



United States
CONSUMER PRODUCT SAFETY COMMISSION
 Washington, D.C. 20207

MEMORANDUM

DATE: February 14, 2006

TO : The Commission
 Todd Stevenson, Secretary

Through: Page Faulk, General Counsel *PCF*
 Patricia Semple, Executive Director *PS*
 Lowell Martin, Deputy Executive Director *L.M.*

FROM : Jacqueline Elder, Assistant Executive Director *JE*
 Office of Hazard Identification and Reduction
 Margaret L. Neily, Project Manager *MN*
 Directorate for Engineering Sciences
 (301-504-7530)

SUBJECT: Responses to Commissioner Moore's Mattress Briefing Package Questions

Commissioner Moore has requested answers to a number of questions related to the staff's briefing package on a draft final mattress flammability standard. Each of the questions is reprinted below, followed by the staff's response.

HIR Questions:

A. One-sided mattresses:

1. Could the expected useful life of one-sided mattresses be significantly less than that of double-sided mattresses? As most mattresses now being manufactured are single-sided, what would a significant reduction in the useful life of most mattresses do to our cost/benefit analysis?

We believe that the 10 to 14 years expected life of a mattress would apply to one-sided mattresses. Nonetheless, using an extreme scenario, where a one-sided mattress is assumed to have a mattress life reduced by half, and using the lower initial estimate of a mattress life (of 10 years), benefits would still be greater than costs. Assuming, with the current risk of death and injury, that consumers only keep a one-sided mattress for five years, the estimated benefits per mattress set would equal \$27.32. These benefits are close to twice the mid-point estimate of expected costs, which equal \$15.07.

2. NIST expressed concern about the performance of one-sided mattresses in real world fire scenarios. That is, while they passed our burner test, when they were tested with burning bed

CPSC INFO: CLEARED for PUBLIC

NO FRAGMENTS OR PRODUCTS IDENTIFIED

**EXCEPTED BY: PETITION
 MAKING ADMIN. PROC.**

NOTE: This document has not been reviewed or accepted by the Commission.
 Initial *rh* Date *2/14/06*

clothes, the mattresses could go to flame. Staff's response was to lower the benefits to be expected from the regulation. Since the vast majority of mattresses are now one-sided, can you explain what calculations were made to figure out the reduction in benefits? How much of the reduction in benefits between the proposed rule estimates and the final rule estimates are attributable to this?

The staff's effectiveness estimates were based on evaluations of mattress sets that meet the draft final standard's criteria. These mattresses were tested in ways that vary from the draft final standard protocol, for example, testing with actual bedclothes or in a test room, to obtain an understanding of the real world fire scenarios they would produce. Our observations were used to estimate the potential benefits (reductions in deaths and injuries) that would be expected from the regulation.

CPSC staff's updated estimates of expected benefits are based on in-depth investigation scenarios in which the mattress has a limited early contribution to the fire, allowing for timely discovery and escape from the fire conditions, but in which the fire eventually grows to become more significant. Mattresses designed to closely conform to the performance criteria, barrier performance characteristics, one-sided mattress designs, and consumer use of unprotected or non-compliant foundations are all possible contributors to growing fire conditions. The staff's updated effectiveness estimates are based on the possibility of a significant fire occurring earlier (as observed in these new mattresses) compared to the estimates (from earlier experimental mattress designs) that were based on this occurring later. The changes primarily affect certain occupants outside the room of fire origin.

Nonetheless, the most important factor in the lower effectiveness estimates is the updated (smaller) estimated number of addressable deaths, and injuries used as the baseline in the final regulatory analysis.

3. "The vulnerability of the design to the burning bedclothes...seemed to be caused by the characteristics of the barrier used on the top/side of the mattress." Did all the mattresses tested use the same barrier? Is this barrier typically used in single-sided mattress construction?

A single-sided mattress design, considered to be a reasonably representative construction, was examined to evaluate the potential vulnerabilities associated with the actual usage of single-sided mattresses that are more lightly protected on the non-sleeping surface. The samples for this test series were purchased from one manufacturer and used a single barrier technology to meet the criteria of the draft final standard. A number of barrier technologies and their variations (including this particular barrier technology), ranging in fire performance, may be used in single-sided or double-sided mattress designs.

4. Staff noted single-sided mattresses placed on an unprotected foundation pose an increased fire hazard. The proposed solution is to put a label on mattresses, which indicates what foundations, if any, the mattress is intended to be used with. Since the label language provides,

at best, only an indirect reason for this direction (assuming a consumer even reads that particular label), what reduction in the effectiveness of the standard is attributed to this solution?

See the information provided in A2.

5. Mattresses that are intended to be used without a foundation may nonetheless be used with one at some point during their life. What problems could this present for users, if any, in terms of the safety of such a combination? How does the fact that the foundation, if sold alone, does not need to meet the open flame standard affect this scenario?

