

Halogenated flame retardants in products: Fire performance and environmental consequences

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Topics to be covered

- Upholstered furniture: TB117
- Thermal insulation in buildings



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- Mandatory for upholstered furniture and baby products containing polyurethane foam sold in California.
- Implemented in 1975 by California Bureau of Home Furnishings and Thermal Insulation (BHFTI).
- Many products sold outside California have switched over to using this standard.

Two questions:

- Does California TB117 improve fire safety?
- Is TB117 associated with adverse health or environmental impacts?



TB117 Test Methods (main tests)

1. Foams are tested for cigarette smolder resistance using a composite specimen test of foam under fabric.
2. Upholstery fabrics (by themselves, without foam) are subjected to the small-flame test of CS 191-53.
3. Bare foam without an upholstery cover is subjected to a 12 second small open flame test.



First Question:

Does California TB117 improve fire safety?



1. The smolder portion of TB117?

90% of US furniture is smolder-resistant in compliance with a voluntary furniture industry UFAC standard (CPSC, 2007)

According to John McCormack, former lab head of BHFTI:

“UFAC Smoldering Tests are actually more well thought out than the current 117 smolder tests and cover other smolder prone components such as upholstery fabrics, internal structural fabrics, smolder-resistant interliners and decorative trims.”

Conclusion:

TB117 does not lead to smolder resistance improvements over what is already provided in the UFAC standard.



2. Open flame part of TB117 for fabrics?

For fabrics, it is identical to the Federal test CS 191-53. All fabrics in the US already meet this standard.

Gordon Damant, former head of the BHFTI, testified in court that he never runs the fabric test since all U.S. fabrics already comply.

Conclusion:

All fabrics already meet the fabric standard (Federal test CS191-53) without needing provisions of the TB117.



3. Open flame part of TB117 for foam?

- There would be a fire safety benefit if TB117 compliant foams :
 - prevented ignition from small-flame sources
 - or
 - reduced the severity of fires



Does meeting TB117 requirements prevent small-flame ignition?

- Once fabric burns, underlying foam is presented with a much larger flame than originally ignited the fabric.



- CPSC tests of TB117 compliant chairs found that they did not resist small-flame ignitions and concluded that *“TB117 component results were not predictive of full scale performance”* and *“TB117...would not, if federally mandated, ensure a substantial reduction in the risk of small open flame ignition of finished articles of furniture.”* (CPSC 1997, 2001)

Does meeting TB117 requirements prevent small-flame ignition? cont'd

- Talley tested a series of 15 matched TB117 and non-TB117 fabric/foam composites exposed to a small-flame source and concluded:

“The TB117 foam made no significant difference in preventing ignition or reducing flame spread.”

Talley, T. H., Phases 1&2, UFAC Small Open Flame Tests and Cigarette Ignition Tests, *Annual AFMA Flammability Conf.* (1995).

- **Conclusion: TB117 foams do not prevent small-flame ignition.**



Do TB117 foams reduce the severity (heat release rate) of fires?

- Heat release rates of TB117 studied in 1982 at NIST:

Table 5

Effect of Padding Type for Specimens With Similar Fabrics

<u>Specimen</u>	<u>Peak \dot{Q} (kW)</u>	<u>Time to Peak (s)</u>	<u>Padding</u>	<u>Fabric</u>
F21	1970	280	California Foam	Polyolefin
F25	1990	260	Non-California Foam	Polyolefin

Babrauskas, V., et al., 1982, Upholstered Furniture Heat Release Rates Measured with a Furniture Calorimeter (NBSIR 82-2604), [U. S.] Natl. Bur. Stand., Gaithersburg MD

No change in heat release rate with TB117 foam.



Fire Safety Conclusion

- Compliance with the California TB117 standard does not enhance the fire safety of furniture and baby products containing foam.



15 times more escape time?

- ❑ A 1988 study of expensive, state-of-the art foams (much higher density; with 50% or more flame retardant content) led to an essentially non-burning outcome.

(Babrauskas, V. et al (1988). *Fire Hazard Comparison of Fire-Retarded and Non-Fire-Retarded Products* (Spec. Publ. SP 749), [U. S.] Natl. Bur. Stand., Gaithersburg MD

- ❑ Foams used to comply with TB117 have about 5% flame retardant and do not provide this result.
- ❑ Industry claims of TB117 giving “15 times more escape time” are made based on a study where the density of the foam was three or more times greater than the density of typical TB117 foam!



Second Question:

Is California TB117 associated with adverse health or environmental impacts?

