



## **Staff Briefing Package**

# **The Feasibility, Benefits and Costs of Adopting TB 117-2013 as a Mandatory National Standard**

September 8<sup>th</sup>, 2016

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# Executive Summary

The Fiscal Year (FY) 2016 Operating Plan directed U.S. Consumer Product Safety Commission (CPSC) staff to prepare a briefing package on adoption of California Technical Bulletin (TB) 117-2013, "Requirements, Test Procedure and Apparatus for Testing the Smolder Resistance of Materials Used in Upholstered Furniture." The Commission directed the staff to:

*By September 1, 2016, the staff will prepare a briefing package on California's Technical Bulletin TB 117-2013. The briefing package will summarize the feasibility, benefits and costs of adopting TB 117-2013 as a mandatory national standard. The briefing package will also address the advantages and disadvantages of adopting TB 117-2013 as compared to the advantages and disadvantages of the upholstered furniture flammability standard proposed by the Commission in March 2008, taking into account the time needed to finalize either standard. The briefing package will include the staff's recommendations for action by the Commission and provide an opportunity for discussing alternative approaches.*

CPSC staff evaluated the feasibility, benefits and costs of adopting TB 117-2013 as a mandatory national standard, compared to the upholstered furniture flammability standard proposed by the Commission in the 2008 notice of proposed rulemaking (2008 NPR). Based on data from the National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA) Annual Survey of Fire Losses, CPSC staff produces estimates of fires and fire losses associated with specific consumer products. From these sources, an estimated annual average of 4,700 fires, 390 deaths, 660 injuries, and \$238 million in property losses are attributed to incidents where upholstered furniture was the first item ignited. These incidents do not necessarily include fires where upholstered furniture was the item most contributing to flame spread and may therefore underestimate the hazard of upholstered furniture flammability. CPSC staff considers fires where upholstered furniture is the first item ignited by a small open-flame source or a smoldering ignition source to be potentially addressable by one or both of TB 117-2013 or the 2008 NPR if they were effective.

TB117-2013, a performance standard for flammability of residential upholstered furniture sold in California, uses a small-scale mockup test that includes a test method to evaluate cover materials used in the construction of upholstered furniture. The test is intended to address fires caused by a smoldering ignition source only. This test method relies on inconsistent standard materials and uses char length as a performance measure, which significantly limits the consistency and repeatability of the test. CPSC staff has determined that the test mockup geometry and pass/fail criteria used by TB 117-2013 do not produce sufficiently consistent results. In addition, small-scale tests like TB 117-2013 have not been shown to predict adequately the performance of real furniture with smolder-prone cover fabric. Consequently, CPSC staff does not believe TB 117-2013 effectively addresses the hazard of smoldering ignition.

In 2008, the Commission proposed a standard for upholstered furniture flammability in an NPR. The proposed test was a small-scale test that was intended to address fires caused by smoldering ignition and small open-flame sources. After publication of the NPR, CPSC staff conducted additional verification testing that demonstrated that the bench-scale test approach did not adequately predict the fire performance of full-scale furniture. CPSC staff's testing has shown

that the small-scale test in the 2008 proposed rule does not adequately predict the flammability performance of real furniture, especially with smolder-prone cover fabric.

Based on these analyses, CPSC staff has determined that neither TB 117-2013, nor the Commission's 2008 NPR, will provide an adequate prediction of real furniture flammability performance. Thus, both TB 117-2013 and the 2008 NPR provide an unknown impact on safety. Both TB 117-2013 and the 2008 NPR rely on a standard foam and a standard cover fabric for the test. CPSC staff testing has previously shown that it is extremely difficult to maintain sufficiently consistent standard foam and fabric materials because of the nature of the materials and batch-to-batch variation inherent in the manufacturing process.

CPSC staff recommends that the Commission not adopt TB 117-2013, and staff recommends the Commission not finalize the 2008 NPR. CPSC staff believes the test methods in both TB 117-2013 and the 2008 NPR are not likely to result in any significant improvements in upholstered furniture fire safety. Staff recommends terminating the current upholstered furniture rulemaking. CPSC Staff intends to develop a new briefing package in FY17 that recommends terminating rulemaking and will include a draft FR notice to terminate rulemaking with the Briefing Package for the Commission to review. CPSC staff recommends pursuing alternative approaches that address the hazard through a combination of research, education and outreach, and voluntary standards efforts.

# Briefing Memorandum



This document has been electronically  
approved and signed.

**Memorandum**

Date: September 8<sup>th</sup>, 2016

TO : The Commission  
Todd A. Stevenson, Secretary

THROUGH: Mary T. Boyle, General Counsel  
Patricia H. Adkins, Executive Director  
DeWane Ray, Deputy Executive Director for Safety Operations

FROM : George A. Borlase, Ph.D., P.E., Assistant Executive Director  
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SUBJECT : The Feasibility, Benefits and Costs of Adopting TB 117-2013 as a Mandatory  
National Standard

**I. Introduction**

The U.S. Consumer Product Safety Commission, (Commission or CPSC) approved the Fiscal Year (FY) 2016 Operating Plan<sup>1</sup> on February 24, 2016. The Operating Plan directed staff to prepare a briefing package on California’s Technical Bulletin (TB) 117-2013 that addresses:

- The feasibility, benefits and costs of adopting TB 117-2013 as a mandatory national standard.
- Advantages and disadvantages of adopting TB 117-2013 as compared to the advantages and disadvantages of the upholstered furniture flammability standard proposed by the Commission in March 2008 (2008 Notice of Proposed Rulemaking (2008 NPR)).
- Recommendations for action by the Commission and provide an opportunity for discussing alternative approaches.

**II. Incident Data**

**2011-2013 Fire Hazard Data**

Based on data from the National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association’s (NFPA) Annual Survey of Fire Losses, CPSC staff produces estimates of fires and fire losses associated with specific consumer products. The total numbers of fires and losses from fires where upholstered furniture was the item first ignited are taken from TAB A. Of the estimated annual average of 4,700 fires, there were an estimated 390 deaths, 660 injuries, and \$238 million in property losses.

Based on the annual losses, CPSC staff has produced estimates of fires that may be “addressable” by a standard, which are a subset of the total fires. When a fire is said to be

addressable by a standard, this means that the fire is of a type that *could* be mitigated by compliant furniture under a furniture flammability standard that adequately addresses the risks associated with the type of fire scenario involved in the upholstered furniture fire. For example, non-addressable fires include arcing electrical hazards and large open flames are not addressed by a smoldering ignition standard. This does not mean that all deaths and injuries that occur in addressable fires would have been prevented had the furniture been compliant under a furniture flammability standard. Staff expects that compliant furniture would prevent a substantial portion but not all deaths and injuries from addressable fires. However, as discussed below, and in staff's supporting technical memorandum, TAB B, many questions remain regarding the feasibility of both TB 117-2013 and the 2008 NPR. Staff has determined that both TB 117-2013 and the 2008 NPR have technical limitations that prevent either from adequately predicting the flammability performance of furniture. The estimates are based on potential standards that are intended to be effective. These numbers only take into account fires where upholstered furniture was the first item ignited. If furniture was considered to be the item contributing the most to the fire, something else being the first item, the numbers may be significantly higher.<sup>2</sup>

Potentially addressable fires based on the NFIRS coding are outlined in TAB A. Table 1 presents the potentially addressable fires and losses where upholstered furniture is the first item ignited by a smoldering ignition source and a small open-flame source. Staff considers upholstered furniture fires with heat sources other than smoldering or small open-flames (such as arcing or large open flame) not to be addressable. The addressable smoldering and small open-flame fire estimates differ from the total number of smoldering ignitions and small open-flame ignitions because these estimates are restricted to addressable fires only. A standard that is designed to address fires caused only by smoking materials would potentially address an estimated annual average of 1,100 of the total fires, 170 deaths, 240 injuries, and \$58 million in losses. A standard that intends to address fires where both smoking materials and small open-flames are the cause would potentially address an estimated annual average of 1,700 total fires, 180 deaths, 360 injuries, and \$86 million in property losses.

**Table 1. Estimated Annual Average (2011-2013) Potentially Addressable Fires and Losses When Upholstered Furniture Was the Item First Ignited.**

<b>Criteria</b>	<b>Smoking Materials</b>	<b>Small Open-Flame</b>	<b>Total</b>
<b>Fires</b>	1,100	600	1,700
<b>Deaths</b>	170	20	180
<b>Injuries</b>	240	120	360
<b>Property losses (\$Millions)</b>	58	29	86

Note: Estimates of fires are rounded to the nearest hundred. Estimates of death and injuries are rounded to the nearest ten. Estimates of property losses are rounded to the nearest million dollars. Detail may not add to totals due to rounding.

### **III. Adopting TB 117-2013 as a National Standard**

California's Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation (BEARHFTI, or the Bureau) is a state consumer protection agency that, among other

things, regulates furniture for California. California initiated a mandatory standard, *\*Requirements, Test Procedure and Apparatus for Testing the Flame Retardance of Resilient Filling Material Used in Upholstered Furniture* Technical Bulletin 117 (TB 117), in 1975. Until its revision in 2013, the standard included a smoldering and an open-flame test method for the resilient filling material of upholstered furniture (typically foam) and a minimal requirement for cover fabric flammability. BEARHFTI has stated that manufacturers met the requirements of the pre-2013 TB 117 by using polyurethane foam treated with flame-retardant chemicals. This standard was revised in 2013 (TB 117-2013). In part, according to BEARHFTI, TB 117 was revised so that “the reliance on flame retardant chemicals will be significantly reduced or eliminated.”<sup>3</sup> Specifically, the test was revised to remove the open-flame ignition test for upholstered furniture filling material and modify the cover fabric requirement to be a test based on ASTM International (ASTM) E1353-08a<sup>e1</sup>. The ASTM standard is based on the industry standard introduced by the Upholstered Furniture Action Council (UFAC), last updated in 1990. TB 117-2013 relies heavily on ASTM E 1353-08 a<sup>e1</sup> for its test method, and it is a small-scale mockup test intended to address only fires that are caused by a smoldering material.

### **Test Method**

TB 117-2013 includes a test method that is primarily focused on the cover material used in a piece of upholstered furniture. A series of tests are conducted where a lit cigarette is placed into the crevice created by a mockup assembly containing two pieces of the cover fabric to be tested and two pieces of standard foam and allowed to burn. If the cover fabric fails, a second series of mockups tested with a barrier material and a standard cover fabric are conducted. The linear char length on the fabric surface is recorded as the pass/fail criteria. The staff’s memorandum at TAB B describes the details of this test procedure.

In the CPSC staff technical memorandum, TAB B, staff discusses the limitations of the TB 117-2013 standard including:

- Staff is unaware of any studies validating the results obtained using the small-scale test protocols in TB 117-2013 and full-scale furniture performance for smolder-prone fabrics;
- TB 117-2013 relies on inconsistent standard materials; and
- TB 117-2013 relies on a vertical char measurement to determine a pass or failure, along with a foam depth of 2 inches.

### ***Use of Inconsistent Standard Materials***

The use of inconsistent standard materials in a fire test method is a significant limitation of TB 117-2013. TB 117-2013 relies on several standard materials in evaluating the individual furniture components. The standard materials include:

- Standard ignition source, a non-filtered cigarette,
- Standard polyurethane foam substrate,
- Standard Type I Cover Fabric, and
- Standard Type II Cover Fabric.

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\* Validation here refers to showing that the prediction has the desired effect.



The standard ignition source specified is either the National Institute for Standards and Technology (NIST)-developed Standard Reference Material (SRM) 1196 cigarette or an equivalent. CPSC staff is unaware of any commercial cigarette meeting the same performance level of the SRM 1196. There is an adequate supply of SRM 1196 cigarettes currently available at NIST and reassurance that future production of SRM 1196 cigarettes will occur. Therefore, TB 117-2013 allows for potential variation of the ignition source by not requiring the SRM 1196 exclusively.

A standard polyurethane foam (SPUF) substrate is used to evaluate cover fabrics and barrier materials. Although TB 117-2013 provides very detailed specifications of the SPUF substrate, the Bureau has only ordered one batch of SPUF substrate and all testing, conclusions and observations have been made based on that initial batch of foam. CPSC testing, as well as CPSC-sponsored research, indicate a large variation in foam from batch to batch. Research funded in an interagency agreement between CPSC and NIST indicates that polyurethane foam with consistent smoldering properties may be difficult to manufacture and that the quality control of key variables, such as pore size, foam mass density, and air flow rate, are critical.<sup>4</sup>

Standard cover fabrics are used to evaluate the barrier and decking materials,<sup>\*</sup> which are the supporting fabrics used in the base of a chair. Industry experience and staff expertise support the fact that fabric variability is inherent in the manufacturing process. This is especially true for fabrics manufactured with cellulose fibers, such as cotton, because there can be crop-to-crop variation. The two standard cover fabrics specified in TB 117-2013 are Type I, 100 percent cotton twill weave, and Type II, 100 percent cotton velvet. The smoldering ignition behavior of fabric depends on the cellulose content of the fiber, fabric weight, content of alkali metal and other ions in the dye and permeability of the fabric because of variations in the weave and pile. Although these variables can be controlled to some extent, manufacturing variations are still present in the finished fabric. The 2008 NPR uses the same 100 percent cotton velvet specified in TB 117-2013. Leading up to, and following publication of the 2008 NPR, CPSC staff met extensively with the manufacturer of the 100 percent cotton velvet about possible options for reducing the variability. The manufacturer was not able to resolve manufacturing variability among rolls of fabric from different lots. During years of testing to support rulemaking activities, CPSC staff observed differences in smoldering properties among the rolls of cotton velvet fabric and reported that obtaining sufficiently consistent standard materials, including the 100 percent cotton velvet fabric for smoldering tests was a challenge that had not been overcome.<sup>7</sup> In addition to the use of standard materials, the test method has other limitations, discussed below.

### ***Performance Measurements***

TB 117-2013 uses vertical char measurements to indicate passing or failing mockup (small-scale test) performance. CPSC staff has found that a vertical char length measurement may not be a sufficient measure for characterizing the smoldering ignition of materials. Staff observed in mockup tests<sup>5</sup> that the smoldering combustion front traveled along or down into the crevice, resulting in a configuration in which multiple burning surfaces can reinforce the strength and duration of the combustion of either surface. In addition, staff's testing indicates that a 2-inch-thick foam geometry may allow the wooden mockup frame to become involved in the ignition

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\* "Decking Material" is a textile fabric used in furniture construction to support a loose seating cushion. It is typically a functional component, rather than an aesthetic component.

process. CPSC staff testing indicated that increasing the foam thickness to 3 inches prevented the mockup frame from becoming involved. Therefore, vertical char may not accurately measure performance of the cover fabric or barrier. As described in TAB B, CPSC studies concluded that measurement of mass loss of the substrate is a better indication of smoldering performance, along with an increase in substrate thickness to 3 inches.

### ***Use of FR Chemicals***

Although not required in the original TB 117 (developed in 1975), California has stated that manufacturers met the requirements of TB 117 by using polyurethane foam treated with flame-retardant chemicals.<sup>3</sup> According to BEARHFTI, in 2013, TB 117 was revised, in part, so that “the reliance on flame retardant chemicals will be significantly reduced or eliminated.”<sup>3</sup> By removing the open-flame requirement from TB 117, the use of FR chemicals may decrease because FR chemicals were believed to be used in the furniture’s foam to pass the open-flame test in TB 117. Some manufacturers may meet the requirements of the revised standard, TB 117-2013, through the use of more smolder-resistant cover fabrics or smolder-resistant barriers beneath the cover fabrics. They may also meet TB 117-2013 with the use of FR chemicals and labels, according to California Senate Bill 1019, which requires upholstered furniture to be labeled to indicate whether it contains FR chemicals. It is unknown whether this labeling requirement has any effect on a manufacturer’s decision to use FR chemicals. There is insufficient information at this time to predict whether manufacturers would elect to use FR chemicals to meet the standard and what those FR chemicals and their potential health effects would be. This is due to reformulations and alternative FR chemicals being introduced, and the lack of toxicity and exposure data available.

### ***Validation of Test Method***

CPSC staff is not aware of any validation studies conducted that confirm the small-scale smoldering evaluations of individual smolder-prone components that measure the performance of full-scale furniture in a smoldering ignition scenario. To assess validity, tests would need to be designed to demonstrate that the fabrics, barriers and foam components in bench-scale constructions show an increase in fire safety when used in full-scale furniture. CPSC staff refers to this issue as “scaling.”

CPSC staff attempted to validate the scaling of the 2008 NPR bench-scale testing protocol. Staff used the same materials employed in actual furniture to construct bench-scale mockups.<sup>2,3,4</sup> Staff’s testing and data analysis reports that “bench-scale performance did not demonstrate an adequate prediction of real furniture flammability performance especially in smoldering ignition tests.”<sup>8</sup> As discussed in detail under Tab B (Technical Review of TB 117-2013 and the CPSC 2008 NPR Test Methods), some of the reasons for this include issues with standard materials, complex sample geometry, and varying thicknesses and arrangements of component materials.

### **Economic Benefits and Costs**

CPSC staff estimates that the TB117-2013 test method would have similar costs and benefits to those of the UFAC program, which staff analyzed in 1996, and found would provide very limited benefits as a mandatory rule, TAB D. CPSC staff conducted an economic analysis on UFAC in 1996. The UFAC analysis is applicable to TB 117-2013 because both are similar bench-scale test methods relying on standard materials using a one-dimensional char length measurement and with a limited ability to predict real-scale furniture. CPSC staff conducted a market evaluation in 1996, which found that approximately 90 percent of upholstered furniture may have been

produced in compliance with the UFAC standard. Although the staff has not updated the market evaluation of the UFAC program, staff has no information indicating that the rate of voluntary conformance has fallen significantly since the previous assessment. Therefore, costs associated with conforming to the standard are fairly minimal because most furniture already complies. CPSC staff estimates the costs of compliance to be less than \$5 million annually. However, because TB 117-2013 does not adequately predict real furniture flammability performance, and because there is already substantial compliance with the UFAC standard, the benefits of adopting TB117-2013 as a mandatory standard would similarly be minimal.