CPSC staff has not tested mattresses intended to be used without a foundation with a foundation. A number of very different mattress designs (such as crib mattresses, futons, or some innerspring mattresses) are intended to be used without a foundation and are, therefore, fully protected. Depending on the mattress style and foundation selected, the use of a protected or complying foundation is not expected to pose any additional risk.

Tests of a compliant mattress on a non-compliant foundation suggested that the overall fire performance of the set could be affected. However, the overall performance of this combination was significantly better than the performance of traditional mattresses that typically exceed 2000 kW within a few minutes. The early fire contribution of the mattress, even with a non-compliant foundation, was substantially reduced and would allow for a timely escape. In all cases, early discovery of the fire and immediate escape from growing fire conditions are critical.

6. Additionally, the testing showed that “when mattresses are closely designed to the performance requirements, as is expected, as the industry develops their new products, flashover conditions could occur earlier than previously measured with experimental and initially over-engineered designs. The staff accounted for this observed behavior by reducing the effectiveness estimates for the staff’s draft final standard.” How much of the reduction in effectiveness from the proposed to the final rule is attributed to the expectation that there will be mattresses on the market that just meet the standard?

The staff’s previous effectiveness estimates were based on experimental mattress designs that incorporated strong barriers that were not necessarily cost-effective to meet the performance criteria. As explained in the response to question A2, the staff reduced the effectiveness estimate to concurrently account for a number of factors, including mattresses designed to closely conform to the performance criteria, which do not impact early fire conditions, but may allow significant fire growth to occur sooner than previously observed. However, the primary factor in the reduction, as noted in the response to question A2, is the updated (smaller) estimates of addressable fires, deaths, and injuries used as the baseline for the final regulatory analysis.

B. FR chemicals:

1. Since California’s mattress flammability standard became effective January 1, 2005, we know that mattress sets that comply with the staff’s draft final mattress flammability standard are presently being marketed in California and nationwide.

a. To your knowledge, do those complying mattress sets currently on the market provide any indications that there is any one technology favored by mattress manufacturers in producing complying mattress sets?

Mattress sets that are compliant with California Technical Bulletin 603 (TB 603) do not appear to favor one type of barrier technology. Mattress designs may incorporate multiple technologies and barrier materials continue to evolve. Design choices are based on a number of factors including mattress design, fuel load, target market, equipment requirements, and cost to comply. The four major mattress manufacturers are currently using four different technologies.

b. To your knowledge, for those mattress manufacturers employing FR chemical treatments as their means for producing complying mattress sets, is there a primary FR chemical treatment presently being utilized?

Mattress components may be constructed using treated fibers, inherently flame resistant fibers, or combinations or blends of these fibers and other traditional fibers. Fire retardant chemicals may be applied to finished component products, possibly as backcoating, used as topical fiber surface treatments, or incorporated into manufactured fibers at the time of formation to produce flame resistant fibers. The use of FR chemical treatments depends on many factors such as the design of the mattress and the compatibility with the fiber or component being treated. Mattress manufacturers are still considering viable options, and no one technology is being exclusively used by the industry.

2. The risk assessment described in the staff's quantitative assessment memo is limited to the assessment of chronic health effects, although the acute health effects of certain FR chemicals and chemical classes are also present. Why should this Commission be confident that exposure to certain FR chemicals used in complying mattress sets will not be at a level to cause acute health effects?

The staff assessed the potential chronic health effects that may occur when consumers sleep on mattresses that contain FR treated barriers. In general, chronic effects occur at considerably lower levels of exposure than acute effects. If no chronic effects are expected, it is unlikely that any acute effects would be experienced by consumers.

C. Durability:

1. Durability testing of FR chemical treated mattresses was conducted to represent bed-wetting scenarios. Staff has used a range of 10 to 14 years for the expected useful life of mattresses. Have there been any studies done to determine the effectiveness of FR chemical treatment over the expected useful life of a mattress? If so, what are the results of those studies?

There have been no studies using actual aged mattresses to determine the effectiveness of FR chemical treatments over the expected useful life of a mattress. Some mattress manufacturers have used methods that simulate aging (such as the mattress roller test) prior to testing and reported equivalent test results before and after the aging.

The staff's migration/exposure studies suggested testing of FR durability and efficacy only for the bed-wetting scenario, which is considered the most severe real life exposure to water. Follow-up flammability tests of mattresses exposed to such a bedwetting scenario indicated that durability requirements appear unnecessary. Pounding tests conducted to measure airborne particles potentially available for inhalation showed no significant dislodging of the FR chemicals. These FR chemicals are expected to be chemically stable under normal conditions for the expected useful life of the mattress.