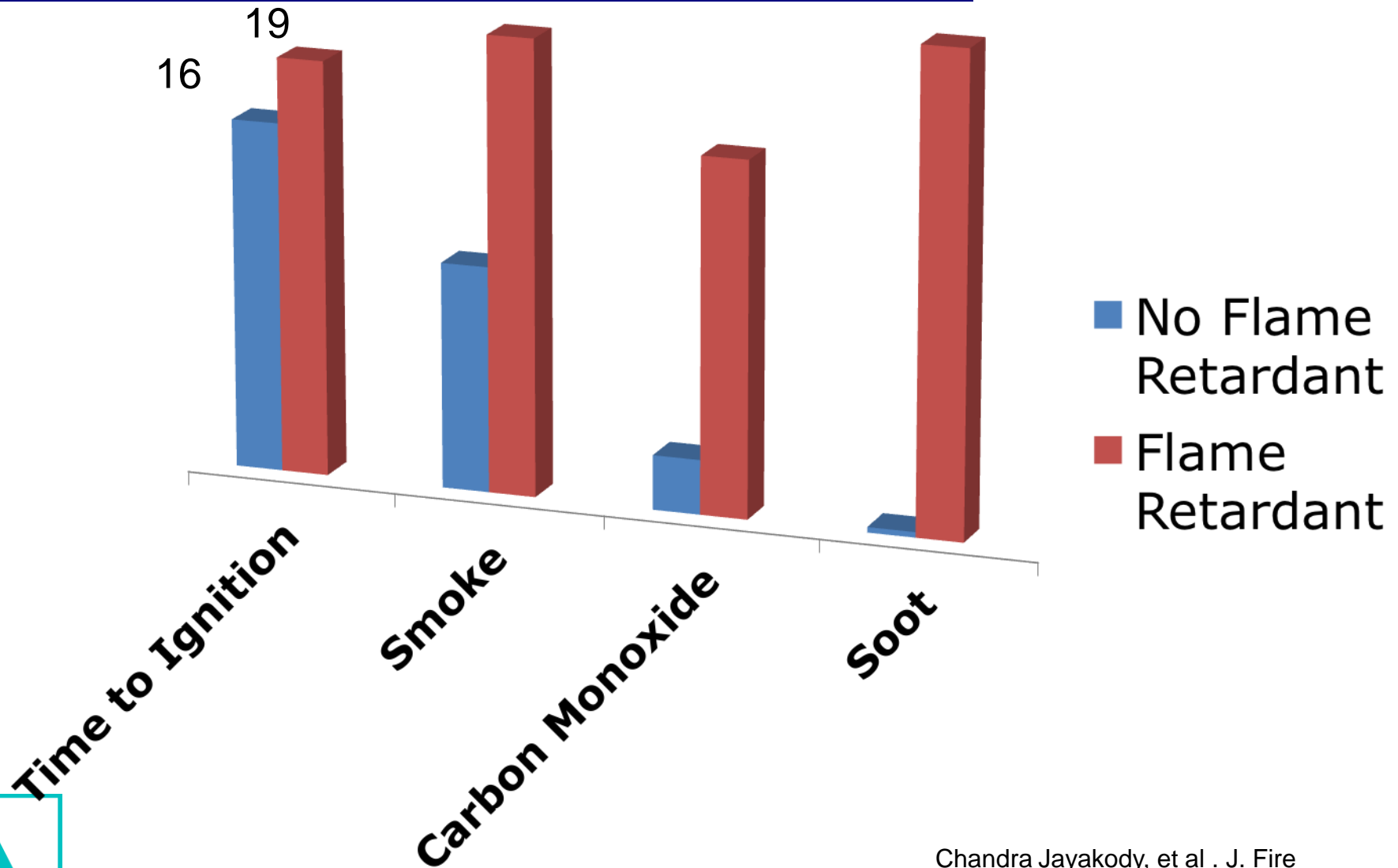
Answer: **Yes!**

Technical details recently published:

Babrauskas, V., Blum, A., Daley, R., and Birnbaum, L., Flame Retardants in Furniture Foam: Benefits and Risks, pp. 265-278 in *Fire Safety Science—Proc. 10th Intl. Symp.*, Intl. Assn. for Fire Safety Science, London (2011).



But fire toxicity is also a question



One possible replacement for TB117...

- Adopt CPSC's proposed furniture flammability regulation.
 - ❑ This proposal deals only with smoldering ignitions, but upgrades current (UFAC, voluntary) practice with a beefed-up mandatory regulation.
 - ❑ It should have a positive effect on reducing fire losses
 - ❑ Does not require FR treatments



U.S. Consumer Product Safety Commission

Proposed fabric smolder rule, 16 CFR 1634

- 85% of current upholstered furniture is constructed with cover fabrics that meet the requirements without chemicals
- 5% of furniture would use barriers to comply;
- 10% would change fabrics,
- flame retardant chemicals not needed to pass



Thermal insulation in buildings

- New work in progress...
- US building codes require plastic insulation foams in buildings to pass ASTM E 84 (Steiner Tunnel flame spread test), with FSI \leq 75 and SDI \leq 450.
- Manufacturers comply by adding brominated flame retardants.
 - Is this appropriate from a fire safety science point of view?
 - NO! For two reasons:
 - (1) most foams must be used behind thermal barrier
 - (2) ASTM E 84 test gives grossly wrong results for foams.



Thermal insulation in buildings (cont'd)

- Flame spread over the surface of a foam would be a legitimate concern only if this were possible.
 - But the Codes simultaneously require use of a thermal barrier (e.g., gypsum wallboard) over the foam, so there is no exposed surface over which flames could spread.
- Tests at UL and other organizations showed that while some materials can be properly evaluated in the ASTM E84 test, plastic foams give nonsensical results when subjected to this test.
 - Even if flame spread testing of foams were desired, ASTM E84 is the wrong test for doing it.



Thermal insulation in buildings (cont'd)

- Environmental and toxicity issues are similar to those for flame retardants used in furniture foams, since same classes of flame retardant agents are used commercially.
- Examples of flame retardants used in building insulation are:
 - HBCD (hexabromocyclododecane), which was nominated for the first EU list of “Substances of Very High Concern” and for listing as a Persistent Organic Pollutant (POP) under the Stockholm Convention.
 - Emerald 3000 and TCPP, (tris (1-chloro-2-propyl) phosphate), which lack adequate information.

Questions??