### **Summary of TB 117-2013**

Although there is industry support for TB 117-2013, as evidenced by their request to the Commission to mandate TB 117-2013 as a national standard,<sup>6</sup> staff has numerous concerns about the standard. TB 117-2013 is unlikely to result in any improvement in upholstered furniture flammability performance because of the scaling issues. The validity of the small-scale test has not been determined; accordingly, furniture that meets TB 117-2013 is unlikely to show the predicted level of performance. Without resolution of these outstanding concerns, CPSC staff would not recommend adopting TB 117-2013 as a mandatory standard in its current form. Additionally, aspects of the test method, such as the thickness of the foam, the use of standard materials that vary among lots, and the use of a char length measurement to determine performance cause the test to be unreliable. These affect the repeatability of the test. TB 117-2013 does not require or restrict the use of FR chemicals. However, there is not enough information at this time to determine the likely use of FR chemicals or their health effects. Staff believes that the resources necessary to resolve the issues would be substantial. A standard that is developed after resolution of these concerns could be significantly different than TB 117-2013. It may not be possible to develop an adequate bench-scale test that is representative of real furniture because of the fundamental issues with developing consistent standard foam and standard cover fabric. To propose an effective standard to the Commission, staff would first need to address and resolve the significant technical issues in the standard. CPSC staff would compile the necessary findings under the applicable statutes and assemble a briefing package for Commission consideration. Rulemaking would require considerable additional staff resources and time.

## **IV. 2008 NPR**

### **Background**

On March 4, 2008, the Commission issued a notice of proposed rulemaking (NPR) for a flammability standard for residential upholstered furniture under the FFA. 73 FR 11702. The NPR proposed performance requirements to reduce the likelihood of upholstered furniture fires ignited by cigarettes or small open flames. Manufacturers and importers of upholstered furniture could choose one of two possible methods for compliance: (1) use upholstery cover material that met the specified cigarette-ignition performance test, *i.e.*, “Type I” furniture; or (2) incorporate an interior fire barrier between the cover fabric and interior filling materials that met both the smoldering and small open-flame resistance tests, *i.e.*, “Type II” furniture. An “interior fire barrier” was defined as a fire-resistant material that is interposed between the upholstery cover fabric and any interior filling material. The 2008 proposed rule on upholstered furniture flammability focused on performance standards that did not require manufacturers or importers to use FR chemical additives to achieve compliance. The 2008 NPR uses a similar smoldering-

ignition test method to TB 117-2013, with certain important test method improvements, and the rulemaking added an open-flame ignition test for barrier fabrics.

### Staff Analysis

At the time the NPR was published in 2008, CPSC staff acknowledged that real-scale validation testing was needed to demonstrate that the bench-scale test approach presented in the NPR was adequate to address the fire performance of full-scale furniture. Shortly after the release of the 2008 NPR, CPSC staff conducted open-flame and smoldering-ignition evaluations using small bench-scale constructions.<sup>7</sup> Staff believed that the standard materials necessary for the validation study would not show any variation, and therefore, would not impact results of the validation study. This did not prove to be the case. Two key issues were revealed during the validation study that staff conducted after the 2008 NPR was published: (1) lack of scaling between bench-scale mock-ups and actual furniture, and (2) lack of consistent standard materials.<sup>8</sup> Each issue is discussed in turn.

First, staff's testing identified scaling issues. The bench-scale performance in staff's testing "did not demonstrate an adequate prediction of real furniture flammability performance, especially in the smoldering ignition tests." The open-flame ignition, bench-scale qualification tests for fire barriers, however, did appear to result in correlation to testing full-size furniture, for the single barrier used in that test series, which could predict improvements in full-scale fire performance in open-flame tests.<sup>8</sup>

The smoldering ignition tests showed that the specified materials did not behave consistently. Cover fabrics that staff expected to result in a range of smolder insult to the underlying foam filling material did not show a practical difference. Similarly, the test of foam smolder performance with and without the presence of a fire barrier was also not practically different. Staff ordered polyurethane foam using the same specifications in the NPR from different manufacturers than the foam used in the preliminary testing. Staff determined that the differences in materials caused inconsistent smoldering results. The bench-scale, *open-flame* tests showed that the barrier was able to prevent ignition of the foam, as predicted.

Subsequently, staff conducted the *full-scale* smolder and open-flame testing of chairs<sup>8,9</sup> with the same cover fabrics, foam, and a fire barrier used in prior bench-scale testing. Based on the bench-scale tests that are used to qualify a fire barrier per the proposed standard, staff expected that the chairs constructed with the fire barrier would not result in any smoldering ignitions and would limit combustion in an open-flame exposure scenario. However, when tested, the fire barrier did not consistently protect against smoldering ignitions. The chairs constructed with the fire barrier demonstrated a considerable amount of smoldering in the smoldering tests and the chairs constructed with the fire barrier were only partially successful in reducing fire severity in the open-flame tests.

Staff believes the 2008 NPR test method is a more robust and repeatable test than TB 117-2013. Despite the test method improvements in foam thickness and mass loss measurement, a CPSC 2009 test series to evaluate the effectiveness of the 2008 NPR in protecting full-scale furniture found that "the bench-scale performance did not demonstrate an adequate prediction of real furniture flammability performance, especially in the smoldering ignition tests."<sup>8</sup> Staff has continued to encounter challenges with the standard foam and standard cover fabrics. Staff has attempted to resolve these problems with standard materials, including working with NIST on

standard foam and with manufacturers on standard cover fabric, but the problems, as of yet, remain unresolved.

Similar to TB 117-2013, the 2008 NPR is a performance standard, and FR-treated fabrics and foam would not be required for compliance with the 2008 NPR, TAB C. However, because the 2008 NPR includes both small open-flame and smoldering test methods, manufacturers may choose to use FR chemicals to comply with the 2008 NPR. The identities of these FR chemicals are often unknown because companies introduce reformulations and alternative FR chemicals. At this time, staff does not have sufficient information to predict whether manufacturers would elect to use FR chemicals to comply with the 2008 NPR, what those FRs would be, and what their health effects might be.

### **Economic Benefits and Costs**

Upholstered furniture is manufactured with a range of fabric types and constructions. Cellulosic-rich fabrics tend to be more prone to smoldering. Based on the economic analysis of the 2008 NPR, discussed in TAB D, staff estimated that about 14 percent of new furniture items manufactured at that time were covered with cellulosic fabrics and would fail the smoldering ignition test for cover fabrics. The estimated costs associated with conforming to the 2008 NPR were quite varied from a simple substitution of complying cover fabrics, to use of more expensive FR chemical treatments and barriers. Staff estimated the cost of compliance would be between \$32 million and \$57 million, annually. Staff estimated benefits of the 2008 NPR would be \$419 million to \$424 million. However, without validation of the bench-scale tests of the 2008 NPR, the previous estimates of benefits are called into question.

### **Summary of the 2008 NPR**

After the 2008 NPR, staff conducted additional test work to assess the preliminary work presented in the NPR. This subsequent work identified significant issues with the proposed test method. The issues include inconsistent standard materials and the inability to show a correlation between bench-scale tests and actual furniture. The NPR test method is more robust than the test methods in TB 117-2013, because the NPR test method requires thicker foam and calculates mass loss instead of the vertical char as a performance measure which results in a more repeatable test. However, staff's subsequent verification testing still showed that "the bench-scale performance did not demonstrate an adequate prediction of real furniture flammability performance, especially in the smoldering ignition tests."<sup>8</sup> CPSC staff has been unable to correlate the bench-scale test in the NPR with full-size furniture performance and has encountered challenges in obtaining standard materials, which have significantly hindered progress on the rulemaking.

## **V. Comparison of TB 117-2013 and 2008 NPR**

### **Adopting TB 117-2013**

If it effectively reduced the flammability risk, TB 117-13 could present certain advantages if adopted as a mandatory national standard. TB 117-2013 is a minimal standard that many manufacturers are already meeting. TB 117-2013 is essentially the same test as UFAC because it is based on ASTM E1353, which, in turn, is based on UFAC, TAB B. A market evaluation conducted by staff in 1996 found that approximately 90 percent of upholstered furniture may have been produced in compliance with the UFAC standard. Therefore, any additional costs associated with conforming to the standard are fairly minimal because most furniture already

complies. The furniture industry is in favor of TB 117-2013 as a national standard, as evidenced by their request to adopt TB 117-2013 as a national standard.<sup>6</sup> TB 117-2013 is a performance standard; accordingly it does not require any specific materials, including FR chemicals, or construction to comply. Additionally, by removing the open-flame testing method from TB117, the use of FR chemicals may decrease because FR chemicals were used in the furniture's foam to pass the open-flame test in TB117.

### **Disadvantages of Adopting TB 117-2013**

There are many disadvantages to adopting TB 117-2013 as a mandatory national standard. Most important, and as discussed in other parts of this package, TB 117-13 would not effectively improve upholstered furniture flammability performance. The test method is also flawed because it relies on standard materials that have not shown sufficient consistency and the standard uses a linear char length measurement that is not representative of actual burning. Like with the adoption of any standard, adoption of TB 117-2013 as a mandatory standard would likely pose an increased regulatory burden because there would likely be additional record keeping, testing, and labeling requirements for the manufacturers as opposed to currently, with no national standard in place.

### **Adopting 2008 NPR**

Similar to TB 117-2013, there are some advantages to adopting the 2008 NPR. The 2008 NPR includes a more repeatable test and potentially addresses more incidents than TB117-2013. The primary differences between TB 112-2013 and the 2008 NPR include: the NPR test method uses thicker foam, uses mass loss as the pass/fail criteria instead of char length, and includes an open-flame test for barriers. Because the 2008 NPR test method is more complex, companies currently testing to TB 117-13 or UFAC would need to make changes. However, the difference between TB 117-2013 and the 2008 NPR is still minimal and would be easy for manufacturers to become compliant. When the Commission issued the 2008 NPR, staff believed that the NPR had addressed the repeatability and inherent variability issues that exist in other standards; however, that was later shown not to be the case. As outlined in TAB D, if the 2008 proposed standard had been effective, the estimated benefits of the 2008 NPR would have been an estimated \$419 million to \$424 million.

### **Disadvantages of 2008 NPR**

Despite CPSC staff's prediction of predicting improved flammability performance of upholstered furniture when the 2008 NPR was released, the result of subsequent testing in 2012 showed that "the bench-scale performance did not demonstrate an adequate prediction of real furniture flammability performance, especially in the smoldering ignition tests."<sup>8</sup> The testing showed that the small-scale mockups did not adequately predict full-scale performance. Staff also has not been able to resolve the inherent variability of standard materials, foam and cover fabric specifically. See TAB B. Based on the last analysis in the 2008 NPR, which was conducted in to support the 2008 NPR, staff estimated that about 14 percent of new furniture items covered with cellulosic fabrics would fail the smoldering ignition test for cover fabrics. The estimated costs associated with conforming to the standard were quite varied, ranging from a simple substitution of complying cover fabrics to more expensive FR treatments and barriers. The cost of compliance was estimated to be between \$32 million and \$57 million annually.

## VI. Summary of Comparison

Both TB-117-2013 and the Commission's 2008 NPR provide for small-scale tests that rely on standard materials. Both TB 117-2013 and the 2008 NPR intend to address smoldering ignition of upholstered furniture. TB 117-2013 and the 2008 NPR have not been shown to adequately predict the performance of real furniture with smolder-prone cover fabric. Therefore, neither TB 117-2013, nor the 2008 NPR would effectively address the hazard of upholstered furniture fires. CPSC staff is not aware of any validation studies on the effectiveness of TB-117-2013. CPSC staff conducted a validation study of the 2008 NPR test method, which concluded: "the bench-scale performance did not demonstrate an adequate prediction of real furniture flammability performance, especially in the smoldering ignition tests."<sup>8</sup>

Both TB 117-2013 and the 2008 NPR rely on a standard foam and a standard cover fabric for the test. CPSC staff has conducted extensive research in this area, and staff's research has shown that it is extremely difficult to maintain sufficiently consistent standard materials because of the inherent variability of the materials and batch-to-batch variation. A lack of consistent standard materials will affect the repeatability of the test for smolder-prone fabrics. CPSC staff has shown that the test mockup geometry and pass/fail criteria used by TB 117-2013 do not produce sufficiently consistent results among tests. In addition, the TB 117-2013 standard will have other challenges that the 2008 NPR does not, including foam thickness and char length measurement issues, as described above.

A primary difference between TB 117-2013 and the 2008 NPR is that the 2008 NPR focuses on two hazard patterns (smoldering ignition and open-flame ignition), while the TB 117-2013 only addresses one hazard pattern (smoldering ignition). The differences may be significant for incidents where the upholstered furniture is the item first ignited, and the differences would be even greater when all incidents in which upholstered furniture contributed to fire fatalities, injuries and other damage. Given staff's experience, the similarities to the smoldering component of the 2008 NPR, and the known issues with the test method and standard materials, TB 117-2013 would likely perform worse at predicting the performance of real furniture and addressing incidents than the 2008 NPR. TB 117-2013 is likely to have a lower cost to implement than the 2008 NPR; however, both are likely to result in similarly minimal improvements to upholstered furniture flammability performance. The economic analysis, included in TAB D, predicts minimal benefits from a TB 117-2013-type test with minimal costs because most furniture already complies. When the NPR was published, staff predicted the NPR would provide greater benefits before staff's subsequent testing, which showed that the test method could not accurately predict the performance of real furniture)) and would impose greater costs than TB 117-2013.

Regarding exposure to potentially harmful chemicals, neither TB 117-2013, nor the 2008 NPR requires or prohibits the use of FR chemicals to comply because they are performance test methods; therefore, FR chemicals could be used to meet either TB 117-2013 or the 2008 NPR.

CPSC staff determined that neither TB 117-2013, nor the 2008 NPR will provide an adequate prediction of real-world furniture performance and will not adequately reduce the fire hazards associated with upholstered furniture. The analysis of benefits and costs showed that although TB 117-2013 would be less burdensome to implement than the 2008 NPR, both would be unlikely to result in any improvements because neither standard is likely to effectively address the hazards associated with the flammability of upholstered furniture.

## VII. Staff Recommendation

Staff recommends that the Commission not adopt TB 117-2013 or finalize the 2008 NPR. CPSC staff believes that neither test method is likely to result in any significant improvements in upholstered furniture fire safety. Neither test method adequately predicts fire performance in full-scale furniture fire scenarios. Neither test method can overcome variability in the test method caused by the variation in standard materials (polyurethane foam and standard cotton velvet).

Staff recommends terminating the current upholstered furniture rulemaking. CPSC Staff intends to develop a new briefing package in FY17 that recommends terminating rulemaking and will include a draft FR notice to terminate rulemaking with the Briefing Package for the Commission to review. CPSC staff recommends pursuing alternative approaches that address the hazard through a combination of research, education and outreach, and voluntary standards efforts. Based on the fundamental difficulties with standard materials and using small scale mockups to predict full scale flammability performance, staff is not confident that an effective mandatory standard to reduce the hazard of rapid energy and heat release from igniting furniture can be developed at this time. Additionally, staff is not confident that with current technology staff could develop a viable proposed mandatory standard using barriers that would perform effectively and be acceptable in the marketplace. Therefore, staff recommends terminating the upholstered furniture rulemaking.

Staff recommends a combined approach for addressing the flammability hazards associated with upholstered furniture including:

- Continuing to participate in the development of voluntary standards\* (working with ASTM and NFPA to revise the current standards or developing new ones);
- Coordinating with stakeholders and researchers to monitor and assess new technologies, materials, and product designs that enhance the flammability performance of upholstered furniture;
- Developing and implementing consumer awareness and education campaigns, particularly targeting vulnerable populations;
- Working to increase the installation and use of smoke alarms and sprinkler systems; and
- Monitoring other possible options and alternative approaches for addressing the fire hazards associated with upholstered furniture fires.

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<sup>1</sup> U.S. Consumer Product Safety Commission Fiscal Year 2016 Operating Plan, February 24, 2016.

<sup>2</sup> Hall, J. "Estimating Fires When a Product is the Primary Fuel But Not the First Fuel, With an Application to Upholstered Furniture," NFPA, February 2014.

<sup>3</sup> BEARHFTI, "INITIAL STATEMENT OF REASONS," March 26, 2013, <http://www.bearhfti.ca.gov/laws/isr.pdf>.

<sup>4</sup> National Institute of Standards and Technology Technical Note 1747, June 2012.

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\* Staff is always working with voluntary standards; even if we don't feel they are currently adequate, it is important to participate and promote the best solutions to problems.



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<sup>5</sup> Memorandum to D. Ray, Project Manager, Upholstered Furniture, from W. Tao, "Evaluation of Test Method and Performance Criteria for Cigarette Ignition (Smoldering) Resistance of Upholstered Furniture Materials" May 12, 2005.

<sup>6</sup> Purdue, Bill, Petition to adopt TB 117-2013 as a national standard, American Home Furnishings Association, October 30<sup>th</sup>, 2015, <http://www.regulations.gov/#!documentDetail;D=CPSC-2008-0005-0052>.

<sup>7</sup> Fansler, L., Memorandum to D. Ray, "Mockup Test Program on Upholstery Fabrics and a Fire Barrier," U.S. Consumer Product Safety Commission, July 2012.

<sup>8</sup> Mehta, S. Memorandum to D. Ray, "Upholstered Furniture Full-Scale Chair Tests – Open-Flame Ignition Results and Analysis," U. S. Consumer Product Safety Commission, May 2012.

<sup>9</sup> Fansler, L., Memorandum to D. Ray, "Summary of Data Collected During Smoldering Chair Tests," U.S. Consumer Product Safety Commission, July 2012.

