkle resistant/no-iron; "easy clean."[15]

PFAS receive particular emphasis in this framework because they are durable by design and cannot be reliably identified from product labels alone. Testing, certification, or direct supplier confirmation is the only way to verify absence. Avoiding PFAS finishes

in baby soft goods is one of the highest-impact, most achievable steps families and manufacturers can take.[23]

# Care and Use Tips

Washing before first use is one of the highest-impact single steps a parent can take, particularly for heavily printed items or products with a noticeable "new" smell, which can indicate residual finish chemistry or solvent. Machine-washable items should be washed on the warm/cold cycle and dried thoroughly before a child uses them. For surface-wash-only items, which is worth noting as a limitation at point of purchase, a thorough wipe-down and air-out period before first contact is advisable.

Aftermarket sprays should be avoided on items that will be mouthed or held close to a child's face. This includes fabric "fresheners," antimicrobial sprays, and waterproofing sprays, all of which add unnecessary chemical exposure to a surface already identified as a close-contact item. The biocides in antimicrobial sprays and the repellents in waterproofing sprays represent exactly the chemical classes this paper identifies as high-concern for infant use.[33,34,35]
Rotating and washing comfort items regularly, particularly those that travel to daycare, public play spaces, or strollers, reduces the accumulation of settled dust and chemical residues on the textile surface. More frequent washing is especially relevant for items used in environments where dust or indoor air quality is a concern.[3]

Inspecting seams, trims, and fasteners periodically is important both for safety and for chemical exposure reasons. Items that are shedding filling material, losing surface fibers in large quantities, or showing adhesive failure at component attachment points should be repaired or retired. Hook-and-loop fasteners in particular can degrade and shed particles with heavy use.[48]

For infants under 12 months, safe-sleep guidance from the Centers for Disease Control and Prevention (CDC) and National Institute of Child Health and Human Development (NICHD) is clear: keep all blankets, pillows, and soft toys out of the infant's sleep environment. Use a wearable blanket or appropriate sleep clothing for warmth instead.[18,19] This guidance exists for safe-sleep reasons independent of chemical

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considerations, but it also happens to reduce the longest-duration close-contact exposure in an infant's day.

# Conclusion

Soft goods are meant to provide comfort. The safest path is usually the simplest: certified organic natural fibers, minimal finishes, and plush designs without plastic components or treated surfaces. When synthetics are used, avoiding performance finishes and applying microfiber-aware care practices can reduce both exposure and environmental impacts.

You can't control every exposure in your child's world. But you *can* make informed choices about the items that spend the most time against their skin, face, and mouth, especially during the earliest years of development.[2]

Choosing simpler materials and avoiding unnecessary finishes reduces one meaningful source of exposure in a practical, achievable way.

# About MADEWORKS Intelligence

MADEWORKS Intelligence (formerly MadeSafe.org) has been driving marketplace change since 2015. We are building a bridge to a safer, more sustainable future for all. Using the MADE Ecosystem Approach, MADEWORKS Intelligence generates insights that support better product development and advance systemic change. By bringing together science, industry leadership, and informed consumer choice, we help turn meaningful information into action, transforming the marketplace for a healthier world.

MADEWORKS Intelligence is a project of Nontoxic Certified Inc., a registered 501(c)(3) nonprofit organization.

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# About Naturepedic

Naturepedic has been the leading certified organic mattress and bedding company for over 20 years that supports an organic, holistic lifestyle by protecting families through safer, healthier, and certified organic products. By not using materials like flame retardant chemicals and polyurethane foam from their line of organic mattresses, Naturepedic is dedicated to protecting consumers and the environment. Our certifications include GOTS, MADE SAFE®, EWG Verified®, GREENGUARD Gold, and many more. The brand is a proud member of the Organic Trade Association and 1% for the Planet, supporting approved nonprofits dedicated to environmental causes. All Naturepedic products, including mattresses, pillows, cushions, and more can be found online at Naturepedic.com, in over 30 Naturepedic stores, and over 150 retailers nationwide.

# Appendix A: Best/Better - Acceptable/Avoid Framework

**Best**

- GOTS-certified organic cotton blankets and lovies (no stain/water repellent finishes).
- Plush toys with embroidered features and minimal add-ons.
- OEKO-TEX STANDARD 100 Product Class I verified baby textiles (when organic is not available).
- MADE SAFE Certified stuffed animals and blankets.

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**Better/Acceptable**

• Conventional cotton/wool/linen without performance finishes; prefer baby-class residue limits.
• Plain polyester/nylon items without PFAS or antimicrobial claims; supported by disclosure/testing.

**Avoid**

• PFAS-treated stain/water resistant textiles.
• Antimicrobial-treated textiles (silver/QACs/triclosan) unless fully disclosed and justified.
• Wrinkle-resistant/no-iron textiles (formaldehyde resins).
• Foam-containing inserts/padding in close-contact baby soft goods.
• Vinyl/PVC coatings or unknown waterproof backings; plastics without phthalate documentation.
• “Bamboo” viscose/rayon without supply chain documentation.

# Appendix B: Shopping Guide

| **Look for** | **Avoid/Question** |
|---|---|
| GOTS organic cotton; minimal finishes | Stain/water resistant claims (ask about PFAS) |
| OEKO-TEX Class I for babies | Antimicrobial/anti-odor claims (ask about biocides) |
| Embroidered plush features | Hard plastic eyes/noses; vinyl coatings |
| Simple construction; clear disclosures | Wrinkle-resistant/no-iron claims |
| Microfiber-aware care guidance | Foam inserts in close-contact items |

Table B1. At-a-glance shopping cues.

