Technical Brief

A Strategic Research Initiative for Furniture Flame Retardants and Flammability

Introduction & Background

Many chemicals including flame retardants are prevalent by nature of material composition and additives in consumer products and furnishings. In 1975, flame retardant chemicals in furniture filling, typically polyurethane foam became customary in response to the California flammability standard, Technical Bulletin 117 (TB 117), primarily to protect against home fires started by small open flames, such as candles, matches, and lighters (Stapleton et al., 2012). As of July 1, 2014, TB 117 has been replaced by TB 117-2013, with changes that impact the use of flame retardants.

Manufacturers are no longer compelled to make their products open-flame resistant; they must only meet the cigarette smoldering resistance tests. Although the use of flame retardants is not prohibited in TB 117- 2013, furniture products can meet the smoldering flammability requirements without the presence of flame retardants.

According to the National Fire Protection Association (NFPA), fires from open flames are still a threat. In recent years fires involving upholstered furniture have annually accounted for the largest share of fire deaths of any first item ignited. Nearly 25 percent of all home fire deaths are attributed to upholstered furniture when it was the primary item contributing to fire spread (Durso, 2014). In healthcare facilities, 45 percent were located in nursing homes; 23 percent were located in hospitals or hospice; 21 percent were located in mental health facilities (Ahrens, 2014). Flame retardants may disrupt the combustion stage of a fire cycle, including avoiding or delaying "flashover," insulate the available fuel source from the material source with a fire-resistant "char" layer, or dilute the flammable gases and oxygen concentrations in the flame formation zone by emitting water, nitrogen or other inert gases.

However, recent research suggests that a measurable fire safety benefit of the use of flame retardants has not been established (Babrauskas, Blum, Daley, & Birnbaum, 2011). Some health scientists are concerned with the human exposure to flame retardant and other semi volatile chemicals that have been linked to serious health problems including diabetes, neurobehavioral and developmental disorders, cancer, reproductive health effects and alteration in thyroid function (Kim, Harden, Toms, & Norman, 2014). Chemicals used as fire retardants have been found in adults, children, breast milk and umbilical cord blood which carry chemicals across the placenta subjecting exposure to neonates in the womb (Roosens et al., 2010); and outdoor pollution, contributing to chemical loads in wastewater, rivers and the natural environment (Schreder & La Guardia, 2014). However, scientific data is limited in understanding how human exposure to flame retardants and other similar chemical occurs and at what levels. This information is needed to assess the risk of exposure and to evaluate mitigative processes.

Purpose

Market demand for "consumer safe products" continues to increase. Chemical control has become a focus with the listing of chemicals related to California's Proposition 65 and the demand of public transparency of chemicals used to manufacture products. Health science is demonstrating that certain halogenated and organophosphate containing flame retardants have the potential for adverse human health impacts; and that these chemicals are found prolifically in the environment as well as public spaces and residential homes. In response, manufacturers, retailers, consumer advocacy groups, regulatory bodies, and other stakeholders are discussing and evaluating potential ways of reducing toxic exposures through elimination of certain chemicals, replacement with safer alternatives, or changes in manufacturing processes.

While much of the current focus is based on hazard information of chemicals, California Proposition 65 and other health assessment programs are concerned with risk of exposure and exposure limits. This research will focus on electronics and furniture to evaluate human exposure routes, risk of exposure and levels of exposure.

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UL Chemical Safety, Underwriters Laboratories Inc.
2211 Newmarket Parkway, Suite 106, Marietta, Georgia 30067
W: ulchemicalsafety.org

Research Questions

1. How does human exposure to flame retardants and other semi-volatile chemicals from consumer products like furniture and small electronics typically occur?
2. What are the levels of human exposure to these chemicals and how can risk be evaluated?
3. How does aging of a product affect the process of human exposure?
4. Can selected chemical and physical alternative construction strategies reduce chemical exposure risk and provide fire safety?
5. How is human exposure affected by the availability of non-furniture products found in a room or office that also contains flame retardants?

Study Design & Methodology

Human exposure potential to flame retardants and other organic chemicals from dermal, ingestion, and breathing air pathways will be evaluated from products constructed with differing flame retardant technologies using simulation in an experimental design.

Technologies will include:

1. No flame retardant (control);
2. Traditional chemical flame retardants commonly used (chlorinated P);
3. Alternative "safe" or "green chemistry" flame retardants; and
4. Alternative nonchemical flame resistant barrier technologies.

All flame retardant technologies will be tested for chemical release and human exposure from newly manufactured products. All measurable chemicals will be identified. The products will be aged and tested again. These samples will be evaluated on performance through a battery of human exposure pathways, including air inhalation, dust inhalation/ingestion, and absorption through skin migration. Finally, tests will be conducted to determine the efficacy of each chair assembly for fire/smoldering resistance.

Expected Results

It is expected that this study will contribute to the knowledge base by providing scientifically sound data generation that can be used to enable test methods, assess risk from chemical exposure, and inform policy about "safe" products. Specifically, outcomes will lead to:

1. Exploration of scientific protocols for assessing human exposure to flame retardants and other SVOC chemicals via inhalation or dermal and ingestion exposure and how this exposure varies with age and design of product
2. Data demonstrating how various manufacturing technologies and materials (with and without flame retardants) affect product flammability and human exposure to chemicals
3. Data demonstrating typical background levels of flame retardant and chemical impurities that may affect human exposure studies
4. Identification of methodologies for comparing alternative and safer flame retardant technologies meeting green chemistry principles while achieving flammability and health performance
5. Defining important parameters for measuring risks of chemical exposure
6. Evaluating potential chemical exposure risks from consumer products common in the indoor environment space
7. Peer reviewed publication of research processes and data.

The overall work and data will contribute to the understanding of chemical exposure potentials and means of evaluating risks associated with furniture and other indoor products.

References

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