# TAB A: Fire Loss Data



UNITED STATES  
 CONSUMER PRODUCT SAFETY COMMISSION  
 BETHESDA, MD 20814

**Memorandum**

Date: June 3, 2016

TO: Andrew Lock  
 Upholstered Furniture Project Manager

THROUGH : Kathleen Stralka  
 Associate Executive Director  
 Directorate for Epidemiology

Stephen Hanway  
 Division Director  
 Division of Hazard Analysis

FROM: David Miller  
 Division of Hazard Analysis

SUBJECT: Fire Loss Estimates for Upholstered Furniture 2004–2013

The FY 2016 Operating Plan of the Consumer Product Safety Commission (CPSC) called for staff to prepare a briefing package on California's mandatory regulation on the flammability of upholstered furniture, Technical Bulletin (TB) 117-2013. The Commission directed staff to summarize the feasibility, benefits and costs of adopting TB117-2013 as a mandatory national standard, as well as address the advantages and disadvantages of adopting TB117-2013 as compared to the upholstered furniture flammability standard proposed by the Commission on March 4, 2008 (73 FR 11702) (2008 NPR)). This memorandum provides the 2004-2013 estimates of fires and fire losses from residential structure fires where upholstered furniture was the *item first ignited*. The memorandum does not include estimates for all fires in which upholstered furniture became involved or contributed to deaths, injuries or property damage; just the fires where upholstered furniture was the *item first ignited*. It also provides the estimates of addressable upholstered furniture fires and associated losses.

Based on the heat source, as well as other factors, some fires are deemed addressable by a potential CPSC upholstered furniture fire safety standard, and some are not. When a fire is said to be *addressable* by the standard, this means that it is of a type that *could* be mitigated by compliant furniture under a furniture flammability standard that adequately eliminates or addresses the risk of injury associated with upholstered furniture fires. Fires that are not addressable are ones that the standard is not intended to address, for example arcing electrical hazards are not addressed by a smoldering ignition standard. This does not mean that all deaths and injuries that occur in addressable fires would not have occurred had the furniture been compliant under a furniture flammability standard. Staff expects that compliant furniture would reduce the risk of death and injury from addressable fires. However, as discussed in the CPSC staff technical memorandum, many questions remain regarding the feasibility of both the TB

This analysis was prepared by the CPSC staff, has not been reviewed or approved by, and may not necessarily reflect the views of the Commission.

117-2013 and the 2008 NPR. Staff has determined that both TB 117-2013 and the 2008 NPR have technical limitations that prevent either from adequately predicting full-size furniture flammability performance. Accordingly, the analysis presented here is premised on the possibility that through future changes either TB 117-2013 or the 2008 NPR becomes a viable mandatory standard.

To determine *addressable fire loss estimates*, staff considered upholstered furniture fires that were ignited by smoking materials or a small open flame (candle, match, or cigarette lighter) to be addressable by the 2008 NPR. Staff considered only the smoking material-ignited fires to be addressable by TB 117. However, due to the problems discovered with the small-scale mockups' failure to predict flammability of full-scale furniture, the degree to which either TB 117-2013 or the 2008 NPR would actually address any of these fire losses is questionable.

Based on data from the National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA) Annual Survey of Fire Losses, CPSC staff produces estimates of fires and fire losses associated with consumer products. These estimates are for fire department-attended fires only. They exclude fires and losses from intentionally\* set fires and include only civilian (*i.e.*, non-emergency personnel) casualties.

**Table 1. Estimated Fires and Losses from Fires Where Upholstered Furniture Was the Item First Ignited<sup>†</sup>**

Year	Fires	Deaths	Injuries	Property Loss (in \$Millions)
2004	7,200	610	800	250
2005	6,700	520	880	312
2006	6,900	480	860	342
2007	6,600	540	780	334
2008	6,000	510	940	352
2009	4,900	420	780	325
2010	4,900	410	710	249
2011	5,100	390	710	265
2012	4,500	370	610	222
2013	4,600	410	670	226

Note: Fires are rounded to the nearest hundred, deaths and injuries to the nearest ten, and property losses to the nearest million dollars.

NFIRS is not a probability sample. Therefore, it is not possible to use statistical inference to assess statistical significance. Staff provides graphs of the estimates to give a sense of changes in upholstered furniture fires, deaths, injuries, and fire losses over time.

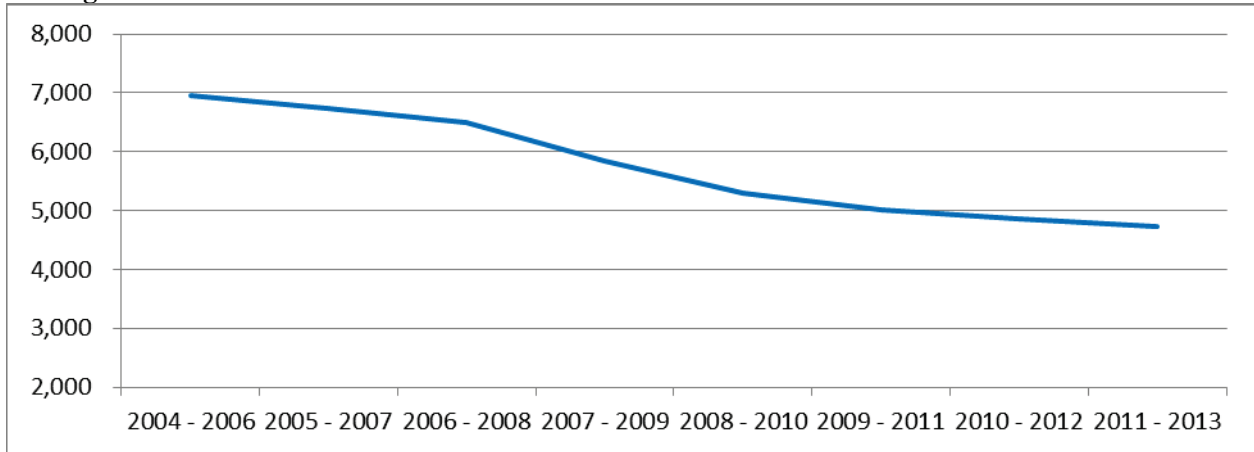
Figures 1 – 4 show 3-year annual averages of the estimates of fires and associated losses where upholstered furniture was the item first ignited. There is a lot of year-to-year variability in the

\* If an intentional fire is identifiable as a 'child play' fire, it is not excluded.

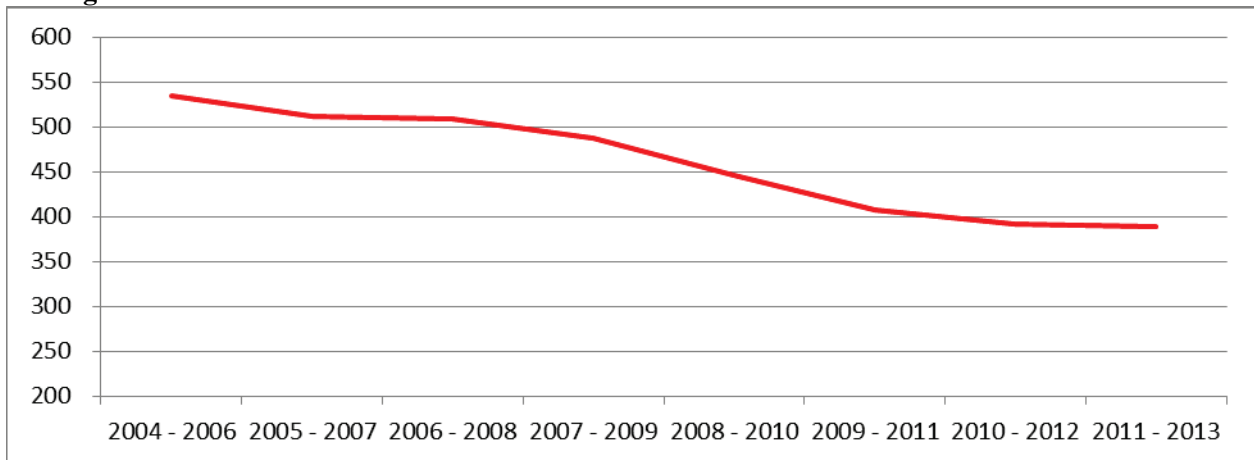
<sup>†</sup> Source: Tables 2a – 2d, "2003 – 2005 Residential Fire Loss Estimates", U.S. Consumer Product Safety Commission, April 2008. Tables 2a – 2d, "2006 – 2008 Residential Fire Loss Estimates," U.S. Consumer Product Safety Commission, July 2011. Tables 2a – 2d, "2009 – 2011 Residential Fire Loss Estimates," U.S. Consumer Product Safety Commission, July 2013. Tables 2a – 2d, "2011 – 2013 Residential Fire Loss Estimates", U.S. Consumer Product Safety Commission, May 2016.

estimates. Using 3-year averages helps to present a clearer picture of what is happening over many years, by smoothing out these fluctuations. Figure 1 provides the fire estimates. Figure 2 shows the death estimates. Figure 3 is the injury estimates. and Figure 4 shows the property loss estimates.

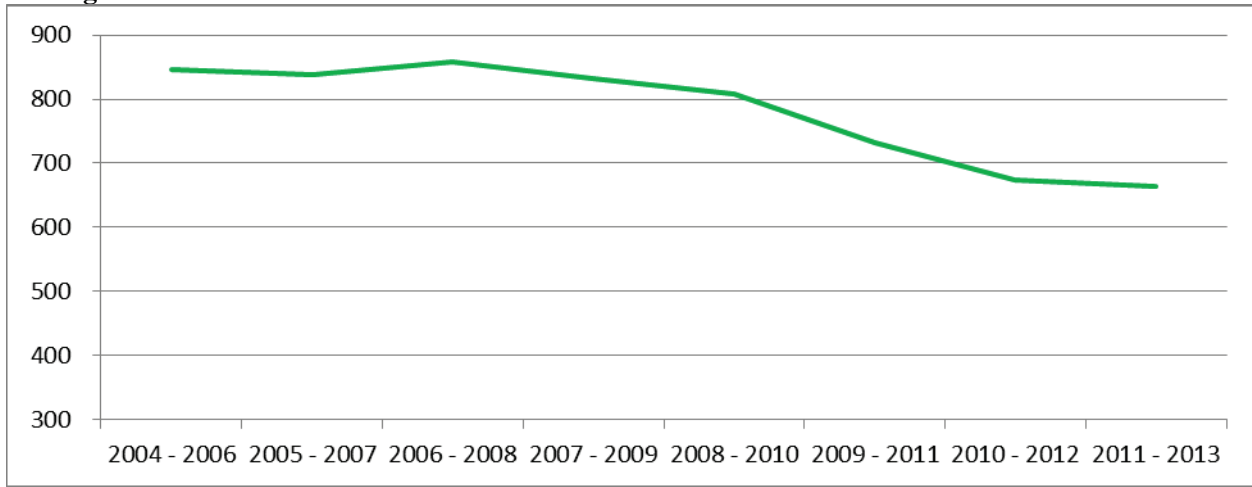
**Figure 1. Estimated Fires Where Upholstered Furniture Was the Item First Ignited, 3-Year Averages**



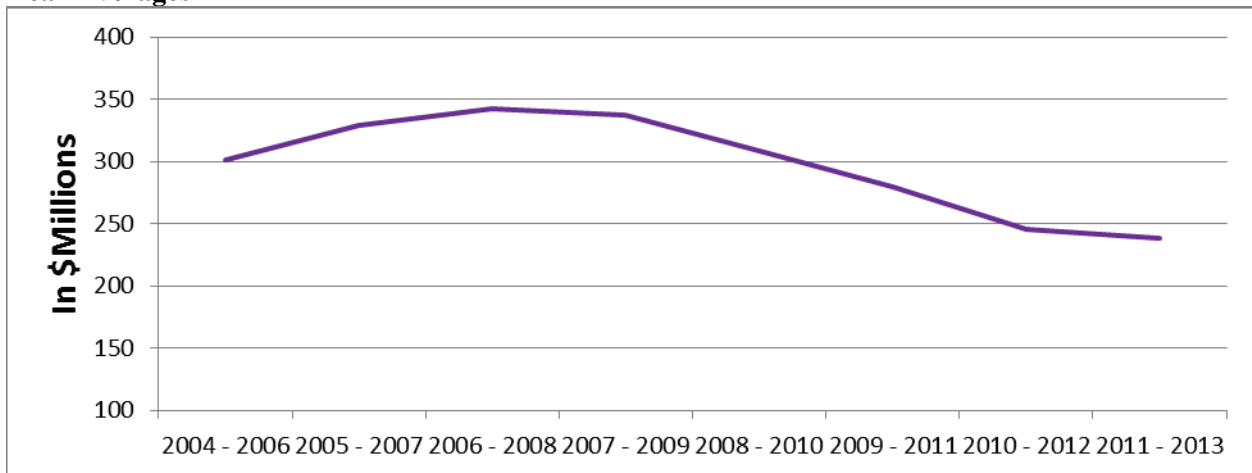
**Figure 2. Estimated Fire Deaths Where Upholstered Furniture Was the Item First Ignited, 3-year Averages**



**Figure 3. Estimated Fire Injuries Where Upholstered Furniture Was the Item First Ignited, 3-Year Averages**



**Figure 4. Estimated Property Loss Where Upholstered Furniture Was the Item First Ignited, 3-Year Averages**



**Addressable Upholstered Furniture Fires and Losses**

Tables 2 - 5 show estimates of **addressable** fires and fire losses from fires where upholstered furniture was the *item first ignited* in the fire. As with the previous estimates, these estimates are limited to fire department-attended, unintentional residential structure fires and to civilian casualties. The estimates are broken down between whether the *heat source* was a small open flame (candle, match, or lighter) or smoking materials. Staff considered upholstered furniture fires with other *heat sources* not to be addressable by a standard. These estimates differ from the estimates in Tables 2a-2d of the Residential Fire Loss Estimate report because these estimates are restricted to **addressable** fires only.

**Table 2. Estimates of Addressable Fires Where Upholstered Furniture Was the Item First Ignited**

Year	Smoking Materials	Small Open Flame	Total
2004	2,200	1,000	3,200
2005	1,800	1,100	2,900
2006	1,800	1,100	2,900
2007	1,700	1,000	2,700
2008	1,500	800	2,300
2009	1,200	600	1,800
2010	1,200	600	1,900
2011	1,200	700	1,800
2012	1,100	600	1,800
2013	1,000	600*	1,600

Note: Fires are rounded to the nearest hundred. Detail may not add to total due to rounding.

**Table 3. Estimates of Addressable Fire Deaths Where Upholstered Furniture Was the Item First Ignited**

Year	Smoking Materials	Small Open Flame	Total
2004	290	20	310
2005	280	60	330
2006	260	10	270
2007	300	50	350
2008	190	50	230
2009	190	20	210
2010	210	70	280
2011	140	40	180
2012	130	10	150
2013	230*	0	230

Note: Deaths are rounded to the nearest ten. Detail may not add to total due to rounding.

**Table 4. Estimates of Addressable Fire Injuries Where Upholstered Furniture Was the Item First Ignited**

Year	Smoking Materials	Small Open Flame	Total
2004	290	140	430
2005	360*	140	510
2006	300	180	490
2007	280	170	450
2008	290	220	510
2009	240	120	360
2010	220	130*	350
2011	220	140	360
2012	270*	140*	410
2013	240*	80*	320

Note: Injuries are rounded to the nearest ten. Detail may not add to total due to rounding.

\* Although addressable fires and fire losses are a subset of total fires and fire losses, the estimate can be higher than the total estimates from the residential fire loss report because there are different variables included in the raking procedure. See Methodology in Appendix for further explanation.

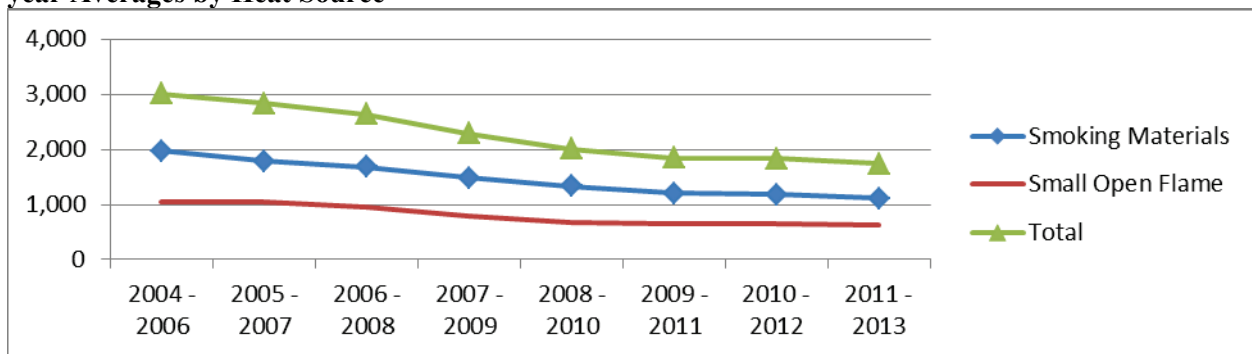
**Table 5. Estimates of Addressable Fire Property Loss (in \$Millions) Where Upholstered Furniture Was the Item First Ignited**

Year	Smoking Materials	Small Open Flame	Total
2004	72	41	113
2005	85 <sup>4</sup>	66	151
2006	99	64	163
2007	98	37	135
2008	74	54	128
2009	76	60	137
2010	59	35	94
2011	68	32	99
2012	57	29	86
2013	49	24	73

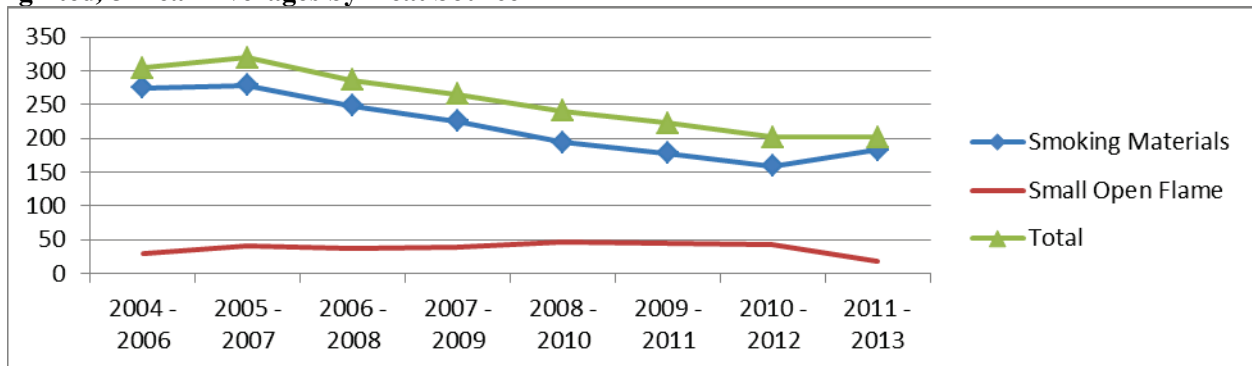
Note: Property loss is rounded to the nearest million dollars. Detail may not add to total due to rounding.