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# Appendix C: Glossary of Terms

**Additive flame retardant:** A flame retardant that is physically mixed into a material rather than chemically bonded to it. Because it is not permanently attached, it may migrate out of a product over time.

**Antimicrobial treatment:** A treatment applied to a material to reduce or inhibit the growth of microorganisms such as bacteria or fungi on the material.

**Aromatic amine:** A class of organic compounds, some of which are known or suspected carcinogens. Certain azo dyes can break down into aromatic amines under specific conditions.

**ASTM F963:** The primary US toy safety standard, establishing requirements for physical, mechanical, flammability, and certain chemical hazards. Compliance with ASTM F963 is mandatory for most toys sold in the US through incorporation into federal regulations.

**Azo dye:** A widely used class of synthetic dyes used to color textiles. Certain azo dyes can degrade into aromatic amines that are restricted under EU regulations because of potential health concerns.

**Biocide:** A substance intended to destroy, deter, or control harmful organisms such as bacteria, fungi, or algae.

**Consumer Product Safety Improvement Act (CPSIA):** A US law establishing safety requirements for children's products, including limits on lead and certain phthalates, as well as testing and certification requirements.

**Di(2-ethylhexyl) phthalate (DEHP):** A phthalate plasticizer used to make some plastics more flexible. DEHP is restricted in certain children's toys and child-care articles because of reproductive and developmental toxicity concerns.

**Durable Water Repellent (DWR):** A finish applied to textiles to increase water repellency by causing water to bead on the surface rather than readily wet the fabric. Historically, many DWR treatments relied on PFAS, although PFAS-free alternatives are increasingly available.

**Endocrine disruptor:** A substance that may interfere with the body's hormone (endocrine) system.

**Fiberfill:** A loose filling material used inside products such as stuffed animals, pillows, and blankets to provide softness, cushioning, and structure.

**Finish (textile finish):** A chemical or physical treatment applied to a textile to change its appearance or provide a functional property, such as stain resistance, wrinkle resistance, water repellency, or antimicrobial activity.

**Flame retardant:** A substance added to a material to delay ignition, reduce flammability, or slow the spread of fire.

**Formaldehyde-based resin:** A resin containing or derived from formaldehyde that may be used in textiles to improve wrinkle resistance, dimensional stability, stiffness, or bonding.

**Global Organic Textile Standard (GOTS):** An international certification standard for textiles made with certified organic fibers. GOTS includes requirements for chemical inputs, environmental and social criteria, traceability, and independent certification throughout textile processing.

**Lyocell:** A regenerated cellulose fiber made by dissolving wood-derived cellulose and reforming it into fibers using a solvent-recovery manufacturing process.

**Microfibers:** Very small fibers released from textiles during manufacturing, use, wear, and washing. Both natural and synthetic textiles shed microfibers, but synthetic microfibers are plastic and may persist in the environment as microplastics.

**Microplastics:** Plastic particles or fibers smaller than 5 millimeters. Synthetic textile microfibers are one form of microplastic.

**Minky fabric:** A soft, plush synthetic fabric, typically made from polyester, that is commonly used in baby blankets and stuffed animals.

**National Institute of Environmental Health Sciences (NIEHS):** A US federal research institute that studies how environmental exposures affect human health.

**OEKO-TEX® STANDARD 100:** An independent certification that tests finished textile products for a broad range of potentially harmful substances. Product Class I applies to products intended for babies and toddlers up to 3 years of age and has the strictest testing requirements.

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**Optical brightener:** A fluorescent substance added to textiles to make whites appear brighter and colors appear more vivid.

**Polyethylene (PE):** A widely used plastic found in products such as pellets, films, molded components, and packaging.

**Performance finish:** A textile finish applied to provide a specific function, such as stain resistance, water repellency, wrinkle resistance, odor control, or antimicrobial activity.

**Per- and polyfluoroalkyl substances (PFAS):** A large class of highly persistent fluorinated chemicals used in some stain-, oil-, and water-repellent finishes. Because many PFAS break down very slowly, they are often referred to as "forever chemicals."

**Phthalates:** A class of chemicals commonly used as plasticizers to increase the flexibility of plastics and in some coatings, adhesives, and printing systems. Certain phthalates have been associated with reproductive, developmental, or endocrine-related health concerns.

**Plasticizer:** A substance added to plastics, coatings, adhesives, or other materials to increase flexibility, softness, or workability.

**Plastisol:** A suspension of polyvinyl chloride (PVC) particles in a liquid plasticizer that is commonly used in screen-printing inks and textile coatings.

**Polyurethane (PU) foam:** A synthetic polymer foam commonly used for cushioning, padding, or structural support in consumer products.

**Polyvinyl chloride (PVC):** A chlorine-containing plastic used in some coatings, backings, prints, and flexible components. Flexible PVC commonly requires plasticizers and may contain other additives.

**Quaternary ammonium compound (QAC):** A class of chemicals used in some disinfectants, preservatives, fabric treatments, and antimicrobial products.

**Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH):** The EU's primary regulation governing the registration, evaluation, authorization, and restriction of chemical substances.

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**Regenerated cellulose:** A manufactured fiber produced by dissolving naturally derived cellulose, usually from wood pulp, and reforming it into fibers. Examples include rayon, viscose, and lyocell.

**Semi-volatile organic compound (SVOC):** An organic chemical that evaporates more slowly than a volatile organic compound (VOC) and may migrate from products into indoor air, dust, and surfaces over time.

**Volatile organic compound (VOC):** An organic chemical that readily evaporates into the air under ordinary indoor conditions. VOCs vary widely in their properties and potential health effects.

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