2. The wetting/durability tests indicated that the use of ammonium polyphosphate in mattresses that are repeatedly exposed to liquid, could allow the interior of the mattress to go to flame earlier than would be anticipated without the liquid exposure. As staff stated, "The limited testing of this design suggests that this behavior could be significant in certain circumstances." In addition to noting our own limited testing, staff notes that a producer of the ammonium polyphosphate barrier product had done tests that showed the mattresses meeting the proposed standard. However, the producer used a different test protocol and provided no detailed test data or observations made during the testing to CPSC. How confident is staff in the producer's results. Could the use of a different protocol have biased their test results?

A producer of ammonium polyphosphate barrier products provided test data based on their own independent testing of mattress designs containing ammonium polyphosphate barrier systems that were tested before exposure to moisture (control mattresses) and after being exposed to treatments simulating a repeated bed-wetting scenario. Detailed test data and observations were not provided. However, the CPSC staff does believe that the test data provided supports the claim that the overall performance of the control samples was equivalent at 30 minutes to the exposed samples.

3. There is a comment and answer on page 249 of the briefing packing relating to the process used by the staff to "age" mattresses during their testing. Does the answer mean that staff cannot correlate the results of their aging process to a particular number of years in the life of a mattress?

The staff's pounding experiments were based on a procedure used by the industry and outside test laboratories to simulate 10 years of use. The heat and moisture aging tests have not been correlated with a specific number of years. As the peer-reviewers suggested, CPSC staff described the barriers as "aged" without estimating a specific number of years that this aging represents.

D. Miscellaneous:

1. The test for determining whether a mattress prototype meets the standard is in the staff's words "a sophisticated performance evaluation." The precision and bias study showed "some significant differences in the test results reported by the participating laboratories." How often was it a failure to correctly follow the test set-up requirements that resulted in the varying results? While the differences apparently did not change the results from a pass to a fail, or

vice versa, how wide a range did we see on the samples? For example, did some tests show a particular mattress as passing with high marks while others showed it as a marginal pass?

A detailed statistical analysis of the test data does not suggest unreasonable sensitivities of the test protocol. Sensitivities were explored by varying a range of possible test technician errors primarily associated with test set-up measurements. The results of the tests in the P&B study were shown not to be influenced by the selected parameters.

The P&B Study was designed to evaluate the robustness and validity of the test method (*test the test*), rather than test the specific mattress designs, and reveal which, if any, test parameters might need to be clarified or revised. Based on the analysis of the test data, the test appears to be a robust, valid test method. The test method is severe enough and the test duration long enough to allow a valid/realistic evaluation of mattress performance. The test method is able to identify relative mattress performance and is capable of measuring differences between good and bad mattress designs.

The reported differences in performance have been attributed to a number of factors. These differences appear to be driven substantially by the inconsistent performance of one of the selected barriers. Although it may have been at one time, the selected barrier does not appear to be representative of those being used in the current residential mattress market. Several other identified factors have been addressed through clarifications or changes to the procedures and other requirements of the standard.

2. If the test room conditions for temperature and humidity are comparable to the conditioning room, is there any need for the twenty minute restriction on the time to begin the test?

The closer the test area conditions are to those of the conditioning room, the less likely the time between removal of the sample and start of test would influence the test. If the conditions in the test area meet the requirements of the conditioning room, there would be no obvious need to restrict the time to begin the test. As a practical matter, however, the test should be conducted within a reasonable time after removal from the conditioning room to ensure continuity of running the test and to minimize the need to recalibrate test equipment. While a laboratory could control the test area conditions in this manner, it would involve additional, unnecessary expenses.

Compliance Question:

The term “corrective action” as used in §1633.6 (c) (1) & (2) is not defined. It would certainly include correcting future production; however, the term can have broader implications. Is the term meant to be used in the narrower sense or in the broader sense in these provisions?

The term “corrective action” is meant to be used in the broader sense. By not defining the term, the staff retains the full array of corrective action options (i.e., correct future production, stop sale, recall from distribution, consumer-level recall, etc.) to address the varying types and degrees of failures that may be found.

OGC Questions:

Preemption: Questions on preemption issues are being answered separately in a restricted memorandum from the Office of the General Counsel.

1. Durability testing of FR chemical treated mattresses was conducted to represent bed-wetting scenarios. Staff has used a range of 10 to 14 years for the expected useful life of mattresses. Have there been any studies done to determine the effectiveness of FR chemical treatment over the expected useful life of a mattress? If so, what are the results of those studies?

There have been no studies using actual aged mattresses to determine the effectiveness of FR chemical treatments over the expected useful life of a mattress. Some mattress manufacturers have used methods that simulate aging (such as the mattress roller test) prior to testing and reported equivalent test results before and after the aging.