Figures 5 – 8 show 3-year averages of these estimates of addressable upholstered furniture fires and associated losses.

**Figure 5. Estimated Addressable Fires where Upholstered Furniture was the Item First Ignited, 3-year Averages by Heat Source**

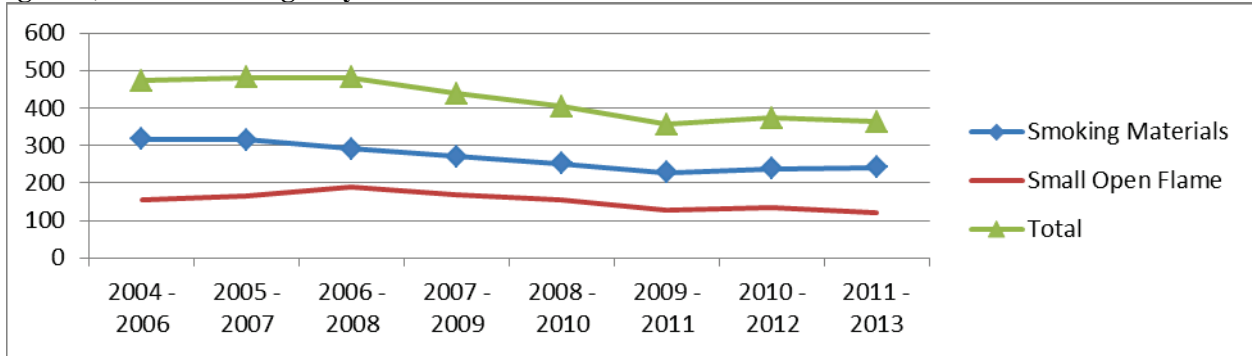


**Figure 6. Estimated Addressable Fire Deaths Where Upholstered Furniture Was the Item First Ignited, 3-Year Averages by Heat Source**

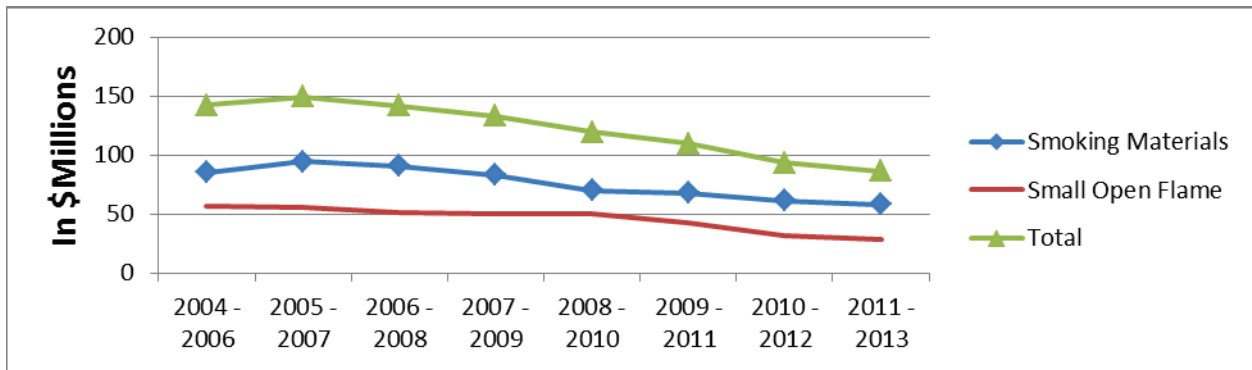




**Figure 7. Estimated Addressable Fire Injuries Where Upholstered Furniture Was the Item First Ignited, 3-Year Averages by Heat Source**



**Figure 8. Estimated Addressable Fire Property Loss Where Upholstered Furniture Was the Item First Ignited, 3-Year Averages by Heat Source**



The estimates of addressable upholstered furniture fires and the associated deaths, injuries, and property loss have decreased between 2004 and 2013 (the most recent year of available estimates). The same is true for the total (addressable and non-addressable) estimates of upholstered furniture fires and losses. Although this is true, there remain a large number of upholstered furniture fire deaths and injuries. The most recent 3-year average estimates (2011–2013) show an annual average of 4,700 upholstered furniture fires, resulting in 390 deaths and 660 injuries. Of these, an estimated annual average (2011-2013) of 1,700 fires, 200 deaths, and 360 injuries are addressable.

## Appendix: Estimation Methodology and Addressability

### Methodology:

The estimates are obtained following the general procedure of the National Estimates Approach.\* This means using NFIRS to estimate the proportion of residential structure fires and fire losses that have upholstered furniture as the *item first ignited*, then multiplying this proportion by residential structure fire and fire loss totals (across all products) obtained from the annual NFPA survey of fire losses.

To estimate the proportion of fires and fire losses involving upholstered furniture, staff performed an imputation method known as *raking*. It is necessary to impute because some of the NFIRS data are incomplete (e.g., the *item first ignited* is sometimes left blank or coded as “unknown”). The raking procedure is performed by a SAS macro.† Raking maintains the marginal distributions for the known data, while imputing the unknown data for all of the variables involved.

The SAS macro that does the raking for the upholstered furniture estimates involves three NFIRS variables: (1) *cause of ignition*; (2) *item first ignited*; and (3) *heat source*. The raking imputes the unknown data for these variables. The *cause of ignition* variable has codes for intentional and unintentional fires. This variable is included because intentional fires and their losses are excluded from the estimates (with the exception of child play). The *item first ignited* variable is the NFIRS variable that has “Upholstered furniture” as one of the codes. For the raking procedure, this variable is broken down to “Upholstered furniture,” “Not upholstered furniture” and “unknown.” The raking imputes the unknown data. The *heat source* variable indicates what provided the source of heat for the fire. For this procedure, it is broken up into “smoking materials” “small open flame,”‡ “other heat source,” and “unknown.” Only fires where the *heat source* is “smoking materials” or “small open flame” are addressable by the draft standard.

The raking procedure is performed separately for the different losses (fires, deaths, injuries, and property losses). After the raking is performed, there are NFIRS estimates for each loss (with intentional fires and their losses excluded), broken down by “smoking materials” and “small open flame.” Then the estimates are weighted up by the totals from the NFPA survey for each particular loss to obtain national estimates.

The upholstered furniture code for the *item first ignited* variable is ‘21 – Upholstered sofa, chair, vehicle seats.’ The *heat source* codes that comprise the “smoking materials” category are: “61 – Cigarette”; “62 – Pipe or cigar”; and “63 – Heat from undetermined smoking material.” The “small open flame” *heat source* codes are: “64 – Match”; “65 – Lighter: cigarette lighter, cigar lighter”; and “66 – Candle.”

The raking procedure for the 2013 deaths estimates produced unusual results. It provided 2013 estimates much higher than previous years despite the fact that there were not more NFIRS deaths in 2013. This also happened in the raking to obtain the 2013 Upholstered Furniture death estimate in the 2011-2013 Residential Fire Loss Estimates report.§ This is more likely to happen with deaths than with other losses because the numbers are smaller and there are more zero-filled categories, which can cause problems for the raking procedure. As in the annual fire loss report, a modification to the raking method was made

\* J. Hall, B. Harwood, “The National Estimates Approach to U.S. Fire Statistics”, *Fire Technology*, May 1989.

† M. Battaglia, D. Hoaglin and D. Izrael, “A SAS Macro for Balancing a Weighted Sample”, SAS Users Group International (SUGI) 25<sup>th</sup> Annual Conference, April 9-12, 2000, Paper #258-25.

‡ ‘Small open flame’ consists of candles, matches, and cigarette lighters.

§ Tables 2b, “2011 – 2013 Residential Fire Loss Estimates,” U.S. Consumer Product Safety Commission, May 2016.

only for the 2013 death estimates. The NFIRS fire deaths for 2011, 2012, and 2013 were pooled and a variable for year was added to the raking. This provided more deaths in the “known” categories into which “unknown” deaths could be allocated. This caused the raking to behave more smoothly. It results in separate estimates for each of 2011, 2012, and 2013. The 2013 death estimates (for “Smoking Materials,” “Small Open Flame,” and “Total”) were used for the 2013 estimates in this report. Because a separate raking procedure was executed to produce addressable fire loss estimates, the estimates may differ from those that appear in the 2011-2013 Residential Fire Loss Estimates report (which includes unaddressable fires). In some cases, the estimate produced in Tables 2-5 above can even exceed the estimates appearing in the 2011-2013 Residential Fire Loss Estimates report because the distribution of knowns prior to allocation for addressable fires differed somewhat from those for all residential structure fires.

#### Addressability and Scope:

It is not expected that all of the fire losses associated with upholstered furniture would be eliminated under CPSC’s 2008 draft standard. draft standard addresses only fires from small open-flame and smoking materials ignitions of upholstered furniture. Ignitions from other sources, such as electric appliances or space heaters, would not be addressable. Under TB 117-2013, only smoking materials ignitions would be addressable.

Before the raking is performed, some NFIRS variables are used to eliminate some cases for being out of scope for the analysis. These variables are *equipment involved in ignition, factors contributing to ignition, area of fire origin, and type of material first ignited*. An example of an out-of-scope case is one where the *item first ignited* is upholstered furniture but the *type of material first ignited* is coded as “Food, starch” Tables A1 and A2 list these NFIRS 5.0 variables, along with the breakdown showing which codes are in scope vs. out of scope:

Table A1: Equipment Involved in Ignition Codes.

<b>Description</b>	<b>Code</b>	<b>Scope</b>
Heating, Ventilating & Systems Air Conditioning	100 – 152	Out
Electrical Distribution, Lighting & Power Transfer	200 – 263	Out
Shop Tools & Industrial Equipment	300 – 377	Out
Commercial & Medical Equipment	400 – 451	Out
Garden Tools & Agricultural Equipment	500 – 538	Out
Kitchen & Cooking Equipment	600 – 656	Out
Electronic and Other Electrical Equipment	700 – 757	Out
Personal & Household Equipment	800 – 897*	Out
Other equipment involved in ignition	000	Out
Equipment involved in ignition undetermined	UUU	In
Other	All other codes	In

\*Excludes 872 “Charcoal lighter” and 873 “Cigarette lighter, pipe lighter.”

Table A2: Factors Contributing to Ignition Codes.

<b>Description</b>	<b>Code</b>	<b>Scope</b>
Cutting, welding too close to combustible	13	Out
Flammable liquid or gas spilled	14	Out
Improper fueling technique	15	Out
Flammable liquid used to kindle fire	16	Out
Washing part, painting with flammable liquid	17	Out
Improper container or storage	18	Out
Mechanical Failure, Malfunction	20 – 27	Out
Electrical Failure, Malfunction	30 – 37	Out
Equipment overloaded	54	Out
Undetermined factor contributing to ignition	UU	In
Other	All other codes	In

Table A3: Type of Material First Ignited Codes.

<b>Description</b>	<b>Code</b>	<b>Scope</b>
Flammable Gas	10 – 19	Out
Flammable, Combustible Liquid	20 – 29	Out
Volatile Solid, Chemical	30 – 39*	Out
Cork	52	Out
Hay, straw	54	Out
Coal, coke, briquettes, peat	56	Out
Food, starch	57	Out
Tobacco	58†	Out
Wood Paper	60 – 69	Out
Wig	75	Out
Human hair	76	Out
Material Compounded with Oil	80 – 89	Out
Multiple types of material first ignited	99	Out
Undetermined type of material	UU	In
Other	All other codes	In

\*Excludes code 33 “Polish, paraffin, wax” when *Heat Source* is 66 “Candle, taper.”

† Excludes code 58 “Tobacco” when *Heat Source* is 61 “Cigarette” or 62 “Pipe or cigar.”

Table A4: Area of Origin Codes.

<b>Description</b>	<b>Code</b>	<b>Scope</b>
Escalator	4	Out
Dumbwaiter or elevator shaft	51	Out
Conduit, pipe, utility, or ventilation shaft	52	Out
Light shaft	53	Out
Chute; laundry or mail, excluding trash chutes	54	Out
Duct: hvac, cable, exhaust, heating, or AC	55	Out
Chimney	57	Out
Conveyor	58	Out
Wall surface	75	Out
Wall surface: exterior	76	Out
Awning	78	Out
Transportation, Vehicle Area	80 – 89	Out
Undetermined area of origin	UU	In
Other	All other codes	In

# **TAB B: Technical Review of TB 117-2013 and the 2008 NPR**



UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
BETHESDA, MD 20814

Fansler, Kim, Lock, Tech Memo Page: 1

## Memorandum

Date: August 11<sup>th</sup>, 2016

TO : Andrew Lock, Ph.D., Project Manager, Upholstered Furniture Project,  
Division of Engineering

THROUGH: Andrew G. Stadnik, P.E.,  
Associate Executive Director, Directorate for Laboratory Sciences

Joel Recht, Ph.D.,  
Associate Executive Director, Directorate for Engineering Sciences

Allyson Tenney,  
Director, Division of Engineering

Andrew Trotta,  
Director, Division of Electrical Engineering and Fire Sciences

FROM : Linda Fansler, Division of Engineering  
Andrew Lock, Ph.D., Division of Engineering  
Yeon Seok Kim, Ph.D., Division of Electrical Engineering and Fire Sciences

SUBJECT : Technical Review of TB 117-2013 and the CPSC 2008 NPR Test Methods for  
Upholstered Furniture Flammability

### I. Introduction

The Commission's FY16 Operating Plan directed staff to:

“summarize the feasibility, benefits and cost of adopting TB 117-2013 as a mandatory national standard. The briefing package will also address the advantages and disadvantages of adopting TB 117-2013 as compared to the advantages and disadvantages of the upholstered furniture flammability standard proposed by the Commission in March 2008.”

This memorandum includes:

- Background on the CPSC's Upholstered Furniture Project;
- The history of California's TB 117-2013;
- A technical discussion of California's TB 117-2013, including the advantages and disadvantages of adopting TB 117-2013 as a mandatory standard; and
- Discussion of CPSC's draft proposed upholstered furniture flammability standard, including the advantages and disadvantages of adopting this draft proposed standard as a mandatory standard.

## II. Background – Upholstered Furniture Project

In 1993, the National Association of State Fire Marshals (NASFM) petitioned the CPSC to issue regulations under the Flammable Fabrics Act Regulations (FFA) to address upholstered furniture fire risks. The Commission granted the petition, in part, and issued an advance notice of proposed rulemaking (ANPR) on June 15, 1994, which directed staff to assess the specific risk of small open-flame-ignited fires. 59 FR 30735 (1994). The Commission denied the other parts of the petition regarding large open-flame-ignited fires, and the Commission deferred action on the petition regarding cigarette-ignited fires, pending a staff evaluation of: (1) the level of voluntary conformance to existing voluntary industry guidelines, and (2) the overall level of cigarette ignition resistance among products on the market.

Following issuance of the 1994 ANPR, CPSC staff developed a draft performance standard and a test method to evaluate the small open-flame performance of upholstered furniture. In October 1997, staff forwarded a briefing package to the Commission, which concluded that a small open-flame standard was feasible and could effectively reduce the risk to consumers, including both small open-flame and cigarette ignitions. Staff recommended that the Commission defer action until the agency could gather additional scientific information to ensure that flame-retardant (FR) upholstery fabric treatments that manufacturers might use would not result in adverse health effects. The staff also recommended that the Commission defer action on the cigarette ignition portion of the 1993 NASFM petition, pending a decision on open-flame ignition. On October 5, 2001, NASFM withdrew the portion of the petition seeking Commission action on cigarette-ignited fires.

In July 2003, CPSC staff recommended that the Commission issue an ANPR to expand the upholstered furniture rulemaking to reinsert consideration of smoldering ignition. The Commission accepted staff's recommendation, and the ANPR was published on October 23, 2003. 68 FR 60619 (2003). The 2003 ANPR sought comment on issues relating to the kinds of standard provisions that might best address the upholstered furniture fire risk in its entirety dealing with both hazard patterns (open flame and smoldering ignition).

On March 4, 2008, the Commission issued a notice of proposed rulemaking (NPR) for a flammability standard for residential upholstered furniture under the FFA. 73 FR 11702. The NPR proposed performance requirements to reduce the likelihood of both open-flame and smoldering-induced ignition of upholstered furniture. Manufacturers and importers of upholstered furniture could choose one of two possible methods for compliance: (1) use upholstery cover material that met the specified cigarette-ignition performance test, *i.e.*, "Type I" furniture; or (2) incorporate an interior fire barrier between the cover fabric and interior filling materials that met both the smoldering and small open-flame resistance tests, *i.e.*, "Type II" furniture. An "interior fire barrier" was defined as a fire-resistant material that is interposed between the upholstery cover fabric and any interior filling material. The 2008 proposed rule on upholstered furniture flammability focused on performance standards that did not require manufacturers or importers to use FR chemical additives to achieve compliance.

At the time the NPR was published in 2008, CPSC staff acknowledged that real-scale validation testing was needed to demonstrate that the bench-scale test approach presented in the NPR was adequate to address the fire performance of full-scale furniture. Shortly after the release of the 2008 NPR, CPSC staff conducted open-flame and smoldering-ignition evaluations using small bench-scale constructions.<sup>1</sup> Staff believed that the standard materials necessary for the validation study would not show any variation, and therefore, they would not impact results of the



validation study. This did not prove to be the case. Two key issues were revealed during the validation study that staff conducted after the 2008 NPR was published: (1) lack of scaling between bench-scale mock-ups and actual furniture, and (2) lack of consistent standard materials.<sup>2</sup> Each issue is discussed in turn.

First, staff's testing identified scaling issues. The bench-scale performance in staff's testing did not demonstrate an adequate prediction of real furniture flammability performance, especially in the smoldering ignition tests. The open-flame ignition bench-scale qualification tests for fire barriers, however, did appear to result in correlation that could predict improvements in full-scale fire performance in open-flame tests.<sup>2</sup>

The smoldering ignition tests showed that the specified materials did not behave consistently. Cover fabrics that staff expected to result in a range of smolder insult to the underlying foam filling material did not show a practical difference. Similarly, the test of foam smolder performance, with and without the presence of a fire barrier, was also not practically different. Staff ordered polyurethane foam from different manufacturers using the same specifications in the NPR as the foam used in the preliminary testing. Staff determined that the differences in materials caused inconsistent smoldering results. The bench-scale open-flame tests showed that the barrier was able to prevent ignition of the foam, as predicted.

In 2013, the Commission published a *Federal Register* Notice Requesting Comments on Upholstered Furniture Fire Safety Technology (CPSC Docket No. CPSC-2008-0005) and held an Upholstered Furniture Fire Safety Technology Meeting. 78 FR 17140 (2013). The goal of the meeting was to "gather additional information about the current and anticipated progress in fire barrier technologies and their application to upholstered furniture." Fifty-one comments were received, and the meeting included panelists and attendees from the furniture and fire barrier industries, the fire services, and government and private research laboratories. Fire barrier technology, test methods and research were discussed at the meeting.

Following the meeting, staff initiated a test program to assess fire barrier technologies. In 2014, staff completed initial flammability testing of full-scale furniture, chemical makeup, and analysis of five fire barriers. The 2014 test program included a series of full-scale smoldering and open-flame tests to evaluate the potential effectiveness of a limited number of fire barrier products in reducing the severity of upholstered furniture fires. In addition, to simulate wear, some chairs were also mechanically stressed before testing.

In general, the use of barriers reduced the severity of the fires and delayed the most intense burning to different degrees. The mechanically stressed chairs burned slightly faster than the non-stressed chairs evaluated in open flame tests. Only two fire barriers were able to prevent fire from occurring some of the time.<sup>3</sup>

Results for the smoldering ignition testing showed that the upholstery fabric contributed more than the fire barrier to whether a chair transitioned to flaming. The non-stressed chairs burned slightly slower than the stressed chairs.

In November 2015, the Commission received a request from the American Home Furnishings Association (AHFA) to adopt TB 117-2013.\* The Office of the General Counsel did not docket

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\* Purdue, Bill, Petition to adopt TB 117-2013 as a national standard, American Home Furnishings Association, October 30<sup>th</sup>, 2015, <http://www.regulations.gov/#!documentDetail;D=CPSC-2008-0005-0052>

the request as a petition, noting that the Commission has active rulemaking on upholstered furniture flammability. However, AHFA was notified that their letter would be treated as a comment and made part of the record in the existing rulemaking process.

In February 2016, as part of the FY 2016 Operating Plan, the Commission directed staff to prepare a briefing package on California's TB 117-2013, specifically discussing the advantages and disadvantages of adopting TB 117-2013 as a mandatory standard and the advantages and disadvantages of adopting CPSC staff's draft 2008 proposed upholstered furniture flammability standard.

### III. California Technical Bulletin 117-2013

#### History of the State of California's TB-117

In California, the Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation, (Bureau or BEARHFTI) develops flammability standards in the form of Technical Bulletins, which are adopted through regulation. California is the only state to have a mandatory flammability standard for residential upholstered furniture. California's mandatory upholstered furniture standard, *Requirements, Test Procedure and Apparatus for Testing the Flame Retardance of Resilient Filling Material Used in Upholstered Furniture* Technical Bulletin 117 (TB-117) went into effect in 1975.<sup>4</sup>

Before revision in 2013, TB-117, a performance standard, required that the filling materials and upholstered furniture cover fabrics meet individual component testing to ensure that they pass open-flame and cigarette smolder tests. The testing provisions for pre-2013 TB-117 required the cover fabric to pass a 1-second small-flame impingement test and for filling materials to be exposed to a 12-second open-flame test and a smolder test. Manufacturers met the open-flame requirement for foam filling material predominately through the use of polyurethane foam treated with FR chemicals, according to the Bureau.<sup>5</sup> Even though TB-117 only required furniture sold in California to comply, manufacturers often sold TB-117-compliant furniture across the United States and Canada to avoid maintaining a double inventory.

The pre-2013 TB-117\* had several limitations, including:<sup>5</sup>

- Not addressing the interactions between the cover fabric and the filling material in fire performance for smoldering, and
- Focusing on the filling material passing a stringent open-flame test when the cover fabric is the first material to ignite.

In 2012, the Bureau was directed<sup>6</sup> to revise the flammability standards for upholstered furniture sold in California. The goal was to review the standards and recommend changes to reduce FR chemicals while continuing to ensure fire safety.<sup>5</sup> Bureau staff began reviewing TB-117, upholstered furniture flammability research conducted by CPSC and others. In addition, Bureau staff conducted research to investigate the interaction of the upholstery cover fabric with foam filling materials.

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\* In March 2000 a minor change was made to TB-117. The change was made to the test procedure for open-flame resistance of battings and pads made from natural fiber, such as cotton. The 'afterglow' failure criterion was dropped, but the criteria of "char length" and "after flame" was maintained. Afterglow was dropped because it was not a reasonable predictor of how natural fiber battings burn.

The Bureau determined<sup>5</sup> that TB-117 did not adequately address the flammability performance of the upholstery cover fabric and the interactions with filling materials with either an open-flame or smoldering ignition source. In addition, research conducted by CPSC indicated that FR foam can actually increase smolder propensity.<sup>7</sup>

The Bureau's research confirmed that upholstery cover fabrics and their interactions with filling materials impact the smoldering performance of upholstered furniture. The Bureau found that "heavier smolder prone fabrics when exposed to a smoldering cigarette impart more energy to the mock-up substrates, resulting in significant weight loss of the polyurethane foams."<sup>8</sup> Conversely, less smolder-prone upholstery fabrics improved the flammability performance and result in less weight loss of the foam filling material.

The Bureau stated "According to existing fire statistics, residential upholstered furniture fires have declined significantly in California and across the nation over the last two decades. National fire incidents related to upholstered furniture have dropped 80 percent resulting in a significant reduction in consumer deaths."<sup>3</sup> The California Department of Public Health reported\* that upholstered furniture fires cause an estimated 50 deaths annually; 44 were smoking-related deaths, as an annual average 2008-2010.<sup>9</sup> In 2011 The National Fire Protection Association reported upholstered furniture fires have dropped 80 percent nationally since 1980, resulting in a significant reduction in consumer deaths.<sup>10</sup>

In spite of the decline in deaths and injuries due to upholstered furniture fires in the State of California, there is still a perceived need to ensure the fire safety of upholstered furniture. The Bureau began work on a new standard to address the flammability performance of the upholstery cover fabric and its interaction with filling materials. The Bureau concluded, based on research available at the time, fire statistics, and available technologies that a new standard should address the predominant source of upholstered furniture fire deaths, which is, smoldering materials.

The Bureau held public workshops<sup>5</sup> on the development of the new upholstered furniture flammability standard and consulted with industry during the development process. In June 2013, TB 117-2013 was introduced. TB 117-2013, "*Requirements, Test Procedure and Apparatus for Testing the Smolder Resistance of Materials Used in Upholstered Furniture*" supersedes TB-117.

### **California Technical Bulletin 117-2013**

The new TB 117-2013 standard, which became effective on January 1, 2014, no longer contains open-flame requirements and only contains smoldering-related requirements. TB 117-2013 expanded the old standard by including smoldering evaluations of cover fabrics, decking materials, barrier materials, and filling materials and the interaction while burning of those upholstery components with each other. Manufacturers were given a year to comply with the new standard; all upholstered furniture sold in the State of California must comply with the requirements of TB 117-2013 as of January 1, 2015.

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\* Data are based on the U.S. Department of Homeland Security, U.S. Fire Administration, National Fire Data Center, Topical Fire Report Series, Smoking-Related Fires in Residential Buildings (2008-2010).

The Bureau<sup>11</sup> describes TB 117-2013 as a “semi-composite” test; components are combined with standard test materials to construct a test specimen. TB 117-2013 requires the use of a fire barrier material when using smolder-prone upholstered fabrics. The inclusion of a fire barrier is intended to slow down the time to ignition. The Bureau concludes this will address the leading cause of upholstered furniture fires today, and provide consumers with “a greater level of fire protection by reducing upholstered furniture’s smolder ignition potential.”<sup>5</sup> Although not currently part of TB 117-2013, the Bureau has plans to investigate the open flame performance of fire barrier materials potentially addressing the transition from smoldering ignition to open flame furniture fires.

In addition to these revisions to the smoldering requirements, TB 117-2013 discontinued the open-flame test with the intent of reducing the use of FR chemicals. Additionally, materials that already complied with TB-117 do not need to be retested. Although TB 117-2013 does not ban the use of FR chemicals, it does make it more likely for manufacturers to pass the standard without the use of FR chemicals because the standard no longer includes an open-flame test.

TB 117-2013 is based on ASTM International (ASTM) standard E1358-08a<sup>e1</sup>, *Standard Test Methods for Cigarette Ignition Resistance of Components of Upholstered Furniture*. The scope of ASTM E1358-08a<sup>e1</sup> states: “These test methods are designed for the assessment of the resistance of upholstered furniture component assemblies to combustion after exposure to smoldering cigarettes under specified conditions.” The Bureau’s Initial Statement of Reasons states<sup>5</sup>: “The standard (ASTM E1358-08a<sup>e1</sup>) has been in existence since the late 1990’s, and has proven to be a reliable testing method for the ignition of upholstered furniture from smoldering sources.” Although the Bureau provides no data or any indication of a study to verify the Bureau’s conclusions, the Bureau states they examined ASTM E1358-08a<sup>e1</sup> and determined that with some modification, ASTM E1358-08a<sup>e1</sup> would provide consumers with adequate protection from smoldering-ignited upholstered furniture fires.<sup>5</sup>

It is important to note that there are several caveats stated in TB 117-2013:

- “These methods are intended to estimate the performance of upholstered furniture under conditions of exposure to a smoldering cigarette. This is accomplished by testing furniture component assemblies. However, interactions between components in production furniture are not necessarily predicted by component assembly testing.”
- “These test methods are not intended to measure the performance of upholstered furniture under conditions of open flame exposure and do not indicate whether the furniture will resist the propagation of flame under severe fire exposure or when tested in a manner that differs substantially from the test standard.”
- “The results obtained with a material component tested in mock-up, in accordance with these test methods, do not necessarily indicate the performance of the same material component in other geometrical configurations, such as in full size furniture.”

The Bureau is currently studying the feasibility of an open-flame test method for barrier materials. A study is ongoing designed to evaluate available and emerging fire barrier materials and other relevant technologies. Included in the study is an examination of open-flame properties of available and emerging fire barrier materials and other relevant technologies. In addition, the Bureau plans to monitor and evaluate the cost effectiveness of using fire barrier materials and determine the feasibility of using fire barrier materials in upholstered furniture constructions.

The Bureau invited CPSC staff to participate in this study. CPSC staff is monitoring this effort by providing comments on a proposed test method, participating in workgroup discussions and reviewing draft findings. The study is conducted in stages with a goal for the final stage to be completed in December 2016.

## **TB 117-2013 Test Method and Requirements**

### ***Summary***

TB 117-2013 is a mandatory standard required in California to evaluate the smolder resistance of the cover fabrics, barrier materials, filling materials, and decking materials used in upholstered furniture. TB 117-2013 consists of four sections outlining the test procedures evaluating individual components. Each test involves a small mockup consisting of the test specimen and the standard materials. The mock-up assembly is exposed to a lighted cigarette, which is allowed to burn its full length. Char length measurements determine whether the individual components pass or fail TB 117-2013.

### ***Specimen preparation***

The test specimen, mock-up assembly, and ignition source are conditioned for a minimum of 24 hours at  $70 \pm 5$  °F ( $21 \pm 3$ °C) and less than 55 percent relative humidity prior to the test. The test should begin within 10 minutes of removal of samples from the conditioning area if the testing and conditioning areas have different conditions. Two-inch (51 mm) thick standard polyurethane substrates are used as supporting panels. Specimen dimensions are as follows:

- Cover Fabric: 8 × 8 inches (203 × 203 mm) for horizontal panel and 8 × 15 inches (203 × 381 mm) for vertical panel.
- Barrier Material: 8 × 8 inches (203 × 203 mm) and 8 × 12 inches (203 × 305 mm) barrier material specimen for horizontal and vertical panels. 8 × 8 inches (203 × 203 mm) and 8 × 15 inches (203 × 381 mm) Standard Type II fabrics for horizontal and vertical panels (see Table 1) are used as cover fabrics.
- Resilient Filling Material: The required thickness of the resilient filling specimen is 2 inches (51 mm). If the material thickness is less than required thickness, stack multiple layers or combine with a 1 inch (25.4 mm) thick removable plywood panel to meet the 2 inch (51 mm) thickness requirement. Standard Type I fabric is used as cover fabrics.
- Decking: 21 × 13.5 inch (533 × 343 mm) with at least 1 inch (25 mm) thickness. 21 × 13.5 inch (533 × 343 mm) Standard Type I fabric is used as cover fabrics.

### ***Test Procedure***

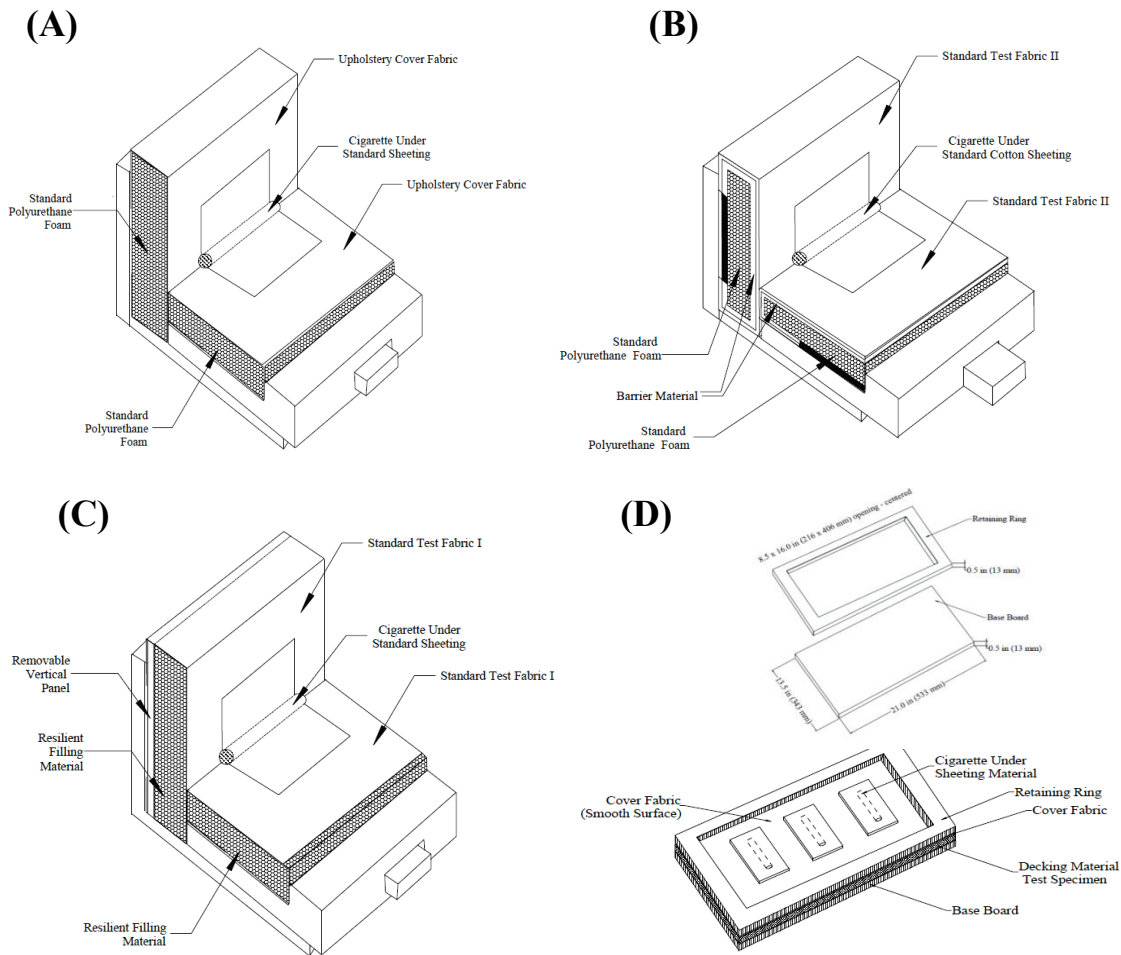
Although not specified in TB 117-2013, the Bureau recommends conducting the test inside of an enclosure.<sup>4</sup> This enclosure is different than the enclosure specified in ASTM E1353-08a<sup>e1</sup>. The enclosure specifications are listed in TB-117-2000, and are 48-inches (1219 mm) long, 21-inches (533 mm) deep, and 18-inches (457 mm) high, with an integral bottom, but without top. The enclosure is designed so that three test mockups may be positioned simultaneously inside of the enclosure.

### **Cover Fabric, Barrier Material, and Resilient Material Test**

1. Construct the horizontal and vertical panels by placing the test specimen on the polyurethane substrate 5 × 8 × 2 inches (127 × 203 × 51 mm) and 8 × 8 × 2 inches (203 × 203 × 51 mm) for horizontal and vertical panels. Resilient-material test panels are constructed by wrapping

each specimen panel with the cover fabric. Place the standard cover fabric on the barrier material and resilient-material specimen.

2. Assemble a test mock-up by placing the constructed panels in a mock-up tester, as shown in Figure 1.
3. If testing multiple specimens simultaneously, place the individual test specimen at least 6 inches apart.
4. Light three cigarettes and place a lighted cigarette on the crevice of each test mock-up.
5. Place a piece of sheeting material (50percent cotton/50percent polyester or 100percent cotton) over each cigarette and allow the cigarettes to burn their full lengths.



**Figure 1.** Mock-up Assembly for Smoldering Ignition Resistance Test of (A) Upholstery Cover Fabrics, (B) Barrier Materials, (C) Resilient Filling Materials, and (D) Decking Materials.<sup>12</sup>

### Decking Material Test

1. Construct the test panel by placing the decking material on the plywood base and covering with the standard Type II cover fabric.
2. Place the plywood retainer ring on top of the cover fabric.

3. If testing multiple specimens simultaneously, place the individual test specimen at least 6 inches apart.
4. Light three cigarettes and place three lighted cigarettes on the surface of cover fabric with equal space from each other.
5. Place a piece of sheeting material (50percent cotton/50percent polyester or 100percent cotton) over each cigarette and allow the cigarettes to burn their full lengths.

***Pass/Fail Criteria***

1. A single mock-up test specimen fails if it continues to smolder after 45 minute test, a vertical char length (horizontal char length for decking material) of more than 1.5 inches (38 mm) develops, or it transitions to open flaming.
2. Test material passes the test if three initial mock-up specimens pass the test.
3. If more than one initial specimen fails, the test material fails the test.
4. If any one of the three initial specimens fails, repeat the test on additional three specimens.
5. If all three additional specimens pass the test, the test material passes the test. If any one of the additional three specimens fails, the test material fails the test.

**Technical Analysis of TB 117-2013**

TB 117-2013 has several limitations:

- TB 117-2013 relies on standard materials.
- There have been no studies validating the results obtained using the small-scale test protocols in TB 117-2013 and full-scale furniture performance; and
- TB 117-2013 relies on a vertical char measurement to determine a pass or failure along with a foam depth of 2 inches.

***Use of Standard Materials***

The use of inconsistent standard materials in a fire test method is a significant limitation of TB 117-2013. TB 117-2013 relies on several standard materials in evaluating the individual furniture components. The standard materials include:

- Standard ignition source, a non-filtered cigarette,
- Standard polyurethane foam substrate,
- Standard Type I Cover Fabric, and
- Standard Type II Cover Fabric.

The standard ignition source specified is either the National Institute for Standards and Technology (NIST) developed Standard Reference Material (SRM) 1196 cigarette or an equivalent. CPSC staff is unaware of any commercial cigarette meeting the same performance level of the SRM 1196. There is an adequate supply of SRM 1196 cigarettes currently available at NIST and reassurance that future production of SRM 1196 cigarettes will occur. Therefore, TB 117-2013 allows for potential variation of the ignition source by not requiring the SRM 1196 exclusively.

A standard polyurethane foam (SPUF) substrate is used to evaluate cover fabrics and barrier materials. Although TB 117-2013 provides very detailed specifications of the SPUF substrate, the Bureau has ordered only one batch of SPUF substrate; and all testing, conclusions and

observations have been made based on that initial batch of foam. CPSC testing, as well as CPSC-sponsored research, indicates a potential for foam to vary from batch to batch. Research funded in an interagency agreement between CPSC and NIST indicates that polyurethane foam with consistent smoldering properties may be difficult to manufacture and that the quality control of key variables, such as pore size, foam mass density, and air flow rate, are critical.<sup>13</sup>

Standard cover fabrics are used to evaluate the barrier and decking materials,<sup>\*</sup> which are the supporting fabrics used in the base of a chair. Industry experience and staff expertise support the fact that fabric variability is inherent in the manufacturing process. This is especially true for fabrics manufactured with cellulose fibers, such as cotton because there can be crop-to-crop variation. The two standard cover fabrics specified in TB 117-2013 are Type I, 100 percent cotton twill weave, and Type II, 100 percent cotton velvet. The smoldering ignition behavior of fabric depends on the cellulose content of the fiber, fabric weight, content of alkali metal and other ions in the dye and permeability of the fabric because of variations in the weave and pile. Although these variables can be controlled to some extent, manufacturing variations are still present in the finished fabric. The 2008 NPR uses the same 100 percent cotton velvet specified in TB 117-2013. Leading up to and following publication of the 2008 NPR, CPSC staff worked closely with the manufacturer of the 100 percent cotton velvet and was not able to resolve manufacturing variability among rolls of fabric from different lots. During years of testing to support rulemaking activities, CPSC staff observed differences in smoldering properties among the rolls of cotton velvet fabric and reported that obtaining sufficiently consistent standard materials, including the 100 percent cotton velvet fabric for smoldering tests was a challenge that had not been overcome.<sup>7</sup> In addition to the use of standard materials, the test method has other limitations, which are discussed below.

#### ***Validation of Test Method***

CPSC staff is not aware of any validation studies conducted that confirm the small-scale smoldering evaluations of individual smolder-prone components to measure the performance of full-scale furniture in a smoldering ignition scenario. To assess validity, tests would be designed to demonstrate that the fabrics, barriers and foam components in bench-scale constructions show an increase in fire safety when used in full-scale furniture. CPSC staff refers to this issue as “scaling.”

CPSC staff attempted to validate the scaling of the 2008 NPR bench-scale testing protocol. Staff used the same materials employed in actual furniture to construct bench-scale mockups.<sup>2,3,4</sup> Staff’s testing and data analysis reports that “bench-scale performance did not demonstrate an adequate prediction of real furniture flammability performance, especially in smoldering ignition tests.”<sup>8</sup> Some of the reasons for this include issues with standard materials, complex sample geometry, and varying thicknesses and arrangements of component materials.

#### ***Performance Measurements***

TB 117-2013 uses vertical char measurements to indicate passing or failing mockup (small-scale test) performance. CPSC staff has found that a vertical char length measurement may not be a sufficient measure for characterizing the smoldering ignition of materials. Staff observed in

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\* “Decking Material” is a textile fabric used in furniture construction to support a loose seating cushion. It is typically a functional component, rather than an aesthetic component.



mockup tests<sup>14</sup> that the smoldering combustion front traveled along or down into the crevice, resulting in a configuration where multiple burning surfaces can reinforce the strength and duration of the combustion of either surface. In addition, staff's testing indicates that a 2-inch thick foam geometry may allow the wooden mockup frame to become involved in the ignition process. Therefore, vertical char may not accurately measure performance of the cover fabric or barrier. As described earlier, CPSC studies concluded that measurement of mass loss of the substrate is a better indication of smoldering performance, along with an increase in substrate thickness to 3 inches.

#### **IV. CPSC 2008 NPR**

##### **Summary of CPSC 2008 NPR**

The CPSC 2008 NPR proposed a test standard designed to establish performance requirements and certification and labeling requirements for upholstered furniture. Manufacturers of upholstered furniture could choose one of two possible methods of compliance: Use cover materials that are sufficiently smolder resistant to meet a cigarette ignition performance test; or use a fire barrier that meets smoldering- and open-flame resistance tests between the cover fabric and interior filling materials. Manufacturers of upholstered furniture would be required to certify compliance with the performance criteria and to comply with certain recordkeeping requirements, as specified in the proposal.

The proposed rule would apply to finished or ready-to-assemble articles of upholstered furniture. Finished articles of upholstered furniture would carry a permanent label containing the manufacturer or importer name and location; month and year of manufacture; model identification; and type identification (designated as Type I or Type II) indicating the means of compliance.

The proposed rule adapted elements and variations of existing standards, including TB-117, ASTM E-1353, tests from the Upholstered Furniture Action Council (UFAC) voluntary industry guidelines and United Kingdom regulations (based on British Standard BS-05852).\*

##### **Test Method Requirements of CPSC 2008 NPR**

###### **Specimen Preparation**

Test specimens and materials shall be conditioned for at least 24 hours prior to testing at  $70 \pm 5$  °F ( $21 \pm 3$  °C) and between 50 and 66 percent relative humidity. Tests should begin within 10 minutes of removal of samples in case the test and conditioning area have different conditions. Three inch (76 mm) thickness polyurethane substrates are used as supporting panels for all tests. Specimen dimensions are as follows:

- Cover fabric smoldering test: 8 × 11 inches (203 × 280 mm) for horizontal panel and 8 × 17 inches (203 × 432 mm) for vertical panel.
- Barrier material smoldering test: 8 × 9 inches (203 × 229 mm) and 8 × 14 inches (203 × 356 mm) barrier material for horizontal and vertical panels. 8 × 11 inches (203 × 280 mm) and 8 × 17 inches (203 × 432 mm) standard cover fabric for horizontal and vertical panels.

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\* Additional information on these standards can be found in Appendix A.

- Barrier material open-flame test: 40 × 27.5 inch (1020 × 700 mm) standard cover fabric and barrier material with triangular cut-outs on both sides.

## Test Procedure

### *Smoldering test*

1. Construct the test panels by placing the test specimen on the polyurethane substrate (5 × 8 × 3 inches (127 × 203 × 76 mm) and 8 × 8 × 3 inches (203 × 203 × 76 mm) for horizontal and vertical panels). Place the cover fabric on the barrier material specimen for the barrier material test.
2. Assemble test mock-ups by placing the constructed panels in the specimen holder.
3. If testing multiple specimens simultaneously, place the individual test specimen a sufficient distance from each other.
4. Light cigarettes and place a lighted cigarette on the crevice of each test mock-up.
5. Place a piece of sheeting material (50 percent cotton/50 percent polyester or 100 percent cotton) over each cigarette, and allow the cigarettes to burn their full lengths.
6. Continue testing for 45 minutes.
7. After test, carefully clean all carbonaceous char from panels and measure the mass loss.

### *Open-flame test*

1. Construct the test panels by placing the test specimen on the polyurethane substrate (18 × 3.25 × 3 inches (457 × 83 × 76 mm) and 18 × 12 × 3 inches (457 × 305 × 76 mm) for horizontal and vertical panels). Attach the assembled panels on the steel frame, as described in the 2008 NPR.
2. Light the ignition flame and stabilize for at least 2 minutes.
3. Place the lit burner tube in the crevice of the mockup and apply for 70 seconds.
4. Observe the mockup combustion behavior for 45 minutes.

## Pass/Fail Criteria

### Smoldering Test

1. The sample passes the test if no mockup continues to smolder after 45 min, no SPUF substrate of any specimen has more than 1 percent mass loss, and no mockup assembly transitions to open flaming.
2. If any of the 10 initial specimens fail, the test shall be repeated on an additional 20 specimens. At least 25 of 30 specimens tested must meet the performance criteria.

### Open-flame test

1. The sample passes the test if no mockup assembly has more than 20 percent mass loss at the end of the 45 minute test.
2. If any of the 10 initial specimens fail, the test shall be repeated on an additional 20 specimens. At least 25 of the 30 specimens tested must meet the performance criteria.

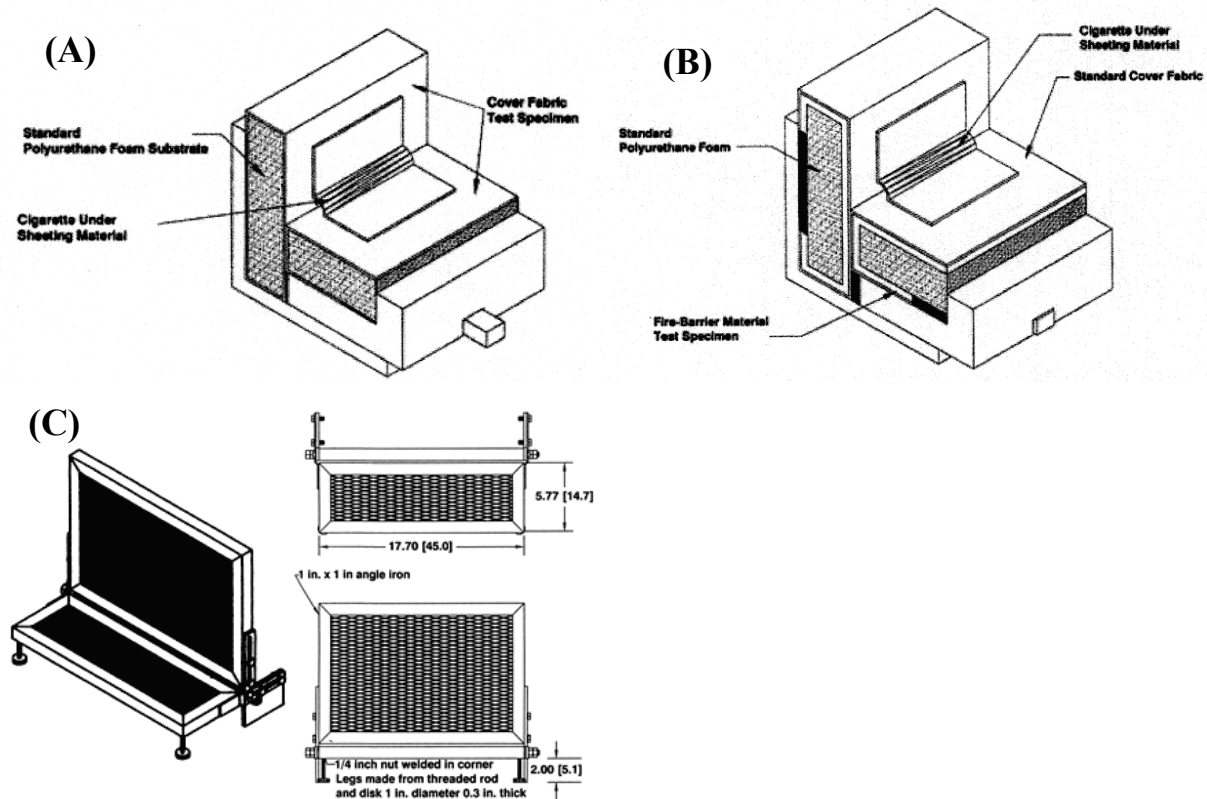


Figure 2. Mock-Up Assembly of Smoldering Ignition Resistance Test of (A) Upholstery Cover Fabric and (B) Interior Barrier Material, and (C) Open-Flame Metal Test Frame.<sup>15</sup>

### Technical Analysis of CPSC 2008 NPR

The CPSC 2008 NPR included provisions to address some of the limitations in the UFAC-style test methods, specifically a provision to qualify standard materials before use and a plan to validate the method using large-scale furniture. At the time that the proposed standard was published, CPSC staff stated that real-scale validation testing was needed to demonstrate that the bench-scale test approach in the NPR was adequate to address the fire performance of full-scale furniture. After publication of the NPR, staff conducted a series of tests to validate the methodology and to assess the potential effectiveness of the proposed standard. The tests were designed to demonstrate that materials (Type I cover fabrics and Type II fire barriers) that met the criteria of the proposed standard in bench-scale construction showed an increase in fire safety when used in a full-scale chair. Staff conducted full-scale testing to characterize the performance of the proposed bench-scale tests as a reliable predictor of full-scale furniture fire performance.

For this test series, the bench-scale performance did not demonstrate an adequate prediction of real furniture flammability performance, especially in the smoldering ignition tests. However, the tests indicated that the open-flame ignition bench-scale qualification tests for fire barriers results in improving full-scale fire performance.

In addition to the scaling issue, this test series demonstrated the need for tighter quality control of the polyurethane foam during the manufacturing process. The smoldering ignition tests showed that the specified materials did not behave consistently. Staff's investigation determined

that the SPUF used in these tests, while meeting the specifications in the proposed rule, did not produce the same smoldering ignition results as the initial foam used in the preliminary testing.

To develop better specifications for SPUF for use in a regulation, CPSC staff contracted with NIST to develop specifications for standard reference material foam. NIST concluded that polyurethane foam with consistent smoldering properties may be difficult to manufacture and that the quality control of key characteristics, such as pore size, foam mass density, and air flow, are critical.

The CPSC 2008 NPR also relies on two standard fabrics to qualify the interior fire barrier materials. Staff chose 100 percent cotton, velvet pile fabric to represent a smolder-prone fabric. The interior fire barrier smoldering-ignition resistance test is intended to measure the cigarette ignition resistance of interior fire barrier materials used in Type II upholstered furniture. One hundred percent rayon, basket-weave fabric is used in open-flame tests to qualify an interior fire barrier and represent a moderately flammable upholstery fabric.

During development of the proposed rule, CPSC staff attempted to minimize the potential for inconsistent results from standard material variability. Specifically, the dependence on cotton velvet fabric could adversely affect the repeatability and reproducibility of test results. Staff developed qualification tests for the standard fabrics and included these in the proposed rule. However, even after staff worked closely with the manufacturer of the cotton velvet fabric to ensure quality control, less than half the rolls purchased met the specification in the proposed rule.

## V. Comparison of TB117-2013 and the CPSC 2008 NPR

There are many similarities between TB 117-2013 and CPSC 2008 NPR. A summary comparison of TB 117-2013 and the CPSC 2008 NPR is provided in Table 2.

Both test methods evaluate cover fabrics and barrier materials for smoldering resistance. Both test methods classify the cover fabric for its smolder performance. Both test methods require the qualification and use of a smolder barrier if the cover fabric is classified as Type II. The smoldering components of both TB 117-2013 and the CPSC 2008 NPR are derived from the same test method; specifically, both are based on UFAC's component testing program.\*

Although TB 117-2013 and the NPR have many similarities, there are also distinct differences. The biggest differences pertain to the scope and the types of ignition scenarios addressed.† The CPSC 2008 NPR requires the same barrier also to pass an open-flame test, while TB 117-2013 does not. TB 117-2013 also includes a filling material and decking requirement. TB 117-2013 uses 2-inch-thick foam for all of its tests, while the CPSC 2008 NPR specifies 3-inch-thick foam geometry. Other spatial dimensions are the same. The smoldering components of both TB 117-2013 and the CPSC 2008 NPR are derived from the same test method; specifically, both are based on UFAC's component testing program.‡ However, there are important technical differences between the two smoldering tests. These include the foam geometry used to evaluate components and the pass/fail criteria.

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\* Additional information regarding the UFAC component test methods can be found in Appendix A.

† BEARHFTI has endeavored to evaluate a potential open-flame test method for inclusion in TB 117-2013, but as of this writing, the effort is not complete. [http://www.bearhfti.ca.gov/industry/work\\_plan\\_research.pdf](http://www.bearhfti.ca.gov/industry/work_plan_research.pdf).

‡ Additional information regarding the UFAC component test methods can be found in Appendix A.

The substantial difference in foam geometry, or foam depth, is important because CPSC staff found that, in some cases, the wooden mockup frame becomes involved in the smoldering process. This occurs when the smoldering progresses through the 2-inch-thick foam. When the wooden frame becomes involved, inaccurate test measurements can occur, which can impact repeatability.

The test methods both specify standard materials; however, the standard materials are not the same, depending on the component being evaluated. TB 117-2013 specifies SPUF and fabrics to be used for its smoldering testing. The CPSC 2008 NPR specifies SPUF and standard fabrics that must be qualified before use. The specification of standard materials is an important aspect of both test methods because variability in materials can affect the performance of materials under test. In 2012, Commission staff reported that obtaining sufficiently consistent standard materials for smoldering tests was a challenge that had not been overcome.<sup>16</sup>

Both test methods measure extent of smoldering, but the way the measurement is conducted is different. TB 117-2013 measures the char length in the vertical direction from the surface of the mockup to classify fabrics and to pass/fail other components. The CPSC 2008 NPR uses mass loss of foam, instead of a vertical char measurement. CPSC staff believes this more accurately represents the degree of smoldering that occurs during the test.

During the development of TB 117-2013, the Bureau adopted two suggestions made by CPSC staff. The use of a draft free enclosure\* is not required and a 45-minute test duration was included. Both of these parameters are found in the CPSC 2008 NRP.<sup>17</sup>

Staff has shown that the smoldering test method proposed in the 2008 NPR produces more repeatable and reproducible test results for classifying cover fabrics and qualifying a smoldering barrier than the UFAC/ASTM test methods<sup>14,18</sup>. CPSC staff believes that, although not perfect, the CPSC 2008 NPR is a more robust test method than TB 117-2013, due to the use of thicker foam geometry and the use of mass loss measurement to determine a pass or failing result.

**Table 2. Comparison of TB 117-2013 and the CPSC 2008 NPR**

	<b>TB 117-2013</b>	<b>CPSC 2008 NPR</b>
<b>Sheeting</b>	100% Cotton or 50% Cotton 50% Polyester blend	100% Cotton extensive specifications
<b>Standard Cover Fabric</b>	Type I 100% Cotton Twill (striped mattress ticking)	100% Cotton Velvet
<b>Standard Cover Fabric</b>	Type II 100% Cotton Velvet	100% Rayon
<b>Standard Ignition Source</b>	SRM 1196 <i>or Equivalent</i>	specifications given (Pall Mall™)
<b>Enclosure</b>	None	None
<b>Spacing</b>	6 inches	sufficient distance apart to avoid heat transfer
<b>Foam</b>	extensive chemical and physical	physical and performance

\* The Bureau suggests a draft enclosure that is different (larger and open) than the ASTM E1353-08a<sup>e1</sup> in their FAQ<sup>11</sup>.

	specifications	specifications
<b>Timing</b>	45 Minutes	45 Minutes
<b>Cover Fabric</b>	Pass < 1.8 inches	Type I/II 10% Mass Loss
<b>Barrier</b>	Type II (TB 117-2013), pass < 2 inches	<1% Mass loss (smolder) < 20% mass loss (open flame)
<b>Decking</b>	Type II cover fabric, pass < 1.5inches	No test
<b>Filling/Padding</b>	Type I cover fabric, pass < 1.5 inches	No test
<b>Laundrying</b>	Type I cover fabric and sheeting AATCC 124-2011	Sheeting AATCC 124-2001

## VI. Summary

CPSC staff was asked to evaluate the feasibility, benefits and cost of adopting TB 117-2013 as a mandatory national standard. This memorandum discusses the feasibility of TB 117-2013 and addresses the advantages and disadvantages of adopting TB 117-2013 versus the CPSC 2008 NPR.

CPSC staff proposed a furniture rule in 2008 before completing all of the necessary testing, validation studies and rigorous standard material evaluations to develop a robust test method. Later, staff completed this work and determined that the test methods proposed in the 2008 NPR were based on preliminary, unverified information. The additional work performed by CPSC staff after the 2008 NPR did not demonstrate feasible or technical improvements for safety in full-scale furniture, and the ongoing issues with variability in standard materials remain insurmountable.

TB 117-2013 has some of the same technical issues, such as variability in standard materials and lack of scaling, as the CPSC 2008 NPR. Staff believes that the use of standard materials will be a growing challenge for TB 117-2013 as it has been for other test methods. Although the Bureau has not conducted validation studies, CPSC staff believes the results will demonstrate the same scaling issues found by CPSC staff and others. In addition, TB 117-2013 is not as robust as CPSC 2008 NPR, due to the foam geometry issues (uses 2 inch thick foam) and the use of vertical char measurements to determine compliance that do not fully and accurately represent the degree of smoldering and overall performance of the component being evaluated.

CPSC staff believes that neither test method is likely to result in any significant improvements in upholstered furniture fire safety. Neither test method represents what happens in full-scale furniture fire scenarios. Neither test method can overcome variability in the test method caused by the required use of standard materials (polyurethane foam and standard cotton velvet). In addition, the specified test procedures and performance criteria in TB 117-2013 introduce a large variability, making the test difficult to repeat and attain consistent results among similar samples.

<sup>1</sup> Fansler, L., Memorandum to D. Ray, "Mockup Test Program on Upholstery Fabrics and a Fire Barrier," U.S. Consumer Product Safety Commission, July 2012.

<sup>2</sup> Mehta, S. Memorandum to D. Ray, "Upholstered Furniture Full Scale Chair Tests – Open Flame Ignition Results and Analysis", U. S. Consumer Product Safety Commission, May 2012.

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- <sup>3</sup> Fansler, L., Lock, A. Memorandum to A. Lock, "Summary Report of Open Flame and Smoldering Tests on Chairs" U.S. Consumer Product Safety Commission, September 2016.
- <sup>4</sup> [http://www.bearhfti.ca.gov/industry/tb\\_117\\_faq\\_sheet.pdf](http://www.bearhfti.ca.gov/industry/tb_117_faq_sheet.pdf).
- <sup>5</sup> BEARHFTI, "INITIAL STATEMENT OF REASONS," March 26, 2013, <http://www.bearhfti.ca.gov/laws/isr.pdf>.
- <sup>6</sup> <https://www.gov.ca.gov/news.php?id=17598>.
- <sup>7</sup> Fansler, L.; Scott, L. Memorandum to D. Ray, "Performance Criteria, and Standard Materials for the CPSC Staff Draft Upholstered Furniture Standard," U. S. Consumer Product Safety Commission, May 2005.
- <sup>8</sup> BEARHFTI, Laboratory Data, "Development of a Flammability Standard for Testing the Smolder Resistance of Upholstered Furniture," October 2012.
- <sup>9</sup> BEARHFTI, Laboratory Data, "California Statistical Data Related to Mortality and Fire-Related Losses." [http://www.bearhfti.ca.gov/laws/attach\\_10.pdf](http://www.bearhfti.ca.gov/laws/attach_10.pdf)
- <sup>10</sup> Ahrens, M. "Home Fires that Began with Upholstered Furniture", National Fire Protection Association, August 2011.
- <sup>11</sup> [http://www.bearhfti.ca.gov/about\\_us/tb117\\_faqs.pdf](http://www.bearhfti.ca.gov/about_us/tb117_faqs.pdf).
- <sup>12</sup> State of California, Technical Bulletin 117-2013.
- <sup>13</sup> National Institute of Standards and Technology Technical Note 1747, June 2012.
- <sup>14</sup> Memorandum to D. Ray, Project Manager, Upholstered Furniture, from W. Tao, "Evaluation of Test Method and Performance Criteria for Cigarette Ignition (Smoldering) Resistance of Upholstered Furniture Materials" May 12, 2005.
- <sup>15</sup> CPSC Standard for the Flammability of Residential Upholstered Furniture; Notice of Proposed Rulemaking 2008
- <sup>16</sup> National Institute of Standards and Technology Technical Note 1747, June 2012.
- <sup>17</sup> Letter from Robert J Howell to Diana Godines, Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation, CPSC Staff Comments on Modified - TB 117 June 2013, September 24, 2013.
- <sup>18</sup> Memorandum to D. Ray, Project Manager, Upholstered Furniture, from L. Scott, "Test Program for Upholstery Fabrics and Fire Barriers" November 8, 2007.

## Appendix A.

### **Other Furniture Flammability Standards: UFAC/NFPA 260/ASTM 1353**

The Upholstered Furniture Action Council (UFAC), founded in 1978, introduced the voluntary test standard in 1979 to measure the cigarette ignition resistance of furniture components, including cover fabric and filling materials. This is a voluntary program, but it is widely adopted by furniture manufacturers.

In 1983, the National Fire Protection Association (NFPA) issued NFPA 260 (first numbered as 260A) – *Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture*. ASTM followed in 1990, by issuing ASTM E1353 – *Standard Test Methods for Cigarette Ignition Resistance of Components of Upholstered Furniture*. These three test standards are almost identical in that they measure the cigarette ignition resistance of the upholstered furniture components (cover fabric, interior fabric, welt cord, filling/padding, barrier material, and decking material) using small mock-up assemblies that have the same dimensions. These methods also classify the furniture components into two categories, depending on the performance. Components that meet the requirement are categorized as Class I (Class A for ASTM 1353) and others are Class II (Class B for ASTM 1353), if they do not meet the requirement. Components are not evaluated together, as found in furniture; individual components are evaluated individually.



Table A.1 Comparison of Furniture Flammability Standards

	<b>TB 117-2013</b>	<b>CPSC 2008 NPR</b>	<b>UFAC</b>	<b>ASTM 1353-08a <sup>§1</sup></b>	<b>NFPA 260</b>
<b>Sheeting</b>	100% Cotton or 50% Cotton 50% Polyester blend	100% Cotton extensive specifications	100% Cotton	100% Cotton or 50% Cotton 50% Polyester blend	100% Cotton or 50% Cotton 50% Polyester blend
<b>Standard Cover Fabric</b>	Type I 100% Cotton Twill Weave (striped mattress ticking)	100% Cotton Velvet	Type I 100% Cotton Twill Weave (striped mattress ticking)	Type I 100% Cotton Twill Weave (striped mattress ticking)	Type I 100% Cotton Twill Weave (striped mattress ticking)
<b>Standard Cover Fabric</b>	Type II 100% Cotton Velvet	100% bright regular Rayon	Type II 100% bright regular Rayon	Type II 100% bright regular Rayon	Type II 100% bright regular Rayon
<b>Standard Ignition Source</b>	SRM 1196 <i>or Equivalent</i>	specifications given (Pall Mall™)	specifications given (Pall Mall™)	specifications given (Pall Mall™)	SRM 1196
<b>Enclosure</b>	None	None	Use Enclosure	Use Enclosure	Use Enclosure
<b>Spacing</b>	6 inches	sufficient distance apart	None	None	None
<b>Foam</b>	extensive chemical and physical specifications	physical and performance specifications	UFAC Standard Polyurethane Foam	Physical specs, nominally UFAC Foam	UFAC Standard Polyurethane Foam
<b>Timing</b>	45 Minutes	45 Minutes	No Time Limit	No Time Limit	No Time Limit
<b>Cover Fabric</b>	Pass < 1.8 inches (vertical char)	Type I/II 10% Mass Loss	Class I/II, < 1.75 inches (vertical char)	Class A/B, < 1.5 inches	Class I/II, < 1.8 inches
<b>Interior Fabric</b>	No test	No test	Type I cover fabric, pass < 1.5 inches (vertical char)	Type I cover fabric, Class A/B, < 1.5 inches	Type I cover fabric, Class I/II, < 1.5 inches
<b>Barrier</b>	Type II (TB 117-2013), pass < 2 inches	< 1% Mass loss (smolder) < 20% Mass loss (open flame)	Type II cover fabric, pass < 1.5 inches	Type II cover fabric, Class A/B, < 2 inches	Type II cover fabric, Class I, II, < 2 inches
<b>Decking</b>	Type II cover fabric, pass < 1.5 inches	No test	Type II cover fabric, pass < 1.5 inches	Type II cover fabric, Class A/B < 1.5 inches	Type II cover fabric, Class I/II, < 1.5 inches
<b>Filling/ Padding</b>	Type I cover fabric, pass < 1.5 inches	No test	Type I cover fabric, pass < 1.5 inches	Type I cover fabric, Class A/B < 1.5 inches	Type I cover fabric, Class I/II, < 1.5 inches
<b>Decorative Trim</b>	No test	No test	Later addition	None	None
<b>Welt Cord</b>	No test	No test	Type II cover fabric, pass < 1.5 inches	Type II cover fabric, Class A/B < 1.5 inches	Type II cover fabric, Class I/II, < 1.5 inches
<b>Laundering</b>	Type I cover fabric and sheeting AATCC 124-2011	sheeting AATCC 124-2001	Type I cover fabric UFAC Procedure	Type I cover fabric and sheeting	Type I cover fabric



# **TAB C: Health Sciences Review of TB 117- 2013 and the 2008 NPR**



UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
5 RESEARCH PLACE  
ROCKVILLE, MD 20850

Biggs, HS Memo, Page: 1

## Memorandum

Date: August 5, 2016

TO : Andrew Lock, Ph.D., Upholstered Furniture Project Manager  
Directorate for Laboratory Sciences  
Division of Electrical Engineering

THROUGH: Alice M. Thaler, DVM, Associate Executive Director, Directorate for  
Health Sciences

Michael A. Babich, Ph.D., Director, Division of Toxicology and Risk  
Assessment

FROM : Melanie B. Biggs, Ph.D., Toxicologist  
Directorate for Health Sciences  
Division of Toxicology and Risk Assessment

SUBJECT : Flame retardant considerations related to TB117-2013 and the 2008  
NPR upholstered furniture flammability test methods\*

## 1. INTRODUCTION

The Commission's Fiscal Year (FY) 2016 Operating Plan directed CPSC staff to prepare a briefing package on California's mandatory flammability regulation of upholstered furniture, Technical Bulletin (TB) 117-2013. This memorandum discusses CPSC staff's work on flame-retardant (FR) chemicals in upholstered furniture and the potential use of FR chemicals in these two test methods.

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\* These comments are those of the CPSC staff and have not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

## 2. BACKGROUND

### a. FR chemicals

The CPSC has proposed flammability standards for residential upholstered furniture under the Flammable Fabrics Act (FFA). In evaluating the potential use of FR chemical technologies to meet a possible flammability rule, CPSC staff evaluates chemical hazards under the Federal Hazardous Substances Act (FHSA). Under the FHSA, any substance or mixture of substances which is “toxic,” as defined in FHSA regulations, is considered to be a “hazardous substance,” if such substance or substances may cause substantial personal injury or substantial illness during or as a result of reasonable foreseeable handling or use. 15 U.S.C. § 1261(f)(1)(A). The FHSA defines the term “toxic” to apply to any substance which has the capacity to produce personal injury or illness through ingestion, inhalation, or absorption through any body surface. 15 U.S.C. § 1261(g). Therefore, when assessing potential chemical hazards under the FHSA, CPSC staff considers not only exposure to the toxic substance, but also any health effects associated with the exposure (CPSC, 1992).

FRs are chemicals added to natural and synthetic materials to improve their resistance to ignition or reduce flame spread after ignition occurs (WHO, 1998). Many products or materials are FR-treated to pass a particular flammability standard. FR chemicals can be inorganic or organic compounds. Inorganic FRs frequently contain aluminum, magnesium, boron, nitrogen, or bromine; and organic FRs typically contain phosphorus, nitrogen, chlorine, or bromine atoms. Pentabromodiphenyl ether (PentaBDE), which belongs to the group of polybrominated diphenyl ethers (PBDEs), was one of the most common FRs used in upholstered furniture before 2004. However, due to PentaBDE’s potential health effects, persistence in the environment, and bioaccumulation, it was phased out by manufacturers in the United States in 2004 (Watkins et al., 2012). The phase-out of PentaBDE and other brominated FRs has led to the development of alternative FRs to meet flammability standards. Studies are ongoing to identify the alternative FR chemicals used in upholstered furniture and products with foam (Stapleton et al., 2009; Stapleton et al., 2011). These studies have shown a shift from PentaBDE to organohalogen or phosphate FR chemicals in these products. Some of these alternative FRs are not bound to the substrate material, such as polyurethane foam, and may be released from the product, leading to potential human and environmental exposures. Additionally, some of these alternative FR chemicals have been associated with endocrine, neurological, or developmental toxicities or cancer in animals (Stapleton et al., 2009; Stapleton et al., 2012). However, some have insufficient toxicity or exposure data, such as vapor phase emission factors, rates of migration from the product, and dermal absorption factors (Babich, 2006). Therefore, although these FR chemicals may be used to meet a standard to reduce flammability, their potential for human exposure and adverse health effects concern CPSC staff. However, these toxicological and exposure data gaps make it difficult to determine the human health risks of these chemicals under the FHSA. As discussed in the next section, staff has previously determined that some FRs could be used without presenting hazards to consumers.

## b. CPSC work on FR chemicals in upholstered furniture

CPSC staff has assessed the potential health risks associated with FR use in upholstered furniture cover fabrics and foam. After issuing the 1994 advance notice of proposed rulemaking (ANPR) (59 FR 30735) to address ignition of upholstered furniture by small open-flame sources, manufacturers reported at that time that they would probably treat fabrics with FR chemicals. As part of the FR risk assessment process, the Commission held a public hearing in May 1998, and furniture manufacturers provided a list of 16 chemicals or chemical classes for use in upholstered furniture, if the draft standard was adopted (Parkes, 1998). CPSC staff completed toxicity reviews on all 16 classes of FR chemicals (more than 50 chemicals) (Babich and Saltzman, 1999; Bittner, 1999; Bittner et al., 2001; Ferrante, 1999a; Ferrante, 1999b; Hatlelid, 1999). In FY 1999, prior to completing the risk assessment and issuing the proposed rule, CPSC followed a mandate from Congress to sponsor a National Research Council (NRC) report on FR chemicals. Staff's toxicity reviews contributed to the NRC report. NRC concluded that eight of the 16 chemicals or classes could be used without presenting a risk to consumers, and NRC recommended additional toxicity and exposure studies for the remaining eight FRs (NRC, 2000). Using the recommendations of the NRC, CPSC staff performed exposure studies on the release of the remaining eight FRs in the NRC study for furniture fabrics and completed a risk assessment of these FR chemicals (Babich and Thomas, 2001). Staff concluded that five FR chemicals would not present a hazard to consumers (CPE, DBDPO, EHDP, HBCD and PA),\* and staff concluded that additional toxicity and exposure data were needed on the remaining chemicals (AT, TDCPP, and THPC).†

The Commission issued another ANPR in 2003 (68 FR 60619) to address ignition of upholstered furniture by small open-flame and smoldering cigarettes. CPSC staff published an updated draft standard in 2005, to reflect input from the public. Members of the public suggested that upholstery cover fabrics would not use FR treatment to comply; rather, the public comments suggested that flexible polyurethane foam or other filling materials would require FR treatment to meet the draft standard (CPSC, 2006). Given these revisions to the standard, CPSC staff assessed the potential health risks from the use of FR chemicals in upholstered furniture foam (Babich, 2006). As discussed above, PBDEs were voluntarily taken off the market in December 2004. Therefore, when staff conducted a risk assessment, a number of alternative FR treatments were available, including melamine, tris (1,3-dichloropropyl-2) phosphate (TDCPP), and several new proprietary formulations, such as Firemaster™ 550 (FM-550™) (EPA, 2005). Staff concluded that melamine would not present a hazard to consumers. Staff also concluded that TDCPP might present a hazard to consumers and suggested that additional exposure data, such as vapor-phase emissions of TDCPP were needed. The staff also concluded that there was insufficient information on the toxicity of FM-550™ or its components to assess their potential health risks (Babich, 2006).

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\* Cyclic phosphonate esters (CPE), Decabromodiphenyl oxide (DBDPO), 2-Ethylhexyl diphenyl phosphate (EHDP), Hexabromocyclododecane (HBCD), and Phosphonic acid, (3-([hydroxymethyl]amino)-3-oxopropyl)-, dimethyl ester (PA)).

† Antimony Trioxide (AT), Tris(1,3-dichloro-2-propyl)phosphate (TDCPP), and Tetrakis(hydroxymethyl) phosphonium chloride (THPC).

### 3. FR CHEMICAL CONSIDERATIONS OF THE 2008 NPR AND TB117-2013

#### a. 2008 NPR

In 2008, the Commission issued an NPR to propose flammability standards for residential upholstered furniture. (73 FR 11702). Manufacturers of upholstered furniture could choose one of two possible methods of compliance: (1) they could use cover materials that are sufficiently smolder resistant to meet a cigarette ignition performance test; or (2) they could place fire barriers that meet smoldering and small open-flame resistance tests between the cover fabric and interior filling materials. FR-treated fabrics and foam would not be required for compliance. However, under the proposed performance standard, manufacturers could still treat some components of the product with FR chemicals to meet the proposed standard.

#### b. Technical Bulletin 117-2013

TB117-2013 is a mandatory standard in California under the Bureau of Electronic and Appliance Repair Home Furnishings and Thermal Insulation (BEARHFTI). TB117-2013 provides test methods for smolder-resistance of cover fabrics, barrier materials, resilient filling materials, and decking materials for use in upholstered furniture. These test methods are not intended to measure the performance of upholstered furniture under conditions of open-flame exposure (BEARHFTI, 2013). TB117-2013 replaces the older TB117 standard from 1975, which focused on open-flame testing for filling materials in upholstered furniture and baby product foams. Although this was a state regulation, TB117 became the *de facto* standard for upholstered furniture for the country. TB117 was updated, in part, due to concerns over FR chemical toxicity and BEARHFTI's conclusions that upholstered furniture fires begin with the cover fabric, not the filling materials. Because FRs were used in the furniture's foam to pass the open-flame test in TB117, omitting the open-flame test means furniture manufacturers are less likely to use FRs to meet TB117-2013; however, there is no prohibition on the use of FRs and manufacturers may still use FRs to comply with smoldering under TB117-2013 or may still use foam containing FRs.

TB117-2013 is a performance standard and does not require or prevent the use of any specific materials to meet its flammability requirements. Although TB 117-2013 does not address labeling, Senate Bill (SB) 1019, which became effective in January 2015, requires labeling of upholstered furniture for the presence or absence of added FR chemicals (BEARHFTI, 2015). Manufacturers of upholstered furniture must comply with both TB117-2013 and SB 1019. "Added FR chemicals" are defined in SB 1019 as "being present in any covered product\* or component† at levels above 1,000 parts per million." The 1,000 ppm level is

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\* Defined as any flexible polyurethane foam or upholstered or reupholstered furniture required to meet TB117-2013.

† Defined as cover fabrics, barrier materials, resilient filling materials, or decking materials.

a cumulative limit when multiple FR chemicals are used within an individual component or covered product (BEARHFTI, 2015).

#### 4. DISCUSSION

The 2008 NPR and TB117-2013 are both flammability standards that are performance based and do not require or prohibit the use of FR chemicals to meet either standard. CPSC's 2008 NPR addresses both small open-flame and smoldering sources associated with fires involving residential upholstered furniture. FR-treated fabrics and foam would not be required for compliance with the 2008 NPR. However, under the proposed performance standard, manufacturers could still treat some components of the product with FR chemicals to meet the proposed standard.

TB117-2013 addresses only smolder resistance of upholstered furniture. By removing the open-flame testing method from TB117, the use of FR chemicals may decrease because FRs were used in the furniture's foam to pass the open-flame test in TB117. Some manufacturers may meet TB117-2013's requirements through the use of either more smolder-resistant cover fabrics or smolder-resistant barriers beneath the cover fabrics. They may also meet TB117-2013 with the use of FRs and labels, according to SB 1019. Staff does not know whether this requirement has any effect on a manufacturer's decision to use FRs. Because TB117-2013 does not require or prohibit the use of FR chemicals to meet the standard, FRs may be used; however, identities of the FR chemicals are often unknown due to reformulations and alternative FRs being introduced.

Staff does not know the extent to which manufacturers do or would use FR chemicals to meet either the 2008 NPR or TB117-2013. Staff also does not know the toxicity and exposure data for these chemicals necessary to assess human health risk. As discussed above, although CPSC staff performed risk assessments on FR chemicals previously, there were significant data gaps regarding toxicity and exposure (Babich, 2006). Additionally, FR chemicals used in current furniture may be different from chemicals staff examined previously and they may warrant updated assessments. To begin filling the toxicological data gaps, in 2005, CPSC staff nominated AT, tris(chloropropyl) phosphate, and one chemical class, aromatic phosphates, to the National Toxicology Program of the Department of Health and Human Services for toxicological testing. These chemicals are currently being tested.

#### 5. CONCLUSIONS

Both TB117-2013 and the 2008 NPR are performance-based, and FR chemicals may be used to meet either. However, because TB117-2013 only addresses test methods for smolder resistance of upholstered furniture and not open flame, FR chemicals might not be needed to meet the standard. Because the 2008 NPR also includes a test method for small open flame, manufacturers may be more likely to use FR chemicals to pass the test. Regardless of CPSC



adopting TB117-2013 or the 2008 NPR, identifying whether and what FR chemicals are being used in upholstered furniture is necessary, along with filling the toxicity and exposure data gaps, to assess human health risk.

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# **TAB D: Economic Considerations**



UNITED STATES  
CONSUMER PRODUCT SAFETY COMMISSION  
5 RESEARCH PLACE  
ROCKVILLE, MD 20850

Smith, EC Memo Page: 1

## Memorandum

Date: July 18, 2016

TO : Andrew Lock, Ph.D., Directorate for Laboratory Sciences,  
Division of Electrical Engineering  
Upholstered Furniture Project Manager

THROUGH: Gregory B. Rodgers, Ph.D., Associate Executive Director,  
Directorate for Economic Analysis

Robert L. Franklin, Supervisory Economist, Directorate for Economic Analysis

FROM : Charles L. Smith, Economist, Directorate for Economic Analysis

SUBJECT : Economic Considerations Related to the Adoption of California TB17-2013 as a  
Mandatory National Standard\*

### I. Introduction

The FY 2016 Operating Plan of the U.S. Consumer Product Safety Commission (CPSC) called for staff to prepare a briefing package on California's mandatory regulation on the flammability of upholstered furniture, Technical Bulletin (TB) 117-2013. Staff was directed to summarize the feasibility, benefits and costs of adopting TB117-2013 as a mandatory national standard, as well as address the advantages and disadvantages of adopting TB117-2013, compared to the upholstered furniture flammability standard proposed by the Commission on March 4, 2008 (73 FR 11702) (2008 NPR). This memorandum presents information on the benefits and costs of adopting either the 2008 NPR or TB117-2013 as a potential CPSC mandatory standard.

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\* These comments are those of the CPSC staff and have not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

## **II. Requirements of TB117-2013 and the Standard Proposed by CPSC in 2008**

### **A. TB117-2013.**

TB117-2013 is based on the ASTM International (ASTM) standard: ASTM E-1353-08a, *Standard Test Methods for Cigarette Ignition Resistance of Components of Upholstered Furniture*. Tests on cover fabric, barrier material, and filling material are conducted using a small mockup that consists of a horizontal and a vertical panel; another small mockup is used to test furniture decking materials. Upholstery cover fabrics are subjected to cigarette-ignition over 2-inch-thick standard polyurethane substrates. If the fabrics fail the component test, they can only be used in complying furniture covering a material that has passed a barrier test, which uses Standard Type II fabric (a 100 percent cotton velvet fabric) for horizontal and vertical panels as cover fabrics. Resilient filling materials must pass smoldering tests that use Standard Type I fabric (a 100 percent cotton mattress ticking) as the cover fabric.

The 2013 revision to TB117 eliminated the open-flame component test from previous versions and revised the smolder test. California officials expected these changes to result in much less use of materials (such as flexible urethane foam) that incorporated flame-retardant (FR) chemicals to comply with the standard. However, TB117-2013 does not prohibit using FR chemicals to make furniture.

### **B. CPSC 2008 Notice of Proposed Rulemaking**

In the 2008 NPR, the CPSC issued a notice of proposed rulemaking (NPR) to propose a flammability standard for residential upholstered furniture that would establish performance requirements to reduce the likelihood of smoldering-induced ignition of upholstered furniture. Under the 2008 NPR, manufacturers of upholstered furniture would have two possible methods for compliance: (1) using cover materials meeting the specified cigarette-ignition performance test (“Type I” furniture); and/or (2) using fire barriers between the cover fabric and interior filling materials that meet the proposed standard’s smoldering and small open-flame ignition resistance tests (“Type II” furniture).

### **C. Comparison of TB117-2013 and the 2008 NPR**

TB117-2013 and the 2008 NPR have similar component tests to assess the cigarette-ignition resistance of upholstery cover fabrics. Both use test fixtures for smoldering ignition tests developed for the Upholstered Furniture Action Council (UFAC) Voluntary Action Program, which has also been adopted by the ASTM standard E1353. However, pass/fail criteria are determined by vertical char length measurements in TB117-2013; whereas, the CPSC 2008 NPR is based on percentage mass loss of the standard polyurethane foam substrate. TB117-2013 only subjects barrier materials to smoldering tests (using a Standard Type II cover fabric); the CPSC 2008 NPR also requires barrier materials to pass an open-flame test over urethane foam covered by a standard test fabric on a metal test fixture. Therefore, an important difference between the

two standards is that the 2008 NPR, unlike TB117-2013, also was expected to address open-flame hazard patterns for furniture that complied by using barriers. A more detailed comparison of the requirements of TB117-2013 and the CPSC 2008 NPR has been provided in Tab B.

### III. Previous Analyses Related to Benefits and Costs

#### A. 2008 NPR

In the 2008 NPR, staff projected that about 14 percent of new furniture items covered with cellulosic fabrics would fail the standard's smoldering ignition test for cover fabrics, and furniture made with these fabrics would require modifications to comply with the proposed standard. Staff estimated the cost impacts of these modifications would range from the less expensive alternative of substituting upholstery fabrics that pass the smoldering requirements for those that do not, to more costly measures of FR-treatment of fabrics and the use of barrier materials that pass additional open-flame and smoldering ignition requirements. Depending on the extent to which fabrics would be FR-treated to comply with the alternative, staff estimated that costs of compliance would range from about \$32 million to \$57 million for the estimated annual production of a little more than 30 million furniture pieces (Smith, 2007).

Staff estimated benefits resulting from the 2008 NPR would range from about \$419 million to \$424 million, most of which (\$410 million) was estimated to result from reductions in cigarette ignitions. These estimated benefits were based on 3-year average fire losses for 2002–2004, in which upholstered furniture was the first item to ignite from smoking materials (*e.g.*, cigarettes) or small open flames. In our analysis, we assumed that the decreasing trend in furniture fires, deaths, injuries and property losses from factors other than fabric ignition resistance (*e.g.*, changes in smoking-related behavior of individuals, increased presence of smoke alarms, and changes in furniture filling materials) would continue. This trend apparently has continued, according to analysis by the Hazard Analysis Division of the CPSC's Directorate for Epidemiology: estimated 3-year averages in annual smoking material fire losses have fallen from 260 addressable civilian (*i.e.*, not fire fighters) deaths and 320 nonfatal civilian injuries during 2002 – 2004 (Miller, 2007) to 170 deaths and 240 injuries during 2011 – 2013 (Miller, 2016). In the 2008 NPR briefing package, staff compared the estimated costs of the 2008 NPR with the estimated benefits (as reported in the 2008 NPR). This comparison yielded estimated net benefits in the range of \$367 million to \$387 million from annual production of upholstered furniture.

We note that the benefits projected to result from the 2008 NPR largely were attributed to improvements in the ignition resistance of furniture covered with the most severely ignition-prone cellulosic fabrics, through FR fabric treatments, to enable them to pass the fabric smoldering test of the 2008 NPR, or through the use of barrier materials that would pass the composite tests of barriers for smoldering and open-flame performance. As discussed in Tab B, a 2012 evaluation of tests of the 2008 NPR led staff to conclude: “. . . the bench-scale performance did not demonstrate an adequate prediction of real furniture flammability performance, especially in the smoldering ignition tests” (Fansler, Lock & Kim, 2016). In addition, staff has

determined that serious issues remain with the standard materials prescribed. Without validation of the bench-scale tests of the 2008 NPR, the previous estimates of benefits are called into question.

## **B. TB117-2013**

Although staff has not conducted a specific assessment of the likely costs and benefits of adopting TB117-2013 as a national standard, the California standard appears to be very similar to the UFAC program (which has been evaluated) in terms of likely costs of compliance and benefits. The UFAC program requires classification of upholstery cover fabrics into either "Class I" or "Class II," based on a cigarette-ignition performance test that is similar to that of TB117-2013. Both tests consider vertical char length for classification of fabrics; although TB117-2013 recommends, but does not require the use of a draft-free test enclosure, and it specifies a test duration of 45 minutes instead of 30 minutes, following suggestions made by CPSC staff (Fansler, Lock & Kim, 2016). Furniture conforming to both UFAC and TB117-2013 must comply with specified construction criteria for decking substrates and filling materials; and more cigarette ignition-prone upholstery cover fabrics must have a complying barrier material between the fabric and other filling materials (although the UFAC Program only requires barriers to be used on seat cushions). The UFAC Program also requires welt cords and interior fabrics to comply with additional tests.

The last market evaluation of conformance with the UFAC program that the CPSC staff conducted occurred in 1996. At that time, based on ignition testing of chairs purchased by the CPSC, staff estimated that about 90 percent of upholstered furniture may have been produced in conformance with the UFAC program. The level of conformance to the voluntary program (including by a majority of units produced by firms that did not participate in the UFAC program) may be largely attributable to the compatibility of the program with commonly used fabrics and filling materials in the production of upholstered furniture. In our analysis of the UFAC program as a regulatory alternative, we concluded that the costs of mandating the requirements of the UFAC program should be minimal (Smith, 2007). Perhaps the major program element associated with costs is the requirement of a smolder-resistant barrier to be used under Class II fabrics when the seat cushion core is standard urethane foam. The primary barrier material for this purpose under the UFAC program is polyester fiberfill cushion wrap. Based on an analysis of market data, we estimated that fewer than 5 percent of upholstered furniture items were being produced with Class II fabrics. The great majority of the seat cushions on these items already were made with polyester wraps, and therefore, they were conforming to the UFAC program. Incremental costs of using polyester wraps on all seat cushions covered with Class II fabrics could total less than \$500,000. Other costs and changes in construction materials associated with the adoption of the UFAC program as a mandatory rule should be very minor. Total costs of compliance for adoption of the UFAC program as a mandatory standard could be less than \$5 million annually.

However, as discussed in Tab B, there are a number of limitations presented by TB 117-2013. These limitations include TB 117-2013's reliance on inconsistent standard materials; there have been no studies validating the results obtained using the small-scale test protocols in TB 117-2013 and full-scale furniture performance, and TB 117-2013 relies on a vertical char measurement to determine a pass or failure along with a foam depth of 2 inches. Staff states that it has no knowledge that validation testing of TB 117-2013 has ever been completed. Moreover, TB 117-2013 acknowledges in the standard: "The results obtained with a material component tested in mock-up . . . do not necessarily indicate the performance of the same material component in other geometrical configurations, such as in full size furniture." Similar to the 2008 NPR, without consistent validation of the bench-scale tests under TB 117-2013, the benefits of adopting TB 117-2013 are questionable and cannot be quantified meaningfully.

Based on the similarities of the UFAC Program and TB117-2013, the percentage of units being manufactured that require modifications and the relatively small associated costs of compliance could be about the same for adoption of TB117-2013 as a national safety standard. The cigarette-ignition resistance of nearly all upholstered items would not be significantly improved by compliance with TB117-2013. Thus, both the costs and the benefits that would result probably would be small if TB117-2013 were mandated as a national standard.

#### **IV. Conclusion.**

An evaluation of the CPSC's 2008 NPR and California's TB 117-2013 did not demonstrate that either bench-scale test adequately predicted the flammability performance of real furniture, and issues remain with procuring sufficiently consistent standard testing materials required under TB 117-2013 or the 2008 NPR. Although CPSC staff considers the 2008 NPR to have test methods for evaluating upholstered furniture components that are more robust than those of TB117-2013, staff does not consider the 2008 NPR to be adequate to address the hazards associated with upholstered furniture flammability. Staff concludes that "neither test method is likely to result in any significant improvements in upholstered furniture fire safety" (Fansler, Lock & Kim, 2016). These findings cast doubt on both the reliability of the previous benefit estimates for the 2008 NPR and on the merits of TB117-2013 as a suitable regulatory alternative.



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